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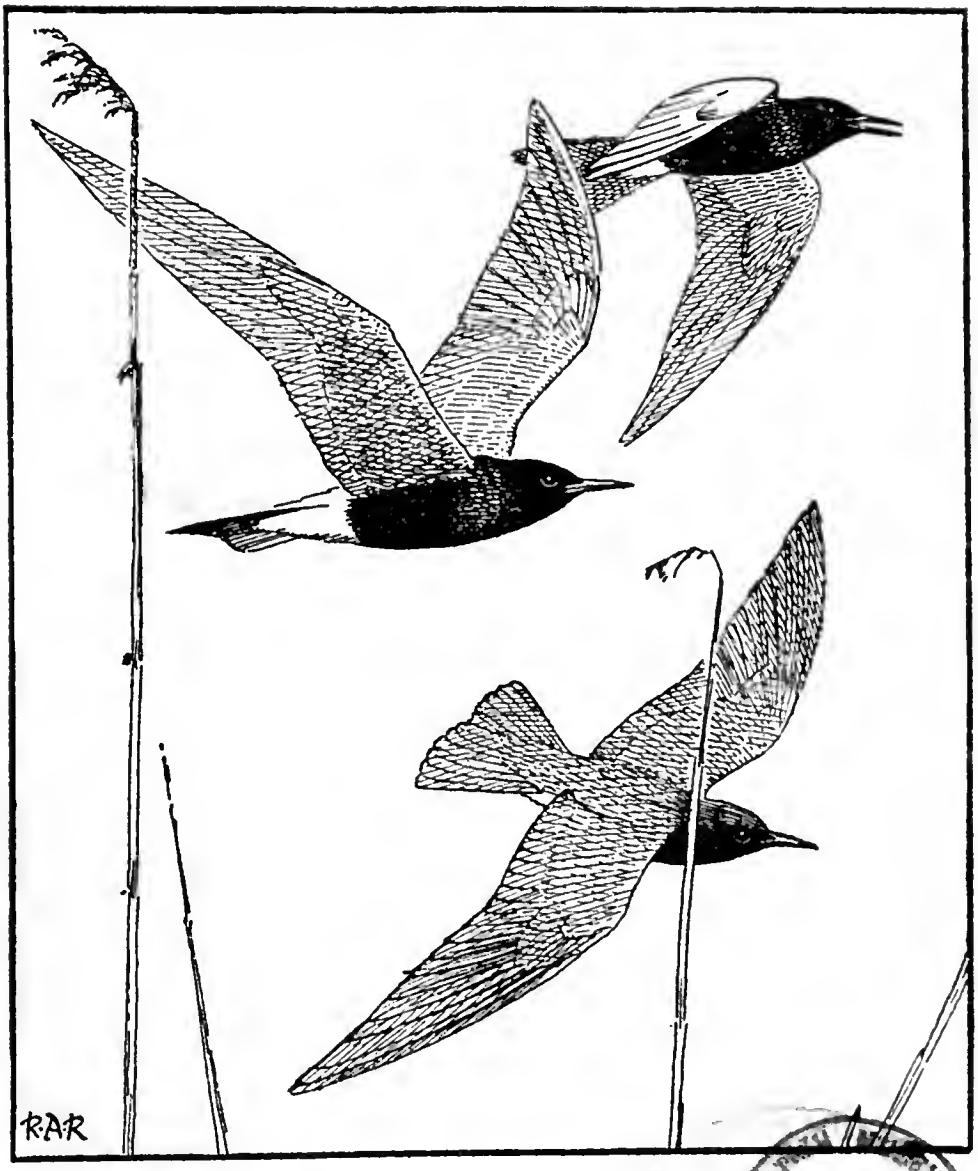

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THE NORFOLK BIRD REPORT
1958

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The Norfolk Bird Report 1958

INTRODUCTION.

The Council of the Norfolk Naturalists Trust, in co-operation with the Norfolk and Norwich Naturalists Society, is pleased to present to members the annual report on the birds of Norfolk.

Although there was no severe weather early in the year, white-fronted geese were present in the Breydon area in larger numbers than for several winters; 1,200 were estimated. Very few pink-footed geese appeared. Higher up the Yare valley, 78 bean geese wintered and among them was a lesser white-fronted goose—the fourth fully authenticated county record. In north Norfolk, brent geese peaked at 2,200 birds. The most exciting visitor on this coast during January was the immature white-tailed eagle, which later in the winter spent its time on the Wash. One, perhaps the same, was seen also on the Suffolk coast. Another interesting bird of prey was the probable marsh hawk (*Circus cyaneus hudsonius*) which arrived at Cley in October, 1957. It was last seen on April 13th having been a regular visitor to the marshes and heathland.

A further influx of waxwings began early in January; the largest numbers were at Cromer including a flock of 50. Smaller numbers reached the centre of Norwich where they attracted attention as they fed fearlessly on berries. The most remarkable occurrence during March was a kite at Ridlington on the 3rd—the first county record for almost 80 years. One, possibly the same bird, was watched near Brampton in Suffolk the following day, whilst a kite was also recorded at Kelling on the 22nd.

Unusual numbers of avocets appeared during April when there were 14 at Cley. Large numbers of blackbirds appeared on the east and north coasts of Norfolk on March 30th and again on April 5th and 6th. Goldcrests, a firecrest and Continental robins were seen at the same time. They were almost certainly emigrants turning back after an abortive attempt to cross the North Sea in adverse wind and weather. This exodus was resumed on April 17th. It was a cold spring and flocks of redwing were much in evidence between April 13th and 20th. A small influx of blue-headed wagtails reached Cley on the 23rd. Then the first two days of May saw a large movement of black terns with 160 at Rockland Broad. This invasion was probably caused by an anti-cyclone then covering much of Europe and Britain, fog in the early morning of the 1st all along the Dutch coast and easterly winds in the North Sea. Other May visitors of special note included purple heron, little bittern, kite, osprey, two woodchat-shrikes and two ortolan buntings.

A number of nests were reported in unusual sites. They included a carrion crow's on the top spar of an electricity pylon near

Lower Thurlton ; a blackbird's in the basket of a bicycle at Hunstanton ; a robin's in a rush bag in a Mulbarton garage and another robin's in the top of a sack of coke at Norwich City station. Within a few yards of the latter nest was a blackbird's with young on an angle-iron bracket on the side of a railway wagon. This wagon had been moved several hundred yards since the eggs were laid. In the grounds of St. Andrew's hospital a pair of rooks selected as a nest site an ornamental wrought-iron globe set at a height of about 60 feet at the top of a water tower. In farm buildings at Stratton St. Michael wrens took over an old swallow's nest, roofed it with moss, and reared a family. Quite close by was a new swallow's nest with young. At Ashby St. Mary a wren regularly fed a brood of robins after one of their parents had been killed. A hen blackbird built a double nest (with two cups) and used only one of them for her eggs. At Wheatfen a chaffinch reared her brood in a blackbird's nest which she stole from its owner. A pied wagtail used a blackbird's nest directly the owner had finished with it. Another blackbird built her nest in the engine of a tractor, completing the work and laying her eggs at intervals when the tractor was not in use. A young cuckoo was found in a blackbird's nest whilst a pair of swallows reared a young cuckoo at Buckenham Tofts. Spotted flycatchers nested in a hanger at Marham aerodrome. Late nests included a song thrushes' at Blakeney where a young bird did not leave the nest until October 4th and a bearded tit's at Hickling with young on September 20th.

The breeding season was of great interest. On the coast, over 1,500 pairs of Sandwich terns and 2,500 pairs of common terns nested, whilst two pairs of kittiwakes nested for the first time at Blakeney Point. There is only one previous nesting record for the county (Scolt Head, 1946). Large numbers of kittiwakes again summered on the Norfolk coast, together with many eider-ducks. A census of breeding black-headed gulls produced a county total of some 1,950 pairs, but the large gullery at Scoulton Mere which has been famous for more than three centuries was deserted. The reason for this sudden abandonment has not been discovered, but the gulls may have been unduly disturbed by the increasing numbers of Canada geese and coypus. In the Broads area, over 55 pairs of bearded tits and 4 pairs of marsh harriers bred. The only breeding Montagu's harriers were again located in the Breck. At Breydon, short-eared owls and pintail nested successfully ; pintail also nested at Cley. Black redstarts bred at Cromer and Yarmouth and blue-headed wagtails at Salthouse. At least 24 fulmar petrels were reared, whilst 322 pairs of nesting herons were counted. Only 2 pairs of collared doves nested and no new breeding localities have been found since the initial " discovery " in 1956. Stonechats bred for the first time since 1945. 68 occupied house-martins' nests were counted at Oxburgh Hall and 44 pairs nested on a farmhouse at Thompson.

Two spoonbills stayed for over a month during the summer at Breydon, quail were reported at half a dozen localities in north Norfolk and there was a small irruption of crossbills in mid-July. A glaucous gull spent the summer on the north coast. In August, the most noteworthy event was the discovery of a great spotted cuckoo dead at Winterton. Other rarities during the month included a little bittern at Cley, an Alpine swift at Trimingham and an aquatic warbler at Holme.

The autumn passage of waders produced few surprises, with the exception of single dotterel, 4 Temminck's stints, 2 avocets and a black-winged stilt. There was, however, an impressive passage of whimbrel during August. Curlew-sandpipers and little stints were scarce, particularly the former. Among the sea birds in early autumn, half-grown razorbills accompanied by their parents were off the north Norfolk coast in the first days of August. Peak numbers of gannets were in early September. More pomatorhine and long-tailed skuas were seen than usual.

In early September, a spectacular drift of outgoing north European summer visitors was noted along the Norfolk coast. At Cley and Blakeney Point during this exciting period no fewer than 10—12 wrynecks were recorded, at least 10 different bluethroats, 6—8 ortolan buntings, 4 each of icterine warbler and red-backed shrike and 3 barred warblers. Also recorded were black redstart (2 on 4th), sedge-warblers, chiffchaffs, wood warblers (singles on August 30th and on September 3rd), reed-warbler and a red-breasted flycatcher on the 13th. A rustic bunting (the second county record) was present from 10th—13th, wheatear influxes were noted on 15th and 17th—18th and yellow wagtail passages on 5th and 7th. Lapland buntings were noted on 12th and 15th (2 each day) and on 18th (3). Migration records for Cley and Blakeney Point taken from Cley Observatory Log between late August and mid-September are given below :

	August								*September*								
	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13
Wryneck						1	3	8	3	5	4		3		1	1	
Wheatear	10	1			20	30	50	150	100	20	10			1	10	3	
Whinchat	4	4	2		6	25	20	10	5	5	1	1	2	2	2	2	14
Redstart	1		1	1		10	100	150	60	50	13	10	20	2	1	1	12
Bluethroat... ...								2	6	4	3	3	1		1		
Grasshopper W. ...			1			3	1	2	1								
Icterine W. ...							3	1							1		
Barred W.... ...				1	1	1			1								
Blackcap				1			2	1								1	
Garden W. ...		1			10	35	70	70	30	30						1	1
Whitethroat ...	1		2	2	2	3	10	10	30	30	3		1		1		4
Lesser White ...				1		1	3	2									
Willow W.... ...	3	6	2	5	6	100	200	200	100	100	45		+		2	3	
Spotted Fly ...				1		3	25	50	2								
Pied Fly	10	2	4	3	5	50	50	50	40	15	1		7		1	1	5
Tree Pipit				2		25	20	20	10	5					1	1	
Red-B. Shrike ...				1	1	1		2	1								
Ortolan Bunting ...						3	6	3	2	1	1	1	1		1		

A hoopoe at Salthouse on August 30th was succeeded by another at Blakeney for a week from September 4th. A juvenile red-footed falcon was at Holme from the 13th—16th and a juvenile bee-eater at Morston on the 17th. At Scolt Head, peak numbers of migrants were on September 4th when there were hundreds of willow warblers, 50 redstarts, a black redstart, 24 pied flycatchers, 22 whinchats and 200 wheatears, also 2 ortolan buntings. The same day, in the pines at Holkham were over 200 pied flycatchers. Redstarts, wheatears and pied flycatchers were also noted at many coastal localities between Hunstanton and Yarmouth during the first week of September. At Cromer, on the evening of the 1st, a pied flycatcher was perching on the coloured illuminations along the sea-front.

In October there was a remarkable number of late swift records. Starling passage began on the 18th and was on an exceptionally large scale between then and the 25th with flock after flock coming in from the sea along the east coast and equally large numbers travelling westwards along the north coast. Large numbers of starlings were reported on the light-vessels off the Norfolk coast during this period. Even fog signals did not prevent them from occupying every possible perch. One night the rigging of the Outer Dowsing was crowded with several thousand birds all of which were later forced on to the deck by high winds. One bird which struck the Dudgeon had been ringed as a nestling in south Sweden in 1957 ; another, found dead on the Inner Dowsing was bearing a Russian ring. Very great numbers of chaffinches appeared between October 19th and 27th, while the main autumn blackbird movement began October 19th and continued well into December. November 4th was another day of heavy movement in east Norfolk with very great numbers of starlings arriving from the sea, together with fieldfares, redwing and lapwing. That night, the calls of waders, redwing and blackbirds were constantly heard over Norwich. On November 3rd 83 blackbirds were counted on a field at Wiveton ; there were over 200 in House Hills, Scolt Head, on the 19th and a large influx at Cromer on the 21st when many struck the lifeboat house light there. On the night of December 22nd/23rd blackbirds, skylarks and fieldfares struck the lantern of the Dudgeon light-vessel and among them was a blackbird ringed in Sweden the previous August.

Following a build-up in south Scandinavia, waxwings again reached the Norfolk coast in numbers from November 19th and two days later there was an influx of woodcock in north Norfolk. A red-breasted goose at Breydon November 10th—30th was considered an escape as it carried a red ring. During December, up to 100 Lapland buntings were present on Morston saltings. In the same month 50 ruffs remained at Wisbech Sewage Farm.

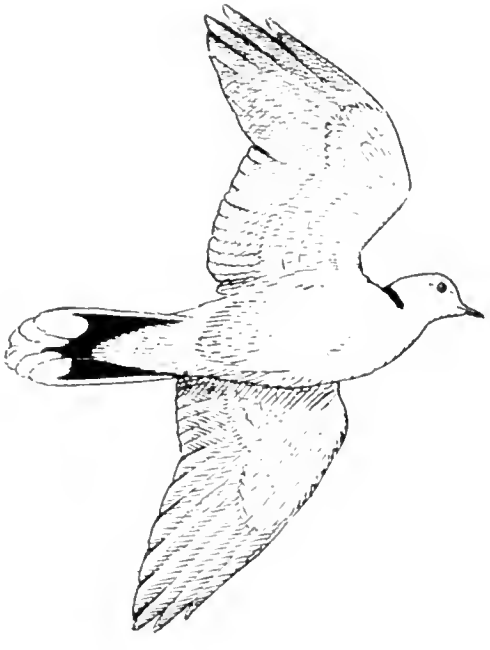
Among the many interesting ringing recoveries will be found a Swedish curlew 31½ years old, an oystercatcher ringed at Scolt Head which reached Morocco, winter records of common and Sandwich

terns in West Africa, teal from the U.S.S.R. and shoveler from Finland.

Varieties reported included an all-white sanderling at Holkham, an all-white ringed plover at Salthouse, a steel-grey swallow at Thornage and a white one at Warham ; white house-martins at Wiveton and Walsingham, and a cream one at Thornage and Brinton ; all-white blackbirds at Attleborough, Necton, Yarmouth and Norwich, a cream-coloured one at Sparham and pied ones at Brisley and Overstrand ; partly white starlings at Dilham, Brancaster and Hardley ; a cream-coloured house-sparrow at Binham and partly white ones at Holt and Thorpe. 235 species of birds were recorded in the county during the year.

We are indebted to Mr. R. A. Richardson for the cover drawing of black terns and other delightful illustrations ; also to Mr. R. P. Bagnall-Oakeley, Dr. K. J. Carlson, Mr. R. Gaze, Mr. P. D. Kirby and Mr. W. J. Woolston for their photographs ; to the Cambridge Bird Club ; to the Gt. Yarmouth Naturalists Society for light-vessel notes, to the Trinity House Depot at Yarmouth and to all other contributors.

Records for the 1959 Report should be sent *by the end of January* to Mr. Michael J. Seago, 33 Acacia Road, Thorpe, Norwich. Records should be in Check List order rather than in diary form.



Collared Dove

Notes on Breeding Birds of the Norfolk Nature Reserves.

SCOLT HEAD ISLAND
(The Nature Conservancy)

WARDEN : R. CHESTNEY

The Warden's records show that the number of birds breeding on the island does not vary a great deal from year to year, except for fluctuation in regard to the colony of terns, but the number of young which survive depends to some extent on local conditions. The season under review was notable for its abnormal rainfall, with cold winds from time to time which must affect ground-nesting birds, particularly terns, in such an exposed area ; moreover, there was an absence of suitable food (whitebait) near at hand. Mortality among young in large bird communities is known to be high and the combination of circumstances this season increased the loss of common tern chicks, very few of which survived to fly.

Mallard.—It was a good breeding year for mallard, and seven nests were found, the first on House Hills on April 1st.

Sheld-Duck.—Large numbers returned to the area in February. A number were paired in early April and on May 7th 147 pairs were counted in the Cockle Bight and marshes adjoining the island. Three nests were examined on May 12th, in one of which were seventeen eggs—possibly laid by two ducks. The first brood of nine young was seen on June 19th ; but the majority of young did not survive the cold wet weather.

Red-Legged Partridge.—No nest was found but one pair with four young were seen later.

Oystercatcher.—An estimated number of ninety pairs nested. All the usual sites were occupied by April 11th but the first eggs were not found until April 28th. Most pairs reared from one to three young.

Ringed Plover.—An estimated number of 200 pairs bred on the island. It was fortunate that the majority of young hatched during one of the brief fine spells of weather and on the whole the season was a successful one.

Redshank.—Nineteen pairs reared young. Each pair took their young down to the nearby marshes within forty-eight hours of hatching.

Black-headed Gull.—There was a small colony of 40 pairs on the marshes east of House Hill, but only eight pairs successfully reared young.

Common Tern.—1,200 nests were counted on June 9th, rather more than last year. Birds were first seen on the Far Point on April 21st. A number were settled on the breeding area on May 12th, and the first nest, with one egg, was found on May 15th. The peak of the egg-laying period was reached from May 25th–June 1st. The first young were hatched on the Far Point on June 5th. Food was not plentiful inshore, and the average time taken for birds to bring in fish was twenty minutes and even longer during the neap tides. The sand-eels were often too large for the young and whitebait so scarce that they constituted only one in twenty of the fish brought in. The young, left uncovered for so long, suffered from cold wind and rain and also from the depredations of greater black-backed gulls. It was inevitable in these circumstances that a high percentage died.

Arctic Tern.—These were heard calling over the Far Point on May 4th and again on May 15th and a pair was identified on the ternery area on May 23rd. A nest, with one egg, was found on May 28th and there were three eggs on the 30th. This nest was well below high tide mark and was moved gradually a distance of forty feet to a safe site, but the birds did not appear to be disturbed. The first egg hatched on June 19th and the other two on the 21st and 22nd, but none of the young survived.

Little Tern.—Twenty-nine nests were counted. The first arrivals were seen on April 21st ; the first nest, with two eggs, was found on May 15th and the first young hatched on June 6th. Nineteen young were seen on the wing but it is thought that more survived to fly.

Sandwich Tern.—A total of 348 nests, in four groups, was recorded on June 7th. Birds were first seen on April 14th, and on April 30th nest scraping began. Hatching was in progress on June 21st in very poor weather, and a number of chicks died. A remarkable instance of shortage of food was that of a three weeks old bird eating a day-old common tern chick—the first time that such an incident has been recorded. The

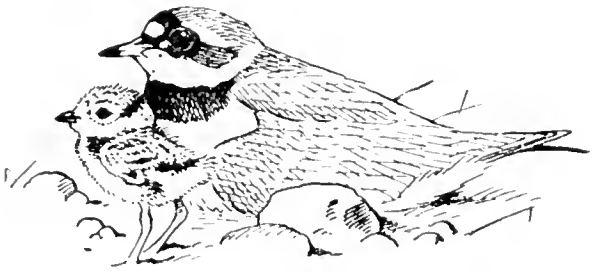
last nest hatched on July 13th. At the end of the season, 240 young birds reached the free flying stage; 182 chicks were ringed on June 23rd.

Short-Eared Owl.—No nest was found but a pair bred on the south side of Norton Creek. Young birds were seen frequently on the Island in July and August.

Swallow.—None nested at the Hut this year.

Yellow Wagtail.—At least two pairs bred on the Island.

Linnet.—Twenty-five nests were found an increase on previous years.



BLAKENEY POINT
(The National Trust)

WARDEN: W. EALES

The following summary on the breeding birds shows the season to have been of much interest in spite of the consistently cold wet weather. The colony of Sandwich terns, estimated at 800 pairs, shows an increase on last year's number and the two pairs of kittiwakes which nested among them provided a new record for Blakeney Point. It was a great disappointment that the two young kittiwakes died five days after hatching following a period of very heavy rain. Common tern chicks were also badly affected but the majority of young Sandwich terns survived to fly. A glaucous gull with some greater black-backed gulls gave the Warden and his assistants some anxiety and one kittiwake's nest was destroyed by these marauders. An egg-collector also caused some excitement and when caught was found to have picked up several Sandwich tern's eggs and one kittiwake egg. He was later charged at Holt Police Court and fined. Incidentally, the kittiwake's egg was replaced in the nest within twenty minutes of its removal and was one of the two which eventually hatched. A disturbance of a lighter nature was made by a hare which ran through the ternery pursued and attacked by a number of angry birds.

Sheld-Duck.—An estimate was made of thirty nesting pairs. The breeding birds were paired by the second week in April, rather later than usual.

Red-Legged Partridge.—One nest found and a brood reared.

Oystercatcher.—These were as numerous as usual ; and seventy-two nests were marked. The first nest was found on the Far Point on May 6th. The first chicks hatched on June 7th and the last on July 22nd.

Ringed Plover.—Forty-seven nests were marked. Although pairing began at the end of March the first nest with eggs was not found until May 2nd, and the peak was reached in the third week of May.

Redshank.—Forty-seven nests were found, the first, with three eggs, on May 8th. The first young hatched on May 28th. The very exposed area of the Old Ternery was again the site of a number of nests.

Kittiwake.—A few were seen on the Point at the end of May and on June 13th ; two pairs were found to be nesting among the Sandwich terns. On the following day there were two eggs in one nest and one in the other, but this second nest was destroyed by a greater black-backed gull. The two young hatched on July 8th and 9th, but were found dead on July 14th. An examination showed them to have died of congestion of the lungs.

Common Tern.—1,140 nests were marked. The first, with two eggs, was found on May 17th but the majority of eggs were laid in early June. The first young were seen on June 24th. Although an estimated number of 75 per cent hatched, only a relatively small proportion survived to fly. This was partly due to the shortage of whitebait inshore which resulted in the young being left too long in adverse weather. Twenty young birds were ringed.

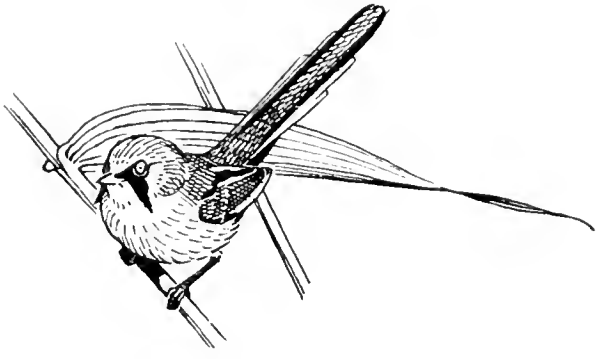
Arctic Tern.—One pair nested and reared two young.

Little Tern.—Eighty-four nests were marked, considerably less than last year. The first arrivals were seen on April 21st. A nest with one egg was found on May 12th and the first chicks hatched on June 8th.

Sandwich Tern.—An estimate of 800 pairs nested in the same area as last year. Birds were seen on April 17th, but did not begin to settle on the nesting site until May 3rd. After this the number increased steadily well into June. The first young were noted on June 9th and at an estimate 95 per cent of the eggs hatched. The loss of chicks was not unduly high ; young Sandwich terns are not so dependant on whitebait for food as the young Common terns and there was a plentiful supply of sand-eels. 416 chicks were ringed. An interesting recovery was a young bird ringed on the Point in July which was picked up dead 250 miles north in Aberlady Bay in East Lothian.

Linnet.—Twenty-five nests, several of which were found in the lupins near the Tea-house.

Skylark.—Forty-five nests were found in the dune area round the Tea-house and there were more in the vicinity of the Hood.



CLEY AND SALTHOUSE
(The Norfolk Naturalists Trust)

WARDEN : W. F. BISHOP

Although the summer was one of the wettest in memory it was not a cold one and there was an abundance of insect life on the marshes. It was, therefore, a good breeding season for birds dependant on this sort of food. Bitterns did not fare well ; there were fewer pairs and only three young were reared. Shovelers appear to be increasing in the area.

Bittern.—Booming was first heard on March 4th. Two nests were found and the young in the earlier one hatched on May 17th. Three young were reared in the two nests.

Mallard.—The number of breeding birds, estimated at 200 pairs, shows an increase on last year's total for the area. The first nest, with nine eggs, was found on April 2nd—a good deal later than usual. In July and August approximately 400 mallard were on the Big Pool daily.

Teal.—No nests were found but there was evidence of four pairs on Cley marshes and of more in the adjoining area.

Garganey.—The first arrivals were seen on March 17th. One pair nested but only two young were reared.

Shoveler.—Eight pairs bred and a number of young birds were on the wing at the end of July.

Gadwall.—At least one pair nested on the marsh and the duck was seen later with young.

Pintail.—One pair bred on the marsh for the first time.

Sheld-Duck.—The normal number of pairs in the area was well maintained. A large number of young were present on Arnold's Marsh from June until August.

Water-Rail.—No nests were found although birds were frequently heard on the marsh.

Oystercatcher.—Three pairs nested but the young suffered from the wet season and only three were reared.

Lapwing.—These appear to be increasing. An estimated number of eighty pairs bred, most of them on nearby arable land.

Ringed Plover.—Very few pairs nested on the mudflats which were much too wet for them. Hardly any young were reared, and most of those hatched died within a few days.

Redshank.—The estimated number of pairs was not quite up to average. Some of the first nests were raided by carrion-crows, but in spite of this initial loss the birds had a very fair season. The young were not so badly affected by the weather as other waders.

Stone-Curlew.—Two nests were found near the Reserve but it is doubtful if the young survived.

Common Tern.—A few pairs attempted to nest on the Salthouse marshes but were not successful in rearing any young.

Little Tern.—The number of nests on the shingle beach was less than last year. A fair number of young were reared and later were seen on the wing.

House-Martin.—The first birds arrived considerably later than usual. Only fourteen pairs nested on the Warden's house, many less than hitherto, but with the abundant food available they reared large broods.

Bearded Tit.—The five birds, two males and three females, which remained on the marsh throughout the winter had a good breeding season, rearing a number of young. The first nestlings hatched on April 26th.

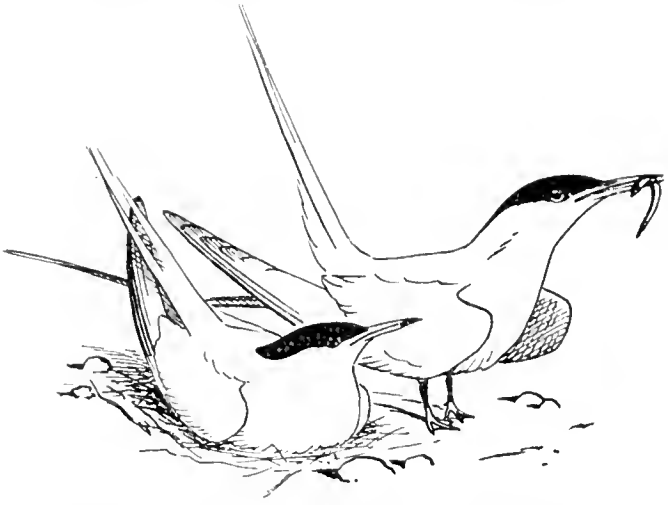
Reed- and Sedge-Warblers.—Both species were late in arriving and reed-warblers were not heard until April 26th. However, eventually there were as many as usual on the marsh, and they had an excellent season.

RANWORTH

(The Norfolk Naturalists Trust)

KEEPER : R. BROWNE

Records of the birds breeding on and around Ranworth and Cockshoot broads show that the number of most species remains fairly constant from year to year. There were nine pairs of great crested grebes at Ranworth and all reared their young. The thirty-eight occupied nests in the Big Carr heronry shows an increase of three pairs on the total for the previous year.

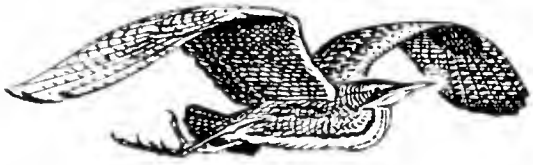


It is interesting to note that cormorants are using trees on the edge of the Carr for roosting ; the site is similar to those used by breeding colonies in Holland. The number of these birds at Ranworth has increased so much in recent winters that their inroads on the fish is viewed with some concern.

The season, with its abundance of insect life, proved an excellent one for mallard. At least 200 pairs bred but they are spread over such a large area that an accurate count is impossible. Teal prefer nesting sites on the edge of the broads and the number breeding is easier to assess. The estimate for the area is from sixty to seventy nests. Shovelers have decreased to some extent in recent years and only twenty pairs nested this season. Less sedge is cut than in the past and the available ground is probably too rough for them.

Six pairs of common terns returned to the broad in the Spring and three pairs nested on one of the old wherries. The nests contained one, two and three eggs respectively ; four young were reared. The wherries are disintegrating very fast now and it is doubtful whether the terns will be able to use them as nesting sites much longer.

There was no evidence of bearded tits nesting although, as usual, a number were present near the broad throughout the winter.



HICKLING
(The Norfolk Naturalists Trust)

WARDENS : E. PIGGIN assisted by G. E. BISHOP

The breeding season was a very good one again for bearded tits and other insectivorous birds and the number of these was well up to average with the exception of house-martins, which arrived

very late. Ground-nesting birds did not do so well. Coypus have been very numerous, and have destroyed acres of sedge, in which bitterns normally nest.

Great Crested Grebe.—The number of twelve breeding pairs in the area remains almost constant. Six nests were found, the first, with two eggs, on April 23rd. An interesting observation made on May 17th was a vicious attack made by a grebe on a mute swan which had ventured too near to its nest. There were three nests in Heigham Sounds; an adult bird was seen here carrying its young on its back in the usual way.

Heron.—Ten nests were counted on April 14th, two in Whiteslea wood, six in the Sounds wood and two in the General's wood.

Bittern.—Booming was first heard on March 28th, considerably later than usual. Single birds were seen throughout the year; two were flushed near the Lodge on March 21st and three were seen in flight on July 27th and September 24th. Five pairs were believed to have bred in the area, but no nests were found.

Mallard.—There were fewer pairs than usual and nesting was later. A brood of eight was seen on April 28th and a nest, with eight eggs, was found in Catfield Dyke on May 8th, and another on May 10th. An estimated total of forty pairs bred on the surrounding marshes.

Garganey.—The first arrival was seen on March 31st. On April 6th there were three pairs on Rush Hills and others were seen later. Two pairs were known to have bred; the nest of one of these, with nine eggs, was found on the marshes near the Lodge.

Shoveler.—Several pairs were seen and a nest with nine eggs was found on Deary's marsh on April 23rd.

Sheld-Duck.—A brood of six was feeding on Rush Hills on June 16th.

Mute Swan.—Eight nests were found, with from three to nine eggs, the first on April 8th. The wintering herd reached a maximum of 425 birds.

Marsh-Harrier.—There were three nests, the first of which was found on May 7th. In two of these broods of five young were hatched; but the third, near Meadow Dyke, was deserted with three eggs, probably following disturbance by yachtsmen. Nine young birds were ringed on June 24th, and it was seen then that they were being fed on small coypu.

Montagu's Harrier.—None nested in the Horsey/Hickling area.

Water-Rail.—A nest with four eggs was found near the Lodge on May 28th. Two more, from which young had been hatched, were discovered by marshmen cutting sedge.

Lapwing.—The first three nests, with eggs, were found on the marsh meadows near the Lodge on April 10th. Six more were counted on April 23rd on Chapman's marshes. A good average number of approximately twenty pairs bred.

Common Snipe.—A few pairs bred but no nests were found.

Redshank.—These were late returning to Hickling and were first heard on March 5th. The first nest, with two eggs, was found on April 28th. An estimate of from fifteen to twenty pairs bred.

Common Tern.—A pair arrived on Rush Hills on May 2nd and two pairs were found to be nesting on May 12th. Unfortunately one clutch of eggs was taken by some predator, probably a carrion-crow or gull, and only one brood of young was reared.

Barn-Owl.—A pair occupied the box at the Lodge and three young were hatched on July 29th. Later, when almost ready to fly, these were found turned out of the nest and dead.

House-Martin.—A few arrived at the Lodge on May 22nd, much later than usual, and there were only two nests. The birds left on September 27th.

Swallow.—Two pairs nested—one in the boathouse and the other in the garage. They left on September 12th.

Bearded Tit.—Although the number did not reach last year's record total it was a very good season and 25 to 30 pairs were distributed round the Broad and Sounds. Food was plentiful and in spite of the wet season the majority of young were reared. The first nest, with four eggs, was found on April 29th, and breeding continued right into September. A very late nest, with two young, was found on September 20th. An abnormally large clutch of eight eggs was found in a nest at Heigham Corner on May 29th.

Grasshopper-Warbler.—It was judged from the number seen and heard that these were more plentiful than in the previous year. The first was heard on April 26th.

Reed-Warbler.—The first arrivals were heard on May 5th, considerably later than usual, but eventually there were as many as usual.

Sedge-Warbler.—The first birds arrived on April 18th ; also rather a late date, but they were as numerous as ever and had an excellent season.

HORSEY

(Major Anthony Buxton)

Keeper : G. Crees

In November 1957, a pair of nuthatches appeared in the Hall gardens at Horsey and fed regularly on nuts at a bird table. They stayed to nest successfully in a nest box but disappeared in the autumn. This is the first occasion that nuthatches have been known to breed at Horsey since at least 1931.

Oystercatchers returned to the marshes on March 28th and although five birds were present during the summer none nested. The first bittern was heard booming March 30th. There were five booming males ; one nest was found. As usual, great crested grebes were on the Mere in early spring, but again none stayed to nest. Water-rails again left before the nesting season.

A male Montagu's harrier appeared May 10th and a female three days later, but they did not stay to nest. In early spring, it was hoped that three pairs of marsh-harriers would breed at Horsey, but in the end only one pair nested, laid only two eggs and hatched only one chick which eventually flew. At the end of the year, seven marsh-harriers (one female and the others immature birds) were at Horsey. One shoveler's nest was found. It is believed to be the only record of shoveler breeding here since the 1938 sea flood.

At least twenty-five pairs of bearded tits nested around Horsey Mere and the first nest, containing two young and three eggs was found May 12th. Some second clutches were lost as a result of high water and heavy rain. Five nests on the north bank of the Mere were found completely under-water, but other bearded tits' nests on the Brayden side of the Mere were on higher ground. Nests of sedge-warblers and reed-buntings also suffered disaster. In some cases, apparently owing to the weight of rain, reed-warblers' nests slid down the reeds into the water.

SCROBY SANDS

(Robin H. Harrison)

The first visit in 1958 was made on June 1st and it was found that a large area at the north-east corner of the sandbank had been scoured away during the winter. 125 common terns' nests, 149 Sandwich terns' nests and seven little terns' nests were counted.

A second visit was made on June 15th when 250 common terns' nests and 327 Sandwich terns' nests were found. One common tern chick had just hatched. Several Kittiwakes were flying over the island.

A week later, on June 22nd, the first young terns were ringed : fifty-one common tern chicks and one Sandwich tern chick. Bad weather prevented any further landing on Scroby until July 6th. A large colony of about 300 Sandwich terns' nests was then found and many of the eggs were hatching, whilst large numbers of young common terns were running over the sands. This trip was the most successful of the season and 102 young Sandwich terns and fifteen young common terns were ringed.

On July 13th, a strong south-west to west wind, with heavy showers, brought an abnormally high tide and caused a number of losses among the young terns. This was discovered on July 20th when a further ten common terns and three Sandwich terns were ringed. Quite a number of juvenile common terns were safely on the wing.

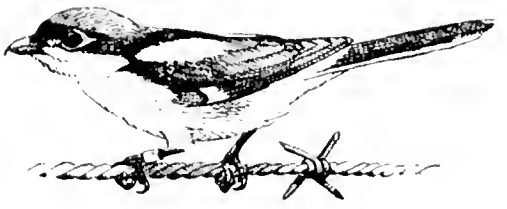
Large numbers of common and Sandwich terns remained at Scroby on July 27th and there were a few late common terns' nests with eggs. A considerable number of kittiwakes was seen. The 1958 breeding season was not as successful as that of the previous year, but it is the fourth year in succession that numbers of young terns have reached the free-flying stage.

A late trip was made to Scroby on August 24th when a large number of sanderling was feeding at the water's edge. Four purple sandpipers were seen, together with many dunlin. Hundreds of greater black-backed gulls had assembled on the Island and there were eighty kittiwakes and a score of cormorants.

Kittiwakes nested at Blakeney Point for the first time. The upper photograph shows one of the two nesting sites, while the lower depicts the first kittiwake chicks to be hatched in Norfolk. Unfortunately, no young were reared. A nest was also recorded at Scolt Head in 1946, but the eggs did not hatch.

Dr. K. J. Carlson

Very little of Breckland remains in its natural state and many stone-curlew now nest in the forest rides and also on arable land which has to be disturbed by cultivation. On the remaining heathlands, the almost complete absence of rabbits leaves the grass too tall for these birds. Certain areas have now been ploughed in the hope that the stone-curlews will return. This photograph was taken at a regular breeding site within eight miles of Norwich



Woodchat-shrike

CLEY BIRD OBSERVATORY
(The Norfolk Naturalists Trust)

WARDEN : R. A. RICHARDSON

Bird ringing, the daily estimate of all species in the area and assisting visiting bird-watchers continued to be the main work of the Observatory in 1958. The registered ringing team was responsible for the year's total of 1,074 birds of ninety-four species and seven, appearing for the first time on the Observatory's ringing list are Montagu's harrier, magpie, grey wagtail, blue-headed wagtail, woodchat shrike, ortolan and rustic bunting. Other noteworthy captures included wryneck, ring ouzel, bluethroat, seven black redstarts, three icterine warblers, barred warbler, great grey shrike and five snow buntings. A selection of the more important recoveries reported during the year follows this Report. The work of the nineteen Bird Observatories recently gained added importance with the appointment by the British Trust for Ornithology of Mr. Kenneth Williamson as migration research officer. A grant from the Nuffield Foundation has made this appointment possible and Mr. Williamson, formerly Director of the Fair Isle Bird Observatory, has already microfilmed much data from previous years for subsequent analysis ; has achieved agreement on the standardization of recording techniques and is editing a new twice-yearly publication of the B.T.O. entitled *Bird Migration*.

In addition, Cley Observatory was able to assist Dr. David Lack in his radar studies of migration by providing evidence and confirmation of species involved.

The two " Heligoland " traps on the Salthouse boundary continued to prove their value by reason of their ready accessibility while the nylon mist-nets came into their own on Blakeney Point during the great fall of drift-migrants in early September.

The Observatory is open throughout the year and prospective visitors can book cottage or hotel accommodation in Cley and district, full details of which are obtainable from the Warden at Hill-top, Cley, Holt, Norfolk.

CLEY BIRD OBSERVATORY RINGING PROGRESS.

Species	1949 1957	1958	Grand Totals	Total Recoveries*
Little Grebe	1		1	
Manx Shearwater	1		1	
Fulmar	28	17	45	1
Heron	16	6	22	3
Bittern	3	1	4	1
Mallard	16	1	17	4
Teal	2		2	
Wigeon	3		3	1
Scaup	8		8	1
Sheld-Duck	5	1	6	
Brent Goose	1		1	
Sparrow Hawk	1		1	
Montagu's Harrier		2	2	
Kestrel	2	6	8	1
Water Rail	3		3	
Corncrake	1		1	
Moorhen	6	2	8	1
Oystercatcher	26	3	29	1
Lapwing	214	59	273	1
Ringed Plover	61	1	62	
Turnstone	1	1	2	
Snipe	2	3	5	
Woodcock	3		3	1
Wood Sandpiper	3		3	
Common Sandpiper	4		4	
Redshank	34	4	38	1
Knot	3		3	
Purple Sandpiper	3		3	
Dunlin	9		9	1
Ruff	7		7	
Grey Phalarope	2		2	
Stone Curlew	3	4	7	
Common Gull	1		1	
Black-headed Gull	188	5	193	5
Common Tern	43	32	75	
Little Tern	9	1	10	
Sandwich Tern	82		82	
Razorbill	4		4	
Little Auk	1	1	2	
Guillemot	4		4	
Stock Dove	26	3	29	2
Wood Pigeon	10	2	12	2
Turtle Dove	38	6	44	4
Collared Dove	2		2	1
Cuckoo	11	2	13	
Barn Owl	19		19	
Little Owl	7	3	10	
Tawny Owl	15	2	17	1
Long-eared Owl	6		6	
Short-eared Owl	10		10	3
Nightjar	3	1	4	
Swift	24	2	26	2
Kingfisher	1		1	
Green Woodpecker	1		1	
Great Spotted Woodpecker	1		1	
Wryneck	2	1	3	
Wood Lark	16		16	
Skylark	169	2	171	3
Swallow	259	17	276	8
House Martin	25	4	29	
Sand Martin	61	3	64	1
Rook	50	10	60	2
Jackdaw	10	8	18	
Magpie		3	3	
Jay	16	1	17	
Great Tit	145	32	177	
Blue Tit	379	72	451	
Coal Tit	28	1	29	
Marsh Tit	13	2	15	
Willow Tit	24		24	
Long-tailed Tit	18		18	
Nuthatch	1	5	6	

Species	1949 1957	1958	Grand Totals	Total Recoveries*
Tree Creeper	16	1	17	
Wren	56	8	64	1
Dipper (Black bellied race)	1		1	
Mistle Thrush	37	7	44	
Fieldfare	9		9	
Song Thrush	440	66	506	5
Redwing	14		14	
Ring Ouzel	1	1	2	
Blackbird	780	114	894	16
Wheatear– Greenland Wheatear	131	3	134	1
Stonechat	8	1	9	2
Whinchat	26	1	27	
Redstart	99	20	119	
Black Redstart	22	7	29	
Nightingale	126	9	135	
Bluethroat	4	1	5	
Robin	461	39	500	3
Grasshopper Warbler	8	5	13	
Reed Warbler	68	6	74	
Sedge Warbler	98	13	111	6
Aquatic Warbler	1		1	
Melodious Warbler	2		2	
Icterine Warbler	1	3	4	
Blackcap	29	2	31	1
Barred Warbler	4	1	5	
Garden Warbler	39	22	61	
Whitethroat	621	51	672	20
Lesser Whitethroat	37	2	39	
Subalpine Warbler	1		1	
Willow Warbler	463	34	497	1
Chiffchaff	37	6	44	
Wood Warbler	11		11	
Goldcrest	32	12	44	
Firecrest	1		1	
Spotted Flycatcher	43	9	52	
Pied Flycatcher	91	20	111	
Red-breasted Flycatcher	1		1	
Hedge Sparrow	336	38	374	
Meadow Pipit	300	38	338	9
Tree Pipit	11	3	14	
Rock Pipit	6	1	7	
Pied Wagtail	55	9	64	1
White Wagtail	1		1	
Grey Wagtail		4	4	
Yellow Wagtail	110	10	120	1
Blue-headed Wagtail		5	5	
Waxwing	1		1	
Great Grey Shrike	2	1	3	
Woodchat Shrike		1	1	
Red-backed Shrike	102	1	103	
Starling	361	17	378	7
Greenfinch	667	35	702	4
Goldfinch	28	1	29	
Linnet	371	7	378	6
Bullfinch	10	8	18	
Chaffinch	591	34	625	2
Brambling	259	16	275	1
Yellow Bunting	146	35	181	
Corn Bunting	5		5	
Ortolan Bunting		1	1	
Rustic Bunting		1	1	
Reed Bunting	188	7	195	
Lapland Bunting	5		5	
Snow Bunting	170	5	175	1
House Sparrow	569	8	577	1
Tree Sparrow	68	9	77	1
House x Tree Sparrow Hybrid	1		1	
GRAND TOTALS	10,420	1,074	11,494	142

ANNUAL RECORD

1949–50 :	1,254 birds of 60 species.	1955 :	1,237 birds of 73 species.
1950–51 :	1,060 birds of 57 species.	1956 :	1,293 birds of 78 species.
1951–52 :	1,466 birds of 71 species.	1957 :	1,311 birds of 82 species.
1952–53 :	1,017 birds of 77 species.	1958 :	1,074 birds of 94 species.
1953–54 :	1,782 birds of 76 species.	1949–58 :	11,494 birds of 138 species.

*Including initial local "re-traps" of birds known or believed to have migrated since ringing, but not of residents.

SELECTED RINGING RECOVERIES

(Notified in 1958)

	Ringed	*Recovered*
Fulmar Petrel	Cromer. 30.6.56 (full grown).	Dead in fishing net off S.W. Norway. July 1958.
Heron (2 nestlings)	Wiveton. 18.5.58.	Dead near Peterboro' 23.9.58; dead Wisbech St. Mary 19.9.58.
Heron	Deeping St. James, Lincs. 28.4.56 (as nestling).	Bayfield Hall, Holt. 7.2.58.
Teal	Staraya Russa, Novgorod Government, U.S.S.R. 10.7.57.	Brundall. 23.1.58.
Teal	How Hill, Ludham. 4.1.58.	Buren, Isle of Ameland (Friesland) Holland. November 1958.
Mallard	How Hill, Ludham. February 1955.	Near Peno (Velikie Luki), U.S.S.R. 27.4.55.
Mallard	How Hill, Ludham. 15.2.58.	Lake Vectilza, near Balvi, Latvian S.S.R. 31.8.58.
Mallard	How Hill, Ludham.	Recoveries notified from Holland (1), Norway (1), Sweden (4) and Finland (1).
Pintail	Oudesluis, Noord Holland. 28.11.57.	Blakeney. 22.12.57.
Shoveler	Near Luvia, S.W. Finland. 19.7.58 (as young).	Hickling Broad. 31.10.58.
Sheld-duck	Estuary of River Weser, Germany. 24.8.52. (Caught while in moult).	Wootton marshes. 26.1.55.
Pink-footed Goose	First ringed by netting in Lincs. 2.12.50 and given second ring on breeding grounds in Iceland. 21.7.53.	Hunstanton boating lake. 22.1.58.
Marsh-Harrier	Hickling Broad. 21.6.56 (as nestling).	Amiens (Somme) France. 23.8.57.
Marsh-Harrier	Hickling Broad. 21.6.56 (as nestling).	Near Spalding, Lincs. 3.6.57.
Marsh-Harrier	Hickling Broad. 24.6.58 (as nestling).	Holbeach marsh, Lincs. 14.9.58.
Kestrel	Thornage, Holt. 29.6.58 (as nestling).	Near Wigan, Lancs. 27.9.58.
Coot	Abberton Reservoir, Essex. 21.2.55. (Caught and released Hauge, Kjellerup, (Jutland) Denmark. 24.4.56).	Rockland St. Mary. 26.1.57.
Oystercatcher	Blakeney Point. 27.7.53 (as nestling).	Netley, near Southampton, Hants. 30.1.57.
Oystercatcher	Scolt Head. 1.7.58 (as young).	Imsouane, Morocco. 26.12.58.
Jack Snipe	Wisbech Sewage Farm. 1.10.57.	Lozere, South France. 21.11.57.
Curlew	Stromsholm, Vastmanland, south Sweden. 4.7.26 (as nestling). This bird was 31½ years old.	Blakeney. 25.1.58.
Dunlin	Amager, Denmark. 19.9.53.	King's Lynn. January 1955.
Greater Black-backed Gull	Rott (Rogaland), Norway. 29.6.56.	Gt. Yarmouth. 16.11.56.

Herring-Gull	Vardo, Norway. 19.7.55 (as nestling). The first record to be received from this northernmost part of the herring gull's breeding range in Europe.	Smith's Knoll light-vessel. 29.10.55.
Common Gull	Langenwerder, Poel Island, Mecklenburg, Germany. 29.6.58 (as young).	Breydon. 9.11.58.
Common Gull	Heroy, Vest-Agder, South Norway. 28.6.57 (as young).	Scolt Head. 15.12.58.
Common Gull	Island of Poel, Mecklenburg, Germany. 12.7.51 (as young).	Brancaster. 10.11.58.
Black-headed Gull	Cley. 21.6.53 (as nestling).	Nesting where ringed 1956–58 inclusive.
Black-headed Gull	Eksund, Norrkoping, Sweden. 6.6.57.	Salthouse Heath. 4.5.58.
Black-headed Gull	Alderfen Broad. 23.6.56 (as young).	Salsburgh, Lanarkshire. 8.9.58. (295 miles N.W.).
Black-headed Gull	Alderfen Broad. 14.6.57 (as young).	Woodplumpton, near Preston, Lancs. 9.8.58 (190 miles W.N.W.).
Common Tern	Scroby Sands. 21.7.57 (as nestling).	Monrovia, Liberia. 15.6.58.
Common Tern	Scroby Sands. 6.7.58 (as nestling).	Joal, Senegal. 22.11.58.
Common Tern	Scolt Head. 2.7.57 (as nestling).	Yoff, near Dakar, Senegal. 2.2.58.
Common Tern	Scolt Head. 3.7.57.	Monrovia, Liberia. 15.6.58.
Common Tern	Scolt Head. 30.6.58.	M'Bour, Senegal. 10.11.58;
Sandwich Tern	Blakeney Point. 23.6.58 (as nestling).	Dakar, Senegal. 30.10.58.
Sandwich Tern	Blakeney Point. 15.6.58 (as nestling).	Esmoriz, North Portugal. September 1958.
Sandwich Tern	Blakeney Point. 18.6.58 (as nestling).	Aberlady Bay, E. Lothian, Scotland. 24.8.58.
Sandwich Tern	Scolt Head. 6.7.56 (as nestling).	Joal, Senegal. 5.5.57.
Sandwich Tern (2 nestlings)	Scolt Head. 9.7.57.	Happisburgh. 17.8.57 ; Wrangle, Lincs. 15.8.57.
Sandwich Tern (2 nestlings)	Scolt Head. 9.7.57.	Dakar, Senegal. 19.2.58 and Dakar. 30.10.58.
Sandwich Tern (4 nestlings)	Scolt Head. 18.6.58.	Crowborough, Sussex. 26.8.58 ; two at Dakar, Senegal, 23.10.58 ; Banana, Congo River, Belgian Congo, 19.12.58.
Collared Dove	Norfolk Site A. 9.9.56 (nestling).	Breeding Norfolk Site B. May 1958.
Tawny Owl	Salthouse Heath. 20.5.56 (nestling).	Caught and released, Great Witchingham. 18.8.58.
Swift	Cley. 16.7.57 (adult with young).	With 2 young under same tiles. 4.7.58.
Swallow (B64159)	Cley. 24.9.54 (adult male).	Nested where ringed 1953–57. Returned 27.4.58 ; found dead 3.6.58.
Swallow (A72833)	Cley. 13.5.56 (adult female).	Nested where ringed 1957–58.

Swallow (E16553)	Cley. 1.9.57 (adult male).	Nested where ringed 1958.
Rook (2 nestlings)	Marsham, Norwich. 22.4.57.	Whissonsett. 12.4.58; Attleborough. 31.10.58.
Great Tit	Mundford near Thetford. 25.5.57 (as nestling).	Hargrave near Bury St. Edmunds. 12.10.57 (20 miles S.).
Blue Tit	Walberswick, Suffolk. 27.10.57.	Little Plumstead. 15.4.58 (25 miles N.N.W.).
Fieldfare	Heskestad (Rogaland), Norway. 1.6.55.	Haddiscoe. 1.2.56.
Song-Thrush	Havering near Romford, Essex. 12.2.56.	Eastmoor near Stoke Ferry. 13.7.57 (67 miles N.N.E.).
Blackbird (X33087)	Cley. 12.4.53 (immature male).	Resident where ringed 1953–58.
Blackbird	Cley. 3.1.58 (adult).	Ronde, E. Jutland, Denmark. 1.5.58.
Blackbird (W40029)	Cley. 31.10.55 (immature male).	Caught and released Ponteland, Northumberland. 15.3.58.
Blackbird	Heligoland. 13.10.58 (migrant).	Caught and released, Cley. 16.11.58.
Blackbird	Island of Ledskar, Bay of Lovsta, Uppland, Sweden. 20.8.58 (as adult).	Dudgeon light-vessel. 23.12.58.
Continental Robin	Cley. 30.3.58 (drift migrant).	Caught and released, Winterton. 18.12.58.
Sedge-Warbler (A12375)	Cley. 1.5.55 (adult)	Nested where ringed 1955–58.
Sedge-Warbler (A56730)	Cley. 22.4.57 (adult)	Nested where ringed 1958.
Whitethroat	Dungeness, Kent. 4.5.57.	Spixworth, near Norwich. 12.5.57. (120 miles N.).
Whitethroat (A56731)	Cley. 23.4.57 (adult).	Nested where ringed 1957–58.
Whitethroat (C31664)	Cley. 26.6.57 (juvenile).	Where ringed. 1.5.58.
Whitethroat (C31390)	Cley. 18.5.57 (adult).	Where ringed. 2.5.58.
Whitethroat (C31705)	Cley. 21.7.57 (adult).	Where ringed 5.5.58.
Whitethroat (A56669)	Cley. 28.5.56 (adult).	Nested where ringed 1956–58.
Starling	Runde (Sunn More), Norway. 6.6.57.	Haisboro' light-vessel. 24.10.57.
Starling	Ryda, Skaraborgs, S. Sweden. 24.5.57 (as nestling).	Dudgeon light-vessel. 19.10.58.
Starling	Rybatschi, Kaliningrad District, U.S.S.R. 24.4.57 (as adult).	Inner Dowsing light-vessel. 25.11.57.
This bird was ringed at the re-named Rossitten, East Prussia, observatory which has recently been opened again by the Russians.		
Starling	Island of Wangeroof, East Frisian Islands. 23.7.57 (as young).	Inner Dowsing light-vessel. 25.11.57.
Tree Sparrow	Cley. 15.12.57.	Near Rheine, Westphalia, N. Germany. 19.11.58.
First foreign recovery of this species.		

NORTH NORFOLK STARLING ROOSTS, 1958

R. P. Bagnall-Oakeley

The very large numbers of immigrant starlings in Norfolk this winter—probably the largest ever—make it increasingly important to record some of the more significant facts regarding their roosts.

The establishment of the first of these was reported by W. G. Bailey in mid-August—a very early date—when about 5,000 birds were assembling every evening in a hawthorn thicket just north of Litcham. These were almost certainly young and non-breeding adults. This roost grew rapidly and had reached about 20,000 by the end of the month. During September the numbers fluctuated considerably and began to dwindle in October until by the 10th the roost was deserted. Small autumn roosts of this kind are observed every year in a variety of sites, though reedbeds, hawthorn thickets and low secondary growth, where woodland has been felled, are preferred. These small roosts gradually become absorbed into the very large ones which usually begin in mid-October and increase with great rapidity as and when the immigrant birds arrive. By late October almost all the smaller roosts have been evacuated, though sometimes, as was the case this year at North Creake they became occupied again as overflows to the main roosts, when these reached saturation point.

This year the North Creake roost began to be occupied in mid-October, though two small plantations about threequarters of a mile to the north of the main roost, had both been used by large numbers of birds (c. 100,000) since the beginning of the month. The huge immigration of the night of October 18th–19th and the nights and days of the following week, was reflected in the enormous build-up in numbers at the North Creake roost and the establishment of a new roost at Lower Gresham which was first occupied on 19th October. Both of these roosts continued to build up, as more and more starlings came in from abroad. In both roosts the first week in November showed very marked swelling of numbers.

An interesting point revealed by observation of homing flights to these roosts was the curious distribution of areas served by them. The smaller Gresham roost regularly accommodated all the birds using the coastal areas north of lines drawn from the site to Stiffkey and Mundesley, even though the birds in the extremities of these areas were far closer to other roosts. From the south the Gresham roost drew birds from only just north of Norwich and many of these usually flew almost parallel with the Norwich—Holt road until they reached Heydon where they either turned eastwards to a collecting area on Oulton aerodrome or joined other flocks moving north-eastwards across their line of flight on a direct route to the roosting site.

This habit of flying parallel to a nearly straight main road made the estimation of speeds of "homing" flight very easy and on ten occasions in conditions varying from flat calm to strong head and tail winds these speeds were found to vary less than two miles per hour on each side of 34 miles per hour. Previous estimates of speeds of homing to other roosts have been the same.

The possible use, as guide lines of such easily followed features as roads and railways, leads to an interesting point which might add weight to such a speculation—the almost complete inability of starlings to home in dense fog. On several nights this year large roosts have been almost empty, while reports of starlings crowding into trees around lighted streets and farmyards, military camps and other improbable roosting sites on these foggy nights, have confirmed that these were lost birds which failed to find their way home. Two such nights were January 15th and 31st, 1958 when flocks of starlings roosted almost anywhere from trees in Melton Constable and Briston streets to the vicinity of lighted chicken houses at North Elmham and Holt.

Two further facts are worth recording briefly. The first was the large mortality among incoming starlings on the night of October 18th–19th when low-flying birds in misty conditions appeared to have been attracted by the lights of military camps along the coast and flew into the maze of wires which all such installations possess. Most of the corpses examined lay immediately below the wires and appear to have been killed instantly by fracturing skulls or breaking necks. Indeed, the pattern of dead starlings on the ground conformed with that of the wires overhead, with those running east to west taking a far higher toll than the north to south ones. This would suggest that though the birds were attracted to the camp sites by their lights, they were trying to continue their flight landwards when they struck the wires. Examination of numerous corpses showed that the force of impact must have been considerable. Over 3,000 dead birds were counted when looking for rings, none of which was found.

The last fact relates to the sudden changes of roosting site which regularly take place at least once each winter. North Creake was evacuated overnight on December 22nd, 1957, though on several nights during the previous week only a small proportion of the total birds returned and large flocks roosted in a variety of woods and copses up to 20 miles away, as if prospecting new sites. The greater part of the North Creake birds moved to the shrubberies round Heydon Hall a distance of 17 miles. Since 32 miles appears to be the maximum that starlings will fly in returning to roosts, a considerable population of the birds which returned nightly to North Creake from the west, north-west and south-west must have formed new roosts or found others more easily within their range. This year both the big roosts were still occupied at the end of

December and numbers seem to have remained stable since a peak was reached at both sites in late November.

In compiling the notes from which these paragraphs have been written, I am grateful to numerous observers who are sufficiently interested and observant to feel that what they have seen is worth recording. I shall be grateful for any observations on starlings especially those relating to roosting habits and winter behaviour, from anyone and at any time.

Red-breasted Flycatcher

CLASSIFIED NOTES

The Wash and Fen records, which have been highly selected, have been taken from the draft of the Cambridge Bird Club Report. Important records from Wisbech Sewage Farm, part of which is on the Lincolnshire side of the county boundary, have also been included. Fuller details of these records, and of many others, may be found in the *Cambridge Bird Club Report* for 1958.

The number preceding the name of each bird refers to the *B.O.U. Check-list of the Birds of Great Britain and Ireland* (1952) where the scientific name may be found. All records refer to 1958, unless otherwise stated. Where no initials appear after a record, details have been supplied by many observers.

1 Black-throated Diver : North coast : Singles on twelve dates at Holme, Holkham, Wells, Cley, Salthouse and Weybourne up to May 17th and from Aug. 29th. East coast : 2 off Horsey, Oct. 12th (MJS). Inland : One, Hardley flood, March 21st–April 19th (MRR, MJS).

2 Great Northern Diver : North coast : One at Morston, April 7th (CO) and one, in summer plumage, off Scolt May 21st (PJM) are the only records.

4 Red-throated Diver : Inland records only are given. One long dead by river Wensum at Taverham, Jan. 7th (LWL) ; one injured near overhead cables at Wighton, Feb. 2nd (RPB-O). Broads area :

2, Horsey Mere, Jan. 9th (GC), singles at Hickling, March 25th and Oct. 13th (GEB) ; river Thurne at Martham, April 23rd (HCB) and Ranworth Broad, Dec. 28th (*per* PRB).

5 **Great Crested Grebe :** Summer counts of *adults :* Broads : Rockland, 24 ; Alderfen, 2 ; Hoveton Great, 16 ; Ranworth, 18 ; Hickling, 24 and Martham, 4. Breck : Didlington, 2 ; Stanford, 2 ; Mickle Mere, 9–10 ; Hill Mere, 3 ; Stradsett Lake, 4 ; Narford, 4 ; Narborough gravel pit, 2 and Thompson, 4. Other waters : Taverham gravel pits, 2 ; Fustyweed gravel pits, 4 ; Lenwade gravel pits, 2 ; Seamere, 10 and Holkham, 4. Wash : 100 estimated between Snettisham and Holme, November 23rd (CBC).

6 **Red-necked Grebe :** North coast : Cley : Singly on Aug. 25th (CJC), Sept. 17th and 20th, Oct. 6th–9th and Nov. 1st (CO) ; 4 off Blakeney Point, Nov. 23rd (CJC). Broads : Singles at Surlingham Broad, March 2nd–18th and at Rockland Broad during second week of March (EAE) and on river Chet at Hardley, April 2nd (MRR).

7 **Slavonian Grebe :** North coast : 1–4 on nine dates at Wells, Blakeney and Cley up to Feb. 9th and from Sept. 28th. Broads : One, Hickling, Jan. 22nd (EP). Wash : Hunstanton, records include 4 on Feb. 16th (CBC).

8 **Black-necked Grebe :** North coast : 2 in Brancaster harbour, Jan. 23rd–27th (RC), one at Salthouse, Feb. 20th (HH) and one at Cley, Nov. 16th (CJC). Wash : Hunstanton : 1–3 till March 16th and 3 on Nov. 23rd (CBC).

16 **Manx Shearwater :** North coast : One off Scolt, Aug. 24th (RC) ; Cley : one Aug. 6th and small passage second week Sept., with one on 25th.

26 **Fulmar Petrel :** Maximum number at Weybourne was 71 on April 29th (RPB-O) and 28 at Cromer, Feb. 23rd. First eggs seen May 23rd and on 26th one sitting bird was trapped at Cromer by a small cliff fall. The bird was released but the egg was broken. Breeding successes as follows : Overstrand–Cromer (one young) ; Cromer–East Runton (14 eggs, 11 young reared and 9 ringed) ; East Runton–West Runton (6 eggs, 5 young ringed) ; West Runton –Sheringham (4 eggs, 3 young ringed) ; Sheringham–Weybourne (about 4 young. At least 10 other nests robbed by boys). At least 24 young reared and 17 of them ringed. Summary by PT. First birds returned to breeding cliffs at Sheringham, Dec. 6th (*per* PRC) and at Cromer and West Runton on 18th (PT). Other interesting records : 2 flying low over Blickling Lake, May 10th ; 2 attempting to land on Cromer church tower, June 27th (CDR). 1–2 at Hunstanton, April 28th (HM-G).

27 **Gannet :** Coastal records all months from April to Dec. Peak passage during first week Sept. with over 50 off Blakeney Point on 5th. Inland, one found exhausted at Gissing 25 miles from sea, April 11th, was later released at Lowestoft (*per* MJS).

28 Cormorant : East coast : Large numbers on Scroby Sands, Dec. 7th in groups of up to 50 (RHH).

29 Shag : Unusual numbers reported in Bedfordshire and neighbouring counties during Feb. During this month one picked up inland at Taverham on 25th (LWL) ; up to 4 seen at Stiffkey and 3 at Wells (HH). 10 other north coast records of singles up to April 4th and from Aug. 1st. Another inland at Hardley flood, Dec. 14th (MRR). Wash records include 4–5 at Hunstanton on March 2nd, where 7 and 3 dead birds on April 13th and 2 on 27th and May 11th (CBC).

30 Heron : Details of heronries as follows :

Borders of Wash : Snettisham, 12 nests. *Fenland :* Islington, 69 ; Denver Sluice, 28. *Breckland :* Black Dyke. Feltwell, 2 ; Wretham Park, 5 (AEV) ; Thompson Water, 2 (AWK) ; Narford Lake (occupied for first time since 1950), one (PCB). *Mid-Norfolk :* Kimberley Park, 16 (PRB). *Broads area :* General McHardy's Wood, Hickling, 2 ; Whiteslea, 2 ; Heigham Sounds Wood, 6 (EP) ; America Wood, Earsham, 14 (JWM) ; Fishley Carr, Acle, 5 ; Upton, 8 (RJ) ; Wickhampton, 31 (ETD, MJS) ; Calthorpe, one (*per* ED) ; Buckenham, 36 ; Mautby, 15 ; Ranworth, 38 (PDK, MJS) ; Ranworth Marshes (Horning Hall), one (RB) ; Ormesby Broad, one (EGS). *North Norfolk :* Melton Constable, 9 (RPB-O) ; Holkham Park (Obelisk Wood), 14 (*per* MJS) and Wiveton Hall, 4 (RGB, CO). Total, 322 nests. None nested at Horstead.

31 Purple Heron : Broads : One at Horsey Mere, May 10th stayed several days (GC).

37 Little Bittern : Broads : One at Buckenham, May 7th (*per* MJS). North coast : One at Cley, Aug. 26th (GP). Satisfactory details received.

38 Bittern : Breck : Probably bred at Thompson Water where birds seen and heard booming from March 29th (PJG, AWK, AEV). A new locality.

42 Spoonbill : Broads area : Breydon, one May 11th ; 2, 17th–24th and 2 from June 7th till July 9th (RHH). Hickling, one May 11th–17th (GEB, EP). North coast : Burnham Overy, one Aug. 25th (RPB-O). Cley, one April 25th, 2, May 10th–21st and one, Sept. 5th–15th.

47 Garganey : North coast : First, Cley, March 10th (HH) with 10 there April 2nd but only one pair nested (WFB). Broads area : Breeding season records from Hardley flood (MRR), Hickling and Strumpshaw Common (MJS).

49 Gadwall : Continues to increase in East/North Norfolk. 30 at Hickling, Feb. 20th (EP) and 15 there Sept. 26th (GEB) ; at least one successful nest at Hoveton Great Broad (MJS) ; minimum of 20 pairs at Rainham Park Lake, June 17th and 12 broods seen each with

4–9 ducklings (PCB); one successful nest at Cley marsh (WFB). Breck: Autumn/winter counts include 40 at Narford, Dec. 29th and 40–60, West Acre gravel pit, Sept. 13th–Oct. 20th (DW); 40, Mickle Mere, Dec. 27th (AEV).

50 Wigeon : Summer records include 7 at Breydon, May 10th (RHH) and one on 17th (MJS); 3 at Cley till mid-May.

52 Pintail : East coast: Breydon, maximum of 70, Feb. 28th–March 2nd falling to 50 by April 19th. One pair nested on same marsh where a pair bred successfully in 1949. 7 ducklings hatched between May 16th–17th (RHH). North coast: Maximum of 24 at Cley, March 31st and one pair bred (WFB). Fens: Ouse Washes, maximum of 2,800 on March 9th (CBC).

53 Shoveler : Broads area spring counts include 60 on flooded marshes, Rockland, March 4th (JES); 30 drakes Hardley flood, April 4th (MRR) and 50, Hickling, April 2nd–3rd (GEB).

55 Scaup : North coast: Apart from 45 at Blakeney, Oct. 6th and 50 there, Dec. 1st (WE); no party exceeded 6 in number. Broads: Pair at Rockland, March 4th April 4th and a drake on 14th (JES).

56 Tufted Duck : Breeding records only are given. 2–3 pairs nest regularly at Bolwick Lake (WLB). Breck: one brood, Cockley Cley Lake; 2 broods, Didlington Lake (CRK); one brood, Thompson Water (AWK) and 2 broods, Rush Mere (PH).

57 Pochard : Breeding records only are given. One brood, Rockland Broad (JES). Breck: Single broods, Rush Mere (PH) and Fowl Mere (PBL).

58 Ferruginous Duck : An adult drake, Cawston Manor Lakes, March 16th–30th. One Cley marsh, April 25th–26th (WFB) was probably the same bird.

60 Golden-eye : North coast: Maxima of 64, Brancaster, Feb. 6th (RC) and 44, Wells harbour, on 12th (JMI). Wash: 70, Snettisham, Jan. 26th (CBC).

61 Long-tailed Duck : North coast: Sheringham, 30–40, Oct. 28th–29th (EMCE). Cley, 1–2 from Jan. 12th to April 17th with 5 on Feb. 19th and a drake, Dec. 9th (CJC). Blakeney, one, Jan. 16th; 1–2 on 30th and one, March 6th (WE). Titchwell, 3, June 5th (MM). Wash: Maximum at Hunstanton, 9 on April 13th (CBC).

62 Velvet Scoter : North coast: Recorded all months *except* Feb., April, July and Dec., but no party exceeded 17 in number.

67 Eider-Duck : A remarkable year and monthly maxima for the main localities are given. North coast: *Brancaster-Titchwell:* Jan. 90; Feb. 80; March 120; April 120; May and June 100; July 80; Aug. 125; Sept. 50; Oct. 120; Nov. 180; Dec. 160. *Morston-Cley:* Jan. 15; Feb. 20; March 68; April 80; May 6;

June 60 ; July 4 ; Aug.–Nov. up to 12 ; Dec. 100. Wash : *Holme-Snettisham :* present till May 4th with 70 on March 2nd and from Sept. 13th with 70 (45 drakes) on Sept. 21st (CBC).

Also recorded at Wells harbour, Jan.–March and in May with maximum of 28 on Jan. 30th (HH) and 200 reported by whelkers about 12 miles off Wells, May–July (*per* RPB-O). East coast : 30 (9 drakes) off Waxham, Oct. 25th (DL).

69 Red-breasted Merganser : North coast : Recorded from usual localities up to June 2nd (when one at Brancaster) and from Sept. 25th. No party exceeded 15. Wash : On East side maximum of 50 on Jan. 26th (CBC).

70 Goosander : Inland records from Ormesby Broad (one, Jan. 19th–JES), Taverham Lake (2, Feb. 21st–LWL), Gunton Great Water (one, March 8th–CDR) and in Breck at Rush Mere (one, March 4th–PH). North coast, 5, Cley, April 5th/6th.

71 Smew : 1–3 from usual localities until March 12th and from Dec. 1st.

73 Sheld-Duck : Inland breeding sites include : North Norfolk : Salthouse and Kelling Heaths, Hempstead woods and old pits and quarries at Binham, Langham and Glandford (HH), Kelling Hall (RPB-O) and Gunton Park (PT). East Norfolk : Hickling Broad. Moult migrants passing east off Scolt on July 4th (15) and on 19th (16 birds–RC).

76 White-fronted Goose : Breydon area : 150 at Halvergate, Jan. 4th and 1,200 reached these marshes by 18th. This is largest number here since 1950–51 winter. They remained throughout Feb. and were last seen on March 6th when 300 flying out to sea. First autumn arrivals (3), Dec. 24th (RHH). North coast : Up to 12 on several dates at Cley, Wiveton and Stiffkey up to May 2nd and from Oct. 6th.

77 Lesser White-fronted Goose : East Norfolk : one in the Yare valley, with bean-geese, Jan. 19th (PDK, MJS) and March 2nd (REH, RCP). Detailed description received. The fourth fully authenticated county record.

78 Bean-Goose (*Anser a. arvensis*) : Yare valley : 67–78 from Jan. 1st until March 2nd. None reported again till Jan. 1959.

Pink-footed Goose (*A. a. brachyrhynchus*) : Breydon area : 29 on Bure marshes, Jan. 18th and 19 there, Feb. 16th. First autumn arrivals Oct. 12th but no party exceeded 23 (RHH).

80 Brent Goose : North coast : Blakeney, maximum of 1,100, Jan.–Feb. declining to 300 on March 13th but increasing to 1,000 on 15th. Last, April 17th. First autumn birds Sept. 14th, but no numbers till mid-Nov. when 200 and peak of 600 by Dec. 27th. Brancaster : up to 700, Jan. 1st–April 17th. On April 18th, only 2 remained (the gander had a broken wing). This pair stayed till

May 1st when the goose left. The gander stayed till end of July. First in autumn, Oct. 18th and peak of 300 by Dec. 26th (RC). Wells, up to 480 in Jan. (HH) declining to 30 by March 9th (PJW). Cley, 4 late birds, April 25th. East coast : Singles at Breydon, April 1st (PRB) and 13th (RHH). Fens : 6 on Ouse Washes, Feb. 23rd (CBC).

82 Canada Goose : In June, a county census showed a total of 1,277 *adult* Canada Geese (at least 102 breeding pairs with the remainder non-breeding birds). Of the breeding birds it is known that 51 pairs produced 215 goslings. They were reported from eight flooded gravel pits, seven stretches of river, 41 lakes and ponds, six Broads, Wolferton salt marsh and the North Walsham–Dilham canal. A total of 63 localities (43 observers).

The Canada Geese in the county fall into three groups. The largest of these groups is in North Norfolk and nearly the whole population winters at Holkham Lake. In 1941, as a result of disturbance and indiscriminate shooting by troops, the population at Holkham numbered about 200. By Sept. 1953, the Holkham population had increased to 440 and to 750 by early 1956. In 1958, there were 809 adults and 58 young there on June 23rd ; an estimate of 1,250 birds at the end of Nov. and an actual count of at least 1,000 on Dec. 2nd.

The second group is in Breckland with the main breeding colony at Narford Lake where 24 adults and 42 goslings in June. There were at least five other nesting waters in this area.

The third and most recently established group is in the Broads area with the main colonies in the Bure valley at Wroxham and Hoveton. These totalled over 40 adults and 14 goslings in June.

85 Whooper-Swan : North coast/Broads area : 1–5 from usual localities until April 21st and from Oct. 20th. Only large numbers : 25 flying east off Holkham, Jan. 26th (RPB-O) and 40, Rockland Broad, March 4th (EAE).

86 Bewick's Swan : Numbers lower than usual. North coast : Salthouse, one, Feb. 22nd (IFK). Cley, 4 west Nov. 22nd and 13 west, Dec. 23rd. East coast : Breydon, 12 on Jan. 18th (RHH) and 4 at Rockland, March 4th (JES). Fens : Ouse Washes, 300 from Jan. 12th through Feb. Only 45 on March 16th and one bird remained throughout the summer (CBC).

92 Rough-legged Buzzard : North : One, Sandringham estate near Flitcham, March 12th (JSA). Broads : One at Horsey, May 1st (GC).

95 Kite : North : One over Ridlington Common, March 3rd (CA, CL) and one over Kelling Heath on the 22nd (ACC). Broads : One over Woodbastwick, May 26th (HJC). Full details received. The first county records since 1881.

Immature white-tailed eagle

97 White-tailed Eagle : The immature bird at Cley at the end of 1957 again appeared there on Jan. 9th, 12th, 15th, 19th and on March 4th. It was first seen in the Snettisham–Heacham area of the Wash on Jan. 26th and then on several occasions until at least Feb. 14th (CBC).

99 Marsh-Harrier : Broads : 4 pairs bred in the Hickling–Horsey area and 10 young successfully reared. At least 11 in this area at end of year. Many records from coastal marshes, Jan. 14th–May 29th and Aug. 5th–Oct. 11th.

100 Hen-Harrier : North coast (Scolt to Salthouse) : At least 2 (one male) until April 25th with an immature male at Scolt ternery, May 21st (RC, PJM). At least 2 (again one male) from Sept. 8th. Broads : A male, Surlingham, till mid-March (EAE). A pair in Hickling/Horsey area until March 22nd and again from Dec. 1st. Breck : A male, Snarehill, Dec. 27th (AEV).

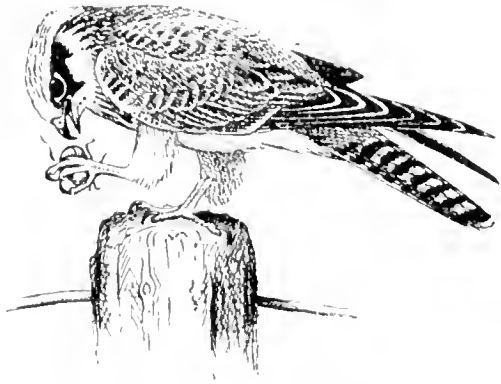
102 Montagu's Harrier : Breck : At the 1957 breeding site first noted April 26th (DW) and by May 4th one male and 3 females there. This single male was in charge of at least 2 females and 2 nests were found, each with 5 eggs. 4 young were successfully reared. Another pair also present at another locality from May 3rd (CRK, DW).

Broads : A male at Wheatfen, April 25th–May 2nd (EAE), a male at Horsey, May 10th and a female on 13th (GC), but none bred. North coast : A female at Cley, May 14th and a male at Scolt ternery on 22nd (PJM).

103 Osprey : Broads : Singly at Rockland, April 7th (EAE), Horsey, May 25th (GC) and Hickling, May 25th–26th and June 4th (GEB, EP). North : One at Selbrigg, April 28th (FM, JC).

104 Hobby : North : Singly at Blakeney, May 2nd (HH) ; Cley, May 10th, July 31st and Aug. 27th (CO) and at Thornage, May 30th (RPB-O). Broads : One, Whiteslea, June 19th (*per* EP).

107 Merlin : North coast : Usual records up to April 8th and from Aug. 27th, with one at Scolt ternery, July 30th (PJM).



Juvenile red-footed falcon

108 Red-footed Falcon : Broads : One at Whiteslea, June 12th (LP) and 22nd (GEB). North coast : A juvenile at Holme, Sept. 13th–16th (CBC). Details supplied.

117 Quail : North Norfolk : Burnham Overy, a pair May 25th (MB). Langham, one struck overhead wires, May 31st (WFB). Binham, heard May 23rd (RS). Cockthorpe, covey of 7, Aug. 21st (RPB-O). Blakeney Point, one May 29th–30th (WE). Morston, heard June 5th and Blakeney heard June 11th 21st (HH). Breck : Oxborough, one caught by a dog, Sept. 25th (CRK).

120 Water-Rail : North coast : In April, one at Blakeney Point on 13th, one dead under wires at Cley on 15th and another wired at Thornage on 20th (RPB-O).

121 Spotted Crake : Broads : Heard at Horsey, April 24th (GC).

125 Corncrake : Cley, one May 10th.

131 Oystercatcher : North coast : 4,000 at Wells, Oct. 29th (HH). Breeding records include 3 nests at Cley, 72 at Blakeney Point and 14 on south side of harbour, 5 at Stiffkey, 2 at Wells, 90 at Scolt, 2 at Titchwell and 2 at Holme. East coast : 3 nests Breydon marshes.
Wash : Maximum on east side was 4,000 on Sept. 28th (CBC).

133 Lapwing : Cley : Big weather influx, March 2nd, flocks remaining till 14th. Easterly passage March 27th–April 4th and on 15th. Main westerly passage of winter visitors daily from Oct. 15th–Nov. 7th with a few on 16th, several on Dec. 2nd and a marked influx during latter half of Dec.

135 Little Ringed Plover : North coast : Cley, singles on May 11th, 12th and 18th ; Salthouse, 2 on Sept. 26th (WFB). Broads : Hickling, one, Aug. 22nd (CJC). Fens : Wisbech Sewage Farm, 4 on July 10th and one throughout Aug. (CBC).

140 Golden Plover : Flocks recorded at usual localities with maximum of 250 at Horsey, April 26th (GC). 4 resembling Northern race at Cley, May 1st–5th.

142 Dotterel : North coast : Cley, one April 19th ; a juvenile, Oct. 11th–12th and probably the same bird on 25th–26th (CO) ; Blakeney, one, Oct. 21st–Nov. 3rd (HH).

146 Great Snipe : Cley : One flushed (at nil range) from dry plantation of five-year old pine trees, April 9th (RAR). Detailed description received.

147 Jack Snipe : Cley, late spring dates April 30th (PJM) and May 2nd (WFB).

148 Woodcock : Only breeding season localities not mentioned in 1957 Report are given. In central Norfolk bred Stratton Strawless and Felthorpe woods (JML). In the west, birds roding at West Bilney, Wormegay, Bawsey and at Sandringham Warren (HM-G). In the Broads area, 2–3 roding at Buckenham and Hassingham Broads (PDK, MJS).
Large numbers in coverts near north coast between Stiffkey and Sheringham, Oct. 18th–25th and further influx at Cley, Nov. 21st–22nd. Unusual record of 12–15 feeding in semi-flooded meadow at Cringleford, Nov. 25th (MJD).

151 Whimbrel : Spring passage in coastal areas from April 6th (BLS) with main movement May 1st–6th including 32 at Breydon on 4th (RHH). Autumn return, July 4th–Oct. 6th with large movements in Aug. At Blakeney, 200 on Aug. 3rd, 6th and 7th and up to 100, 9th–18th (HH). At Scolt, three flocks totalling 180 flying west, Aug. 29th (RC). At Holme, 100 passing west, Aug. 18th, 54 on 20th and 89 on 22nd (CBC).

154 Black-tailed Godwit : Records from north coast (Stiffkey–Cley), Broads (Hickling, Horsey) and Breydon, March 29th–June 25th and July 7th–Oct. 6th. Largest parties 12 at Hickling, May 5th (EP) and 17 at Breydon, July 7th (RHH). Winter records from Wash (2 at Terrington, Jan. 12th–CBC) and Blakeney Point (one, Dec. 22nd–PGRB). Inland, one at Kimberley Lake, April 29th (PRB).

155 Bar-tailed Godwit : North coast : Winter flocks include 100 at Morston and 170 at Brancaster. Broads : Hickling, 2, April 18th and 3, Sept. 21st (GEB). Wash : Maximum 1,100 between Snettisham and Heacham, Jan. 5th (CBC).

156 Green Sandpiper : Recorded all months except Dec. Winter records from Litcham, Fakenham, Corpusty Mill, Taverham Mill, Rockland Broad and Buckenham.

157 Wood-Sandpiper : North/East coasts : Spring passage noted at Blakeney and Cley, May 4th–16th with maximum of 6 on 15th and one display flighting and singing on 2 dates at Cley. Autumn return, July 4th–September 19th with maxima of 9 at Hickling, Sept. 7th (EP) and 10 at Cley on 9th. Inland, singly at Gunton Great Water, May 1st (PJM) and Sept. 6th (PT).

W. J. Woolston

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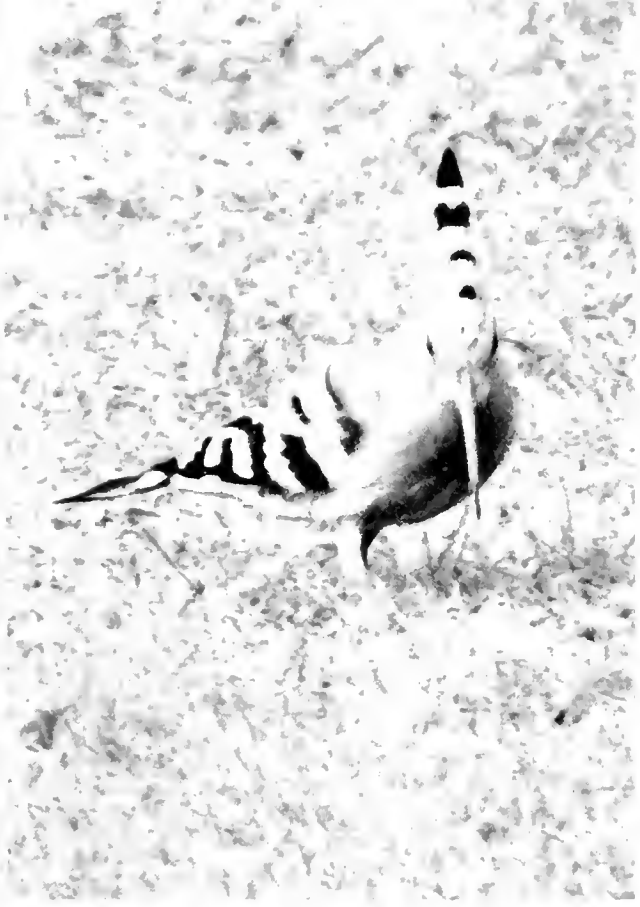
1958 was a very good year for Sandwich terns with over 1,500 pairs. This photograph shows part of the Scroby colony. Other record seasons have been 1940 (1,650 pairs), 1943 (2,000 pairs) and 1946 (1,900 pairs).



Copyright R. P. Bagnall-Oakeley

This hoopoe remained in a Blakeney garden for a week in early September.

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lpine swift at Trimingham, ugust 18th. The ninth county record of this rare vagrant.

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The autumn passage of Arctic skuas was very noticeable on the north Norfolk coast. This dark-phase immature bird was resting on Cley beach.

159 Common Sandpiper : Passage records April 4th–Oct. 22nd. Maximum 30 flying west at Brancaster, Aug. 18th (RC).

162 Spotted Redshank : North coast : Records from Brancaster, Burnham Overy, Morston, Blakeney and Cley, March 27th–May 28th and Aug. 3rd–Sept. 25th. Maxima 25 Blakeney Point, April 6th and 5 at Cley, Sept. 9th. Broads : Hickling, one, April 23rd, 1–2, Aug. 16th–Sept. 25th (GEB, CJC, EP). Fens : Wisbech Sewage Farm, maximum of 14 on Sept. 27th (CBC).

165 Greenshank : North/East coasts and Broads : Spring passage from April 15th (maximum 5 together). Autumn return from July 3rd with main passage mid-Aug.–mid-Sept. and late birds through Oct. and until Nov. 4th. Maxima 17 at Cley, Aug. 17th, 12 at Breydon, Sept. 8th and 20th, 18 at Blakeney, Sept. 3rd–10th and 32 there on 9th.

170 Purple Sandpiper : North coast : Records of 1–2 birds (and once 4) at usual localities on Jan. 20th and in periods March 1st–April 26th and Aug. 4th–Dec. 31st. East coast : 4 at Scroby, Aug. 24th (RHH). Wash : Hunstanton, up to 12 until March 2nd and up to 4 from Nov. 30th (CBC).

171 Little Stint : North coast : Cley, 2, April 30th, singles, Aug. 11th, 17th and 23rd. Main passage, Sept. 5th–21st with maximum of 4. 1–3 on 4 dates in Oct. and singly on Nov. 30th (PJM) and Dec. 7th (PC).

173 Temminck's Stint : North coast : Cley/Blakeney : 2, Sept. 2nd (PRC, CO) and one on 4th (CO). Fens : Wisbech Sewage Farm, one, Sept. 9th–13th (CBC).

178 Dunlin : North coast : Cley, an influx of long-billed birds (probably Northern race), with *tundrae*-type ringed plovers on May 30th.

179 Curlew-Sandpiper : Very scarce in autumn. At Cley Blakeney, 3, Aug. 11th, singly on 25th and 31st, one, Sept. 8th/9th and 1–2, Oct. 3rd–7th. East coast : A late bird at Breydon, Nov. 9th (MJS).

181 Sanderling : Wash : 1,000–2,000 at Wolferton, July 27th (MG).

184 Ruff : North/East coasts and Broads : 1–2 wintered on Glaven river meadows. Passage records from usual localities with main spring movement during first week of May when 80–100 on Cley marsh including males in full breeding plumage and 10 at Strumpshaw Common. Autumn passage, July 12th–Oct. 19th, with maximum of 12 at Salthouse, Sept. 6th. Fens : Wisbech Sewage Farm, peak of 80 on Sept. 20th and still 50 in Dec. (CBC).

185 Avocet : North coast : 2 at Brancaster, March 28th (RC), 6 at Blakeney, April 1st (WE). At Cley, 8 on April 1st, up to 14

between April 4th and 11th, 2, Sept. 4th–6th and one on 14th. 5, Burnham Overy Staithe, April 6th–8th (MB). East coast : 2 at Breydon, April 12th–27th (RHH).

186 Black-winged Stilt : North coast : One flew along shore at Holme and alighted on Thornham marsh, Aug. 31st (CBC). First county record since 1945.

189 Stone-Curlew : Since publication of the *Birds of Norfolk* (1930) status in North Norfolk has altered and up to 12 pairs now breed regularly at eight localities all within five miles of Holt.

193 Arctic Skua : North coast : Singly off Cley on 3 dates in last week of April ; off Scolt, one May 17th, 2, June 3rd and one, June 25th/27th. Autumn passage from July 17th until Oct. 21st with peak movements Aug. 3rd, Sept. 8th–10th and on 25th. East coast : One off Hemsby, May 18th (JES). Wash : An interesting winter record of 2 at Hunstanton, Jan. 12th (CBC).

194 Great Skua : North coast (Scolt, Blakeney and Cley), 1–2 on 17 dates between July 31st and Oct. 16th. Wash : Hunstanton, one, Sept. 21st and 4 on 25th (CBC).

195 Pomatorhine Skua : North coast : Cley, up to 3 on several dates between Sept. 5th and 20th (9 birds). Blakeney, singly on Aug. 30th (PNK) and Sept. 6th (EAC).

196 Long-tailed Skua : North coast : Scolt, one on Aug. 20th (RC). Cley, singly on Sept. 6th, 14th, 19th and 25th.

202 Glaucous Gull : North coast (Cromer–Blakeney Point) : 1–2 immature birds on many dates from Jan. 14th. One stayed until at least June 26th ; the other (a year older) remained until Aug. 1st when found dying. Other records include one at Wells, Jan. 30th (HH) and single adults at Cley, Feb. 7th and 23rd and March 8th–13th.

203 Iceland Gull : Cromer : One on March 16th (RAFC).

207 Little Gull : North coast : Up to 3 at Scolt, Blakeney and Cley in periods Feb. 27th–May 31st and July 5th–Sept. 24th with one on Dec. 19th. Broads area : Singly at Wroxham Broad, April 24th (RPB-O) and at Hardley flood, Oct. 19th–Nov. 16th (MRR). Fens : Wisbech Sewage Farm, one, Sept. 18th–26th (CBC).

208 Black-headed Gull : Numbers of *pairs* at breeding localities : North coast : Scolt, 40 but only 8 successful (RC) ; Wells, 150 (*per* WFB) ; Wareham, 200 (*per* RAR) ; Stiffkey, 25–30 ; Morston, 150 ; Wiveton/Blakeney fresh marsh, 88 (HH) ; Blakeney Point, 70 (WE) and Cley/Salthouse, 200–300 (WFB). Broads area : Alderfen, 215 (MJS, ETD) ; Cantley reservoir, 150 (GN) ; Hickling, 70–80 (EP). Wash : Wolferton, 200 (CBC). Fens : Wissington Beet factory, probably 350 (CBC). Total, about 1,950 breeding pairs.

211 Kittiwake : North/East coasts : Recorded every month and 2 pairs nested on Blakeney Point but no young reared. Summer

counts include up to 170 at Scolt in June, 166 in July and 180 in Aug. (RC, PJM) ; 50 at Morston, July 20th (HH) and 80 at Scroby, Aug. 24th (RHH).

212 Black Tern : Main spring passage first week of May. On May 1st, exceptional number of 160 at Rockland Broad (PDK), 20 at Seamere (CG), 35 at Hardley flood (MRR) and 15 at Cley. On 2nd, 40 at Hickling (EP), 21 at Rockland Broad (MJS) and 15 at Hardley (MRR). 9 records of up to 3 birds during June and first half July. Autumn passage from July 26th. Maximum at Cley 15–20 on Aug. 29th and Sept. 2nd ; at Hickling 32 on Aug. 18th (RPB-O) ; at Scolt total of 148 in 4 groups flying west on Aug. 31st (RC). Fens : 1–2 late birds at Wisbech, Sept. 20th–Oct. 26th with 4 on Sept. 26th (CBC). Wash : One late bird at Snettisham, Oct. 12th–30th (CBC).

213 White-winged Black Tern : Fens, an immature at Wisbech Sewage Farm, Sept. 21st–Oct. 7th (CBC). Details supplied.

217 Common Tern : First, April 12th ; last (Common/Arctic), Oct. 24th (RC). Breeding records include : North coast : Scolt, 1,200 nests, Blakeney Point, 1,140 nests. East coast : Scroby Sands, 250 nests. Broads : Ranworth, 3 pairs, Hickling, 2 pairs ; Ormesby, 4 pairs and How Hill, one nest.
Westerly passage of juveniles at Cley, Sept. 26th/27th.

218 Arctic Tern : North coast breeding records : Single nests at Scolt and Blakeney Point. 2 3 pairs nested unsuccessfully near Wells.

219 Roseate Tern : North coast : None bred, but 10 records of 1–2 birds between Scolt and Blakeney Point, May 17th–Aug. 25th.

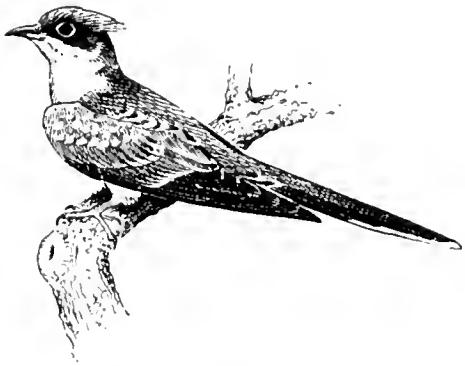
222 Little Tern : Recorded from April 20th with a straggler at Scolt until Oct. 18th (JFP). Breeding records include : North coast: Holme, 13 pairs ; Scolt, 29 nests ; Wells, 2 pairs ; Stiffkey, 2 pairs ; Blakeney Point, 84 nests and 5 pairs on south side of harbour. East coast : Winterton, 6 pairs ; Scroby, 7 pairs.

223 Sandwich Tern : Recorded March 27th–Oct. 19th. Breeding records : Scolt, 348 pairs ; near Wells, 23 pairs ; Blakeney Point, 800 pairs and Scroby Sands, 350 pairs. Spring peak at Cley was 400, April 26th.

226 Little Auk : North coast : Cromer, one freshly dead, Feb. 27th (PT) ; Cley, 5 on Oct. 18th and singles on 31st, Nov. 10th and 16th. Scolt, singles Dec. 3rd and 7th (RC). East coast : Waxham, one Oct. 25th (DL). Wash : Snettisham, one Nov. 15th–16th (CBC).

229 Black Guillemot : One just off Cley beach, June 13th (PNK).

230 Puffin : North coast : One dead at Salthouse, March 10th (HH) and one dead at Morston, April 13th (PRC). Cley, 6 west, Nov. 1st. Scolt, 3 on Aug. 10th–11th ; 5 on 16th and one on 27th (RC). East coast : One dead at Yarmouth, Dec. 18th (*per* ETD).



Great spotted cuckoo

234 Wood-Pigeon : Single winter-bred juveniles dead at Cley, March 26th and at North Creake, Dec. 28th.

235 Turtle-Dove : Recorded April 26th (HH) to Sept. 26th (PRC). At Cley, small flocks west on 8 days, May 6th–22nd and 6 west, June 14th. Wash : 50 at Wolferton, Aug. 10th (MG).

Collared Dove: (*Streptopelia decaocto*). *Site A :* At least 3 present June 8th and a nest with one egg, 19 feet up in a pine tree on July 12th.

Site B : Present from Jan. 30th till Oct. 11th, with up to 7 in early months of year. On May 24th, 2 young just able to fly but no other evidence of successful breeding although 3 pairs summered.

Site E : 2 regularly throughout Nov.

237 Cuckoo : First April 20th. Pair frequented Scolt Head throughout summer and at least 2 young successfully reared (PJM). 2, Blakeney Point, Aug. 17th.

238 Great Spotted Cuckoo : Winterton, a first-summer bird found dead in the dunes, Aug. 6th (GTW) is now in the collection at Norwich Castle Museum. The third county record.

248 Long-eared Owl : Only recorded from North Norfolk where at least one pair bred on Salthouse Heath ; one at Holme, Nov. 2nd (CBC) and one over North Creake starling roost in mid-Dec. (RAR, MG).

249 Short-eared Owl : Breeding records : Breydon, 2 pairs on marshes adjoining the estuary (RHH) ; Brancaster, a pair on the mainland near Scolt Head (RC) and Bircham area, 2 pairs (RPB-O).

252 Nightjar : Recorded May 3rd–Sept. 17th. Only breeding season localities not mentioned in 1957 Report are given. In North Norfolk, 3 breeding pairs Hempstead woods and one pair, Bodham Common (GHCB).

255 Swift : First April 24th, but main arrival from May 1st. Several records during second half Sept. and following very late birds in Oct. : Holme, 7 on 1st, 3 on 3rd and one on 5th (CBC) ; Scolt, one on 1st, 5 on 2nd, 2 on 3rd, one on 8th and 19th ; Cley,

Juvenile Bee-eater

singly on 5th and 13th ; Sheringham, one on 12th ; Cromer, 2 on 7th and 14th ; Overstrand, one on 13th ; Happisburgh, 2 from 9th till 16th and Poringland, one on 4th.

For an account of weather movements of swifts, 1955 57, in East Anglia, see *Bird Study*, Vol. 5 pp. 128–142.

256 Alpine Swift : Trimingham, one flying west with swifts, Aug. 18th, was filmed by RPB-O. The ninth county record.

259 Bee-eater : Morston, one Sept. 17th (HH) had no projecting tail-feathers so was probably a juvenile. The first county record since 1939.

261 Hoopoe : North Norfolk : One Sheringham, April 21st (EMCE). One Salthouse, Aug. 30th (EAC) ; another at Blakeney, Sept. 5th–11th and at Cley Hall Farm on 13th. Breck : One flying north Thetford Heath, May 4th (LL-E).

265 Wryneck : North coast : Drift migrants at Cley and Blakeney Sept. 2nd–18th with maximum of 8 on 4th ; total of at least 12 birds. Cromer, 2 on Sept. 6th (RAFC) and one on 10th (JHW). Holme, 2 on Sept. 3rd and one on 4th and 7th (CBC). East coast : One flew at night, into a bedroom of a house at Ridlington near Walcot, Sept. 2nd (*per* RMB).

272 Skylark : Cley, main autumn passage (west) Oct. 12th–Nov. 3rd.

273 Shore-Lark : North coast : Records from usual localities between Salthouse and Scolt up to April 28th (when 4 at Cley) and from Sept. 25th. Maximum 25 at Cley, April 4th.

274 Swallow : Recorded March 27th–Nov. 22nd/25th.

276 House-Martin : Recorded April 3rd–Nov. 4th. Young still being fed in a nest at Salthouse, Oct. 5th (PJW) and at Cromer on 15th (CDR).

277 Sand-Martin : Recorded March 27th–Oct. 11th.

278 Golden Oriole : Single males at Horsey, May 17th and 25th (GC). One at Scolt, Sept. 10th (Miss Louth) and 13th (RC). Details supplied.

281 Hooded Crow : Coastal records up to April 27th (with one at Winterton, May 18th–JES) and from Oct. 1st. Easterly exodus at Cley, March 29th and April 4th–8th. Main autumn influx third week Oct. (CO). The only report of over 15 birds was 28 at Stiffkey (HH).

282 Rook : At Cley, spring exodus of winter visitors March 17th, 27th/29th and April 1st/2nd. Autumn arrival Oct. 23rd–Nov. 9th (CO).

284 Magpie : Winter roost at Foxley contained up to 35 birds, but was down to 16 by mid-March (RPB-O).

290 Coal-Tit : Cley, one came in from sea, Aug. 28th (PCJ).

295 Bearded Tit : Broads : Breeding records from Hickling Broad/Heigham Sounds (25–30 pairs), Horsey (about 25 pairs) and Martham (at least 4 pairs). Up to 6 in vicinity of Barton Broad from mid-June. Winter records from Ranworth and Surlingham. North coast : 2 breeding pairs at Cley.

300 Black-bellied Dipper (*Cinclus c. cinclus*) : The bird at Lexham at the end of 1957 remained until Feb. 9th (WGB).

302 Fieldfare : Small weather movement at Cley, Jan. 23rd (CO) and last spring birds May 5th (PGRB). One dead Blakeney Point, Sept. 16th but no more till Oct. 3rd and main influx commenced on 19th.

304 Redwing : Flocks of up to 200 present at several localities until April 20th with one at Marham on May 12th (DW). First in autumn Sept. 23rd (GWC), but very few till main arrival Oct. 17th–25th. Further influxes Nov. 16th and 28th.

307 Ring Ouzel : Spring : Cley, singly on April 6th, 20th, 26th and 27th (CO) ; Holkham, 2 on April 15th (CO) ; Blakeney, one April 6th, 2 on 7th and singles on 15th and 18th (HH) ; Overy Staithe, one, April 6th (MB) ; Wiveton, one, April 20th (PRC) ; Horsey, 3 on May 2nd (GC).
Autumn : Cley, singles, Aug. 11th and Oct. 25th (CO) ; Blakeney, one, Oct. 18th (WE). Winter : Blakeney, one on Dec. 1st (HH).

308 Blackbird : North coast : Big influxes March 30th and April 5th/6th. In autumn, main arrival from Oct. 19th–26th with further influxes Oct. 30th, Nov. 1st–5th (many), 7th, 16th, 19th–21st and Dec. 1st.

311 Wheatear : Spring : First, Cley, March 24th with influxes March 27th–29th, April 4th, 20th (many, mostly males) and 27th (CO). Greenland wheatears (*Oenanthe o. leucorhoa*) passing through Cley, May 5th–21st with a marked influx on 20th.

Autumn passage July 30th Nov. 2nd (EMC) with peak numbers Sept. 3rd–5th. Greenland birds at Cley, Sept. 17th/18th and 25th–27th (CO).

317 Stonechat : 1–5 recorded up to April 20th and from Sept. 5th at Scolt, Morston, Blakeney Point, Wiveton, Cley, Sheringham, Hemsby, Hickling and Brisley, with 15 at Holme on Feb. 16th (CBC), when a small influx also noted at Cley.
Single pairs bred successfully at Kelling Heath (CLM), Dersingham Common (GJ) and Buxton Heath (RPB-O) where a freshly dead juvenile found Oct. 5th (DELH).

318 Whinchat : North coast (Scolt-Cley) : First April 12th (HH) and from April 27th to May 20th with small peaks on May 6th, 9th and 20th (CO). North/East coasts : Autumn passage Aug. 17th–Oct. 6th with peak numbers Sept. 2nd–9th. Breck : Bred, Brettenham Heath (GPD).

320 Redstart : North coast (Scolt–Cley) : Spring arrival from April 23rd with late male at Scolt on June 2nd (PJM). North/East coasts : Autumn passage Aug. 19th–Oct. 30th with large drift movement commencing Sept. 2nd and peaking on 4th/5th.

321 Black Redstart : One pair reared 4 young at Cromer (MW, CO). 2 pairs nested successfully in Yarmouth, at the Marina on Marine Parade and at the new Power Station on South Denes (RHH). A singing male in Norwich May 19th to July 9th (PDK).
1–4 observed on passage between March 30th–April 29th (with singles May 25th and June 1st) and from Sept. 3rd–Oct. 27th at Hunstanton, Scolt, Holkham, Wells, Blakeney, Cley, Salthouse, Sheringham, West Runton, Hemsby, Binham, and Harleston.

322 Nightingale : Spring arrival from April 23rd. Not fewer than 50 singing males along coastal belt Blakeney–West Runton and to about 3 miles inland (HH).

324 Bluethroat : North coast (Blakeney, Cley and Salthouse) : one, Aug. 20th with up to 6 drift migrants daily from Sept. 2nd–11th. Holme, one trapped, Sept. 3rd (CBC).

327 Grasshopper-Warbler : Spring arrival from April 24th (GHCB). Drift migrants on Blakeney Point, Aug. 30th–Sept. 5th (maximum of 5).

338 Aquatic Warbler : One at Holme, Aug. 20th (CBC–to whom details supplied).

340 Icterine Warbler : North coast : At least 11 birds during Sept. as follows : Blakeney Point, 3–4 (RJJ, CO) and Holme, 2, one of which was trapped (CBC) on 3rd ; Cley, one (MM) and Blakeney, one (HH) on 4th ; Morston–Stiffkey, 2 on 5th (HH) ; Titchwell, one on 6th (RJJ, DH) and Blakeney Point, one on 11th (RJJ, CO).

343 Blackcap : A winter record from Cley where a female, Dec. 16th–23rd (RAR).

344 Barred Warbler : North coast : Single drift migrants on Aug. 28th, 31st and Sept. 1st–7th inclusive also on 13th at Holme, Burnham Overy, Stiffkey, Morston, Blakeney Point and Blakeney (RPB-O, CBC, CO, HH). All were immatures.

346 Garden Warbler : Cley/Blakeney Point : Drift movement began Sept. 1st, numbers peaking at 70 on the 3rd. Further small influxes (re-determined passage) Sept. 12th/13th and 18th/19th ; last, Oct. 9th (CO).

354 Willow-Warbler : First, March 29th (AWK), but main arrival not till April 18th. Autumn passage noted on north coast from Aug. 12th, but obscured by big drift movement from end Aug.–Sept. 7th with peak numbers on 3rd/4th when 1–2 of the Northern race *acredula* at Blakeney Point (CO). Last, one singing, Oct. 1st (HH).

356 Chiffchaff : Spring arrival from March 28th. Last in autumn Oct. 11th when singles singing at Blakeney (HH) and Norwich (PDK).

357 Wood-Warbler : First, May 1st (HH). Pairs or singing males in breeding season at West Runton, Hempstead, Glandford, High Kelling (2 sites), Gresham's School woods, Weybourne and Wormegay (RPB-O, BAC, CBC, HH).

364 Goldcrest : At Cley, drift migrants March 28th–April 26th with maximum of 15 on March 30th.

365 Firecrest : One near North Walsham first week of April, with drift migrant goldcrests (CA). Another at Burnham Overy, Sept. 8th (RPB-O). Details supplied.

366 Spotted Flycatcher : Large drift movement noted on coast, Aug. 31st–Sept. 6th, with maximum of 50 on Blakeney Point, Sept. 4th/5th (CO).

368 Pied Flycatcher : In spring, singles at Blakeney, May 2nd and 6th (HH) ; 2 at Scolt on 14th (PJM) and one at Northrepps on 15th (JHW). Autumn passage noted at many coastal localities (with one Mousehold Heath, Norwich, Sept. 4th–PRB) from Aug. 4th (GC) until Sept. 21st (HH), but obscured by drift movement of late Aug./early Sept. when up to 50 per day at Blakeney Point (CO), 85 at Holme, Sept. 3rd and even larger numbers at Holkham on 4th (TC-S).

370 Red-breasted Flycatcher : One at Burnham Overy, Sept. 7th (RPB-O) and one at Blakeney Point on 13th (CO).

371 Hedge-Sparrow : Wells, 50–60 in pinewoods and dunes, April 5th–7th (CWH) during influx of blackbirds, robins and goldcrests.

376 Tree-Pipit : Spring arrival from April 23rd. At Cley/Blakeney Point, autumn passage from Aug. 5th merging into drift movement from Aug. 31st–Sept. 12th (maximum 25 on 2nd). Last, Sept. 28th.

379 Rock Pipit (*Anthus s. petrosus*) : Coastal records up to April 29th and from Sept. 11th. 1–2 birds resembling the Scandinavian race, *littoralis* at Cley, March 6th.

380 White Wagtail (*Motacilla a. alba*) : Cley/Blakeney : Spring passage April 6th–May 1st and in autumn, Sept. 5th–26th.

381 Grey Wagtail : Single *breeding pairs* at : Aylsham Mill (MISS RUST) ; Gressenhall (MISS PUDDY) ; Ebridge Mill (CA) and Briggate Mill (PRC) on North Walsham–Dilham Canal ; Letheringsett Mill (RPB-O) and in Breck at Ickburgh where 2 broods reared in same nest (AEV).

Migrants at Cley : 8 on beach, Aug. 3rd ; one in from sea, Sept. 5th and one, Oct. 22nd. Winter records from usual localities.

382 Yellow Wagtail (*Motacilla f. flavissima*) : At Cley, first March 30th, but no numbers till main arrival began April 15th. First females April 23rd and passage ceased on 29th. Autumn : small influxes, Sept. 3rd and 5th ; last, Oct. 10th (CO).

Blue-headed Wagtail (*M. f. flava*): Cley/Salthouse : A small influx of at least 6 birds of both sexes, April 23rd 27th (WFB). Kelling Heath, a male on May 25th (LL-E). Salthouse, a pair nested successfully and reared 5 young on the grazing marshes (JH, PGRB, CO).

383 Waxwing : An influx began in early Jan. with a further irruption from Nov. 19th.

January : In East Norfolk, 11 in Norwich on 14th and 6 on 21st. In the South, 2 at Ellingham Hall, 22nd–23rd. In the North, one at Blakeney, 7th and 3, West Runton, 24th ; 50 at Cromer, 4th, 9 on 8th, 12 on 16th and 3 on 19th ; 3 at Sheringham, 27th.

February : In the East, up to 8 Earlham Hall, 6th–19th ; 2 in Norwich, 21st ; 3, Forncett, 22nd 23rd. In the North, one at Fakenham, 10th–15th.

March : In the East, 4–11 in Norwich, 21st–23rd and singles at Thorpe, 16th and 30th. In the North, 5 at Cromer on 1st and 3 at Northrepps on 14th. In the West, 2 near Thetford, 16th.

November : One, Inner Dowsing light-vessel, 29th. In the North, 2 at Cawston, 20th ; 7 at Cromer, 19th.

December : In the East, 14 at Wheatfen, 20th–25th ; 2, Hempstead, 11th ; Horsey, 7 on 3rd and 5 on 11th. In the North, at Cley 8 on 8th, 25 on 9th, 11 on 11th/12th and 8 on 15th ; Blakeney/Morston, up to 26 from 13th–25th ; Stiffkey, 12 on 19th ; Holt area, present from 5th with 30 on 14th and same day 17 on Thornage road, 30–40 on 16th and up to 7, 28th–31st ; Wiveton, 3 on 10th ; Cromer, 3 on 11th and 24th and one on 25th ; Overstrand, 2 on 27th ; Brancaster Staithe, one on 15th and 3 arriving from sea, 26th.

384 Great Grey Shrike : Singles at Bodham Common, Jan. 19th (GHCB) ; Salthouse Heath, April 30th–May 7th ; Heckingham Common, May 14th (MRR) ; Glandford, May 27th and Cley, Nov. 9th (PRC).

386 Woodchat-Shrike : Salthouse Heath, a first summer male trapped and ringed, May 4th remained till 9th (RAR, CO). Buxton Heath, a male, June 15th (ETD). Details supplied.

388 Red-backed Shrike : Spring arrival from May 15th. Only breeding season localities not mentioned in 1957 Report are given : a male at West Runton (HH) and single pairs at Kipton Heath (DW) and Dersingham Common (GJ) ; also a male in Breck near Mundford, May 25th (AEV).

389 Starling : Winter Roosts, see pages 22–24.
North/East coasts : In autumn, main immigration occurred between Oct. 18th–25th and Nov. 1st and 6th–12th and was on a scale more immense than anything seen during the past nine years at least.

394 Siskin : Only recorded at Taverham where 1–2, Jan. 19th, Feb. 16th and March 26th (LWL).

395 Linnet : Cley, westerly spring passage, March 29th–30th and April 15th–29th.

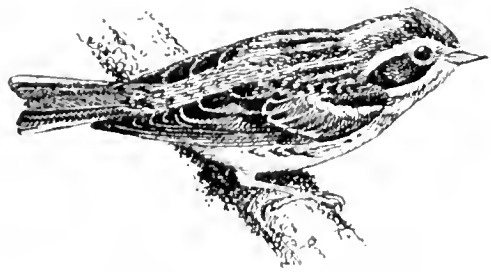
396 Twite : North coast : Recorded at usual localities up to March 25th and from Oct. 12th. Maxima : 100 at Holme (CBC) and 100 Blakeney Point (CJC) both in Jan. East coast : 25 at Breydon, Nov. 9th (MJS).

397 Redpoll : Only breeding season localities not mentioned in 1956–57 Reports are given : High Kelling, Blakeney, West Raynham, Shouldham (one nest found), Setchey, South Wootton, King's Lynn and in Breck at Narborough and Brettenham Heath.
At Scolt, one May 14th, 3 on 20th and singles on 29th and June 29th (PJM). Cley, 2 west on Sept. 28th.

404 Crossbill : North Norfolk : Small flock at Holkham, March 9th ; small parties up to 10, Kelling Pines, April 18th (RPB-O). Breck : Largest party 30 at Narford, Sept. 27th (DW).
Small irruption in July when 7 at Cromer on 11th (RAFC) ; 2 at Ridlington Heath on 15th and 9–10 there on 17th (CA) and on Wash, 10 at Wolferton on 13th (CBC).

407 Chaffinch : At Cley, very heavy westerly passage, Oct. 19th–27th with especially large numbers passing daily from the 23rd ; 400 west, Nov. 1st (CO).

408 Brambling : Recorded up to April 27th and from Oct. 11th. Largest number : peak of 500 at end of Jan., Cley Eye ; 500 at Saxlingham, Oct. 27th (RPB-O) and 250–300 at Marham, Nov. 13th (DW). No other flock exceeded 100.



Female Rustic Bunting

410 Corn-Bunting : A summary of recent records suggests little change in distribution since publication of the *Birds of Norfolk* (1930). The corn-bunting may be found throughout the year in almost every coastal parish from Yarmouth to Hunstanton. Peak numbers in these areas occur in March when flocks of 20–40 may be seen. It may also be found along the east side of the Wash, whilst it is common in the Fens. In the Breck, Ring Mere, Wretham Heath and West Acre are regular sites. In the remainder of the county, however, it is extremely local or absent.

416 Ortolan Bunting : Spring : Salthouse, one, April 24th (PGRB) and a pair there, May 9th (CO). Autumn : Stiffkey, one, Aug. 27th (HH) ; Cley/Blakeney : up to 6 daily during drift migration, Sept. 2nd–6th with singles 7th–9th and on 11th ; Scolt, 2, Sept. 4th (RC) ; Holme, 2, Sept. 7th (CBC).

419 Rustic Bunting : Blakeney Point, a female, Sept. 10th–13th was ringed on 12th (PW, CO). The second county record.

422 Lapland-Bunting : North coast (Salthouse–Stiffkey) : Up to 5 till mid-March and one, April 4th. First in autumn, Sept. 11th with 20 on Oct. 6th and till end of Nov. 50–100, in small scattered flocks, on Morston saltings during Dec.

423 Snow-Bunting : East coast : 4 at Yarmouth harbour mouth, March 4th/5th ; 30 at Breydon, Oct. 26th and 58 on Yarmouth beach, Nov. 8th. North coast : Blakeney/Cley/Salthouse : Up to 300 till spring departure and last on April 16th. Autumn arrival from Sept. 16th with 300 from Nov. 22nd onwards. Scolt : Up to 50 in early part of year ; first in autumn, Sept. 23rd and 70 by Nov. 7th.

425 Tree-Sparrow : Cley Eye, a flock of 1,500 during Jan., Feb. and early March were probably Continental immigrants (see page 21).

The following, not mentioned in the Classified Notes, were also recorded in 1958 (breeding species in italics) : *Little Grebe, Mallard, Teal,* Common Scoter, *Mute Swan, Sparrow-Hawk,* Peregrine Falcon, *Kestrel, Red-legged Partridge, Partridge, Pheasant, Moorhen, Coot, Ringed Plover,* Grey Plover, Turnstone, *Common Snipe,* Curlew,

Redshank, Knot, Greater Black-backed Gull, Lesser Black-backed Gull, Herring-Gull, Common Gull, Razorbill, Guillemot, *Stock-Dove, Barn-Owl, Little Owl, Tawny Owl, Kingfisher, Green Woodpecker, Greater Spotted Woodpecker, Lesser Spotted Woodpecker, Wood-Lark, Carrion-Crow, Jackdaw, Jay, Great Tit, Blue Tit, Marsh-Tit, Willow-Tit, Long-tailed Tit, Nuthatch, Tree-Creeper, Wren, Mistle-Thrush, Song-Thrush, Robin, Reed-Warbler, Sedge-Warbler, Whitethroat, Lesser Whitethroat, Meadow-Pipit, Pied Wagtail, Hawfinch, Greenfinch, Goldfinch, Bullfinch, Yellow Hammer, Reed-Bunting*, and *House-Sparrow*.

Autumn Bluethroat

1958 LIGHT-VESSEL NOTES

Compiled by R. A. RICHARDSON

Little Grebe. Singly, Newarp, November 16th and 26th.

Leach's/Storm Petrel.—One, Lynn Well, October 29th ; a few Outer Dowsing, November 5th/6th and two, Newarp, 6th/7th.

Scaup. - A female, Lynn Well, May 1st.

Common Scoter.—30 S.W., Lynn Well, April 15th ; 50 N.W., June 8th ; 50, S.W., July 31st and again August 1st.

Sparrow-Hawk.— One, Inner Dowsing, November 15th.

Water-Rail.—Singly, Dudgeon, October 28th ; Outer Dowsing, November 6th and Lynn Well on 11th.

Moorhen.—Three, Lynn Well, April 18th ; one on THV *Warden* off Cromer, October 30th and one, Lynn Well, November 7th.

Coot.—One, Newarp, November 25th.

Common Snipe.—Several, Smith's Knoll, August 6th/7th and 12, Lynn Well, November 15th.

Curlew.—20, Lynn Well, April 14th ; several Smith's Knoll, August 6th/7th and 10th ; a few Newarp November 6th, 12th and 19th with 25 there on 24th ; several Dudgeon November 17th.

Knot.—12 Lynn Well November 16th.

Wood-Pigeon. One, Lynn Well, October 29th and many Inner Dowsing November 27th.

Long-eared Owl. Singly Lynn Well, October 28th and November 6th and at Newarp, October 29th.

Swift.—13, south, Lynn Well, June 19th ; one, Smith's Knoll, August 14th. Several S.E. at Lynn Well, September 8th.

Skylark.—Few, Haisboro', January 14th and February 15th with 50, Smith's Knoll, on 19th. In autumn recorded on 20 dates between October 12th and December 11th at nine vessels. Peak movements October 23rd–29th and November 11th–19th.

Swallow.—Singly, Lynn Well, April 21st (N.E.) and 30th.

House-Martin.—6, Dudgeon, May 23rd.

Hooded Crow.—One, Lynn Well, March 28th, 3 N.W. there April 1st ; 4 Newarp, November 6th.

Rook.—2, Lynn Well, October 24th ; several west at Newarp, October 25th/26th. A few Newarp, November 2nd with 8 on 6th (when 4 at Outer Dowsing). 5, Inner Dowsing, November 13th.

Blue Tit.—4, Lynn Well, April 1st.

Wren.—One, Corton, October 9th.

Fieldfare.—1,500 Outer Dowsing, October 26th; 10 Newarp on 27th/28th; 50, Lynn Well, November 6th; several Haisboro' on 23rd and Inner Dowsing on 27th where there were a few December 16th.

Redwing.—Several S.W.-W. Lynn Well, October 18th; 20 there on 28th and 10 at Newarp same date. One Corton, November 5th; 50, Lynn Well same date, 20 on 11th and 6 on 16th; 50 Newarp, November 18th and fewer on 26th.

Blackbird.—Small numbers at Lynn Well, April 4th–18th. Many occurred at Lynn Well, the Dowsings, Haisboro', Dudgeon and Newarp from October 17th–December 8th, with a few at Lynn Well on 16th. The preponderance of males is remarked upon.

Redstart.—Several Lynn Well, September 1st and 20 there October 24th.

Robin.—Singly Lynn Well, April 5th, Newarp October, 29th, THV *Warden* off Cromer, October 30th, 2, Corton, November 5th and one Lynn Well on 15th.

Waxwing.—One Inner Dowsing, November 29th.

Greenfinch.—Several at Newarp and Smith's Knoll, October 23rd, some exhausted and in sea.

Chaffinch.—In spring, a few, Lynn Well, March 30th, April 1st and 5th with 3 travelling W.N.W. on 30th. In autumn, recorded on 12 dates between October 12th and December 11th at 8 vessels. Peak numbers October 23rd–30th.

Brambling.—A few Lynn Well March 30th, 2 October 26th, a few on THV *Warden* off Cromer on 30th and 2 Lynn Well November 15th.

Yellow Hammer.—One, Lynn Well, December 16th.

Montague's Harrier

LAPWINGS AT NORFOLK LIGHT-VESSELS, 1958

Dates	Lynn Well	Inner Dowsing	Outer Dowsing	Dudgeon	Newarp	Smith's Knoll
Mar. 13	—	—	—	—	—	150 W.
30	Several	—	—	—	—	—
June 19	20 S.W.	—	—	—	—	—
25	10 S.	—	—	—	—	—
July 10	50 N.W.	—	—	—	—	—
Oct. 18	15 W.	—	—	—	—	—
24	50	—	—	—	—	—
30	30 S.	—	—	—	—	—
Nov. 2	—	Several	—	—	—	—
6	20	Several	100	Several	—	—
16	20	—	—	Several	—	—
19	—	Several	—	—	Many	—
25	100	—	—	—	22 S.W.	—
27	—	Several	—	—	—	—
28	—	Many	—	—	—	—
Dec. 3	—	Several	—	—	—	—

STARLINGS AT NORFOLK LIGHT-VESSELS, 1958

Date	Lynn Well	Inner Dowsing	Dudgeon	Outer Dowsing	Haisboro'	Newarp	Corton
Jan. 16	—	—	—	—	Few E.	—	—
Feb. 15	—	—	—	—	Few	—	—
Mar. 30	3,000	—	—	—	—	—	—
April 1	1,000	—	—	—	—	—	—
4	2,000	—	—	—	—	—	—
14	300	—	—	—	—	—	—
15	30 E.	—	—	—	—	—	—
18	1,000	—	—	—	—	—	—
Oct. 12	2,000	—	—	2,000	—	—	—
14	—	—	—	—	Several W.	—	—
18	Many	—	—	—	—	—	—
19	—	—	—	—	Sev. W.	1–2,000	Many W.
21	—	—	—	—	—	Many	Many
23	300	—	Many	Many	Few W.	—	—
26	—	Many	Many	500	Sev. W.	—	—
28	100	Many	Several	—	—	*c.* 200	—
29/30	2–3,000	—	Several	Many	Many	5,000	Many W.
31	—	Many	Many	—	—	—	—
Nov. 1	1,000	Many	—	5,000	Sev. W.	1,000's	—
4	—	Many	Many	3–4,000	—	1,000's	—
5	3–4,000	Many	Many	2,000	—	Fewer	—
6	2–3,000	—	Fewer	Several	—	1–2,000	—
7	—	Many	Fewer	—	—	100's	—
11	3,000	Many	Fewer	1,000	—	100+	—
14	300	Many	Fewer	—	—	—	—
15	2,000	Many	—	5,000	Many	—	—
19	—	Many	Few	—	Many	100+	Few
22	—	Several	—	—	Several	—	—
24	—	—	—	—	—	500+	—
25	200	—	—	—	—	—	—
27	—	Many	—	—	—	—	—
28	—	Few	—	—	—	—	—
29	—	12	—	—	—	—	—
Dec. 2/3	—	Several	—	—	—	—	—
8	—	Few	—	—	Several	—	—
11	—	Several	—	—	Several	—	—
12/16	—	Few	—	Few	—	—	—

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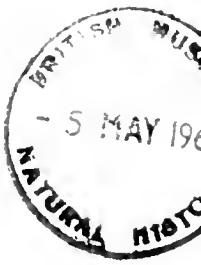

THE PURPLE (HYBRID) MARRAM, *AMMOCALAMAGROSTIS BALTICA* (FLUEGGE) P. FOURN. IN EAST ANGLIA

By E. A. Ellis

From 1792 to 1805, the dunes protecting the lowland country of east Norfolk, from Winterton northward to Happisburgh, were breached by the sea in many places, and the Sea Breach Commissioners engaged one of the country's foremost geologists, William Smith, to survey this part of the coast and to direct new coast defence works. In Smith's report (c. 1805), attention is called to a pecular variety of marram grass found in the area and distinguished from the common kind by possessing broader leaves, very tall stalks and flower spikes " up to nine inches long." It was seen by Smith growing " inside the dunes " and he expressed the view that it " might be taken for a different species." It seems reasonable to assume, from the description given and from what is known of the local vegetation today, that Smith's plant was *Ammocalamagrostis baltica*, which was first described botanically as *Arundo baltica* by Fluegge in Schrad. *Fl. Germ.* 1, 223 (1806), and later regarded as a hybrid produced by marram (*Ammophila arenaria*) and bush grass (*Calamagrostis epigejos*).

H. G. Glasspoole discovered a colony of *A. baltica* on Caister marrams, just north of Great Yarmouth, in 1885 and this has persisted until now. C. E. Salmon and S. W. White recorded that the grass was plentiful along the Norfolk coast from Caister to Winterton in July, 1915 ; this is true of it today. F. Robinson reported the discovery of *A. baltica* on Blakeney Point in the course of an excursion made by the Norfolk and Norwich Naturalists' Society on May 20th, 1923, but this was based on the misidentification of a " broad-leaved " form of *A. arenaria* collected in non-flowering condition. I saw this broad-leaved form in flower at Blakeney Point on July 8th, 1956 : the leaves looked broad because they were flattened instead of being curled as in normal plants, but in no case did I find a width of more than 6 mm.

In 1953, I inspected most of the dunes along the coast of Norfolk and Suffolk with a view to plotting the distribution of *A. baltica*. I failed to discover this grass growing anywhere between Holme-next-the-Sea and Waxham (areas from which it was absent included Scolt Head Island, Blakeney Point and the dunes running south from Happisburgh to Waxham). From immediately south of Waxham to Hemsby it was present more or less continuously. At Horsey, north of the Gap, I found it to be locally dominant not only in both yellow and grey dune areas, but also on sandy knolls stretching inland over sub-maritime fen, where common marram was absent. It was plentiful at Winterton, near the village and on the high dunes running south to Hemsby. There were a few

clumps under low cliffs at Scratby and a few more at Caister. The grass appeared in plenty again in the seaward edge of Yarmouth North Denes near the Caister boundary and it was present in small numbers on new dunes which had developed on the beach adjacent to the North parade during the second world war. A few plants were noticed towards the harbour mouth, on the South Denes.

In 1953, the year of the memorable North Sea surge, *A. baltica* was already established in at least three localities on the coast of Suffolk, namely at the south end of Gorleston cliffs, in grey dunes at Kessingland and (a few plants only) just south of Benacre sluice. I failed to find it between Easton Broad and Dunwich, at Minsmere, Aldeburgh and Thorpeness.

The East Suffolk and Norfolk River Board undertook extensive marram planting in the course of repairing the coast defence works immediately following the 1953 surge. Much of the marram used was taken from Winterton and plants of *A. baltica* from this locality were introduced at many points on the sea banks of both counties, e.g. at Holme, Brancaster, Easton, Southwold, Walberswick, Dunwich and Minsmere. A few plants which I saw at Gunton, just north of Lowestoft, in 1957, may have been introduced at an earlier date, as may have been those I found at Sizewell in 1958.

All the flowering specimens I have seen have resembled one another closely, having purplish panicles, yellow anthers and other features characteristic of the Norfolk, as distinct from the Northumberland and Scottish forms of the hybrid. Whether or not our *A. baltica* originated through hybridisation in the Winterton-Horsey area (I have not seen *C. epigejos* there), it appears likely that all the plants growing on the East Anglian coast came from this centre, in some cases through marram planting and in others as the result of living fragments of rhizomes being dispersed by the sea.

A. baltica grows well as a pioneer colonist of bare beach sand at the outer fringe of yellow dunes and its drooping leaves collect and hold more sand than do those of the stiffer *A. arenaria*. It is found persisting in grey dunes and thriving where *A. arenaria* has become depauperate or has died out, and is also able to grow on sandy peat subject to occasional flooding. It is vigorous in spreading laterally by means of its rhizomes, whereas the rhizomes of the common marram tend to penetrate the sand vertically rather than horizontally.

Plants growing within a half-metre radius of *A. baltica* on Great Yarmouth North Denes, August 14th, 1953 were :

Achillea millefolium
Agropyron junceiforme x A. pungens.
Agrostis tenuis
Ammophila arenaria
Calystegia soldanella

Carex arenaria
Convolvulus arvensis
Corynephorus canescens
Dactylis glomerata
Daucus carota
Elymus arenarius
Festuca rubra
Galium verum
Hieracium umbellatum
Honckenia peploides
Hypochaeris radicata
Jasione montana
Leontodon autumnale
Lotus corniculatus
Ononis repens var. horrida
Plantago lanceolata
Trifolium arvense
Vicia cracca

Plants closely associated with *A. baltica* on grey dunes at Winterton, 12th August, 1953, included *Ammophila arenaria, Carex arenaria, Corynephorus canescens, Dactylis glomerata, Galium hercynicum, Holcus lanatus, Hypochaeris radicata, Polypodium vulgare* and *Rumex acetosella.*

Coreid bugs, *Chorosoma schillingii* (Sch.) were feeding on flower heads of both common and purple marrams at Winterton in August, 1953.

The living leaves of both grasses are commonly parasited by the rust fungus *Puccinia ammophilina* (Kleb.) Mains, uredospores being found at all seasons. In December, 1958, both uredo- and teleutospores of the crown-rust, *Puccinia coronata* Corda were abundant on *A. baltica* on Yarmouth North Denes. The flowers of both marrams commonly bear large horn-like ergots of *Claviceps purpurea* (Fr.) Tul. in autumn. Other micro-fungi common to these two grasses on the Norfolk coast include *Lophodermium arundinaceum* (Schrad.) Chev. var *abbreviatum* (Rob.) Kckx, *Tiarospora perforans* (Rob.) v. Hoehn., *Psammina bommeriae* Rouss. & Sacc. *Papularia sphaerosperma* (Pers. ex Fr.) v. Hoehn. and *Tetraploa aristata* B. & Br.

In the very dry summer of 1959, *A. baltica* failed to produce flowering panicles almost throughout its territory at Horsey and Winterton. This was the same for *A. arenaria* except in yellow dunes nearest the sea. In a few damp hollows in yellow dunes, *A. baltica* flowered normally.

This short contribution to knowledge of the history and biology of one of East Anglia's more interesting and valuable dune grasses is offered in the hope that the purple hybrid marram may receive more critical attention from local naturalists in the future.

NOTES ON THE VEGETATION AT BLAKENEY POINT, NORFOLK, IN 1956.

By Frank W. Jane

A number of points of interest were noted in the flora of Blakeney Point during the summer of 1956 and these are recorded in the present note. Rabbits disappeared from this area during the winter of 1954/5 and it would seem that some changes in the vegetation may be traced directly to absence of rabbit browsing : others are less readily accounted for, but it is not improbable that some may be attributable to the catastrophic flooding caused by the North Sea surge of 31st January, 1953. Moreover, from June onward, the 1956 summer was abnormal, being cool, wet and sunless.

There are now numerous vigorous sucker shoots of white poplar (*Populus alba* L.), produced by the three trees in the plantation near the laboratory. This sucker growth was conspicuous in 1955, but in 1956 was even more striking. It does not seem unlikely that such sucker shoots were always produced by these trees, for the plentiful production of root suckers is a well known feature of the white poplar, but that previously their development was checked by rabbit browsing.

A marked feature of the Headland dunes in August, 1956, was the very small amount of flowering ragwort (*Senecio jacobaea* L.) ; in other years at this time the dunes have been studded with the yellow inflorescences. Flowering plants were tolerably common on the Hood and on the Watch-house bank, while ragwort plants in all stages of rosette growth were abundant throughout the area. No suggestions can be made as to what factor or factors affected the flowering in this way and in the main, the inhibiting effect was confined to the Headland dune system.

Among members of the flora which appeared to be spreading in the area are :—

Polypody (*Polypodium vulgare* L.). The clumps of this plant on the grey dunes appeared to be very vigorous and a large patch was observed on the main ridge of the Headland dunes : this species has only been noted previously on the old, grey dunes.

Yellow Horned-poppy (*Glaucium flavum* Crantz.). A striking increase in the numbers of this plant has occurred during the past few seasons, along the main shingle bank, and it is now the most conspicuous, and probably one of the most common, flowering plants on the shingle in the region of the Hood and Watch-house bank.

Matted Sea Lavender (*Limonium bellidifolium* (Gouan) Dum.). The invasion of the formerly bare, or nearly bare, Great Sandy low by embryo dunes has been going on for a number of years. The lower lying areas between these dunes are occupied by several species of plants, of which sea milkwort (*Glaux maritima* L.)

in the most common. In 1956, for the first time, one or two plants of *Limonium bellidifolium* were noted in this area : this plant is, of course, abundant enough in its rather restricted habitat elsewhere on the Point.

Sea Plantain (*Plantago maritima* L.). This is a plant which, during my twenty-seven years acquaintance with Blakeney Point, has always been something of a rarity west of the Watch-house bank, although it is common enough on the Morston marshes. Since the war it has usually been possible to find a plant or two in the Boathouse low and during the last few years it has been on the increase. In 1956 the low just mentioned contained a number of flowering specimens and some of these were much more luxuriant plants than I have previously found in the area.

Wood Groundsel (*Senecio sylvaticus* L.). This species is recorded by Oliver & Salisbury* as very rare on the Watch-house bank and as rare on the Long Hills. I have never myself found it in either of these localities, but since the war, at least, there have always been a few plants on the Hood. In 1956 it was present in quantity on the Hood, certainly in an abundance not noticed previously. Some of the clumps were several square yards in area. The plant was also noticed growing luxuriantly on the Morston marshes.

Sea Aster (*Aster tripolium* L.). One of the features of the vegetation of 1956 was the abundance of sea aster in the Pelvetia marsh, an area in which the annual salicornias tended to be dominant. This marsh was formerly criss-crossed by rabbit runs and the nibbled leaves of sea aster and their abundance on the drift lines, indicated that the plant was much eaten by rabbits. Now that the growth of the plant is not checked by browsing, it looks as if it may spread rapidly on the Pelvetia marsh, where it was always common at the more westerly end, to the detriment of the salicornias.

The asters at Blakeney Point almost all have rayless inflorescences and a few years ago it needed some searching to find a plant in which ray florets were present. During the last few years more plants with the rayed inflorescence have been observed, although even now such plants form a minute fraction of the aster plants on the Point.

Sea Wormwood (*Artemisia maritima* L.). This is a plant which, in my experience, has always been rare on the area west of the Watch-house bank, although common enough on the more easterly Marrams and on the Morston marshes. Occasional plants were encountered in 1956 on the shingle fronting the Headland dune system, a locality where odd plants have been observed previously. My impression in 1956 was that the species is increasing along this area of shingle.

Sea Arrow-grass (*Triglochin maritima* L.). This again, is scarcely a common plant on the Point west of the Watch-house bank. In 1956 a few fruiting plants were found in Glaux low, a

locality in which I have not previously noticed them. Probably they were not new to this low, but have previously been kept cropped short by the rabbits. This species was also much commoner in 1956 than in former years at the top of the Aster marsh, but here again it may well be that the former scarcity was more apparent than real and that browsing kept them down.

Grey Hair-grass (*Corynephorus canescens* (L.) Beauv.). This rare grass, which is well established on the Hood and on some of the grey dunes behind the Headland, is in a flourishing condition and for some years appears to have been slowly increasing. In 1956 a single plant was found on the shingle fronting the Headland dune system, a curious habitat for a plant which, at Blakeney Point at least, is confined to the fixed dunes.

A feature which attracted attention in the summer of 1956 was the large stature of some of the plants. Thus, in the darnel poa (*Desmazeria marina* (L.) Druce.) plants up to about 10 cm. long were quite common in Boathouse low, while plants of the knotted pearlwort (*Sagina nodosa* (L.) Fenzl.) as much as 10 cm. high were also abundant in the same locality. Numerous luxuriant specimens of the smooth cat's ear (*Hypochaeris glabra* L.) were noted, as were some uncommonly large plants of the slender cudweed (*Filago minima* (Sm.) Pero.). It is not suggested that any of these plants attained to dimensions abnormal for the species, but at Blakeney Point, where none of them is uncommon in suitable localities, they are generally depauperate plants, so that the numerous larger specimens present in 1956 could scarcely fail to attract attention. Here again, it is possible to suggest that freedom from rabbit browsing may account for the difference, but 1956 was an abnormally wet summer from June onwards and it may be that the habitats were moister than usual and that this is sufficient to explain the increase in size. A moister habitat may also account for the fresh and vigorous appearance of the polpody plants, which was apparent in August and September, 1956.

Along the beach in front of the Headland dune system the strand flora was particularly luxuriant in 1956. Sea rocket (*Cakile maritima* Scop.) was abundant and gave some fine patches of colour to this area. Shore orache (*Atriplex littoralis* L.), hastate orache (*Atriplex hastata* L.) and Ray's knotgrass (*Polygonum raii* Bab.) were plentiful and included many large plants and in late August and early September some clumps of *Atriplex hastata* had turned crimson and gave a vivid display of colour. Curiously enough, the saltwort (*Salsola kali* L.), although common enough in this habitat, did not appear to be growing with its usual vigour and no large, luxuriant specimens were observed. It is not easy to account for this luxuriance of the strand flora in a particular year. It may be attributable to the absence of rabbits, or to the abnormally wet, cool summer. Again, owing to the catastrophic high tide early in 1953, the terns now nest along the beach instead

of concentrating, in the main, on Far Point. Thus, the ground in this area is undoubtedly enriched with nitrogenous material. It may not be unduly rash to suggest that more abundant supplies of water and of nitrogenous nutrients, may together explain the vigorous growth of the plants in this area during 1956.

On the dunes of the Headland, in an area reached by the water in the 1953 flooding, the remains of a plant of teasel (*Dipsacus fullonum* L.) probably a last year's plant, was found. It might be expected that the extensive flooding of 1953 would result in numerous plants being deposited on the dunes as seeds and the appearance of some unusual casuals in succeeding years might have been expected. Nevertheless, it was a distinct surprise to find on the dunes, in 1956, flowering specimens of such moisture loving plants as gipsywort (*Lycopus europaeus* L.) and skull-cap (*Scutellaria galericulata* L.). The former was a single well-branched plant, of rather short stature. The skull-cap was brought to me by Master Graham Bean who found a small patch of about ten plants, none more than 6 inches high. I found another patch of about fifty plants close by. It may be that the seeds of both these species had lain dormant since they were deposited by the 1953 flood, until 1956 produced a wet enough summer to bring about their germination and growth. Both plants, however, are perennials and may well have been present before 1956 : they were found in a little frequented part of the dunes.

Reference must also be made to another casual of the Blakeney Point area, the black nightshade (*Solanum nigrum* L.). This species was often seen along the drift line, particularly the line occurring at the seaward end of the Pelvetia marsh, in the Long Hills region. I have seen very few black nightshade plants on the Point during the past two or three years and did not find one in 1956. If, as I presume, the plant owes its origin on the Point to sea borne seeds, it is difficult to suggest any reason for this diminution in its numbers, for it shows no signs of decrease as a weed of cultivated land.

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A SALT-MARSH AT THORNHAM, IN NORTH-WEST NORFOLK.

Compiled By J. F. Peake

V. J. Chapman has suggested that a possible stage in the natural succession of the vegetation on a salt-marsh might be a community dominated by reeds (*Phragmites communis*), and it was with this hypothesis in mind that the Norfolk and Norwich Naturalists' Society surveyed an area of marsh at Thornham, on June 22nd, 1958. From Brancaster Staithe to Holme similar plant communities exist, which appear to illustrate the type of transition mentioned above, but only at Thornham is a relatively undisturbed example found.

Programme :

(1) To make a general survey of the salt-marsh zonation.

(2) To make a transect, recording the changes in vegetation, between the General Salt-marsh zone and the reedbed (Phragmitetum). The transect line was divided into units 10 metres long, and in each of these ten quadrats of a ¼ sq. m. were made, five on each side of the line, and parallel to it.

(3) To level the transect line, and obtain an accurate picture of the variations in height of the land surface, as these have an important influence on the frequency of tidal coverage and drainage.

(4) To take a series of bores along the transect line.

(5) To sample the fauna of the various habitats.

This investigation was undertaken by the following members :—

Miss R. M. Barnes
Miss L. N. Brunning
Mrs. H. Field
Miss B. Green
Miss Harper
Miss R. Jones
Miss Maxey
Miss Noble
Miss B. Vizard
Miss Whiteman
B. Cave
R. R. Clarke
E. Daniels
B. F. T. Ducker
Dr. E. Duffey
K. Durrant
J. Field
D. Geddes
L. C. Johnson
J. F. Peake
W. J. Peake
P. Robson

Results :

(1) General Survey : The map Fig. 1, shows the extent of the area studied. The zonation of the lower marshes follows closely that described by Chapman for Scolt Head Island ; therefore in this account the same terminology is employed wherever applicable.

Seaward, the salt-marsh is protected by an extensive sand flat and shingle bar, known as Thornham West Island. The most seaward zone is dominated by *Salicornia* species (Salicornietum),

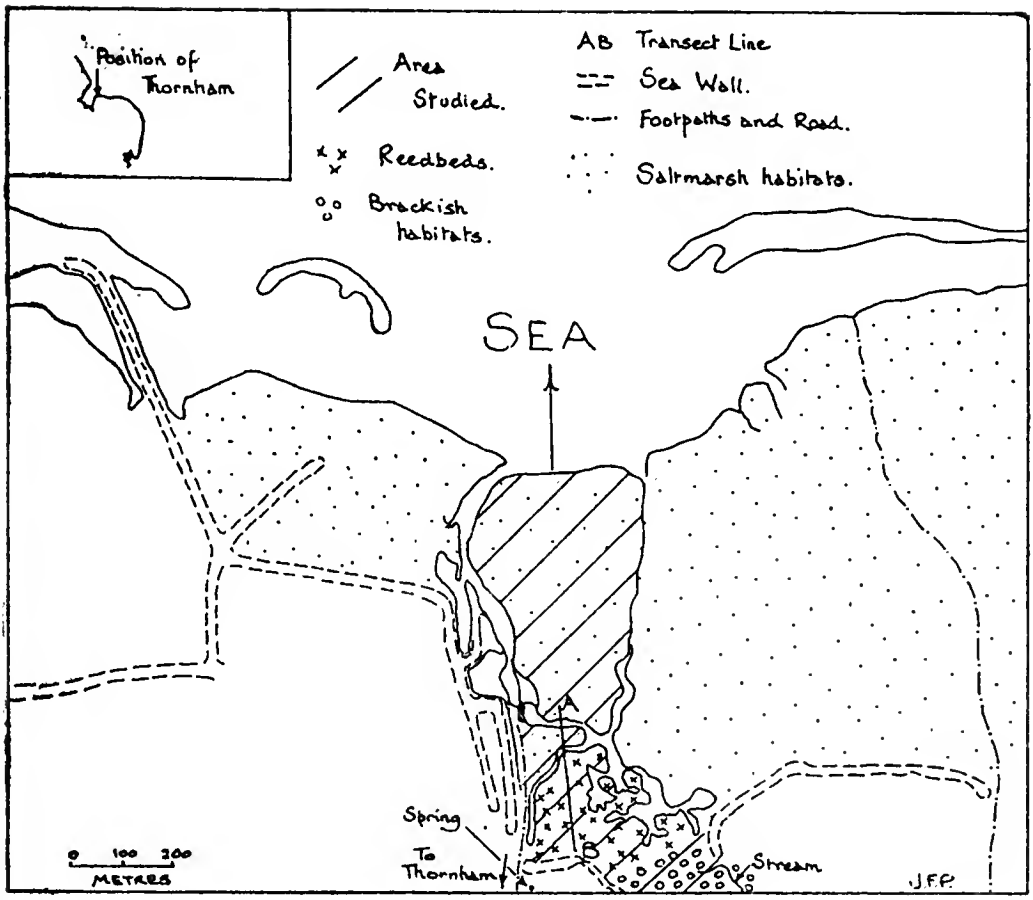

FIG. 1. Map of area studied.

but it changes rapidly into a complex association, characterised by the dominance of *Aster tripolium* (Asteretum). Here the marshes are intersected by many creeks and pools, which support a different flora than the surrounding areas, with *Halimione portulacoides* and *Salicornia* species particularly noticeable. The recent reduction in grazing of the marsh plants, by rabbits, has allowed many plants to form an unusually luxuriant growth. *Puccinellia maritima* has increased enormously, and in this zone it is now locally co-dominant with the aster, or even dominant.

The General Salt-marsh zone, which comes next, has no single dominant plant species, instead, the following are locally important :—

Puccinellia maritima
Limonium vulgare
Spergularia marginata
Triglochin maritima
Armeria maritima
Plantago maritima
Juncus maritima

Again *Puccinellia maritima* is extremely conspicuous, especially in the upper levels, i.e. landward, where *Juncus maritima* is more frequent. However, a zone dominated by *Juncus* does not follow, as is the case at Scolt Head.

On the landward side of these salt-marshes are the reedbeds (*Phragmitetum*), and it was the transition to this community that was the subject of special study.

In the south-east corner, at a higher level than the reedbeds, is a brackish grassland habitat, containing a strange admixture of species ; *Festuca rubra* covers large parts of the area, and *Agropyron pungens* is locally dominant.

(2) The results of the transect, levelling and bores are incorporated in a diagram, Fig. 2 and it seems unneccesary to give a more detailed account.

(3) It is hoped at a future data to give a check list of the animals recorded in the various habitats.

Discussion :

In a consideration of the vegetation it is important to remember that, in the past, these salt-marshes were subject to human interference. Extensive embanking was carried out, but subsequent breaching of the banks and inundation by seawater, have given rise to brackish habitats, as in the south-eastern part of this area. Also Thornham was an important harbour, which has become silted up ; it is now impossible to estimate all the changes that must have taken place during that period of high human activity.

The marsh, on the seaward side of the transect, is very similar to the General Salt-marsh zone existing on Scolt Head Island. However, the later succession at Thornham differs from the basic plan for Scolt. At Thornham the General Salt-marsh zone is followed by another community with a similar flora, except for the addition of *Juncus maritima*, which is locally co-dominate with many other plant species. There is then a gradual change to an area completely dominated by *Phragmites communis*, when other plants present are extremely weak and etiolated.

The presence of *Phragmites* in the salt-marsh must be associated with a decrease in the salinity of the substrate ; this can be achieved either by raising the height of the land through deposition, or by a supply of fresh water diluting and washing away any sea water entering the area, or by a combination of both. The levelling shows that small changes occur in the height of the land surface, but these do not appear sufficient to account for the changes in the vegetation, nor are they completely consistent with them. As can be seen from the map, a spring exists to the south-west of the marsh, and a small stream to the south-east ; from these, fresh water could enter the area by flowing over an impervious layer, such as the deposit of ferruginous clay, which exists near the surface of the marsh. It might be possible for water to enter the hollow, with the peat deposit, either from a spring, or by bypassing the belt of clay. A complication, to this explanation, is a dyke which has been cut on the landward side of the marsh at the base of the sea wall. In it there is a luxurious growth of *Phragmites*,

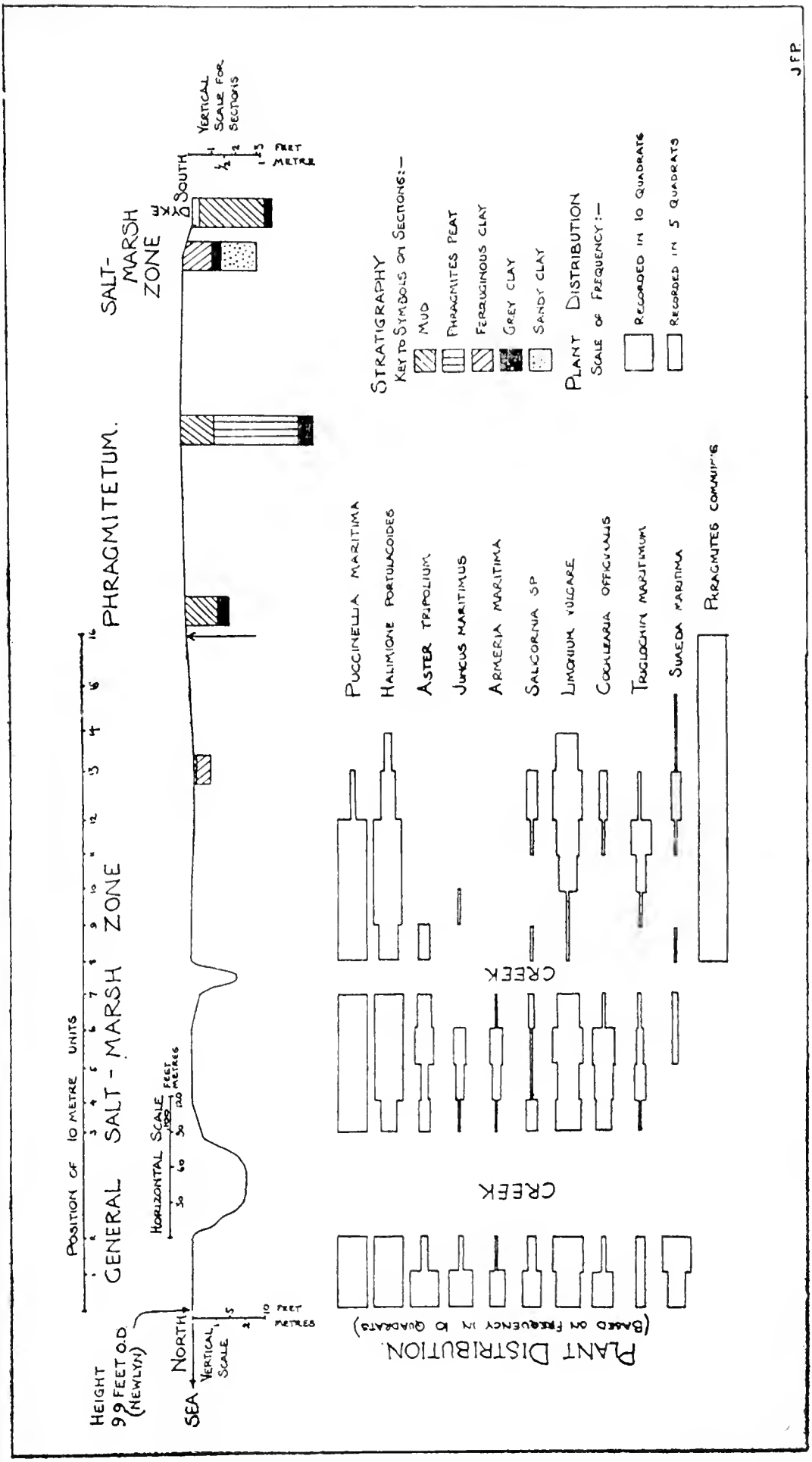
GENERAL SALT-MARSH ZONE
PHRAGMITETUM.
SALT-MARSH ZONE
POSITION OF 10 METRE UNITS
HORIZONTAL SCALE FEET METRES
HEIGHT 99 FEET O.D. (NEWLYN)
SEA
NORTH
SOUTH
VERTICAL SCALE
VERTICAL SCALE FOR SECTIONS
FEET METRE
STRATIGRAPHY
KEY TO SYMBOLS ON SECTIONS:—
MUD
PHRAGMITES PEAT
FERRUGINOUS CLAY
GREY CLAY
SANDY CLAY
PLANT DISTRIBUTION
SCALE OF FREQUENCY:—
RECORDED IN 10 QUADRATS
RECORDED IN 5 QUADRATS
CREEK
CREEK
PLANT DISTRIBUTION
(BASED ON FREQUENCY IN 10 QUADRATS)
PUCCINELLIA MARITIMA
HALIMIONE PORTULACOIDES
ASTER TRIPOLIUM
JUNCUS MARITIMUS
ARMERIA MARITIMA
SALICORNIA SP
LIMONIUM VULGARE
COCHLEARIA OFFICINALIS
TRIGLOCHIN MARITIMUM
SUAEDA MARITIMA
PHRAGMITES COMMUNIS
J.F.P.

FIG. 2.

which could, somewhere along its length provide a nucleus for the spread of the plant into surrounding habitats. Also this dyke may serve as a reservoir for water with a lowered salinity, but unfortunately no salinity measurements were made.

The stratigraphical data reveals that where the *Phragmites* is most luxuriant and flowering there is beneath it a layer of phragmites peat 127 cms. thick. In contrast to this are those areas where the *Phragmites* is less dense, non-flowering, shorter, and mixed with salt-marsh plants, here there is a deposit of hard ferruginous clay, through which it is almost impossible to bore. The reduction of the available water in the clay, compared with the peat and mud deposits, might be important in limiting the spread of the *Phragmites*. Also, the clay could prove a mechanical barrier to the rhizomes of the *Phragmites*. It is important to note that between the reedbed and the dyke, on the landward side, the vegetation reverts to a salt-marsh type, with only occasional plants of *Phragmites* ; underneath it there is a thick band of clay. These observations do not preclude the possibility of salinity having some retarding effect on the spread of the *Phragmites* into the salt-marsh. At the base of the *Phragmites* there is a recent deposit of black mud, with a large amount of decaying plant remains. This suggests that the conditions necessary for the formation of peat have now ceased to exist. Where a layer of mud lies directly over the clay, the reeds are able to survive and flower, but not so luxuriantly as on the peat. A situation similar to this might have existed when *Phragmites* first colonised the area ; the evidence from boring shows that *Phragmites* most likely colonised a mud deposit on the bottom of the depression, as the lower 34 cms. of peat has a large amount of mud mixed with it.

A problem raised is how a thick band of peat could develop in such a position ; before an answer can be attempted it is imperative that a series of bores is put down and a detailed examination is made of the peat. Changes in the height of the land surface must also be taken into consideration. However, it does seem likely that the peat band was formed in the remains of an old creek system which was blocked, thereby preventing the free flow of sea water. Examination of air photographs shows that the luxuriant *Phragmites* occurs in twisting belts reminiscent of a creek formation.

In the seventeenth century a freshwater pool containing reeds existed near the salt-marshes at Titchwell ; this most likely owed its origin to some human interference. Similar areas might have existed along this coastline, from Brancaster Staithe to Holme, and have been instrumental in the development of the reedbeds now found in the salt-marshes.

CONCLUSIONS :

These observations show that *Phragmites* is present in the salt-marsh succession in this area because of a series of peculiar

local conditions. It is likely that human interference has had an important influence, in blocking the creek system and cutting drainage dykes. However, much work remains to be done, to test some of the suggestions put forward in this paper.

ACKNOWLEDGMENTS :

The compiler would like to thank Misses R. M. Barnes and B. Green, and Mr. B. F. T. Ducker, for discussing the problems raised in this paper.

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PLANT CHECK LIST :

	Salicornietum	*Asteretum*	*General Salt Marsh*	*Phragmitetum*	*Brackish habitat*
Agropyron pungens					x
Agropyron repens					x
Agrostis stolonifera					x
Alopecurus geniculatus					x
Apium graveolens					x
Armeria maritima		x	x		
Artemisia maritima		x	x		
Aster tripolium	x	x	x	x	
Atriplex hastata				x	x
Atriplex littoralis				x	
Carex distans					x
Carex extensa					x
Carex otrubae					x
Cochlearia anglica			x	x	x
Cochlearia danica					x
Eleocharis palustris					x
Festuca rubra			x		x
Glaux maritima			x	x	x
Halimione portulacoides		x	x	x	
Hordeum secalium					x
Juncus bufonius					x
Juncus gerardii			x		x
Juncus maritimus			x		
Limonium vulgare		x	x	x	
Oenanthe lachenalii					x
Phragmites communis				x	x
Plantago maritima		x	x	x	x
Plantago coronopus			x		
Potentilla anserina					x
Puccinellia distans					x
Puccinellia fasciculata					x

PLANT CHECK LIST:

	Salicornietum	*Asteretum*	*General Salt Marsh*	*Phragmitetum*	*Brackish habitat*
Puccinellia maritima		x	x	x	x
Ranunculus sceleratus					x
Salicornia perennis	x	x	x		
Salicornia europaea	x	x	x	x	
Scirpus maritimus			x		
Spartina townsendii		x	x		
Spergularia marginata		x	x		
Spergularia salina			x		
Suaeda maritima	x	x	x	x	
Triglochin maritimum			x	x	x
Triglochin palustre					x

ALIEN PLANTS FROM A NORWICH RUBBISH-TIP

By Ruth M. Barnes

Rubbish-tips, together with dockyards and railway-sidings, often prove of considerable interest botanically, since in these artificial habitats species of foreign plants, the seeds of which are unintentionally introduced, may become well-established as aliens.

In October, 1958, in company with Dr. J. G. Dony and Miss B. M. Vizard, I explored several rubbish-tips on the outskirts of Norwich. The most productive, from a botanist's point of view, was the corporation tip at Harford Bridges, where we found, still in flower and in fruit, a number of alien species. Predominant among the colonisers of this rubbish-tip were members of the cabbage family (Cruciferae) and the grass family (Gramineae).

The Harford tip covers several acres of land, but only certain parts of it are in active use for refuse disposal at any one time, while on the less disturbed ground and on the marginal areas of the tip a suitable substratum exists for colonisation by plants.

Among the species which may be classed as " escapes " from cultivation can be listed the black mustard *Brassica nigra* (L.) Koch, the white mustard *Sinapis alba* L., and the radish *Raphanus sativus* L.

Weeds of waste places and cultivated land were represented by several " introduced " species, most of which are now widespread throughout the country :—the wall rocket or stinkweed *Diplotaxis muralis* (L.) DC. from southern and central Europe ; the tall rocket *Sisymbrium altissimum* L. and the Eastern rocket *Sisymbrium orientale* L., natives of south-east Europe and the Near East which frequently appeared on bombed sites during the 1939–45 war. The treacle mustard *Erysimum cheiranthoides* L. which may be described as almost a cosmopolitan weed, was present also.

Another group of " introduced " species comprised various grasses such as the canary grass *Phalaris canariensis* L., the common millet *Panicum miliaceum* L. and the green bristle-grass *Setaria viridis* (L.) Beauv., all of which are found in proprietary bird-seed mixtures ; it is suggested that the presence of these plants on the rubbish-tip is directly related to the keeping of canaries and budgerigars by Norwich householders. Other species probably originating as bird-seed were the common flax *Linum usitatissimum* L. and the gold of pleasure *Camelina sativa* (L.) Crantz which occurs as a weed in flax crops and is native to eastern Europe and western Asia. Perhaps the most interesting of the " bird-seed weeds " were two species of *Rapistrum :* yellow-flowered, mustard-like plants. One has been identified as *Rapistrum perenne* (L.) All., a steppe species, a native of central and south-eastern Europe, and the other, *Rapistrum hispanicum* (L.) Crantz var. *hirsutum* (Cariot) O. E. Schultz, a native of the Mediterranean

region ; both are " new " to Norfolk. An allied species, *Rapistrum rugosum* (L.) All. was recorded from a Norwich waste patch near St. Miles bridge in June, 1915 by W. G. Clarke (*Trans. Norf. & Norw. Nat. Soc.*, Vol. X, p. 172). This plant probably arrived with imported barley, but later became exterminated in that locality.

The alien species of the Harford tip show every sign of flourishing and becoming successful colonisers of their unstable habitat, but their ultimate success will depend very largely on the methods of rubbish disposal practised by the Norwich health authorities in the future.

NEW, RARE AND CRITICAL NORFOLK LICHENS—1

By S. A. Manning

Since the last notes on Norfolk lichens appeared in these *Transactions* (Manning, 1944) a *Census Catalogue of British Lichens* (Watson, 1953) has been published. It is possible to extract from this a list of lichens recorded for Norfolk or either of the vice-county divisions (East Norfolk, v.c. 27, and West Norfolk, v.c. 28), which are separated by the line 1° E. longitude. I therefore propose to use the Census Catalogue as a starting-point and, in these and future notes, the Catalogue number will follow the name of a species.

I. The Subgenus Cladina of the genus Cladonia.

There has been some confusion over the members of this Subgenus so it would be useful to review their status in Norfolk.

Cladonia rangiferina (L.) Web. (874). Watson (1953) includes this for West Norfolk, but states that records given for the southern counties are probably erroneous. It was recorded from Blakeney Point (McLean, 1915), but not noticed there by Watson in 1920 or by Richards in 1927 (Oliver, 1928–29). Bloomfield (1905) recorded it for Norfolk with the remark " Heaths common," but Dr. Watson told me that this was probably wrong. It is, then, doubtful whether this has ever been a Norfolk plant.

C. sylvatica Hoffm. (875). This has been recorded from several stations in each vice-county, but, in view of modern work on the Subgenus Cladina, the records would appear to need checking. I have checked specimens placed in my own herbarium under this name and all are now referred to other species.

C. tenuis (Flörke) Harm. (876). Watson (1953) gives this for East Norfolk and as doubtful for West Norfolk. The only published record I can find is of *Cladonia sylvatica* f. *tenuis* from Blakeney Point (McLean, 1915), but, as Watson (1953) points out, this may not agree with Harmand's conception of the species. *C. tenuis* can now be accredited to the flora of both vice-counties.

East Norfolk : Winterton " slacks," 10.4.1936, Wilby Warren, March, 1951.

West Norfolk : Wire Hills, Scolt Head Island, 1.8.1936 (E. A. Ellis).

Old grey dunes, Blakeney Point, 18.9.1958 (E. L. Swann). All this material has been checked by Prof. des Abbayes, author of the monograph on the *Cladinae*.

C. leucophaea Des Abb. (877). This has not yet been detected in Norfolk, but should be searched for.

C. mitis Sands. (878). Watson (1953) gives this for both vice-counties. He informed me that Miss A. L. Smith had referred a Blakeney specimen leg. ? to this species ; but I do not know what

other records his Catalogue entries were based on. The following gatherings have since been identified as belonging to this species (confirmed P. W. James).

East Norfolk: Swannington Common, 22.3.1936. West Norfolk: Roydon Common, near King's Lynn, July, 1953 (E. A. Ellis).

C. impexa Harm. (879). This is known from both vice-counties. It was found at Scolt Head Island by Mr. E. A. Ellis in 1936 (Dickinson, 1938), and the following are records based on specimens in my herbarium.

East Norfolk: Buxton Heath, Hevingham, 6.8.1939 (E. A. Ellis), 30.8.1945 (E. A. Ellis), 14.5.1948. West Norfolk: Wire Hills, Scolt Head Island, 1.8.1936 (E. A. Ellis), Roydon Common, near King's Lynn, July, 1953 (E. A. Ellis), Wolferton Fen, on dry *Calluna vulgaris* islands and on *Erica tetralix* hummocks in Sphagnum bog, 9.8.1958 (E. L. Swann).

C. alpestris (L.) Rabenh. (880). Watson (1953) considers this to be doubtful for both East and West Norfolk. It is regarded as very rare in this country, being found in the highlands of Scotland and Ireland (Tallis, 1958); but was recorded from Scolt Head Island (Dickinson in Steers, 1934). Miss Dickinson has recently (1958) informed me that she has no named specimens and remembers having difficulty with the subgenus *Cladina*. "*Cladonia sylvatica* Leighton f. *alpestris*" was recorded from Blakeney Point (McLean, 1915). Dr. Watson, to whom McLean did not send a specimen, told me that the plant might have been *C. impexa* or *C. mitis*. It would be wise, then, not to regard *C. alpestris* as a Norfolk plant.

II. The genus Usnea.

Mr. P. W. James, British Museum (Natural History), has recently (1958) revised all available Norfolk material of this genus and six species are now known to have occurred in the county.

Usnea hirta (L.) Wigg. emend. Mot. (4). East Norfolk: Felthorpe, on old wooden gate, 26.7.1936; Old Buckenham, on fallen oak branch, 20.3.1950, and on fallen ash, February, 1950.

Usnea florida (L.) Wigg. (13). The specimen collected by K. Trimmer (author of *Flora of Norfolk*, 1866) at Dunston, East Norfolk (Manning, 1938[1]) has been re-examined and its identity confirmed.

Usnea comosa (Ach.) Röhl. (14). East Norfolk: Wheatfen Broad, Surlingham, on oak and ash, 22.11.1936, 6.4.1942 (this latter gathering was recorded by Manning, 1944); Old Buckenham, on willow trunks, 10.2.1950 and 15.3.1950.

Usnea glabrescens (Nyl.) Wain. (26). East Norfolk: Wheatfen Broad, Surlingham, 28.4.1935 (R. Burn).

Usnea sublurida Stirt. (29). A specimen collected by Miss A. M. Barnard at Marsham, East Norfolk, December, 1844, was referred to this species by Dr. W. Watson.

Usnea ceratina Ach. (30). This was recorded as a Norfolk plant from oaks at Dunston Common, East Norfolk, 21.4.1936 (Manning, 1938[1]) under the synonym *Usnea plicata* Web. This species was also collected from sweet chestnut bark at Felthorpe, East Norfolk, 11.10.1936.

In view of this revision, my published records of " *Usnea florida* Web. var. *hirta* Ach." (Manning, 1938[2], 1944) should be disregarded, and the plants from Blakeney Point, Norfolk, which were referred to by this name (Oliver, 1928–29) need further study.

III. Vice-county records additional to those in the Census Catalogue (Watson, 1953).

Details of the following additions are given in Sections I and II of these notes.

Cladonia tenuis (876) for v.c. 28.
Usnea hirta (4) for v.c. 27.
Usnea florida (13) for v.c. 27.
Usnea glabrescens (26) for v.c. 27.
Usnea ceratina (30) for v.c. 27.

Other new vice-county records are :

Lecanora chlarotera Nyl. (142). East Norfolk : Costessey (K. Trimmer), f. *chlarotera :* Norwich, May, 1852 (F. Mackie), Horsford–Felthorpe area, on bark of young oak, 11.5.1948. f. *rugosella* (Zahlbr.) Poelt : Old Buckenham, on *Salix* bark, 21.3.1949, on hornbeam bark, 2.4.1950. f. *crassula* (Magn.) Poelt : Thorpe Hamlet, Norwich (K. Trimmer), Old Buckenham, on ash bark, February, 1950, on hornbeam bark, 2.4.1950, on bark of oak twigs, March, 1950.

Lecanora confusa Almb. Watson (1953) gives this for East Norfolk under its synonym *Lecanora expallens* (Pers.) Ach. var. *lutescens* (DC.) Nyl. (166). As it is not clear how this record was made, it is of interest to note that P. W. James found the species in material collected by K. Trimmer at Costessey, East Norfolk. I found it on the bark of oak twigs at Old Buckenham, East Norfolk, March, 1950.

Lecanora conizaeoides Nyl. ex Cromb. (172). West Norfolk, Sandringham, on larch bark, 16.8.1936 ; Wolferton Fen, on dead *Calluna* branches, 9.8.1958 (E. L. Swann) ; Weeting, on Scots pine bark, 23.8.1958 (E. L. Swann).

Lecanora subfuscata Magn. f. *subfuscata* (not given in Census Catalogue). East Norfolk : Costessey (K. Trimmer).

Rhizocarpon reductum Th. Fr. (838). East Norfolk : Horsford Heath (K. Trimmer). West Norfolk : Scolt Head Island, on

pebbles, 1.6.1936 (E. A. Ellis). These gatherings had been placed under *Rhizocarpon confervoides* DC., which, as Watson (1953) points out, is " a nomen vagum sec. many authors."

Cladonia crispata (Ach.) Flot. (904). West Norfolk : Wolferton Fen, in the Callunetum, 9.8.1958 (E. L. Swann). var. *cetrariaeformis* (Del.) Wain., Roydon Common, near King's Lynn, July, 1953 (E. A. Ellis).

Cladonia cenotea (Ach.) Schaer. var. *glauca* (Flörke) Leight. (908). West Norfolk : Roydon Common, near King's Lynn, July, 1953 (E. A. Ellis).

ACKNOWLEDGMENTS

Grateful thanks are due to Dr. W. Watson, Mr. J. R. Laundon, Prof. H. des Abbayes and Mr. P. W. James for much valuable help and encouragement, Miss R. M. Barnes for the loan of material from the Kirby Trimmer collection at Norwich Castle Museum, and to Messrs. R. Burn, E. A. Ellis and E. L. Swann for collecting the specimens mentioned.

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NOTES ON RECENTLY DISCOVERED REMAINS OF EXTINCT NORFOLK MAMMALS

By Barbara Green

Three of the most important remains of fossil mammals to be found in Norfolk for fifty years were discovered in 1958. Scouring tides along the east Norfolk coast removed sand from large areas of the Forest Bed, and from it were taken skulls of Wild Pig and Bison. During dredging operations, a large part of the skeleton of an Aurochs, the extinct Giant Ox, was found in fen near the river Waveney. These fossils are now preserved in Norwich Castle Museum.

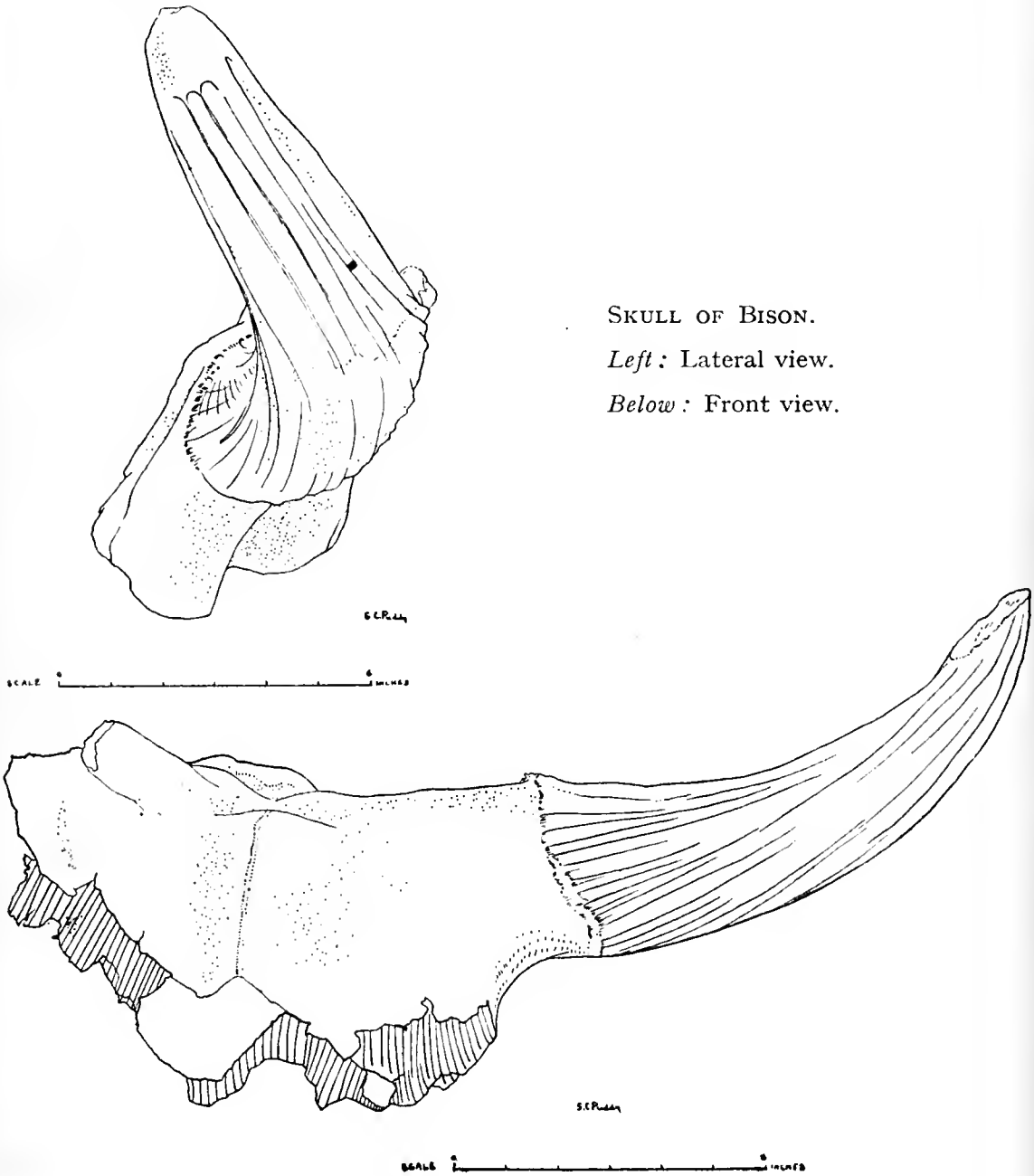
Skull of Wild Pig—*Sus scrofa* L.

During January 1958, the Upper Freshwater Bed at West Runton was exposed to a greater depth than at any time in the last twenty years. An iron-stained sandy bed was just visible beneath the peat which forms the upper part of this deposit. Part of the skull was found embedded in this sandy layer, at its junction with the peat. Some of this sandy matrix was removed with the skull and it was possible to identify three of the molluscan species in this material, *Anodonta cygnaea*, *Pisidium amnicum* and *Viviparus viviparus*, all of which are typical of the Upper Freshwater Bed.

The skull is incomplete, the front portion being missing, but most of the hinder part remains. Much of the skull is shattered and, unfortunately, because of distortion due to crushing, it may be impossible to repair completely the surviving portion. All the molars and premolars remain on the left side as well as the socket for the incisor, but on the right there are only two molars. These teeth are fairly worn and it is obviously the skull of a mature beast. This is the most important fossil of pig to be recovered from the Forest Bed. Most earlier records are of teeth, but a fragment of lower jaw and a metacarpal have also been found.

The animal represented by these earlier remains was thought by E. T. Newton (1882) to be identical with the Post-glacial Wild Boar *Sus scrofa* Linn. Four molars, found in the Forest Bed at Sidestrand, were compared with those of a Recent animal and found to be almost identical. However, other workers did not agree and a variety of names has been suggested for the pig found in the Forest Bed. Though remains of wild pig are rather scanty in both British and continental deposits of this period, it seems probable that there were two different groups (Kahlke 1955). Remains found at Mauer, Mosbach and Süssenborn (Germany) appear to be those of animals somewhat smaller than the Norfolk specimens. This continental group can probably be referred to *Sus strozzi* Meneghini, while the English animals of this period are probably an extinct sub-species of *Sus scrofa*. M. A. C. Hinton

(Osborn 1922, p. 433) suggested the name *Sus scrofa palaeochoerus*, but his reasons for this were apparently never published. However, it is hoped that this new skull from the Forest Bed at West Runton will provide sufficient evidence to determine the relationship of the Norfolk species and serve to establish a suitable name.



SKULL OF BISON.
Left: Lateral view.
Below: Front view.

SKULL OF BISON—*Bison schoetensacki* Freudenberg

This fossil was found lying on the blue clay of the Estuarine Series of the Forest Bed at Bacton, after the tidal scour in January 1958. Only the hind part of the skull survives with one horn-core

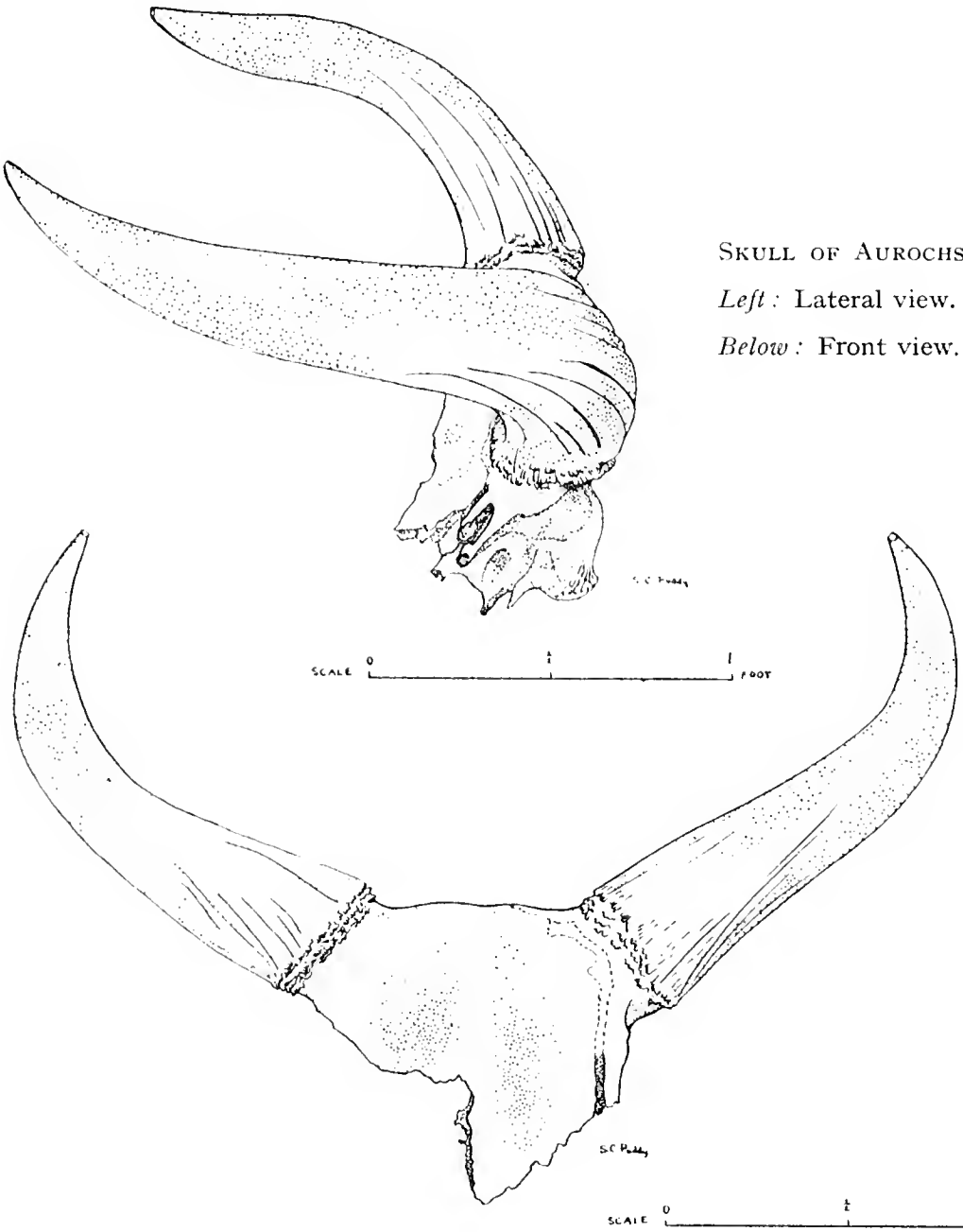
attached and part of the base of the other. A portion of the second horn-core was found, but so far it has not been possible to join this to the rest. Remains previously found have included teeth, parts of limb-bones and horn-cores, but this is the first record of a skull with an attached horn-core.

Until recently, writers have referred all British Pleistocene bison to *Bison priscus* (Bojanus), but it now seems probable that in England, as on the Continent, there are two distinct types, one a large animal with long wide-spreading horns, the other being a smaller animal with much shorter horns. This latter type has been described from deposits at Mauer in Germany as *Bison schoetensacki* Freudenberg (1914). It is suggested that these Mauer deposits are of the same age as the Forest Bed and the description of approximately the Mauer Bison appears to fit the skull from Bacton. It is, however, impossible to be certain of this until the Norfolk specimen has been compared with that from Mauer.

Skeleton of Aurochs—*Bos primigenius* Bojanus

While deepening a drain in September 1958 in fen near the river Waveney at Roydon, near Diss, workmen of the East Suffolk and Norfolk Rivers Board discovered a number of bones of an animal which proved to be an Aurochs or Giant Ox. The bones were found at a depth of 6 feet in fen silt and are therefore certainly Post-glacial in date. They were found spread over a distance of some twenty yards along the drain, but there are fresh breaks in some of the bones and it seems probable that the rest of the skeleton remains buried there. The bones found include the upper bones of three legs, parts of the shoulder blades and the pelvis, foot bones, a number of vertebrae and part of the skull with the horn-cores attached. The horn-cores measured 33 inches apart at their widest.

Remains of this Giant Ox, which stood about six feet high at the shoulder, have been recorded from Post-glacial deposits in many parts of Britain. However, the majority of the remains recovered are skulls and horn-cores and odd bones; only a few even partly complete skeletons are known. The Aurochs probably became extinct in England during the Bronze Age (Piggott 1954, 10), about 1000 B.C., though some may have lingered for a few centuries in the wilder parts of Scotland and Wales. On the Continent, however, these animals were hunted for many centuries and the last was killed in A.D. 1627 near Warsaw in Poland. Few of the British remains have been accurately dated and it is hoped, not only to recover more of the Roydon skeleton, but also to take samples of the fen for pollen analysis. It seems possible, from the comparatively shallow depth at which these remains were found, that this animal may be one of the last of the Giant Oxen in England.



SKULL OF AUROCHS.
Left: Lateral view.
Below: Front view.

I should like to thank Miss S. C. Puddy for her drawings of the Bison and Aurochs skulls and Miss M. Howard for her help in identifying the Bison.

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Moulting Grey Seal Pup.

Scroby sandbank, 28.12.1958.

Photographs by W. J. Woolston

Grey Seal Pup.

Scroby sandbank, 30.11.1958.

THE GREY SEAL (*HALICHOERUS GRYPUS*) IN NORFOLK

By Ruth M. Barnes

The following notes, in chronological order, provide a brief outline of the observed occurrences of the Atlantic Grey Seal in Norfolk from 1881 to 1958.

24th December, 1881. Mr. Goodson, a Trinity pilot, and his son, captured and killed an old female which was watching over the dead carcase of its newly-born young near the Long Sand in Lynn Roads, The Wash. The skins came into the possession of Mr. F. J. Cresswell of Lynn and were later examined by Thomas Southwell ; the skulls were unfortunately destroyed. Mr. Southwell wrote : " I think there need not be the slightest hesitation in claiming the grey seal as a straggler to the Norfolk coast," *Trans. Norf. & Norw. Nat. Soc.*, Vol. III, pp. 415–418. (Also Vol. III, p. 654 ; Vol. III, p. 670 ; Vol. V, p. 408 ; Vol. V, p. 419).

28th November, 1882. A young female was shot on Breydon (skin and skull now preserved in Norwich Castle Museum). In the flesh, it measured 4 ft. 3 in. to the end of the hind flipper, tail 4 in., weight 58 lb. T. Southwell, *Trans. Norf. & Norw. Nat. Soc.*, Vol. III, p. 564. (Also Vo. III, p. 670 ; Vol. V, p. 408 ; Vol. V, p. 419).

28th February, 1892. A grey seal (old female) was captured by two fishermen off Wells. The animal measured more than 6 ft. in length. It lived in captivity for several days and was exhibited in the neighbouring villages. Its skull was presented to the Norwich Museum by Col. H. W. Feilden. *Trans. Norf. & Norw. Nat. Soc.*, Vol. V, p. 419. (Also Vol. V, p. 408 ; Vol. V, p. 633).

30th October, 1904. " A newly-born individual was found floating in the Wash in an exhausted condition, and did not long survive its capture." This statement appeared in an article by Thomas Southwell, published in *The Field*, 1904, and is quoted by A. H. Patterson, " Nature in Eastern Norfolk, p. 319 (1905).

June, 1958. Dr. K. M. Backhouse and the Earl of Cranbrook identified six or seven grey seals, in a colony of common seals, on Scroby sandbank, off Great Yarmouth.

In October, about 100 grey seals were seen near the sandbank.

29th November, 1958. " Skipper " Woodhouse of Caister discovered four pups on Scroby and this was later confirmed by Mr. W. J. Woolston and Mr. P. J. Trett.

7th December, 1958. The sandbank was visited by a party of Yarmouth and Norwich naturalists. Eight pups (all female, their ages ranging from a few days to about two–three weeks) were marked with metal tags by Professor H. R. Hewer of Imperial College, London. Only one bull grey seal was identified on this occasion, although there were a number of cows in a mixed herd with common seals.

SOME FLIES OF THE NORTH NORFOLK SEA COAST

By K. C. Durrant

The coastline extending from Weybourne to Holme exhibits a variety of zonal features, including sand dunes, shingle ridges, salt marshes and grazing meadows. Each zone has its own characteristic Diptera and in the following account mention is made of some of the more typical species likely to be encountered on expeditions to the area during the summer.

On the beach itself, where seaweed and other drifted material forms a tide-mark, two rather shy, dull grey flies, *Ceratinostoma ostiorum* (Hal.) and *Scatomyza litorea* Fall. will be disturbed. These are somewhat similar in appearance to the Ginger Dung Fly, *Scopeuma stercorarium* (L.), of the same family (Cordiluridae), but are rather smaller.

Old war-time gun foundations and other unsightly masses of concrete remain here and there on the shingle ridges and dunes and on these it is not unusual to see beautiful greenish-bronze hover-flies, *Eristalis aeneus* (Scop.) resting; although a coastal insect, this species has been found occasionally on bombed sites in London.

Where sea bindweed and yellow horned poppy grow in the sand, the fairy-like *Phthiria pulicaria* (Mik.) often abounds; it is like a very small edition of the bee-fly, *Bombylius major* L., to whose family (Bombyliidae) it belongs.

Numbers of small greenish flies will often be found in the clumps of marram grass and when disturbed, they tend to hop instead of to fly; these are *Meromyza pratorum* Mg. (Chloropidae). A small fly, *Paroxyna plantaginis* (Hal.) (Trypetidae) is to be seen settled on the marram's flower-heads where its brown-spotted wings camouflage it so well that it seems to be part of the plant.

Two flies likely to be found basking on the hot sand are the rather flat-bodied *Villa circumdata* (Mg.) (Bombyliidae) and the beautiful silver-bodied *Thereva annulata* Fab. (Therevidae); the latter often falls a prey to a small Digger Wasp, *Oxybelus argentatus* Curt., which closely resembles it in size, shape and colour. Also in sandy hollows squat two species of Assassin Flies (Asilidae), the large *Philonicus albiceps* (Mg.) and the smaller, more hairy, *Dysmachus trigonus* (Mg.). These are grey in colour and their prey consists of a variety of flies, beetles and spiders; they are also cannibals.

Where salt marshes are covered with sea lavender, *Statinia marginata* (Fab.) (Sciomyzidae) and the very small *Rivellia syngenesiae* (Fab.) (Platystomatidae) are likely to be taken by sweeping with a net. The most abundant fly on the salt marshes is *Scopeuma stercorarium* (L.) and its variety *merdarium* (Fab.)

which is of a darker, khaki colour and smaller than the typical bright ginger-coloured form. These dung flies are always present where cattle graze on the marshes.

The flowers of sea aster and ragwort attract a great many flies, including several members of the large genus *Syrphus*, the hover-flies with yellow lunules or cross bands on their black bodies. The most frequent visitors are *Syrphus corollae* Fab., *S. albostriatus* Fall. and *S. vitripennis* Mg. Another species present on the flowers is the small, black-and-white *Nemotelus notatus* Zett. (Stratiomyidae), a coastal insect.

At the sides of small pools in the marshes, the metallic green *Dolichopus nubilus* Mg. can be seen dancing like ballerinas, while pairs of small brownish Dolichopodids, *Hydrophorus oceanus* (Macq.) run together across the water in the manner of pond-skaters (Gerridae).

Reed beds are a feature of some of the marshes and here the small flies to be noticed resting on the reed leaves include *Melieria picta* (Mg.) and *M. omissa* (Mg.) (Otitidae), two species with black-spotted wings, and the similarly attractive *Ceroxys urticae* (L.), in the same family. One of the large horse-flies, *Tabanus solstitialis* Mg. is often present here; the females are persistent biters and do not need to be searched for.

Two of the more interesting flies of the grazing areas are the orange-coloured *Pyrophaena granditarsa* Forst. and the black *P. rosarum* (Fab.) (Syrphidae), which pick their way in flight among the grasses somewhat like miniature helicopters negotiating jungle clearings. The males possess curiously flattened front tarsi.

RARE DRAGONFLIES IN NORFOLK

By K. C. Durrant

The following notes refer to five of the rarer species of dragonflies (Odonata) observed by the writer in Norfolk in recent years.

1. The Demoiselle Agrion : *Agrion virgo* L. This beautiful insect was first taken by the writer at the edge of a small open pond on Hoe Common, near East Dereham, on 2nd August, 1946. The river Blackwater which runs close to this spot is a regular habitat of *Agrion splendens* Harr., and at the first sight of a dozen or so *Agrion* females at the pond, it was assumed that these were of the commoner species ; but when the texture and colour of the wings came to be examined, some doubt was felt about this. In *A. splendens* the mature female has yellowish green wings and a bright green metallic abdomen ; but in these specimens the wings were pinkish brown and the abdomens had little metallic lustre. When examples were compared with authentic specimens of *A. virgo*, they were found to match these perfectly. Unfortunately, no males were found. The pond has since been filled in with refuse and no longer exists.

2. The Emperor Dragonfly : *Anax imperator* Leach. This is one of our largest dragonflies. The abdomen of the male is bright blue with a black central line above, that of the female being grass green, with a similar line. This species was first taken by the writer on 27th June, 1950, on a small pool occupying a hollow excavated by a bulldozer at a bomb disposal site on Wendling aerodrome. Two pairs were found in copula and egg-laying was in progress, while a few odd males were seen hawking over the water. Earlier, it was known that this species had colonised various small ponds within eight miles of Wendling. In the latter locality it was seen every year until 1957, after which the pool became choked with greater reed-mace (*Typha latifolia*) and produced no more of the dragonflies.

3. The Small Red Damsel-fly, *Ceriagrion tenellum* (de Vill.). This is one of the smallest British dragonflies and is a real gem in more than one sense, being both rare and of a beautiful clear red body-colour (although the male has a broad black band on top). A colony of this species was discovered on a small calcareous fen near East Dereham on 3rd August, 1955, when about a score occupied a very small area fringed by a belt of reeds (*Phragmites communis*). Several pairs were seen in copula on this occasion. The colony appears to have been able to hold its own in subsequent years, but remains confined to the small area in which it was first noticed. Egg-laying has been witnessed, the eggs being deposited in small puddles formed in the footprints of cattle.

4. The Keeled Orthetrum, *Orthetrum caerulescens* Fab. The males of this species possess fine powdery blue abdomens and are extremely active. On 3rd August, 1955, several pairs were found mated on the same fen as that occupied by *C. tenellum*, a few miles from East Dereham. Some unattached males were seen hawking over the reeds. Since then, odd specimens have been noticed in the locality every summer, but never so plentifully as on the first occasion.

5. The Black Sympetrum, *Sympetrum scoticum* Leach. On an excursion of the Norfolk and Norwich Naturalists' Society to Roydon Common near King's Lynn, on 9th August, 1953, the distinctive black males of this species, new to the county, were recognised by the writer. Several pairs were seen in copula near one shallow boggy pool and unmated females were ranging farther afield over the heather. Specimens were taken and their identification as *S. scoticum* confirmed. This colony has persisted at Roydon Common every year since it was first discovered.

SOME NOTES ON THE CADDIS FLIES OF THE NORWICH DISTRICT

By E. T. Daniels

The following notes record the results of collecting and observing Caddis flies since 1938, with a break during World War II. With one exception (*Brachycentrus subnubilus*) all the species have been recorded within, or a few hundred yards from, the boundaries of Norwich, and from this limited area thirty-nine kinds of Caddis have been collected. This compares with a total of fifty-five species in an unpublished paper by the late Claude Morley covering collections made over a wide area of Broadland and part of the Brecks.

Some Caddis are readily attracted to light and will fly several miles from water. The genera particularly prone to this kind of dispersal are *Phryganea* and *Limnophilus*, and the presence of adults is not conclusive proof of breeding in the area in which they occur, but from the regularity and frequency with which they have been noted I am satisfied that those species marked with an asterisk do in fact breed in the area selected for this study. The others may, of course, but I cannot be sure. As might be expected the majority of those recorded are inhabitants of still waters or very slow running rivers but three, *Chaetopteryx villosa*, *Sericostoma personatum* and *Silo nigricornis*, require a fair rate of current flow if they are to flourish. The richest part of the area comprises that portion of the River Wensum known locally as the Back River, and extending from the New Mills to Hellesdon Mill. The ledges and parapets of the various bridges, the tree trunks and riverside vegetation, as well as the drainage ditches abound in Caddis under suitable conditions. Many bask or fly freely in bright sunshine and the swarms (up to 300 individuals) of brownish flies with very long antennae are a common sight flying just above the water. They usually consist of *Leptocerus* species (mostly *L. cinereus*), but sometimes individuals of *Mystacides azurea* or *M. nigra* associate with *Leptocerus* or form separate but much smaller swarms of their own. A. Brindle has discussed these daylight swarms and points out they consist of males. From time to time a female appears, mates with a selected male and the pair then leave the swarm to rest on the bankside vegetation. He distinguished two types of swarm, one where the swarm moves as a unit rapidly over the surface of the water, individuals weaving to and fro horizontally, and the other where the swarm remains stationary as a unit, the individual members moving up and down in it. He found swarms of *Mystacides azurea* behaved in the second way, while the *Leptocerus* species generally formed swarms of the first type.

The New Mills form a kind of frontier—upstream is a wealth of Caddis life and downstream very little, although two of the common and conspicuous autumn species, *Anabolia nervosa* and *Halesus radiatus* (attracted, I suspect, by light) occur regularly and *Polycentropus flavomaculatus* breeds near St. George's Bridge, in spite of river pollution. The reasons for this demarcation line are presumably the sluices and the pollution which begins shortly downstream, but the Mill buildings themselves are often swarming with Caddis when mass hatches occur. The Yare Caddis fauna differs in composition markedly from that of the Wensum. In particular, *Chaetopteryx villosa, Sericostoma personatum* and *Goëra pilosa* are important and often abundant constituents. The two former seem to be quite absent from the Wensum, and *G. pilosa* has only been noted three times on that river.

In the following notes under individual headings, the English names in brackets are those by which the species is known to fly fishermen.

**Phryganea grandis* Linne (Great Red Sedge or Murragh). Our largest Caddis. Occurs from mid-May to early July on the Back River.

**Phryganea striata* Linne (Great Red Sedge or Murragh). Somewhat smaller than the preceding and reddish-brown instead of greyish, this species occurs in May and June, on the Wensum, sometimes in abundance as in June, 1957 when it was flying in the evening just above the water along the river bank at Hellesdon. Also, one on the Yare.

Grammotaulius atomarius Fabricius. Twice noted in July and September, by Wensum. Comes to light.

Glyphotaelius pellucidus Retzius. Very variable in colour but easily recognised by the excised apices of the anterior wings. I have records from May to September, and have twice seen it in my area on the Yare and Wensum. It is however more of a pond and fen insect. The larva characteristically fastens leaves to its case, either the entire leaf or large discs cut from it.

**Limnophilus rhombicus* Linne. The largest *Limnophilus*, yellow with a central whitish patch on the fore-wing. In June and July not uncommon on the Wensum, once on the Yare. Has a distinct scent.

**Limnophilus flavicornis* Fabricius. An autumn species, very common on the Back River where I have seen it in dozens on a single alder tree. Once on the Yare. On the River Walk marshes the larva commonly forms its case of shells.

Limnophilus marmoratus Curtis. My only Norwich record is an example which I took at light on my window a few days ago (12.10.58).

**Limnophilus lunatus* Curtis. (Cinnamon Sedge). Common from late August until well into October. On Yare and Wensum and frequently at light.

Limnophilus politus McLachlan. Only one record—on Wensum. Is widely distributed in Broadland in late autumn.

**Limnophilus nigriceps* Zetterstedt. Only once met with, in Wensum marshes, but then in great quantity. The ditches had been cleared out and the Caddis occurred on the heaps of debris in bright sunshine on 31.10.54.

Limnophilus affinis Curtis. Once at Old Lakenham Bridge in May.

Limnophilus auricula Curtis. Two records, on both rivers, in May and June.

Limnophilus sparsus Curtis. Twice occurred on Wensum, in July and October. Comes to light and also taken at sugar.

**Anabolia nervosa* Curtis. An almost uniformly dark brown, medium-sized Caddis. Very common on the Yare from mid-September to end-October, when dozens may be obtained on the bridges. Also on the Wensum in numbers. The larva attaches a long stick to its case.

**Halesus radiatus* Curtis. (Caperer). Very common on Wensum from mid-September to end-October, and also, but less abundantly, on the Yare. Comes to light, Mr. D. Ruthven having obtained it in his light trap at Sprowston some miles from suitable water. I have noted that very fresh specimens have a strong, characteristic, odour, which I suspect to be associated with the meconial fluid. Mr. D. E. Kimmins, to whom I communicated this, informs me that an American worker has recorded some species of American *Stenophytax* as producing a strong odour, apparently also connected with the meconial fluid. He discussed the subject in a short paper.

**Chaetopteryx villosa* Fabricius. Only occurs on Yare, where I have taken it every year I have searched for it, in October. It is a small, greyish, Caddis, with very rounded wings, covered with granulations and long stiff hairs.

**Sericostoma personatum* Spence. (Welshman's Button). On the Yare in May, where it is often very common. It is a beautiful insect when fresh, having golden or reddish-brown forewings and black hindwings.

**Goëra pilosa* Fabricius. (Medium Sedge). Occurs from May to July on the Yare from Earlham Bridge down to Trowse Bridge, and sometimes swarms on the waterside herbage. I have one record from the Wensum.

Silo nigricornis Pictet. I have found this twice on the Wensum, in May.

**Brachycentrus subnubilus* Curtis (Grannom or Greentail). This species does not occur in the area here dealt with, as it is found in the upper Wensum at Ringland and Taverham. It is, however, mentioned specially because the distribution map in J. R. Harris's book gives only twelve stations in the British Isles, none of them from Norfolk, the nearest appearing to be in South Essex. The present is a suitable opportunity to point out the Norfolk distribution. It is the first Caddis I notice in the spring, and may be found from mid-April, often in quantity on the bridges. The female is commonly to be seen with a large, greenish egg-mass attached to the end of the abdomen, hence the fishermen's name of Greentail. In the Castle Museum there is a specimen labelled " Felthorpe, 10.4.1882."

**Lepidostoma hirtum* Fabricius. I have only one locality for this insect, Hellesdon Mills, where, however, it was not uncommon on 30.8.53.

**Molanna angustata* Curtis. Quite common on the Wensum bridges from May to September, and occasional on the Yare.

**Leptocerus nigronervosus* Retzius. I have found this handsome species year after year, but at one spot only, and only in May, on the Wensum. It is much larger than the other *Leptocerus* (although very large *L. fulvus* will occasionally equal it) and is conspicuous as it sits in the sun with its very black neuration and long black antennae. It is very alert and not easy to catch.

**Leptocerus fulvus* Rambur. Another handsome species. Reddish, or yellowish-brown, and with yellow and black antennae. It may be seen on the Wensum in July and August, and has occurred very abundantly at the New Mills.

Leptocerus alboguttatus Hagen. I once took this species near City Station, on the Wensum, on 25.10.54—a late date for a *Leptocerus*.

**Leptocerus aterrimus* Stephens. (Black Silverhorns). Widespread in May, June and July by the Yare and Wensum. Very like *Mystacides nigra*, but is sooty, not shining black, and the wing tips are not bent in at rest. Sometimes seen in small swarms.

**Leptocerus cinereus* Curtis. (Brown Silverhorns). Has occurred in May, but mainly in July. On the Wensum abundantly, and also on the Yare near Keswick.

**Leptocerus albifrons* Linne. Occurs in September at Hellesdon. A very pretty fly, with chocolate-brown wings and snowy cross markings.

Leptocerus dissimilis Stephens. Once in June on the Wensum.

**Mystacides nigra* Linne. Quite frequent from May to September, sitting on the bridges and vegetation in full sunlight. Also found, though not so abundantly, on the Yare. Very long antennae, ringed with white.

**Mystacides azurea* Linne. (This species shares with *L. aterrimus* the fisherman's name of Black Silverhorns). Very like the preceding, but with a steely-blue sheen, and conspicuously reddish eyes. If anything, commoner than *M. nigra*, and in the same localities at the same period.

**Triaenodes bicolor* Curtis. A beautiful little Caddis, with reddish forewings and smoky-black hindwings. Common in June on the Wensum marshes flying over the ditches. The larva can be obtained in these ditches, where it builds a characteristic case composed of strips of green vegetation arranged spirally. It is long and slender, and the larva swims easily with the case dangling vertically, strenuously thrashing the water with its strongly fringed legs.

Hydropsyche angustipennis Curtis. (Grey Flag [Sedge]). One record in July on the Wensum.

**Hydropsyche guttata* Pictet. (Grey Flag [Sedge]). In some numbers on the Yare in July.

Neureclipsis bimaculata Linne. One record on the Yare in May.

**Polycentropus flavomaculatus* Pictet. One of the commonest species on the Wensum from May to August. A small very pretty species, with brownish-grey wings closely flecked with golden yellow markings. It breeds in the centre of the city.

Cyrnus trimaculatus Curtis. On the Wensum in August. Requires careful examination to distinguish from previous species, and may well be common and widespread.

**Tinodes waeneri* Linne. (Small Red Sedge). Often very common on the Wensum, in some seasons apparently *the* commonest. A small species (8 mm.) golden brown all over, with elongate and narrow apices to the wings and very distinct neuration.

**Agapetus fuscipes* Curtis. A very delicate and tiny (5 mm.) fly, with black wings. Abundant on the Wensum in June among riverside vegetation.

*Denotes species breeding in the area.

In the foregoing list I have followed the lead of Dr. Hickin and used the spelling *Limnophilus* instead of the more correct *Limnephilus*. The former appears in all the English textbooks and has the advantage of familiarity and cannot lead to confusion.

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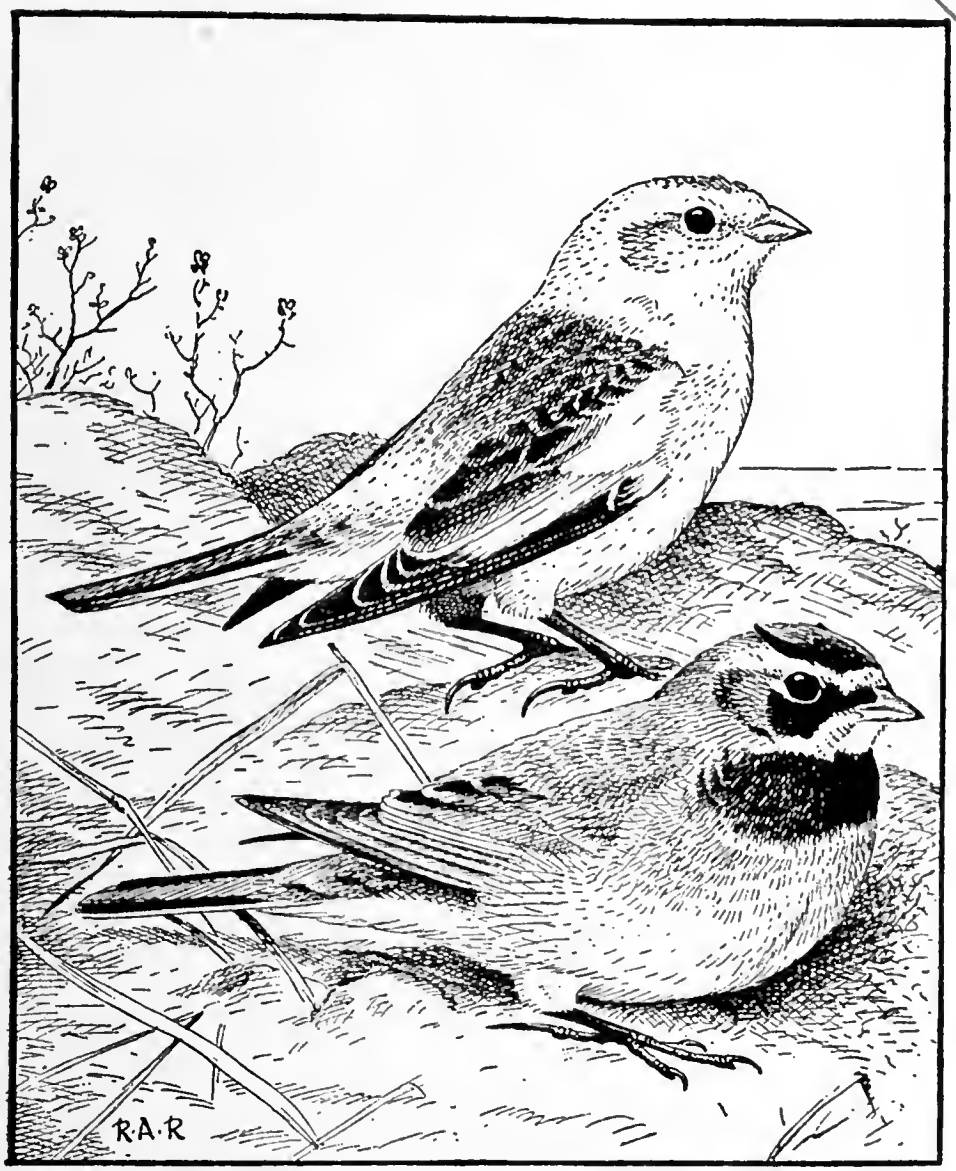
PUBLICATIONS.

Papers on Norfolk natural history intended for publication in the *Transactions* should be sent to the General Editor, E. A. Ellis, Wheatfen Broad, Surlingham, Norwich, by August 31st in each year, for the autumn part published in November. This part will comprise articles (of moderate length) 60% ; records (fauna and flora other than birds and mammals) 20% and miscellaneous items (including the Secretary's Report and Financial Statement) 20%.

Bird records should be sent to Mr. M. J. Seago, 33, Acacia Road, Norwich, and mammal records to Mr. F. J. T. Page, 77, Surrey Street, Norwich, by January 31st, to be edited by them for the joint Bird and Mammal Report published annually in May.

The Committee has agreed on the policy outlined above, also that a minimum of 50% of the Society's income shall be expended on *Transactions* and that the Society shall issue, in addition, special publications, as appropriate. This policy is to remain in force for five years, from January, 1960.

THE NORFOLK BIRD AND MAMMAL REPORT



1959

(Transactions of The Norfolk and Norwich Naturalists Society, Volume 19 Part 3)

NORFOLK BIRD REPORT - 1959

Edited by
MICHAEL J. SEAGO

Assisted by the Records Committee :
R. A. RICHARDSON, A. H. DAUKES AND E. A. ELLIS

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NORFOLK MAMMAL REPORT - 1959

Edited by
F. J. TAYLOR PAGE

Assisted by
R. P. BAGNALL-OAKELEY AND E. A. ELLIS

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Norfolk Bird Report 1959

INTRODUCTION.

THE Council of the Norfolk Naturalists Trust, in co-operation with the Norfolk and Norwich Naturalists Society, is pleased to present to members the annual report on the birds of Norfolk.

January : Single grey phalaropes appeared at Sea Mere on 3rd and at Cromer on 17th. The cold spell between 9th and 17th was too short-lived to bring any really unusual visitors. In north Norfolk, brent geese peaked at 2,600 birds. In the Breydon area, the numbers of white-fronted geese were very low and did not exceed 68. Only small parties of pink-feet were observed.

The following table gives peak numbers of white-fronted geese in east Norfolk since the end of the last war :

1945/46 :	250	1950/51 :	1,500	1954/55 :	800
46/47 :	500	51/52 :	600	55/56 :	500
47/48 :	800	52/53 :	800	56/57 :	150
48/49 :	1,500	53/54 :	250	57/58 :	1,200
49/50 :	600			58/59 :	68

Up to 160 bean-geese wintered in the Yare valley. Waxwings were only reported in small numbers and the numerous parties reaching Norfolk during the previous month had doubtless moved to inland counties. A puffin was found dying at Litcham on 13th.

February : On the north coast, a little stint was at Cley on 2nd ; the wintering flock of Lapland buntings at Morston began dispersing by 15th ; a maximum of 250 eider-ducks were at Brancaster and 6 stonechats appeared at Cley on 26th. In the Fens, peak numbers of wildfowl were reached on 15th with a herd of 343 Bewick's swans on the Ouse Washes, together with 800 pochard and large numbers of pintail and wigeon.

March : The first garganey arrived at Cley on 4th with the first wheatear there on 20th. 3 early hoopoes were seen on 12th—2 at Wheatfen and one at Aylsham. The 23rd brought 2 black redstarts to Cley and 24th the first chiffchaff and a great grey shrike ; also stone-curlew at Marham. 2 Sandwich terns reached Salthouse on 25th. A ring ouzel appeared at Cley on 26th and sand martin, greenshank and 7 Sandwich terns next day when 20 black redstarts were counted between Sheringham and Cley. Up to 8 goosanders were in the Breck at Narford Lake. There were early whimbrel at Breydon and Cley on 28th with the first yellow wagtails ; the following day at Cley, ring ouzel, black redstart and white wagtail were seen. A ferruginous duck stayed at Cawston Manor lakes throughout the month.

April : The first three paragraphs are from Cley Observatory log.

Sandwich terns rose to 60 on 1st and on 2nd, 5 shore-larks were seen ; there were 3 avocets, a firecrest, male Lapland bunting, and 2—3 each of willow warbler and chiffchaff next day. The first swallow came on 5th with over 100 Sandwich terns. Next day, 2 yellow wagtails and 16 siskins appeared to be followed on 7th by the first sedge-warbler. The first blackcap appeared on 9th and a late hen-harrier on 11th.

An influx of Sandwich terns brought the number to 250 by 13th, willow warbler passage was getting under way, with 2 ring ouzels and black redstarts and on 14th new arrivals were tree pipit, nightingale, 2 whitethroats and an immature glaucous gull. At night 40 yellow wagtails roosted in the reed-beds. The first cuckoo and common tern came on 15th and female yellow wagtails began to arrive, the males being now widespread. There was also a third small influx of wheatears, including some big birds, also 4 bramblings.

The first redstart and grasshopper-warbler, with 2 black redstarts, appeared on 17th and first reed-warblers on 21st. The 23rd brought lesser whitethroat, turtle dove, 2 fieldfares, a whinchat, and on 25th the first swift and an avocet. The first wood warbler came on 24th and there was an influx of big wheatears, with the first 3 common and one green sandpiper. Swallows were moving west in good numbers with 1—2 house-martins until 29th when there were 4 little terns. On 30th the Sandwich tern numbers suddenly leapt to 400, the peak before dispersal to the breeding grounds.

Elsewhere, summer migrants were on the whole late in arriving with the exception of chiffchaffs and cuckoos, whilst a grasshopper-warbler returned to Wheatfen by 15th. The most exciting visitor was a kite at Weybourne on 15th.

May : The first three paragraphs are from Cley Observatory log.

Greenshank and great grey shrike appeared on 1st with a second great grey shrike, a dotterel and 3 little stints on 3rd and pied flycatcher and blue-headed wagtail on 6th. Whinchats and whimbrel were passing steadily and grey plovers, turnstones and both godwits figured among the waders at this time. Garden warblers appeared on 8th.

On 9th began an exciting phase in the spring migration. A male red-footed falcon was hawking over the reed-beds, 40 whimbrel passed west, grey plover, green sandpiper and little stint were present, and a spoonbill was followed at dusk by a purple heron. An avocet joined the spoonbill on 10th and a crane flew slowly up and down the marshes. A Montagu's harrier passed over and 80 black terns gradually moved eastwards as they fed over the pools.

Another Montagu's harrier, the avocet and spoonbill, a Kentish plover, 2 wood sandpipers and 4 ruffs were present on 11th, the black terns being reduced to 10. On 12th, first nightjars and spotted flycatcher were seen, also 20 wood sandpipers, red-backed shrikes following on 13th.

A wood sandpiper was singing on 17th. Several brown and white *acredula* willow warblers occurred on 22nd, with 50 black terns moving east and an increase in wood sandpipers. Many swifts passed. Next day, 5 avocets and 50 black terns appeared. A late hooded crow passed west on 30th.

Elsewhere, about 100 crossbills (half of them red birds) were at Kelling on 3rd, a hoopoe at Whiteslea on 11th, 2 gull-billed terns over arable land at Weybourne on 12th and a male red-footed falcon swooped low over Blakeney Point on 15th. The same day, a red-throated pipit was seen at Scolt Head and was joined by a second bird on 16th. 2 ospreys appeared at Horsey on 9th ; one stayed at Hickling 11th—20th and another visited Cawston Manor lakes 14th—18th.

At Hickling Broad, Rush Hills wader ground was full of interest with 9 ruffs on 6th and 7 on 13th, usually 3—4 greenshank, single spotted redshank on 9th and 28th, parties of 3—5 turnstones, 4 wood sandpipers on 24th/25th and 3 on 26th/28th, 3 grey plover on 12th and 4 green sandpipers on 20th ; also numbers of black terns. At Breydon, peak numbers of waders occurred between 17th and 21st including both godwits, knot, grey and golden plovers. A spoonbill was there on 21st and an ortolan bunting at Scolt on 22nd. Wisbech sewage farm held on 23rd spotted redshank, greenshank, a little and 2 Temminck's stints, 4 curlew-sandpipers, sanderling, 30 ruffs and 180 black terns. Other rare waders at Wisbech S.F. included a Temminck's stint on 21st, a broad-billed sandpiper on 19th, a Kentish plover on 21st and up to 6 avocets on 29th—31st.

At Scolt, on 27th, parties of 17, 19 and 10 turnstones were watched climbing high over the Cockle Bight and then departing NNE, loudly calling. A feature of the month were two big invasions of black terns, one at the beginning of the second week and the other in the fourth. The first influx reached spectacular numbers at Cley, even larger numbers appeared between 22nd and 25th with up to 120 at Rockland Broad, 50 at Cley and 180 at Wisbech S.F.

Spoonbills were feeding at Hickling on many dates and 2 there 19th—26th were joined by a third bird on 27th. All stayed till 29th. On 31st, 3 spoonbills at Minsmere (Suffolk) were very probably the same birds.

June : At Cley, a crane flew west at sunset on 1st and 6 spoonbills arrived on 27th (earlier the same afternoon they were seen flying east at Scolt). These spoonbills left Cley on 28th and were seen at Breydon July 5th. 14 spotted redshank were at Wisbech sewage farm on 24th. On 24th/25th there was a westward movement of lapwing at Cley and a wood sandpiper arrived on 27th. The limelight was stolen however by 2 Caspian terns at Hickling on 17th. Up to 200 kittiwakes summered at Scolt and there were over 1,000 at Scroby on 19th.

Unusual nest sites reported included a song thrushes' in a horse collar at Holt, a robin's on the top of a broom against a stable wall at Holt and another robin's in a horse collar at Baconsthorpe. At Snetterton, a pied wagtail built a nest beside the driver's cab of a twenty ton excavator. The excavator moved hundreds of yards a day but 4 young were reared. At Norwich, a wren built its nest in a gardener's cap hanging in a shed whilst at North Burlingham a blackbird's nest with a full clutch of eggs was found on the ground in the middle of a field of broccoli. Blue tits raised a brood under the capping at the top of West Harling church tower 63 feet from the ground. At Corpusty Mill, a wren's nest was built in a 1958 swallow's nest. The swallows built again alongside and reared young.

The warm, dry, summer benefited many breeding birds. At Breydon, sheld-duck had one of their most successful seasons. One evening in mid-June there, 127 young were counted along a mile of estuary wall. On the coast, 920 pairs of Sandwich terns and 1,700 pairs of common terns nested. 100 pairs of black-headed gulls returned to Scoulton Mere which had been deserted in 1958, but many eggs were destroyed. 2 pairs of wigeon nested at Norton and a pair of pintail at Cley. At least 18 young fulmar petrels were reared. 430 pairs of nesting herons were counted compared with 322 pairs the previous year. 2—3 pairs of collared doves nested. Stonechats bred successfully at Winterton. In the Broads area, bearded tits enjoyed a highly successful season and 4 pairs of marsh-harriers nested. No Montagu's harriers are known to have bred in the county. Black redstarts nested, unsuccessfully, for the first time in Norwich. Quail nested at Kirstead Ling and 2 pairs of curlew at Wretham.

July : No rarities were reported, but at Cley there was an early passage of waders. Curlew passage remained in full swing till 3rd when 100 came in from sea. Many lapwings also arrived next day with a green sandpiper. 3 greenshank accompanied the lapwing flocks on 11th. 6 little ringed plover were at Wisbech sewage farm on 15th/17th. All the lapwing moving west on 16th were adults in wing moult and they were followed by 5 whimbrel and 5 black-tailed godwits. 2 avocets arrived on 18th.

August : The first four paragraphs relate to Cley/Blakeney.

A guillemot and its half-grown flightless chick were swimming close inshore on 1st and a corncrake appeared on 3rd. A little ringed plover came in on 7th and on 10th, 2 curlew-sandpipers, a black tern and 2 roseate terns were seen. Wader passage reached a peak on 11th with 17 species including 30 whimbrel, 8 wood sandpipers, 7 adult curlew-sandpipers, 2 little stints, 8 greenshank, 2 spotted redshanks and 40 turnstones.

A great skua was seen on 13th, while on 14th many house martins passed west. 6 kestrels arrived on 15th, 2 cuckoos were flying east and also recorded were 7 curlew sandpipers, 6 ruffs, 2 spotted redshanks, 4 black-tailed godwits and 20—30 wood-sandpipers. Next day over 1,000 curlew passed in half an hour.

A juvenile Montagu's harrier appeared on 17th. Next day, 3 little gulls arrived with a little ringed plover and spotted redshank. 3 dotterel were seen on 10th, also 5 wood-sandpipers and another little gull. A red-necked phalarope appeared on 21st. 15 black terns were moving west with flocks of common terns and the opening phase of passerine migration was indicated by the presence of 10 wheatears, 10 whinchats, 2 redstarts, single garden and willow warblers, a lesser whitethroat and an increase in whitethroats. A wryneck followed on 22nd with 10 pied flycatchers ; another wryneck came on 23rd. An aquatic warbler on 27th was a herald of things to come.

Passerine birds on 28th included the first barred warbler. A sooty shearwater was also seen. The 30th brought a spotted crake and a second barred warbler. Waders at this time included a little stint, ruffs, curlew-sandpipers and a party of 23 grey plovers (all except 2 in breeding plumage).

At no time during this and the following month were any big movements of small passerines observed, presumably because the prolonged spell of calm and clear weather provided perfect migration conditions which enabled birds to continue without stopping. The most notable visitor at Scolt was a barred warbler ringed on 31st. Among the waders, wood-sandpipers reached peak numbers between 11th and 17th. In addition to those at Cley, 23 were at Brancaster on 11th. The next day, at Scolt, a party of 21 common sandpipers flew west and whimbrel were heading west all day. A highlight was a gathering of 47 dotterel at Terrington marsh on 20th.

September : The first five paragraphs relate to Cley/Blakeney.

An early fieldfare, red-backed shrike and 3 pied flycatchers arrived on 1st. A third barred warbler was recorded on 2nd with 2 ortolans, white wagtail, pied and spotted flycatchers, tree pipit, redstarts, garden warblers, wheatears and whinchats. On 3rd, 4 woodlarks were feeding on the beach, an ortolan was seen and the

sea produced a pomatorhine and 10 Arctic skuas. The first bluethroat arrived on 4th, also another barred warbler. On 5th, 2 bluethroats were present, while 3 great and 20 Arctic skuas were off shore and curlew-sandpiper numbers suddenly rose to 20. A fourth bluethroat, a red-breasted flycatcher and a grasshopper warbler were new on 6th and there were 8 pied flycatchers.

A Leach's petrel and a little gull were seen at sea on 9th. The first goldcrest was present on 10th with a grasshopper warbler, while next day saw a red-necked grebe, a coal tit, 10 long-tailed tits, 2 ortolans and 30 whinchats. 5 siskins appeared on 12th while 3 Lapland buntings arrived on 13th. Another sooty shearwater was seen at sea. The 15th brought the first young grey plovers and next day the first rock pipit and 20 whinchats appeared.

Newly arrived passerines on 17th included pied flycatchers, a Siberian lesser whitethroat and a red-breasted flycatcher. On 18th came the first hen harrier, woodcock and jack snipe, with an ortolan.

The 19th proved to be a big day of migration. Many lapwings and starlings were coasting west, a corncrake and a turtle dove were seen and there was a big passage of Hirundines (swallows predominating) ; also the first 2 bramblings. On 20th, a coal tit, 20 whinchats and 6 grey wagtails (moving west) were recorded.

Two corncrakes and a jack snipe appeared on 23rd. Siskins were passing in small numbers most days at this time, more than recorded for some years. Blue, coal and long-tailed tits were turning up in unexpected places on 24th. The following day brought 2 corncrakes, 40—50 snow buntings and a pied woodpecker, while 2 hen harriers were quartering the arable land adjoining the marshes. The 30th heralded the beginning of the early October movement which was perhaps the most profitable period of the autumn—13 goldcrests, a firecrest, 12 redstarts, 14 song thrushes and bramblings.

On the east coast, the highlight was a group of 3 barred warblers (probably on re-determined passage) at Sea Palling on 18th, with them were pied flycatchers, redstarts and whitethroats. At Breydon the peak wader passage was reached on 12th with whimbrel, grey plover, greenshank, bar-tailed godwits, green sandpiper and ruffs. September's most unusual bird of prey was a red-footed falcon found dead near Acle on 27th. At Hickling, a Caspian tern remained on the Broad until October 2nd.

Single red-breasted flycatchers appeared at Holkham on 2nd and 17th and there were 2 at Holme on 19th. Also at Holme, on 6th, were several whinchats, 20 redstarts and 20 pied flycatchers ; together with a barred warbler. A barred warbler was also present there next day. A remarkable total of 400 gannets was off Hunstanton and Holme on 13th. At Scolt, on 28th a kingfisher was at the pond in House Hills and on 30th a red-backed shrike appeared with blackcap, redstarts and pied flycatcher.

October : The first seven paragraphs relate to Cley/Blakeney.

A second firecrest on 1st was accompanied by 16 goldcrests, grey and yellow wagtails, chaffinches, bramblings, redwing, song-thrushes, blackbirds, whinchats, redstarts, blackcap and pied flycatcher, while 6 little gulls were at sea. Blue and long-tailed tits were again in evidence on 2nd and a late turtle dove and ring ouzel were also seen. The 4th was a day of large-scale immigration continuing till well after nightfall. Many song-thrushes and redwings were coming in from the sea with several blackbirds, 3 ring ouzels, a great grey shrike, merlin, hooded crow, several robins, 10 redstarts, many goldcrests, 3 blackcaps, spotted and pied flycatchers, siskins, chaffinches, bramblings, garden warblers and chiffchaffs. The influx continued on 5th with many skylarks, starlings and chaffinches arriving but fewer blackbirds. Thrushes and redwings again came in from noon on 7th accompanied by a few blackbirds and a ring ouzel and there were 12 siskins, a great tit, black redstart, 1—2 Lapland buntings and a woodcock.

The 8th brought in another great grey shrike, with great numbers of song thrushes and redwings ; starlings, greenfinches, chaffinches and bramblings were also arriving but robins and goldcrests were fewer. On 9th, great, blue and long-tailed tits appeared in numbers, with meadow pipits, siskins and tree sparrows. Immense numbers of redwings arrived on 10th with 12 ring ouzels and many song-thrushes, blackbirds and 2 fieldfares. Many goldcrests (again with several robins), 4 blackcaps, 2 garden warblers, redstarts, chiffchaff and a long-eared owl were seen. A northern pied woodpecker was ringed on 11th and there was an influx of snipe, rooks, starlings, skylarks, many redwings, song thrushes, blackbirds, 4 ring ouzels, 4 blackcaps, 6 redstarts and several robins. Also seen were 20 siskins, 50 twites, house and tree sparrows, chaffinches,bramblings, 2 woodlarks, chiffchaffs and pied flycatchers.

On 12th, 5 little gulls were seen ; rooks, lapwings, starlings and 20 mistle thrushes were moving west, meadow pipits were arriving and there was a moderate influx of Turdidae. Reed and yellow buntings increased sharply, many apparently drifting westwards accompanied by house and tree sparrows.

There were further big arrivals of redwings, thrushes and blackbirds on 14th, with a few fieldfares, a chiffchaff, garden warbler, stonechat, blackcap, short-toed lark, 10 long-tailed and 3 coal tits, 12 twites and 2 Lapland buntings. 6 little gulls were on the pools. Blackbirds increased on 16th with a further arrival of chaffinches, bramblings, skylarks, rooks, jackdaws, twites, siskins and redwings. A new fall of robins and goldcrests occurred on 17th and 8 long-tailed tits were seen. Single coal tits appeared almost daily at this

time and the finch, starling and lapwing passage was unabated. A heavy easterly movement of auks developed on 20th. At least 750 razorbills were involved ; also 2 puffins.

A black redstart was seen on 22nd and next day many fieldfares were moving west with several redwings. 3 Lapland buntings and 3 stonechats were recorded on 24th, the fieldfares and redwings still going by. There was an exceptional influx of little gulls at the end of the month with 7 on 26th, 25 on 27th, 12 on 28th, 15 on 29th, 5 on 30th, 2 on 31st and 7 on November 1st.

On 28th a force 9 north to north-west gale set in and ravaged the coast throughout the day and night. The sea spilt over the shingle beach at Cley. Over 30 great, 25 Arctic and 3 pomatorhine skuas passed within a few hours and some were swept inland. Hundreds of kittiwakes entering Blakeney harbour found themselves carried eastwards headlong down the coast. Fleeting glimpses were obtained of 2 storm-petrels and a Leach's petrel " as they fluttered over the yawning trough like black marionettes." On 29th the wind backed to the west and gradually diminished in strength. Skuas dropped in numbers, but were replaced by 2 grey phalaropes, 17 little auks moving west, a glaucous gull and kittiwakes in much the same numbers. 2 black guillemots and a storm-petrel were recorded.

Westward migration was resumed on a most impressive scale on 30th. It was most pronounced up to mid-day, but was still in progress at sunset. It was estimated that 5,000 skylarks, 5,000 fieldfares, 2,500 redwings, 300 blackbirds and 100,000 starlings passed along the coast at Cley. Many were totally exhausted. A grey phalarope was on the sea with another on 31st when a total of 25 little auks moved west. A waxwing appeared on 31st and thousands of starlings passed west.

At Scolt, 30 house sparrows appeared on 2nd, and were followed next day by blue tits and black redstart. On 4th, 30 song-thrushes, several goldcrests, and black redstart arrived. More song-thrushes and blackbirds were noted on 5th with robins, goldcrests and bramblings. Fieldfares arrived on 8th, with parties of bramblings. A late whimbrel passed over next day, when a kingfisher was in House Hills. On 10th, a great tit arrived, with wrens, song-thrushes, many redwings, blackbirds, robins and goldcrests. A siskin passed next day. At Holme, between 4th—11th, the pine plantation behind the dunes contained up to 4 blue, 10 coal and 10 long-tailed tits, 30 song-thrushes, 50 redwings, a few ring ouzels and pied flycatchers, numbers of blackbirds, bramblings, and robins, 15 redstarts (on 4th), 10—20 goldcrests rising to 80—100 on 11th. Also on 11th, 2 woodcock (one of which was trapped and recovered at the end of the year in Finistere, France), and 2 pied woodpeckers with another on 25th. Up to 25 goldcrests were moving through until 25th.

A honey-buzzard was shot at High Kelling on 7th and a ring ouzel struck the Lynn Well light-vessel on 13th. On 17th, a birch spinney and orchard at Waxham were alive with many hundreds of birds including redwings, song-thrushes, blackbirds, long-tailed, coal and great tits, goldcrests and bramblings; also 6—10 ring ouzels and redpolls.

Very heavy movements took place during the last 2 days of the month. At Cromer, there were great influxes of lapwing, skylarks, blackbirds and starlings. Between Stiffkey and Sheringham an all day influx of starlings, fieldfares, blackbirds, song-thrushes, redwings, hooded crows, rooks and lapwings was witnessed on 30th. In the Breck peak numbers of gadwall (90—100) were reached at West Acre.

Small numbers of little auks appeared on the coast with a few inland from 28th. Yet another invasion of waxwings began on 30th. On the last day of the month, it was estimated that 22,500 black-headed and common gulls were roosting at Breydon.

November : The first paragraph relates to Cley/Blakeney.

A conservative estimate of 30,000 starlings, 30,000 skylarks and 5,000 lapwings passed west along the coast during the morning of 1st. Many fieldfares passed west, 4 little gulls were seen and 34 waxwings arrived. There was an influx of blackbirds on 3rd. From 15th—18th many kittiwakes and several little gulls passed east along the shore. 15 Bewick's swans flew west and 5 shore-larks were seen. A great grey shrike was present on 20th. Next day 12 long-tailed tits came in from the sea at a good height and made off inland. A late swallow was still present on 22nd and next day 12 stock doves accompanied rooks and hooded crows heading west.

The 1st was one of the best days of late autumn movement. At Cromer, Sheringham and Wells, there was a huge all-day passage of skylarks and starlings with many lapwings. At Holme, 10,000 lapwings were estimated, together with skylarks, fieldfares and starlings. On the east side of The Wash between Heacham and Hunstanton, large numbers of starlings, redwings, and skylarks were flying WNW until dusk. Skylarks were passing at the rate of 4,000 an hour. On the muds were 10,000 gulls, mainly herring gulls but including many greater black-backs. A Leach's petrel was seen off Sheringham.

On 2nd, at Snettisham, there was a southerly movement of many starlings, skylarks, chaffinches, lapwings, rooks and field-fares. 7 siskins were also noted. Numerous parties of waxwings appeared in the county but the majority did not stay long. On 13th, following a SE gale, a storm-petrel was found on a boating lake at Yarmouth. There was a little crake at Brinton on 15th. An influx of woodcock was noted on 26th and 26 were flushed in a small wood at Brinton. An avocet was at Brancaster on 30th.

A remarkable feature of the late autumn was the immensity of wood-pigeon movement. At Yarmouth, on the morning of 23rd shortly after daybreak until 10 a.m. flock after flock arrived from a NE direction. Many continued in a SE direction, but others passed SW over Yarmouth. The flocks ranged from parties of 50 to companies of 400—500 and approached the shore just north of Scroby. On 21st flocks of wood-pigeons also passed over Yarmouth and again on 24th. One stock dove was found exhausted in the centre of Yarmouth at this time. Further big influxes were noted at Yarmouth, December 4th/5th. The Newarp light-vessel (9½ miles off Winterton) reported numbers of wood-pigeons on the night of December 3rd/4th and 2 were killed. The Haisbro' light-vessel (8½ miles NE of Mundesley) reported many circling the vessel and some alighting on 22nd and again on December 6th. The Inner Dowsing light-vessel (10 miles off the Lincolnshire coast) had many on December 4th, 6 of which landed and others on 5th. At Cley, phenomenal numbers arrived from direction of the sea on 19th, 21st and 24th. Tens of thousands passed. One flock on 24th was 150 yards broad and extended for half a mile. At Scolt, on 30th, 45 came in from a NNE direction and continued inland ; flocks of up to 300 were flying east and west during the day ; 3 tired birds were found December 1st and the next day, groups of 25 and 37 came in from the sea and one was completely exhausted.

December : A late house-martin stayed at Gooderstone 4th—6th. Following severe SW—S gales in SW England on 6th/7th, a storm-petrel was picked up dead at Norwich on 8th. The same day a grey phalarope was seen at Sheringham. 5,400 sheld-duck were on The Wash at Snettisham on 12th. A drake red-crested pochard visited three north Norfolk lakes from 15th onwards. The first fulmars had returned to their breeding cliffs by 24th. At the end of the month, 800 brent geese had reached Morston and there were 400 at Brancaster. A water pipit was identified at Cley on 26th. On 31st an unusually large flock of 60 snipe was seen at Stiffkey and there was a remarkable total of 500 eiders in The Wash. Up to 26 shore-larks frequented Cley beach.

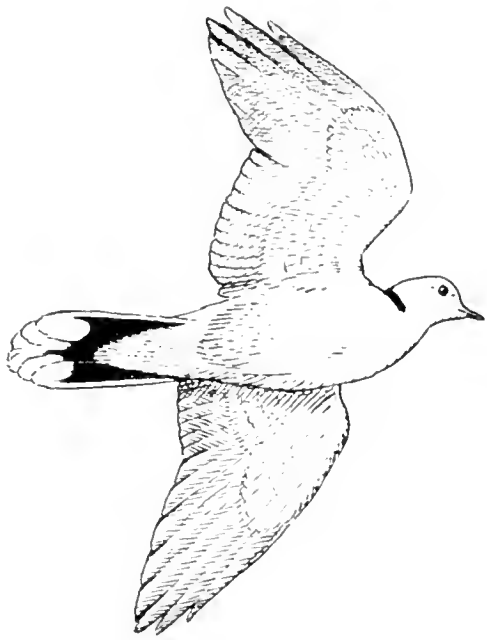
Varieties reported included an all white pheasant at Holt, 2 rooks with white wing patches at Thorpe-next-Norwich and at Corpusty, an all-white hedge-sparrow killed by house sparrows at Blofield, a very pale starling with white wings at Horsford and a partly white house sparrow at Blakeney. 233 species of birds were recorded in the county during the year.

We are indebted to R. A. Richardson for the cover drawing of snow bunting and shore-lark and for other delightful illustrations ; also to J. V. Beer, P. R. Clarke, C. C. Doncaster and R. Jones for their photographs ; to the Cambridge Bird Club, to the Gt. Yarmouth Naturalists Society for light-vessel notes ; to the Trinity House Depot at Yarmouth ; to *British Birds* and to all other contributors.

Records for the 1960 Report should be sent *by the end of January* to Michael J. Seago, 33 Acacia Road, Thorpe, Norwich, NOR 71T. Records should be in Check List order rather than in diary form.

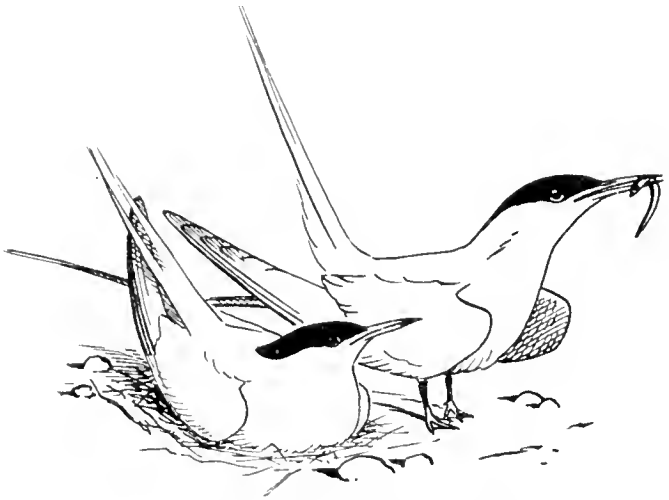
Attention may be drawn to the following papers affecting Norfolk published recently :

" The spread of the Eider in Gt. Britain " (*British Birds*, Vol. 52, pp. 245 – 258) ; " Watching Migration by Radar " (*British Birds*, Vol. 52, pp. 258 – 267) ; " Migration across the North Sea studied by Radar " : Part 1 Survey through the year (*Ibis*, 101 (1959) pp. 209 – 234) and Part 2 The Spring departure 1956 – 59 (*Ibis*, 102 (1960), pp. 26 – 57) ; " The September drift-movements of 1956 and 1958 (*British Birds*, Vol. 52 pp. 334 – 377) ; " A Winter census on The Wash (*Bird Study*, Vol. 6 pp. 123 – 132) ; " Bewick's Swans in the British Isles in the Winters of 1954/5 and 1955/6 " (*British Birds*, Vol. 52 pp. 393 – 416) ; " The irruption of tits in autumn 1957 (*British Birds*, Vol. 53 pp. 49 – 77, 99 – 117 and 176 – 192) and " The coastal roosting of gulls in England and Wales 1955/6 (*Bird Study*, Vol. 7 pp. 32 – 52).



Collared Dove

Notes on Breeding Birds of the Norfolk Nature Reserves.



SCOLT HEAD ISLAND
(The Nature Conservancy)

WARDEN : R. CHESTNEY
ASSISTANT WARDEN : P. J. MOUNTFORD

In 1959, the Assistant Warden carried out a close survey of breeding species outside the Ternery Area and it was thus possible to obtain a more comprehensive picture of the resident bird population this year than in the past. Records for the whole of the island are summarised below :

Species	*Number of nests or pairs of birds*	*Hatching success*	*Fledging success*	*Young ringed*
Mallard	14 nests	?	?	
Sheld-duck	150–200 pairs	?	Poor	
Red-legged Partridge	3–4 nests	Good	Fair	
Partridge	1 nest certain	Good	Good	
Oystercatcher	73 pairs	Fair	Very poor	13
Ringed Plover	150–175 pairs	Poor	Very poor	12
Redshank	80–100	Fair	?	
Black-headed Gull	30 pairs	Nil	Nil	
Common Tern	400 pairs	135 nests	17	
Arctic Tern	1 nest	1	Nil	
Little Tern	19 nests	Poor	Poor	
Sandwich Tern	20 nests	Poor	Nil	
Stock-Dove	1 nest certain	?	Nil	
Cuckoo	1 pair	?	2	
Skylark	Bred generally	Good	Good	5
Meadow-Pipit	Bred generally	Good	Good	4
Linnet	30 pairs	Fair-good	Fair-good	15
Reed-Bunting	18 pairs	Poor	Poor	5

One adult of each of the following species was ringed :

Cuckoo, Skylark, Meadow-Pipit, Reed-Bunting.

Many species suffered losses of eggs through the interference of rats, black-headed gulls, carrion crows and high spring tides. At Scolt Head terns of all three species had an exceptionally poor breeding season.

An open sheld-duck's nest was made in marram grass on Low Hills and three out of seven eggs hatched ; another sheld-duck's nest in the same area was made in a tunnel of marram grass and hidden from view. The reason may have been an acute shortage of holes.

BLAKENEY POINT
(The National Trust)

WARDEN : W. EALES

Although Sandwich terns did not nest on the Point in 1959, the breeding season for most other species was good. The Far Point was badly affected by high tides during June, when two hundred nests of common tern were lost, together with eight oystercatchers', one Arctic tern's and several ringed plovers'. This area is becoming more and more subject to inundations.

A short-eared owl was a regular visitor during the period when terns were hatching and took a large number of chicks. Rats were more troublesome than usual during the dry weather. Whitebait were very scarce during the summer.

Several times, roseate terns were seen, but none succeeded in breeding.

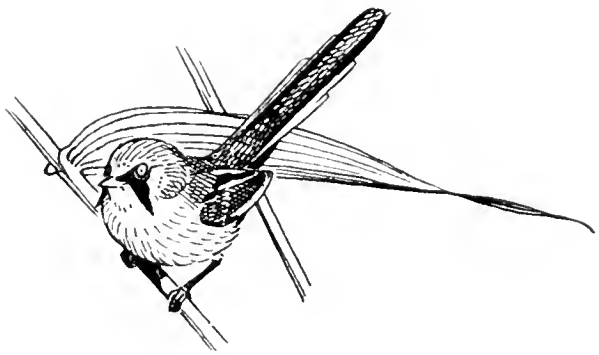
During the hot summer, nests of some species were found very late. Some common terns were hatching on 6th August, ringed plovers on 9th August, skylarks on 13th August and linnets on 15th August.

There was a notable increase in the number of redshanks nesting in the Ternery Area ; some birds chose sites well out on the shingle ridges, using only a few wisps of marram grass as a partial covering for their eggs.

The following is a summary of nests marked and estimated :

	Marked	*Estimated*
Sheld-duck	27	45–50
Red-legged Partridge ...	2	

	Marked	*Estimated*
Oystercatcher	91	
Ringed Plover	76	
Redshank	38	50
Common Tern	970	
Arctic Tern	2	
Little Tern	94	
Swallow	1	
Skylark	53	75
Linnet	21	40



CLEY AND SALTHOUSE
(The Norfolk Naturalists Trust)

WARDEN : W. F. BISHOP

A fine, dry summer greatly favoured many of the nesting species, especially the bearded tits and mallard.

Bittern.—The weather was mild at the end of February and booming commenced earlier than usual, being heard on February 27th. The first nest, containing four eggs, was found on April 13th and by May 4th all eggs were hatched. Five males were booming : four at Cley and one at Salthouse. One nest at Salthouse contained newly hatched chicks on May 16th.

Mallard.—It was estimated that 250–300 pairs bred in the area in 1959 and a large percentage of young were reared.

Teal.—No nests were found, but it is thought that at least three pairs bred on Cley Marsh.

Garganey.—Two pairs arrived on March 4th and a further two pairs were present on March 27th. Eleven young were flying on July 16th.

Shoveler.—A further increase was noted ; at least twenty pairs bred.

Gadwall.—It was estimated that about eight pairs nested.

Pintail.—One pair, probably the same as in 1958, bred in the area.

Sheld-duck.—Many of these ducks now nest in hedges and long grass. They enjoyed a very successful breeding season and large numbers of young were on Arnold's marsh during June. The first young were flying on July 21st.

Water-Rail.—Young were seen from the East Bank in June.

Oystercatcher.—It was estimated that 8–10 pairs bred and reared young (these included birds nesting on arable land adjoining the marsh).

Lapwing.—The increase in breeding numbers continued. 15 pairs nested in one field adjoining the marsh, there being a total of approximately 100 nests on marsh and farmland.

Ringed Plover.—Only 6–8 pairs bred, following the disastrous season of 1958. All reared young successfully.

Redshank.—40–50 pairs bred and enjoyed a successful season.

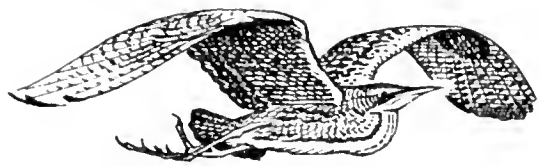
Stone-Curlew.—Young were reared in four nests in the vicinity of Cley Hall Farm.

Common Tern.—38 pairs with nests in early June, but after a female rat had taken a disastrous toll of chicks one night, only about a third of the young survived.

Little Tern.—A decreasing species in the area. Only 6 pairs bred and reared young.

House-Martin.—22 pairs bred on the Watcher's Cottage.

Bearded Tit.—There were about fifteen pairs at the beginning of the season: more than ever before. The first nest was found on April 11th and the first young left the nest on April 27th. Several pairs reared third broods and the nesting season was highly favourable.



HICKLING
(The Norfolk Naturalists Trust)

WARDENS: E. PIGGIN assisted by G. E. BISHOP

Great Crested Grebe.—Fourteen breeding pairs on Hickling Broad and Heigham Sounds. Eight nests were found.

Heron.—As in 1958, ten nests were counted: two in Whiteslea wood, five in the Sounds wood and three in the General's wood.

Bittern.—Booming was first heard March 1st. One nest was found May 6th containing one egg and three chicks. A second nest contained two eggs and one chick May 22nd. On June 3rd, six bitterns were flying together over Heigham Corner.

Garganey.—The first pair arrived March 18th and there were six pairs by the end of April. A brood of nine ducklings was watched June 25th.

Mute Swan.—A herd of up to 350 was resident on the Broad throughout the year. Eight nests were found.

Marsh-Harrier.—In early April, five hens and two cocks were present. Two nests were found on Wet Spurling's May 6th and both hens appeared to be served by the same cock. One nest held four eggs, the first of which hatched May 27th. On June 21st, two of the young died and the hen disappeared. The orphan chick was fed by hand and was ringed on the 24th. At the second nest, which contained three eggs, two young hatched and both reached the free-flying stage. One was ringed. The third nest near Sounds wood had five eggs, but the hen disappeared.

Common Tern.—First noted May 3rd. Two pairs nested on Rush Hills and a third pair on a "hover" on Heigham Sounds.

Bearded Tit.—These birds enjoyed one of their best breeding seasons. The first nest was found on Swim Coots April 26th and throughout May and June the wardens' diaries record the discovery of many nests at Hickling Broad, Whiteslea and Heigham Sounds. At least 45 pairs are estimated to have bred.

HORSEY

(Major Anthony Buxton)

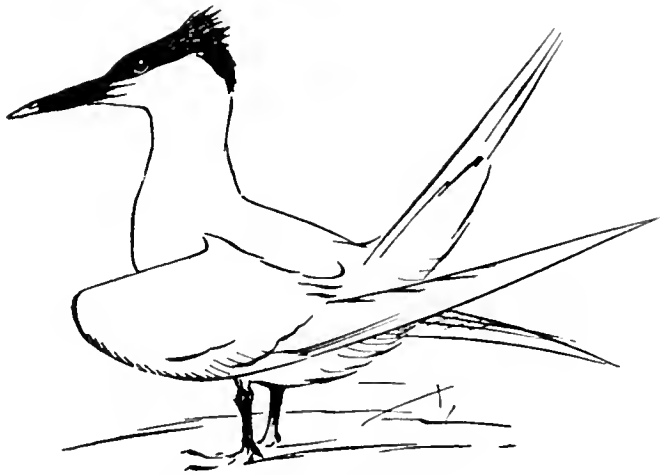
Reeper: G. Crees

1959 was a remarkably good season for bearded tits and at least twenty pairs nested around Horsey Mere. They all appeared to have three broods. A pair was nest building April 17th and the first nest with six eggs was found two days later. One nest was liberally lined with bittern and mallard feathers. During Sep-

tember parties of ten to fifteen bearded tits were frequently observed travelling high over the reed-beds. At the end of the autumn, a compact flock of at least ninety was seen.

A cock marsh-harrier had two hens. One hen laid three eggs, two of which hatched and both young reached the free-flying stage. When the nest of the other hen was looked at it contained no eggs. This nest was in thick sedge and there were no tracks up to it. The two nests were about 500 yards apart. At the end of the year, three marsh-harriers were still at Horsey. No Montagu's harriers were seen.

The first bittern was heard booming March 3rd; there were at least five booming males. A water-rail's nest with six eggs was found on Brayden marshes April 24th. No oystercatchers or short-eared owls bred. A pair of goldcrests nested successfully in a cedar tree in the Hall gardens—for the first time since at least 1931.



SCROBY SANDS

(Robin H. Harrison)

The first visit in 1959 was made on June 7th. 210 common terns' nests were counted and there were four newly hatched common tern chicks. It was, however, disappointing to find only one small group of 23 Sandwich terns' nests with eggs. The main colony of some 300 Sandwich terns' nests had been destroyed; these nests had been in four groups and the sand was littered with broken egg-shells. There was little doubt that the eggs had been plundered by greater black-backed gulls of which there were several hundred on the sandbank. In previous years it has been late summer before any big number of these gulls has assembled at Scroby. A small colony of eight little terns' nests was found at the north-east corner of the sands. Each contained two eggs. Between two and three hundred kittiwakes were seen.

Adverse weather prevented any further landing on Scroby until July 5th. There were then hundreds of young common terns on the sands, some almost fully fledged. 70 young common terns were ringed. A new colony of 121 Sandwich terns' nests was found and many of the eggs were hatching. Nineteen young Sandwich terns were ringed. Over 700 kittiwakes were on the island.

On July 7th, it was found that more Sandwich terns had hatched and a further twenty were ringed, together with 34 young common terns. Many juvenile common terns were on the wing, but there was also a large number of eggs.

It was discovered on July 19th that the remaining colony of Sandwich tern eggs and chicks had been destroyed. Again there was little doubt that greater black-backed gulls were responsible. Only one survivor was found, a chick ringed on July 5th. A further 67 young common terns were ringed and there were several common tern nests containing eggs.

On July 21st, 18 young common terns were ringed. There was no sign of any new Sandwich tern nests. A final trip was made to Scroby on July 26th when there were still quite a number of common terns' eggs. A further 37 young common terns were ringed. This made a total of 226—the largest number of common terns yet ringed here in one season.

Wryneck

CLEY BIRD OBSERVATORY

(Warden : R. A. Richardson)

As many members will already know, Cley Bird Observatory became independent of the Norfolk Naturalists Trust on 1st January 1959 and a local committee was formed to manage its affairs. The N.N.T. sponsored the Observatory from the time of its inception by R. A. Richardson in 1949 and the two organisations will continue working together towards the better understanding of bird migration and related subjects.

1959 was a record year for the Observatory. 2,846 birds of 102 species were ringed (2,098 trapped and 748 as nestlings) and the grand total since 1949 now stands at 14,384 birds of 148 species. Ten species appeared on the ringing list for the first time : eider, mute swan, common partridge, spotted crake, two jack snipe, shorelark, three bearded tits, three siskins, two twites and three lesser redpolls while others worthy of mention were little grebe, seven fulmars, eleven herons, water-rail, fourteen snipe, wood and common sandpipers, three ruffs, 426 Sandwich terns, 2 collared doves, Northern greater spotted woodpecker, wryneck, willow tit, great grey shrike, waxwing and two Lapland buntings. A selection of recent recoveries follows this report.

Experimental rings of neater, non-overlap pattern have been issued to ringers handling a wide diversity of species and this is making possible the compilation of a revised list of appropriate sizes.

Full accounts of the spring and autumn migrations as observed at Cley were published, with similar reports from the other Observatories, in parts 2 and 3 of *Bird Migration*, a new journal of the British Trust for Ornithology. In addition a number of requests for information on specific subjects were answered and the Observatory continued to co-operate with Dr. David Lack whose studies, by means of radar, of migration in East Anglia is producing startling and hitherto unsuspected facts about the magnitude, direction and altitude of movements affecting Norfolk and the North Sea.

The daily estimate of all species present in the Observatory area was maintained continuously throughout the year and the willing assistance and keen interest of the many visiting bird-watchers have been of great value.

We are fortunate to enjoy continued access to the blackthorn thicket on the Salthouse boundary (the site of the Heligoland traps) and to the eminently productive mist-netting grounds on Blakeney Point and Snipe's marsh, Cley. To all concerned our grateful thanks, not least to Barry Spence who spent a total of some fifteen weeks as assistant warden and whose skill and enthusiasm was largely responsible for the increase of over a thousand on our previous best ringing total.

Prospective visitors can book hotel or cottage accommodation in the Cley district, details of which may be obtained from R. A. Richardson at Hill-top, Cley, Holt, Norfolk.

CLEY BIRD OBSERVATORY RINGING PROGRESS.

Species	1959	Total since 1949	Total Recoveries*
Little Grebe	1	2	
Manx Shearwater		1	
Fulmar	7	52	
Heron	11	33	5
Bittern		4	1
Mallard	1	18	4
Teal		2	
Wigeon		3	1
Scaup		8	2
Eider	1	1	
Sheld-Duck	1	7	
Brent Goose		1	
Mute Swan	1	1	
Sparrow Hawk		1	
Montagu's Harrier		2	
Kestrel	8	16	1
Common Partridge	1	1	
Water Rail	1	4	
Spotted Crake	1	1	
Corncrake		1	
Moorhen	1	9	1
Oystercatcher	3	32	1
Lapwing	32	305	1
Ringed Plover	9	71	
Turnstone		2	
Snipe	14	19	
Jack Snipe	2	2	
Woodcock		3	1
Wood Sandpiper	1	4	
Common Sandpiper	1	5	
Redshank	3	41	1
Knot		3	
Purple Sandpiper		3	
Dunlin		9	1
Ruff	3	10	
Grey Phalarope		2	
Stone Curlew		7	
Common Gull		1	
Black-headed Gull	31	224	6
Common Tern	26	101	1
Little Tern	1	11	
Sandwich Tern	426	508	1
Razorbill		4	
Little Auk		2	
Guillemot	1	5	
Stock Dove	4	33	2
Wood Pigeon	1	13	2
Turtle Dove	2	46	4
Collared Dove	2	4	1
Cuckoo	3	16	
Barn Owl	3	22	
Little Owl		8	
Tawny Owl	5	22	1
Long-eared Owl		6	
Short-eared Owl		10	3
Nightjar		4	
Swift		26	2
Kingfisher		1	
Green Woodpecker	1	2	
Great Spotted Woodpecker	2	3	
Wryneck	1	4	
Woodlark		16	
Skylark	9	180	3
Shorelark	1	1	
Swallow	176	452	8
House Martin	36	65	
Sand Martin	32	96	1
Rook		60	2
Jackdaw	5	23	1
Magpie	4	7	
Jay		17	
Great Tit	28	204	
Blue Tit	69	520	
Coal Tit		29	
Marsh Tit	3	18	
Willow Tit	1	25	
Long-tailed Tit	43	61	
Bearded Tit	3	3	
Nuthatch	5	11	
Tree Creeper	1	18	
Wren	26	90	1
Dipper (Black-bellied race)		1	
Mistle Thrush	1	45	
Fieldfare		9	
Song Thrush	242	718	5
Redwing	24	38	1
Ring Ouzel	3	5	
Blackbird	196	1,086	17
Wheatear	10	144	1
Stonechat	1	10	2
Whinchat	25	52	
Redstart	24	143	
Black Redstart		29	
Nightingale		135	
Bluethroat	2	7	
Robin	129	629	3
Grasshopper Warbler	1	14	
Reed Warbler	23	97	
Sedge Warbler	14	125	7
Aquatic Warbler		1	
Melodious Warbler		2	
Icterine Warbler		4	
Blackcap	2	152	1
Barred Warbler	2	7	
Garden Warbler	12	73	
Whitethroat	37	709	21
Lesser Whitethroat	4	43	
Subalpine Warbler		1	
Willow Warbler	31	528	1
Chiffchaff	11	54	
Wood Warbler		11	
Goldcrest	118	162	
Firecrest	2	3	
Spotted Flycatcher	25	77	
Pied Flycatcher	11	122	
Red-breasted Flycatcher	2	3	
Hedge Sparrow	98	472	
Meadow Pipit	29	367	9
Tree Pipit	7	21	
Rock Pipit	1	8	
Pied Wagtail	1	65	1
White Wagtail	1	2	
Grey Wagtail		4	
Yellow Wagtail	8	128	2
Blue-headed Wagtail		5	
Waxwing	1	2	
Great Grey Shrike	1	4	
Woodchat Shrike		1	
Red-backed Shrike		103	
Starling	100	478	9
Greenfinch	89	891	4
Goldfinch	19	49	
Siskin	3	3	
Linnet	26	404	6
Twite	2	2	
Lesser Redpoll	3	3	
Bullfinch	9	27	
Chaffinch	108	723	2
Brambling	22	297	1
Yellow Bunting	109	290	
Corn Bunting		5	
Ortolan Bunting		1	
Rustic Bunting		1	
Reed Bunting	42	247	
Lapland Bunting	2	7	
Snow Bunting		175	1
House Sparrow	88	665	1
Tree Sparrow	56	136	1
House x Tree Sparrow Hybrid		1	
GRAND TOTALS	2,846	14,384	153

*Including initial local " re-traps " of birds known or believed to have migrated since ringing, but not of residents.

Species Total : 1959—102 ; Since 1949—148.

SELECTED RINGING RECOVERIES

(Notified in 1959)

	Ringed	Recovered
Shag	Farne Islands. 10.6.57 (as young).	King's Lynn. 27.1.58.
Shag	Isle of May. 3.6.57 (as young).	Overy Staithe. 9.2.58.
Shag	Farne Islands. 21.6.57 (as young).	Near King's Lynn. 9.3.58.
Shag	Farne Islands. 29.6.57 (as young).	Brancaster Staithe. 16.3.58.
Shag	Isle of May. 14.7.56 (as young).	Thornham. 16.3.58.
Shag	Farne Islands. 7.7.58 (as young).	Stow Bedon, Attleborough. 13.1.59.
Heron	Denver. 26.4.58.	Aveiro (Beira Litoral), Portugal. 16.10.58.
Heron	Wiveton. 18.5.58 (as nestling).	Ballynabraggett, Co. Down. 17.1.59.
Mallard	How Hill, Ludham. 8.2.56	Leshukonskoe (Archangel), U.S.S.R. 20.8.58.
Mallard	How Hill, Ludham. 5.2.58.	Near Olecko (Bialystok), Poland. September, 1958.
Mallard	How Hill, Ludham. 5.2.58.	Near Kannus (Vaasa), Finland. 11.5.59.
Mallard	How Hill, Ludham	Recoveries notified from Holland (2), Germany (1) and Sweden (1).
Teal	How Hill, Ludham. 4.1.58.	Byske (Vasterbotten), Sweden. 21.8.59.
Gadwall	Abberton, Essex. 24.5.57.	Gressenhall. 11.10.58.
Scaup	Cley. 28.2.54.	Ust-Tsilma, Pechora River, Komi, U.S.S.R. 25.5.58.
Scaup	Dereham. June 1955 (as captive bred juvenile).	Great Stambridge, Essex. Autumn 1958.
Coot	Abberton, Essex. 11.1.57.	Rockland Broad. 17.1.59.
Lapwing	Breydon. 10.5.58 (as nestling).	St. Jean de Liversay (Charente-Maritime), France. 20.1.59.
Ringed Plover	Scolt Head. 20.6.58.	Skegness, Lincs. 13.10.59.
Turnstone	Daneborg, N.E. Greenland. 2.6.56.	Sea Palling. 25.1.59.
Curlew	Pori, Finland. 6.6.56 (as nestling).	Stiffkey. 15.1.58.
Dunlin	Holme. 19.8.58.	Near Vila Do Conde (Douro Litoral), Portugal. November 1958.
Dunlin	Revtangen, Norway. 29.9.57.	Terrington marshes. 3.12.58.
Dunlin	Island of Amager, near Copenhagen, Denmark. 11.8.58.	Breydon. 10.1.59
Herring Gull	Rottumeroog, West Frisian Is., Holland. 20.8.56.	Wootton marshes. 26.4.58.
Black-headed Gull	Near Riga, Latvian S.S.R. 6.6.56.	Breydon. January 1958.
Black-headed Gull	Island of Nordre Ronner in Kattegat. 29.6.59 (as young).	Brancaster. 20.10.59.
Kittiwake	North Shields, Northumberland. 1.7.58 (as nestling).	Scolt Head. 25.5.59.
Common Tern	Scolt Head. 30.6.58.	Near Freetown, Sierra Leone. 19.1.59.

Common Tern	Scolt Head. 6.7.58.	Near Port-Etienne, Mauritania. End February 1959.
Common Tern	Scolt Head. 27.6.58.	Sassandra, Ivory Coast. 15.5.59.
Common Tern	Scroby Sands. 18.6.58 (as nestling).	Dakar, Senegal. 11.12.58.
Common Tern	Scroby Sands. 7.7.59 (as nestling).	Happisburgh. 16.8.59
Common Tern (V32207)	Stiffkey. 29.6.58 (as nestling).	Dakar, Senegal. 23.6.59 (caught and released).
Common Tern	Scolt Head. 30.6.58 (as nestling).	M'Bour, Senegal. 10.11.58.
Common Tern	Scolt Head. 3.7.57 (as nestling).	Monrovia, Liberia. 15.6.58.
Sandwich Tern (2 nestlings)	Scolt Head. 18.6.58.	Keta Lagoon, Ghana, 7.6.59; and Anyoko Lagoon, near Keta, Ghana, 14.10.59.
Sandwich Tern	Scolt Head. 23.6.58 (as nestling).	Hann beach, near Dakar, Senegal. 27.3.59.
Sandwich Tern	Scolt Head. 2.7.57 (as nestling).	Keta Lagoon, Ghana. 7.6.59.
Sandwich Tern	Stiffkey. 21.6.59 (as nestling).	Portimao, Portugal. 27.9.59.
Sandwich Tern	Scolt Head. 5.7.57 (as nestling).	Spain, Near Cartagena (Murcia), September 1958.
Swallow (A72833)	Cley. 13.5.56 (as female).	Nested where ringed, 1956–59.
Swallow (E16553)	Cley. 1.9.57 (as male). (These swallows are a pair).	Nested where ringed, 1957–59.
Song-Thrush	Aylsham. 14.9.58.	Montendre (Charente-Maritime), W. France. 30.11.59.
Redwing	Cley. 7.10.59 (as first winter).	Moron de la Frontera (Seville), Spain. 10.12.59.
Blackbird	Sokndal, S. Norway. 14.6.57 (as young).	Cley. 22.11.59.
Blackbird (X33087)	Cley. 12.4.53.	Regularly where ringed till January 1959.
Sedge-Warbler (K11682)	Cley. 24.5.58 (as adult).	Nested where ringed, 1958–59.
Whitethroat (A56669)	Cley. 28.5.56 (adult).	Nested where ringed, 1956–59.
Whitethroat (C31390)	Cley. 18.5.57 (adult).	Nested where ringed, 1957–59.
Whitethroat (E16832)	Cley. 10.5.58 (adult).	Nested where ringed, 1958–59.
Spotted Flycatcher	High Kelling. 22.6.58 (as nestling).	Eneriz, near Puente de la Reina (Navarre), Spain. 14.9.59.
Pied Flycatcher	Holme. 22.9.57.	Near Vila Franca Das Naves (Beira Alta), Portugal. 22.10.58.
Yellow Wagtail	Cley. 5.6.58 (as nestling).	Lisbon, Portugal. 27.9.59.
Starling	Cley. 15.1.59.	Loxstedt (Niedersachsen), Germany. 14.10.59.
Starling (R51753)	Sheringham. 19.1.59.	Wilhelmshaven, Germany. 3.5.59 (trapped and released where nesting).
Starling	Kandava, Latvian S.S.R. 1.6.58 (as nestling).	Inner Dowsing light-vessel. 5.11.58.
Starling	Loosduinen, Holland. 21.10.53. Transported to Geneva, Switzerland.	Alderford. 16.3.58.

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During 1959, 2,846 birds were ringed by Clev. Bird Observatory, including ten species not previously ringed. One of the additions was this Shore-lark, only the second ringed in Britain. Since the Observatory was established in 1949, 14,381 birds of 118 species have been marked and recoveries reported from 12 European countries, Africa and Siberia.

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t of a large flock of 47 Dotterel resting on reclaimed land just behind the sea wall at Ferrington rsh, August 20th. They allowed approach to within six feet. This flock appears to be the largest recorded in England this century.

R. Jones

Attention may be drawn to the B.T.O. Greater Spotted Woodpecker enquiry. The objects of this are to determine (1) the present status of this woodpecker, (2) whether the practice of visiting bird tables is due to a new "tameness" or due to a shortage of other food and (3) whether the habit of attacking nest boxes is a new one and due to a shortage of nesting sites.

Caspian Tern

CLASSIFIED NOTES

The Wash and Fen records, which have been highly selected, have been taken from the draft of the Cambridge Bird Club Report. Important records from Wisbech Sewage Farm, part of which is on the Lincolnshire side of the county boundary, have also been included. Fuller details of these records, and of many others, may be found in the *Cambridge Bird Club Report* for 1959.

The number preceding the name of each bird refers to the *B.O.U. Check-list of the Birds of Great Britain and Ireland* (1952) where the scientific name may be found. All records refer to 1959, unless otherwise stated. Where no initials appear after a record, details have been supplied by many observers.

1 Black-throated Diver : North coast : Singles (and once 2) on 18 dates at Scolt, Burnham Overy, Titchwell, Wells and Blakeney Point to Salthouse up to May 31st and from Aug. 30th when one still in breeding plumage.

2 Great Northern Diver : North coast : Singles (and once 4) on 14 dates at Scolt, Wells, Blakeney and Cley up to Jan. 31st, on April 23rd and from Sept. 4th.

4 Red-throated Diver : Inland records only are given. One, Sea Mere, Jan. 11th–14th (CG) ; 2, Holkham Lake, late Jan. (RPB-O) ; 2, Horsey Mere, Sept. 6th (GC) ; one, Breydon, Nov. 21st (RHH) and one Kelling Hall lake, Dec. 12th, which later died (RPB-O).

5 Great Crested Grebe : Summer count of *adults* : Broads: Rockland, 28 ; Hickling/Heigham Sounds, 28 ; Wroxham, 6 and Alderfen, 2. Breck : Narborough gravel pit, 2 ; Mickle Mere, 10–17 ; Hill Mere, 2 ; Thompson, 4 ; Narford, 8 ; Stanford, 3 and Fowl Mere, one. Other waters : Taverham gravel pits, 4 ; Earsham gravel pits, 2 ; Hardley flood, 2–3 ; Wolterton Lake, 2 and Cawston Manor, one.

Wash : 40–50, Holme to Hunstanton, Nov. 1st (CBC).

6 Red-necked Grebe : North coast : Scolt, one, Nov. 7th (RC) , Burnham Overy, one, Oct. 8th (RPB-O) ; Wells, one, Jan. 28th (HH) ; Cley, singly, Sept. 11th, 19th, 26th and 28th and 2, Oct. 20th. East coast : Mundesley, an oiled immature, Dec. 29th (RAR). Wash : Singles at Hunstanton, March 1st, Nov. 1st and 8th and Dec. 9th and 12th ; also at Snettisham, Dec. 9th (CBC).

7 Slavonian Grebe : North coast : 1–6 on 6 dates at Wells, Titchwell, Blakeney and Cley up to Jan. 28th and from Nov. 6th. Broads : One at Hickling, Jan. 31st (EP). Wash : Hunstanton, maximum of 20, March 1st (CBC).

8 Black-necked Grebe : North coast : 1–5 on 6 dates at Scolt, Wells, Cley and Salthouse up to March 19th and from Sept. 1st. Wash : Rather scarce and 3 at Hunstanton on March 1st was largest party (CBC).

12 Leach's Petrel : North coast : Singles at Cley, Sept. 9th, 26th and 27th, and Oct. 28th ; and at Sheringham, Nov. 1st.

14 Storm-Petrel : North coast : Scolt, one, Sept. 12th (RC) ; Cley, 2, Oct. 28th and one, 29th. East coast : Yarmouth, one on a boating lake, Nov. 14th (RHH). Inland, one found dead at Norwich, Dec. 8th (*per* FJTP). Wash : Hunstanton, one, Oct. 28th (L.L-E).

16 Manx Shearwater : North coast : Cley, odd birds, Sept. 13th–20th included at least 3 *mauretanicus*, also singly Oct. 20th and 28th. Blakeney Point, 7, Oct. 25th and one on 27th.

21 Sooty Shearwater : North coast : singly at Cley, Aug. 28th (JMCC, JC) and Sept. 13th (RJJ). Four previous county records.

26 Fulmar Petrel : Maximum numbers include 68, Weybourne to Sheringham, May 3rd ; 21, Beeston, June 28th ; 20, W. Runton, June 28th ; 28, E. Runton, May 4th and 31, Cromer, April 20th and May 4th. First eggs seen May 19th.

Breeding successes : Weybourne–Sheringham (20 nests, at least 8 robbed and only 3 young reported. One nest—robbed—was in a nearby railway cutting) ; Beeston, (3 young ringed) ; E. Runton (6 young, 4 ringed) ; Cromer (6 young) and Mundesley (one egg). At least 18 young reared. Birds also present at Overstrand and Happisburgh (PT, RPB-O and other observers).

First bird returned to breeding cliffs Dec. 24th (PRC). A blue phase bird at Cromer, Jan. 7th (EAE).

27 Gannet : Coastal records all months from March to Nov. Peak movements Sept. 13th, when 400 (in 2 flocks) in Wash off Hunstanton (CBC) and Oct. 5th when very many off Cley including 150 in 15 minutes.

29 Shag : North coast : One found 2 miles inland at Brancaster, Jan. 24th was later released (RC). Singles at Blakeney Point, Oct. 19th and at Cley, May 17th and Dec. 18th/19th.

30 Heron : Details of heronries as follows :

Borders of Wash : Snettisham, 19 nests. *Fenland :* Islington, 134 ; Denver Sluice, 53. *Breckland :* Wretham Park, 6 (AEV) ; Thompson Water, 3 and 1 (AWK, AEV) ; Narford Lake, 4 (PCB) and Didlington, 2 (CRK). *Mid-Norfolk :* Kimberley Park, 18 (PRB). Broads area : General McHardy's wood, 3 ; Whiteslea, 2 ; Heigham Sounds wood, 5 (EP) ; America wood, Earsham, 12 (JWM) ; Fishley Carr, Acle, 6 and Upton, 8 (RJ) ; Wickhampton, 31 (ETD, MJS) ; Buckenham, 37 ; Mautby, 20 and Ranworth, 34 (MJS), Ranworth marshes (Horning Hall), 2 (RB). *North Norfolk :* Melton Constable, 13 (RPB-O) ; Holkham Park (Obelisk wood), 13 (*per* MJS) ; and Wiveton Hall, 4 (RGB, CO). Total, 430 nests. None nested at Black Dyke Feltwell, Calthorpe or Ormesby Broad.

31 Purple Heron : North coast, one at Cley, May 9th (RAR).

38 Bittern : Broads : A male booming, river Bure near " Stracey Arms " (RHH). A new locality. Breck : Autumn records from Rush Mere (PH) and Thompson (AWK).

42 Spoonbill : Broads area : Hickling, one April 26th–May 1st ; one, May 10th–13th ; 2, 19th–26th were joined by a third bird on 27th and all stayed till 29th ; one, June 2nd–6th and 3 again on 7th (EP, GEB). Breydon : one, May 21st (GRS) and 6, July 5th (RHH).

North coast : Cley, one, May 9th–11th ; Blakeney, 5, May 10th (HH) ; 6 flying east at Scolt, June 27th (RC) alighted at Cley later same afternoon, but left next day (CO) ; Burnham Overy, one flying east, Sept. 3rd (RPB-O).

47 Garganey : First at Cley March 4th (WFB) and at Hardley on 11th where 3 pairs by end of month (MRR). Spring records include : Broads area, 4 at Horsey, April 19th ; Breydon, a pair March 26th onwards and Hickling, at least 6 pairs. Breck : A pair at Thompson, April 5th (AEV) ; a drake at Ring Mere, June 13th and at Lang Mere on 24th (PRB).

49 Gadwall : Breck : Autumn/winter counts include 60 at Narford, Jan. 7th (PCB) and 110 there, Nov. 22nd (AEV) ; 90–100 at West Acre, Sept.–Oct. (DW) ; 60 at Mickle Mere, Nov. 29th and 75 at Thompson, Dec. 20th (CAEK, AEV).

50 Wigeon : Summer records include one at Holkham Lake in early June ; 2 at Cley throughout May and 3 on July 1st ; 4 at Hickling till May 28th and 3 till June 10th. Two nests found June 10th on Norton fresh-marshes containing 7 eggs and one egg respectively (RC). The first breeding records for this area of the county.

52 Pintail : East coast : Breydon, maximum of 49 on Jan. 24th (RHH). No breeding record although a pair stayed till May 14th. North coast : One pair nested at Cley.

53 Shoveler : Largest numbers : Breck, 100 at Narford, March 1st (DW) and 60–70 there, Nov. 22nd (AEV) ; 50 at Hickling, March 4th–13th.

54 Red-crested Pochard : A drake at Bayfield, Brinton and Kelling Hall lakes, Dec. 15th–31st (RPB-O, GL, JF). See " The status of the Red-crested Pochard in the British Isles " by G. A. Pyman *British Birds*, Vol. LII, pp. 42–56). None has been present in the Great Fransham collection since 1956 (Sir S. Renshaw). See also 1954 Report, p. 24.

55 Scaup : Wash : Maximum of 180, Holme to Snettisham, Dec. 12th (CBC).

56 Tufted Duck : Breeding records only are given. Breck, 2 broods at Cockley Cley (CRK) and 3 records at Thompson Water (AWK). North : One brood on a lake near Holt (RPB-O).

57 Pochard : Broads, 2 broods at Rockland (JES, MJS). No other breeding records received. Breck : Maximum, 120 at Narford, March 8th (DW).

58 Ferruginous Duck : One, Cawston Manor lakes, Feb. 28th–March 31st (CAW). See 1956–58 Reports.

60 Golden-eye : Recorded up to May 30th and from Oct. 13th. North coast maxima : 53 at Scolt, Dec. 9th and 40 at Cley end of Jan. Broads maximum : 100 at Hickling, Feb. 24th.

61 Long-tailed Duck : North coast : Holme, one, Dec. 30th (CBC), Brancaster, singles, Oct. 21st, 30th and Nov. 6th–7th (RC), Wells, 3, March 20th (HH), and 2, Dec. 9th (RPB-O), Blakeney, 2, Feb. 1st (AEV), Cley, one, Nov. 8th–14th. Wash : Hunstanton, maximum of 4 on Dec. 9th (CBC).

62 Velvet Scoter : North coast (Holme–Cley) : Recorded all months *except* May–July. No party exceeded 9 in number except record of several flocks of up to 50 ten miles off Brancaster, Sept. 12th (RPB-O). Wash : Hunstanton–Heacham, maximum of 50 on Dec. 20th (CBC).

64 Common Scoter : North/East coasts : No flocks over 150 reported except 500 off Thornham, Feb. 1st (AEV). Wash : Largest estimate, 2,000 on Dec. 6th (CBC).

67 Eider-Duck : Wash : Heacham–Hunstanton, up to 4, Jan.–March. Reported from Sept. 27th with remarkable total of 500 on Dec. 6th and 31st (CBC). North coast : Monthly maxima for the

main locality are given : *Brancaster–Thornham* : Jan. 63 ; Feb. 250 ; March, 120 ; April, 148 ; May 85 ; June 17 ; July 20 ; Aug. 16 ; Sept. none ; Oct. 13 ; Nov. 19 and Dec. 14. Also recorded at Wells, Jan. 21st–March 20th with maximum of 28 (HH) ; at Cley, Blakeney and Salthouse, Feb.–April, June and Aug.–Oct. with maximum of 20 apart from 140–160 off Blakeney, Feb. 1st ; and off Weybourne where 2 on Dec. 31st.

69 Red-breasted Merganser : North coast : Recorded from usual localities up to May 17th (with one at Brancaster, June 20th) and from Sept. 19th. No party exceeded 10. Also a drake at Holkham Lake, end Nov. (RPB-O). East coast : One at Breydon, Jan. 13th ; 3 off Caister, March 8th (DKB). Wash : Snettisham–Hunstanton, maximum of 50–60 in Feb., March and Nov. (CBC).

70 Goosander : Breck : Narford Lake, up to 8 on 5 dates between Jan. 7th and March 8th (PCB, DW) and 5 on Nov. 22nd (AEV) ; Thompson Water, singly on Nov. 1st and Dec. 12th (AWK, AEV). Only other records : 3 at Sea Mere, Jan. 4th, another there Dec. 30th (CG), one at Ranworth, Jan. 5th (HJC) and 3 at Holkham Lake, end Dec. (RPB-O).

71 Smew : North coast and Broads : Only 3 records. A drake at Horsey, Feb. 2nd (GC) ; one shot at Waxham, Dec. 30th (*per* EAE) and one, Cley/Salthouse, Dec. 13th–30th.

73 Sheld-Duck : Moult migrant records : Scolt, 20 east at sea 1945 hours, July 7th (RC, PJM) ; Blakeney, 44 east, July 27th (HH). Wash : Maximum count, 5,400 at Snettisham, Dec. 12th (CBC).

[Egyptian Goose (*Alopochen aegyptiacus*) Largest full-winged colony at Holkham Park (71 adults and 3 broods of young in June 1958. Also present at Fustyweed gravel pits (2 pairs bred 1958), Salhouse Broad (2–3 pairs in summer 1958), Hillington Lake (1–2, 1954–56), Stradsett Lake (2, 1958), Beeston Hall (up to 15 during Nov.) and Gunton Park (one pair bred) (MJS, AEV).]

76 White-fronted Goose : Breydon area : Smallest number since at least 1928 with maximum of 68 on Feb. 15th ; last noted on 28th when 63. First autumn arrivals (21) on Oct. 10th (RHH). North coast : Records include one shot at Blakeney, Sept. 16th (PNK) and 3 at Holme, Oct. 11th (CBC).

78 Bean-Goose (*Anser a. arvensis*) Yare valley : Up to 102 from Jan. 31st–March 3rd, with 160–170 in three gaggles on Feb. 13th (RHH, RFR, MJS).

Pink-footed Goose (*A. a. brachyrhynchus*) Breydon area : 14 wintered on Bure marshes during 1958–59 winter. North coast : 45 at Stiffkey in Jan. and 25–30 there from Nov. 20th (WE).

80 Brent Goose : North coast : Blakeney : maximum of 2,000 during Jan. and early Feb. declining to 650 by March 8th. 11

remained till early April and last one seen April 13th. Few returned by Nov. 10th and 800 by end of year. Brancaster: Maximum of 400 in Jan. and 300 in Feb., up to 250 till March 14th and last noted (80) on 29th. First in autumn (20) on Nov. 7th, 100 by Dec. 2nd and 400 by end of year (RC). Wells: Up to 160 in Jan., 280 in Feb. and last spring birds March 20th; 40 again by Nov. 23rd (HH). East coast: Breydon, 7 on Jan. 18th (RHH).

81 Barnacle Goose : East coast: Breydon, one on March 7th (DVB).

85 Whooper-Swan : North coast and Broads: 1–18 in usual areas up to March 30th and from Oct. 30th. Also recorded at Taverham Lake where 5, Nov. 8th–16th (LWL, GRS) and in Breck at Rush Mere, where 7 Nov. 22nd (PH). Larger numbers as follows: Horsey, 32 on Jan. 16th (GC); Hickling, 60 also on 16th (EP) and 41 next day (GEB) when 2 flights totalling 54 west over Gt. Witchingham (PW); Surlingham, 45 north-east, Feb. 24th (EAE).

86 Bewick's Swan : North coast (Hôlme, Brancaster, Gun Hill, Wells, Stiffkey, Blakeney and Cley) and Broads area (Breydon, Hardley, Wheatfen, Rockland and Hickling): Recorded up to May 1st and from Nov. 1st. Maxima: 12 at Breydon, Jan. 10th (RHH), 15 west at Cley, Nov. 18th and 23 at Holme, Feb. 1st where 16–18 from 22nd till March 1st (CBC). Wash: 34 at Snettisham, March 23rd (CBC). Breck: 4 at Didlington, Nov. 22nd (AEV) and 4 at Fowl Mere on 29th (CAEK). Fens: Ouse Washes, 80–100 through Jan., increasing to 268 on Feb. 7th and to 343 on 15th; last reported (39 birds) March 13th. 15–16 from Dec. 10th. Wisbech Sewage Farm, records include 39 on March 8th and a late bird till April 26th (CBC).

91 Buzzard : North: One shot at Felbrigg, Feb. 27th; singles over Holt Lowes, March 2nd and at Cawston, Nov. 5th (RPB-O); at Blakeney, July 6th–10th (HH) and at Holkham, Aug. 17th (ORM).

95 Kite : North: One at Muckleburgh Hill, Weybourne, April 15th (PRC). Satisfactory details received. See 1958 Report, p. 29.

98 Honey-Buzzard : North: One shot at a wasps' nest at High Kelling, Oct. 7th " in mistake for a crow " (identity confirmed by RPB-O). Only the fourth county record since publication of *Birds of Norfolk* in 1930.

99 Marsh-Harrier : Broads: 4 nests, with eggs, in Hickling/Horsey area but only 5 young successfully reared. Usual winter records including 5 over Wheatfen, Feb. 1st (EAE). Many records from coastal marshes between early April and Oct. 31st.

100 Hen-Harrier : North coast (Holme-Cley): Single " ringtails " frequently till end of March with one at Cley, April 11th and

again from Sept. 18th (with at least 2 from Sept. 25th till end of year). Broads area (Hickling, Horsey and Breydon) : Singles on several dates till Feb. 10th and from Nov. 16th with a male at Hickling, Jan. 19th. Also singly at Horsford Heath, Nov. 14th (RPB-O) and Foulden Common, Dec. 30th (DW).

102 Montagu's Harrier : Single birds on 8 dates on North coast at Cley/Blakeney and inland at Saxlingham Common and Ring Mere between May 7th and Aug. 7th. None is known to have nested in the county. One of the melanistic form at Bargate Fen, Sept. 11th (PJM). See 1956 Report.

103 Osprey : Broads : 2 at Horsey, May 9th (GC) and one at Hickling, 11th–20th (GEB, EP). Also one at Cawston manor lakes, May 14th–18th (MJS, CAW).

104 Hobby : North coast : Singly at Blakeney, April 25th, May 7th, June 20th and Aug. 4th (HH) ; at Scolt, May 31st and June 6th (RC, PJM) and at Cley, June 24th, July 24th and Aug. 23rd and 26th.

108 Red-footed Falcon : North : A male at Cley, May 9th (RAR, BRS, AJ) and a male at Blakeney Point on 15th (RG). East : A juvenile found dead on Acle New Road near "Stracey Arms," Sept. 27th (HFA). Full details supplied, together with remains of Acle bird.

117 Quail : North : Heard at Binham, June 12th (RS) ; one calling at Blakeney, July 16th–19th (HH) and 2 at Blakeney Point on 20th/21st (WE). South : A nest with 9 eggs at Kirstead Ling near Brooke, Aug. 21st (EAE).

119 Crane : North coast : Singly at Cley, May 10th (PJW, RAR) and June 1st (PJH).

121 Spotted Crake : North coast : One caught by observer's dog at Stiffkey, May 27th (HH). A first-winter bird at Cley, Aug. 30th–Sept. 5th was ringed on 4th.

124 Little Crake : North : A male at Brinton Lake on several dates from Nov. 15th ; also watched for ten minutes at 20 yards range on Jan. 14th, 1960 (RPB-O). Field sketch and full details received. Only one other published record since B. B. Riviere's *Birds of Norfolk* (1930).

125 Corncrake : East : One, long dead, Scroby Sands, June 19th (MJS). North : Singles at Morston, Aug. 3rd (EMCE) and at Letheringsett on 10th (RPB-O). At least 3, Cley/Blakeney, Sept. 13th–27th.

131 Oystercatcher : Breeding records : North coast : 8–10 nests at Cley, 91 at Blakeney Point and at least 14 on south side of

harbour including nests on arable fields ; 2 at Stiffkey, 2 at Wells and 73 at Scolt. East coast : 2 nests on Breydon marshes (RHH).

Large numbers : Wash, Snettisham–Hunstanton, 5,250 on Nov. 14th and an estimated peak of 7,000 on Dec. 30th (CBC). North, 3–4,000 roosting at Thornham, Feb. 22nd, 3,500 at Holme, Sept. 15th and 2,500 there, Nov. 1st (AEV).

135 Little Ringed Plover : North coast : Singly at Cley, Aug. 7th, 18th and 28th (MFMM, CO), and at Blakeney, Oct. 6th (HH). Fens : Wisbech sewage farm, autumn maximum of 6, July 15th/17th (CBC).

136 : Kentish Plover : North coast : A male at Cley, May 11th/12th (RAR). Fens : One at Wisbech sewage farm, May 21st (CBC).

139 Grey Plover : North coast : Unusual numbers in early autumn including 70 at Blakeney, Sept. 7th. Largest winter count there was 300, Feb. 24th (HH).

140 Golden Plover : The larger flocks are given. 200, Halvergate, Dec. 26th (RHH), 400, Horsey, Dec. 16th (GC), 300, Calthorpe, March 1st (CDR), 200, Marham, Feb. 2nd and 1,000 there, Dec. 24th (DW), 450 showing the characters of the Northern race at Swannington, April 5th and 250 there on 12th (RPB-O) and 3–400 Feltwell, Nov. 21st (AEV).

142 Dotterel : North coast : One at Cley, May 3rd (BRS) and 3 there, Aug. 19th (MFMM). Wash : Remarkable flock of 47, Terrington marsh, Aug. 20th (CBC). See *British Birds*, Vol. 53, p. 84. 2, Hunstanton golf course, Sept. 6th (CBC).

146 Great Snipe : Corpusty Mill, one, Sept. 3rd–7th (JML). Full details have been received.

151 Whimbrel : Spring passage in coastal areas from March 28th (RHH, CO). Autumn return from July 6th with peak numbers during first week of Aug. when up to 200 at Blakeney. A late bird at Brancaster, Oct. 9th (PJM).

154 Black-tailed Godwit : Records from usual localities between Feb. 25th and Oct. 11th. Largest parties, 7 at Breydon, May 10th (RHH) and 12 west at Cley, Sept. 9th. Also one on Scroby Sands, June 4th (DAJB)—a new locality. Fens : Wisbech sewage farm, maximum 12–15, July 15th (CBC).

155 Bar-tailed Godwit : North coast : Winter flocks include 120 at Brancaster, Jan. 24th (RC) and 300 at Holme, Oct. 21st. Wash : Snettisham, 1,000 on Nov. 8th (CBC).

156 Green Sandpiper : Recorded every month, with winter records from Bungay Common, Litcham, Corpusty Mill, Fakenham, Brinton, Hunworth and West Acre.

157 Wood-Sandpiper : North coast (Brancaster, Blakeney and Cley) and Hickling Broad : Spring passage, May 5th—31st with one at Brancaster, June 26th (PJM). Maximum, 20 at Cley, May 12th. Autumn return July 27th–Sept. 11th. Maxima, 10 on Aug. 11th, 20–30 on 15th and 18 on 17th—all at Cley ; also 23 at Brancaster, Aug. 11th (PJM). Breck : 2 at Lang Mere, Aug. 31st (PRB).

162 Spotted Redshank : North coast : None recorded until June when singles at Cley on 16th, at Titchwell on 19th and at Morston and Scolt on 26th. Autumn passage records of 1–3 birds at usual localities, Aug. 11th–Oct. 11th with 1–2 at small waters near Holt, Aug. 20th and Sept. 19th. East coast : Breydon, one, May 14th (NH). Broads : Hickling, singles, May 9th and 28th and 4 on Aug. 17th. Fens : Wisbech sewage farm, up to 4, May 1st–24th ; in summer from June 18th–30th with 14 on 24th, and from July 9th to Oct. 18th with peak of 22 on Sept. 4th (CBC).

165 Greenshank : North/East coasts : Breydon and Broads : Spring passage from March 23rd with parties up to 6. Autumn return from July 9th with peak passage, mid-Aug. to Sept. 11th when up to 16 together. Late birds through Oct. and until Nov. 12th. Breck : One at Lang Mere, Aug. 14th (PRB). Fens : Wisbech sewage farm, peak of 20 on Aug. 20th (CBC).

169 Knot : Wash : Estimate of 20–25,000 at Hunstanton, Nov. 29th (CBC).

170 Purple Sandpiper : North coast (Holme, Titchwell, Brancaster, Blakeney, Cley, Sheringham and W. Runton) : Records of 1–3 birds in all months *except* April–July inclusive. Wash : Records include up to 4, Hunstanton-Heacham, Feb. 21st–March 15th and from Nov. 1st (CBC).

171 Little Stint : North coast : Cley, one, Feb. 2nd, up to 3, May 3rd–9th and one, June 16th. Very small autumn passage at Holme, Cley and Blakeney, Aug. 11th–Sept. 18th and on Oct. 4th with a late bird Nov. 8th. Broads : Hickling, one, Aug. 17th (EP). Fens : Wisbech sewage farm, one, May 10th, 1–2 from 19th–24th, one, June 20th and up to 7, July 25th–Sept. 22nd (CBC). Wash : Snettisham, one, May 10th is only spring record (CBC).

173 Temminck's Stint : Fens : Wisbech sewage farm, one on May 21st, 2 on 23rd and one on June 2nd (CBC).

179 Curlew-Sandpiper : North coast (Holme, Blakeney and Cley) : Spring, one, May 27th (HH). Small autumn passage July 30th–Oct. 11th with first juveniles Aug. 12th. Maximum 20 at Cley, Sept. 5th. East coast : Breydon, 2, Aug. 31st (MJS) and 2, Sept. 14th (RHH). Fens : Wisbech sewage farm, one, May 23rd and autumn peak of 40–50 on Sept. 4th–8th (CBC).

183 Broad-billed Sandpiper : Fens : One at Wisbech sewage farm, May 19th (CBC—to whom full details supplied). The eighth county record.

184 Ruff : North/East coasts, Broads (Hickling, Horsey) and Breydon : Spring passage from March 1st with maxima of 14 at Cley, April 7th, 9 at Hickling, May 6th and 10 east at Cley on 23rd. Autumn return (up to 15 together) until Sept. 17th with second movement, Oct. 6th–25th. Fens : Wisbech sewage farm, 20–40, latter half of March, up to 50 in July, 80 in Aug., 20 in Sept. and 100 in Oct. (CBC).

185 Avocet : North coast : Cley, 3, April 3rd ; one on 25th, one, May 10th–13th, 5 on 23rd and one, 24th–25th, 2, July 18th and one, Oct. 5th–9th. Blakeney : 2, May 10th (HH). Brancaster : one, Nov. 30th (RC). Fens : Wisbech sewage farm, 6, May 29th/30th and 3 on 31st (CBC).

187 Grey Phalarope : North coast : One at Cromer, Jan. 17th (PT). Cley, 2, Oct. 28th/29th and one, 30th/31st. Sheringham, one on sea, Dec. 8th (PRC). Inland, one at Sea Mere, Jan. 3rd (CG).

188 Red-necked Phalarope : North coast : a juvenile at Cley, Aug. 21st–29th.

189 Stone-Curlew : First, Marham, March 24th (DW) ; last, Edgefield Heath, Oct. 10th (CJC).

193 Arctic Skua : North coast : 2, Blakeney Point, April 23rd ; singles at Cley, May 4th and 17th and at Scolt, May 17th and June 30th. Autumn passage, July 3rd–Oct. 29th. Maxima 17 off Scolt, Aug. 28th, 20 off Cley, Sept. 5th and 25 off Cley, Oct. 28th during severe gale. Wash : Hunstanton, maximum of 25, Aug. 30th (CBC).

194 Great Skua : North coast (Holme, Brancaster, Blakeney and Cley) : Autumn passage, Aug. 13th–Oct. 29th. Maxima 5 off Cley, Sept. 13th and 30 there, Oct. 28th during severe gale.

195 Pomatorhine Skua : More records than usual. North coast : Scolt, 2 on Aug. 28th (RC). Cley, 3 on Aug. 26th, 6 on 28th, 2 on 29th, singly on 30th–31st, Sept. 3rd, 4th, 7th and 13th, 3 on 15th, singly on 16th and 28th, 3 on Oct. 28th and one on 29th.

196 Long-tailed Skua : North coast, more than usual. Cley, 3 on Sept. 13th, 3 on 17th, one on 19th and 3 on Oct. 28th.

198 Greater Black-backed Gull : East coast : Breydon counts include 700 adults, Aug. 31st (MJS).

202 Glaucous Gull : North coast records of 1–2 birds (and once 4) at Brancaster, Holkham, Wells, Blakeney and Cley, on many dates up to April 29th and from Aug. 28th. East coast : one at Yarmouth, March 8th (DKB).

207 Little Gull : North coast (Scolt, Wells, Blakeney and Cley) : Up to 4 in periods, Jan. 1st–Feb. 11th, April 1st and July 27th–Dec. 13th with 8 east off Cley, Nov. 15th. Remarkable numbers off Cley and Salthouse end of Oct. with 7 on 26th, 5 on 27th (when 20 off Blakeney Point), 12 on 28th, 15 on 29th, 5 on 30th, 2 on 31st and 7 on Nov. 1st.

208 Black-headed Gull : Numbers of pairs at breeding localities : North coast : Scolt, 30 but no young reared (RC) ; Stiffkey, 42 ; Morston, 150 and Blakeney saltings (a new colony) 37 (HH). Broads area : Alderfen, 164 (MJS) and Cantley reservoir, 100 but no young reared (*per* MJS). Inland : Scoulton Mere, 100 but many eggs destroyed (GJ). Wash : Wolferton saltings, 300 (AEV). Fens : Wissington beet factory, 300 (AEV).

211 Kittiwake : North/East coasts : Summer counts include : 50 at Morston, July 9th and 50 at Blakeney on 25th (HH). At Scolt, 130 on May 23rd, 60 west June 10th, 200 July 6th, 80 on 7th and 90–100 on 17th (PJM). At Scroby, 2–300 on June 7th and 7–800 on July 5th (RHH) with 1,040 on June 19th (MJS).

Migratory movements off Cley : 140–150 east, Sept. 13th (EAC, PJW) and 1,000–1,500 east during gales, Oct. 28th/29th.

Wash : Hunstanton, maxima of 300, Aug. 30th with 200, Oct. 25th when 200–250 west off Holme (CBC).

212 Black Tern : First spring birds, May 8th. Peak movements at the beginning of second week and in fourth week of May are shown by following records from selected localities :

	8th	9th	10th	11th	12th	21st	22nd	23rd	24th	25th
Rockland Broad	3	1	17	11			65	50	120	70
Hickling Broad	9	4	4	20	9	2	9	4	6	
Cley/Salthouse			80	10	20	20	50	50	20	7
Wisbech S.F.		16				57		180	180	
Scolt Head							25	13	6	1
Thompson Water			5				5		11	

Spring passage ended May 31st and during the month reported from 18 localities. Small return passage, July 18th–Sept. 15th.

215 Gull-billed Tern : North coast : Weybourne, 2 flying east over arable land, May 12th (PRC). Details received.

216 Caspian Tern : Broads : Hickling, 2 on Rush Hills, June 17th were still present on 26th (EP). One there, Sept. 10th, 11th, 29th, 30th and Oct. 1st/2nd (EP, PDK, RP, JDW). Details supplied. First county records since 1918.

217 Common Tern : First, April 15th ; last (Common/Arctic), Nov. 15th. Breeding records include : Wash, Snettisham gravel pits, 15 pairs. North coast : Near Wells, 60 nests ; Scolt, 400 nests ; Blakeney Point, 970 nests and Arnold's marsh, Cley, 38 nests. East coast : Scroby Sands, 210 nests. Broads : Ranworth, 5 nests ; Hickling, 3 nests and Ormesby, 3 nests.

218 Arctic Tern : North coast : Recorded May 4th–Oct. 4th. 2 nests at Blakeney Point, one at Scolt and 1–2 near Wells.

219 Roseate Tern : North coast : None bred, but several records between Scolt and Cley, May 22nd–Sept. 4th including 2 pairs displaying at Scolt, July 7th.

222 Little Tern : First, April 19th with a very late straggler at Cley, Oct. 4th and at Blakeney on 5th. Breeding records include : North coast : Scolt, 19 nests ; Holkham–Wells, 10 pairs ; Stiffkey, 2 pairs ; Blakeney Point, 94 and 6 pairs on south side of harbour. East coast : Scroby, 8 nests.

223 Sandwich Tern : Recorded March 25th–Oct. 27th. Breeding records : Scolt, 20 nests ; near Wells, 600 pairs and 426 chicks ringed, and Scroby Sands, 300 pairs but only one young reared. Spring peak at Cley was 400 on April 30th.

226 Little Auk : Wash : Admiralty Point, 2, Oct. 29th ; Snettisham, one, Nov. 2nd ; Heacham/Hunstanton, one, Nov. 14th and 11, Dec. 12th (CBC). North coast : Scolt, one, Dec. 5th (RC) ; Burnham Overy, one dead, Feb. 1st (CAEK) ; Cley, one dead, Jan. 24th, several Oct. 28th, total of 17 on 29th, 4 on 30th, total of 25 on 31st, 5 on Nov. 1st, one on 6th, 9 on 18th and one on 2nd. East coast : Waxham, one dead, Feb. 22nd (CG) ; Hemsby, one dying, Oct. 31st (*per* EAE). Inland : One struck high tension cables at Ellingham and one on Yare near Buckenham, Oct. 31st (*per* EAE) ; one at Ashby St. Mary, Nov. 4th (*per* EAE) and one on Bure near Stokesby Ferry, Nov. 15th (RHH).

229 Black Guillemot : North coast : singles off Cley on Sept. 21st, Oct. 11th and 17th/18th with 2 on 29th.

230 Puffin : North coast (Brancaster, Blakeney and Cley) : 14 records of 1–3 birds, Jan. 2nd–25th and Aug. 31st—Oct. 25th. Inland, one dying at Litcham, Jan. 13th (WGB).

234 Wood-Pigeon : North/East coasts : Immense influx noted at Cley, Scolt Head and Yarmouth, Nov. 19th–24th with smaller numbers, Dec. 1st–3rd.

235 Turtle-Dove : Recorded April 18th–Oct. 12th.

Collared Dove (*Streptopelia decaocto*) *Site A* (Overstrand), odd birds occasionally throughout year but no evidence of breeding. *Site B* (Cromer), 2 definite pairs ; 2 nestlings ringed on July 3rd

and another nest found from which young had recently fledged—no doubt first brood of same parents. Up to 8 on allotments there during winter. *Site F* (Aylmerton), a pair reared at least one young.

248 Long-eared Owl : Only 2 breeding records : at Blakeney on North coast where unsuccessful (RAR) and in Fens at Denver (CBC). None reported elsewhere except one in Breck at Blackdyke, Feltwell, April 24th (AEV).

249 Short-eared Owl : East coast : One pair bred on Halvergate marshes (RHH). North coast : One pair bred at Norton (RC) and in breeding season 4 pairs in Stiffkey–Blakeney area (HH). Winter records at usual localities with up to 5 together.

252 Nightjar : Recorded May 12th–Oct. 2nd when a freshly killed bird picked up on Norwich–Holt road at Buxton (RPB-O). A male, Mousehold Heath, June 3rd (GRS)—a new locality. Wash : Reported at Wolferton, June 28th and bred at Dersingham Fen (CBC). Fen border : Recorded E. Winch Common (AEV). See 1957/58 Reports.

255 Swift : Recorded April 25th–Sept. 27th. Main influx began May 3rd.

258 Kingfisher : At Scolt Head, singles, Sept. 28th and Oct. 9th (PJM).

261 Hoopoe : 2 at Wheatfen, March 12th (EAE) and one at Aylsham same day (CLM). Hickling, one at Whiteslea, May 11th (GEB).

263 Greater Spotted Woodpecker : North coast : A bird of the Northern race, *D.m.major*, ringed at Blakeney Point, Oct. 11th.

264 Lesser Spotted Woodpecker : A summary of recent records indicates little apparent change since publication of *Birds of Norfolk* (1930) and it remains the scarcest of the three woodpeckers. In the East (east of a line running from Cromer southwards through Norwich to Harleston) recorded at 23 localities (including centre of Norwich and 3 sites on outskirts and also at 10 sites in Broads area. In the North-central (north of a line between Norwich and Beechamwell) at 27 localities. In the South-central at 26 localities (all in the Breck *except* Runhall, Carlton Forehoe, Sea Mere, Intwood and Wymondham College. In the West (west of a line running from Thornham southwards through Narborough and Beechamwell) at 7 localities (Holme, Heacham, Snettisham, Sandringham, Wolferton, N. Wootton and King's Lynn).

265 Wryneck : Wash coast : One at S. Wootton, May 3rd and 2 at Hunstanton golf course, Sept. 6th (CBC). North : Hempstead woods, one on May 28th (HH) ; Scolt, one on Aug. 21st and one dead Sept. 22nd (RC) ; Holkham, one, Sept. 1st–6th and 9th

(RPB-O) ; Blakeney Point, 2 on Aug. 23rd with one till 27th ; Sheringham, singles, Sept. 8th (PRC) and 15th (EMCE) ; Felbrigg, one on Aug. 22nd (ACC). East : Singles at Winterton, Aug. 24th (JES) and at Horsey, on 30th (GC).

Additional 1958 record : One at Scolt, Sept. 5th (*per* JFM).

The *Birds of Norfolk* (1930) states the wryneck " is almost entirely confined as a breeding species to a few localities in the extreme south-western area of the county." No localities were however published and readers are asked to report any former breeding sites known to them. A pair nested at Lakenham in a broken street lamp about 1910 ; breeding was recorded regularly at Aylsham until 1900, at Fleggburgh until 1907, at Drayton until 1913, in the Wymondham area up to 1914, at Ellingham Hall until 1919 and at Thetford close to the golf course until at least 1927.

269 Short-toed Lark : North coast : One at Cley, Oct. 14th (MJC, EJLW). Very detailed descriptions received.

271 Wood-Lark : North coast : Migrants at Blakeney Point : 4, Sept. 3rd and 2 on Oct. 11th ; also one at Holme, Oct. 4th (CBC).

273 Shore-Lark : North coast (Scolt, Wells, Stiffkey, Blakeney Point, Cley and Salthouse) : Recorded up to early April and from Oct. 1st. Maximum, at Cley/Salthouse, 26 during Dec.

274 Swallow : First, March 29th. Latest Nov. 18th at Weeting, 22nd at Cley and 29th at Coltishall.

276 House-Martin : First April 8th. A very late bird at Gooderstone, Dec. 4th–6th (CRK).

277 Sand-Martin : Recorded March 27th–Oct. 11th.

281 Hooded Crow : Very scarce and recorded away from coast only at Thwaite St. Mary, Ranworth and Hickling. Coastal records up to April 14th (with singles at Horsey, May 18th and at Cley on 30th) and from Oct. 4th. Largest parties (17/18 and 37) noted at Wells, with maximum elsewhere of 10.

290 Coal-Tit : North coast : Up to 4 immigrants of the Continental race (*P.a. ater*) noted at Cley on 13 dates between Sept. 11th and Oct. 22nd.

294 Long-tailed Tit : North coast : Cley/Blakeney Point, probable immigrants noted as follows : 10 on Sept. 11th, 8 on 24th, 11 on 26th, 9 on Oct. 2nd, 12 on 9th, 10 on 12th, 10 on 14th, 8 on 17th, 12 in from sea high up on Nov. 21st, 7 on 27th and small parties throughout Dec. 3 birds ringed at Cley, Oct. 17th were re-trapped in Jan. 1960 so had not moved far.

295 Bearded Tit : Broads : Breeding records from Hickling/Heigham Sounds/Horsey area (at least 65 pairs), Barton (3 pairs)

and Waveney valley (1–2 pairs). Winter records also from Reedham and Rockland Broad.

North coast : 15 breeding pairs at Cley. A late autumn influx noted at Cley (including 2 ringed birds), at Brancaster (up to 4, Oct. 15th–31st—RC, GHE) and at Selbrigg Pond and Hempstead Mill (up to 8–RPB-O).

302 Fieldfare : Last spring birds, April 23rd. In autumn, early ones at Blakeney Point, Sept. 1st, at Scolt on 3rd (BC) and at Horsey on 8th (GC). Main influx commenced Oct. 23rd.

303 Song-Thrush : North/East coasts : Autumn arrivals on a large scale with main influx noted at Scolt, Blakeney Point and at Horsey, Oct. 4th–16th.

304 Redwing : Large concentrations along North coast in first half of March ; last 2, April 5th. First in autumn, Sept. 21st.

307 Ring-Ouzel : Spring : North coast : Singles at Blakeney, March 13th and at Salthouse on 26th and 30th ; 2 at Salthouse, April 13th ; singles at Morston on 15th, E. Runton on 16th and at Salthouse on 27th. Autumn : Wash : One struck Lynn Well light vessel, Oct. 13th (wing produced to MJS). North coast : 1–4 at Cley/Blakeney Point, Oct. 2nd–11th with 12 on 10th ; 2–4 at Holme on 4th ; singles at Titchwell, Oct. 6th and Holme on 11th and 16th and 2 at Cromer on 11th. East coast : 6–10 at Waxham, Oct. 17th.

311 Wheatear : Coastal records March 7th–Oct. 23rd and in Breck from March 22nd.

317 Stonechat : Coastal records of 1–3 birds up to March 29th and from Aug. 10th along Wash (at Heacham, Snettisham and Dersingham) and at Holme, Titchwell, Stiffkey, Blakeney Point, Salthouse, Cley, Sheringham, Cromer, Waxham and Horsey. Maximum of 5 at Cley, Feb. 26th. Also 2 at Haddiscoe, Nov. 9th onwards. One pair bred successfully at Winterton (JES, GRS). Another pair at Horsford Heath, mid-May to late July but no proof of breeding (RPB-O).

318 Whinchat : North coast (Scolt–Cley) and East coast (Horsey, Winterton and Breydon) : Spring passage April 23rd–June 3rd with maximum of 6 at Cley, May 8th. Autumn passage, Aug. 12th–Sept. 29th.

320 Redstart : North/East coasts : Small spring passage, April 15th–May 23rd and in autumn from Aug. 12th–Oct. 16th. Breck : Breeding localities include Thompson, Tottington, Merton, Stanford and Cressingham (GJ, AEV). Fen border : 4–5 pairs bred at Bawsey ; a pair at Shouldham Warren, May 29th (CBC).

321 Black Redstart : One pair bred unsuccessfully in centre of Norwich ; nest and 4 eggs presented to Norwich Castle Museum (JHS). A male singing among derelict buildings in Yarmouth during last week in May (RHH), but no evidence of breeding there. First spring birds March 23rd, 3 records of 1–2 birds on 25th/26th, and unusual total of 16 at Sheringham on 27th (with 2 at Weybourne, 2 at Cromer and singles at Cley and Kelling same date). Then 1–2 March 28th–April 1st, April 13th and 17th with a late bird at Scolt, May 25th. In autumn : single birds, Sept. 5th–Oct. 22nd. Localities not already listed include Marham, Blakeney Point, Salthouse, Beeston and Breydon.

322 Nightingale : Spring arrival from April 14th. One found dead by EAE in centre of Norwich May 26th was probably same bird reported singing in the vicinity close to Chapelfield Gardens.

324 Bluethroat : North coast : Blakeney Point, one Sept. 4th, 2 on 5th, 2–3 on 6th (when also one at Cley) and singly on 7th and Oct. 11th.

338 Aquatic Warbler : North coast : Cley, one in reed-beds, Aug. 27th (CCD, WFB). Satisfactory details received.

343 Blackcap : First, April 7th. More than usually in evidence during Oct. along North coast between 1st and 25th. At Cley, 3 on 4th, 4 on 10th/11th and at least 6 different single birds. At Scolt, one on 19th (RC). At Holme, 2 on 11th (CBC).

344 Barred Warbler : North coast : Cley/Blakeney, single immatures Aug. 28th, 30th, Sept. 2nd, 4th–7th and 11th. (Last mentioned bird found dead at Cley and presented to Norwich Castle Museum). Scolt, an immature ringed Aug. 31st (BC). Holme, single immatures, Sept. 6th/7th (CBC). Burnham Overy/ Holkham, single immatures, Sept. 1st, 2nd, 5th and 8th (RPB-O). East coast : Sea Palling, 3, Sept. 18th (DL, MTM) one with yellow eyes.

356 Chiffchaff : First, March 22nd and recorded at 15 localities by 31st. Last, singing, Oct. 28th.

357 Wood-Warbler : North : Bred Gresham's school woods and Selbrigg Woods. Singing males at High Kelling and Hempstead.

365 Firecrest : North coast : Blakeney Point, one on April 3rd ; one on Sept. 30th and 2 on Oct. 1st (both ringed).

368 Pied Flycatcher : North/East coasts : Spring : Scolt, 2 on May 21st and one on 22nd (PJM) ; Blakeney, singles April 28th and May 9th ; Cley, singles May 6th, 22nd and 23rd ; Happisburgh, one dead May 31st (HFA) ; Horsey, 5 on May 3rd (GC) and Hickling, 2 on April 30th (EP).

The autumn wader passage was at its peak during the latter half of August. Among the many waders on Clev marsh was this juvenile red-necked phalarope which remained for nine days.

R. Jones

The red-backed shrike has decreased considerably during this century and readers are reminded of the B.T.O. enquiry. One of the purposes of this is to establish the present status of this species, and all records are welcome.

Autumn passage noted at many coastal localities, Aug. 16th–Oct. 12th with a straggler at Wisbech sewage farm, Oct. 30th (AEV).

370 Red-breasted Flycatcher : North coast : Holkham, one, Sept. 2nd (RPB-O) ; Blakeney Point, an adult on 6th–7th (ringed) ; Holkham, one on 17th ; Cley, a first-winter bird on 17th (ringed) ; Holme, 2 on 19th (IJF-L, DIMW) and Blakeney, one on 26th (HH).

378 Red-throated Pipit : North coast : Scolt Head, a male in breeding plumage, May 15th–21st with a second bird on 16th (RC, PJM, JFP, RPB-O). Very detailed descriptions received. The second county record.

379 Rock-Pipit (*Anthus s. littoralis*) : North coast : Singles of the Scandinavian race at Cley, March 6th–10th and 19th with 5 on 21st.

Water-Pipit (*A.s. spinoletta*) : North coast : Wells, one Oct. 23rd (HH) with rock-pipits. Cley, one Dec. 26th–31st (RAR, MFMM and other observers). Detailed descriptions received in each case.

381 Grey Wagtail : Breeding season records only are given. Taverham Mill, one male summered (LWL) ; Marlingford–Bawburgh Mills, 3 flying young, May 3rd (EQB) ; Buckenham Tofts, a pair bred by river Wissey (GJ) ; Gressenhall, a pair but no evidence of nesting (s. c. PUDDY) ; Selbrigg Pond, a pair bred unsuccessfully ; Hempstead Mill, a pair bred but no young reared (PJW) ; Letheringsett, one nest and West Acre, one nest (RPB-O).

382 Blue-headed Wagtail *M.f. flava*) : North coast : Single males at Cley, May 6th (CO) and at Blakeney, Sept. 7th (HH).

383 Waxwing : Small numbers during first quarter with a further irruption from Oct. 30th.

January : East Norfolk : Norwich, 4–6 on 15th. North : Blakeney, 1–2 on 13th, 27th and 31st with 6 on 16th ; Cley, 1–2 on 7th, 9th and 17th ; Holt, 6 on 1st and Overstrand, 5 on 23rd. West : North Wootton, 5 on 18th.

February : North : Blakeney, 2 on 14th ; Cley, one on 13th and 5 on 16th ; Cromer, one on 16th and Burnham Overy, 2 on 3rd–5th.

March : North : Cley, one on 7th and Holt, 4 from 8th till 31st.

April : East : Norwich, 2 on 20th. North : Holt, 4 till 8th.

October : West, Clenchwarton, 20–30 on 31st. North : Cley, one on 31st ; Sheringham, 3 on 30th and Cromer, 27 on 31st.

November : North : Saxthorpe, 3 on 18th ; Blakeney, 2 on 16th ; Cley, 32 on 1st, 5 remaining on 5th and last seen on 22nd ; Brancaster, one on 8th ; Holme, 50 on 1st, 12 on 8th and 4 on 14th ; Sheringham, 6 on 1st and one on 9th ; Stiffkey, 2 on 2nd and 8 on 7th ; Holt, 2 on 6th, one dead on 8th and 4 on 9th. East : Waxham, 7 from 12th–22nd ; Caister-on-Sea, 12 on 29th ; Rockland Broad,

3 on 2nd, Wheatfen, 2 on 11th ; Claxton, 19 on 24th ; Norwich (College Road area), 11, 9th–11th, 18 on 15th and 2 on 21st ; Thorpe St. Andrew, 10 on 7th ; Taverham, one on 13th and Barford, 1–2, 28th–30th.

December : North : Sheringham, 8, 9th–12th and 2 on 25th. Beeston, 5 on 4th/5th ; Corpusty, Horsford and St. Faiths, 3 parties of 4–7 on 11th ; Felthorpe, 9 on 18th. East : Barford, 1–2, 1st/2nd. West : E. Harling, one on 19th ; Watton, 3–20 during the month.

384 Great Grey Shrike : Single birds as follows : North : Salthouse Heath, March 24th–26th, May 2nd and Nov. 20th ; Blakeney, May 23rd and Nov. 16th (HH) ; Blakeney Point, Oct. 4th–5th (ringed) ; Salthouse, Oct. 8th and Holme, Oct. 11th. East : Hemsby, April 13th (*per* AGH) and Winterton, April 19th (JES). West : E. Harling, March 21st (PAB).

388 Red-backed Shrike : Breeding season distribution : Wash : One pair at Hunstanton. North coast : Total of 9 pairs at 5 localities. Breck : Single pairs at 3 sites. Central : One pair bred at usual site near Norwich. Autumn : One at Ingoldisthorpe, Aug. 7th (JSA) ; one at Scolt, Sept. 30th (PJM) ; 2 at Cley, Aug. 23rd and one, Sept. 1st/2nd.

391 Hawfinch : 1958/9 records from Wolferton, Sandringham, Marham, W. Harling, Mattishall, Wiveton, Cley area, Aylsham, Cringleford, Thorpe St. Andrew, Norwich (where one dead inner courtyard of Castle Museum, July 1st, 1958), Keswick, Stockton and Shotesham.

394 Siskin : More records than for several years. Parties up to 30–35 reported inland at Sandringham, Selbrigg and Hempstead Mill, Gresham School ponds, Gunton Park, Cawston Manor, Mousehold Heath, Taverham, Wroxham, Watton and Narford up to March 13th and from Nov. 1st. North coast : Cley, 15 on April 6th ; a few arriving or passing west daily during last week of Sept. and throughout Oct. with maximum of 20 on Oct. 11th. Holkham dunes, 14 on Oct. 12th (CJC). Holme, 5 on Sept. 20th and from Oct. 16th–Nov. 24th with 4 on Oct. 24th and Nov. 8th (CBC). Wash : Wolferton, one, Nov. 1st and 7 southwards at Snettisham on 2nd (CBC).

396 Twite : North coast : Recorded at usual localities up to March 23rd and from Oct. 6th. Maxima : 400 at Thornham, Dec. 8th–10th (CBC) ; 150 at Holme, Feb. 1st (CJC) and over 100 there, Oct. 25th (AEV) ; 50 at Blakeney Point, Oct. 11th ; 40 at Morston on 22nd and 50 at Scolt, Nov. 8th (SM). East coast : Breydon, 28 on Oct. 17th (MJS).

397 Redpoll : Breeding season records from Shouldham, E. Winch, Bawsey, Hempstead woods, Roudham and Foulden. 20 at Mouse-

hold Heath, March 13th, together with one showing the characteristics of the Continental race, *C.f. flammea* (DKB).

401 Bullfinch : Numbers increasing markedly in several localities in North Norfolk and in the Broads area. A male showing the characteristics of the Northern race, *P.p. pyrrhula*, at Blakeney, Nov. 11th (BH).

404 Crossbill : North : High Kelling, 15 from April 17th with 100 on May 3rd and present till at least 23rd ; Sheringham, 40 on May 10th (GJ, TCS) ; Weasenham, one April 17th (WGB) ; Ridlington, pair on May 7th (CA). Central : Thorpe St. Andrew, up to 5, Nov. 7th–Dec. 21st (MJS). South : Diss, one dead, April 26th (*per* RMB). Breck : Only recorded at 3 localities.

408 Brambling : Recorded up to April 17th when 4 at High Kelling. First in autumn, Sept. 19th. Only three winter flocks over 100 strong, the maxima being 200 and 3–400.

416 Ortolan Bunting : North coast : Scolt, a male, May 22nd (PJM, RC) ; Blakeney Point, up to 3 between Sept. 2nd and 11th ; Cley, one on 18th.

422 Lapland Bunting : North coast (Holme–Cley) : large number at Morston where wintering flocks totalling 100 began to disperse by mid-Feb., the last being seen there March 28th with a male on Blakeney Point, April 3rd. First in autumn, Sept. 13th. Regular till end of year but no large numbers.

423 Snow Bunting : North/East coasts : Recorded up to March 25th and from Sept. 13th. Maxima recorded for the main localities : Holme, 140 end of Nov. (AEV) ; Scolt, up to 160 during Jan. (RC) ; Cley/Blakeney Point, 400 till spring departure and 400 by end of year : Breydon, 120 on Jan. 25th (MJS, RHH). Inland : 40 south over Coltishall, Dec. 30th (PCB). Ouse Washes : One at Welney, Jan. 25th (CBC).

425 Tree-Sparrow : North coast : Over 1,000 at Stiffkey, Nov. 19th were not in area next day (PRC). A House x Tree-sparrow hybrid, resembling the 1956 bird, at Salthouse, Aug. 13th (MFMM).

The following, not mentioned in the Classified Notes, were also recorded in 1959 (breeding species in italics) : *Little Grebe*, Cormorant, *Canada Goose*, *Mute Swan*, *Sparrow-Hawk*, Peregrine Falcon, Merlin, *Kestrel*, *Red-legged Partridge*, *Partridge*, *Pheasant*, *Water-Rail*, *Moorhen*, *Coot*, *Lapwing*, *Ringed Plover*, Turnstone, *Common Snipe*, Jack Snipe, *Woodcock*, *Curlew*, Common Sandpiper, *Redshank*, Dunlin, Sanderling, Lesser Black-backed Gull, Herring-Gull, Common Gull, Razorbill, Guillemot, *Stock-Dove*, *Cuckoo*, *Barn-Owl*, *Little Owl*, *Tawny Owl*, *Green Woodpecker*, *Skylark*, *Carrion-Crow*, *Rook*, *Jackdaw*, *Magpie*, *Jay*, *Great Tit*, *Blue Tit*,

Marsh Tit, Willow Tit, Nuthatch, Tree-Creeper, Wren, Mistle-Thrush, Blackbird, Robin, Grasshopper-Warbler, Reed Warbler, Sedge-Warbler, Garden Warbler, Whitethroat, Lesser Whitethroat, Willow-Warbler, Goldcrest, Spotted Flycatcher, Hedge-Sparrow, Meadow-Pipit, Tree-Pipit, Pied Wagtail, White Wagtail, *Yellow Wagtail, Starling, Greenfinch, Goldfinch, Linnet, Chaffinch, Yellow-hammer, Corn-Bunting, Reed-Bunting,* and *House-Sparrow.*

Autumn Bluethroat

SELECTED 1959 LIGHT-VESSEL NOTES

R. A. RICHARDSON

Leach's/Storm Petrel.—Lynn Well, one October 1st and 4 on 4th.

Kestrel.—Lynn Well, one August 13th.

Water-Rail.—Haisboro', one October 12th.

Moorhen.—Inner Dowsing, one December 9th.

Lapwing.—Lynn Well, 100 September 24th and a few October 2nd and 9th. Inner Dowsing, 20 August 22nd and 14, October 23rd. Haisboro', 13 west November 14th. Newarp, a few December 2nd–4th. Corton, several west September 30th.

Woodcock.—Haisboro', one October 29th.

Wood-Pigeon.—Inner Dowsing, 2 October 12th, many December 4th and a few next day. Haisboro', several November 22nd and December 6th. Newarp, one December 3rd/4th.

Cuckoo.—Newarp, one killed August 3rd.

Long-eared Owl.—Inner Dowsing, one eating a starling, November 1st.

Short-eared Owl.—Haisboro', one November 6th.

Skylark.—Autumn records on 17 dates between September 24th and November 23rd at six vessels. Peak movements end September to October 12th.

Jackdaw.—Inner Dowsing, 4 October 12th and one on 31st. Newarp, 2 October 30th/31st. Corton, one November 1st.

Magpie.—Haisboro', 10 west November 1st.

Great Tit.—Newarp, 6 October 10th. Corton, one dead, September 30th.

Blue Tit.—Newarp, 4 October 11th.

Fieldfare.—Newarp, a few October 26th and 30th/31st. Corton, several October 30th.

Song-Thrush.—Corton, one dead, October 1st. Small numbers of " thrushes " (including redwing) at Lynn Well, Outer Dowsing, Newarp and Cross Sands September 24th, October 4th and 11th–15th and November 1st.

Ring Ouzel.—Lynn Well, singly October 11th and 13th. Corton, 2 October 30th.

Blackbird.—Lynn Well, many November 1st/2nd. Inner Dowsing, several October 2nd. Haisboro', several November 22nd. Corton, many October 11th/12th and November 1st and many west, on 2nd.

Robin.—Lynn Well, 2 October 4th and 2 on 9th. Newarp, a few October 11th. Corton, 2 October 30th.

Blackcap.—Lynn Well, one October 9th.

Goldcrest.—Lynn Well, 24 October 9th. Inner Dowsing, 2 October 7th and 3 on 12th. Corton, one dead, September 24th.

Great Grey Shrike.—Haisboro', one carrying small bird, November 5th.

Starling.—Autumn records at seven vessels September 30th–December 5th. Large numbers on many nights during October and first week November, including 5,000 at Inner Dowsing, October 31st ; 5,000 at Outer Dowsing October 12th ; 1,000 at Newarp October 11th and November 1st and 2,000 there on 6th/7th.

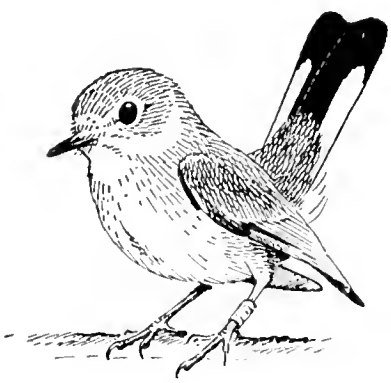
Goldfinch.—Haisboro', one November 11th.

Siskin.—Haisboro', several, October 12th.

Chaffinch.—Many autumn records September 24th–October 31st at Lynn Well, Inner Dowsing, Outer Dowsing, Haisboro', Newarp and Corton. Peak numbers during second week October.

Brambling.—Lynn Well, a few October 6th. Newarp, a few October 24th and 26th. Corton, several October 10th/11th.

Reed-Bunting.—Lynn Well, one October 22nd.



Red-breasted Flycatcher

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Norfolk Mammal Report 1959

INTRODUCTION

Each year since 1953, a summary of the records of Norfolk mammals has been issued by the Norfolk and Norwich Naturalists' Society. We welcome this opportunity to present the Report for 1959 in more permanent form. While at present it cannot be expected to be so comprehensive as the Bird Report, it is hoped that it will stimulate additional observation, and develop as attractively as the ornithological records have done.

As this is the first time that the two reports have been published together, it was suggested that an historical background was desirable. This proved to be a major task, and likely to detract from the main purpose in hand of presenting the records for 1959. Only brief mention is therefore made of the past status of each species, except in so far as it is necessary to do so more fully in order to comment adequately on the present distribution and population fluctuation. It is hoped that it will be possible to produce later a special paper which will survey the knowledge we have of the Norfolk mammals of the past.

Sixty-one species have been recorded in the county, out of the one hundred and fourteen on the British list. Of these, only about forty are now likely to be met with in the county and in its coastal waters, and some of these but rarely. We have, however, only limited information on the Bats and Cetaceans. The former alone would, if more widely studied, provide an opportunity of adding to the county list. Some species of our mammals have not been recorded for over a century. Some, such as the Yellow-necked Mouse, are of uncertain distribution. At least one, the Black Rat, is verging on extinction. Replacing these species of limited range and doubtful status, the Coypu has made tremendous advances in the past ten years. In very recent times the appearance of the Mink as a feral escape from captivity, and even the domestic cat as a completely wild, breeding mammal, may add two species to our records.

Changes are constantly at work. The dramatic decrease in the rabbit population due to myxomatosis, has been followed by a puzzling increase in the number of hares, for example. An annual survey provides a means of following what is going on, and stimulates enquiry. We have about ninety individual observers

and schools providing information. The sampling effect they can produce, in reporting on the deaths of mammals due to road traffic, on trapping experiments, on the catches of cats, on the corpses on gamekeepers' gibbets, and on direct numerical counts, together with the reports from the Hunts, records from pest control officers and agricultural workers, the Forestry Commission censuses, and the game bags of large estates, have all contributed to improving the accuracy and completeness of what is presented here. The collecting of the available information has proved a worth-while task, and with five years of enquiry behind us we now have a fair conception of the nature and distribution of our mammal population.

All the records are card indexed, and most of them entered on a series of maps. These are now showing less of the effect of distribution of the observers, and more truly the distribution of the individual species of mammal. Gaps remain to be filled, however, especially in west Norfolk, and these can only be dealt with if our members will send in notes of even the most common species from as many localities as possible, and giving brief particulars of numbers and dates.

The Society's thanks are due to all correspondents whose work has been included in this report. We are anxious to increase the number of recorders. This work can be done through schools very effectively, and we already receive considerable help from a number of these. Records for the 1960 report should be sent **by the end of January** to Mr. F. J. Taylor Page, 77, Surrey Street, Norwich.

CLASSIFIED NOTES

Hedgehog (*Erinaceus europaeus*)

One of the most widespread animals in the county. Reports suggest that hedgehogs are plentiful and probably showing an increase, though this may be due to the fact that owing to the dry summer, they wandered widely in search of water and were likely to have been noticed more frequently. The wet summer of 1958 produced an abundance of slugs and snails, which could have contributed to successful breeding. This would make itself evident in 1959.

Road traffic is responsible for heavy mortality. Increased use of the roads during the fine long summer inevitably took heavy toll, and this could not therefore be used as certain evidence of improved status; indeed, in some places fewer rather than more have been reported dead on the road. Where regular trapping has been carried out by gamekeepers, comparative numbers in 1958 and 1959, particularly in coastal areas, confirm that there is a larger population.

Much remains to be learned of the natural history of this animal. Observations on such habits as self-anointing, territory defence, and mating display, would be of considerable value. Colour varieties are always interesting. For example, we had a report this year of an albino at Bodham (RPB-O).

Common Shrew (*Sorex araneus*)

No regular trapping appears to have been done in the county this year, and in consequence comparative figures cannot be given. Observations mainly in south-west Norfolk show patches of abundance. In open agricultural areas, shrews have taken to living most frequently in hedgerows. Toxic sprays are thought to have had some effect in reduction of numbers in some places (RVE).

While it is common to find the corpses of old adults lying above ground towards the end of the year, in 1959 many older adults were still active at the end of November. This may be evidence that shrews are living longer (EAE).

Pigmy Shrew (*Sorex minutus*)

Still more plentiful than Common Shrew in several woodlands round Holt (RPB-O). Increase in population was noted at Blofield (DT), and occasional records come from Calthorpe Broad Estate (BFTD), Ellingham (ECS), Taverham Mill (LWL) and Geldeston (WS). It is probable that the population of pigmy shrews is high everywhere. A special cover over the opening above the trap control of a Longworth trap is necessary if any pigmy shrews that are caught are to be prevented from escaping.

Water Shrew (*Neomys fodiens bicolor*)

It has been particularly interesting to have new stations for this species in addition to those given last year. One was observed at the edge of a small pool on the marshes at Somerton (JS). A few have been seen on the Waveney marshes (WS), and at Taverham (LWL). Horsey Mere is known to support some, but they have not been seen recently (AB). Two were watched from a photographic hide on the bank of the Glaven below Hempstead Mill, and one was found dead on the road bridge over the Wensum at Gnist (RPB-O).

Mole (*Talpa europaea*)

In the opinion of Sprowston Agricultural Station, the mole population is static and likely to decrease, as action against these animals becomes more stringent. Reports of increase and decrease over the county appear to be fairly balanced, though estimates based on mere observation of surface workings are likely to be of dubious accuracy. Activity appears more noticeable on ground used for cultivation of sugar beet and lucerne, in the earlier part of the year as some of the fields used for these crops lie uncultivated

for a considerable time. Different fields appear to be worked in different years. Crop spraying seems to clear the ground of moles very rapidly.

During 1959, and possibly associated with drought conditions, they became more evident in marsh areas and in woods. A good deal of surface rooting occurred, and in some instances very deep burrows were made.

A mole " castle " was opened up in north Norfolk. It contained five young and a store of sixteen decapitated or mutilated, but living earthworms (RPB-O). White or cream coloured specimens of moles were reported from Barnham (WMS), Fakenham (JML), and Old Costessey (NCM).

Bats

While there is most definite evidence that all species of bat are less common, particularly in Norwich, scarcity is now frequently mentioned in reports from the country. Houses and churches seem less hospitable. A colony of **Pipistrelle Bats** (*Pipistrellus pipistrellus*), for example, was destroyed by gassing in Stody church in August (RPB-O). Fewer hollow trees are left standing, chalk pits are filled in and poisonous sprays all doubtless contribute to the difficulties faced by bats in finding shelter and food. It is probable that they have never recovered from the set-back experienced in the winter of 1947. The **Noctule Bat** (*Nyctalus noctula*), while not common everywhere, has built up small colonies in places. Seventeen were found in a hollow elm, felled near Wendling (RPB-O), a few were seen regularly at Corpusty from May to August (JML) and at Surlingham from late March to early June (EAE), and at least thirty inhabit a hollow tree at Langmere (PRB). Single specimens were reported from four other stations.

The only other species commonly recognised is the **Long-eared Bat** (*Plecotus auritus*). It is usually found roosting in trees in North Norfolk, but one roost observed during July and composed entirely of nursing females, was discovered in a shooting hut in woods at Kelling. Other records come from Blofield (DT), Hemsby (NCM), Caister Hall (DAJB), Stoke Holy Cross (MEM), and South Raynham (PRB).

A colony of fifteen **Natterer's Bat** (*Myotis nattereri*), lived in an old poplar at Glandford and a few still may be seen in the neighbourhood. A **Whiskered Bat** (*Myotis mystacinus*), was taken at Brinton on September 19th (RPB-O). Watch should be kept for the **Lesser Horseshoe Bat** (*Rhinolophus hipposideros*), which is known to inhabit chalk caves at Bury St. Edmunds. One ringed there on January 9th was re-taken March 14th. Possibility of this species being found in south Norfolk is not remote, and we might hope equally for the spread of the **Serotine Bat** (*Eptesicus serotinus*), from the small colony at Somerleyton.

Rabbit (*Oryctolagus cuniculus*)

In spite of efforts of the Rabbit Clearance Societies which now cover a very large proportion of the county, a noticeable increase in many local populations is occurring. In some places numbers have built up strongly, but in others rabbits are still entirely absent. Myxomatosis returned, particularly in the cold weather, when it is thought that the surviving surface-living animals once more took to burrows where they were again infected by the rabbit flea.

The litter average appears to go up where the population is notably diminished ; it is now seven instead of five. The dry summer produced good breeding conditions, and marshy areas particularly served as centres for outward migration. In some instances, litters have been noted of up to a dozen. Despite this, in some places rabbits have probably never been fewer than at the present time. At Bawdeswell, for example, the average catch used to be 1000 or so at harvest time. This year it was 4 (QEG).

Hare (*Lepus europaeus occidentalis*)

In common with many other counties in the British Isles, Norfolk has shown a remarkable build up of the hare population in the post-myxomatosis years. This cannot be accounted for solely by a succession of good breeding seasons, for while 1959 was probably the most successful for many years, 1958 with its wet conditions, was very poor. Only a small proportion of the leverets survived, and the wet feeding conditions appeared to produce liver diseases in the adults. The drier weather of the present year encouraged a long and successful breeding season, commencing in the first week in March, and in some places continuing until the first week in December. Numbers of hares in excess of anything previously known have been shot, not only in areas where they had regularly been taken, but also in many new ones where their appearance otherwise would have been unusual. No adequate explanation appears to have been put forward. As far as we know, it bears no relationship to the scarcity of rabbits, and the matter requires a great deal more investigation. A suggestion that rabbits used to destroy the leverets in their forms has received no general substantiation.

Bank Vole (*Clethrionomys glareolus*)

Few records of these small climbing mammals have come in, though the general impression is that there has been a good breeding year. Populations are known to reach a peak, after which there may be a very marked decline. One of these peak populations was recorded at South Wootton (GBH).

A report from Stockton (MRR) of bank voles inhabiting nests of moss, grass and twigs, and lined with hair, built three feet up in some young fir trees, led to the hope that the identification, which

was uncertain, might in fact prove to be that of **Dormouse** (*Muscardinus avellanarius*). Stockton is one of the three parishes in which, according to Barrett-Hamilton, Dormouse was introduced from Surrey in 1844. Despite investigations by Thomas Southwell, extending over twenty years, it was never shown to be present, and while the chances against survival since that time are exceedingly remote, we hope that during 1960 it may be possible to record its discovery once again in the county. As if to add weight to this, an unconfirmed report of a dormouse taken dead in a store at Rackheath by an ex-Norfolk gamekeeper, came in this year (ATP).

Field Vole (*Microtus agrestis*)

This species was more generally distributed until many permanent pastures came under the plough. Periodically, well-established breeding populations suffer a set-back due to disturbance from crop rotation, and in consequence field voles are now more commonly found in coastal grasslands and river valleys. Even here they may now be subject to the effects of chemical sprays, and vole plagues seem less likely. The causes which produce these vast increases in numbers, followed by sudden decrease are still being studied, and no definite explanation has yet been given. On Breydon marshes, for example, these increases are accompanied by a noticeable increase in the predators, such as kestrels and short-eared owls (RHH).

Water Vole (*Arvicola amphibius amphibius*)

At one time water voles were relatively common, but decreased numbers are now reported from a number of places. One contributor (HJ), attributes this in the Hingham–Attleborough area, to the drying up of water courses, but the reason elsewhere is unknown. Possibly, as at Hickling, the coypu is proving a competitor, or at least a disturbing factor (EP). Brown and black varieties were reported from Corpusty (JML), and at Taverham it was noted that they are eaten occasionally by herons (LWL).

Long-tailed Field Mouse (*Apodemus sylvaticus*)

Generally plentiful, particularly towards the end of the year. During November, twenty-seven were trapped at Watton (GJ). Doubtless the effects of the summer and the excellent seed crops from wild plants in the autumn will increase the possibility of even larger populations in 1960. Increase of the Weasel (q.v.) may be correlated with this.

Yellow-necked Mouse (*Apodemus flavicollis*)

Watch was maintained at Ellingham where this species was found last year for the first time (ECS), but no further specimens have been taken.

Harvest Mouse (*Micromys minutus*)

On the whole few records have come in for this species this year, and one gathers that it is not very common. Reduced numbers of static populations have been noted at Calthorpe Broad (BFTD), Taverham (LWL), Bolwick (JNW), Attleborough (HJ), Binham (RS) and north Norfolk (RPB-O). Two new stations were reported, Tuttington and Felmingham, when work on rick proofing was in progress (RAD).

House Mouse (*Mus musculus*)

More commonly met with outside human dwellings than formerly. Hundreds found in stacks being threshed at Hethersett (HWB). This has been the experience elsewhere. Records of decreased numbers have been received.

Black Rat (*Rattus rattus*)

An undoubted specimen was taken in premises adjacent to the River Yare in Norwich (ATP). One was found some years ago in a city warehouse away from the river, but this is the first time we have been able to record it. None has been taken at Yarmouth, one of the main strongholds in the early twenties (RHH), and the species may be verging on extinction in the county.

Brown Rat (*Rattus norvegicus*)

Despite the fact that ricks no longer provide such regular assurance of shelter, owing to the use of the combine harvester, and that vast numbers are regularly poisoned, the brown rat appears to have maintained its status, though a temporary decrease was noted by rodent operators during the dry summer. Hedgebanks are frequented more often, and rats are now the most common animals killed on the road. In the summer drought they took to climbing in search of berries in blackberry and blackthorn. Some were even observed raiding plum and apple trees (BB, DMM, EAE). Many took to the coastal marshes, especially between Wells and Stiffkey, where they lived on shellfish and small crabs (RVE, RC).

A family of four albinos was destroyed at Bressingham early in the year, and an adult albino was shot at Further Fen, Roydon, not far from the same place, in early May (EDP). Two sandy specimens, one from Thornage and one from Letheringsett were killed in the late Autumn. Several of the same variety also seen in the vicinity of bungalows on Hemsby dunes (RPB-O).

Red Squirrel (*Sciurus vulgaris leucorus*)

With hedgehog and coypu, red squirrel hold the distinction of having been noted more widely in the county than any other mammal. This is probably because of its size and roving nature. Despite this, it seems fairly successful at avoiding death on the road.

wright

[illegible] Photo

fpa : Foxes were reported for the first time for many years in the Broads area at Repps-Martham and Hickling. Increases were also reported at Costessey where 10 were shot. Two litters of five leverets at Brinton. 1959 was a most successful breeding season and the hare population at the present time is remarkably high.

R. P. Bagnall-Oakeley

Road traffic during the fine long summer took heavy toll of the hedgehog population

Thetford Chase remains its chief stronghold, but wherever there is woodland, there, in all probability, a few will be found, especially in south and central areas. Control had to be exerted at Thetford to avoid recurrence of serious damage to tree crops over thirty years old. In part of the Chase, a concourse of squirrels, about thirty in number, was observed in a large beech tree, and on another occasion squirrels were observed licking the leaves of an oak tree, probably to obtain honey-dew (FJTP). Damage to a carrot crop was noted at Swaffham, where the squirrel population seems to have built up. They are also reported as very numerous at Horsford (FEDB), and increasing to the peak of a cycle in the Holt area (RPB-O). A specimen of the black variety, recorded once before many years ago at Ellingham Hall, was noted in September (ECS).

Grey Squirrel (*Sciurus carolinensis*)

Several reports have come in of unconfirmed suspects. One was seen at least three times at Castleacre, late in the year, and others at Croxton and Shropham. Care should be taken to avoid confusion between this species and the Red, in winter pelage.

Coypu (*Myocastor coypus*)

During the period 1956–59, totals were kept of the number of reports that were received. 1956 and 1957 showed 17 and 21 respectively. 1958 produced 58, and 1959, 65. There is no doubt at all that the population is expanding too rapidly and getting out of hand. On two farms at Waxham and Catfield, over two hundred were destroyed. From an eight-pound female, six well-developed young were taken, and several others of similar weight carried between four and seven foetuses. Consistent trapping showed that the largest numbers and largest average size (twelve to thirteen pounds) were in October. In November, very few were taken and all were small with an average weight of six pounds. December showed a marked increase in numbers and size, average nine pounds, and again in January all were small, about five or six pounds weight.

Almost every part of the county shows that their range has widened, and is increasing steadily. Some have been taken in holes in hedge banks, and far from water, as in south-west Norfolk (WMS). At Shipdham, three adults and five young were trapped in inland pits unconnected with streams. Some reached the coast at Trimingham, and were reported to be living in holes at the base of the cliff, and feeding on beach refuse (XCM).

Serious damage to sugar beet and other crops has produced losses totalling £70 to £80 per acre. While there have been undoubted advantages from the clearance of river channels of encroaching reed by coypus, damage to the crops of reed and sedge

on Norfolk Naturalists' Trust property at Hickling, the sale of which forms an important part of the Trust income, has seriously reduced their value. The crop is said to be the worst for thirty years. It is also thought that the considerable damage to vegetation at Scoulton Mere, and the disturbance produced, seriously affected the numbers of Black-headed gulls attempting to nest there.

Burrows of other animals have been enlarged and in some places actual burrowing in the river banks appears to have been proved (AB). Low-winter temperatures appears to be an important natural control, particularly among the young. While a market remains for the pelts, much control is being exerted by Man, but this seems insufficient to prevent numbers reaching pest proportions.

Fox (*Vulpes vulpes*)

Distribution through the county is very variable, but this year there is evidence of widening range, with reports for the first time for many years from the Broads areas (YM) at Repps and at Martham, where they were believed to be preying upon coypus, voles and hares. Two dog foxes, and a vixen with seven cubs, were at Hickling early in the year, but most of these were killed (MJS). Increases were reported from Mundford (TWT), Costessey, where forty were shot (RVE), Weybourne, where about thirty were killed (HFA), Stratton Strawless (EAE) and Ellingham (ECS). Decreases have, however, been noted in west and central Norfolk.

Late in the year, a disease, first recorded near Peterborough in April, caused death among foxes in the West Norfolk Hunt area. This disease, temporarily called fox encephalitis, produces blindness, haemorrhage in the gut, and inflammation of the brain leading to various signs of madness. This disease, the cause of which is unknown has hitherto not affected our wild life.

Badger (*Meles meles*)

Although Norfolk has been said to be an unsuitable county for badgers, and various explanations have been given for what was regarded as a low population, it is with some satisfaction that we are able to record the existence of ten setts, almost certainly all in use. Most of them are in the west and central areas covered by the West Norfolk Hunt, but there is at least one in north Norfolk. On three occasions, the Hunt pursued a fox to earth, and each time the fox used an occupied badger sett. It is hopeful news when farming and hunting fraternities seem to welcome badgers on their land, and leave them unmolested.

Otter (*Lutra lutra*)

Now found mainly only in quieter streams, and possibly not so numerous, though there is a suggestion of increase along the coastal

strip from Holme to Blakeney, where they leave fresh water and enter the sea (SS, RVE). Several pairs regularly breed in, and work, the Glaven valley, and evidence of their presence was seen at Selbrigg Pond, Hempstead Mill, Bayfield and Brinton lakes. Regular disturbance by reed cutting and dyke cleaning, and the increasing use of rivers for angling, may account for a decrease in some places, particularly in the Broads.

Abundant evidence of otters noted in the quiet reaches of the Wensum above Raynham (RPB-O).

Remains of two very young coypus found associated with otter's seals at Guist, suggest that coypu is likely to form an ingredient of otter diet in future (RPB-O). At Taverham, the remains of eels, crayfish, pike and roach have been found left by otters. Breeding is known to have occurred in this area (LWL).

Stoat (*Mustela erminea stabilis*)

Many observers report reduced numbers. The largest populations now appear to be found in marsh areas, where the diet includes water vole, eel, moorhen and frog. It has been suggested also that stoats have turned to rats and mice as food. Stoats are found more often than heretofore in corn stacks, but it is likely that they are as often killed by rats (HR).

Comparative numbers of stoats killed on one estate in Breckland show progressive reduction from 146 in 1956 to 62 in 1959. Although rabbits are returning and increasing here, the stoat population continues to fall (JAD).

Weasel (*Mustela nivalis*)

An increasing number of records suggests that there is probably a rise in the population, perhaps related to increases in numbers of voles or field mice. In the Binham–Fakenham area, weasels hunt in kale fields, taking small birds such as larks and linnets which roost there at night. They frequently use mole runs for shelter (RS). They have been taken in ricks at Felmingham and Tuttington (RAD). The main hunting grounds everywhere appear to be hedgerows (WS).

Mink (*Mustela vison*)

At least ten mink farms are known in the county, and it is hardly surprising that escapes have occurred. One, captured in Yarmouth, had travelled about ten miles from Somerton. In August, one was trapped at Thompson Mere, many miles from any mink farm. It was a male, about three years old. Body measurement, 2 ft. ; tail, 7 in. An almost certain specimen, was seen twice in Lynford forest later in the year (OCSD). One was also reported as having been shot at Winterton (NCM).

Feral Domestic Cat (*Felis domesticus*)

It is worthy of note that domestic cats have recently been observed living and breeding in the wild. Reference was made in an article in the *Eastern Daily Press* to the fact that there are "more wild cats in our woods and copses than for a thousand years," and this may be said to be true of Norfolk. Five are known in North Walsham Wood (JBB), one with several kittens was seen in Thetford Chase (FJTP), and others are known at Horsford. Additional reports would be valued.

Seals

While control of the **Common Seal** (*Phoca vitulina*) on Scroby Sands now seems unnecessary, as numbers are down to less than one hundred for most of the year, in the Wash they are reported to be increasing and estimated as about 2500 (EDP). A fair number are also to be seen on the sand-bars at the mouth of Blakeney harbour, and odd individuals turn up during all months at Scolt Head (JFP). There appears to be a high mortality, adults and young being often found dead on the beach. The first young on Scroby were recorded on June 12th, with a peak period during the first week in July (PGT, RIHH).

In June, about forty **Grey Atlantic Seals** (*Halichoerus grypus*), were swimming with the Common Seals off Scroby, and by November 22nd numbers had increased to about eighty. Nine young are thought to have been produced, but breeding dates are unknown. It is of interest to note that in the period 1951–53, seals with young were recorded on the beach at Scolt Head *late in the year*. They could only be this species.

A marked calf from N. Wamses in the Farne Islands born 16.11.58, was found alive at Sea Palling 16.1.59, and returned to the sea (GWH).

Deer

Red Deer (*Cervus elaphus*), are now widely dispersed through Thetford Chase in small herds, or single old stags. Usually at the breeding season one old stag, several younger ones and up to four or five hinds are together and may remain so up to the end of the year. The first photographs of some of these were taken in November by Mr. P. Richards of the Great Yarmouth Naturalists' Society. Four outstanding animals have been shot, one, a twenty pointer, and the three others, all thirteen pointers. All have a very similar appearance, with fine tray points. It has been suggested that they show features characteristic of the famous Warnham Park herd (FJTP).

Fallow Deer (*Dama dama*). A few still remain at Newton St. Faiths, harried by forestry activities, and rarely seen, as they are almost completely nocturnal. The last remaining hind of the old Rackheath park herd was killed on the road at the end of April (EDP).

Roe Deer (*Capreolus capreolus*). Heavier control, with the killing of about forty bucks, has been exerted this year. It remains to be seen what the effect will be in Thetford Chase. As was foreseen several years ago, deer have reached Swaffham forest and slight damage has been reported in the Drymere area.

Muntjac (*Munstiauc reevesi*). Only two unconfirmed reports have come to hand, one of a small deer about eighteen inches high, seen on the Mundford–Methwold road in December, and one of similar size killed on the A.11 at Fettlebridge, near the Hargham estate.

Whales

A Lesser Rorqual (*Balaenoptera acutorostrata*), was stranded between Waxham and Sea Palling 24.5.59. The last one of this species previously recorded was 13.10.43. It is probably the most frequently stranded among the larger whales. This one constitutes about the fifteenth record from the time of Sir Thomas Browne. Its measurements were : Length—16 ft. 7 in. ; Body circumference —9 ft. ; Tail span—4 ft. ; Weight approximately—$2\frac{1}{2}$ tons (EDP).

Porpoise (*Phocaena phocaena*)

Two strandings were reported to the British Museum of Natural History : 25.6.59 Great Yarmouth—Female, 2 ft. 7 in. ; 22.10.59 Caister—Two males, 4 ft. $3\frac{1}{4}$ in. and 5 ft. 6 in.

A number were inshore off Scolt Head in August and September, probably feeding on whitebait, mackerel and herring (JFP).

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NOTES ON THE BRYOPHYTES OF THE BRECKLAND HEATHS

By B. Ducker and E. L. Swann

Breckland is a well defined part of the East Anglian landscape, with a sandy soil derived mainly from glacial drift, partly calcareous, partly leached and acid. Rainfall is low. The plant life of the area is determined primarily by the combination of a light, well-draining soil in a dry climate, but important differences in the vegetation of Breckland depend on differences in the soils whose comparatively even texture varies a great deal chemically.

The surface of Breckland is undulating with gentle slopes ; its western boundary is formed by the Fenland. On the remaining margins, lies higher ground, divided by the trough of the joint basin of the west-flowing Little Ouse, and the east-flowing Waveney. The three rivers traversing the region and rising in the higher ground to the north, east and south, flow westwards along a gentle gradient into the Fenland ; the Wissey, near the northern boundary, the Lark near the southern, and the Little Ouse, cutting Breckland into approximately equal, northern and southern halves. In the eastern part of the region, lie the meres, in themselves features of particular physiographic interest. The mysterious manner in which the water-levels of the meres fluctuate, together with their location in a dry-open countryside provide unusual living conditions for the plants and animals colonising them.

The bryological interest of the region is not confined to the tracts of open heathland, but the lists of mosses and liverworts which follow have been compiled solely from heathland areas. A number of other species are to be found around the meres, on the fallows, and in the stubbles of arable land, in the woodlands, and from the fen, wet-heath, and carr habitats of the river valleys ; a review of the bryophytic flora from these situations may well form the subject of a separate account.

The various records have been made at different times during the past eight years, as the result of frequent visits to a number of sites throughout Breckland. In certain instances, reference is made to records from other sources and these are duly acknowledged.

In his studies of Breckland ecology, Watt[5] draws attention to the variation in the general appearance and floristic composition of the so-called " grass-heath." This diversity is primarily due to the soil. Studies of soil profiles have enabled seven categories to be distinguished, and these show a series of stages in soil-profile development from calcareous, shallow, immature soils derived from chalky boulder clay to a deep, well-marked podsol. Each type of grassland on the different soil-profile stages with their associated flowering plants, mosses, liverworts and lichens may be considered

as the starting point of a sere, with sand-sedge, heather or bracken as potentional invaders ; any one of these species may become dominant, depending on local conditions, but there is no simple successional sequence between the grass-heath communities and possible invaders.

The following bryophyte lists for various heathland areas in Breckland are accompanied by brief notes on habitat ; the importance of bryophytes as " indicator " plants, i.e., revealing something of the potentialities of the land on which they grow, has come to be appreciated to an increasing extent, and there is often a very close and precise relation between the acidity or alkalinity of a soil and the flora it supports. The variation of soil types in Breckland is reflected in the range of bryophyte species which are recorded from the heathland habitats.

(1) Mosses

Acrocladium cuspidatum—chalk grassland in Breckland, in the shade (ELS).

Aloina ambigua—colonising chalk exposures of small pits—Weeting Heath (ELS).

Aulacomnium androgynum—rotton pine stump—Weeting Heath (ELS).

Barbula convoluta—on bare soil in a short grassy sward, Thetford Heath (BD) ; Pilgrims Walk, Weeting (ELS) ; Weeting Heath (ELS).

B. fallax—in some of the small pits in the central zone—Weeting Heath (ELS).

B. recurvirostra—among *Festuca ovina*—Thetford Heath (BD).

B. unguiculata—on bare soil disturbed by moles, in *Festuca ovina* grassland—Thetford Heath (BD) also Weeting Heath (BD).

Brachythecium albicans—open flinty lichen area—Thetford Heath (BD) ; among lichen and moss—Foxhole Heath (BD) ; on overgrown tarmac—East Wretham Heath (BD) ; on compacted sand tracks in the shade—Weeting Heath (ELS). Frequent in depauperate forms on sandy heath of Breckland (ELS).

B. glareosum—recorded at Weeting in 1948 by Dr. F. Rose.

B. rutabulum—in the elm-grove—Weeting Heath (ELS).

Bryum argenteum—common where rain wash brings small sand particles along solid tracks such as roadsides in the forests (ELS).

Bryum caespiticium : on bare soil on calcareous lichen-grassland. Thetford Heath (BD).

B. erythrocarpum : from calcareous grass-lichen community. Weeting Heath (ELS AND BD).

Camptothecium lutescens—abundant throughout Breckland (ELS) ; abundant among recolonising vegetation of the ploughed

areas—Thetford Heath, Weeting Heath (BD) ; Thetford Golf Course (ELS) ; Weeting Heath (ELS) ; Black Ditches, Risby (BD).

C. sericeum—Devil's Dyke—Weeting Heath (ELS).

Campylium chrysophyllum—from *Festuca ovina* grassland, and also among the recolonising vegetation of the ploughed areas—Thetford Heath (BD) ; among recolonising vegetation of the ploughed areas—Weeting Heath (BD) ; Thetford Golf Course (ELS) ; Weeting Heath (ELS).

Campylopus brevipilus—in the thin turf of the central zone around the burrows—Weeting Heath (ELS).

Ceratodon purpureus—abundant—Thetford Heath (BD) ; on ploughed area—Weeting Heath (BD) ; very abundant throughout Breckland. When fruiting in late spring the red setae are conspicuous and give colour to the heathland (ELS).

Climacium dendroides — chalk grassland — Weeting Heath (ELS) ; East Harling Common (ELS) ; Stow Bedon (ELS) ; *Festuca ovina* grassland—Thetford Heath (BD).

Ctenidium molluscum—chalk grassland, Black Ditches, Risby (BD) ; Devil's Dyke, Weeting Heath—frequent (ELS).

Dicranoweissia cirrata—on tree in elm grove—Weeting Heath (ELS).

Dicranum scoparium—abundant in heathland pits, and depressions of " brecks " (ELS) ; abundant on both Weeting Heath and Thetford Heath (BD) ; present in fescue-sand sedge sward, Barnhamcross Common (BD).

Ditrichum flexicaule—chalk grassland—Weeting Heath (ELS) ; among *Festuca ovina*—Thetford Heath (BD).

Encalypta streptocarpa—on chalk exposures, Weeting Heath, but much less frequent than *E. vulgaris* (ELS).

E. vulgaris—frequent on soil exposures where calcareous, Weeting Heath (ELS) ; on bare soil among sand sedge and fescue, Thetford Heath (BD).

Eurhynchium pulchellum var praecox—a species new to the British flora. First discovered by Dr. Francis Rose on chalk grassland at Lakenheath Warren—May, 1950.

E. swartzii—grass heath—Thetford Heath (BD). Frequent, Santon, Two-mile Bottom, Thetford, Weeting Heath (ELS).

E. swartzii var rigida—on the east facing slope of the large pit near the boundary stone—Weeting Heath (Townsend and Swann 1958—the only record).

Fissidens cristatus—rare amongst the grass where some shelter is provided. Weeting Heath (ELS) ; among deep *Festuca ovina*, Thetford Heath (BD).

F. taxifolius—among grasses recolonising ploughed area—Weeting Heath (BD).

Funaria hygrometrica—frequent on sites of fires in or by the sides of woodlands throughout the district. Frog Hill, Stanford (ELS) ; Weeting Heath (ELS).

Hypnum cupressiforme var tectorum—chalk grassland, Weeting Heath (ELS) ; among *Festuca ovina*—Thetford Heath (BD).

H. cupressiforme var ericetorum—among heather, Foxhole Heath and Cavenham Heath (BD) ; among fescue, Thetford Heath (BD) ; on the more acid grassland, Weeting Heath (ELS).

Hylocomium splendens — among recolonising grasses on ploughed area—Weeting Heath (BD) ; in *Festuca ovina* sward—Weeting Heath (BD) ; in sward of sand sedge and fescue—Barnham-cross Common (BD).

Mnium affine—in the elm grove—Weeting Heath (ELS).

Mn. cuspidatum—in the elm grove—Weeting Heath (ELS).

Mn. longirostum—among recolonising grasses on ploughed patch—Weeting Heath (BD) ; in *Festuca ovina* sward—Weeting Heath (BD). Devil's Dyke, Cranwich (ELS). Weeting Heath (ELS). Hockham (ELS).

Mn. undulatum—in *Festuca ovina* sward—Weeting Heath (BD).

Phascum curvicolle—exposed sides of pits on chalk—Weeting Heath (ELS).

P. cuspidatum—on bare soil—Weeting Heath (BD).

Pleurochaete squarrosa—very rare. Thin turf of Devil's Dyke, Weeting Heath. No mention in Nicholson's *Flora of Norfolk*. First record, Dr. Francis Rose, October, 1957.

Pleurozium schreberi—among the larger grass tussocks, Weeting Heath (ELS) among fescue—sandsedge sward Thetford Heath (BD). Very common among heather and widely distributed in Breckland (ELS).

Pohlia nutans—common on the heaths and in woodland. The persistence of the seta after the shedding of the capsule is characteristic (ELS).

Polytrichum juniperinum among *Festuca ovina*—Weeting Heath (BD) ; in grass heath, Thetford Heath (BD) ; on stony trackway, East Wretham Heath (BD). Common on the less mobile sand areas (ELS).

P. nanum—colonising bare sand on Red Lodge Heath, Thetford. A rare species (ELS).

P. piliferum—common on the more mobile sand areas, and is the pioneer of open sandy places (ELS) ; on fescue-bent-lichen areas —Thetford Heath (BD) ; on moss-lichen heath—Foxhole Heath (BD) ; Agrostis-lichen areas Wangford Warren (A. C. Jermy) ; Agrostis-lichen areas—Cavenham Heath (BD), colonising open sand in S.E. corner of Weeting Heath, but now ploughed (ELS).

Pottia davalliana—on bare soil in grass heath—Weeting Heath (M. Macfarlane).

P. lanceolata—on bare soil among recolonising grasses of ploughed area—Thetford Heath (BD).

Pseudoscleropodium purum—among grass and heather, Foxhole Heath (BD) ; chalk grassland, Black Ditches, Risby (BD) ; among *Festuca ovina*, Thetford Heath (BD) ; in sand-sedge/fescue sward, Barnhamcross Common (BD) ; among grass tussocks, Weeting Heath (ELS).

Rhacomitrium canescens—chalky exposures, S.E. corner Thetford Heath (BD) ; colonising open sand of S.E. part (now ploughed) Weeting Heath (ELS) ; open sandy ground, Shouldham Warren (ELS).

Rhodobryum roseum—in *Festuca-Agrostis-Koeleria* turf—Weeting Heath (BD) ; among recolonising grasses on ploughed area, Weeting Heath (BD) ; among *Festuca*, Thetford Heath (BD) ; abundant only in an elm grove near Mt. Ephraim, Weeting (ELS) ; Foulden (ELS); Garboldisham (ELS) ; Weeting Heath (ELS).

Rhytidiadelphus squarrosus—in *Festuca ovina* turf—Thetford Heath and Weeting Heath (BD) ; in sand-sedge/fescue sward, Barnhamcross Common (BD) ; in deep *Festuca* turf, East Wretham Heath (BD) ; in pit on N.W. side Weeting Heath (ELS).

R. triquetrus—in *Festuca ovina* turf—Thetford Heath (BD) ; in turf on N. side Weeting Heath (ELS).

Rhytidium rugosum—among *Festuca* turf, Thetford ; also on chalky exposures S.E. corner Thetford Heath (BD) ; among recolonising grasses of ploughed area, Weeting Heath (BD) ; in *Festuca* turf, Icklingham Plains (BD) ; although given as very rare in Nicholson's *Flora of Norfolk*, we have seen it varying from occasional to locally frequent at Santon, Weeting Heath, Cranwich and Brandon (ELS).

Thuidium abietinum—in *Festuca ovina* sward, Weeting Heath and Thetford Heath (BD) ; Santon and Weeting Heath (ELS).

T. philiberti—in sand-sedge/fescue, Thetford Heath (BD).

Tortula laevipila—epiphyte on bole of ash tree—Weeting Heath (M. Macfarlane).

T. ruraliformis—grass heath, Weeting Heath (BD) ; among recolonising grasses on ploughed area, Thetford Heath (BD) ; in moss-lichen association, Foxhole Heath (BD).

T. ruralis—in recolonising grasses of ploughed area, Weeting Heath (BD) ; among *Festuca ovina*—Thetford Heath (BD).

Weissia microstoma—from Devil's Dyke and also on E. facing slope of large pit, Weeting Heath (ELS).

(2) LIVERWORTS.

Cephaloziella starkeii—on compacted sand of shady track, N. side, Weeting Heath (ELS).

Lophocolea cuspidata—in Festuca sward, Weeting Heath (BD).

Ptilidium ciliare—grass heath, Thetford Heath and Weeting Heath (BD) ; grass heath with much Agrostis, Cavenham Heath (BD) ; among heather, Foxhole Heath (BD) ; grows with heather when the bushes are large enough to afford the necessary shelter and damp atmosphere, Two-mile Bottom, Thetford, Lakenheath Warren (ELS).

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ALGAE IN THE WHEATFEN NATURE RESERVE

By K. B. Clarke

INTRODUCTION

As part of a study of the algae of the Broads region the Wheatfen–Rockland area was examined in 1959. The aims were to see how the plankton of the waters compared with that of other broads, to determine what part algae played in the life of the area and to try to throw some light on the changes in the freshwater flora which Mr. Ellis has noted during the last decade.

This area has been adequately described elsewhere[1] and it will suffice to mention here that the flood tide enters Rockland Broad (100 acres, 3–6 ft. deep) by two channels from the river Yare, and from Rockland Broad water moves up the Wheatfen channel to raise the level of the Wheatfen system of pools and ditches by 1½ ft. The tide runs quite swiftly in these channels. A surface velocity of 2·7 ft./second was measured in the dyke connecting Wheatfen with Rockland Broad. The bottom is everywhere an inoffensive mud of dark fawn colour which dries locally only on exceptionally low tides. Only at some points in the main channel and on Rockland Broad is there evidence of erosion of the mud. Large areas of water are overgrown with *Glyceria maxima* which floats and occasionally obstructs the channels, probably causing local scour when it does so but leading to increased deposition of mud behind it.

The waters of this area are most interesting due to the abundance and variety of their diatom population. They provide a sharp contrast to the broads of the Bure valley. At Wheatfen the organisms are all mud-loving forms, while in the Bure valley broads they are all plankton forms and the bottom, due to lack of illumination through the highly turbid water, is uncongenial to diatom growth.

Slides illustrating this paper are deposited with E. A. Ellis at Wheatfen.

The Plankton

The water is muddy. The material in suspension in the water is very largely derived from the mud surface. The forms are mostly mud-loving forms. There is, however, some true plankton originating from either the river itself (a burst of *Coscinodiscus lacustris* in September) or from the remoter parts of Rockland Broad (the bays, etc.). A few diatoms from the lower estuary are also brought in by the tide. Both *Actinoptychus undulatus* and *Gyrosigma fasciola* have been found, these being normally inhabitants of Breydon. The salt water *Diploneis interrupta* also occurs.

These show that at least some of the material being deposited at Wheatfen comes up-river from Breydon. Inglis and Allen (1957) have reported a similar landward movement of silt from the Thames Estuary.

The Mud Surface.

At low water the mud surface can be seen to have brown patches on it due to heavy growth of diatoms. Most of these are creeping species which probably owe their presence here to their ability to escape when buried. Although they cover the mud surface these diatoms have no binding power and their only effect here is probably one of oxygen production at the mud surface. In places, however, *Oscillatoria limosa* has an important role in binding together the mud surface and where it is present the surface can be peeled off like a skin.

The Scum.

A distinctive feature of Wheatfen is the amount of scum on the water surface, especially as the tide rises. Wherever the water flows under a floating obstruction it gathers into a continuous brown cover to the surface often yards across. This scum has its origin in the flooding of the mud when mud-particles and algae are lifted due rather to surface tension than to drying. The phenomenon can be observed on wet clammy days when drying of the surface would be unlikely. Very similar scums are produced on the salt marshes of the lower Waveney where areas of bare mud are flooded each tide. On these salt marshes there is almost a complete absence of algae and the scum is entirely mud particles showing that although the Wheatfen scums consist almost entirely of algae they are not essential to its formation. The organisms in the scum are a mixture of mud surface community with the incoming plankton from Rockland Broad and the River. This is perhaps explained by adhesion of plankton organisms to the scum but more likely these are simply being lifted off the mud after deposition on an earlier tide.

This scum in one of the side dykes at Wheatfen was the source of a number of new fungal spores described by Ingold & Ellis[2]. Where *Oscillatoria limosa* covers the mud surface pieces up to several inches across tear off and float along immediately below the surface. The author has observed a similar phenomenon on a large number of English rivers.

The Glyceria.

Only around their edges do the floating masses of Glyceria provide any habitat for algae. This would be poor but for the local activity of coypu, which trample the edges and thus leave a strip of damaged vegetation up to 12 in. wide covered with shallow

water. This strip abounds in epiphytic diatoms, some of which do not occur widely in the rest of the area.

The Soil Surface.

Wherever the tidal water floods over the land it deposits diatoms and mud. These diatoms, especially in the lower parts which are flooded or moistened nearly every tide, continue to thrive although they probably form a doomed community with a high rate of influx and low rate of survival. It would be interesting to know whether these diatoms play any significant part in the life of the fen.

The Trees.

As always in this kind of fen, a number of trees are submerged on the lower parts of their trunks at times. Some have a zone of moss on the trunk at this level. Both the bare trunk and the moss abound in diatoms. Most of these are derived from the plankton or the scum, but in the case of the moss there do appear to be definite types confined to this habitat. Such a diatom is *Nitzschia parvula*.

The Vaucheria—Nettle Fringe.

In parts the surface of the mud about high water mark is covered with a green carpet of a species of *Vaucheria*. This alga occurs in a similar position along the edge of the *Phragmites* from Breydon right up to Norwich so that this is not a zone confined to Wheatfen. *Vaucheria* by its thick mat of filaments is, however, an ideal protection of the mud against scour and it must also play a part in capturing and holding suspended matter in the water and thus raising the bank. However, it extends only down to about high water neaps and thus is easily undermined.

The Status of the Wheatfen Waters.

Mr. Ellis noted during the early 1950's that green algae and submerged water weeds began to disappear from Wheatfen. As this coincided with the introduction of " detergents " into large scale domestic use it is tempting to ascribe the difficulties of the plants to these chemical substances. However, the concentrations of detergents likely to be present at Wheatfen are small and it has been found elsewhere that the phosphate " builders " used with the detergents actually favour growth.

A more likely explanation is that the area has now become part of the zone of regeneration following the pollution of the river by the Norwich outfall, 6 miles upstream. The absence of chlorophyllaceous plants, abundance of diatoms and increased turbidity of the water are all characteristic of the lower zones of regeneration following pollution of rivers but they are criteria which should be

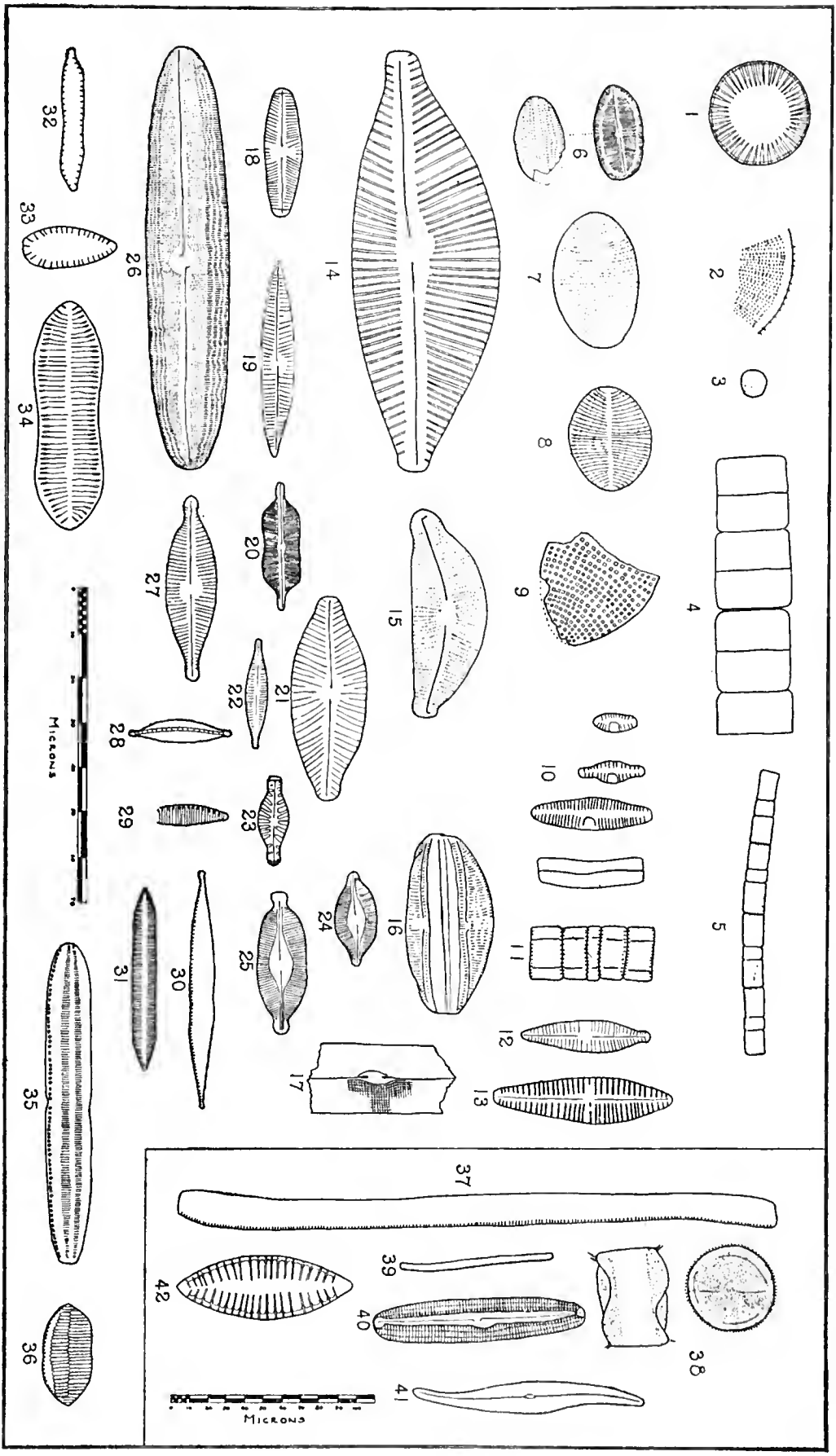

FIG. 1. DIATOMS FROM WHEATFEN

applied with caution, especially to the broadland waters where all can arise from other causes. Most of the diatoms present fall into the Mesophyllic classification of Kolkwitz & Marsson[3] (lower zone of regeneration) but this indicates as much the muddy nature of their habitats as the degree of pollution. The same caution must be used with the chemical criteria and for this reason it has not been thought worthwhile to carry out the extensive analyses needed to show, at best, that there is a likelihood that sewage pollution is the cause. Indeed, such action is largely rendered unnecessary as during the last few years the Norwich City Sewage Works have put in hand extensive alterations in order to produce a better effluent. The introduction of detergents may, nevertheless, have contributed to the extension of the zone of regeneration downstream as far as or beyond Rockland because their bad effect on sewage works, especially overloaded ones, is well known and also they restrict the uptake of oxygen from the air thus perhaps slowing down the self purification phenomenon in rivers.

When one compares the algae there at present with Griffiths account[4] of conditions in 1924, there is not a striking change. All of the species of *Scenedesmus* and *Tetrastrum* are absent now, including *T. Rocklandensis* which was first described from here as its name implies. These are both green algae but other green algae which he found are still in the Rockland Plankton.

There is little relationship between these waters and other broadland waters. In fact, they appear to be unique in this country and to find comparable waters one must look to some of the North European estuaries in Holland and Germany. Many of these are also typified by large growths of *Coscinodiscus lacustris* which was such a feature here during the autumn.

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1. Cyclotella Meneghiniana
2. Coscinodiscus lacustris (detail of valve)
3. Stephanodiscus Hantzschii
4. Melosira varians
5. M. ambigua
6. Cocconeis diminuta
7. C. placentula
8. C. pediculus
9. C. scutellum
10. Achnanthes lanceolata
11. Fragillaria construens
12. Gomphonema angustatum
13. G. lanceolatum
14. Cymbella Ehrenbergii
15. C. affinis
16. Amphora ovalis
17. Gyrosigma acuminatum
18. Navicula pupula
19. N. viridula
20. N. binodis
21. N. gastrum
22. N. cryptocephala
23. N. hungarica var capitata
24. N. (Caloneis) amphisbaena var subsalina
25. N. (Caloneis) amphisbaena
26. N. (Neidium) iridis
27. N. rhynchocephala
28. Nitzschia dissipata
29. N. fonticola var pelagica
30. N. capitatella
31. Nitzschia hungarica
32. N. parvula
33. Surirella minuta
34. Cymatopleura solea
35. Nitzschia tryblionella
36. N. tryblionella var victoriae
37. N. sigmoidea
38. Coscinodiscus lacustris
39. Nitzschia vermicularis
40. Pinnularia viridis
41. Gyrosigma acuminatum
42. Surirella biseriata

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The author wishes to acknowledge the readiness with which Mr. E. A. Ellis at Wheatfen placed at his disposal not only the means of taking the samples, but also his wide knowledge of Wheatfen and its natural history. He wishes also to thank the Directors of the Lowestoft Water Company for the use of their laboratory facilities.

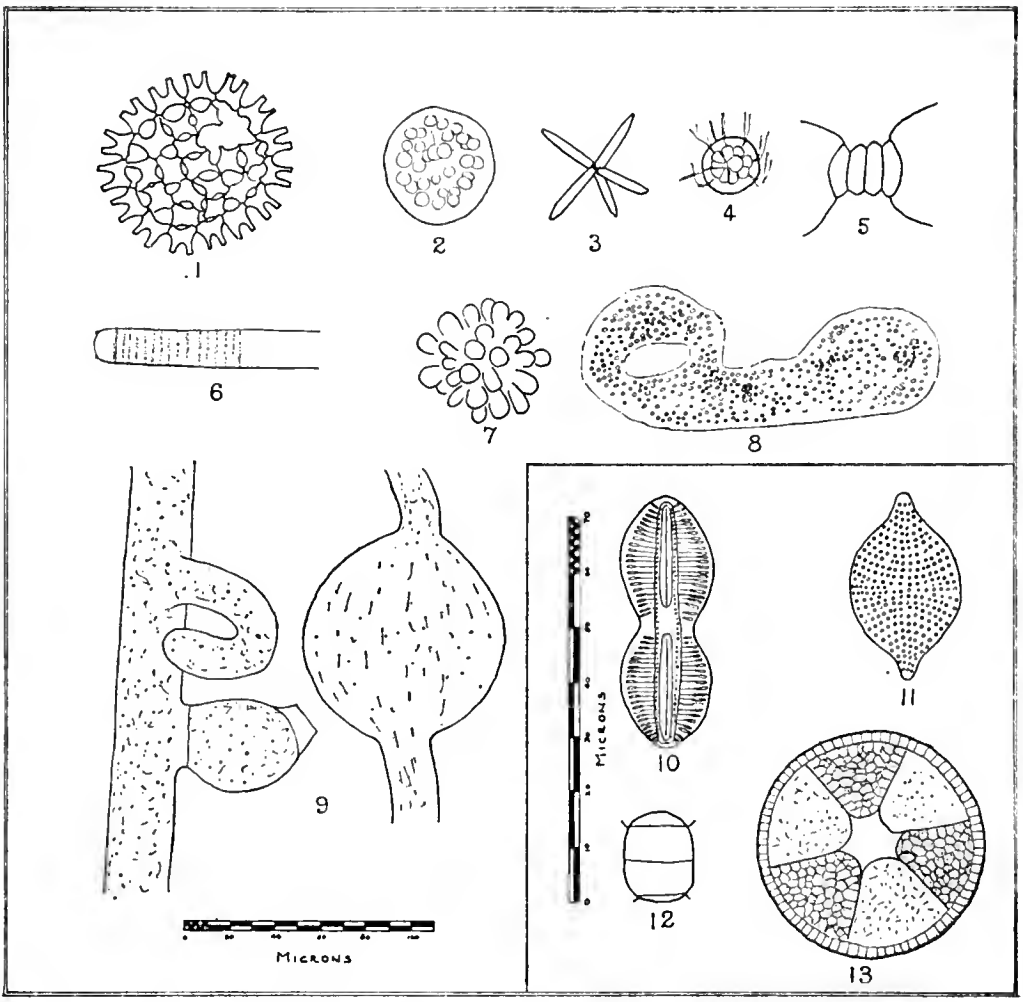

FIG. 2. OTHER ALGAE AND MARINE DIATOMS FROM WHEATFEN

1. Pediastrum duplex
2. Dictyosphaerium
3. Actiniastrum Hantzschii var fluviatile
4. Pandorina morum
5. Scenedesmus quadricauda
6. Oscillatoria limosa
7. Synura uvella
8. Microcystis
9. Vaucheria

Marine Diatoms

10. Diploneis interrupta
11. Raphoneis amphiceros var Rhombica
12. Melosira nummuloides
13. Actinoptychus undulatus

TABLE I

PER CENT COMPOSITION OF SAMPLES—100 ORGANISMS COUNTED

	Wheatfen Broad Mud Surface 17 Feb., 1959	Wheatfen Broad Plankton 17., Feb 1959	Wheatfen Broad Scum 17 Feb., 1959	Rockland Broad Plankton 22 Sept., 1959	Rockland Broad Side Bay Plankton 22 Sept., 1959	Home Dyke Wheatfen Scum 22 Sept., 1959	Wheatfen Broad Plankton 6 Nov., 1959	Moss on Trees 6 Nov., 1959
DIATOMS.								
Cyclotella Meneghiniana	33	14	60			43	2	25
Coscinodiscus lacustris				86	47	18	14	4
Stephanodiscus Hantzschii						1	4	3
Melosira varians (fil.)				1		4		
M. ambigua (fil.)						1		
Cocconeis sp.	5	4	3			2		3
Achnanthes lanceolata	2		7			1		
Fragilaria construens	1	4	1					
Gomphonema angustatum		1				1		
G. lanceolatum								1
Cymbella Ehrenbergii	1	1	2			1	2	
C. affinis	1		1			1		
*Amphora ovalis	16	52	8			4		3
Gyrosigma acuminatum						4	2	
Navicula sp.	1	5	4				8	4
N. amphisbaena	11	2	4			3	2	
N. iridis		1				1		
N. rhynochocephala	5	2	1					
Pinnularia viridis	9	4				3	2	
Nitzschia sp.	9	2	2		4	14	10	
N. sigmoidea			2				20	
N. parvula			1					54
N. vermicularis								1
Surirella biseriata		6					8	
S. minuta			2	1				2
Cymatopleura solea	3		1				14	
GREEN ALGAE								
Pediastrum duplex (col)				4	10			
Actinastrum Hantzschii var fluviatile (col)				4	3			
Pandorina morum (col)					14			
Dictyophaerium (col)					5			
Closterium sp.							2	
Scenedesmus quadricauda							2	
CHRYSOPHYCEAE								
Synura uvella (col)				4	3		2	
BLUE GREEN ALGAE								
Microcystis sp. (col)					9			
Oscillatoria sp. (fil.)		2		1			6	
Aphanocapsa sp. (col)					1			

*NOTE—A. ovalis var pediculus occurred attached to all Nitzschia sigmoidea and some Pinnularia in some numbers but was not counted.

Unless otherwise noted, counts are cells.

The counts in the table do not give one a real picture of the plankton. It consisted largely of mud particles with which the masses of organisms were closely associated. Most particles in February for instance, had several Amphora ovalis and Cyclotella Meneghiniana on them.

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ROTIFER FAUNA OF EAST NORFOLK
(Supplementary List)

By H. G. S. Wright

In 1957 (*Transactions Norf. & Norw. Nat. Soc.* 18, Part 5) the writer gave an account of ninety-seven species of rotifers encountered in East Norfolk waters within a ten-mile radius of Cawston during the preceding three years. A further forty-one species identified since are recorded in the present paper, together with two others taken from a ditch of brackish water at Brancaster.

The number of sources exploited has been small, but concentration upon a restricted area has its advantages, because conditions in a lake or pond vary with the seasons and the effects upon microscopic life are often marked. By going to the same stations month by month one is likely to take forms that occur only sporadically and which might well be missed if intervals between visits were longer.

Stations.

In the appended list of Rotifers the numbers in parenthesis relate to the sources from which they were obtained. In the list of habitats some indication is given of the plants with which the Rotifers were associated.

1. Bog pool on Cawston Heath (*Sphagnum cuspidatum, Drepanoclados fluitans*). 2. Temporary water on Cawston Heath. 3. Roadside lake at Westwick (*Nitella, Fontinalis antipyretica, Juncus*). 4. Stourton Water, Cawston Manor estate (*Elodea canadensis, Potamogeton natans, Fontinalis antipyretica, Cephalozia bicuspidata, Drepanoclados aduncus, Phragmites communis, Juncus*). 5. Lenwade Pits (*Myriophyllum spicatum, Ceratophyllum demersum*). 6. Booton Pits (*Myriophyllum spicatum, Ceratophyllum demersum, Ranunculus aquatilis, Fontinalis antipyretica, Chara fragilis*). 7. Haveringland Lake (*Ceratophyllum demersum, Ranunculus aquatilis*). 8. Crow Hall Farm, Cawston. 9. Bluestone Lake (*Ceratophyllum demersum*). 10. Thirtle's Moat, Cawston (*Potamogeton natans, Myriophyllum spicatum*). 11. River Bure creek near Aylsham North Station (*Myriophyllum spicatum, Elodea canadensis, Ranunculus aquatilis*). 12. Brackish ditch near N.W. Norfolk Clubhouse, Brancaster.

Species Recorded.

Family Notommatidae.—*Cephalodella catellina* (Müller) (2, 7). *C. ventripes* (Dixon-Nuttall) (4). *C. exigua* (Gosse) (2). *Monommata longiseta* (Müll.) (4). *Itura aurita* (Ehr.) (1, 8). *Enteroplea lacustris* (Ehr.) (1). *Notommata cerberus* (Gosse) (1). *N. lenis* Harring and Myers (1). *N. copeus* (Ehr.) (1). *N. tripus* (Ehr.) (6). *Resticula*

nyssa H. and M. (1). *Pleurotrocha petromyzon* (Ehr.) (7). *Proales doliaris* (Rousselet) (1).

Sub-Fam. Dichranophorinae.—*Dichranophorus uncinatus* (Milne) (1).

Fam. Synchaetidae.—*Synchaeta baltica* (Ehr.) (12). *Polyarthra remota* Skorikov (1). *Microcodon clavus* (Ehr.) (1, 3).

Fam. Trichocercidae.—*Trichocerca elongata* (Gosse) (1). *T. bidens* (Lucks) (1, 4).

Fam. Brachionidae.—*Keratella cochlearis tecta* (Gosse) (1). *K. quadrata curvicornis* (Ehr.) (4). *Notholca spinifera* (Gosse) (12).

Fam. Euchlanidae.—*Euchlanis lyra* (Hudson) (4). *Dapidia triquetra* (Gosse). *D. calpidia* (Gosse) (4, 11). *Dipleuchlanis propatula* (Gosse) (1). *Lophocharis salpina* Ehr. (9). *Mytilina mucronata spinigera* (Ehr.) (10). *Lecane stichaea* (H. and M.) (1). *Bryceella stylata* (Milne) (1). *Lepadella acuminata* (Ehr.) (1). *Squatinella tridentata* (Fresenius) (1). *S. longispinata* (Tatem) (4).

Fam. Filiniidae.—*Filinia brachiata* (Rouss) (8).

Fam. Flosculariidae.—*Ptygura longipes* (Wills) (1, 3). *P. pilula* (Cubitt) (1, 3). *P. velata* (Gosse) (3, 5).

Fam. Conochilidae.—*Conochilus hippocrepis* (Schrank) (1).

Fam. Collothecidae.—*Collotheca cyclops* (Cubitt) (1). *C. pelagica* (Rouss) (4). (Also two others, so far undescribed and still under observation).

Order Bdelloida.—*Adineta vaga* (Davis) (1). *Rotaria neptunoida* (Milne) (1, 8).

The most prolific source so far discovered in the area under notice is a small shallow bog pool in a deep hollow on Cawston Heath. The water here is slightly acid (pH. 5–6.5.) and there is a rich marginal growth of Sphagnum and other mosses.

To date no fewer than sixty-six species of Rotatoria, including a large proportion of rare forms, have been recorded here by the present writer, and the number of Collotheca species exceeds anything he has found at a single station anywhere else in this country, the total being twelve.

An ecologist might find this pool a profitable subject for study. It is the only piece of standing water on either Cawston or Marsham heaths, and, though there are numerous hollows similar to that in which the pool is situated, none of these appears to have an impermeable bottom. It is widely accepted that in acid waters the number of Rotifer species is liable to be large, with a limited number of individuals, whereas in alkaline sources there is an abundance of individuals of fewer species. This applies fairly well to the Cawston Heath pool, where, as stated, the variety of species

is very wide ; but some of them have at times been represented by large numbers.

The water, being shallow, is quickly affected by drought or heavy rains and by temperature changes, and the variable conditions induced in these ways are often strongly reflected, quantitatively and qualitatively, in the microscopic animal and plant life. Duck, waterhens, herons and other water-loving birds have occasionally been flushed here, and they can be expected to transport on their feet or feathers Rotifers or their eggs, some of which take to their new quarters. However, of the sixty-six species taken from this water only eleven have been found in any of the other sources in the area covered by this record, all of which are of either neutral or slightly alkaline reaction.

NEW, RARE AND CRITICAL NORFOLK LICHENS—II

By S. A. Manning

As in the first instalment of these notes (Manning, 1960), the number following the name of a species refers to the *Census Catalogue of British Lichens* (Watson, 1953). Collectors' names are given in brackets, except where the author collected the material. Specimens are preserved in the author's herbarium unless otherwise stated.

I. The genus Collema.

In view of modern work on this genus (Degelius, 1954 ; Wade, 1958) and the consequent revision of nomenclature, it seems advisable to publish the following records. All the determinations were made by Mr. A. E. Wade.

Collema tenax (Sw.) Ach. em. Degel. (Included in 1064).

West Norfolk : Weeting, colonising exposed soil in pit, 14.10.1958 (E. L. Swann). This gathering was too immature to place under any variety. Watson (1953) does not record this species for West Norfolk.

C. tenax var. *ceranoides* (Borr.) Degel. (=*C. ceranoides* (Borr.) Nyl., 1067).

East Norfolk : East Carlton, *c.* mid-nineteenth century (K. Trimmer, in herb. Norwich Castle Museum).

C. tenax var. *vulgare* (Schaer.) Degel. (=*C. pulposum* (Bernh.) Ach.) (1062).

East Norfolk : Eaton, on the ground in the chalk pit, 4.7.1936 (see Manning, 1938) and 22.6.1939 (E. A. Ellis) ; Dunston, on moss on lime at top of old flint wall, 27.8.1936 (in herb. Norwich Castle Museum). This was recorded in error as *C. crispum* Ach. (Manning, 1938). Old Buckenham, on ground in closely mown grass of cricket field, February and March, 1951, on ground in bare patch amongst grass, 9.5.1950, on burnt ground in open grassy space, May and July, 1950, on recently burnt earth in a woodland clearing in association with the moss *Funaria hygrometrica*, 23.3.1950. These observations on the habitat ecology of *C. tenax* support the views of Degelius (1954) that it belongs to the pioneers of more or less bare soil.

C. limosum (Ach.) Ach. (=*C. glaucescens* Hoffm., 1065).

East Norfolk : West Runton area, on wet sandy cliff face, 31.10.1948.

C. crispum (Huds.) G. H. Web. non Ach. (=*C. cheileum* Ach., 1075).

East Norfolk : Carrow Abbey and Bishopsthorpe (Kirby Trimmer, in herb. Norwich Castle Museum).

C. cristatum (L.) G. H. Web. var. *cristatum* (?1071).

East Norfolk : Old Buckenham, with *C. tenax* var. *vulgare*, on ground in closely mown grass of cricket field, February and March, 1951.

II. The genus Cladonia.

(a) *The Cladonia furcata complex :* Among the *Cladoniae* of the subsection *Chasmariae*, *C. furcata* (Huds.) Schrad. (906), *C. subrangiformis* Sandstede (not given in Census Catalogue) and *C. rangiformis* Hoffm. (907) form a group of closely related species which have interested lichenologists for some time (des Abbayes, 1937 ; Evans, 1954 ; Laundon, 1958). Waton (1953) gives the first and third species for both East and West Norfolk, and there are specimens to support these records in Norwich Castle Museum or my own herbarium. In addition, *C. subrangiformis*, a plant of dry calcareous soils and siliceous soils with sparse vegetation, can now be accredited to the flora of Norfolk.

C. furcata (Huds.) Schrad. (906). The following records support the Census Catalogue entries.

East Norfolk : Beeston Regis, on light sandy soil with the moss *Polytrichum* sp., 5.11.1948 ; Old Buckenham, on heathy ground of the Warren, 21.10.1949.

West Norfolk : Weeting, in pit on chalk grassland, 14.10.1958 (E. L. Swann). Prof. des Abbayes determined this as var. *racemosa* (Flk.) Wain. f. *squamulifera* Sandst.

C. subrangiformis Sandstede.

West Norfolk : Blakeney Point, old grey dunes, 18.9.1958 (E. L. Swann) ; Scolt Head Island, 4.7.1937 (E. A. Ellis, in herb. Norwich Castle Museum). Both samples contain atronorine and fumarprotocetraric acid. Prof. des Abbayes kindly confirmed my determination of the Blakeney material. The Scolt Head specimen had previously been placed under *C. furcata*.

C. rangiformis Hoffm. (907).

East Norfolk : Drayton Brecks, May, 1936.

West Norfolk : Scolt Head Island, 4.7.1937 (E. A. Ellis). Both specimens are preserved in Norwich Castle Museum. They produced no colour reaction when tested with an alcoholic solution of paraphenylene-diamine (designated Pd), indicating the absence of fumarprotocetraric acid ; but the presence of atronorine, a characteristic lichen substance of *C. rangiformis*, was demonstrated by Asahina's microchemical method in each case (Asahina, 1936[1], 1936[2], 1950 ; Evans, 1943).

C. rangiformis f. *aberrans* des Abbayes. Des Abbayes (1937, 1946, and in a letter dated 14.3.1960) has called attention to a form of this species which becomes red with Pd on the squamules and at the extremities of the podetia. This chemical variation cannot

be distinguished morphologically and he therefore designates it as form *aberrans*, indicating that it is chiefly the dwarf forms, furnished with squamules, forms preferring very dry and sunny places, which present this reaction. This form is known from Spain and France. I have specimens of it from South Devon, v.c.3 (two limestone areas), North Devon, v.c.4 (sand dunes), West Sussex, v.c.13 (chalk down turf), West Kent, v.c.16 (in grassy poor pasture, where the local rocks are sandstones of the Hastings Beds), and Mr. A. E. Wade (letter dated 13.6.1960) informs me that there are specimens in the National Museum of Wales from Glamorgan, v.c.41 (limestone pasture), Brecon, v.c.42 (turfy wall top in a limestone area) and West Sussex, v.c.13 (Pagham Beach). It can now also be recorded from Norfolk.

East Norfolk : Horsford–Felthorpe area, on " heathy " soil amongst mosses and short grasses, 11.5.1948 ; Old Buckenham, on rough grassy ground, 22.10.1949. Atronorine is present in each of the samples in my own herbarium.

C. scabriuscula (Del.) Leight. (=*C. furcata* (Huds.) Schrad. var. *scabriuscula* (Del.) Coem. =*C. furcata* var. *recurva* A. L. Sm., 906). As this plant is now given specific rank, I have examined the material placed in my herbarium under the varietal name, together with some more recent material, and can confirm its existence in East Norfolk (Watson, 1953). It should be searched for in West Norfolk.

East Norfolk : Beeston Regis, on light sandy soil, 5.11.1948 ; Felthorpe, 3.10.1937 ; Horsford, 4.12.1940 ; Horsford–Felthorpe area, on " heathy " ground, 11.5.1948 ; Old Buckenham, on light soil in woodland, 17.3.1950, on " heathy " ground of the Warren, 4.12.1949.

(b) *The sub-genus Cladina :* In the first part of these notes (Manning, 1960), the need for checking the records of " *Cladonia sylvatica* Hoffm." (875) was suggested. Since then two authentic Norfolk specimens of *Cladonia sylvatica* (L.) Harm. em. Sandst. have been examined.

West Norfolk : Thetford golf course, February, 1952 (E. Dahl, in herb. University College of North Wales, Bangor) ; Holme-next-the-Sea, grassland on stabilised dunes, August, 1952 (E. Dahl and M. C. F. Proctor, in herb. Proctor). The Holme material belongs to the very rare form *sorediata* Sandst.

III. The genus Peltigera.

Watson (1953) records five species of *Peltigera* from Norfolk, but the East Norfolk (v.c.27) entry for *Peltigera malacea* (Ach.) Fr. (993) should be deleted from the Census Catalogue. This was based on incorrectly determined material from Drayton Brecks, near Norwich, 16.4.1936, and my published record should also be

disregarded (Manning, 1938). The Drayton plant is, in fact, *Peltigera rufescens* (Weis.) Hoffm. (995) and I am indebted to Mr. A. E. Wade for kindly confirming this revised determination. The following records support Watson's entries for the remaining four Norfolk species.

P. canina (L.) Willd. (994).

East Norfolk : Drayton and Horsford Heath, K. Trimmer (Norwich Castle Museum nineteenth century collections) ; Costessey, April, 1858 (from an old collection now incorporated in my own herbarium) ; Felbrigg, 21.5.1936 (E. A. Ellis) ; Old Buckenham, on light mossy soil and on old tree-stump, January–March, 1949, and March, 1950.

West Norfolk : Bromehill, Swaffham Road Wood, 17.4.1949 (G. P. Larwood) ; Santon, near Grimes Graves, abundant in woodland rides, 23.8.1958 (E. L. Swann).

P. rufescens (Weis.) Hoffm. (995).

East Norfolk : Drayton Brecks, 16.4.1936 (specimens in Norwich Castle Museum and in my own herbarium) ; Old Buckenham, on ground in hard tennis court, 27.3.1949, on ground in open grassy space, 7.2.1950, and on light soil at margin of a wood, 19.3.1950.

P. spuria DC. (996).

East Norfolk : Surlingham, Wheatfen Broad, 4.3.1937 (M. J. D. Cockle) ; Old Buckenham, on mossy soil, 28.1.1949.

West Norfolk : Scolt Head Island, Long Hills, 3.8.1936 (E. A. Ellis).

P. polydactyla (Neck.) Hoffm. (999).

East Norfolk : Hellesdon (Miss A. M. Barnard, Norwich Castle Museum nineteenth century collections) ; Felthorpe, May, 1858 (from an old collection now incorporated in my own herbarium) ; Beeston Regis, on light sandy soil, 30.10.1948 and 5.11.1948 ; Old Buckenham, on ground at grassy margin of cultivated land, 5.2.1950, and on ground in open grassy space, 7.2.1950.

West Norfolk : Scolt Head Island, among mosses, 1.6.1936 (E. A. Ellis).

IV. Vice-county records additional to those in the Census Catalogue (Watson, 1953).

Details of the following additions are given in Sections I and II of these notes.

Collema tenax (Sw.) Ach. em. Degel. (under 1064) for v.c.28.

Collema cristatum (L.) G. H. Web. var. *cristatum* (?1071) for v.c.27.

Cladonia subrangiformis Sandst. for v.c.28.

Other new vice-county records are :

Lecidea fuscoatra (L.) Ach. var. *grisella* (Flk.) Nyl. (385).

East Norfolk : On stone, Holt Lowes, R. Wigham (Norwich Castle Museum nineteenth century collections). Determined by A. E. Wade, January, 1959.

Cladonia major (Hag.) Sandst.

East Norfolk : South Lopham, Little Fen, growing with *Drosera rotundifolia*, 26.7.1953 (E. A. Ellis). Determined by P. W. James, 1958. New to the British lichen flora (James, 1959).
Chaenotheca trichialis (Ach.) Th.Fr. (1221).

East Norfolk : Old Buckenham, on bark of *Pinus*, November, 1950. Determined by S. A. Manning, May, 1960.

ACKNOWLEDGMENTS

Grateful thanks are due to Dr. Y. Asahina, Prof. Henry des Abbayes, Messrs. P. W. James and A. E. Wade for their kind help and encouragement, and also to Miss R. M. Barnes, Dr. M. C. F. Proctor and Prof. P. W. Richards who were kind enough to lend me material from collections in their care. My gratitude to Messrs. E. Dahl, E. A. Ellis, G. P. Larwood, E. L. Swann and E. C. Wallace and to the late Mr. M. J. D. Cockle, who collected many of the specimens mentioned, is no less. Finally, I must record my great debt to the late Dr. W. Watson, who never refused his valuable help, and to the late Prof. A. W. Evans of Yale University, who sent me his papers on the *Cladoniae* and introduced me to Asahina's important microchemical studies.

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A FURTHER NOTE ON DOLOMEDES PLANTARIUS CLERCK IN THE WAVENEY VALLEY

By Eric Duffey

Since the first British specimen (a female) of this spider was taken in Redgrave Fen, Suffolk, in July, 1956 (Duffey 1958), further searches have been made for additional specimens, particularly of the male. In July, 1958, two half-grown males were taken in the same fen area but on the Norfolk side of the River Waveney. In captivity they fed very readily on blowflies and both passed through two moults before they died, still immature, through being accidentally left by a sunny window, which caused their glass containers to become too hot.

In May, 1959, a small specimen, about 5 mm. in length, was taken in the same area and reared in the laboratory. After several moults it reached sub-adult stage in August and then refused all food offered in spite of repeated efforts to tempt it. Although the laboratory temperature never fell very low even at night when the radiators were switched off, the spider (an immature female) appeared to become more and more sluggish, and I began to doubt whether it would survive. On the 4th November I decided to place it in the open outside the laboratory in the hope that a period of much colder temperatures would induce hibernation and that revival afterwards would restore its appetite. On several occasions in frosty weather when I examined the spider it could be handled very readily and apart from slight leg twitches it made no movement whatsoever.

After two months' hibernation the spider was brought indoors again on the 1st January, 1960, but it was about a month before it accepted its first meal. It had not eaten for five months. It continued to feed regularly after this, although a scarcity of flies sometimes meant a fast of two or even three weeks. In early April the last skin was moulted and the spider was adult. It was now 19 mm. in length and the pale lateral stripes were a dull yellow. On the abdomen the stripes were narrow and relatively inconspicuous.

On the 8th June, the spider produced a virginal egg-sac which she carried about under her body. On the 13th June, she was presented with a newly captured male but resisted all his approaches and by the following morning she had devoured him. The infertile egg-sac was carried about by the spider for about six weeks, when she started to abandon it for short periods. By the end of July she showed no further interest in it. After the 13th June, she refused further food and on the 5th August, was found dead.

It is probable that this particular specimen lived for about two years, although the life span may have been influenced by the

long period in captivity. When first taken at the beginning of May, 1959, the spider had probably passed through two moults, so that it could not have been born that year and probably overwintered as a juvenile after hatching late in the season in 1958.

This is borne out by the results of a successful expedition to the Redgrave Fen area in the Waveney Valley from the 9th to 11th June, 1960, when I was accompanied by Mr. G. H. Locket and Mr. D. J. Clark. I am indebted to both for notes on the specimens they took. During this period we examined two main areas of this large fen, one in Norfolk, north of the Waveney, and the second in Redgrave Fen, West Suffolk, south of the Waveney. The fen habitat, which is similar in each area, has been described in Duffey, 1958. In both we found numbers of specimens of the spider, although a careful search was necessary because of the nature of the thick vegetation. Our visit seemed to coincide with the period when most of the adults taken were males, and the females were either sub-adult or had obviously recently moulted their last skin. Half-grown specimens of both sexes were also fairly common, although adult males were more numerous than immature males. The smallest specimen examined was about 5 mm. in length and was probably hatched at the end of the 1959 season, hibernating as a juvenile in the 1959–60 winter, and will reach maturity in 1961. Judging from the relative numbers of adult and immature spiders in the period 9th to 11th June, it seems unlikely that many *D. plantarius* young are hatched before the second half of the month. This suggests that the first young to emerge overwinter as half-grown spiders maturing the following year, while the latest to hatch would still be very tiny when activity began again the following spring. These latter spiders would not reach maturity until the second year after hatching, e.g. the captive female described above, which lived in the laboratory from May, 1959 until August, 1960.

Bonnet (1930) recorded a body length range for *D. plantarius* females from 13 mm. to 23 mm. and for males 11 mm. to 17 mm.

We also recorded considerable variation in size in the Redgrave Fen specimens, as follows :—

Body Length :

Males	*Females*
10 mm.—2 specimens	13 mm.—2 specimens
11 mm.—2 specimens	14 mm.—1 specimen
12 mm.—4 specimens	15 mm.—1 specimen
13 mm.—2 specimens	16 mm.—1 specimen
16 mm.—1 specimen	17 mm.—1 specimen
Mean length—12.0 mm.	18 mm.—1 specimen
	19 mm.—1 specimen
	Mean length—15.6 mm.

Colouration is equally variable and the range is well covered by the illustrations in Plate II of Bonnet's thesis. The cephalothorax varies from a pale brown to a chocolate brown ; the abdomen is usually darker and varies from medium brown to almost black ; the legs are usually pale brown but may be darker. It is a characteristic of *D. plantarius* that the pale lateral stripes are not infrequently absent while this is a very rare occurrence in *D. fimbriatus*. D. J. Clark tells me that the abdominal stripes are frequently missing in *fimbriatus* but that the bands are always present on the cephalothorax. Two specimens of *plantarius* taken in June, 1960 were completely brown, a male and an immature female, and the first British specimen taken in 1956 was also of this colour form. The stripe colour in the remaining specimens varied from white or cream to a bright yellow. On the cephalothorax the stripes were usually conspicuous, but on the abdomen they were frequently thin and relatively inconspicuous. An unusual and beautiful colour form illustrated by Bonnet (body only) in Plate II, 10a and 12, was recorded in three immature Redgrave specimens. In one specimen the stripes are completely white, and slightly wider on the cephalothorax. There is a white streak on the fovea and a series of white spots on the upper surface of the abdomen. The legs are also speckled with

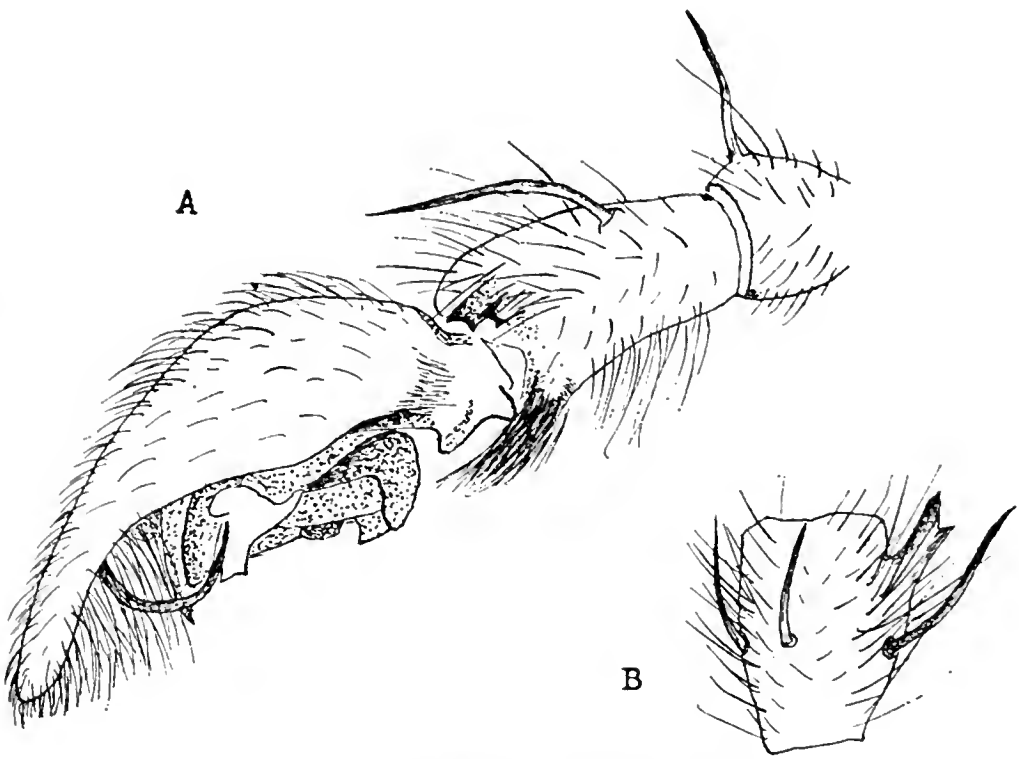

FIG. 1. *Dolomedes plantarius* Clerck

A. Left palp, seen from side.

B. Dorsal view of apophysis on right palpal tibia.

white spots. A second specimen is very similar except that the stripes are pale yellow and in addition have broken and irregular edges. In the third specimen the spots changed from white to deep yellow when the spider became adult. The whole appearance is very striking and in conspicuous contrast to the typical colour.

The Redgrave specimens taken in June, 1960, included several males, here recorded in this country for the first time. The palp and tibial apophysis are illustrated in Figure 1. The bifurcation of the apophysis can be clearly seen and distinguishes this species from *D. fimbriatus*.

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NORFOLK ASILIDAE (ROBBER FLIES)

By K. C. Durrant

The members of the Asilidae are predatory on other insects, some of which are large and more formidably armed than themselves. They sit motionless on hedgerow foliage, tree trunks, logs or on sandy ground, often for long periods and wait until unwary insects come within range of capture. Darting attacks are made very suddenly and the quarry is injected with a potent poison secreted in glands near the proboscis. The victim becomes quiescent quickly and the robber fly sucks its body juices through a rigid, piercing proboscis.

These flies have never been very common in Norfolk as a whole, but certain species may abound locally in their special habitats, chiefly in what remains of undisturbed country.

The annotated list which follows refers to Asilidae noticed in Norfolk since 1946.

LIST OF SPECIES

Leptogaster cylindrica (Deg.). Widely distributed throughout the county : June, July.

L. guttiventris (Zett.). Local in Breckland, June, July. One was taken at Grimes Graves in July, 1960. Morley and Atmore (1914–15) recorded this insect from Merton and Thetford.

Dioctria oelandica (L.). Local, in woods and spinneys, mid-Norfolk : May, June.

D. atricapilla (Mg.). Very rare : only two examples, from East Dereham, May and July.

D. rufipes (Deg.). Common, especially on hedges : June, July.

D. baumhaueri (Mg.). As common as the last : June, July.

Laphria marginata (L.). Very rare. I took one pair in cop. at Bittering, near East Dereham, 28th June, 1950.

Philonicus albiceps (Mg.). A common hunter on coastal sand dunes : July, August.

Asilus crabroniformis (L.). This insect used to be very common on all large heaths before the second world war, but is now found only rarely, in August and September. It is our largest Asilid.

Dysmachus trigonus (Mg.). Common with *Ph. albiceps* on dunes ; also found on many Breckland heaths : June, July.

Eutolmus rufibarbis (Mg.). Very local and scarce : July, August. I took a pair in cop at Roydon Common, near King's Lynn, 5th July, 1959.

Machinus atricapillus (Fall.). This insect is found chiefly round the borders of commons, where it rests head downwards on tree trunks, like the common "down-looker fly," *Rhagio scolopacea* (L.) : July, August.

M. rusticus (Mg.). Rarer than the previous species and found only along the southern edge of the county : August.

Epitriptus cingulatus (Fab.). Very local, Dereham district, rare : August.

E. arthriticus (Zell.). West Norfolk heaths, rare : July.

Neoitamus cyanurus (Loew). Not common, but scattered over the county. I have taken one from my window in East Dereham and a female at Ringmere, on birch, 3rd July, 1960.

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AN ANNOTATED LIST OF THE FLOWERING PLANTS ON BLAKENEY POINT, NORFOLK.

(The National Trust)

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INTRODUCTION

This list has been compiled during the past few years. Its basis is, of course, the list published by Oliver and Salisbury in 1913. Numerous additions have been made to the plant list since that date especially during the last few years when the absence of rabbits owing to myxomatosis has enabled many plants (especially grasses) to flourish. The original list of Oliver and Salisbury contained about 120 species, while the present list records 180 species of which thirty-eight are grasses.

I have tried to include every plant which has ever been recorded for the Point. In such a habitat there are inevitably some transient species. Propagules arrive by sea and the resulting plants may survive for some years and then die out. Where known I have given the dates of arrival and of disappearance of a species since in some cases these may be of biological interest.

The names used in this list are those given in Clapham, Tutin and Warburg (1952) except for the grasses for which Hubbard (1954) was used. The names are thus largely in agreement with those in the "Excursion Flora . . ." of Clapham, Tutin and Warburg (1959). I have given synonyms in those instances where they are the better-known names or where it was under the synonym that the plant was recorded for the Point. This should enable available information about any plant to be tracked down fairly easily.

This list owes much to the collaboration of colleagues and students who have botanised regularly since 1946 on Blakeney Point. The bibliography provides a reasonably complete list of the publications relating to the angiosperm vegetation of the area.

PLANT LIST

ANGIOSPERMAE

ARCHICHLAMYDEAE

Ranales

Ranunculaceae

Ranunculus repens L. Creeping Buttercup. A rare casual, occasionally recorded for the main shingle bank.

Thalictrum minus L. Lesser Meadow Rue. A plant occurs on the dunes. First observed in 1957 by Mr. J. W. Hopkins. It was still there in 1959.

RHOEADALES

Papaveraceae

Papaver rhoeas L. Field Poppy. A rare casual. This cornfield plant was recorded by Salisbury once from the main shingle bank.

Glaucium flavum Crantz Yellow Horned-poppy. A biennial, sometimes perennial, plant of the shingle. Especially abundant on the main shingle ridge between the Hood and the Marams. It produces many seeds. According to Salisbury (1952) a single plant may produce up to 60,000 seeds. Germination is good ; a crop of seedling rosettes can often be seen surrounding a parent plant. There was hardly a plant to be found on the main ridge in the summer of 1953 following the great flood of the previous February. It was there in fair numbers in 1954, and by 1957 was again abundant.

Cruciferae

Crambe maritima L. Seakale. A single specimen of this handsome plant occurred on the main shingle ridge beyond Watch House towards Cley. This established itself from seed (derived from the Calshot Shingle Spit) sown on the selfsame spot in January, 1912 by Professor F. W. Oliver. It was destroyed in the floods of 1953. Swann (1955) reports " not seen recently " (i.e. in the county of Norfolk).

Cakile maritima Scop. Sea Rocket. An annual plant of the strand line. Plants will also be found on and behind the seaward face of the main dune ridge, where seed has been carried by the high tides during winter storms. Germination occurs in the spring and is spread over a long period. The seedlings have fleshy, strap-shaped cotyledons. Seed is produced in great quantity. The pods separate at the constriction into two parts, each part containing a single seed ; that in the upper part is the heavier one. The seed is dispersed by the tide.

Capsella bursa-pastoris (L.) Medic. Shepherd's Purse. In disturbed ground near the Lifeboat Houses.

Cochlearia anglica L. Long-leaved Scurvy-grass. Rather rare, mainly confined to the *Suaeda fruticosa* zones on the flanks of the older lateral shingle banks.

Cochlearia danica L. Danish Scurvy-grass. A biennial plant. Recorded on the Yankee Bank and from the upper edges of the marsh.

Cochlearia officinalis L. Common Scurvy-grass. A perennial plant, a member of the so-called " general salt marsh community." Comes into flower very early in the season.

Erophila verna (L.) Chevall. Spring Whitlow Grass [Syn. *Draba verna* L.]. A very short-lived spring-flowering dune annual. Abundant on the fixed dunes and lichen heaths. By early summer only the dried remains of this plant will be found.

Armoracia rusticana Gaertn., Mey & Scherb. Horse-Radish. One plant occurs on the dunes in front of the New Lifeboat House.

Resedaceae

Reseda luteola L. Dyer's Rocket, Weld. A casual ; in disturbed ground by the Lifeboat Houses.

VIOLALES

Violaceae

Viola tricolor L. Wild Pansy. A single plant of *Viola* was found on the dunes by Dr. W. G. Chaloner in June, 1958. The plant which was very small and depauperate may have been the maritime spp. *curtisii*. We were unable to find it elsewhere on the dunes nor was it found again the following year.

TAMARICALES

Tamaricaceae

Tamarix anglica Webb Tamarisk. Clump by the laboratory planted about 1916 or 1917 by Professor F. W. Oliver. Plants near the edge of the plantation and on the paths behind the main dunes planted in January, 1956.

Frankeniaceae

Frankenia laevis L. Sea Heath. A mediterranean plant almost at the limit of its northern range. It grows in the *Suaeda fruticosa* zone on the flanks of the older laterals, where the shingle is stabilised and there is a good admixture of sand. It is a constant associate of *Limonium bellidifolium* (q.v.) in muddy shingly lows which are regularly flooded by the higher tides, e.g. in Boathouse Low and in the small low at the side of the Yankee Bank. *Frankenia laevis* appears to be spreading on the Point. It is said to produce few fertile seeds in its Norfolk stations.

CENTROSPERMAE

Caryophyllaceae

Silene maritima With. Sea Campion. A deep-rooted plant with an extensive underground system. It can tolerate some movement of shingle when growing on the main bank. Salisbury has described it as a " *Psamma* (*Ammophila*) of the shingle." Also grows on sand. It was abundant on the eroded dunes of the Long Hills. The deep roots penetrated to the shingle. Its leaves remain green throughout the winter, but the buds from which the following year's growth will occur are subterranean. *Silene* appears to have become very much less abundant these last few years. This may be due to competition from grasses. The Yankee Bank is developing a closed carpet of vegetation and this appears to have been paralleled by the decrease in *Silene*. The absence of rabbits with its effect upon the grasses may be tied up with the decrease. The flowers of *Silene maritima* are very variable. They have been investigated by Salisbury (1912), who recognised several different forms.

Silene alba (Mill.) E. H. L. Krause White Campion [Syn. *Melandrium album* (Mill.) Garcke]. A casual. This cornfield plant was recorded on the Hood by Salisbury in 1913.

Cerastium semidecandrum L. Little Mouse-ear Chickweed. A very abundant winter annual occurring on the fixed dunes, stabilised shingle and in the shingly-sandy lows.

Cerastium atrovirens Bab. Dark-green Mouse-ear Chickweed. [Syn. *C. tetrandrum* Curt.]. A winter annual distributed like *C. semidecandrum*, but probably not so abundant.

Cerastium vulgatum L. Common Mouse-ear Chickweed. This plant, which is normally perennial, probably behaves as an annual on the dunes. Its distribution is similar to the two preceding species.

Stellaria apetala Ucria Lesser Chickweed (includes *S. boreana* Jord.). An annual plant of the dunes. Seed germinates mainly in the spring.

Sagina nodosa (L.) Fenzl Knotted Pearlwort.

Sagina apetala Ard. Common Pearlwort.

Sagina maritima Don. Sea Pearlwort.

Sagina procumbens L. Procumbent Pearlwort. On the Watch House Bank near the house in 1956. Also among the stones near the laboratory.

Honckenya peploides (L.) Ehrh. Sea Sandwort [Syn. *Arenaria peploides* L.]. A shingle plant with an extensive underground system. Its leaves die back in winter, growth taking place the following spring from subterranean buds. It can tolerate some shingle movement but seems to prefer shingle in which there is plenty of sand. It can tolerate a high concentration of salt and is often found on the strand line where it will accumulate sand and form miniature dunes in advance of the dune system proper. In the Blakeney Point Report, 1920–23 F. W. Oliver noted that seedlings were rarely seen although *Honckenya* is one of the commonest plants of the shingle and produces a very large number of seed capsules. In the standardised germination tests carried out by Miss Margaret Adams in 1919 germination was 2 per cent. But even this low level of germination would, of course, represent a large number of seedlings in a plant which produces seed on such a vast scale.

Arenaria serpyllifolia L. Thyme-leaved Sandwort. An annual, sometimes perennial, plant found regularly on the stabilised shingle of the lateral banks.

Spergularia media (L.) C. Presl Greater Sea-Spurrey [Syn. *S. marginata* (D.C.) Kittel]. A perennial plant of the upper saltmarshes.

Spergularia marina (L.) Griseb. Lesser Sea-Spurrey [Syn. *S. salina* J. & C. Presl]. An annual plant of upper and drier margins of the saltmarshes. *S. marina* is a very variable plant and it is possible that hybrids between it and *S. media* occur.

Chenopodiaceae

Chenopodium album L. Fat Hen. An occasional plant of the shingle.

Beta maritima L. Sea beet. A characteristic plant of the shingle. It is found on the main shingle bank towards and beyond Watch House.

Atriplex hastata L. Hastate Orache.

Atriplex littoralis L. Shore Orache.

Atriplex patula L. Common Orache. These three species of *Atriplex* are found on the shingle. *A. littoralis* especially is often abundant on the upper limit of the drift line on the marsh side of the main bank, and on both drift lines of the lateral banks.

Halimione portulacoides (L.) Aell. Sea Purslane [Syn. *Obione portulacoides* (L.) Moq.]. A perennial plant found at all levels of the marsh. In the lowest marshes *Halimione* occurs along the sides of the creeks, i.e. in the better drained areas. Its mass of woody stems overhanging the creek margins acts as an efficient filter as the water drains off the marsh. As it accumulates mud by this means, the sides of the creeks are raised. As the level of the marsh rises the *Halimione* may become more widely spread. There are several examples of marshes by the Marams where *Halimione* has become dominant and spread over the marsh and has killed out the other species.

Sueda fruticosa Forsk. Shrubby Seablite. A woody shrub of the shingle. It grows on the marsh side of the main ridge and on both flanks of the lateral ridges. When partially buried by shingle the plants are stimulated into vigorous growth. They help to stabilise the shingle and since during moderate movement of the shingle the plants will accumulate it around their stems they will tend to increase the height of the shingle bank, in their immediate neighbourhood. Under natural conditions *S. fruticosa* establishes itself by seed dispersed with tidal drift.

Oliver in the Blakeney Report for 1914 discussed the propagation of this plant. It roots readily from cuttings which grow rapidly. Oliver recommended that where such cuttings are planted for shingle stabilisation they should be supplemented by seed scattered broadcast.

S. fruticosa ripens heavy crops of seed about two years out of five. Along beachway the *Suaeda* bushes were kept coppiced by the rabbits and formed small hummocks. These show a wide and beautiful range of colours in the autumn. The tall bushes change colour only at the tips of their shoots and these regions soon lose their leaves. It was suggested that the colour changes are a pathological phenomenon. Old, more or less moribund plants are stimulated by the addition of new sand, shingle or humus (or by transplanting into a garden) and become deep green

and lack the autumn colours. (See also Oliver and Salisbury, 1913.)

Suaeda fruticosa is a mediterranean species and is here nearing the northern limit of its range.

Suaeda maritima (L.) Dum. Herbaceous Seablite. An annual saltmarsh plant occurring usually well below the high tide level but also always abundant along the high tide mark behind the main ridge.

Salsola kali L. Saltwort. An annual, prickly plant of the strand line and, less abundantly, of the drift line on the marsh side. The plants have a very deep root system, and a tiny seedling will have a main root going down for twelve inches or more. Saltwort is tolerant of sea water. It was formerly collected and burnt (like *Salicornia*) to provide soda for glass-making.

Salicornia perennis (Gouan) Mill. [Syn. *Salicornia radicans* Sm.]. A somewhat woody perennial plant found at the upper levels of the marshes and, restricted to the sides of the drainage channels, in the lower marshes. Some of the shoots possess a fine coppery-bronze colour.

Salicornia herbacea auct. Glasswort or Marsh Samphire [Syn. *Salicornia europaea* auct.]. Taxonomically a difficult group of plants. The following species have been recognised on the marshes :

S. disarticulata Dum.

S. dolichostachys Moss

S. stricta agg.

(*S. stricta* Dum.

S. ramosissima Woods

S. gracillima (Towns.) Moss).

Species of the annual Salicornias are among the earliest colonists of mud, leading to marsh formation.

Samphire is collected locally and made into a pickle. Formerly it was collected and burned on a large scale for its ash content which was used in glass making.

GERANIALES

Geraniaceae

Geranium molle L. Dove's-foot Cranesbill. Occasional plants occur on the stabilised shingle banks and on the older grey dunes.

Erodium cicutarium (L.) L'Herit. Common Storksbill. A common, somewhat variable plant of the fixed dunes and lichen heaths.

Sub-species *dunense* may occur.

SAPINDALES

Aceraceae

Acer pseudoplatanus L. Sycamore. A single tree in the plantation. It was probably planted about 1916 or 1917.

CELASTRALES

Celastraceae

Euonymus europaeus L. Spindle-tree. Two plants behind the plantation, possibly from bird-sown seed or possibly planted, although I can find no record of this. The plants are flourishing, sending up suckers and fruiting.

LEGUMINOSAE

Papilionaceae

Lupinus arboreus Sims Tree Lupin. Originally planted ; near the Lifeboat Houses and the Laboratory. It appears to be spreading particularly in the shingle of Long Low.

Trifolium dubium Sibth. Lesser Yellow Trefoil. On some of the lateral shingle banks and in some dry shingle lows (e.g. Long Low).

Trifolium arvense L. Hare's-foot. On the Marams, Watch House and Yankee Banks.

Trifolium campestre Schreb. Hop Trefoil [Syn. *Trifolium procumbens* auct.].

Trifolium striatum L. Soft Trefoil. Both these species occur on some of the older shingle laterals.

Trifolium repens L. White Clover, Dutch Clover. There is a small patch of this plant persisting on the Headland dunes.

Trifolium scabrum L. Rough Trefoil. Has been recorded for the Watch House Bank.

Lotus corniculatus L. Birdsfoot Trefoil, Eggs-and-Bacon. This plant grows on the crest of some of the lateral shingle banks, e.g. Watch House and Yankee Banks.

Vicia angustifolia (L.) Reichard Narrow-leaved Vetch. Salisbury (1913) recorded it as an occasional plant on the Watch House Bank and on two of the Marrams. More recently it has appeared on Yankee Bank.

Lathyrus japonicus Willd. Sea Pea [Syn. *Lathyrus maritimus* Bigel.]. I found several plants in flower on the shingle near East Point in August/September, 1959. It had not been recorded before on Blakeney.

Mr. E. A. Ellis informs me that in 1954 with Mr. Adye of the East Suffolk and Norfolk River Board he sowed 100 seeds in the shingle at Cley Beach over a distance of about 300 yards running west from where the road comes down to the beach. The seed was collected in 1953 from Shingle Street in Suffolk.

The Sea Pea, although occurring in the adjoining counties of Suffolk and Lincolnshire, is not apparently native to Norfolk. Swann (1958) records that along with *Corynephorus canescens* and the hybrid marram grass it has been introduced in the Dunes " west of Brancaster Golf Club as part of the sea defences in 1953–54."

ROSALES

Rosaceae

Filipendula ulmaria (L.) Maxim. Meadow-sweet. A plant was found growing with a patch of *Scutellaria* in a hollow on the main dunes by Mr. R. Gaze in 1956. It was still there in 1959.

Rubus fruticosus L. (agg.). Blackberry, Bramble. A very occasional plant on the dunes, e.g. on the Long Hills, the Hood and around the Lifeboat Houses.

Potentilla anserina L. Silverweed. Occurs around the margin of Glaux Low, on the Hood, and in odd places on the seaward side of the dunes where flotsam gets washed up.

Aphanes arvensis L. Parsley Piert [Syn. *Alchemilla arvensis* (L.) Scop.]. Occurs sparsely on the older shingle laterals. Recorded on the Yankee Bank in 1956.

Crassulaceae

Sedum acre L. Wall-pepper, Yellow Stonecrop, Biting Stonecrop. An abundant plant on the fixed dunes and shingle.

Sedum anglicum Huds. English Stonecrop. A beautiful plant with pink and white flowers found on the shingle. Locally abundant on Yankee and Watch House Banks. Not so widespread nor so abundant as *S. acre*.

MYRTALES

Elaeagnaceae

Hippophae rhamnoides L. Sea Buckthorn. Several plants on the trackways behind the main dune ridge where they were planted in January, 1956. Two of the plants are now (1959) going ahead nicely and suckering up. One has a long row of sucker shoots appearing.

There are also three or four plants on the Hood which were planted in 1956 or 1957.

Onagraceae

Epilobium hirsutum L. Great Hairy Willow-herb, Codlins and Cream. Very rare. Was recorded for the main shingle bank by Salisbury in 1913.

Chamaenerion angustifolium (L.) Scop. Rosebay Willow-herb, Fireweed [Syn. *Epilobium angustifolium* L.]. Rare. A casual found occasionally on the main shingle ridge. Possibly it is to be seen more frequently now.

UMBELLALES

Umbelliferae

Eryngium maritimum L. Sea Holly. A perennial plant of mobile sand dunes and of shingle which contains a good deal of sand. A comparatively rare plant on Blakeney Point, occurring only among the embryo dunes forming near the entrance to Great Sandy Low.

Anthriscus caucalis Bieb. Bur Chervil [Syn. *Anthriscus neglecta* Bois & Reut.]. In disturbed ground near the Lifeboat Houses.

EUPHORBIALES

Euphorbiaceae

Euphorbia paralias L. Sea Spurge. Shown me in June, 1959 by Mr. R. Gaze on the dunes near the neck of Glaux Low. Still present and flowering in June, 1960. This is the first record I have of this plant on the Point although Professor Jane tells me he saw a plant in 1947. It is very common on Scolt Head.

POLYGONALES

Polygonaceae

Polygonum aviculare (agg.). Knotgrass. On the main shingle ridge.

Polygonum raii Bab. Ray's Knotgrass. First recorded by Professor F. W. Jane in 1955, who found it growing among *P. aviculare* on the main shingle ridge. (See Jane, 1958.)

Rumex acetosa L. Sorrel. Recorded by Salisbury (1913) for the main shingle bank. Very rare. Not seen recently.

Rumex acetosella L. Sheep's Sorrel. A common plant, occurring in patches on the lateral shingle banks, the lichen heaths, and on the older dunes where the marram is deteriorating. Flowers freely. An indicator plant of somewhat acid conditions.

Rumex crispus L. var. *trigranulatus*. Curled Dock. A perennial plant, growing on the main shingle ridge and, less abundantly, on the lateral ridges.

URTICALES

Urticaceae

Urtica dioica L. Stinging Nettle. Very rare. Recorded as a casual on the Long Hills by Salisbury in 1913. Also recorded for the Hood where it is still present.

SALICALES

Salicaceae

Populus balsamifera L. Balsam Poplar. Planted in the plantation by Professor F. W. Oliver in 1916–17. The original tree has gradually been dying back since the floods of 1953 and is now dead but several suckers have appeared.

Populus alba L. White Poplar. The original trees in the plantation planted by Professor F. W. Oliver in 1916–17 are now dead. Since 1955 they have suckered very freely on the slopes about the plantation. They are now (1959) forming quite a dense thicket. Perhaps the absence of rabbits has enabled them to get away.

METACHLAMYDEAE

PLUMBAGINALES

Plumbaginaceae

Limonium bellidifolium (Gouan) Dum. Matted Sea Lavender [Syn. *Statice reticulata* auct. angl., non L.]. Occurs on the shingle where there is a good deposit of mud, e.g. on the edges of the lateral shingle banks, and in the shingly lows such as Boathouse Low. It appears always to occur in places which are flooded occasionally by the higher tides. It is constantly associated with *Frankenia laevis* (q.v.). *Limonium bellidifolium* has a very characteristic appearance. Its much branched inflorescences are spread upon the ground. Its leaves, which are in the form of a basal rosette, turn reddish in colour and wither before flowering.

This plant is a mediterranean species and is here near the northern limit of its range.

Limonium binervosum (G.E.Sm.) C. E. Salmon Rock Sea Lavender. On Blakeney Point this is the sea lavender of the shingle. It is especially abundant on the shingle plateau on the N.W. side of the upper Pelvetia marsh, where it approaches the main shingle beach. It first became abundant in this region about 1914. Oliver correlated its spread into the hitherto barren area with the high tide of 1921 which brought seed to the area. This lends colour to the view that the tides are the important agency in the dispersal of shore plants. Occasional plants occur on the main shingle bank, but it appears to prefer areas where there is much sand mixed with the shingle. It often forms a distinctive zone on the flanks of the lateral banks, e.g. on the Marrams and, in places, on the Yankee Bank.

Limonium binervosum is a somewhat variable plant and certain depauperate forms can be found. Certain broad-leaved forms of *L. binervosum*, suspected by Salisbury to be of hybrid origin, have been shown by Choudhuri (1942) to be hybrids between *L. binervosum* and *L. bellidifolium*.

Limonium humile Mill. Lax-flowered Sea Lavender [Syn. *Statice rariflora* Drejer]. A saltmarsh plant. In the vegetative condition it is difficult to distinguish from *L. vulgare* (q.v.). Its distribution is not completely known, but it is probably confined to the lower levels of the marsh.

Limonium vulgare Mill. Sea Lavender [Syn. *Statice limonium* L.]. A common plant of the saltmarshes found usually at higher levels than the previous species. It may become locally dominant as it does, for example, on certain of the older marshes beyond the Watch House Bank.

Hybrids (*L. Neumani* Salmon) between *L. vulgare* and *L. humile* have been reported, and their existence in the Blakeney Point populations has been confirmed by Choudhuri (1942).

The sea lavender provide one of the three main flowering " seasons " on the Point. Their flowering usually extends from the third week of July until the middle of August.

Armeria maritima (Mill.) Willd. Thrift, Sea Pink. On Blakeney Point this is essentially a plant of the shingle. It is often one of the dominants on the crests of the lateral shingle banks, e.g. on Watch House Bank. It occurs, less abundantly, on the upper edges of the older marshes by the Marams.

PRIMULALES

Primulaceae

Anagallis arvensis L. Scarlet Pimpernel, Shepherd's Weather-glass, Poor Man's Weather-glass. Found occasionally on the shingle banks, shingly lows and on the older dunes. The leaves sometimes become somewhat fleshy.

Glaux maritima L. Sea Milkwort, Black Saltwort. Salisbury (1952) describes this plant as a pseudo-annual. It perennates and spreads by means of fleshy stolons, while its aerial shoots are annual.

This plant flowers abundantly. It is apetalous, with pink, petalloid sepals.

It grows in places where there is some deposition of mud or sand, usually as a result of flooding by high tides. This plant gives its name to Glaux Low, over which it forms a more or less complete carpet. This has taken place since 1910. By about 1917 it had occupied more than half the Low.

TUBIFLORAE

Boraginaceae

Cynoglossum officinale L. Hound's-tongue. A biennial plant with a stout fleshy taproot, found scattered in small groups mainly on the yellow dunes. The plant is said to have a " mouse-like odour which is unmistakable." It has an efficient dispersal mechanism in the fruits with hooked spines. Germination occurs normally in April. " It is intermittent and may be spread over a period of eight years " (Salisbury, 1952).

Echium vulgare L. Viper's Bugloss. One specimen of this beautiful plant was found in flower on the Hood in June, 1959. It has not previously been seen on the Point.

Myosotis discolor Pers. Yellow-and-Blue Forget-me-not. Was recorded by Salisbury (1913) as a rare plant on the Long Hills.

Myosotis ramosissima Rochel. Early Forget-me-not (Syns. *Myosotis collina* Hoffn. *Myosotis hispida* Schlecht]. A very abundant, short-lived, dune annual. It is common on the fixed dunes and lichen heaths, but less common in the shingly lows and on the stabilised lateral shingle banks.

Mertensia maritima (L.) S. F. Gray Northern Shore-wort. " First seen at Blakeney Point in 1905. In 1914 there were five plants. Last seen in 1931 and now appears to have gone " (Swann, 1955).

This was the most southerly station on the east coast for this rare shingle plant, which according to Clapham, Tutin and Warburg (1952) is apparently decreasing everywhere.

Convolvulaceae

Convolvulus arvensis L. Bindweed, Cornbine. An odd plant on the seaward edge of the dunes where detritus has been washed up.

Calystegia soldanella (L.) R.Br. Sea Bindweed [Syn. *Convolvulus soldanella* L.]. A procumbent rhizomatous, perennial dune plant with kidney-shaped leaves and very striking flowers, which are pale mauve or pink with paler bands down the middles of the five lobes. The youngest leaf at the apex of the rhizome is bent back so that the petiole receives the pressure as the rhizome grows through the sand.

Hepburn (1952) writes that rabbits will eat the flowers but leave the leaves untouched. The evidence from Blakeney does not seem to support this view. *C. soldanella* used to be a common plant on the Point and then it virtually disappeared. A small patch was growing on the mobile sand behind the big blow-outs in the Beacon Hills. Since the disappearance of the rabbits this has spread extensively and flowering is now profuse. The plant is now appearing in many other parts of the Point.

Solanaceae

Solanum dulcamara L. Bittersweet, Woody Nightshade. A very rare casual which has been recorded from the dunes on the Headland.

Solanum nigrum L. Black Nightshade. A casual which has been recorded from the Long Hills, and from the Beacon Hills. It is also found occasionally along some of the drift lines on the marsh side of the shingle bank.

Scrophulariaceae

Veronica arvensis L. Wall Speedwell. Reported by Salisbury (1913) as occurring on the Long Hills. Rather rare.

Veronica officinalis L. Common Speedwell. Present on the Hood, but rather rare.

Labiatae

Lycopus europaeus L. Gipsy-wort. A plant was found on the dunes by Professor F. W. Jane in 1956.

Scutellaria galericulata L. Skull-cap. First noticed in 1955 on the seaward face of the main dunes, where detritus had been washed up. In 1957 another patch of this plant was found elsewhere on the dunes.

PLANTAGINALES

Plantaginaceae

Plantago coronopus L. Buck's-horn Plantain. A very variable plant of the stablilised shingle and of the sandy-shingly lows. Normally biennial, but Salisbury (1913) considers that some of the plants are undoubtedly perennial. It can tolerate a high salt concentration. Some of the smaller, apparently depauperate plants have been referred to f. *pygmaea*.

Plantago lanceolata L. Ribwort. Found occasionally. Recorded on the Watch House Bank in 1956.

Plantago maritima L. Sea Plantain. Found as scattered plants about the mid-level of the Salicornia marshes. On the higher level marshes it is a component of the so-called " general salt marsh community " and here it occurs in patches as, for example, on the marshes by the Marams. Occasional plants of *P. maritima* may be found in the lows (e.g. in Glaux and Boathouse Lows), among the embryo dunes and even on the strand line, due to tidal distribution.

RUBIALES

Rubiaceae

Sherardia arvensis L. Field Madder. Recorded for the Hood ; very rare.

Galium verum L. Lady's Bedstraw. Found on the Hood, the Long Hills and on some of the older, lateral shingle banks. It was first recorded from the Yankee Bank in 1956.

Galium saxatile L. Heath Bedstraw. Found on the older dunes near Long Hills in June, 1957.

Caprifoliaceae

Sambucus nigra L. Elder. Several specimens of this shrub are to be found on the Point, e.g. on the Hood and on the Long Hills. Probably the results of birds distributing the fruits.

Valerianaceae

Valerianella locusta (L.) Betcke Lambs' Lettuce, Corn Salad [Syn. *V. olitoria* (L.) Poll.]. One time fairly common on the Long Hills but now rare. Has been reported occasionally on the seaward side of the main dunes in recent years.

Dipsacaceae

Dipsacus fullonum L. Teasel. An occasional plant occurs.

ASTERALES

Compositae

Senecio vulgaris L. Groundsel. Found occasionally on the shingle and dunes, and in disturbed soil, e.g. around the Lifeboat Houses.

Senecio sylvaticus L. Wood Groundsel. Recorded by Salisbury (1913) as " very rare," occurring on the highest part of the eighth lateral shingle bank. For some years now it has been found regularly on the Hood.

Senecio jacobaea L. Ragwort. A common plant on both dunes and the shingle. It seems to favour disturbed ground and was especially abundant on those regions of the older dunes where there were extensive rabbit burrows, many of which had collapsed. It has been much less abundant this last four years. Many of the areas in which it formerly grew abundantly are now more stabilised following the disappearance of the rabbits and the consequent better growth of the grasses especially *Festuca rubra.*

Senecio jacobaea is the food plant of the caterpillars of the Cinnabar moth, which sometimes defoliate the plants.

Tussilago farfara L. Coltsfoot. This plant of stiff, heavy soils is occasionally recorded as a casual on the Point. Salisbury (1913) so recorded it, and a plant was found growing on the drift line in June, 1956 and was still there in 1959. It was probably the result of a piece of rhizome washed up by the tide.

Filago minima (Sm.) Pers. Slender Cudweed. This small, grey-green annual is extremely abundant on the grey dunes, lichen heaths and stabilised sandy-shingles. It is very short-lived and is easily overlooked since the specimens on the Point are usually minute.

Aster tripolium L. Sea Aster. A very abundant, marsh-forming plant. It forms tussocks among the *Salicornia herbacea* at the lower levels of the marsh. It accumulates mud and causes the general level of the marshes to increase and gradually forms a continuous sward. (One often refers to " Aster marshes ".)

The Aster on the marshes on Blakeney Point is nearly all of the ray-less form (var. *discoideus* Rchb.) with only the yellow disc florets. A very occasional plant with the mauve ray florets will be found.

Erigeron canadensis L. Canadian Fleabane. Observed in 1957 on the main shingle bank.

Bellis perennis L. Daisy. Recorded by Salisbury (1913) for the Watch House Bank. Its occasional presence here, and perhaps elsewhere on the Point is probably due to human activity. It was noted on the main shingle ridge in 1957.

Tripleurospermum maritimum (L.) Koch Scentless Mayweed [Syn. *Matricaria maritima* L.]. (Includes *M. inodora* L.). A rare plant (on the Point) found occasionally on the main shingle bank where it was noted, for example, in 1958.

Artemisia maritima L. Sea Wormwood. This grey-green plant, which has a very characteristic smell when crushed, is found at the upper margins of the older marshes, and on the shingle

fringing such marshes. It also occurs in some of the lows and has appeared on the Yankee Bank.

Cirsium vulgare (Savi) Ten. Spear Thistle [Syn. *Carduus lanceolatus* L.]. An occasional plant of the shingle and dunes.

Cirsium arvense (L.) Scop. Creeping Thistle, Field Thistle [Syn. *Carduus arvensis* (L.) Sm.]. Found regularly in small numbers on the main dunes and the shingle.

Hypochaeris glabra L. Smooth Cat's Ear. An annual plant whose small rosettes may be found on the lichen heaths and old grey dunes.

Hypochaeris radicata L. Cat's Ear. Found regularly on the older dunes. It usually occurs in patches of several plants.

Leontodon autumnalis L. Autumnal Hawkbit. Rare. Recorded on the crests of some of the older lateral shingle banks.

Leontodon hispidus L. Rough Hawkbit. Occasionally on the older dunes and on the lateral shingle banks. It was recorded, for example, on Watch House Bank in 1956.

Sonchus arvensis L. var. *littoralis*. Field Milk-Thistle. On the shingle banks, often growing among the *Suaeda fruticosa* bushes, or among the patches of *Honckenya peploides* or *Festuca rubra*.

Sonchus oleraceus L. Milk- or Sow-Thistle. Frequent on the shingle banks including the main ridge.

Sonchus asper (L.) Hill. Spiny Milk- or Sow-Thistle. This plant, which closely resembles *S. oleraceus*, has been recorded for the Point.

Hieracium pilosella L. Mouse-ear Hawkweed. Found regularly but not abundantly on the older dunes and lichen heaths.

Taraxacum officinale Weber, *sensu lato*. Common Dandelion. Members of this taxonomically difficult genus occur. Salisbury (1913) recorded *T. erythrospermum* from Long Hills. It probably occurs elsewhere on the old grey dunes and lichen heaths.

MONOCOTYLEDONES

NAJADALES

Juncaginaceae

Triglochin maritima L. Sea Arrow-grass. Found as scattered plants about the mid-level of the Aster marsh. At higher levels it can be found in patches forming part of the mosaic which is referred to as the " general salt marsh community." Odd plants of *T. maritima* may be found in the lows where they may have been carried by high tides. It has been observed in both Glaux Low and Boathouse Low.

Zosteraceae

Zostera marina L. Eel-grass, Grass-wrack, Widgeon-grass. It is less tolerant of exposure than *Z. noltii* (see below) and occurs

just above the low tide level. On the Point it is often (? always) found growing in small runnels left when the tide retreats. It is less common than *Z. noltii* on the Point.

Zostera noltii Hornem. [Syn. *Zostera nana* Roth.]. More abundant than *Z. marina* and more tolerant of exposure. It grows upon sloppy mud and is often exposed at low tide. Both these species of *Zostera* are rhizomatous perennials. Pollination is brought about by water. Reproduction is mainly vegetative by the breaking up of the rhizome (Clapham, Tutin and Warburg, 1952).

LILIFLORAE

Liliaceae

Asparagus officinalis L. Asparagus. There is a single plant to be found near the well ; it was first observed in 1957.

Kniphofia sp. (cultivar.). Red-hot Poker. Originally planted at least twenty years ago. They appear to maintain themselves satisfactorily.

Yucca sp. Yucca, Adam's Needle. Planted between twenty and thirty years ago on the dunes between the Laboratory and the plantation. It is flourishing and flowers most years. In 1956 the main plant bore eleven inflorescences.

Juncaceae

Juncus bufonius L. Toad Rush. A small, tufted, annual plant abundant in Glaux Low. In 1958 it appeared in Long Low where it is now in great quantity.

Juncus gerardii Lois. A single plant appeared in Glaux Low in 1916. This was thought to be due to the tidal entry the preceding November. *J. gerardii* is now common in Glaux Low, and has now spread into Great Sandy Low.

Juncus maritimus Lam. Sea Rush. Occurs in the bay formed by the depression in the Hood. This was the only station for this plant on the Point, but in 1958 several plants appeared in the region where Glaux Low joins Great Sandy Low, and here, there are now nine clumps (1960).

Luzula campestris (L.) D.C. Sweep's Brush, Field Woodrush. Recorded by Salisbury (1913) as common on the Hood, and still present there but by no means abundant.

Luzula pilosa (L.) Willd. Hairy Woodrush. Reported on the Hood by Dr. P. J. Newbould in 1958.

Amaryllidaceae

Narcissus pseudonarcissus L. (cultivars.). Daffodil. Planted in the sand near the Laboratory. They appear to be maintaining themselves and flower each year.

Iridaceae

Iris pseudacorus L. Yellow Flag. A solitary specimen occurred on one of the dunes in the main dune system. It was

known for some years and first flowered in 1913. Another plant appeared in 1914. These plants probably originated from fragments of rhizomes brought in by the tidal drift. I found a plant on the dunes in 1955, but do not know if it flowered.

ORCHIDALES

Orchidaceae

Epipactis palustris (L.) Crantz. Marsh Helleborine. A solitary flowering specimen was found in 1914 by Mr. (now Sir Frederick) Hooper, high up on the dunes of the Headland some distance north of Great Sandy Low. A photograph of this plant appeared in the Blakeney Point Report for 1914, page 14.

CYPERALES

Cyperaceae

Carex arenaria L. Sand Sedge. Abundant on the old grey dunes (" Carex dunes ") and on the lichen heaths. Common on the Hood.

This plant has flowered profusely each summer following the disappearance of the rabbits.

Carex otrubae Podp. False Fox Sedge. First recorded, in 1956, on the Yankee Bank. Found in the following year in two other places on the dunes where detritus had been washed up.

Carex distans L. Distant Sedge. Found in Glaux Low in 1959.

GLUMIFLORAE

Gramineae

Tribe Bromeae

Bromus mollis L. (agg.). Lop-grass. Occurs in some abundance on the Watch House Bank. Has been recorded (Salisbury, 1913) as very rare on the Long Hills, and as rare on the Hood.

Bromus sterilis L. Barren Brome. Found on the Long Hills by Dr. P. J. Newbould in 1958.

Tribe Hordeae

Agropyron caninum (L.) Beauv. Bearded Couch-grass. A native plant of hedgerows and woods which was found growing in some quantity on Yankee Bank in June, 1956. It was still there in 1959.

Agropyron junceiforme (A. & D. Löve) A. & D. Löve Sand Couch-grass [Syn. *Triticum junceum* Beauv.]. The main grass forming fore-dunes which, however, never reach more than four feet in height. The habit of the grass is spreading, a distinct contrast to the other dune forming grasses. When marram grass (*Ammophila arenaria*) starts to grow on an Agropyron dune the *Agropyron junceiforme* is soon eliminated.

Agropyron junceiforme is tolerant of salt in soil and water and will withstand prolonged inundation with sea water. It is, perhaps,

this tolerance to saline conditions, which permits this plant to flourish very close to the high water mark. Under dry conditions the leaves of this grass, which have a smooth edge, become rolled.

A. junceiforme may hybridise with *A. pungens*.

Agropyron pungens (Pers.) Roem. & Schult. Sea Couch-grass. A glaucus, grey-green, stiff, handsome grass which occurs occasionally on the yellow, consolidated dunes and, more abundantly, on the shingle and especially on the muddy sand or gravel at the margins of salt marshes. Fine specimens of this grass will be found on the Marrams.

A. pungens is less tolerant of saline conditions than *A. junceiforme*. Its leaves are rolled and their margins are toothed. Hubbard (1955) describes *A. pungens* as a variable grass ; it may form hybrids with both *A. junceiforme* and *A. repens*.

Agrophyron repens (L.) Beauv. Couch, Twitch. A casual ; not abundant on the Point.

Elymus arenarius L. Sea Lyme-grass. One patch on the main dune ridge beside a path. It has held its own for some years and is now spreading. There were 220 shoots in 1957, 340 in 1958, 722 shoots in 1959 and 972 in 1960. It is in a very vulnerable position. Salisbury (1913) referred to a single specimen of this plant on the dunes.

In 1959 two other patches of this plant were found. One, on the edge of the dunes near the lagoon, growing among *Agropyron junceiforme*, had twenty-nine shoots, and the other on the shingle leading to Far Point had forty shoots. In 1960 these two clumps had eighty and sixty shoots respectively.

Elymus will be recognised among the marram grass by its broad leaves, which roll up in dry conditions. The foliage dies away in autumn and thus the plant gives but limited protection to the dune surface. It is not such an efficient dune builder as *Ammophila*. *Elymus* has been planted at a number of places along the east coast.

Hordeum murinum L. Wall Barley. Occasional plants occur near the Lifeboat Houses.

Tribe Festuceae

Festuca arenaria Osb. Sand Fescue [Syn. *Festuca rubra* var. *arenaria*]. The exact taxonomic status of this grass is not clear. However, it occupies a distinct ecological niche, forming a band-like zone on the seaward edge of the consolidated main dune ridge where wind-blown sand is still being deposited.

Festuca ovina L. Sheep's Fescue. Not common on the Point. Salisbury (1913) recorded it as " rather rare " for some of the older lateral shingle banks. It was found on the Yankee Bank in 1956.

Festuca rubra L. (subsp. *rubra*). Red or Creeping Fescue. Common, occurring on the consolidated shingle and on the dunes. On the dunes this grass makes its appearance behind the zone occupied by the *Festuca arenaria*. Since the disappearance of the rabbits this grass is flourishing and in some areas the dunes are developing as " fescue grass-land."

Lolium perenne L. Rye-grass, Ray-grass. A casual ; found very occasionally. A patch was found on the Headland dunes in 1958.

var. *tenue* was recorded by Salisbury (1913) as " very rare " in his list of plants found growing on the main shingle ridge.

Vulpia bromoides (L.) S. F. Gray. Squirrel-tail Fescue, Barren Fescue. Recorded for the Watch House Bank in 1956.

Poa annua L. Annual Meadow-grass, Annual Poa. Sometimes, in spite of its specific name, a short-lived perennial. Can be found on the shingle, in the lows and on the eroded margins of the older dunes.

Poa pratensis L. Meadow-grass. Found on some of the older shingle banks, and also on the consolidated dunes of the Headland, notably behind the big blow-outs.

Poa subcaerulea Sm. Spreading Meadow-grass. Found on the older dunes of the Headland. In the absence of rabbits it may play an important part in the dune succession at the stage when the marram grass is deteriorating.

The exact taxonomic status of the last two species of *Poa* is uncertain.

Puccinellia maritima (Huds.) Parl. Sea Poa [Syn. *Glyceria maritima* (Huds.) Mert. & Koch]. This grass occurs at various levels in the salt marshes, and along the marsh edge of the shingle. At the upper levels of the marsh it may become more or less dominant as it does locally on some of the marshes in the Marrams.

This plant provides good grazing on " saltings."

Different growth forms of this plant can be found in different parts of the marshes. It is also possible that other species of *Puccinellia* occur. This genus would repay further study at Blakeney Point.

Catapodium marinum (L.) C. E. Hubbard Darnel Poa, Stiff Sand-grass [Syns. *Poa loliacea* Huds., *Desmazeria marina* (L.) Druce]. Regularly found on the shingle at the beginning of the Yankee Bank where the vegetation cover is relatively sparse, and in the sandy-gravel elsewhere on the Point.

Catapodium rigidum (L.) C. E. Hubbard. Hard Poa, Fern Grass [Syns. *Poa rigida* L., *Desmazeria rigida* (L.) Tutin, *Scleropoa rigida* (L.) Griseb.]. A small annual grass whose leaves often have a slight purplish tinge ; found on the sandy-gravel.

Cynosurus cristatus L. Crested Dog's-tail. Found on the Hood by Dr. P. J. Newbould in 1958.

Dactylis glomerata L. Cock's-foot. A casual ; not often seen on the Point. A patch was seen on the Hood and another on the Headland dunes in 1959.

Tribe Aveneae

Anthoxanthum odoratum L. Sweet Vernal-grass. In 1958 it was found on the dunes where detritus had been washed up. Also found on the Beacon Hills in the same season.

Arrhenatherum elatius (L.) Beauv. ex. J. & C. Presl Tall or False Oat-grass [Syn. *Arrenatherum avenaceum* Beauv.]. A casual. This plant was recorded by Salisbury (1913) as " very rare " on the main shingle bank. A patch of this grass was found on the Headland dunes in 1958.

Koeleria gracilis Pers. Crested Hair-grass [Syn. *Koeleria cristata* (L.) Pers.]. Recorded by Salisbury (1913) as occurring on the eighth lateral shingle bank. Very rare. A clump of this grass was found near the well in 1957 and another patch on the main dune ridge.

Corynephorus canescens (L.) Beauv. Grey Hair-grass [Syn. *Aira canescens* L., *Weingartneria canescens* (L.) Bernh.]. A rare grass, native to Norfolk, Suffolk and the Channel Islands. Elsewhere in the British Isles it is probably introduced. On the Point it is abundant on the Hood. For at least the last thirty years there has been a patch of it on the old Carex dunes near the huts. Small tussocks occur elsewhere. It was noted on the Yankee Bank for the first time in 1956 and on the main dune ridge in 1957. This charming grass appears to be spreading ; this, perhaps, is related to the disappearance of the rabbits.

Aira praecox L. Early Hair-grass. A small, short-lived, annual plant extremely abundant on the consolidated dunes, grey dunes, lichen heaths, and on sandy shingle in the lows and on the lateral shingle banks. It flowers abundantly in the early part of the year but in summer only dried remains of this plant can be found, so giving a very inadequate idea of the abundance and distribution of this species. It was exceptionally abundant in 1959 and again in 1960. There were huge drifts of it everywhere.

Holcus lanatus L. Yorkshire Fog. Relatively rare on the Point. It was seen on the Hood in 1958 and 1959.

Trisetum flavescens (L.) Beauv. Yellow or Golden Oat-grass. A patch of this stoloniferous grass was found on the Beacon Hills by Dr. P. J. Newbould in 1958.

Tribe Agrostideae

Ammophila arenaria (L.) Link Marram Grass [Syn. *Psamma arenaria* Roem & Schult]. Marram grass is, on the Point, the dune

builder *par excellence*. Continued deposition of wind-blown sand stimulates it to vigorous growth. The plant remains bright green and inflorescences appear in large numbers. When the supply of fresh sand is cut off the Marram deteriorates, the plants becoming less green, many of the leaves and shoots dying and turning brown. Under these conditions it does not flower. Such degenerate Marram can be rejuvenated by the arrival of fresh supplies of sand. Such rejuvenated dunes can be seen near the big blow-outs on the Headland, where the sand from the blow-outs has been deposited on an old dune. The rejuvenation gives the appearance of a new actively growing dune over-rolling on to an old one.

Standing on a high point in the dune system one can pick out the actively growing dunes by the greenness of the Marram. Oliver in the Blakeney Report for 1927–29 records that " in the autumn of 1928 full-grown plants ripened great quantities of seed, which germinated profusely to form, in 1929, continuous lawns of seedlings occupying the bays and spaces between. By July these young plants, often present to the number of eighty per square yard had five or six leaves and were about six inches high. Sand was being actively collected and was about three inches deep."

While *Agropyron junceiforme* is regarded as the real pioneer dune former, the Marram can, and on Blakeney Point does, function as a pioneer if numerous individuals are present to ensure good deposition of sand.

There was a good crop of Marram seedlings in 1956 ; these are now, in 1959, accumulating sand.

The seed of Marram is slow to germinate. Germination may be accelerated by treatment with acids or by friction. Oliver (Blakeney Report, 1920–23) suggested that in seeds commonly distributed by currents of sea water this deferred germination may be a valuable attribute.

Marram grass is said not to tolerate immersion in salt water. Observations at Blakeney Point suggest that it will tolerate at least a certain amount of immersion.

During the First World War experiments were made to test the suitability of Marram grass for paper making. (Blakeney Point Reports, 1915–16, 1917–19). The yield based on dry weight of grass was low and there were difficulties in bleaching the material. It was eventually decided that it was not suitable for the manufacture of fine papers.

Agrostis tenuis Sibth. Common Bent-grass, Brown Top. One doubtful record for the Watch House Bank in 1956.

Agrostis stolonifera L. Fiorin, White Bent, Creeping Bent [Syn. *Agrostis maritima* Lam.]. Forms a definite zone on the crest of the lateral shingle ridges. A zone of *Agrostis stolonifera*

occurs at the Hood on the sandy shingle in the depression, and it it also found in Long Low.

Phleum arenarium L. Sand Cat's-tail, Sand Timothy Grass, Annual Timothy Grass. Very abundant, short-lived annual plant of the consolidated yellow dunes, Carex dunes, lichen heaths and sandy shingle.

Tribe Monermeae

Parapholis incurva (L.) C. E. Hubbard Curved Sea Hard-grass [Syn. *Lepturus incurvus* (L.) Druce]. A rare annual grass occurring on muddy gravel, near the edges of salt marshes. A mediterranean species. It was recorded on the Yankee Bank in 1956.

Parapholis strigosa (Dum.) C. E. Hubbard Sea Hard-grass [Syn. *Lepturus filiformis* (Roth.) Trin.]. A rather rare annual grass occurring on the sandy or muddy consolidated shingle of the older lateral shingle banks.

Tribe Arundineae

Phragmites communis Trin. Common Reed. Several plants appeared in Glaux Low in 1959. One was sending out long runners over the ground. These plants almost certainly originated from pieces of rhizome brought in by the tides during the previous winter.

Tribe Spartineae

Spartina townsendii H. & J. Groves Cord-grass, Rice-grass. In the spring of 1911 a few plants were placed in the mud by Oliver. They were eaten down by rabbits during the summer of the same year (Oliver, 1924). In January, 1925, Oliver sowed a few seeds on the marsh west of the Watch House Bank at a time when this marsh was composed of wet, sloppy mud. There were well-developed, flowering plants present by the autumn of 1927. These Oliver attempted to eradicate (Oliver, 1927). Probably there was some survival, perhaps of seed. This marsh is now a *Spartina* meadow and the plant is now widely spread over the Blakeney marshes. It is uncertain whether all the *Spartina* has come from these original plantings since *Spartina* has been widely planted around other parts of the coast.

Spartina colonises very sloppy mud often replacing *Zostera* and it will often invade creeks. It is well suited for growing in these situations. It has roots of two types, thick, unbranched long roots which may penetrate several feet vertically into the mud and serve mainly for anchorage, and large quantities of thinner, well-branched feeding roots which lie near the surface. The roots, rhizomes and leaves all possess large air canals, which perhaps fit this plant to grow in this kind of habitat in which the mud is often deficient in oxygen. The stiff, tall (up to three feet)

shoots of *Spartina* are remarkably efficient at collecting organic debris and silt, so soon raising the level of the marsh in the immediate vicinity of the clump. The growing circular clumps are very characteristic. Their growth has recently been investigated by Caldwell (1957).

"Seeds not only germinate speedily but the percentage germination is high. Growing in their native mud, the young plants will be six or eight inches high by the first summer ; they carry at the base as many as ten or twelve sprouting buds, including one or more stolons which will carry their buds to a distance. These are especially characteristic of established plants. A dense tuft of roots is shown by yearling plants, both anchoring and surface—the former already reaching to a depth of a foot. By the second year the plant forms a typical tussock, six to twelve inches in diameter, and extends vegetatively in all directions." (Oliver, 1925.)

Mature *Spartina* meadows elsewhere on the coast furnish good grazing which is said to be relished by cattle.

Spartina townsendii has been tried as a source of material for paper manufacture. The yield was low (about 30 per cent of the dry weight of fibre boiled) but the main difficulty was that it was impossible to bleach the pulp to a satisfactory colour.

The most important economic use of this plant is in the reclamation and stabilising of muddy foreshores. It has been notably so used in Holland.

Spartina townsendii appeared spontaneously in Southampton Water in 1870 and in 1880 it was recognised and named as a distinct species by H. & J. Groves. At about the turn of the century the plant began to spread and in the following years its spread was quite spectacular. It was suggested in 1926 that *S. townsendii* had arisen in Southampton Water as a natural hybrid between the British species, *S. maritima* (Curt.) Fernald and the introduced North American species, *S. alterniflora* Lois. which was known to occur there. This view was substantiated by the cytological work of Huskins in 1930, who showed that *S. townsendii* had a chromosome number of $2N=126$, *S. maritima* $2N=56$ and *S. alterniflora* with $2N=70$. However, it has recently been shown that the original collections of *S. townsendii* were of a slenderer, male-sterile form with $2N=63$. Presumably the fertile, vigorous form, *Spartina* 126 arose from this by a doubling of the chromosomes and that this was followed by the rapid spread of the plant.

I have retained here the name *townsendii* for our plant which is undoubtedly the fertile "126" form, although this specific epithet properly belongs to the male-sterile plant which is still to be found locally along the south coast.

Spartina maritima (Curt.) Fernald Cord-grass [Syn. *Spartina stricta* (Ait.) Roth.]. Said by Salisbury in Oliver and Salisbury (1913) to occur in the Blakeney Channel adjacent to the reclaimed salt marshes. It has not been reported in recent years.

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REPORT OF MEETINGS AND EXCURSIONS, 1959–1960

1959

MAY 3RD. About 50 members assembled on Salthouse Heath and divided into several parties to study the bird-life of the area. After lunch, a visit was made to the Cley Bird Observatory where the Warden, Mr. R. A. Richardson, demonstrated the traps. He later led a party to watch Crossbills in pine trees at High Kelling. Mrs. G. M. Hart was elected to membership of the Society.

MAY 24TH. Under the guidance of Mr. Brian Ducker of the Nature Conservancy, members investigated the plant and animal life of East Wretham Heath in the vicinity of Ringmere and Langmere.

JUNE 7TH. In perfect weather conditions, an excursion was made to Hickling Broad under the leadership of Miss R. M. Barnes and Mr. L. C. Johnson. Members took boats on to the Broad where Charophytes were found in profusion. Swallowtail butterflies were numerous along the marsh walls.

JUNE 27TH. Mr. Brian Ducker led an expedition to Bawdeswell Heath where plants of the dry- and wet-heath communities were studied.

JULY 12TH. Members explored Whinhill Covert, Wolferton, under the guidance of Mr. E. L. Swann, and later visited the salt-marshes and beach. Notable " finds " of the day were Puss Moth caterpillars on a sallow bush, and a colony of fasciated Carline Thistles on the beach. The following were elected to membership:— Flt. Lt. P. Halligey, Miss M. A. Hodgson, Mrs. M. E. Hoppins, Mr. E. G. M. Niblett, Mr. R. J. Parrott, Mr. P. J. Stead, Mrs. E. P. Tillett, Miss W. Wenn.

JULY 26TH. Members met at Alderfen Broad, but owing to the low level of the water it was not possible to take out a boat, so Miss Mary Dunbar then led the party to Barton Broad, where, through the kindness of Col. Danby, an expedition was made by boat and on foot to the area surrounding the Broad.

SEPTEMBER 6TH. The Fallow Deer, geese and other waterfowl in the Park at Holkham were seen to advantage, and under the leadership of Miss R. M. Barnes and Mr. T. W. Irvine, the large party of members later walked through the pine woods and across the beach at Holkham Gap. Mr. E. L. Swann drew members' attention to an off-shore sand-dune which was steadily becoming colonised by plants. Mr. J. H. Shorten was elected to membership of the Society.

OCTOBER 3RD. At the opening meeting of the winter session, Mr. J. E. Lousley gave a talk on the " Flowers of the Isles of Scilly " which was illustrated with his own colour transparencies, and showed many species which had been introduced into the islands.

OCTOBER 4TH. A Fungus Foray was held in the Breck area. Following the hot, dry summer few agarics were to be found at East Wretham Heath, but under the guidance of Mr. E. A. Ellis members turned their attention to the micro-fungi. Later in the day, the party stopped to explore the banks of the River Thet at Bridgham where a rust new to East Anglia was found. A few specimens of some of the larger toadstools were collected from wooded areas at West Harling.

OCTOBER 15TH. The Botany Group held a discussion meeting.

NOVEMBER 6TH. Dr. Norman Moore of the Nature Conservancy Research Station at Furzebrook, Dorset, spoke to the Society on " Research and Management in the Nature Reserves of South-West England." The following new members were elected :— Miss M. B. Danvers, Group-Capt. J. H. Iremonger and family, Miss E. Sutton, Miss G. Thorn, Miss U. C. Unthank, Mr. G. White and family.

NOVEMBER 12TH. The Entomology Group held a discussion meeting.

NOVEMBER 19TH. The Society Annual Dinner was held in the Flixton Room of the Samson and Hercules House. 86 members and their friends attended. The chief guest was Lt.-Col. C. L. Boyle, Secretary of the Fauna Preservation Society who spoke of his work with that organisation.

DECEMBER 5TH. Dr. Mary Lobban gave an account of her experiences in Alaska, in a talk entitled " A Biologist in the Arctic " which she illustrated with colour transparencies.

1960

JANUARY 2ND. The Annual Christmas Lecture which was open to the public attracted a large audience which included many school children. Mr. Maxwell Knight gave useful advice and answered questions on " Hand-rearing Birds and Mammals." His talk was illustrated with slides and short films.

JANUARY 7TH. A symposium, " The Work of Young Naturalists " was held at the Castle Museum. Eight senior pupils from Norfolk Grammar Schools talked about research problems which they had been recently investigating.

JANUARY 22ND. At short notice, owing to the indisposition of Mr. R. Spencer who should have lectured on " Bird Migration," Mr. John Buxton arranged a programme of his own colour films. These depicted wild life at Horsey throughout the year, and were greatly appreciated by a large audience. Mr. J. F. Chambers, Mr. P. J. Meaney and Miss J. M. Moore were elected to membership of the Society.

FEBRUARY 4TH. The Mammal Group held a discussion meeting.

FEBRUARY 19TH. Dr. Colin Butler of the Rothamsted Experimental Station talked on " The Social Organisation of a Honeybee Community " illustrating his lecture with slides and film. The audience, which included members of the Norfolk Beekeepers Association, were told about recent work on the synthesis of " queen substance." Mrs. J. Carlile, Master S. N. J. Cook, Mr. K. W. K. Palmer, Mrs. J. Seligman and family were elected to membership of the Society.

MARCH 4TH. A public lecture was held in the Stuart Hall and a capacity audience saw the colour film " Island of Birds," made by the Royal Society for the Protection of Birds and filmed at Havergate Island. The proceeds from the lecture were divided between the Society and the R.S.P.B.

MARCH 17TH. The Bird Group held a discussion meeting.

MARCH 19TH. Mr. L. C. Johnson delivered his presidential address entitled " A Population Study." His theme was the adaptation of insects to an aquatic existence, and was illustrated by the projection of living material. The meeting was held at the Castle Museum, and Mr. H. J. Outram, Mr. and Mrs. R. L. Howitt were elected to membership.

APRIL 9TH. Mr. E. A. Ellis opened the proceedings of the 91st Annual Meeting by informing members of the sudden death, on April 2nd, of the retiring President, Mr. L. C. Johnson. Tribute was paid to Mr. Johnson's work for the Society, especially during his past year of office.

The Hon. Secretary's and Hon. Treasurer's reports were read and accepted. The following officers were elected to serve for 1960–61 :—President, Mr. K. C. Durrant ; Vice-Presidents, Major A. Buxton, Mr. E. A. Ellis, Mr. R. Jones, Mr. F. J. Taylor Page, Mr. J. E. Sainty, Professor J. A. Steers ; President-elect, Dr. J. M. Lambert ; General Secretary (Meetings), Mr. P. R. Banham ; Assistant Secretary (Membership & Publications), Miss R. M. Barnes ; Assistant Secretary (Minutes), Miss R. Jones ; Excursions Secretary, Miss E. B. Green ; Treasurer, Mr. E. T. Daniels ; Assistant Treasurer, Mr. J. E. Timbers ; Editor, Mr. E. A. Ellis ; Auditor, Mr. H. Riley ; Committee Members, Mr. P. M. Robson, Mr. M. J. Seago, Mr. C. Gosling, Dr. P. J. L. Hunter.

Mr. F. J. Taylor Page, as retiring General Secretary, was warmly thanked for his past services to the Society, and Mr. K. C. Durrant, the new President, was welcomed to the chair. The following were elected members of the Society :—Mr. C. Goate, Mrs. G. M. Huggins and family, Miss D. Pike, Miss B. E. Rawlins,

and Miss M. E. Spurr. The meeting closed with a colour-film, " The Edge of Britain," which depicted wild-life on the island of Foula.

All indoor meetings were held at the Assembly House, Theatre Street, Norwich, unless otherwise stated.

During the period under review, the Committee met 7 times.

RUTH M. BARNES.

Norfolk & Norwich Naturalists' Society

Patron:
HER MAJESTY THE QUEEN.

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President-Elect: DR. J. M. LAMBERT.

Vice-Presidents:
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Assistant Secretary (Membership & Publications):
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Recorders:—

Mammals: F. J. T. PAGE, 77, Surrey Street, Norwich.

Birds: M. J. SEAGO, 33, Acacia Road, Norwich.

Reptiles & Amphibians: P. R. BANHAM, Chalet 72, Wymondham College, Norfolk.

Fishes: E. Q. BITTON, Church Farm, Runhall, Norwich.

Insects: E. T. DANIELS, 41, Brian Avenue, Norwich.
K. C. DURRANT, 31, Sandy Lane, Dereham, Norfolk.

Woodlice, Centipedes, Millipedes: MISS R. M. BARNES, Castle Museum, Norwich.

Marine Biology: R. HAMOND, Morston, Holt, Norfolk.

Freshwater Biology: T. B. TERRY, Wymondham College, Norfolk.

Microscopy: J. L. TILLETT, 115, Buckingham Road, Norwich.

Parasitology: L. E. S. HOWES, 26, Corie Road, Colman Road, Norwich.

Flowering Plants and Ferns:
East Norfolk: E. A. ELLIS, Wheatfen Broad, Surlingham, Norwich.
West Norfolk: E. L. SWANN, 282, Wootton Road, King's Lynn.

Bryophytes: B. F. T. DUCKER, The Nature Conservancy, Government Offices, Bishopgate, Norwich.

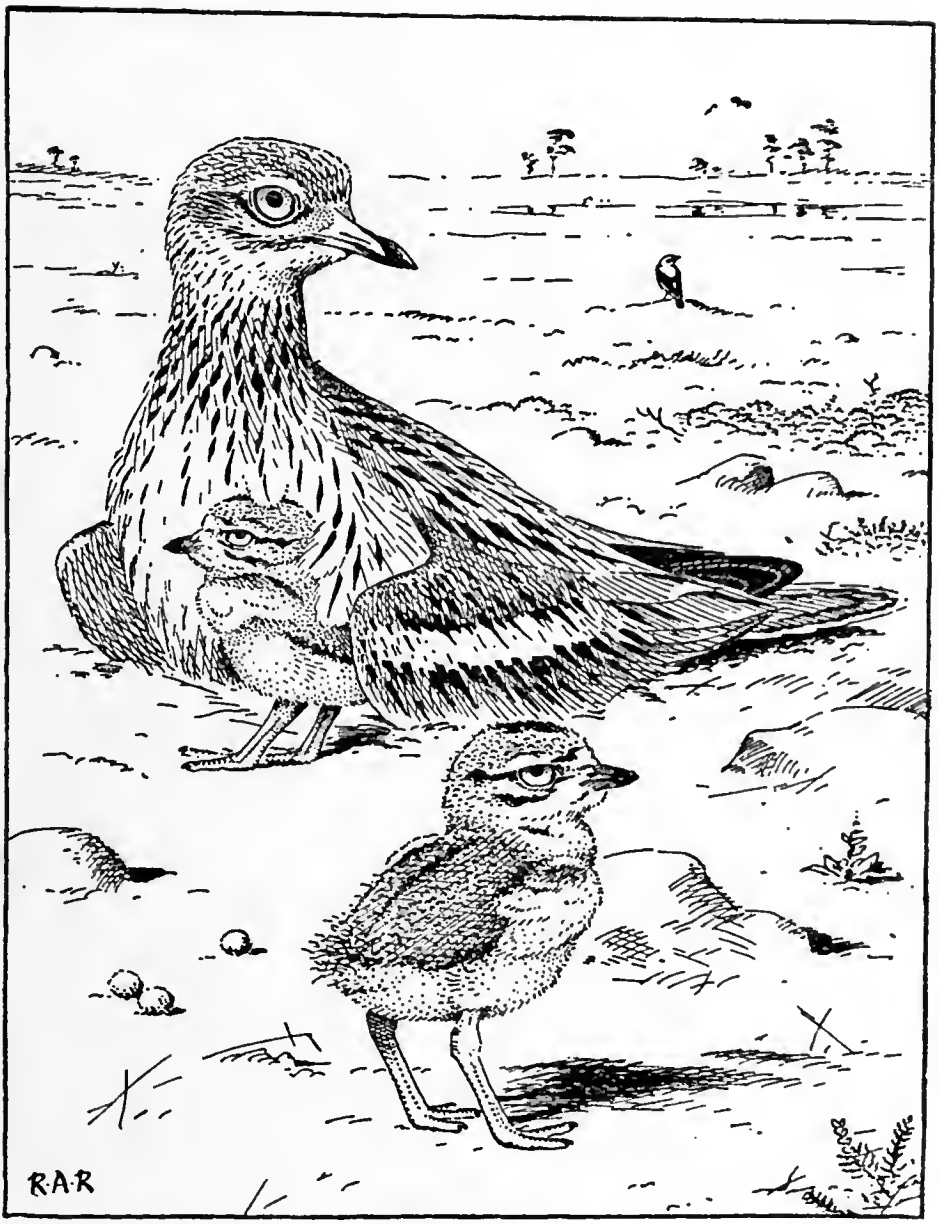
Lichens: S. A. MANNING, 181, College Road, Norwich.

Fungi: E. A. ELLIS, Wheatfen Broad, Surlingham, Norwich.

Algae: K. B. CLARKE, Decoy House, Browston, Gt. Yarmouth.

Geology: MISS E. B. GREEN, Castle Museum, Norwich.
THE NORWICH PARAMOUDRA CLUB, (Sec. I. Harrowven, 79, Falcon Road West, Sprowston, Norwich.).

THE NORFOLK BIRD AND MAMMAL REPORT



1960

(Transactions of The Norfolk and Norwich Naturalists Society, Volume 19 Part 5)

NORFOLK BIRD REPORT - 1960

Edited by
MICHAEL J. SEAGO

Records Committee:
R. A. RICHARDSON, E. A. ELLIS AND THE EDITOR

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NORFOLK MAMMAL REPORT - 1960

Edited by
F. J. TAYLOR PAGE

Assisted by
R. P. BAGNALL-OAKELEY AND E. A. ELLIS

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(Castle Museum, Norwich)

Norfolk Bird Report 1960

INTRODUCTION

THE Council of the Norfolk Naturalists Trust, in co-operation with the Norfolk & Norwich Naturalists Society, is pleased to present to members the annual report on the birds of Norfolk.

Winter

January–February: As in the previous year, the only cold spell occurred in mid-January and was of too short a duration to bring any unusual visitors. In the Breydon area were up to 400 white-fronted geese, with 80 bean-geese in the Yare valley. Among the latter was a single lesser white-front—the fifth fully authenticated county record. At Cawston, a ferruginous duck arrived Feb. 17th, remaining until early May. On the North coast, brent geese peaked at 1,500 birds. A drake red-crested pochard stayed at Bayfield Lake until Jan. 23rd. Three days later one was shot nearby. A Siberian herring gull was at Blakeney Point on Jan. 4th. Single black guillemots were in Wells harbour on Jan. 1st and off Blakeney Point five days later. Notable wildfowl concentrations on The Wash included 200 velvet scoters in mid-Jan. and 430 eider-ducks during Feb.

March: The first spring migrants were chiffchaffs at Cley on 2nd followed by garganey at Hardley on 12th and Sandwich terns and wheatear both at Cley on 27th. An avocet reached Cley on 19th. March was also the time of the wildfowl. At Gore Point, 17 long-tailed ducks were found on 20th. On The Wash, red-breasted mergansers peaked at 60 birds and there were 200 eider-ducks. In the Breck, Narford Lake had 22 goosanders on 13th.

Spring

April: The first two paragraphs are from the 1960 Report of Cley Bird Observatory.

The month opened with a spoonbill and the pair of water pipits present since late 1959 were in full nuptial dress. Sandwich tern numbers built up to a maximum of 350 by 19th. The 3rd saw the arrival of an avocet, sand martins, redstart and white wagtails. There were swallows on 4th, willow warbler on 5th and the first sedge warbler on 7th. 2 avocets appeared on 6th.

Pride of place must go to the kite on 8th; 6 male yellow wagtails arrived the same day. The first nightingale was heard on 10th with common sandpiper on 13th. Migrants on 16th included ring

ouzel, cuckoo, whitethroat, tree pipit, whinchat and another avocet. The next day, the first house martins and reed warbler appeared. The first blackcap followed on 18th, then whimbrel and firecrest on 19th. There were bee-eaters at Cley and Blakeney on 21st (2 remained at Blakeney till 26th with one lingering till May 2nd). 2 lesser whitethroats appeared on 22nd with the first little tern next day. A swift came in on 25th and there were common terns next day.

Elsewhere, an osprey appeared at Hardley on 23rd and a hoopoe at Thornham on 25th. The 28th was distinguished by an ortolan bunting at Blakeney and 2 cranes at Brancaster.

May: The first three paragraphs are from the Cley Observatory Report.

A little shearwater, male Kentish plover and " red " curlew-sandpiper certainly gave distinction to May-day; and 5 Demoiselle cranes which came from the east were undoubtedly, from their imperfect secondaries, escapes from captivity. 2 tired collared doves were in the plantation on Blakeney Point on 4th when the first wood sandpiper arrived.

Another influx of summer migrants on 5th brought the first red-backed shrike. Interesting waders at this time were 2 avocets on 6th and a dotterel next day. A wader influx on 9th included " black " spotted redshank, ruffs, both godwits, grey and Northern golden plovers. In addition there was the first spotted flycatcher. Of interest on 13th were red-footed falcon, little gull, black-tailed godwits and ruffs. 30 turtle doves moved east on 14th.

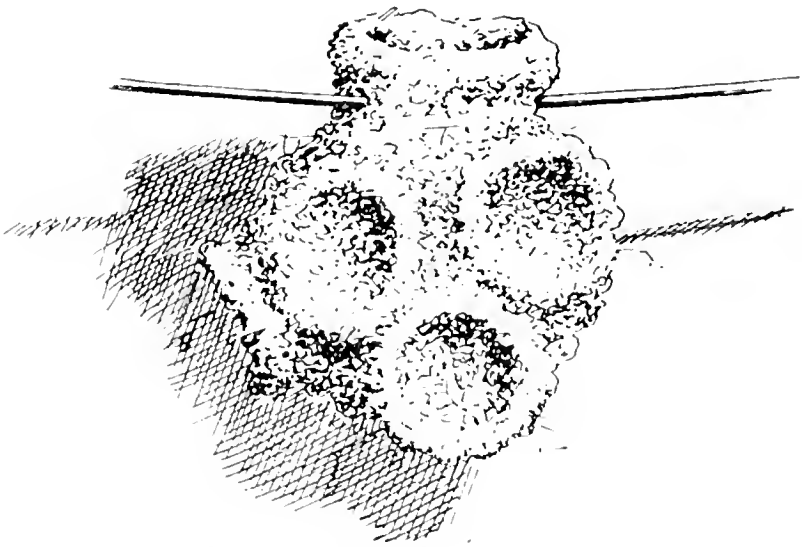
Quality was considerable on 15th with tawny pipit and lesser grey shrike at Salthouse, while next day a male woodchat shrike arrived. A hoopoe was seen on 19th and another woodchat was on the Point on 20th. 2 black redstarts and 3 marsh-harriers were seen on 21st and a subalpine warbler was trapped next day. On 26th a third woodchat appeared and there were 3 little stints.

Other vagrants during May included a crane at Breydon on 4th and 8th and an Alpine swift at the same place on 12th; a white-winged black tern at Edgefield lake on 14th; an icterine warbler singing at Scolt Head on 20th; a fourth woodchat at Thornham on 26th and a Temminck's stint at Hickling on 30th. Hoopoes appeared at five localities. A particularly interesting event was a late pair of snow buntings at Thornham on 25th.

A watch for departing waders was again kept at Scolt. On five evenings during the second half of the month, parties of turnstones headed north over the sea excitedly calling. The 21st was the best evening when groups of 63, 17 and 15 departed within an hour.

A very striking movement of black terns took place during the second week. At Cley there were 50 on 9th and a total of 162 on

10th, these passing eastward non-stop till mid-morning when most halted to feed, all departing at sunset. Next day 100 behaved similarly, but declined rapidly in the early afternoon and the peak came on 12th with 372 passing east. There were only 30–40 next day. At Breydon on "Godwit Day" (the 12th), 67 black terns crossed the estuary in the eve, all heading eastward. At Hickling, 200 had congregated in Heigham Corner by the 13th; 80 made a brief stay at Cawston Manor lakes and the same day 70 appeared over artificial lakes at Edgefield.



Remarkable House-martin's nest at Buxton

Summer

June: At Cley, late migrants continued to pass through. 6 black terns, 3 little gulls and 6 little stints all appearing on 3rd. The following day, Arctic waders included red knot, 8 reeves and 12 grey plover. A male red-headed bunting on 5th was in perfect summer plumage and probably not an "escape"; a "red" curlew-sandpiper, spoonbill and Kentish plover also appeared. Spotted redshank and wood sandpiper arrived next day. An adult spoonbill joined the first on 12th.

June's most noteworthy visitor was a roller near Acle on 4th with a hoopoe at Sea Palling the same day. The 12th was distinguished by a night heron at Hoveton Great Broad. A hobby was found dead near Reepham on 15th. Spoonbills in ones and twos visited Breydon, Hickling and Cley.

Unusual nest sites reported included a blackbird's in a bicycle basket in a Wymondham college cycle shed; a wren's in the sleeve of a gardener's jacket at Blakeney and another wren's under a bicycle seat at Coltishall. A pair of robins bred successfully in a busy joinery shop at Saxlingham Thorpe. At Corpusty, goldcrests

nested in a thick ivy-covered willow in preference to nearby yews. Sheld-duck nested in a haystack at Blakeney Downs. Moorhen's nested in a police launch on the Wensum at Norwich.

At North Walsham, a house-martin's nest was built in a very unusual and precarious situation. It was fixed to a television aerial wire which runs along the end of a house at a good height. The structure was not attached to the wall at any point and was built and balanced on the wire alone. Two more remarkable house-martin's nests were on a Buxton house. Each nest was constructed round a thick wire running under the eaves. The first nest cluster contained five cups and the other three cups. The lower cups acted as counterbalances and reached their final position by swinging below the supporting wire when they became too heavy. Both structures were hanging clear of the wall.

The nesting season was prolonged. A great tit at Sprowston had five eggs by Feb. 21st and a full clutch of nine a week later. Blackbirds were still breeding in mid-August and on 19th, at Blakeney, there were eggs in two nests and young in three others. A brood of spotted flycatchers at Corpusty did not leave the nest until Sept. 8th.

680 pairs of Sandwich terns and 1,700 pairs of common terns nested on the coast, but very few young reached the free-flying stage. High tides, strong winds and carpets of foam spelt disaster at the end of June. 200 pairs of black-headed gulls returned to Scoulton Mere, probably as a result of the reduced numbers of coypus and Canada geese there. 376 pairs of nesting herons were counted compared with 430 pairs in 1959. Collared doves extended their range and bred at both Yarmouth and Hunstanton. Stone-chats nested successfully at Horsey. Black redstarts reared young at Yarmouth, but the pairs which took up residence in the centre of Norwich were unsuccessful. In Breckland, a pair of curlew reared two young at Brettenham Heath. In Broadland, bearded tits had a very good season but no marsh-harriers reared young. No Montagu's harriers bred in the county. This is extremely dis-appointing. Although both species are protected by law, it is still very dangerous for these (or any other) birds of prey to hunt outside a nature reserve.

The little ringed plover was a most welcome and long overdue addition to the county list of breeding birds. Two pairs of adults with three young were found in a partly flooded gravel pit. The site was discovered from the air and the same observer is endeavour-ing to plot more of the hidden gravel workings not appearing on ordnance survey maps.

July: July's most unusual bird was a black guillemot found exhausted at Winterton on 16th. It had been ringed as young in Sweden less than a month previously. 2 avocets arrived at Cley

on 9th where there was a large westward migration of Sandwich and common terns on 15th. Several halted to rest on Arnold's marsh where 2 first summer common terns with white foreheads were distinguished. This is a rare plumage phase here, most immatures appearing to remain near the African coast in their first year. The month closed with a spoonbill flying westwards at Cley and one, almost certainly the same bird, stayed at Holme for the first half of Aug. Swifts departed in large numbers at this time and a drifting, screaming, spiral of over 500 was watched high over Norwich.

A vigorous campaign to reduce the wood-pigeon population was in full swing between mid-July and the end of Sept. During the first three weeks of July, 14 rabbit clearance societies in the county claimed to have destroyed 25,816 wood-pigeons' nests, 16,105 eggs and 5,795 young. In the Holt area alone, during July, 7,500 nests and a similar number of eggs were destroyed, together with 3,200 young.

Autumn

August: The first two paragraphs are from Cley Observatory Report.

The 3rd brought a Sabine's gull to Arnold's marsh. On 6th, at Blakeney Point, an icterine warbler was discovered in company with willow warbler and whinchat. The 10th saw 14 greenshanks and the next day brought a hobby and an increase in Arctic skuas including 10 pale phase adults all moving east. Sandwich tern numbers suddenly rose to 150 on 13th and on 15th, 50 gannets passed west. On 15th, 22 curlew-sandpipers and a black-tailed godwit moved westward.

The 19th was a big day of westward Arctic wader passage including 60 curlew, 30 bar-tailed godwits, 30 knot, 9 ruffs, 4 curlew-sandpipers (the first juveniles), golden plovers, 6 greenshank, turnstones, grey plovers and 5 little stints. A pectoral sandpiper arrived on 28th and at least 27 black terns, including a party of 17, were recorded. A little gull and 3 spotted redshank were new on 29th. On 30th, a strong eastward passage of gannets took place with skuas, razorbills, Manx shearwaters and fulmars. 2 purple sandpipers arrived with other Northern waders and 8 grey wagtails were seen. The 31st brought yet another large-scale passage of Arctic waders with bar-tailed godwits, whimbrel and knot (100 of each) predominating. An adult dotterel was on the Eye Field.

Wader passage reached peak numbers at the end of the month when Rush Hills at Hickling had attracted 36 ruffs and 12 black-tailed godwits. At Breydon on 31st seventeen species of waders had collected at high water including 17 black-tailed and 27 bar-

tailed godwits, greenshank and curlew-sandpipers. On the North coast at Scolt over 1,300 bar-tailed godwits passed westward during the three day period commencing on 30th. The most noteworthy Passerine was a hoopoe at Brinton from 21st to 23rd.

September: The first five paragraphs relate to Cley/Blakeney.

Northern waders in full strength again on 1st, including 15 ruffs. A juvenile dotterel joined the adult on 2nd and the first barred warbler arrived with an early redwing. Next day 35 little stints arrived from the sea. A tree-creeper was on the Point on 4th. A pomatorhine skua accompanied the now familiar sea-bird and wader passage. A wryneck appeared on 5th and a little gull passed through. 3 great skuas and a long-tailed, and a red-necked grebe were seen next day while a second barred warbler appeared. An ortolan arrived on 7th with a Temminck's stint to be followed on 9th by a fall of redstarts, whinchats and pied flycatchers. Another icterine warbler arrived on 12th with pied flycatchers and 12 little stints. The third barred warbler of the autumn was present on 13th and the next day was notable for a flock of 30 turtle doves at Morston.

A pectoral sandpiper 15th–22nd was joined by a second bird for the last 4 days of its stay. Sea-watching was prolific on 16th with eastward movements of 250 gannets, 30 razorbills, 10 Manx shearwaters, 4 sooty shearwaters, Arctic and great skuas and 2 little gulls. Another wryneck appeared with the first bluethroat and 60 tree pipits were watched arriving from the sea. The 17th saw 200 more gannets passing to the east with one great, one long-tailed and 4 Arctic skuas, a sooty shearwater, 14 little stints, 10 wood sandpipers and 2 curlew-sandpipers. There were 3 ortolans and the first rock pipits of the autumn.

An immature Mediterranean black-headed gull was at Salthouse on 18th. The first snow bunting arrived on 19th and a Richard's pipit was chasing skylarks on the beach.

The 20th was a wonderful sea-watch day though weather conditions made observation all but impossible at times with sheets of rain and a full gale backing from S.E. through N.E. to N.W. Among the birds seen were 30 sooty, one great, one Balearic and several Manx shearwaters, 2 Leach's petrels, many gannets and skuas, little gull, kittiwakes and a great many waders. It was during this period also that the largest Sept. arrival of small Scandinavian passerines took place with at least 7 bluethroats, many redstarts, a black redstart, robins, blackcaps, garden warblers, pied flycatchers, whitethroats and wheatears. It was interesting to note a complete absence of whinchats and willow warblers.

Other species of special note at this time included a dotterel on 21st; 3 Lapland buntings, an invasion of 150 ruffs and 100 little stints on 22nd; 3 black redstarts and a firecrest on 24th; a barred

warbler (fourth of the autumn) with one bluethroat on 25th and, on 27th, a red-breasted flycatcher, the first brambling and a very early waxwing. The 28th brought a big fall of song thrushes and redwings with robins a close third. 9 ring ouzels arrived on 29th with 2 merlins, a peregrine (attacking 2 herons), 30 siskins and 1–2 bluethroats. Redwings and song-thrushes were still arriving on 30th.

After a highly successful season, bearded tits became restless and began " breaking out " from the breeding areas. They appeared in a number of localities during the autumn. Interesting birds of prey included 3 single honey-buzzards in the North, whilst an osprey stayed almost a month in the Aylsham–Cawston district. 1960 was a remarkable year for siskins with no less than 300 at Kelling on 22nd and 350 at Winterton on 23rd. A Mediterranean black-headed gull stayed at Winterton from 24th till Oct. 9th and a grey phalarope was at Brancaster from 16th till 21st. Other highlights included icterine warbler at Holme on 11th and at Holkham on 23rd; a Pectoral sandpiper at Wisbech S.F. on 17th/18th; tawny pipit at Gore Point on 25th/26th and firecrest at Blakeney on 27th.

October: The first two paragraphs relate to Cley/Blakeney.

The month opened with the arrival of many Continental robins and goldcrests, the first great grey shrike, another red-breasted flycatcher and a little bunting. A pectoral sandpiper stayed from 2nd–8th; also on 2nd, 20 long-tailed tits headed west over Blakeney Point. There was a little owl on the Point on 6th with a pomatorhine skua next day.

Very great numbers of lapwings travelled west on 13th. Starlings took over the fly-lines from the lapwings on 15th and a great grey shrike was in Walsey Hills. The 16th saw yet another big arrival of robins, redwings and song-thrushes with the first 3 hooded crows. There were 1–2 long-eared owls on Blakeney Point with redstarts, blackcap and chiffchaff. Salthouse had spoonbill, black redstart and the first shore-lark. Redwing were heard calling overhead after dark on 18th, heralding a very large immigration of this species on 19th when they were accompanied by blackbirds and fieldfares and on 20th by song-thrushes. Many skylarks also came in on 21st.

There was an influx of rough-legged buzzards on the East Coast early in Oct. and they were reported in the county at Somerton, Cley, Holme and Hunstanton. A spoonbill stayed in the Breydon area from 8th till early Dec. A firecrest at Ludham on 17th was of particular interest. Notable waders included a grey phalarope at Hickling Broad 11th–20th and a peak of 90 ruffs at Wisbech S.F. Late summer visitors included reed warbler at Cley and spotted flycatcher at Holme both on 23rd; and swifts at Wells on 20th and 26th and at Cley on 27th.

End of Year

November: A grey phalarope was at Holme on 6th. A herd of 62 Bewick's swans arrived from the south high over Cley on the morning of 8th and departed towards the west. The same day a Greenland white-fronted goose arrived among the feral grey-lags on Cley marshes and a German-ringed Continental hedge-sparrow was trapped there on 13th (ringed on Heligoland a month previously). A very late cuckoo stayed at Haddiscoe 14th–17th. The 20th was distinguished by a rough-legged buzzard which stayed at Cley till the end of the year and by the arrival of 6 waxwings at Wiveton. Unusual numbers of shags arrived off Cromer with a peak of 43 on 27th.

December: Hirundines remained remarkably late. The last swallow was at Gorleston on 2nd; sand martins were identified at Cromer on 1st and one remained at Happisburgh till 25th; the last house-martin was at Horsey on 8th. Wader highlights were an avocet on Arnold's marsh on 2nd and a grey phalarope off Sheringham on 4th. On 25th, a water pipit returned to Cley. The year ended with some interesting wildfowl totals: 70–80 gadwall in the Breck, 900 pintail on the Pymore to Denver stretch of The Washes and 250 shoveler on Denver Washes.

* * * * *

Varieties reported included melanistic pheasants at Castle Acre and at Riddlesthorpe Heath; all white blackbirds at Sprowston and Necton and pied ones in Norwich and at Mundford and East Harling. At Hellesdon, were 2 unusual house-martins; one was all white and the other creamy-brown. A pallid robin at Caister Hall was sandy above with a pale orange breast. An all white moorhen was caught at Reedham. Freak gulls caused much confusion. All white common gulls were seen at Wells April 13th and at Scolt May 11th. An all white black-headed gull was in Yarmouth harbour Dec. 3rd and 10th. A large gull originally considered glaucous, in Yarmouth harbour from Nov. 16th till Feb. 1961 was all white with the exception of narrow black bands on both wing surfaces. The wings were comparable with those of a greater black-back, the bill was yellow with red at the angle and the legs and feet were pink. The iris was blue with a yellowish orbital ring. 245 species of birds were recorded in the county during the year.

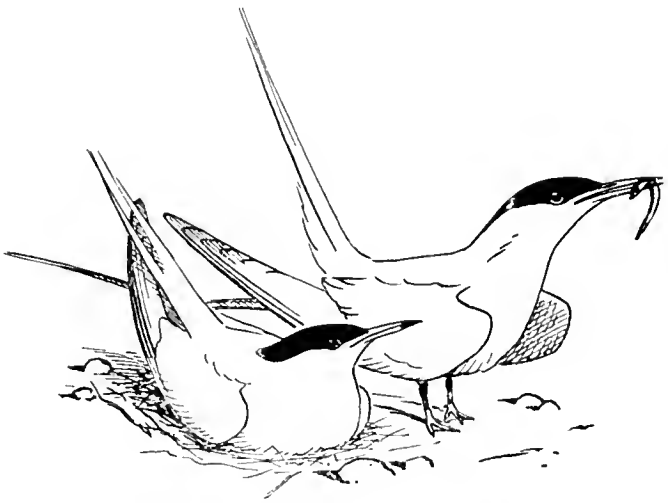
We are indebted to R. A. Richardson for the cover drawing of stone-curlews and for other illustrations; also to R. P. Bagnall-Oakeley, Dr. K. J. Carlson and J. High for their photographs; to the Cambridge Bird Club (in particular G. M. S. Easy); to the Great Yarmouth Naturalists Society for light-vessel notes; to the Trinity House Depot at Yarmouth; to *British Birds* and to all other contributors.

Records for the 1961 Report should be sent **by the end of January** to Michael J. Seago, 33 Acacia Road, Thorpe, Norwich, Nor 71T. Records should be in Check List order rather than in diary form.

Attention may be drawn to the following papers affecting Norfolk published recently:

" The Mute Swan census in England and Wales, 1955–56 " (*Bird Study*, Vol. 7, pp. 208–223); " Observations from a light-vessel on Passerine immigration into The Wash in autumn 1956 " (*British Birds*, Vol. 53, pp. 435–443); " Four Invasions of Waxwings during 1956–60 " (*British Birds*, Vol. 54, pp. 1–30); " Waxwings feeding on apples and their rate of berry consumption " (*British Birds*, Vol. 54, pp. 39–41) and " Autumn drift migration on the English East coast " (*British Birds*,Vol. 53, pp. 325–352 and 379–397).

Notes on Breeding Birds of the Norfolk Nature Reserves



SCOLT HEAD ISLAND
(The Nature Conservancy)

WARDEN: R. CHESTNEY
ASSISTANT WARDEN: K. G. SPENCER

The breeding season for the terns was disappointing. The fine, warm, spells during the early summer ended on 25th June when winds became northerly and the temperature dropped rapidly. Winds reached gale force by the 28th and 165 dead common tern chicks were found. Two days later the Wardens found the ternery covered in eighteen inches of foam extending to the dunes. After the foam cleared, 437 dead common tern chicks were found. They were all that remained of some 400 broods. Many other chicks died as a result of shortage of food, including birds which had reached the free-flying stage.

On 2nd July it was found that 130 common tern chicks had survived and there were 50 clutches of eggs. Some eggs were flooded out by high tides and many were eaten by black-headed gulls. Only 15 common terns hatched from the surviving clutches.

During the second and third weeks of July there was the almost annual build-up of common terns. A peak of 3,000 was reached on the evening of the 18th.

The first Sandwich terns arrived 8th April. On 8th May, eight pairs were on the point of nesting and 2 nests were found that evening. They were soon deserted, however, and there were no other attempts at nesting. The largest group of Sandwich terns during the nesting season totalled 40, on 18th June. During the last week of July, up to 450 Sandwich terns, including 40–50 juveniles, stayed at Scolt.

Records for the whole of the Island are summarised below:

	Number of nests or pairs of birds
Mallard	15 nests
Shield-Duck	150–200 pairs
Canada Goose	2 nests
Red-legged Partridge	3 nests
Partridge	3 nests
Pheasant	1 pair with chicks
Oystercatcher	90 nests
Ringed Plover	140 pairs
Redshank	40 pairs
Black-headed Gull	30 pairs
Common Tern	520 nests
Arctic Tern	1 nest
Little Tern	21 nests
Sandwich Tern	2 nests
Cuckoo	3 young reared
Yellow Wagtail	1 nest

BLAKENEY POINT
(The National Trust)

WARDEN : W. EALES

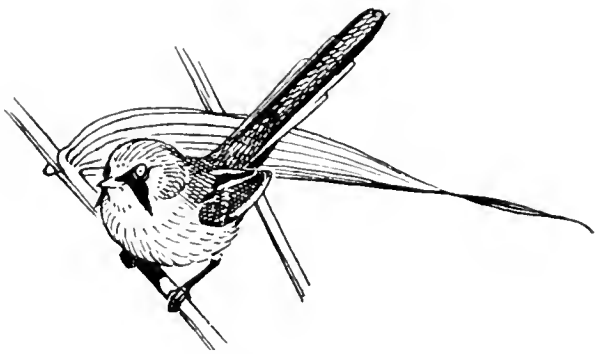
For the second year in succession, Sandwich terns did not nest on the Point, but common and particularly little terns arrived in good numbers. Several chicks had reached the free flying stage by the end of June but there then developed a storm and thick foam covered the greater part of the nesting ground. Practically all the tern chicks were destroyed and eggs covered. It was the worst instance of foam destruction in the Warden's experience. The Sandwich terns nesting near Wells suffered similarly and over forty young birds were washed-up dead at Blakeney Point. Sixteen of them had been ringed.

Although the terns' breeding season was disastrous, other birds did well, particularly ringed plovers and redshank. Nesting away from the outer beaches, they escaped the high tides and foam. A pair of reed buntings nested successfully among the terns, in a clump of marram.

The experimental wiring-off of a small area of the nesting ground was a success. The birds became very tame and allowed themselves to be photographed at distances down to ten feet. Remarkable numbers of people visited the Point, as many as 450 coming on a single day.

The following is a summary of nests marked:

Sheld-Duck ..	42 *estimated*	Redshank	54
Red-legged Partridge ..	3	Common Tern	918
Oystercatcher	78	Little Tern	97
Ringed Plover	84	Swallow	2
Reed Bunting	1		



CLEY AND SALTHOUSE
(The Norfolk Naturalists Trust)
WARDEN: W. F. BISHOP

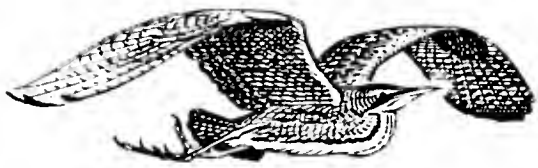
The spring and early summer were fine and warm and breeding ducks had a very good season. The birds left the marsh early, however, because of dry conditions and the Big Pool was completely dry for the first time in 25 years.

Mallard and teal numbers were maintained, whilst shovelers increased to at least 20 pairs. More spectacular was the increase in gadwall and over 12 pairs summered. Garganey arrived Mar. 18th and three pairs remained throughout April. Two pairs of pintail bred successfully. Sheld-duck had a good nesting season and with an increase in the rabbit population were able to occupy rabbit burrows once more.

Among breeding waders, redshanks had a good season. Many early clutches of lapwings' eggs were taken by carrion crows. Ringed plovers increased to about 20 pairs. Only two stone-curlews' nests were found—in the vicinity of Cley Hall Farm.

Terns had a disappointing time. The few common terns' nests on Arnold's marsh were washed out June 29th by very high tides. One pair reared young on the North Drain marshes. Little terns continue to decrease. No nests were found and only a very few young were noted.

Bearded tits had an excellent year. At least 25 pairs bred and young birds were abundant at the end of the summer. An increase in coypus has resulted in a decrease in bitterns. No nests were found, but a young bird still showing down was seen in July. One pair of herons nested in The Hangs wood rearing three young.



HICKLING

(The Norfolk Naturalists Trust)

WARDENS : E. PIGGIN assisted by G. E. BISHOP)

1960 was another record year for bearded tits and it is estimated that 60 pairs nested round the Broad and Heigham Sounds. The first nest, with five eggs, was found near Whiteslea April 20th and between then and the second week of July many others were discovered. Bearded tits prefer nesting in thick sedge, but due to the depredation of coypus they were forced to seek other nesting sites. Some nests were under clumps of lesser reed mace; others were reported in great pond sedge.

As in 1959, there appeared to be a similar autumn movement of bearded tits away from Hickling. One October morning, a party of 15 climbed to a great height until they were lost to view. Shortly after, they swooped downwards with great noise and excitement.

Ringed plovers bred – for the first time – on Rush Hills. The nest, containing four eggs, hatched June 28th. Other breeding birds of interest included three pairs of common terns, twelve pairs of great crested grebes, fourteen pairs of herons and 15–20 pairs of shovelers. Up to five pairs of gadwall and four pairs of garganey were on Rush Hills wader ground during the spring and early summer. The first garganey arrived March 16th.

Bitterns began booming March 4th; at least six males were present. It is disappointing to record that no marsh-harriers were reared. A pair nested near Ball's Dyke, but the cock disappeared. When the hen left the nest for food, the two eggs were pecked, apparently by carrion crows. This hen remained all the summer, but no further cock appeared until early November. No Montagu's harriers were reported.

Over 400 mute swans were resident on the Broad; nine nests were found. Single pairs of Canada geese and feral grey-lag geese nested on Heigham Sounds.

HORSEY

(Mr. John Buxton)

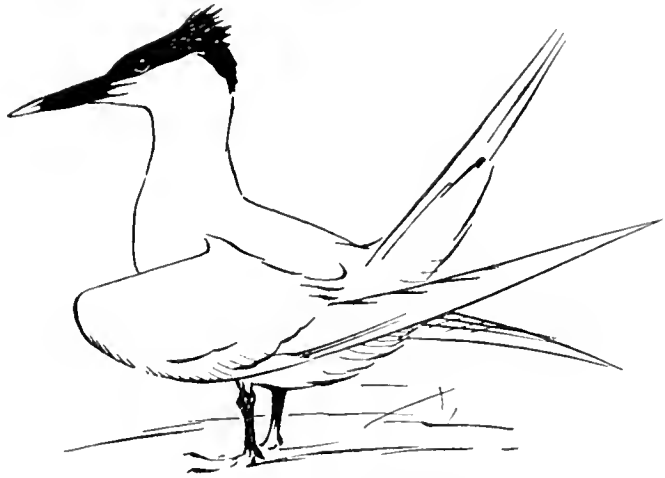
Keeper : G. Crees

Bearded tits again nested in numbers round Horsey Mere. 25 pairs were estimated. The first nest was found April 23rd but the young died, probably through lack of food during a cold, wet spell. Towards the end of September parties of bearded tits appeared to be " breaking out " from the Horsey reedbeds. Groups of five to fifteen were frequently watched flying high before disappearing from view.

Two male and three female marsh-harriers arrived in the spring, but none paired and no nest was found. The harrier breeding grounds at Horsey, formerly covered with sedge so thick that it was difficult to walk through, have been so cropped by coypus that no areas of thick sedge remain. No Montagu's harriers were seen.

Bitterns began booming March 23rd. A nest found in Starch Grass May 20th contained four eggs, but only two hatched. A second nest near the boat-house contained four eggs June 13th. All hatched successfully. There were at least six booming males.

No oystercatchers or short-eared owls bred. A pair of water-rails with small young were watched May 16th. A nest, with eight eggs found in Starch Grass June 4th was unsuccessful, however. Stonechats made a welcome return and a pair nested—for the first time since 1937—at Horsey Gap. Five young were reared. In the late autumn, a family party of stonechats could always be found at Horsey in fields of sugar-beet being lifted. Abundant insects were doubtless the attraction.



SCROBY SANDS
(Robin H. Harrison)

The first visit in 1960 was made on June 6th. 320 pairs of Sandwich and 270 pairs of common terns were found. The sands had changed little during the winter; the highest parts lying at the north-east and south-east corners of the island. A high-water survey July 8th, with spring tides, revealed that these corners were three feet above high water.

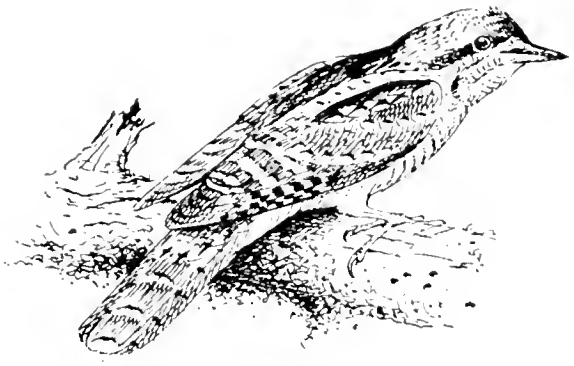
On June 16th, 130 young common and 121 young Sandwich terns were ringed. 327 Sandwich terns' nests were counted in five groups, the largest containing 115 nests. Many eggs were on the point of hatching. Three days later, there were scores of young terns on the sands. A further 28 common and 2 Sandwich tern chicks were ringed a record number for Scroby.

The fine, warm, weather of early summer ended abruptly on July 1st when a north-west gale caused abnormally high tides. Heavy seas pounded the sandbank. Three days later, the sea had moderated sufficiently to allow landing. Not a single chick or egg had survived. Thick white foam covered even the highest points.

Adverse weather prevented any further landing until July 23rd. Although numbers of adult common and Sandwich terns were seen, no further nests were found. 150 kittiwakes were on the island and great numbers of greater black-backed gulls were quarrelling over the carcases of common seal pups.

CLEY BIRD OBSERVATORY
(Warden : R. A. Richardson)

Once again the routine daily census of all birds in the Observatory area was maintained throughout the year and no efforts were spared to ensure that visitors fully enjoyed their bird-watching



Wryneck

holidays by keeping them supplied with up to the minute information and assisting them with identification problems.

1,271 birds of 85 species were ringed (748 being trapped and 523 as nestlings) and a selection of recent recoveries may be found among those which follow the Ringing Progress table. Two species appear for the first time in this table—little stint and carrion crow, while others worthy of mention are icterine, subalpine and barred warblers, bluethroats, bearded tits, black redstart, red-breasted flycatcher and woodchat shrike.

Information was supplied to Dr. David Lack continuing his research into migration by means of radar, and the Observatory also took part in the red-backed shrike enquiry and the Road Deaths investigation organised by the B.T.O. which also published full reports of the spring and autumn migrations at Cley in the bulletin *Bird Migration*.

We joined the Council for Nature and suggested that it should approach the Federation of Rabbit Clearance Societies with a view to suspending gassing operations in districts where sheld-ducks are incubating in the burrows. This has been done.

All friends of the Observatory will have noted with satisfaction the even tighter controls on bird ringing and trapping techniques recently introduced and it is again our proud record that among the many birds handled by us there was not one casualty. What a contrast with the not far distant days when regional reports consisted largely of " obituary notices " of rare and unusual birds.

We are grateful to Norfolk County Council for continued access to the Walsey Hills trap site and to the National Trust to use mist-nets on Blakeney Point at migration times. It is also a pleasure to record our appreciation to all those interested people whose goodwill and generous support have made possible another full year of enjoyable study.

Details of hotel and cottage accommodation in the Cley district may be obtained from R. A. Richardson, Hill-top, Cley, Holt, Norfolk.

Species	1960	Total since 1949	Total Recoveries
Little Grebe	1	3	
Manx Shearwater		1	
Fulmar		52	
Heron	7	40	6
Bittern		4	1
Mallard	2	20	4
Teal		2	
Wigeon		3	1
Scaup		8	2
Eider		1	
Sheld-Duck		7	
Brent Goose		1	
Mute Swan	1	2	
Sparrowhawk		1	
Montagu's Harrier		2	
Kestrel	5	21	1
Common Patridge		1	
Water Rail	1	5	
Spotted Crake		1	
Cornerake		1	
Moorhen	2	12	1
Oystercatcher	1	33	1
Lapwing	62	367	1
Ringed Plover	6	77	
Turnstone		2	
Snipe	4	23	1
Jack Snipe		2	
Woodcock	2	5	1
Wood Sandpiper		4	
Common Sandpiper		5	
Redshank	3	44	1
Knot		3	
Purple Sandpiper		3	
Little Stint	10	10	
Dunlin	11	20	1
Ruff		10	
Grey Phalarope		2	
Stone Curlew	3	10	
Common Gull		1	
Black-headed Gull	34	258	6
Common Tern	10	111	1
Little Tern	6	17	
Sandwich Tern	244	752	3
Razorbill		4	
Little Auk		2	
Guillemot		5	
Stock Dove	1	34	2
Wood Pigeon	1	14	2
Turtle Dove	8	54	4
Collared Dove		4	1
Cuckoo	1	17	
Barn Owl	3	25	
Little Owl		8	
Tawny Owl	2	24	1
Long-eared Owl		6	
Short-eared Owl		10	3
Nightjar		4	
Swift		26	2
Kingfisher	1	2	
Green Woodpecker		2	
Great Spotted Woodpecker		3	
Wryneck		4	
Woodlark		16	
Skylark	9	189	3
Shorelark		1	
Swallow	17	469	8
House Martin	1	66	
Sand Martin	11	107	1
Carrion Crow	4	4	
Rook		60	2
Jackdaw		23	1
Magpie	5	12	
Jay		17	
Great Tit	34	238	
Blue Tit	32	552	
Coal Tit	7	36	
Marsh Tit		18	
Willow Tit		25	
Long-tailed Tit	14	75	
Bearded Tit	2	5	
Nuthatch	1	12	
Treecreeper	8	26	
Wren	29	119	1
Black-bellied Dipper		1	
Mistle Thrush	4	49	
Fieldfare		9	
Song Thrush	52	770	7
Redwing	1	39	1
Ring Ouzel		5	
Blackbird	80	1,166	20
Wheatear	3	147	1
Stonechat	1	11	2
Whinchat	2	54	
Redstart	27	170	
Black Redstart	1	30	
Nightingale	16	151	
Bluethroat	3	10	
Robin	118	747	3
Grasshopper Warbler	1	15	
Reed Warbler	20	117	1
Sedge Warbler	7	132	9
Aquatic Warbler		1	
Melodious Warbler		2	
Icterine Warbler	1	5	
Blackcap	23	175	1
Barred Warbler	2	9	
Garden Warbler	17	90	
Whitethroat	38	747	24
Lesser Whitethroat	5	48	
Subalpine Warbler	1	2	
Willow Warbler	13	541	1
Chiffchaff	4	58	
Wood Warbler		11	
Goldcrest	19	181	
Firecrest		3	
Spotted Flycatcher	6	83	1
Pied Flycatcher	4	126	
Red-breasted Flycatcher	1	4	
Dunnock	64	536	
Meadow Pipit	3	370	9
Tree Pipit	3	24	
Rock Pipit		8	
Pied/White Wagtail	5	72	1
Grey Wagtail		4	
Yellow/Blue-headed Wagtail	6	139	2
Waxwing		2	
Great Grey Shrike		4	
Woodchat Shrike	1	2	
Red-backed Shrike	2	105	
Starling	6	484	10
Greenfinch	15	906	5
Goldfinch		49	
Siskin		3	
Linnet	10	414	6
Twite		2	
Lesser Redpoll		3	
Bullfinch	11	38	
Chaffinch	10	733	2
Brambling		297	1
Yellowhammer	24	314	
Corn Bunting		5	
Ortolan Bunting		1	
Rustic Bunting		1	
Reed Bunting	7	254	1
Lapland Bunting		7	
Snow Bunting		175	1
Tree Sparrow	1	137	1
House Sparrow	27	692	1
House x Tree Sparrow Hybrid		1	
GRAND TOTALS	1,271	15,656	174

Species Total: 1960—85; Since 1949—150

SELECTED RINGING RECOVERIES

(Notified in 1960)

Attention may be drawn to the *Cambridge Bird Club Report*, 1959, pp. 25–26, for a summary of Welney starling recoveries, including 31 abroad.

	Ringed	*Recovered*
Heron	Denver Sluice. 1.6.58 (as young).	Rijpwetering (Zuid-Holland), Netherlands. 5.4.59.
Heron	Denver Sluice. 27.4.59 (as young).	Near Kirklington, York. 16.7.59.
Heron	Denver Sluice. 4.5.59 (as young).	Cockerham, Lancs. 5.10.59.
Mallard	Jagaretfurbundet, Stockholm, Sweden. 3.7.59.	How Hill, Ludham. 15.1.60 (trapped and released).
Mallard	How Hill, Ludham.	Recoveries notified from Denmark (7) and Netherlands (3).
Mallard	How Hill, Ludham. 14.1.60	Legowo near Pruszcz (Gdansk), Poland. 19.11.60.
Mallard	How Hill, Ludham. 18.1.60.	Near Smedsbyn, Boden (Norrbotten), Sweden. 21.8.60.
Mallard	How Hill, Ludham. 15.2.60.	Saleby, near Lidkoping (Skaraborg,) Sweden. 23.10.60.
Mallard	How Hill, Ludham. 19.2.60.	Hohenstein, near Oldenburg, (Schleswig-Holstein), Germany. 8.10.60.
Mallard	Pori, Finland. 9.6.58 (as young)	Narborough. 16.12.59.
Teal	Le Sambuc (Bouches-du-Rhone), France. 18.12.58.	East Somerton. 10.12.59.
Gadwall	Sandringham. 4.8.60 (as hand reared young).	Schinnen (Limburg), Netherlands. 19.11.60.
Sheld-duck	Slimbridge, Glos. 4.5.55.	Terrington. 20.8.59.
Mute Swan	Kew, Surrey. 28.12.57.	Near Ludham. 9.9.59.
Sparrowhawk	Signilskar, Aland Is., Finland. 3.9.57 (as young).	Woodbastwick. 24.12.57.
Marsh-Harrier	Hickling Broad. 24.6.58 (as young).	Walberswick, Suffolk. 3.7.60.
Coot (3 birds)	Abberton Reservoir, Essex. 1.3.55, 25.2.59 and 14.8.58 respectively.	Hickling Broad. 2.1.60.
Snipe	Gooderstone, Swaffham. 12.6.60 (as young).	Jublians (Mayenne), N.W. France. 6.8.60.
Woodcock	Rijs (Friesland), Netherlands. 21.11.55.	Riddlesworth. 21.1.56.
Woodcock	Holme. 11.10.59.	Huelgoat (Finistere), France. 13.12.59.
Curlew	Le Zoute (West Flanders), Belgium. 15.5.59.	Terrington marshes. 13.12.59.
Redshank	Scolt Head. 25.5.60 (as young).	Baie de Pernerff near Damgan (Morbihan), France. 29.10.60.
Dunlin C 822205	Amager, Denmark. 22.7.59.	Terrington marshes. 18.8.59 (caught and released).
Dunlin	Amager, Denmark. 10.9.53 (as young).	Blakeney. 22.12.54.
Dunlin	Amager, Denmark. 9.8.51.	Scratby. 17.3.54.
Dunlin HkiP20985	Pori, Finland. 6.9.58.	Terrington marshes. 18.8.59 (caught and released).
Dunlin	Revtangen (Rogaland), Norway. 30.9.56.	Brancaster Staithe. Jan. 1958.

Dunlin	Ottenby, Oland, Sweden. 16.7.53.	Bacton. 10.2.58.
Sanderling S78933	Norwick, Shetland. 3.9.59.	Thornham. 1.11.59 (caught and released).
Ruff	Cley. 30.8.59.	Naryan Mar in delta of Pechora river (Archangel), U.S.S.R. 3.6.60.
Common Gull	Island of Fehmarn, Baltic coast of Germany. 15.7.57 (as young).	Burnham Market. 3.8.60.
Common Gull	Hollnos, Sweden. 3.7.59 (as young).	Breydon. 29.8.60.
Black-headed Gull	Hauho, Finland. 25.6.59 (as young).	Witton near North Walsham. 22.1.60.
Black-headed Gull	Bravik near Norrkoping, Sweden. 9.9.59 (immature).	Bradwell. 10.3.60.
Kittiwake	Farne Islands. 18.7.58 (as young).	Lynn Well light-vessel, The Wash. 26.5.59.
Kittiwake	Farne Islands. 27.6.56 and 7.7.58.	Brancaster. 4.6.60.
Common Tern R70400	Scolt Head. 2.7.60 (as young).	Cartaya (Huelva), Spain. 27.10.60. Caught and released.
Sandwich Tern	Stiffkey. 21.6.58 (as young).	Freetown Bay, Sierra Leone, Jan. 1960.
Sandwich Tern	Stiffkey. 21.6.58 (as young).	Aguilas (Murcia), S.E. Spain. April 1960.
Black Guillemot	Island of Tistlarna, west coast of Sweden. 22.6.60 (as young).	Winterton. 16.7.60.
Shore-Lark 58838	Salthouse. 29.12.59.	Still present 5.2.60.
Bearded Tit	Cley. 29.12.59.	Nesting where ringed. 8.5.60.
Bearded Tit	Cley. 5.2.60.	Feeding fledged young where ringed. 14.5.60.
Wren	Gibraltar Point, Lincs. 27.4.58.	Buxton. 11.4.59.
Wren	Abberton, Essex. 23.1.59.	East Harling. 12.5.59.
Song Thrush	Cley. 17.12.58.	Braga (Minho), N.W. Portugal. 22.1.60.
Song Thrush	Cley. 17.10.59 (as migrant).	Paterna de Rivera (Cadiz), south Spain. June 1960.
Blackbird	Cley. 16.11.58.	Forsnas, Osterbymo (Ostergotland), Sweden. 25.7.59.
Blackbird	Cley. 15.10.59 (as immigrant).	Clonmel (Co. Tipperary), Eire. January 1960.
Blackbird	Cley. 15.10.59 (as immigrant).	Fla, Hallingdal (Buskerud), Norway. 11.4.60.
Blackbird	Scolt Head. 1.9.59.	Near Rambouillet (Seine-et-Oise), France. 25.10.59.
Blackbird	Bankeryd (Smaland), Sweden. 25.8.58.	Suffield. 11.1.59.
Blackbird	Ytterby (Bohuslan), Sweden. 22.6.53 (as young).	Taverham. 26.1.58.
Whitethroat	Cley. 29.4.59.	Lagos (Algarve), Portugal. September 1959.
Whitethroat	Bradwell-on-Sea, Essex. 2.5.59.	Syleham. 6.5.59.
Spotted Flycatcher	Cromer. 6.7.59 (as young).	High Kelling, Holt. 8.8.60.
Hedge Sparrow H9887385	Heligoland Observatory, Germany. 10.10.60.	Cley. 13.11.60 (trapped and released).
Starling	Sheringham. 23.1.59.	Salzwedel (Sachsen-Anhalt), Germany. 9.7.60.

Starling K98496	The Hague, Netherlands. 5.2.59.	Aylsham. 10.1.60 (trapped and released).
Starling	Alvsjo near Stockholm, Sweden. 16.5.59 (as young).	Inner Dowsing light vessel. 21.3.60.
Starling	Near Batetsk, Novgorod area, U.S.S.R. May 1959 (as young).	Inner Dowsing light vessel, 2.4.60.
Starling	Ribatschi (formerly Rossitten), Kaliningrad District, U.S.S.R. 2.7.59.	Poringland. 15.11.59.
Starling	Ventes Ragas, Lithuania, (formerly Windenburg). 26.7.58 (as young).	Norwich. 3.1.60.
Starling	Minsk, U.S.S.R. May 1956 (as young).	Great Witchingham. 31.1.57.
Starling	Ristikula, Estonian S.S.R. 2.6.58 (as young).	Potter Heigham. 12.1.59.
Starling	Welney, Oct.–Nov. 1957.	2 in Germany, one in Poland and 3 in U.S.S.R.—all in breeding season.

These six recoveries indicate that the starlings in the large winter roosts may be of mixed origin.

Reed Bunting K11947	Blakeney Point. 11.9.58.	Nesting at Scolt Head. 12.5.60.

Hoopoe

CLASSIFIED NOTES

The Wash and Fen records, which have been highly selected, have been taken from the draft of the Cambridge Bird Club Report. Important records from Wisbech Sewage Farm, part of which is on the Lincolnshire side of the county boundary, have also been included. Fuller details of these records, and many others, may be found in the *Cambridge Bird Club Report* for 1960.

The number preceding the name of each bird refers to the *B.O.U. Check-list of the Birds of Great Britain and Ireland* (1952) where the scientific name may be found. All records refer to 1960, unless otherwise stated. Where no initials appear after a record, details have been supplied by many observers. No plumage descriptions are given of rarities accepted by the Rare Birds Committee of *British Birds*.

1 **Black-throated Diver**: North coast: Singles (and once 2) on 7 dates, Holme–Cley, up to March 5th and from Aug. 21st when one still in breeding plumage. East coast: One, Winterton, Sept. 26th (JLFP). Wash: 8 winter records of 1–2 birds at Hunstanton and Snettisham (CBC).

2 **Great Northern Diver**: North coast: 1–3 on 8 dates, Holme–Cley, up to May 6th and from Dec. 24th. Wash: 4 winter records of singles at Hunstanton and Heacham (CBC).

4 **Red-throated Diver**: Inland records only are given—all of single birds. Holkham lake, Jan.–Feb. 22nd; Gt. Witchingham, dead, Jan. 31st (GB); Blickling lake, March 13th (CDR) and in Breck at Wretham Park, Jan. 31st (HRB) and Narford lake, Nov. 6th (DW).

5 **Great Crested Grebe:** Summer counts of *adults:* Broads: Upton, 2; Hickling/Heigham Sounds, 24; Burnt Fen, 4; Rockland, 42; Alderfen, 2; Ranworth Inner, 34 and Filby, 20. Breck: Narford, 5; Narborough G.P., 2; Mickle Mere, 18 on April 10th (GMSE) and Thompson, 4. Fens: Welney G.P., 2. Other waters: Hardley flood, 6 and bred (one pair) for first time; Sea Mere, 6–9, Blickling lake, 5 and Holkham lake, 4.

Wash: Maximum of 55, Hunstanton–Snettisham, March 20th (CBC).

6 **Red-necked Grebe:** North coast: 2 at Holme, Jan. 31st (CBC). Singly at Wells, Jan. 8th and Blakeney, Aug. 31st (HH) and at Cley, Sept. 6th, 22nd and 23rd. Wash: Hunstanton, one, March 5th (CBC).

7 **Slavonian Grebe:** North coast: 1–2 on several dates at Brancaster, Wells, Cley and Sheringham up to April 8th and from Sept. 3rd. Wash: Scarcer than usual and only ones and twos reported (CBC).

8 **Black-necked Grebe:** North coast: 1–2 at Brancaster, Wells and Blakeney up to March 8th and from Oct. 25th. Wash: Recorded up to March 6th and from Nov. 13th with maximum of 15 on March 6th (CBC).

12 **Leach's Petrel:** North coast: Cley, 2 east, Sept. 20th.

16 **Manx Shearwater:** North coast: Holme, 2, Sept. 16th (CBC). Cley, one, March 27th (EAC); 2, April 24th; one, Aug. 30th; 1–3, Sept. 9th, 12th, 13th 15th, and 18th; 10 on 16th and several on 20th. Single *mauretanicus* seen well off Cley, Sept. 16th and 20th. Broads: Hickling, an exhausted bird, Aug. 30th (EP).

17 **Little Shearwater:** North: One of the Madeiran race (*P.b. baroli*) freshly dead on beach between Cley and Blakeney Point, May 1st (CJRT, RMN). The seventh British and third county record. See *British Birds*, Vol. 54, p. 39.

19 **Great Shearwater:** North: Cley, one, Sept. 20th (BRS, RJJ, NP). The fourth county record.

21 **Sooty Shearwater:** North: Cley, 4, Sept. 16th; one on 17th and 30–40 west on 20th. Prior to 1960, there were only 6 county records.

26 **Fulmar Petrel:** Recorded Weybourne to Happisburgh with maximum of 71, Weybourne–Cromer, on April 30th. No details of breeding successes. First birds (4) returned to breeding cliffs, Dec. 17th and 28 at Cromer by end of month (CDR).

Fulmar petrels began colonising north Norfolk in 1940, but it was not until 1947 that successful breeding took place and five young were reared. 1957 was a record year with 26–28 chicks reared between Weybourne and Sidestrand. Breeding has also taken place at Mundesley. Fulmars began prospecting Happisburgh cliffs in 1956 but breeding has yet to be proved there.

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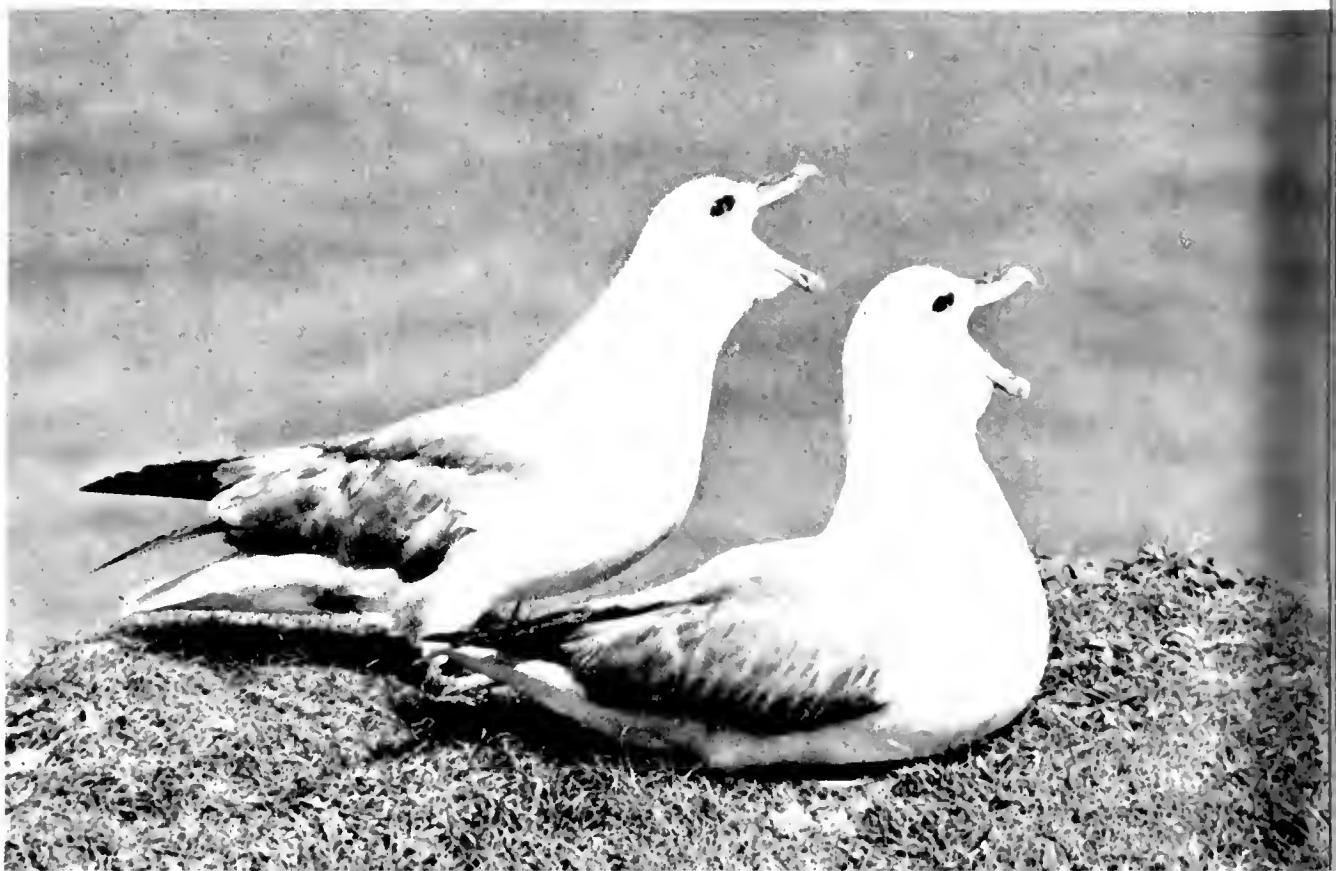
Fulmars do not desert the breeding cliffs until the end of August and begin returning as early as the first week of December. A fulmar ringed in June 1956 at Cromer was recovered in a fishing net off south-west Norway in July 1958. Blue phase birds are occasionally recorded



27 Gannet: Coastal records in March and from May to December inclusive. Peak numbers Sept. 16th/17th when 300–350 off Cley and 90–100, Holme–Snettisham.

29 Shag: Unusual numbers. North coast: Recorded all months July–Dec. with 9 off Cley, Sept. 26th; 14 at Cromer Pier, Nov. 12th, 22 there on 19th and peak of 43 on 27th (CDR). Wash: Hunstanton–Heacham, maximum of 12, Feb. 7th (CBC).

30 Heron: Details of heronries as follows:

Borders of Wash: Snettisham, 11 nests. *Fenland:* Islington, 85 and Denver Sluice, 36 (AEV). *Breckland:* Thompson Water, 3 (AWK); Narford Lake, 7 (AEV, DW) and Didlington, 2 (CRK). *Mid-Norfolk:* Kimberley Park, 22 (PRB). *Broads area:* General McHardy's wood, 4; Whiteslea, 4; Heigham Sounds wood, 6 (EP); America wood, Earsham, 15 (JWM); Fishley Carr Acle, 8 and Upton, 5 plus (RJ); Wickhampton, 31 (ETD, MJS); Buckenham, 42; Mautby, 15 and Ranworth, 43 (MJS); Ranworth marshes (Horning Hall), 3 (RB); Heron Carr Barton Broad, 4 (DS) and Belaugh Broad, 2 (RECD). *North:* Melton Constable, 8 (RPB-O); Holkham Park (Obelisk wood), 7; Gunton Park, 8 (*per* MJS); Wiveton Hall, 4 (CO) and Cley (The Hangs), one (WFB). Total 376 nests. None nested in Wretham Park (AEV).

36 Night Heron: Broads: An adult, Hoveton Great Broad, June 12th (CDJ). See *British Birds*, Vol. 53, pp. 159–160 regarding suspicion of night herons being escapes from Edinburgh Zoo. A colony established in Holland in 1946 may, however, be the source of the post-war records.

38 Bittern: North: One male booming at Selbrigg Pond. A new locality.

42 Spoonbill: Broads area: Breydon, singles on April 22nd 24th and June 4th; 2, June 25th (PRA) and one, Oct. 8th–Dec. 5th. Hickling, singles on May 30th and June 10th; 2, June 18th–25th. North coast: Cley, one, April 1st; one June 5th–12th when joined by a second bird, the 2 being last seen on 21st; one west July 31st and one, Oct. 16th. Holme, one, July 31st–Aug. 14th (CBC).

47 Garganey: First, Hardley, March 12th (MRR). A drake at Breydon, April 16th (PRA) and a pair on Sea Mere, May 13th (CG). Breeding season records from Cley (2 pairs), Horsey (one pair, May 14th), Cantley reservoir (2 pairs) and Hickling (4 pairs). Breck: 2 drakes, Thompson Water, May 28th (BSN).

49 Gadwall: Breck: Counts include 60 at Mickle Mere, Feb. 13th (CAEK); 30 at Thompson Water, April 10th (GMSE); 46 at Narford

Lake, Dec. 7th (DW) and 70–80 at Little Cressingham on 31st (GJ). Continues to increase in North/East Norfolk and breeding proved for first time at Hardley (MRR).

50 **Wigeon:** Fens: Ouse Washes, maximum of 5,000 in Welney area, Feb. 28th (CBC). Summer records include 4 at Hickling Broad, May 11th–20th with a drake till June 21st (GEB).

52 **Pintail:** East coast: Decreasing at Breydon and largest party was 27, March 13th (RHH). None bred there. Fens: Ouse Washes, maxima 1,200 in Welney area, Feb. 28th and 900, Pymore–Denver, Dec. 31st (CBC).

53 **Shoveler:** Largest numbers: Breck: 50 at Narford, Feb. 7th and Dec. 7th (DW). Broads: 50 at Hickling, March 26th (GEB). Fens: 250 on Denver Washes and 200 on Welney Washes, Dec. 31st (CBC).

54 **Red-crested Pochard:** North: The 1959 drake remained at Bayfield lake till Jan. 23rd. On Jan. 26th a drake was shot near Holt and has been preserved (RPB-O). See 1959 Report, p. 118 and *British Birds*, Vol. 52, pp. 42—56.

55 **Scaup:** Wash: Hunstanton, maximum of 50, Dec. 10th (CBC).

56 **Tufted Duck:** Breeding records only are given. Fens: 3 broods, Stow Bardolph (AEV). Breck: One brood, West Acre (DW); one brood, Didlington and 2 broods Cockley Cley (CRK); one brood Sturston Carr and 2 broods, Buckenham Tofts (GJ) and one brood, Thompson Water (AWK). North: One brood, Kelling Hall lake (RPB-O).

57 **Pochard:** Breck: Maximum of 50, Narford, Feb. 7th (DW). Only reported breeding at Rockland Broad where 2 pairs successful (JES, MJS).

58 **Ferruginous Duck:** One, Cawston Manor lakes, Feb. 17th–May 5th (CAW and other observers). See 1956–59 Reports.

60 **Golden-eye:** North coast: Maxima: Wells 40 on Feb. 17th; Burnham Overy, 50 on Feb. 24th (HH); Scolt, 46 on March 21st (RC) and a late duck there May 24th/25th. Breck: 2–3 at Narborough G.P. and Mickle Mere up to March 13th and from Nov. 6th. Wash: Hunstanton–Snettisham, maximum of 50, Feb. 28th. One with injured wing at Snettisham G.P. from Aug. 1st and one June 4th may have been same bird (CBC).

61 **Long-tailed Duck:** More than usual. East: One, Winterton, Nov. 7th (PRA). North: 1–5 at Titchwell, Brancaster, Wells, Blakeney and Cley up to Feb. 17th and from Oct. 10th, with 17 at

Gore Point, March 20th. Wash: Hunstanton–Snettisham, 18 winter records with maximum of 4 birds.

62 Velvet Scoter: East: Records include one dying at Yarmouth boating lake, March 13th (*per* RMB), and one, Breydon, July 24th (RHH). North coast: Recorded Jan.–April, Sept. and Nov. No party exceeded 12 in number except 50 at Wells, Feb. 17th and 30 there, March 18th (HH). Wash: Hunstanton–Heacham, recorded up to March 13th and from Oct. 22nd; over 50 and 100 on several occasions and 200, Jan. 17th (CBC).

64 Common Scoter: North/East coasts: No flock exceeded 300 Wash: 2,000 off Heacham, Jan.–March and during Dec. with maximum of 2,500 on Jan. 30th (CBC).

67 Eider-Duck: East coast: Yarmouth harbour entrance, 1–2, June 29th, Sept. 4th–Oct. 19th and Dec. 4th.

North coast: Brancaster–Thornham area: present all year, with 10–40 until Aug., when numbers reduced; 30 again by end Nov. and 17 during Dec. At Scolt, 4 considered flightless May 17th; 11 in a similar condition June 21st and 12 on 24th (RC, KGS). Up to 10 at Cley/Salthouse; 13 at Wells; 5 at Burnham Overy; 60 at Sheringham, Oct. 11th (PDK) and up to 50 at sea 5 miles off-shore at Wells and Burnham, July–Sept. (RPB-O).

Wash: Heacham/Hunstanton: over 300, Jan.–Feb. with 430 on Feb. 7th and still 200 on March 5th; 90 on Dec. 29th (CBC).

69 Red-breasted Merganser: East: A drake Yarmouth harbour, Dec. 10th (PRA, RWC) and 3 off Winterton next day (RCM). North: Late birds at Scolt, May 25th (one) and June 28th–July 2nd (2). Autumn records from Sept. 21st. No party exceeded 12. Wash: Hunstanton–Snettisham, 30–40 frequent in winter and maximum of 60, March 18th. A late bird at Snettisham G.P. June 12th (CBC). Fens: 2 on Ouse Washes at Welney, Dec. 31st (CBC).

70 Goosander: Recorded on coast at Cley, Wells, Holkham lake and Scolt and inland at Horsey Mere and Gunton Park up to May 1st and from Sept. 21st. No party exceeded 9. Breck: Thompson Water, 3 on Nov. 6th (CAEK); West Mere, Tottington, 2 on Dec. 27th (GJ); Narford lake, 17 on Feb. 7th; 22 on March 13th; 11 on Dec. 7th and 13 on 28th when 16 at nearby Narborough G.P. (DW, JSC). Fens: Welney Washes, maximum of 10, Feb. 28th (CBC).

71 Smew: North: A red-head, Jan. 5th–8th and a drake on 12th at Cley. Breck: One, Mickle Mere, Feb. 13th (CAEK). Fens: One, Welney Washes, Feb. 28th (CBC).

73 **Sheld-Duck:** Evening moult migrant records at Scolt: First signs June 19th when 3 flew N.W. 6 departed in a similar direction on 21st, 6 again on 25th and 3 on July 15th—possibly to a Wash assembly point. Real migration flights on July 7th—when flocks of 25, 31 and 21 heading east during evening (KGS).

76 **White-fronted Goose:** Breydon area: Late arrival and first party of 27, Jan. 15th, increasing to 100 by 22nd and then to a peak of 400 by the end of Jan. Last noted March 10th (RHH). North: Cley, an adult of the Greenland race, *flavirostris*, Nov. 8th–Dec. 4th.

77 **Lesser White-fronted Goose:** East: One in the Yare valley, with bean-geese, Feb. 4th, 7th and 13th (MJS). The fifth fully authenticated county record.

78 **Bean-Goose** (*A.a. arvensis*): East: Yare valley, 48 Jan. 9th increasing to 80 by Feb. 4th. This number remained till Feb. 13th, but none seen subsequently (MJS).

Pink-footed Goose (*A.a. brachyrhynchus*): Breydon area: 17, Jan. 24th; 39 very early arrivals, Aug. 18th; 27, Oct. 22nd–29th and 19, Dec. 18th–31st (RHH). North coast: 33, Stiffkey, Dec. 31st (HH). Wash: 1,200 off Wolferton, Jan. 24th and 300, Snettisham, Feb. 7th (CBC).

80 **Brent Goose:** North coast: Blakeney harbour, maximum of 7–800, Jan.–Feb. declining to 200 in March and last (12) on April 24th. 8, Sept. 2nd and 4 on 18th; 400 during Nov. and peak of 1,250 by end of year. Brancaster harbour, maximum of 400, Jan.–Feb.; 200 in March and last 2, April 11th. First return (30) on Nov. 7th, 300 by Nov. 30th and 550 by end Dec. Wells harbour, up to 160 in January, 300 on Feb. 1st declining to 180 by 17th and 30 on March 18th. 357, Dec. 22nd onwards (HH).

Wash: Hunstanton, maximum of 100, Feb. 27th and 60, Nov./Dec. (CBC).

85 **Whooper-Swan:** North: Cley, one, Jan. 6th joined by another next day; Blakeney, 2, Oct. 15th/17th (HH). Breck: West Mere Tottington, 2, Dec. 25th (GJ). Fens: Hilgay Washes, 2, Dec. 3rd; Welney, 2 on 31st; Wisbech S.F., 3, Jan. 10th (CBC). Wash: Heacham–Snettisham, maximum of 8, Jan. 10th (CBC).

Records received of herds of swans claimed as whoopers during the period Nov. 7th–9th have been withheld. In our view these birds were Bewick's travelling westward to the Washes. The first Bewick's reached the Ouse Washes Oct. 29th (CBC). Bewick's swan is now much more common than the whooper swan and there have been many cases of misidentification in recent years. The best identifying features of Bewick's are its relatively short, thick, neck

and its small head with short, shallow bill. The calls of Bewick's and whoopers vary and identification by voice alone is not recommended to inexperienced observers. See "Bewick's Swans in the British Isles in the Winters of 1954–55 and 1955–56" (*British Birds*, Vol. LII, pp. 393–416).

86 Bewick's Swan: North coast (Holme, Blakeney and Cley) and East coast (Breydon). Recorded up to March 25th and from Oct. 30th. Maxima: Cley, 62 arrived from the south and departed westwards, Nov. 8th; Breydon, 12 on March 19th (DVB), 9 on Nov. 8th, 15 on Dec. 11th (PRA) and 12th (RHH). Breck: Thompson Water, 7 on Jan. 17th (GJ). Also recorded inland at Sea Mere where 13, Jan. 24th (CG, MJS). Fens (Onse Washes): Welney–Denver, 77 on Feb. 21st and 44 on Dec. 31st. An injured bird summered (for the third year) at Welney Washes (CBC).

91 Buzzard: North: One, injured, at Castle Acre, July (HB). Singles at Brinton, March 20th (RPB-O) and Scolt, June 13th (KGS).

92 Rough-legged Buzzard: Unusual number towards end of year. East: 2, Somerton, Oct. 2nd (JES). One shot mid-Nov. "within 6 miles of Norwich" was examined by FEDD-B. North: Cley/Salt-

house, one, Oct. 19th, Nov. 20th, 27th and from Dec. 16th–31st. Kelling, one on several dates, Dec. 12th–31st (RPB-O, WFB). Holme, one, Oct. 18th (AJH). Wash: Hunstanton, one over the golf course, Oct. 16th (CBC).

93 Sparrow-Hawk: Practically non-existent in many areas. Keeper's "gallows" watched regularly in north Norfolk by RPB-O have shown none for a long time.

95 Kite: North: Cley, one, April 8th (WFB).

98 Honey-Buzzard: North: An immature found trapped at Gresham had to be destroyed, Sept. 17th. Skin preserved at Norwich Castle Museum. A much darker bird on several occasions between Sept. 20th–Oct. 28th at Selbrigg. Watched on Oct. 1st,

digging out a wasps' nest (RPB-O). Holkham, one in from the sea, Sept. 19th (RJJ).

99 Marsh-Harrier: Broads: No successful nests. Many records for coastal marshes, between Thornham and Cley, Feb.–May and Aug.–Oct. including 3 at Cley, May 21st.

100 Hen-Harrier: North coast: Scolt, pair, Jan.–March with the female till April 22nd and one, Oct. 2nd–31st. Cley/Blakeney/Morston, singly on many dates, Jan. 24th–April 21st with one north out to sea May 2nd; singly Oct. 19th, Nov. 12th and 14th. Otherwise only recorded on Wash at Snettisham (Feb. 14th–CBC) and at Hickling Broad (Oct. 26th).

102 Montagu's Harrier: None bred. Singly on 9 dates on North coast at Scolt, Morston, Blakeney, Cley and Kelling and inland at Haddiscoe and at the 1957–58 Breck breeding site between April 29th and Sept. 9th. Wash: One, Terrington, Aug. 5th (CBC).

103 Osprey: Broads area: Hardley, one on April 23rd (MRR). Aylsham–Cawston area, one, Sept. 17th to mid-Oct. (FBE).

104 Hobby: North: Singly at Blakeney, May 6th and July 1st (HH), at Cley, Aug. 11th and at Holme, Sept. 16th (CBC). Broads: One at Rockland, May 13th (PDK, PAGR). Breck: Singly at Thompson Water May 28th (BSN) and at Narborough, Aug. 16th (CRK). Also inland near Reepham where one found dead June 15th (*per* EGH) and skin in Norwich Castle Museum.

105 Peregrine Falcon: Coastal records from Hunstanton, Holme, Scolt, Blakeney and Cley; in the Breck at Stanford and on the Ouse Washes at Denver.

107 Merlin: Coastal records from Sandringham, Scolt, Cley, Blakeney, Horsey and Winterton.

108 Red-footed Falcon: North: Cley, a female eastward May 13th (RAR, AJ, GT, RC).

117 Quail: A dead female Brancaster Staithe, May 15th (RC) is now in Bolton Museum. Calling at Binham, May 17th and June 13th (RS) and July 1st (HH); 2, Happisburgh, June 15th–25th (GWC); heard at Haveringland, May 20th (RPB-O); 2 calling in separate localities at West Barsham, Aug. 5th (JSA) and one calling at Ditchingham on same date (MS).

119 Crane: North: 2 at Brancaster, April 28th/29th (RC, RAR). East: One at Breydon, May 4th and 8th (RHH).

121 Spotted Crake: North: One, Blakeney, Aug. 19th (HH).

124 Little Crake: North: The 1959 Brinton bird observed Jan. 6th, 8th and 13th (RPB-O). See 1959 Report, p. 121.

131 Oystercatcher: Breeding records: North: 10 nests Cley area, 78 at Blakeney Point, and 16 on south side of harbour, 7 at Stiffkey, 7 at Wells, 2 at Burnham Overy and 90 at Scolt. East: Single nests at Breydon and on arable land at Runham.

Large numbers: North: Thornham high tide roost, 3,500 on Oct. 26th; Holme, 3,500 on Aug. 10th, 4–5,000 on Sept. 7th and Nov. 20th. Wash: Snettisham low tide counts include 3,000 on Oct. 16th and Dec. 27th; Hunstanton, 5,500 on Nov. 19th (CBC).

134 Ringed Plover: Broads: A pair bred at Hickling—a new site. Wash: Records seldom exceeded 50 but increase towards end of Aug., with 600 at Terrington on 23rd and 200 at Snettisham on 28th (CBC).

135 Little Ringed Plover: Fen borders: 2 pairs, with 3 young, at one site between July 20th and Aug. 3rd. First county breeding record.

Fens: Wisbech S.F. maximum was 2, Aug. 23rd and 29th (CBC). North: Singly at Blakeney, Sept. 23rd and at Stiffkey, Oct. 3rd (HH). East: One, Cantley reservoir, Aug. 10th (MJS).

136 Kentish Plover: North: Cley, singly on May 1st and June 5th. Fens: One on Cambs/Norfolk boundary, April 18th (CBC).

139 Grey Plover: Wash: Nene–Ouse mouth, 800 on May 10th and 400 on Aug. 7th (CBC). Autumn maxima: North: 80 at Blakeney, Sept. 16th–27th and 90 at Stiffkey, Oct. 3rd (HH). East: 70 at Breydon, Oct. 1st (PRA).

140 Golden Plover: The larger flocks include: 300, Holme, March 20th (CG); 300, Beeston, Jan. 6th–20th (WGB); 220, Hingham, Nov. 11th (ALB); 2,000, Cawston, Nov. 30th (*per* WFB) and flocks of 300 and 500 at Horsey, Dec. 10th (GC).

142 Dotterel: North: Cley, one, May 7th (WFB); an adult and a juvenile, Aug. 31st–Sept. 7th (CO); one, Sept. 21st (AHD).

143 Turnstone: Larger numbers: North: 80 at Wells, Feb. 17th and 80 at Blakeney, May 10th. Wash (E. side) 150, March 12th and Oct. 16th (CBC).

147 Jack Snipe: Autumn arrival from Sept. 15th at Cley where marked arrival 28th/29th. First at Winterton, Sept. 28th (JLFP).

151 Whimbrel: North/East coasts: Spring passage from April 3rd (RHH) and autumn return from July 9th. Heaviest passage during Aug. when 110–120 at Scolt on 4th (RC) and 100 at Blakeney next day (HH) and 100 west at Cley on 21st. Last, one at Blakeney, Oct. 23rd (LL-E). Wash: Nene-Ouse mouth, maximum of 200, May 9th and 150, Aug. 26th (CBC).

154 Black-tailed Godwit: Records from usual North coast, Broads localities and Breydon between March 6th and Oct. 19th. Largest parties: 16 at Stiffkey, May 16th (HH); 8–12 at Hickling, Aug. 28th–30th (EP) and up to 17 at Breydon, Aug. 11th–Sept. 1st. Wash: Winter records from Wootton (15, Jan. 16th) and Lynn Channel (one, Feb. 28th–CBC). Fens: Up to 13 in autumn at Wisbech S.F. (CBC).

155 Bar-tailed Godwit: East/North coasts: Spring records at Breydon include 22, April 24th (GRS) and 24, May 4th (RHH). Heavy westward passage at end of Aug. when 100 at Cley on 31st. At Scolt over 1,300 westward Aug. 30th–Sept. 1st (RC). Wash: Hunstanton, maximum flying out at high tide 906 on Feb. 27th. Snettisham, 1,000 on Jan. 10th (CBC).

156 Green Sandpiper: Recorded all months except Jan. Winter records from Wells, Gooderstone, Southburgh, Cranworth, West Acre, Helhoughton, Hunworth and Breydon.

157 Wood-Sandpiper: North (Holme–Cley) and East (Horsey, Hickling, Breydon and Cantley): Spring passage of 1–3 between May 4th and June 10th. Autumn return from July 23rd till Sept. 24th. Maxima: 4, Cantley, Aug. 24th–29th; 7 at Cley, Aug. 27th and 10 there Sept. 17th. Fens: Wisbech S.F., maximum of 10, Sept. 4th (CBC).

162 Spotted Redshank: North coast (Holme–Cley), spring passage of singles March 16th–June 7th. In autumn, 1–4 on many dates Aug. 6th—Oct. 3rd with 5 at Cley, Sept. 23rd and odd birds until Nov. 28th. Broads: Horsey, one, Aug. 28th (GC). Hickling, 1–3, May 7th to June 9th and 1–2, Aug. 29th to Sept. 7th (EP, GB). East coast: Breydon, one, Jan. 13th (GRS), singly on 7 dates, Sept. 6th–Dec. 17th with 6 on Oct. 1st (PRA). Wash: Winter records include singles at Snettisham, Dec. 4th and at Hunstanton on 29th (CBC). Fens: Wisbech S.F., maximum of 20, Sept. 26th (CBC).

165 Greenshank: Spring passage from April 14th (maximum 6 at Breydon on May 12th). Main autumn return throughout Aug./Sept. with maxima of 14 at Cley, Aug. 10th; 15–20 at Holme, Aug. 10th–28th (CBC) and 20 at Blakeney, Sept. 5th (HH). Late birds through Oct. and until Nov. 19th.

169 Knot: Wash/North coast: Flock roosting at Thornham at high tides and feeding at Snettisham estimated at 27,000–35,000 on several occasions, Oct. 31st–Nov. 20th (CBC).

170 Purple Sandpiper: North coast (Thornham–Cley): Records of 1–6 birds in all months except Jan., May–July and Oct. Wash: Hunstanton, recorded up to April 3rd and in Nov./Dec. with maximum of 7 on Feb. 28th (CBC). East coast: Yarmouth harbour, one filmed Sept. 27th (RWA).

171 Little Stint: North coast: Spring passage at Cley and Salthouse: 1–3, May 11th–26th, 6 on June 4th when displaying and singing, decreasing to 3 on 6th, singly 19th and 27th. Autumn passage Aug. 14th–Oct. 23rd with following peaks at Cley: 35 on Sept. 3rd; 24 on 16th; 50–60 on 21st and over 100 from 22nd till end of month. At Holme, peak of 22, Sept. 18th and at Wells, 25 on 25th (NA, HPC). East: Breydon, one May 10th (MJS) and in autumn 1–5 from Sept. 1st–Oct. 16th (PRA). Cantley, 3 on Sept. 6th (MJS). Broads: Hickling, 3, June 26th; singly on Aug. 3rd, 4th and 15th with 6 on Sept. 27th. Fens: Wisbech S.F. maximum of 14, Sept. 18th (CBC).

173 Temminck's Stint: Broads: Hickling, one, May 30th (EP). North: Cley, one, Sept. 7th (WFB).

176 Pectoral Sandpiper: North coast: Cley, one on Aug. 28th (RAR) and Sept. 15th–22nd was joined by a second bird for the last four days of its stay. One again at Cley, Oct. 2nd–8th (WFB, AHD). Fens: Wisbech S.F.: one, Sept. 17th–18th (CBC).

179 Curlew-Sandpiper: North/East coasts: Spring: Singly at Breydon, April 25th (PAGR) and at Cley, May 1st and June 5th. Autumn passage Aug. 5th–Oct. 5th when peaks of 22, Aug. 16th and 10, Sept. 15th at Cley; up to 4 at Holme, up to 2 at Breydon and singly at Cantley. Fens: Wisbech S.F., maximum of 12, Sept. 17th (CBC).

181 Sanderling: North coast: Largest flocks reported at Holme and Thornham where 300 on Oct. 9th (CBC); and at Scolt where 200 on May 11th/13th, 250 on 16th and 150, Dec. 19th (RC, KGS).

184 Ruff: North coast (Holme–Salthouse), Hickling Broad and East coast (Breydon and Cantley): Winter records from Wells where 2, Jan. 25th (HH) and Cley where one throughout Jan./Feb. Spring passage from early March with maxima of 9–10 at Hickling, May 9th/10th and 11 at Cley (including 3 males in breeding plumage), May 10th. Autumn: First peak end Aug. when maxima of 36 at Hickling (Aug. 30th) and 15 at Cley (Sept. 1st). Heavy movement began at Cley, Sept. 19th reaching 100 on 21st and 150 from

22nd till end of month; still 24 on Oct. 2nd. This movement coincided with similar arrival of little stints and were doubtless Arctic birds. Fens: Wisbech S.F., maximum of 90, Oct. 16th (CBC).

185 Avocet: North coast: Blakeney, one, March 19th (CO) and 2, Sept. 27th (HH). Weybourne, one, April 3rd. Cley, 2, April 6th; one from 16th–20th; 2, May 6th; one, July 9th/10th and a late bird, Dec. 1st–10th.

187 Grey Phalarope: North: Singly at Brancaster, Sept. 16th and 21st (RC); at Holme, Nov. 6th (CBC) and at Sheringham, Dec. 4th (EMCE). Broads: Hickling, one, Oct. 11th–20th (EP, GEB).

189 Stone-Curlew: Breck: Largest autumn gathering 13 at Weeting, Aug. 7th (CNA, HPC). North: High proportion of nests on arable land are destroyed and birds forced to desert by agricultural processes: 2 nests, South Creake (sugar-beet singling); one, Barningham (spraying) and 2 Langham and Cockthorpe (rolling). Most nest again hence tendency for birds of the farm-lands to stay late–several early Oct. this year (RPB-O).

193 Arctic Skua: North/East coasts: One at Cley, Jan. 6th/7th. Autumn passage from last week July till Oct. 26th with stragglers till Nov. 6th. Maximum, 35 off Cley, Sept. 6th.

194 Great Skua: North coast (Holme–Cley): Autumn passage of 1–3 birds, Aug. 26th–Oct. 17th. Late birds at Holme Nov. 6th (2) and 27th (12–CBC).

195 Pomatorhine Skua: North coast: Cley, singly on 7 dates, Aug. 24th–Oct. 7th. Weybourne, one, Aug. 28th (HR).

196 Long-tailed Skua: North coast: Cley, singly on Sept. 3rd, 5th, 6th, 9th and 17th.

198 Greater Black-backed Gull: Largest numbers: East: 780 at Breydon, Nov. 8th (PRA). North: 700 at Stiffkey, Oct. 10th (HH).

199 Lesser Black-backed Gull: North: Cley, 100 moving west, Jan. 4th (RAR). An unusual winter number.

200 Herring-Gull: North: Blakeney Point, an adult of the Siberian race *heuglini*, Jan. 4th (MFMM).

202 Glaucous Gull: North coast (Scolt–Cley): 8 records of singles up to March 14th and from Oct. 24th.

205 Mediterranean Black-headed Gull: North: A first winter bird at Salthouse, Sept. 18th (DKB, ICTN). East: A second year bird, Winterton, Sept. 24th (MJS, SFS), 25th (PDK), 26th (GRS) and again on Oct. 9th (MJS).

207 Little Gull: North coast (Holme–Cley): 2, Feb. 10th; singly May 11th–14th; 2–3, June 4th and 2 on 16th; 1–2 on 14 dates between Aug. 21st and Sept. 20th; 1–2 on 4 dates Oct. 10th–30th and one, Dec. 22nd. East: Yarmouth, one dying, Dec. 10th (PRA, RWC).

208 Black-headed Gull: Number of *pairs* at breeding localities: North: Scolt, 30 but no young reared (RC); Burnham Overy, 15; Stiffkey, 63 and Morston–Blakeney saltings, 180 (HH). Broads area: Alderfen, 226 (ETD, MJS), Surlingham, 15 (EAE). Inland: Scoulton Mere, 200 (GJ). Fens: Wissington B.F., 400 (CBC).

209 Sabine's Gull: North: Cley, one, Aug. 3rd (RGH).

211 Kittiwake: North/East coasts: Summer counts: Scroby, 150 on July 23rd (RHH). Scolt, 60, July 18th; 80, 21st; 100, 24th and 74 on 28th (RC, KGS).

212 Black Tern: First spring birds May 7th and an exceptional eastward passage between then and May 14th. The following selected records are for this period: Breydon: 6 flights totalling 67 during eve of 12th (MJS). Hickling Broad: 10 on 8th, 30 on 9th and 22 on 10th whilst on 12th/13th frequent parties of 15–20 moving east and at least 100 passed on each of these days; by the late eve of 13th, 200 had collected (GEB, EP). Rockland Broad: 30 on 9th, 20 on 10th, 12 on 11th, 20 on 13th and 17 on 14th (MJS, PDK). Stourton Water, Cawston: 80 on 14th and same day 35 over farm pond at Holt and up to 70 over artificial lakes at Edgefield (RPB-O). Cley: 3 on 8th, 50 on 9th, 162 on 10th, 100 on 11th, 372 on 12th, 30 on 13th and 12 on 14th (CO). Scolt: 22 on 9th and 12 on 12th (RC).

Autumn passage began July 24th, but apart from 27 at Cley on Aug. 28th, no party exceeded 17. Last, Cley, Oct. 9th.

213 White-winged Black Tern: North: Edgefield lake, one with black terns May 14th. Photographed by RPB-O and although not suitable for reproduction they readily confirm identification.

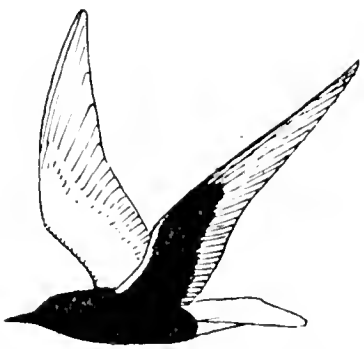
217 Common Tern: First, Cley, April 10th. Last (Common/Arctic) at Holme, Nov. 6th (CBC) and at Blakeney, Nov. 7th, 11th (PNK) and 16th (HH). Breeding records include: North: Scolt, 520 nests and Blakeney Point, 918 nests. East: Scroby Sands, 270 nests. Broads: Ranworth, 9 pairs summered, 5 nests with eggs and 4 young, June 22nd; Hickling and Ormesby, 3 nests each. At Surlingham Broad, 3 pairs summered.

Late summer build-up noted at Scolt during second half July with maximum of 3,000 on 18th (RC) and at Holme where 2,000, Aug. 12th and 2,500 on 28th (CBC).

218 Arctic Tern: North coast: Recorded from April 29th. One pair nested, unsuccessfully, at Scolt.

219 Roseate Tern: North (Scolt–Blakeney): 1–2 on several dates, May 14th–Aug. 29th. None known to have bred.

222 Little Tern: Recorded April 15th–Sept. 26th. Breeding records of *pairs* include: North: Hunstanton–Holme, 13 (CBC); Scolt, 12; Burnham Overy, 4; Wells, 2; Stiffkey, 5; Blakeney Point, 97 and 10 on south side of harbour. East: Up to 50 pairs along 4–5 miles of shore between Hemsby and Horsey, May 28th (GRS), but comparatively few breeding successes.



White-winged Black Tern

223 Sandwich Tern: Recorded March 27th–Oct. 31st when 2 at Holme (CBC). Breeding records: Scolt, 2 nests; near Wells, 3–400 pairs and Scroby Sands, 327 pairs. Few young reared. Spring peak at Cley was 500 on May 1st prior to departure to breeding grounds. Influx of 450 including 40–50 juveniles at Scolt end July (RC).

226 Little Auk: Wash: Snettisham G.P., one caught, Jan. 17th (CBC). North coast: Cley, 2 west, Nov. 6th. 3 picked up dead inland after gales, Dec. 4th: at Bale, Snoring and Swaffham (RPB-O). East: Waxham, one, Oct. 18th (JLFP, REP) and parties totalling 40 off Winterton, Nov. 7th (PRA).

229 Black Guillemot: North: Wells harbour, one Dec. 31st, 1959, and Jan. 1st (HR). Cley, one, Jan. 5th. East: Winterton, one exhausted July 16th (DELH, JES) died 2 days later. It had been ringed as young in Sweden June 22nd.

230 Puffin: East: One dying, Gorleston beach, Jan. 11th (*per* MJS). North: Singles at Cley, Jan. 6th and at Blakeney and Burnham Overy, Aug. 31st (HH, MEY).

234 Wood-Pigeon: East: Yarmouth, large flock coming in from sea at dawn Nov. 18th and another flock of 4–500 observed from a fishing boat a mile off-shore there on 26th (RHH). Over 5,000 nests

claimed as destroyed by North Walsham & District Rabbit Clearance Society in an area of 20,000 acres.

Collared Dove (*Streptopelia decaocto*): Breeding season distribution: North: Gunton, 2–8 with turtle-doves at duck farm June 14th–July 28th (EAS). Cromer, at least 6 pairs bred prolifically. Overstrand (originally Site A), one May 6th (TMC). Cley, one July 19th–28th (RAR). Aylmerton, one pair end of June. East: Yarmouth, single pairs bred successfully at 2 sites. West: Hunstanton, one pair bred successfully.

Other interesting records: 2 very tired birds in pines, Blakeney Point, May 4th (PG); 3, Burnham Market, Sept. 3rd (AM); 18 together, East Runton, Sept. 15th (KMN); up to 8, Overstrand, Oct.–Nov. (IFK) when one at Caister (WJW) and 2 Brancaster (RC).

237 **Cuckoo:** A very late juvenile at Haddiscoe, Nov. 14th–17th (RWC).

246 **Little Owl:** Blakeney Point, one, Oct. 6th.

248 **Long-eared Owl:** Only one breeding record received: at least one pair nested successfully Salthouse Heath. Fens: Dead bird at Welney in spring (CBC). 1–2 in *Suaeda* bushes, Blakeney Point, Oct. 16th.

249 **Short-eared Owl:** North/East coasts: Records each month, up to 4 together, but no breeding records.

255 **Swift:** First in spring at Breydon, April 23rd (RHH) and at Breydon, Cley and Blakeney on 25th. Ten records during second half of Sept. and following relate to very late birds in Oct.: Wells on 20th and 26th; Cley on 3rd and 27th; Blakeney Point on 3rd; Scolt on 6th and Wisbech S.F. on 1st (CBC).

256 **Alpine Swift:** East: Breydon, one, May 12th (MJS). Tenth county record.

259 **Bee-eater:** North: Cley, one westward April 21st (RAR) and 2 at Blakeney later same day (WFB, DMM) which remained till 26th, with a single bird on May 2nd (HH).

260 **Roller:** East: One, Acle New Road marshes near "Stracey Arms," June 4th (RHH). First county record since 1938.

261 **Hoopoe:** East: Singly at Horsey, May 10th–12th (AB, GC); at How Hill, Ludham, on 11th (MRB); at Glandford on 19th (RH); and at Sea Palling, June 4th (*per* EP). North Singles at: Thornham, April 25th–27th (RC); Bircham, May 14th–19th (RC) and at Burnham Deepdale on 15th (RC, KGS); Brinton, Aug. 21st–23rd (*per* MS).

265 Wryneck: North: Burnham marshes, one, Sept. 2nd (RPB-O) and Blakeney Point, singly on 5th and 16th. One calling at Bawdeswell April 4th–7th (Q. E. GURNEY *per* RPB-O).

273 Shore-Lark: North coast: Recorded at usual localities between Scolt and Salthouse up to April 22nd (maximum 24 at Cley, Feb. 22nd) and from Oct. 2nd (maxima 14 at Cley and 19 at Scolt end Dec.).

274 Swallow: Twelve Nov. records with latest at Holkham on 13th and at Blakeney on 16th. Also one at Gorleston, Dec. 2nd (PRA).

276 House-Martin: Twelve Nov. records and following relate to Dec.: Cromer on 1st (CDR) and 2nd (SW), California and Hingham on 2nd (RWA, ALB), Thorpe on 4th (AGH), Wymondham College on 5th (MG, PRB) and Horsey on 8th (AB).

277 Sand-Martin: Exceptionally late: 2, Cromer cliffs, Dec. 1st (RPB-O) and one at Happisburgh till Dec. 25th (MNM).

281 Hooded Crow: Scarce in North coast areas particularly at end of year when increase noted on East coast and 80 at Caister, Dec. 1st–5th (PJLH). Breck: 14 at Bodney, March 17th (GJ) is only record.

294 Long-tailed Tit: North: Unusual numbers on coast, particularly in Oct. On 16th, flocks common between Thornham and Heacham and next day 7 at Blakeney Point. Several "retraps" at Cley of ringed birds proved that 3–4 parties were involved in what appeared to be a limited circulation through the Cley district. Wash: 2 flocks flew out from Snettisham high over the sea, Oct. 13th (CBC).

295 Bearded Tit: Broads area: Breeding records from Hickling/Heigham Sounds/Horsey area (at least 85 pairs), Barton (3 pairs) and Waveney valley (at least 2 pairs). Wintering birds still present at Rockland, March 20th, Ormesby, April 18th and Surlingham on 22nd.

North: Cley, 25 breeding pairs. At Titchwell, 20–25, Feb. 21st (CG). At Thornham, one seen and others heard Jan. 2nd and recorded again from Oct. 9th when 20. 6–10 moved to Holme Broadwater by 16th, 12 by 22nd and 1–4 by end of year (RC, CBC). At Brancaster, 4–8 between Nov. 14th and 28th (RC). At Burnham Overy 2 on Sept. 24th (HH). At Selbrigg/Hempstead Pond, parties up to 8, late Nov. and Dec. (RPB-O).

Wash: Snettisham G.P. one, Oct. 30th (CBC).

302 Fieldfare: Still 100 at Marham, April 20th (DW) and single stragglers at Scolt (KGS) and Cley May 13th and at Holme on 15th (CBC). First in autumn one at Holme, Sept. 16th (CBC).

304 Redwing: Autumn: an early one, Blakeney Point, Sept. 1st. Main arrival (North/East coasts) began Sept. 28th. Second wave from Oct. 16th and by end of month, and in Nov., very large numbers in Breck. At Cranworth, 3–5,000 roosting in one wood (ALB).

307 Ring-Ouzel: North coast (Scolt, Wells, Blakeney, Cley, Salthouse and Cromer): Spring passage, March 13th–May 20th with maximum of 6, Salthouse Heath May 20th. In autumn, recorded Sept. 19th–Nov. 1st with maximum of 9 at Cley, Sept. 29th. Fens: Wisbech S.F. one, Oct. 1st (CBC).

311 Wheatear: Late autumn birds include 3 at Weybourne, Oct. 28th and singles at Holme on 29th, at Hunstanton, Nov. 6th and again at Holme on Nov. 20th. Also at Breydon, Nov. 3rd–5th and on 20th.

317 Stonechat: Autumn/winter records of 1–5 birds along North coast (at 6 localities) and on East coast at Horsey, Winterton, Gorleston and Haddiscoe. Maximum 7 at Winterton, Oct. 2nd (JLFP). Fens: Denver, one, Dec. 25th (CBC).

One pair bred successfully at Horsey. Another pair summered at Hemsby (DELH, JES), but no proof of breeding.

320 Redstart: North: Pairs during June at West Runton, High Kelling, Bayfield, Glandford, Letheringsett (HH) and Weybourne (RAR). Breck: Bred at Merton, Little Cressingham, Stanford and West Tofts (GJ, CRK).

321 Black Redstart: Norwich: First noted May 10th in St. Andrew's Church area and a nest, with 6 eggs, found June 6th. No young reared. The presence of a second pair suspected (EWM and other observers). Birds remained in area till Oct. 22nd (ETD). Another pair arrived in the city centre June 15th and quickly began nest building. No eggs laid although male stayed till 21st (MJS). Yarmouth: 2 males singing May 4th–18th (RHH) and a pair reported to have reared 4 young (*per* RWC).

Migration: North coast: (Hunstanton–Salthouse), 1–3 birds at usual sites April 1st–May 23rd (when 3, Blakeney Point) and from Sept. 7th–Nov. 16th (with maximum of 3 Blakeney Point, Sept. 24th). Elsewhere, singles at Rackheath, March 26th (PADH), at Horsey on 28th (GC), at Marham, Oct. 29th (DW) and at Briston, Nov. 1st.

322 **Nightingale:** Spring arrival from April 10th (CO).

324 **Bluethroat:** North: Scolt, one, Oct. 6th (RC). Cley/Blakeney Point, 1–2, Sept. 16th–22nd with 8 on 20th and 1–2 on 29th (3 ringed). East: Winterton, one, Sept. 23rd (JLFP).

333 **Reed-Warbler:** An early bird at Cley, April 17th. Last, Oct. 23rd:

340 **Icterine Warbler:** North: Scolt, a male singing, May 20th (RAR, RC) was ringed; Blakeney Point, a first-winter bird Aug. 6th/7th (PW, CO) was ringed; Holme, one, Sept. 11th (CBC); Cley, a first winter bird on 12th (DW, LM, RAR) and Holkham, one on 23rd (RJJ).

344 **Barred Warbler:** North: Holkham dunes, one Aug. 2nd and Burnham Overy, 2 on 15th, RPB-O). Blakeney Point, singles, Sept. 2nd–4th (ringed–CO), 6th and 13th (CO) and 18th (HH). Cley, one, Sept. 25th–29th (ringed–CO). All juvenile birds.

351 **Subalpine Warbler:** North: Blakeney Point, a first summer male ringed May 22nd (CO). Third county record.

356 **Chiffchaff:** Early spring records include 2–3 at Cley throughout March from 2nd (CO) and one at Westwick on 13th. October records include Thornham and Cromer on 16th and Blakeney on 17th and 30th.

357 **Wood-Warbler:** North: Breeding season records: West Runton woods, 4 pairs; Upper Sheringham woods, 2 pairs; Glandford woods, one singing; Hempstead woods, 2 singing and High Kelling, 2 (HH).

365 **Firecrest:** North: Blakeney Point, singly on April 19th (DAW) and Sept. 24th (BLS). Blakeney, one, Sept. 27th (HH). East: Ludham, one, Oct. 17th (JLFP, REP).

366 **Spotted Flycatcher:** North: A late bird at Holme, Oct. 23rd (CBC).

368 **Pied Flycatcher:** North/East coasts: Spring: Singly inland at Corpusty April 22nd (JML) and at Cawston, May 4th–8th (CAW); 10 at Horsey on 10th (GC); 3 at Cley, on 12th and singles there 14th, 20th/21st (CO) also one at Scolt on 20th (KGS). One at Blakeney, May 12th and 2 there on 31st (HH).

Autumn peaks: 15 at Cley, Sept 9th (CO) and 15–20 at Holme on 16th (CBC).

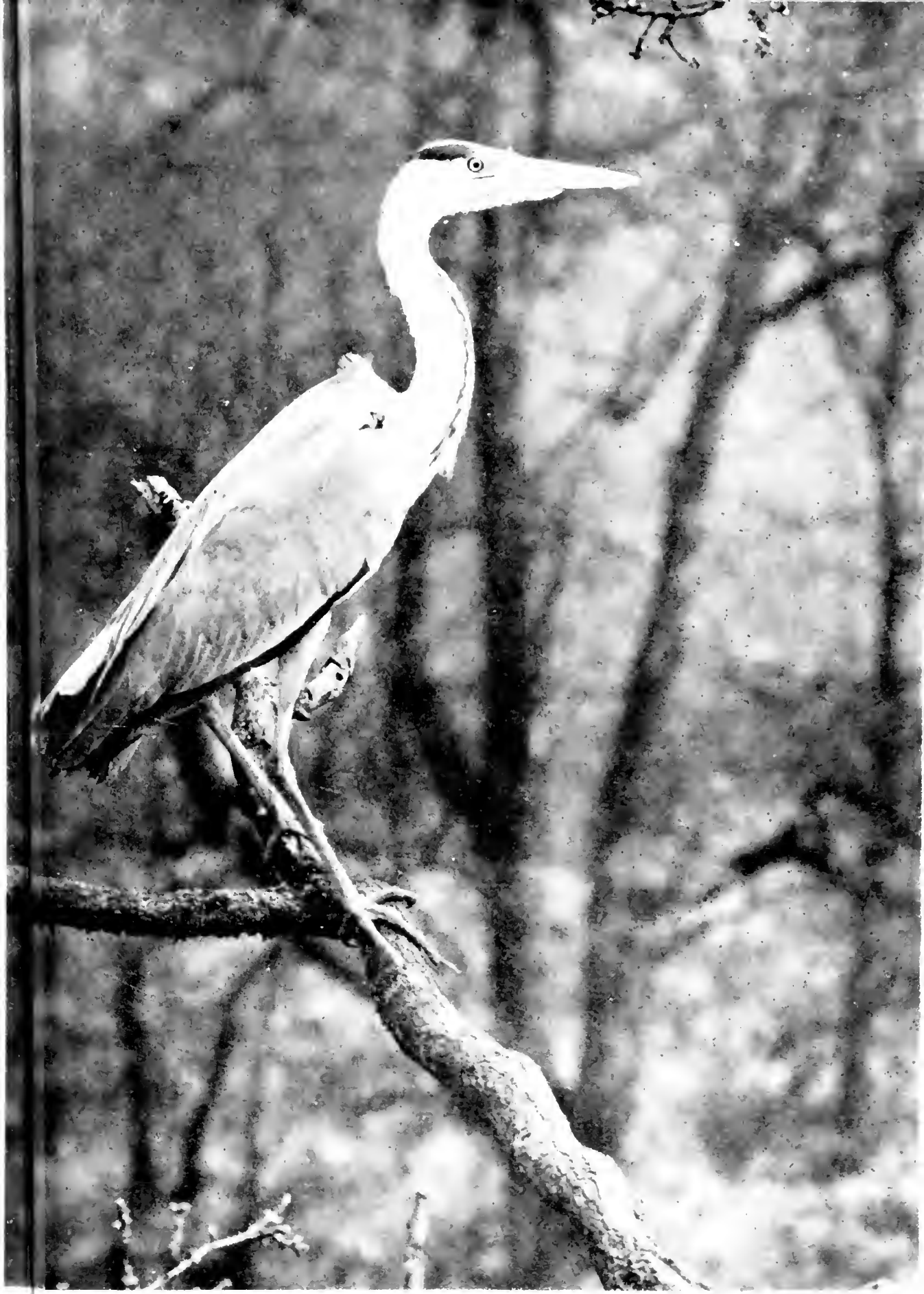


PLATE 5

Twenty-five heronries were discovered in the counties of Worcester, Gloucester and Hereford. The largest heronries are at Ishington, Beckenham and Ramsbury. The average size of the heronries is about one hundred and eighty nests, including the eighty-four nests at Ishington.

In the winters between 1956–57 and 1959–60 there were four successive invasions of waxwings to Norfolk, a series unprecedented since records have been kept. These studies of Waxwings in north Norfolk indicate their main foods, guelder rose berries, apples and *Cotoneaster* berries. The apple (in the upper right plate) was $2\frac{1}{2}$ inches in diameter and was eaten in four short visits. Another waxwing ate some 300 *Cotoneaster* berries (roughly the equivalent of its own weight) in $2\frac{1}{2}$ hours (*photos:* R. P. Bagnall-Oakeley).

370 **Red-breasted Flycatcher:** North: Blakeney, one, Sept. 18th (HH). Blakeney Point, a first winter bird ringed Sept. 27th and a second bird there, Oct. 1st.

374 **Richard's Pipit:** North: Cley, one on Sept. 19th (RAR). Observer familiar with species.

375 **Tawny Pipit:** North: Salthouse, one, May 15th–18th (CBC and many others). Gore Point, one, Sept. 25th/26th (CBC).

379 **Water-Pipit** (*A.s. spinoletta*): North: Cley, the Dec. 1959 bird proved to be a male and was joined by a female in Feb. Both assumed full summer plumage before departing April 3rd. One reappeared in the identical place, Dec. 25th (CO). Blakeney, one, Jan. 20th–March 30th, when in summer plumage (HH).

381 **Grey Wagtail:** Breeding season records: East Bilney, one nest (JHS); Hilborough Mill and Narborough Mill, single pairs but no nests (DW); Horning Lock, one nest (CA); Brinton, Letheringsett and River Bure above Corpusty—single nests at each locality (RPB-O). Usual winter records.

382 **Blue-headed Wagtail** (*M.f. flava*): North: Pair, Salthouse marshes, June 27th and July 12th (HH). Fens: Welney, a male, July 8th (CBC).

383 **Waxwing:** East: One dead, Caister, Feb. 18th (HD). North: Hempstead, one, Jan. 29th (HH), Cley, one, Sept. 27th and Oct. 22nd with 2 there, Nov. 20th and later at Wiveton where 6 Dec. 1st—11th, 4 from 12th–23rd and one till end of year. Holt, one, Nov. 27th and Thornage, 4 on 29th (RPB-O). Blakeney, 2, Dec. 29th–31st (HH).

384 **Great Grey Shrike:** Singles as follows: East: Waxham, Oct. 18th and 27th (JLFP) and at Horsey (probably same bird) on 31st (GC). North: Blakeney/Morston, Jan. 20th–Feb. 15th (HH). Salthouse Heath, Feb. 4th. Blakeney Point, Oct. 1st/2nd and Cley on 15th. Salthouse Heath, Dec. 29th–31st. Holme, 2–3, Oct. 2nd and one, 30th–31st (CBC). Holkham Meals, Oct. 24th (LL-E) and Brancaster Common, Dec. 17th (RC). West: Necton–Little Dunham Road, Nov. 1st (WGB).

385 **Lesser Grey Shrike:** North: Salthouse Heath, one, May 15th/16th (ECJS). A convincing verbal description, stressing the conclusive point of the black forehead, given to RAR at the time.

386 **Woodchat-Shrike:** Unusual number in May on North coast: Salthouse Heath, one, 16th/17th (ECJS, DMB and others); Blakeney Point, one, 20th–22nd (ECJS, CO); Thornham, one, 26th (CBC) and Cley, one, 26th (CO–ringed).

388 Red-backed Shrike: Spring arrival from May 5th. Breeding season distribution: Wash: Hunstanton, 2 pairs (CBC). North coast: total of 11–12 pairs at 7 localities. Breck: only one pair reported (GPD). Broads: One pair (*per* EP). Central: 2 pairs bred at usual site near Norwich (RJ).

391 Hawfinch: North: Records from Hempstead, Wiveton, Cley, Blakeney, West Runton, High Kelling, Holkham Park (where 12, Jan. 2nd–RP), Brinton, Holt and Weybourne. West: Gooderstone. Breck: Merton (one pair bred). Central: Norwich (Newmarket Road).

394 Siskin: A remarkable year with records from 54 localities up to April 24th and from Sept. 19th. The largest flocks only are given: North: 300 at Kelling, Sept. 22nd. East: 350, Winterton Decoy wood, Sept. 23rd (JLFP). Breck: 30, Watton, Jan. 10th and 60, Saham, Feb. 21st (GJ); Narford, 30, Oct. 2nd and 30–40 on 16th (GMSE, AEV). Central: Flocks of 30–40 totalling well over 100 birds at Runhall, Coston, Thuxton, Hardingham and Reymerston area during Feb. (EQB).

396 Twite: North coast: Autumn records from Oct. 9th. Maxima (Oct.), 50 at Blakeney; 200 at Thornham and 200 at Holme (CBC). East coast: Breydon, up to 30 from Oct. 16th.

401 Bullfinch: Continues to increase in many localities. Parties of 25 at Salthouse Heath (EF) and at Selbrigg and 15 at Holt (RPB-O).

404 Crossbill: North: 5–6 pairs bred in Kelling area (RPB-O). Breck: Records from 5 localities. Wash: Wolferton, 3, Jan. 10th and 4, June 26th (CBC). Central: One over centre of Norwich, April 24th (PDK).

408 Brambling: Recorded up to April 6th and from Sept. 23rd. Largest flock was 400 at Ladyswood, Marham, Dec. (DW). Up to 12 in centre of Norwich, Feb. 23rd–26th (JTF, MJS).

413 Red-headed Bunting: North: Cley, a male, June 5th (PN, SJ, WFB) was considered wild but it should be remembered that these birds, mostly males, are imported into Great Britain and other West European countries in enormous numbers each year as cage birds.

416 Ortolan Bunting: North: Blakeney, a male, April 28th and one, Aug. 26th (HH). Blakeney Point, one, Sept. 7th. Cley, 3, Sept. 17th (WHD).

420 Little Bunting: North: Cley, one, Oct. 1st (ES).

421 Reed-Bunting: Flock of 70 at Swannington, March 13th (ETD) is an unusual number inland.

422 Lapland Bunting: North coast (Holme–Cley), parties of 6–9 till end Feb. First in autumn, Sept. 21st at Holme and Cley. Maximum at end of year 20 plus at Morston.

423 Snow-Bunting: North/East coasts: Recorded up to March 28th with a late pair at Thornham, May 25th (PDK) and from Sept. 19th.

425 Tree-Sparrow: Largest numbers: Fens: 500, Wisbech S.F., May 2nd (RTS, WA). Wash: 1,000, Hunstanton cliffs, Oct. 16th and many headed out west across mouth of Wash (CBC).

The following, not mentioned in the Classified Notes, were also recorded in 1960 (breeding species in italics): *Little Grebe*, Cormorant, *Mallard*, *Teal*, *Canada Goose*, *Mute Swan*, *Kestrel*, *Red-legged Partridge*, *Partridge*, *Pheasant*, *Water-Rail*, *Moorhen*, *Coot*, *Lapwing*, *Common Snipe*, *Woodcock*, *Curlew*, Common Sandpiper, *Redshank*, Dunlin, Common Gull, Razorbill, Guillemot, *Stock-Dove*, *Turtle-Dove*, *Barn-Owl*, *Tawny Owl*, *Nightjar*, *Kingfisher*, *Green Woodpecker*, *Greater spotted Woodpecker*, *Lesser spotted Woodpecker*, *Wood-Lark*, *Skylark*, *Carrion-Crow*, *Rook*, *Jackdaw*, *Magpie*, *Jay*, *Great Tit*, *Blue Tit*, *Coal Tit*, *Marsh-Tit*, *Willow-Tit*, *Nuthatch*, *Tree-Creeper*, *Wren*, *Mistle-Thrush*, *Song-Thrush*, *Blackbird*, *Whinchat*, *Robin*, *Grasshopper-Warbler*, *Sedge-Warbler*, *Blackcap*, *Garden-Warbler*, *Whitethroat*, *Lesser Whitethroat*, *Willow Warbler*, *Goldcrest*, *Hedge-Sparrow*, *Meadow-Pipit*, *Tree-Pipit*, Rock-Pipit, *Pied Wagtail*, White Wagtail, *Starling*, *Greenfinch*, *Goldfinch*, *Linnet*, *Redpoll*, *Chaffinch*, *Yellowhammer*, *Corn-Bunting* and *House-Sparrow*.

SELECTED 1960 LIGHT-VESSEL NOTES

R. A. Richardson

Leach's/Storm-Petrel: One, Inner Dowsing, Sept. 24th.

Heron: One, Inner Dowsing, Oct. 20th.

Sparrow-Hawk: One eating small passerine, Outer Dowsing, Sept. 17th.

Kestrel: One, Cross Sands, Sept. 7th.

Moorhen: Several, Haisboro', Oct. 20th and singly there Nov. 13th and Dec. 29th.

Lapwing: Hundreds, Smith's Knoll, Oct. 19th/20th. 20–30, Lynn Well, Nov. 7th and flocks of 60–70 there, Dec. 30th. Several, Haisboro', Nov. 20th and Dec. 29th. A few, Newarp, Nov. 17th/18th.

Golden Plover: One, Outer Dowsing, Sept. 16th.

Common Snipe: One dead, Haisboro', Nov. 20th.

Curlew: One, Newarp, Nov. 25th/26th and a few there, Dec. 11th/12th.

Long-eared Owl: Singly Inner Dowsing, Oct. 10th and Smith's Knoll, Oct. 6th.

Skylark: Hundreds at Newarp, Jan. 25th; 200 at Dudgeon, Feb. 27th and 300 there next day. Autumn records, Sept. 9th–Nov. 21st with peak numbers, Oct. 18th–25th.

Hooded Crow: Smith's Knoll, Oct. 29th and Haisboro' next day.

Rook: Several west, Haisboro', Oct. 26th.

Jackdaw: 6, Lynn Well, Oct. 31st.

Fieldfare: Recorded Inner Dowsing, Haisboro' and Cross Sands on seven dates, Oct. 7th–26th.

Redwing: Several, Haisboro', Oct. 20th, 22nd and 23rd. Several, Smith's Knoll, Oct. 21st/22nd.

Blackbird: Recorded Haisboro', Newarp, Smith's Knoll, Dudgeon and Cross Sands, Oct. 18th–27th and Nov. 19th. Peak numbers Oct. 19th/20th when hundreds at Smith's Knoll.

Robin: One, Inner Dowsing, Sept. 30th.

Pied Flycatcher: One, Inner Dowsing, Oct. 16th.

Brambling: Several, Newarp, Oct. 18th/19th.

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Norfolk Mammal Report 1960

INTRODUCTION

This is the seventh annual report on Norfolk mammals. From somewhat simple beginnings we have been able to build up quite a lengthy list of contributors, and their reports now cover most of the county, with the possible exception of the Fens. Our records are thus more adequate, and the general inferences which can be drawn are probably more accurate. In effect, we now take regular sampling from a large number of annual observations, and draw much safer conclusions. Unlike the Bird Report, which is concerned with about four hundred or more species and the more frequent occurrence of rarities, the Mammal Report deals with relatively few species and is more concerned with changes in populations, the inter-relationships of predator and prey, the effects of disease, and the widespread impact of Man.

With only about forty species of mammals to consider, we have been able, therefore, to deal more completely with the annual status of even quite common creatures. This has made it possible for useful information to be supplied by those who might otherwise have regarded their observations as trivial. All records become significant when set alongside those of others, and the conclusions that have been drawn in this report owe a good deal to the regular observations of school children, as well as to the work of more skilled and observant naturalists.

It is noteworthy that a stricter care is developing in the way in which our observers submit their reports. We now get more frequent numerical details and records of dates and ecological data than we did several years ago. Information becomes of increasing significance if it can be related to these. For example, two extremely wet years—1958 and 1960—with an intervening dry year, gave an invaluable opportunity for studying the effects of weather on populations of common mammals. The effect on the breeding populations of Hare and Mole has been most noticeable. More people are taking an interest in the analysis of road casualties. Intensive daily observations and numerical records of the species killed on a particular stretch of road over a whole year are invaluable. Comparison of these shows interesting possibilities in estimation of the relative abundance of certain hedgerow inhabitants. It is already clear that there are " accident black-spots " for

certain species. Weather and season can also be shown to play a part in the production of higher mortality rates.

Normally rarities do not occupy our attention to any great degree. It is usually impossible to locate any mammalian newcomers again once they have been identified, so that others may gather, as do the bird-watchers, to add a new species to their tally. This does not mean that the mammal-watchers are none the less delighted when some new or infrequently seen animal can be included in the year's report. 1960 gives us the opportunity to record the Lesser Horseshoe Bat, only once before taken in the county many years ago. The other outstanding and important record is of a relative newcomer, the Muntjac, which has made spasmodic and sometimes uncertain appearances in the county since 1951. Whether it is becoming established is unknown, and observations in woodland with a dense bramble component in the shrub layer might well produce evidence of its presence on a breeding basis.

It is becoming increasingly important to keep a vigilant watch on the status of our mammals, either to encourage a stricter protection or an increased but humane control. Most of our mammals are so well established that complete extermination is unlikely or impossible. Nevertheless, the widespread use of seed dressings, and particularly the chlorinated hydrocarbons, has done much damage already to some species. Myxomatosis continues to have an impact on the rabbit population, and an inevitable effect on its predators. Fortunately sporting and naturalist interests are now so strong in the county, that Man himself is ensuring the continued existence of some species. Mammals find protection in Nature reserves and the increased forest areas. Education through the press, radio and television is having a most valuable influence in mitigating the more extreme forms of cruelty and influencing more and more people towards a desire to protect wild life. Toleration within limits now makes it much more likely than heretofore that badgers, otters, deer, and other of our larger mammals will be seen by those prepared to take the necessary trouble.

Our thanks are once again due to all whose observations have made this report possible. May we ask for increased records of our relatively little known bats; for regular numerical records of casualties from known stretches of road; for more detailed observations of common mammals; all of which will assist in giving a better impression of changes in status. Volunteers are also badly needed to undertake special studies of some of our less frequently observed residents such as the otter, the water shrew and the yellow-necked mouse. Records for the 1961 report should be sent by *the end of January*, 1962 to F. J. Taylor Page, 77 Surrey Street, Norwich Nor 853.

CLASSIFIED NOTES

Hedgehog (*Erinaceus europaeus*)

The population of adult hedgehogs in the county was probably quite high after the good breeding season of 1959. The very wet conditions which prevailed in the latter months of 1960 from mid-June might have been expected to have reduced the second litters of the year. Nevertheless, road casualties which are a valuable indicator of population fluctuations, showed an increase over the whole year of about 30 per cent in north Norfolk compared with the 1959 figures (RPB-O). On the other hand in some areas where numerical records were kept there were indications of a corresponding decline. The greatest mortality was among immature animals and occurred in October and November when the volume of traffic was considerably lower than in the summer months. Unfortunately we have not yet developed a very adequate system of obtaining detailed observations, but the following will indicate the type of records which we should like to have from many other areas.

On the Watton–Brandon road, March 1st–Dec. 31st, 78 dead hedgehogs were counted (GJ). From April to December in the Beetley–East Dereham area 29 (DM), and during the same period on the Reepham road between Attlebridge and Norwich 8 (MES). The numbers counted on the road between Saxthorpe and Norwich averaged 1 per 12 miles per week (RPB-O). Almost all of these were run over in four separate short stretches of road of less than two hundred yards each, and in every instance these were where woodland came down to the road on both sides and served as crossing places. They were, in fact, "accident black spots". Here the highest mortality was in June and July, exceeding slightly the figure for October and November which gave the highest rate for north Norfolk as a whole. Over the whole county, hedgehog occupies fourth place in the total casualty list, an indication that despite this annual reduction in population in recent times, numbers are apparently remaining high.

A further reduction on a smaller scale appears to be due to the susceptibility of these animals to poisoning by metaldehyde used in slug killing mixtures. Many taking the poisoned slugs as food die within a day or two.

An interesting sidelight which came to our notice this year was provided by the old churchwarden accounts from Necton, where it was recorded that in 1663 payment was made for 37 "urchins", and similarly in 1668, 36. Even to-day the gamekeeper exerts further control. During the year at Elveden 163 were killed as compared with 212 last year (VAH). 7 were noted on a gibbet at Brettenham in June (JCT).

Copyright H. Ayr

Large herds of common seals frequent The Wash where they breed on the sandbanks. The Blakeney colony is over a hundred strong. At Scroby, 200 had assembled on the sandbank in early July following a period of north westerly gales.

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Left: Whiskered bat in Grime's Graves where this species has probably been an inhabitant continuously since Neolithic times. *Right:* Noctule bat. An increasing number of reports suggests that the status of Norfolk bats is improving.

Two unusual places for hibernation were recorded. The first was an island to which the animal must have swum a distance of twenty yards. The other was beneath a low thatched roof in a ruined farm building, and reached only by climbing the crumbling structure of the wall.

Common Shrew (*Sorex araneus*)

Regular observation is very necessary if the correct status of this mammal is to be assessed. Reports of frequency and infrequency in different parts of the county may probably be correlated with the way in which shrews appear to build up their populations in small areas very strongly over a few months after which there is a rapid decline. Two such areas were described, one at Brinton with much open ivy-covered ground, and another at Hempstead with a plentiful cover of low vegetation. Both became infested with common shrews during June and July. They were noticed hunting insects which were at the time temporarily abundant. At Brinton, at least thirty were active in an area approximately 20 ft. square, feeding on a small species of crane-fly which had settled from dancing swarms during a cloudy spell. They were quite indifferent to the presence of human beings (RPB-O).

Apart from these accounts of bursts of activity, reports of shrews are less common than heretofore, and one is led to think that they have suffered a decline, particularly in farming areas and close to human habitations.

Pigmy Shrew (*Sorex minutus*)

Superficial observation without trapping evidence suggests that there is no longer any reason to believe that the populations which seemed to exceed those of Common Shrew in a few places in the county, have been maintained. Though still common at Holt (RPB-O), Blofield (GT) and Ellingham (ECS), there are no longer as many as in 1959. Shrews are rarely found dead on the roads. This could, however, be associated with the fact that carrion crows haunt the roads at first light and easily remove such tiny prey.

Water Shrew (*Neomys fodiens bicolor*)

It is possible that some shrew-like animals seen away from water could be individuals of this species, and all shrews handled should be examined carefully for the fringe of hairs round the edges of feet and toes, and forming a keel below the tail. Observations are infrequent, but irregular records have been made in streams at Kelling and in the Glaven valley (RPB-O). One was watched feeding on sawfly larvae at Holt. Several new stations were recorded. A belated one from Caister Castle moat, recorded in 1959 (DAJB) was added to two others in 1960, one at Walsey Hills (RAR) and one

killed on the road at Woodbastwick (GT). The mapping of the distribution of water shrew shows that we have no records at all from central, south and south-west Norfolk.

Mole (*Talpa europaea*)

There has been considerable uncertainty this year as to what has been happening to the mole. From observations based upon the amount of surface workings, and the numbers trapped by mole-catchers, it seems that in general the wet year favoured moles, but flooding in the valleys affected local populations adversely. Surface workings became particularly numerous on the lighter lands (RVE). Soil improvement in the Brecklands has increasingly encouraged this mammal, and activity is frequently on a considerable scale. This is always greatest in the spring and early summer (JAH). In a part of Breckland tunnelling had taken place in areas covered by *Polytrichum* moss (JCT). Hundreds were caught by two keepers on the Merton estate (RDG). In contrast to this, local mole catchers at Corpusty took only twelve during the whole of 1960. It is possible that crop spraying is affecting the worm population, and this may lead to seemingly dramatic movements of moles on a large scale. Migration to dry pastures from the waterlogged Glaven valley was noted in the autumn. One dry, sandy-loam field at Saxlingham, where moles are rarely seen, became heavily infested during September soon after the post-harvest rough cultivation. A mass departure occurred soon after, though there was no apparent reason (RPB-O). Information concerning such movements would be of particular interest.

At Kelling, twelve out of thirty moles trapped in one field had an extensive area of yellowish-orange fur on the belly. Two were completely orange-yellow on the under side (RPB-O). A completely golden coloured specimen was captured at Merton *c.* 1958 (RDG). This was not recorded at the time.

Bats

Our record of bats is enlivened this year with the capture and identification in the hand of two Lesser Horseshoe Bats (*Rhinolophus hipposideros*). This is the first report we have had since one was taken at Happisburgh in 1914. The possibility of the spread of this species in the south of the county was suggested in the Report for 1959, but it had not been expected quite so far eastward. It is still hoped that the colony of Serotine Bats (*Eptesicus serotinus*) will eventually spread northwards into the county, and naturalists in the Reedham and Yarmouth areas might reasonably expect to find a colony of this large bat in a roof top or hollow tree.

The increase of the records of bats is encouraging, and is not without significance that the status of our bats may be improving once again. Unfortunately most naturalists are inexpert in the

recognition of bats and while the Long-eared Bat (*Plecotus auritus*) is commonly recognised—we had two records, one at Hales (MR) and one at Blofield (GT)—all small bats are usually stated to be Pipistrelles (*Pipistrellus pipistrellus*), and all large bats are thought to be Noctules (*Nyctalus noctula*). " Safe " records of the latter were made at Marham, where four were identified circling round the air traffic control tower (DW); at Corpusty (JL); at Fowlmere in the Breckland (PB); and in north Norfolk (RPB-O). Pipistrelles seem to be widely dispersed in local colonies throughout the county. A large colony exists in the fifteenth-century Caister Hall (DAJB).

Two Whiskered Bats (*Myotis mystacinus*) hibernated in the domed roof of the ice house at Brinton Hall (RPB-O). A few still remain throughout the year at Grimes Graves (FJTP).

Rabbit (*Oryctolagus cuniculus*)

Although it is the opinion of the Ministry of Agriculture that the rabbit population in Norfolk is lower than it has ever been, due to the activities of the Rabbit Clearance Societies and renewed waves of myxomatosis, there is no doubt at all that the many reports received indicate that an immune strain of rabbit is established in many areas, and pockets of these are increasing and spreading.

In the earlier part of the year there had been a building up of populations, particularly in scrub and forest areas where action against them is difficult. Breeding continued without interruption, and burrows were seldom made. Individuals appeared to wander widely, and once again road casualties were high. On the Watton-Brandon road over a period of 209 days, 406 dead rabbits were counted (GJ). Deteriorating weather and myxomatosis resulted in checking breeding, and there was a marked decline in numbers in the autumn. Many dead and dying rabbits were reported in the last three months of the year in very many places, but even so, whereas in the years immediately following 1954 the disease almost entirely exterminated the rabbit population, now there are few places in the county which still report this mammal as a rarity. An albino variety was reported from Shotesham and North Walsham, and a black variety from East Carleton and Binham.

Hare (*Lepus europaeus occidentalis*)

The peak population reached in many parts of the county over the period 1954–59, showed a major decline everywhere for the first time this year. One estimate put the reduction at as much as 60 per cent (RVE), but attributed it to last year's drives and shoots. The bags then obtained reflected, however, the very considerable numbers of hares everywhere, despite the reduction due to the effects of wet conditions to which hares are very susceptible. At Thompson, the number shot during each season from 1954 to

1960 is as follows: 26, 68, 139, 171, 81 (a wet year), 178 (a dry year) and 103 (a wet year) (RDG).

Comparative figures from Elveden on our southern boundary are 1,080, 948, 1,627, 3143, 2,493, 3810 and 4,836. Alongside the bags of rabbits, these figures are striking: 19,839, 8,601, 401 (Myxomatosis), 1,864, 4,968, 5,427, 8,993 (VAH).

Road mortality during the winter months of 1960 was low, as it was in the winter of 1958. For several roads around Holt where casualties have been noted for a number of years, the winter mortality has clearly reflected the success of the previous summer breeding season. Thus in the winter months (November to February) following the wet summer of 1958, the figure of 1 per 30 miles of road per week was recorded, but after the very fine 1959 summer, the corresponding winter mortality rose to 1 per 6 miles per week. After 1960's wet summer (but dry May and June), the winter road toll was 1 per 28 miles per week (RPB-O).

Bank Vole (*Clethrionomys glareolus*)

This seems to be one of our less well-known mammals, and is possibly sometimes confused with Field Vole. Our map records show that the known distribution is confined almost entirely to the eastern half of the county, but doubtless trapping experiments would give interesting records in hedgerows and ivy-covered banks elsewhere. Several were caught by cats at Blofield, and the tails of a few were discovered in a kestrel's nest in Blofield Church tower (DT). Bank voles were also noted nibbling houseleek, and feeding on dittander blanching under pots at Wheatfen (EAE). Others were found in an apple store at Aylsham (CLM). Analysis of owl pellets in the Holt area showed a marked preponderance of bones of this species (GS). It is probable that with the decline in the number of certain predators such as stoats, bank voles may increase noticeably in population status.

Field Vole (*Microtus agrestis*)

There has certainly been an increase in Field Voles. They became more abundant in 1960 than for several years, and were especially noticeable in areas of coarse grass and rank vegetation on the margin of flood water or just above it. Several were seen in very wet ground at Hockham in December (EAE), and at Corpusty (JL) and Hales (MR), as well as in marshy pasture beyond the river wall at Heigham Sound (RAD). They were exceptionally numerous round Brinton Lake and on Thornage water meadows.

Signs of a vole plague on Thetford Heath were noted in September (JCT), but decreases were reported at Calthorpe Broad (FT) and Horsey (AB). Voles were not reported on any road casualty list this year.

Water Vole (*Arvicola amphibius amphibius*)

Continued locally quite common in spite of the high coypu population in the Bure above Corpusty (JL), in the Yare valley dykes at Buckenham (GT), and in the wall of the River Thurne at Heigham Sound (RAD). Most of the Broadland marshes support a few, but elsewhere the numbers have decreased noticeably and reports are few. Three were caught in the Spring, far from water, when they fell into holes dug by builders at High Kelling. Two of these were black (RPB-O). This black variety is also reported from Corpusty (JL), Bawdeswell (QEG) and Hethersett (HWB). It is locally common in the Broadland marshes and resembles very closely the sub-species *A.a. reta* found in Scotland north of the Clyde and Tay. It is known, however, that the skull of the black form found in Norfolk more nearly resembles the skull of *A.a. amphibius*, and it is unlikely that our East Anglian black water voles are a surviving remnant of *A.a. reta*. The dominant black mutation appears to be an ancient one, but its survival significance is unknown.

Long-tailed Field Mouse (*Apodemus sylvaticus*)

As with many of our smaller mammals, observations made are spasmodic and variable. Regular and systematic trapping records would be extremely useful, but for the present we have to rely on occasional sight records and reports of catches of cats. *Apodemus* is rare on the road casualty lists because all small mammals which are killed at night by traffic tend to be eaten by carrion feeders which patrol the roads at daybreak. Undoubtedly many mice are killed on the roads as well as being killed by their natural predators.

The general impression gained is of some increase in numbers late in the year, but that distribution was likely to be patchy and very local. In the Breck at Thetford and Cavenham Heaths the species was abundant in clumps of *Calluna* where the old flowering shoots appeared to be eaten. These were left much scattered round the plants (JCT). Many were taken in traps at Great Moulton, where one was also observed sitting up and "singing" (HR). Numerous nests were ploughed up at Binham (RS), and some woods round Holt contained unusually large numbers (RPB-O).

Yellow-necked Mouse (*Apodemus flavicollis*)

Once again this species has been captured and identified at Ellingham (ECS). We can be fairly certain that it exists elsewhere in the county, particularly in the south, but until some experimental trapping is carried out we cannot be sure of its range.

House Mouse (*Mus musculus*)

Larger numbers were reported in stacks in a few places. Sometimes hundreds were present in stacks at Horningtoft, and con-

siderable quantities of dead ones were brought into the local school to feed a barn owl during February and March. The owl ate six at a time and showed definite preference for them (CM).

Harvest Mouse (*Micromys minutus*)

In comparison with last year, more records have come in for 1960 and suggest that there has been a good breeding year. More appear to have been seen in marsh and fen borders, and along river margins in north and east Norfolk (EAE). Increased numbers were noted in stacks by threshing crews at Holt and Melton Constable (RPB-O), and Booton (RM), Horningtoft (DM), Binham (RS) and Tuttington (RAD).

Black Rat (*Rattus rattus*)

Undoubtedly the work of rodent operators in recent years has been effective in reducing this species to the point of extinction. Records had been regular in the past from Yarmouth and King's Lynn, but several years have passed since one was taken or reported.

Brown Rat (*Rattus norvegicus*)

An appreciable increase everywhere. Control of rats ceased during the periods when foot and mouth disease and fowl pest were rife. Some time afterwards, many places were reported as having almost staggering infestations (JP). This may also be associated with the fact that considerable numbers of dead carcasses of coypu have been left unburied during the period of heavy control this year, and sugar beet hales have been longer at the roadside and in field owing to the wet conditions. After threshing, many more were found dead on the roads (DM). Increases on the mainland have led to larger numbers on Scolt Head Island than ever before. Their food comprises carrion, mussels and marram seed (RC). On Breydon marshes, considerable numbers of lapwing and redshank eggs were taken (RHH). In the north Norfolk marshes, some hunt along the tide lines at last light. Large infestations moved into the regular spawning places used by toads. The practice of eating the toads has become a regular habit. It has occurred now for several years, and the rats arrived before the toads as if in anticipation of their coming (RPB-O).

On the roads, casualties among rats were greater than for almost any other mammal with the exception of the rabbit in Breckland areas where it once again holds the record. The most vulnerable places were near grain stacks, sugar beet hales and farm buildings. During the extremely wet part of the year many migrated from marshland areas to the uplands (HJC).

Red Squirrel (*Sciurus vulgaris leucorus*)

It may be surprising to many to learn that red squirrel is very widespread in Norfolk and for some years the population has been high. Reports now suggest that though still common, the red squirrel has commenced a decline from the peak of a cycle of abundance. It is known that squirrels can contract a disease resembling myxomatosis but so far this has not been reported in Norfolk. Some have, however, been found at Swaffham dead or dying without apparent cause (DFM), and a few have been found dead elsewhere. In forested areas squirrels figure in the road casualties, but compared with other animals, they manage to avoid death successfully, possibly because they are diurnal in habit.

An unconfirmed report of Grey Squirrel (*Sciurus carolinensis*) was received from South and East Raynham, but as this was in November it is possible that an error of identification was made and that it was a Red Squirrel in winter coat.

Coypu (*Myocastor coypus*)

Throughout the county the infestation of coypu has reached pest proportions. On July 15th the Minister of Agriculture announced that control of coypus should be brought within the sphere of Rabbit Clearance Societies, and there is now virtually a war being waged against the animal. Extensive operations are in progress over a wide area (RVE). Already vast numbers have been trapped and shot. At Watton 680 were taken on the upper reaches of the River Wissey and the River Thet during the latter months of the year. The Raveningham, Yare Valley and Hedenham Societies accounted for 2,015 between Feb. 6th and March 15th.

Coypu by no means confines itself to water. It has been found wherever food supplies were abundant and any form of damp cover existed. The damage done was serious, not only to crops but to river banks. Despite the fact that coypus are ill-equipped to dig, burrows were found where there was little cover. Holes up to twelve or fifteen feet in length contained not unusually six or eight packed in head to tail. Sometimes they have been found huddled together beneath dense undergrowth, usually on platforms of dry vegetation.

Although some advantage is gained by their clearance of reed beds in Broadland waterways and the increase of areas attractive to various types of wildfowl, the damage in general now far outweighs the usefulness. For example, large areas of the osiers at Burgh Castle used in basket making, and the sedges and reeds at Hickling used in thatching, have been ruined. Penetration of the coypu into the breeding areas of some of our Nature reserves led to concern for the continued existence of some of our rare birds such as the bittern, owing to the damage caused to nesting sites. Roots

of Water Dock and Great Willow Herb, and the rhizomes of Yellow Iris have been much used as food. Some coypus have acquired a taste for Swan mussel (*Anodonta cygnea*) and hundreds may be eaten in a few months. Special feeding places are often used, and very large piles of shells accumulate there.

The mild winter of 1960 failed to control their spread, which is now mainly in a southerly and westerly direction. Existing colonies have rapidly increased. Where roads passed through areas of abundance, casualties were high. The Acle New Road, for example, had a mortality rate of about 6 per night during the week-ends of the summer months. It appears to have a total rate of about 400 per year.

Fox (*Vulpes vulpes*)

Despite the setback caused by the disease which affected the fox and its distribution in the latter part of 1959 and early 1960, there was an undoubted increase following the decline. One estimate placed the population in certain areas well above what it was three years ago. Except in the hunting country it is never likely to become high, as the preservation of game and foxes do not go together. The largest numbers are to be found in central Norfolk where toleration exists even though no compensation is given for damage done. Woodlands with thick cover helped the survival of the fox elsewhere. At one time Horsford and Stratton Strawless woods probably harboured more than anywhere else in the county. Forestry Commission clearances have made much of the area unsuitable, however, and possibly accounted for the wanderings of foxes into the Broads and coastal areas of eastern Norfolk where they had not been seen for many years. First records of this kind came from Forncett (MJS), Marham Fen (DW) and Reedham (RHH).

The disease which affected foxes, now attributed to a form of poisoning caused by the animals eating dead or dying victims of the effects of seed dressings, probably accounted for the death of a fair number of Norfolk foxes along with several hundred in east and central England. Carcasses were found at Acle, Lynford, Watton, Harford and parts of north Norfolk. A form of madness appeared to affect some foxes and led to fighting. A fox brush minus the fox, and a vixen minus the brush were seen at Beccles (EDP).

Badger (*Meles meles*)

On the whole Norfolk does not provide good soil conditions which would tend to encourage badgers to build sets. However, in recent years, and where disturbance is trivial or lacking, the badger has tended to increase encouragingly in the county, particularly in central and north Norfolk, where in damp oakwood conditions on the clay soils abutting on to sands, small populations

have been steadily building up. Private woodland, where an interest in the preservation of the badger as a worth-while mammal now exists, has also helped. In some places the growth of new woodlands has assisted in binding the soils. In at least one place the excavated material is a very light sub-soil. Enquiries have shown that little or no damage attributable to the badger has been experienced. Travellers by night in the Bintree–Foxley area, in the Sandringham area, on the A11 and in the Sandringham–Holt area might now well expect to see a badger on the road. It is hoped that every care will be taken to avoid a casualty.

Otter (*Lutra lutra*)

Movements of otters are difficult to assess in these days. Coypus have taken to using otter runs, and where once otters were regularly seen, they now seem to be scarce. None were killed by the otter hunts at Aylsham (SS) or at Horsey (AB), and none have been seen at Seamere (CG), Caister (DAJB), Woodbastwick (HJC) and Castleacre (HB). Decreases are said to have occurred in several other areas. The work of the River Board in clearing dead trees appears to be a contributory cause in reduction in the main rivers of the county.

On the other hand, otters are not easy creatures to observe, and mammalogists must be prepared to put themselves to some trouble in order to find them. A large specimen was watched by Mr. Eric Simms on the mud above high water mark at Brancaster in the early morning of Sept. 30th. Two regularly hunted through Brinton lake, where they fed upon pike and moorhens. Spraints were frequently left on the boathouse staging (RPB-O).

At Langley a large specimen from the River Chet was said to have attacked a man, and later one weighing 26 lb. and measuring 48 in. in length was killed (EDP). Others were taken or observed at Acle (HFA), Surlingham (EAE) and in the Glaven valley (RPB-O). A dog otter just over 4 ft. in length and weighing 21 lb. was a road casualty at Melton Constable on Aug. 2nd. A few were reported fishing in the fresh marshes and creeks at Scolt Head (RC).

Stoat (*Mustela erminea stabilis*)

Whether the return of the rabbit will re-establish the stoat in anything like the numbers formerly observed remains to be seen, but 1960 probably marked the end of a most noticeable decline. In Breckland as a whole the stoat is rarely seen nowadays, although near Brandon alone about 200 were formerly shot every season when rabbits were numerous. A few stoats have been found dead this year, but although some attribute this to starvation, it is more likely attributable to their feeding on animals that have been victims of the use of seed dressings.

The fact that stoats used to be regular road casualties and are now killed only very occasionally indicates how scarce they have become. This year, however, there have been slight increases reported from Elveden (VAH), and in many parts of north Norfolk (RPB-O), at Calthorpe (GT) and Breydon (RHH). Elsewhere the population is at low ebb.

Weasel (*Mustela nivalis*)

Although weasels were also reported as more scarce in many parts of Great Britain, in Norfolk the population has certainly been maintained, and reports even suggest that they are increasing. They were frequently seen on the roads and mortality proved not to be high, although 36 were counted on the Cawston–Aylsham road (RM). 11 were counted on a gibbet at Brettenham (JCT). One old gamekeeper volunteered the information that weasels had a better chance of survival than stoats because both parents cared for the young. Among stoats only the female provides the food and is responsible for moving the family to places of safety.

A violent fight between a weasel and stoat was watched during March in a lane near Corpusty. It lasted over ten minutes, and the participants were frequently locked together and rolled over and over in a mass like a furry ball. There was a great deal of hissing and squeaking. The stoat eventually carried off the limp body of the weasel (RPB-O).

Domestic Cat (*Felis domesticus*)

For many years now, farmers have been encouraging cats to become feral or semi-feral in order to keep down rats and mice. The cats have usually disappeared and returned some months later with a nearly-grown family, to tide over the bad weather. Regularly in the copses behind the houses on the A11 at Cringleford in years gone by families have been reared. This is no uncommon thing, for about 1870 an overcoat was made lined with the fur of cats shot in Trimingham woods. One was shot there in April (DAJB).

Seals

The number of Common Seals (*Phoca vitulina*) fluctuates considerably at Scroby Sands. On the first visit of the Great Yarmouth naturalists on June 6th, well over 150 were hauled out. On the 16th, the shore population had dropped to 40, but on July 3rd, following a week of north-west gales, about 200 had sought shelter from the heavy seas. In spite of the bad conditions, 25 pups were present, the last week in June and the first week in July being the peak period. The population dropped again by July 10th, probably due to the presence of a group of wireless enthusiasts who set up a radio station that week-end. The behaviour of the seals

there at night was described for the first time. The seals appear to keep up an almost incessant barking and growling, interrupted periodically by the high-pitched whining of the pups (PGT, WJW, RHH). 132 seals were counted on Aug. 16th (EDP).

Not only the weather but a need for a wide search for food appeared to account for the variability in the number of seals recorded. Some were seen up the River Yare several miles inland (EDP). At Blakeney, about 100 were counted, and in the Wash an estimated and more or less stable population of approximately 2,500 was reported (EDP).

In previous years, the Grey Atlantic Seal (*Halichoerus grypus*) has had a fairly good breeding season. 4 pups survived the storms and were observed by the R.A.F. on Nov. 24th. 8 more were present on Dec. 16th. The peak time for calving appears to be two weeks later than in the Farne Islands. A tail-tagged animal was seen at Scroby on May 15th but it was impossible to approach closely. One 3-week-old male marked at Staple Island 1.12.60, was found alive at Cley 31.12.60. It had what appeared to be gunshot wounds in the hind limbs. It was seen again at Cley on the first day of 1961 and its condition was not good (GH).

With a view to keeping a check on marked seals, we have been asked by the Hancock Museum, Newcastle-upon-Tyne, to give the colour markings used. They are: Farne Islands, Yellow; Orkneys. Red; Rona (Pale Green).

Deer

Red Deer (*Cervus elaphus*)

Thetford Chase continues to harbour quite a number of grown stags, a few with good heads. There was a strong rut in September despite the bad weather. Continuous and intensive felling in various parts of the woodlands keeps them on the move, but a tendency to follow a more or less circular route through the forest such as occurs in other parts of Great Britain seems to be maintained and counting is therefore uncertain and difficult. The hinds are very strong. Three have been shot to keep numbers in balance. The calving was, however, not as good as expected (DW, FJTP).

During the rut in late September, a large buck frequented the Horsford area, together with two smaller black ones, remnants of the once larger herd there. Considerable disturbance over about 400 acres doubtless prevented the re-building of this herd, feral members from Dudwick deer paddock (FEDB). In woods east of Castle Rising, a small herd has developed. Three bucks were seen in July. One was completely white, and two others were typical fallow. Slight damage by browsing was noted (RH). In February, 12 of the Houghton Park herd died suddenly. No cause could be assigned. We know very little about disease in deer but it is no

unknown thing. In days gone by it was always recorded as " died of a murrain ".

Roe Deer (*Capreolus capreolus*)

With the appointment of a deer forester in Thetford Chase, a better safeguard has been developed for the welfare of the roe deer which in times past have been the victims of deer drives, snaring and indiscriminate shooting. About 20 maimed or poorly developed animals have been removed in many parts of the forest. In addition 27 bucks have been shot by the St. Hubert Club, of which 6 were above the usual average for antlers though not outstandingly good. Thetford Chase is now less suitable in many places for roe. Much of it is high forest and much clear felling is going on. This is tending to move the deer outwards and reports were received from the more marginal plantations where roe had not previously been seen. Very few fawns were seen during May and June (FJTP, DW).

Reeves's Muntjac (*Muntiacus reevesi*)

For several years now we have had isolated reports of muntjac being seen or killed in the county. The first record in 1951 was from Walsingham. Others followed at Lowestoft in 1952 and Thetford Chase in 1953. Some unconfirmed reports which were very probably of muntjacs were received in 1958 and 1959, but in 1960 an undoubted muntjac was shot at Holkham Hall late in the year. It is very likely that this species is spreading slowly into Norfolk. Unsuspected, it built itself up into a breeding species in Huntingdonshire two years ago and it is possible that from this stock that stragglers are moving across country into our own county. We can reasonably expect further reports in the near future (FJTP).

Whales

Porpoise (*Phocaena phocaena*)

Four strandings (one in April and three in June and July) were reported from Scolt Head (RC), and one was observed close inshore at Cley in October (PB).

Dolphin (*Lagenorhynchus albirostris*)

One was found dead on the shore at Waxham, Dec. 24th (CG). We are anxious to keep records of all strandings. Will those living near the coast please be sure to send in full details, not only for our own Report but also for the national records at the British Museum of Natural History.

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THE GEOLOGY OF NORFOLK

A collection of papers assembled by the
PARAMOUDRA CLUB
to mark its tenth anniversary.

Edited by G. P. LARWOOD and B. M. FUNNELL

CONTENTS

TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY,
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THE GEOLOGY OF NORFOLK

INTRODUCTION

The present collection of papers incorporates the results of important recent investigations, and provides a comprehensive, up-to-date account of the pre-Holocene geology of Norfolk. It has been assembled by the Paramoudra Club to mark its tenth anniversary, and is published in co-operation with the Norfolk and Norwich Naturalists' Society.

The Paramoudra Club was founded in 1950, as an association of student geologists, to promote interest in the geology of the county of Norfolk, and now includes in its membership many professional and amateur geologists from Norfolk and elsewhere. The members of the Paramoudra Club take this opportunity to thank those authors whose contributions have made this publication possible. Figures 1, 2, and 10 are based in part on Crown Copyright Geological Survey maps by permission of the Controller of H.M. Stationery Office.

A brief summary of the geology of Norfolk will be found in the British Association publication "Norwich and its Region" (1961).

TABLE 1. STRATA OF NORFOLK

Formations, Zones and Deposits	*Stages*	*Periods and Systems*	
Barrier Islands and Spits Broadland and Fenland Deposits	Post-Glacial	Holocene	
Hunstanton Till and Outwash Deposits	Last (Hunstanton) Glaciation	Pleistocene	
Morston Raised Beach	Ipswichian Interglacial		
Gipping Till and Outwash Deposits	Gipping Glaciation		
Nar Valley Clay Nar Valley Freshwater Beds	Hoxnian Interglacial		
Lowestoft Till Corton Beds Cromer Till and Norwich Brickearth *Leda myalis* Bed	Lowestoft Glaciation		
Arctic Freshwater Bed Cromer Forest Bed Series	Cromerian Interglacial		
Weybourne Crag Norwich Crag { Upper Division / Lower Division }	Icenian		
Ludham Crag	?Butleyan		
London Clay	Ypresian	Eocene and Palaeocene	
Reading Beds	Sparnacian		
?Thanet Sands	?Thanetian		
Zone of *Belemnella lanceolata*	Maastrichtian	Upper	Cretaceous
Zone of *Belemnitella mucronata* Zone of *Gonioteuthis quadrata* Zone of *Marsupites testudinarius* Zone of *Uintacrinus* Zoze of *Micraster cor-anguinum* Zone of *Micraster cor-testudinarium*	Senonian		
Zone of *Holaster planus* Zone of *Terebratulina lata* Zone of *Inoceramus labiatus*	Turonian		
Zone of *Holaster subglobosus* Zone of *Schloenbachia varians*	Cenomanian		
Red Rock and Gault Clay	Albian	Lower	
Lower Greensand: Carstone	Aptian		
Lower Greensand: Snettisham Clay Lower Greensand: Sandringham Sands	Neocomian		
Kimeridge Clay	Kimeridgian	Jurassic	

THE SUB-CRETACEOUS ROCKS OF NORFOLK

By R. G. Thurrell

The oldest formation exposed at the surface in Norfolk is the Upper Jurassic Kimeridge Clay, but the buried pre-Kimeridgian sequence is known to some extent from deep borings within the county at North Creake and near Southery, and by inference and extrapolation from boreholes elsewhere in the northern part of East Anglia. These borings reveal a sequence of Mesozoic sediments resting on an irregular surface cut across a basement of Palaeozoic or older rocks. Variations in the configuration and in the physical characteristics of this Palaeozoic basement to the south and south-west of Norfolk have also been determined by seismic methods (Bullard and others, 1940), and more recently the Geological Survey (Sum. Prog. Geol. Surv. for 1958, p. 8) has completed gravity and magnetic surveys over East Anglia which reveal so far unexplained strong negative anomalies in the Fens and in North Norfolk (see Gravity overlay for Geol. Surv. "Quarter Inch" Map, Sheet 12, 1960).

THE PALAEOZOIC AND PRE-MESOZOIC FLOOR

The Palaeozoic floor beneath East Anglia forms the north-western part of the London-Brabant massif which has remained resistant to deformation since the coal-bearing strata in Kent and around Namur in Belgium were preserved in downfolds along its southern borders, towards the close of the Carboniferous period. Subsequent denudation gradually reduced the stable-block to an area of low relief and upon this peneplain the succeeding Mesozoic rocks were laid down with strong unconformity.

The only place in Norfolk where the Mesozoic cover has been penetrated in a deep boring is at North Creake, eleven miles east-south-east of Hunstanton, where Triassic rocks rest directly on the Pre-Cambrian basement at 2,561 ft. below Ordnance Datum (O.D.). No Palaeozoic rocks were present (Kent, 1947). In Suffolk and in Cambridgeshire however the floor has been encountered more frequently.

At Lowestoft, Lower Greensand was found to rest on Palaeozoic rocks of possibly Silurian age at a depth of 1,615 ft. below O.D., and at Harwich (Essex) old rocks of uncertain age were encountered at 1,013 ft. below O.D., overlain by Gault. At Stutton, eight miles south-east of Ipswich, again the Gault rests directly on rocks which are probably Upper Silurian (Ludlovian) or Downtonian in age at a depth of 974 ft. below O.D. Near Bury St. Edmunds, at Culford, the Palaeozoic floor was struck at only 527 ft. where it was overlain by Lower Greensand, but there was no definite evidence of the age of the older rocks. The shallowest occurrence of Palaeozoic rocks in northern East Anglia so far known is below Cambridge, where Carboniferous Limestone is present 355 ft. down, below Lower Lias. Further north-east at Soham, 97 ft. of red-beds of possibly Permo-Triassic age separate the Lower Lias from the Palaeozoic floor which consists of steeply dipping marine Devonian facies at a depth of 777 ft. below O.D.

This far-flung scatter of information shows that the surface of the Palaeozoic floor rises steadily south and south-westwards underground beneath Norfolk towards a ridge or undulating plateau beneath Cambridge and Culford, and then falls away east and south-eastward towards Stutton and Harwich. Unfortunately, the data so far available concerning the stratigraphy and structure of the rocks which outcrop on the surface of

the platform are too scattered to allow the insertion of geological boundaries however tentative.

This concept of gently sloping subterranean surfaces culminating in the region of Cambridge is supported by geophysical data and by the evidence of borings in the Mesozoic cover which have not reached the Palaeozoic floor but which suggest that the floor continues to plunge away north-eastwards beneath Norfolk. A borehole at Coombs, near Stowmarket, stopped short of the floor after passing through 57 ft. of drift deposits and 838 ft. of Cretaceous beds. Another hole at Holkham Hall was stopped in ?Kimeridge Clay at 713 ft. below O.D., having penetrated 655 ft. of Chalk, 8 ft. of Red Chalk, 10 ft. of Gault and 70 ft. of Carstone. A deep boring at Messrs. Colman's works at Norwich (Whitaker, 1921) passed through 12 ft. of superficial deposits, 1,152 ft. of Chalk, 6 ft. of Upper Greensand and 36 ft. of Gault, and yet did not reach the Palaeozoic floor.

Seismic investigations undertaken by members of the Department of Geodesy and Geophysics at Cambridge (Bullard and others, 1940) in conjunction with borehole evidence confirm the northerly slope of the basement beneath north-west Suffolk and south-west Norfolk. At Lakenheath results indicate that the Chalk, underlain by Gault and Lower Greensand, rests directly on the Palaeozoic floor at 810 ft. below O.D., and at Feltwell, five miles to the north, where Jurassic rocks may also be present, the floor is probably at 830 ft. below O.D.

Further evidence that the Mesozoic sedimentary wedge continues to thicken northward as the relatively more dense rocks of Palaeozoic and Pre-Cambrian age become more deeply buried is suggested by the pattern of isogams shown on the gravity overlay map recently published by the Geological Survey (1960). In general, the line along which the force of gravity was found to be normal runs east and west across central Norfolk, and the country to the south shows a slight positive gravity anomaly and that to the north a much stronger negative anomaly. Even allowing for the effect of predictable or probable variations in the composition of the rocks in the Mesozoic cover, it is clear that the increasing depth of the basement or some far-reaching change in its physical characteristics must in large measure be responsible for the low value of the gravity measurements in the region towards the North Norfolk coast and in the northern part of the Fens. Research is still proceeding and no further comment can be made at present.

Since the Palaeozoic floor shelves away gradually northward beneath Norfolk, successive Mesozoic strata tend to thin out southward as they overlap onto the sloping basement. It is clear from the numerous borehole records where Gault rests directly on Palaeozoic rocks that the highest parts of the massif were not submerged completely before the widespread advance of the sea in the Albian transgression. In his account of the boring at North Creake, Dr. Kent (1947) has constructed a map showing the probable south-eastern limits of the various horizons in the area and their relationship to each other according as the sea was advancing or retreating from the flanks of the Palaeozoic land-mass. Only slight modifications to the map are necessary in the light of more recent information.

The earliest Mesozoic representative at North Creake, the *Bunter Sandstone*, is 132 ft. thick and consists of fairly homogeneous white water-laid medium-grained pebbly quartz sandstone locally cemented by pyrite crystals. It rests unconformably on dark greenish-grey somewhat sheared Pre-Cambrian (Charnian) tuff or agglomerate rich in mica and

chlorite. We have no evidence of the lateral extent of this Pre-Cambrian rock type. The *Keuper Marls* are lithologically very similar to rocks of that age at their outcrop in the Midlands, but the thickness of both Triassic divisions is such that North Creake is evidently well north of the feather-edge of the formation, although the Bunter, being somewhat attenuated, is probably overlapped southward, the Keuper transgressing beyond it across the Palaeozoic floor. (See summary of North Creake Borehole, below).

Rhaetic beds are so imperfectly represented in the borehole that one must presume that they are rapidly overlapped over the area to the south and east by the *Lias*. Lithologically the Lower and Middle Lias consist of thick grey shales and clays with subsidiary thin muddy limestones, calcareous sandstone and occasional ironstones, passing up into bituminous shales of Upper Lias age. These earlier Jurassic beds were deposited in almost completely conformable sequence, but they thin southward and through slow upwarping of the Palaeozoic floor towards the end of Liassic time, they were truncated progressively in that direction by the transgression of the sea which laid down the Great Oolite Series.

There is no representative of either the Inferior Oolite or the Northampton Sands Ironstone under Norfolk; most of the Upper Lias has been eroded from the sequence at North Creake while in both the Soham borehole (Edmunds, 1956, p. 33) and the Cambridge borehole (Ibid., 1954, p. 28) only the Lower Lias is represented below the Great Oolite Series. At Southery (Pringle, 1923) even the *Great Oolite* is attenuated: only ten feet in the upper part of the Series is present overlying Middle and Lower Lias.

Succeeding the Great Oolite at North Creake are six feet of broken-shell crystalline limestone, representing the upper subdivision of the *Cornbrash*, and 46 ft. of sandy *Kellaways Beds*. These two horizons indicate shallow shelf-sea conditions in the area, linked with a withdrawal of the deeper water towards the north. Neither rock is recorded from the Severals House boring near Southery, and at Soham and Cambridge both have only very thin representatives. Erosion after Kellaways times probably accounts for the thinness or absence of these two divisions to the south, but in northern Norfolk at least, deposition appears to have been almost uninterrupted.

In *Oxford Clay* times, represented at North Creake by 138 ft. of grey sometimes bituminous and pyritic shales and subsidiary muddy limestone seams, and at Southery by up to 158 ft. of similar but more fossiliferous material, deposition again extended further southward. The shoreline must have run just northwest of both Culford and Lowestoft boreholes, but southeast of Cambridge and Soham, where the clay, though thin, is present. Most of Norfolk must have been open sea, and yet the proved thickness of Oxford Clay is only half as great as in mid-Lincolnshire. Dr. Arkell (1937) has shown that at Southery, at least, this apparent attenuation is due to the fact that the uppermost and lowest zones are either missing or extremely thin.

Apart from the highest zone of the *Corallian* (that of *Ringsteadia pseudocordata*, which at 40 ft. is thicker in Norfolk than anywhere else in this country), both that division and the Kimeridge Clay are similarly reduced as compared with their equivalents in Central Lincolnshire. Their uniform clay facies does not suggest proximity to a contemporary coastline, and their present subsurface extension to the south and east is presumably controlled by pre-Aptian uplift and erosion, so that the

Kimeridge Clay will be overstepped first, the Corallian clays next and the Oxfordian extend furthest south beneath the transgressive Neocomian and Lower Greensand. The feather edges of each of these Jurassic clays must lie under South Norfolk since none of them was located in either Culford or Lowestoft boreholes.

Lithologically the Corallian (Ampthill) clays do not greatly differ from those above and below in the North Creake borehole, but the lowest part of the division is characterised there and at Southery by hard medium-grey limestone which is however, not at all comparable with the well-known coral limestone facies at Upware in Cambridgeshire. Although it is quite possible that the Corallian shoreline may have supported such a development in Norfolk, there is no evidence of it, at present. As shown by the thicknesses recorded for the formation at North Creake (85 ft.) and Southery (70 ft.), the Ampthill Clay thins southward below West Norfolk, but no evidence is available to suggest how rapid the attenuation may be in the ground to the east and south-east. It is likely that the succeeding Kimeridge Clay undergoes a similar although more rapid thinning in the same direction.

SUMMARY OF THE LOG OF THE NORTH CREAKE BOREHOLE
71 ft. O.D.

Formation	*Thickness (ft.)*	*Depth of Base (ft.)*
Chalk	471	471
Upper Greensand	10	481
Hunstanton Red Rock	6	487
Lower Greensand and Neocomian	216	703
Kimeridge Clay	160	863
Corallian (Ampthill) Clay	85	948
Oxford Clay and Kellaways Beds	184	1132
Cornbrash	6	1138
Great Oolite Series	97	1235
Lias — Upper	41	1276
Lias — Middle	77	1353
Lias — Lower	423	1776
Rhaetic	14	1790
Keuper	513	2303
Bunter	132	2435
Pre-Cambrian (penetrated to)	197	2632

THE KIMERIDGE CLAY

Kimeridge Clay underlies the eastern part of the Fens and rises through the superficial deposits here and there as low straggling "islands" which provide firm and fairly well drained foundations for Ely, Chatteris, Littleport and March. In Norfolk, Hilgay and Southery are built upon one such island. It is capped by outliers of Neocomian Sandringham Sand and by boulder clay and gravels. Northward, the dark grey shaly clays outcrop intermittently in a narrow belt rarely more than half a mile wide which extends from Fordham for about 15 miles to South Wootton, where it finally disappears beneath the deposits bordering the Wash (Figs. 1, 2). The outcrop is frequently obscured by spreads of Pleistocene gravel and boulder clay between Wimbotsham and King's Lynn, or by broad alluvial tracts in the re-entrant valleys which transect the low Cretaceous escarpment wherever westward-flowing streams flow out towards the fen beyond. Almost

all of the Norfolk fen is immediately underlain by Kimeridge Clay, but Ampthill Clay probably occupies an undefined part in the extreme west of the county, although definite evidence is lacking.

Because of the small area of its outcrop in Norfolk, the Kimeridge Clay has very little topographical effect and negligible influence on the soils and agriculture. At the present time the clay is used only for strengthening the raised river banks in the fens and for making them watertight, but in the past there were many small brick-works scattered along the outcrop. They enjoyed only limited activity however, because of the prevalence in the exposed part of the Kimeridge Clay of bituminous shales unsuitable for bricks, and because of the restrictions imposed by the thickness of the drift cover in some places.

The search for indigenous oil supplies during the Great War resulted in a rapid exploration of the so-called " Wormegay basin," (Forbes Leslie, 1916, p. 16), and many boreholes were sunk to assess the possibilities of oil production from the Kimeridge Clay. An extraction plant supplied with bituminous shale from a shallow mine was put into operation at Setch, but the low yield of petroleum, approximately 40 gallons per ton, and the cost of extracting it, rendered the enterprise uneconomic and it became rapidly defunct.

The best exposures at the present time are to be found in the deep cuttings periodically exposed along the flood relief channels which are being constructed between King's Lynn and Stoke Ferry along the eastern border of the Fens. These earthworks cut through the unconsolidated fen deposits and show that the estuarine silts, sand, peat and plastic clay which give rise to such favourable soils, are underlain by a gently undulating surface of sticky, very dark grey, shaly clay. This clay is usually struck within 25 ft. of the surface, and often much less, except where certain ancient drainage channels take the fen deposits down to perhaps three times that depth. A buried channel cut at least 60 ft. into Kimeridge Clay was found in borings at Wiggenhall St. Germans road bridge. It appears to follow a westerly course from Setch and probably represents an old bed of the River Nar. Shallower " washouts " up to 20 ft. deep are commonplace in this area.

The bedded shaly Kimeridge Clay beneath the fen deposits, especially in the vicinity of former drainage channels, is frequently weathered into an unconsolidated clayey mixture containing slabs of shale and fragments of cementstone scattered at all angles. This " head " deposit may reach a thickness of ten feet or more and when it becomes saturated at times of heavy rainfall, or by flooding, it tends to become unstable and may flow out as a dense, muddy sludge from the banks of newly cut channels, even though the underlying Kimeridge shales remain quite firm. Kimeridge head is present just north of Denver Sluice and in the region of the Wiggenhalls.

In the region of Stow Railway Station large numbers of flattened circular cementstone doggers are common at two or three horizons within 20 ft. of the surface. The doggers measure up to 8 ft. in diameter and about 2 ft. in thickness at the centre. Broken open, they very frequently reveal a central hollow filled, or partly filled, with crystalline calcite, from which gaping cracks lined with calcite radiate throughout the central part of the stone, but very rarely do they reach the outside. These doggers appear to be a primary sedimentary feature since the surrounding shaly clays have been demonstrably compressed around them. Similar cementstones are also common in the Kimeridge Clay in the cut-off channel at Gravelhouse Farm, Fordham.

Also in the region of Stow Station, the shales—when freshly dug—are speckled with pale blue amorphous vivianite, with even greater powdery concentrations along certain well marked bedding surfaces. This mineral, a hydrated phosphate of iron, tends to form where ferrous compounds, such as pyrite, and phosphatic debris in the form of coprolites or bones are closely associated. And, indeed, numerous pliosauran remains have been discovered at Stow.

The surface outcrop of the Kimeridge Clay in West Norfolk, being so narrow and discontinuous, gives little idea of the underground extent and thickness of the formation.

The whole of the Kimeridge Clay present below the sub-Cretaceous unconformity was pierced in two of the three boreholes near Southery (Pringle, 1923, Arkell, 1937) and the total thickness was 143 ft. in one boring and 147 ft. in the other. In the boring at North Creake 160 ft. of the clay was recorded immediately beneath the Neocomian. At Holkham Hall borehole (Whitaker, 1921, p. 94), " a very tenaceous clay, possibly Kimeridge Clay " was found below 70 ft. of Neocomian at a depth of 743 ft. At Downham Market, a boring for water (loc. cit., p. 83), penetrated 29 ft. of Sandringham Sand and then 187 ft. predominantly of blue clay, not all of which is likely to have been Kimeridge Clay, while the Crimplesham Hall boring (ibid., p. 72–3), proved 120 ft. of dark grey and blue clay with shell fragments, which, beginning at a depth of 112 ft. may well represent most of the division, although in each case there is no palaeontological or lithological evidence of horizon in the Kimeridge Clay. Similarly, a borehole at King's Lynn (ibid., p. 99), penetrated 630 ft. of " clay with septaria " and, although undocumented, it must contain representatives of all three Upper Jurassic clays considering thicknesses alone.

Between West Winch and Setch old workings and boreholes for oil-shales penetrated the following succession, but there are no records of the depth of the base of the Kimeridge Clay in that region:

(4)	base of Cretaceous (Sandringham Sand)	
	——————unconformity——————	
(3)	shale including oil-shale with a thin limestone near the top	Smith's Series (upper part of Kim. Clay)
(2)	thin yellow sandstone bands	? = Yellow Ledge Stone Band of Kimeridge Bay, Dorset
(1)	shales, with oil-shale and with *Exogyra virgula* at depth of 100 ft. below base of Cretaceous	Puny Drain Series (Lower Kimeridge Clay)

The relative thinness of the Kimeridge Clay in Norfolk as compared with over 1,500 ft. in Dorset, is primarily due not to the absence of beds through the existence of non-sequences, but to slow deposition and to the truncation of the upper zones by pre-Cretaceous denudation. In the Southery borings, Dr. Arkell recognised all but the highest zones, but the condensed character of the sequence is clearly demonstrated in the cores from Southery. For example, the pyritized radial plates of the free-swimming crinoid *Saccocoma* which characterise the " Blackstone " of Kimeridge Bay, Dorset, have a vertical range of 13 ft. in the Upper Kimeridge Clay. At Southery this fossil is confined to a bed of greenish-black oil-shale less than one foot thick. Other evidence of slow accumulation is to be found in the absence of large uncrushed shells, in the great abundance of small bivalves, such as *Lucina minuscula* Blake, and in the occurrence of thin seams of finely broken shell debris consisting pre-

dominantly of opalescent fragments of ammonite shells which were broken down before their incorporation in the shale.

Unfortunately no cores were taken from the Mesozoic succession penetrated at North Creake, and very little detailed information about the Kimeridgian zonation was obtained from the washings. The synopsis below has been extracted from records of the Southery borings, with supplementary information from borings near King's Lynn.

Zones	*Approx. Thicknesses*	*Lithology and Fauna*	
		Glauconitic green to dark grey sand and sand-rock	Lower Cretaceous (Neocomian sand)
Unconformity			
	9 in.	phosphatic nodule bed containing much debris of fossils (ammonites of *Pavlovia* type).	
Erosional gap: equivalent of most of the Upper Kimeridge Clay			
	17 ft. +	black shelly clay with numerous beds of greenish brown oil-shale	
Zone of *Subplanites* spp.	8 in. to 1 ft.	hard oil-shale with *Saccocoma, Lucina minuscula, Ostrea bononiae* Sauvage, and fish teeth	"Blackstone" or Kimeridge Coal
	12 ft.	brownish-grey shale with *Modiola autissiodorensis* (Cott.)	
	8 in.	cementstone	Yellow Stone band
?*Gravesia* zones	30 ft.	black shelly clay with *Exogyra virgula* (Defr.) & *Lithacoceras* sp.	
Zone of *Aulacostephanus pseudomutabilis*	5ft.	black shales with *Lingula ovalis* J. Sow. & *Amoeboceras krausei* (Salf.)	
Zones of *Pararasenia mutabilis, Rasenia cymodoce* and *Pictonia baylei*	45 ft.	bluish-grey shaly clay and occasional thin earthy limestones *Protocardia morinica* (de Lor) above, *Amoeboceras* cf. *kitcheni* (Salf.) in lower part and *Rasenia* cf. *uralensis* at base	Lower Kimeridge Clay
	40 ft.	blue-grey shaly clay with periodic earthy limestone bands, *Rasenia* sp. above, *Amoeboceras* and ? *Pictonia* towards base	
Base of Kimeridge Clay lithologically undefined.			

Fauna. Fossils are plentiful throughout the succession in Norfolk and some are common at certain horizons. Most are preserved as crushed impressions in the shale or clay with an adhering powder of white or pinkish crumbling calcitic shell-material, which may be slightly iridescent

or pearly if it is particularly well preserved. The body chambers of ammonites, and certain large lamellibranchs, may partly retain their original contours due to a filling of perhaps clay or cementstone, but only very rarely may undistorted examples be found, unless from nodules.

Apart from the ubiquitous occurrence of thin-shelled lamellibranchs, such as *Lucina minuscula* Blake, in great numbers, certain shells besides ammonites are good indicators of general level in the formation. The lowest beds may locally yield the large flat oyster *Ostrea delta* William Smith, while an associated small incurved oyster with radial ribs, *Exogyra virgula* (Defr.) has a longer upward range in the Lower Kimeridge Clay and does not normally occur higher than the *Gravesia* zones. *Discina latissima* (J. Sow) is commonest in the lower levels of the Kimeridge Clay.

At the base of the Kimeridge Clay in the West Norfolk boreholes there appears to be an imperceptible lithological passage into the Corallian: there is no sign either of seams with *Ostrea delta* or of phosphatic nodule beds such as occur in Cambridgeshire at the junction and below it. The dividing line is therefore placed palaeontologically between the last occurrence of *Prionodoceras* and first appearance of *Rasenia*. In the boring at North Creake, the discovery of a ribbed fragment of a brachiopod, *?Rhactorhynchia inconstans* (J. Sow.), gave supporting evidence of the position of the base of the Kimeridge Clay, which however was nevertheless decided mainly upon the slight lithological change recognisable there at this horizon.

In the Upper Kimeridge Clay, *Lucina minuscula* is probably the commonest lamellibranch, but *Modiola autissiodorensis* (Cott.) is commonest in the shales above a distinctive pale muddy limestone band in West Norfolk, which is equivalent to the Yellow Stone Bed in Dorset.

The top of the Kimeridge Clay in Norfolk is marked by a thin band of black rolled phosphatic nodules, many of which are themselves abraded fragments of Upper Kimeridgian ammonites of *Pavlovia* type. Small black pebbles of phosphate may be found in the fields where this bed outcrops, and at Snowre Hall, Fordham, the bed has been exposed in an unweathered condition in the earthworks for a major drain.

The remains of fish, mainly teeth, and of marine reptiles have been discovered at various horizons. During the construction of the Flood Relief Channel between Denver Sluice and King's Lynn in 1958, many reptilian bones were dug in the region of Stow Bridge, including a pliosauran skeleton which was almost complete but very fragile. The discovery of a similar giant pliosaur, *Stretosaurus macromerus* (Phillips) at Stretham near Ely has recently been described (Tarlo, 1959), and during the work now going ahead near Denver, vertebrae and limb bones referable to this group of pliosaurs continue to be uncovered in the Kimeridge Clay.

Jurassic rocks younger than the Kimeridge Clay are not known in Norfolk, and it is doubtful whether any Portlandian or Purbeckian rocks were ever deposited. Towards the end of the Kimeridgian, the Older Kimeric earth movements began to affect the Norfolk area, with the result that the so-called London-Brabant massif stood higher than before and a long period of denudation of the exposed Kimeridge Clay began. In the Lower Cretaceous period the sea re-advanced from the north into the area. The sandy deposits of this sea were laid down on the eroded Kimeridge Clay surface incorporating much Kimeridgian debris in the basal nodule bed, as well as much contemporary material from the Lower Cretaceous sea floor.

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THE LOWER CRETACEOUS DEPOSITS OF NORFOLK

By G. P. Larwood

The general relationships of the Lower Cretaceous deposits of Great Britain were discussed by Boswell (1929) and the pre-Gault Clay sequences in the Lower Cretaceous of England were described and reviewed by Kirkaldy (1939). Recently, Casey (1961) has described the stratigraphical palaeontology of the Lower Greensands (s.s.). A brief account of the Lower Cretaceous deposits in Norfolk is given by Chatwin (1961, pp. 19–26).

The Lower Cretaceous deposits of west Norfolk range in age from the Neocomian (Sandringham Sands and Snettisham Clay) to the Albian (Gault and Red Rock). Although the term " Lower Greensand " has been applied to the three oldest units in this sequence, only part of the Carstone appears to be equivalent to the Lower Greensand of southern England, and the underlying Snettisham Clay and Sandringham Sands are pre-Aptian deposits.

In west Norfolk Lower Cretaceous deposits outcrop from Hunstanton to Southery, five miles south of Downham Market (figs. 1 and 2). The northern part of the outcrop is fairly free of Glacial Drift cover, but south of King's Lynn extensive areas of Glacial and later deposits obscure the Lower Cretaceous. The outcrop is widest south-east of King's Lynn where it extends eastwards for over six miles from the edge of Fenland. The upper part of the Lower Cretaceous sequence is exposed in the cliffs north of Hunstanton where the Red Rock is the most prominent band, but to the south this passes laterally into normal Gault Clay and this is poorly exposed in a narrow, low-lying, irregular band of country immediately west of the Lower Chalk escarpment.

NEOCOMIAN DEPOSITS

From West Newton northwards it is possible to distinguish two divisions in the Neocomian deposits—the Sandringham Sands below, resting unconformably on an eroded surface of Kimeridge Clay, and the Snettisham Clay above. South of West Newton the Snettisham Clay passes laterally into sandy-clays, sands and sandy flagstones and is thus very difficult to separate lithologically from the Sandringham Sands or from the southward extension of the overlying Carstone. Although it thus becomes difficult to estimate the thickness of the Sandringham Sands it is clear that this varies. Whitaker and Jukes-Browne (1899, p. 5) considered them to be " probably over 100 feet " thick and various borings have subsequently confirmed this estimate. The deep boring at North Creake described by Kent (1947), passed through 133 feet of ferruginous quartz sands beneath the Snettisham Clay, and Pringle (1919, p. 65) regarded all the 111 feet of glauconitic sands penetrated in a boring at West Bilney as belonging to the Sandringham Sands. Other borings have passed through smaller thicknesses of glauconitic sands, but it is not certain whether these are equivalent in age to the Sandringham Sands or to later Neocomian, Aptian or even Albian deposits. Boswell (1920, pp. 46–48) recorded a boring at Crimplesham where only 65 feet of sands and clays separate the Gault Clay from the Kimeridge Clay. In the deeper boring at Severals House, near Southery, only three feet of glauconitic sands and hard " sandrock " with black phosphatic nodules occupy an equivalent position (Pringle, 1923, p. 129). Attenuated deposits of " Lower Greensand " were penetrated in the deep borings at

Culford (32 feet thick) and at Lowestoft (41 feet thick); in each boring the sands were found to rest directly on Palaeozoic rocks.

SANDRINGHAM SANDS

The base of the Sandringham Sands is seldom exposed, but recent excavations east of Fordham, on the line of the Cut-Off Channel of the Fen Flood Relief Scheme, have cut through the junction of the sands with the Kimeridge Clay (TL/625993). Here the basal bed is a coarse, glauconitic, pebbly, quartz sand incorporating many small, rolled phosphatised fragments of Kimeridgian ammonites and internal casts of lamellibranchs and small, white-weathering, phosphatic nodules. This basal conglomeratic bed is about one foot thick and is overlain by grey-green, glauconitic, quartz sands.

Kent (1947, p. 7) draws attention to the character of the basal Sandringham Sands in the North Creake borehole section and states that the "hard pyritic calcareous sandstone with glauconite grains, [is] virtually identical with the unweathered Spilsby Sandstone basement bed."

Deep excavations immediately south-west of Abbey and West Dereham Station, about two miles to the east-north-east of Fordham (TL/655997), have exposed a higher part of the Sandringham Sands of this area. The upper part of the section consists of orange-brown, fine, quartz sands with scattered pebbles. Beneath this oxidised zone are grey, clayey sands passing down into grey-green, patchily cemented sands which overlie a thin layer of very pebbly sand. Three feet of grey-green and white, coarse, glauconitic, quartz sands intervene between this pebbly layer and a strongly cemented, poorly graded, polygenetic conglomerate with sub-angular and rounded pebbles in a limonitic sandstone matrix. The conglomerate passes down into very pebbly dark grey sands, and these rest sharply on blue-grey silty sands with, near the base, a layer of non-calcareous nodules. These contain large fragments of carbonised wood, bored by marine lamellibranchs, and phosphatised casts and moulds of many lamellibranchs, some belemnites and occasional ammonites. Contractors' bore-logs for this locality show that the blue-grey silty sands, with occasional beds of harder cemented sandstone, continue below the visible base of the excavated section for at least 25 feet—giving a thickness of at least 46 feet for the sands at this point. The excavations near Abbey and West Dereham Station thus reveal a distinctive lithology in the lower part of the Sandringham Sands which contain abundant glauconite and a varied marine molluscan fauna. The occurrence near the base of the Sandringham Sands of phosphatic nodules and the presence of phosphatised casts and moulds of mollusca and of fragments of molluscan-bored wood in nodules and free in the sands near Abbey and West Dereham Station indicate that the rate of deposition was at times slow.

The Sandringham Sands are also well exposed to the north, at Bawsey (east of King's Lynn) and at various localities near South and North Wootton, Castle Rising and Dersingham (all north-east of King's Lynn). At Bawsey extensive shallow workings expose white and orange-brown, limonite stained, quartz sands with localised current-bedding. Some green coloured sands in the north-west part of the pits at Bawsey consist of quartz grains with a coating of pale green, apparently chloritic, material and elsewhere in the pits sands with sparsely scattered grains of glauconite occur, but this mineral is not so common as in the exposures south of West Dereham. Exposures of typical upper Sandringham Sands

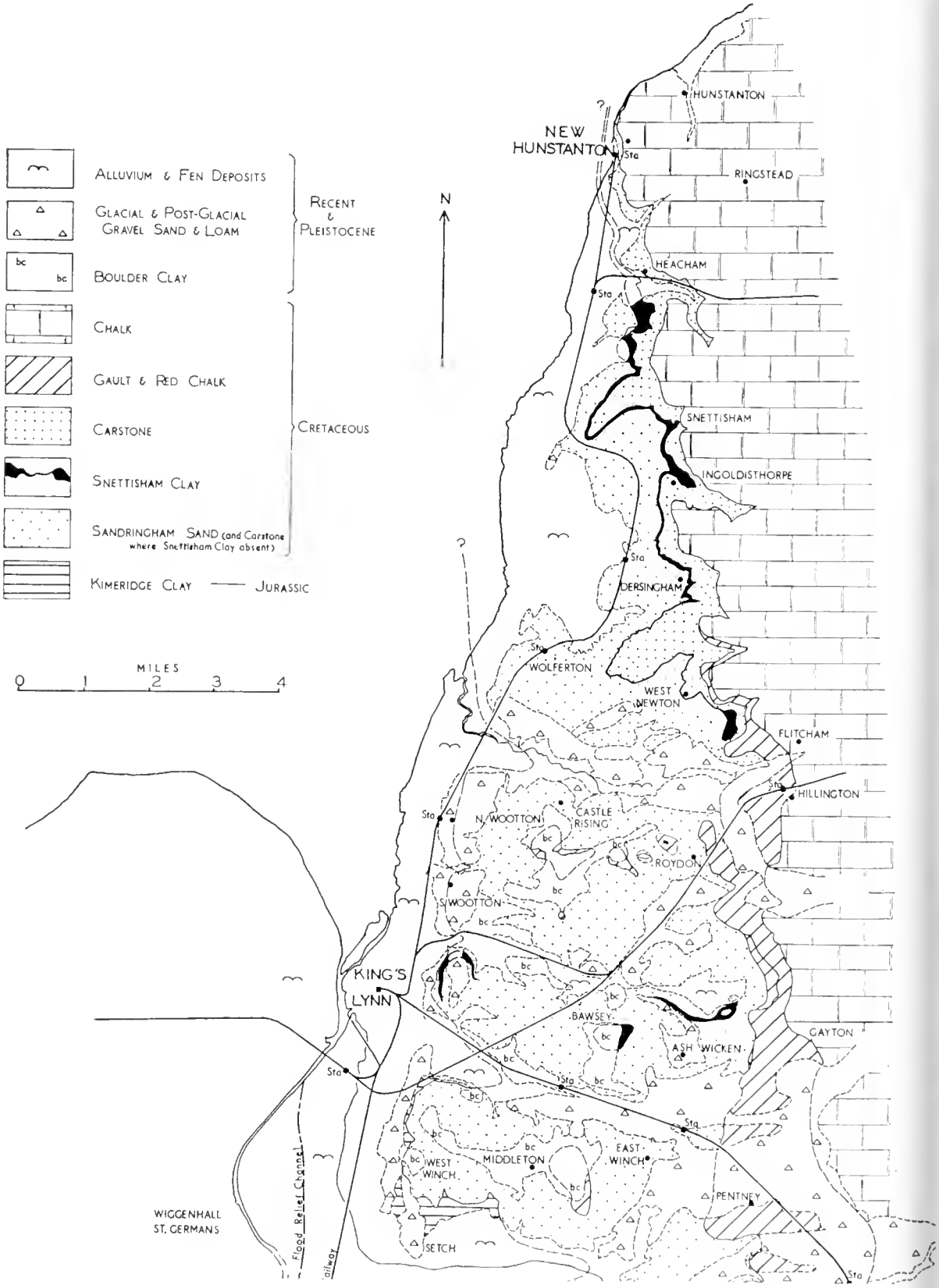

FIG. 1. Geological Map of North-West Norfolk

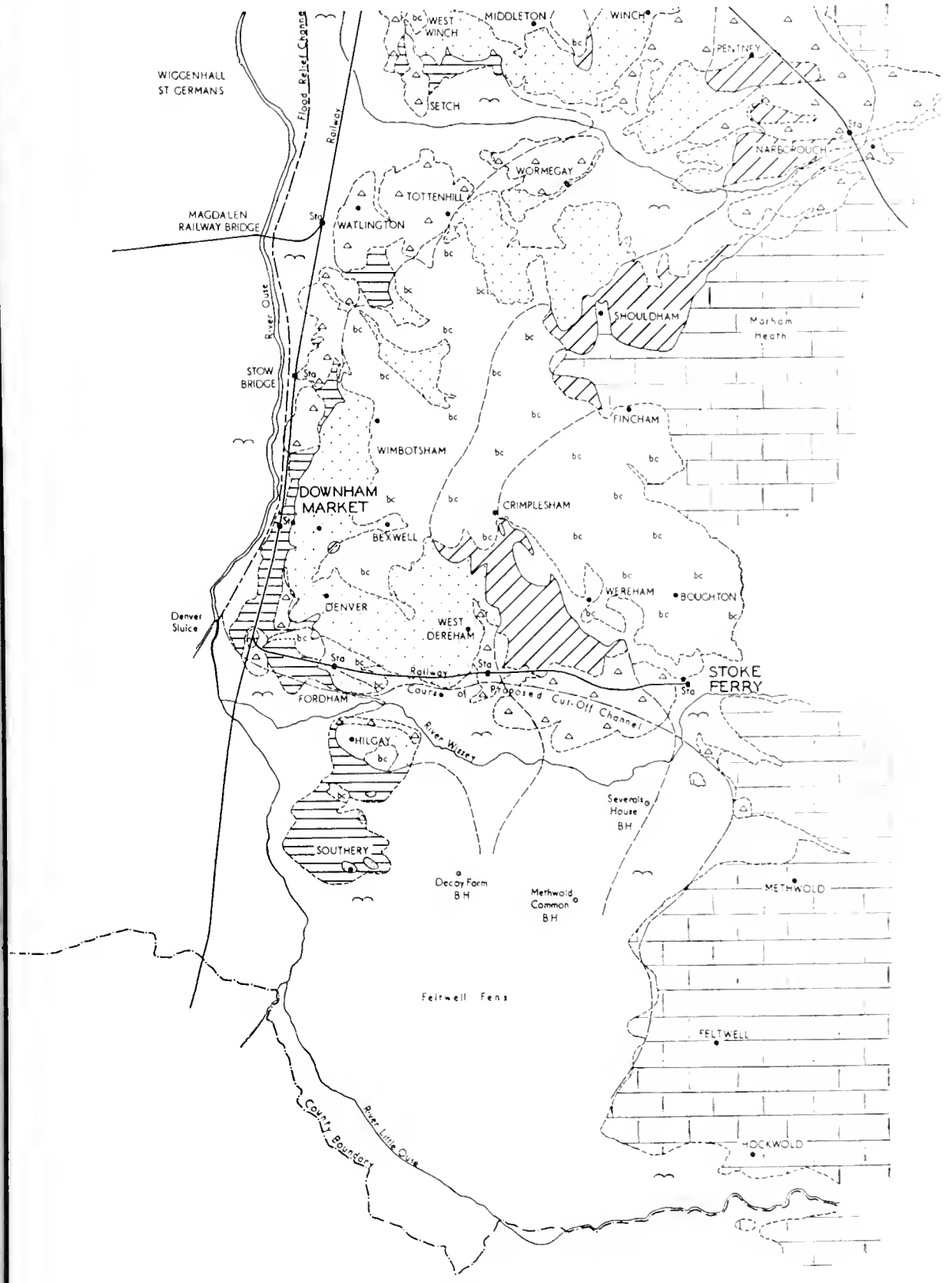

FIG. 2. Geological Map of South-West Norfolk
(The scale and symbols as for fig. 1)

occur near Dersingham (TF/681293) and in the railway cutting east-north-east of Wolferton Station (TF/663287). At each of these localities about 40 feet of the sands are exposed. At Dersingham pale brown, fine, quartz sands with limonitic ironstone layers overlie a sequence of partly current-bedded, coarse and finer grained, white, quartz sands of variable grade. The current-bedding units are seldom more than one foot thick and small scale " herring-bone " current-bedding occurs in three-inch layers near the top of the section. The cutting near Wolferton Station exposes flaggy-ironstones at the top of the section and a variable sequence of sands similar to those at Dersingham. Limonitic nodules occur in a thin, clayey sand about eight feet beneath the top of the section near Wolferton Station.

Schwarzacher (1953), in a study of cross-bedding and grain-size in the Lower Cretaceous sands of East Anglia, has found that, in the Sandringham Sands in Norfolk, westerly components of the current-bedding are smaller than easterly ones and that two size-units of cross-bedding structures may be distinguished. Smaller units occur which are 5 to 20 cms. thick and often lie between parallel beds, and larger units—1 to 5 ms. thick—which may have truncated tops with no signs of top-set beds. Schwarzacher concluded that in Sandringham Sand times a north-south coastline had apparently lain near the Wash, between Norfolk and Lincolnshire, and that the occurrence of contiguous beds in the Sandringham Sands with opposing current-bedding dips possibly suggests " a more or less horizontal floor in the middle of the basin."

Rastall (1919, p. 214) has described the results of an analysis of the heavy minerals from samples of Sandringham Sands from a pit near Castle Rising. In these samples kyanite and tourmaline were found to be the dominant characteristic minerals and staurolite was common. Rutile was less common and small amounts of zircon, green biotite, dark green and blue hornblende, pale green pyroxene and flakes of muscovite also occurred. One sample yielded a large number of grains of garnet.

In the north part of the outcrop in north-west Norfolk, the junction of the Sandringham Sands with the overlying Snettisham Clay is not often exposed. The floor of the old brick pit at Heacham is cut in the top of the Sandringham Sands but the junction with the Snettisham Clay, which is exposed in the overgrown face of the pit, is not visible. About six miles to the south of Heacham, deep drainage ditches east of West Newton Farm exposed, in 1956, the Snettisham Clay resting on very fine grained, strongly limonitic, orange-brown, quartz sands—the top of the Sandringham Sands. A thin, irregular, limonitic ironstone band occurs at this locality between the two formations.

Whitaker, Skertchly & Jukes-Brown (1893, pp. 11–19) recorded various exposures of " Lower Greensand " in the southern part of the outcrop of the Neocomian deposits in west Norfolk, but it is not certain how many of these descriptions may refer to the Sandringham Sands or younger horizons. Whitaker & Jukes-Browne (1899, pp. 5–9) also listed details of exposures of the Sandringham Sands north-east of King's Lynn. In this area the Snettisham Clay is developed and clearly defines the upper limit of the Sandringham Sands.

Most of the Sandringham Sands are unfossiliferous and their precise age is therefore unknown. Lamplugh (1899, pp. 21–25, 27) has discussed the poorly preserved fauna obtained from ironstone bands in the sands near Wolferton and from Roydon Common to the south-east. He listed wood fragments, *Serpula* sp., a ? polyzoan, gastropod fragments and a number of lamellibranchs which he referred to various genera including

" *Trigonia*." The recent discovery of a much better preserved molluscan fauna, not yet completely identified, in the glauconitic sands near Abbey and West Dereham Station, will aid correlation with the Lincolnshire and Yorkshire Neocomian deposits. Lamplugh (1899, p. 24) has already tentatively compared the lower part of the Sandringham Sands with the Berriasian Spilsby Sandstone (Infra-Valanginian of Spath, 1924), and the newly discovered fauna from the lower part of the excavation near Abbey and West Dereham Station may well be characteristic of this stage of the Neocomian.[1] Correlation of the upper part of the Sandringham Sands is very uncertain; it is probably pre-Barremian, but Lamplugh has suggested (1899, p. 24) that the clayey nodular layers with plant remains at the top of the Sandringham Sands may be " closely allied to the Snettisham Beds in age." He also tentatively interpreted the southward increase in number of plant remains in the Snettisham Clay and underlying or equivalent ironstone layers as indicating " the proximity of land " and that these deposits " may not impossibly be of estuarine origin."

SNETTISHAM CLAY

The Snettisham Clay is present in the north of the area only. It has a very narrow and irregular outcrop which may be traced continuously from the south side of Heacham through Snettisham, Ingoldisthorpe and Dersingham to just south of West Newton. Over this tract it forms a feature marked by small springs and the widespread growth of rushes at its junction with the overlying Carstone. In the north it is at least 30 feet thick, but south of West Newton it is reduced to less than eight feet and cannot be traced with certainty further to the south. It is not known how much of the sands, clayey-sands and thinly-bedded sandstones to the south are true lateral equivalents of the Snettisham Clay nor is it possible to separate the arenaceous facies of the Snettisham Clay from the underlying Sandringham Sands or the finer grained overlying Carstone. It is possible that small patches of clay east of King's Lynn, at Bawsey and north of Ashwicken may be local lenticles of the Snettisham Clay, but they are unfossiliferous and their precise age is not known.

The deep boring at North Creake passed through 25 feet of Snettisham Clay varying from a " pinkish buff clay with dark brown limonite ooliths . . ." at the top, to a " pinkish, light grey, and greenish sandy clay (with quartz and dark limonite grains in a silty clay matrix) and clayey sand " above a " stiff light brown sandy clay with limonite grains "—the latter 19 feet thick. Kent (1947, p. 6) also notes that the junction of the Snettisham Clay with the overlying Carstone is here gradational and that the sandy nature of the Snettisham Clay in the North Creake bore-hole section indicates " that only a moderate increase in current velocities would be needed to produce the predominantly sandy facies of the later bed [the Carstone]."

At outcrop the Snettisham Clay is very poorly exposed. To the south of Heacham in Heacham Old Brickpit (TF/677364) the working face is now very overgrown, but there are small exposures in the red-brown, slightly silty clay with lines of small, concentrically layered, limonitised clay-ironstone nodules which contain fragments of casts and moulds of ammonites and small lamellibranchs. The clay is again poorly

[1] Casey (1961b) has recently reported on the fauna from the nodules in the blue-grey silty sands exposed in the base of the excavation near Abbey and West Dereham Station and has concluded that " the Sandringham Sands are wholly or in part of Berriasian age . . ."

exposed at the site of Snettisham Old Brickworks west of Park Farm, Snettisham (TF/689339). Here it is a pale yellow-grey, buttery deposit surrounding large, limonitised clay-ironstone nodules. In 1956 deep trenching immediately south of Heacham Church (TF/681379) cut through nine feet of Carstone and penetrated four feet into the underlying pale, brown-grey Snettisham Clay. At this locality it is very silty and contains many small flakes of mica. There is thus considerable variation in the lithology of the Snettisham Clay in a short distance, but near the type locality there is no exposed development of the facies containing limonitic ooliths found in the boring at North Creake. At the southern end of the outcrop deep drainage ditches east of West Newton Farm exposed the whole of the thinned Snettisham Clay (TF/700273). At this locality the clay is weathered to a light yellow-brown and is very sandy containing, at the base, numerous small subangular pebbles and occasional, white-weathering phosphatic nodules. Whitaker & Jukes-Browne (1899, pp. 9–12) give details of several exposures of the Snettisham Clay many of which are no longer visible.

The fauna and flora of the Snettisham Clay was reviewed by Lamplugh (1899, pp. 21–26). He listed (pp. 25, 26) lignite and the plant *Weichselia reticulata* (Stokes & Webb) [=W. (*Lonchopteris*) *mantelli?*], fish vertebrae, a serpulid, two brachiopod genera, belemnites, seven genera of gastropods, eighteen genera of lamellibranchs—including "*Trigonia*," *Thetironia minor* (J. de C. Sowerby) [=*Thetis sowerbyi* Roem.], *Oxytoma* sp. [=*Avicula* sp.], *Resatrix* sp. [=*Cytheraea* sp.] and *Entolium orbiculare* (J. Sowerby) [=*Pecten orbicularis* Sowerby]—and ammonites which he assigned to the genus *Crioceras*. In a review of the ammonites of the Specton Clay and the subdivisions of the Neocomian Spath (1924, p. 79) revised the nomenclature of the ammonites from the Snettisham Clay at Heacham assigning them to three genera—*Paracrioceras* (*P. occultum*, *P.* aff. *varicosum*, *P.* cf. *elegans*); *Acrioceras* (*A.* cf. *tabarellii*, *A.* cf. *silesiacum*, *A.?* sp. nov.?) and *Hoplocrioceras* (*H.* aff. *loeviusculum*). These genera and species indicate a Lower Barremian age for the Snettisham Clay.

APTIAN AND ALBIAN DEPOSITS

CARSTONE

The distinctive ginger-brown Carstone which forms the lower part of the succession exposed in the cliffs at Hunstanton overlies the Snettisham Clay and grades rapidly upwards into the Hunstanton Red Rock. The Carstone outcrops southwards from Hunstanton forming a small but prominent feature east of the outcrop of the Snettisham Clay, but south of West Newton, where the facies of the Snettisham Clay becomes arenaceous, it is difficult to determine the base of the Carstone and to separate it from the underlying sands. In the north of the area the thickness of the Carstone is at least 40 feet and in the deep boring at North Creake, eleven miles from Hunstanton, 58 feet was penetrated. In this boring Kent (1947, pp. 5, 6) distinguished two lithological divisions in the Carstone: a predominantly coarse and gritty sandstone with irregular fragments of limonite concretions, phosphatic nodules and, especially at the base, quartz and quartzite pebbles, extending for 28 feet below the Red Rock, and the remainder of uniform grade with very abundant limonite ooliths.

The coarse and pebbly character of the upper part of the Carstone is well displayed in the cliffs at Hunstanton where the deposit is thick-bedded and massive, well-jointed in parts but becoming more friable or

flaggy near the top. About 15 feet beneath the overlying Red Rock the Carstone is conglomeratic with many small pebbles of quartzite, chert and occasional silicified oolites. The Carstone in the cliff section is locally current-bedded on a fairly large scale. Well-jointed but finer grained Carstone is quarried just north of Snettisham (TF/685349), and the deposit is everywhere strongly ferruginous with abundant limonite thickly coating the sub-rounded quartz grains and with frequent brown or black, smooth, highly polished grains which are limonite ooliths with siliceous or green glauconite cores. Rastall (1919, 1930) has described the petrography of the Carstone: kyanite and staurolite are the dominant heavy minerals, tourmaline, rutile and zircon fairly common, and garnet, pyroxene and a chloritoid distinctly rare. Details of various exposures of the Carstone were given by Whitaker & Jukes-Browne (1899, pp. 12–16) who referred also to the basal beds of the Carstone exposed on the foreshore at Hunstanton at very low tides. The base is here conglomeratic with fossiliferous phosphatic nodules which are indigenous, and occasional gritty nodules derived from the underlying Snettisham Clay. This phosphatic nodule horizon was not recognised in the boring at North Creake, where dull grey ferruginous sandstones rest on the Snettisham Clay, nor was it present at the base of the Carstone exposed in a temporary section, immediately south of Heacham Church, where orange-brown, limonite-rich, slightly pebbly sands directly overlie the Snettisham Clay. The Carstone may be traced to east of West Newton but south of this it is not possible to separate it lithologically from the Sandy Neocomian deposits. It is probable that the upper part of the section, recently exposed by excavations near Abbey & West Dereham Station, at the southern end of the outcrop, may be equivalent in age to part of the Carstone in the north, and considerably younger than the fossiliferous blue-grey silty sands beneath (Casey, 1961*b*). The abrupt change in lithology from these silty sands to the well-cemented conglomerate (see p. 283) marks a significant change in deposition and a period of erosion of the lower beds.

Except for the basal bed, the normal lithology of the more ferruginous and well cemented Carstone of the north of the county is unfossiliferous apart from occasional fragments of very poorly preserved wood. The comparatively rich ammonite fauna of the basal bed has recently been reviewed by Casey (1961*a*, p. 571). He has concluded that " the assemblage is composed of two faunas only, both Lower Aptian in age " and he has listed the following ammonites:—" *bowerbanki* Zone (*transitoria* Subzone), *Tropaeum bowerbanki Id.*, var. *densistriatum*, *T. drewi*, *T. sp. indet.*, *Australiceras gigas*, *Tonohamites* (?) *sp. nov.*, *Cheloniceras* (*Ch.*) *cornuelianum*, *Ch.* (*Ch.*) *crassum*, *Id.*, var. *nov.*, *Ch.* (*Ch.*) *spp. nov.*, *Dufrenoyia furcata*, *D. truncata*, *D. transitoria* sp. nov., *D. sp. nov. fissicostatus* Zone (*bodei* Subzone), *Ancyloceras* cf. *varians*, *Prodeshayesites fissicostatus*, *P. bodei*, *P. laeviusculus*, *P. spp. nov.*" The lamellibranch *Mulletia mulletia* also occurs.

Casey also refers to the " only other ammonitiferous deposits of Lower Greensand age in Norfolk "—those which were described by Teall (1875) and Whitaker, Skertchley & Jukes-Browne (1893) from West Dereham where sandy phosphate-workings at the base of the Gault revealed a fauna characteristic of the *mammillatum* Zone (*kitchini* Subzone) of the Lower Albian.

Thus the lowest part of the Carstone in the north contains Lower Aptian fossils and the topmost sands beneath the Gault in the south are Lower Albian in age. Casey (1961*a*, p. 571) has suggested from the

way in which it grades up into the Red Rock, that the upper part of the unfossiliferous ferruginous Carstone in the north is also of Albian age.

GAULT CLAY AND THE HUNSTANTON RED ROCK

The youngest deposits of the Lower Cretaceous in Norfolk are richly fossiliferous and of very varied lithology. In the south-west of the county Gault Clay of fairly normal type outcrops between Wereham and West Dereham to the north-west of Stoke Ferry. Between Crimplesham and Fincham glacial deposits obscure the clay, but around Shouldham, and west of Narborough, the Gault is again exposed at the surface. Further north, between Gayton and Ashwicken and extending, in a narrow but more continuous outcrop, to Roydon, Hillington and Flitcham the normal facies of the Gault Clay changes to variously coloured marly clays, and passes laterally northwards into the distinctive Red Rock facies which extends from Dersingham to the cliffs at Hunstanton.

As the lithology changes from normal Gault Clay in the south to the Red Rock in the north so the deposits become rapidly thinner. This northward reduction is evident in Cambridgeshire where the Gault is only 150 feet thick compared with the full normal succession of 230 feet in Bedfordshire. Near Wereham there is probably less than 60 feet of pale-grey marly Gault with a phosphatic nodule horizon at its base. This pale-grey marly facies continues in the outcrops around Shouldham, but here the estimated thickness is only 30 to 40 feet, the upper part is more calcareous, and the phosphatic nodule horizon apparently is not developed at the base. Whitaker, Skertchly & Jukes-Browne (1893, p. 22) referred to a shallow boring at Narborough where only " 20 feet of marly clay [was] identified as Gault." The southern end of the more continuous outcrop near Gayton is now very poorly exposed, but Whitaker *et. al.* (1893, p. 25) recorded a stream section near Grimston, about two miles north of Gayton, exposing 20 feet of deposits which are the local representative of the Gault. In this section 10 feet of white marls overlie two thin beds of hard limestone separated by a thin pink marl, the lower hard limestone resting on about eight feet of very dark grey clay. A similar succession was recorded by Jukes-Browne & Hill (1887, p. 550) from a pit near Roydon Church, but here the upper white marls become hard near the top forming a pale yellow limestone.

The Gault deposits continue to thin northwards to just east of Dersingham where they are only about seven feet thick. Here the lower part consists of brown and red calcareous clay and the upper part of soft green-white marls. From this point northwards the Gault is reduced to four feet of pink, ferruginous limestone with small pebbles—the Red Rock. This peculiar and very distinctive deposit has attracted the attention of many workers in the past. William Smith first recorded its occurrence in 1816 (p. 10) and Sedgwick (1826, p. 342) first suggested its correlation with the " Cambridge galt." Subsequently S. Woodward (1833, pp. 29, 54) and C. B. Rose (1835, pp. 172, 180, 275; 1836, p. 41) described the deposit. More detailed accounts were written by Wiltshire (1859, p. 260; 1869, p. 427) and by Seeley (1861, p. 233; 1864*a*, p. 327; 1864*b*, p. 276; 1866, p. 173). These descriptions and discussions of the age of the Red Rock and many other shorter references to the deposit were reviewed by Whitaker (1883, pp. 212–36). Jukes-Browne described the Red Rock in the Geological Survey Memoir for Sheet 69 (Whitaker & Jukes-Browne, 1889, pp. 35–45) and compiled a more complete faunal list. Rastall has also described the lithology (1910, p. 151) and has investigated the heavy minerals of the deposit (1930, pp. 436–58).

Three slightly different bands may be distinguished in the Red Rock in the cliffs at Hunstanton. The lowest ten inches is softer and more calcareous with scattered small pebbles and limonite-coated quartz grains—exactly similar to those of the underlying Carstone. The middle two feet is a darker pink, often nodular limestone with many small pebbles and a high proportion of quartz grains and is more fossiliferous than the lowest part. In the topmost band the Red Rock is harder and mottled pale or dark pink with white patches and is the most calcareous part of the deposit. Whereas the base of the Red Rock grades rapidly down into the Carstone, the top is sharply differentiated from the overlying Cenomanian and is marked by a thin seam of soft, fine grained, very dark red, highly ferruginous material.

The Red Rock is not well exposed inland; it can be seen beneath the subsoil resting on Carstone in the pit just north of Snettisham, but although there are no other permanent exposures its course is easily traced across ploughed fields at the foot of the Lower Chalk escarpment. Little is known of the eastward extent of the deposit. It was penetrated in the boring at North Creake where it consists of six feet of " pale yellow chalk and orange chalk with scattered grit grains, and deep red very gritty chalk with *Inoceramus* fragments [and] a few ' lydite ' pebbles " (Kent, 1947, p. 3). Whitaker (1878, pp. 16–18) published the details of a boring at Holkham Hall in which the Red Rock horizon was penetrated at about 655 feet beneath the surface. The " Red Marls " were found to be eight feet thick and to overlie 10 feet of " Blue Gault " which rested on 70 feet of sands and sandstones. This succession shows that the Red Rock facies was developed earlier in the west than in the east.

In his description of the sandy residue of the Red Rock, Rastall (1930, p. 445) states " This sand is simply Carstone: it shows the same types of sand grains and rock chips, with the same brownish-yellow stain; the same glauconite; the same highly polished spherical black grains in approximately the same proportion, and the same heavy minerals after separation." This applies to the whole of the Red Rock which was extensively sampled. The only marked change which Rastall found was the presence of a large number of " much smaller grains of an entirely different mineral assemblage " in the thin seam of red material between the Red Rock and the basal Cenomanian. In addition to the larger heavy mineral grains characteristic of the Red Rock he found small grains of zircon, rutile, tourmaline, epidote, zoisite, (?) garnet, pyroxene and blue amphibole.

Rastall has concluded that the heavy mineral assemblage in the Red Rock was derived from a land area to the south or east and that there was a definite change in direction of derivation at the end of Red Rock times marked by the distinctive assemblage in the highly ferruginous seam at the top. The high iron content of the Red Rock—as much as 40 per cent but usually about 10 per cent—is consistent with the sediment being derived from a lateritic land surface undergoing tropical weathering.

Deposition of the Red Rock was slow and the fauna shows it is a condensed equivalent of a great thickness of normal Gault Clay elsewhere. The fossils from the lower part may indicate that this is equivalent to the Lower Gault, but distinctive Upper Gault lamellibranchs have been found within one foot of the base so that the greater part is of Upper Gault age.

The extensive faunal list compiled by Jukes-Browne in the Geological Survey Memoir (Whitaker & Jukes-Browne, 1889, pp. 42–45) included

foraminifera, sponges, corals, echinoids and a crinoid, serpulids, crustaceans, many cyclostomatous polyzoa and a few cheilostomatous polyzoa, a small number of distinctive brachiopods, many mollusca and occasional fish and reptilian remains. The majority of generic and specific names used in Jukes-Browne's list now need revision and I am indebted to Dr. R. Casey who has very kindly provided the following revised list of fossil Mollusca from the Hunstanton Red Rock.

Lamellibranchia

Spondylus gibbosus d'Orbigny
Plicatula gurgitis Pictet & Roux
Plicatula minuta Seeley
Entolium orbiculare (J. Sowerby)
Eopecten studeri (Pictet & Roux)
Lima (*Plagiostoma*) *globosa* (J. de C. Sowerby)
Aucellina gryphaeoides (J. de C. Sowerby)
Liopistha sp.
Inoceramus concentricus Parkinson
Inoceramus concentricus var. *subsulcatus* Wiltshire
Inoceramus sulcatus Parkinson
Inoceramus tenuis Mantell
Inoceramus anglicus Woods
Ostrea vesicularis Lamarck
Lopha diluviana (Linné)
Exogyra conica (J. de C. Sowerby)
Diploschiza sp.

Gastropoda

Anchura (*Perissoptera*) *marginata* (J. de C. Sowerby)
Metacerithium ornatissimum (Deshayes)
Gyrodes genti (J. Sowerby)

Cephalopoda

Beudanticeras beudanti (Brongniart)
Beudanticeras sphaerotum (Seeley)
Hoplites canavariformis Spath
Hoplites pretethydis Spath
Anahoplites planus (Mantell)
Dimorphoplites hilli Spath
Dimorphoplites alternatus (Woodward)
Dimorphoplites alternatus var. *perelegans* Spath
Euhoplites ochetonotus (Seeley)
Euhoplites solenotus (Seeley)
Euhoplites sublautus Spath
Euhoplites sublautus var. *monocanthus* Spath
Euhoplites subcrenatus Spath
Euhoplites trapezoidalis Spath
Euhoplites armatus Spath
Euhoplites opalinus Spath
Mortoniceras pricei (Spath)
Mortoniceras (*Deiradoceras*) *devonense* Spath
Mortoniceras (*Deiradoceras*) *cunningtoni* Spath
Mortoniceras (*Deiradoceras*) *albense* Spath
Cymatoceras albense (d'Orbigny)
Cymatoceras hunstantonensis (Foord & Crick)
Neohibolites minimus (Miller)
Neohibolites minimus var. *pinguis* Stolley

Neohibolites minimus var. *oblongus* Stolley
Neohibolites minimus var. *attenuatus* (J. de Sowerby)
Neohibolites minimus var. *submedius* Swinnerton
Neohibolites minimus var. *ultimus* (d'Orbigny)

The better preserved specimens which were assigned to the cheilostomatous polyzoan *Membranipora* have also been revised recently (Thomas & Larwood, 1960, p. 381) and belong to *Rhammatopora gaultina* (Vine).

It has not yet been possible to revise the nomenclature of the remaining fossil groups listed by Jukes-Browne. The fish, mollusca, brachiopods and echinoderms which were collected and recorded from the more normal facies of the Gault Clay in Norfolk by Whitaker, Skertchly & Jukes-Browne (1893, pp. 26, 27) also need taxonomic revision.

In general, the Lower Cretaceous deposits in Norfolk vary markedly in thickness and in faunal and lithological facies from north to south. This variation may be related to the positive stability of the Norfolk area during much of the Cretaceous. Areas to the north and south were submerged earlier and subsided more rapidly. In the next section, Peake & Hancock indicate that the effects of the positive stability of the East Anglian area in Lower Cretaceous times may be traced into the Upper Cretaceous which again exhibits significant changes in lithological and faunal facies in the Norfolk area.

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THE UPPER CRETACEOUS OF NORFOLK

By N. B. Peake and J. M. Hancock

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INTRODUCTION

Further advances of the sea during the Upper Cretaceous resulted in deepening water in the Norfolk region. The chalk deposited is present over the whole county (although generally hidden by Drift) except for a narrow strip in the west, bordering the Wash. It is the first Cretaceous formation to be continuous in general character from southern England to Yorkshire, and here reaches a thickness of 1,350 feet. The influence of the older axis of uplift continued during the earlier part of the period, and the lower chalk in the north-west of the county seems to have been deposited in shallower water. Typically a very soft white limestone, chalk is so fine grained that its wholly organic origin is not immediately apparent. This fine-grained material is largely made up of fragments of planktonic algae known as coccoliths, together with lesser amounts of foraminifera, polyzoa and lamellibranch débris. Silica—probably originally as sponge-spicules—has been redistributed to make flint, which is a form of quartz with water occluded in sub-microscopic cavities. The flint mostly occurs as lines of nodules (roughly parallel with the bedding-planes) ranging up to irregular masses a yard or more across, but commonly about fist-size. These occasionally run together to form tabular sheets, and at certain horizons there occur large flints, typically barrel-shaped, often with a vertical cavity, known as Paramoudras, sometimes arranged in a vertical column, rising from one horizontal flint-band to another above. These curious flints were first described from Ireland by Buckland (1817) and in Norfolk are called " Potstones."

Three principal divisions of the Chalk are generally recognised in Britain—Lower, Middle and Upper—but it is equally convenient in Norfolk to work with the stages recognised internationally. The zones into which the Chalk is further subdivided are indicated in Fig. 3. It should be noted that the fossils by which the zones are named are not necessarily abundant in, or confined to their particular zones in Norfolk. Moreover, disproportionate attention has been given to the Cenomanian, Upper Senonian and Maastrichtian in the classical localities of Hunstanton, Norwich and Trimingham. Even in this work, although the accounts of the Cenomanian, lower Turonian, and the *B. mucronata* and *B. lanceolata*

Zones are the results of our own observations except where stated, the faunal accounts of the intervening beds are based largely on earlier work—particularly the unpublished notebooks of H. Dixon Hewitt.

HISTORICAL

There are early descriptions of the Chalk by Taylor (1823) and Rose (1835) but the first work of importance is that of Samuel Woodward (1833), and this not so much for its text as for its plates of fossils. Woodward divided the Chalk into three and listed in detail the fauna of each division. The wealth of species peculiar to the higher beds was thus recognised early, and Darwin, Davidson, Duncan, Sharpe and Wright based descriptions in their monographs on Norfolk material. But it was not until 1876 that Barrois brought this faunal knowledge back into stratigraphical use. With his wide experience of the Cretaceous of north-west Europe he recognised and delineated zones, and noted that the Trimingham chalk, already known to be younger than that of Norwich, contained species characteristic of Maastricht and Ciply (i.e. Maastrichtian). The work of Clement Reid (1882), Whitaker (1887, etc.) and H. B. Woodward (1884, etc.), mainly recorded in Sheet Memoirs of H.M. Geological Survey, added to this knowledge, and the most detailed account of the Lower Chalk to date was given by Jukes-Browne and Hill (1887); this is largely summarised in their general work of 1903.

During the first decade of the present century there was a spate of heated papers on the tectonic status of the Trimingham sections, by Bonney, Brydone, Hill, Howorth and Jukes-Browne. Of these workers, Brydone alone subdivided and mapped the fleeting foreshore exposures at Trimingham with detailed accuracy (1908), and all subsequent work there must be based on this. Although Rowe did much collecting in the county, his work remains unpublished, but part is incorporated in a zonal map in Boswell's (1920) paper on the surface and dip of the Chalk in Norfolk.

In the south-west, Hewitt (1924, 1935) zoned the exposures of the chalk of the Thetford area up to the Zone of *Uintacrinus*. His painstaking records have demonstrated occurrences at unusual horizons of many well-known species and serve to accentuate our ignorance about these horizons throughout the rest of Norfolk. During the same period, Brydone attempted to trace the boundaries of the Zones of *Uintacrinus* and above across the whole county—no mean task in view of the great intervals between the few exposures.

OUTCROPS, AND THE PROVENANCE OF MUSEUM COLLECTIONS

Although underlying the greater part of the county, the Chalk is seldom seen on the surface, being covered by Pleistocene over most of the area, and by Palaeocene and Eocene in the east. Furthermore, successive glaciations often caused disturbances in the beds beneath, resulting in frost-shattering and -heaving and sometimes in overthrusting and actual transport of huge blocks of chalk. Except for the extreme west, it is only where river valleys have cut down deep enough through these later deposits that the chalk actually outcrops on the surface, and it is along such valleys that nearly all the recorded pits have been dug.

On the north coast, where cliff-sections might be expected to occur, westerly longshore drift during recent times has caused the development of shingle spits backed by salt-marshes upon the sand flats west of Weybourne; the old degraded sea cliff is now well inland, and the chalk

unexposed, except along the east side of the Wash, where a strike-section cut into the Lower Chalk escarpment occurs for one mile north from Hunstanton. East of Weybourne Hope, at which point the longshore drift becomes (south-) easterly, and deep water comes close inshore, low cliffs do occur, but by this point the steady E.N.E. dip of the chalk surface (see Pl. I) has brought the latter down to a mere 15 feet above O.D., and within another two miles, at Sheringham, this has dropped below mean tide level. Eastwards from there to Cromer, chalk is seen only near low water level, after scouring tides (usually generated by strong north-westerly winds) have removed some of the sand and shingle cover. Cromer Pier is founded upon chalk, which is below the low water mark even of spring tides, and the only chalk seen east of this point consists of glacially-disturbed masses, now many feet above the expected level of the chalk surface. A few of these masses present bluffs at the base of the soft glacial cliffs, where falls often conceal them; others now left in front of the present cliff-line by erosion (which averages 2–3 feet annually) have been bevelled down to low water mark, and are normally covered by sand. During abnormally low spring tides, portions are occasionally revealed in the ever-shifting drainage channels which run along the foot of the steep pebble beach before finding outlets through the sand flats. Such is the case at Trimingham, where the greater part of the masses mapped by Brydone (as temporary removals of the sand-cover permitted) lie within an army minefield as yet uncleared owing to these unstable conditions.

Inland, during earlier centuries, much use was made of chalk, either in its raw state ("marl") or after calcining to lime, for improving the acid glacial soils. Marl-pits were dug wherever there were surface indications of chalk—many of those in the east being dug in glacially re-arranged chalk or in erratic blocks. Hand working often led to conspicuous fossils being picked out and set aside, and from these some of the earliest collections (such as those of Fitch, King, Rose and S. Woodward, now in the Norwich Castle Museum) were probably made. Easier transport gradually led to fewer but larger workings; many (especially around Norwich) were dug into valley-sides until the removal of ever-increasing amounts of overburden became unprofitable, or were deepened below the water-table until flooded. Once abandoned, such pits are soon obliterated by collapse of the soft overburden. The few pits existing to-day are worked by mechanical means, and the occasional fossils found on their surfaces are often shattered thereby; intensive working usually means that faces are not left alone long enough to become weathered by the gentle action of frost and rain. Even on the coast, the building of groynes near Cromer and Sheringham has reduced the number of occasions on which the beach is temporarily scoured away.

COLLECTING TO-DAY

Nonetheless, opportunities for adding to existing knowledge of the fauna and distribution of the zones are still very great. Excavations for drains and sewerage schemes, and for foundations of large buildings, can yield valuable information to workers on the spot, and it is most important that the provenance of any fossils should be recorded as accurately as possible, both geographically and in vertical position within the section where found; one or two vertical sections given in the following pages may assist in this. It would be most helpful if more collectors showed their finds to experts, who can usually be contacted through their local museums.

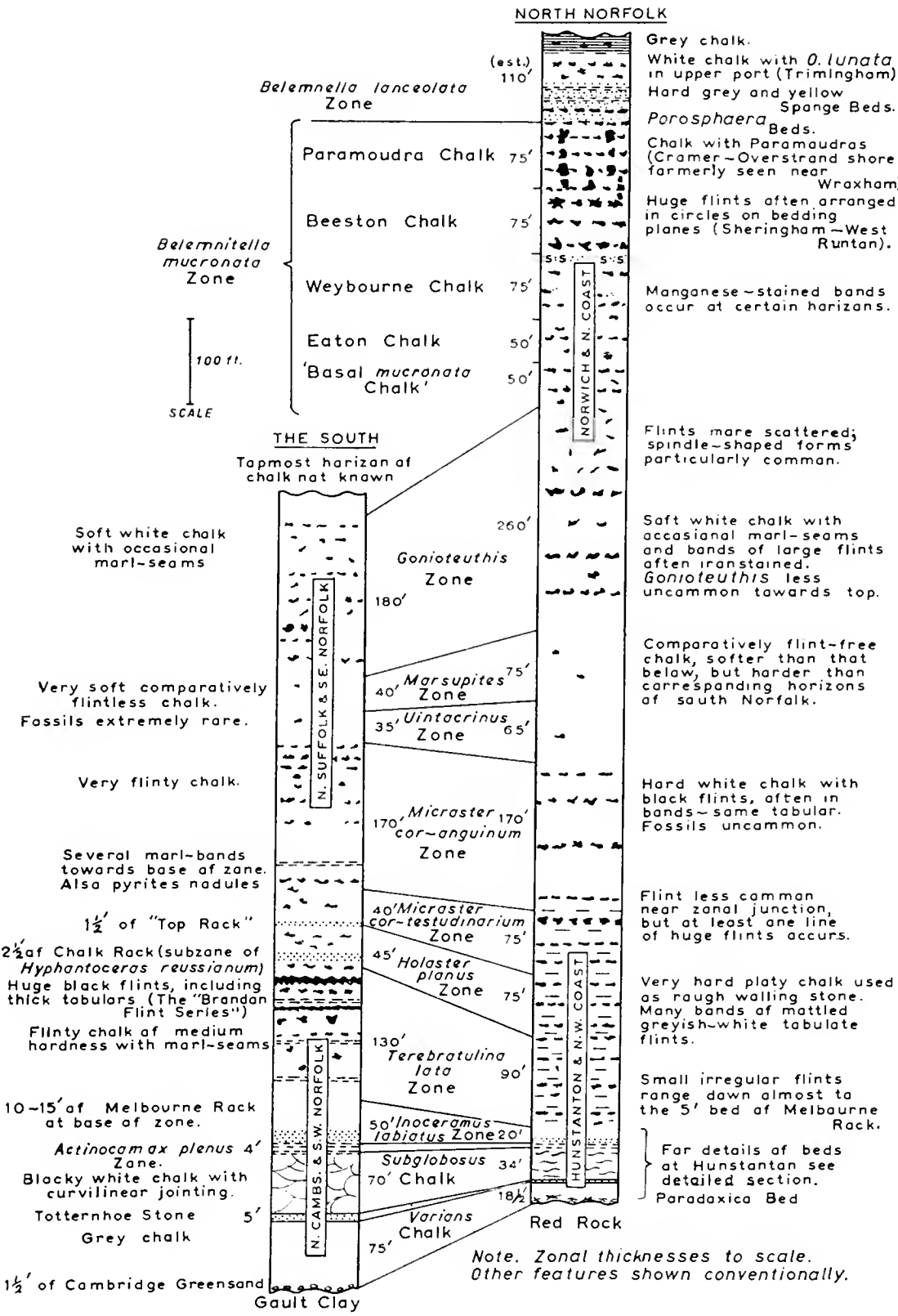
Two cautionary notes are necessary. First, with regard to material found loose: inland pits frequently change hands, and chalk or discarded flint is often transported from one pit to another for processing or filling-in, and specimens not actually collected *in situ* are always suspect; also, fossils found loose upon the foreshore may not have originated in the outcrops on which they lie—many having come from the Drift into which they had been earlier derived, and others carried alongshore by tides. Secondly specimens collected from, or near, the coast are always heavily charged with marine salts, which must be removed by continuous soaking in repeated changes of fresh water for several weeks. If this is not done, crystallisation will occur, and the specimens will crumble and disintegrate after a few months of storage; a fuzzy growth upon the surface usually indicates the onset of this phenomenon, and whenever seen, soaking must be recommenced.

STRUCTURE, THICKNESSES, AND THE ZONAL MAP

The earliest reasonable estimate of the dip of the chalk of Norfolk was made by Gunn (1865), who obtained a figure of 29 feet per mile for the base of the formation from Hunstanton to Norwich, and an identical figure for the top from Norwich to Yarmouth, where the chalk surface is 506 feet below O.D. Unfortunately he failed to recognise the separate factors which go to make up these figures. Boswell (1916), from boring records then available, prepared a map showing the contours of the chalk surface, and he estimated (1920) the formational dip in central Norfolk at about 35 feet per mile, lessening towards the east. He pointed out that over the greater part of the county the surface dips at only 8 or 9 feet per mile—thus preserving younger zones progressively eastwards; but it approaches the formational dip beneath the Palaeogene, so that no higher zones may be expected east of Happisburgh—where London Clay overlies the Chalk (Boswell, 1920; Downing, 1959). In the southern part of the county, the formational dip is only about half the above figure, which results in a broadening of the zonal outcrops, and a much greater bevelling of these beneath the Palaeogene east of Diss—so that there is only 1,055 feet of chalk beneath Lowestoft, whereas at least 1,200 feet is present at Norwich and possibly 1,350 feet at Trimingham.

Baker (1918), using Boswell's map as a basis, produced an isopachyte map of the East Anglian chalk in order to obtain a picture of the sub-Caenozoic land surface (assuming the base of the chalk to have remained horizontal) and thus to estimate the extent of pre-Palaeogene denudation. If zonal thicknesses do not vary, then their outcrops should follow the isopachytes, and, using available thickness estimates, he plotted these. His resultant map bears a startling resemblance to that which has been prepared for the present work—a remarkable achievement in view of the fact that Baker made no use of field data.

The present map is based upon 340 zoned exposures. 186 of these were pits visited by Dr. A. W. Rowe between 1905 and 1911 and recorded by him in field books now deposited in the British Museum (Natural History). A further 86 exposures (many temporary) in the Thetford area were zoned by Hewitt (1924, 1935); these were accompanied by detailed measurements and careful records, which have in many cases enabled even their sub-zonal horizons to be reliably estimated. 20 of the pits zoned by Hewitt had (unknown to him) also been examined by Rowe, and it thus became possible to make allowance for personal idiosyncrasies in assigning zonal limits. Another 22 exposures, mainly in the *Uintacrinus* and *Marsupites* Zones, were recorded by Brydone (1930, 1932, 1932a,



DIAGRAMMATIC SECTION THROUGH THE NORFOLK CHALK

FIG. 3

1933); the remainder are pits recorded by H.M. Geological Survey (including many originally zoned by Jukes-Browne and Hill, 1887) or by the present authors.

As indicated earlier, the majority of exposures (except in the west) are confined to river valleys, and large tracts of ground between them are covered by drift, several hundred feet thick in places. For extrapolation over these areas, the contours of Boswell's (1920) map were used. The total number of pits whose assigned zones did not fit failed to reach double figures, and the majority of these were in the barren chalk immediately above or below the Zone of *Micraster coranguinum*—the lower boundary of which is placed higher than is customary in the south of England (the lower third of the Zone, in which the *Micraster* are still " low-zonal " has been treated as belonging to the *M. cortestudinarium* Zone). As will be explained later, the subdivisions adopted for the *B. mucronata* Zone are somewhat arbitrary, pending a fuller study of the faunal records, and, in particular of *Belemnitella* and *Echinocorys*, both of which undergo useful morphological changes through the Zone. Whilst it is hoped that these boundaries will prove a stimulus for further study of the critical sections, too much reliance should not be placed on them, since (a) there are no exposures on the coast between Stiffkey and Weybourne, nor inland between the coast and Frettenham, (b) around Norwich there has been much glacial disturbance, especially near the present river valleys, where the majority of exposures have been sited, (c) in the Norwich area the dip is low, so that an error of 20 feet in elevation can shift a zonal boundary by a mile, and (d) many pits around Norwich formerly had depths exceeding 30 feet, so that a zonal boundary might reasonably be expected to occur within such pits—yet available fossils in museums are seldom marked with anything more than a locality (if that).

Examination of the map immediately reveals the greater width of outcrops in the south, due to the lessening in formational dip—in particular, the swing of the top of the *Marsupites* Zone as far east as Scole is aided by the form of the chalk surface, which shows (on Boswell's map) a " through-valley," corresponding to the present Ouse-Waveney system. The concomitant easterly deflection of the subdivisional boundaries with the *B. mucronata* Zone to the south of Norwich materially assists the interpretation of exposures in that area. The continuation of these boundaries beneath the Eocene of south-eastern Norfolk remains a matter for conjecture—but it is known that up to 30 feet of the basal beds of the *B. mucronata* Zone are present near Ipswich.

The only additional deep boring recorded since the Geological Survey's water-supply Memoir (Whitaker, 1921) is at North Creake (Kent, 1947), but the zonal map has made it possible to re-examine the records of three older borings with advantage, and to check them against the table of thicknesses here given (Fig. 3)—which has been compiled after reference to all earlier estimates and from the width of outcrops on the zonal map. That at Holkham (Rose, 1869; Whitaker, 1878), on the north coast, apparently commenced about 30 feet above the base of the *Marsupites* Zone, and actually passed through 635 feet of chalk. It thus appears that the zones below that of *Holaster planus*, which reach their greatest observed attenuation near Hunstanton, must also thicken eastwards from that place. On the other hand, a boring at Diss (Taylor, 1837) in the extreme south-east of the county, which commenced at about the same horizon, revealed only 490 feet of chalk. Reference to

the table shows that here the zones below *H. planus* must have an overall thickness nearer to that at Hunstanton than that of their outcrops in the south-west. This could indicate a N.N.W.-S.S.E. alignment for the uplift (and hence of shallowing) which occurs near Hunstanton. Finally, the boring at Norwich, presumably commenced about the middle of the Beeston Chalk, passed through 1,152 feet; to give this figure, unless the thickness of the lower half of the *B. mucronata* zone has been underestimated, then that of the lower zones of the chalk must here again be greater than at Hunstanton or Diss.

CENOMANIAN

In Norfolk the stage is divided into three by a hard bed known as the Totternhoe Stone, which forms the middle division. For many years in England, the Cenomanian has been subdivided into a lower zone of *Schloenbachia varians* and an upper one of *Holaster subglobosus*, but the boundary between the two has always been poorly defined. *S. varians* has rarely been correctly identified, the range of the two index species overlap, and it would seem that *H. subglobosus* appears earlier in northern England than in the south. In the latter it is now possible to subdivide the Cenomanian into three ammonite zones based on the succession around Le Mans in France, the type locality for the stage (Hancock, 1959), but in Norfolk it is still convenient to refer to the beds below the Totternhoe Stone as *Varians* Chalk and to those above as *Subglobosus* Chalk.

Most of our knowledge of the Cenomanian is due to Jukes-Browne and Hill (1887, 1903) and the following account draws heavily on their work. Not only were many more exposures available to them than to-day but they even put down borings where exposures were absent. Recently it has not been possible to see the base of the Chalk between Cambridge and Hunstanton.

The Cenomanian undergoes great changes as it passes from the south to the north of the county, and its thickness greatly diminishes. From about 160 feet in Cambridgeshire, it is reduced to about 125 feet near Stoke Ferry; from there it decreases rapidly northward until at Marham it is about 90 feet, and at Hunstanton it is only around 56 feet.

Varians Chalk. In Cambridgeshire the basement bed of the Chalk is the Cambridge Greensand. In the southern part of Norfolk, between the rivers Little Ouse and Wissey, the lowest horizons of the chalk lie below the Fenland, but they come to the surface near Stoke Ferry. Between Stoke Ferry and Shouldham there is glauconitic chalk at the base but the glauconite grains are very small. Further north this bed disappears, and a hard white chalky limestone rests directly on the Gault marls.

As far north as Stoke Ferry the Chalk Marl above consists of alternating soft and hard beds, and it maintains a thickness of 70 to 75 feet; but north of Stoke the soft beds seem to thin out, and the harder beds become more purely calcareous, owing to elimination of the sand and clay. In the north the Varians Chalk consists entirely of hard greyish-white chalk, and at Hunstanton it is only 18½ feet thick; this must be regarded as a condensed equivalent of the Chalk Marl.

The diminished thickness of the *Varians* Chalk at Hunstanton is due both to condensation and to several planes of submarine erosion. The erosion-planes are most obvious near the base (see Fig. 4), particularly within and on the Paradoxica Bed. The erosion surfaces and chalk pebbles on them are green stained, probably with glauconite, but there is no

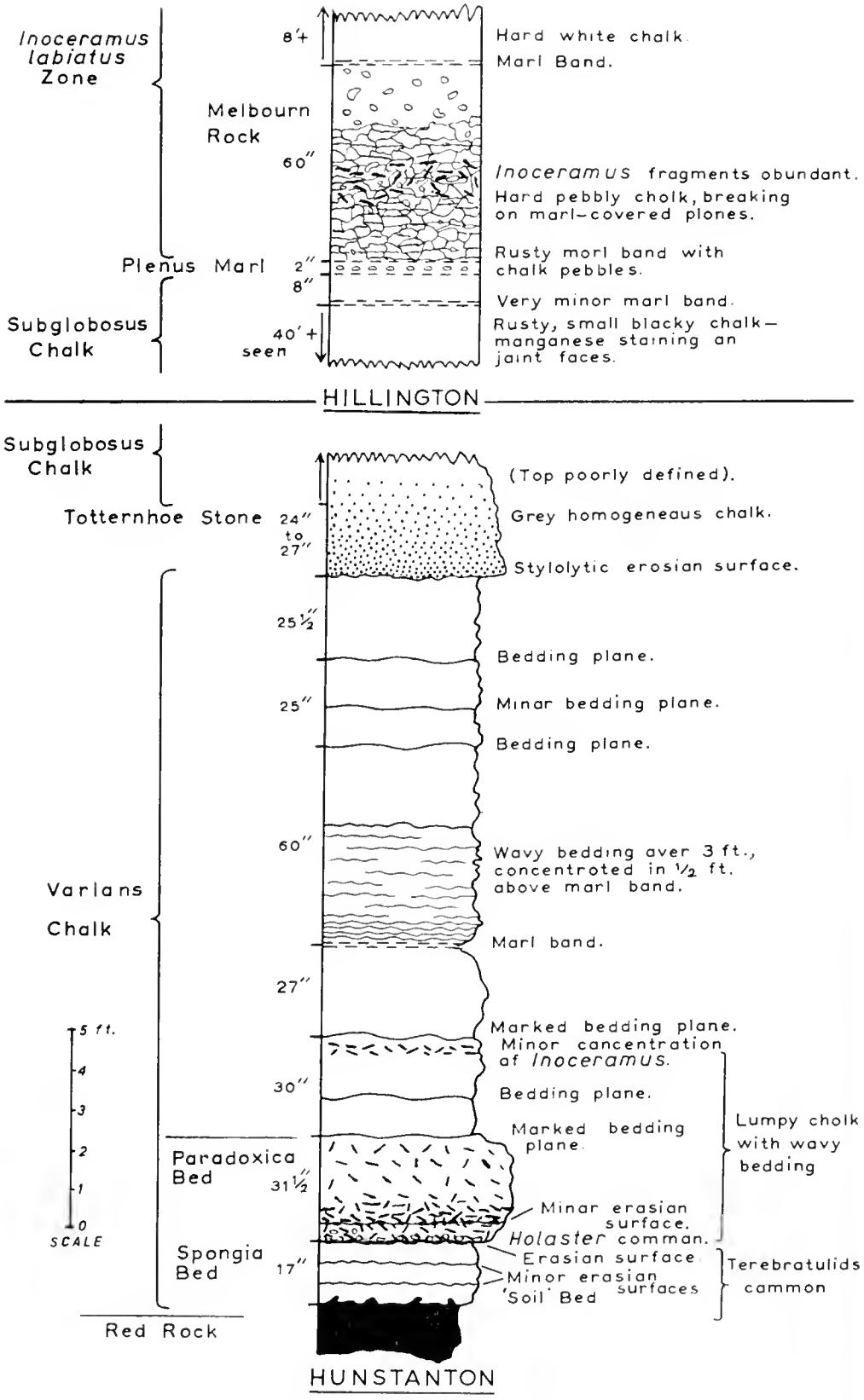


FIG. 4. The Cenomanian and lower Turonian Succession in North-West Norfolk

phosphatisation and no obvious grains of glauconite. Soft-bodied organisms have left casts of their burrows which now form radiating, cylindrical, branching and intertwining masses; they were once thought to be sponges and actually named *Spongia paradoxica*. The condensation facies is also most obvious in the lower levels. The lithology (Hill, in Jukes-Browne and Hill 1887, 1903, pp. 282–83) is a concentration of the coarser materials of the ordinary chalk—mostly *Inoceramus* fragments, foraminifera and " spheres," most of the coccoliths having been winnowed out or deposited at too shallow a depth (less than 30 fathoms) for them to be abundant. There is now a cement of finely crystalline calcite making the rock harder than most chalk.

Totternhoe Stone. At Burwell in Cambridgeshire the Stone is about 15 to 18 feet thick, although its upper limit is indefinite. At the southern edge of Norfolk it is only about 5 feet thick, at Stoke Ferry about 4 feet and at Hunstanton only 2 feet. It is a tough grey gritty chalk, with a layer of glauconite-coated pebbles at its base, like those in the " brassil " of Burwell. It is mainly composed of comminuted shell fragments (60 to 70 per cent); glauconite is a common accessory, but quartz grains are few and very small.

Subglobosus Chalk. The *Subglobosus* Chalk is better exposed than the Totternhoe Stone and the beds below. Its thickness diminishes northwards (Cambridgeshire 70 feet; between Stoke Ferry and Gayton at least 50 feet; Heacham 34 feet) but even in the north of the county it still resembles chalk of the same level in Cambridgeshire and to the south. It is a grey chalk whose hardness increases northwards. Curvilinear jointing simulating low angle current and lenticular bedding is common in the lower part although this possibly decreases northwards. Wavy bedding shown up by marl bands is prominent and probably this is more common in the north. The upper half is harder, whiter and more regularly bedded although in the far north wavy bedding is marked even in the upper levels.

Fauna and Correlation. (i) Cephalopods. It is unfortunate that ammonites are rare in the Cenomanian of Norfolk, outside the *Varians* Chalk and Totternhoe Stone in the south. At Blackdike Farm (229) the upper part of the *Varians* Chalk contains many individuals of *Schloenbachia*, including: *S. varians* (J. Sowerby), *S. intermedia* (Mantell) and *S. subvarians* Spath and varieties, which are not absolutely diagnostic but suggest the Lower Cenomanian. In the same pit large *Austiniceras* are common in the Totternhoe Stone. In the Dixon Hewitt collection in the Geological Survey Museum there is a *Calycoceras* (Ze 2967) from Whitedike Farm, one mile north of the above.

Apart from *Austiniceras* at Hunstanton, the only ammonites seen north of Stoke Ferry were in the Survey collection:

Hypoturrilites tuberculatus (Bose)—R.609 " from pit ½ mile north-east of Dersingham."

Calycoceras sp.—R.771 " from below Grey Bed, ½ mile north-north-east of Snettisham church."

These tell us little; *Hypoturrilites* is usually characteristic of the Lower Cenomanian, but there is a *Hypoturrilites gravesianus* (d'Orbigny) in the Sedgwick Museum (B.308) from the Totternhoe Stone of Cambridgeshire, where most of the ammonites are typically Middle Cenomanian forms, eg.

Turrilites (*Euturrilites*) *scheuchzerianus* Bosc—B.35806
Acanthoceras aff. *evolutum* Spath—B.35932
Acanthoceras subflexuosum Spath—B.35730.

Jukes-Browne and Hill (1887, 1903) list a number of ammonites from Norfolk which we have not seen. If the *Ammonites rhotomagensis* which they record (1887, p. 576) from the Inoceramus Bed at Hunstanton is really an *Acanthoceras*, then only the basal Paradoxica Bed is Lower Cenomanian.

There is no ammonite evidence on the boundary between Middle and Upper Cenomanian.

The rare belemnite *Belemnocamax boweri* Crick, occurring also in Lincolnshire and Yorkshire, has been found in a loose block at Hunstanton (Wright and Wright, 1951).

(ii) Echinoderms. *Discoidea cylindrica* (Lamarck) ranges throughout the Cenomanian. Its shape variations described from Lincolnshire by Bower and Farmery (1910) appear to hold good in Norfolk, viz.: typically pentagonally based with a pyramidal profile at the base of the stage, grading up into flattish discoidal with a circular base, near the top of the stage.

At only one level are echinoids very common—a two-inch pebble bed resting on the eroded top of the Paradoxica Bed at Hunstanton (see Fig. 4). They are dominantly *Holaster subglobosus* (Leske), much smaller than the average in southern England, the largest examples being about 4 cm. long; they are variable in shape and range to *H. coravium* (Lamarck) and *H. altus bischoffi* Renevier. In southern England *Holaster subglobosus* does not become common until the base of the Middle Cenomanian (Zone of *Acanthoceras rhotomagense*) but occasional examples have been found by C. W. Wright as early as the Albian Zone of *Stoliczkaia dispar* in Dorset. *H. altus* predominates in the early Cenomanian fauna of Wilmington (Devon). The *Holaster* fauna at Hunstanton could be interpreted as dating the *Inoceramus* Bed as Middle Cenomanian, or it might be a Lower Cenomanian evolutionary intermediate, coming between the early Cenomanian Wilmington fauna and the typical *H. subglobosus* fauna of the Middle Cenomanian. Nevertheless, this does suggest that only the Paradoxica Bed is Lower Cenomanian.

The *Holaster* band also yields less frequent specimens of *Hemiaster;* these may account for Jukes-Browne's record of *Epiaster crassissimus* d'Orbigny, which we have not seen. Several Cidarids have been recorded from the *Inoceramus* Bed and above, and from it we collected a *Trochotiara* sp.

Typical large specimens of *Holaster subglobosus* (Leske) are found in the *subglobosus* Chalk away from the coast, and are replaced by *Holaster trecensis* auct. Angl. non Leymerie (probably = *H. gregoryi* Lambert) towards the top of the stage.

Of the asteroids, *Calliderma smithiae* (Forbes) occurs in the *Varians* Chalk at Whitedike Farm and elsewhere.

(iii) Brachiopods. In the bottom few feet of the chalk at Hunstanton the commonest fossils are brachiopods. They are nearly all terebratulids, and in the Paradoxica Bed not more than 2 cm. long, so that they are nearly all juveniles, which makes identification difficult. Those in the *Inoceramus* Bed are larger, probably adult. With the help of a collection made by C. V. Jeans and I. Platten, Table 1 has been prepared.

TABLE 2

BRACHIOPODS FROM THE CHALK AT HUNSTANTON

From immediately beneath the Totternhoe Stone:

Concinnithyris aff. *albensis* (Leymerie)	1
Ornatothyris pentagonalis Sahni	1

From the Inoceramus Bed, exact level uncertain:

" *Terebratula* " *biplicata* (J. Sowerby)	2

From the *Holaster* band at the base of the Inoceramus Bed:

" *Terebratula* " *biplicata* (J. Sowerby)	2
Ornatothyris obtusa (J. de C. Sowerby)	2
O. pentagonalis Sahni	1
O. between *pentagonalis* and *latissima* Sahni	9

From the Paradoxica Bed: i) Horizon unspecified:

Ornatothyris pentagonalis Sahni	1
O. aff. *pentagonalis* Sahni	1
ii) top 3½ inches:	
O. aff. *pentagonalis* Sahni	1
iii) between 7½ and 13½ inches above the base:	
Ornatothyris juv.	2
Concinnithyris subundata (J. Sowerby)	1
? " *Terebratula* " *biplicata* (J. Sowerby)	1
iv) from the bottom 7½ inches:	
" *Terebratula* " *biplicata* (J. Sowerby)	3
Ornatothyris juv.	3
O. aff. *pentagonalis* Sahni	3
O. between *botusa* and *pentagonalis*	1
Concinnithyris subundata (J. Sowerby)	2
? *Concinnithyris* juv.	1
Kingena	1
" *Rhynchonella* " aff. *carteri* Davidson	1

This list shows no marked distinctions between the levels within the bottom 5 feet, but it should be noted that the *Ornatothyris* aff. *pentagonalis* which is common about half a foot above the base, is of a distinctive shape rarely seen away from Hunstanton. This fauna is essentially the same as the indigenous Cenomanian fauna of the Cambridge Greensand in which the commonest brachiopods are:

Ornatothyris obtusa (J. de C. Sowerby)
" *Terebratula* " *biplicata* (J. Sowerby)

and from which we have also collected:

Ornatothyris pentagonalis Sahni
?*Concinnithyris subundata* (J. Sowerby) juv.
Terebratulina triangularis Etheridge
Kingena
Orbirhynchia parkinsoni Owen
" *Rhynchonella* " *carteri* Davidson

The parallel is so close that there would seem no doubt that the Paradoxica and Inoceramus Beds are Lower Cenomanian.

At the same time the generic distribution of the brachiopods is largely a matter of the facies. *Ornatothyris* is associated with condensed beds, often with distinct erosion surfaces and chalk pebbles. In the south of the county it recurs in quantity in the basal pebble bed of the Totternhoe Stone and again in the pebbly Plenus Marls at Marham. In the quieter, steadier sedimentation of both the *Varians* and *Subglobosus* Chalks *Concinnithyris* is the usual terebratulid genus (e.g. at Hunstanton, Heacham, Hillington, Marham, etc.).

(iv) Lamellibranchs. Several Pectinids have been recorded from this stage in Norfolk; *Neithea quinquecostata* (J. Sowerby) and *Aequipecten beaveri* (J. Sowerby) from the Totternhoe Stone (the latter also ranging down into the *Varians* Chalk at Hunstanton), *Entolium orbiculare* (J. Sowerby) throughout. *Camptonectes dubrisiensis* (Woods) and *C. gaultinus* (Woods) are known from the *Subglobosus* Chalk of Stoke Ferry. *Ostrea diluviana* L. appears in the *Varians* Chalk at Hunstanton and a small grypheate form of *Ostrea vesicularis* Lamarck is known from the Totternhoe Stone which also contains *Spondylus* spp. Several Limids are known, including *Lima* (*Mantellum*) *elongata* (J. Sowerby) from the *Subglobosus* Chalk, and *Lima aspera* (Mantell) from the Totternhoe Stone. *Inoceramus tenuis* Mantell occurs below the Totternhoe Stone, along with *Inoceramus crippsi* Mantell, and the var. *reachensis* R. Etheridge Sen. of the latter occurs above.

(v) Other groups. The coral *Onchatrochus serpentinus* Duncan first appears in the *Inoceramus* Bed at Hunstanton and ranges upward, while the gastropods " *Pleurotomaria* " and " *Trochus* " appear in the Totternhoe Stone. From Norfolk, Withers (1935) records the cirripede *Arcoscalpellum trilineatum* (Darwin) only from the *Subglobosus* Chalk, but *Cretiscalpellum glabrum* (Roemer) from this horizon, ranges right up into the Maastrichtian.

TURONIAN

The stage is divided into four zones:

(d) *Holaster planus*
(c) *Terebratulina lata*
(b) *Inoceramus labiatus* (formerly *Rhynchonella cuvieri*)
(a) *Actinocamax plenus*

The thicknesses in Norfolk are indicated in Fig. 3. The thin Zone of *Actinocamax plenus* can be recognised on its lithology which includes soft marls, so that the whole is usually called the Plenus Marls. By contrast the basal few feet of the overlying *I. labiatus* Zone is a hard pebbly chalk known as the Melbourn Rock. But the contrast between the two formations is less than in southern England—the Plenus Marls here containing chalk pebbles and the Melbourn Rock wavy streaks of marl.

The Melbourn Rock grades up into firm white chalk, which in southern Norfolk is comparatively soft and interrupted in the lower part of the *T. lata* Zone by a number of marl bands—at least one of which attains a thickness of 4 inches. Higher up there are several more marl bands and a few feet above the base of the *H. planus* Zone a 1½ foot bed of true Chalk Rock occurs with its characteristic fauna. At the very top of the stage a 1 foot band of Top Rock is present. In the north however, the upper part of the Turonian is predominently hard and these rock beds cannot be distinguished.

Flint first appears at the base of the *T. lata* Zone as small irregular nodules with thick white rinds but bands of large intensely black flints, frequently tabular, occur higher up in the zone. In north Norfolk however, these flints set in earlier, immediately above the Melbourn Rock, and the upper part of the Turonian is a very hard chalk with flint occurring as thick flat tabular masses, mottled light grey or even white, in fairly regular bands three to four feet apart, as well as in great scattered lumps which have been (wrongly) called paramoudras. Neither the Chalk Rock nor its characteristic fauna can be distinguished and fossils generally are

rarer than in the south. In this facies it is difficult to determine precisely the top of the stage, but the ambulacral features of *Micraster* (when this can be found) continue to indicate the horizon, as in southern England, although the other test features of this genus do not.

Zone of *Actinocamax plenus*

Near Cambridge this zone contains some 1½ feet of hard white chalk sandwiched between two prominent marl beds. Although *Actinocamax* can be found occasionally, the commonest fossil is *Ostrea vesicularis* Lamarck.

Exposures are scarce in south Norfolk. Jukes-Browne and Hill (1887, pp. 566–67) saw an exposure north of Whitington where there were 1½ feet of " . . . buff-coloured marl enclosing loose lumps or nodules of hard chalk and the only fossils were *Terebratula semiglobosa* and *Rhynchonella plicatilis*, the latter being abundant and the same variety of that species which is characteristic of the zone in Cambridgeshire and elsewhere." This recalls the centre of the outcrop around Marham where at Limekiln Plantation the section is:

Inoceramus labiatus Zone	5. Faintly green chalk, the bottom few feet slightly pebbly with wavy marl partings	to 12 ft.
	4. Prominent rust band with large rusty chalk pebbles	4 to 6 in.
	3. Pebbly chalk	7 in.
Plenus Marls	2. Green-grey marl, chalk and rust-stained pebbles	3 to 7 in.
Subglobosus Chalk	1. Chalk with numerous green wavy marl streaks passing down to more massive chalk	to 10 ft.

Bed 2 is considered to be the Plenus Marls in spite of the pebbles. Most of the fossils were found loose but sufficient were collected *in situ* to distinguish the fauna. *Ostrea vesicularis* was not found, even the lamellibranchs encrusting the pebbles being *Diploschiza nilssoni* (Hagenow).

Brachiopods are always common and in some lenticles are as abundant as anywhere in the British Chalk. Much the commonest genus is *Ornatothyris* and it has been possible to examine about 100 of these from the Jefferies collection in the Sedgwick Museum, Cambridge. The rugation is weak compared with the examples from the Cenomanian of Cambridgeshire figured by Sahni (1929, Pl. 7) but they are placed in *Ornatothyris* not only on their general shape, but because (i) they have a large foramen in a pronounced beak, (ii) the dorsal valve is depressed or flat, and (iii) they are uniplicate or rectimarginate. Sahni's species are probably only shape variations, and of his " Cenomanian " species only the extreme inflated forms *O. minor* and *O. ovalis* are absent. The commonest forms are *O. pentagonalis* and its varieties.

Other brachiopods include *Concinnithyris subundata* (J. Sowerby) (juvenile); *Orbirhynchia praedispansa* Pettit, and *O. wiesti* (Quenstedt). *C. bulla* (J. de C. Sowerby) and *O. multicostata* Pettitt were found loose but are probably also from the Plenus Marls.

This rich brachiopod fauna has not been found elsewhere. The Jefferies collection contains a few brachiopods from Barton Bendish only two miles to the south, and only one is an *Ornatothyris*.

The Plenus Marls continue to the northern limit of the county but only as a single marl band a few inches thick and poorly fossiliferous.

Zone of *Inoceramus labiatus*

It is the basal part of the Zone, developed here as the pebbly Melbourn Rock, which is the most fossiliferous. The Plenus Marls being pebbly in Norfolk, the Melbourn Rock is less clearly marked off lithologically than in southern England, but the fauna is recognisably the same. There are numerous *Inoceramus* including *I. labiatus* (Schlotheim) and *I. lamarcki* Parkinson, and in the northern part of the county some levels are packed with their fragments. The brachiopods are mainly rhynchonellids—*Orbirhynchia cuvieri* (d'Orbigny); *O.* aff. *wiesti* (Quenstedt); *O.* cf. *praedispansa* Pettitt; *O.* cf. *compta* Pettitt.

In addition to this standard fauna there are fossils which are much rarer in southern England. The ammonite *Lewesiceras peramplum* (Mantell) is common at Wilton (257) and Hillington (40) and both yield *Mammites nodosoides* (Schlotheim) (Sedgwick Museum, Cambridge and King's Lynn Museum). (*M. nodosoides* is also known from the Melbourn Rock at Cherry Hinton, Cambs.—Sedgwick Museum). This correlates the Melbourn Rock with the Craie marneuse of the type Lower Turonian (see Lecointre, 1959).

In north Norfolk terebratulids become as common as the rhynchonellids although their combined frequency is less than that of the rhynchonellids in the south of the county. Both *Concinnithyris* (e.g. *C. protobesa* Sahni) and the earliest *Gibbithyris* (e.g. *G.* cf. *semiglobosa* J. Sowerby sp.), are to be found. A *Terebratulina* (*? striata*) also appears to characterise this horizon.

Large thin-tested specimens of *Conulus subrotundus* Mantell are quite common in the Melbourn Rock, together with smaller passage forms to *Conulus castanea* (Brongniart). A large incomplete *Discoidea* found at Wilton (257) appeared to have affinities with the Cenomanian *D. cylindrica*, and may link it with *D. dixoni* Forbes which also occurs. *Holaster* of early *planus* type appears at this level, though generally crushed; also a small *Gauthieria* sp., as well as Cidarid spines.

Above the Melbourn Rock, which is but four to six feet thick in Norfolk, *Inoceramus* seems to be the only common fossil. The species are the same as at the base of the Zone, although *I. lamarcki* var. *apicalis* Woods is here the commonest.

Zone of *Terebratulina lata*

The zonal base is nowhere clearly defined in Norfolk, and is rarely exposed. It may be conveniently placed at the point where *Inoceramus labiatus* (Schlotheim) ceases to occur, and the larger forms of *I. lamarcki* Parkinson become dominant. In the south, the chalk of the Zone is white and fairly soft, although harder bands are frequent—especially in the lower half of the Zone. Bands of grey marl—some of which are several inches thick—are not unusual, and are locally termed "pipeclay." Flints, which are small and scattered at the base, become more frequent higher up, and the highest beds of the Zone near the southern county boundary are as flinty as any horizon in Great Britain. They include several tabulars and some vast flints weighing up to half-a-ton, called "gulls." The flint was extensively mined up to the end of the nineteenth century for "knapping" to make gun-flints, and the residual cores, and the flints from the less-favoured bands, were widely used as building-stone in the area. Individual flint-bands which could be recognised over an (albeit limited) area, received names such as "Wallstone," "Floorstone," "Upper Crust," etc., while the pipeclays were numbered from the top downwards. The chalky "head" above the solid surface was

termed " deadline " (" didlum " in local dialect). An account of gun-flint manufacture, including a detailed section of a modern shaft, is given by Clarke (1935). Grimes Graves, north-east of Brandon, are similar shafts of Neolithic age, dug into the same beds.

The massive black flint-bands appear to lose their identity away from the Brandon-Thetford area, and north of Swaffham the Zone thins somewhat, and the chalk becomes much harder and lithologically indistinguishable from that of the zone above. In north-west Norfolk, this chalk has served extensively as rough building stone and walls of it will stand for centuries provided they are capped by brick to keep the chalk dry, and hence immune from the effects of frost. Almost continuous bands, made up of large flattish, mottled grey flints occur at intervals of 3 to 4 feet, and fossils seem to be very scarce.

The fauna here recorded for the Zone comes mainly from the south. The zone-fossil is generally far from common, but Rowe found it " in profusion " near Swaffham (24); it has not been recorded from north Norfolk. An *Orbirhynchia* (perhaps *heberti* Pettitt) is a much commoner guide-fossil, and *O. reedensis* (Etheridge) also occurs. *Gibbithyris semiglobosa* (J. Sowerby) and *Terebratulina striata* sensu Davidson complete the brachiopod fauna.

There are two ammonite records, *Scaphites geinitzi* d'Orbigny from Brandon (216), quite low in the zone, and a Pachydiscid. Among lamellibranchs, *Inoceramus* is again the most common, *I. lamarcki* Parkinson and its huge variety *cuvieri* J. de C. Sowerby being the usual forms. *Ostrea vesicularis* Lamarck and *Spondylus latus* (J. Sowerby) are fairly common, and *Diploschiza nilssoni* (Hagenow) is often found attached to echinoids.

Holaster (*Sternotaxis*) *planus* Mantell is the commonest echinoid, but *Micraster corbovis* Forbes sets in about halfway up the zone. At the top of the zone, near Thetford, passage forms to *M. cortestudinarium* Goldfuss (which includes *M. praecursor* Rowe) occur; on the strength of some which are fairly typical specimens of the latter form, Hewitt (1924, 1935) placed these beds in the zone above (q.v.)—in which he would thus include the uppermost beds of the " Brandon Flint Series." At one exposure (24) near Swaffham, many of the *Micraster* have normal ambulacra, but exhibit other test-features which are unexpectedly advanced, such as a prominent labral tip, deep ambital notch, etc.—either alone, or in combination. At the same place, *Infulaster excentricus* (S. Woodward, ex Rose MS.) is uniquely common; other Norfolk records of this rare echinoid may well be from the same horizon. Examples of *Echinocorys* sp. nov. aff. *gravesi* Desor have been found in the Thetford area. These are a large, tall form, with flanks which rise almost vertically from the ambitus, before sloping steeply towards a more or less conical apex; they are quite unlike the gibbous forms of the zone above. *Gauthieria radiata* (Sorignet) and spines of " *Cidaris* " *serrifera* Forbes also occur. *Bourgueticrinus ellipticus* (Miller), and an " *Isocrinus* aff. *klocdeni* (Hagenow) " are recorded from Thetford, and the asteroids *Arthraster dixoni* Forbes, *Metopaster parkinsoni* (Forbes) and *Crateraster quinqueloba* (Goldfuss) all occur, along with *Calliderma smithii* (Forbes) which ranges up from below.

Among other fossils, sponges, chiefly *Ventriculites* spp., and serpulids are the most common.

Zone of Holaster planus

In south Norfolk, the base of the Zone is marked by a variable band of hard rust-stained chalk, containing green-coated chalk pebbles, and averaging 1½ feet thick. Known as the Chalk Rock, it indicates the temporary onset of shallow-water conditions, and, as in the Chilterns and elsewhere, it is characterised by a special facies fauna, and is often designated the Subzone of *Hyphantoceras reussianum* (d'Orbigny). There is little evidence, beyond a few *Micraster* " of *planus* zone type " found below it, by Hewitt, that this bed is diachronous and his (1935) inclusion of lower beds in the Zone is here ignored. Hewitt was the first to describe the true Chalk Rock in Norfolk. Earlier references, in Geological Survey publications and elsewhere, to " Chalk Rock " in the county, often apply to what has now come to be known as the Top Rock.

The 40 foot or so of chalk above the Chalk Rock is hard and white with a good deal of interstitial marly veining and black flint scattered and in bands, some tabular. Extra hard bands occur, but the first continuous one is the one-foot bed of Top Rock which constitutes the upper boundary of the stage. Lithologically the Top Rock resembles parts of the Chalk Rock, in that it is a semi-crystalline limestone which rings to the hammer, but it is more uniform and more readily forms a topographical feature. The top few inches contains rolled chalk pebbles, and has a green-coated upper surface; but, in contrast to the true Chalk Rock, the Top Rock is rather barren of fossils, and shows nothing of the " *reussianum* fauna." The Top Rock has been traced as far north as Swaffham, but neither it nor the Chalk Rock have been seen beyond that place. In north Norfolk, the zone is composed of hard platy chalk, with bands of thick, grey-mottled, slab-like flints at regular intervals of every few feet, and fossils are conspicuously scarce.

The following list gives some of the more important forms from the extensive fauna recorded from the Chalk Rock near Thetford by Hewitt (1924, 1935). Among ammonites, in addition to the subzonal species, are *Bostrychoceras woodsi* (Kitchin), *Subprionocyclus neptuni* (Geinitz), *Scaphites geinitzi* d'Orbigny, *Metaptychoceras smithi* (Woods) and *Allocrioceras*, *Sciponoceras* and Pachydiscids. The lamellibranch *Astarte* aff. *laticostata* Deshayes, was described as new to the English Chalk by Cox (1935): *Barbatia* spp., *Cardita cancellata* Woods, *Cardium turoniense* Woods, *Cuspidaria pulchra* (J. de C. Sowerby), *Inoceramus costellatus* Woods, and *Trapezium trapezoidale* Roemer are all characteristic, in addition to the common lamellibranchs of the zone, described below. Among gastropods, *Trochus* cf. *schlueteri* Woods, *Turbo* (*Solariella*) *gemmatus* (J. de C. Sowerby) and a *Turritella* sp. are noteworthy. Sponges are common, and of the corals, *Parasmilia* spp. including *centralis* (Mantell), and *Caryophyllia cylindracea* (Reuss) appear to be confined to the Chalk Rock.

The other fossils of the Zone, most of which also range through the Chalk Rock, include *H.* (*Sternotaxis*) *planus* (Mantell) and *H.* (*S.*) *placenta* Agassiz, as well as *Micraster* of the *leskei*, *corbovis* and *praecursor* groups. *Echinocorys* is generally rare, although Rowe (in MS.) found it common at Swaffham (24): Cidarid spines of several species complete the echnioid fauna. Ossicles of " *Isocrinus* aff. *kloedeni* (Hagenow) " are fairly common, as is *Bourgueticrinus* which ranges upwards through the Senonian. Several asteroid species are known, but *Mitraster hunteri* (Forbes), *Stauranderaster bulbiferus* (Forbes) and an *Ophryaster* sp. have been recorded only from this Zone, in south Norfolk. Among terebratulids,

Gibbithyris spp. are common, and of several rhynchonellids, *Cretirhynchia minor* Pettitt is noted from Santon Warren (247). *Terebratulina striata* sensu Davidson is fairly common, but ranges throughout almost the whole of the Turonian and Senonian. One of the most useful zonal fossils is *Inoceramus costellatus* Woods. *Lima* (*Plagiostoma*) *cretacea* Woods and *L.* (*P.*) *hoperi* (Mantell) are also good indices of the Zone although by no means confined to it. *Chlamys cretosa* (Defrance) and *Plicatula barroisi* Peron, both make their first appearance at this level, in Norfolk, but range upwards. The cirripedes *Cretiscalpellum glabrum* (Roemer), *C. striatum* (Darwin) and *Arcoscalpellum angustatum* (Geinitz) are all fairly common.

Only a few of the above forms have been recorded from northern Norfolk, although *Echinocorys* is perhaps slightly less rare there; Barrois (1876) recorded a fragmentary belemnite, from Docking (8), which he referred to *Belemnitella* aff. *strehlensis* Fritsch and Schloenbach.

C. W. Wright states (*in litt.*) that asteroid ossicles found near the top of the Zone in Swaffham railway cutting (24, 25) are of forms generally characteristic of the *M. coranguinum* Zone of southern England—a similar phenomenon being observed at Kiplingcotes, Yorkshire.

LOWER SENONIAN

If we divide the stage into three, in Great Britain, then the lowest division becomes synonymous with the

Zone of *Micraster cortestudinarium*

This is perhaps the most colourless of all the zones of the Norfolk chalk, and shows nothing of the rich fauna which characterises it in the south of England. Its base is taken as occurring immediately above the one-foot band of Top Rock. The chalk is fairly hard and sometimes stained yellowish. The flints are black without cortices, and there are lines of globular flints, individually up to the size of a melon, as well as huge scattered masses and tabulars. Marl-bands are present, and pyrites occurs locally as large nodular masses at certain horizons. It has not so far proved possible to relate the top of the Zone to any particular lithological feature, as may be done in many southern English sections, and for convenience it has here been taken as the upper limit of the occurrence of "low zonal" *Micraster*—i.e. the lowest limit of *Micraster* having "divided" or strongly "sub-divided" ambulacra. This means that chalk equivalent to that normally included as the "lowest third" of the *M. coranguinum* Zone of southern England is placed in the *M. cortestudinarium* Zone. Chalk of this horizon is probably seen at the base of the huge pit at Euston (303), just south of the county boundary, where pieces of large *Inoceramus lamarcki cuvieri* J. Sowerby are the only common fossils. Further north it is seen at the base of the large pit at Newton-by-Castleacre (309) (below the conspicuous marl-band) and again at Helhoughton (58), where a marl-band also occurs near the top of the section, beneath which is a line of huge horned flints, individually two feet or more across. Towards the north coast, the Zone appears to thicken and takes on the monotonous lithology of the two zones below it (q.v.). This uniform lithology continues up into the lower part of the succeeding zone.

The principal means of distinguishing the Zone is by the condition of the ambulacra of the infrequent *Micraster*, which range from "strongly sutured" to "sub-divided." Unfortunately, more especially in the north, not all the other test-features of this genus always follow the parallel sequence of development postulated by Rowe (1899) from the south of

England. The few specimens of *Echinocorys* seen also differ from the common southern English forms—having a very flat base, sometimes nearly circular, with a sharp ambitus and the apex somewhat posterior of central. Superficially they resemble Trimingham forms, and are probably similar to one figured as *Echinocorys vulgaris striata* Lambert (Smiser, 1935, Pl. 2, Fig. 1) from the Craie de St. Vaast (zone of *Inoceramus involutus*) of Belgium. From the Thetford area, Hewitt records Cidarid spines and a single specimen of *Cardiotaxis cotteaui* (d'Orbigny) (220). *Inoceramus lamarcki latus* J. de C. Sowerby (of which the type comes from Swaffham). *I. lamarcki websteri* Woods, *I. inconstans* Woods, and its var. *striatus* Mantell are all recorded from Swaffham, and *I. involutus* J. de C. Sowerby from Thetford and Brancaster. *Pinna decussata* Goldfuss also occurs at Swaffham.

A. W. Rowe (in MS.) states that in the Swaffham railway cutting section (25), *Holaster* (*Sternotaxis*) *placenta* Agassiz was " rather common " and that he collected seven *Micraster*, six *Echinocorys* and six *Kingena lima*, but he nevertheless remarks that " it is one of the poorest sections in fossils which R[owe] and S[herborne] have ever seen." The collections of Fitch, King and Rose, in the Norwich Museum all contain many specimens marked " Swaffham." Some are clearly flint casts from the drift but others must have been collected *in situ;* they include, however, a number of forms which would not normally be expected from the *M. cortestudinarium* chalk, such as *Offaster pilula* (Lamarck), and a *Galeola* which appears to be an undescribed species. Further examination of these, and of the records of exposures possibly available to those early workers, will be needed before the zonal provenance of this material can even be hazarded. Certainly there are large erratics of relatively undisturbed chalk in the area (e.g. 341) which might have yielded some of them.

MIDDLE SENONIAN

This division comprises three zones:

(c) *Marsupites*
(b) *Uintacrinus*
(a) *Micraster coranguinum*

Here, for the first time in Norfolk, we find that the general character of the chalk approximates more nearly to its counterparts in southern England. The name-fossils are all confined to their own zones, although, of course, in other parts of Britain, *Micraster* of *coranguinum* type does occur right up through the stage. Its absence from the upper two zones here is possibly merely a reflection of their barrenness of nearly all macro-fossils. As in the zones below, the chalk tends to harden northwards. Near the north coast, exposures of the lowest part of the *coranguinum* Zone continue to exhibit the same facies of platy chalk with greyish slab-like flints as occurs in the zones beneath, but the appearance of the faces of quarries in the higher beds of that Zone, with their regular lines of black nodular flint, is much more reminiscent of equivalent southern English horizons.

Zone of *Micraster coranguinum*

The chalk of this Zone is, in the south, distinctly softer and whiter than that of the underlying zones, and much finer grained. Flints are no less common than below, but no longer form gigantic masses—being more generally nodular. Often they are arranged in bands—some tabular. The tendency to regular alignment is greater towards the top of the Zone,

which, unlike the lower part, varies but little from south to north of the county (see under previous zone). Fossils are nowhere abundant but evidently become more frequent in the highest beds, where, from former quarries around Litcham in particular, most of the early Museum collections were derived.

Micraster and *Echinocorys* near the base of the Zone show the same tendencies as those of the zone below, but specimens from the highest beds are typical " southern " forms, e.g. *M. coranguinum* (Leske) and its var. *latior* Rowe and the " tall dome " form of *Echinocorys*, all from Litcham. *Conulus albogalerus* Leske becomes commoner in the higher beds and evidently forms a band of tall, very conical forms such as is known from north-east Kent. There is one record of *Hagenowia rostrata* (Forbes) from Rushford (238).

Regular echinoids are also a marked feature and include (generally known only as detached spines) " *Cidaris* " *serrifera* Forbes, which actually ranges above and below the Zone, " *Cidaris* " *perornata* Forbes, *Stereocidaris sceptrifera* (Mantell), *Tylocidaris clavigera* (Koenig), " *Cidaris* " *subvesiculosa* d'Orbigny and *Phymosoma koenigi* (Mantell) which are mainly confined to it. *Bourgueticrinus* ossicles are fairly common, but we have not studied their shape-variations. Of the asteroids *Crateraster quinqueloba* (Goldfuss) and *Metopaster parkinsoni* (Forbes) are common, and *M. uncatus* (Forbes) and *Tholaster ocelatus* (Forbes) are recorded only from this Zone. There are no ammonite records, but *Actinocamax westphalicus* Schlueter is found high in the zone, and *A. verus* Miller occurs regularly in the topmost beds.

Among brachiopods *Kingena lima* (Defrance), *Terebratulina striata* sensu Davidson, *Lacazella* (*Bifolium*) *wetherelli* (Morris), *Crania egnabergensis* Retzius and *Cretirhynchia* spp. are all characteristically common. Of lamellibranchs, *Ostrea boucheroni* Coquand, and fragments of *Inoceramus lamarcki cuvieri* are the most frequent, but *Chlamys cretosa* (Defrance) and *Spondylus* spp. are also found. *Diploschiza nilssoni* (Hagenow) is often seen encrusting other forms. The sponges *Porosphaera globularis* (Phillips), *P. sessilis* Brydone and *Ventriculites mammilaris* T. Smith all occur, along with the coral *Parasmilia centralis* (Mantell).

Zone of *Uintacrinus*

The chalk of this Zone is very soft and crumbly, and appears to have suffered some glacial disturbance in most of the pits where it has been seen. It is comparatively free from flints; those which do occur are often rounded nodules, frequently hollow and enclosing sponge debris. Dendritic manganese is often observed—usually as blackish spots on joint faces. The base of the Zone is hard to identify as it is defined by the lowest occurrence of the tiny, isolated and rare ossicles of *Uintacrinus*. The boundary shown on the map is based largely upon the work of Brydone (1932, 1932a) and upon the presence, immediately to the west, of pits in the *M. coranguinum* Zone yielding the tall *Conulus albogalerus* Leske and *Actinocamax verus* Miller—both of which characterise the topmost beds of that zone. In other parts of Britain the top of the *Uintacrinus* Zone generally coincides with the upper limit of the name-fossil, and there is no reason to suppose it to be otherwise here. The greater thickness estimated for this and the succeeding zone in north Norfolk is based largely upon the thickness of " flintless chalk " recorded

from boreholes, supported by the known figures for the next nearest outcrop, in Yorkshire, where the combined thickness for the two zones exceeds 200 feet.

Macro-fossils are decidedly rare in the Zone—the most prominent being *Actinocamax verus* Miller, which ranges right through it. Plates of the zonal crinoid may generally be obtained after prolonged search, and Cidarid spines occur occasionally. The long-range *Porosphaera globularis* (Phillips) is accompanied by occasional *P. nuciformis* (Hagenow) and *P. pustulosa* Brydone, which do not occur in the adjacent zones. Among lamellibranchs, *Neithea quinquecostata* (J. Sowerby), *Chlamys cretosa* (Defrance), *Plicatula barroisi* Peron and *Spondylus* spp. have been found, as well as *Ostrea vesicularis* Lamarck, *O. boucheroni* Coquand, *O. incurva* Nilsson and *Gryphaeostrea canaliculata* (J. Sowerby). The tiny brachiopods *Kingena lima* (Defrance) and *Magas pumilus* (J. Sowerby) have been recorded, and also *Terebratulina striata* sensu Davidson. Two ostracods appear regularly—*Bairdia subdeltoidea* (Muenster) and *Cytherella ovata* (Roemer), as well as the cirripedes *Preverruca vinculum* Withers, *Eoverruca hewitti* Withers and *Arcoscalpellum fossula* (Darwin).

Zone of *Marsupites*

The outcrop of this Zone marks the line of the principal watershed of the county, and the chalk surface is reached in but few of the river valleys. As a result, only nine exposures have been recorded from the Zone, and the boundaries drawn upon the map were obtained by extrapolation. The chalk appears to be generally similar to that of the *Uintacrinus* Zone below (q.v.), and most of the fossils of that zone seem to range up into this one. The diagnostic form is *Marsupites testudinarius* (Schlotheim), and *Gonioteuthis granulata* (Blainville) also starts to appear. A group of specimens of *Echinocorys* resembling, but slightly larger than, typical *elevata* Brydone, is recorded from East Barsham (Hayward, 1940). Earlier fossil records are generally confused by the fact that all the chalk between the *M. coranguinum* and *B. mucronata* zones was at one time called the " Marsupite Chalk," and, from the available lists few can be reliably identified with currently-accepted species.

Brydone (1932) reported that at Wattisfield, Suffolk (then thought to be high in the *Marsupites* Zone) he had found brachials of a *Uintacrinus* which he believed to be identical with the *Uintacrinus* sp. nov. he had earlier reported as distinguishing the uppermost beds of the *Marsupites* Zone of Sussex (Brydone, 1914) and Margate [*sic*]. He claimed to have found the same crinoid " very sparingly " at North Elmham (32). In a subsequent paper, however (Brydone, 1932a) he admitted that he had been wrong at Wattisfield, which (he shows) is clearly in the (albeit unexpectedly broad) outcrop of the *Uintacrinus* Zone, and that at North Elmham " the plate " [*sic*] which he had found " is quite inconclusive, and must be attributed to the last days of *Marsupites*."

UPPER SENONIAN

The Upper Senonian in Norfolk is divisible into two zones only,

(b) *Belemnitella mucronata*

(a) *Gonioteuthis* (=old Zone of *Actinocamax quadratus*)

Together, these comprise nearly 600 feet of chalk—more than half the total thickness proved in the Norwich boring—and their combined outcrop here is equal in width to that of all the zones below. Lithologically

there is little to distinguish them from their equivalents in southern England (which may attain 800 feet in the Isle of Wight, where the top is probably of Weybourne Chalk age), but detailed correlation of their faunas is difficult.

Zone of *Gonioteuthis* (termed by Brydone the "Zone of granulated *Actinocamax*")

The chalk between the top of the Marsupites Zone and the base of the *B. mucronata* Zone is, in Norfolk, characterised by the regular occurrence of *Gonioteuthis* belonging to the *granulata-quadrata* evolutionary series. In southern England, from the equivalent horizon—the old Zone of *Actinocamax quadratus*—Brydone (1912) split a lower Zone of *Offaster pilula*, leaving an upper (restricted) one of *Gonioteuthis quadrata*. The lower zone is distinguished by the abundance, at most horizons, of its name-fossil, and by a number of "belts" characterised by distinctive shape-variations of *Echinocorys;* the upper zone is less positively determined, but (although belemnites are uncommon in either zone) the true *Gonioteuthis quadrata* (Blainville) is said to be confined to it. In Yorkshire (where the top of the zone is not seen) as in Norfolk, an *Offaster pilula* Zone cannot be distinguished, and in Yorkshire *Inoceramus lingua* Goldfuss serves as the index-fossil. Unfortunately, too little is yet known of the range of this fossil in Norfolk for its adoption here, and moreover it is found also in the succeeding zone at Norwich.

The chalk of this Zone is generally soft, though firmer than that of the zone below, and with a greater tendency to break along bedding-planes. The lower part is very white, with flint occurring fairly freely generally in bands but towards the top the chalk is often yellowish, and the flints more scattered—often spindle-shaped or as hollow round nodules containing sponge débris. Fossils are usually hard to find, and correlation between exposures is difficult or impossible. *Gonioteuthis* tends to pass from forms with shallow and circular alveolar cavities (*granulata* of Blainville) to ones with deep and quadrate cavities (*quadrata* of Blainville) near the top, but any group of specimens from one horizon generally shows great variation in this character—shallow but quadrate cavities being found quite low in the Zone, and deep but circular ones quite high (*fide* Brydone): specimens collected from Wells (280)—which is still in the lower part of the Zone—already show deep and quadrate cavities; also, a very stout form was noted in the Geological Survey collection (HBW. 550) from Bintree (31). *Actinocamax verus* Miller ranges well up into the Zone, and records of *Belemnitella lanceolata* Sharpe, from near the top, may well be *B. praecursor* Stolley. *Echinocorys* is far from common; a specimen from near the base of the Zone at Banham (279) in the Geological Survey collection is a typical *E. tectiformis* Brydone, such as would be expected from the lowest part of the *Offaster pilula* Zone; a typical specimen from Wells (280), figured by Hayward (1940, Pl. 1, Fig. 1), though somewhat larger, could, apparently, have come from just above the *O. pilula* Zone in the south of England, while a form collected from the topmost beds of the zone at Stiffkey (283) could not be matched from the southern English chalk—where, in any case, it becomes rare. *Micraster* (perhaps *M. schroederi* Lambert) has been recorded, and *Offaster pilula* (Lamarck) certainly occurs; in fact, specimens of the latter are very common in the Drift, and might indicate occurrences at horizons not seen *in situ*.

The lamellibranchs *Inoceramus lingua* Goldfuss and *Pteria* (*Oxytoma*) *tenuicostata* (Roemer) first appear in the Wells (280) chalk—the latter

being known only from the *Gonioteuthis* Zone. Among Asteroids, *Pycinaster magnificus* Spencer and *Stauranderaster senonensis* Spencer are notable in the upper part of the Zone. The sponge, *Retispinopora arbusculum* Brydone and occasional ossicles of *Bourgueticrinus* also occur.

Zone of *Belemnitella mucronata*

This is the classical "Norwich Chalk" of the early authors. The extensive and often beautifully-preserved fauna seen in museums came from the many manually-worked pits formerly extant in the area (see pages 295, 298). Of a probable thickness of more than 400 feet, only an aggregate of 180 feet is now exposed—and even this may include some overlaps. As a result, many horizons cannot now be seen. Spencer (1913), on the basis of asteroids, split the chalk above the *Gonioteuthis* Zone into lower, middle and upper divisions—the last being what is now the Zone of *Belemnella lanceolata* (q.v.). Brydone (1938, etc.) referred to five horizons based upon broader faunal considerations, and Dr. T. Barnard (*in litt.*) suggests that six divisions can be recognised, based upon foraminifera. Until detailed examination of the museum material has been completed, we have adopted a sixfold subdivision based mainly upon Brydone's horizons. The thicknesses given in Fig. 1 for these subdivisions are arbitrarily estimated, and they are briefly described below before the faunal characters of the Zone are dealt with.

(a) The Basal *mucronata* Chalk

This is characterised by typical *Belemnitella mucronata* sensu Arkhangelsky and abundant *Volviflustrellaria taverensis* Brydone. There is no sign of the band of *Echinocorys subconicula* Brydone, of small and conical form (=*E. lata fastigata* Lambert), which that author took to mark the base of the zone in Hampshire (although specimens have been seen from the drift) but a large race of *E. subconicula* (resembling *E. lamberti* Smiser non Gauthier) is common throughout the subdivision. In view of the lesser frequency of belemnites in southern England, it is possible that Brydone may have placed the Zonal base in Hampshire slightly higher than in Norfolk. This Chalk was formerly exposed in many small pits around Ringland and Taverham, at Tharston (49), and at Morston and Cley Green (82) on the north coast. Brydone notes a change in lithology at the zonal base (pit 287, and elsewhere) from soft yellowish chalk to slightly firmer white chalk with more frequent flints. The upper part is probably best seen at Drayton (152), where an *Echinocorys* aff. *subglobosa* Goldfuss also begins to appear at the top of the section.

(b) "Eaton Chalk"

The greater part of this division cannot now be examined *in situ*—although its base is presumed to occur at Drayton (152) and its top at Keswick (294); much material was formerly yielded by underground workings at Eaton (158) and quarries at Earlham (155, 156). An overgrown pit at Cley (296) perhaps shows chalk of this horizon, which is characterised by the absence of *Volviflustrellaria taverensis* Brydone, and the presence of *Membranipora eleanorae* Brydone, together with "a large tall conical form of *Echinocorys*, having a flat circular base" (Brydone). *E. pyramidata* sensu Lambert (=*E. ovata* sensu Portlock) and its var. *quenstedti* Lambert were noted (Geological Survey Museum) among others from Eaton.

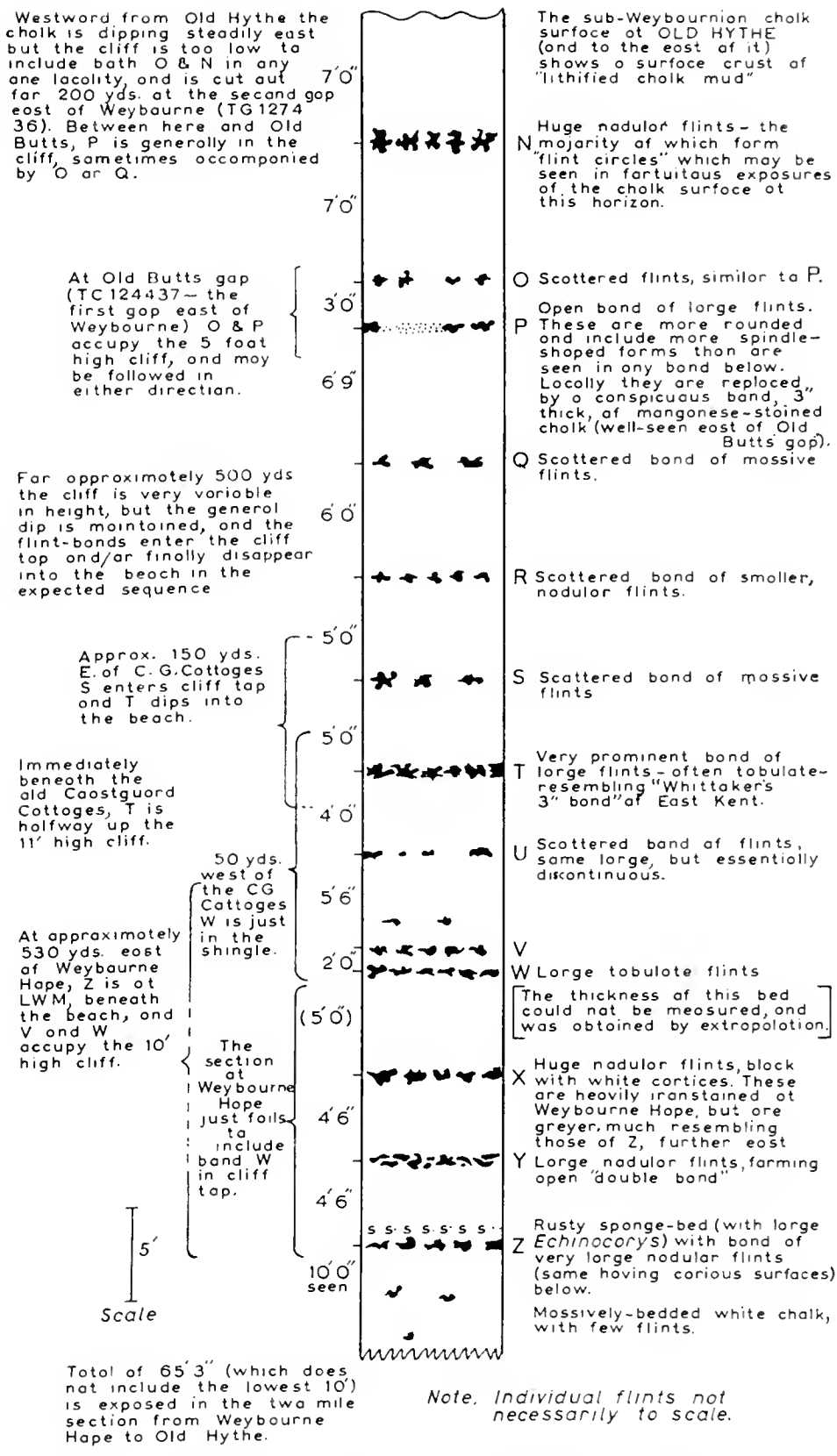


FIG. 5. Synthetic vertical section of the coastal chalk eastwards from Weybourne Hope

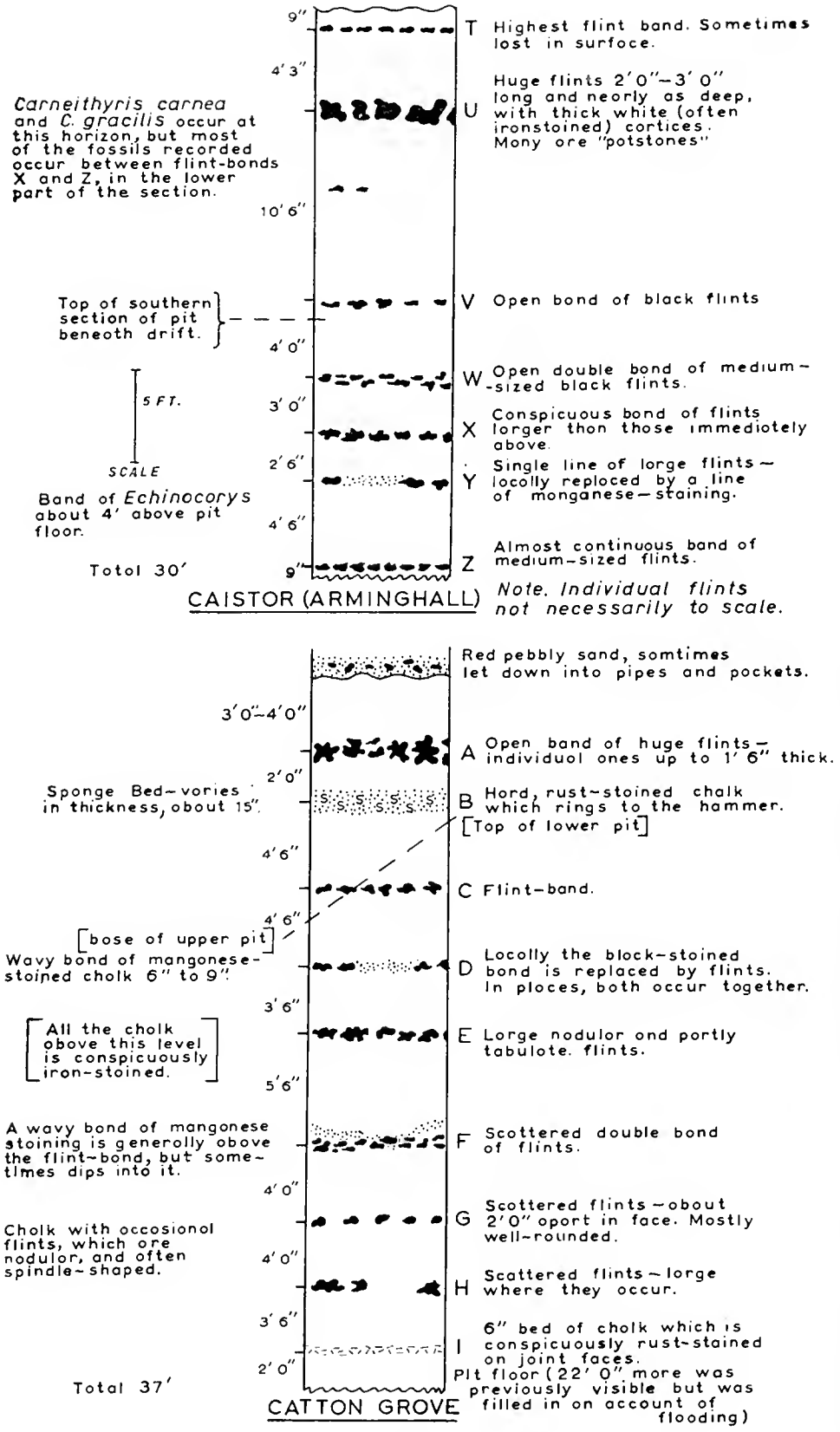


FIG. 6. Actual sections of two quarries near Norwich

(c) " Weybourne Chalk "

This division is taken to include the 75 feet or more of chalk exposed along the two miles of coast between Weybourne and Old Hithe Gap (1 mile west of Sheringham), in the interrupted line of low chalk bluffs at the foot of the Pleistocene cliffs. The vertical section (Fig. 5) was prepared by following individual flint-bands (distinguishable by their nature or spacing) as the general easterly dip steadily brings in higher beds. It is hoped that its publication will enable field-workers to collect with reference to the lettered flint-bands; museum material from the whole section is generally marked " Weybourne," Brydone (1906, p. 130) having believed that the dip was non-existent, or even westerly. Unfortunately, the (lesser) dip of the chalk-surface itself brings this to beach-level at Old Hithe, and only impermanent foreshore exposures are available eastwards from there—whence no reliable vertical section has yet been compiled. Specimens of *Echinocorys subglobosa fonticola* Arnaud are common below the sponge-bed, and range above it, where they are accompanied by *E. gibba* (Lamarck). In the highest beds, towards Sheringham, typical large *E. ovata* Leske (sensu Smiser non Lambert) also occur. The steeply conical *M. (Isomicraster) stolleyi* Lambert (*Epiaster gibbus* Schlueter pars) ranges throughout the section and is accompanied by the rarer, large flat *Micraster glyphus* Schlueter.

Inland sections of this chalk were formerly seen at Harford Bridges (161, 162– which probably included some of the Eaton Chalk and a sponge-bed which may have corresponded to that at Weybourne) and is still visible in the lower part of the pit at Catton Grove (327). Brydone (1938) states that it is characterised by " *Serpula* " *accumulata* S. Woodward (although this becomes scarce near the top) and *Membranipora insultans* Brydone. *Cardiotaxis*, found in the lower part, is the inflated narrow species, *heberti* Cotteau. The *Belemnitella* in the upper part of the division are mainly slim, often waisted forms ranging between *B. mucronata* sensu Arkhangelsky and *B. langei* Jeletzky, i.e. mostly *B. langei* as figured by Birkelund (1957, Pl. 2, Fig. 6, and Pl. 3, Fig. 1). *B. mucronata minor* Jeletzky (Sharpe, 1853, Pl. 1, Fig. 2), a slender form without an appreciable waist, also occurs and often attains a large size.

(d) The Catton Sponge Bed

This bed, formerly seen near the base of Attoe's Pit (159) and visible near the top at Catton Grove (327), appears to mark a convenient faunal boundary. It also possesses a considerable fauna of its own, and has probably yielded several of the recorded ammonites. Brydone (1938) suggested that it may be identical with the " Cast Bed " which used to be seen near the base of the famous pit at Thorpe (153), and it is almost certainly equivalent to one of three sponge-beds which we have recognised on the foreshore at Sheringham—where ammonites have also been found.

(e) " Beeston Chalk "

This is the highest division from which a representative fauna has so far been obtained. It occurs on the foreshore between Sheringham and the Runtons, beneath Beeston Hill. Here *Micraster* and *Isomicraster* are no longer found, but *Cardiotaxis ananchytis* (Leske) appears to be characteristic, if not common, and *Galerites abbreviatus* Desor occurs sparingly. Inland it was formerly represented at Thorpe (153) and Whitlingham (154), but the best current exposure is at Caistor (166), which must be only slightly above the Catton Sponge Bed; a higher

horizon is seen at Frettenham (199). Some of the *Echinocorys* at the base of the division are still aff. *gibba* Leske, but *E.* aff. *conoidea* Goldfuss soon sets in, and is already the commoner form at Caistor, while it occurs exclusively at Beeston. A typical *E. conoidea* seen in the Geological Survey Collection from Mousehold Heath indicated an even higher horizon, which was borne out by the accompanying belemnites.

A marked feature of this division is the occurrence of " Flint Circles." These consist of knobbly flints (which often run into one another) arranged in almost perfect circles varying from 2 to 10 feet or more in diameter, upon bedding-planes. Sometimes two or more circles are concentric, and there may be a hollow-cored paramoudra at the centre. One circle is never seen to cut another, and they have no vertical development beyond the normal thickness of the flints of which they are formed—so that they cannot be recognised in cliffs or quarries, except where these have fortuitously exposed a bedding-plane (e.g. Caistor, and the Runton erratic). On wavecut platforms along the north coast, they occur from Old Hithe to East Runton, but are most common beneath Beeston Hill, where they look like " fairy-rings seen in meadows " (Reid, 1882).

(f) The Paramoudra Chalk

This name has been applied to the 75 feet or so of chalk which presumably comes between the Beeston Chalk and the top of the stage near Overstrand. There are no inland exposures now available, but the great series of workings between Wroxham and Horstead, alongside the River Bure (now overgrown and constituting " Little Switzerland ") must have exposed this chalk; Lyell (1838) figures a drawing from there by Mrs. Gunn, in which several vertical columns of paramoudras are beautifully shown. A paramoudra is a massive flint averaging 3 feet high by a foot in diameter (but sometimes much larger), and having a flint-free vertical core filled with hardened chalk; the exterior is generally smooth and typically barrel-shaped, but becomes nobbly where it rises through a normal horizontal flint-band. Individual paramoudras occur in many Norwich pits but their arrangement in vertically-aligned columns is mainly confined to this division; such columns were first described from Moira, Co. Antrim, by Buckland (1817) (" Moira pears "?—but a derivation from the gaelic " *peira muireach,*" meaning " sea pears " has been suggested, see Woodward, 1882; Arkell & Tomkeieff, 1953). Fitch (1840) noted that there is often a pencil-thick vertical tube, lined with a greenish film, passing through the hard chalk core, and Taylor (1824) observed that hardened chalk is also present between the individual flints in a column. One or more such columns were reported (Woodward, 1882) in the former St. James's Pit, Norwich, but little chalk remains visible there to-day—although we obtained *Magas pumilus* J. Sowerby and abundant " *Isocrinus* " ossicles. The occurrence of columns on the north coast cannot be confirmed, owing to the absence of vertical sections, but paramoudras are particularly abundant on the foreshore between East Runton and Overstrand.

Little is known of the fauna of this division, and the foreshore chalk between East Runton and Cromer is extraordinarily barren. East of Cromer the chalk surface lies below the low-water-mark and cannot be examined, but there is indirect evidence of an offshore reef of (glacially-disturbed?) chalk. From near Overstrand we have collected freshly-derived lumps of intensely hard yellowish chalk containing abundant *Echinocorys pyramidata* Portlock (sensu Wright non Lambert)—possibly related to that figured by Moskveena (1959) from the uppermost Senonian

and the Maastrichtian of the Caucasus. Most of them are sharply conical to a degree unknown among other English or Belgian species. The chalk erratics near Overstrand, which probably belong to this division are discussed in a later section.

FAUNA (i) Cephalopods

One can summarise the belemnites (sometimes called " whistlefish " or " thunderbolts " by the quarrymen) of the Zone by saying that they change from being dominantly stout and conical (*Belemnitella mucronata* sensu Arkhangelsky) near the base of the Zone, to being dominantly thin and waisted (*Belemnitella langei* Jeletzky) near the top. There is every transition between these two extremes, two typical intermediate forms being *Belemnitella mucronata minor* Jeletzky and *Belemnitella langei* sensu Birkelund non Jeletzky. There is variety at any one level so that it is necessary to have a representative collection of about six specimens before being confident of the horizon. However, the really slim forms, referable to *B. langei*, do not appear until some way above the base, in the Weybourne Chalk. Conversely the very stout form *Belemnitella mucronata senior* Nowak (uncommon even near the base of the Zone) barely ranges to the middle of the Zone—probably just into the Weybourne Chalk. Nevertheless, there are occasional examples from the Beeston Chalk which, although slimmer, are still referable to *Belemnitella mucronata* sensu Arkhangelsky.

Of the intermediate forms and their offshoots, the variety figured by Jeletzky (1951a, Pl. 2, Fig. 4) as *Belemnitella* n.sp.aff. *mucronata* is not common but is confined to the Eaton and Weybourne Chalks. *Belemnitella mucronata minor* Jeletzky and *Belemnitella langei* sensu Birkelund non Jeletzky are specially characteristic of the Weybourne Chalk, but they are not confined to it.

Of the ammonites, *Bostrychoceras* spp. including *B. polyplocum* (Roemer) are known from several pits around Norwich, up to the level of Caistor (166) and *Baculites vertebralis* Lamarck was common in a former pit at Norwich (189), probably in the Weybourne Chalk. *Pachydiscus oldhami* (Sharpe) and *Menuites portlocki* (Sharpe) are both recorded from Harford Bridges, while *Diplomoceras cylindraceum* (Defrance) and *Neancyloceras bipunctatum* (Schlueter) both occur in " hard bands."

(ii) Echinoderms

Certain distinctive forms of *Echinocorys* have already been noted; groups of specimens from any one level can probably be used to determine the horizon in the same way as the belemnites, but, as with the former, much rigid collecting still needs to be done. Brighton (1939) records a *Galeola* sp. nov. aff. *papillosa* (Gmelin, ex Klein) from the Eaton Chalk; we have collected very similar forms from immediately below the Zonal base in Hampshire. *Micraster*, as noted above, is not seen in the Beeston Chalk on the coast, but is recorded from Thorpe and Whitlingham, where *Galerites abbreviatus* Desor was also frequent. *Hagenowia rostrata* Forbes has been recorded from the Weybourne Chalk at Norwich, and *Phymosoma magnificum* Agassiz from Thorpe.

Asteroids are common, and include several species of *Metopaster* as well as *Recurvaster radiatus* (Spencer), *Teichaster favosus* (Spencer) and *Chomataster* species. " *Isocrinus* " ossicles are frequent in the higher beds.

(iii) Brachiopods

Magas pumilus J. Sowerby occurs regularly in all but the lowest beds, and *Kingena lima* (Defrance) ranges throughout. Many of the types of the terebratulids monographed by Sahni (1929) are from Norwich, including all his species of *Carneithyris, Ellipsothyris, Magnithyris* and *Ornithothyris,* as well as the huge *Neoliothyrina obesa* Sahni. An early *Chatwinothyris* (*symphytica* Sahni) also occurs. Among ryhnchonellids, of the "*limbata* series," *Cretirhynchia lentiformis* (S. Woodward) is common below the Catton Sponge Bed and *C. arcuata* Pettitt above it; of the "*plicatilis* series," *C. norvicensis* Pettitt comes in at the base of the Weybourne Chalk and ranges upwards, while of the "*exculpta* series," *C. woodwardi* (Davidson) is recorded from Harford Bridges. A *Terebratulina* sp. occurs, and the rare *Trigonosemus elegans* Koenig was first described from "Norwich."

(iv) Lamellibranchs

These are common. *Ostrea* generally retains a pinkish hue, and gryphaeate forms of *O. vesicularis* Lamarck occur at most horizons—often having been attached to belemnites. *O. semiplana* J. de C. Sowerby is especially abundant at Catton and reaches a great size. Spondylids, Pectinids and Limids are frequent, and *Inoceramus lingua* Goldfuss and *I. balticus* Boehm both occur in the lower beds. An *Astarte* sp. was found at Harford Bridges (*fide* C. W. Wright) and Woods records an *Arca* and a *Cardium*—both new to the English Chalk.

(v) Other Invertebrates

Withers (1935) records a very considerable suite of cirripedes from the Norwich Chalk. Most of the commoner sponge genera are present, and *Coeloptychium agaricoides* Goldfuss has been recorded from Harford Bridges and elsewhere.

Among corals, *Parasmilia* and *Trochosmilia* species are fairly common, and *Axogaster cretacea* Lonsdale and *Diblasus gravensis* Lonsdale also occur.

(vi) Vertebrates

Bones of the reptile *Mosasaurus* have been recorded as *Leiodon anceps* Owen from the former Lollard's Pit (187) and others around Norwich. The fish, monographed by A. S. Woodward (1902–12), include a considerable number from this Zone.

On the beach west of Sheringham are seen the Tubular Chalk Stacks whose pre-crag origin was described by Burnaby (1950). Formed around post-Cretaceous solution-pipes, they are of ordinary chalk which has been rendered marble-hard by the infilling of the interstices normally present with calcium carbonate. We have seen others near West Runton, and inland at Caistor (166) and at Coddenham, Suffolk.

MAASTRICHTIAN

As noted in the next section the chalk of this Stage is known only from glacially-moved blocks—none of which has so far revealed a base resting upon undoubted Senonian. Nor have any Upper Maastrichtian fossils yet been found—all the chalk exposed being referred to the Lower Maastrichtian, Zone of *Belemnella lanceolata,* in which *B. lanceolata* (Schlotheim) occurs throughout. About 110 feet are present, lithologically

divisible into four horizons, which are described below, and detailed in Fig. 7. This is based mainly upon personal observation but the thickness of the Sponge Beds, which alone may be seen at both Sidestrand and Trimingham, is entirely from Brydone's measurements on the wave-cut platform which exposed the Sponge Beds much better then.

(a) Porosphaera Beds and below

These are composed of soft, but massive, chalk with flint-bands—two of which are very distinctive, especially where exposed upon bedding-planes in the beach-platform (normally covered by sand), where the "flints-with-holes" stand proud like huge sultana-cakes. Some of the chalk also contains bluish-grey lenticular streaks, averaging six inches long, oriented irregularly. The Porosphaera Beds are characterised by abundant *P. globularis* (Phillips) and *B. lanceolata lanceolata* (Schlotheim) as well as *Echinocorys*, many specimens of which are very thick-tested and truly gigantic—some attaining a length of 110 mms. and (occasionally) as great a height. Though variable in shape, they have several distinctive features (including prominent ambulacral pore-pairs and a flat base) and all fall within the general range of forms covered by *E. belgicus* Lambert, as interpreted by Smiser. *Cretirhynchia magna* Pettitt is reasonably common, as is *Kingena lima* (Defrance), which becomes rare above.

(b) Sponge Beds

Only the top is occasionally exposed at Trimingham, and the lowest few feet are seen at Sidestrand. The chalk is hard, rough, and yellow (though often grey on the foreshore, where the iron is in a reduced state), and includes several erosion-surfaces of greenish-grey marl, with green-coated hard chalk pebbles. Large masses of pyrites are not infrequent, and the ambulacra of echinoids are sometimes impregnated with it, giving them a black appearance. Some of these echinoids are partly hollow—the remainder being filled with particularly hard, dense chalk—and show a tendency towards secondary calcite growth inside, in optical continuity with each plate of the test. When weathered-out upon the wavecut platforms, these echinoids often appear slightly pentagonal, due presumably to the increased abrasion-resistance of the impregnated ambulacra. Sharp impressions of huge sponge-masses are common (mostly *Ventriculites*, but also *Laosciadia* (=*Seliscothon*) and many others)—often impregnated with black manganese-oxide, which also encrusts many of the belemnites to a remarkable degree. A *Cretirhynchia* occurs, resembling *C. arcuata* Pettitt but having far too many ribs, together with *C. triminghamensis* Pettitt. Terebratulids occur in addition to a number of unusual lamellibranchs, including *Arca* and *Barbatia* spp.; other fossils are dealt with in the general faunal account.

Flints in the Sponge Beds often have thick but discontinuous rough white cortices, which seem to merge into the surrounding chalk, and give them an odd carious appearance; the cortices often include broken shell-fragments, echinoid spines and other débris. Flints of this type occur (though not exclusively) right up to the top of the stage, and can always be recognised when found loose upon the shore, or in the drift. Brydone (1908) took the top of the Sponge Beds as being marked by a thick "greasy" marl-band upon the shore; a very similar marl-band occurs in the bluff at Little Marl Point, but absolute correlation of the two is not certain (see Fig. 7).

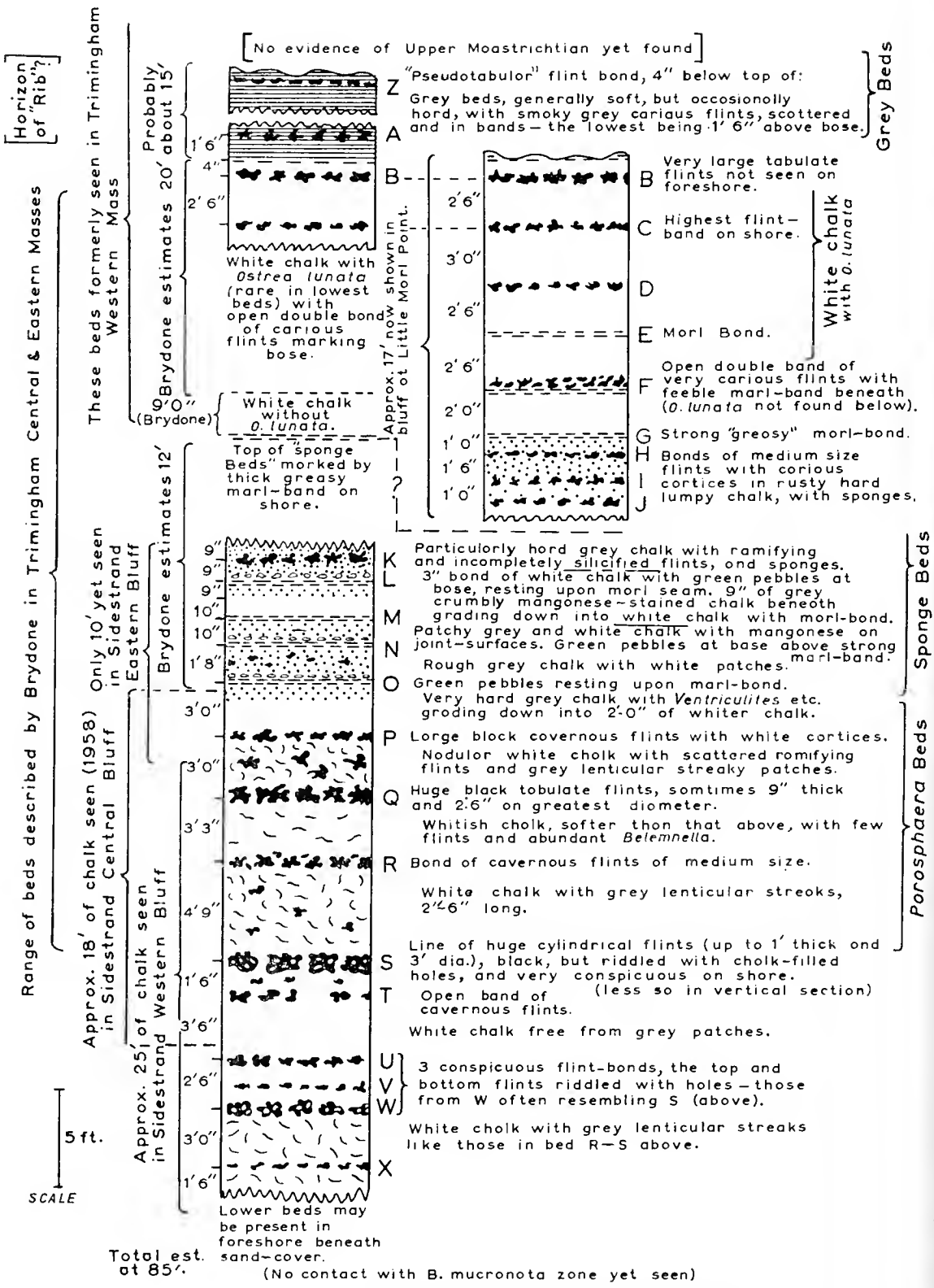


FIG. 7. Synthetic vertical section of the Maastrichtian of Sidestrand and Trimingham

(c) White Chalk without *Ostrea lunata* and White Chalk with *O. lunata*

There is about 30 feet (*fide* Brydone) of white chalk succeeding the Sponge Beds, in the lowest 9 feet of which *Ostrea lunata* Nilsson is extremely rare; in the remainder it is abundant—some bands being packed with it—so that 20 or more may be found attached to a single flint. The *Echinocorys* immediately above the Sponge Beds are still mainly large forms, with affinities to *E. belgica*, but are flatter and obviously transitional to *E. ciplyensis* Lambert, which first appears in the White Chalk with *O. lunata*, and ranges upward. This very distinctive form has a flat base, semicircular anteriorly and roughly parabolic posteriorly; in longitudinal profile it has a steep rounded anterior slope and a longer shallow posterior one. The result is that while the apex is central, two-thirds of the area of the test is posterior to it. As this Chalk has yielded by far the greatest number of specimens marked "Trimingham" in museum-collections, its fauna is dealt with in the general account below.

(d) Grey Beds

We have had no opportunity of examining these beds *in situ;* they were previously seen only in the Western Mass at Trimingham, parts of which are now exposed for an aggregate of only an hour or so annually, after favourable (and usually unpredictable) combinations of wind and tide. The *Echinocorys* from them are smaller, and perhaps closer to *E. limburgica* Lambert; the true *Cretirhynchia limbata* (Schlotheim) also occurs. *O. lunata* is apparently not present in the Grey Chalk, although the "rib" of chalk nearest to Mundesley (see map) is soft and greyish, and contains the small *Echinocorys* as well as *O. lunata;* the horizon of the 6 feet or so of chalk which it exposes cannot be properly fixed—its sole interest being that it is the only chalk at Trimingham outside the minefield which is generally visible.

Fauna (i) Cephalopods

The only ammonite record is a *Bostrychoceras* sp. from Sidestrand. "*Nautilus danicus*" (? *Hercoglossa*) occurs in the White Chalk at Trimingham. *Belemnella lanceolata lanceolata* (Schlotheim) and *Belemnella occidentalis* Birkelund range throughout, but the former is more common. *Belemnella licharewi* Jeletzky (Birkelund, 1957, P. 3, Fig. 4) first occurs near the base of the Sponge Beds and becomes commoner as one ascends, and *B. lanceolata lanceolata* (Schlotheim) decreases in proportion; there is a complete range between these forms—an intermediate one being figured by Birkelund (1957, Pl. 4, Fig. 2) as *B. lanceolata lanceolata*.

(ii) Echinoderms

After *Echinocorys* the commonest echinoids are *Galerites* spp. Formerly referred to *Conulopsis*, the taxonomy of these is very unsatisfactory, but they range from small and pointed ("*G. abbreviatus*") via large subconical ("*G. wollemanni*") and more globular ("*G. roemeri*") to flat bun-shaped ("*G. orbignyanus*"). The first of these is already common in the upper part of the *B. mucronata* Zone, but the last three are practically confined to the *B. lanceolata* Zone, and really large specimens are seldom seen below the White Chalk with *Ostrea lunata*. *Cardiotaxis* cf. *ananchytis* (Leslie) is not uncommon in the White Chalk; closely similar forms in the Geological Survey Museum were termed *Stegaster* sp. by Brydone. An incomplete possible *Seunaster* aff. *altus* (Seunes) collected from Sidestrand by Green and Howlett is in the Norwich Castle Museum.

Austinocrinus bicoronatus (Hagenow) occurs in the Porosphaera Beds, while *Isselicrinus buchii* (Roemer) is confined to the Zone and ranges throughout (*fide* Brydone). *Metopaster undulatus triminghamensis* Wright and Wright and *Stauranderaster bulbiferus* (Forbes) are common in the Porosphaera Beds, where an un-named *Pycinaster* first occurs, and ranges upwards.

(iii) Brachiopods

In addition to those already mentioned, *Terebratulina gracilis* Schlotheim and *T. gisei* Hagenow, while never common, are good index fossils. Three species of *Chatwinothyris* occur, including *C. subcardinalis* Sahni. *Trigonosemus elegans* Koenig and *T. pulchellus* Nilsson are rare, and have been found chiefly in the Grey Beds.

(iv) Lamellibranchs

Gryphaeostrea canaliculata (J. Sowerby) and *Ostrea vesicularis* Lamarck (which reaches a huge size in the *Porosphaera* Beds) are common at certain horizons, along with *Neithea quinquecostata* (J. Sowerby), *Pecten nilssoni* Goldfuss and *Aequipecten pulchellus* (Nilsson), which first occurs in the White Chalk and becomes less rare upwards. *Pseudoptera coerulescens* (Nilsson) is also found in the White Chalk, and Limids and Spondylids are not infrequent.

(v) Other groups

Certain Serpulids are characteristic. The five-angled *Ditrupula triminghamiensis* B-Nielsen occurs in all but the Sponge Beds, to which the smooth four-angled "*Serpula*" *canteriata* Hagenow *trimensis* Brydone is restricted, while "*Serpula*" *conica* Hagenow occurs throughout.

There are many polyzoa, but *Cellepora accumulata* Hagenow *bellicosa* Brydone, *Vincularia allas* Brydone and two *Onychocella* spp. are unknown above the *Porosphaera* Beds.

A little above the Sponge Beds the regular forms of *Porosphaera* are rare, and irregular forms become dominant. Of the corals, large specimens of *Trochosmilia cornucopiae* (Duncan) are conspicuous.

THE GLACIALLY-TRANSPORTED CHALK OF NORTH NORFOLK

Having considered the stratigraphical relationships of the highest beds of the Norfolk chalk, it is necessary to discuss briefly the effects of the Pleistocene ice-movements upon them. Scattered over the north and east of the county are many erratic blocks, in some of which the bedding is virtually undisturbed while in others the matrix is largely rearranged, with the flints shattered and drawn out in stringers; some show even more complete rearrangement—the chalk having lost all traces of its original structure, and including waterworn pebbles of flint and other rocks, together with derived fossils of all ages up to Pleistocene. This last type must be regarded as Pleistocene deposits made up predominantly of material from the Cretaceous beds over which the ice passed. Quarries at Heydon (302) and Holt (96) currently show good sections in such deposits: they contain 80 per cent of calcium carbonate with fragmentary fossils characteristic of the upper part of the *Gonioteuthis* and basal *mucronata* zones—about 100 feet above the buried surface of which they now lie. Erratic blocks of similar material are seen at Weybourne (301) and Beeston (329), and at several points high in the cliffs

between the latter place and Mundesley. No stratigraphical consideration can be given to these, nor to the inland erratics, since their field relationships can seldom be made out. Marshall (1787) refers to the chalk of the erratics in the neighbourhood of Thorpe Market; " It does not lie in strata . . . but in distinct masses of different figures and magnitudes, rising with irregular heads towards the surface, and sinking to a depth of perhaps 10 and 20 feet, and sometimes to a depth unfathomed. If the abyss of sand (*sic*) in which they lie buried could be rendered transparent, these clouds of marl would be seen scattered under the surface of this country in resemblance of the clouds of vapour which we frequently see in summer suspended in the atmosphere." Later accounts of these erratic blocks are given by Trimmer (1847), Reade (1882, etc.) and others.

There remain, however, several masses of chalk along the coast between Sheringham and Mundesley which are (or have been) well enough exposed to contribute usefully to our stratigraphical knowledge. For nearly 1,000 yards between East and West Runton, the cliff shows a section through a huge tabular mass of chalk (331) within the boulder clay. The chalk is lying for the most part horizontally but is sometimes sharply folded, and fractured into separate masses surrounded by glacial material; much of the mass carries an undisturbed capping of Crag and in at least one place this is conformably overlain by Cromer Forest Bed Series. Towards East Runton it thickens until it occupies almost the whole height of the cliff; here it consists of three or more repetitions of the same set of beds - one being thrust completely over another. In some places these overthrusts are along bedding-planes and are hard to detect, but in others the lower beds have been folded before the next set were thrust over them—planing off the crests of the folds. The chalk appears quite similar to that of the foreshore below it, and like the latter is very barren of macro-fossils, beyond an occasional *Echinocorys* and *Belemnitella;* also the huge flints in the erratic mass undoubtedly form part of flint-circles similar to those seen on the shore. If it can be assumed that the ice movement which brought this erratic to its present position came from the north or north-west, then, of course, it will have travelled along the line of strike, and will naturally rest above beds of its own age. Certainly the topmost beds preserved beneath the Crag cappings, in the masses to the east (described below) appear to occur in the expected stratigraphical sequence, viz: progressively higher beds eastwards.

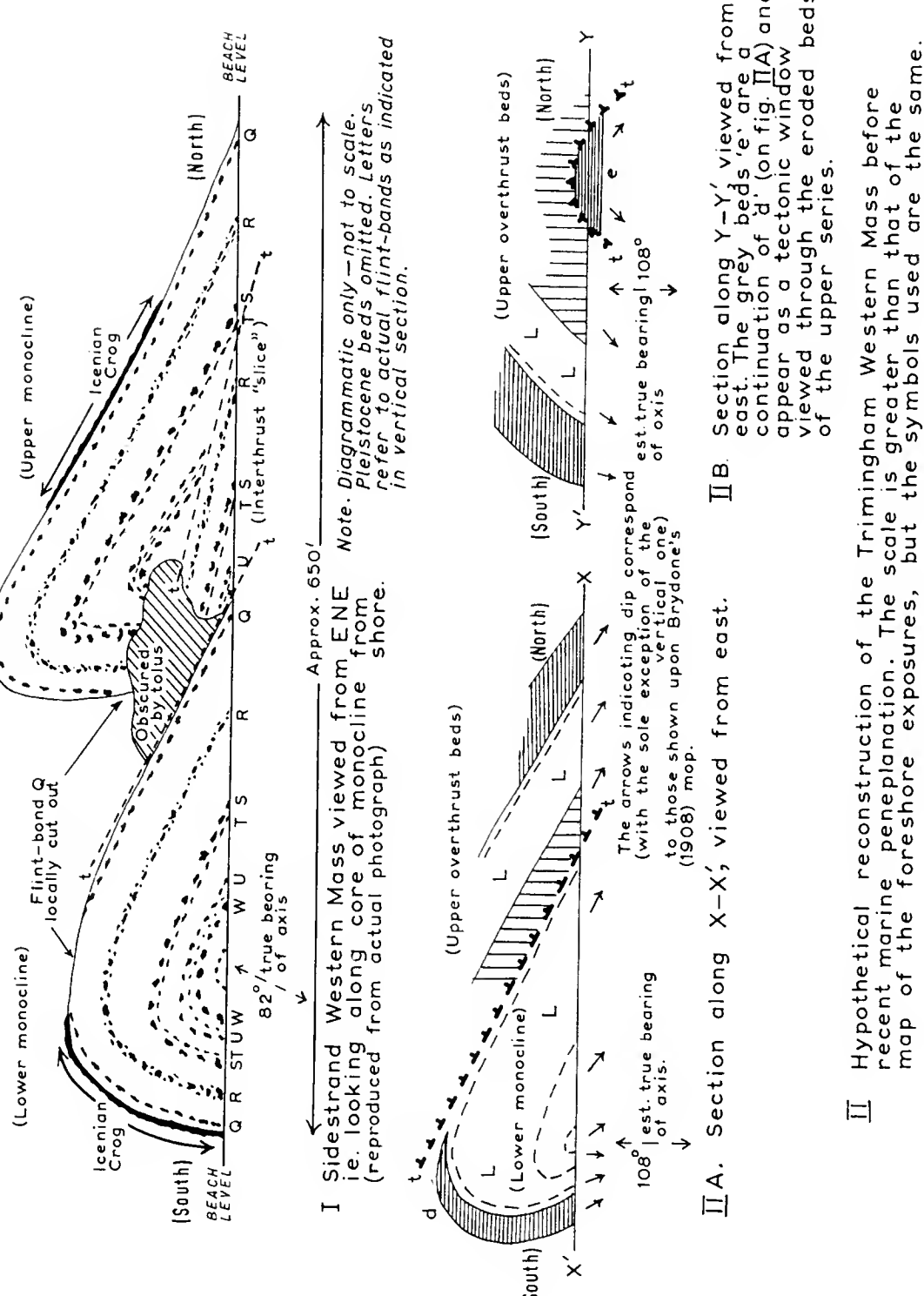
The next series of chalk masses occurs at Overstrand (332); the first exposure noticed here was in 1878, and Brydone (1906) states that by 1896 there were no less than ten of these masses, all but one lying on a thick bed of till which ran along the foot of the cliff for nearly half a mile. He records *Austinocrinus bicoronatus* (Hagenow), " *Rhynchonella reedensis* " (? *Orbirhynchia*), *Micraster glyphus* and four Senonian polyzoan species, all unknown from Trimingham, but one at least—*Membranipora* (? *Homalostega*) *clathrata*—known from the Beeston and Paramoudra Chalks. Artificial sloping of the cliffs had all but obscured these masses by 1905, but erosion since 1939 has once again exposed the easternmost and largest, beneath the site of the old Overstrand Hotel. It is about 300 feet long, and its western end appears to exhibit a 40-foot vertical section of chalk dipping at 15 deg. south, but like the Runton erratic, turns out to consist of a series of overthrust repetitions of the same set of beds—the uppermost being the most complete and comprising 15 feet of hardish white chalk with seven bands of medium sized flints. The planes of separation appear as " marl bands " in the face of the bluff.

Belemnitella mucronata and an *Echinocorys* closely resembling those from the Overstrand foreshore, have been obtained. If a true 40 feet vertical section were really exhibited, there should be some hope of the upper and lower beds being represented in the masses to the east and west respectively, but no such overlap has so far been detected in the 15 feet of beds actually present. This apparently represents the highest chalk of the *B. mucronata* Zone exposed in Norfolk—all those to the east exhibiting only beds of Maastrichtian age. These latter all occupy lower positions in the cliff, and in no case have they been actually seen to rest upon till. It is the present authors' opinion, however, that they differ in no great way from the masses already described—except insomuch as arises from variations in hardness of the chalk involved—and that at the time of their emplacement all these masses were probably at the same absolute height above the true chalk surface, which was more nearly horizontal than to-day. The progressive lowering to the east can easily be explained by Pleistocene post-Pleistocene downwarping of the southern part of the North Sea Basin, for which there is evidence elsewhere in East Anglia and in Holland.

In 1937 Brydone first reported the appearance of a mass of chalk (333) in the cliff at Sidestrand, and by 1948 this had the form shown in Fig. 8 (I). By this time a second mass (the " Sidestrand Central Mass " —334) forming an elongated dome running 350 feet along the base of the cliff and rising some 15 feet at its centre had been exposed a few yards to the east of the earlier (" Western ") one. Erosion caused by the great storm of 1953 cut deep into these masses, and began to expose a third (" Eastern "—335) one further east still, and on the western boundary of the minefield. Insofar as can be seen, all these masses have their longer axes orientated approximately east–west, and exhibit shallow northern limbs but steep (even overturned) southern ones. The western and central masses are also capped by Crag " Stone Bed "—traces of which have recently begun to appear in the eastern one. By 1959, the central mass had been eroded back well towards its steep northern limb, and the cliff, here mainly of sandy outwash gravel, saturated with water, was piled steeply behind it. During the night of December 8th, following heavy rain and gales, the greater part of this mass slid bodily seawards for a distance of 240 feet—pushed forward by the soft glacial material which slid down in its wake. This lends support to the idea that it does indeed rest upon till which acted as a lubricant.

The next bedded chalk exposed to the east was first seen in 1898 (Bonney and Hill, 1905) at a point on the shore beneath the Crown and Anchor Hotel at Trimingham (336). It appeared as a shallow dome 4 feet high by 50 feet long, but was not known to Brydone, and had probably disappeared by 1905. Its sole interest is that it occurred at a point midway between the Sidestrand masses and those next described—thus providing a link between them. Hudleston (1906) reported a last remnant of chalk at this spot, but appears to have mistaken the position, since his photograph clearly shows part of Brydone's " Northern Bluff " (see below).

The classical masses at Trimingham are shown on the accompanying map, which is based on those of Brydone (1908). The " Northern Bluff " (of the Western Mass—337) was the subject of fierce controversy in the early part of this century. Reid (1882) and Brydone (1906) both considered that the chalk was *in situ*. Reid had suggested that the folding was caused by movement of ice having rucked up the beds over which it passed " into an inverted anticlinal . . . like a tablecloth creased by the



II Hypothetical reconstruction of the Trimingham Western Mass before recent marine peneplanation. The scale is greater than that of the map of the foreshore exposures, but the symbols used are the same.

FIG. 8. Glacially-moved masses near Sidestrand and Trimingham (overthrust toward the south)

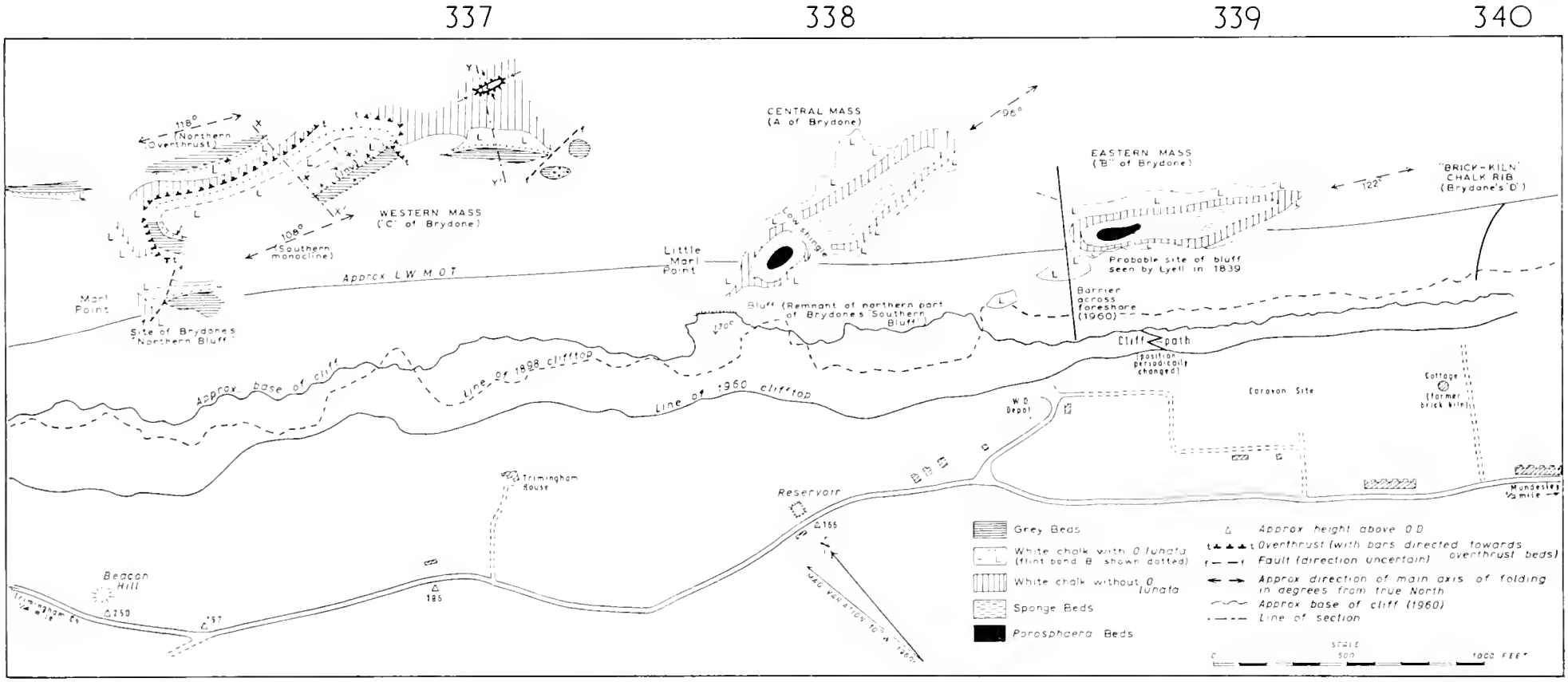


FIG. 9. The foreshore exposures near Trimingham

sliding of a heavy book," and that further pressure could result in the upper limb being sheared off completely and driven into the overlying boulder clay. Brydone, however, believed that the masses were fossilized sea-stacks and the folds of Cretaceous age, while Howarth (1907) attributed the folding to " earthquake waves." Bonney and Hill (1905) alone regarded the Trimingham masses as being erratic boulders like those of the Runtons, but thought their folding to be pre-glacial and that floating ice had carried them from the south-west. They vigorously opposed Reid's theory, but subsequent studies in glacial tectonics, elsewhere, make it apparent that his ideas were fundamentally sound—although the mechanism by which such masses can be plucked from the outcrop-surface still requires elucidation. An initial doming perhaps caused by large-scale frost-heaving may provide an answer.

Brydone mapped the actual outcrops on the foreshore with great accuracy—since largely confirmed by photography from the clifftop (Sainty, 1949), but failed to recognise that large-scale overthrusting was present, and his vertical sequences (1908, 1909), when integrated, include many repetitions of the same beds; if accepted, there would be something like 170 feet of Maastrichtian chalk in Norfolk. If, however, we assume a structure similar to that of the Western Mass at Sidestrand (see Fig. 8, IIA and Fig. 9), and allow that Brydone probably failed to detect overthrusts on the shore, where these led to no disconformity of dip, then the sequence in the Trimingham Western Mass becomes readily decipherable, and ties up with those of the other masses. The " inlier " of " White chalk with *O. lunata* " near the eastern end becomes a tectonic window, eroded through the upper overthrust series to expose the highest beds of the tectonic unit below—a tiny glacial analogue of features seen in the nappes of the Alps. Comparable structures have been described by Slater (1927) from the Danish island of Moen, where chalk of similar age is likewise engulfed in till.

The overturned northern limb of the upper series was seen in the northern bluff by Reid (1882), and Jukes-Browne and Hill (1904) refigure this and also a strike-section showing undulating beds in the face, strikingly similar to those observed at Sidestrand and the Runtons. When Lyell (1840) first saw the northern bluff, it was 318 feet long, but by the time it was figured by Brydone (1906a) it had shrunk to three detached masses—the last of which was washed away in February 1907; to-day, even the foreshore exposure is below normal low-water mark, and portions are only rarely exposed when abnormally low spring tides (assisted by offshore winds) occur after a period when north-westerly gales have swept away the sand-cover.

The other two Trimingham masses are simple elongated domes with steep southern limbs, as indicated by the dip of the flint-bands on the shore. Both exhibited bluffs when first seen by Lyell (ibid.), but ,of these, only the Central (338) remained by Brydone's time, and to-day all that exists of it is one block of chalk 20 feet high and 105 feet long, having a 30 degree dip into the cliff at 210 degrees (true). Brydone (1908) found 9 inches of Crag capping a " pseudo-tabular " flint-band (which evidently forms the highest member of the Grey Chalk) on the foreshore exposure of the Eastern Mass (339). 300 yards further east, a narrow " rib " of chalk (340), varying from 2 to 4 feet in thickness runs across the foreshore, and some part of it is generally visible in one of the longshore drainage channels. It dips north at about 30 degrees into the till which also seems to underlie it; in 1905 an area of its surface measuring 90 feet by 12 feet was seen by Brydone.

No further masses are known to the east of this point, but there are early records of " marl " having been seen on the foreshore as far east as Happisburgh. A small erratic of rearranged chalk was seen by the authors enclosed within the till on the foreshore near Bacton, and a loose flint nearby yielded a cast of a large (?) *Phymosoma*. Dilligent search among the débris on the shore there, however, has failed to reveal evidence of any material which could have been derived from beds younger than those at Trimingham.

The only other mass worthy of note is a small dome of very soft friable chalk with small flints which has appeared in recent years at the base of the cliff about 500 yards east of Beeston Hill (330). C. W. Wright (*in litt.*) sees evidence which suggests that this is younger than any chalk there exposed on the foreshore—and which its lithology certainly does not resemble.

THE UPPER CRETACEOUS SETTING OF EAST ANGLIA

During the early Cretaceous part of Norfolk was land, to the north and south of which were contrasting types of deposition. The Gault and Red Rock, which are the earliest formations making a continuous outcrop, show marked changes in facies and thickness in north-west Norfolk. A Hunstanton–Diss *schwelle* continued to affect the thickness of the Chalk until late in the Turonian. Even after the *schwelle* effect disappeared during the Senonian, the area continued to be the southern frontier of a northern lithological and faunal Province, plainly recognisable in Yorkshire, and allied to that of north-west Germany.

In western Europe, Chalk sedimentation usually begins with a basement bed which is sandy, with both quartz and glauconite, and many of the fossils are phosphatised. These conditions existed in southern Norfolk, and extended to the north of Marham. North of this, to the coast at Hunstanton, there is no basement bed—the basal chalk being essentially free of detritus. The Red Rock, in spite of its Albian age and its iron content, has several of the characteristics of a chalk basement bed, but it is clearly capped by an erosion surface separating it from the white chalk. Nor is there a true basement bed in Lincolnshire, Yorkshire, Mull, Morven, north-east and south-west Antrim or parts of Derry. This probably indicates rapid transgression over an area of low relief, so that the shoreline, with its marginal belt of detrital deposition, was quickly moved far away. At the same time, bottom currents must have been too weak to tear material off the bed beneath. Moreover, the lack of phosphatisation suggests that the condensed Paradoxica and Inoceramus Beds were not deposited as slowly as the average chalk basement bed, although it may be that the sea was less than 50 metres deep and hence in the shallow zone where the phytoplankton removes the available phosphate (Kazakov, 1937, 1950). The Paradoxica and Inoceramus Beds continue through Lincolnshire with essentially the same lithology, and the Inoceramus Bed ranges into Yorkshire (Jukes-Browne and Hill, 1903, p. 283). It is doubtful if this lithology is represented in southern England, the Beer Stone of Devon, for example, lacking even the foraminifera and " spheres." The burrow casts are found elsewhere accompanying minor breaks in deposition, e.g. in the green bands of the White Limestone in south-west Antrim (Hancock, 1961).

In their abundance of *Ornatothyris*, the Cenomanian and Lower Turonian, not only of Norfolk but also of Cambridgeshire, are northern

in type. This genus is absent in southern England but ranges northwards into Yorkshire and eastwards through Germany (K. Evans *in litt.*) to the Caucasus (Moskveena, 1959).

The *T. lata* Zone is more uniform throughout, in England, than the zones which precede it, and evidently marks a considerable deepening of the chalk sea. In Norfolk, the presence of several thick marl bands, particularly in the north, may indicate a local shallowing. Conditions evidently favoured echinoids (e.g. *Holaster planus* sets in immediately above the Plenus Marls) but *Terebratulina lata* itself—so abundant elsewhere—is here rare. Not all faunal groups show differences between the northern and southern Provinces, but seldom are these more obvious than among the echinoderms. The boundary between the two Provinces probably lay near Swaffham; here *Infulaster excentricus* (of regular occurrence in Lincolnshire and Yorkshire, but unknown from southern England) appears in some abundance; in Westphalia it is common enough to have been cited as an index-fossil and Moskveena (1959) records it from the Caucasus. In the north of Norfolk, the monotonous lithology of hard platy chalk with mottled grey slab-like flints is like that of Lincolnshire and Yorkshire (and this persists until the lower part of the *M. coranguinum* Zone).

North of Swaffham the Chalk Rock and Top Rock disappear. Asteroid ossicles from Swaffham include two forms characteristic of the *H. planus* Zone of Yorkshire—*Metopaster exulptus* Spencer (which does not occur in the south until the *M. cortestudinarium* Zone) and a form which has been described as an early type of *M. quadratus* Spencer (see Wright and Wright, 1940). North from here many of the *Micraster* are of "northern-Province" type, i.e. with some or all of the features of the test, other than the ambulacra, not following the southern English pattern (although a group seen from Swaffham itself appear to do so).

The upper part of the *M. coranguinum* Zone is of southern facies, i.e. relatively soft chalk with many lines of black flints, conical forms of *Conulus albogalerus* common towards the top and *Hagenowia rostrata* very rare, in contrast to the hard flintless chalk of Yorkshire with *H. rostrata* abundant, and conical *C. albogalerus* absent. The soft flintless and poorly fossiliferous chalk of the Zones named after the free-swimming crinoids *Uintacrinus* and *Marsupites* differs little from that of south Suffolk; only in Sussex, Hampshire and Dorset are these Zones truly flinty, and they are there succeeded by up to 110 feet of the *Offaster pilula* Zone, characterised by its name fossil and by belts with *Echinocorys* of distinctive shapes. In many parts of southern England the *O. pilula* Zone shows signs of condensation—e.g. numerous marl bands in Wilts, Hants and Sussex; pebble-covered erosion surfaces at Culver in the Isle of Wight, and phosphatic chalk at Taplow in Berkshire. In East Anglia (as in Yorkshire) there is no trace of the characteristic *pilula*-Zone forms of *Echinocorys* beyond one, the low-zonal *E. tectiformis* Brydone (=*E. striata* Smiser non Lambert, from the basal Craie de Trivière). All but this one are also absent from Belgium, where there appears to be a gap within the Craie de Trivière between the basal *pilula*-Zone horizon and the chalk above with *G. quadrata*. High-zonal *Gonioteuthis* with deep alveoli are found at Wells not far above the top of the *Marsupites* Zone and the *Echinocorys* from Wells are also more like those from the (restricted) Zone of *G. quadrata* of the south. We feel that in Belgium, East Anglia and perhaps Yorkshire, chalk of the greater part of the *O. pilula* Zone may not have been deposited.

TABLE 3—

Stage	Southern England	Northern Ireland	*Belemnites*
Upper Maastrichtian		(not represented)	*Belemnella casimirovensis* *Belemnitella junior*
Lower Maastrichtian		" Pellet " Chalk of Ballycastle	*Belemnella licharewi*
	(not represented)	(not represented)	*Belemnella lanceolata*
Upper Senonian		(3) White Limestone	*Belemnitella langei* dominant
	Highest chalk of Isle of Wight and Dorset		*Belemnitella mucronata minor* and allied forms common
	B. mucronata Zone	Possibly present only in north Antrim (Ballintoy Harbour) and near Dungiven, Co. Derry	*Belemnitella mucronata* sensu stricto
	Base of Zone in Hants (2) *G. quadrata* Zone	Top of Hibernian Greensands near Belfast=basal White Limestone at Magheramorne	*Gonioteuthis quadrata*

TABLE 3—cont.—

Echinoids	Norfolk	Western Belgium (4)	Eastern Belgium (6)
	(not represented)	Tuffeau de St. Symphorien	Tuffeau de Maastricht
		Craie de Ciply (*P. pulchellus* band and above)	Craie grossiere Tiger Chalk Grey Chalk
E. aff. *limburgica*	Grey Beds	?	
E. ciplyensis	White Chalk with *O. lunata* White Chalk	Craie de Ciply (below *P. pulchellus* band)	"Lacune"
	Sponge Beds	?	
E. belgica	Porosphaera Beds	Craie de Spiennes	Hard Ground
E. (passage forms)	(Sidestrand chalk)		
E. pyramidata Portlock (7)	Paramoudra Chalk		"Lacune"
?			
E. conoidea *Galerites roemeri-abbreviatus*	Beeston Chalk	?	N.R.?
E. aff. *conoidea* *Cardiotaxis ananchytis*		Craie de Nouvelles	White Chalk
E. ovata auctt.	Catton Sponge Bed		
E. gibba and *M. stolleyi*	Weybourne Chalk		
E. subglobosa fonticola	Eaton Chalk	Craie d'Obourg	
E. subglobosa and *C. heberti*			
E. pyramidata auct. var. *quenstedti*		(5)	
E. marginata approaching *subglobosa*			"Lacune"
E. lamberti (8)	Basal Mucronata Chalk	Conglomerat d'Obourg	Glauconitic Chalk
E. lata fastigata			"Lacune"
?	Gonioteuthis Zone	Craie de Trivière	Smectite de Herve

The *B. mucronata* Zone is absent in both Lincolnshire and Yorkshire, and even in Antrim and the Isle of Wight is incomplete (see table 3), although the upper part of the Zone represents the widest extent of the Cretaceous sea in western Europe. The *Echinocorys* and *Belemnitella* sequences are most easily compared with those of the Mons Basin in western Belgium, although our limited study suggests that the White Limestone in Northern Ireland shows a succession which is complete for the upper two-thirds of the Zone. But the western Belgian succession has a number of breaks marked by submarine erosion surfaces which are sometimes capped by a fossil-rich bed. The " sponge-beds " in Norfolk probably indicate similar but minor shallowings of the sea resulting in condensation of the sediment and preservation of aragonite-shelled fossils, but without submarine erosion. We have no idea if any Norfolk sponge bed can be correlated with a particular erosion surface in Belgium. In Ireland, the glauconitic and burrow-marked " green bands " in the White Limestone are the same type of phenomenon. All three regions are close to or over ancient massifs. By contrast, such phenomena are absent in the Isle of Wight which is a centre of thick Mesozoic depression; here, the greater part of the 400 feet of *mucronata*-chalk contains *E. lamberti* and the top is no higher than the lowest part of the Weybourne Chalk (Spencer, 1913); the corresponding beds in Norfolk occupy hardly more than 100 feet.

Unfortunately we know little about the top of the Beeston Chalk and even less about the Paramoudra Chalk, so that a horizon corresponding with the presumed Nouvelles-Spiennes gap in Belgium cannot be indicated. As *E. belgica*, characterising the lower part of the *B. lanceolata* Zone, is said to appear in the upper part of the Craie de Spiennes, then we may reasonably put the Spiennes-Ciply gap above this horizon. Erosion surfaces within the overlying Sponge Beds of Sidestrand (see Fig. 5) mark a regressive phase, but they are succeeded by the deeper-water White Chalk, which brings in *O. lunata* itself. The " Pellet " Chalk of Ballycastle, Co. Antrim (in which we have found *E. ciplyensis*) perhaps belongs to this horizon, which would thus mark another (albeit temporary) transgressive phase. The Grey Beds at the top of the British Maastrichtian succession contain *Trigonosemus* and *Pecten pulchellus* and correspond to part of the Craie de Ciply—but the highest beds of the latter which are Upper Maastrichtian, appear to have no Norfolk equivalent. All the horizons preserved in Norfolk are still chalk, whilst the nearest equivalents in Belgium are already shallow-water *tuffeau*.

NOTES ON THE CORRELATION TABLE

(1) Thicknesses of formations are not to scale. To save space, *Echinocorys* has been written as " *E*," *Micraster* as " *M*," and authors omitted.

(2) Brydone (1912) placed the boundary in Hampshire at the uppermost occurrence of *Gonioteuthis quadrata*, although *Belemnitella mucronata* appears (rarely) about 12 feet below this.

(3) We have *Echinocorys belgica* from the top of the White Limestone west of Ballycastle, but no *Belemnella* has been found in Ireland.

(4) There are possibly more gaps in the succession in western Belgium (cf. Jeletzky, 1951).

(5) Basal Craie d'Obourg contains *E. lamberti*, which correlates with the Basal Mucronata Chalk. On the other hand the Conglomerat d'Obourg contains *Belemnitella langei*, and the belemnite fauna suggests that

the Conglomerat d'Obourg extends higher—possibly as high as the top of the Eaton Chalk.

(6) This correlation is based on Schmid (1959).

(7) This is the true *E. pyramidata* of Portlock, figured by T. Wright (1864–82) from Portlock's (unfigured) type-specimen.

(8) *E. lamberti* appears to range higher in Belgium, and probably in the Isle of Wight and Northern Ireland.

LIST OF EXPOSURES IN THE CHALK OF NORFOLK

These are selected from 340 recorded exposures used in preparing the Zonal Map, and are mostly marked upon it. The numbers following the six-figure National Grid References are those from the MS. list deposited with the British Museum (Natural History), H.M. Geological Survey and Norwich Castle Museum. The prefixes indicate the present condition of exposures (where known) as under:

*excellent section, still accessible.
†some chalk still visible in 1960.
‡site exists, but no chalk currently visible.
‖site obliterated. Those listed formerly showed important sections from which much museum material was obtained.

Note: The inclusion of a pit in this list is no indication that permission to visit will be granted, nor is the omission of an owner's name intended to imply that permission is not required.

Varians Chalk, with Totternhoe Stone and *Subglobosus* Chalk above:

TF/673415 *Cliff-section for 1 mile N. from Hunstanton, with many fallen blocks. See pp. 299, 301 and fig. 4. Cliffs form part of LeStrange estate – permission from Estate Office, Heacham, Norfolk.

TL/690885 *229 By Blackdike Farm, 2 miles SW. of Feltwell Church. See p. 301. The new Fen Drain, now being cut, will pass through this pit.

Subglobosus Chalk:

TF/727200 *304 Limeworks, W. side of B1153, ½ mile N. of Gayton Church.

Subglobosus Chalk, with *Plenus* Marls and *Inoceramus labiatus* Zone above:

TF/687367 *145 Heacham, large old pit at end of lane, E. side of A149, ½ mile S. of bridge over Heacham River. Details given by Jukes-Browne and Hill (1887, p. 570 and 1903, p. 213) and Whitaker (1899, pp. 53, 65).

TF/724249 *40 Hillington, near King's Lynn. W. side of B1153, ¼ mile S. of Church. Large pit worked by West Norfolk Super Lime Co. See fig. 4.

TF/715051 *109 Barton Bendish, ¼ mile SSE. of Church.

TF/705080 *111 Marham, Limekiln Plantation, 1¼ miles S. of Church. See p. 303.

Zone of *Inoceramus labiatus:*

TL/736880 †257 Flooded pit (E. C. Thompson, Esq.) adjoining Wilton Church. Rubble heaps yield many small fossils.

Zone of *Terebratulina lata:*

TF/773140 †313 Narford, small pit by entrance to The Kennels, on N. side of road, ½ mile E. of Narford Hall (permission from the latter). *Inoceramus* abundant.

TL/788863 *216 Brandon (Suffolk), Whiting Pit, F. W. Mount & Sons, 48 Thetford Road. Deep face—includes section through very old limekiln.

TL/793855 †215 Lingheath, 1 mile S. of Brandon (Suffolk). Old mineshafts, normally inaccessible, show the "Brandon Flint Series" at top of Zone.

Zone of *Hotaster planus:*

TF/731247 †34 Thornham, Parish Pit. W. side of road, ½ mile SSW. of Church. Partly filled with rubbish. Shows "northern province" type chalk.

TF/762433 †33 Titchwell, Parish Pit. W. side of road, ½ mile S. of Church. Partly filled with rubbish. As above.

Zone of *Micraster cortestudinarium:*

TF/851273 *58 Helhoughton, E. side of road halfway to East Rudham. Large working by Wm. Howes & Sons, of Frettenham, Norwich. Very barren.

Junction of *Micraster cortestudinarium* and *M. coranguinum* Zones:

TF/836150 *309 Newton-by-Castleacre, ½ mile SE. of Church, on road to Great Dunham. Agricultural Contractors Ltd., of Sudbury, Suffolk.

TL/895776 *303 Euston (Suffolk), Willowmere Spinney, W. side of A1088, 4 miles SSE. of Thetford. Euston Lime Co., of Walton Hse., Fordham, Ely, Cambs.

Zone of *M. coranguinum:*

TF/843432 *65 Burnham Overy, Parish Pit. E. side of Mill Road, ¼ mile N. of Church. Deep face—not now worked.

TF/853419 †311 Burnham Thorpe, in grounds of Manor House, 100 yards NE. of Church. Small pit which yields occasional fossils.

TF/873042 *84 Ashill-near-Watton, N. side of B1077, 1 mile W. of Church. Ashill Lime Co.—worked irregularly.

Uintacrinus Zone:

TM/004869 127 East Harling. Large but shallow old pit in glacially-disturbed chalk. Another, 300 yards to the west (242).

Gonioteuthis Zone:

TF/928429 *280 Wells, S. side of A149, immediately E. of level-crossing SE. of town. Leicester Lime Co. Ltd. (Head Office).

TF/975428 †283 Stiffkey—in yard of Hall Farm, 200 yards S. of Church. Small pit near top of Zone. Another (284), 300 yards NE. of it.

TG/129184 †136 Several old pits on Alderford Common, 1 mile N. of Attlebridge.

Zone of *Belemnitella mucronata*—pits arranged in ascending order of horizon.

TG/175132 *152 Drayton, N. side of Costessey Lane, ½ mile SW. of "Red Lion." Leicester Lime Co. Ltd., of Wells, Norfolk. See p. 314.

TG/201093 ||155 Dereham Road. A former pit here ("Stonehills"), and another to the east of it (156, Earlham Limeworks) yielded many fossils of the Eaton Chalk horizon.

TG/208063 †158 Eaton Limeworks, opposite Police Sportsground. Chalk was formerly worked from extensive tunnels, now sealed off.

TG/212048 *294 Keswick, beside lane, 300 yards S. of Mill. Leicester Lime Co. Ltd., of Wells, Norfolk. Eaton Chalk of slightly higher horizon.

TG/221057 ||161/162 Two pits at Harford Bridges, now filled-in, exposed top of Eaton Chalk, and fair thickness of Weybourne Chalk. See p. 317.

TG/110438 *Cliff-section for 2 miles E. from Weybourne Hope. See p. 317, and fig. 5. Top of Eaton Chalk (?) beneath beach at Weybourne Hope.

TG/229109 *327 Catton Grove, on private ground. Permission only from Robt. Campling, Limekiln Garage, Sprowston Road, Norwich. Mainly topmost Weybourne Chalk, with Sponge Bed near top of pit, and a few feet of Beeston Chalk above it. See section in fig. 6.

TG/231111 ||159 Attoe's Pit, New Catton. 300 yards N. of above, on N. side of Woodcock Road. Exposed Catton Sponge Bed near base, and yielded many museum-specimens marked "Catton."

TG/160436 †Foreshore exposures, generally sand-covered, show topmost Weybourne Chalk for 1 mile W. of Sheringham, and Beeston Chalk for two miles E. of it to West Runton (site for "Flint Circles").

TG/238046 *166 Caistor St. Edmund. E. side of road, ¼ mile S. of Arminghall turn. Frettenham Lime Co. Ltd., of Frettenham, Norwich. Beeston Chalk only just above Catton Sponge Bed horizon. See section in fig. 6.

TG/246173 †199 Frettenham, 200 yards SW. of Church. William Howes & Son, Frettenham, Norwich. Worked from flooded excavations by dragline.

TG/292094 †192 St. James Hollow, opposite Nelson Barracks. Originally vast, two small exposures at base show Beeston Chalk. Lollard's Pit (187), S. of it, and behind gasworks, yielded *Mosasaurus*.

TG/276090 †153 Thorpe St. Andrew. Pit NW. of railway-bridge over Yarmouth Road formerly showed high Beeston Chalk, with many fossils. See p. 317.

TG/270078 ‡154 Whitlingham, due S. of above, on S. side of river. See p. 317.

TG/275173 ‖194 Little Switzerland, N. of Wroxham Hall. Showed Paramoudra Chalk, and was figured ("Horstead") in Lyell's "Elements." See p. 318.

TG/220420 ‡Sporadic L.W.M. exposures from East Runton to Cromer, and derived material thence to Overstrand, yield Paramoudras, etc.

TG/255406 †332 Cliff erratics beneath former Overstrand Hotel. Top Senonian. See p. 325.

Zone of *Belemnella lanceolata*

TG/255404 *333/335 Masses at Sidestrand show lowest Maastrichtian. See fig. 8, and accompanying text, and section on fig. 7.

TG/298379 ‡337/339 Foreshore chalk generally sand-covered. Single bluff (338) within minefield. Special permission sometimes possible (at some risk!) by prior arrangement with War Department. Portions of Eastern Mass sometimes seen outside barrier and a few feet of "Rib D" (340).

The following pits (mostly now obliterated) are also mentioned in the text (page numbers quoted in brackets) or shown upon the map—pl. I ("M"):

8 Docking (TF/768380) (p. 309)
21 Houghton St. Giles (TF/928354) (M)
22 Thorpland Hall (TF/936321) (M)
24, 25 Swaffham railway cutting (M) (TF/979094 to 805094) (p. 309)
31 Bintree Mill (TG/001241) (p. 313)
32 North Elmham (TF/990219) (p. 312)
49 Tharston (TM/188948) (M, p. 314)
51 Newton Flotman (TM/211983) (M)
*62 South Creake (TF/862358) (M)
74 Great Walsingham (TF/942376) (M)
‖82 Cley Green, Wiveton Road (TG/048433) (p. 314)
†96 Holt (TG/069379) (M, p. 324)
98 Quiddenham (TM/021871) (M)
129 High Starlings (TM/046875) (M)
*139 Sedgeford (TF/709361) (M)
189 St. Giles Street, Norwich (TG/228086) (p. 319)
*198 Frettenham, Spixworth (TG/237167) (M)
218 Hiss Farm, Lakenheath (TL/725861) (M)
‡220 Thetford, Kilverstone (TL/888850) (M)
238 Rushford (TL/940830) (p. 311)
‖247 Santon Warren (TL/841876) (p. 309)
‖279 Banham limekiln (TM/065878?) (p. 313)
†287 Deighton Hills, Attlebridge (TG/149156) (p. 314)
†296 Cley, by A149 (TG/054440) (M, p. 314)
*301 Weybourne Mill (TG/112431) (p. 324)
*302 Heydon, Corpusty (TG/120289) (M, p. 324)
†329 Beeston Hill, S. side (TG/169432) (p. 324)
†330 H.W.M. beneath ditto (TG/178433) (p. 330)
*331 Between E. and W. Runton (TG/194429) (p. 325)

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THE PALAEOGENE AND EARLY PLEISTOCENE OF NORFOLK

By B. M. Funnell

The Caenozoic deposits of Norfolk fall naturally into three groups, the Palaeocene and Eocene, the early Pleistocene, and the late Pleistocene and Holocene. The Palaeocene and Eocene deposits occur at depth under eastern Norfolk, and are principally marine in origin. The early Pleistocene deposits are also marine in origin, and characteristically consist of " crag " or shelly sand. The later Pleistocene and Holocene are represented by glacial, interglacial and post-glacial deposits, which are largely terrestrial in origin. Only the first two groups are considered in this section.

THE PALAEOGENE

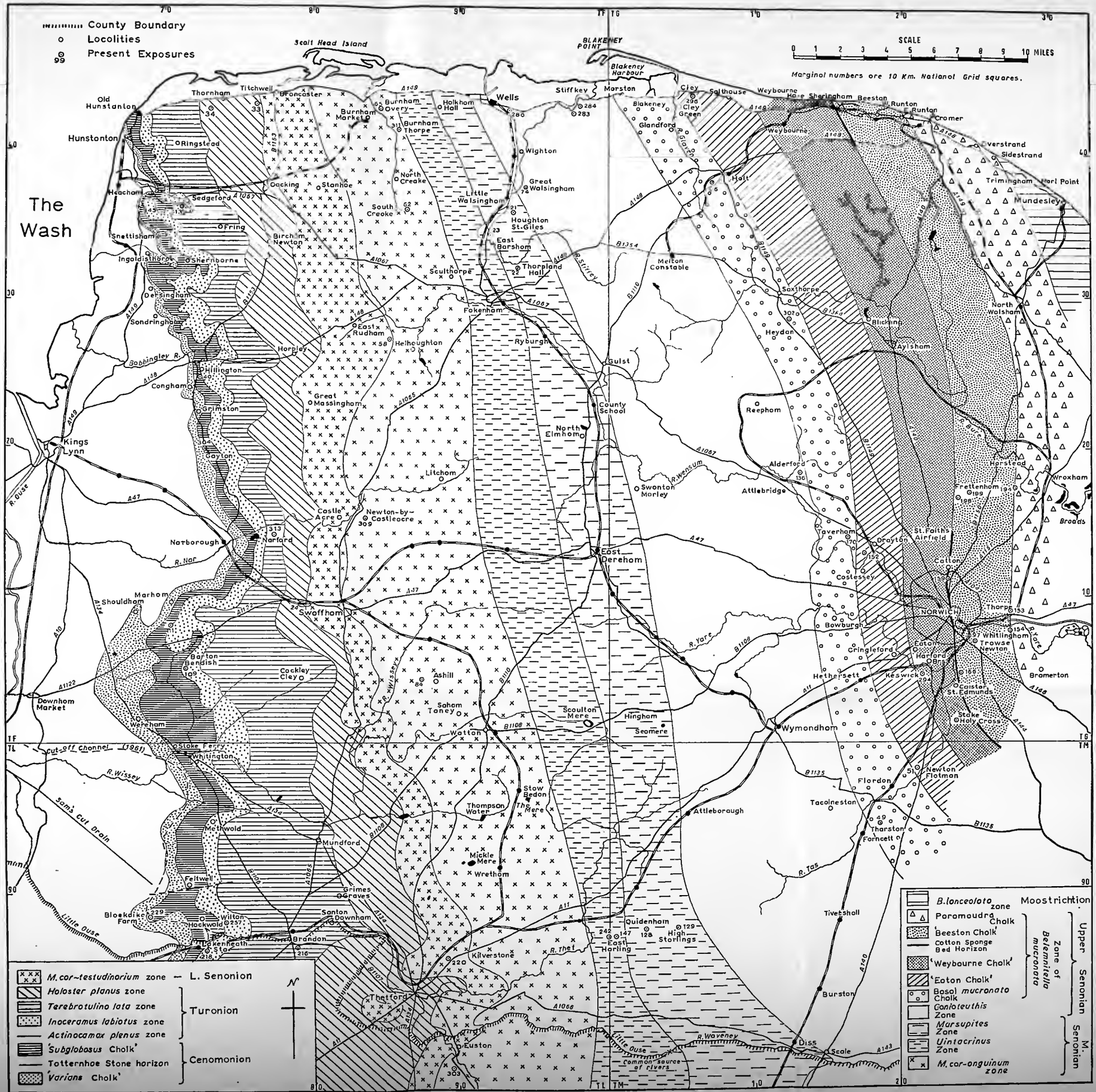
History of investigation

Palaeogene (=Lower Tertiary) is a convenient term used by Continental geologists to refer jointly to the Palaeocene, Eocene and Oligocene. Only Palaeocene and Eocene deposits are present in Norfolk. Attention was first drawn to these by Prestwich (1860), when he described the samples obtained from a deep boring made at Great Yarmouth. No further information was obtained during the course of the official geological survey (Woodward 1882*a*, p. 31; Whitaker & Dalton 1887, p. 3; Blake1890, pp. 7–11, 81–82), but Boswell (1916, pp. 540–44, Pls. L–LI; 1920, pp. 38–39, 46, 55, 57–58, Pl. I) later gave a fuller account of their distribution which incorporated information obtained from three further borings at Southwood, Cantley and Wheatacre.

Subsequent publications have added little to this account. Whitaker (1921, pp. 69, 119) classified the deposits at Southwood and Cantley as " Glacial Drift," but this interpretation is probably incorrect. Woodland (1942, p. 36) recorded Eocene deposits beneath Crag at Burgh St. Peter, and part of south Norfolk is covered by his general description of the Eocene (including Palaeocene) deposits of Suffolk and Essex (1946, pp. 21—27, Figs. 7, 9, 10). The occurrence of London Clay at Great Yarmouth was referred to by Davis & Elliott (1958, pp. 256–57) and Downing (1959, Fig. 1) has published a revision of the western boundary of the Eocene in Norfolk, presumably based on unpublished Geological Survey records.

Summary of present knowledge

Palaeocene deposits are known only from beneath Great Yarmouth, where they rest on Chalk at —506 feet O.D. They are 46 feet thick, and consist of green sands at the base, passing up into brown and grey clays with lignite. (The figures given by Chatwin (1961, p. 39) are inaccurate.) They have usually all been referred to the *Reading Beds*, but the green sands at the base contain green-coated flints, and in Suffolk such sediments have been referred to the *Thanet Sands* (Boswell 1916, p. 552). No fossils have been recorded, and the attribution to formations known from the London Basin is based simply on similarities in lithology and stratigraphical position. The green, probably glauconitic, sands below, indicate marine conditions, whilst the lignite-containing clays above suggest a possibly fluviatile environment. If the suggested correlation is correct, these would correspond to the Upper Palaeocene (Thanetian) marine transgression and subsequent (Sparnacian) regression in the North Sea Basin.


County Boundary
Localities
Present Exposures
99
Scalt Head Island
BLAKENEY POINT
Blakeney Harbour
SCALE
0 1 2 3 4 5 6 7 8 9 10 MILES
Marginal numbers are 10 Km. National Grid squares.
The Wash
Old Hunstanton
Hunstanton
Thornham
Titchwell
Brancaster
Burnham Market
Burnham Overy
Burnham Thorpe
Holkham Hall
Wells
Stiffkey
Morston
Cley
Salthouse
Weybourne
Sheringham
Beeston
Runton
Cromer
Blakeney
Glandford
Weybourne
Wighton
Great Walsingham
Little Walsingham
Holt
Overstrand
Sidestrand
Trimingham
Mundesley
Mark Point
Ringstead
Docking
Stanhoe
North Creake
South Creake
Houghton St. Giles
East Barsham
Thorpland Hall
Sedgeford
Heacham
Snettisham
Ingoldisthorpe
Shernborne
Dersingham
Sandringham
Birchm Newton
Fring
Sculthorpe
Fakenham
Melton Constable
Saxthorpe
North Walsham
Blickling
Aylsham
Heydon
East Rudham
Helhoughton
Horpley
Ryburgh
Gulst
Bobbingley R.
Hillington
Congham
Grimston
Great Massingham
County School
North Elmham
Reepham
Kings Lynn
Gayton
Litcham
Alderford
Swanton Morley
R. Wensum
Attlebridge
Frettenham
Horstead
Wroxham
Broads
R. Ouse
Castle Acre
Newton-by-Castleacre
Narborough
Narford
R. Nar
East Dereham
Taverham
Drayton
St. Faiths Airfield
Cawton
Costessey
Marham
Shouldham
Swaffham
NORWICH
Thorpe
Bowburgh
Whitlingham
Trowse Newton
Eaton
Harford Bdge
Cringleford
Barton Bendish
Cockley Cley
Ashill
R. Wissey
R. Yare
Hethersett
Keswick
Caistor St. Edmunds
Bramerton
Downham Market
Wereham
Saham Toney
Scoulton Mere
Hingham
Seamere
Wymondham
Stoke Holy Cross
Stoke Ferry
Whittington
Watton
Cut-off Channel (1961)
R. Wissey
Stow Bedon
The Mere
Thompson Water
Newton Flotman
Flordon
Tacolneston
Attleborough
Tharston
Forncett
Sam's Cut Drain
Methwold
Mundford
Mickle Mere
Wretham
Feltwell
Grimes Graves
Hockwold
Wilton
Bloxham Farm
Santon Downham
Brandon
Lakenheath
Stoke
Little Ouse
R. Thet
Kilverstone
Thetford
Euston
Quidenham
East Harling
High Storlings
Tivetshall
Burston
R. Waveney
Diss
Scole
Little Ouse
Common source of rivers
M.cor-testudinarium zone — L. Senonian
Holaster planus zone
Terebrotulina lata zone
Inoceramus labiotus zone
Actinocamax plenus zone
Turonian
'Subglobosus Cholk'
Totternhoe Stone horizon
'Varians Cholk'
Cenomonian
B. lanceolata zone
Poramoudra Cholk
'Beeston Cholk'
Cotton Sponge Bed Horizon
'Weybourne Cholk'
'Eaton Cholk'
Basal mucronata Cholk
Gonioteuthis Zone
Marsupites Zone
Uintacrinus Zone
M. cor-anguinum zone
Zone of Belemnitella mucronata
Upper Senonian
M. Senonian
Moostrichtion

Overlying the Reading Beds at Great Yarmouth are 310 feet of Eocene *London Clay*. At this point its base lies at —460 feet O.D., but the formation thins westward, and comes to rest directly on the Chalk. Beneath the Crag at Ludham it is 38 feet thick, and its base rests on Chalk at —208 feet O.D. (cf. Forbes 1952, p. 362). At its western feather-edge, at a maximum of approximately 10 miles from the present coast, its base has risen to roughly —100 feet O.D. (Fig. 10). It consists of brown, brown-grey and grey clays, sometimes micaceous and sandy, with pyrites and courses of septaria, exactly like the same formation in the London Basin. No fossils are known, but there is little doubt that, like the London Clay further south, it represents a Lower Eocene (Ypresian) marine transgression in the North Sea Basin.

The Palaeogene—Pleistocene interval

No Neogene (=Upper Tertiary, i.e. Miocene and Pliocene) deposits are known from Norfolk, and this was probably a period of extensive erosion, even greater than that which intervened between the Cretaceous and the Palaeocene (Boswell 1916, p. 544; Baker 1918, p. 415).

THE EARLY PLEISTOCENE

History of investigation

In accordance with the recommendation of the XVIIIth International Congress (1948), the Crag of Norfolk is now referred to the Pleistocene (Boswell 1952; van Voorthuysen 1957). Originally "crag" was a Suffolk dialect word designating shelly sands (Arkell & Tomkieff 1953, p. 31), but its geological application has been extended to the formations containing such deposits. The marine shells contained in the Crags attracted attention as early as the eighteenth century, and, in the mid-nineteenth century, their systematic study gave rise to some of the earliest monographs of the Paleontographical Society. This early period of intensive investigation (see bibliographies of Woodward 1882*a*, pp. 171–204; Reid 1890, pp. 290–312) culminated in the official geological survey of the latter half of the nineteenth century (Woodward 1882*a*, 1884; Reid 1882, 1890; Whitaker & Dalton 1887; Blake 1888, 1890).

Subsequently the gifted amateur, F. W. Harmer, returned to the study of the Crags, and, in 1899, proposed a stratigraphical classification which has not been substantially modified since. His later work, completed by the posthumous publication of the final part of his revision of the Crag mollusca in 1924, was a remarkable vindication of the views he had earlier expressed. In 1896 (1896*b*, p. 10) Harmer had said: "The information which has been gained during so many years by so many able geologists concerning the Crag beds in East Anglia, is not, I think, likely in the future to be largely added to." Although this statement is somewhat belied by his own later work, events since his death have largely confirmed the prediction.

Since 1925 little has been added to our knowledge of the Crag of Norfolk. However, in 1957, research was started on the foraminifera of the Crag, and more recently Dr. R. G. West has commenced an investigation of the pollen. Some results are already available from these investigations, and, as far as possible, these have been incorporated in the ensuing account.

The Base of the Crag

The contour map of the base of the Crag (Fig. 10) has been compiled exclusively from published sources. The outcrop line has been taken from

the ten miles to one inch " Geological Map of England & Wales " (1957). The somewhat generalised contours to the west are taken from Boswell (1920, Pl. I); the contours for north-east Norfolk are after Downing (1959, Fig. 1), and those for south-east Norfolk and Suffolk are from Woodland (1946, Fig. 7).

[It has been found necessary to modify Downing's contours around Loddon in order to effect a junction with Woodland's further south; the course of the western boundary of the Eocene has also been modified thereabouts, where it seems to have been extended by Downing to include the questionable occurrence of London Clay at Ellingham (cf. Whitaker 1921, p. 84). Small portions of the +50 ft. contour, around Postwick, and of the —50 ft. contour, inland from Mundesley, have been omitted. It is unfortunate that the basic data for Downing's maps has not been published, although it is presumably contained in the unpublished hydrogeological survey of Norfolk completed by him in 1955 (Buchan 1956, p. 65). Woodland's boundary for the Crag is followed south of Diss, but elsewhere this is taken from the 1957 map. An alternative interpretation of the borehole data is possible in the vicinity of Spexhall, indicating that the closed basin shown on the map may open northwards into the depression which runs under Ellingham (O. T. Jones, personal communication).]

Three features of the base of the Crag particularly claim attention:

1. A series of S.S.W.–N.N.E. trending depressions, extending to depths greater than —150 ft. O.D.

2. An apparently uniform plain, inclining gently eastwards from about +100 ft. O.D. in the west, to depths of —50 ft. O.D. in north-east Norfolk, and O.D. in south Norfolk.

3. A N.W.–S.E. trending bevel in north Norfolk.

There is so far no satisfactory explanation of the origin of the S.S.W.–N.N.E. trending depressions. Woodland (1946, pp. 17–19, 31–33) referred to them as synclines, and considered them to be " the result of actual folding, which took place under conditions of continual subsidence when the Norwich Crag was being deposited " (p. 32). It is clear from his account (pp. 31, 45–47) that he regarded the low yields of water obtained from the Chalk beneath these depressions as the result of the tectonic closure of fissures. However, it is also possible that the closure is the consequence of depth of burial, and the relative opening on the intervening elevations the result of ground-water solution rather than tectonism. There is therefore a possibility that these depressions had a topographic origin, at least in part.

The question cannot be resolved until more is known of the succession of deposits in the depressions. At Ludham it has been found that the LIII horizon, which lies between —82 ft. and —95 ft. O.D. in the Ludham Pilot boring, was probably represented at about —45 ft. O.D. in a boring little more than a mile to the south. This implies either an original difference in level, or subsequent folding. As the foraminifera in the southern boring indicate, if anything, a rather greater depth of water at the time of deposition, there is a slight preference for the tectonic explanation, but much more evidence is required before any definite conclusions can be made.

The progressive deepening of the depressions towards the North Sea may be the consequence of subsequent downwarping in that direction.

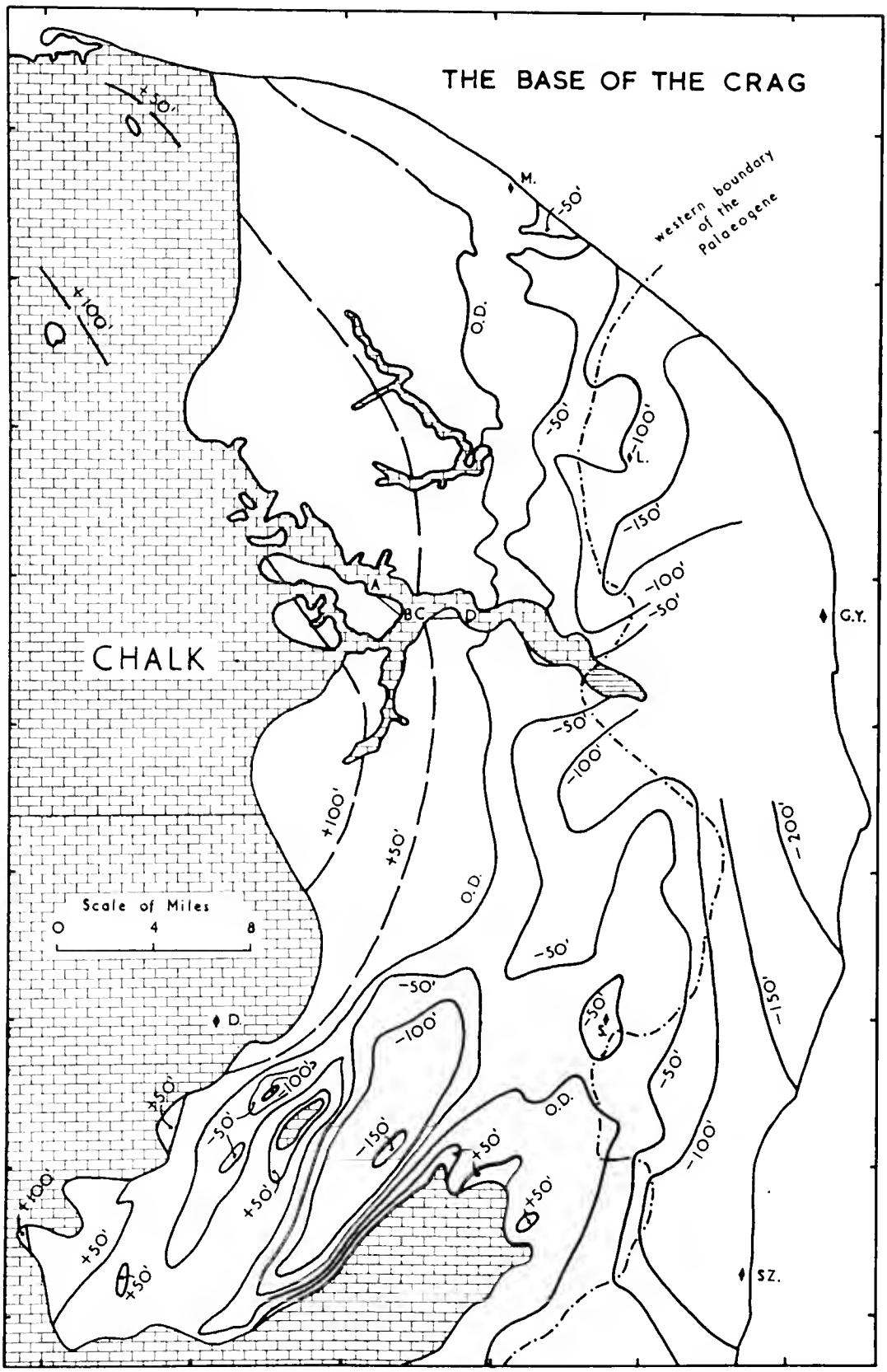


FIG. 10. D.—Diss, G.Y.—Great Yarmouth, L.—Ludham, M.—Mundesley, S.—Spexhall, Sz.—Sizewell

The inclined plain to the west of the depressions probably represents a peneplain, developed in Chalk during the Palaeogene—Pleistocene interval, and inundated by the Norwich Crag sea. Its inclination may be partly the result of downwarping towards the centre of the North Sea Basin subsequent to its inundation.

The N.W.–S.E. trending bevel, underlying the Weybourne Crag in north Norfolk, appears to be distinct from the surface overlain by the Norwich Crag. Burnaby (1950, pp. 239–40) has given reasons for believing that the Weybourne Crag inundation only slightly modified a pre-existing Chalk land surface of low relief. The present eastward inclination of the presumed pre-Weybournian water-table (Burnaby 1950, pp. 228–31) may be evidence of subsequent tilting towards the North Sea Basin. If this is so, the trend of the north Norfolk coast in Weybourne Crag times must have been very much the same as it is at present.

The Succession at Ludham

The classic investigations of the Crag were concerned almost exclusively with its surface outcrop, and the deposits occurring at depth under eastern Norfolk have remained almost completely unknown. Samples from borings have rarely been preserved, and when they have the mollusca have almost invariably been too few or too fragmentary for satisfactory interpretation. Prestwich, for instance (1860, p. 451) regarded the 120 feet of shelly sands and clays underlying Great Yarmouth as "Recent Estuarine," whereas only Harmer (1896*a*, p. 750) attributed them, almost certainly correctly, to the Crag.

At the end of 1950, the Ludham Pilot boring was put down for exploratory water supply purposes at a site, now the Smallburgh & Rural District Council's Waterworks, between Ludham and Catfield (N.G. ref.: TG 385199). Samples from this boring were preserved, and in 1957 an examination of the foraminifera was commenced. Subsequently, in 1959, the Royal Society of London financed a boring at the same site to enable a comprehensive investigation of the pollen, foraminifera and mollusca of this important sequence to be undertaken. Work on the 1959 samples is still in progress, but investigation of the samples from the Ludham Pilot boring is essentially complete, and this, unless otherwise specified, forms the basis of the following account.

Lithology

Between —32·5 ft. and —165·5 ft. O.D. the Ludham Pilot boring passed through 133 feet of more or less fossiliferous Crag deposits, which here rest on London Clay. The sediments are grey in colour, and consist of shelly sands, and silty and micaceous clays, which sometimes also contain shells. The sequence of deposits is as follows:

L VII	Grey clay	—32·5 ft. to	—38·5 ft. O.D.
L VI	Grey sand with a few shells	to	—43 ft. O.D.
	Grey sand with shells	,,	—54·5 ft. ,,
L V	Fine grey sand with a few shells, and thin seams of grey clay	to	—58·5 ft. O.D.
	Fine grey sand	,,	—64 ft. ,,
	Grey sand and grey clay	,,	—72·5 ft. ,,

L IV	Grey silty sand	to —77·5 ft. O.D.
	Grey silty clay	,, —82·5 ft. ,,
L III	Grey silty sand with shells	to —86·5 ft. O.D.
	Grey silty clay with shells, and thin seams of sand	,, —91·5 ft. ,,
L II	Grey clay, and sand with shells	to —114·5 ft. O.D.
	Grey sand with shells	,, —119·5 ft. ,,
L I*	Grey sand with shells, and thin seams of grey clay	to —124·5 ft. O.D.
	Grey clay and sand	,, —128 ft. ,,
	Grey sand with shells, and thin seams of grey clay	151·5 ft. ,,
	Grey sand with shells, and small pebbles	,, —152·5 ft. ,,
	Grey clay, sand and shells	,, —155·5 ft. ,,
	Shells and pebbles	,, —156·5 ft. ,,
	Grey sand with comminuted shells	,, —160·5 ft. ,,
	Grey sand with shells	,, —165·5 ft. ,,

(*Indices of corresponding palaeontological horizons, tentatively recognised on the basis of the assemblages of foraminifera; the approximate vertical limits of these horizons are given by the horizontal lines).

The sediments between —91·5 ft. and —165·5 ft. O.D., subsequently referred to as the Ludham Crag, consist of coarse, shelly sands, with thin gravelly layers, composed of flint and phosphate (coprolitic) pebbles, in the lower portion, and with thin seams of clay in the upper portion. In these respects the sediments closely resemble the Red and *Scrobicularia* Crags of Suffolk. The level of the base of the Crag in the boring is exceptional; in the Ludham district generally it lies at about —100 ft. O.D. (Downing 1959, Fig. 1). There is no marked basement bed of large flints as there is where the Norwich and Weybourne Crags rest on Chalk.

The sediments above —91·5 ft. O.D. contain much more clay than the Crag at outcrop in Norfolk (cf. Prestwich 1860, p. 451). In the Ludham Pilot boring it is not possible to recognise either of the two clay beds described by Downing (1959, p. 85, Fig. 3). Extrapolation of the structure contours on the base of Downing's northern clay bed to the site of the boring indicates that it would be expected at about —55 ft. O.D., but the two principal clay beds in the boring extend from —32·5 ft. to —38·5 ft. O.D. (horizon L VII), and from —77·5 ft. to —82·5 ft. O.D. (horizon L IV), the intervening sediments being mainly sandy.

The Foraminifera

The small size, numerical abundance, and wide distribution of the foraminifera of the Crags, makes them particularly suitable for quantitative studies, and for the study of samples from borings. Their intermediate diameter is generally less than a millimetre (1,000 μ), and a thousand, or more, can usually be obtained from 50 grammes of original sediment. They occur in almost all Crag sediments, including those in which mollusca are rare or absent.

The quantitative distribution of the Ludham Pilot foraminifera in the 500–250μ size range is given in Fig. 11 and Table 4. Fig. 11 shows

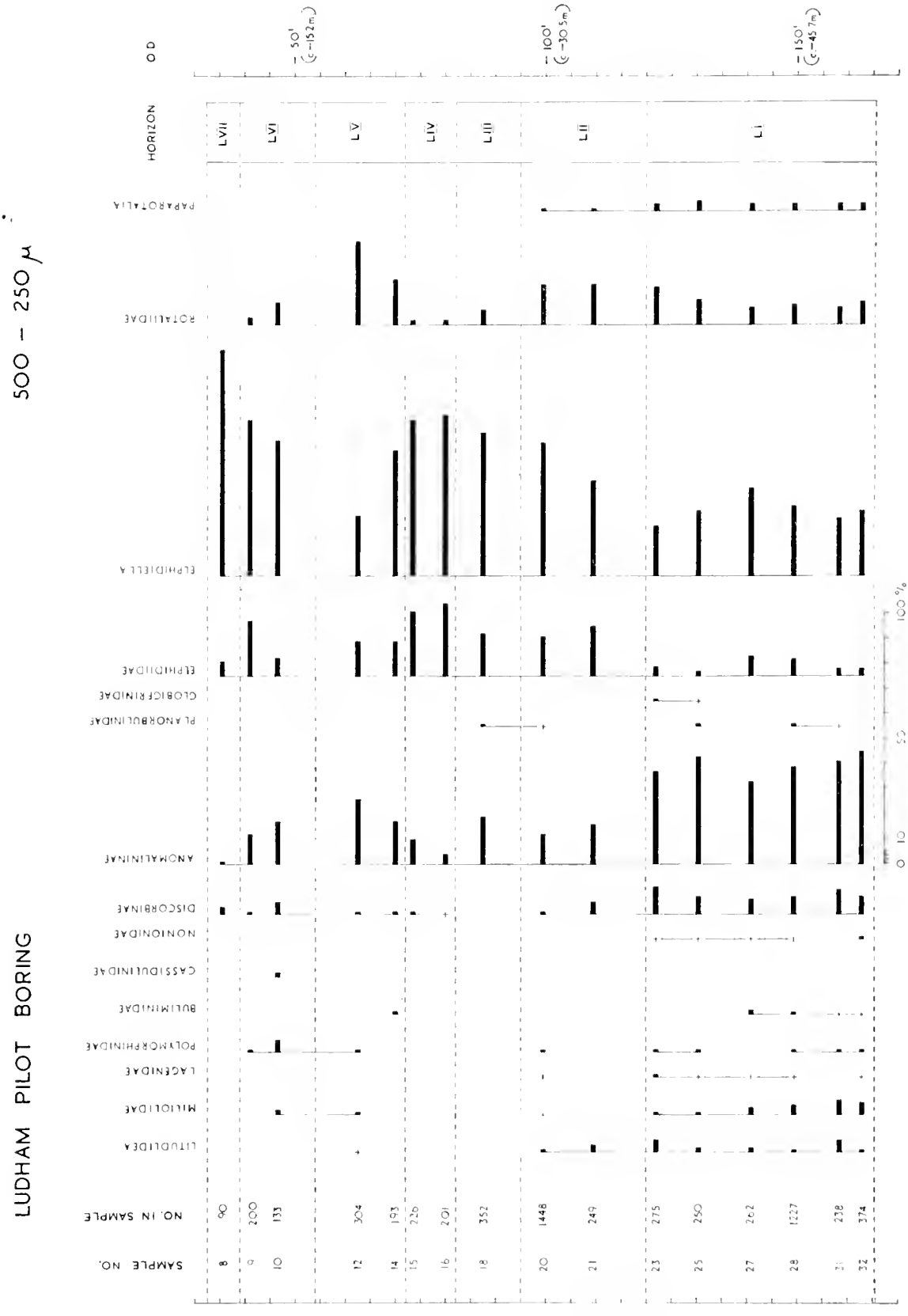


FIG. 11. General composition of foraminiferal assemblages

TABLE 4

LUDHAM PILOT BORING 500—250μ

Sample No.	8	9	10	12	14	15	16	18	20	21	23	25	27	28	31	32
No. in Sample	90	200	133	304	193	226	201	352	1448	249	275	250	262	1227	238	374
Buccella frigida	1		2	1												
B. inusitata	2	1	4		1	1	0		0	2	5	4	3	3	5	4
Bulimina aculeata													1	0		0
Bulimina														0	0	
Cassidulina laevigata var. carinata			2													
Cibicides lobatula	1	12	15	26	17	10	4	19	7	9	12	21	18	25	27	23
C. lobatula var. grossa		1	2						2	4	12	11	5	5	5	5
C. pseudoungeriana									1	2	10	8	7	5	6	12
C. subhaidingerii									1	2	4	2	3	4	3	5
Dorothia gibbosa var. alleni										0	0				0	
Elphidiella hannai	90	62	54	24	50	62	64	57	53	38	20	26	35	28	23	26
Elphidium cf. bartletti		2														
E. clavatum		1	3	1	2				0	4	1		1	1	1	
E. crispum						0			0	1	2		2	1		1
E. excavatum				0		0	1	1	3	3						
E. frigidum	3	7	2	0	2	4	3	4	3	1	0	2	2	1	0	1
E. haagensis						0	1				0			0		1
E. macellum var. granulosum				5	2	3	7	2	1	3			2	3	0	0
E. orbiculare	2	12	2													
E. pseudolessonii				2	5	11	10	7	8	7				0		
F. selsevensis		1		5	4	7	6	2	1			0	1	1	1	0
Elphidium			1	2				1	0	1	0	0		0	0	
Eponides repandus									0	2	5	2	2	2	1	1
Faujasina subrotunda						0										
Gaudryina (Siphogaudryina) tumidula										1	1				1	
Globigerina bulloides											1	0				
Globulina aff. myristiformis									0		0	0		1	0	0
G. gibba																0
G. gibba var. longitudinalis				0												
G. inaequalis									0					0	0	
G. minuta														0		
G. rotundata											0					
Globulina			2													
Guttulina lactea		1	3	1												
G. problema									0							
Lenticulina rotulata									0		1	0	0	0		
Lenticulina																0
Neoconorbina millettii											0				0	
Nonion boueanum																0
N. crassesuturatus											0			0		
N. lamarcki													0			
Nonion																0
Oolina acuticosta													0			
O. williamsoni					1											
Oolina														0		
Pararotalia serrata									1	1	3	4	3	3	3	3
Planorbulina mediterranensis								1	0			2		1	0	
Pseudopolymorphina															0	
Pullenia sphaeroides												0		0		
Quinqueloculina dunkerquiana														0		
Q. seminulum			2	1					0		0	1	3	1	3	
Q. aff. seminulum											0					3
Quinqueloculina											0			2	3	2
Rosalina mediterranensis															0	
R. parisiensis				0	1				0		1	1	1	2	3	2
" Rotalia " beccarii		3	9	33	18	2	2	5	15	16	15	10	7	8	7	9
" R." perlucida								1	0							
Sigmomorphina williamsoni											0	0				
Textularia sagittula				0					0	0	4	2	2	0	3	0
T. suttonensis									0							
T. cf. truncata											1	0		0	0	
Textularia									0							
Textulariella trochoides									0	2			0	0		0

the distribution of families and genera, Table 4 the distribution of species. (All results are given to the nearest per cent: + on Fig. 11, and 0 on Table 4, indicate less than 0·5 per cent.) Seven palaeontological horizons have been tentatively recognised in the Ludham Pilot succession on the basis of the foraminiferal assemblages. The approximate vertical limits of these horizons are indicated on Fig. 11.

The lowest horizon (L I) contains an abundant fauna, which exhibits high percentages of the Anomalininae and *Elphidiella*, substantial amounts of the Lituolidea, Miliolidae, Discorbinae, Elphidiidae, Rotaliidae and *Pararotalia*, and numerous examples of the Lagenidae, Polymorphinidae, Buliminidae, Nonionidae and Planorbulinidae. The Globigerinidae are also represented. In all these respects the assemblages resemble those obtainable from the Red Crag of Suffolk; they differ from all known Icenian (Chillesford, Norwich and Weybourne Crag) assemblages. They particularly resemble Newbournian-Butleyan Red Crag assemblages, but there is no evidence of the apparently cold episode, which is indicated by foraminifera from the Neutral Farm pit at Butley. The specific composition of the assemblages also resembles the Newbournian-Butleyan Red Crag. *Pararotalia serrata* and the Lituolid species referred to *Dorothia* and *Gaudryina* have West Indian, or at least Mediterranean affinities, and represent a Pliocene-relict fauna, left over from the period of the Coralline Crag. Other species which are confined to the two lowermost horizons at Ludham, also belong to the same category. The persistence of these forms indicates a comparatively warm climate, but the strong representation of *Elphidiella hannai* is evidence of the deterioration which had set in at the beginning of the Pleistocene. The fauna as a whole indicates a shallow, sub-littoral environment. The abundance of the Anomalininae, amongst other things, suggests a depth of about 50 feet (15 m.).

Horizon L II contains a similar fauna to L I, but the reduction of the Anomalininae, Lituolidea, Discorbinae and *Pararotalia*, and the virtual suppression of accessory groups, indicates significant differences. The assemblages of this horizon resemble those found in the *Scrobicularia* Crag of Suffolk. The *Scrobicularia* Crag, which was referred by Harmer (1900, p. 721) to the latest Butleyan, undoubtedly includes material derived from the nearby occurrences of Coralline Crag. There are some erratic fluctuations in the foraminiferal assemblages, caused by the incorporation of Coralline Crag foraminifera, but these do not entirely obscure an underlying similarity to the L II assemblages. The specific composition of the L II and *Scrobicularia* Crag assemblages is also comparable. The continued presence of small percentages of the Lituolidea and *Pararotalia* suggest a continuing warm climate, but the increasing importance of *Elphidiella*, and the Elphidiidae generally, is indicative of deteriorating conditions. The rise of the Elphidiidae and Rotaliidae, at the expense of the Anomalininae and certain accessory groups, would be consistent with shallowing water, now probably less than 50 feet deep. The Anomalininae and Discorbinae commonly exist attached to algae, whereas the Elphidiidae and Rotaliidae are more characteristic of estuarine, tidal-flat, and beach environments.

L I and L II differ from all the succeeding horizons in the Ludham Pilot boring in containing Pliocene-relict forms, particularly *Pararotalia* and Lituolid genera other than *Textularia*. They also differ in this respect from all known Icenian assemblages. For these reasons it would be both inappropriate and misleading to refer to them as Norwich Crag. The term *Ludham Crag* is therefore introduced for these deposits, pending

a possible definitive correlation with the Butleyan Crags of Suffolk. It should be noticed that, if the Ludham Crag is equivalent to the Butleyan, it is the first known occurrence north of Aldeburgh, a distance of approximately 40 miles, and it poses a question concerning the age of at least the lower levels of the Crag occupying the S.S.W.–N.N.E. trending depressions under east Norfolk and Suffolk. However, the Ludham Crag occupies a hollow, below the general level of the base of the Crag in the Ludham district, and may be an isolated occurrence. The thickness of the deposit is approximately equivalent to the amount of shallowing indicated by the foraminifera it contains, and this may imply a static sea-level during its accumulation.

Horizon L III contains the first assemblage in the boring which is comparable with any Icenian assemblage. The abundance of *Elphidiella*, and the absence of almost all other groups, except for the Anomalininae (*Cibicides lobatula* only), Elphidiidae and Rotaliidae, is characteristic of the impoverished Icenian assemblages. Pliocene-relict forms are no longer found. However, the presence of "*Rotalia*" *perlucida*, and, in the 250–125μ size range, *Textularia suttonensis* and *Nonionella turgida*, links this horizon with L II. Similar assemblages are found in the Crag of Thorpe (Aldringham) and Sizewell (Rifle Range) in Suffolk. The first of these occurrences Harmer (1900, p. 708) classified in the Lower Division of the Norwich Crag (zone of *Spisula* [*Mactra*] *subtruncata*). Horizon L III also seems to be represented by a sample obtained by Dr. W. A. Macfadyen at a depth of —45 ft. O.D., from a boring made south-east of Ludham (N.G. Ref.: TG 390182), by the Royal Engineers in 1941. His slide No. 292 contains the following species:

Buccella inusitata (1%), *Bulimina* cf. *aculeata* (3%), *Cassidulina laevigata* (3%), *Cibicides lobatula* (11%), *C. subhaidingerii* (1%), *Elphidiella hannai* (26%), *Elphidium haagensis* (1%), *E. macellum* var. *granulosum* (4%), *E. pseudolessonii* (5%), *E. selseyensis* (26%), *E.* sp. (1%), *Globulina gibba* (2%), *G.* aff. *myristiformis* (3%), *Guttulina lactea* (1%), *G. problema* (1%), *Rosalina globularis* (1%), *R. williamsoni* (2%), "*Rotalia*" *beccarii* (6%), *Textularia suttonensis* (3%). Total: 116 specimens.

Specific determinations are by the present author, and the percentages are based on the specimens in the 500–250μ size range only. The numerical representation of the species on the slide is probably approximately quantitative, with the common species rather under-, and the rarer species rather over-represented. The combination of a lack of Pliocene-relict forms and the presence of *Textularia suttonensis* ("*Rotalia*" *perlucida* is also present in the 250–125μ size range), clearly relates this to the L III horizon, but in this boring it occurs 40 to 50 feet higher relative to O.D., whereas the presence of *Bulimina* cf. *aculeata* and *Cassidulina laevigata* may imply deposition in originally rather deeper water (see p. 342).

In spite of the marked impoverishment of the fauna, those species which remain at the L III horizon are in substantially the same proportions as before. This, together with the appreciable percentage of "*Rotalia*" *beccarii*, and the presence of *Planorbulina mediterranensis*, indicates that the climate was still equivalent to that which characterised subsequent interglacials. Possibly the impoverishment is largely the result of local ecological changes. The high percentages of *Elphidiella*, and the Elphidiidae, and the presence of the two species *Elphidium excavatum* and "*Rotalia*" *perlucida*, which are also present in L II, indicate a very shallow water, estuarine or bay-head environment. On the other hand

the impoverishment may be related to two other phenomena which characterise the transition from the Butleyan to the Icenian Crags. Not only are a large number of southern forms not found above this boundary, but the tests of the foraminifera, and the shells of the mollusca, are generally thinner above it than they are below. It is possible that all these phenomena are a consequence of the closure of the southern, or Channel, entrance to the North Sea Basin from the Atlantic.

The L IV horizon represents the culmination of the trends shown by L III. No surface outcrop of Crag yields exactly comparable assemblages, although the Crag of Easton Bavents in Suffolk, which was referred by Harmer (1900, p. 708) to the Upper Division of the Norwich Crag (zone of *Astarte semisulcata* [*borealis*]), presents some analogies. The further reduction of the Anomalininae and Rotaliidae, with a concomitant increase in cold-tolerant *Elphidiella* and Elphidiidae, brings the assemblages very close to glacial in their indications. Only the presence of 2% of " *Rotalia* " *beccarii*, which appears to be restricted to the Post-Glacial in the North Sea Basin, suggests that the climate should not be defined as glacial, although it is also true that the assemblages lack definite cold-water indicators such as *Elphidium orbiculare*. It is possible that there is a disconformity above this horizon in the Ludham Pilot sequence. Foraminifera from this level are brown in colour, suggesting that, at some time subsequent to deposition, they have been in the zone of oxidation, whereas foraminifera from the overlying horizon (e.g. sample 12) are grey, suggesting that they have been continuously in the zone of reducing conditions since deposition. It seems reasonable to infer that the L IV horizon must have been brought into the zone of oxidation before the overlying sediments were deposited, and this indicates a probable disconformity. Such a disconformity might be the consequence of a (? glacio-eustatic) lowering of sea-level at the end of the L IV horizon, and possibly a period of more severe cold is therefore unrepresented. The foraminifera of the L IV horizon indicate much the same shallow-water conditions as those of L III.

There is a definite recovery of the foraminiferal assemblages at the L V horizon. A decrease in the cold-tolerant *Elphidiella* and the Elphidiidae generally, is accompanied by a reciprocal increase in the Anomalininae and Rotaliidae, and some accessory groups are present again. There is, however, nothing like a return to the assemblages of the Ludham Crag (L I and L II). The specific composition of the assemblages shows considerable similarities with those of the BI horizon at Bramerton (see Table 5), and the faunas of both horizons suggest a full interglacial climate. *Textularia*, which is apparently the only genus of the Lituolidea present in the Icenian, is represented by *T. sagittula*—the most persistent species of the genus, but nevertheless apparently confined to periods of interglacial-type climate in the North Sea Basin. Apart from the climatic implications of the increase in the Anomalininae and Rotaliidae, they may also indicate a more open-sea, sub-littoral environment, which may be correlated with the transgression of the sea to the vicinity of Norwich (cf. p. 354).

The trends which produced the L V horizon are soon reversed, and *Elphidiella* and the Elphidiidae again increase at the expense of the Anomalininae and Rotaliidae in L VI. Two new cold-tolerant species occur amongst the Elphidiidae, namely *Elphidium orbiculare* and *E.* cf. *bartletti*, and there are some exceptionally large specimens of *Elphidiella*, *E.* aff. *sibirica*, in the 1,000–500μ size range. *Elphidium orbiculare* has been found at only one level earlier than this, and that is in the Butleyan

Red Crag of the Neutral Farm Pit (see p. 348); at the present day it only ranges as far south as the Orkneys in appreciable numbers, whilst *E.* cf. *bartletti* can be found in the fjords of Spitsbergen. The specimens referred to *Elphidiella* aff. *sibirica* may simply be overgrown specimens of *E. hannai*, which have postponed reproduction, while continuing to grow, under unfavourable conditions (see Bradshaw 1957, p. 1145). In the entry of *Elphidium orbiculare*, and other respects, L VI resembles the B II horizon at Bramerton. Increasing cold is clearly indicated, and the reduction of "*Rotalia*" *beccarii* suggests that the cold was verging on, but not quite, glacial in intensity. The large, carinated specimens of *Cassidulina laevigata* var. *carinata* in the L VI horizon are intermediate in character between the two types described by Feyling-Hanssen (1954, p. 133) from the Late-, and Post-Glacial respectively, of the Oslo region. However, the carination, like the thickening of the test of *Cibicides lobatula* var. *grossa*, may be simply an adaptation to existence in coarser sediments, and the indications are that the L VI horizon accumulated under open-sea, possibly stormier conditions, than L V.

The final horizon in the Ludham Pilot boring is L VII. This contains a very impoverished assemblage dominated by *Elphidiella hannai*. All the remaining species are also cold-tolerant, and are found commonly in Arctic seas at the present day. "*Rotalia*" *beccarii* is absent. The fauna therefore resembles the B III horizon of Bramerton; it also resembles assemblages obtained from the Crag of both Sidestrand (see Fig. 13 and Table 5) and Weybourne (Macfadyen 1933, pp. 486–87). The Weybourne Crag was classified as the uppermost part of the Icenian (zone of *Macoma* [*Tellina*] *balthica*) by Harmer (1902, pp. 430–31), but its status at present is a little uncertain (see p. 357). The exclusively cold-tolerant character of the L VII assemblage indicates very cold conditions, and the absence of "*Rotalia*" *beccarii* suggests that the climate was truly glacial. Shallow water is also indicated, although it is not possible to specify the nature of the environment more precisely on account of the extreme impoverishment of the fauna.

Mollusca

The proportion of identifiable mollusca obtained from the Ludham Pilot boring was rather low, and a definitive account must await the outcome of an examination of those obtained from the Royal Society boring in 1959. The Ludham Crag yielded plentiful remains of *Chlamys* (*Aequipecten*) *opercularis*, *Mytilus edulis*, *Calyptraea chinensis*, and *Nucella lapillus*, but very little of immediate significance for its stratigraphic or climatic interpretation.

Echinodermata

The Ludham Crag contains many examples of the small echinoid *Echinocyamus pusillus*.

Ostracoda

These occur almost throughout, but are much less frequent than the Foraminifera. "*Cythere*" *hoptonensis*, an interesting, coarsely ornamented, species, which was recorded first from the Corton Beds, and subsequently from off Portugal, is common in the Ludham Crag.

Bryozoa

The Ludham Crag contains a number of species recorded by Lagaaij (1952) from Pliocene and early Pleistocene deposits in the Netherlands, but no determinable specimens have so far been obtained from the overlying horizons.

Cirripedia

The Ludham Crag contains an abundance of barnacle remains, but, for the most part, these have not yet been identified.

Pollen

The unoxidised clayey sediments of the Ludham succession have proved to contain appreciable amounts of pollen, associated with hystrichospheres (marine microplankton). A preliminary examination of samples from the Ludham Pilot boring, carried out in 1958, showed that the lower part of the boring, corresponding to the Ludham Crag, contains substantial amounts of the Pliocene-relict genera *Tsuga*, and *Pterocarya*. In this respect the flora resembles the Tiglian of the Netherlands' succession. L 111 also contains *Tsuga* and *Pterocarya*, and, in general, the pollen of the three lower horizons indicates the presence of mixed coniferous and deciduous forest. Above this there are high percentages of *Pinus*, indicating a deterioration of climate. Subsequent analysis of the samples from the Royal Society boring has shown that in this upper part of the boring there are indications of two cold and two warm phases, which correspond essentially with those indicated by the foraminifera, except that the uppermost warm phase is above the limit of occurrence of the foraminifera. Evaluation of these later analyses is still in progress, but at this stage it appears unlikely that there will be any marked disagreement with the conclusions based on the evidence of the foraminifera.

The Succession at Bramerton

The Bramerton Common section has long been regarded as a type-section of the Norwich Crag (Reid 1890, p. 124), although the locality was referred to the Upper Division of the Norwich Crag (zone of *Astarte semisulcata* [*borealis*]) by Harmer (1900, p. 708). It was first described by R. Taylor (1823), and has subsequently been described by S. V. Wood junior (1865, section 24), S. V. Wood junior & F. W. Harmer (1872, section XVI), and H. B. Woodward (1882*a*, p. 82). Superficially R. Taylor's description differs considerably from the later ones, and it also appeared to differ from an 1825 manuscript description by S. Woodward (*fide* H. B. Woodward 1882*a*, p. 82). The later descriptions have several features in common, which were also evident in the section excavated in 1958. These are: (a) a lower shell bed, resting on a basement bed of large flints (5 to 8 feet thick), (b) a middle bed of sand, more or less without shells (12 to 15 feet thick), (c) an upper shell bed (up to 3 feet thick), separated by about 3 feet of sand from (d) a clay bed (up to 5 feet thick). None of the published descriptions, except R. Taylor's, appear to include any higher deposits.

A full description of the section excavated in 1958 is given in Fig. 12. It was located towards the southern end of the degraded, tree-covered face, on the east side of the road (N.G. Ref.: TG 29450595), and at no time was it more than 2 yards wide; it was therefore impossible to make any extensive observations on lateral variation. Samples were collected for foraminifera throughout. Subsequent examination of the foraminiferal assemblages has suggested the tentative recognition of three palaeontological horizons in the Bramerton succession. The general and specific compositions of the foraminiferal assemblages (500–250μ size range only), are given in Fig. 13 and Table 5 respectively.

Horizon B I includes the lowest part of the section, and contains the lower shell bed. The foraminiferal fauna is somewhat restricted, as is usual in the Icenian, with an abundance of *Elphidiella hannai*. However, the Lituolidea, and the Discorbinae other than *Buccella*, are

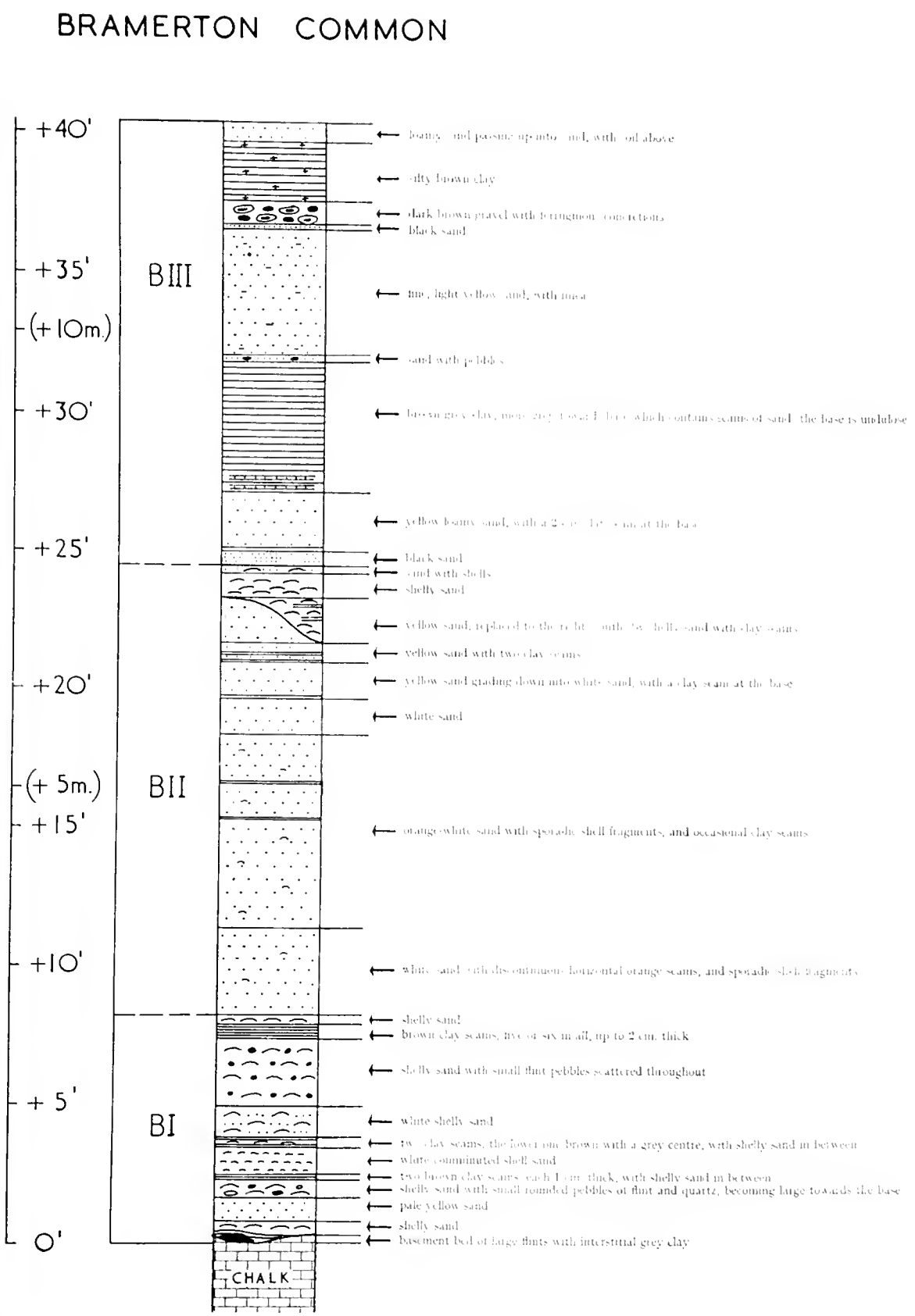

BRAMERTON COMMON
+40'
+35'
(+10m.)
+30'
+25'
+20'
(+ 5m.)
+15'
+10'
+ 5'
0'
BIII
BII
BI
CHALK
loamy sand passing up into sand, with soil above
silty brown clay
dark brown gravel with ferruginous concretions
black sand
fine, light yellow sand, with mica
sand with pebbles
brown grey clay, more grey towards base which contains seams of sand; the base is undulose
yellow loamy sand, with a 2 cm. layer of flint pebbles at the base
black sand
sand with shells
shelly sand
yellow sand, replaced to the north by shelly sand with clay seams
yellow sand with two clay seams
yellow sand grading down into white sand, with a clay seam at the base
white sand
orange-white sand with sporadic shell fragments, and occasional clay seams
white sand with discontinuous horizontal orange seams, and sporadic shell fragments
shelly sand
brown clay seams, five or six in all, up to 2 cm. thick
shelly sand with small flint pebbles scattered throughout
white shelly sand
two clay seams, the lower one brown with a grey centre, with shelly sand in between
white comminuted shell sand
two brown clay seams, each 1 cm. thick, with shelly sand in between
shelly sand with small rounded pebbles of flint and quartz, becoming large towards the base
pale yellow sand
shelly sand
basement bed of large flints with interstitial grey clay

FIG. 12.

represented, and amongst the Anomalininae *Cibicides lobatula* is accompanied by *C. lobatula* var. *grossa*, *C. pseudoungeriana*, and *C. subhaidingerii*. Together with other species these comprise quite a varied fauna for the Icenian, and the faunal lists (e.g. Prestwich 1871, pp. 457–58) show that this is also true for the mollusca. In the presence of the Lituolidea, and the Discorbinae other than *Buccella*, the B I foraminifera resemble those from the L V horizon of Ludham, and the species of *Elphidium* are virtually the same in both instances. The presence of " *Rotalia* " *beccarii*, together with *Textularia sagittula*, *Eponides repandus*, *Rosalina parisiensis*, and *Cibicides pseudoungeriana*, indicates a climate corresponding to full interglacial conditions and not substantially different from the present day. It is clear that the marine transgression which brought the Norwich Crag sea to this point coincided with a period of comparatively warm climate (? glacio-eustatic rise in sea-level). Notice also the apparently corresponding return to more open-sea conditions at Ludham at the L V horizon.

Foraminifera are plentiful in Horizon B II, between the lower and upper shell beds, although remains of mollusca are scarce and fragmental. The foraminiferal assemblages are, however, impoverished with respect to B I; *Elphidium orbiculare* enters, while the representation of " *Rotalia* " *beccarii* decreases, and some species such as *Rosalina parisiensis* disappear. In these respects, and particularly in the entry of *Elphidium orbiculare*, this horizon resembles the L VI horizon of Ludham. Like that horizon too, the foraminifera of B II indicate a trend towards a glacial climate. There are some exceptionally large specimens of *Elphidium pseudolessonii* and *E. frigidum* in the 1,000–500μ size range, which may result from the slow continuation of growth, pending retarded reproduction, under unfavourable (cold) conditions. A northward increase in the size of species of *Elphidium* in the Pacific, probably caused by this phenomenon, has been demonstrated by Nicol (1944).

The B III horizon is based on an assemblage preserved as limonitic replacements. It occurs above the clay bed, and consists almost entirely of *Elphidiella hannai*, which is associated with only a few other cold-tolerant species. Similar impoverished assemblages lacking " *Rotalia* " *beccarii* are characteristic of the L VII horizon of Ludham, and the Crag of Sidestrand (Fig. 13 and Table 5) and Weybourne (Macfadyen 1932, pp. 486–87). The impoverishment and lack of " *Rotalia* " *beccarii* suggest that the climate was by this stage glacial, and indicate that a further cooling had taken place since the B II horizon.

The two lower horizons at Bramerton (B I and B II) contain numerous abnormal foraminifera, which have distorted chambers or coiling. These features indicate stagnant waters at the head of a bay, possibly combined with a freshwater influx (cf. Arnal 1955*a*, 1955*b*). Similar conclusions have been arrived at by previous authors on the basis of the presence of freshwater mollusca, and the distortion of marine mollusca, in the lower shell bed at Bramerton (Reid 1890, p. 115). The evidence of the foraminifera, outlined above, also supports J. F. Taylor's much-criticised contention that the upper shell bed represents colder conditions than the lower (Reid 1890, pp. 114, 116).

It should be noticed that, although it is not possible to recognise the exact lithological divisions described by R. Taylor for the upper part of the section, the measured distance of the B III assemblage above the surface of the Chalk is approximately the same as that of his third shell bed (Stratum 5). It is therefore reasonable to suppose that the section which he saw may have been fossiliferous, i.e. unleached, to a higher

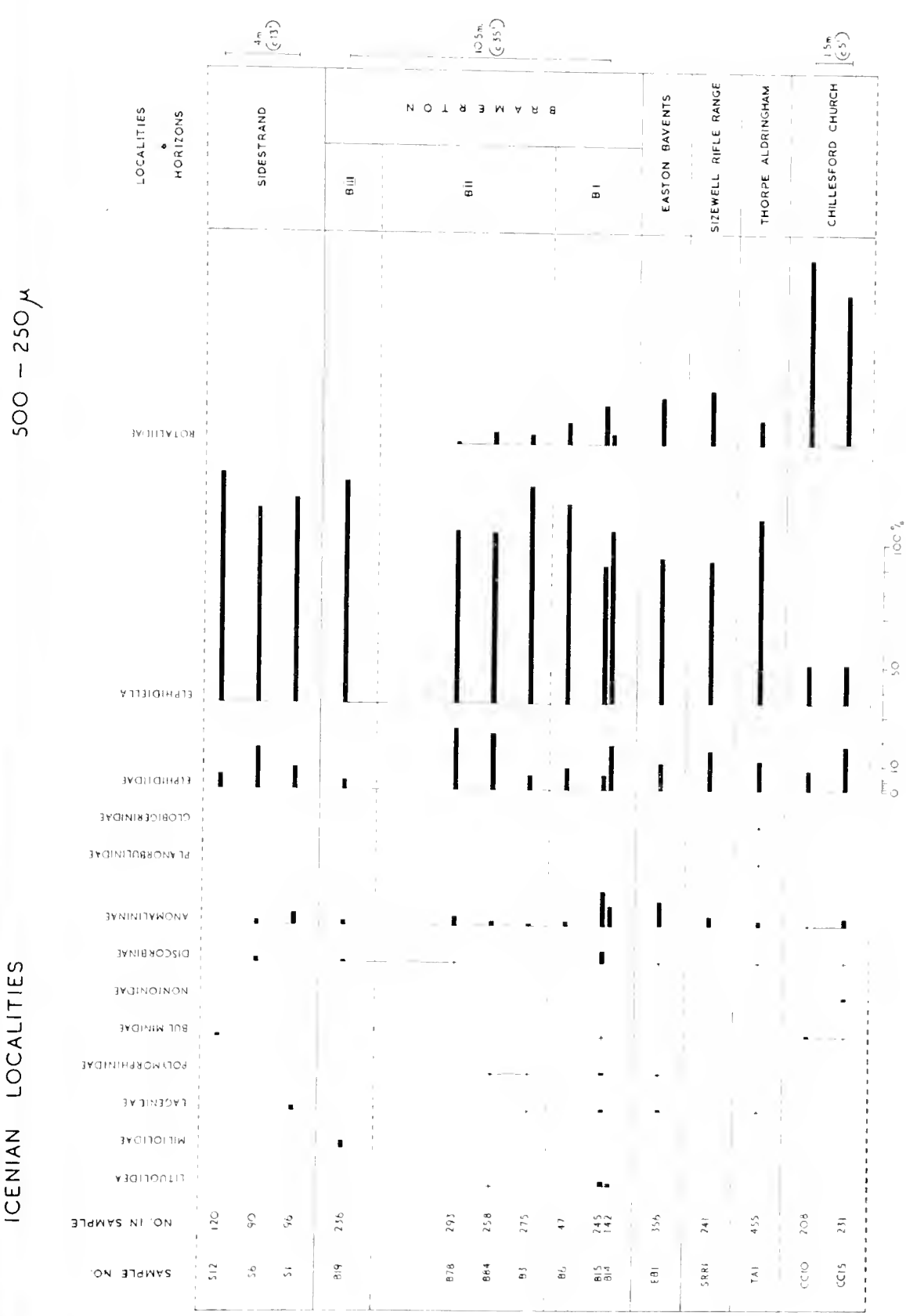


FIG. 13. General composition of foraminiferal assemblages

ICENIAN LOCALITIES 500—250μ

	S			B							EB	SRR	TA	CC	
Sample No.	12	6	1	19	78	84	3	6	15	14	1	2	1	10	15
No. in Sample	120	90	96	236	293	258	275	47	245	142	356	241	455	208	231
Buccella frigida		2		0							0				
B. inusitata				0	0				2				0		
Bulimina marginata														0	
Bulimina														0	0
Cibicides lobatula		2	5	0	4	2	1	2	9	7	10	4	2	0	2
C. lobatula var. grossa									2						1
C. pseudoungeriana									2	1					
C. subhaidingerii									1						
Cibicides							1								
Elphidiella hannai	93	79	83	90	70	69	88	81	56	70	59	58	75	16	16
Elphidium cf. bartletti			1												
E. clavatum		2	3		0	1	1		1	4	5		0	6	6
E. crispum									1				0		
E. excavatum	1	2		0	0		0	2	0			1	3		
E. frigidum	2	9	2	0	7	4	0	2	0	4	5	0	0		0
E. cf. gunteri												1	0		
E. macellum var. granulosum						3	0		1	6		0	2		
E. orbiculare	2		1		0		0								
E. pseudolessonii	1		2	3	17	15	3	4	1	4	1	12	6	2	12
E. selseyensis		3				1	0		1			0			
Eponides repandus									2						
Globulina gibba									0						
G. aff. myristiformis									0						
Globigerina bulloides													0		
Guttulina lactea						0	0				0				
Lagena striata													0		
Lenticulina rotulata			2				0		1		1				
Nonion															0
Nonionella turgida															1
Oolina melo	1														
O. williamsoni									0						
Planorbulina mediterranensis													1		
Quinqueloculina seminulum				3											
Rosalina parisiensis									0						0
" Rotalia " beccarii					1	5	4	9	16	4	19	22	10	75	61
" R." perlucida												1			
Textularia sagittula						0			1	1					
T. cf. truncata									1						

S=Sidestrand B=Bramerton EB=Easton Bavents SRR=Sizewell Rifle Range TA=Thorpe (Aldringham) CC=Chillesford Church.

TABLE 5. Specific composition of foraminiferal assemblages

level than any seen subsequently. Once this has been conceded it is clear that his description of the lower part of the section is essentially similar to those of later authors, in the presence of a lower shell bed (Stratum 10), and an upper shell bed (Stratum 8), with 15 feet of intervening sand (Stratum 9). Taylor does not record a clay bed, but, as Woodward has remarked (1882*a*, p. 82), this has by no means always been present in the exposures, and the higher part of the succession, which Taylor describes, has apparently not been included in the descriptions of later authors.

The Weybourne Crag

In common with other deposits occurring at the base of the north Norfolk cliffs, the Weybourne Crag is somewhat vicariously exposed. Knowledge of its contents and relationships is almost restricted to the observations of Clement Reid (1882, pp. 11–19), which were collected over a period of several years. He selected the occurrence at East Runton as typical (*ibid.*, p. 15), but this section has not been adequately exposed for critical examination in recent years. In 1958 a series of samples was obtained from an exposure of Crag between Overstrand and Sidestrand, subsequently visited by the Geologists' Association (Baden-Powell & West 1960, p. 73). The results of an examination of the foraminifera in the 500–250μ size range from this locality are given in Fig. 13 and Table 5. An essentially similar assemblage was described from the Crag of Weybourne by Macfadyen (1932, pp. 486–87). These impoverished assemblages, dominated by *Elphidiella hannai*, and containing only cold-tolerant species, suggest cold conditions. The combination of the presence of *Elphidium orbiculare* and the absence of "*Rotalia*" *beccarii* indicates semi-glacial (i.e. equivalent to Late-Glacial) conditions. *Elphidiella* aff. *sibirica* (1,000–500μ), *Elphidium* cf. *bartletti* and *E. frigidum* are characteristic Arctic species. Like the B III assemblage at Bramerton, and the L VII assemblage at Ludham, they would seem to imply a Scandinavian ice-cap, and probably valley glaciers in Scotland and Northern England (see Godwin 1956, p. 306).

There is some question as to whether all the deposits which are attributed to the Weybourne Crag (because of the occurrence of the mollusc *Macoma balthica*) belong to one horizon, and there is a possibility that an impoverished marine fauna of this type may be a recurring one at the end of the early Pleistocene in Norfolk. Only detailed studies can resolve this problem, and the result of these cannot be anticipated here.

The western (marginal) facies of the "Norwich Crag Series"

The samples obtained from borings put down along the line of the proposed North–West Intercepting and Rising Main Sewers under Norwich and Trowse in 1951, provided, amongst other things, an excellent opportunity for the study of the lithological variation of the marginal facies of the Crag. These samples were examined by the author in 1952, and are preserved, together with an annotated copy of the boring records, at the Castle Museum, Norwich. The variations in lithology are portrayed diagrammatically in Fig. 14; the line of the borings is indicated on Fig. 10.

The description which follows includes all those deposits which H. B. Woodward included in his "Norwich Crag Series" (1882*a*, p. 31). Along the line of the borings the Series in general shows a lateral transition from a sandy gravel in the west, to a series of beds of gravel, sand and clay (the sand and clay sometimes also occurring as rapid alternations) in the east. Shells occur at or near the base towards the east, whereas an influx of quartz and quartzite pebbles is typical of the top of the Series, particularly in the west.

West of the Yare the Series is essentially a sandy gravel. The gravel component is of medium size (2–4 cm. intermediate diameter), rarely large (4–6 cm. intermediate diameter), and typically well-rounded, sometimes sub-rounded. The pebbles are usually flint, but small (1–2 cm. intermediate diameter) quartz and quartzite pebbles occur virtually throughout the Series in this westernmost sector. Above 70 ft. O.D., however, up to 50% of the pebbles may be medium well-rounded quartz

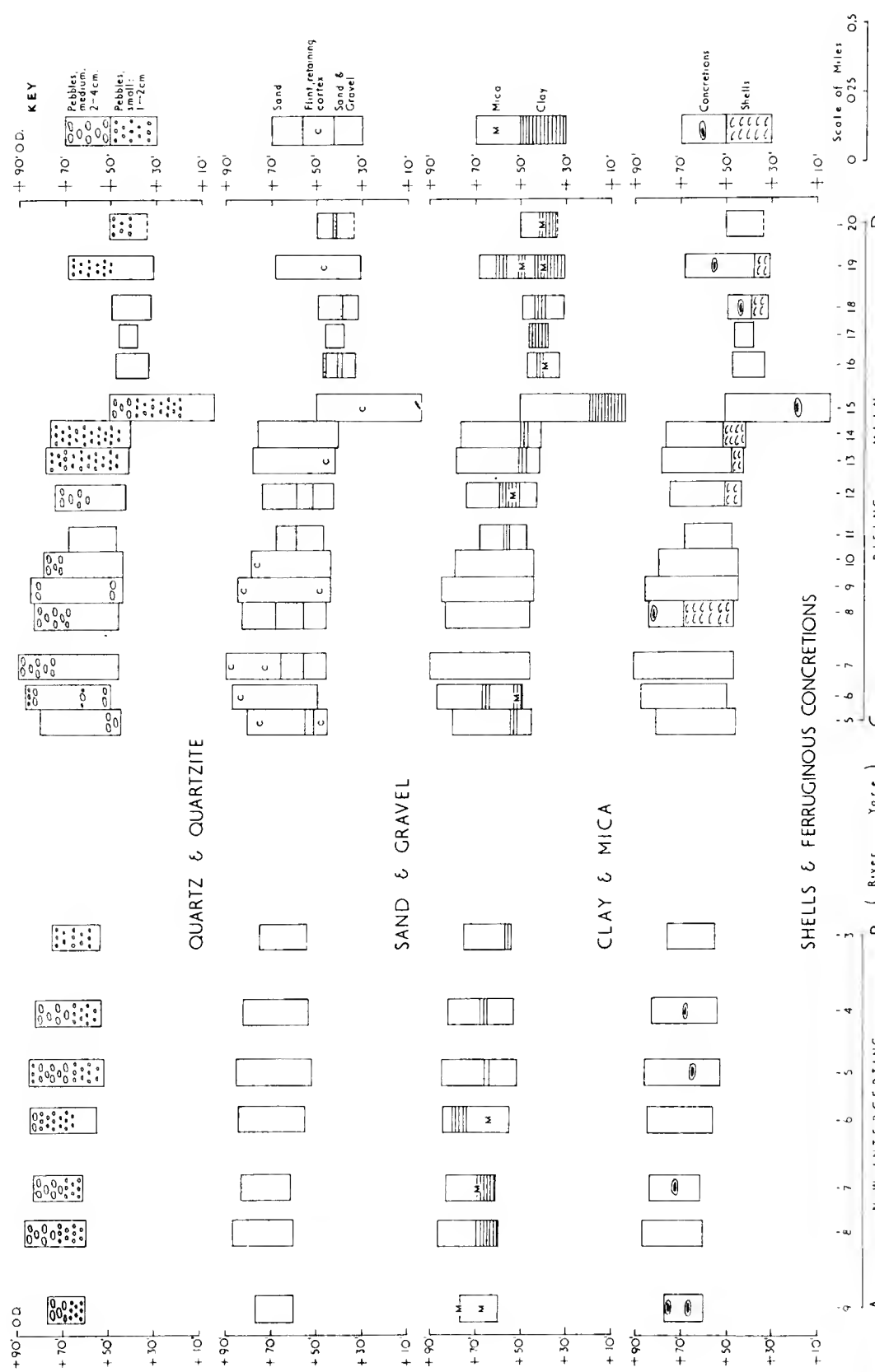

'NORWICH CRAG SERIES' LITHOLOGY Western (marginal) facies, under, and east of, Norwich
KEY
Pebbles, medium, 2–4cm.
Pebbles, small, 1–2cm
Sand
Flint retaining cortex
Sand & Gravel
Mica
Clay
Concretions
Shells
+90' O.D.
+70'
+50'
+30'
+10'
QUARTZ & QUARTZITE
SAND & GRAVEL
CLAY & MICA
SHELLS & FERRUGINOUS CONCRETIONS
A (N.W.)
N W INTERCEPTING
B (SE.)
(River Yare)
C (W.)
RISING MAIN
D (E.)
Scale of Miles
0 0·25 0·5

FIG. 14

and quartzite pebbles, and the associated flint pebbles are no longer rounded, but usually sub-rounded or even sub-angular. Furthermore, the quartz-quartzite-flint gravel has quartz grit rather than sand in the interstices. Beds of sand and shells are absent from the sequences, but they contain both clay and mica.

Immediately east of the Yare the Series contains much sandy gravel with medium, rounded flint pebbles. However, the constituents of the gravel component are more varied and there is greater variety in the accompanying sediments. The flints are, if anything, less well-rounded than those in the lower part of the westernmost sequences, and sometimes retain portions of cortex. Small pebbles and granules of flint, both rounded and sub-angular, may be present and the medium pebbles are sometimes angular. Small quartz and quartzite pebbles occur occasionally, and exceptionally, medium quartz and quartzite pebbles occur at the base of the Series. Medium quartz and quartzite pebbles are again found generally above 70 ft. O.D., but rarely make up even 25% of the total pebble content. Clay is not abundant, but occurs at all levels, except the highest, and characteristically contains mica. Considerable beds of sand occur at levels about 10 feet above the base, but, with one exception, shells are absent.

Further east still, from approximately Rising Main 12 onwards, the Series continues to contain much sandy gravel with medium, rounded, flint pebbles and other types of pebbles, mainly as described for the previous sector. In general, however, all traces of flint cortex seem to have been removed. The high-level, quartz-quartzite-flint gravel seems to be represented only by the occurrence of small quartz and quartzite pebbles. One boring (R.M. 15) revealed an exceptionally low level for the Chalk surface, with an overlying sequence which included small and medium quartz and quartzite pebbles in the uppermost layers. This is consistent with solution-pipe subsidence, and the consequent preservation of medium quartz and quartzite pebbles at the top of the sequence shows that their absence in this easternmost sector is the result of erosion rather than non-deposition. Clay increases in importance in this sector and there are fewer beds of sand, although a considerable amount of sand occurs intercalated in rapid alternations of sand and clay. Shell beds are commonly found immediately above the base of the Series. Samples from the base of the Series, consisting of a mixture of chalk, chips and angular pieces of flint, probably result from the breaking-up of the basement bed by boring operations. This bed may be less well-developed, or even absent, in the more westerly sectors.

The high-level quartz-quartzite-flint gravels have been variously referred to as the Pebbly Sands and Pebble Beds, the Bure Valley Beds, and the Westleton Beds. These gravels are almost certainly distinct from the Norwich Crag (*sensu stricto*), but are considered here, as criteria for their separation have not yet been satisfactorily worked out. There appears to be a progressive increase in the content of quartz and quartzite pebbles as the " Norwich Crag Series " is ascended, commencing with the introduction of small quartz and quartzite pebbles, and culminating in the presence of up to 50% of medium quartz and quartzite pebbles. This trend, first observed in the boring samples just described, has subsequently been investigated by members of the Paramoudra Club at the City of Norwich School, in the Whitlingham pit (N.G. Ref.: TG 268077). They found that, almost without exception, up to 10 feet above the base, the gravel content greater than 1·3 cm. intermediate diameter consisted almost exclusively of flint, and the very small gravel

(0·6–1·3 cm. intermediate diameter) contained only 5% quartz and quartzite. Observations above this level shew up to 25% of quartz and quartzite in the very small gravel, up to 15% in the small gravel (1·3–2·2 cm. intermediate diameter), and up to 10% in the medium gravel (2·2–3·2 cm. intermediate diameter). Counts of medium-large gravel (2–5 cm. intermediate diameter), made by the author from the highest deposit visible on the east side of the pit, gave 40% of quartz and quartzite pebbles.

It should be emphasised that quartz and quartzite pebbles, particularly small pebbles, may be found in small proportions even at or near the base of the Norwich Crag (*s.s.*), as mentioned above, but high proportions of medium quartz and quartzite pebbles are only found at high-levels in the " Norwich Crag Series."

The quartz-quartzite-flint gravels have often been referred to as the Bure Valley Beds (e.g. Baden-Powell & West 1960, p. 71), and it is clear that they must be regarded as belonging to this division as it was originally applied (S. V. Wood jun., in S. V. Wood sen. 1866, p. 547). However, the Bure Valley Beds also, and perhaps more specifically, include those deposits which contain *Macoma balthica* and are probably equivalent to the Weybourne Crag (Wood & Harmer 1872, pp. xv–xvii; Woodward 1882*b*, pp. 453–54). Excavation of deposits of this type east of Crostwick (N.G. Ref.: TG 272161), referred to by Woodward (1882*a*, p. 63), revealed that the medium-large (2–5 cm. intermediate diameter) gravel contained only 3% of quartz and quartzite. It therefore differs in this respect from the high-level quartz-quartzite-flint gravels of the " Norwich Crag Series," but is lithologically indistinguishable from the gravels of the Norwich Crag (*s.s.*).

Apart from the instances already mentioned, 25% of quartz and quartzite pebbles of medium-large size was recorded as the result of a small count just below the soil at the Pound Lane pit (N.G. Ref.: TG 275090), and high proportions of quartz and quartzite pebbles can also be seen beneath Norwich Brickearth at Catton brickworks (N.G. Ref.: TG 234130) and Horsham St. Faiths (N.G. Ref.: TG 221150). High proportions of quartz and quartzite pebbles have also been observed by the author in temporary exposures beside the Rackheath road (N.G. Ref.: TG 275139), in the grounds of the West Norwich Hospital (N.G. Ref.: TG 208090) and elsewhere. All these occurrences are at a similar stratigraphical level high in the " Norwich Crag Series." The advent of large numbers of quartz and quartzite pebbles in Norfolk is probably indicative of an event of some considerable palaeogeographical significance. Reid recorded approximately 40% quartz and quartzite pebbles from the " Cromer Forest Bed Series " of Bacton (1890, p. 170). It is likely that the quartz and quartzite pebbles in both the " Cromer Forest Bed Series " and the " Norwich Crag Series " originate from the Rhine drainage basin. This is not to say that the proto-Rhine necessarily extended as far as the Norwich district—the pebbles may in this instance have been introduced by long-shore drifting—but it does indicate a change from an earlier regime when the pebbles consisted almost exclusively of flint, presumably derived locally from the erosion of the Chalk. It is probable that the erosional relationship sometimes observed beneath high-level gravels in the " Norwich Crag Series " may have a greater significance than was attributed to it by Woodward (1882*a*, p. 34). It would also be interesting to know whether the occurrence of quartz and quartzite pebbles is related to the presence of tourmaline-staurolite, as opposed to garnet-amphibole-epidote heavy mineral assemblages. Both

assemblages were recorded from the " Norwich Crag Series " by Solomon (1935, p. 221), when he attributed the uppermost part to his Westleton Series. However, I am inclined to agree with Woodward (1882*b*, pp. 453–56; and in Prestwich 1890, p. 118) that these beds should not be equated with the Westleton *Beds* of Westleton (in which quartz and quartzite pebbles are both small and infrequent), even though they may be correctly referred to the Westleton *Series* as defined by Solomon.

The " Chillesford Clay " of Norfolk

The Chillesford Clay was first described from the locality of Chillesford in Suffolk (Prestwich 1849). It was subsequently correlated with various clay beds throughout Norfolk and Suffolk, until the term became practically synonomous with the lithological description " clay with mica." H. B. Woodward (1882*a*, pp. 34–35; 1882*b*, pp. 452–53) made some outspoken comments on the practice of arbitrarily correlating clay beds in such demonstrably variable deposits. And, although reliance on the occurrence of " Chillesford Clay " for the purposes of correlation was never again taken to the extremes that it had been (e.g. Wood & Harmer 1872, pp. viii–xi), nevertheless Harmer's conception of an estuary of the Rhine (1896, pp. 768 71; 1902, pp. 446–48, Fig. 76) is tacitly based on a general correlation of the Icenian clay beds of Norfolk and Suffolk.

It is clear that in the western (marginal) facies of the " Norwich Crag Series," with which H. B. Woodward had most intimate experience, clay beds are not confined to any one horizon but occur at almost all levels in the succession. In the eastern facies however, where clayey sediments are generally more common, it is possible that definite beds of clay do occur. Downing (1959) has interpreted unpublished boring records as demonstrating two such beds, but in view of the difficulty of recognising these in the Ludham borings there must remain some uncertainty as to whether they are either continuous or distinct.

The Chillesford Clay of the type area appears to be devoid of a determinable fauna, but the immediately underlying Chillesford Crag does contain a limited fauna of foraminifera, mollusca, etc. Two Chillesford Crag foraminiferal assemblages are shown in Fig. 13 and Table 5 (cf. Macfadyen 1932, pp. 486–90; van Voorthuysen & Pannekoek 1950, pp. 210–11). They indicate an interglacial-type climate, and the abundance of " *Rotalia* " *beccarii* is suggestive of a tidal-flat or lagoonal environment. In fact the specialised character of the foraminiferal fauna makes it almost impossible to allocate it to its correct position in the stratigraphical succession. The restricted molluscan fauna is equally unhelpful in this respect. (Only the earliest lists of Chillesford Crag mollusca refer to the type locality.)

The Chillesford Crag has commonly been placed between the Norwich and Weybourne Crags, ostensibly on the basis of the mollusca (Harmer 1900, p. 723), but probably chiefly on the basis of the supposed widespread occurrence of the overlying Chillesford Clay at the top of Norwich Crag sequences. However, the B II horizon of Bramerton, which underlies the so-called bed of " Chillesford Clay," is, on the basis of the foraminifera, too cold in its indications to be correlated with the Chillesford Crag, and moreover, there appears to be no sufficiently warm episode between the Norwich and Weybourne Crags to be even a potential correlative of that Crag. The same is true of the L VI horizon which underlies the L VII clay bed at Ludham, but the assemblages of L III, which underlie the L IV clay bed, might be equivalent to the Chillesford Crag, climatically at least. The Chillesford Crag foraminifera themselves

would be consistent with the possibility that it is most closely related to the Lower Division of the Norwich Crag of Thorpe (Aldringham) and Sizewell (Rifle Range), but this suggestion is extremely tentative.

In the present state of knowledge it may be concluded:
(a) that the term Chillesford Clay should be restricted to the formation outcropping in the type area. Even the clay of Easton Bavents, less than 15 miles further north, is reported to contain Scandinavian heavy minerals (Solomon 1935, p. 223), and on those grounds cannot be equivalent to the Chillesford Clay (*sensu stricto*),
(b) that there is at present no evidence for correlating any clay bed in Norfolk with the Chillesford Clay,
(c) that there may be a widespread clay-bed horizon in Norfolk, but, if there is, it seems most likely to be that of the L VII horizon of Ludham, which contains a fauna so far indistinguishable from the Weybourne Crag (cf. Reid 1890, p. 131).

The prospect of future investigations

Many important investigations of the Palaeogene and early Pleistocene deposits of Norfolk will almost certainly be carried out on samples from borings. Although occasionally it may be possible to put down borings specifically for scientific purposes, to test particular theories, at critical junctures, in general it will remain most important that samples from borings put down for other purposes should be preserved, even though they may not be immediately utilised. This particularly applies to borings made in Palaeogene and early Pleistocene deposits. Unfortunately the techniques involved in the detailed examination of samples from borings are such that they will never be widely available, but there is ample opportunity for initiative in seeing that potentially valuable samples from borings are not lost or destroyed.

It is hardly possible, or desirable, to continue studies on the mollusca in the classical manner. The number of exposures now available is very small, and apart from the excavation of old sites, only the Whitlingham pit, and the ephemeral exposures of Weybourne Crag on the coast between Weybourne and Sidestrand, are readily available. Even with such restricted opportunities, however, there are still considerable possibilities for the quantitative study of the mollusca, preferably according to the method of Sorgenfrei (1958, p. 33). Collection of quantities of material foot by foot should give interesting information on the succession and distribution of molluscan assemblages in the Norfolk Crag.

There is also opportunity for zoologists to study the distribution of foraminifera, mollusca and other suitable marine invertebrates around the coasts of Norfolk, and compare them with their distribution in the Crag. It is in fact the detailed information on the fascinating, interrelated changes in faunas, floras and climate, which can be derived by comparison with their modern counterparts, which makes the study of the palaeontology of the Norfolk Crag such an interesting subject.

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THE GLACIAL AND INTERGLACIAL DEPOSITS OF NORFOLK

By R. G. West

The general succession of glacials and interglacials of East Anglia is shown in the table of strata (Table 1). This classification forms the basis of the following account, although, as we shall see, in many instances it is impossible to correlate particular deposits, especially those in north-east Norfolk, with the general East Anglian sequence.

The Cromer Forest Bed Series

This sequence of intercalated organic and inorganic, freshwater and marine deposits, which lies immediately beneath the earliest East Anglian glacial deposits around the coast from Weybourne to Kessingland, in Suffolk, was described in great detail by Clement Reid (1882, 1890). He subdivided the Series into a Lower Freshwater Bed, a middle Estuarine Bed and an Upper Freshwater Bed. Reid commented at length on the flora and fauna of the Series. In particular he showed that the plants and terrestrial fauna indicate temperate conditions, but the marine fauna a decidedly colder climate. Reid envisaged no major climatic changes during the formation of the Forest Bed Series. He suggested that the differences between the terrestrial and marine biota resulted from changes in the relative levels of land and sea during the Early Pleistocene, which effected a connection between this country and the continent and closed the English Channel. The former allowed the appearance of a large mammalian fauna and a flora with continental connections, the latter an increase in the number of northern marine species.

Reid's views on the Cromer Forest Bed Series have to be modified in the light of two recent pieces of research. The first is the pollen analysis of the Upper Freshwater Bed by Thomson (in Woldstedt 1951), and the second an investigation of the deer by Azzaroli (1953). Thomson's pollen diagram shows vegetational and climatic changes during part of an interglacial climatic cycle, with boreal pine and birch forest at the base, an increase of temperate mixed oak forest trees (oak, elm, lime) in the middle, and a final dominance of pine and spruce at the top. The significance of the diagram is that it shows climatic and vegetational changes following an early cold period, which presumably may be represented in part by the Estuarine Bed. It is clear that the Upper Freshwater Bed is interglacial in the accepted (climatic) use of that term (West & Godwin 1958), even though there is no true glacial deposit below it. This being so, the Lower Freshwater Bed, with a flora strongly indicative of temperate conditions, must represent an earlier pre-Estuarine Bed temperate period.

Azzaroli's work on the deer also points to the complexity of the Cromer Forest Bed Series. He showed that the so-called Forest Bed deer fauna could be split into three distinct faunas of considerable difference in age, one from the Weybourne Crag, one from the Estuarine Bed and one from the Upper Freshwater Bed.

The relation of the Cromer Forest Bed Series to the beds above and below is not at all clear. The Lower Freshwater Bed was described by Reid resting on the Weybourne Crag at Trimingham. This suggests a change from cold marine conditions in the Weybourne Crag to temperate freshwater conditions in the Lower Freshwater Bed. The *Leda myalis* Bed and the Arctic Freshwater Bed were described by Reid. They overlie the Cromer Forest Bed Series, and suggest both cold marine and cold

terrestrial conditions after the Upper Freshwater Bed temperate period. But the exact relations between these three in terms of climate and land/sea-level changes is far from clear.

The relations of the Cromer Forest Bed Series to the Weybourne Crag and *Leda myalis* and Arctic Freshwater Beds requires re-investigation, as does the detailed stratigraphy and palaeobotany of the Cromer Forest Bed Series itself. Pollen analysis of all these deposits offers a very encouraging line of research, and this work is now in progress at the Subdepartment of Quaternary Research at Cambridge. Once the detailed palaeobotany is known, it may then be possible to elucidate the relative land- and sea-level changes which evidently took place during the deposition of the Cromer Forest Bed Series.

It is unfortunate that the term Cromerian has come into use as a general term to describe an early interglacial in Europe. It seems probable that there are in fact two temperate horizons within the Forest Bed Series. Which is the Cromerian Interglacial? As a distinctive pollen diagram has been obtained from the Upper Freshwater Bed, it is this horizon that is referred to as Cromerian by continental authors when correlating interglacials defined by pollen analysis. It therefore seems best at present to continue to regard the Upper Freshwater Bed as the type deposit of the Cromerian Interglacial.

Lowestoft Glaciation

In Suffolk there is a clear tripartite division of the deposits lying between the Cromer Forest Bed Series, which is exposed on the coast between Corton and Kessingland (Blake 1890), and the succeeding interglacial deposits at Hoxne, near Diss, the type site of the Hoxnian Interglacial. This is the succession "Comer Till"—Corton Beds (Mid-glacial Sands)—Lowestoft Till. I consider that there is not yet enough evidence to characterise the Corton Beds at their type site as representing interglacial conditions of climate, and for this reason all the deposits between the Cromerian and Hoxnian Interglacials must be interpreted as belonging to one glaciation, which included two periods of ice advance, the Cromer Advance and the Lowestoft Advance. The question of the Corton Beds is considered in more detail later.

The tripartite succession clearly extends northwards into east Norfolk, as seen in the coast sections of Flegg (Green, Larwood & Martin, 1953). Here the lower till, described by Green, Larwood & Martin as Norwich Brickearth, was deposited by an ice advance from the north-west, while the upper till (Lowestoft Till) was deposited by an ice advance from the west; stone orientation studies suggest that these two ice advances should be correlated respectively with the Cromer and Lowestoft Advances of West and Donner (1956).

Further north in Norfolk the Lowestoft Till gives place to a boulder clay with a chalky matrix. This chalky boulder clay is correlated with the Lowestoft Till, as its erratics (Baden-Powell 1948) and the orientations of its stones (West & Donner 1956) indicate a general west to east ice movement tallying with the general direction of the Lowestoft Advance further south.

It will be convenient at this stage to discuss the North Sea Drift (which includes the Cromer Till proper and the Norwich Brickearth), the Contorted Drift and the Corton Beds in turn. It must be emphasised that it is not at all certain how the coastal glacial succession of the north-east, with the North Sea Drift, Contorted Drift and so-called Corton Beds, should be correlated with the clear tripartite succession of southern Norfolk and Suffolk.

North Sea Drift

This drift comprises the Norwich Brickearth and its supposed correlative the Cromer Till. The former occurs mainly inland, the latter on the coast in the north-east. They are distinguished by the red-brown colour and apparently more advanced weathering of the Norwich Brickearth compared with the fresher and greyer Cromer Till. However, although the Norwich Brickearth is generally brown and decalcified where it occurs at the surface, elsewhere it is not. The following observations are contributed by B. M. Funnell: "At Hevingham (TG 183202), where the stone orientation measurements gave a direction of 120 deg. (Grid N.), and where a rhomb porphyry boulder was found *in situ*, the Norwich Brickearth is distinctly grey towards the base as it extends below the local water-table. Beneath Norwich the Brickearth may contain grains of chalk, as shown by samples from borings (TG 233078, TG 236077), and at Old Costessey Brickyard pebbles of chalk can be found in it. This last locality was recorded by Woodward (1882, p. 118) as chalky boulder clay, but stone orientation measurements show a preferred direction of 135 deg. (grid N.). As at Hevingham, this is close to other measurements made on the Norwich Brickearth in this region, but is distinct from directions given by the local equivalent of the Lowestoft Till. (Measurements made on such a till at Old Costessey (TG 147120) gave a preferred direction of 65 deg. (grid N.).)" The calcareous type of Norwich Brickearth is also present on the coast of Flegg. Stone orientation diagrams from both the Norwich Brickearth and the Cromer Till give a similar north-west to south-east direction for the ice movement which deposited them. The similarity of direction may be evidence for their contemporaneity in spite of the differences in appearance. On the other hand, Boswell (1916) found that the Norwich Brickearth had a characteristic mechanical composition not shared by the coastal drifts. Possibly they were contemporaneous but deposited by different lobes of ice.

The North Sea Drift sequence is, however, far more complicated than it would so far appear. This is shown by the descriptions of the coastal sequence by Reid (1882) and Solomon (1932). Reid subdivided the Cromer Till into First and Second Tills. Solomon divided his North Sea Drift into a lower and an upper till, which were not identical with Reid's two tills. Only much detailed study of the coastal till sequences can resolve the complicated history of the North Sea Drift.

Contortions in the drift and the Contorted Drift

The Contorted Drift was separated from the Cromer Till by Reid (1882) and subsequent authors. However, it is difficult to distinguish in some of the north-east coastal sections where contortions affect all the tills. Solomon (1932) correlated the brown boulder clay of the Contorted Drift with the Lowestoft (Great Eastern) Till. If this is correct the Corton Beds of the more southerly coastal sections are missing from the north-east. We may note that there is no positive evidence in these cliff sections of true interglacial conditions between the North Sea Drift and the Contorted Drift.

The contortions seen in the cliffs have a complex origin. Two causes can be distinguished. First, the melting of dead ice of a down-melting ice sheet, causing the slumping of englacial and supraglacial material; secondly, the contortion of sediments by ice pushing near the margin of an ice sheet, to form the kind of end-moraine known as a push-moraine. In some sections two periods of contortion can be distinguished, as, for

example, near the walls of the large sand-basins in the cliffs near West Runton. Here the bedding of the sands lies at a very steep angle indeed against an eroded surface of the Contorted Drift. In many coastal sections narrow bands of till are seen. These are known to form next to shear-planes near the margins of present-day ice sheets in Spitsbergen (Donner & West 1957), and their presence in the contorted drift also suggests the end-moraine character of the deposits. The apparent stratification of many tills of the contorted drift probably results from deposition in shear-planes in ice. Stone orientation results in such tills are difficult to interpret as narrow band tills may give an orinetation transverse to the direction of ice movement, as has been found in a narrow band till near Sheringham, and in such tills in process of formation in Spitsbergen (Glen, Donner & West 1957). On the other hand, a study of the structure and orientation of the contortions themselves should give much-needed information about the age and direction of the ice advances to which the contortions are related.

Corton Beds and the interval between the upper and lower tills of the Lowestoft Glaciation

The Corton Beds (Mid-glacial Sands) at their type site are obviously interglacial in the stratigraphical sense that they lie between two tills, but whether they indicate true (climatic) interglacial conditions has long been a matter of dispute. Some have considered the considerable fauna to be indigenous, others that it is derived. From a stratigraphical point of view the Corton Beds indicate a retreat of the ice and the deposition of water-laid sands between the Cromer and Lowestoft Ice Advances. It is the magnitude and climate of this retreat stage which is in question. If the fauna is largely or entirely derived, the sands may be glacio-marine or glacio-fluvial, with no large amelioration of climate proven. If the fauna is not derived a temperate climate and marine deposition is indicated. D. F. W. Baden-Powell, P. Cambridge and B. M. Funnell have very kindly contributed the following notes dealing with the faunal evidence. These make the nature of the controversy quite clear.

Note 1 by D. F. W. Baden-Powell

When geologists started to subdivide the Norfolk Drift in the 1850's, two main types of glacial till were recognised in eastern Norfolk, now known as the North Sea Drift and the Lowestoft Till. Between these two tills a thick sand formation was also noticed; this was named the Middle Glacial Sand by Searles Wood, and was mapped by him and by the officers of the Geological Survey over an area measuring 50 by 20 miles between Lowestoft and Sheringham, with a maximum thickness of about 80 ft.

The Middle Glacial Sand is now known as the Corton Beds, and where it is fossiliferous, contains a peculiar marine fauna only known in a few other places in Britain. The assemblage of shells is essentially intermediate in type between that of the Crag and that of the present day, as it contains a few extinct species, especially *Nucula cobboldiae*, *Tellina obliqua* and *Nassa reticosa*, although many other Crag species which might have been expected to be present if this were redeposited Crag, are unknown in the Corton Beds. Two other extinct shells, *Woodia hoptonensis* and *Trophon mediglacialis*, are unique to this fossil horizon. These peculiarities are combined with the first appearance in East Anglian stratigraphy of modern shells unknown in the Crag, such as *Chlamys varia*, as well as other shells which indicate that the climate was warmer than

to-day. A similar assemblage is also known from the Isle of Man and from the Wexford Gravels of Southern Ireland, and probably occurs also in the Drift of the Yorkshire and Aberdeen coasts.

The warm climate is confirmed by the presence of Prehistoric Man represented by flint implements found in the intertidal beds near the base of the Corton Beds; these implements were made from flakes in a very primitive way and are of earlier type than the Clactonoid flakes of the succeeding Hoxne Interglacial. A warm climate is also suggested by the find of *Bos* remains at Davey's Pit, Bungay (Baden-Powell 1950), though it is not certain these came from the Corton Beds as a veneer of valley gravels is also found in this section.

NOTE 2 BY P. CAMBRIDGE

Sands occurring in the glacial series at various points on the coast between Lowestoft and Sheringham have been referred to as Corton Beds. However, it seems certain that these beds are not all at exactly the same horizon and certain anomalies in the types of mollusca found make it unlikely that this is a natural assemblage. The vast majority of the shells fit in well with the theory that these beds contain the debris of Icenian Crag, with a few species derived from earlier deposits. Almost all the shells of these sands are fragmentary and worn and no polyzoa or cirripedes are found attached to them. Large, heavy shells are almost entirely wanting. Generally speaking, bi-valves predominate, but the valves are always separated. Small Chalk fossils, such as valves of *Crania*, polyzoan fragments and echinoid remains are fairly frequently found.

From an examination of collections in the Castle Museum, Norwich, the following species are fairly typical of these beds at Corton (an asterisk indicates an extinct species):

Cardium edule	*Nucella lapillus*
Chlamys opercularis	*Turritella incrassata**
Arctica islandica	*Astarte semisulcata* (=*borealis*)*
Mya arenaria	*Acila cobboldiae**
Glycimeris glycimeris	*Macoma obliqua**
*Nassarius reticosus**	*Venus fasciata*

A somewhat different fauna has been found in the cliff south of California Gap (TG 549126), where the writer identified the following species:

Cardium edule	*Scaphella lamberti** (fragment)
Glycimeris glycimeris	*Balanus* spp.
*Nassarius reticosus**	(valves very common)
*Turritella incrassata**	
Astarte montagui	

A large contorted mass of sand, which has been referred to the Corton Beds, occurs at the top of the cliffs just before reaching West Runton Gap from the east. The following shells were identified by the writer:

Cardium edule (common
Arctica islandica (fragments)
Macoma balthica (very common, frequently fairly complete)
Littorina sp. (fragments)
Mya sp. (fragments)
*Nassarius reticosus costatus** (one fragment)

M. P. Kerney identified the following species of freshwater shells, which were better preserved than the numerous marine shells:

Viviparus sp. (one example), *Valvata goldfussiana* (one example) The latter is a Cromerian species. At this point on the coast the assemblage has changed considerably. Derivative (?) Red Crag material still occurs rarely, but the remainder of the admittedly limited fauna would agree better with a mixture of Weybournian and Forest Bed Series species. Somewhat similar shelly sands occur about Sheringham, but the fauna is even more limited and consists mainly of large numbers of *Macoma balthica* with fragments of *Cardium edule*, *Arctica islandica* and *Mya* sp.

Note 3 by B. M. Funnell

Foraminifera have been recorded from the Corton Beds by Macfadyen (1932, pp. 486–90). He described two assemblages, one from Corton (locality 10) and another from Ormesby (locality 8). The Corton assemblage contained representatives of forty-four species from the Chalk and six species from the Jurassic. It contained sixteen species which Macfadyen classed as indigenous, one species which he classed as Lower Pliocene, and ten which he classed as of doubtful age. I have examined examples of the twenty-seven species contained in these last three categories which are mounted on Macfadyen's slides nos. 100, 100a and 100b. Almost without exception these can be matched with species occurring in the Ludham borings, although several are confined to the Ludham Crag. The exceptions are those determined by Macfadyen as *Bulimina affinis*, *B. brevis*, *Cristellaria papillosa*, *Reussia spinulosa* var. *glabrata*, *Nodosaria obliquestriata*, and *Vaginulina legumen;* none except the first two species are represented by more than two specimens. The Ormesby assemblage contains no Mesozoic species, and although examination of Macfadyen's slide no. 95 (cells 1–11) indicates that his published list is incomplete, all of the species represented occur in the Crag of Norfolk. The list of species from the *Leda myalis* Bed (*loc. cit.* locality 9) is strongly reminiscent of those from the Corton Beds, and all could be largely derived from the Crag of Norfolk, with the addition of other species from Jurassic and Cretaceous sources.

Many of the Ostracoda of the Corton Beds, which were described by Brady, Crosskey & Robertson (1874, pp. 103–04), also occur in the Crag of Norfolk; the occurrence of the distinctive species "*Cythere*" *hoptonensis* in the Ludham Crag has already been mentioned in the account of the Early Pleistocene.

The next point about the Corton Beds to be considered is whether the sands of the sand-basins of the West Runton area are correctly correlated with the sands of the type area. Baden-Powell & Moir (1942) support this correlation. If it is correct then the Contorted Drift belongs to the North Sea Drift and not to the Lowestoft (Great Eastern) Glaciation, as was suggested by Solomon (1932). The field evidence suggests to me that it is not possible to make a positive correlation of the West Runton sands with those of the type area. It seems more likely that these sands are outwash sands, perhaps sub-glacial, and perhaps connected with the outwash episode which formed the Briton's Lane Gravels of Baden-Powell & Reid Moir (1942), in the Cromer Ridge south of Sheringham. This latter correlation was indeed suggested by Baden-Powell & Reid Moir on the basis of finding similar implements in both the deposits concerned. It is also supported by the finding of fragmentary, and evidently derived, marine shells of the same species in both deposits (see

Baden-Powell & West, 1960 pp. 74, 76). If Baden-Powell & Moir (1942) are correct in their correlation of the Norfolk occurrences with the type deposits at Corton, the finding of implements in the sands and gravels of this outwash episode suggests an interval of deglaciation between the North Sea Drift and the Lowestoft Till, as noted by Baden-Powell & Moir. On the other hand, if Solomon is correct in associating the Contorted Drift with the Lowestoft (Great Eastern) Glaciation, then the basin sands may have been formed during a retreat stage of the Lowestoft Ice Advance or during the later Gipping Glaciation. The finding of implements in the sands supports the latter correlation rather than the former, and if this correlation was correct, it would follow that the implements were made in the Hoxnian Interglacial. However, the Briton's Lane type of gravel, rich in erratics, occurs under and related to the chalky boulder clay or marly drift further west in Norfolk. This chalky boulder clay has been correlated with the Lowestoft Till (see above), which would suggest that the Briton's Lane outwash gravels (and the basin sands if they are contemporaneous) are of Lowestoft age.

Finally, we should consider the often-cited "interglacial" period of erosion between the North Sea Drift and the Lowestoft Till evidenced by the buried channel in the Yare Valley which is cut through North Sea Drift and Crag into Chalk and contains Lowestoft Till and outwash. Funnell (1958) has recently discussed this buried channel and he concludes that it was formed not sub-aerially but sub-glacially in relation to the Lowestoft Ice Advance.

Hoxnian Interglacial

The interglacial temperate period following the retreat of the ice of the Lowestoft Advance is well known from lake deposits lying on the Lowestoft Till in Suffolk, particularly those at Hoxne, near Diss (West 1956, 1960). This is the type site for the interglacial. In West Norfolk the interglacial is also recorded in the freshwater and estuarine beds of the Nar Valley, which have recently been studied by L. A. Stevens (1960). The deposits overlie a till correlated with the Lowestoft Till on the basis of stone orientation and erratic content. The vegetational succession of the Nar Valley beds, as discovered by pollen analysis, closely resembles that found at Hoxne, with an early park-tundra stage (zone I), followed by a mixed oak forest stage (zone II), and finally a mixed oak forest-coniferous stage (zone III) with pine, spruce and silver fir. The change from freshwater to estuarine sedimentation, indicative of a relative rise of sea level, takes place near the transition from zone II to zone III, and the maximum height of the transgression, as indicated by the highest estuarine sediments found by Stevens, was at least 75 ft. O.D. The presence of the estuarine deposits on the east margin of the Fens indicates that in Hoxnian times a precursor of the Wash was already in existence.

A further pollen diagram from this interglacial is presented in Fig. 15. This is from a lake deposit overlying the Lowestoft Till at Saint Cross, South Elmham, 2 miles south-east of Homersfield in the Waveney Valley. A boring in the old brick-pit at Saint Cross (TM 303840) showed the following succession:

0–50 cm.	Made ground
50–112 cm.	Red and grey sandy clay with flints
112–210 cm.	Calcareous grey-brown clay-mud with shell fragments

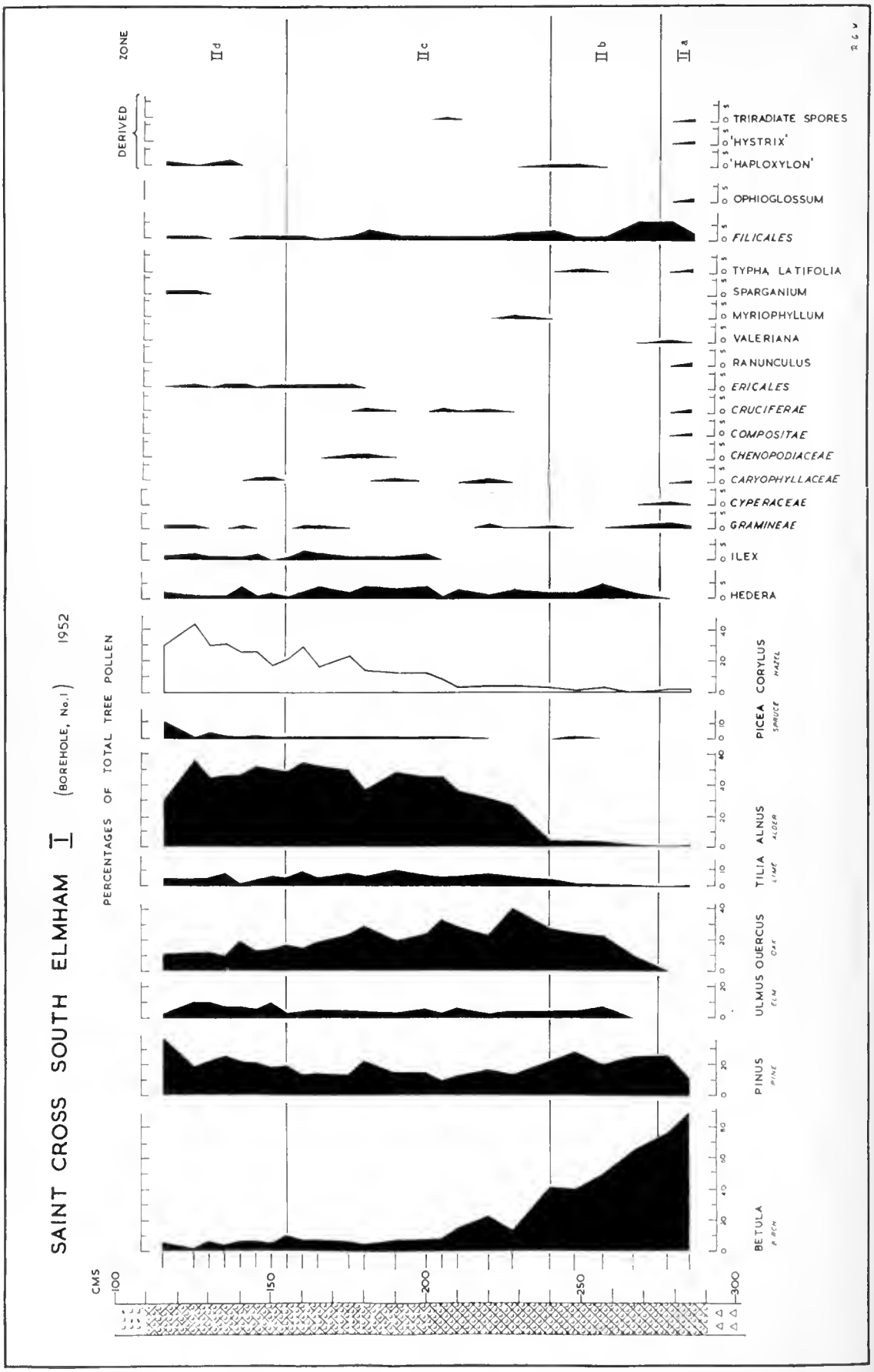

FIG. 15. Pollen diagram from lacustrine deposits at Saint Cross South Elmham

210–275 cm. Calcareous dark brown clay-mud, sandier at the base
275–290 cm. Calcareous black clay-mud
290–330 cm. Pale blue stiff sandy clay with chalk pebbles (Lowestoft Till)

The zonation of the pollen diagram from this boring exactly parallels the zonation at Hoxne, 8 miles to the west. The diagram covers a part of the interglacial, only the Early-Temperate Stage (zone H), which is characterised by the development of mixed oak forest, being represented.

It is unfortunate that no organic deposits of Hoxnian age have yet been discovered in the centre and north-east part of Norfolk, where the glacial stratigraphy is so hard to interpret. The finding of such a deposit in the coastal section would greatly facilitate the interpretation of the glacial sequence.

Gipping Glaciation

Tills of this glaciation have been distinguished in west Norfolk only. In the Nar Valley, Gipping Till and related outwash (cannon-shot) gravels were described by Stevens (1960). The gravels overlie the Nar Valley interglacial beds. In Breckland, Gipping Tills have been described by Baden-Powell (1948) and by West & Donner (1956). From the evidence of the distribution of the till, its erratics (Baden-Powell 1948) and the stone orientation (West & Donner 1956), it appears that the Gipping ice advanced over the western part of Norfolk down towards Ipswich—the eastern part of a large ice sheet which extended south nearly to London and west into the Midlands.

Many of the spreads of cannon-shot gravel in central Norfolk may be related to the outwash of the Gipping Glaciation, but these gravels still await detailed investigation.

In the Waveney Valley old kame terraces occur in the region from Diss to Homersfield, and near and to the east of the latter place. Funnell (1955) has described a terrace, at least partially fluvio-glacial in origin, the gravels of which contain a "cold" fauna, with mammoth, woolly rhinoceros and Irish elk. In 1960, plant remains indicating similar climatic conditions were also discovered in these sands and gravels at Broome, and are now being examined. It seems most likely that the outwash terrace is of Gipping age, otherwise we have to postulate a lobe of ice down the Waveney Valley during the Last Glaciation. It may prove possible to obtain evidence on the age of the terrace by a radiocarbon measurement of the organic deposit containing the plant remains.

Ipswichian Interglacial

Organic deposits of this interglacial are known from Suffolk, from near Cambridge, and from several places in the south of England. As yet none have been discovered in Norfolk[1]. However, it is possible that the peaty Mundesley River Bed (see Reid 1882) is of this age. The River Bed deposit lies in a valley cut in the Contorted and older drifts. An interesting fauna has been found in it, including *Emys lutaria* and *Hydrobia marginata*. Both these were found in the Ipswichian Interglacial deposit at Bobbitshole, Ipswich (Sparks 1957; West 1957). The water fern *Salvinia natans* has also been found in both these deposits. Determination of the age of the River Bed by pollen analysis would be very valuable for the interpretation of the coastal glacial sequence, and the deposit should be easily accessible by boring.

[1] Interglacial freshwater deposits of this age were discovered in August 1961 in the Fen Flood Relief Cut-Off Channel excavations near Stoke Ferry.

The raised beach between Morston and Stiffkey (Solomon 1932) has been correlated with this interglacial. Evidence for the age of the shingle is provided by the presence of weathered Hunstanton Till over it. The low height of the shingle implies no great difference of the interglacial sea-level from present sea-level.

Hunstanton (Last) Glaciation

The Hunstanton Till of the north-west and north coasts of Norfolk has been correlated with the Hessle Till of east Lincolnshire and east Yorkshire by many authors. Recent work by Suggate & West (1959) on the stone orientation of the till and on Late-Glacial deposits lying on its Lincolnshire correlative provide further evidence of the Last Glaciation age of the Hunstanton Till. The fine esker in Hunstanton Park is also related to this final stage of glaciation in north Norfolk, as are marginal drainage features elsewhere on the coast, as at Stiffkey.

The topography and gravels of north-east Norfolk

East of Stiffkey the glacial topography is still fresh enough to suggest a possible Last Glaciation age for the kames, kame terraces, outwash plains and the Blakeney Ridge. A preliminary description and discussion of these constructional features has been given by West (1957*a*). It appears that they are related to a lobe of ice which stood in the Glaven Valley and abutted against the rising ground to the east and west along the coast. The boulder gravels forming these features are the erratic-poor Blakeney Gravels of Baden-Powell & Moir (1942). They differ very much from the outwash gravels associated with the Hunstanton Till and also from the gravels of the Briton's Lane type, both of which are rich in erratics. In addition, the gravels near the surface of the features are considerably disturbed by cryoturbation. It therefore seems probable that these glacial features are older than the Hunstanton Glaciation and that they belong to a retreat phase of the Gipping Glaciation, which in this part of Norfolk may have reached its southern limit in this area. The preservation of such glacial features of the older glaciations is also known from Europe, where topographic features related to later stages of the Saale Glaciation are well known.

If this correlation is correct then a yet older stage of glaciation (Lowestoft?) is suggested for the erratic-rich Briton's Lane Gravels, which take part in an older topography dissected heavily by periglacial valleys, as described by West (1957*a*). Such a correlation of the Briton's Lane Gravels agrees with the dating of the chalky boulder clay associated with it, mentioned on p. 371. That a significant interval occurred between the chalky boulder clay and the Blakeney Gravels is also shown by the unconformable relation between this boulder clay and the constructional features formed by the Blakeney Gravel in the Glaven Valley area.

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I would like to thank Mr. B. M. Funnell for his helpful comments and discussion on many of the topics which I have considered here.

POSTSCRIPT

In April 1961, during a survey of the cliff sections from Weybourne to Happisburgh, the Arctic Freshwater Bed of Reid (1882, 1890) was rediscovered in the cliff section 50 metres south-east from the south-east end of the beach defences at Mundesley. The Arctic Freshwater Bed was in a channel cut in the underlying gravels and silts. The section towards the base of the cliff can be summarized as follows:

Grey chalky till (Cromer Till) of variable thickness, averaging 100 cm. thick.

Yellow-brown stratified sand, with scattered comminuted shells, and thin seams of organic detritus, 200 cm. thick.

Grey laminated peaty silt, with mosses, fruits and seeds, and leaves of *Salix* cf. *polaris*, lying in a channel about 50 cm. deep and 4 m. wide cut in the underlying bed. The peaty silt varies in thickness from 5 to 30 cm.

Rusty and yellow gravel and sand, with lenses of grey sand and grey clayey silt. At the top next to the channel is a band of grey clayey silt 30 cm. thick.

(Beach level)

Analyses of the pollen, fruits and seeds, leaves and mosses from this section are as yet unfinished.

The Arctic Freshwater Bed clearly represents a phase of cold climatic conditions prior to the ice advance which deposited the grey till. The sand below the till, with scattered communited shells and organic detritus is probably an outwash deposit. Such sand is frequently found below the till around the coast. There is no evidence to support a correlation of this sand with the *Leda myalis* Bed of West Runton.

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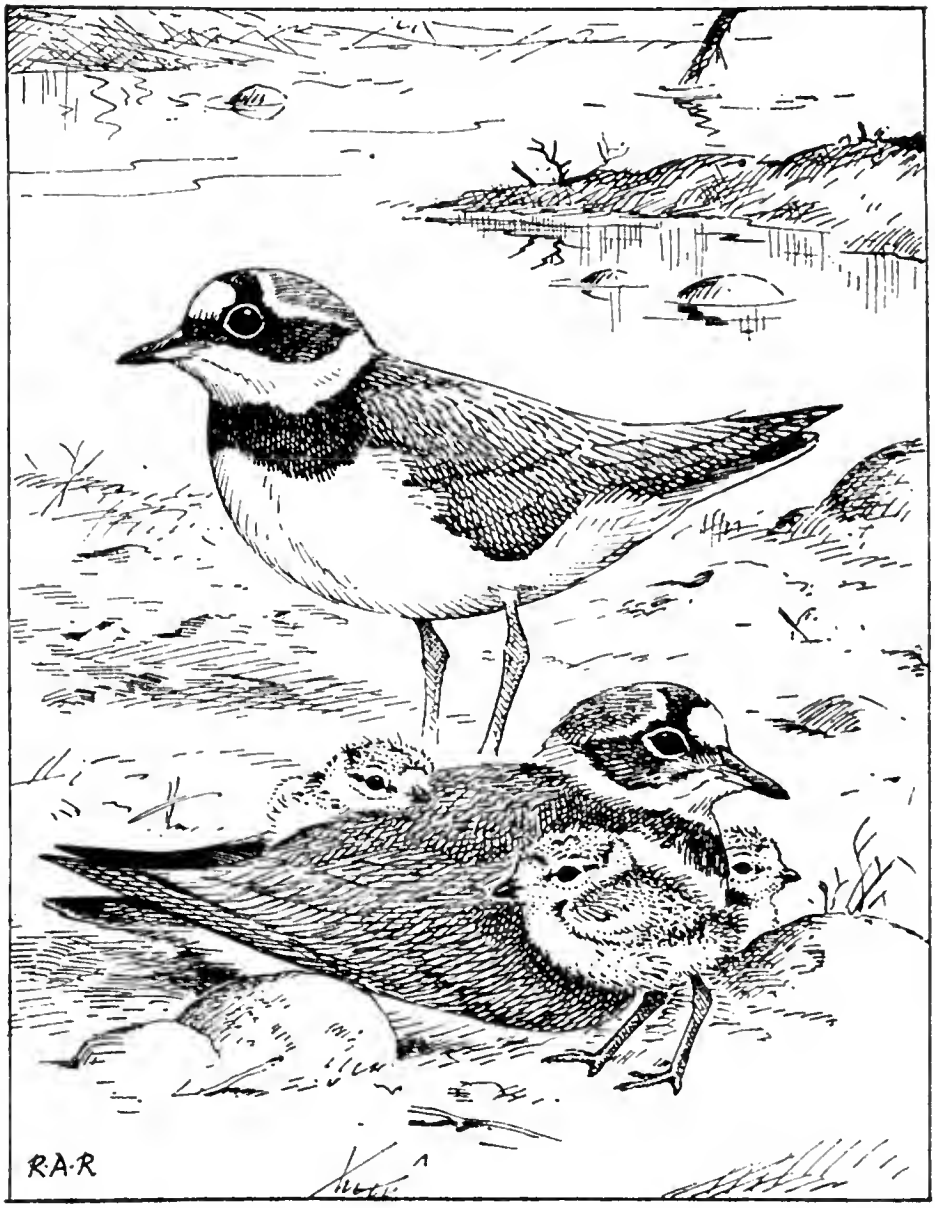
Copies of this publication may be obtained from the Paramoudra Club and the Norfolk & Norwich Naturalists' Society, price eight shillings (including postage), at The Castle Museum, Norwich, NOR 65B.

THE NORFOLK BIRD AND MAMMAL REPORT

1961



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Norfolk Bird Report 1961

INTRODUCTION

THE Council of the Norfolk Naturalists' Trust, in co-operation with the Norfolk & Norwich Naturalists' Society, is pleased to present to members the annual report on the birds of Norfolk.

Winter

In East Norfolk, goose totals were disappointing. White-fronts peaked at 140, beans at 30 and pink-feet at 23. On the North coast, a lesser white-front was identified amongst 91 brents at Cley. Brents peaked at a maximum of 3,000 birds. Winter highlights included kite at North Walsham and Cley; Mediterranean black-headed gull at Cley; spoonbill at Breydon; rough-legged buzzards and great grey shrikes at eight localities. Over 300 velvet scoters were counted between Hunstanton and Heacham in early March.

The wood pigeon campaign was intensified and it is estimated some 150,000 were shot on Feb. 6th.

Spring

April's most noteworthy visitors were hoopoe on Salthouse Heath on 23rd and male red-footed falcon at Cley on 30th. The latter re-appeared next day and what was presumably a different bird on May 16th. Ospreys were reported at eleven localities. In contrast with 1960, no large-scale movement of black terns developed but small groups made a brief appearance on May 13th/14th. The largest concentration was a total of 50 at Hickling.

Interesting waders which make up the May picture every year included Kentish plover at Cley on 8th/9th, up to 7 wood sandpipers, and Temminck's stints at both Cley and Wisbech S.F. on 21st.

At Scolt, a watch was kept for departing waders. Many small flocks of turnstones (maximum 30 birds) headed north each evening between May 22nd and 30th. 15 ruffs headed east on 29th whilst 142 grey plover were seen during the spring movement. Another surprise was a Mediterranean black-headed gull at Cley, May 9th. There were single male red-headed buntings at Cley, Salthouse and Breydon during May.

Summer

Unusual nest sites reported included a blackbird's between the radiator and the radiator grille of an ambulance at R.A.F. Station, Watton. A pair of blackbirds at Beighton reared 4 broods, 3 of

them in the same nest. At Methwold, song thrushes built a nest in sprouting broccoli. Two moorhen's nests at Sandringham were built in elder hedges; one at 8 feet, the other at 10 feet. At Thompson, 2 moorhen's nests were 15 feet high in thorns. 4 moorhen's nests at Blakeney were in hedges at heights up to 11 feet. The first brood left the nest by March 28th and a third brood departed Aug. 18th. Robins built a nest in the top of a kitchen mop propped up against the wall inside a shed at Bunwell.

A song thrushes' nest at Horsey was taken over and lined by a spotted flycatcher. Four flycatchers hatched and these were fed by both parent flycatchers and one song thrush. In Norwich, song thrushes successfully reared a brood and when they left the nest it was then occupied by chaffinches who constructed their own nest within the thrushes' and laid 3 eggs. A Surlingham song thrush returned to her old nest where she had brought off an earlier family and laid 3 eggs. Another song thrushes' nest at West Mere was in nettles at ground level.

At Eaton, blackbirds chose a stack of wooden crates with 4 in. by 4 in. wooded sections in them. On April 7th a nest was begun in the right-hand corner section of a crate in the second row of the stack. In 4 days a nest in the eighth crate from one end was almost complete, but by this time efforts had been made to build nests in exactly the same position in 14 other crates!

Pied wagtails nested inside a girder at the bottom of the jib of a large excavator in daily use at Frettenham. Wrens nested in a loudspeaker at an Aylsham auction room and in a swallow's nest at Corpusty Mill.

The nesting season was prolonged. A song thrush at Thompson had a full clutch of eggs, Feb. 29th. Young house martins were still in the nest at Thorpe, Oct. 12th and at Cromer on 22nd.

567 pairs of Sandwich terns and 2,100 pairs of common terns nested on the coast. At Ranworth Broad, a floating raft was provided for common terns and 12 pairs bred; the decaying wherry platforms had become unsuitable. 430 pairs of nesting herons, over 480 adult great crested grebes and 900 mute swans were counted.

Collared doves continued to increase and 40 had collected at one Yarmouth site at the end of the breeding season. Collared doves spread in a remarkable manner in 1961 and have now occurred in 36 counties. They have nested in 18 of them including quite a number of counties well away from the East coast including Dorset, Cornwall, Nottingham, Lancashire and Cheshire.

Black redstarts nested at Yarmouth. In Broadland, bearded tits again had a good season, but no marsh or Montagu's harriers bred. Little ringed plovers returned to the 1960 site and were also present at four other localities.

July's most unusual bird was a surprisingly early white-rumped sandpiper at Salthouse from 28th to 30th. Also of interest are the records of sheld-duck departing from the North coast and the Wash on moult migration to Knechtsand on the North Sea coast of Germany.

Autumn

The August wader pageant included parties of adult curlew-sandpipers still in breeding plumage, but compared with the 1960 invasion, little stints were scarce. Among other Northern waders, Temminck's stints appeared at Cley and Wisbech S.F. between Aug. 11th and Sept. 11th. An early purple sandpiper reached Breydon, Aug. 7th and black-tailed godwits were regular at Breydon for ten weeks. 17 species of waders were seen at Cantley settling ponds including red-necked phalarope, little ringed plover and spotted redshank. Other autumn wader highlights included a pectoral and 15 wood sandpipers and up to 20 spotted redshanks at Wisbech S.F.; 2 avocets at Breydon; and dotterel, pectoral sandpipers and red-necked phalarope at Cley.

Among interesting autumn warblers were aquatic at Cley, Aug. 11th and at Holme, Sept. 17th; icterine at Blakeney Point, Aug. 11th and Oct. 3rd; and barred at Cley, Aug. 31st and at Blakeney, Sept. 19th/20th. Easily the most fascinating record was a first winter male Radde's bush warbler from eastern Siberia at The Hood, Oct. 3rd.

Other noteworthy arrivals during this period included black redstart at Blakeney, bluethroats at Cley, Blakeney and Scolt, 5 ortolans at Cley, and red-breasted flycatchers at Blakeney and Holme. Among September birds of prey were honey buzzard at Cley and osprey at Hickling and Ormesby.

Between Oct. 16th and 18th severe N.W. to N. gales swept the Norfolk coast and among the many sea birds observed on the North coast and in the Wash were all four species of skuas. At Cley, on 18th, 82 Arctic skuas passed to the east, some were blown well inland and were seen over the coast road. 9 pomarine skuas were also identified there. At Heacham the same day 80 Arctic skuas were watched moving into the Wash and 6 headed inland. Numbers remained high in both localities next day. Leach's petrels and little auks appeared at the same time.

End of Year

Another N.W. gale sprang up Nov. 4th and sooty shearwater and black guillemot were at sea off Cromer. 10 great skuas appeared in the Wash between Hunstanton and Heacham. The gale abated next day when there was a spectacular influx of blackbirds and

other birds all down the East coast. Fieldfares were abundant: 35,000 arrived at Hunstanton but few of these birds came down as the blackbirds did.

At Cley on the 5th there were many thousands of blackbirds, at Mundesley 270 were counted on the clifftop, dozens appeared in gardens at Brancaster and at Horsey, some 300 were feeding in a meadow at Surlingham, coastal fields between E. Runton and Antingham were alive with them, over 3,000 arrived at Holme, several hundreds were in floodlit trees close to Cantley sugar beet factory, at Corpusty flights of up to 50 arrived from the east almost without a break for over three hours. At Yarmouth, numerous parties of blackbirds were watched coming in off the sea and by afternoon the whole district was alive with them. Many hundreds were on the marshes adjoining the Acle New Road and every roadside willow had two or three. In St. George's Park and St. Nicholas' churchyard, Yarmouth, blackbirds were present by the score. Light-vessels off the Norfolk coast had very large visitations. Drifter crews fishing in the Smith's Knoll area reported hundreds of blackbirds round their vessels at night. At Scolt, they arrived at the rate of over a thousand an hour. Inland, there were 400 at Swanton Morley, 300 at Hockham and 200 at Ovington.

Other notable November visitors were barnacle geese at Breydon, Salthouse, Holme and Scolt; firecrests at Cley and at Holme, waxwings from the 5th and a late hoopoe at Ridlington on 18th (possibly the bird at Mundesley on Oct. 30th). A flamingo over Thorpe on the 11th was presumably the same one filmed on the Stour at Manningtree the following day. It was an all-vermilion bird of the American race.

December reports included 35 black-necked grebes off Hunstanton, 2 adult lesser white-fronted geese in the Yare valley, a white-tailed eagle at Blakeney and at Holme, and an enormous concentration of kittiwakes in the Wash.

* * * * *

During an investigation on behalf of the Game Research Association into the effects of toxic seed-dressings one large-scale incident of mortality was discovered on a Norfolk farm near King's Lynn. The following dead birds were accounted for:—Pigeons (wood pigeons and stock doves but not separated) 175; in addition 269 wood pigeons and 20 stock doves were counted; greenfinch 68, chaffinch 39, tree sparrow 24, carrion crow 2, hedge sparrow 6, hooded crow 1, goldfinch 1, brambling 11, house sparrow 10, sparrowhawk 1, yellowhammer 8, unspecified small birds over 100, pheasant 140, lapwing 5, red-legged partridge 20, partridge 1, blackbird 6, song thrush 1, skylark 5, moorhen 5, jay 3, tawny owl 2, long-eared owl 2, barn owl 1, turtle dove 1, linnet 1, yellow wagtail 1. Total: Over 931.

Deaths were first noted at the end of Feb. and continued until mid-April, there was a resumption from mid-May to mid-June probably due to deliberate poisoning (JSA).

* * * * *

Varieties reported included an all-white moorhen photographed at Reedham, partly white blackbirds at Gorleston, Norwich, Alderford and Sheringham; also a pinky-buff blackbird at the latter place.

A melanistic golden plover appeared at Marham and melanistic house sparrow at Attlebridge. An all-white house sparrow was observed at East Bradenham, a roan-coloured starling at Taverham and a white swallow was bred at Claxton. A starling at Cley and Salthouse had fawn wings and tail but normal body; another there had a white tail. 236 species of birds were recorded in the county during the year.

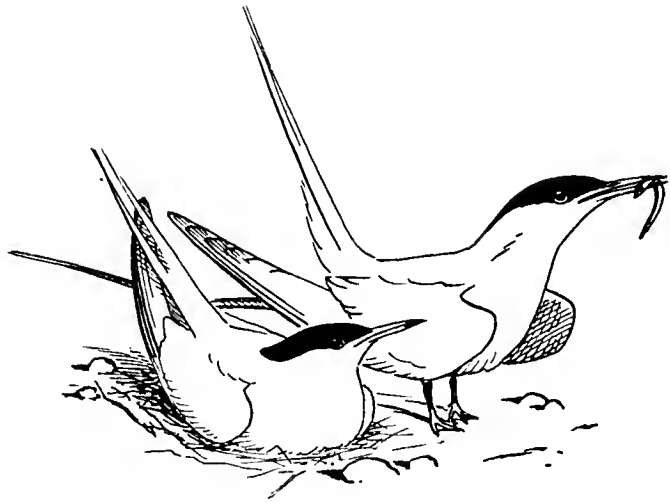
We are indebted to R. A. Richardson for the cover drawing of little ringed plovers and for other illustrations; also to D. M. T. Ettlinger, A. Gilpin, H. A. Hems, J. High and R. Jones for their photographs; to the Cambridge Bird Club (in particular G. M. S. Easy), to the Gt. Yarmouth Naturalists Society for light-vessel notes; to the Trinity House Depot at Yarmouth; to *British Birds* and to all other contributors.

Records for the 1962 Report should be sent **by the end of January** to Michael J. Seago, 33 Acacia Road, Thorpe, Norwich, NOR 71T. Records should be in Check List order rather than in diary form.

Attention may be drawn to the following papers affecting Norfolk published recently:

"The winter status of the lesser black-backed gull, 1959–60" (*Bird Study*, Vol. 8, pp. 127–147); "The inland breeding of the Oystercatcher in Gt. Britain, 1958–59" (*Bird Study*, Vol. 8, pp. 194–209); "The autumn movements of the wood pigeon" (*Bird Study*, Vol. 9, pp. 7–41); "Census of Black-headed Gull colonies in England & Wales, 1958" (*Bird Study*, Vol. 9, pp. 56–71); and "Dowitchers in Gt. Britain and Ireland" (*British Birds*, Vol. 54, pp. 343–356).

Notes on Breeding Birds of the Reserves



Scolt Head Island

(The Nature Conservancy)

WARDEN: R. CHESTNEY
ASSISTANT WARDEN: P. J. MAKEPEACE

The breeding season, although an improvement on 1960, was rather disappointing. Only 70 young Sandwich terns reached the free flying stage. By 1st July, 600 common tern chicks had hatched and at least 360 chicks had been found dead. Three days later, gale force northerly winds brought an exceptionally high tide and many young terns and clutches of eggs were lost. Some young Sandwich terns reached the mainland, but none survived. A short-eared owl fed almost daily on newly hatched common terns. On one occasion it was disturbed feeding on a young Sandwich tern. Some clutches of terns' eggs were destroyed by black-headed gulls and oystercatchers.

Human interference was disturbing. Twenty clutches of ringed plovers' eggs "disappeared" during the fine weather at Whitsun. Oystercatchers also suffered and at least 20 clutches were lost in the course of the season. Of 42 oystercatchers' nests found at Beach Point, Long Hills, Felters Hill and Butchers Beach, only 2 were known to succeed. 18 were destroyed by high tides. Of 100 ringed plovers' nests, mostly first clutches, 42 were destroyed by high tides on 1st June. Most of the first brood young redshank perished at the same time. From a total of 39 redshanks' nests found during incubation, 31 clutches hatched.

First broods of sheld-duck appeared 5th June. There was a concentration of 150 young in the vicinity of Little Ramsey 17th July. By the second week of July, over 2,000 common terns had assembled, together with 1,500 adult and 100 young Sandwich

terns. At the end of the month the evening assembly of Sandwich terns peaked at 3,000. Both Arctic and roseate terns were observed, but neither bred.

Records for the whole of the Island are summarised below:

	Number of nests or pairs of birds
Mallard	11 nests
Sheld-Duck	Over 100 pairs
Canada Goose	4 nests
Red-legged Partridge	8–10 pairs
Partridge	8–10 pairs
Oystercatcher	67 nests
Ringed Plover	158 nests
Lapwing	2 nests
Redshank	43 nests
Black-headed Gull	40 pairs
Common Tern	900 nests
Little Tern	28 nests
Sandwich Tern	472 nests
Wood-Pigeon	1 nest
Swallow	1 nest

Blakeney Point

(The National Trust)

WARDEN: W. EALES

Despite storm damage, the breeding season was more successful than in 1960 and many more common tern chicks reached the free flying stage. A number of terns had arrived by the end of April, but the first common tern's egg was not found until May 17th; little terns had five or six nests with eggs on May 8th.

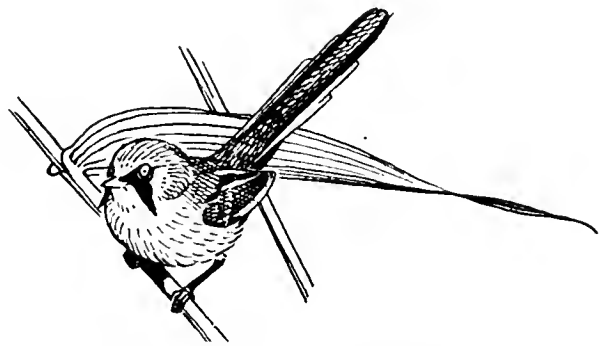
Following severe north-easterly gales with driving rain on June 1st, the majority of the terns' eggs were washed out, but repeat clutches resulted in one of the best common tern seasons for several years. Further gales from the north-west on June 12th brought in the same type of foam which caused so much destruction in 1960, but little damage was done. During the latter half of June large numbers of chicks hatched, but on July 4th a force nine gale resulted in almost the whole of the nesting area being under water.

No Sandwich or Arctic terns nested. Single pairs of partridge, lapwing and hedge-sparrow all bred for the first time, whilst two pairs of house-sparrows bred after an absence of many years.

The ternery at the Far Point and the Old Ternery were both wired off. This was a success and the common terns, no longer disturbed, remained brooding while visitors approached to within twenty feet of them. Thus the wire provided a protected area to the advantage of both birds and visitors.

The following is a summary of nests:

Sheld-Duck	36	Redshank	40
Red-legged Partridge ..	3	Common Tern ..	1000–1100
Oystercatcher	65	Little Tern	120
Ringed Plover ..	90–100	Swallow	2



Cley and Salthouse

(The Norfolk Naturalists' Trust)

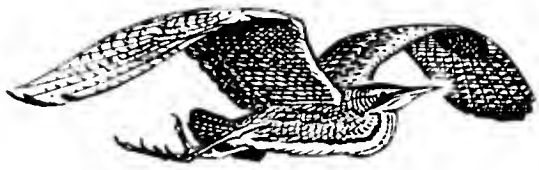
WARDEN: W. F. BISHOP

With a mild spring, ducks had a good nesting season. Mallard and sheld-duck numbers were maintained, two pairs of garganey, six pairs of teal and one pair of pintail bred. Twenty pairs of shoveler and ten pairs of gadwall summered.

Terns again had a disappointing season. One pair of common terns bred successfully on the North drain marshes, but the small colony on Arnold's marsh lost their eggs following high tides. A few pairs of little terns bred. Ringed plovers and oystercatchers had a more successful season than in 1960. Two pairs of stone-curlews reared young in the vicinity of Cley Hall farm.

Four bitterns were booming at Cley and Salthouse, but no nests were found. The Warden destroyed 600 coypus during the year. These animals are, without doubt, attracted to bitterns' nesting platforms where they perform their toilet. Three pairs of herons nested in The Hangs.

The bearded tit colony was larger than ever before. It is estimated there were thirty pairs, including eight to ten nests at Salthouse. The first nest was found April 1st. Some broods of young came to grief, possibly due to an increase of weasels along East Bank.



Hickling

(The Norfolk Naturalists' Trust)

WARDENS: E. PIGGIN assisted by G. E. BISHOP

Bearded tits again enjoyed a successful breeding season. Between 50 and 60 pairs nested round the Broad, at Whiteslea and Heigham Sounds. The first nest was found April 6th and the first eggs hatched nine days later. By the first days of May several young bearded tits had left their nests. The Wardens found at least 36 nests. Towards the end of the summer parties of twenty young were to be seen in the reedbeds. It is thought that ten to fifteen pairs remained to winter in the area.

Bitterns began booming as early as February 20th; five were booming at Hickling and three on the Sounds. For the second year in succession no marsh-harriers nested although birds were present all summer. Despite continuous trapping, coypus continued to damage the remaining reed and sedge beds. No Montagu's harriers were reported.

Common terns increased and five pairs nested on Rush Hills. Other interesting breeding birds included 11 pairs of great crested grebes and a similar number of herons; also single pairs of Canada geese and feral grey-lag geese. During the spring up to 20 gadwall, two pairs of garganey (which arrived March 15th), and 15 drake shoveler were on Rush Hills. Sheld-duck bred successfully. One pair of barn owls nested at Whiteslea Lodge.

Horsey

(MR. JOHN BUXTON)

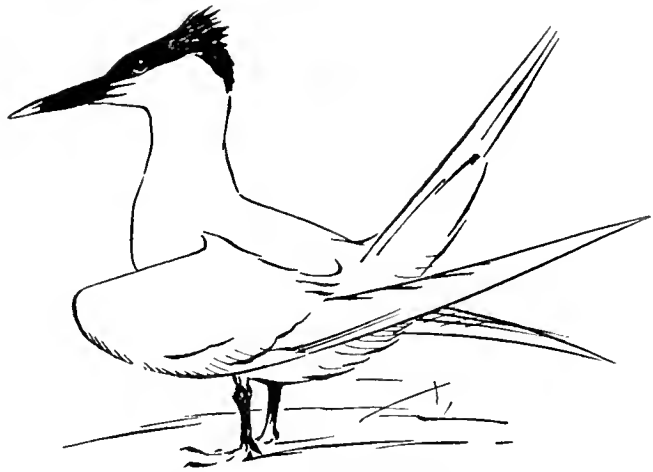
KEEPER: G. GREES

As in 1960, a total of about 25 pairs of bearded tits nested round Horsey Mere. The first nest found April 20th contained four young. Later in the season, several bearded tits' nests were lost in mysterious circumstances. One of the culprits was found to be a water shrew. Eruptive behaviour of small flocks was again recorded during September and October. Groups were observed flying high, then suddenly dropping into the reeds before taking wing again. Most departures were north-westerly. On October 9th, a party of 15 bearded tits flew over the Mere before disappearing in a north-easterly direction.

Five marsh harriers including two males arrived early in April but none paired and there was no attempt at nesting. A male Montagu's harrier arrived April 26th, but did not stay; a hen Montagu's appeared May 10th and stayed a fortnight in the district.

Bitterns began booming March 2nd. A nest found at Horsey Brayden April 26th contained four eggs and all hatched successfully. There were five booming males.

A water-rail's nest with nine eggs was recorded May 10th; a pair of stonechats reared two broods and short-eared owls were thought to have bred. No oystercatchers attempted to breed.



Scroby Sands

(Robin H. Harrison)

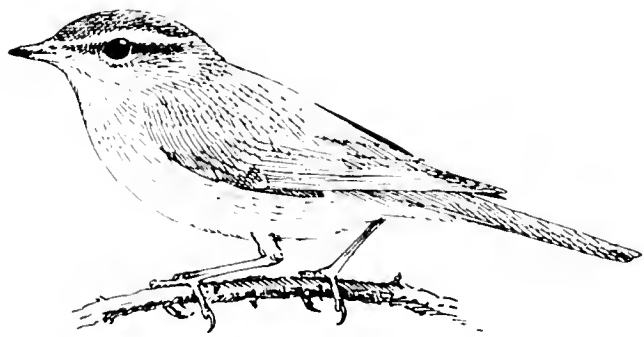
The first visit in 1961 was made on June 8th when scores of common and Sandwich terns' nests were found. Some common terns' eggs were on the point of hatching.

On June 26th, 95 Sandwich terns' nests were counted and there were some 200 common terns' nests. One of the few common tern chicks to survive spring tides earlier in the month was ringed. A

week later, 70 common tern chicks were ringed, also 7 young Sandwich terns. There were hundreds of terns' eggs still to hatch. A single little tern's nest was noted.

Everything seemed set for a good breeding season but on July 4th a north-westerly gale caused an abnormally high tide and mountainous seas. The tide was in fact a foot higher than it had been on July 1st 1960 when the sandbank had been completely covered. Unsettled weather continued for several days and it was not until July 14th that a landing was possible. As was to be expected, no chicks had survived. A few Sandwich and common terns were still present and three common terns' nests with eggs were found. These eggs soon disappeared, however, and were doubtless taken by greater black-backed gulls. Large numbers of these big gulls had assembled by the end of the month and they quickly devoured the carcases of common seal pups.

A final visit was made July 21st. Sandwich and common terns were still fishing close to Scroby, but for the second year in succession the nesting season had been a complete failure.



Radde's Bush-warbler

Cley Bird Observatory

WARDEN: R. A. RICHARDSON

As in past years the recording of migration was the Observatory's primary concern, and it was maintained almost daily.

1,290 birds of 78 species were ringed during the year, including five species new to the Observatory ringing list: Canada goose, red-legged partridge, little ringed plover, Radde's bush-warbler and red-headed bunting. Others worthy of mention were wryneck, bluethroat, 2 icterine warblers and red-breasted flycatcher.

A number of recoveries were reported and a selection follows the Ringing Progress list.

Full reports were sent to Kenneth Williamson (Migration Research Officer of the British Trust for Ornithology) for analysis in *Bird Migration*.

We are again grateful to Norfolk County Council for continued use of the trapping thicket at Walsey Hills on the Salthouse boundary; to Mr. Newton Leman for allowing the Ringing Hut to stand on his property and to the National Trust for permission to use mist-nets on Blakeney Point.

Details of hotel and cottage accommodation in the neighbourhood may be obtained by sending a stamped envelope to the Hon. Secretary, C.B.O., The Green Farm House, Cley, Holt, Norfolk.

* * * * *

A detailed account of the year's migration at Cley appears in *Cley Bird Observatory Annual Report*, 1961. Some of the most interesting observations appear below. Attention may also be drawn to the recently published *Check-list of the Birds of Cley & Neighbouring Norfolk Parishes* by R. A. Richardson. This 36-page volume gives the local status of 300 species with notes on habitat and dates of rarities.

* * * * *

March: The first 2 stone curlews returned to Salthouse Heath on 8th and the first 2 pairs of garganey were present next day. The first white wagtail appeared on 11th. A Sandwich tern arrived on 15th followed next day by the first wheatear.

A blackcap was new on 17th. 3 black-tailed godwits and 3 reeves followed next day. A sand martin passed on 28th, while on 30th the Sandwich tern flock stood at 30 with 50 present on 31st together with 8 wheatears and a ring ouzel.

April: A spotted redshank was new on 1st. 110 Sandwich terns were assembled next day, the first 2 swallows arrived and a willow warbler and a green sandpiper were seen. A little ringed plover came in on 3rd with an avocet. On the 5th Sandwich terns totalled 200. The first yellow wagtail arrived on 6th. Next day saw the first sedge-warbler and house martin. The first whitethroat followed on 8th. Redstart and nightingale both arrived on 10th. A cuckoo appeared on 12th, Greenland wheatear on 13th, blue-headed wagtail on 15th and common tern on 17th. A buzzard appeared on 19th; black tern, tree pipit and lesser whitethroat were all new. The first common sandpiper was seen on 20th with 5 little terns next day. On 22nd a black redstart was on the Point with a hoopoe on Salthouse Heath on 23rd when the first reed warbler was recorded. 4 black terns came in on 25th, a whinchat on 26th, avocet on 28th, pied flycatcher on 29th and a male red-footed falcon and a marsh harrier on the last day of the month.

May: The red-footed falcon re-appeared on 1st to be followed next day by a male red-headed bunting. The 3rd brought the first wood warbler. New on 4th were a garden warbler and red-backed shrikes. An immense westward passage of swifts and hirundines

took place on 5th and the first spotted flycatcher arrived. A little stint was seen on 7th, Kentish plover and Montagu's harrier on 8th and a first-summer Mediterranean gull followed next day. More Arctic waders were on the move including grey plovers, sanderling, knot, Arctic ringed plovers and whimbrel.

A hobby was over the marshes on 13th; the first nightjar was on the Heath and 5 black terns passed westward. Black tern numbers rose to 8 on 14th when there were 7 wood sandpipers. A cock red-headed bunting was at Salthouse, but it may have been the bird of 2nd May which on 3rd was mist-netted and ringed and taken from the dangerously busy coast road to the security of Salthouse Heath.

Another, or the same, male red-footed falcon was seen on 16th and a Temminck's stint appeared among the waders on 21st.

July: The first Arctic skua of the autumn arrived on 11th, and Northern waders again started to play a prominent role in daily observations. The first adult curlew-sandpiper was present on 16th. A great skua appeared on 21st and gannets began to appear inshore. Most noteworthy visitor was a white-rumped sandpiper from 28th to 30th.

August: 2 spotted redshank and 4 wood sandpipers were seen on 1st, with little stint, curlew-sandpiper, grey plover, knot, turnstone and whimbrel all newly arrived from the tundra next day. A little ringed plover, purple sandpiper, bar-tailed godwits and sanderling appeared on 3rd.

On the evening of 9th a party of 20 black terns suddenly arrived and left soon afterwards to the eastward, towering high into the sky. A tiny and short-lived arrival of European passerines was noted on 11th consisting of just four birds—a sedge warbler, pied flycatcher, aquatic warbler and an icterine. 2 dotterel passed through on 15th with another little ringed plover on 19th. 40 bar-tailed godwits and 9 black-tailed godwits followed on 20th. The first juvenile curlew-sandpipers appeared on 22nd, their travelling companions being knots, grey plovers, sanderling, ruffs and bar-tailed godwits. The 23rd brought 4 dotterel.

A young male peregrine came in from the sea on 27th and 6 spotted redshank arrived next day. The 30th brought 2 little gulls, pied flycatchers and 3 ortolans; a barred warbler following on 31st.

September: 2 wrynecks were on Blakeney Point on 2nd. Next day brought an evening arrival of 30 ruffs and reeves, a merlin, 6–7 Manx shearwaters and 2 little gulls, while all 4 species of skua were recorded. This movement continued next day with 12 great skuas and at least 30 Arctics, while Blakeney Point produced a goodly assortment of newly-arrived Scandinavian passerines

including 2 bluethroats, ortolan, black redstart, 40 wheatears, 30 pied flycatchers, 12 redstarts, 10 whinchats, willow, sedge and garden warblers, tree pipits and a red-backed shrike.

New birds on 5th included a bluethroat, wryneck and a Northern willow warbler. At Cley 12 little stints appeared with 4 spotted redshanks. On 7th the sea was productive with a strong eastward passage of 50 gannets, 80 Arctic skuas, 4 great skuas, single pomarine and long-tailed skuas and 3 Manx shearwaters. A Temminck's stint was new on 8th.

The 14th brought a honey buzzard, the first snow bunting and, on Blakeney Point, a wood warbler. A juvenile dotterel was on the beach on 16th with enormous numbers of swallows and house martins passing next day. New passerines included an ortolan and the first 2 Lapland buntings. At Blakeney on 19th an influx included 4 ring ouzels and a black redstart. On 22nd a buzzard came in from the sea, on 23rd there was a black redstart on the Point and a great spotted woodpecker was there next day. All 4 skua species were again reported on 24th. An immature red-breasted flycatcher was the highlight of 25th to be followed on 27th by 1–2 pectoral sandpipers.

October: The 3rd was probably our most exciting day of the year; it most certainly produced the rarest bird, for shortly after ringing an icterine warbler among the tree-lupins on Blakeney Point, a strange, large, dark olive leaf warbler was mist-netted in the *Suaeda* bushes at The Hood which proved to be a first winter male Radde's bush warbler.

The 7th brought many small, dark, song thrushes to Blakeney Point, together with robins, goldcrests, redstarts, 2–3 black redstarts, many chaffinches, a few bramblings and siskins and the first few redwings. A pectoral sandpiper was on Cley marsh on 8th.

Between 16th and 18th a severe gale ravaged the coast, veering gradually from N.W. to N. Among the species recorded were many skuas of all 4 species (Arctics predominating), at least 3 Leach's petrels and some little auks. When the storm had abated thousands of starlings and lapwings and a lot of skylarks resumed their spectacular westward passage with many wigeon and a few brent geese. Many hundreds of tree sparrows were also passing west on 22nd, the first shore-lark was seen and among a small party of long-tailed tits were some at least with pure white heads suggestive of Continental origin.

Immense numbers of starlings passed west on 29th, 200–300 twites moved eastward and a late Sandwich tern was inshore. The starlings continued unabated next day.

November: Another N.W. gale sprang up on 4th with 13 little auks and a big afternoon arrival of blackbirds. The gale abated on 5th, which provided the most spectacular day's immigration anyone

here can remember. Most of the birds arrived from the N.E., the waterfowl and most of the starlings turning westward on reaching the coast. Species involved were hundreds of thousands of starlings, many skylarks, fieldfares, redwings, wigeon, mallard, teal, brent geese, knot, dunlin, snow buntings, a few little auks and a dozen waxwings. As if this were not enough, the most immense "fall" of blackbirds began at mid-morning and continued till evening, females predominating till noon, males till late afternoon, and then a mixture till nightfall.

Two firecrests were seen on 11th, a water pipit returned to Snipe's marsh on 12th and a barnacle goose was at Salthouse on 17th. The month ended with a great grey shrike on the Heath on 27th.

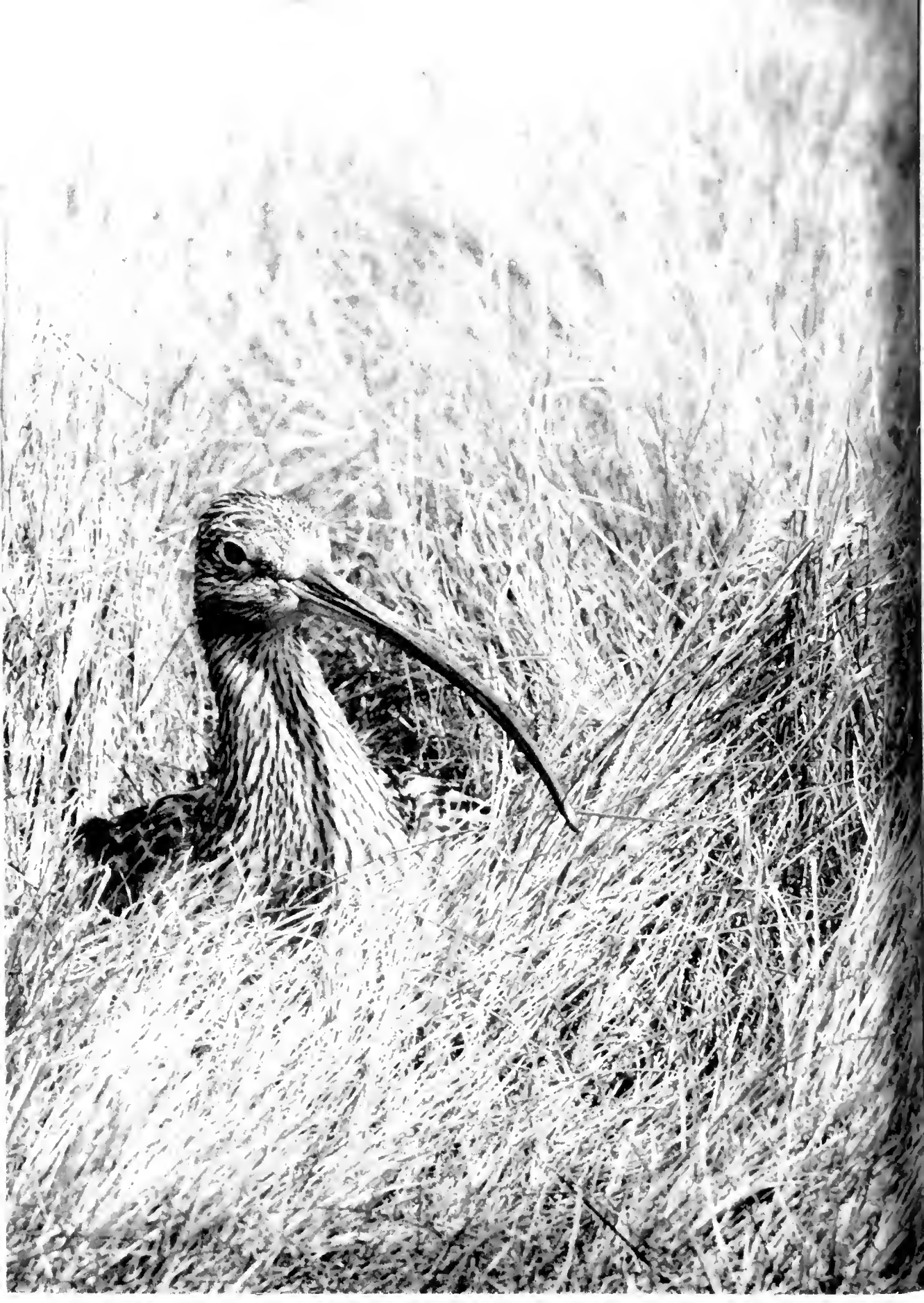
Hoopoe

CLEY BIRD OBSERVATORY RINGING PROGRESS

Species	1961	Total since 1949	Total Recoveries
Little Grebe		3	
Manx Shearwater		1	
Fulmar	8	60	1
Heron	3	43	7
Bittern		4	1
Mallard	1	21	5
Teal		2	
Wigeon		3	1
Scaup		8	2
Eider		1	
Sheld-Duck	6	13	
Brent Goose		1	
Canada Goose	11	11	
Mute Swan	6	8	
Sparrowhawk		1	
Montagu's Harrier		2	
Kestrel		21	2
Red-legged Partridge	1	1	
Common Partridge		1	
Water Rail	1	6	
Spotted Crake		1	
Corncrake		1	
Moorhen	3	15	1
Oystercatcher	1	34	1
Lapwing	35	402	3
Ringed Plover	9	86	
Little Ringed Plover	2	2	
Turnstone		2	
Snipe	6	29	1
Jack Snipe		2	
Woodcock		5	1
Wood Sandpiper	2	6	
Common Sandpiper	1	6	
Redshank	5	49	1
Knot		3	
Purple Sandpiper	1	4	
Little Stint		10	
Dunlin		20	1
Ruff		10	1
Grey Phalarope		2	
Stone Curlew		10	
Common Gull		1	
Black-headed Gull	7	265	6
Common Tern	5	116	1
Little Tern	11	28	
Sandwich Tern		752	5
Razorbill		4	
Little Auk		2	
Guillemot		5	
Stock Dove		34	2
Wood Pigeon	2	16	3
Turtle Dove	18	72	4
Collared Dove		4	1
Cuckoo	1	18	
Barn Owl	1	26	
Little Owl		8	
Tawny Owl	4	28	1
Long-eared Owl		6	
Short-eared Owl		10	3
Nightjar	1	5	
Swift		26	2
Kingfisher		2	
Green Woodpecker		2	
Great Spotted Woodpecker		3	
Wryneck	1	5	
Woodlark		16	
Skylark	5	194	3
Shorelark		1	
Swallow	113	582	9
House Martin	9	75	
Sand Martin	26	133	1
Carrion Crow		4	
Rook		60	2
Jackdaw		23	1
Magpie		12	
Jay		17	
Great Tit	8	246	
Blue Tit	28	580	
Coal Tit	2	38	
Marsh Tit		18	
Willow Tit		25	
Long-tailed Tit	31	106	1
Bearded Tit	1	6	
Nuthatch		12	
Treecreeper	1	27	
Wren	43	162	2
Black-belled Dipper		1	
Mistle Thrush		49	
Fieldfare	1	10	
Song Thrush	53	823	9
Redwing		39	1
Ring Ouzel	1	6	
Blackbird	60	1,226	21
Wheatear		147	1
Stonechat		11	2
Whinchat		54	
Redstart	13	183	
Black Redstart		30	
Nightingale	1	152	
Bluethroat	1	11	
Robin	54	801	3
Grasshopper Warbler		15	
Reed Warbler	49	166	1
Sedge Warbler	31	163	11
Aquatic Warbler		1	
Melodious Warbler		2	
Icterine Warbler	2	7	
Blackcap	3	178	1
Barred Warbler		9	
Garden Warbler	2	92	
Whitethroat	50	797	25
Lesser Whitethroat	3	51	
Subalpine Warbler		2	
Willow Warbler	15	556	1
Chiffchaff	6	64	
Wood Warbler		11	
Radde's Warbler	1	1	
Goldcrest	15	196	
Firecrest		3	
Spotted Flycatcher		83	1
Pied Flycatcher	22	148	
Red-breasted Flycatcher	1	5	
Dunnock	111	647	1
Meadow Pipit	5	375	9
Tree Pipit	1	25	
Rock Pipit		8	
Pied/White Wagtail	2	74	1
Grey Wagtail		4	
Yellow/Blue-headed Wagtail		139	2
Waxwing		2	
Great Grey Shrike		4	
Woodchat Shrike		2	
Red-backed Shrike	2	107	
Starling	4	488	11
Greenfinch	40	946	5
Goldfinch	8	57	
Siskin		3	
Linnet	71	485	6
Twite		2	
Lesser Redpoll	1	4	
Bullfinch	16	54	
Chaffinch	13	746	2
Brambling		297	1
Yellow Hammer	49	363	
Corn Bunting	3	8	
Red-headed Bunting	1	1	
Ortolan Bunting		1	
Rustic Bunting		1	
Reed Bunting	5	259	1
Lapland Bunting		7	
Snow Bunting		175	1
Tree Sparrow	7	144	1
House Sparrow	147	839	1
House x Tree Sparrow Hybrid		1	
GRAND TOTALS	1,290	16,946	195

Species Total: 1961—78; Since 1949—153

Stonechat numbers in Norfolk began declining after 1938 and by 1940 it was extinct, continued as a breeding bird to [illegible] Black Expanses of gorse in the Sandlings were cut 1945. A welcome return was made in 1958 when two pairs nested and in 1961 [illegible] pairs



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Increasing numbers of Curlew have bred in the Breck in recent years. In the Stanford area, in 1961, six pairs were present and two broods of young were found.

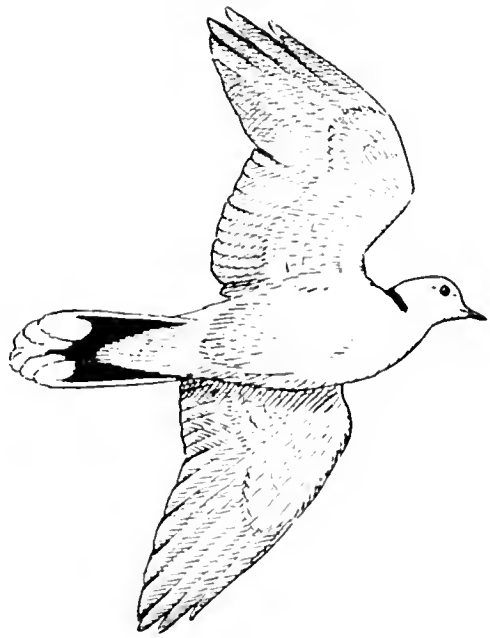
Selected Ringing Recoveries

(Notified in 1961)

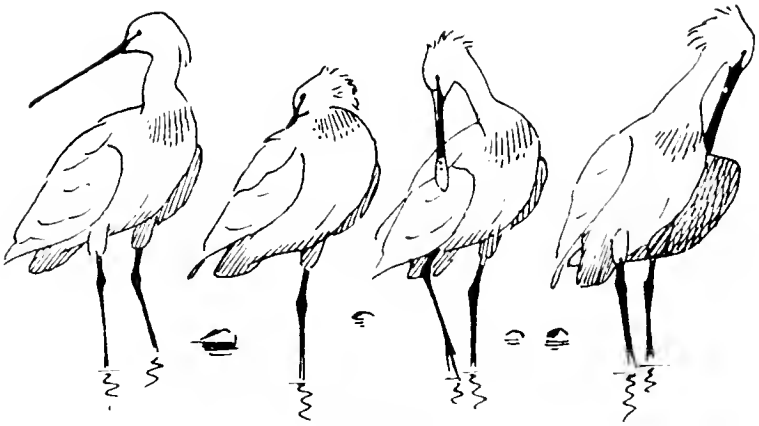
	Ringed	*Recovered*
Heron	Wiveton. 19.4.59. (as young).	Hazelford Ferry, Newark, 12.2.61.
Heron (3 birds)	Denver. 27.4.59.	Tarbes (Hautes-Pyrenees), France. 14.1.60; Preston (Lancs) 23.5.60. & Crickhowell (Brecon) 6.12.60.
Heron	Denver. 7.5.60.	Reville, Manche, France. 5.1.61.
Mallard	How Hill. 9.2.56.	Holwerd (Friesland), Netherlands. 7.1.61.
Mallard	How Hill. 14.2.56.	Hooge, North Frisian Islands. 9.12.60.
Mallard	How Hill. 15.2.56.	Suglitza, Segexha, Karelian A.S.S.R. 25.1.61.
Mallard	How Hill. 29.2.56.	Sint Anna Parochie (Friesland), Netherlands. 17.11.60.
Mallard	How Hill. 29.2.56.	Ballum near Logumkloster, (Jutland), Denmark. 22.12.59.
Mallard	How Hill. 16.1.60.	Larsmo, Engmo Island (Vaasa), Finland. 18.9.61.
Mallard	How Hill. 17.1.60.	Viborg (Leningrad), U.S.S.R. 14.8.60.
Mallard	How Hill. 18.1.60.	Samso Island, Denmark. Nov. 1960.
Mallard	How Hill. 18.1.60.	Narva (Leningrad), U.S.S.R. 14.8.60.
Mallard	How Hill. 10.2.60.	Riga, Latvian S.S.R. 21.8.60.
Mallard	How Hill. 14.2.60.	Ostrov (Pskov), U.S.S.R. 14.8.60.
Mallard	How Hill. 15.2.60.	Vastergarn near Masterby (Gotland), Sweden. 10.11.61.
Mallard	How Hill. 18.2.60.	Hortlax (Norbotten), Sweden. 29.9.61.
Mallard	How Hill. 18.2.60.	Berck Plage (Pas de Calais), France. 7.2.61.
Mallard	Meet Kerke, Bruges, Belgium. 8.11.59.	Barsham. Jan. 1961.
Mallard	Vest Stadil Fjord (Jutland), Denmark. 25.7.59 (as young).	Walsingham. 25.7.60.
Teal	How Hill. Feb. 1955.	Lavau-sur-Loire near Cordemais (Loire - Atlantique), France. 27.10.60.
Garganey	Engwierum (Friesland), Netherlands. Aug. 1958.	Burnham Overy. 3.9.58.
Wigeon	Wieringen (Noord-Holland) Netherlands. 25.1.55.	Norfolk. Feb/March 1957.
Pintail	Haarsteeg (Noord-Brabant), Netherlands. 25.2.57.	North Wootton. 9.1.59.
Sheld-duck	Estuary of river Weser, Germany. 31.8.58 (adult in moult).	Breydon. 28.1.61.
Sheld-duck	Walberswick. 31.8.60 (as young).	Terrington, King's Lynn. 13.9.60.
Lapwing	Gooderstone, Swaffham. 13.5.58. (as young).	Les Sables d'Olonne (Vendee), France. Oct. 1960.
Lapwing	Reenwijk, Netherlands. 21.3.55.	East Winch. 5.2.57.

Lapwing	Reeuwijk, Netherlands. 4.12.55.	Earsham. 8.1.58.
Curlew	Toysa, Finland. 6.6.60 (as young).	Brancaster. 3.10.60.
Knot	Revtangen (Rogaland) Norway. 21.9.52	Snettisham. 4.12.60.
Dunlin (7 birds)	Pori, Finland. 23.8.59. Ledskar, Sweden. 22.7.59 Ottenby, Oland, Sweden. 22.7.52. Ottenby, Sweden. 17.8.52. Revtangen, Norway. 30.9.56. Revtangen, Norway. 9.9.58. Amager, Denmark. 4.7.60.	Terrington. 24.8.60. All trapped and released
Great Black-backed Gull	Meloyvar (Troms), Norway. 20.7.59.	Gore Point. 23.1.60.
Herring Gull	Bass Rock. 23.6.59.	Terrington. 7.8.60.
Herring Gull	Isle of May. 30.8.57. (as young).	Thompson near Watton. 4.1.60.
Black-headed Gull	Lake Engure near Riga, Latvian S.S.R. 29.5.60. (as young).	Swardeston. 10.2.61.
Common Tern	Scroby Sands. 15.6.56.	Scolt Head. 14.6.61. Dead at Nest.
Common Tern	Scolt Head. 7.7.60. (as young).	Keta, Ghana. 17.9.61.
Common Tern	Coquet Island, Northumberland. 20.7.60. (as young).	Gt. Yarmouth. 4.9.60.
Sandwich Tern	Stiffkey. 21.6.59. (as young).	St. Vivienne du Medoc (Gironde) France. 3.9.61.
Sandwich Tern P16043	Stiffkey. 26.6.60. (as young).	Caught and released Porto Amboim, Angola, W. Africa. 26.6.61.
Guillemot	Calf of Man. 19.6.59. (as young).	Winterton. 27.8.60.
Blue Tit	Minsmere. 2.10.61.	Gorleston. 7.11.61. Released.
Fieldfare	Sundsvall, E. Sweden. 2.6.61.	Breydon marshes. 27.12.61.
Song-thrush	Cley. 10.10.59. (as Continental immigrant).	La Puerta de Segura (Jaen), Spain. 13.1.61.
Song-thrush	Blakeney Point. 16.10.60. (as Continental immigrant).	Queyrac (Gironde), W. France. Early Dec. 1961.
Redwing	Near Lake Engure, Riga, Latvian S.S.R. 27.6.60. (as young).	Acle. Early Feb. 1961.
Blackbird	Ytterby (Bohuslan) Sweden. 8.4.56.	Lyng. Jan. 1960.
Blackbird	Cley. 19.4.58. As adult.	Tim, Ringkobing (Jutland), Denmark. Sept. 1960.
Robin	Portland Bill, Dorset. 3.10.59.	Martham. 22.3.60.
Starling	Ventes Ragas, west coast of Lithuanian S.S.R. 21.6.61. (as young)	Inner Dowsing light-vessel. 15.10.61.
Starling	Near Hattula, south Finland. 27.5.61. (as young).	Haisbro' light-vessel. 30.10.61.
Starling	Loosduinen, Netherlands, 7.11.53. Then released in Geneva, Switzerland.	North Creake. Jan. 1956.
Starling	Wassenaar, Netherlands. 25.10.57. Then released in Basle, Switzerland.	Yarmouth Roads. 19.10.58.
Starling	Ventes Ragas, Lithuanian S.S.R. 23.6.61. (as young).	Haisbro' light-vessel. 30.10.61.
Starling	Sheringham. 19.1.59.	Flensted, Lasby (Jutland), Denmark. 1.3.61.

(**Greenfinch**	Meulebeke (W. Flanders), Belgium. 3.4.60.	Stoke Mill. 17.4.60.
(**Greenfinch**	Tourcoing (Nord) France. 16.2.60.	Scole. 7.5.60.
(**Greenfinch**	Fromelles (Nord) France. 31.1.60.	Needham. 4.5.60.
House Sparrow	Cley. 4.7.52. (as young)	Blakeney. End May 1961.



Collared Dove



Spoonbills

Classified Notes

The Wash and Fen records have been selected from the draft of the Cambridge Bird Club Report. Important records from Wisbech Sewage Farm, part of which is on the Lincolnshire side of the county boundary, have also been included. Fuller details may be found in the *Cambridge Bird Club Report* for 1961.

The number preceding the name of each bird refers to the *B.O.U. Check-list of the Birds of Great Britain and Ireland* (1952) where the scientific name may be found. All records refer to 1961, unless otherwise stated. Where no initials appear after a record, details have been supplied by many observers. No plumage descriptions are given of rarities accepted by the Rare Birds Committee of *British Birds*.

1 **Black-throated Diver**: One inland record: Haddiscoe Cut, mid-Jan.–Feb. 15th (RWC). Usual coastal records.

2 **Great Northern Diver**: East coast: One, Mundesley, Nov. 8th (RB). North: Singly at Wells, Jan. 25th (HH) and off Scolt, Dec. 12th/13th (RC). Wash: 3 winter records of 1–2, Heacham–Hunstanton (CBC).

5 **Great Crested Grebe**: During May/June, all known sites were visited and there was a county total of over 481 *adults*. 47 sites were occupied. The 1954 count revealed a total of 342 *adults* (see 1954 Report, p. 20).

Broads: Martham, 4 adults; Hickling, 14; Heigham Sounds, 8; Barton, 42–60; Alderfen, 1; Rockland, 30; Surlingham, 2–6; Burnt Fen, 4; Filby, 16; Rollesby (including 8 at Lady Broad), 69; Ormesby, 40; South Walsham, 10; Ranworth Inner, 30; Malthouse, 2; Wroxham, 26; Hoveton Great, 45; Black Horse, 10–20; Belaugh, 2; Woodbastwick Old Hall, 2; Upton, 2; Woodbastwick Decoy, 6; Salhouse, 8; Hardley flood, 10 and river Bure at Woodbastwick, 4 (one pair bred successfully). *Breck:* Stanford Water, 2; Thompson,

2; Mickle Mere, 13–19; Narford, 2–3; Narborough G.P., 2; Saham Tony Mere, 6; West Wretham Hill Mere and Rush Mere, 1–2 and Shadwell Lake, 4. *Fens:* Hilgay G.P., one; Welney G.P., 1–4; Runcton Holme G.P., 2; Downham Market–King's Lynn Relief channel, 2. *Other lakes and gravel pits:* Cawston Manor, 2; Felbrigg Pond, 2; Haveringland lake, 4; Blickling, 4; Sea Mere, 4–9; Holkham, 6; Stradsett, 12; Lenwade G.P., 6; Fustyweed (Elsing) G.P., 2; Taverham G.P., 2; Wortwell G.P., 2; Wolterton, 2; Scoulton, 4 and Melton Constable, 4. Negative reports from Horsey Mere, Buckenham Broads, Didlington lake, Fowl Mere, Stourton Water Cawston, Gunton Park, Reymerston G.P. and Beeston St. Lawrence lake.

Wash: Hunstanton–Snettisham counts include 100, Feb. 13th; 130, Aug. 13th and 250, Dec. 17th (CBC).

6 **Red-necked Grebe:** North coast: One, Wells, Feb. 2nd (HH) and 2, Brancaster, Nov. 19th (HR). Wash: Hunstanton, 2, Feb. 5th–March 12th and at least 4, Dec. 17th (CBC).

7 **Slavonian Grebe:** North coast: Singles in winter at Cley, Stiffkey and Wells. Broads: One, Horsey, March 28th (GC). Inland, 2 at Sea Mere, Feb. 6th and 2 at Narford on 16th (CG). Wash: Hunstanton, ones and twos in winter (CBC).

8 **Black-necked Grebe:** North: Singly, Scolt, Oct. 21st and Nov. 17th (RC); 4, Wells, Nov. 24th (HH). Wash: Recorded to April 8th and from Oct. 28th with 10–15 off Hunstanton cliffs end Nov. to mid-Dec. and 35, Heacham–Hunstanton, Dec. 17th (CBC).

12 **Leach's Petrel:** North: Cley, one on Oct. 18th and 4 on 19th. Wash: Heacham, 2, Oct. 19th (CBC).

16 **Manx Shearwater:** North (Cley, Scolt and Holme): 1–6 recorded on 11 dates, July 16th–Oct. 19th. Also 2 off Cley, May 21st.

21 **Sooty Shearwater:** North: Singles off Blakeney Point, Sept. 16th (DFB); Holme, Oct. 18th/19th (CBC) and Cromer, Nov. 4th (PT).

26 **Fulmar Petrel:** Recorded Weybourne to Happisburgh. No details of breeding successes but 38 pairs between Cromer and Sheringham. First (2) returned Cromer Nov. 19th then rapid build-up (CDR).

27 **Gannet:** Inland: An immature found at Hoe 20 miles from coast Nov. 20th (HR). Usual autumn coastal passage.

28 **Cormorant:** Wash: Remarkable flock of 80 off Snettisham, Sept. 9th (CBC).

29 **Shag:** North: 2, Cley, Jan. 14th; one, Morston, Feb. 14th (HH) and one, Scolt, May 16th–22nd (PJM). Wash: 1–3, Oct.–Dec. (CBC).

30 **Heron:** Details of heronries as follows:

Borders of Wash: Snettisham, 15 nests. *Fens:* Islington, 83 and Denver Sluice, 56 (AEV). *Breck:* Thompson Water, 4 (AWK); Didlington, 7 and Stoke Ferry, one (new site 1960 when also one nest—AEV). *Mid-Norfolk:* Kimberley Park, 25 (PRB) and Keswick, one (*per* EAE). *Broads area:* Gen. McHardy's wood, 3; Whiteslea, 3; Heigham Sounds wood, 5 (EP); America wood, Earsham, 13 (JWM); Fishley Carr Acle, 6 (RJ); Upton, 9 (RJ, MJS); Wickhampton, 39 (ETD, MJS); Buckenham, 43; Mautby, 23 and Ranworth, 40 (MJS); Ranworth marshes (Horning Hall), 6 (RB); Heron Carr, Barton Broad, 7 (DS); Belaugh Broad, 2 (RECD) and 3 new sites each with one nest: Wheatfen (EAE), Runham (*per* PRA) and Martham Ferry (*per* RJ). *North:* Melton Constable, 11 (RPB-O); Holkham Park (Obelisk wood), 11; Gunton Park (The Grove), 7 (*per* MJS); Wiveton Hall, 4 (CO) and Cley (The Hangs), 3 (WFB). Total: 430 nests at 29 sites. None nested in Narford Park (DW).

38 **Bittern:** Yare valley, one pair bred successfully at Reedham (KP). A new locality.

42 **Spoonbill:** East: Breydon, the immature which stayed 2 months in late 1960 re-appeared Feb. 15th (RFH) and stayed till April 13th. During the first half of Jan. one, doubtless the same, was on the Suffolk Blyth. Also 2 there June 21st and one, July 10th and 20th (RHH). Broads: Hickling, one on May 28th (EP).

47 **Garganey:** First, Cley (2 pairs) March 9th and Breydon on 11th (PRA). Breeding season records from Cley (maximum 5), Surlingham Broad (one male), Martham Broad (3), Blackfleet Broad (3); Hardley (2 pairs), Hickling (2 pairs) and Cantley reservoir (one pair). Breck: A pair Lang Mere, June 8th (CBH). Fens: Ouse Washes, spring maximum 11, April 8th (CBC).

49 **Gadwall:** Maximum counts: Breck: 62 at Narford, Jan. 22nd, 50 on Feb. 22nd and March 1st and 50 at West Acre G.P. Nov. 22nd (DW); 100–120 at Little Cressingham, Jan. 1st (GJ) and 200–220 at Stanford Water, May 30th (WJ *per* GJ). Mid-Norfolk: 40 at Sea Mere, March 16th (CG). Broads: 30 at Hickling, March 15th (EP). North: 30–40 at Bayfield, Jan. 12th–14th (PJW); 40 at Raynham, Sept. 10th (AEV) and 25 at Cley in mid-Dec.

50 **Wigeon:** Winter counts include 2,000 at Morston third week Jan. with further increase in following week. Summer records include up to 4 drakes at Hickling till end of May and one drake, June 26th (EP); up to 6 at Breydon, May 6th–June 24th (PRA). Fens: Ouse Washes, Welney–Hilgay, maximum of 6,000, Feb. 4th (CBC).

52 **Pintail:** East: Breydon, peaks of 35, Jan. 28th (PRA) and 80, Dec. 31st (RHH). Breck: 11, Little Cressingham, Dec. 30th (GJ). North: Cley, 44 on April 1st. Fens: Ouse Washes, maximum of 3,000 on March 5th (CBC).

53 Shoveler: Largest counts: Broads area: 300, Hickling, March 15th (EP); 50, Hardley, May 22nd (PRA); 100, Berney Arms, Oct. 28th (RIH). Breck: 50, Narford Lake, Dec. 12th (DW) and 68 Little Cressingham–Bodney, Dec. 31st (GJ). Fens: Ouse Washes, Hilgay–Welney, up to 310, Jan. 1st–early Feb. (CBC).

55 Scaup: North/East coasts: 1–10 in usual areas, with 60 west at Blakeney, Oct. 12th (HH). Breck: One, Narford lake, Feb. 22nd (DW). Broads area: Single drakes at Breydon, May 11th–20th and Aug. 15th (PRA) and at Cantley reservoir, Aug. 14th–18th (PRA, GRS) also a pair, Ranworth, April 30th (MJS). Wash: Heacham–Hunstanton, counts include 600, Feb. 5th; 150, March 5th and 60 by Dec. 28th (CBC).

56 Tufted Duck: Breeding records only are given. Fens: 7 broods Runcton Holme (AEV, DW). Breck (total of 16–17 broods): one brood Lang Mere; one, Fowl Mere; 2, Shadwell lake; one, West Acre G.P.; 2, Stanford Water; 3, Tottington West Mere (AEV); one, Thompson Common (AWK); 2 3, Cockley Cley (CRK) and 3, Rush Mere (PH).

57 Pochard: Broads area: 2 broods Rockland (ETD, WKL) and one brood, Surlingham (CBH). Over 200, Horsey Mere, Dec. 21st (PRA). Breck: 2 broods Stanford Water (AWK, AEV) and one brood, Tottington West Mere (AEV). Winter maximum of 47, Fowl Mere, Dec. 24th (GJ).

61 Long-tailed Duck: Broads: One, Surlingham, Nov. 26th (CBH). East: One, Winterton, Aug. 26th (MJS). North: Cley, 3 through Jan.–Feb. 19th and 4 west, Nov. 4th. Wells, 2, Jan. 12th and Feb. 13th; one, Nov. 10th (HH). Scolt, 2, Jan. 16th and singly Dec. 26th–30th (RC). Wash: Hunstanton–Heacham, recorded up to April 8th and from Oct. 28th with 16, Nov. 12th and 25, Dec. 17th (CBC).

62 Velvet Scoter: North: No party exceeded 7 in number. Wash: Hunstanton–Heacham, 185–200, Feb. 5th–10th; 325 on March 5th and 100 by Oct. 29th (CBC).

64 Common Scoter: North/East coasts: No flocks over 400 reported. Wash: Heacham–Hunstanton, many winter counts 1,500–2,500 with maximum of 3,000 (CBC).

67 Eider-Duck: East: Drake, Waxham, Oct. 14th (MJS). 40 near Corton L.V. (6 miles off Yarmouth) Nov. 3rd (RIH). North: Brancaster area: Present all year with up to 20 in spring/summer. Up to 15 at Cley and 20 at Wells in winter. Wash: Heacham–Hunstanton, up to 30 on 3 dates Jan.–March and build-up Nov.–Dec. with 350 by 17th (CBC).

69 Red-breasted Merganser: East: A drake, Breydon, Dec. 16th (PRA). North: Parties up to 15 at usual localities. Wash: Hunstanton–King's Lynn, 50–60 in winter and one summered on Snettisham G.P. minus a wing (CBC). Breck: 4 at Narford, Feb. 5th (CBC).

70 **Goosander**: Breck: Largest number, as usual, at Narford where 32, Jan. 22nd; 36, Feb. 1st; 24 March 15th and 4, Dec. 12th. Also 4 at Thompson, Jan. 9th (ALB) and 17 there Feb. 5th (CBC). 1–3 at Breydon, Horsey Mere, Cantley, Sea Mere and Wells.

71 **Smew**: Breck: One, Narford, Jan. 22nd–Feb. 1st. Sea Mere, 2–4, Jan. 26th–31st (CG). No others reported.

73 **Sheld-Duck**: Moult migrant records: At Scolt: two distinct movements: a westerly one commenced June 16th and consisted of small groups usually of less than 10 leaving the Island during eve. A light easterly movement commenced June 14th and lasted till July 10th. 250 counted during this period. Movement recommenced July 22nd on much heavier scale, 200 birds being seen during 6 days (PJM). At Cley, 30 east July 22nd with several east next day; 30 west, Nov. 4th and 180 west next day. On Wash, at Wolferton, total of 2,600 headed north shortly before dusk July 23rd in flocks of 100–150. Next weekend, only 50 remained on East side of Wash (CBC). Off Mundesley, 31 coasting NW Nov. 4th and 3 moved NW on 5th (RB). Inland breeding sites include Gunton Park (2 pairs), Hickling, Surlingham and Cantley. Winter counts: Breydon, 559, Feb. 11th and 564, Dec. 30th (PRA). Holme, 1,150, Dec. 17th (CBC).

75 **Grey-lag Goose**: Yare valley, singly with the bean geese, Jan. 15th and Dec. 26th–31st (MJS). 3 at Breydon, Dec. 27th (PRA, GRS). North: Holme, 16, Dec. 24th (CBC).

76 **White-fronted Goose**: Breydon area: First 20, Jan. 15th increasing to 140 by early Feb. till end of month and 15 till March 11th. Autumn arrivals (15) Nov. 25th; 150 on Dec. 23rd and 200 by end of year (RHH, PRA).

77 **Lesser White-fronted Goose**: East: 2 adults in Yare valley, with bean geese, Dec. 26th/27th (MJS *et al*). North: An immature with 91 brents at Cley, Feb. 3rd–8th (RAR). The sixth and seventh fully authenticated county records.

78 **Bean-Goose** (*A.a. arvensis*): East: Yare valley, 7, Jan. 7th–15th increasing to 30 by the 29th (MJS). Last noted March 2nd (*per* RHH). 52, Dec. 26th–31st. North: Cley, 3, Feb. 28th–March 13th with 4 on 5th.

Pink-footed Goose (*A.a. brachyrhynchus*): Breydon area: 23, Feb. 24th (PRA). Last 17, March 18th. First in autumn (5), Nov. 30th with 16, Dec. 16th (RHH). North: 33, Stiffkey, Jan. 4th (HH).

80 **Brent Goose**: North: Blakeney, maximum of 1,800, Jan. 1st, declining to 800 by Feb. 4th and to 45 by March 25th; 800 by end of year. Cley, 91 (including 64 immatures) Feb. 3rd declining to 48 by March 1st. Wells, maximum of 1,150 end Jan. and early Feb. and remarkable peak of 2,250, Feb. 17th; only 80, March 11th (HH); 200 by end of year (HR). Brancaster, 550 through Jan./Feb. till March 6th when increase to 600 but down to 400 by 13th; 56, Nov. 5th; 600 by end of month and 400–450 during Dec. (RC).

Wash: Hunstanton, maximum of 400 (CBC). East: Breydon: One, March 11th–18th (PRA) and Nov. 12th and 2, Dec. 9th (RHH).

81 Barnacle-Goose: East: Breydon, one, Nov. 18th–19th (PRA, MJS). North: Salthouse, one, Nov. 17th–18th; Holme, one on 14th and 2 on 18th; Scolt, 2 on 20th/21st (RC). Wash: Hunstanton, one with brents, Dec. 28th (CBC).

84 Mute Swan: A second census was carried out in April/May (see 1955 Report, p. 36) and a county total of 904 adults, *including* 105 breeding pairs, was reached. Distribution as follows: River Waveney, 104; Nar, 4; Wissey, 30; Yare, 47; Thurne, 19; Ant, 7; Glaven, 4; Tas, 3; Bure, 107; Wensum, 19. Broads: 381 (including 340 at Hickling). Other waters (lakes, ponds, flooded gravel pits and marshes), 179. Excluded from the census were the Little Ouse, Great Ouse and Fens.

85 Whooper-Swan: North coast: Broads (Horsey, Hickling) and Breck (Lang Mere, Thompson, Rush Mere, West Mere and Stanford) 1–21 up to Feb. 28th and from Nov. 3rd.

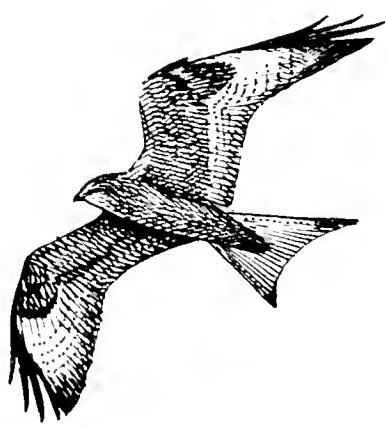
86 Bewick's Swan: East: Breydon, 3, Jan. 28th; 24, Dec. 16th (PRA) and 20 on 25th (RHH). Horsey Mere, 12 on Nov. 19th (JB). North: 8 records at Cley with maximum of 35 west, Dec. 16th. Breck: 13 Lang Mere, Dec. 17th (PRB). Fens: Ouse Washes: 100, Jan. 21st–Feb. 4th declining to 30 by March 5th; 17, Nov. 25th (CBC). Wisbech S.F.: 23, Nov. 12th (CBC).

91 Buzzard: North: Singly at Cley, April 19th and Sept. 22nd (CO) and at Blakeney on 29th (HH). A male preserved by HFA had been shot in the county Sept. 13th. Fens: One, Wallington Hall, Aug. 20th (CBC).

92 Rough-legged Buzzard: North: One, Cley, Jan. 1st–22nd. One shot Oulton, March 12th (now in Norwich Castle Museum). Broads: One, Horsey, March 10th (GC).

93 Sparrow-Hawk: Recorded from 21 localities.

95 Kite: North: Singly at Cley Feb. 15th–18th and March 4th (WFB, RAR, BB, RH) and at North Walsham, Jan. 25th–early Feb. and March 22nd (CL). Broads: One at Surlingham, March 22nd (EAE).



97 White-tailed Eagle: North: One, Blakeney Point, Dec. 6th (WE) and 15th (RM) and on beach at Holme, 24th (GMSE).

98 Honey-Buzzard: North: Cley, one east Sept. 14th (DFB, MB, GHL, GHR). Each observer familiar with this species and spent several weeks watching them at the nest in 1961.

99 Marsh-Harrier: None bred although at least 5 (including 2 males) arrived in Hickling/Horsey area in early April. 13 records of 1–2 on North coast marshes with 2 at Breydon, Aug. 23rd (PRA).

100 Hen-Harrier: Breck: One at Gooderstone, from early Dec. (CRK). Broads: 2 at Horsey, Nov. 1st (GC). East: Breydon, a male, Oct. 28th (RHH). North: Blakeney–Morston, singly on 5 dates, Jan. 6th–Feb. 12th (HH). Scolt, one, Oct. 13th (RC).

102 Montagu's Harrier: None bred. North: Singly at Cley May 8th and at Blakeney, Sept. 7th (HH). Broads: A male at Horsey, April 26th; a hen May 10th (GC) and a hen at Winterton on 23rd (RLCW). Central: One, East Bilney, May 25th (DMM). Fens: A pair at one site displaying early June but no nest.

103 Osprey: Singles as follows: North: Weybourne, May 22nd (CWH); Scolt, 24th (RC) and 29th (PJM); Antingham Ponds, 31st–June 6th (JHI); Blakeney and Cley, June 6th (WFB, WE, RP). Central: Sea Mere, May 5th/6th (CG, NL) and Lenwade G.P. 6th (JCC). Breck: Rush Mere, May 7th (PH) and Tottington West Mere, June 30th (WJ *per* GJ). Broads: Hickling, April 20th–28th (EP); Horsey, 27th (GC); Hickling, Sept. 8th (EP) and Ormesby on 9th (CW). An unpublished 1960 Breck record: one at Hill Mere, June 10th (PH).

104 Hobby: North: One at Cley, May 13th. West: One at Middleton, July 29th (CBC).

108 Red-footed Falcon: North: Cley, a male, April 30th–May 1st. Possibly same bird seen well May 16th (RAR, BB, E & TF, DB). Scolt: A female, June 16th (RC).

117 Quail: North: One calling, Blakeney, June 15th (HH). One, Cley Eye, Sept. 20th.

[**Golden Pheasant** (*Chrysolophus pictus*): Breck: Large numbers in Thetford Chase, especially in the Wretham–Hockham–Thompson triangle (ALB). Further records welcomed].

[**Demoiselle Crane** (*A. virgo*): North: One at Holme, Sept. 9th (CBC)].

121 Spotted Crake: Broads: Horsey, one, Nov. 4th (GC). North: Cley, one, Oct. 22nd (ARMB *et al*).

125 Corncrake: East: Winterton, one found dead Oct. 5th and now in Norwich Castle Museum collection; 2 there on 11th (JB). North: Cley, one, Oct. 23rd (WFB). Fens: Wisbech S.F. one, May 23rd (CBC).

126 Moorhen: One of the "hairy" variety caught at Hindringham, May 6th (RS, RPB-O). See 1955 Report, p. 39.

131 Oystercatcher: Breeding records: North: 65 nests at Blakeney Point and 22 pairs on south side of harbour; 3 pairs at Stiffkey, 11 pairs at Wells, 2 pairs at Overy Staithe and 67 nests at Scolt. East: One nest at Runham on arable (PRA). Wash: 3 pairs at Snettisham (CBC). Largest numbers: North: Wells, 1,600, March 3rd (HH) and 1,500, Dec. 7th (ALB). Wash: Snettisham, 10,000, Sept. 24th and 6,000, Nov. 12th (CBC).

135 Little Ringed Plover: West: Birds present during summer at five localities and breeding proved at two: *Site A* (Fen border where bred 1960), first noted May 15th and one pair reared 2 young. *Site B:* 2 pairs from June 4th; on July 5th 3 flying young and a fresh nest with 3 eggs; last noted Aug. 7th. *Site C:* Pair present July 7th–31st. *Site D:* One May 22nd; pair June 24th and pair which drove away a second pair July 6th. *Site E:* Pair July 30th. Passage records: East: Cantley, one Aug. 7th 15th (GRS, MJS). North: Cley, singly April 3rd, Aug. 3rd/4th and Aug. 19th (CO); Burnham Overy Staithe, one, May 20th (HH).

136 Kentish Plover: North: Cley, one, May 8th/9th.

139 Grey Plover: Autumn maxima: East: Breydon, 57, Oct. 7th (PRA). North: Blakeney, 80, Aug. 23rd; 90, Sept. 9th and 60, Oct. 16th (HH). Holme, 800, Sept. 8th and 1,600 on 24th (CBC).

140 Golden Plover: North/East: October peak includes over 500 Martham Holmes (GC) and 600, Blakeney/Morston (HH). Fens: 4,000–5,000, Ouse Washes, mid-March early April (CBC).

142 Dotterel: North: Cley, 2 west Aug. 15th, 4 west on 23rd (MFMM) and a juvenile on beach, Sept. 16th/17th.

143 Turnstone: North: Larger counts include 100 at Scolt, May 2nd (PJM); 60 at Blakeney Sept. 9th (HH) and 50 at Wells Dec. 29th (ALB). Wash: 300 at Terrington, end Aug. (CBC).

147 Jack Snipe: East: Large influx on lower Bure saltings and marshes Nov. 25th; 67 on wing at one time (RHH).

148 Woodcock: Breeding season localities for years 1959–61 inclusive are given (see also 1957/8 Reports): Broads area: bred Ormesby and Burnt Fen, roding at Upton. In North, recorded at Aylmerton and Hempstead; in the west roding at Marham, Feltwell and E. Winch; and in the Breck roding at Foulden and Cockley Cley and bred Thompson and Roudham.

150 Curlew: Breck: 6 pairs in Stanford area during summer and 2 broods of young found (AWK, GI).

151 Whimbrel: North/East coasts: Main spring passage from April 21st; peak of 95 heading N.E. at Breydon May 11th (PRA). Autumn return from July 1st with heaviest passage in Aug. when

up to 100 at Blakeney. Late birds at Breydon (2) Oct. 15th (RHH) at Blakeney, 8th–18th (HH) and at Brancaster, Dec. 11th/12th (RC).

154 Black-tailed Godwit: Recorded March–Oct. at usual localities. Largest parties at Breydon (where regular June 10th–Sept. 24th) with peak of 23 Aug. 26th. At Cley, records include 9, Aug. 20th and 8, Sept. 8th.

155 Bar-tailed Godwit: North: Largest autumn counts: 100 west off Weybourne, Aug. 18th (HH) and 1,500, Holme, Sept. 24th (CBC). In winter, 250 at Holme, Feb. 6th (RAR). Wash: 2,800, Hunstanton, Oct. 8th (CBC).

156 Green Sandpiper: Recorded all months except March and Oct. In winter at 8 localities. Maximum 15 at Cantley, Aug. 8th (MJS).

157 Wood-Sandpiper: Passage records from usual localities with up to 7 at Cley in mid-May. Last 2 at Salthouse Sept. 30th (MJS) and 3 at Cley, Oct. 2nd (WFB). Fens: Spring maximum of 7, May 18th and 15, Aug. 11th at Wisbech S.F. (CBC).

159 Common Sandpiper: East: One at Burgh Castle, Jan. 22nd (PRA) is only winter record. Fens: Up to 60, Wisbech S.F. Aug. 17th (CBC).

162 Spotted Redshank: North/East coasts, including Hickling and Cantley: Recorded April and June–Nov. also in Feb. and Dec. (at both Breydon and Scolt). Maxima at Cley where 6, Aug. 28th and 7, Sept. 6th. Fens: Wisbech S.F., recorded May 18th–20th and from Aug. 6th–Nov. 12th with autumn peak of 20 (CBC).

165 Greenshank: Spring passage of 1–4 birds from March 4th. Autumn return from July 1st to Oct. 18th with peak movements mid-Aug. to Sept. 6th when up to 18–20 together.

169 Knot: Wash: 12,000 or more summered at Snettisham. Maximum Hunstanton counts: 30,000, Oct. 28th and 22,000, Nov. 19th (CBC).

170 Purple Sandpiper: North coast (Thornham–Cley): 1–3 (with 8 at Scolt, April 17th–21st) recorded Jan.–May and Aug.–Dec. East: Breydon, one, Aug. 7th (GJ) and Yarmouth harbour, one, Sept. 4th (PRA, RWA). Wash: Heacham–Hunstanton, 1–6 to March 12th and from Sept. 17th (CBC).

171 Little Stint: North/East coasts: Spring passage of 1–2 birds May 7th–June 4th. Autumn return July 28th–Nov. 2nd with peak of 12 at Cley, Sept. 5th. Hickling Broad: 1–2, May 4th, 13th and 17th (EP, MJS). Fens: Wisbech S.F., up to 9, Aug. 9th–Oct. 22nd with 2, Nov. 12th and one on 19th (CBC).

173 Temminck's Stint: North: Cley, singly May 21st and Sept. 8th–11th. Fens: Wisbech S.F. singles May 21st, Aug. 11th and 22nd and Sept. 10th (CBC).

175 White-rumped Sandpiper: North: Cley and Salthouse, an adult, July 28th–30th (RAR, EF *et al*). Third county record.

176 Pectoral Sandpiper: North: Cley, 1–2, Sept. 27th–28th; one, Oct. 4th–11th (WFB). Fens: Wisbech S.F. one, Sept. 17th–21st (CBC).

179 Curlew-Sandpiper: North/East coasts: Only one spring record (one at Cley, May 21st–PJW). Very small autumn passage with adults from July16th–Aug. 21st (maximum of 6 red birds at Breydon Aug. 11th–PRA) and first juveniles Aug. 22nd; last Sept. 15th. Fens: Ouse Washes, Welney, 4 on May 21st (CBC).

181 Sanderling: Wash: Snettisham counts include 1,200, May 28th; 2,500, July 30th and 1,500, Aug. 13th (CBC).

184 Ruff: North/East coasts, Broads, Breydon and Cantley: Spring passage from Feb. 19th with maxima of 10 at Hickling April 20th and 15 east off Scolt May 29th (PJM). Peak autumn passage during first days of Sept. again coinciding with largest little stint numbers. Maxima 30 at Cley Sept. 3rd and 7 at Breydon on 6th. Fens: Wisbech S.F. up to 20 in spring; 70, Aug. 22nd; 85 on Sept. 8th fewer then (60–70) till Oct. 14th (CBC).

185 Avocet: East: Breydon, one June 9th–Aug. 11th; 2, Aug. 23rd (PRA). North: Cley, one, April 28th/29th.

187 Grey Phalarope: North: Singly at Gun Hill, Scolt, Oct. 22nd (LL-E) and at Holme, Nov. 4th. Wash: One, Snettisham, Oct. 22nd (CBC).

188 Red-necked Phalarope: East: Cantley, one Aug. 27th (MJS)–29th (PRA, GRS). North: Salthouse, one, Sept. 22nd (WFB).

189 Stone-Curlew: North: First 2, Salthouse Heath, March 8th and still present in Oct. Breck: Autumn gatherings include 10 at Weeting Aug. 7th (PN) and 12 at Stanford Heath, Sept. 15th (GJ). Last, Hockham, Oct. 26th (ALB).

193 Arctic Skua: North/East coasts: Autumn passage July 7th–Oct. 18th. Cley maxima include 80, Sept. 7th, 82 east in gale Oct. 18th and 47 east in gale on 19th. Wash area: 4 moving inland (16 present) Terrington, Aug. 19th; 15 moving inland, Holme, Sept. 5th; 27 moving inland Terrington on 7th; 80 moving into Wash and 6 inland, Heacham, Oct. 18th; 38 into Wash and 8 moving inland at Holme to shelter in meadow on 19th; 9 going inland, Thornham, Nov. 4th (CBC).

194 Great Skua: North coast (Holme–Salthouse): Autumn passage of 1–4 birds (with 12 off Cley Sept. 4th and 17 Holme on 8th–CBC) July 16th–Nov. 5th. Wash: 10, Hunstanton–Heacham Nov. 4th and a late bird at Snettisham Dec. 3rd (CBC).

195 Pomarine Skua: North: Cley/Blakeney, singly on 10 dates Aug. 2nd–Nov. 5th, with 2 on Nov. 4th and 9 (including 2 adults) all east, Oct. 18th. Holkham, 2, Aug. 2nd (JSA). Holme, one, Oct. 15th and 27 on 19th (CBC).

196 Long-tailed Skua: North: Cley, singly on 8 dates, Aug. 2nd–Oct. 18th with 2 on Aug. 19th. Scolt, one, Aug. 6th (RC).

198 Greater Black-backed Gull: East: Breydon, maximum of 1,000, Aug. 25th (PRA).

199 Lesser Black-backed Gull: North: Winter records of 3–4, Overstrand–Cromer, Dec. 24th and one on 28th (IFK).

200 Herring Gull: North: Single adults with yellow legs at Scolt, Aug. 23rd (RC) and at Blakeney, Nov. 4th (HH).

202 Glaucous Gull: North (Scolt–Cley) 10 records of 1–2 birds up to Feb. 13th (with one, May 17th) and from Oct. 23rd. East: Mundesley, one, Nov. 5th (RB).

203 Iceland Gull: North: Cley, singly, Oct. 21st (ARMB) and Dec. 30th (GHE).

205 Mediterranean Black-headed Gull: North: Cley, an adult Feb. 19th (RLL, CFM) and a first summer bird May 9th (RAR).

207 Little Gull: North (Wells, Blakeney and Cley): 1–2 (and once 3), Jan. 17th, May 9th–21st and on 9 dates between July 28th and Nov. 5th. East: Singly at Yarmouth Aug. 4th and at Breydon on 29th (PRA).

208 Black-headed Gull: Number of *pairs* at breeding localities: North: Scolt, 40, Overy Staithe saltings, 11, Stiffkey only 18, Morston–Blakeney saltings down to 42 (HH). Broads: Alderfen, 268 (ETD, MJS), Surlingham, 10 (EAE), and Martham, 13 (RLCW). Inland: Scoulton Mere, none nested on Heath and 80–100 pairs on Low Meadows had little success (GJ, AEV). Fens: Wissington B.F. 300–350 (AEV).

211 Kittiwake: North/East coasts: Summer counts: Scroby, 930, June 18th (MJS). Scolt, 60–70, second week of June to early July. Wash area: 800 N.N.E. at Hunstanton and 1,200 moving out of Wash at Holme, Oct. 19th. 2,250 entering Wash passing Holme Nov. 4th. Remarkable flock estimated 7 miles long feeding down centre of Wash Dec. 24th had possibly taken shelter after gales (CBC).

212 Black Tern: Spring passage began early with birds at Cley and Hickling April 19th. Small movement May 13th (including 25 at Breydon in 3 groups, total of 50 at Hickling, 7 at Filby/Rollesby Broads, 5 at Cley and 12 at Scolt) and 14th (including 14 at Hickling, 9 at Stokesby and 8 at Cley). Autumn passage July 30th–Sept. 19th, but apart from 20 at Cley, Aug. 8th, no party exceeded 5.

217 Common Tern: First, Blakeney, April 10th (HH). Last (Common/Arctic) Winterton, Oct. 31st (PRA) with 3 on Wash off Heacham Nov. 12th (CBC). Numbers of *nests* at breeding localities: North: Scolt, 900 and Blakeney Point, 1,000–1,100. East: Scroby

Not until 1960 did the Little Ringed Plover become an addition to the county list of breeding birds. The site was discovered from the air. In 1961, birds were present at five localities and breeding was proved at two. On passage, they have appeared annually since 1919 when two were identified at Saltfleet.

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Above: During May and June over 480 adult Great Crested Grebes were counted on 47 sheets of water. Largest concentration was 69 at Rollesby Broad. Considerable numbers winter in the Wash and 250 were noted between Hunstanton and Snettisham in December.

Below: Little grebes breed on many small lakes and ponds in the county and also on Breckland meres. This photograph was taken at the Cat-pits, Kelling, a regular breeding haunt for at least half a century.

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Sands, 200. Broads area: Ranworth, 12; Hickling, 5; Ormesby 7 and Hardley flood, one pair almost certainly bred; Surlingham, 2 pairs summered.

218 Arctic Tern: North: Recorded April 28th–Aug. 28th. None known to have bred.

219 Roseate Tern: North: None bred, but 1–2 at Blakeney/Scolt, May 11th–Sept. 10th.

222 Little Tern: Recorded April 15th (HH)–Sept. 26th. Breeding records of *pairs* include: Wash, Snettisham, 2–3 (CBC). North: Scolt, 21; Overy Staithe, 2; Wells and Stiffkey, 2 each; Blakeney Point, 120 and 10 on south side of harbour; Cley–Salthouse, 8. East: Winterton area, 2 colonies totalling 33 nests (RLCW).

223 Sandwich Tern: First March 15th. Last (4) Oct. 30th off Scolt (RC), Nov. 3rd (when one dying at Stiffkey–HH) and Nov. 12th when 2 off Heacham (CBC). Spring peak at Cley was 200, April 5th. Breeding records: Scolt, 472 nests and Scroby Sands, 95 nests.

226 Little Auk: North: Cley, 1–2 passing Oct. 19th; 13 passing Nov. 4th with a few more on 5th; 4 Holme and 5 Gore Point (one with starling flock), Nov. 4th; 5 Hunstanton–Holme on 5th (CBC). East: Yarmouth, one, Nov. 4th (PRA).

229 Black Guillemot: North: One off Cromer, Nov. 4th (PT).

230 Puffin: North: Singly at Cley/Blakeney, Aug. 26th (HH), Sept. 3rd and 16th.

235 Turtle-Dove: Summer flocks include 100 at Titchwell, first week July (*per* RH), 50–60 at Sea Mere mid-July increasing to 200 by early Aug. (CG) and 250 at Stow Bridge, Aug. 27th (CBC).

Collared Dove (*Streptopelia decaocto*): Breeding season distribution: North: 10–12 pairs, Cromer–Overstrand area, also present Hunstanton and one pair at Blakeney. East: Yarmouth–Gorleston: Recorded during summer at 8 sites and at least 6 pairs bred (including 3 pairs in St. George's Park). At one site 40 present (32 in one chicken run) on July 26th, with parties of 9–15 and once 21 at other sites in autumn and winter (PRA, RHH *et al*). E. Somerton, a pair, end of April (RLCW).

248 Long-eared Owl: North: A nest on Salthouse Heath April 2nd held 4 eggs and a newly hatched young one, but was robbed soon afterwards. No other breeding records received. 2, Blakeney, Sept. 29th (HH). Wash area: One, Sandringham, April 30th (CBC).

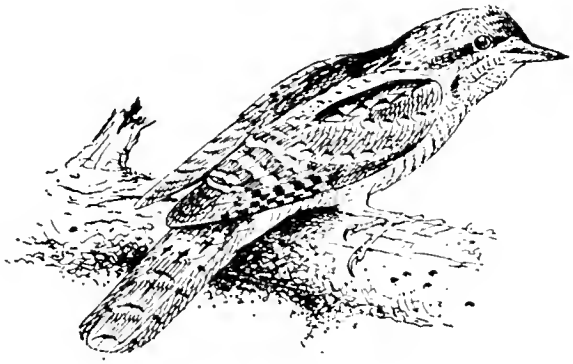
249 Short-eared Owl: East: One pair bred successfully Halvergate (RHH). North/East coasts: Usual winter records with maximum of 23 at Scolt, Nov. 21st. Fens: 12–13 together W. Walton, Jan. 27th (HPC).

252 Nightjar: Recorded May 13th–Oct. 4th when one on road by Buxton Heath (JML).

255 Swift: First, Cley, April 19th, but scarce till 30th. At Scolt, westerly passage June 16th with 100 increasing daily till peak of 700 on 22nd and held till 25th (PJM). Last, Cley, Oct. 3rd.

261 **Hoopoe:** North: Singly at Salthouse Heath April 23rd (DB), Fakenham, May 6th (WMM), Mundesley, Oct. 30th (RB) and Ridlington Common, Nov. 18th (CA).

263 **Greater Spotted Woodpecker:** North: One, Blakeney Point, Sept. 24th.



265 **Wryneck:** Central: One, Taverham, July 23rd (GAG). North: 2, Blakeney Point, Sept. 2nd and one on 5th. One, Holkham, Sept. 3rd (HPC, CNA). Singly at Scolt, Sept. 4th–8th (RC).

271 **Wood-Lark:** Central: Recorded at Horsford (PRA, GRS) and Felthorpe (ALB). Decreasing and all records welcomed.

273 **Shore-Lark:** North coast: Recorded at usual sites between Holme and Cley up to April 22nd (maximum 19 at Scolt Jan. 2nd) and from Oct. 8th (maximum 16–18 Blakeney Point in Dec.).

274 **Swallow:** First, Burgh Castle, March 27th (PRA). Eight Nov. records with latest at Briston on 22nd and at Caister, Yarmouth and Cley on 24th.

276 **House-Martin:** First April 6th. Young still in nest at Thorpe Oct. 12th (MJS). Six Nov. records with latest at Cley on 26th.

281 **Hooded Crow:** Again scarce in North coast area. East coast: 69 near Caister Jan. 15th, over 50 Caister airfield March 4th and a straggler there May 21st (RCM).

294 **Long-tailed Tit:** North: Cley, a party of 10 some, at least, of which had white heads Oct. 22nd (WFB). Blakeney, at least 2 with white heads Oct. 21st/22nd and Nov. 9th/10th (HH).

295 **Bearded Tit:** Broads area: Breeding records from Hickling/Heigham Sounds area (at least 75 85 pairs), Martham Broad (5 pairs), Barton (2 pairs), How Hill, Rockland Broad (one pair) and Waveney valley (7 pairs). Wintering birds remained at Surlingham Broad till April but no proof of breeding; also a male at Filby Broad Feb. 19th (AGH) and 2 at Hardley March 28th (PRA). High numbers again wintered at Surlingham and several at Hardley 1961–62 (PRA, MRR). At Haddiscoe during first few days of Oct.

many observed moving up river Waveney and on 3rd (when peak emigration from Minsmere, Suffolk) 6 parties totalling 25 counted in an hour (RWC). North: Cley/Salthouse, 30 breeding pairs. Blakeney Point, 2, Oct. 5th. Titchwell, party, Nov. 19th (HR). Holme Broadwater, 2, March 12th; 2 moving west Oct. 8th, 6 on 29th and frequently 3–4 up to Dec. 24th (CBC). Brancaster: 20, Dec. 6th (RC).

302 **Fieldfare:** North: Very late records of singles at Blakeney, May 25th/27th and June 8th/9th (HH).

307 **Ring Ouzel:** North: Singly at Cley, March 24th and 31st, April 1st and May 1st and at Scolt, May 1st (RC) and 2nd (PJM). 4 at Blakeney Point, Sept. 19th and one there Oct. 20th. East: One at Gorleston, Oct. 3rd (PRA). Wash: 2, Wolferton, May 14th (CBC).

308 **Blackbird:** A most spectacular arrival Nov. 4th/5th. See page 380.

311 **Wheatear:** Coastal records March 16th–Oct. 31st and in Breck March 19th–Oct. 8th.

317 **Stonechat:** North: 2 pairs bred successfully at Blakeney/Morston (HH). East: One pair reared two broods at Horsey (GC) and 2 pairs bred successfully Hemsby–Winterton (JES, RLCW). Many autumn/winter records of 1–5 birds along North coast (8 localities) and on East coast at Haddiscoe, Halvergate, Breydon, Winterton and Horsey. Breck: A male, Didlington, Feb. 19th (CNA, HPC). Wash: 7 records including 4 at Snettisham, Feb. 5th (CBC).

320 **Redstart:** North: Breeding pairs at Cley Park, Kelling and Weybourne Woods. Central: A pair bred at Marsham (CAW). Breck: Bred at Merton, Little Cressingham, Stanford, Tottington and West Tofts (GJ). North: Single late birds at Cley Oct. 29th and at Sheringham Nov. 7th.

321 **Black Redstart:** Only breeding records from Yarmouth where a nest near Southtown Road (*per* PRA); mummified remains of a young bird found in warehouse near Power Station in early Oct. (CA). North coast (Scolt–Cromer): Single birds at usual sites March 10th–April 23rd with one at Scolt ternery July 12th (RC, PJM) and at Kelling Heath on 16th and 1–3 birds from Sept. 4th–Dec. 28th. Elsewhere, singles at Norwich Feb. 8th (EWM) and at Breydon, Sept. 23rd (PRA).

322 **Nightingale:** Spring arrival from April 10th.

324 **Bluethroat:** North: Cley/Blakeney Point, 1–3, Sept. 4th–6th and singly 19th–20th. Scolt, one, Sept. 6th (RC).

327 **Grasshopper-Warbler:** Broads: Spring arrival from April 11th.

337 **Sedge-Warbler:** Spring arrival from April 6th.

338 **Aquatic Warbler:** North: Singles at Cley Aug. 11th (RAR, BB, RH *et al*) and at Holme, Sept. 17th (CBC).

340 **Icterine Warbler:** North: Single immatures, Blakeney Point, Aug. 11th and Oct. 3rd. Both ringed.

343 **Blackcap:** Early birds at Blakeney from March 16th (HH) and at Cley next day. A late female at Yarmouth, Nov. 18th (PRA).

344 **Barred Warbler:** North: Single juveniles at Cley, Aug. 31st (CO) and at Blakeney, Sept. 19th–20th (HH).

348 **Lesser Whitethroat:** First, Kelling, April 10th. A bird of the Siberian race *blythi* at Blakeney Point, Sept. 9th—22nd was ringed by CO.

354 **Willow Warbler:** Spring arrival from April 2nd. A bird of the Northern race *acredula* at Blakeney Point Sept. 5th.

356 **Chiffchaff:** Winter records, singly at Cley, Jan. 7th and 22nd and Feb. 12th–20th (3 birds). Spring passage from March 1st at Cley and from 12th in Breck. A late one singing, Blakeney, Oct. 16th (HH).

357 **Wood-Warbler:** North: First, Kelling, May 3rd. Breeding season records of single pairs at W. Runton, Upper Sheringham, Glandford, Hempstead and Holkham. One, Blakeney Point, Sept. 14th. West: Sandringham woods, one, April 30th (CBC). Decreasing, all records welcome.

363 **Radde's Bush-Warbler:** North: A first winter male ringed at The Hood, Oct. 3rd. Last seen on 5th (BRS, RH, RAR, HGA, KW *et al*). First county and second British record of this central and east Siberian species. Full details and a photograph appear in *British Birds*, Vol. 55, pp. 166–168.

365 **Firecrest:** North: 2 at Walsey Hills, Cley, Nov. 11th (*per* RAR). Holme, singly April 9th and Nov. 12th–14th (CBC).

368 **Pied Flycatcher:** North: Blakeney, 2, April 16th; one on 27th (HH) and 29th/30th; also one, Holkham, May 2nd. Autumn passage noted Holme–Salthouse, Aug. 11th–Oct. 7th. Maxima: Up to 100 in Holkham pines Sept. 3rd (CNA, HPC) and 30 on Blakeney Point on 4th. East: Yarmouth: Maxima of 12 Sept. 5th (MJS), and 18 on 9th with 2 on Oct. 1st (PRA).

370 **Red-breasted Flycatcher:** North: One at Blakeney, Sept. 19th–25th (HH) and a first winter bird on Point, 25th–29th. Holme firs, one, Sept. 4th–5th (CBC).

379 **Water Pipit** (*A.s. spinoletta*): North: Cley, one, Jan. 1st–Feb. 20th and again from Nov. 12th.

381 **Grey Wagtail:** In June, GRS visited 23 water-mills including 6 along Wensum, 4 along N. Walsham to Dilham canal, 5 along Bure, 3 along Yare, 2 along Waveney and Hapton Mill on Tas. Observer found single pairs breeding at Taverham and Hellesdon; birds also present at Bintree, Briggate and Marlingford. Additional

breeding season records: Whitwell Mill near Gt. Witchingham (male mid-June–RAR), Blickling Mill (pair with young–JML), Hilborough Mill and Narborough Mill (single pairs bred), Gressenhall (pair summered–SCP) and Tottington (adult feeding young June 5th–GJ).

382 **Blue-headed Wagtail** (*M.f. flava*): Fens: Wisbech S.F., one trapped Aug. 20th (CBC).

383 **Waxwing:** Jan. 1st 31st: Parties of 1–6 (and once 12) at Blakeney, High Kelling, Ridlington, Corpusty, Norwich and Wheatfen. Nov. 5th–mid-Dec.: Well over 40 records of 1–13 birds (with 30 at Wheatfen) at 29 localities.

384 **Great Grey Shrike:** Singles as follows: North: Salthouse Heath, Jan. 1st–April 9th and Nov. 26th to end of year; Blakeney/Morston, Jan. 17th–Feb. 14th and Blakeney, Dec. 25th (HB); Brancaster, Feb. 16th (*per* RC); Holme, Oct. 21st 22nd (CBC). Broads area: High Mill Ludham, Feb. 22nd (*per* EAE); Horsey, Jan. 1st for a few days and again April 5th (GC); Hickling, March 6th (EP) and Brundall, Dec. 25th (PRA). Also one dead at Winterton, March 20th (JB). Breck: Foulden, Feb. 19th (CBC) and Two Mile Bottom, Nov. 19th (CNA, HPC). Wash: Snettisham, Nov. 14th (CBC).

388 **Red-backed Shrike:** Breeding season distribution: West: One pair bred near King's Lynn (CBC). North coast: Total of 12 pairs at 8 localities. Breck: Recorded at 4 sites, but breeding only proved at one (GJ, IFK). East: 2 pairs bred at one site (RLCW).

East: An immature at Walcott, Sept. 10th-14th ringed and photographed by MJC showed the characters of one of the *isabellinus* group of central Asia, known as the red-tailed shrikes.

391 **Hawfinch:** North: Records from Salthouse Heath, Cley, Blakeney, Wiveton, Holt, High Kelling and W. Runton. Central: Ringland, Eaton Park, Norwich and Cranworth.

394 **Siskin:** For third year in succession unusual numbers recorded from some 35 localities up to April 17th and from Sept. 19th. Largest numbers in Breck including 75, Fowl Mere, Jan. 1st and 50 Saham Mere on 15th; 60, Watton, Feb. 5th; 150, Fowl Mere, Dec. 24th; 200, Stanford Water on 25th (GJ) and 50 Narborough on 31st (CNA, HPC). Central: Ringland, 2 adults and 3 fully fledged young Aug. 9th (RAFC) may refer to wild birds but siskins are still commonly kept as cage birds.

397 **Redpoll:** Singles showing the characteristics of the Continental race, *C.f. flammea*, in Upper Sheringham woods April 2nd (ECD), Blakeney Point Oct. 21st (ARMB), Wootton, Dec. 17th (GMSE) and at Taverham on 18th (NL).

401 **Bullfinch:** As in 1959 60, marked increases at many localities in Breck, central and North districts. Parties of 10–20 frequently reported with 45 on Salthouse Heath end Dec. One west Norfolk fruit grower claims to have destroyed some 300 bullfinches a year on 10 acres in the last 3 years (*per* EAE).

404 Crossbill: Breck: Records from 4 localities. North/West: 9 spring/summer records of 1–7 at Holkham, Wells, Blakeney, Salthouse Heath, Dersingham and Sandringham. Central: 2, Ringland, March 16th (RAFC).

408 Brambling: Recorded up to April 2nd and from Oct. 3rd with a late male near Walsingham, June 16th (HH). Largest winter flocks totalled 100–120 apart from 500 in Breck at St. Helen's well, Jan. 8th (CBC) and 300 at Rockland St. Mary early Dec. (EAE).

413 Red-headed Bunting: North: Single males at Cley, May 2nd/3rd (ringed by co and no sign of having been in captivity) and Salthouse, May 13th/14th (AGH, SW). East: Breydon, a male May 13th and 20th (PRA). See 1960 Report, p. 246.

416 Ortolan Bunting: North: Blakeney, a male, May 19th (HH). Cley, 3, Aug. 31st and singly Sept. 4th and 17th.

422 Lapland Bunting: North coast: Parties up to 11 till March 4th. First in autumn Sept. 17th with singles at Mundesley, Nov. 2nd–7th (RB). East (Halvergate/Breydon): Singly Dec. 28th/30th (PRA, GRS).

423 Snow Bunting: North/East coasts: Recorded up to April 9th and from Sept. 14th. Large total of 300–350 near Breydon, Nov. 19th (MJS). At Mundesley 55 came from sea and 235 coasting NW, Nov. 5th (RB).

The following, not mentioned in the Classified Notes, were also recorded in 1961 (breeding species in italics): Red-throated Diver, *Little Grebe*, *Mallard*, *Teal*, Golden-eye, *Canada Goose*, Peregrine Falcon, Merlin, *Kestrel*, *Red-legged Partridge*, *Partridge*, *Pheasant*, *Water-Rail*, *Coot*, *Lapwing*, *Ringed Plover*, *Common Snipe*, *Redshank*, Dunlin, Common Gull, Razorbill, Guillemot, *Stock-Dove*, *Wood-Pigeon*, *Cuckoo*, *Barn-Owl*, *Little Owl*, *Tawny Owl*, *Kingfisher*, *Green Woodpecker*, *Lesser Spotted Woodpecker*, *Skylark*, *Sand-Martin*, *Carrion-Crow*, *Rook*, *Jackdaw*, *Magpie*, *Jay*, *Great Tit*, *Blue Tit*, *Coal Tit*, *Marsh Tit*, *Willow Tit*, *Nuthatch*, *Tree-Creeper*, *Wren*, *Mistle-Thrush*, *Song-Thrush*, Redwing, *Whinchat*, *Robin*, *Reed-Warbler*, *Garden Warbler*, *Whitethroat*, *Goldcrest*, *Spotted Flycatcher*, *Hedge-Sparrow*, *Meadow-Pipit*, *Tree-Pipit*, Rock-Pipit, *Pied Wagtail*, White Wagtail, *Yellow Wagtail*, *Starling*, *Greenfinch*, *Goldfinch*, *Linnet*, Twite, *Chaffinch*, *Yellowhammer*, *Corn-Bunting*, *Reed-Bunting*, *House-Sparrow* and *Tree-Sparrow*.

Selected 1961 Light-Vessel Notes

Compiled by R. A. RICHARDSON

Leach's/Storm-Petrel: Haisboro', one, Nov. 7th/8th.

Heron: Haisboro', one, Dec. 14th/15th.

Sheld-Duck: Inner Dowsing, one, Nov. 7th.

Birds of Prey: Early Sept. brought a number of interesting reports of various hawks as follows: Haisboro', two "buzzards" on 4th; Corton a "buzzard" on 3rd; Cross Sands, a sparrowhawk on 1st; Smith's Knoll, two sparrowhawks on 4th preying on small migrant passerines including a robin, with a third bird on 5th. What was presumably another was on the Haisboro' on 4th. Cross Sands claims an osprey on 2nd and there was a kestrel on the Newarp on 3rd/4th.

Water-Rail: Haisboro', five between Oct. 16th and 20th, three there Nov. 7th/8th and one, Dec. 15th/16th.

Moorhen: Haisboro', one, Oct. 16th, two Nov. 7th/8th and one, Dec. 15th.

Lapwing: Inner Dowsing, Dudgeon, Haisboro' and Newarp all shared in the big immigration of Nov. 6th/7th. Cross Sands reported several passing westward, Sept. 24th and Haisboro' had a number on Nov. 14th/15th and Dec. 14th.

Jack Snipe: Haisboro', one, Nov. 5th/6th.

Woodcock: Haisboro', one, Nov. 6th/7th and four, Dec. 15th/16th.

Barn Owl: Haisboro', one, Nov. 6th.

Skylark: Newarp, Haisboro' and Lynn Well all report a movement on Sept. 3rd and the latter station again had a number passing on Sept. 19th and 24th. Early Oct. brought numbers to Lynn Well, Outer Dowsing and Haisboro', the latter crew observing a resumed immigration between Oct. 13th and 22nd. It is puzzling that the big influx in early Nov. was remarked upon only in the Haisboro' diary.

Mistle-Thrush: Haisboro', singly Nov. 6th and 15th.

Fieldfare: Haisboro', a number between Nov. 1st and 7th and a few, Nov. 14th–16th. Newarp, a few, Oct. 3rd and several on 31st and Nov. 14th/15th.

Redwing: Haisboro', several, Sept. 23rd, Oct. 2nd, Nov. 5th–7th and Dec. 14th.

Blackbird: Lynn Well and Haisboro' both had a few on board on Oct. 4th/5th, the latter reporting several more on Oct. 21st/22nd. Between Nov. 1st–9th however Lynn Well, Inner Dowsing, Dudgeon and Haisboro' all had very large visitations

especially between 5th and 7th. Doubtless all other vessels were similarly invaded during the "avalanche" of Continental birds which descended on the East Coast at this time.

Redstart: Records include a late bird on Haisboro' Nov. 6th/7th. It is of great interest to note that a male was also seen at Sheringham on Nov. 7th, a remarkable date.

Starling: First autumn arrivals appeared at the Haisboro' on Sept. 23rd and all vessels reported recurrent arrivals from early Oct. till mid-Dec. and experienced the memorable "tidal waves" of birds on Oct. 20th, 29th/30th and Nov. 5th/6th.

Hawfinch: Haisboro', two, Oct. 7th.

Reed-Bunting: Haisboro', one, Dec. 15th/16th.

Snow-Bunting: Haisboro', two, Nov. 15th.

The following were also recorded in 1961: Cormorant, Common Scoter, Golden Plover, Snipe, Curlew, Knot, Jackdaw, Song-Thrush, Wheatear, Robin, Spotted Flycatcher, Pied Flycatcher, Meadow-Pipit, Pied Wagtail and Chaffinch.

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Norfolk Mammal Report 1961

INTRODUCTION

We are pleased to present to our members the eighth report on Norfolk mammals. The number of records that come in each year is now quite impressive. When they are all sorted out, the picture given is likely to be reasonably accurate with regard to trends in population, effects of seasonal change, the impact of disease and the effectiveness of control. We hope that the report reflects these changes adequately. By keeping a finger on the pulse of animal life in the county, we shall, over a period of years, have a much clearer idea of when and where a species has extended its range or, conversely, follow the steps by which it has approached near extinction. Norfolk naturalists are in the vanguard of those maintaining this form of watchfulness over our wild life. There is no doubt at all that this is necessary. While landowners, keepers and sportsmen continue to wage war on badgers and otters in the mistaken belief that they are a serious menace to game and fish, these species remain in peril of becoming lost to the county.

A National Badger Survey is about to be launched and it is to be hoped that we shall be able to report that the badger is sufficiently well established on Norfolk estates where it is protected that we may regard it as safe for the future.

The decrease in stoats is to be deplored. They are the natural enemies of rabbits and one would have thought it well worth while to enlist their help now that rabbits are increasing again; yet the destruction of stoats continues unabated.

The mammal distribution maps which have been in course of construction for a number of years now are beginning to show their value. During the last few years, for example, the outward movement of the fox from central and west Norfolk to the north, south and east has become very apparent. Concentration of the muntjac records in a rather restricted area in North Norfolk suggests the possibility that we may discover, as did Warwickshire and Huntingdonshire, that this species of deer has become established on a breeding basis without it being realised that it had gained ground so strongly. Although the muntjac may never achieve pest proportions owing to its sensitivity to winter conditions, and its damage potential is far less than that of the coypu or the rabbit, the outward migration from Bedfordshire is an interesting one, and most important to control properly.

The other deer—red, fallow and roe—are being adequately controlled in the county. A special supplement on Norfolk deer is given at the end of this Report.

It is encouraging to be able to report that effects of the use of toxic chemicals appear to have been very limited this year. Seed dressings containing dieldrin, aldrin and heptachlor may no longer be used at all for spring sown grain, and will in future only be used for autumn and winter wheat when there is real danger from the wheatbulb fly. No further records of deaths of foxes have been sent in. Instead, foxes seem to be reaching a peak in their numbers. There appears to have been a very general increase, and foxes have been killed in many places in the county where they had not been seen for half a century or more. The coypu still continues to figure prominently in the reports from the Rabbit Clearance Societies, and it is obvious that its suppression is not going to be an easy matter. Rabbits have returned to many of their old haunts, and re-established themselves despite control. Many of them are now almost immune to the effects of myxomatosis. The Hare population is now steadily declining. Meanwhile an enormous increase in the number of Brown Rats has been causing consternation in almost every part of the county. The general impression is that bats are present in greater numbers than for some years past, but this may be due to the increasing attention given to them by observers. It is specially important that those interested in these small mammals should make every effort to catch specimens and have them properly identified. We still need many more people prepared to do regular trapping of mice, voles and shrews. A preliminary investigation using break-back traps (protected inside containers) might yield valuable details of distribution. We have no evidence for a more northerly range of the Yellow-necked Mouse beyond the south-eastern border of the county, and we lack information on the present status of the common House Mouse.

We thank all who have contributed records for inclusion in this report, and would welcome the help of many additional observers. There is ample scope for original work on mammals to be undertaken by young people in schools as well as for more experienced naturalists. The important thing is that detailed records should be kept as regularly as possible. Those for the 1962 Report should sent *by the end of January* 1962 to F. J. Taylor Page, Flat 5, "Fairmile", 98, Newmarket Road, Norwich, NOR 27D. *Tel.:* 53365.

Classified Notes

INSECTIVORA

Hedgehog (*Erinaceus europaeus*)

At the end of 1960, there were indications that the population of the hedgehog was declining slightly in some parts of the county, and this trend appears to have been maintained in a fairly general way throughout the county. Records of sightings and road

casualties have been fewer compared with those of the previous year. Nevertheless, where woodlands and copses, parkland, thick hedgerows and garden shrubberies afford food and protection, considerable numbers exist, despite gamekeepers and fast traffic. In the Horstead area, for example, about 50 were trapped, and about as many were killed on the roads in the neighbourhood (LGC).

The motor car seems to be the greatest enemy of the hedgehog, and many continue to meet their doom at night, particularly after rain, when they become very active and seem to be attracted on to the roads in their search for food. Continued observation of a known stretch of road is very valuable in providing information about movements of hedgehogs in relation to weather, periods of greatest activity and regularly used "crossings". It is a fairly reliable method of sampling the population in any area. On the Holt–Norwich road, the count made showed a mortality rate of 12 per mile per week. 75 per cent of the victims were concentrated at points where woodlands came down to the road on either side (RPB-O). On the 7 miles between Thetford and Brandon 56 were killed in June and 45 in December (WS), while on a similar length of road between Watton and Brandon with less woodland on either side, only 18 carcasses were noted between January and October (GJ). During the year, on the road between Surlingham and Norwich, only 6 were counted, of which three were in Surlingham itself (EAE). The five-mile stretch from Yarmouth to the Stracey Arms yields an interesting comparison in distribution in marshland areas; a report of only 4 carcasses suggests that the hedgehog finds this unsuitable terrain (PJLH). It is equally uncommon on the Breckland heaths (JCT), and around the coastal marshes.

The existence of hedgehogs on Blakeney Point has always been something of a mystery, but recently it has been revealed that during the early days of the first world war, one was observed being carried along on top of a floating door in the tidal channel. It was found on shore a few days later. It is just possible that others have made a similar journey, or managed to swim across at a period of low tide (EAE).

The relative scarcity of badger and fox in many parts of the county has given the hedgehog the advantage of building up its population without natural control. As the fox ranges more widely, some effect on the number of hedgehogs may be noticeable in a few years time. It is unusual to report any form of colour variation or disease in hedgehogs, but this year two specimens, one from Kelling and another at Weybourne were noticeably affected by what might be a form of ringworm. Both had completely bare pink patches on the back, each about 1½ inches in diameter (RPB-O).

Common Shrew (*Sorex araneus*)

The small mammals always provide us with something of a problem. Few people notice them, and our estimate of their status is very much dependent upon observations of carcasses resulting either from natural mortality or from the activities of domestic animals or owls. The study of owl pellets is a piece of regular investigation that rural schools would find of absorbing interest to young people.

Often an increase of short-eared owls is indicative of the presence of a high population of small mammals. Increased numbers of shrews were believed to account for the increase of owls reported from Scolt Head this year (RC). Higher populations were also apparent near Reepham (EI), North Walsham (JBB), Corpusty (JL) and Witton (FRW). Regular live trapping throughout the year in Longworth traps or fall traps in jam jars would be most useful if conducted by small groups all over the county.

Pigmy Shrew (*Sorex minutus*)

As with the Common Shrew, we have very little direct evidence of any changes in population. The species appears to be common in the heather on some of the Breckland heaths. Five were taken together in a jam jar trap on Tuddenham Heath in December, probably because they were travelling nose to tail, in caravan (JCT). A high population was recorded at Scolt Head (RC), but farther east, around Holt, numbers have declined, and only two skulls were taken from pellets of Barn Owls (RPB-O). Both Common and Pigmy shrews are regular inhabitants of the house at Wheatfen (EAE), and Pigmy shrew was also reported from Calthorpe Broad Nature Reserve, Corpusty, Caister (Gt. Yarmouth) and East Bilney.

Water Shrew (*Neomys fodiens bicolor*)

Two new stations for Water Shrew were recorded this year. One was at Whitwell Hall, Reepham, but the animal here was unfortunately found drowned in the valve of an hydraulic ram (EI). The second was observed feeding on tadpoles in the upper Wensum, at West Raynham (RPB-O). An unusual sidelight on the natural history of this species came from the marshes at Horsey Mere (AB) where, owing to the high level of water in the reed beds a Water Shrew was able to attack and remove several young birds from the nests of bearded tits, reed buntings and sedge-warblers. Small numbers were recorded at Wheatfen (EAE), and one was also noted in the lake at Brinton (RPB-O). No records of this species have ever come in from the south and south west of Norfolk.

Mole (*Talpa europaea*)

Considerable variation occurs in the estimates of the status of the mole in different parts of the county, but in general it can

be stated that moles are found commonly almost everywhere except in very wet marshes. They become very common in low grazing meadows which have dried out to some extent (JL), especially in August and September, but a somewhat dramatic change takes place in the latter part of the year when activity suddenly becomes very noticeable in higher, drier ground. This took place at Langham and Cockthorpe in November (RPB-O), and Surlingham in December (EAE).

A good deal of surface burrowing occurs in poor sandy soils (JCT), often resulting in damage to seedlings in the Breck. One observer (CG) reports that the main feeding times appear to be around midday and at 3 p.m., and that the male is the main traveller. Winter hills become more numerous suddenly at the onset of cold weather (EAE).

Much more adequate reports concerning the seasonal variation in population of moles could be made if our observers would get into touch with mole catchers all over the county and collect the details of the numbers killed in each month. Decreases are reported where spraying is done (GC), and increases have been noted in the south, south-west and north-east. 35 specimens were taken from a single run near Thetford during January and February (WS), and 19 carcasses were noted on the Thetford–Watton road during the year (GJ). It is unusual to find moles as road casualties.

An orange-coloured variation was reported from Thurlton, a cream one from Costessey, and a brownish-grey one from Hethersett (NCM). The fairly rare white form made an unusual appearance in the south at Bressingham, the first ever reported from south Norfolk. White moles have been taken fairly frequently in the north in previous years (EDP).

CHIROPTERA

For some years we have been concerned about the very few records of Norfolk bats, but since 1960 not only have more of our observers taken an interest in collecting information; also, there are signs of a revival in the populations of several species. We welcome the formation of a Bat unit under Mr. John Woolston, and the work that he and his team are doing on the survey of bat roosts in the eastern part of the county.

Large colonies of the Pipistrelle bat (*Pipistrellus pipistrellus*) are reported from a number of Norfolk churches. One has about 500 individuals (WJW). Several observers record that this species is more numerous than for several years. The colony in a pile of railway sleepers at Great Moulton is again flourishing (HR). First flights were noted at several places during the second week in February, and hibernation appeared to set in during the first week in November. The mild autumn allowed occasional flights during the early days of December, and a few were actually seen on the wing in the very cold weather at the end of that month (RPB-O).

right *L. H. J.*

Long Tailed Field Mouse is common everywhere in woods and on heaths. Woodlands contain chestnut, hazel and oak support an abundant population. At Thetford, one entered a beehive and was stung to death.

right *H. A. Hems*

k Voles were reported from only three localities. Observers are requested to do systematic live ping in various parts of the county to enable the status of this mammal to be determined. Bank Vole remains are frequent in Tawny Owl pellets.

Copyright *R. P. Bagnall-Oakeley*

1961 saw a large-scale campaign against Coypu throughout the county. Despite this there has been a westerly spread into the Fens and the southerly movement has continued as far as Roydon in Essex.

During the year, Long-eared Bats were observed at Martham, Surlingham and in Holt woods.

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A PRELIMINARY NOTE ON THE PIPISTRELLE COLONY AT WORSTEAD CHURCH, 1961

A large colony of pipistrelle bats was known to be inhabiting the fourteenth-century church at Worstead, and by arrangement with the church authorities who wished to clear the church of bats it was decided to make use of this opportunity for some experimental work on pipistrelles. Nine visits were made between the 5th July and the 11th September, 1961; those taking part included: R. F. Barnes, R. M. Barnes, H. E. Jenner, S. C. Puddy, J. M. Taylor, P. G. W. Trett and W. J. Woolston who was responsible for organising the project.

Over 250 bats were removed from the church, marked in various ways with different colour dyes and released at Norwich, Caister, Yarmouth, Lowestoft, Benacre and Sheringham.

Sex	*Released*	*Recovered at Worstead*	*Min. dist. travelled*
Female (lactating)	Norwich, July 10th	July 31st	10½ miles
Two, sex ?	Lowestoft, July 17th	July 25th	25 miles
Male	Caister, July 17th	August 9th	16½ miles
Female (lactating)	Caister, July 20th	July 31st	16½ miles
Female	Caister, July 20th	August 14th	16½ miles
Male	Benacre, July 25th	August 9th	30 miles

It is hoped to return to Worstead church during 1962 and carry out further investigations on the pipistrelle colony.

The Noctule (*Nyctalus noctula*) was frequently reported, mainly during the months of April to August. 3 or 4 were at Little Ormesby on April 26th (WJW), 8 occupy a roost in an ash tree at East Somerton (WJW) (JB), 24 were reported flying at 9 p.m. at Stawbridge gravel pits on July 29th (RB), and 20 at the Harford tip on August 17th (RMB). The small colony of the Daubenton's Bat (*Myotis daubentoni*) at Eaton chalk pits has unfortunately been much reduced by human interference during the year, and when last visited in June, only two individuals were found (WJW). It is possible that another roost exists in the neighbourhood, but it has not been discovered. In the same way, the Whiskered bats (*Myotis mystacinus*) at Grimes' Graves have declined probably owing to the increased number of visitors in the past few years (FJTP). A small roost exists at Brinton (RPB-O), and a few Natterer's Bats (*Myotis nattereri*) still inhabit the roof of Brinton Hall. They fly over the lake in the early evening, and can also be seen over Selbrigg and Hempstead mill ponds.

Long-eared bats (*Plecotus auritus*) were seen at Martham (NCM), and Surlingham (EAE), and are common in the Holt woods (RPB-O). The Lesser Horseshoe Bats (*Rhinolophus hipposideros*), reported from Ellingham in 1960, have not been reported again this year.

LAGOMORPHA

Rabbit (*Oryctolagus cuniculus*)

Almost everywhere in the county, sporadic increases in the rabbit population are now frequent. Myxomatosis in either a virulent or attenuated form almost as frequently breaks out, and reduction of numbers follows. Recovery, however, now seems to be more frequent. Rabbit Clearance Societies have done good work in maintaining a systematic and humane control, but despite this there remain many places, often difficult of access, where breeding populations thrive unhindered. In consequence, reports have been coming in of increases, though some observers continue to note either the complete absence of rabbits, or their scarcity, mainly at places around the coast. Once again rabbits outstrip hares in the number appearing in road casualty lists in the Breck areas (GJ). There appear to be far more there than for the past six years. This is substantiated by the records of control from Elveden which we have been privileged to use as an excellent reference for comparable figures for Hare and Rabbit in the last few years (VAH). During the two years 1960 and 1961, the totals are: Hares 9,176, Rabbits 11,304. In previous years, the total number of hares killed far outstripped that for rabbits, and it is now obvious that rabbits are rapidly regaining ground, while the population of hares is declining. Actually for 1961, the figures are almost equal (4,340 Hares to 4,211 Rabbits), but the latter figure does not include the many that were killed by myxomatosis. The problem of control is now much increased by the fact that larger numbers of adults lie out rough in the hedgerows, where gassing is impossible.

Hare (*Lepus europaeus occidentalis*)

Although numbers remain high, the general inference from the records of the county as a whole is that the decline from the peak population in 1961 is very noticeable, and reports of considerable decrease in numbers in open fields are quite frequent. High populations remain on the drier soils of the Breck (JCT) and in North Norfolk. In the latter area, the road casualties were nearly equal to those of the 1961 peak year—1 per 6 miles per week (RPB-O). At Barningham, a total of six guns bagged 140 hares during the annual shoot (EDP). At Binham, 31 were shot on 130 acres, and 19 on 17 acres (RS).

Hares continue to spread in the marsh areas of the Yare and Bure. They were seen increasingly in the woodland and reed marsh at Surlingham (EAE), and on the Yarmouth–Stracey Arms road, they figure prominently in the casualty list (PJLH).

RODENTIA

Bank Vole (*Clethrionomys glareolus*)

Very few records are ever sent in for this mammal in Norfolk, and one can only suspect that despite the fact that it is undoubtedly very common, few people ever see it or identify it. We badly need a few naturalists who would get enthusiastic enough to do some systematic live trapping in various parts of the county, and give us the results of their investigations. We should very much welcome rural schools doing such work which is well within the scope of senior pupils. It involves the regular setting and visitation of a trap line, and the recording of the small mammals taken.

In the three areas where Bank vole is reported—Calthorpe Broad (FT), Wheatfen (EAE) and Bawdeswell (RPB-O), the species is stated to be common, and at times in large numbers. Bank voles are active day and night, and their remains are frequent in the pellets of tawny owls.

Field Vole (*Microtus agrestis*)

The increased numbers in marshes and grassy roadside verges in 1960 seem to have been maintained. At Breydon, they were the prey of Barn owl, Short-eared owl and Kestrel (RHH), and at Attlebridge they were frequently taken by domestic cats (MES). Larger numbers were noticed crossing the road at East Bilney (DM), though it is unusual to find them in any road casualty list.

Water Vole (*Arvicola amphibius amphibius*)

Though not abundant, water voles are fairly plentiful in most of our Norfolk rivers where there is little human disturbance of their activities, and in some mill ponds, notably those at Selbrigg and Hempstead, numbers are unusually high (RPB-O). Damage was caused to maize at Loddon, and there are fairly large colonies in the south-west of the county (RYE).

Of those observed in north Norfolk, up to 50 per cent are of the black variety. Black specimens were also common at Aylsham (CDR), in the lake at Bolwick Hall, Marsham (NCM), and in the Yare (EAE). Very dark brown specimens were sent to the Norwich Castle Museum from Brooke, Wroxham, Trunch and Hethersett (RMB).

An interesting piece of behaviour was noted in the river Bure at Blickling during July. A water vole, under observation, appeared deliberately to remove a leaf of a water plant and to carry it over its head as it swam, apparently using it as a defensive camouflage.

Long Tailed Field Mouse (*Apodemus sylvaticus*)

This small mammal is undoubtedly very common everywhere in woods and on heathlands in the county. Pine woods are less frequently used, but deciduous woods containing sweet chestnut, hazel and oak support an abundant population. *Apodemus* is even found in wet alder carrs along the Yare valley (FJTP). Numerous burrows were made in sugar beet fields at Binham (RS). On the Breckland heaths it is common, feeding on heather shoots (JCT). At Thetford, one entered a beehive and was stung to death. The bees covered the carcass with propolis (WS).

During the winter, field mice became more plentiful in houses at Beetley (DM), Merton (RG), Caister (DAJB), and North Walsham (IWC), and at Great Moulton where outdoor trapping was carried out, specimens were taken during the months from January to the end of May (HR). Although occasionally seen on roads at night, no road casualty list included a single field mouse.

Yellow-necked Mouse (*Apodemus flavicollis*)

Our only known station is at Ellingham Hall, near Bungay, where it is found outside in the garden and in the greenhouse. One was again caught this year on February 17th (ECS).

Harvest Mouse (*Micromys minutus*)

Only a few reports of this small mammal have come to hand. Some have been making nests in woods at East Bilney (DM), and have been found regularly during every month in the marshes at Surlingham (EAE).

House Mouse (*Mus musculus*)

Although the pest control officers report a slight increase, most of the reports from our observers state that house mice are fewer in number and in some instance, scarce. This is put down to the efficacy of rodent poisons and their rapid effect on mice. We have very little knowledge of the present status of the species in the county as a whole.

Black Rat (*Rattus rattus*)

At present the county seems to be clear of this species. It is certainly at the point of extinction or near extinction.

Brown Rat (*Rattus norvegicus*)

Considerable increase in numbers occurred from about mid-summer. It appeared to start on the west side of the county in the Fens and gradually spread eastward. There seem to be many possible reasons for this, though the most important was the long period of mild wet weather following the long dry summer of 1959, when the rat population was at low ebb. There have been two

good breeding seasons since. Coupled with them was the difficulty of gathering in the 1960 harvest. On the heavier lands less autumn ploughing took place, and there was food and cover in abundance in many places. It was not realised how swiftly the rats were spreading, and little was done to control the increasing numbers (ATP).

Sugar beet provides regular winter feed. Carcasses of coypus left by trappers provide another source of food as do the dead starlings in the Norfolk roosts and spawning toads in north Norfolk. The decrease of ferreting, the ban on the use of the gin traps, the decline in the stoat population, the increase of large-scale chicken rearing, and the moving of huts after fowl pest, may all have played a part in the mass spread of rats about the countryside. One poultry farmer picked up 2,000 dead rats when his chickens were gassed to control fowl-pest (ATP).

Movement by night was evident from the larger numbers found dead on the roads, particularly after harvest. Flooding also caused movement to higher ground. In one area, the kill was 5 per mile for a distance of 27 miles.

Red Squirrel (*Sciurus vulgaris leucorus*)

Although there was an indication last year that the red squirrel had reached a peak in its cycle of abundance and was on the decline, good breeding conditions have enabled it to hold its own. Norfolk has always been an important stronghold for the species, and it is interesting to find it even now spreading into new areas. Newly maturing pine woods are being colonised both in the Breck (FJTP), and in north Norfolk (RPB-O). Small numbers have managed to continue to live in Norwich in the Newmarket Road area (FJTP), and at Thorpe (MJS). Bird tables are frequently visited in the Holt area, at North Walsham and in the south at Ellingham.

The rare very dark variety is still to be seen at Ellingham Hall (ECS). There appears to be no evidence for the introduction of any dark coloured squirrels of the central European race, and as far as is known, these black-looking squirrels are natural melanistic mutants. Road casualties are high only in Breckland. On the Watton–Brandon road, 32 were killed between January 1st and October 31st.

Coypu (*Myocastor coypus*)

This year has seen a large-scale campaign against coypu throughout the county. While there has been a considerable decrease in numbers in the east, in places where trapping has been intensive, as, for example, the Broads region, there is some doubt as to whether the control is adequate. As forecast last year, there has been a spread in a westerly direction into the Fens of

Cambridgeshire and the Isle of Ely, and the southerly movement has continued as far south as Roydon in Essex. The figure of 70,000 is given for the number destroyed in Norfolk alone in 1961 (RYE).

The marshland areas still support large numbers. Almost everywhere where streams and wet places provide food and shelter, the coypu has become resident, sometimes in plague proportions. The number of carcasses noted on the Acle New Road was as high as ever. On the 5 mile stretch from Yarmouth to the Stracey Arms 7 were killed in one night alone between 6.30 and 9.30 (RPB-O). Over a period of 35 days 18 were recorded, and during the year 115 (PJLH). Yet in the Acle area alone, the Rabbit Clearance Society dealt with nearly 14,000 (EDP). 500 were killed in the Cley and Salthouse marshes between August and December (RPB-O). Serious effects on nesting bitterns have been reported (WFB).

Even on large areas of waterless country as at Horsford, Harling and Kelling Heaths, they manage to survive. One at Castleacre was three miles from the nearest water (HB). Considerable numbers have been attracted to the waste sugar beet in Cantley sludge settling ponds, and during the flooding of the Yare many took to visiting riverside gardens to feed on vegetables. Plants which appear to be particularly favoured are: polyanthus, young osiers, the bark of grey sallow, kale and water lilies. A suggestion was made during the year that coypus should be introduced into the Kariba dam area to control the water cabbage (*Salvinia auriculata*) which threatens the commercial fishing in the lake. The grazing habits of coypu have also been much in evidence; it is said that 20 coypu can eat as much grass as a single bullock. In the Broads rivers, it has been noticeable that purple loosestrife (*Lythrum salicaria*) is generally avoided by these animals, and in consequence it has colonised on a large scale many places, where other types of vegetation have been cleared by coypus (EAE).

A female bearing eight young was reported from Didlington (WJW); she weighed only 6 lb. (HFA), and another from Caister marshes, containing nine embryos, weighed 16 lb. One specimen from the Trowse meadows was 3 ft. 4 in. in length, and a 3-ft. long female killed at Middleton weighed nearly 2 stone (EDP). Litters appear to be large in recently colonised areas. At Salthouse, a female was seen with nine young ones, and a newly caught female at Brinton gave birth to eight young in captivity (RPB-O).

CARNIVORA

Fox (*Vulpes vulpes*)

The very noticeable increase of foxes is one of the outstanding points of this year's report, though it seems to be associated with areas far from the fox hunting country of mid-Norfolk. Indeed,

in this latter area reports state that there are fewer than in the last few years. Farther south, at Seamere, there were also fewer, and for the first time no action was taken against them (CG). However, farther west, north and north-east towards the coast, in the east in the Broads areas, the Yare valley, and in the south-east, foxes have been recorded for the first time for many years. A vixen with seven cubs was killed at Repps (YM); a dog fox weighing 18 lb. was shot at Blofield (ST); 4 young foxes were killed in a large-scale shoot at Carleton Rode (EDP); a full-grown dog fox and vixen were killed at South Elmham (EDP);—all these are from areas where foxes were stated not to have been seen for forty or fifty years or more.

In north Norfolk foxes are very much more numerous. At least thirty were destroyed in the Holt area alone, and four earths containing cubs were also gassed. A very large dog fox in fine condition was found at West Beckham. It measured 4 ft. 1 in. from nose to tail and weighed 28½ lb. Seven foxes were shot during a drive through a small wood at Thursford (RPB-O).

No further disease has been reported. All the foxes killed by the hunt were in excellent condition and exceptionally large and strong (THB). This may be attributable to the increase in rats and rabbits. Another brush minus fox was picked up, this time at East Bilney (DM).

Badger (*Meles meles*)

Last year we reported that the re-establishment of badger in the county had been going on encouragingly. Sets are known to be occupied in north, central and west Norfolk. One just over the border in King's Forest in west Suffolk may eventually make possible the return of the species to some suitable parts of the Breckland forests (FJTP).

A set containing cubs was unfortunately disturbed during road-making at Selbrigg woods. The cubs were later seen about two miles away, and two were senselessly destroyed. Two adults were also killed at Letheringsett (RPB-O). A new station in the north-east was located in January following a sighting of a badger crossing the road (HE).

An unconfirmed report of a dead badger seen on the Stoke Holy Cross–Caister road may indicate that there is a set in the vicinity. Badgers are known to have existed in the Shotesham area about 25 years ago.

The main stronghold at the moment is on the boulder clay in mid-Norfolk, and several occupied sets are known which at the moment are safe from interference (FJTP). Elsewhere badgers have little chance of becoming established since they are so consistently destroyed in the interests of game preservation. This persecution is almost certainly needless, since badgers have little effect on game,

as is shown in counties where both are numerous. Fortunately foresters are taking a much greater interest in the wild life around them, and in one place at least in the county, badger gates have been set in the fences, and as these are now used regularly the fences suffer no damage (FJTP).

Otter (*Lutra lutra*)

The former distribution of the otter seems to have been much modified in recent years. Around Horsey (AB), Aylsham (SS) and Castleacre (HB), very few are now seen. Elsewhere they have been observed more frequently than for some time. Six were watched in the Deepdale freshwater marshes off Scolt Head (RC). A few live in the coastal marshes between Stiffkey and Weybourne, where they feed on eels, and shore crabs, and in the shooting season, wounded wildfowl (RPB-O). One was seen at Burnham Overy marshes, and one was found dying on the road at Thursford at a crossing point regularly used for the last six or seven years (RPB-O). An increase in north Norfolk is also supported by observations between Thornage and Gunthorpe.

In the south-west there are a few in the Little Ouse (JCT); two were observed in the lake near Santon Downham (ELS), and others at Thompson Water (RG). In the south and east, a few have been seen singly or in pairs in the Waveney valley (DAJB), the Yare valley (EAE) and the Wensum valley (SP).

Stoat (*Mustela erminea stabilis*)

There seems no doubt at all that stoats have decreased in number almost everywhere in the county. Only at Calthorpe Broad (FT) and Watton (JD) have slight increases been noted.

Gamekeepers continue to destroy stoats as steadily as in former days when they were numerous, though one would have thought their natural use in maintaining a control over rabbits and rats would be taken into account. At Larling, 10 were shot in June, and 18 in December (WS). The marshlands no longer seem to harbour very many (EAE).

A few with black and white striped faces were seen at Taverham (MES), one brown and white one was noted at Glandford in late December (RPB-O), and one in ermine was observed in the Bure–Breydon marshes (PT). Road casualty lists show that only two were seen in north Norfolk (RPB-O), two on the Yarmouth–Stracey Arms road (RHH), and three on the Watton–Brandon road (GJ).

Weasel (*Mustela nivalis*)

In contrast to the stoat, the weasel is now seen much more frequently and an increase in road casualties has been recorded, particularly in the spring. Scolt Head produced its first records for ten years (RC), and at least sixteen recorders made mention of apparent local increases.

A completely white weasel, but not albino, was seen on several occasions at Swaffham forest (RPB-O), and a very light ginger, almost cream-coloured specimen was recorded at Shipdham in April (DMM). Another not quite so light was seen at Brisley on May 7th. A white blaze on the forehead was an identification mark of one at Brinton (RPB-O).

Mink (*Mustela vison*)

A number of counties in England are reporting increases in feral mink. This year the Aylsham and District Rabbit Clearance Society operating over some 16,000 acres caught two (EDP). Another entered a coypu trap at Oxnead (RVE). This may indicate that we can expect further evidence of the existence in the wild of this introduced mammal.

Feral Domestic Cat (*Felis domesticus*)

Evidence exists for an increasing number of semi-wild domestic cats. At Witton and Thetford they live in holes on refuse tips (RVE). They also inhabit thickets and woodlands at Aylsham (SS), North Walsham (MARM), East Bilney and Bylaugh (DM), and the Horsford–Swardeston area (FRDB). They appear to manage very well on the available small mammals and rabbits. When disturbed, they go to ground if possible.

Seals

The Common Seal (*Phoca vitulina*) on Scroby Sands has a fairly stable population in July each year of about 150 adults. On July 2nd, however, there were only 80 with six pups all rather less than a week old. On July 4th a N.W. gale brought up an abnormally high tide which completely covered the Sands, but when a visit was paid by members of the Yarmouth Naturalists' Society on July 14th, two separate herds were found hauled out, despite the storm, and the usual 150 or so were counted. 16 pups were noted, 11 of which were not more than a week old. As last year, the first week of July proved to be the peak period for the birth of the pups. Only two newly born young were found dead.

On July 21st, three separate herds had been formed, but the total number of adults remained the same. Most of the pups were in the sea, and only two, a few hours old, were ashore.

During the early part of November, after an easterly gale, three common seals appeared at the entrance to Breydon Water. They stayed together until the cold spell at the end of the year, diving in the main stream for flounders and smelts. At low tide they hauled out on a mussel-covered knoll below Breydon bridge despite considerable human activity on the bridge, railway and barges (RHH).

Common seals have also been seen in small numbers at Scroby Island during the year (RC). Stranding of pups or young beasts has occurred at Horsey (JW), Cley (HFA), Yarmouth South Denes, Caister, Winterton, Hopton and West Runton (EDP). One adult again ventured up the Yare as far as Surlingham in the autumn (EDP) and a young one hauled out on the river bank at Reedham on November 3rd (EDP).

Even as long ago as fifty years, the Eastern Sea Fisheries Board was concerned with the number of common seals in the Wash. The *Eastern Daily Press*, March 22nd 1911, reported that it had been suggested that a cruiser should be sent to the Wash to destroy the seals with its guns, in order to prevent the seals from destroying the fish. At that time there were only about 200. Numbers to-day are considerably higher.

The Grey Atlantic Seal (*Halichoerus grypus*). A small herd of 18, separate from the herds of Common seals, was seen on Scroby July 14th. On July 21st, the number had increased to 47—one herd of 27 and another of 20 (RHH).

Births of pups were recorded as follows: November 19th 2 males, 1 female; November 26th 4 males, 1 female; December 3rd 1 male, 1 female; December 10th 1 male.

There has been no significant increase in the size of the adult colony.

No. 6262 marked at Staple Island (Farnes) on December 1st, 1960 at 3 weeks was seen at Cley on December 31st, 1960 and again on January 1st, 1961. It appeared to have gunshot wounds and a catarrhal infection of eyes and nostrils. Though lively enough to be hostile, its condition was described as "not good".

No. 6283 marked North Wamses (Farnes) on December 24th, 1960. A young male in its first coat. Found at Hemsby on November 19th, 1961 and returned to the sea (GH).

A stranding was also reported at Sea Palling in mid-December. It was a young animal, 3 ft. long and weighing about 40 lb. It had been wounded in the back as though struck by a ship's propeller (EDP). Another was at Scolt Head early in January; it was about 2 ft. long and weighed 20–25 lb. (RC).

ARTIODACTYLA

Red Deer (*Cervus elaphus*)

In the opinion of those responsible for control of the deer in Thetford Chase, at least twenty red deer stags exist in the Forestry Commission plantings, together with an unspecified number of hinds. They are moved about to some extent by forestry operations, but the rutting areas which have been used in the past are still favoured whenever possible. Fine specimens of these deer may

sometimes be seen. Late in the year, two were observed alongside the road at Mundford, and showed no fear as a car passed them at a distance of only four yards (EDP). It is now possible to cycle or walk through the forests, and watch these animals. One observer came within 200 yards range of two between Fowlmere and Langmere on 23rd November, and he was able to witness a sparring match for ten minutes (ALB).

There now appears to be some danger in Thetford Chase that deer may cross roads in front of vehicles. Ten incidents have been reported during the year (EDP). Control involved the shooting of 3 stags and 9 hinds (FC). There is a tendency to exaggerate numbers, but there is no doubt that increase in the herds is taking place (FJTP).

Fallow Deer (*Dama dama*)

The only area where this species now exists in Norfolk so far as is known is in the range of woodlands in the Horsford–Stratton Strawless district (PRP). Small parties of three or four have been seen during nearly every month of the year (FEDB). They are of the dark variety. A single white one was reported in October.

Roe Deer (*Capreolus capreolus*)

Control of the roe deer has been rather severe. 45 bucks and 73 does have been removed at Thetford (DW), (FC). This compares with a total of 103 last year. The deer have become much more widespread where once they were localised, and they can now be found almost everywhere in Thetford Chase and even beyond. One female was shot at Gressenhall (HFA), and certain observations suggest that the species may now have spread as far as Horsford (GCR), (PRP), (FJTP).

Muntjac Deer (*Muntiacus reevesi*)

Late in January, a single buck was killed by dogs on the Norfolk border at Elveden. This is the most obvious line of country through which these small deer would reach us from Huntingdonshire or Cambridgeshire, where they are now believed to exist in fair numbers and on a breeding basis. Muntjac bucks tend to wander at harvest time through standing crops, and then later on they are cut off when the fields stand bare after harvest. Thetford Chase probably does not provide quite the type of shelter these deer prefer, as on sandy soil the herb and shrub layers are not usually profuse. On the boulder clay farther north, the woodlands have abundant brambles, and it is from this area that most of the 1961 records have come, not far from Holkham where the 1960 specimen was shot.

One was seen at Thursford in early January (WMM) and another near Crowland Wood, Binham. Another, or possibly the same one, was seen at Coldmoor Plantation, Hindringham on

June 7th (RS). A gamekeeper at Reedham, who identified a deer seen near Cantley on January 28th as a roe, was probably mistaken. An article on Muntjac deer in the *Eastern Daily Press* brought in a letter from a lorry driver. In it he identified, from the description in the article, a deer he had seen at Cantley. There seems little doubt it was a muntjac (FJTP). It made for the Yare marshes, but no further reports have come from that area where the animal was certainly in inhospitable territory.

CETACEA

Common Porpoise (*Phocaena phocaena*)

A large school of porpoises appears to have been inshore on more than one occasion. On June 23rd it was so big, that it took between ten and fifteen minutes to pass. It was going east, off Cromer, and observation was easy as the animals were only fifty yards from the beach (IFK). Several strandings took place. A female was ashore at Sheringham on July 5th (BM). Another was washed in at Cley in September (HFA), about the time when the several small schools appear to have moved round the coast towards Holkham. They were offshore there during August and September, and two beasts feeding on mackerel ran aground temporarily in shallow water (RPB-O).

On October 3rd, at least six were again off Sheringham, all full grown animals, and about three were within 100 ft. of the shore (IFK). Towards the end of the year, on December 5th, a 5-ft. specimen was stranded on the North Beach, Great Yarmouth (BM).

White-beaked Dolphin (*Lagenorhynchus albirostris*)

Only one was reported this year; the British Museum recorded an unconfirmed identification of a juvenile, 6 ft. in length at East Runton beach on April 29th. We should again like to make a special appeal for records of all strandings and offshore sightings of whales and seals.

Norfolk Deer Records

There are no records as to when the last indigenous red deer was killed in Norfolk, nor when red deer became feral in the county. It is possible that there may always have been a few in the south and west where there were large parks at Euston, Shadwell, Didlington and Ampton. Winfarthing also has an ancient park which was "full of deer" in 1759. Melton Constable park in the north dates back to the thirteenth century, and Houghton in the north-west had a famous herd in the eighteenth century. William Lowen, chief huntsman of Windsor forest was paid £166 10s. 0d. "for taking one hundred red deer at Houghton Park and conveying forty of them to Windsor forest".

In view of the fact that red deer jump into and out of parks to-day, there is no reason to think they behaved differently in past centuries. In modern times, a 17-pointer jumped into Melton Constable park. It came from elsewhere, possibly Gunton park. In the 1930's, a large stag was known to the foresters. It was sometimes seen at Mundford, sometimes at Croxton. It was described to me as being a very large beast. There could easily have been more than one of them about at that time, for these older stags are very wily creatures and rarely seen.

When Didlington park was used for military purposes during the war, a stag used to swim across the lake to an island. Leslie Paul describes this in *Heron Lake*, and says that it was reputed to be an outlier from the Stag Hunt. Outliers are probably only part of the explanation of the origin of the red deer herds in Breckland to-day, though they were known as far back as the late nineteenth century.

In 1950, the Norwich Stag Hunt had about ten known outliers, among them a hind. Two calves were born out. From that time, the records of red deer in the Chase steadily increased, though very few people had until that time any idea that red deer were about. I saw signs of them in Santon forest and West Tofts in 1952, and I stalked my first red stag in 1953 at West Harling. In 1954 I watched two hinds and three stags in their rutting area in the same forest, and in 1955 I saw for the first and last time an exceptionally fine 21-pointer, with seven hinds and a calf, on September 29th, during the rut.

This stag was shot by a member of the St. Hubert Club on September 25th, 1956. On the following day another, a 13-pointer, was taken. Since then, the following have been removed:

1957 ..	A 13-pointer, killed by a farmer with a shot gun. By control, 1 stag, 3 hinds.
1958 ..	By control. 2 stags—a 21-pointer and a 13-pointer.
1959 ..	By control. 5 stags, 6 hinds. Among these a 20-pointer and three 13-pointers.
1960 ..	By control. 1 stag, 9 hinds.
1961 ..	By control. 3 stags, 9 hinds. Among these a 19-pointer.

Total: 14 stags, 27 hinds.

The roe deer are known to have been introduced about 1884. They were confined mainly to the old forests of five estates. From 1922 onwards these forests were clear felled in most instances for replanting. Between that time and 1950 there was regular driving and snaring in an attempt to control damage. Much of the danger to forest trees by fraying and browsing had passed by 1956, and

sporting rights were granted for roe stalking. The Commission also commenced control in view of the need to prevent damage at the time when clear felling of mature pine stands commenced and replanting took place.

Since 1956, 166 bucks and 115 does have been removed from the whole area of Thetford Chase. This information is given by courtesy of the Forestry Commission.

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