







DOVE MARINE LABORATORY,
Cullercoats, Northumberland.

REPORT

For the year ending June 30th, 1919.

EDITED BY ALEXANDER MEEK,

PROFESSOR OF ZOOLOGY, ARMSTRONG COLLEGE, IN THE UNIVERSITY OF DURHAM,

AND

DIRECTOR OF THE DOVE MARINE LABORATORY.

*Published by the Marine Laboratory Committee of Armstrong College
on behalf of the Northumberland Sea Fisheries Committee
and other contributing authorities.*



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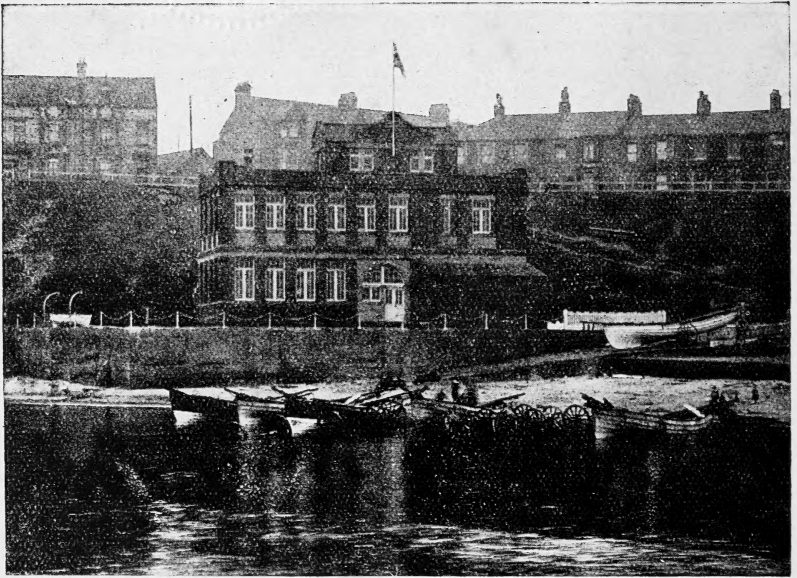
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Dove Marine Laboratory, Cullercoats.

SUMMARY AND GENERAL REPORT.

The Report this year is taken up almost entirely with papers dealing with the results of the investigations relating to herrings.

The first paper, by Mrs. Cowan, gives an account of the investigations made in 1918. Thirteen samples were examined, the total number of herring being 3,000, and included two samples which were measured according to the agreed upon methods for determining racial characters. The first sample of the season presented herring, 46 per cent. of which had four winter rings, but the rest indicated a return to the conditions so characteristic of the Northumberland Coast herring, the predominant age-group of which is three winter-ring. As will be seen, moreover, the general notes showed that the herring were immature, the gonads being usually in stages I. and II. Only one landing, that of July 29th, was observed to be in a state of approaching maturity.

This is followed by a paper by Mr. Storrow, who returned to the Laboratory in February of this year, in which the attempt is made to consider as a whole the results obtained during the years 1912 to 1918 from the standpoint of age, and the growth up to the formation of the first winter ring. We were led to make this approach to an analysis of our records from the consideration that the growth to the first winter ring would tend to determine the source of the immature herring which are summer migrants to our coast.

The Northumberland Coast herrings may be defined as a shoal of young herrings, having for their predominant year class fish with three winter rings. Following the restricted fishing of 1915, herrings with four winter rings predominated in 1916 and 1917. Few herrings occur in the samples with five or more winter rings, and, on the other hand, the number with two winter rings gives no indication of the abundance of fish with three winter rings to be expected in the following year. The small number of fish with two winter rings is not due to the selective power

of the drift net, but rather to their absence from the shoal. The samples of 1917, for instance, gave no indication that fish with three winter rings would predominate in 1918.

From the age-composition of the 1916 samples the Northumberland Coast shoal appears to occupy the ground between the Farne Islands and opposite the mouth of the Tees. During that year the shoal was augmented in July and August by the immigration into it of herring with four and five winter rings, and the distribution of the fish with four winter rings supports the opinion of the fishermen that our herrings come from the north-east. These larger herring used to be followed by mature fish, and spawning took place especially in the neighbourhood and to the north of the Farnes, but the period of our investigations has been marked by a dearth of spawning, and the evidence of its happening has been mainly derived from data referring to "spawny haddocks."

There is evidence therefore that during the herring season a succession of shoals appears in our coastal waters. The season commences by the fishing 100 miles or more from the coast, and the smaller coastal herring appear in the latter part of May. Our results indicate that the Northumberland Coast herring consist in June and July of herring with a comparatively small first year growth, and are followed about the end of July or the beginning of August by herring with a larger first year growth. Again, towards the end of August and the beginning of September fish with a smaller first year growth are once more abundant. The samples of 1916 indicated that the herring with the larger first year growth were more particularly restricted to the southern portion of the fishing ground, and this points to separate shoals. It has to be noted also that herrings with two winter rings have in all seasons a larger first year growth than the herring of other year groups. The observation is doubtless intensified by the facts we have already published as to the difference in the rate of growth of the scale and the fish, but it is with the other observations of importance as indicating that a herring with a large first year growth regularly visits the Northumberland Coast during its years of immaturity. A sample of the spring spawning herring of the Firth of Forth has been found to have a first year growth practically the same as that of the herring of the Northumberland Coast. The fluctuations of the Firth of Forth fishery follow closely

those of the Northumberland Coast shoal, and these considerations, together with the observations we have already published as to the source of the post larval herring of the Tyne, give good grounds for saying that a large section of the herrings of the Northumberland Coast is composed of young fish which afterwards become the spring spawners of the Firth of Forth.

To this account is appended a statement as to the growth of the 1914 samples, which were examined to furnish data for racial investigations.

Mr. Storrow also gives an account of the age and growth of a Ballan Wrasse, which was kept under observation from 1915 to 1917, and has furnished the welcome evidence that the growth and the age as determined by the scales coincide with the history during the same period in the free condition.

The above will serve to illustrate the relationship of Northumberland with the east coast of Scotland, and the desirability of linking up our work with that of Scotland. It will also serve as an excuse for our expression of disappointment that the conferences with reference to reconstruction have not resulted in marine research being made a National rather than a Departmental affair. The movement for nationalisation began with a view to centralising administration, but the opposition of Scotland to the scheme was sufficient to bring it to an untimely end. Nevertheless, even if it were found too difficult to unify administration, it was obviously more than desirable to take steps to co-ordinate fishery and marine investigations, while recognising and admitting that administration should be closely identified with investigation. Home Rule in both respects is uneconomical and ineffective. Legislation, which should be national in character, tends to be hindered rather than promoted, and moreover political boundaries have no significance in the sea. From the point of view of research it ought to be recognised and understood that our coasts are intimately linked together and with the seas around our islands.

When new schemes of research in fisheries are formulated, it appears to be forgotten or overlooked that a vast accumulation of material is in existence resulting from the many investigations

which have already been made, and that much of this has not yet been sufficiently analysed. Before starting upon these new schemes we ought to be in a position to answer the following questions :—

- (a) What do we want to know that we do not know ?
- (b) Are we sure that the knowledge is not already available ?
- (c) How do we propose to obtain the required information ?

It may be urged and with reason that all kind of work relating to the sea is essential and important, and that it is undesirable to limit it to problems which may be defined as of economic importance. The demarcation between Applied and Pure Science is by no means always apparent, and indeed a great deal of the work which lies before us may be said to belong to the domain of the latter. It is to be hoped, therefore, that whatever the control may finally turn out to be, the resources of the country with respect to the Marine Laboratories, the Universities and the Museums will be fully utilised before new schemes involving additional expenditure are considered.

ALEXANDER MEEK.

31st October, 1919.



HERRING INVESTIGATIONS, 1918.

HERRING INVESTIGATION, 1918.

BY DOROTHY COWAN.

During the herring season of 1918, twelve samples, 3,000 fish have been examined. As the fishing grounds were determined by the Naval Authorities, and all the vessels fished in a comparatively small area, the samples are representative of the fish landed.

With the exception of the samples from Berwick and one from North Shields, the herrings have been examined in curing houses in order to allow of the fish being cured and put on the market for food. Thanks are due to all who facilitated the work, especially to Mr. Richard Dawson whilst he was at North Shields, and to Mr. Peter Cowie, of Berwick. The first sample from Berwick and one from North Shields, which were examined at the Laboratory were used at the request of the Board of Agriculture and Fisheries for the purpose of obtaining racial characters. Copies of the measurements and the age composition of the samples have been forwarded to the Board.

The date and origin of the samples are given in Table I. Chart I gives the localities from which they were taken, and shows that, with the exception of sample A1, the fish examined came from the ordinary fishing ground of the Northumberland and Durham coasts.

Particulars as to size and age are given in Tables II. and III., and following the plan adopted in former years a further analysis of size and age is given in Table IV.

The predominant year class during the season of 1918 was that with three winter rings, and this year class comprises from forty to sixty per cent. of the fish examined in all samples, with one exception. The exception is sample 1, which contains 46 per cent. of herring with four winter rings. It was taken fairly early in the season, 12th July, and the place of capture was, as will be

seen on Chart I, nearer the shore than any of the other samples. The number of fish with two winter rings is small, the highest percentage being found in sample A2, which came from the most northerly locality of the Northumberland coast. This sample was taken 2nd August, and contained the smallest percentage of fish with four and five winter rings, and was made up of much smaller fish than any of the other samples.

Last season herrings with four winter rings were found to be predominant, but this year fish of that age are not so abundant as those a year younger, and comprise only from twenty to thirty per cent. of the samples. In no sample were herrings with five winter rings so plentiful as to form twenty per cent. of the sample, and older herrings were few in number.

As in previous years, the herrings of the Northumberland coast have been found to belong to a shoal or shoals of young fish varying in age somewhat, but having few individuals with five or more winter rings shown on their scales. During the seasons of 1916 and 1917, herring with four winter rings were predominant, but the shoals of last season were younger by approximately one year.

The only sample which resembles the samples of 1917 is sample 1, but the age composition of the other samples makes it quite clear that this sample cannot be taken as representative of the shoals found off our coast during 1918.

The conditions under which the investigations were conducted did not allow of detailed examination as to sex and maturity, but general notes were made as to the condition of the gonads. Sample A2 consisted of small fish, and the majority had gonads at stage II. or between stages I. and II. In no case were gonads found developed as far as stage IV., not even towards the end of August, at which time there seemed to be little difference between the herrings then examined and some of those examined in July. Curers generally complained throughout the season of the soft and oily nature of the herrings with which they were dealing. Only one landing is known of, 29th July, which was described by the curers as consisting of good large fish, firm and maturing.

TABLE I.

Sample.	Date.	No. in Sample.	Locality.
A1 ...	26th June ...	250	15 miles N.E. of Berwick, 40 fathoms.
A2 ...	2nd August ...	250	35 miles S.E. of Berwick, 55 fathoms.
1 ...	12th July ...	250	10 miles N.E. of Tyne.
2 ...	29th July ...	250	13 miles E.S.E. of Tyne.
3 ...	2nd August ...	250	17 miles S.E. of Tyne.
4 ...	6th August ...	250	25 miles N.E. by N. of Tyne.
5 ...	8th August ...	250	25 miles E. of Tyne.
6 ...	12th August	250	30 miles E. by N. $\frac{1}{2}$ N. of Tyne.
7 ...	14th August	250	18 miles S.E. by E. of Tyne.
8 ...	19th August	250	27 miles N.E. by E. of Tyne.
9 ...	21st August ...	250	12 miles E.S.E. of Tyne.
10 ...	22nd August	250	30 miles N.E. $\frac{1}{2}$ N of Tyne.

TABLE II.—SIZE.

CENTIMETRES.

Sample.		18	19	20	21	22	23	24	25	26	27	28	29
A1	Nos. ...	—	2	3	23	71	84	44	18	5	—	—	—
	% ...	—	0·8	1·2	9·2	28·4	33·6	17·6	7·2	2·0	—	—	—
A2	Nos. ...	5	9	61	74	52	25	10	9	2	1	1	1
	% ...	2·0	3·6	24·4	29·6	20·8	10·0	4·0	3·6	0·8	0·4	0·4	0·4
1	Nos. ...	—	—	2	1	20	43	75	81	25	3	—	—
	% ...	—	—	0·8	0·4	8·0	17·2	30·0	32·4	10·0	1·2	—	—
2	Nos. ...	—	—	—	10	49	84	72	25	10	—	—	—
	% ...	—	—	—	4·0	19·6	33·6	28·8	10·0	4·0	—	—	—
3	Nos. ...	—	—	2	7	15	62	95	46	13	8	2	—
	% ...	—	—	0·8	2·8	6·0	24·8	38·0	18·4	5·2	3·2	0·8	—
4	Nos. ...	—	—	—	1	8	60	103	50	15	8	3	2
	% ...	—	—	—	0·4	3·2	24·0	41·2	20·0	6·0	3·2	1·2	0·8
5	Nos. ...	—	—	—	—	2	71	102	50	17	5	2	1
	% ...	—	—	—	—	0·8	28·4	40·8	20·0	6·8	2·0	0·8	0·4
6	Nos. ...	—	—	1	2	14	46	98	54	23	7	4	1
	% ...	—	—	0·4	0·8	5·6	18·4	39·2	21·6	9·2	2·8	1·6	0·4
7	Nos. ...	—	—	1	2	10	37	91	74	24	7	2	2
	% ...	—	—	0·4	0·8	4·0	14·8	36·4	29·6	9·6	2·8	0·8	0·8
8	Nos. ...	—	—	—	3	6	52	90	61	25	9	3	1
	% ...	—	—	—	1·2	2·4	20·8	36·0	24·4	10·0	3·6	1·2	0·4
9	Nos. ...	—	—	—	1	5	35	85	83	29	10	2	—
	% ...	—	—	—	0·4	2·0	14·0	34·0	33·2	11·6	4·0	0·8	—
10	Nos. ...	—	—	—	—	10	28	78	81	36	11	4	2
	% ...	—	—	—	—	4·0	11·2	31·2	32·4	14·4	4·4	1·6	0·8

TABLE III.—AGE
WINTER RINGS.

Sample.		1	2	3	4	5	6	7	8	9
A1	Nos. ...	—	36	151	47	7	1	—	—	—
	% ...	—	14.9	62.4	19.4	2.9	0.4	—	—	—
A2	Nos. ...	3	92	126	15	6	2	2	—	—
	% ...	1.2	37.4	51.2	6.1	2.4	0.8	0.8	—	—
1	Nos. ...	—	6	85	112	30	7	1	—	—
	% ...	—	2.5	35.3	46.5	12.5	2.9	0.4	—	—
2	Nos. ...	—	34	124	72	16	4	—	—	—
	% ...	—	13.6	49.6	28.8	6.4	1.6	—	—	—
3	Nos. ...	—	28	130	53	28	6	4	1	—
	% ...	—	11.2	52.0	21.2	11.2	2.4	1.6	0.4	—
4	Nos. ...	—	27	101	70	33	10	3	3	—
	% ...	—	10.9	40.9	28.3	13.4	4.1	1.2	1.2	—
5	Nos. ...	—	25	107	63	39	8	5	1	—
	% ...	—	10.1	43.1	25.5	15.7	3.2	2.0	0.4	—
6	Nos. ...	—	18	101	65	36	17	5	2	—
	% ...	—	7.4	41.4	26.6	14.8	6.9	2.1	0.8	—
7	Nos. ...	—	16	114	71	35	9	3	2	—
	% ...	—	6.4	45.6	28.4	14.0	3.6	1.2	0.8	—
8	Nos. ...	—	7	121	63	35	14	4	2	—
	% ...	—	2.8	49.2	25.6	14.2	5.7	1.6	0.8	—
9	Nos. ...	—	5	109	69	48	14	4	—	1
	% ...	—	2.0	43.6	27.6	19.2	5.6	1.6	—	0.4
10	Nos. ...	—	2	104	81	43	9	7	4	—
	% ...	—	0.8	41.6	32.4	17.2	3.6	2.8	1.6	—

TABLE IV.—SIZE AND AGE.

CENTIMETRES.

Sample.	Winter Rings	18	19	20	21	22	23	24	25	26	27	28	29	Total.
A1	2	—	2	3	12	16	3	—	—	—	—	—	—	36
	3	—	—	—	11	51	60	25	4	—	—	—	—	151
	4	—	—	—	—	1	16	16	12	2	—	—	—	47
	5	—	—	—	—	—	—	3	2	2	—	—	—	7
	6	—	—	—	—	—	—	—	—	1	—	—	—	1
		—	2	3	23	68	79	44	18	5	—	—	—	242
A2	1	2	1	—	—	—	—	—	—	—	—	—	—	3
	2	3	8	40	34	7	—	—	—	—	—	—	—	92
	3	—	—	20	39	43	19	5	—	—	—	—	—	126
	4	—	—	—	—	—	6	5	4	—	—	—	—	15
	5	—	—	—	—	—	—	—	5	1	—	—	—	6
	6	—	—	—	—	—	—	—	—	1	1	—	—	2
	7	—	—	—	—	—	—	—	—	—	—	1	1	2
		5	9	60	73	50	25	10	9	2	1	1	1	246
1	2	—	—	2	—	4	—	—	—	—	—	—	—	6
	3	—	—	—	1	14	28	22	18	2	—	—	—	85
	4	—	—	—	—	1	13	43	41	13	1	—	—	112
	5	—	—	—	—	—	1	4	17	7	1	—	—	30
	6	—	—	—	—	—	—	2	3	2	—	—	—	7
	7	—	—	—	—	—	—	—	—	1	—	—	—	1
		—	—	2	1	19	42	71	79	25	2	—	—	241
2	2	—	—	—	6	23	4	1	—	—	—	—	—	34
	3	—	—	—	4	26	62	30	2	—	—	—	—	124
	4	—	—	—	—	—	18	39	12	3	—	—	—	72
	5	—	—	—	—	—	—	2	10	4	—	—	—	16
	6	—	—	—	—	—	—	—	1	3	—	—	—	4
			—	—	—	10	49	84	72	25	10	—	—	—
3	2	—	—	2	5	9	12	—	—	—	—	—	—	28
	3	—	—	—	2	6	48	69	5	—	—	—	—	130
	4	—	—	—	—	—	2	26	22	3	—	—	—	53
	5	—	—	—	—	—	—	—	19	7	2	—	—	28
	6	—	—	—	—	—	—	—	—	3	3	—	—	6
	7	—	—	—	—	—	—	—	—	—	3	1	—	4
	8	—	—	—	—	—	—	—	—	—	—	1	—	1
			—	—	2	7	15	62	95	46	13	8	2	—	250
4	2	—	—	—	1	4	22	—	—	—	—	—	—	27
	3	—	—	—	—	4	35	60	2	—	—	—	—	101
	4	—	—	—	—	—	1	42	24	3	—	—	—	70
	5	—	—	—	—	—	—	1	22	10	—	—	—	33
	6	—	—	—	—	—	—	—	1	2	5	2	—	10
	7	—	—	—	—	—	—	—	—	—	2	1	—	3
	8	—	—	—	—	—	—	—	—	—	1	—	2	3
			—	—	—	1	8	58	103	49	15	8	3	2	247

TABLE IV.—Continued.

CENTIMETRES.

Sample.	Winter Rings.	18	19	20	21	22	23	24	25	26	27	28	29	Total.	
5	2	—	—	—	—	2	23	—	—	—	—	—	—	25	
	3	—	—	—	—	—	44	60	3	—	—	—	—	107	
	4	—	—	—	—	—	3	40	18	2	—	—	—	63	
	5	—	—	—	—	—	—	1	27	10	1	—	—	39	
	6	—	—	—	—	—	—	—	2	4	2	—	—	8	
	7	—	—	—	—	—	—	—	—	1	2	1	1	5	
	8	—	—	—	—	—	—	—	—	—	—	1	—	1	
			—	—	—	—	2	70	101	50	17	5	2	1	248
6	2	—	—	1	2	6	9	—	—	—	—	—	—	18	
	3	—	—	—	—	7	33	59	2	—	—	—	—	101	
	4	—	—	—	—	—	3	35	24	3	—	—	—	65	
	5	—	—	—	—	—	—	—	26	9	1	—	—	36	
	6	—	—	—	—	—	—	—	2	11	4	—	—	17	
	7	—	—	—	—	—	—	—	—	—	2	3	—	5	
	8	—	—	—	—	—	—	—	—	—	—	1	1	2	
			—	—	1	2	13	45	94	54	23	7	4	1	244
7	2	—	—	1	2	6	7	—	—	—	—	—	—	16	
	3	—	—	—	—	4	29	72	8	1	—	—	—	114	
	4	—	—	—	—	—	1	19	41	9	1	—	—	71	
	5	—	—	—	—	—	—	—	24	10	1	—	—	35	
	6	—	—	—	—	—	—	—	1	4	4	—	—	9	
	7	—	—	—	—	—	—	—	—	—	—	1	2	3	
	8	—	—	—	—	—	—	—	—	—	—	1	1	2	
			—	—	1	2	10	37	91	74	24	7	2	2	250
8	2	—	—	—	2	3	2	—	—	—	—	—	—	7	
	3	—	—	1	3	45	66	6	—	—	—	—	—	121	
	4	—	—	—	—	4	22	31	6	—	—	—	—	63	
	5	—	—	—	—	—	—	22	12	1	—	—	—	35	
	6	—	—	—	—	—	—	1	7	5	1	—	—	14	
	7	—	—	—	—	—	—	—	—	2	2	—	—	4	
	8	—	—	—	—	—	—	—	—	1	—	1	—	2	
			—	—	1	5	52	90	60	25	9	3	1	—	246
9	2	—	—	—	1	2	2	—	—	—	—	—	—	5	
	3	—	—	—	—	3	32	62	12	—	—	—	—	109	
	4	—	—	—	—	—	1	23	37	8	—	—	—	69	
	5	—	—	—	—	—	—	—	33	13	2	—	—	48	
	6	—	—	—	—	—	—	—	1	8	5	—	—	14	
	7	—	—	—	—	—	—	—	—	—	2	2	—	4	
	9	—	—	—	—	—	—	—	—	—	1	—	—	1	
			—	—	—	1	5	35	85	83	29	10	2	—	250

TABLE IV.—Continued.

CENTIMETRES.

Sample.	Winter Rings.	18	19	20	21	22	23	24	25	26	27	28	29	Total.
10	2	—	—	—	—	2	—	—	—	—	—	—	—	2
	3	—	—	—	—	8	27	52	17	—	—	—	—	104
	4	—	—	—	—	—	1	24	40	16	—	—	—	81
	5	—	—	—	—	—	—	2	22	18	1	—	—	43
	6	—	—	—	—	—	—	—	2	2	5	—	—	9
	7	—	—	—	—	—	—	—	—	—	4	2	1	7
	8	—	—	—	—	—	—	—	—	—	1	2	1	4
		—	—	—	—	10	28	78	81	36	11	4	2	250

THE HERRINGS OF THE NORTHUMBERLAND COAST.

By B. STORROW.

The landings of large quantities of trawled herrings caught in the vicinity of the Dogger Bank in 1911 was considered by Professor Meek to demand the commencement of herring investigations at Cullercoats. These were begun, and during the latter part of 1911 and the season of 1912 opportunity was taken to become familiar with the methods of research used by Norwegian investigators, Hjort, Dahl and Lea, and to obtain information relating to our local herring shoals. The chief difficulty was the finding of a quick method for examining the herring scales for the purpose of age determination. It is felt that this has been accomplished. On Friday, 30th May of this year, two samples of herring, containing altogether 400 fish, were received. The examination of them for length, sex, development of gonads, and the taking of scale samples was commenced at 11 a.m., and by Monday evening, 2nd June, the age composition of the samples was known, the examination of the scales being done by one person only. But the general methods for the examination of herring scales are now so well known as to need no description.

The difference of opinion between trawl and drift net fishermen came to its height in 1913, and more than justified the beginning of the investigations. By the end of that year we were in a position to report on the two shoals of herring, those of the Northumberland coast and the Dogger Bank, and to point out the difference between them.

In 1914, at the request of the Board of Agriculture and Fisheries, data were obtained for the purpose of racial investigations. These data were forwarded to the Board, and in addition the Board was furnished with the age of the herrings examined. In order to further forward these racial investigations the annual

growth of each herring, roughly 3,200 in number, has been determined since my return, and is now published (Table II.).

In 1915, restrictions imposed on the herring fishing did not allow of many herrings being examined, but the Northumberland Coast shoal was sampled. Increased fishing in 1916 gave facilities for further work, and this has been continued, the continuation of the sampling in 1917-1918, and the age determination of 1916, 1917 and 1918 samples being done chiefly by Mrs. Cowan.

Detailed information regarding the samples examined is to be found in previous Reports. Below are given the numbers examined each year :—

	Trawled.	Drift Net.	Total.
1911	101	30	131
1912	118	110	228
1913	1,707	1,503	3,210
1914	650*	2,594	3,244
1915	869†	—	869
1916	—	3,422	3,422
1917	—	3,200	3,200
1918	—	3,000	3,000
	3,445	13,859	17,304

AGE.—The Northumberland Coast herring are young fish, and the age composition of the shoals has been found to vary with the intensity of the fishing.

The drift net herring of 1911 came from Yarmouth.

In 1912, the number examined was small, and the time of sampling was late in the season, 6th and 10th September, but the predominant year group was that with three winter rings. The same feature marked the shoals in 1913, and in 1914, when the sampling was carried out on a larger scale, and again in 1915 when fishing was considerably restricted owing to war conditions. In 1916, the predominant year group consisted of fish with four winter rings, and similarly in 1917. A change took place in 1918, and the samples again had herrings with three winter rings for their predominant year group.

The age composition of the samples examined was as follows:—

* Contains 250 Northumberland Coast herrings caught by trawler.

† Contains 300 Northumberland Coast herrings caught by trawler.

AGE COMPOSITION OF NORTHUMBERLAND COAST HERRINGS.

	WINTER RINGS.												
	1	2	3	4	5	6	7	8	9	10	11	12	
1912	...	1	14	35	28	11	6	1	3	1	—	—	—
1913	...	—	14	49	28	6	2	1	0.3	+	+	+	+
1914	...	0.4	27	51	15	5	1	0.5	0.1	0.1	+	—	—
1915	...	0.3	17	67	12	3	0.3	—	—	—	—	0.3	—
1916	...	—	4	24	45	21	5	2	0.6	0.1	+	—	—
1917	...	—	0.5	27	49	17	4	2	0.6	0.2	—	—	—
1918	...	+	10	46	26	12	3	1.0	0.5	+	—	—	—

For purposes of comparison the catches of herring landed at Northumberland ports are here given, the figures being derived from the reports of the fishery officers to the Northumberland Sea Fisheries Committee, and obtained from Government returns :—

Year.	Cwts.	Year.	Cwts.
1910...	...	1915...	...
1911...	...	1916...	...
1912...	...	1917...	...
1913...	...	1918...	...
1914...	...		

Quantities of trawled herrings were landed at North Shields as follows :—1911, 22,000 cwts. ; 1912, 20,000 cwts. ; 1913, 59,000 cwts.

The change in the age composition of the shoals in 1916 following the restrictions of 1915 was so marked that there seems little doubt that the age composition of the shoals was influenced by the restricted fishing.

The shoals in 1916 were practically a year older, and contained, according to the samples examined, 45 per cent. of fish with four winter rings. An increase in the number of fish with five winter rings was also present, and the percentage of these fish, 21, was higher than in any previous year. Older herrings were few in number, the greater part of them, 5 per cent., having six winter rings. In the following year, 1917, the shoals were practically of the same age as in 1916, 49 per cent. of the herrings had four winter rings and 17 per cent. had five winter rings. Drift net fishing in 1916 was greater than in 1915, but far from normal, and it cannot be said to be sufficient to account for the predominant year class of 1916, herrings with four winter rings, being represented in 1917 by 17 per cent. only of herrings with

five winter rings, nor the herrings of 1916 with five winter rings, and comprising 21 per cent. of the samples being represented in 1917 by 4 per cent. with six winter rings.

The presence of a high percentage of herrings with three winter rings in the samples of 1918 may be accounted for by the arrival on our coast of a rich year class, but again we have no evidence of the predominant year classes of 1916 and 1917 influencing to any great extent the number of older fish amongst the shoals, and the percentages of herrings with five and more winter rings were less than in 1916 and 1917.

Another point worthy of attention is the small percentage of herrings with two winter rings in the samples. In 1914 these comprised 27 per cent. of the samples, and were more abundant than in any other year. In the following year, 1915, the percentage of herrings, 67 per cent., with three winter rings was the highest of which we have any record. But there is no sign in the samples of 1917, when the fish with two winter rings represented less than one per cent. of the fish examined, that in the following year, 1918, herring with three winter rings would be the predominant year class. It cannot be said that the number of herrings with two winter rings gives an indication of what the age composition of the shoal will be in the following year. There is a slight indication in 1914 but not sufficient to give reason for expecting in 1915 that herrings with three winter rings would be present in such a high percentage as 67. Whilst the drift net may be selective as regards the size of the fish caught, yet had herrings with two winter rings been present in the shoals fished in 1917 in sufficient numbers to make herrings with three winter rings the predominant year group of 1918, they ought to have been represented in the samples by more than one per cent., or the mesh of the nets used has been much greater than that used in other years. Also, if the small percentage of fish with two winter rings be attributed to the selective power of the method of fishing this is more evident in 1916 and 1917, and to some extent in 1918, than in the other years. It is not thought that the low percentage of herrings with two winter rings is due to selection arising from the method of fishing, but that these fish are not present in any great number in the shoals fished. In support of this, there is a sample of Northumberland Coast herring caught by trawl

net in 1914, and the percentage of herrings with two winter rings was 26·8 per cent.*

It would appear then that not only are the herrings of the Northumberland Coast shoal young fish, but that they come to this locality after the formation of the third winter ring, return the following year if not captured, and then leave the district, few returning after the formation of the fifth winter ring. Where they come from cannot be stated, but an attempt will be made later to show the probable migrations of the fish after leaving the Northumberland coast.

The samples of 1916 give further information respecting the herrings with three and four winter rings, and show a distribution of year classes along the coast influenced by locality and time. From the Farne Islands to the southern portion of the Durham coast, slightly north of the mouth of the Tees, the herrings with three winter rings during June and the beginning of July were more abundant, and the age composition of the samples was lower than that of the samples caught to the north and south of this area.

Localities from whence the samples of 1916 came are shown on Chart I., page 33.

Samples 1, B1 and B2 were taken 6th June, 30th June and 1st July respectively. They were caught south of the Farne Islands, and represent the herrings from the northern portion of the area under consideration. The age composition of these samples was as follows :—

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample 1	...	4·8	37·1	47·0	9·9	0·4	0·8
, B1	...	18·8	55·6	22·4	2·4	0·8	—
, B2	...	19·5	55·5	20·5	4·0	—	0·5

The southern portion of the area furnished samples 2 and 3, caught 6th and 7th July respectively. They had the following age composition, which differs little from that of the samples from the northern portion of the area.

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample 2	...	3·2	39·2	40·4	13·2	3·2	0·8
, 3	...	21·6	44·7	25·1	6·5	1·5	0·5

* Report, New Series, IV. pp 17 and 25.

Samples A1 and A2 were caught north of the Farne Islands on 27th and 28th of June, and had a higher age composition than samples 1, B1 and B2. The age composition of samples A1 and A2 was as follows:—

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample A1	...	—	19.9	58.1	26.2	3.6	1.2
„ A2	...	—	1.0	49.5	35.0	11.0	3.5

Sample C1 was caught 13th July to the south of samples 2 and 3. The age composition of this sample, which was higher than that of samples 2 and 3, was as follows:—

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample C1	...	0.5	20.6	52.5	20.6	4.1	2.0

Towards the end of July and during August and the beginning of September, the age composition of the samples which came from the fishing grounds from the Farne Islands to the south of the Durham coast, was much higher than earlier in the herring season, and shows an immigration into the area of fish with four and five winter rings.

From the northern portion of the area samples A3, D1 and A4 were obtained on 27th July, 26th August and 9th September respectively. They were caught very near the localities from which samples 1, B1 and B2 came in June and the beginning of July, and they had the following age composition, which differed from that of the earlier samples. Herrings with four winter rings now greatly predominated.

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample A3	...	—	19.5	58.5	15.5	4.5	2.0
„ D1	...	—	12.1	57.2	25.0	4.0	1.7
„ A4	...	—	16.8	50.0	25.6	5.2	2.4

The southern portion of the area was represented by samples 5 and 6, caught 22nd August and 30th August respectively, in much the same locality as samples 2 and 3 taken in early July. They had the following age composition:—

		WINTER RINGS.					
		2	3	4	5	6	6+
Sample 5	...	—	8.0	43.0	36.5	9.5	3.0
„ 6	...	—	20.2	51.0	25.6	2.4	1.2

From the middle of the area sample 4 was obtained on 16th August, and had an age composition as follows :—

WINTER RINGS.						
	2	3	4	5	6	6+
Sample 4 ...	—	11.1	54.3	30.2	3.5	0.5

The general opinion of the older fishermen of our coast who fished the shoals of full herring in August and September some twenty years ago is that the herrings came from the north-east. The samples of 1916 taken in the latter part of July, August and the beginning of September are of interest in this connexion when arranged as below according to the position of capture :—

	Sample.	Date.	Percentage with four Winter Rings.
From the northern portion of the area ...	A3	27th July ...	58.5
	D1	26th August ...	57.2
	A4	9th September ...	50.0
From the middle of the area ...	4	16th August ...	54.3
From the southern portion of the area ...	5	22nd August ...	43.0
	6	30th August ...	51.0

The samples of 1917 do not admit of the same comparative examination owing to the time and place of their capture. But they also show that herrings with three winter rings were more abundant in July, and that herrings with five winter rings became more prominent in August.* More samples were taken during September in 1917, and they indicate a decrease in the beginning of the month of fish with five winter rings.†

The immigration of fish with four and five winter rings in 1916 and to some extent in 1917 is in marked contrast to the findings of previous years, when no such phenomenon was observed. The only factor or the chief factor which can account for this change is the restricted fishing.

In 1914‡ there was evidence that within the area from the Farnes to the Tees there was a smaller area stretching from the Coquet to Seaham in which segregation took place according to age. From the central portion of this smaller area the samples yielded more of the younger herring than did those from the northern and southern portions, where herrings with three winter

* Report, New Series, VII.

† *Ibid.*

‡ Report, New Series, IV., page 22.

rings were found in higher numbers. These conditions are similar to those which obtained in 1916, except that in 1916 the area in which segregation took place was of greater extent, and the herrings were older and the evidence of segregation disappeared in the latter part of July with the immigration of older herrings.

The age composition of the samples of trawled herrings from the Dogger Bank and off the Yorkshire coast has been shown in previous reports to differ from that of the Northumberland Coast herring in that every year the samples contained older fish, and different year classes predominated.

SPAWNING.—During the period of our investigations there has been little evidence of spawning to any extent in the waters of the district, and most of the evidence we have has been obtained from haddocks which have been feeding on herring eggs. No sample of spawning fish has been examined, and the sample containing most mature fish came from 12 miles east of Craster, 26th August, 1916, and had about 25 per cent. of full fish ready for spawning.* Since 1915, we have received reports of the presence of full fish, larger and more developed than the general run of the herrings landed at the ports in the latter part of August, and occasionally records of spent fish have been received. On the 4th and 5th of October, 1915, large ripe fish, the roe and milt running, were landed at North Shields, but not in any great quantity. "Spawny" haddocks have been landed by trawlers in the latter part of August and in September, and records of their place of capture have been given in previous reports.

Although evidence of full and spawning fish has been more plentiful since 1915, we have no evidence to show that our coast has been a spawning ground to anything like the extent as would appear to be the case some twenty years ago when the shoals of Berwick Bay, the Longstone, and Craster Smooth provided the chief fishing of the district. Fishing for herrings then began in August, at the earliest towards the end of July, and was continued into September. The herrings passed from mature to spents towards the end of August, and were replaced by a shoal of smaller but full herrings. Berwick Bay and Craster Smooth yielded herrings about ten inches in length, which is about the average

* Report, New Series, VI., page 11.

size for herrings with four winter rings, and these were classified by herring curers as mat-fulls. Larger herrings were caught on the ground to the north-east of the Longstone.

Fishing now begins as soon as the herrings appear off the coast. In April drifters come to North Shields. They catch herrings for bait for line fishing about 100 miles from the port, and as soon as the young herrings come nearer the coast the shoals are fished, and the fishery is pursued with increasing intensity from May to September, smaller quantities being caught towards the middle and end of September and the beginning of October. For the five years, 1910 to 1914, the yearly average of Northumberland Coast herrings landed at the ports of Northumberland was 508,000 cwts. It is not urged that protective measures ought to be taken in connexion with our local herring shoals, as so far as is known the fishing is still highly productive. But it is thought desirable to draw attention to the intensity with which the shoal is fished, to the length of the fishing season, to the age composition of the shoal, and to compare the area as a spawning ground with its position some twenty years ago.

GROWTH (Table I.)—When reporting on the herrings examined in 1913,* a table was given to show the average size at the formation of the winter rings for each year group of the samples. This method of analysis is considered deficient in that it does not show the variation which occurs, and whilst the average growth of the Northumberland Coast herring differs from that of oceanic herring as sampled by Hjort at Stornoway and the Shetlands,† it is not thought that the growth determinations expressed as averages can yield the whole of the information desired and show differences, if any exist, for shoals of North Sea herrings.

The period elapsing between hatching and the formation of the first winter ring varies according to the spawning time of the adult. It is therefore assumed that any difference of growth between two or more shoals of herring will be most evident from a consideration of the growth made to the formation of the first winter ring, and also that any mixing of shoals as suggested by Hjort and Lea for a sample of herrings caught off Grimsby‡ will

* Report New Series, III.

† Pub. de Cir., No. 53.

‡ Pub. de Cir., No. 61, page 9.

be evident from similar treatment of the samples. Hjort's Grimsby sample gave less evidence of mixing as the herrings grew older, and the growth attained at the formation of the third winter ring more nearly approached uniformity.

The first year growth of a number of the herrings examined at Cullercoats has therefore been determined and expressed to the nearest centimetre, a growth of from 7.6 to 8.5 being taken as 8 cms. The whole of the samples for 1913, 1914 and 1915 have been treated in this manner. Time has not allowed of a similar treatment of the whole of the samples of other years, but selected samples have been examined.

1913.—The samples of 1913 were small, especially at the beginning of the investigations. The table setting forth particulars relating to growth is therefore slightly different from the rest of the tables which give similar data, but it is thought the table will be found to supply sufficient detail for purposes of comparison.

Herrings with two winter rings from the Northumberland Coast shoal (A to M) had on the whole a greater first year growth than those from the shoals of trawled herring (N to X), the particulars relating to them being summarised as follows :—

PERCENTAGE AT CENTIMETRES.

Samples.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A to M ...	—	—	0.5	1	8	15	24	27	18	6	1	210
N to X ...	—	—	—	6	16	25	25	18	9	2	—	167

Herrings with three winter rings were the predominant year class of the Northumberland Coast shoal, and differed little in their first year growth from fish of the same age amongst the trawled samples, the growth being as follows :—

PERCENTAGE AT CENTIMETRES.

Samples.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A to M ...	0.1	0.3	3	8	26	26	17	13	6	0.5	0.3	737
N to X ...	0.4	0.8	9	7	21	27	18	12	6	0.4	—	254

The Northumberland Coast herrings with four winter rings had a smaller first year growth than those of the trawled samples, the growth being as follows :—

PERCENTAGE AT CENTIMETRES.

Samples.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A to M ...	—	2	6	24	34	18	7	7	2	0.5	0.5	429
N to X ...	0.2	1	4	17	27	25	15	9	2	1	—	530

Both the herrings of three and four winter rings of the Northumberland Coast shoal give indication of the immigration into the shoal in August of fish with a comparatively large first year growth. This change, which is followed in September by an immigration of fish with a slightly smaller first year growth, is not so evident as in 1914, and the size and the scattered nature of the origin of the samples make it desirable that this immigration be dealt with when considering the samples of 1914.

1914.—The greater part of the herrings with two winter rings in the samples of 1914 had made a growth of from 9 to 12 cm to the formation of the first winter ring. These fish were found in the samples in varying numbers, and as has already been pointed out the numbers varied with the position of capture (page 23). The first year growth of these fish also varies, and the variation would appear to depend upon the numbers in which they were present in the samples. If the samples are arranged so that the sample with the greatest number of herrings with two winter rings comes first and that with the smallest number last, it is seen that the growth attained up to the formation of the first winter ring increases as the numbers decrease.

Sample.	PERCENTAGE AT CENTIMETRES.											Nos.	
	4	5	6	7	8	9	10	11	12	13	14		
7	...	—	—	—	6	14	20	20	23	12	3	2	115
5	...	—	—	2	10	15	22	23	19	7	2	1	110
2	...	—	—	—	3	8	12	29	26	15	8	—	78
10	...	—	1	3	6	12	11	27	15	17	6	1	66
4	...	—	—	—	4	8	15	25	30	9	9	—	53
9	...	—	—	—	—	5	19	29	26	21	—	—	42
6	...	—	—	—	—	5	10	18	39	18	8	1	39
3	...	—	—	—	—	6	3	11	28	36	17	—	36
8	...	—	—	—	—	—	3	13	45	29	10	—	31

Sample 10 is somewhat different from the other samples, suggesting a mixture of fish with different first year growths. It will be seen later that this sample shows a change of growth for herrings with three and four winter rings.

The herrings with three winter rings were the predominant year class. The first sample examined, sample 1, was taken 30th April 100 miles east of the Tyne. It contained 49 fish, 10.5 per cent., with three winter rings, and the growth of these fish up to formation of the first winter ring is so like that for the fish

of similar age in sample 2 that it would appear the herrings of three winter rings present 100 miles from the coast at the end of April had by the middle of May arrived on the grounds of the Northumberland Coast herrings. The bulk of the fish had in their first year made a growth of from 8 to 11 cm. ; 80 per cent. with this growth was in sample 1 and 81 per cent. in sample 2, or expressed differently, samples 1 and 2 contained 56 and 57 per cent. respectively, with a growth of from 8 to 9 cm., and both had 14 and 10 per cent., with a growth of 10 and 11 cm. It was stated when reporting on the samples of 1914* that sample 1 consisted of recovering spents and virgin fish, and that the gonads owing to their condition gave difficulty in the exact determination of their state. It would appear from the above that at this time of the year, April, when it is stated by fishermen that they can catch sufficient herrings for bait purposes almost anywhere in the North Sea, that there is a mixing of shoals, which is followed by segregation of the younger year groups to partake of a feeding migration to waters nearer the coast.

The first year growth to the nearest centimetre for the herrings of three winter rings in the 1914 samples is here expressed in percentages :—

PERCENTAGE AT CENTIMETRES.													
Sample.	4	5	6	7	8	9	10	11	12	13	14	Total.	
1	...	—	2	2	6	26	30	14	10	2	6	—	49
2	...	—	2	1	15	28	29	14	10	—	1	—	80
3	...	—	—	1	14	29	19	17	11	8	2	—	124
4	...	—	—	4	11	34	29	11	5	3	2	—	147
5	...	—	1	4	11	38	25	13	3	2	1	1	97
6	...	—	2	9	14	28	25	10	9	2	1	—	150
7	...	—	3	10	21	27	25	9	5	1	—	—	117
8	...	—	—	4	14	23	30	11	9	5	2	1	132
9	...	1	—	5	13	29	20	13	13	4	2	—	165
10	...	—	1	2	17	18	24	15	13	6	3	—	96

If these data for the Northumberland Coast herring be arranged as below, it will be seen that there was during the latter part of June and in July an addition to the shoal of fish with a small first year growth. Towards the end of July herrings with a larger first year growth began to arrive, and were present in considerable numbers in sample 10 taken towards the end of August.

* Report, New Series, IV., page 23.

Sample.	Percentage with first year growth less than 8 cm.	Percentage with first year growth greater than 9 cm.	Date.
2... ..	18	25	19th May.
3... ..	15	38	8th June.
4... ..	15	21	22nd June.
5... ..	16	20	6th July.
6... ..	25	22	13th July.
7... ..	34	15	20th July.
8... ..	18	28	27th July.
9... ..	19	32	5th August.
10... ..	20	37	24th August.

Herrings with four winter rings were present in sample 1 in large numbers, and comprised 32 per cent. of the sample. But herrings of this age did not come into the Northumberland Coast shoal in any large numbers, or if they did so, the number was hidden by the predominant year class with three winter rings. During June and July the greater number of these fish had a growth of 8 and 9 cm. In August, fish with a larger first year growth arrived, and in sample 10 the greater part of the fish were those which had made a first year growth of 9 and 10 cm. This will be evident from the following table, which gives the first year growth of herrings with four winter rings.

Sample.	PERCENTAGE AT CENTIMETRES.											Total
	4	5	6	7	8	9	10	11	12	13	14	
1	—	1	—	1	18	33	16	14	10	6	2	151
2	—	—	—	—	54	24	8	8	—	8	—	13
3	—	—	—	8	22	24	16	16	8	6	2	51
4	—	—	—	8	34	21	13	13	8	3	—	38
5	—	—	—	9	34	19	13	9	9	6	—	32
6	—	—	2	5	30	20	18	18	7	—	—	40
7	—	—	—	25	12	—	38	12	12	—	—	8
8	—	2	2	5	24	25	17	15	8	2	—	59
9	—	—	4	16	12	44	8	8	8	—	—	25
10	—	—	2	4	13	25	36	11	9	—	—	53

In relation to the above, which shows the late arrival of herrings of three and four winter rings which have made a comparatively large growth up to the formation of the first winter ring, we have to note the growth increment made during the year when captured.

The samples of 1913* gave evidence of a change in the shoals during the beginning of September, shown by the samples having a smaller growth increment for 1913 than those captured earlier

* Report New Series, III., page 63.

in the season. The growth increments made by the herrings in 1914 showed a somewhat similar change as follows :—

Sample.	Growth increment made during 1914 by herrings with						Date.
	Three winter rings.			Four winter rings.			
2 ...	1.1	...	...	0.7	...	...	19th May.
3... ..	1.6	...	...	0.8	...	...	8th June.
4... ..	1.6	...	...	1.1	...	...	22nd June.
5... ..	2.1	...	...	1.0	...	...	6th July.
6... ..	2.0	...	...	1.0	...	...	13th July.
7... ..	2.2	...	...	1.1	...	...	20th July.
8... ..	2.3	...	...	1.2	...	...	27th July.
9... ..	2.3	...	...	1.4	...	...	5th August.
10... ..	1.7	...	...	1.0	...	...	24th August.

Evidently a change takes place in our local shoal towards the latter part of July, fish with a comparatively large first year growth increasing in number. This change continues during August, and by the latter part of that month or the beginning of September (1913) the change which has taken place is such that the average growth increment for the year of capture has been influenced.

This is of interest when connected with the time of fishing some twenty years ago, when the herring season for our coast did not begin until August, the latter part of July at the earliest, and shoals of full herring were fished towards the end of August and the beginning of September.

Sample 11, 1914, was taken 8th September 30 miles S.E. by E. of Hartlepool. When considering the age composition it was pointed out that the samples of 1916 denoted the mouth of the Tees as being approximately the southern limit of the Northumberland Coast shoal.

The age composition of samples 2 to 10, Northumberland Coast herrings, and of sample 11 here follow :—

Samples.	WINTER RINGS.								
	1	2	3	4	5	6	7	8	9
2 to 10	0.4	27.0	51.0	15.0	5.0	1.0	0.5	0.1	0.1
11	—	4.5	50.5	24.0	14.5	2.5	3.0	1.0	0.5

Whilst the predominant year class is still that with three winter rings, sample 11 is marked by the small percentage of younger fish, and the higher percentages of older fish. There were nine herrings only with two winter rings, and the first year growth of these was generally greater than the average for those

of the same age in samples 2 to 10, being as follows :—1 at 9 cm., 2 at 10 cm., 1 at 11 cm., 2 at 12 cm., 2 at 13 cm. and 1 at 14 cm. .

The first year growth made by herrings of three and four winter rings in sample 11 was as follows :—

PERCENTAGE AT CENTIMETRES.												
Winter Rings.	4	5	6	7	8	9	10	11	12	13	14	Nos.
3	—	1	4	11	20	16	14	9	15	8	2	100
4	—	—	—	6	10	39	23	13	4	4	—	48

Of herrings with three winter rings having a greater first year growth than 9 cm. there was 48 per cent., a higher percentage than in any of the Northumberland Coast samples, which had an average of 26 per cent., and a maximum of 38 per cent. of fish making a growth of over 9 cm. in the first year. These fish also give indication of a mixture of two growth groups.

The first year growth of the herrings with four winter rings is practically the same as that found in the Northumberland samples in August.

Two samples of Yorkshire Coast trawled herring, samples 12 and 13, coming from ca. 70 miles E.S.E. of the Tyne, yielded a first year growth for herrings with two, three and four winter rings as follows :—

PERCENTAGE AT CENTIMETRES.												
Winter Rings.	4	5	6	7	8	9	10	11	12	13	14	Nos.
2	—	—	3	9	18	6	18	6	12	23	6	34
3	—	—	2	8	21	27	15	11	11	2	1	99*
4	—	—	—	5	8	19	28	14	17	6	3	64

The herrings of two winter rings though present in small number suggest a mixture of fish with different growths for the first year. Those with three winter rings had 48 per cent. which had made a first year growth of 8 and 9 cm., 10 per cent. with a growth of less than 8 cm., and 41 per cent. with a growth greater than 9 cm. They were different therefore from the Northumberland Coast herring in that more fish were present with a growth of more than 9 cm. Herrings of four winter rings had made a first year growth greater on the whole than those of either the Northumberland Coast or the Yorkshire Coast drift net herrings, and whilst containing fish of a similar growth to those obtained

* 1 at 15 centimetres.

from the other localities, the samples for this year class, as also for the year class with two winter rings, points to a mixture of at least two growth groups, one having a growth similar to the herrings of the Northumberland coast and the other group having a larger growth.

1915.—The samples of 1915,* whilst only three in number, allow of comparison between Northumberland Coast herrings (sample 1) and those trawled from the Yorkshire coast, about 70 miles E.S.E. of the Tyne (samples 2 and 3).

The first year growth of fish with two winter rings in these samples expressed as percentages was as follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
1	—	—	—	—	4	12	18	28	24	14	—	50
2	—	—	—	2	3	14	22	35	15	7	2	65
3	—	—	—	3	11	11	23	23	17	11	—	35

The herrings with two winter rings from the Northumberland coast had a slightly larger growth than those of the trawled herrings. For the herrings with three winter rings, the same can be said. The first year growth of this year class was as follows :—

PERCENTAGE AT CENTIMETRES.

Sample	4	5	6	7	8	9	10	11	12	13	14	Nos.
1	—	1	4	14	29	21	20	8	1	2	—	201
2	—	1	5	21	30	24	10	7	3	—	—	154
3	—	—	—	9	29	36	19	4	3	—	—	114

The percentages here differ from those of 1914 when there were more herrings with a larger first year growth amongst the trawled samples. The herrings with four winter rings from the trawled samples of the Yorkshire coast had as in 1914 a larger growth than the Northumberland Coast fish, and the particulars were as follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
1	—	—	—	13	37	32	11	8	—	—	—	38
2	—	3	3	14	22	23	19	13	1	1	—	64
3	—	—	—	13	23	30	21	11	2	—	—	56

1916.—It has been shown from a consideration of the age composition of the samples taken in June and July, 1916, that the

* Report, New Series, V., page 19.

Northumberland Coast shoal was limited by the Farne Islands to the north, and the region of the mouth of the Tees to the south, and also that during August the herrings with four winter rings were more abundant in the northern portion of the fishing ground than the southern. A consideration of the first year growth of the samples for which the growth has been calculated shows a somewhat similar limitation of the shoal, especially in the south, and also a distribution along the coast according to the first year growth, the herrings with the greater first year growth being more plentiful in the southern portion.

The samples of June and early July, for which the first year growth has been determined and their date of capture, are A1, 27th June; B1, 30th June; 2, 6th June; C1, 13th July. The position of capture will be seen on Chart I.

The first year growth of herrings with four winter rings indicates a slight difference between samples A1 and B1, the former having more fish with a first year growth of 8 cm. and over than the latter. Sample 2 coming from the southern portion of the fishing ground contains fish with a greater first year growth than those from the northern portion, samples A1 and B1; and sample C1, marking the southern limit of the grounds, gives evidence of a mixture of fish having a similar first year growth to those of sample 2, with fish having a smaller first year growth. The first year growth of herrings with four winter rings in these samples here follows:—

PERCENTAGE AT CENTIMETRES.

Samples.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	6	11	16	26	26	9	5	1	1	—	—	144
B1	5	9	20	34	21	7	4	—	—	—	—	56
2	2	7	9	22	32	22	3	3	1	—	—	101
C1	8	16	10	23	27	10	5	1	—	—	—	115

Herrings with three winter rings also vary in the first year growth with the place of capture. Sample A1 contained only 27 fish of this age, and on the whole they had a larger first year growth than fish of a similar age in sample B1. Sample 2 had fewer fish than sample B1 with a first year growth less than 8 cm., and sample C1 differed from sample 2 in the same way as was found for herring with four winter rings, there being indications of an addition of fish with a comparatively small first year growth. The particulars are as follows:—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	—	—	—	11	26	18	30	11	4	—	—	27
B1	1	6	14	18	23	21	12	4	—	—	—	138
2	1	2	4	11	31	25	16	5	4	1	—	98
C1	2	7	13	13	27	24	9	2	2	—	—	45

Of herrings with five winter rings there were six only in sample B1. Those of sample A1 had a smaller first year growth than those in sample 2, and sample C1 again differs from sample 2, and in the same way as found for the herrings with three and four winter rings, but sample 2 with 15 per cent. with a first year growth of 5 cm. probably also gives evidence of a mixture of growth groups. The first year growth was as follows :—

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	11	11	22	29	23	2	3	—	—	—	—	65
2	3	15	12	15	36	9	9	—	—	—	—	33
C1	9	20	20	22	13	11	4	—	—	—	—	45

Sample 4 was taken 16th August ; sample 5, 22nd August ; and sample D1, 26th August ; and as will be seen from the chart they represent different parts of the fishing ground. Herrings with four winter rings had in August become the predominant year class throughout the area, and the samples show, as will be seen from the following data, the fish of this age with a comparatively large first year growth more abundant in the southern portion of the area. These samples when compared with those of June and early July give evidence that fish with a comparatively large first year growth had joined the shoal in August as happened in 1914. The first year growth for herrings with four winter rings here follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
D1	1	4	15	31	26	14	6	3	—	1	—	141
4	1	5	14	24	24	21	7	4	1	—	—	106
5	—	3	8	14	26	25	12	8	2	—	—	86

The numbers of fish with three winter rings are too small to admit of comparison, but those of five winter rings are of interest. When the examination of sample D1 was being made note was taken that about a fourth of the sample was found to be ready for spawning.* Twenty-five per cent. of the sample consisted of

* Report, New Series, VI., page 11.

herrings with five winter rings, and not one had made a first year growth of less than 6 cm., and 80 per cent. had a first year growth of 6 to 8 cm. As will be seen below, sample 5 differs from sample 4.

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
D1	—	—	29	27	24	11	3	5	—	—	—	62
4	3	5	22	39	19	7	3	2	—	—	—	59
5	7	14	17	26	21	11	4	1	—	—	—	73

Sample A4 came from the northern part of the fishing ground in the beginning of September, the 9th. It shows evidence of the change mentioned for September, 1913, brought about by the addition of fish with a comparatively small first year growth. The particulars relating to the first year growth made by the fish of this sample here follow :—

PERCENTAGE AT CENTIMETRES.

Winter Rings.	4	5	6	7	8	9	10	11	12	13	14	Nos.
3	—	—	14	24	19	17	24	2	—	—	—	42
4	1	8	19	24	17	20	8	3	—	—	—	125
5	3	6	22	25	25	16	3	—	—	—	—	64

1917.*—Sample A1 came from 15 miles N.E. of Berwick, 7th July, and sample 2 came from 24 miles N.E. by N. of the Tyne, 20th July. The difference between the first year growth of the herrings with three and four winter rings in these samples is comparable with the difference found between the samples of 1916 in June and July when it was shown that sample C1 which marked the southern limit of our fishing grounds bore evidence of mixing of growth groups. Sample 2 of 1917 differs from sample A1, having a greater range of growth for the majority of the fish, and the herrings of four winter rings give indication of a mixing of growth groups.

The first year growth of herrings with three winter rings here follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	—	—	2	8	23	36	21	7	2	—	—	84
2	1	1	7	13	22	22	17	15	2	1	—	110

The first year growth of herrings with four winter rings was as follows :—

* Report, New Series, VII., page 8.

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	—	2	9	13	36	20	12	7	1	—	—	126
2	1	5	19	20	15	23	15	2	—	—	—	110

Samples A3 and A5, 9th August and 5th September respectively, show the change which has been observed to take place in other years at the beginning of September, the addition to the shoal of herrings with a comparatively small first year growth. Sample A3 had nineteen herrings only with three winter rings. The growth of herrings with four winter rings is here given :—

PERCENTAGE AT CENTIMETRES

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A3	1	2	7	16	24	22	18	11	—	—	—	114
A5	2	12	20	32	19	15	4	5	—	—	—	112

1918.—The first year growth of samples of this year has been determined with the object of showing the relationship between the most northern sample, A1, 15 miles N.E. of Berwick, 26th June, and the fish of the Northumberland coast, represented by sample 1, 10 miles N.E. of the Tyne, 12th July, and also the change in the shoal which has been shown to take place during August of previous years.

Sample A1 for fish with three and four winter rings had a smaller first year growth than had sample 1, and thus the two samples can be compared with the samples of 1916, which showed the fish with the largest first year growth more abundant in the southern portion of the Northumberland shoal.

The first year growth of herrings with three winter rings here follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Ncs.
A1	1	3	9	16	29	26	12	4	1	—	—	151
1	—	2	2	12	26	22	22	11	1	—	—	85*

Herrings with four winter rings had the following first year growth :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A1	6	—	15	21	23	19	9	4	2	—	—	47
1	—	2	8	18	22	22	14	6	2	—	—	112

* One at 15 cm.

The August samples, A2, 4, 10, came from practically the same locality on the 2nd, 6th and 22nd respectively. They indicate in the case of the herrings with three winter rings the joining of the shoal in August of fish with a comparatively large first year growth, and towards the end of August the coming of fish with a smaller first year growth.

The first year growth for herrings with three winter rings was as follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A2	—	—	2	12	25	28	22	8	2	—	—	126
4	—	—	—	1	18	33	30	14	5	—	—	101
10	—	—	2	15	31	35	14	3	—	—	—	104

Herrings with four winter rings were not the predominant year class in 1918, and sample A2 contained fifteen fish only of this age. The other two August samples show the same difference for fish with four winter rings as they do for those a year younger. The first year growth was as follows :—

PERCENTAGE AT CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Nos.
A4	—	—	—	6	39	34	20	1	—	—	—	70
10	—	—	2	26	31	27	12	1	—	—	—	81

From the foregoing consideration of the first year growth made by the herrings of the Northumberland Coast shoal it would appear that there are continued additions to the shoal throughout the season. The herrings appear off the coast in May coming from deeper water, being in April 100 miles from the coast (sample 1, 1914). During June and July there are additions to the shoal of fish which have made a comparatively small first year growth, and these are followed in August by fish with a larger first year growth, which in sample 10, 1914, showed a decreased growth for the year of capture. In September, there is a further addition to the shoal of fish with a comparatively small first year growth.

It is assumed that these changes are brought about by immigration into the shoal and not by emigration from it. Whilst emigration may take place there is no evidence of it, and it is thought that the heavy fishing to which the shoal is subjected makes immigration necessary to maintain the herring population of the fishing ground.

It would appear also that the shoal increased in extent after the restrictions of 1915. It extended in 1916 as far south as the mouth of the Tees, evidence of mixing of growth groups being obtained from this region. The extent northwards is difficult to estimate from the first year growth, but from a consideration of age composition the Farne Islands in 1916 seem to be its northern limit. In 1917, the shoal, viewed from the first year growth, extended north of St. Abbs, and gave evidence of mixing about the region of the Coquet. If the shoal had moved north to this extent in 1917 and had its southern limit in the vicinity of the Coquet, the same cannot be said with any certainty to have obtained in 1918. Sample 1 of 1918 may be taken as giving slight indications of mixing, and the fish with four winter rings of samples 4 and 10 had a first year growth which reminds one of the growth of the samples from the southern portion of the region in 1916.

The distribution along the coast according to the growth attained at the formation of the first winter ring, as observed in the samples of 1916, is of interest, but it cannot at present be connected with any other phenomenon.

RETURN OF HERRINGS TO THE SHOAL.—By considering the first year growth of the different age groups in their successive years, *e.g.*, by taking the herrings of two winter rings in 1913, and so on to the fish with five winter rings in 1916, an indication will be given of the extent to which the herrings of the Northumberland coast return to the same ground with increasing age. This has been done for four year groups, the fish with two winter rings in 1913, 1914, 1915 and 1916.

All the samples for which the first year growth has been determined are not included in their respective years. The aim has been to fairly represent the shoals, and where changes have been observed, as sample 10 of 1914 and sample D1 of 1916, which contained 25 per cent. of fish ready for spawning, and where a year class is very poorly represented these samples have been omitted. Whilst the omitting of a sample has been considered the fairest way of considering the matter with our present knowledge, yet in some cases little difference is shown in the final percentages determined.

The herrings with two winter rings in 1913 had a much larger first year growth than those of three, four and five winter rings

in the following years. Those with three winter rings of 1914 had practically the same first year growth as the fish with four winter rings in 1915. But in 1916, when the herrings had five winter rings, this year class gave a smaller first year growth than in previous years. The data are as follows :—

PERCENTAGE AT CENTIMETRES.

Year.	Winter Rings.	4	5	6	7	8	9	10	11	12	13	14
1913	2	—	—	0.5	1	8	15	24	27	18	6	1
1914	3	0.1	1	5	14	29	25	12	8	4	1	0.2
1915	4	—	—	—	13	37	32	11	8	—	—	—*
1916	5	6	10	19	28	24	9	4	0.7	—	—	—

The herrings with two winter rings in 1914 had, like those of the previous year, a higher first year growth than the fish of three winter rings in 1915, which had also a larger first year growth than the herrings with four winter rings in 1916. The herrings with five winter rings in 1917 had a growth the same as the herrings of four winter rings of 1916.

The particulars of the first year growth of this year class here follow :—

PERCENTAGE AT CENTIMETRES.

Year.	Winter Rings.	4	5	6	7	8	9	10	11	12	13	14
1914	2	—	—	0.4	4	10	16	20	27	15	6	1
1915	3	—	1	4	14	29	21	20	8	1	2	—
1916	4	2	7	14	23	24	18	6	3	0.8	—	—
1917	5	1	5	11	22	27	23	8	3	—	—	—

There were only 55 herrings with two winter rings in 1915, and the first year growth made by these was greater than the average for the two previous years, but not greater than that found in some of the sample of 1914, when it has been seen the first year growth of herrings of this age varied with the number present in the samples. Unlike the two previous year classes considered above, the herrings of three, four and five winter rings have practically the same growth for the first year, the data being as follows :—

PERCENTAGE AT CENTIMETRES.

Year.	Winter Rings.	4	5	6	7	8	9	10	11	12	13	14
1915	2	—	—	—	—	4	12	18	28	24	14	—
1916	3	0.9	3	9	15	24	22	17	6	2	0.3	—
1917	4	0.4	3	11	17	26	20	15	6	1	—	—
1918	5	—	3	6	14	32	21	17	4	2	—	—

* In 1915, only one sample of the Northumberland Coast herrings was examined. It contained thirty-eight fish with four winter rings.

The herrings with two winter rings of 1916 had three in 1917, and four winter rings in 1918. They again show a larger first year growth than in succeeding years, but not so large a growth as that made by fish of the same age in previous years. The first year growth of fish of three and four winter rings is again the same. The particulars here follow :—

Year.	Winter Rings.	PERCENTAGE AT CENTIMETRES.										
		4	5	6	7	8	9	10	11	12	13	14
1916	2	—	—	—	4	7	24	35	25	4	2	—
1917	3	0·3	0·7	4	13	23	26	19	11	2	0·7	—
1918	4	—	1	4	17	29	27	16	4	1	0·4	—

From the consideration of the above it would appear that the herrings return to the Northumberland Coast shoal after the formation of the third winter ring. 1916, the year following the restricted fishing of 1915, gives a decreased first year growth for herrings with four and five winter rings, but apart from this year the first year growth shows practically no variation, and it is assumed that this factor points to the yearly return of the herrings,

The first year growth made by herrings with two winter rings was always greater than that found in succeeding years, but it was distinctly smaller for fish of this age in 1916. The samples of 1917 contained 17 fish only having two winter rings; these were all in one sample, the growth of which has not been determined. The 1918 herrings with two winter rings had a first year growth smaller than those of 1916, the particulars being as follows:—

Year.	Winter Rings	PERCENTAGE AT CENTIMETRES.										
		4	5	6	7	8	9	10	11	12	13	14
1918	2	—	—	1	6	16	32	27	26	2	—	—

There is evidence of a change in respect to the herrings with two winter rings, and the data point to fish of this age with a much smaller first year growth and probably from a different spawning ground being present in the Northumberland shoal in 1916 and 1918. This and the increased first year growth for fish of five winter rings are probably due to the restricted fishing, which following the heavy fishing to which in previous years the shoal was subjected, would bring about an increased first year growth for fish of five winter rings, if Lee * is correct that the fish with a small first year growth are late in joining the shoal.

* Pub. de Cir., No. 66.

But there is a considerable difference between the first year growth of fish with two winter rings in 1918 and the first year growth of any of the older fish of this or other years, and this factor is probably explained by the work of Professor Meek, in which he showed that the relationship between the size of the scale and the length of the herring varied with size and age.*

THE FIRTH OF FORTH HERRING.—A sample of herrings was obtained from the Firth of Forth, between Prestonpans and Musselburgh, on the 1st of February, 1917, and the age composition of this sample was given in the Report for that year. Owing to the edge of the scale and the last winter ring coinciding the age of the sample has been reported * as being a year younger than it was. There was no fish in this sample with less than five winter rings, and the fish from the state of the gonads came from a spawning shoal.

There is a close relationship between the first year growth of the herrings of this sample and that made by the herrings of the Northumberland Coast shoal. Samples 4 and 5 taken 1916, and representing the herrings present off our coast in August, in which month herrings with four winter rings have been shown to join the local shoal, have a first year growth for fish with four winter rings very like that of the Firth of Forth herrings. Sample D1 is not used for the purpose of comparison, for it has been stated that this sample contained 25 per cent. of fish ready for spawning. The samples of 1917 had also a similar first year growth for fish with five winter rings. The particulars here follow :—

Sample.	Year.	Winter Rings.	PERCENTAGE AT CENTIMETRES.								
			4	5	6	7	8	9	10	11	12
Northumber- land ...	1916	4	0.5	4	11	19	25	23	9	6	2
Firth of Forth	1917	5	—	3	11	15	23	30	11	6	1
Northumber- land ...	1917	5	1	5	11	22	27	23	8	3	—

Herrings a year older, that is, with five winter rings in the Northumberland samples of 1916, and with six winter rings in the Firth of Forth sample, have a still closer relationship in the first year growth, the particulars being as follows :—

* Report, New Series. V., page 11.

† Report, New Series, VI., page 18.

PERCENTAGE AT CENTIMETRES.

Sample.	Winter Rings.	PERCENTAGE AT CENTIMETRES.								
		4	5	6	7	8	9	10	11	
Northumberland ...	5	6	10	19	28	24	9	4	0.7	
Firth of Forth ...	6	2	12	15	28	20	12	10	1	

The fluctuations in the catches of herrings during the winter fishing in the Firth of Forth bear a closer relationship to those of the Northumberland coast than they do to those of the summer fisheries of the Firth of Forth.

The accompanying table shows the catches for the fisheries above mentioned. The quantities for the Northumberland shoal are those landed on the Northumberland coast only, and do not include any landed at Durham ports. During 1911 and 1912, there was a decline in the catches from the Northumberland Coast and the summer fisheries of the Firth of Forth, followed in 1913 by a slight increase in the Firth of Forth fisheries, but by a large increase, the catch being almost three times as large, in the Northumberland fishery. The Firth of Forth winter fishing also shows fluctuations, but there is no decrease until 1913, which is followed in 1914 by a large increase from 42,737 cwts. in 1913 to 143,467 cwts. in 1914. This increase is so large that it can hardly have been brought about by the slight increase of 1913 in the Firth of Forth summer fishing, when the catches were only about one-seventh greater than in 1912, and is much more closely related to the Northumberland fishery, the catches for which increased from 285,895 cwts. in 1912 to 695,680 cwts. in 1913.

QUANTITY OF HERRINGS LANDED DURING WINTER FISHING (1st January to 31st March) *

At.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
Eyemouth	7,770	7,034	5,205	1,018	9,835	5,945	—	—	—
Leith	13,349	8,804	8,036	10,476	29,132	1,635	8,191	12,456	—
Anstruther	39,775	54,293	58,666	31,243	104,500	25,637	7,916	19,807	—
	60,894	70,131	71,907	42,737	143,467	33,217	16,107	32,263	—

EARLY SUMMER FISHING (1st April to 30th June).*

Eyemouth	73,595	38,038	37,986	42,551	40,545	6,139	15,663	11,133	—
Leith	2,872	1,855	923	281	723	119	851	1,567	—
Anstruther	19,729	6,029	2,101	6,180	798	140	1,979	709	—
	96,196	45,922	41,010	49,012	42,066	6,398	18,493	13,409	—

GREAT SUMMER FISHING (1st July to 31st December).*

Eyemouth	96,293	87,731	63,183	70,703	46,608	4,564	27,783	42,829	—
Leith	1,442	861	2,009	1,769	1,870	154	1,251	1,211	—
Anstruther	38,415	29,941	16,398	21,065	3,964	—	263	1,217	—
	136,150	118,533	81,590	93,537	52,442	4,718	29,297	45,257	—

HERRINGS LANDED AT NORTHERLAND PORTS (less Trawled Herrings).

	730,909	480,524	285,895	695,680	347,806	27,442	197,359	237,820	212,917
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* From Reports, Fishery Board, Scotland.

After 1914 war conditions affected the herring fishing, and comparison cannot be made.

The samples of 1914 showed a change in the growth increment made during that year, fish with a small growth for 1914 being found in sample 10. Herrings with three winter rings in 1914 would have six winter rings in 1917, and in order to see if this difference of growth has any connexion with the Firth of Forth herrings the growth made by fish with six winter rings in the Firth of Forth sample during the periods between the formation of the third and fourth and fourth and fifth winter rings has been determined and is shown graphically on the opposite page, together with similar details relating to the growth of herrings with five winter rings. It will be observed that the Firth of Forth sample contains fish which during the years under consideration made varying growths.

The connexion shown above between the herrings of the Northumberland coast and the winter fishery of the Firth of Forth naturally brings forward the question of the spawning which is known to take place off the Northumberland coast in August and September. The opinion held at present, but which is open to modification with the obtaining of additional data, is that the young herrings on attaining first maturity may spawn in the autumn, and that these may be joined by older fish maturing at the same time; afterwards the herrings which passed their earlier years in summer and autumn shoals off the Northumberland coast tend to become spring spawners in the Firth of Forth.

It is not intended at present to express any opinion as to spring and autumn spawning herrings in general, or as to what extent other summer shoals of the North Sea may be spring spawners, but it is hoped that the investigations now being conducted will throw further light upon the subject.



t_5

WINTER RINGS 5



t_4



t_5

WINTER RINGS 6



t_4

FIRTH OF FORTH SAMPLE.

t_4 and t_5 for herrings with 5 and 6 winter rings.

TABLE I.—1913 SAMPLES.
FIRST YEAR GROWTH.—HERRINGS WITH TWO WINTER RINGS.
CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Total.
A	—	—	—	—	1	1	—	2	1	1	1	7
B	—	—	—	—	—	—	—	2	2	—	—	4
C	—	—	—	—	1	4	8	7	6	2	—	28
D	—	—	—	—	1	2	7	4	—	—	—	14
E	—	—	—	—	1	—	5	4	—	3	—	13
F	—	—	—	—	1	1	—	5	—	—	—	7
G	—	—	—	—	—	2	1	2	4	—	—	9
H	—	—	—	—	—	—	3	2	1	—	—	6
I	—	—	—	—	—	—	1	1	3	1	—	6
J	—	—	—	—	1	1	1	2	5	2	1	13
K	—	—	—	—	2	2	7	10	6	1	—	28
L	—	—	—	—	1	5	7	9	7	2	—	31
M	—	—	1	3	7	14	10	6	3	—	—	44
N	—	—	—	—	—	—	—	—	—	—	—	—
O	—	—	—	—	5	4	7	2	2	—	—	20
P	—	—	—	—	—	—	—	—	—	—	—	—
Q	—	—	—	—	1	6	7	6	—	—	—	20
R	—	—	—	—	—	—	—	2	—	—	—	2
S	—	—	—	—	1	4	—	5	2	—	—	12
T	—	—	—	—	1	—	—	—	1	—	—	2
U	—	—	—	—	3	5	3	3	2	—	—	16
V	—	—	—	3	2	7	1	5	2	2	—	22
W	—	—	—	5	12	13	16	5	2	—	—	53
X	—	—	—	2	2	2	7	2	4	1	—	20

TABLE I.—1913 SAMPLES.

FIRST YEAR GROWTH.—HERRINGS WITH THREE WINTER RINGS.

CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Total
A	—	—	—	—	13	9	7	1	2	—	1	33
B	—	—	—	2	3	6	10	3	4	—	—	28
C	—	—	2	9	19	21	4	3	1	—	—	59
D	—	—	5	6	13	9	5	3	1	—	—	42
E	—	—	1	4	6	8	9	9	2	—	—	39
F	—	—	1	2	8	11	5	7	8	1	—	43
G	—	—	2	2	9	10	8	7	2	—	—	40
H	—	—	1	5	8	7	13	8	8	—	—	50
I	—	—	1	3	15	12	10	8	3	—	1	53
J	—	1	—	7	27	26	19	11	2	1	—	94
K	—	1	3	8	33	32	14	15	4	2	—	112
L	1	—	5	4	26	26	16	15	2	—	—	95
M	—	—	3	4	12	16	8	4	2	—	—	49
N	1	—	—	1	3	6	6	7	1	—	—	25
O	—	—	8	3	7	9	6	4	4	1	—	42
P	—	—	2	1	2	5	3	3	1	—	—	17
Q	—	1	6	5	9	7	7	1	—	—	—	36
R	—	—	—	—	1	4	1	1	1	—	—	8
S	—	—	1	1	8	7	7	2	2	—	—	28
T	—	—	1	3	1	5	2	5	2	—	—	19
U	—	—	—	2	5	9	5	2	—	—	—	23
V	—	1	2	—	2	5	1	3	—	—	—	14
W	—	—	1	1	5	4	3	1	1	—	—	16
X	—	—	1	—	10	7	4	2	2	—	—	26

TABLE I.—1913 SAMPLES.

FIRST YEAR GROWTH.—HERRINGS WITH FOUR WINTER RINGS.

CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Total.
A	—	—	—	5	13	3	—	4	—	—	—	25
B	—	—	1	6	6	3	2	1	1	—	—	20
C	—	—	1	5	10	2	—	—	—	—	—	18
D	—	—	2	8	5	6	1	—	—	—	—	22
E	—	—	1	4	3	6	2	2	1	—	1	20
F	—	2	—	5	12	4	7	5	—	—	—	35
G	—	—	1	13	14	5	6	3	2	—	—	44
H	—	—	4	4	6	5	3	3	1	1	—	27
I	—	—	—	7	12	8	1	1	—	—	1	30
J	—	4	4	19	20	10	4	3	2	—	—	66
K	—	1	3	11	17	9	1	2	2	1	—	47
L	—	1	8	17	20	12	2	4	1	—	—	65
M	—	—	1	1	5	2	—	1	—	—	—	10
N	1	—	4	19	32	19	16	7	—	—	—	98
O	—	2	1	10	16	8	6	7	1	1	—	52
P	—	1	1	7	19	19	10	2	1	—	—	60
Q	—	1	1	13	14	12	3	4	—	1	—	49
R	—	—	1	3	9	12	5	2	—	—	—	32
S	—	—	1	4	11	11	8	3	1	1	—	40
T	—	2	3	7	10	10	8	2	4	—	—	46
U	—	—	2	8	7	10	4	4	—	—	—	35
V	—	—	2	10	10	18	9	11	2	1	—	63
W	—	—	—	2	6	3	5	—	1	—	—	17
X	—	—	4	8	8	8	5	3	1	1	—	38

TABLE I.—1913 SAMPLES.
 FIRST YEAR GROWTH.—HERRINGS WITH FIVE WINTER RINGS.
 CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Total.
A	—	—	—	3	—	—	1	—	—	—	—	4
B	1	—	—	4	6	1	1	—	1	—	—	14
C	—	—	—	1	1	—	—	—	—	—	—	2
D	—	—	1	—	—	1	3	—	—	—	—	5
E	—	—	—	3	3	—	—	—	—	—	—	6
F	—	—	2	5	—	2	1	1	—	—	—	11
G	—	—	1	1	3	—	1	—	—	—	—	6
H	—	—	—	—	1	—	1	—	1	—	—	3
I	—	—	—	2	—	—	1	—	—	—	—	3
J	—	—	3	6	4	3	—	—	—	—	—	16
K	—	—	—	1	3	1	—	1	—	—	—	6
L	—	—	—	1	2	5	—	—	1	—	—	9
M	—	—	—	—	1	—	—	—	—	—	—	1
N	—	3	5	6	11	5	4	3	1	1	—	39
O	—	—	1	4	1	5	2	—	—	—	—	13
P	—	1	5	7	11	3	8	3	—	—	—	38
Q	—	1	2	6	11	6	1	1	—	—	—	28
R	—	—	1	2	6	1	2	3	—	—	—	15
S	—	—	1	7	6	8	4	2	2	—	—	30
T	—	—	—	5	9	5	1	1	3	—	—	24
U	—	—	—	2	4	4	4	5	1	—	—	20
V	—	1	1	7	8	9	6	1	—	—	—	33
W	—	—	—	2	3	4	1	1	—	—	—	11
X	—	—	—	14	11	7	4	2	—	—	—	38

TABLE I.—1913 SAMPLES.

FIRST YEAR GROWTH.—HERRINGS WITH SIX AND MORE WINTER RINGS.

CENTIMETRES.

Sample.	4	5	6	7	8	9	10	11	12	13	14	Total.
A	—	—	—	—	—	—	—	—	—	—	—	—
B	—	—	—	—	—	—	—	—	—	—	—	—
C	—	—	—	—	—	—	—	—	—	—	—	—
D	—	—	—	—	—	—	—	—	—	—	—	—
E	—	—	—	—	—	—	—	—	—	—	—	—
F	—	—	—	—	—	—	—	—	1	—	—	1
G	—	—	—	1	—	—	—	—	—	—	—	1
H	—	—	1	1	1	7	3	1	—	—	—	14
I	—	—	—	—	1	2	1	3	—	—	—	7
J	—	—	—	2	3	1	3	—	—	—	—	9
K	—	—	2	—	2	1	—	—	—	—	—	5
L	—	—	—	—	—	—	3	—	—	—	—	3
M	—	—	—	—	—	—	1	—	—	—	—	1
N	—	—	1	4	8	7	5	7	1	—	—	33
O	—	—	2	3	7	11	7	6	—	1	—	37
P	—	—	3	7	25	14	15	5	4	—	—	73
Q	—	—	1	4	8	8	3	2	—	—	—	26
R	—	—	1	3	10	11	10	—	3	—	—	38
S	—	1	3	5	16	4	14	3	3	—	—	49
T	—	—	1	8	18	16	9	6	1	1	—	60
U	—	1	1	4	13	20	10	9	4	2	—	64
V	—	—	1	4	2	6	9	6	—	—	—	28
W	—	—	—	2	1	4	2	—	1	—	—	10
X	—	—	—	5	7	12	7	4	1	1	—	37

TABLE I.—1914 SAMPLES.—FIRST YEAR GROWTH.

CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
1	2	Nos. ...	—	—	—	—	—	—	—	2	1	—	—	3
	3	Nos. ...	—	1	1	3	13	15	7	5	1	3	—	49
		% ...	—	2	2	6	26	30	14	10	2	6	—	
	4	Nos. ...	—	1	—	1	27	50	24	21	15	9	3	151
		% ...	—	1	—	1	18	33	16	14	10	6	2	
	5	Nos. ...	—	1	4	17	41	51	24	10	4	1	1	154
		% ...	—	1	3	11	27	33	16	6	3	1	1	
6		Nos. ...	—	—	7	15	22	21	6	6	2	1	—	80
		% ...	—	—	9	19	27	26	8	8	2	1	—	
	7 to 9	Nos. ...	—	—	—	4	9	10	1	3	2	—	—	29
2	2	Nos. ...	—	—	—	2	6	9	23	20	12	6	—	78
		% ...	—	—	—	3	8	12	29	26	15	8	—	
	3	Nos. ...	—	2	1	12	22	23	11	8	—	1	—	80
		% ...	—	2	1	15	28	29	14	10	—	1	—	
	4	Nos. ...	—	—	—	—	7	3	1	1	—	1	—	13
		% ...	—	—	—	—	54	24	8	8	—	8	—	
3	2	Nos. ...	—	—	—	—	2	1	4	10	13	6	—	36
		% ...	—	—	—	—	6	3	11	28	36	17	—	
	3	Nos. ...	—	—	1	17	36	23	21	14	10	2	—	124
		% ...	—	—	1	14	29	19	17	11	8	2	—	
	4	Nos. ...	—	—	—	4	11	12	8	8	4	3	1	51
		% ...	—	—	—	8	22	24	16	16	8	6	2	
	5 to 10	Nos. ...	—	—	1	6	14	8	3	3	1	2	1	39
4	2	Nos. ...	—	—	—	2	4	8	13	16	5	5	—	53
		% ...	—	—	—	4	8	15	25	30	9	9	—	
	3	Nos. ...	—	—	6	16	50	43	16	8	5	3	—	147
		% ...	—	—	4	11	34	29	11	5	3	2	—	
	4	Nos. ...	—	—	—	3	13	8	5	5	3	1	—	38
		% ...	—	—	—	8	34	21	13	13	8	3	—	
	5 & 6	Nos. ...	—	—	—	1	4	3	1	—	—	—	—	9
5	2	Nos. ...	—	—	2	11	16	24	25	21	8	2	1	110
		% ...	—	—	2	10	15	22	23	19	7	2	1	
	3	Nos. ...	—	1	4	11	37	24	13	3	2	1	1	97
		% ...	—	1	4	11	38	25	13	3	2	1	1	
	4	Nos. ...	—	—	—	3	11	6	4	3	3	2	—	32
		% ...	—	—	—	9	34	19	13	9	9	6	—	
	5	Nos. ...	—	—	—	1	2	4	2	—	—	—	—	9
6	2	Nos. ...	—	—	—	—	2	4	7	15	7	3	1	39
		% ...	—	—	—	—	5	10	18	39	18	8	3	
	3	Nos. ...	—	3	13	21	42	39	15	14	3	2	—	150
		% ...	—	2	9	14	28	25	10	9	2	1	—	
	4	Nos. ...	—	—	1	2	12	8	7	7	3	—	—	40
		% ...	—	—	2	5	30	20	18	18	7	—	—	
	5 to 7	Nos. ...	—	—	1	5	3	2	1	2	3	1	—	18

TABLE I.—1914 SAMPLES.—FIRST YEAR GROWTH.

CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
7	1	Nos. ...	—	—	—	—	—	—	—	—	—	1	—	2*
	2	Nos. ...	—	—	—	7	16	23	23	27	14	3	2	115
		% ...	—	—	—	6	14	20	20	23	12	3	2	
	3	Nos. ...	—	4	12	24	31	29	10	6	1	—	—	117
		% ...	—	3	10	21	27	25	9	5	1	—	—	
	4	Nos. ...	—	—	—	2	1	—	3	1	1	—	—	8
5 to 7	Nos. ...	—	—	—	1	2	2	—	—	—	—	—	5	
8	2	Nos. ...	—	—	—	—	—	1	4	14	9	3	—	31
		% ...	—	—	—	—	—	3	13	45	20	10	—	
	3	Nos. ...	—	—	5	19	30	40	15	12	7	3	1	132
		% ...	—	—	4	14	23	30	11	9	5	2	1	
	4	Nos. ...	—	1	1	3	14	15	10	9	5	1	—	59
		% ...	—	2	2	5	24	25	17	15	8	2	—	
5 to 9	Nos. ...	—	—	—	2	10	9	—	4	2	—	—	27	
	% ...	—	—	—	2	10	9	—	4	2	—	—		
9	1	Nos. ...	—	—	—	—	—	—	—	1	—	—	—	1
	2	Nos. ...	—	—	—	—	2	8	12	11	9	—	—	42
		% ...	—	—	—	—	5	19	29	26	21	—	—	
	3	Nos. ...	1	—	9	22	48	33	22	21	6	3	—	165
		% ...	1	—	5	13	29	20	13	13	4	2	—	
	4	Nos. ...	—	—	1	4	3	11	2	2	2	—	—	25
% ...		—	—	4	16	12	44	8	8	8	—	—		
5 to 8	Nos. ...	—	—	2	3	7	3	1	—	—	—	—	16	
	% ...	—	—	2	3	7	3	1	—	—	—	—		
10	1	Nos. ...	—	—	—	—	—	—	—	—	—	2	2	5†
	2	Nos. ...	—	1	2	4	8	7	18	10	11	4	1	66‡
		% ...	—	1	3	6	12	11	27	15	17	6	1	
	3	Nos. ...	—	1	2	16	17	23	15	13	6	3	—	96‡
		% ...	—	1	2	17	18	24	15	13	6	3	—	
	4	Nos. ...	—	—	1	2	7	13	19	6	5	—	—	53
% ...		—	—	2	4	13	25	36	11	9	—	—		
5 to 9	Nos. ...	—	—	—	4	5	9	5	1	1	1	—	26	
11	2	Nos. ...	—	—	—	—	—	1	2	1	2	2	1	9
	3	Nos. ...	—	1	4	11	20	16	14	9	15	8	2	100‡
		% ...	—	—	—	3	5	19	11	6	2	2	—	
	4	Nos. ...	—	—	—	3	5	19	11	6	2	2	—	48
		% ...	—	—	—	6	10	39	23	13	4	4	—	
5 to 9	Nos. ...	—	—	2	4	11	9	8	6	1	—	1	42‡	
12	2	Nos. ...	—	—	—	—	2	1	4	—	2	2	—	11
	3	Nos. ...	—	—	1	—	12	12	6	6	6	7	—	44
		% ...	—	—	2	—	27	27	14	14	16	—	—	
	4	Nos. ...	—	—	—	—	3	13	6	8	2	2	—	34
		% ...	—	—	—	—	9	38	18	24	6	6	—	
	5	Nos. ...	—	—	1	5	16	16	18	8	—	2	—	66
% ...		—	—	1	8	24	24	27	12	—	3	—		
6 to 10	Nos. ...	—	—	2	6	11	10	9	2	2	—	—	42	
	% ...	—	—	5	14	26	24	21	5	5	—	—		

* One at 16 cm.

† One at 15 cm.

‡ One total length uncertain.

TABLE I.—1914 SAMPLES.—FIRST YEAR GROWTH.
CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
13	1	Nos. ...	—	—	—	—	—	—	—	1	1	1	1	4
	2	Nos. ...	—	—	1	3	4	1	2	2	2	6	2	23
		% ...	—	—	4	13	17	4	9	9	9	26	9	
	3	Nos. ...	—	—	1	8	9	15	9	5	4	2	1	55*
		% ...	—	—	2	15	16	27	16	9	7	4	2	
	4	Nos. ...	—	—	—	3	5	9	5	3	3	2	—	30
		% ...	—	—	—	10	17	30	17	10	10	7	—	
	5	Nos. ...	—	—	1	6	8	11	12	4	5	1	1	49
		% ...	—	—	2	12	16	22	24	8	10	2	2	
	6 to 13	Nos. ...	—	—	1	4	8	11	5	7	3	—	—	39
		% ...	—	—	3	10	20	28	13	18	8	—	—	

* One at 15 cm.

TABLE I.—1915 SAMPLES.—FIRST YEAR GROWTH.
CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
1	1	Nos. ...	—	—	—	—	—	—	—	1	—	—	—	1
	2	Nos. ...	—	—	—	—	2	6	9	14	12	7	—	50
		% ...	—	—	—	—	4	12	18	28	24	14	—	
	3	Nos. ...	—	3	9	27	58	42	39	17	1	5	—	201
		% ...	—	1	4	14	29	21	20	8	1	2	—	
	4	Nos. ...	—	—	—	5	14	12	4	3	—	—	—	38
		% ...	—	—	—	13	37	32	11	8	—	—	—	
5	Nos. ...	—	—	—	2	2	3	—	1	—	—	—	8	
6 to 11	Nos. ...	—	—	—	1	1	—	—	—	—	—	—	2	
2	2	Nos. ...	—	—	—	1	2	9	14	23	10	5	1	65
		% ...	—	—	—	2	3	14	22	35	15	7	2	
	3	Nos. ...	—	1	7	33	46	37	15	10	5	—	—	154
		% ...	—	1	5	21	30	24	10	7	3	—	—	
	4	Nos. ...	—	2	2	9	14	15	12	8	1	1	—	64
		% ...	—	3	3	14	22	23	19	13	1	1	—	
	5	Nos. ...	—	—	—	2	2	2	1	—	1	—	—	8
6	Nos. ...	—	—	1	5	11	3	2	1	—	—	—	23	
7 to 10	Nos. ...	—	—	—	—	2	1	1	1	—	—	—	5	
3	1	Nos. ...	—	—	—	—	—	—	—	1	—	—	1	2
	2	Nos. ...	—	—	—	1	4	4	8	8	6	4	—	35
		% ...	—	—	—	3	11	11	23	23	17	11	—	
	3	Nos. ...	—	—	—	10	33	41	22	5	3	—	—	114
		% ...	—	—	—	9	29	36	19	4	3	—	—	
	4	Nos. ...	—	—	—	7	13	17	12	6	1	—	—	56
		% ...	—	—	—	13	23	30	21	11	2	—	—	
5	Nos. ...	—	—	—	—	5	1	1	1	—	—	—	8	
6	Nos. ...	—	—	2	6	5	5	5	4	2	—	—	29	
8 to 10	Nos. ...	—	—	—	—	—	—	2	2	—	1	—	5	

TABLE I.—1916 SAMPLES.—FIRST YEAR GROWTH.
CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
D1	3	Nos. ...	—	—	2	2	11	9	5	1	—	—	—	30
		% ...	—	—	7	7	37	30	17	3	—	—	—	
	4	Nos. ...	1	6	21	43	37	20	8	4	—	1	—	141
		% ...	1	4	15	31	26	14	6	3	—	1	—	
	5	Nos. ...	—	—	18	17	15	7	2	3	—	—	—	62
% ...		—	—	29	27	24	11	3	5	—	—	—		
6 & 7	Nos. ...	—	1	2	6	2	2	—	1	—	—	—	14	
C1	2	Nos. ...	—	—	—	—	—	—	—	1	—	—	—	1
		% ...	1	3	6	6	12	11	4	1	1	—	—	
	3	Nos. ...	1	3	6	6	12	11	4	1	1	—	—	45
		% ...	2	7	13	13	27	24	9	2	2	—	—	
	4	Nos. ...	9	18	12	27	31	11	6	1	—	—	—	115
		% ...	8	16	10	23	27	10	5	1	—	—	—	
	5	Nos. ...	4	9	9	10	6	5	2	—	—	—	—	45
% ...		9	20	20	22	13	11	4	—	—	—	—		
6 to 9	Nos. ...	4	3	3	1	2	—	—	—	—	—	—	13	

TABLE I.—1918 SAMPLES.—FIRST YEAR GROWTH.

CENTIMETRES.

Sample.	Winter Rings.		4	5	6	7	8	9	10	11	12	13	14	Total.
A1	2	Nos. ...	—	—	1	2	4	9	12	5	2	—	1	36
		% ...	—	—	3	6	11	25	33	14	6	—	3	
	3	Nos. ...	1	4	13	25	43	40	18	6	1	—	—	151
		% ...	1	3	9	16	29	26	12	4	1	—	—	
	4	Nos. ...	3	—	7	10	11	9	4	2	1	—	—	47
		% ...	6	—	15	21	23	19	9	4	2	—	—	
5	Nos. ...	—	—	2	3	—	1	—	—	1	—	—	7	
	% ...	—	—	29	43	—	14	—	—	14	—	—		
6	Nos. ...	—	—	—	—	—	—	1	—	—	—	—	1	
A2	1	Nos. ...	—	—	—	—	1	—	—	1	1	—	—	3
		Nos. ...	—	—	1	7	19	34	20	9	2	—	—	92
	3	% ...	—	—	1	8	21	36	22	10	2	—	—	
		Nos. ...	—	—	3	15	32	35	28	10	3	—	—	126
	4	% ...	—	—	2	12	25	28	22	8	2	—	—	
		Nos. ...	—	—	—	1	3	2	4	2	2	1	—	15
	5	% ...	—	—	—	7	20	13	27	13	13	7	—	
		Nos. ...	—	—	—	—	2	1	2	1	—	—	—	6
	6 & 7	Nos. ...	—	—	—	—	—	2	—	2	—	—	—	4
	1	2	Nos. ...	—	—	—	1	—	4	—	1	—	—	—
Nos. ...			—	2	2	10	22	19	19	9	1	—	—	85*
4		% ...	—	2	2	12	26	22	22	11	1	—	—	
		Nos. ...	—	3	9	21	27	26	17	7	2	—	—	112
5		% ...	—	2	8	18	22	22	14	6	2	—	—	
		Nos. ...	—	3	5	5	5	5	6	1	—	—	—	30
6 & 7	Nos. ...	—	10	17	17	17	17	20	3	—	—	—	9	
4	2	Nos. ...	—	—	—	—	—	3	13	11	—	—	—	27
		Nos. ...	—	—	—	1	18	33	30	14	5	—	—	101
	4	Nos. ...	—	—	—	4	27	24	14	1	—	—	—	70
		% ...	—	—	—	6	39	34	20	1	—	—	—	
	5	Nos. ...	—	—	—	2	13	8	6	2	2	—	—	33
		% ...	—	—	—	6	39	24	18	6	6	—	—	
6 to 8	Nos. ...	—	—	—	—	4	3	5	3	1	—	—	16	
10	2	Nos. ...	—	—	—	—	1	—	1	—	—	—	—	2
		Nos. ...	—	—	2	16	32	36	15	3	—	—	—	104
	4	% ...	—	—	2	15	31	35	14	3	—	—	—	
		Nos. ...	—	—	2	21	25	22	10	1	—	—	—	81
	5	% ...	—	—	2	26	31	27	12	1	—	—	—	
		Nos. ...	—	—	2	9	16	10	5	1	—	—	—	43
6 to 8	Nos. ...	—	—	5	21	36	23	12	2	—	—	—	19	

* One under 15 cm.

TABLE II.—1914 SAMPLES.—GROWTH.

SAMPLE 1.—WINTER RINGS, 2 and 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
29	21.8	12.5	20.7	—	48	23.0	10.0	18.2	22.5
212	21.9	11.3	20.7	—	441	23.1	9.6	18.0	22.3
264	22.0	11.5	20.8	—	25	23.2	10.8	20.0	22.8
153	21.1	8.0	16.5	20.7	407	23.3	9.5	16.7	22.8
307	21.2	8.5	14.5	20.6	282	23.3	8.1	15.0	22.5
205	21.7	6.6	15.3	21.2	221	23.3	5.5	14.0	22.1
109	21.9	8.7	16.1	21.3	163	23.3	9.0	18.0	22.6
5	21.9	8.2	16.9	21.3	118	23.3	9.7	16.8	22.6
191	22.0	8.7	15.6	21.2	67	23.3	12.5	19.5	23.0
319	22.1	8.6	15.2	21.2	54	23.3	9.5	19.1	22.6
248	22.3	5.7	13.7	21.6	3	23.4	9.4	16.1	22.5
241	22.4	8.7	17.4	21.7	359	23.4	8.0	16.1	22.8
9	22.4	7.4	14.7	22.2	267	23.4	7.7	17.9	22.9
121	22.5	7.8	15.2	21.6	215	23.7	10.8	17.6	22.8
117	22.5	11.0	16.1	21.6	411	23.8	8.5	18.3	23.2
200	22.6	9.3	18.6	22.0	138	23.8	8.0	19.0	22.9
352	22.7	9.5	17.4	22.2	206	24.0	10.3	17.9	23.1
224	22.7	8.9	15.9	22.3	110	24.2	8.2	18.4	23.5
69	22.7	8.5	18.8	22.3	414	24.2	9.7	18.8	23.3
11	22.8	9.2	16.1	22.0	140	24.3	8.7	21.1	24.1
276	22.8	6.6	14.0	22.0	451	24.5	10.8	19.4	23.7
165	22.8	8.9	16.5	22.1	444	24.9	10.4	20.8	23.7
198	22.9	8.6	15.6	21.8	332	25.1	11.5	21.3	24.8
247	23.0	8.2	16.2	22.4	211	25.1	13.2	20.7	24.6
183	23.0	9.7	17.2	22.5	262	25.3	12.7	21.5	24.7
146	23.0	8.3	17.6	22.2	21	25.5	13.2	22.3	25.2

SAMPLE 1 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
76	22.2	7.9	15.0	19.0	22.0	18	24.6	9.2	17.1	21.5	24.4
369	22.3	8.0	15.3	18.9	21.8	53	24.6	11.3	18.5	22.1	24.4
134	23.6	8.5	16.0	20.3	23.2	72	24.6	9.0	17.8	22.1	24.2
389	23.6	8.2	15.7	20.4	23.4	75	24.6	9.2	17.2	20.7	24.0
326	23.7	8.9	16.2	21.0	23.4	77	24.6	10.0	19.0	22.0	24.4
309	23.9	5.4	15.3	21.7	23.7	174	24.6	7.7	15.4	21.4	24.2
208	24.1	8.3	16.4	20.6	23.8	180	24.6	9.3	17.3	21.2	24.0
367	24.1	8.5	15.5	20.5	23.6	184	24.6	8.6	16.0	20.4	24.1
114	24.2	9.0	15.6	20.6	23.8	47	24.7	10.7	18.7	22.3	24.5
363	24.2	8.0	15.4	20.5	23.9	148	24.7	9.2	16.0	21.6	24.4
457	24.2	8.6	15.8	21.4	23.9	179	24.7	7.6	14.2	19.6	23.9
357	24.3	7.7	15.8	21.2	24.1	217	24.7	9.0	16.1	21.5	24.3
454	24.3	8.3	16.9	21.2	24.0	226	24.7	10.1	17.0	22.1	24.5
13	24.4	13.7	19.6	22.6	24.3	311	24.7	9.5	13.8	22.3	24.3
306	24.4	7.8	16.6	21.3	23.9	320	24.7	8.4	16.4	21.8	24.4
461	24.4	9.3	16.6	21.0	23.8	15	24.8	8.9	16.1	21.5	24.2
308	24.5	8.9	17.1	21.5	24.1	152	24.8	9.5	16.9	21.8	24.6

SAMPLE 1 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
188	24.8	9.2	16.0	22.3	24.6	223	25.5	10.7	19.9	23.5	25.4
240	24.8	8.6	16.3	21.7	24.3	271	25.5	11.7	20.3	23.7	25.3
386	24.8	8.3	14.9	21.0	24.4	301	25.5	9.2	17.6	23.0	25.3
4	24.9	8.4	15.5	21.4	24.6	323	25.5	12.3	20.5	23.8	25.3
91	24.9	9.3	18.1	21.6	24.2	340	25.5	9.9	19.0	22.8	25.3
130	24.9	9.8	18.2	21.9	24.5	400	25.5	11.0	19.5	22.7	25.0
216	24.9	9.9	19.9	22.8	24.7	408	25.5	10.7	18.6	22.7	25.2
268	24.9	9.1	16.8	21.6	24.6	111	25.6	9.2	17.3	22.4	25.3
296	24.9	13.2	20.6	23.2	24.7	151	25.6	9.9	19.9	23.2	25.5
368	24.9	10.3	18.1	22.2	24.5	218	25.6	11.0	18.2	22.1	25.1
446	24.9	9.5	18.3	22.4	24.5	260	25.6	8.2	16.8	22.5	25.2
455	24.9	8.5	17.7	21.8	24.5	266	25.6	12.7	18.8	23.3	25.2
31	25.0	8.9	16.3	21.2	24.3	328	25.6	11.6	20.3	23.4	25.4
52	25.0	8.6	15.3	21.7	24.8	383	25.6	8.0	17.7	23.0	25.4
74	25.0	9.4	17.4	21.8	24.9	439	25.6	9.5	17.1	22.5	25.2
133	25.0	8.8	17.5	21.8	24.8	445	25.6	8.9	17.2	22.1	25.1
169	25.0	9.6	17.2	21.7	24.8	144	25.7	8.7	18.7	22.8	25.5
232	25.0	10.1	18.8	22.5	24.6	193	25.7	11.8	20.5	23.8	25.7
240	25.0	9.2	16.1	22.0	24.8	202	25.7	11.5	19.0	23.2	25.3
330	25.0	11.7	21.0	23.1	24.5	374	25.7	9.3	17.0	22.7	25.0
362	25.0	12.3	20.3	23.3	24.8	28	25.8	11.1	19.4	23.4	25.4
378	25.0	9.2	17.3	22.2	24.7	101	25.8	6.8	16.2	22.2	25.5
420	25.0	9.0	16.1	21.6	24.5	448	25.8	8.0	17.6	22.9	25.5
182	25.1	9.2	16.2	22.1	24.7	289	25.9	10.0	19.0	22.8	25.5
227	25.1	9.1	19.1	23.2	24.9	349	25.9	9.4	18.3	23.0	25.6
339	25.1	8.0	15.1	22.2	24.9	370	25.9	8.0	18.6	23.2	25.7
392	25.1	10.5	18.5	22.6	24.8	375	25.9	13.7	20.5	23.8	25.6
49	25.2	9.3	18.0	23.0	24.9	397	25.9	10.3	20.9	24.2	25.7
98	25.2	7.8	17.9	22.0	24.9	458	25.9	10.5	18.5	22.6	25.4
305	25.2	9.4	15.7	21.6	24.6	462	25.9	7.9	17.3	22.8	25.5
398	25.2	12.6	19.8	23.1	25.1	12	26.0	8.6	15.8	22.3	25.8
459	25.2	11.4	19.5	23.1	25.0	16	26.0	8.6	16.7	22.7	25.7
10	25.3	8.7	16.3	21.3	24.8	257	26.0	10.9	19.5	23.4	25.7
46	25.3	9.8	19.3	23.0	25.0	355	26.0	9.3	17.4	22.1	25.5
57	25.3	12.0	20.9	23.5	25.0	380	26.0	11.0	18.8	22.9	25.5
64	25.3	10.7	20.0	23.2	25.0	59	26.1	11.5	16.5	23.0	25.7
252	25.3	9.3	16.8	21.7	24.9	113	26.1	10.4	17.8	22.8	25.8
298	25.3	10.2	17.3	22.0	25.2	139	26.1	11.9	20.2	23.5	25.8
402	25.3	8.1	17.4	22.6	25.0	172	26.1	13.0	21.0	24.0	25.8
2	25.4	9.9	17.7	22.5	25.2	409	26.1	10.8	19.2	23.3	25.5
192	25.4	8.7	15.0	20.2	24.6	432	26.1	10.8	19.6	24.0	25.9
234	25.4	9.7	19.0	22.8	25.2	6	26.2	13.0	20.4	23.6	25.9
395	25.4	12.7	20.2	23.3	25.1	105	26.2	10.6	19.4	23.1	25.8
437	25.4	9.4	18.3	23.1	25.2	186	26.2	12.4	20.0	23.2	25.8
410	25.4	10.1	17.8	22.3	25.0	335	26.2	10.2	19.2	23.3	25.9
36	25.5	9.2	16.3	22.4	25.0	364	26.2	12.1	19.9	23.6	26.0
68	25.5	9.4	17.3	22.2	25.2	382	26.2	12.6	21.0	23.8	25.9
104	25.5	8.0	16.3	22.1	25.2	63	26.3	10.2	18.4	24.4	26.1
159	25.5	8.3	17.0	21.8	25.0	230	26.3	10.6	20.3	24.3	26.1
162	25.5	11.3	20.7	24.1	25.4	94	26.4	9.3	18.4	22.8	26.2
189	25.5	10.8	17.6	23.0	25.3	228	26.4	12.0	22.0	24.7	26.2

SAMPLE 1 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
333	26.4	10.2	18.6	23.2	26.0	225	26.8	12.8	21.3	24.7	26.6
44	26.5	11.3	19.8	23.5	26.2	336	26.8	10.9	21.2	24.7	26.7
142	26.5	12.1	20.7	24.0	26.3	420	26.8	9.5	19.3	23.6	26.5
343	26.5	12.2	19.9	23.7	26.2	433	26.8	8.3	19.5	24.3	26.5
384	26.5	10.3	18.7	23.7	26.2	26	26.9	13.8	22.8	25.2	26.7
35	26.6	8.6	17.4	23.2	26.4	30	27.1	12.0	20.5	24.7	26.7
135	26.6	11.6	20.7	24.0	26.3	220	27.8	11.9	21.7	25.1	27.4
321	26.6	10.1	19.9	24.0	26.4						

SAMPLE 1 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
353	24.1	7.3	14.9	19.1	21.8	23.8	166	25.4	7.6	13.0	20.0	23.0	25.2
285	24.2	7.0	15.9	20.0	22.4	23.9	236	25.4	9.8	16.4	21.3	23.6	25.3
399	24.4	6.7	15.0	21.3	23.3	24.2	372	25.4	9.3	17.7	21.8	24.2	25.3
404	24.6	9.0	14.4	20.4	22.9	24.3	434	25.4	9.7	17.1	22.7	24.4	25.3
233	24.7	6.1	14.7	20.3	23.2	24.5	19	25.5	10.6	16.6	21.7	23.8	25.2
45	24.8	8.2	17.8	21.7	23.2	24.6	167	25.5	7.6	14.0	20.1	23.5	25.2
209	24.8	8.5	17.1	21.2	23.5	24.5	207	25.5	12.4	18.8	22.1	24.4	25.4
253	24.8	6.6	13.3	19.7	22.9	24.7	300	25.5	10.3	17.1	21.6	23.7	25.3
265	24.8	7.6	14.4	20.6	22.8	24.6	324	25.5	9.1	18.1	21.8	24.0	25.3
149	24.9	7.3	14.8	21.2	23.3	24.7	346	25.5	8.8	17.3	22.5	24.3	25.4
417	24.9	8.9	15.1	22.3	23.9	24.8	385	25.5	8.3	17.1	22.2	24.5	25.3
23	25.0	10.2	17.1	22.1	23.9	24.8	405	25.5	6.7	15.2	21.5	23.8	25.3
24	25.0	8.1	15.9	20.8	23.1	24.7	412	25.5	10.0	18.7	22.6	24.4	25.3
50	25.0	10.2	17.6	21.0	23.5	24.3	427	25.5	9.6	19.3	23.0	24.6	25.4
157	25.0	9.1	16.2	21.8	24.1	24.9	89	25.6	7.4	15.5	20.0	22.8	25.2
293	25.0	7.2	14.3	20.5	23.7	24.9	168	25.6	10.7	17.0	21.8	24.2	25.4
304	25.0	6.5	13.8	20.0	23.3	24.9	278	25.6	9.5	18.4	22.4	24.4	25.4
423	25.0	9.1	18.5	22.3	24.0	24.9	303	25.6	9.8	16.9	21.0	23.8	25.3
286	25.1	7.7	13.0	20.3	23.4	24.8	338	25.6	8.7	17.8	21.6	24.1	25.4
403	25.1	8.6	17.8	21.9	24.1	24.9	342	25.6	9.0	15.5	21.1	24.0	25.3
37	25.2	7.3	14.0	20.3	22.9	24.9	351	25.6	10.0	18.2	22.6	24.5	25.4
85	25.2	9.8	16.3	21.2	23.8	25.0	354	25.6	8.6	19.1	22.7	24.3	25.4
214	25.2	10.5	18.6	22.0	24.0	25.0	388	25.6	9.4	17.6	21.6	24.1	25.5
222	25.2	8.9	16.7	21.2	23.5	24.9	32	25.7	9.8	17.9	22.5	24.6	25.5
17	25.3	7.5	15.5	20.8	23.3	25.2	82	25.7	9.8	18.7	22.6	24.5	25.6
122	25.3	8.5	15.0	20.9	23.6	25.1	88	25.7	7.9	17.0	22.5	24.3	25.5
150	25.3	6.8	13.9	20.8	24.0	25.2	96	25.7	7.4	16.0	21.8	24.2	25.6
187	25.3	7.8	15.9	21.8	23.6	25.1	119	25.7	8.1	14.6	22.2	24.2	25.5
219	25.3	8.8	17.6	21.7	23.8	25.2	145	25.7	7.2	16.7	22.9	24.6	25.5
261	25.3	7.9	14.5	19.5	22.6	25.0	213	25.7	9.5	17.3	22.0	24.1	25.5
292	25.3	8.4	16.1	21.8	24.0	25.1	239	25.7	8.2	16.8	22.6	24.8	25.6
387	25.3	7.7	15.6	21.7	23.8	25.1	279	25.7	7.9	16.8	21.4	24.3	25.4
466	25.3	8.4	16.0	22.2	24.0	25.2	341	25.7	5.8	12.8	20.0	24.0	25.6
112	25.4	7.8	17.2	21.7	23.8	25.1	373	25.7	9.4	16.4	22.2	24.2	25.5
136	25.4	8.6	15.7	22.0	23.9	25.2	464	25.7	8.2	16.5	22.3	24.5	25.5

SAMPLE 1 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
14	25·8	8·7	15·3	21·3	23·8	25·7	123	26·3	7·5	15·4	22·5	24·8	26·1
83	25·8	8·2	18·1	21·8	24·2	25·6	124	26·3	9·1	17·6	22·8	24·8	26·0
210	25·8	9·1	17·4	21·4	24·1	25·6	173	26·3	5·1	13·8	22·0	24·5	26·1
327	25·8	11·0	19·8	23·0	24·6	25·7	291	26·3	10·4	19·3	22·5	24·8	26·2
348	25·8	9·4	19·5	22·6	24·6	25·6	443	26·3	9·7	17·7	22·9	24·7	26·2
358	25·8	7·7	13·9	20·0	23·2	25·5	87	26·4	9·6	18·7	22·6	24·9	26·3
421	25·8	8·2	15·8	20·9	23·8	25·5	95	26·4	8·7	18·3	22·6	25·3	26·3
178	25·9	9·6	16·0	21·5	24·1	25·8	120	26·4	9·0	18·0	23·1	25·0	26·2
203	25·9	7·2	16·2	21·7	23·6	25·5	245	26·4	9·3	17·5	22·7	24·9	26·2
244	25·9	9·5	17·3	22·5	24·8	25·8	325	26·4	9·3	18·1	22·6	24·8	26·2
273	25·9	8·2	15·9	20·5	24·0	25·5	345	26·4	12·6	19·9	23·6	25·3	26·3
294	25·9	9·0	16·7	22·9	24·7	25·8	415	26·4	11·2	17·8	22·3	24·5	26·0
317	25·9	9·1	15·9	21·7	24·3	25·8	418	26·4	8·3	14·6	21·8	25·2	26·2
347	25·9	8·5	15·4	22·1	24·6	25·7	164	26·5	8·8	18·3	22·6	24·7	26·3
401	25·9	8·0	15·2	21·3	23·7	25·6	237	26·5	8·6	15·5	21·0	24·1	26·3
416	25·9	8·7	18·5	22·8	24·7	25·7	366	26·5	10·5	18·5	21·8	24·7	26·4
429	25·9	9·2	17·3	22·5	25·1	25·8	449	26·5	8·2	16·1	22·0	24·6	26·3
8	26·0	8·9	18·8	22·9	24·7	25·9	463	26·5	8·0	17·1	22·4	24·9	26·2
34	26·0	8·9	16·5	21·6	24·5	25·7	81	26·6	8·9	17·8	24·0	25·6	26·5
41	26·0	10·2	19·9	22·7	24·8	25·9	90	26·6	8·0	16·1	22·1	24·5	26·3
80	26·0	11·2	19·0	23·0	24·9	25·8	161	26·6	9·5	16·5	22·0	24·5	26·3
106	26·0	7·6	15·0	20·2	23·6	25·7	33	26·7	8·7	17·4	22·8	25·4	26·5
143	26·0	8·5	13·4	21·8	24·5	25·9	127	26·7	8·6	17·4	22·9	24·9	26·6
242	26·0	8·5	18·5	23·1	24·8	25·8	1561	26·7	9·2	16·7	22·2	25·0	26·5
258	26·0	8·0	15·2	21·4	24·2	25·6	435	26·7	8·2	19·3	23·8	25·6	26·5
287	26·0	9·2	17·3	22·3	24·7	25·9	442	26·7	11·4	19·8	23·6	25·3	26·3
20	26·1	8·3	14·4	20·7	23·6	25·9	453	26·7	10·2	17·1	22·0	24·6	26·3
55	26·1	9·0	19·1	22·4	24·5	26·0	78	26·8	10·2	20·2	23·7	25·8	26·7
71	26·1	9·0	18·3	23·0	25·2	25·9	204	26·9	8·8	18·6	23·4	25·3	26·7
181	26·1	8·3	16·1	23·5	25·0	26·0	250	26·9	6·1	15·7	21·8	24·8	26·6
273	26·1	7·6	15·4	22·2	25·0	26·0	381	26·9	7·4	15·0	22·7	25·4	26·8
288	26·1	11·7	19·8	23·2	24·8	26·0	1	27·0	9·0	17·0	22·9	25·5	26·8
310	26·1	9·4	18·7	22·8	24·6	26·0	84	27·0	12·4	19·7	24·4	26·0	26·8
318	26·1	10·2	17·3	23·4	25·0	26·0	97	27·0	9·9	18·6	23·0	25·1	26·7
329	26·1	8·0	15·1	21·0	23·3	25·5	334	27·0	9·0	17·8	23·2	25·6	26·8
371	26·1	9·3	17·4	22·4	24·8	26·0	160	27·2	13·8	21·5	24·5	26·0	27·0
379	26·1	7·8	18·4	23·5	25·1	26·0	312	27·3	7·2	14·8	20·2	24·0	27·0
396	26·1	11·0	19·7	23·2	24·9	26·0	460	27·3	11·4	19·0	23·1	25·5	27·1
413	26·1	9·0	18·4	22·5	24·7	25·8	102	27·6	9·6	17·2	22·5	25·2	27·3
176	26·2	11·3	19·1	23·2	25·0	26·0	65	27·7	11·8	19·7	23·7	26·2	27·5
269	26·2	8·7	17·5	22·4	25·0	26·0	280	27·7	9·0	18·6	24·8	26·6	27·6
465	26·3	8·3	18·4	23·0	24·9	26·0	39	28·5	10·6	22·3	25·3	27·4	28·3

SAMPLE 1 Continued.—WINTER RINGS, 6.

No.	Size.	1	2	3	4	5	6
	Cm.						
115	24.7	7.8	13.0	19.5	22.5	23.8	24.6
99	24.8	9.2	16.9	21.3	22.8	23.9	24.7
154	24.9	8.1	13.6	21.0	23.0	24.0	24.8
302	24.9	6.9	14.0	20.0	22.8	24.3	24.8
467	24.9	7.5	15.7	21.5	23.4	24.3	24.7
456	25.0	9.7	15.1	20.0	22.8	24.0	24.8
108	25.1	7.4	13.5	19.8	22.6	24.0	25.0
100	25.2	7.3	14.8	20.8	23.5	24.4	25.1
73	25.3	6.3	14.0	20.0	22.4	23.9	25.1
406	25.3	6.5	15.5	20.7	23.3	24.3	25.2
425	25.3	11.0	16.4	21.8	23.4	24.5	25.3
199	25.4	8.1	15.5	20.4	22.7	24.1	25.2
70	25.6	7.0	16.3	22.0	23.8	24.7	25.4
393	25.6	8.3	14.7	20.7	23.7	24.7	25.5
131	25.7	7.6	14.7	21.0	23.2	24.6	25.6
66	25.8	5.7	14.5	19.6	23.4	24.8	25.7
137	25.8	7.8	15.2	21.2	23.4	24.9	25.7
361	25.8	8.5	16.2	22.1	23.9	25.2	25.7
365	25.9	8.0	15.3	20.1	23.4	25.1	25.8
377	25.9	7.7	13.6	19.0	22.7	24.6	25.8
58	26.0	11.3	19.7	23.5	24.7	25.4	25.9
175	26.0	8.5	15.3	21.0	23.5	25.1	25.7
194	26.0	7.0	13.9	21.2	23.4	24.6	25.8
254	26.0	9.5	15.4	20.9	23.6	25.1	26.0
314	26.0	8.6	16.1	22.0	24.1	25.3	25.9
391	26.0	9.2	17.4	22.0	24.2	25.4	26.0
394	26.0	9.5	17.8	21.4	23.7	25.0	25.8
452	26.0	8.4	15.9	21.7	24.0	25.1	25.9
147	26.1	7.4	13.5	19.3	23.2	25.1	26.0
190	26.1	8.4	18.0	23.0	24.7	25.4	26.0
42	26.2	7.7	16.0	21.9	24.2	25.2	26.1
60	26.2	8.6	15.8	22.6	24.2	25.1	26.0
155	26.2	9.1	15.1	21.2	23.5	25.0	26.0
185	26.2	8.2	15.0	20.9	23.8	25.3	26.0
313	26.2	7.8	14.0	19.9	22.8	24.8	26.0
62	26.3	8.6	14.9	20.2	24.0	25.1	26.1
92	26.3	11.3	19.0	23.0	24.4	25.4	26.2
201	26.3	7.6	16.7	22.6	24.6	25.5	26.2
231	26.3	6.5	16.4	21.3	23.8	25.2	26.2
283	26.3	8.3	17.3	22.4	24.7	25.5	26.2
337	26.3	7.2	15.0	20.3	23.4	25.2	26.2
171	26.4	7.0	15.1	21.1	23.8	25.3	26.2
177	26.4	9.7	17.6	22.1	23.9	25.1	26.1
196	26.4	7.4	14.5	21.0	23.8	25.3	26.3
229	26.4	7.6	15.5	21.2	23.9	25.2	26.3
272	26.4	11.7	18.5	22.4	24.8	25.8	26.4
331	26.4	9.7	16.6	21.7	24.2	25.4	26.3
22	26.5	9.5	17.1	21.9	24.4	25.7	26.3
43	26.5	9.2	15.7	19.5	23.1	25.2	26.3
61	26.5	10.2	17.1	22.9	25.2	26.0	26.4
103	26.5	7.4	14.3	20.6	23.8	25.4	26.3

SAMPLE 1 Continued.—WINTER RINGS, 6.

No.	Size.	1	2	3	4	5	6
	Cm.						
284	26.5	7.4	14.6	21.2	23.7	25.6	26.4
376	26.5	8.1	16.6	22.8	25.0	25.9	26.5
422	26.6	9.1	16.5	21.9	23.9	25.5	26.5
450	26.6	8.2	15.8	22.3	24.4	25.9	26.5
7	26.7	5.9	13.6	21.2	24.3	25.6	26.6
360	26.7	8.5	16.2	22.1	24.9	26.0	26.6
447	26.7	9.1	17.4	23.4	25.3	26.2	26.7
132	26.8	7.2	16.0	21.7	24.0	25.2	26.7
107	26.9	7.3	16.7	22.4	24.7	26.0	26.8
125	26.9	9.4	15.2	20.5	24.2	25.4	26.8
238	26.9	6.4	14.3	20.9	24.3	25.8	26.8
316	26.9	9.2	19.0	23.7	25.4	26.2	26.8
129	27.0	12.4	19.5	24.2	25.4	26.0	26.8
322	27.1	10.8	19.9	23.8	25.4	26.4	27.1
93	27.2	6.5	13.2	20.2	24.2	26.1	27.1
390	27.2	8.6	16.8	23.4	25.2	26.5	27.1
419	27.2	11.5	20.3	24.0	25.7	26.7	27.1
431	27.2	7.7	16.1	20.5	23.1	25.3	27.0
256	27.3	10.0	19.0	23.0	25.5	26.7	27.3
299	27.3	9.4	16.7	22.4	25.0	26.4	27.2
313	27.4	9.3	18.5	22.7	24.8	26.4	27.3
141	27.5	8.8	17.9	24.1	25.9	27.0	27.5
255	27.6	9.8	19.4	24.0	26.0	26.9	27.6
275	27.6	9.4	18.2	22.4	24.9	26.7	27.5
281	27.7	9.0	16.4	22.4	25.7	27.2	27.7
27	27.8	8.8	17.0	23.9	25.9	26.9	27.7
426	27.9	7.5	17.0	22.4	25.4	26.9	27.8
86	28.1	11.3	20.3	24.4	26.3	27.5	28.1
295	28.6	13.2	19.9	24.2	26.2	27.5	28.5

SAMPLE 1 Continued.—WINTER RINGS, 7 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
263	26.4	8.3	15.2	21.6	23.7	25.1	26.0	26.4	—	—
440	26.5	7.3	15.0	19.7	22.5	24.4	25.5	26.4	—	—
128	26.6	6.8	15.6	22.3	24.2	25.4	26.2	26.6	—	—
158	26.6	8.7	15.5	20.9	23.3	24.8	25.8	26.6	—	—
195	26.6	8.2	15.7	21.5	23.8	24.8	25.6	26.4	—	—
277	26.7	7.5	14.5	20.1	23.0	24.8	26.0	26.7	—	—
270	26.8	8.6	14.7	20.8	23.8	25.7	26.4	26.8	—	—
56	27.1	10.7	18.3	22.3	24.1	25.9	26.8	27.1	—	—
197	27.3	7.7	16.4	21.8	24.2	25.9	26.8	27.3	—	—
126	27.5	9.0	19.3	23.7	25.5	26.4	27.1	27.5	—	—
38	27.7	8.1	16.1	22.0	24.8	26.0	26.9	27.7	—	—
170	27.7	10.2	17.7	22.9	25.5	26.5	27.3	27.7	—	—
356	28.0	9.2	16.4	21.0	23.8	25.5	27.0	27.9	—	—

SAMPLE 1 Continued.—WINTER RINGS, 7 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
436	28.2	9.5	18.2	24.0	26.3	27.3	27.8	28.2	—	—
297	28.3	8.3	16.5	22.3	25.6	26.6	27.5	28.2	—	—
51	28.9	11.8	19.7	23.9	26.1	27.3	28.1	28.8	—	—
251	26.8	8.8	15.8	21.0	23.2	24.6	25.6	26.2	26.8	—
246	27.4	9.4	17.3	22.0	23.8	25.0	26.0	26.9	27.4	—
116	27.5	11.3	17.2	22.8	24.3	25.7	26.6	27.2	27.5	—
438	27.5	6.9	13.3	20.7	23.8	25.8	26.5	27.0	27.5	—
243	28.5	8.4	16.6	22.4	25.2	26.8	27.7	28.2	28.5	—
235	28.6	11.7	19.6	22.7	25.0	26.8	27.4	28.0	28.6	—
344	28.9	9.1	16.2	21.6	24.6	26.8	27.8	28.6	28.9	—
350	29.0	7.9	14.6	20.6	24.2	26.1	27.6	28.2	29.0	—
79	27.5	8.0	16.0	21.5	24.4	25.5	26.1	26.8	27.2	27.5
290	27.6	8.9	16.7	22.0	24.0	25.2	26.2	26.8	27.3	27.6
428	27.8	9.0	16.4	20.4	23.2	25.3	26.6	27.2	27.5	27.8
259	28.5	10.6	18.7	21.7	23.5	25.0	26.2	27.0	27.9	28.5
40	28.6	7.8	15.4	20.2	23.0	25.0	26.6	27.4	28.2	28.6

SAMPLE 2.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
617	19.3	9.0	17.7	561	21.2	10.6	19.5
527	19.4	9.9	17.7	569	21.3	10.6	18.8
488	19.5	8.1	18.0	591	21.4	12.4	19.8
593	19.7	9.0	17.4	592	21.4	11.2	19.2
477	20.0	9.3	18.2	625	21.4	7.5	19.6
508	20.0	10.9	18.0	586	21.5	11.4	19.8
526	20.0	7.3	17.8	607	21.5	10.3	19.7
521	20.1	8.2	18.7	620	21.5	12.5	19.8
500	20.2	8.3	18.3	532	21.6	7.6	19.4
588	20.2	10.9	17.9	571	21.6	11.6	19.8
481	20.3	9.2	18.6	513	21.7	11.5	20.2
556	20.3	9.3	18.2	554	21.7	13.3	19.6
601	20.4	11.1	18.9	503	21.8	12.7	19.5
524	20.5	10.5	18.2	590	21.8	8.5	20.0
543	20.5	10.2	18.7	602	21.8	9.1	19.5
630	20.5	10.3	18.6	623	21.8	10.2	20.1
584	20.6	10.2	19.0	544	21.9	12.3	20.0
539	20.7	13.1	19.2	516	22.0	9.4	18.6
549	20.7	10.7	19.3	587	22.0	9.9	20.1
538	20.8	10.0	19.4	603	22.0	11.3	20.0
546	20.8	9.9	19.2	476	22.1	11.0	20.6
557	20.8	10.4	19.3	479	22.2	11.1	20.0
562	20.8	11.3	18.9	582	22.2	11.6	20.3
577	20.8	10.8	18.9	485	22.4	10.8	20.5
589	20.8	9.6	19.0	572	22.4	11.5	20.6
471	20.9	8.7	17.3	628	22.4	11.4	21.1
483	20.9	10.1	19.3	484	22.5	10.3	20.5
530	20.9	11.1	19.4	493	22.5	9.3	20.2
537	20.9	10.1	18.9	495	22.5	10.0	20.3
542	20.9	9.8	19.4	595	22.5	12.1	20.3
606	20.9	10.3	17.8	615	22.5	13.2	20.5
616	20.9	10.5	19.0	551	22.7	12.5	21.3
507	21.0	11.3	19.5	553	22.7	11.3	21.2
545	21.0	8.4	19.4	631	22.8	10.4	21.5
564	21.0	11.7	19.5	518	22.9	11.8	20.4
523	21.1	10.0	19.0	634	22.9	13.4	21.0
596	21.1	12.1	19.4	570	23.0	12.7	20.9
533	21.2	10.5	19.2	549	23.2	11.6	21.4
541	21.2	10.5	19.2	580	23.3	11.7	21.7

SAMPLE 2 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
522	19.8	6.7	13.2	18.7	478	20.8	8.0	15.0	19.8
618	19.9	5.5	13.1	18.5	565	20.8	8.4	15.8	19.5
473	20.3	8.3	15.5	19.3	496	21.0	8.6	16.1	20.4
612	20.3	6.7	14.5	19.3	555	21.3	9.4	16.4	20.2
568	20.5	7.0	13.7	19.2	598	21.3	11.5	18.1	20.8

SAMPLE 2 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
514	21.4	4.8	14.1	20.5	585	22.7	7.0	17.0	21.8
622	21.4	8.7	14.9	20.3	490	22.8	9.0	15.2	21.4
575	21.5	8.1	16.1	20.6	559	22.8	6.7	13.7	21.3
519	21.7	9.0	17.3	20.6	576	22.8	10.3	16.0	22.0
552	21.7	7.8	15.1	20.4	638	22.8	8.0	15.4	21.9
566	21.7	8.8	16.3	20.7	505	22.9	8.2	15.0	21.0
510	21.8	9.7	15.4	20.8	529	22.9	9.2	16.0	22.0
512	21.8	10.1	18.0	21.3	531	22.9	8.9	16.7	21.5
560	21.8	8.5	16.5	20.7	597	23.0	9.0	15.2	21.7
563	21.9	6.9	16.3	20.5	604	23.0	11.2	17.9	22.3
632	21.9	9.2	16.3	20.6	613	23.0	11.3	19.2	22.2
573	21.9	6.4	14.4	20.8	635	23.0	8.5	10.9	22.2
581	22.0	7.1	16.2	20.6	636	23.0	8.2	16.8	21.9
574	22.0	9.0	15.6	21.0	469	23.1	7.5	16.8	21.8
627	22.1	9.7	16.0	20.9	528	23.1	9.5	17.9	21.7
515	22.2	11.0	18.1	21.3	624	23.1	11.0	19.3	22.1
540	22.2	8.3	16.0	20.9	626	23.2	9.7	16.5	21.9
548	22.2	7.4	16.2	21.0	629	23.2	10.6	17.8	22.4
614	22.2	7.8	14.6	21.1	475	23.3	8.3	16.1	22.7
480	22.3	6.8	16.7	21.0	558	23.3	8.0	16.2	22.2
525	22.3	8.2	15.7	20.8	611	23.3	7.4	16.3	22.1
583	22.3	8.2	15.9	21.3	482	23.4	9.0	19.5	22.5
599	22.3	9.4	17.4	21.6	619	23.4	8.9	16.3	22.0
487	22.5	9.6	16.8	21.6	492	23.5	13.2	19.4	22.5
501	22.5	8.2	18.0	21.5	609	23.5	8.3	18.8	22.6
520	22.5	9.4	18.2	21.7	511	23.6	9.9	19.1	22.9
550	22.5	10.1	15.9	21.4	470	23.7	9.5	18.9	22.8
468	22.6	6.8	17.0	21.8	491	23.7	9.2	19.1	22.5
489	22.6	9.7	17.5	21.4	502	23.9	11.3	17.9	22.8
534	22.6	9.6	16.8	21.4	486	24.0	9.9	18.3	23.2
567	22.6	8.1	16.7	21.5	497	24.1	9.3	18.1	23.0
578	22.6	8.5	15.7	21.5	509	24.2	9.4	18.7	23.3
579	22.6	9.1	16.4	21.7	498	24.3	8.2	15.6	23.2
472	22.7	9.0	16.3	21.8	633	24.3	9.2	19.7	23.1
517	22.7	7.8	18.2	21.7	504	24.7	11.5	20.4	23.7

SAMPLE 2 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
499	22.4	9.4	15.1	20.0	21.8	594	24.4	9.9	17.7	22.2	23.9
605	23.3	7.6	14.0	20.2	22.7	639	24.5	12.7	20.3	22.8	24.0
608	23.7	8.3	15.4	19.9	22.4	610	24.6	8.9	17.6	21.6	23.8
535	23.9	8.3	17.2	21.8	23.4	600	24.7	8.4	15.9	20.6	24.1
506	24.1	8.0	16.8	20.8	23.3	536	25.3	10.9	16.5	22.2	24.5
474	24.2	8.6	14.2	19.5	23.5	621	25.4	8.3	14.3	20.9	24.7
637	24.2	8.4	15.7	21.0	23.7						

SAMPLE 3.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
735	20.4	9.7	18.0	802	23.0	10.7	20.7
665	21.4	7.9	18.8	668	23.0	10.5	20.3
749	21.4	10.3	18.5	722	23.2	12.1	20.5
662	21.6	12.6	19.8	780	23.2	12.0	21.0
851	21.7	11.9	19.3	813	23.2	12.4	20.0
697	21.8	11.3	19.0	688	23.3	12.1	20.8
864	21.8	10.3	19.5	658	23.5	10.9	20.9
797	22.0	10.6	19.3	696	23.5	12.2	21.0
863	22.0	10.0	19.8	790	23.5	12.5	21.2
774	22.1	10.7	18.8	861	23.5	11.2	21.3
820	22.1	11.5	20.3	693	23.6	12.7	20.6
798	22.2	9.2	20.1	652	23.7	12.3	21.8
777	22.3	11.5	20.0	796	23.8	12.2	19.8
887	22.3	7.9	19.8	842	24.1	13.0	21.3
794	22.6	11.7	20.2	672	24.2	12.3	21.0
691	22.9	11.7	20.2	651	24.3	13.4	21.4
706	22.9	13.2	20.0	731	24.5	12.9	22.1
659	23.0	11.2	20.9	757	24.5	12.0	21.3

SAMPLE 3 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
755	22.0	7.2	14.1	20.3	867	23.2	7.3	14.5	21.6
781	22.2	9.0	15.0	20.3	647	23.3	7.8	17.0	22.0
812	22.2	6.8	15.7	20.6	657	23.3	7.7	16.8	21.9
708	22.3	7.4	16.0	20.8	776	23.3	9.0	15.8	21.5
663	22.4	8.7	14.8	20.7	805	23.4	7.6	16.2	21.7
778	22.5	6.8	13.3	20.4	827	23.4	8.1	15.1	21.9
868	22.5	7.6	13.8	20.8	832	23.4	7.5	15.5	21.8
734	22.6	7.4	14.2	21.3	849	23.4	8.1	14.7	21.6
889	22.7	7.2	16.2	21.3	872	23.4	9.0	18.2	22.2
713	22.8	7.6	14.0	20.8	644	23.5	7.6	14.4	21.8
721	22.8	7.3	17.5	21.5	718	23.5	7.2	15.3	21.3
707	22.8	7.5	14.7	21.1	858	23.5	8.8	14.7	21.9
726	22.9	8.0	16.2	21.0	871	23.5	8.2	14.7	21.8
739	22.9	8.5	15.2	21.6	674	23.6	8.2	16.3	22.1
719	23.0	7.6	15.9	21.1	801	23.6	10.2	17.0	21.6
733	23.0	8.8	17.3	21.4	844	23.6	9.8	17.0	22.0
833	23.0	8.6	17.1	21.9	643	23.7	8.7	16.5	21.9
862	23.0	9.9	18.0	22.0	669	23.7	8.8	16.8	22.3
878	23.0	6.9	17.8	21.8	715	23.7	8.3	16.9	22.3
759	23.1	7.8	16.9	21.6	729	23.7	9.0	15.7	22.1
711	23.2	7.9	15.7	21.8	730	23.7	10.2	18.5	22.4
741	23.2	10.2	18.1	21.7	763	23.7	8.0	16.0	22.1
760	23.2	10.8	16.8	21.8	767	23.7	9.3	17.2	22.2
819	23.2	8.6	15.7	21.2	648	23.8	10.9	19.8	22.9
824	23.2	12.0	16.9	21.9	773	23.8	11.0	19.0	22.6
848	23.2	8.3	16.7	21.8	807	23.8	10.8	17.9	22.3

SAMPLE 3 Continued.—WINTER RINGS, 3

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
882	23.8	10.2	19.0	22.5	667	24.4	8.3	17.4	22.7
679	23.9	8.5	15.4	21.9	683	24.4	10.5	19.3	23.0
704	23.9	10.0	16.2	22.3	699	24.4	8.7	16.2	22.5
709	23.9	7.3	14.1	22.1	702	24.4	7.6	14.8	22.5
748	23.9	9.6	17.5	22.5	830	24.4	7.5	16.3	22.6
772	23.9	9.1	17.0	22.3	855	24.4	11.3	17.2	23.1
740	23.9	8.5	16.6	22.7	654	24.5	11.8	17.6	23.3
655	24.0	12.1	19.9	23.0	840	24.5	11.2	18.8	22.8
681	24.0	6.4	14.4	22.0	685	24.6	9.1	17.7	23.0
689	24.0	10.0	19.2	23.0	678	24.7	9.0	17.5	23.4
738	24.0	7.4	16.6	22.6	714	24.7	8.0	17.3	22.9
742	24.0	7.8	16.9	22.5	649	24.9	11.0	18.0	23.3
793	24.0	7.3	14.5	22.4	670	24.9	7.7	15.8	23.6
800	24.0	7.8	15.9	21.9	692	24.9	12.3	18.3	23.5
828	24.0	9.7	16.2	21.9	737	24.9	10.1	17.7	22.8
829	24.0	8.0	16.9	22.0	771	24.9	9.6	18.9	23.4
845	24.0	8.8	16.2	22.1	856	24.9	9.3	19.2	23.4
853	24.0	10.7	17.4	22.4	698	25.0	12.3	18.1	23.1
854	24.0	8.4	17.7	22.5	761	25.0	11.5	19.6	23.4
877	24.0	7.6	16.4	22.2	785	25.0	8.3	16.0	22.9
701	24.1	7.8	14.9	22.0	808	25.0	10.4	18.9	23.8
765	24.1	7.7	17.0	22.7	809	25.0	9.2	17.0	22.7
795	24.1	7.3	16.2	22.3	816	25.0	11.2	20.2	23.9
806	24.1	12.0	19.0	22.8	843	25.0	10.0	18.6	23.4
841	24.1	8.6	15.3	21.8	736	25.2	10.5	19.1	24.0
642	24.2	9.8	18.0	23.1	888	25.2	10.1	19.2	24.0
684	24.2	9.3	18.2	22.7	885	25.3	10.9	18.7	23.8
720	24.2	8.8	17.1	22.6	732	25.4	10.8	19.3	23.8
728	24.2	10.3	19.7	22.8	818	25.4	12.3	18.7	23.8
803	24.2	12.1	16.8	22.0	694	25.5	9.3	18.3	23.2
682	24.3	11.5	19.1	22.7	789	25.5	12.8	19.3	23.7
723	24.3	9.7	16.8	22.5	746	25.6	11.6	20.1	24.3
810	24.3	8.5	16.6	22.4	661	25.7	10.2	20.5	24.3
836	24.3	8.0	17.0	22.5	825	25.8	12.4	21.1	24.6
650	24.4	7.8	18.0	23.0	656	25.9	12.9	20.9	24.8
664	24.4	8.2	16.0	23.0	835	27.2	9.9	18.8	25.2

SAMPLE 3 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
837	24.0	11.4	18.9	21.6	23.4	744	25.0	7.8	17.4	21.8	24.4
814	24.1	8.1	15.4	21.4	23.4	766	25.0	9.3	18.8	22.1	24.4
705	24.3	7.1	16.2	21.4	23.8	857	25.0	8.6	15.8	21.7	24.3
859	24.4	9.3	15.5	21.3	23.6	646	25.1	7.0	14.1	20.3	23.7
747	24.6	9.7	16.2	20.2	23.3	686	25.2	8.3	17.7	22.7	24.6
822	24.6	8.0	13.0	19.3	23.1	769	25.3	8.6	14.8	20.6	24.0
724	24.7	11.3	19.2	22.4	24.2	770	25.3	9.2	16.8	22.0	24.5

SAMPLE 3 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
752	25.4	8.5	15.6	21.5	24.7	879	26.1	7.7	19.0	22.9	25.5
779	25.4	9.0	17.1	22.3	24.7	653	26.2	7.2	14.8	22.0	25.1
725	25.5	11.2	18.5	22.3	24.7	671	26.2	9.7	17.8	23.0	25.5
804	25.5	9.2	18.9	22.8	25.0	700	26.2	11.8	20.8	23.5	25.5
847	25.5	10.1	18.1	22.5	24.8	750	26.2	13.3	19.5	22.8	25.1
876	25.5	10.0	17.1	22.2	24.6	640	26.5	12.4	20.5	24.0	25.9
677	25.6	8.7	18.0	22.7	24.7	645	26.5	8.8	20.0	23.3	25.7
775	25.6	8.3	16.6	21.5	24.7	831	26.5	9.8	18.4	22.9	25.8
782	25.6	10.9	19.6	22.8	25.0	860	26.5	8.1	17.8	23.8	26.0
817	25.6	10.7	19.5	23.0	24.9	873	26.6	11.4	20.0	23.5	25.9
826	25.6	9.1	17.2	21.6	24.7	784	26.7	11.3	21.0	23.9	25.9
717	25.8	10.2	17.8	22.1	24.7	751	26.9	12.5	20.0	23.6	26.1
811	25.8	7.3	17.1	21.7	24.9	839	26.9	10.0	19.1	24.0	26.1
834	25.8	8.0	18.0	22.4	25.0	870	26.9	9.2	20.2	24.1	26.3
743	26.0	13.0	20.0	23.2	25.5	852	27.0	11.8	20.3	23.9	26.0
799	26.0	7.8	15.6	22.9	25.3	787	27.1	11.0	19.5	24.1	26.4
815	26.0	13.4	19.8	22.8	24.9	673	27.2	9.5	19.3	23.6	26.3
695	26.1	9.6	17.4	22.4	25.0	884	27.4	13.8	21.3	24.7	26.9
783	26.1	8.0	17.3	22.5	25.1						

SAMPLE 3 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
850	25.0	10.1	16.3	20.3	22.8	24.7	712	26.3	8.9	17.6	22.3	24.3	25.8
716	25.2	7.5	17.7	21.9	23.4	24.8	660	26.4	10.4	16.4	22.4	24.5	26.0
753	25.5	8.6	14.7	21.7	23.6	24.9	865	26.4	12.2	19.6	23.0	24.8	26.0
676	25.7	8.2	13.9	21.7	24.0	25.2	641	26.5	7.6	14.8	20.2	24.1	25.9
754	25.7	10.7	17.8	21.5	23.9	25.2	791	26.6	9.2	18.2	22.7	24.8	26.2
880	25.8	7.3	15.5	21.8	23.0	25.2	762	26.8	7.4	15.0	22.4	24.8	26.4
675	26.0	7.9	16.8	22.0	24.3	25.4	768	27.0	9.6	15.7	22.4	25.0	26.5
690	26.0	8.0	18.0	22.2	24.6	25.7	727	27.7	13.6	20.1	23.5	25.5	27.2
703	26.1	7.9	16.8	21.6	24.6	25.7	758	27.7	9.5	20.2	24.3	26.4	27.4
823	26.1	7.0	14.4	21.2	23.8	25.4	869	28.3	12.3	20.9	25.0	26.6	27.8
883	26.2	9.3	16.7	21.3	24.3	25.8	680	29.1	13.4	21.0	25.0	27.0	28.5

SAMPLE 3 Continued.—WINTER RINGS, 6 to 10.

No.	Size.	1	2	3	4	5	6	7	8	9	10
	Cm.										
764	25.9	7.4	16.8	22.0	23.7	24.7	25.7	—	—	—	—
881	26.1	9.4	16.4	21.2	23.4	25.1	25.9	—	—	—	—
846	26.4	8.8	17.9	21.3	23.6	24.8	25.9	—	—	—	—
866	26.9	8.4	15.2	21.8	24.5	25.7	26.5	—	—	—	—
666	27.0	8.3	15.0	21.0	24.3	25.7	26.7	—	—	—	—
886	27.1	7.8	16.2	21.6	24.3	25.5	26.7	—	—	—	—
745	27.2	7.1	13.9	20.0	23.0	25.2	26.9	—	—	—	—
874	27.4	8.8	18.7	23.0	25.1	26.1	27.1	—	—	—	—
838	27.5	8.5	16.0	21.7	24.9	26.4	27.3	—	—	—	—
821	28.0	7.6	15.6	22.0	25.2	26.9	27.8	—	—	—	—
786	28.3	7.6	15.9	22.2	25.4	26.7	27.8	—	—	—	—
756	27.0	8.0	14.1	19.9	23.0	24.9	26.0	26.7	—	—	—
875	27.3	11.1	19.0	21.8	23.8	25.3	26.3	27.2	—	—	—
687	27.8	8.5	15.7	21.7	24.5	26.0	26.7	27.6	—	—	—
792	29.3	8.5	17.9	21.8	24.8	26.7	27.8	28.5	29.2	—	—
710	27.5	5.8	13.2	18.8	22.0	23.5	24.9	26.0	26.8	27.3	—
788*	29.4	11.4	19.5	21.6	24.6	25.8	26.7	27.6	28.3	28.8	29.3

* Growth like that of 1904 year-class marked herrings of Norway.

SAMPLE 4.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
1072	20.3	10.1	16.9	954	22.3	9.8	20.2
1074	20.4	8.5	17.4	1089	22.3	12.2	19.9
1073	20.5	7.9	17.3	915	22.4	9.1	19.7
1078	20.7	7.4	17.6	999	22.4	11.0	19.7
927	20.9	10.1	18.1	919	22.5	11.3	20.4
985	21.0	9.0	17.9	955	22.5	13.2	20.5
970	21.0	8.4	18.2	1084	22.5	11.0	19.5
928	21.1	10.5	19.0	947	22.6	11.5	19.7
925	21.2	10.7	18.5	989	22.6	10.4	19.8
979	21.3	10.1	18.0	993	22.6	10.6	19.7
1076	21.4	10.0	18.6	988	22.7	11.4	19.8
1077	21.5	7.7	17.7	965	22.8	10.9	19.9
1080	21.4	10.4	18.0	948	22.8	11.8	20.4
923	21.6	9.1	18.7	1045	22.9	10.2	19.0
976	21.6	8.8	18.3	890	23.0	11.3	18.8
977	21.6	10.7	18.7	916	23.0	10.1	20.4
780	21.6	10.7	19.0	920	23.0	11.4	19.5
1075	21.6	12.2	18.8	1117	23.0	11.5	20.3
922	21.7	10.6	18.4	1048	23.1	13.3	20.7
974	21.7	10.2	18.9	1102	23.2	9.8	20.4
978	21.7	8.8	17.6	1099	23.4	12.0	21.1
981	21.7	9.0	18.8	1024	23.6	12.8	20.8
1079	21.7	10.1	19.0	1049	23.7	13.4	21.8
973	21.8	11.3	19.2	902	23.8	12.0	20.0
969	21.9	7.0	17.9	891	24.1	9.4	19.7
956	22.2	8.6	18.9	1100	24.1	13.1	21.2
990	22.2	11.2	20.2				

SAMPLE 4 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
984	20.9	8.7	14.5	18.4	1001	22.3	7.9	15.7	20.3
971	21.1	7.7	15.2	19.2	1087	22.3	7.6	16.8	20.5
975	21.3	10.4	16.0	19.9	910	22.4	8.2	18.3	21.4
926	21.5	7.1	15.3	20.2	912	22.4	9.2	16.8	21.2
968	21.5	8.2	16.5	20.2	914	22.4	9.7	17.1	21.1
983	21.6	5.7	13.9	20.6	1083	22.4	6.3	13.3	19.7
953	21.8	8.8	15.2	20.4	1091	22.4	9.1	16.2	21.2
972	21.8	6.9	14.2	20.1	918	22.5	7.9	15.6	21.0
917	21.9	7.6	17.4	21.1	987	22.5	7.7	16.0	20.8
924	22.0	7.0	15.0	20.5	1113	22.5	6.4	15.3	21.3
982	22.0	8.6	17.0	20.6	909	22.6	9.3	15.8	21.0
998	22.0	7.6	13.1	18.3	946	22.6	9.5	17.4	21.1
921	22.1	8.3	14.6	20.4	996	22.6	8.5	17.5	20.9
949	22.1	7.0	16.0	20.5	1002	22.6	8.1	15.6	20.6
951	22.1	8.5	14.7	20.5	1086	22.6	9.0	16.3	21.3
1081	22.1	9.6	16.8	20.6	1088	22.6	8.4	14.5	20.9
1090	22.1	7.7	16.5	20.4	950	22.7	7.3	16.3	21.4

SAMPLE 4 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
952	22·7	6·3	15·9	21·4	1046	23·5	10·4	16·4	21·7
992	22·7	7·5	14·8	20·8	1110	23·5	9·1	17·3	22·1
1082	22·7	8·2	16·6	20·9	908	23·6	7·7	15·4	21·8
1096	22·7	8·0	17·1	21·3	958	23·6	11·6	18·2	22·5
994	22·8	8·2	16·9	21·0	959	23·6	10·0	16·8	22·0
1000	22·8	8·3	15·3	21·5	1053	23·6	8·8	15·8	21·8
1044	22·8	5·7	14·0	20·3	1025	23·7	11·5	19·2	22·3
1092	22·8	8·8	18·0	21·5	1026	23·7	10·3	18·5	22·2
1101	22·8	8·5	16·4	21·2	1034	23·7	8·1	16·2	22·3
1104	22·8	8·3	15·0	20·9	1047	23·7	8·4	16·4	22·5
986	22·9	7·8	16·4	21·4	1103	23·7	8·8	17·0	22·3
995	22·9	6·8	14·9	20·7	1109	23·7	8·6	17·2	22·1
991	22·9	7·4	17·6	21·0	1112	23·7	8·1	17·0	21·9
904	23·0	9·2	17·9	21·6	900	23·8	11·5	19·0	22·6
907	23·0	9·9	15·3	21·1	901	23·8	10·0	18·7	22·4
1027	23·0	8·1	15·4	21·3	1022	23·8	9·4	16·5	22·5
1085	23·0	8·3	15·4	20·9	1028	23·8	9·5	18·1	22·1
1094	23·0	8·5	15·9	21·1	1051	23·8	8·0	14·6	22·0
1097	23·0	9·4	17·4	21·4	1052	23·8	8·5	16·3	22·1
911	23·1	9·2	17·5	21·9	1106	23·8	8·5	16·3	22·3
913	23·1	8·9	15·6	21·5	896	23·9	9·1	16·7	22·0
963	23·1	11·0	16·5	21·3	957	23·9	8·6	16·8	21·2
964	23·1	7·8	15·3	21·5	966	23·9	7·8	17·0	21·9
1035	23·1	8·2	17·0	21·2	1040	23·9	9·0	17·0	21·7
1037	23·1	9·8	15·9	21·5	1107	23·9	9·2	16·8	21·9
1041	23·1	8·7	16·3	21·2	893	24·0	8·2	15·7	21·7
1050	23·1	7·0	17·5	21·9	895	24·0	10·2	18·9	22·9
1095	23·1	7·8	17·3	21·9	897	24·0	11·1	17·7	22·7
1098	23·1	10·3	17·3	21·5	905	24·0	9·5	15·6	22·3
1105	23·1	8·6	16·9	21·6	1020	24·0	8·0	16·6	22·5
892	23·2	6·7	14·8	21·2	1029	24·0	8·0	17·3	22·5
894	23·2	8·8	18·3	21·8	1108	24·0	10·4	16·8	22·1
1018	23·2	9·5	17·3	21·8	1120	24·0	8·0	16·5	21·8
1019	23·2	10·0	17·4	22·0	929	24·1	6·7	14·6	21·9
1039	23·2	8·1	14·5	21·1	932	24·1	8·9	16·0	22·5
1054	23·2	7·1	17·4	21·0	937	24·1	9·1	16·2	21·9
1055	23·2	8·0	16·1	21·7	939	24·2	9·5	15·6	22·0
898	23·3	8·5	17·4	21·4	945	24·2	7·2	13·9	22·6
906	23·3	7·4	16·6	21·6	1013	24·2	8·4	16·9	22·7
962	23·3	9·5	17·5	22·7	1006	24·3	8·1	15·7	23·0
1032	23·3	8·9	17·0	21·7	1012	24·3	7·7	17·5	22·3
1036	23·3	10·6	17·1	21·9	1115	24·3	7·7	15·3	22·1
899	23·4	8·0	17·2	22·2	930	24·4	12·2	19·5	23·4
960	23·4	10·0	18·2	22·1	933	24·4	8·0	15·7	22·2
961	23·4	9·3	17·8	22·0	1009	24·4	8·7	17·1	23·2
1023	23·4	9·6	17·4	21·5	1125	24·4	13·2	18·9	22·6
1038	23·4	8·4	17·1	21·6	940	24·5	6·8	15·5	22·7
1111	23·4	9·1	15·1	20·9	1003	24·5	7·3	16·5	20·6
903	23·5	8·8	17·7	22·0	1017	24·5	12·3	20·0	23·3
1021	23·5	9·1	17·3	22·0	1010	24·6	8·6	17·5	23·2
1043	23·5	8·9	16·9	21·5	935	24·7	12·7	20·4	23·9

SAMPLE 4 Continued.—WINTER RINGS, 3

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
943	24.7	19.7	17.8	22.8	1058	25.4	10.0	16.9	23.8
1015	24.8	9.5	18.8	22.9	931	25.5	12.2	21.1	24.3
934	25.0	8.7	17.5	23.0	1118	25.5	12.2	18.7	23.4
1008	25.2	9.0	18.2	23.2	1059	26.1	12.6	20.4	24.7
936	25.4	6.5	17.0	23.3	1065	26.2	10.8	21.6	24.7
944	25.4	10.7	18.7	24.1					

SAMPLE 4 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
1056	22.9	9.5	15.6	19.2	21.7	1057	25.4	8.8	17.2	21.7	24.4
1042	23.7	7.8	15.4	20.0	22.7	1071	25.7	8.8	17.3	21.9	24.6
967	23.8	8.2	15.4	20.2	23.0	1068	25.9	9.8	19.2	23.2	25.0
1004	24.0	8.0	15.0	20.8	23.0	1064	26.0	6.9	17.1	22.0	24.8
1031	24.0	7.2	14.1	19.3	22.5	1069	26.0	8.3	17.3	21.6	24.8
942	24.2	8.5	15.2	20.7	23.2	1067	26.1	8.9	16.1	22.1	24.8
1007	24.3	7.9	14.1	19.1	22.2	1062	26.2	10.8	17.8	22.5	25.2
1014	24.3	8.0	15.7	20.6	23.5	1066	26.2	8.8	15.0	21.6	25.2
1011	24.4	7.9	13.8	18.9	22.3	1134	26.3	11.5	20.9	23.8	25.7
938	24.5	9.2	15.8	20.6	23.6	1061	26.4	12.3	20.8	23.6	25.7
1030	24.5	8.4	15.4	20.2	23.7	1063	26.4	9.9	19.9	23.2	25.4
1123	24.5	8.3	16.2	20.9	23.5	1132	26.4	10.1	19.3	23.7	25.7
1005	24.6	8.5	15.0	20.2	23.6	1070	26.6	8.1	17.8	22.3	25.3
1016	24.6	8.9	15.4	21.8	24.1	1137	26.6	13.0	20.7	24.1	25.7
1126	24.6	9.6	17.5	21.3	23.2	1133	26.7	11.6	20.3	23.4	25.7
1116	24.8	7.5	16.3	21.5	23.9	1136	26.7	8.6	18.2	23.3	25.6
1122	25.1	11.3	19.7	22.7	24.4	1130	26.8	10.0	19.0	23.0	25.6
1127	25.1	10.9	17.9	21.7	24.1	1138	26.9	11.9	21.5	24.7	26.2
1114	25.2	8.5	16.5	21.5	24.0	1129	27.2	11.5	21.6	25.1	26.7

SAMPLE 4 Continued.—WINTER RINGS, 5 and 6.

No.	Size.	1	2	3	4	5	6
	Cm.						
1033	24.0	7.7	15.2	19.4	22.0	23.3	—
1119	24.6	7.1	15.3	21.0	23.2	24.1	—
1121	24.9	9.1	16.8	20.7	22.9	24.3	—
1124	25.3	8.8	15.2	20.0	22.5	24.4	—
1060	25.9	10.3	17.8	21.4	23.7	25.4	—
1131	26.7	8.7	17.8	22.6	24.8	26.0	—
1128	26.9	8.3	14.9	21.8	24.8	26.4	—
1139	27.6	8.0	14.3	20.7	24.0	26.1	—
1135	26.4	8.5	16.2	20.2	22.6	24.5	25.9

941	24.2	} Age uncertain.
997	22.9	
1093	22.5	

SAMPLE 5.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
1196	19·3	7·1	14·5	1223	21·9	11·2	19·1
1197	19·8	6·6	14·1	1228	21·9	10·2	18·7
1365	19·8	9·0	16·5	1240	21·9	11·0	18·7
1337	20·0	8·5	16·1	1279	21·9	7·5	16·1
1294	20·3	7·4	16·8	1282	21·9	8·2	18·3
1359	20·3	6·2	15·8	1327	21·9	10·6	18·2
1295	20·4	8·5	15·4	1194	22·0	8·4	17·4
1174	20·5	7·9	16·7	1270	22·0	9·5	17·9
1224	20·5	9·4	16·8	1287	22·0	11·1	17·9
1238	20·5	9·0	17·2	1206	22·0	10·7	18·9
1141	20·6	7·9	16·7	1242	22·0	9·3	18·5
1160	20·6	6·8	16·9	1298	22·0	8·2	18·6
1175	20·6	9·0	17·0	1357	22·0	11·0	18·7
1285	20·6	8·7	17·6	1374	22·0	9·9	19·1
1382	20·6	8·0	17·1	1335	22·1	9·0	19·3
1177	20·7	9·3	17·0	1370	22·1	8·6	17·3
1367	20·7	8·0	17·0	1146	22·2	11·0	19·3
1200	20·8	8·2	17·9	1239	22·2	10·6	18·7
1249	20·8	6·4	15·6	1300	22·2	10·7	19·1
1258	20·8	8·5	17·0	1309	22·2	9·2	18·3
1165	21·0	8·7	17·4	1169	22·3	9·6	19·7
1218	21·0	8·7	16·8	1273	22·3	9·1	18·7
1280	21·0	8·4	16·7	1355	22·3	13·8	19·7
1384	21·0	7·0	17·0	1358	22·3	10·3	20·0
1389	21·0	7·3	17·4	1360	22·3	12·1	19·6
1170	21·1	10·2	18·0	1193	22·4	10·0	18·0
1207	21·1	8·2	16·7	1222	22·4	11·7	18·6
1163	21·2	11·3	18·2	1275	22·4	10·2	19·6
1176	21·2	10·4	16·6	1296	22·4	9·3	19·2
1274	21·2	9·3	17·5	1385	22·4	9·8	18·9
1277	21·2	7·8	17·2	1366	22·5	11·0	19·0
1284	21·2	9·9	17·5	1312	22·6	9·6	18·5
1313	21·2	7·1	16·7	1349	22·6	10·6	19·0
1210	21·3	10·0	17·8	1371	22·6	10·1	18·7
1330	21·3	9·6	18·2	1372	22·6	10·2	19·1
1290	21·4	9·2	18·0	1148	22·7	10·8	19·3
1362	21·4	10·2	18·2	1291	22·7	10·7	20·4
1288	21·4	8·9	18·1	1356	22·7	10·4	20·4
1283	21·5	10·0	17·8	1208	22·8	9·7	20·0
1293	21·5	11·7	18·7	1351	22·8	10·7	19·7
1310	21·5	10·8	18·2	1363	22·8	10·5	20·3
1321	21·5	8·9	18·3	1145	22·9	10·8	19·5
1322	21·5	12·3	18·2	1195	23·0	9·8	19·5
1338	21·5	9·8	18·2	1314	23·0	7·5	18·7
1199	21·6	8·2	18·0	1386	23·0	11·8	19·8
1204	21·6	6·8	17·8	1297	23·1	11·9	20·6
1205	21·6	9·0	18·1	1369	23·2	10·3	19·4
1209	21·6	7·2	18·6	1164	23·3	10·6	21·1
1187	21·7	9·8	17·6	1320	23·3	9·6	18·9
1219	21·7	8·2	17·4	1302	23·4	12·4	20·3
1388	21·7	11·6	19·0	1332	23·5	9·2	20·8
1259	21·8	8·8	18·9	1227	23·6	11·5	20·8
1305	21·8	9·4	17·5	1234	23·7	11·5	20·4
1142	21·9	11·4	18·5	1345	24·0	12·7	20·2
1171	21·9	9·2	18·2	1301	24·8	12·8	22·4

SAMPLE 5 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
1183	21-0	7-9	16-8	19-0	1154	23-5	8-5	16-3	21-8
1286	21-0	7-1	13-0	18-8	1192	23-5	7-6	19-5	22-2
1368	21-5	8-0	13-7	18-9	1256	23-5	8-2	14-8	20-5
1265	21-7	8-3	16-5	19-9	1260	23-5	13-1	18-7	21-9
1267	21-8	8-0	16-2	20-2	1333	23-5	10-3	16-7	21-7
1303	21-8	8-8	16-8	20-0	1383	23-5	10-0	16-8	21-2
1377	22-0	7-0	14-9	20-5	1166	23-6	9-1	18-7	21-8
1329	22-1	7-7	12-6	19-3	1190	23-6	7-5	15-9	20-8
1237	22-2	8-7	17-2	21-8	1343	23-6	8-0	14-8	20-2
1243	22-3	6-6	12-7	20-0	1248	23-7	8-3	16-1	21-9
1373	22-3	8-8	15-7	20-3	1354	23-7	8-2	17-8	21-8
1336	22-3	8-2	15-2	20-6	1361	23-7	8-7	14-7	20-7
1181	22-5	5-4	12-3	19-5	1378	23-7	8-0	14-9	20-8
1232	22-5	10-2	16-5	20-6	1149	23-8	8-7	17-5	22-1
1292	22-5	8-4	15-7	20-6	1158	23-8	10-4	16-4	21-6
1150	22-6	8-4	15-8	21-0	1229	23-8	8-8	16-9	21-7
1159	22-6	10-2	16-6	20-8	1268	23-8	7-3	14-5	20-6
1215	22-6	7-3	15-8	20-2	1325	23-8	9-1	18-5	22-2
1315	22-6	9-8	17-7	21-3	1156	23-9	11-8	18-8	22-4
1328	22-6	8-6	13-8	19-9	1214	23-9	9-0	18-0	21-8
1387	22-6	8-4	15-3	20-6	1185	24-0	10-5	18-3	22-7
1172	22-7	6-0	12-5	20-3	1186	24-0	8-0	16-3	21-8
1140	22-8	6-9	13-5	20-8	1331	24-0	7-7	17-6	22-1
1143	22-8	6-3	12-8	18-8	1341	24-0	8-0	14-9	21-8
1201	22-8	6-4	14-2	20-6	1379	24-0	7-7	15-2	21-8
1299	22-8	9-3	16-0	20-3	1180	24-2	7-6	18-8	22-9
1317	22-8	7-4	14-0	20-0	1198	24-3	8-0	18-6	22-5
1173	22-9	9-0	18-1	21-2	1233	24-3	8-1	15-8	21-9
1179	22-9	8-1	14-4	21-2	1306	24-3	9-3	17-0	22-3
1182	22-9	10-0	16-0	21-4	1375	24-3	9-7	17-7	22-0
1257	22-9	7-3	16-4	20-6	1319	24-4	8-8	17-9	21-8
1167	23-0	8-3	16-7	21-2	1262	24-6	9-4	16-9	22-4
1178	23-0	8-8	15-2	20-7	1307	24-6	8-8	18-8	23-2
1334	23-0	8-3	14-8	20-9	1144	24-6	8-8	17-1	22-8
1342	23-0	6-4	14-9	20-1	1244	24-7	8-6	16-1	22-6
1352	23-0	8-4	14-7	21-0	1247	24-7	9-4	17-5	22-8
1269	23-1	7-4	17-7	21-3	1380	24-7	9-8	19-0	23-0
1308	23-1	10-1	18-5	21-6	1151	24-9	7-7	17-2	22-6
1339	23-1	8-1	14-6	21-0	1203	24-9	9-5	19-4	23-2
1353	23-1	7-7	14-5	20-7	1303	24-9	10-8	19-3	22-7
1272	23-2	7-8	15-6	20-7	1157	25-0	11-2	20-4	23-4
1281	23-2	7-6	14-4	20-8	1323	25-1	14-2	20-9	24-1
1318	23-2	7-3	15-3	20-4	1202	25-2	11-0	20-2	23-6
1189	23-3	7-8	13-8	21-6	1212	25-2	12-0	19-6	23-1
1255	23-3	8-0	15-1	21-4	1311	25-2	9-6	15-7	22-7
1266	23-4	8-4	14-3	21-2	1245	25-4	8-8	17-7	23-3
1271	23-4	7-9	15-7	21-0	1231	25-7	8-6	16-7	23-8
1289	23-4	8-1	16-0	21-4	1261	26-1	10-3	19-0	23-7
1381	23-4	8-8	16-6	21-7					

SAMPLE 5 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
1188	23.5	8.2	14.3	19.3	22.5	1263	25.4	8.1	16.5	21.8	24.6
1226	23.9	7.8	14.5	19.7	22.9	1326	25.4	10.2	18.2	21.9	24.2
1276	24.0	8.8	15.0	20.0	22.8	1168	25.5	12.7	17.8	21.7	24.7
1278	24.0	8.5	14.7	19.4	22.8	1344	25.5	10.0	19.0	22.5	24.5
1264	24.2	7.0	13.9	20.3	23.3	1152	25.6	6.8	17.7	22.0	24.9
1235	24.3	9.2	15.8	20.6	23.5	1155	25.9	7.8	16.4	21.9	25.0
1225	24.5	8.4	15.7	21.3	23.5	1153	26.0	11.5	19.4	22.8	25.0
1316	24.5	8.2	15.2	20.5	23.4	1162	26.0	8.3	17.7	22.7	24.9
1324	24.5	9.0	14.4	20.0	23.3	1376	26.0	13.0	20.7	23.0	25.5
1346	24.5	7.6	15.6	21.1	23.5	1161	26.1	8.0	17.0	22.3	25.3
1364	25.0	8.9	14.8	20.6	23.9	1251	26.1	11.3	20.3	23.3	25.2
1217	25.2	9.0	16.2	21.2	24.4	1147	26.2	7.2	19.5	23.8	25.5
1221	25.3	9.8	18.4	22.4	24.7	1216	26.3	8.6	17.3	23.1	25.5
1254	25.3	11.0	18.6	22.8	24.6	1347	26.3	12.1	20.0	23.0	25.2
1184	25.4	8.1	14.5	18.6	23.1	1340	27.0	12.1	20.1	23.8	26.2
1213	25.4	11.6	19.4	22.4	24.7	1348	28.0	10.2	19.9	24.3	27.1

SAMPLE 5 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5
	Cm.					
1191	25.3	10.0	19.0	21.8	24.0	25.0
1230	25.9	10.1	17.6	21.9	24.1	25.3
1250	26.2	8.9	18.4	22.8	24.5	25.5
1350	26.2	8.3	15.9	22.5	24.6	25.6
1236	26.3	7.8	18.4	22.3	24.6	25.8
1220	27.0	8.8	16.0	21.9	25.2	26.5
1252	27.4	9.2	17.3	22.6	25.7	26.9
1246	27.8	8.8	17.9	22.8	25.5	27.1
1241	28.3	7.1	13.3	21.7	25.2	27.4

1211	26.7	} Age uncertain.
1253	23.9	

SAMPLE 6.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
1516	21.5	9.5	18.4	1624	23.0	10.1	19.7
1526	21.9	9.1	18.4	1623	23.1	11.1	20.2
1525	22.0	8.2	17.1	1416	23.2	11.4	20.3
1617	22.1	11.0	18.6	1425	23.2	11.4	20.8
1581	22.3	8.0	18.6	1557	23.2	12.0	19.2
1589	22.3	9.5	19.5	1567	23.2	10.2	20.4
1629	22.3	11.2	18.9	1521	23.3	11.5	20.8
1625	22.3	10.3	18.5	1479	23.5	12.5	19.6
1458	22.4	11.8	19.8	1480	23.5	10.4	20.4
1451	22.5	9.2	18.6	1503	23.5	11.4	20.8
1580	22.5	10.9	19.2	1603	23.8	12.1	20.6
1607	22.6	10.8	19.5	1400	24.0	10.9	21.2
1638	22.6	10.6	20.2	1431	24.1	14.1	21.9
1415	22.7	11.6	18.9	1432	24.1	10.5	20.4
1429	22.7	10.9	19.4	1465	24.1	12.7	20.5
1518	22.7	11.1	18.7	1558	24.1	12.6	22.1
1575	22.7	9.9	19.6	1456	24.2	11.2	20.4
1606	22.8	11.7	19.7	1527	24.4	11.4	20.5
1489	23.0	11.6	20.3	1554	24.6	13.0	21.7
1569	23.0	10.2	20.0				

SAMPLE 6 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
1444	22.4	9.3	15.0	19.7	1542	23.2	5.9	13.8	20.6
1523	22.4	7.2	14.6	20.3	1633	23.2	8.8	15.7	21.2
1584	22.4	8.0	15.8	20.6	1634	23.2	7.6	14.9	21.0
1639	22.4	6.8	13.8	19.9	1395	23.3	8.0	15.1	20.8
1442	22.5	8.7	16.6	20.6	1500	23.3	9.2	17.6	21.5
1517	22.5	6.7	15.5	20.5	1393	23.4	11.1	16.2	21.8
1520	22.5	7.9	15.7	20.8	1576	23.4	5.6	12.5	20.5
1512	22.6	6.9	14.7	20.4	1408	23.5	9.1	16.2	21.4
1627	22.6	7.6	14.9	19.9	1450	23.5	8.5	16.3	21.4
1553	22.7	6.3	13.9	20.0	1487	23.5	8.0	16.1	21.2
1514	22.8	7.8	15.4	20.4	1502	23.5	9.4	17.9	22.0
1433	22.9	8.7	16.7	21.6	1505	23.5	7.9	14.7	20.8
1392	23.0	6.3	13.5	21.2	1533	23.5	9.7	17.8	22.2
1440	23.0	7.7	14.2	21.2	1543	23.5	6.5	16.2	21.5
1441	23.0	6.2	13.7	21.0	1559	23.5	7.3	15.2	21.8
1443	23.0	8.9	17.3	21.0	1577	23.5	8.3	15.7	20.8
1473	23.0	5.8	14.4	20.3	1587	23.5	10.7	16.8	21.0
1592	23.0	7.0	13.7	20.8	1588	23.5	8.1	15.2	21.2
1609	23.0	8.2	14.7	21.0	1596	23.5	7.2	16.0	21.7
1618	23.0	8.2	17.8	21.3	1602	23.5	10.6	16.6	21.0
1419	23.1	10.0	17.0	21.4	1604	23.5	8.3	14.5	20.8
1488	23.1	9.6	15.9	21.6	1614	23.5	9.0	16.5	21.9
1572	23.1	6.7	16.0	21.2	1449	23.6	6.8	17.8	21.6

SAMPLE 6 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm			
1460	23·6	8·5	15·0	21·4	1427	24·5	9·6	17·0	22·4
1509	23·6	8·7	15·8	21·6	1428	24·5	9·2	17·7	22·5
1597	23·6	5·4	12·8	21·1	1436	24·5	10·9	16·9	22·6
1411	23·7	10·9	15·1	22·0	1483	24·5	11·7	18·1	22·8
1445	23·7	5·5	14·1	21·7	1484	24·5	9·5	17·7	22·4
1448	23·7	9·2	18·7	22·0	1501	24·5	6·9	16·1	22·7
1462	23·7	6·3	14·2	21·7	1528	24·5	8·3	16·7	22·5
1475	23·7	10·3	19·6	22·2	1544	24·5	9·2	17·8	23·0
1493	23·7	6·5	17·9	22·1	1615	24·5	8·6	18·5	22·8
1536	23·7	6·2	13·8	21·4	1401	24·6	10·0	18·9	23·2
1404	23·8	7·2	15·0	22·2	1439	24·6	7·4	17·7	23·0
1407	23·8	9·8	18·4	22·4	1467	24·6	9·0	17·3	22·3
1410	23·8	6·0	13·2	21·3	1469	24·6	8·7	18·7	23·3
1435	23·8	8·2	15·9	21·8	1492	24·6	8·9	15·6	22·3
1507	23·8	8·4	16·2	21·9	1537	24·6	7·9	16·4	22·8
1598	23·8	7·7	15·3	22·0	1414	24·7	10·3	16·6	22·2
1601	23·8	8·3	16·8	21·4	1418	24·7	7·7	15·8	23·1
1610	23·8	9·6	19·0	22·5	1496	24·7	10·4	17·7	23·0
1628	23·8	8·9	18·5	22·0	1586	24·7	8·0	14·7	22·8
1563	23·9	7·6	18·1	22·3	1613	24·7	7·5	17·9	22·5
1605	23·9	7·4	16·2	21·5	1636	24·7	8·9	16·7	22·2
1616	23·9	8·9	17·0	22·4	1552	24·8	11·7	17·7	22·5
1398	24·0	12·3	19·5	22·8	1620	24·8	9·5	17·9	22·4
1406	24·0	7·8	16·8	21·8	1452	24·9	9·3	18·0	22·5
1468	24·0	5·4	13·9	22·1	1454	24·9	10·3	19·9	23·5
1582	24·0	7·8	15·1	21·9	1485	24·9	7·3	15·6	22·7
1622	24·0	8·0	15·3	21·7	1524	24·9	9·0	17·3	22·7
1476	24·1	8·6	16·9	22·3	1562	24·9	8·2	17·0	22·7
1486	24·1	8·3	17·2	22·7	1430	25·0	8·2	16·3	23·7
1497	24·1	7·8	16·0	22·1	1530	25·0	9·7	16·8	22·7
1515	24·1	8·1	18·0	22·7	1593	25·0	10·8	18·9	22·7
1556	24·1	9·0	18·3	22·2	1595	25·0	11·1	18·1	23·5
1583	24·1	12·8	17·8	22·0	1390	25·1	9·4	15·8	23·1
1612	24·1	7·1	17·1	22·1	1394	25·1	9·5	17·0	22·6
1632	24·1	7·3	15·9	22·2	1457	25·1	8·6	15·8	22·7
1391	24·2	8·5	15·8	21·9	1412	25·2	7·9	17·4	23·3
1423	24·2	8·8	16·5	21·4	1482	25·2	10·7	19·2	23·6
1434	24·2	9·0	18·0	22·4	1619	25·2	9·1	18·8	23·4
1511	24·2	7·5	15·7	22·2	1424	25·3	9·4	16·4	23·0
1579	24·2	10·3	18·7	22·3	1490	25·3	11·5	18·0	23·4
1413	24·3	10·6	20·4	23·0	1635	25·3	10·9	19·2	23·1
1438	24·3	8·6	16·3	22·5	1504	25·4	8·9	15·7	22·6
1491	24·3	7·6	17·2	22·3	1534	25·5	11·2	19·1	23·7
1565	24·3	6·4	13·6	21·8	1594	25·6	9·2	17·3	23·6
1574	24·3	10·0	17·2	22·8	1608	25·6	10·7	19·2	23·5
1590	24·3	5·6	13·6	21·9	1474	25·6	6·2	15·2	23·7
1621	24·3	8·2	17·3	22·8	1519	25·7	8·4	17·6	24·0
1420	24·4	7·0	14·4	21·2	1437	25·8	8·8	16·5	23·4
1463	24·4	8·2	16·7	22·4	1481	25·9	10·6	19·2	23·6
1498	24·4	8·0	17·2	22·6	1571	26·3	8·5	17·8	23·8
1568	24·4	10·1	18·1	23·0	1531	26·4	12·7	18·6	24·3
1600	24·4	7·0	13·3	21·9	1631	26·4	8·2	18·0	24·0

SAMPLE 6 Continued.—WINTER RINGS 4

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
1477	23.8	7.8	15.4	19.5	22.4	1591	25.5	9.5	16.9	21.6	24.4
1599	23.8	9.0	16.0	19.2	22.2	1478	25.6	9.9	16.7	22.4	24.5
1459	23.9	9.3	15.2	19.9	22.8	1522	25.6	10.3	18.8	23.2	24.9
1548	24.0	8.6	16.1	20.4	23.0	1421	25.7	8.4	17.0	22.1	24.8
1626	24.1	9.4	16.8	20.6	23.0	1446	25.8	10.3	19.7	24.7	25.9
1471	24.3	7.9	15.4	20.1	22.8	1453	25.8	10.9	19.5	22.9	25.0
1566	24.4	7.8	14.8	21.4	23.6	1470	25.8	8.2	18.2	22.2	24.9
1508	24.5	7.1	14.2	19.9	23.2	1570	25.8	10.6	18.8	22.2	24.3
1399	24.7	8.4	13.9	20.6	23.8	1455	25.9	10.0	18.4	22.2	24.8
1541	24.8	8.0	18.7	22.1	24.1	1529	25.9	7.4	14.3	19.6	24.1
1405	25.0	8.5	15.7	21.5	23.9	1540	26.2	8.8	17.9	22.3	25.2
1422	25.1	7.6	16.1	21.2	24.0	1499	26.3	11.5	19.8	23.7	25.5
1637	25.1	9.2	18.1	21.4	23.7	1396	26.4	11.4	19.7	22.9	25.4
1494	25.2	12.2	19.1	22.9	24.4	1461	26.5	10.2	19.0	23.2	25.3
1538	25.2	8.2	17.5	22.3	24.3	1513	26.7	11.1	20.8	23.7	25.5
1550	25.2	8.7	15.5	20.7	24.2	1546	26.7	11.3	21.3	24.2	26.0
1466	25.4	8.2	16.2	20.8	24.4	1506	27.1	10.2	20.8	24.1	25.9
1611	25.4	9.8	18.1	21.6	24.2	1510	27.1	12.5	22.1	24.9	26.5
1545	25.5	10.7	19.3	22.7	24.8	1555	27.9	11.9	20.9	24.3	26.6
1551	25.5	6.5	13.4	19.2	24.0	1630	28.3	8.2	15.5	22.4	27.1

SAMPLE 6 Continued.—WINTER RINGS, 5 to 7.

No.	Size.	1	2	3	4	5	6	7
	Cm.							
1402	25.3	8.3	14.0	18.8	21.9	24.0	—	—
1472	25.7	6.8	17.6	22.3	24.2	25.3	—	—
1539	25.8	5.9	12.6	19.8	23.0	25.0	—	—
1447	25.9	9.1	18.6	22.8	24.7	25.5	—	—
1585	25.9	6.9	13.9	19.5	22.6	24.9	—	—
1409	26.1	11.5	18.6	22.7	24.7	25.7	—	—
1564	26.4	7.9	14.0	21.4	23.8	25.7	—	—
1549	26.9	10.8	19.5	23.5	25.5	26.4	—	—
1403	27.0	9.2	17.8	22.7	25.2	26.5	—	—
1417	28.1	12.9	20.4	25.0	26.7	27.6	—	—
1535	28.3	11.7	20.0	25.0	26.4	27.6	—	—
1573	28.5	10.3	17.5	23.3	26.2	27.8	—	—
1397	26.6	6.7	16.5	21.3	23.3	24.8	25.9	—
1561	26.7	6.8	13.8	20.2	24.3	25.4	26.3	—
1426	27.0	7.4	14.1	19.9	23.5	25.5	26.5	—
1560	27.8	8.1	15.6	22.3	25.5	26.3	27.3	—
1495	28.4	12.4	19.8	24.1	25.9	27.1	28.0	—
1578	29.0	12.5	19.8	24.2	26.1	27.5	28.2	28.9

1464 24.4
1532 22.1
1547 24.2

} Age uncertain.

SAMPLE 7.—WINTER RINGS, 1 and 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
1693	19·6	13·5	—	1850	22·3	10·4	19·3
1657	21·4	15·8	—	1855	22·3	10·4	17·8
1714	20·3	6·9	15·9	1875	22·3	9·4	17·5
1740	20·4	7·6	16·1	1882	22·3	10·3	18·7
1831	20·4	8·3	17·4	1890	22·3	8·8	19·0
1710	20·7	7·5	16·9	1649	22·4	9·2	19·5
1706	20·8	6·9	15·3	1699	22·4	10·3	19·1
1728	21·0	7·6	16·4	1734	22·4	3·3	19·0
1760	21·0	10·8	18·5	1762	22·4	10·3	18·8
1814	21·2	8·0	17·2	1822	22·4	9·1	18·2
1856	21·2	7·9	17·8	1662	22·5	10·7	19·5
1738	21·3	8·6	16·0	1676	22·5	9·3	19·3
1739	21·3	9·0	17·4	1759	22·5	11·6	18·9
1877	21·3	7·6	17·6	1799	22·5	12·0	19·1
1695	21·4	7·0	15·7	1805	22·5	11·3	19·3
1720	21·5	10·2	17·7	1645	22·6	10·6	18·5
1802	21·5	10·4	18·1	1675	22·6	9·8	19·2
1835	21·5	11·8	18·1	1727	22·6	12·4	18·8
1840	21·5	7·4	18·0	1786	22·6	11·3	20·1
1872	21·5	11·4	18·7	1820	22·6	10·6	19·0
1749	21·6	7·6	17·6	1643	22·7	12·6	20·6
1765	21·6	6·6	17·4	1751	22·7	9·7	18·9
1874	21·6	9·7	18·6	1847	22·7	8·8	18·8
1689	21·7	7·9	18·6	1880	22·7	10·7	19·0
1836	21·7	9·1	18·6	1659	22·8	10·4	19·3
1870	21·7	8·6	16·8	1692	22·8	10·1	19·2
1883	21·7	10·0	17·7	1694	22·8	13·6	19·0
1688	21·8	9·3	18·8	1781	22·8	10·7	20·0
1763	21·8	10·6	18·8	1804	22·8	9·9	16·7
1806	21·8	8·5	16·3	1811	22·9	11·5	19·7
1828	21·8	9·2	18·5	1879	22·9	9·9	20·1
1860	21·8	11·2	18·8	1663	23·0	10·4	19·2
1887	21·8	12·0	19·1	1687	23·0	11·9	19·5
1697	21·9	9·2	17·8	1722	23·0	11·1	19·5
1757	21·9	9·5	17·1	1733	23·0	9·3	18·8
1842	21·9	10·6	19·4	1748	23·0	10·4	20·6
1881	21·9	8·3	19·0	1767	23·0	11·9	20·3
1650	22·0	10·2	18·1	1808	23·0	8·3	17·7
1679	22·0	9·3	18·5	1812	23·0	10·2	20·0
1771	22·0	7·9	18·0	1833	23·0	11·8	19·5
1778	22·0	8·4	18·2	1859	23·0	10·8	20·1
1816	22·0	9·0	17·6	1878	23·0	11·1	19·2
1849	22·0	10·5	19·0	1642	23·2	11·9	20·0
1873	22·0	9·4	18·5	1658	23·2	10·9	19·6
1756	22·1	9·4	18·5	1678	23·2	11·1	19·0
1793	22·1	11·7	19·1	1810	23·2	11·0	20·1
1837	22·1	7·3	18·4	1803	23·3	11·9	20·2
1647	22·2	9·3	18·7	1660	23·5	11·5	20·3
1736	22·2	10·6	19·7	1862	23·5	11·1	20·5
1865	22·2	10·2	19·2	1785	23·6	11·8	20·6
1885	22·2	10·8	18·5	1726	23·7	9·3	18·3
1653	22·3	10·0	18·9	1838	23·7	12·3	21·2
1655	22·3	11·0	19·8	1664	24·0	12·5	20·3
1702	22·3	10·1	19·1	1782	24·0	11·2	20·9
1703	22·3	8·2	18·7	1818	24·1	11·5	21·0
1773	22·3	8·8	18·5	1844	24·1	12·6	20·9
1830	22·3	11·3	19·4	1684	24·2	12·8	20·6
1846	22·3	8·8	18·6	1654	25·1	14·0	22·3
1848	22·3	8·4	17·5				

SAMPLE 7 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
1746	21·8	8·2	14·6	19·6	1854	23·5	7·3	16·7	21·7
1867	21·8	4·6	12·2	19·1	1680	23·6	9·4	17·1	21·6
1690	22·0	8·1	15·1	19·7	1685	23·6	7·4	15·1	21·1
1704	22·0	9·2	13·9	19·0	1777	23·6	5·7	13·1	20·6
1807	22·0	7·3	13·6	19·7	1779	23·6	5·9	13·9	21·0
1857	22·0	7·3	12·7	20·0	1792	23·6	11·1	16·8	21·8
1755	22·1	7·3	14·9	19·4	1839	23·6	7·9	15·1	21·7
1871	22·2	5·3	12·9	19·9	1667	23·7	7·8	16·3	21·1
1747	22·3	10·7	15·6	20·4	1732	23·7	10·8	16·9	21·2
1801	22·5	6·6	14·3	20·8	1766	23·7	8·3	15·7	22·2
1888	22·5	7·4	15·1	20·0	1770	23·7	7·8	16·5	21·5
1672	22·6	6·2	14·1	20·3	1868	23·7	10·5	18·1	21·6
1674	22·6	8·0	16·3	20·6	1698	23·8	6·4	15·9	21·3
1737	22·6	7·4	14·0	20·2	1711	23·8	8·7	16·6	22·1
1705	22·6	7·8	16·1	19·6	1745	23·8	8·2	14·9	21·5
1750	22·7	9·3	15·3	20·2	1824	23·8	9·3	15·8	21·6
1815	22·7	7·3	14·2	20·0	1832	23·8	8·0	15·1	21·2
1826	22·7	6·4	13·1	20·3	1707	23·8	6·7	14·0	22·1
1886	22·7	7·3	18·2	21·4	1843	23·8	10·0	17·5	21·5
1768	22·8	8·0	15·6	20·4	1670	23·9	9·0	17·6	22·0
1787	22·8	7·0	13·6	20·0	1754	23·9	9·7	16·4	22·2
1821	22·8	9·8	18·0	21·3	1788	23·9	9·1	17·8	22·0
1864	22·8	8·3	16·2	20·3	1825	23·9	8·2	15·9	21·7
1866	22·8	8·7	14·5	20·9	1869	23·9	5·2	14·3	21·9
1884	22·8	8·7	15·7	21·0	1666	23·9	8·0	17·8	22·1
1731	22·9	7·9	16·8	20·8	1656	24·0	9·1	17·3	21·9
1764	22·9	8·5	15·7	20·9	1681	24·0	7·8	15·1	21·5
1797	22·9	8·5	15·4	20·6	1742	24·0	7·0	15·2	21·4
1798	22·9	9·5	16·5	20·7	1780	24·0	8·9	16·2	22·1
1691	23·0	7·6	14·7	20·4	1669	24·1	9·4	15·8	21·7
1719	23·0	5·7	14·1	20·7	1713	24·1	7·3	15·5	22·4
1723	23·0	8·8	14·7	20·2	1809	24·1	11·4	17·9	21·9
1795	23·0	6·9	14·4	20·2	1841	24·1	5·6	13·9	21·9
1648	23·1	7·1	14·8	20·7	1644	24·3	8·1	18·2	22·3
1683	23·1	7·1	14·0	20·3	1700	24·3	12·0	17·1	21·8
1682	23·2	6·0	15·6	20·5	1725	24·3	9·6	19·2	22·9
1724	23·2	9·3	15·6	20·6	1774	24·3	9·1	17·8	21·9
1743	23·2	7·7	14·9	21·5	1641	24·4	6·2	13·5	22·0
1790	23·2	7·6	15·4	20·4	1791	24·4	7·5	16·2	21·6
1827	23·2	8·3	15·5	21·0	1819	24·4	9·5	18·4	22·6
1829	23·2	8·1	14·5	20·0	1677	24·5	9·0	17·5	22·3
1889	23·2	6·6	11·2	20·1	1876	24·5	8·3	17·3	22·4
1701	23·3	10·1	15·7	20·5	1665	24·6	6·1	14·7	21·8
1741	23·3	7·3	15·3	21·1	1671	24·6	6·4	14·9	21·5
1813	23·3	11·1	18·5	21·6	1717	24·6	7·0	15·0	21·9
1823	23·3	8·2	14·4	21·1	1735	24·6	9·7	17·4	22·4
1668	23·4	8·8	15·5	21·0	1817	24·6	8·6	16·8	22·7
1673	23·4	5·9	13·5	20·0	1861	24·6	9·2	18·1	22·5
1729	23·4	8·9	15·2	21·3	1661	24·8	7·7	14·6	21·3
1834	23·4	8·6	15·9	21·3	1753	24·8	9·8	17·6	23·1
1851	23·4	7·0	16·6	20·7	1730	24·9	9·6	18·3	23·0
1652	23·5	9·5	16·7	21·1	1800	25·0	8·0	15·7	23·1
1708	23·5	10·3	16·4	21·0	1718	25·1	8·8	15·3	22·2
1716	23·5	7·8	15·9	21·6	1721	25·2	9·2	18·4	23·7
1752	23·5	7·1	14·4	21·4	1744	25·2	11·5	19·9	23·5
1775	23·5	9·2	17·7	21·0	1783	25·2	8·9	17·7	23·0
1776	23·5	5·0	13·9	20·6	1709	25·5	8·2	17·3	23·3
1794	23·5	7·3	14·4	20·7	1686	26·2	9·4	21·7	25·0
1853	23·5	7·7	13·2	20·7					

SAMPLE 7 Continued.—WINTER RINGS, 4 to 7.

No.	Size.	1	2	3	4	5	6	7
	Cm.							
1646	23.6	7.6	14.3	19.0	22.3	—	—	—
1696	24.4	10.1	16.3	21.0	23.1	—	—	—
1852	25.0	6.8	15.9	21.7	23.9	—	—	—
1863	25.0	10.0	16.3	21.1	23.7	—	—	—
1712	25.9	7.3	16.6	22.0	24.8	—	—	—
1772	26.0	10.0	17.5	23.0	25.2	—	—	—
1845	26.2	11.6	20.0	23.8	25.4	—	—	—
1651	26.7	10.8	20.9	24.2	26.0	—	—	—
1769	24.9	8.8	15.3	19.7	22.6	24.0	—	—
1796	25.6	8.2	15.3	19.1	22.1	24.2	—	—
1784	25.8	8.6	15.5	21.2	23.4	24.3	25.2	—
1761	26.5	8.4	13.9	20.7	22.8	24.4	25.7	—
1640	28.0	7.3	15.6	21.3	24.2	26.1	27.3	27.8

SAMPLE 8.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
2117	22·8	11·4	19·1	2116	23·5	10·7	19·0
1944	22·9	12·0	19·7	1926	23·7	12·2	20·0
1947	22·9	9·6	17·8	2050	23·7	11·2	21·2
2002	22·9	10·7	19·8	2078	23·7	10·9	21·1
2097	23·0	11·6	19·0	1990	23·9	10·2	20·3
2134	23·0	11·6	19·9	2011	23·9	9·9	20·1
2021	23·1	11·0	19·9	2045	23·9	11·6	20·5
2032	23·2	11·2	20·8	2092	23·9	11·4	20·7
2037	23·2	12·1	21·0	2112	24·0	11·8	19·6
1917	23·3	11·0	20·1	2130	24·2	11·3	20·6
1925	23·3	11·9	20·0	1899	24·6	13·5	21·6
1967	23·3	11·2	19·7	1912	24·7	13·4	21·6
1941	23·4	9·3	19·2	1974	24·8	12·7	22·8
2035	23·4	10·9	20·4	2094	25·0	11·7	21·4
2038	23·5	10·5	19·7	2096	25·0	11·2	21·5
2067	23·5	10·6	20·5				

SAMPLE 8 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2013	21·8	7·0	15·4	20·3	1932	23·8	8·1	16·8	21·4
1972	22·4	7·7	13·6	19·8	1968	23·8	8·8	15·8	21·2
1976	22·7	8·0	17·1	20·9	1979	23·8	8·3	15·9	21·2
2053	23·0	6·4	14·2	20·2	2009	23·8	9·9	15·7	21·3
2077	23·2	8·7	16·3	21·4	2055	23·8	12·5	18·0	22·0
2140	23·2	7·4	16·1	21·4	2090	23·8	7·1	13·8	21·6
2016	23·3	7·3	15·9	20·6	2100	23·8	10·1	17·6	22·3
2033	23·3	6·3	16·3	20·9	2128	23·8	6·8	14·6	21·4
2087	23·3	8·9	15·2	20·2	1958	23·9	7·7	14·3	21·6
2137	23·3	7·0	14·2	20·8	1975	23·9	6·7	14·1	21·5
2010	23·4	8·3	16·9	21·6	1978	23·9	8·9	17·7	21·9
2069	23·4	7·8	16·5	21·3	1995	23·9	10·8	15·8	21·7
2073	23·4	9·5	18·1	22·1	2110	23·9	9·2	16·1	22·2
1915	23·5	7·5	14·4	20·6	2113	23·9	9·9	18·1	22·2
1922	23·5	9·5	16·8	21·0	1921	24·0	8·3	16·5	21·7
1931	23·5	9·2	15·3	21·1	1985	24·0	8·8	18·0	22·3
1933	23·5	10·7	16·4	21·6	2022	24·0	8·8	17·6	22·0
2003	23·5	8·5	14·9	21·2	1940	24·1	7·4	15·2	21·9
2008	23·5	8·4	17·8	21·4	2043	24·1	8·7	16·7	22·0
2111	23·5	7·0	13·0	20·9	2139	24·1	7·5	16·9	21·9
1914	23·6	11·6	18·1	21·7	1955	24·2	8·2	17·7	22·3
1945	23·6	8·6	15·5	21·3	1981	24·2	9·0	16·7	21·6
1949	23·6	8·5	17·1	21·6	1984	24·2	8·4	17·9	21·7
2036	23·6	8·4	13·2	21·4	2030	24·2	9·0	16·2	22·4
2004	23·7	8·6	17·2	21·1	2052	24·2	7·5	16·4	22·3
2120	23·7	8·9	16·0	21·9	2054	24·2	12·8	20·0	22·7
2138	23·7	7·4	16·9	22·3	2063	24·2	9·7	17·2	22·3

SAMPLE 8 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2080	24.2	10.9	16.3	21.5	1980	24.9	7.1	17.0	22.9
2119	24.2	10.1	17.6	22.2	1992	24.9	7.9	16.9	23.0
1909	24.3	11.6	18.2	22.1	2019	24.9	8.0	17.3	22.5
1902	24.3	7.2	16.1	22.1	2060	24.9	8.8	15.8	23.2
1924	24.3	8.6	15.3	21.2	1939	25.0	10.0	19.5	23.4
1956	24.3	8.0	15.3	21.4	1948	25.0	8.7	15.8	22.3
1962	24.3	8.7	16.2	21.6	1977	25.0	7.6	14.5	22.5
1970	24.3	10.5	17.0	22.6	1999	25.0	11.1	17.4	22.9
2006	24.3	10.4	17.9	22.9	2089	25.0	10.5	16.5	23.4
2042	24.3	9.5	18.3	22.0	2127	25.0	10.2	18.5	22.7
2072	24.3	7.1	14.7	22.0	2131	25.0	10.8	18.9	23.2
2118	24.3	6.5	14.6	21.5	1896	25.1	8.3	15.7	23.4
1898	24.4	9.3	19.0	23.1	1901	25.1	13.0	20.5	23.4
1937	24.4	5.9	14.3	21.9	1938	25.1	9.1	17.6	23.1
1964	24.4	12.6	19.6	22.7	2088	25.1	8.9	17.9	22.9
1982	24.4	12.4	18.5	22.6	1905	25.2	10.6	18.5	23.0
1983	24.4	7.7	15.7	21.9	1935	25.2	8.4	17.0	23.0
2020	24.4	8.0	15.9	22.4	2044	25.2	10.2	17.5	22.1
2057	24.4	8.9	15.7	21.4	2061	25.2	8.4	16.6	23.2
2075	24.4	8.6	16.1	22.2	2065	25.2	8.5	18.1	22.9
2105	24.4	8.7	18.0	22.2	1965	25.3	7.3	15.1	22.8
1953	24.5	7.7	18.0	22.4	2114	25.3	6.3	15.4	23.1
2017	24.5	9.3	17.0	22.5	1920	25.5	10.8	19.2	23.6
2041	24.5	8.7	15.9	21.7	2083	25.5	8.6	16.9	22.8
2076	24.5	9.5	16.7	22.7	2093	25.5	10.9	17.3	23.0
2086	24.5	7.3	15.6	21.8	2048	25.6	8.6	17.0	23.2
2126	24.5	11.3	18.3	22.5	2005	25.7	12.1	17.6	23.5
1911	24.6	9.1	20.3	23.1	2084	25.8	9.4	17.7	23.2
2012	24.6	8.0	17.6	22.3	2125	25.8	11.4	19.3	23.8
1903	24.7	8.2	17.8	22.4	1989	25.9	11.2	19.5	23.7
1909	24.7	9.4	19.1	23.1	2062	25.9	8.4	17.3	23.1
1910	24.7	8.6	16.7	22.2	1928	26.0	9.2	19.6	23.7
1942	24.7	8.8	15.5	21.7	2049	26.3	10.1	17.2	23.0
1994	24.7	7.2	14.5	22.5	2109	26.4	8.6	18.2	23.6
1996	24.7	8.3	17.5	22.1	1943	26.5	9.5	18.1	24.5
1908	24.8	10.3	20.0	23.2	2074	26.5	11.7	17.8	23.7
1916	24.8	11.4	19.7	22.8	1963	26.6	9.8	18.7	23.7
1929	24.8	10.4	17.9	22.4	1906	26.7	11.8	20.3	24.6
1952	24.9	7.6	14.9	22.0	2001	27.9	13.7	20.1	26.0

SAMPLE 8 Continued.—WINTER RINGS, 4.

No.	Size	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2121	23.1	6.4	15.3	19.6	21.7	2066	24.5	6.6	15.0	20.6	23.2
2079	24.1	8.0	14.2	21.5	23.5	2085	24.5	8.5	15.9	20.4	23.4
1946	24.2	8.2	15.2	20.1	23.0	2024	24.6	9.2	17.3	21.7	23.8
2070	24.3	9.7	16.6	20.9	23.4	2133	24.7	8.4	15.8	20.1	23.3
2101	24.3	5.7	15.3	20.7	23.4	2029	24.9	7.4	14.5	21.1	23.6

SAMPLE 8 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2047	24.9	9.5	16.6	20.9	23.1	2132	25.9	7.9	17.4	22.2	24.8
2108	24.0	9.4	17.6	21.4	23.9	1987	26.0	11.8	19.8	22.6	24.7
1934	25.0	9.5	16.9	21.3	23.6	2051	26.0	10.6	19.9	22.9	24.8
1893	25.1	10.7	18.4	22.1	24.0	2107	26.0	8.8	17.3	21.9	24.9
2034	25.1	9.3	17.7	21.8	24.0	1971	26.1	12.3	19.5	22.7	25.0
1988	25.2	10.7	18.0	21.6	23.7	1897	26.2	8.7	16.8	22.3	25.1
2081	25.2	9.9	16.6	21.9	24.5	1960	26.2	12.6	18.1	22.2	24.7
2099	25.2	9.2	15.8	22.3	24.2	2058	26.2	10.2	18.1	23.0	25.1
1894	25.3	10.1	16.2	21.3	24.1	2135	26.2	8.7	16.5	21.9	24.8
2027	25.3	9.7	17.3	21.7	24.1	1923	26.3	8.3	17.0	21.6	24.6
1913	25.4	9.5	16.9	21.9	24.3	2031	26.3	11.6	18.8	23.2	25.3
1918	25.5	8.0	16.5	22.0	24.5	2082	26.3	10.1	17.9	22.3	25.2
2026	25.5	8.6	17.4	22.0	24.5	2122	26.3	11.0	19.2	22.7	25.3
2056	25.5	8.5	14.5	20.7	23.9	1891	26.5	7.5	14.1	21.3	25.1
1959	25.6	8.5	17.4	21.4	24.1	1950	26.5	10.6	17.4	23.4	26.3
2102	25.6	8.9	16.5	20.8	24.2	2018	26.5	9.6	19.1	22.5	25.0
1919	25.7	8.0	17.7	23.0	24.6	1936	26.6	11.4	20.1	23.5	25.4
1973	25.7	9.3	16.9	22.2	24.7	2064	26.6	10.1	17.7	22.7	25.1
1895	25.8	8.3	16.0	20.8	24.4	2059	26.9	7.6	17.2	23.0	25.7
1954	25.8	12.0	18.9	22.0	24.4	1961	27.1	5.4	13.6	21.7	25.6
2015	25.8	9.7	17.4	21.6	24.5	1997	27.4	10.1	19.9	23.3	26.1
2123	25.8	8.1	16.5	22.1	24.7	1969	27.5	11.0	19.8	23.3	26.0
2023	25.9	10.7	20.1	23.0	24.9	1907	27.7	8.9	18.7	24.0	26.7
2025	25.9	8.2	17.5	22.0	24.7	2136	27.9	11.6	21.4	24.7	26.6
2068	25.9	10.6	20.7	23.3	25.1						

SAMPLE 8 Continued.—WINTER RINGS, 5 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
2028	24.8	8.0	15.6	19.9	22.3	24.0	—	—	—	—
1986	25.1	8.1	14.5	21.2	23.2	24.4	—	—	—	—
2039	25.2	9.3	17.7	21.6	23.5	24.7	—	—	—	—
1930	25.5	9.5	17.1	21.6	23.6	24.7	—	—	—	—
2124	25.7	8.2	14.3	19.5	22.7	25.0	—	—	—	—
1904	25.7	8.3	14.5	19.6	22.6	25.0	—	—	—	—
2129	25.7	11.0	19.8	22.9	24.4	25.3	—	—	—	—
2098	25.8	9.5	16.4	21.7	23.7	25.1	—	—	—	—
1937	25.9	9.1	17.1	22.0	23.9	25.1	—	—	—	—
2115	25.9	10.7	18.1	22.0	23.9	25.1	—	—	—	—
1927	26.0	8.0	15.7	20.7	23.6	24.9	—	—	—	—
2091	26.0	8.3	15.9	22.1	24.8	25.6	—	—	—	—
2095	26.1	9.1	15.2	21.3	23.8	25.5	—	—	—	—
2103	26.2	7.5	14.6	20.7	24.0	25.7	—	—	—	—
1992	26.4	9.5	17.1	22.2	24.6	25.9	—	—	—	—
1998	26.4	9.0	17.1	22.6	25.0	26.4	—	—	—	—

SAMPLE 8 Continued.—WINTER RINGS, 5 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
2106	26.8	7.1	13.5	21.0	24.5	25.8	—	—	—	—
1966	27.3	9.4	17.6	22.1	24.9	26.5	—	—	—	—
2014	27.5	10.6	18.0	23.3	25.6	26.9	—	—	—	—
2007	25.6	8.2	15.0	20.3	22.7	24.3	25.2	—	—	—
1892	26.3	7.9	16.4	21.1	23.3	24.3	25.4	—	—	—
1991	26.3	7.7	14.1	20.9	23.2	24.6	25.7	—	—	—
2104	26.5	7.8	15.5	20.9	23.1	24.8	25.8	—	—	—
2000	27.0	11.8	20.1	22.9	24.8	25.9	26.6	—	—	—
1951	27.7	8.8	14.6	19.1	22.9	24.9	26.2	27.0	—	—
2040	28.7	11.9	20.7	24.2	25.7	27.0	27.4	28.0	28.4	—
2046	27.3	10.7	18.7	22.0	23.6	24.7	25.4	26.0	26.5	27.0

SAMPLE 9.—WINTER RINGS, 1 and 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
2247	21.4	11.0	—	2387	22.8	8.4	17.8
2386	20.5	8.6	16.1	2333	22.9	11.3	19.8
2176	21.1	10.5	18.1	2177	22.9	8.9	18.8
2171	21.7	8.7	16.5	2260	23.0	12.3	19.3
2194	21.8	8.7	17.4	2168	23.1	12.3	21.2
2301	22.0	12.0	19.0	2322	23.1	10.3	20.0
2166	22.1	9.0	18.3	2221	23.2	11.7	20.8
2225	22.1	8.3	18.4	2146	23.4	11.6	20.3
2162	22.2	9.2	19.3	2169	23.4	11.4	20.2
2329	22.2	10.5	19.2	2299	23.4	11.1	20.5
2277	22.3	9.2	19.2	2353	23.4	12.2	20.3
2283	22.3	10.9	19.0	2380	23.4	10.1	19.8
2211	22.4	10.0	19.2	2241	23.5	10.3	21.4
2280	22.4	10.5	19.1	2178	23.6	11.3	20.3
2167	22.5	9.8	18.5	2226	23.6	9.9	20.4
2187	22.5	11.2	19.3	2382	23.6	11.4	19.8
2270	22.5	9.7	19.1	2184	23.8	11.7	21.0
2224	22.6	8.9	18.7	2240	23.8	11.4	20.4
2264	22.6	10.8	19.1	2262	23.9	10.9	21.3
2336	22.8	11.1	19.9	2342	24.0	12.0	20.8
2351	22.8	9.6	19.5	2294	24.3	12.1	19.7
2356	22.8	10.5	19.4				

SAMPLE 9 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2272	21.3	6.7	14.0	19.3	2305	23.0	7.3	16.0	21.3
2282	21.9	8.4	16.1	19.7	2246	23.1	6.9	14.9	20.8
2259	22.0	6.4	13.0	19.6	2250	23.1	7.6	14.4	20.5
2208	22.3	9.1	15.3	19.8	2256	23.1	9.0	17.0	20.8
2275	22.3	7.7	14.9	19.5	2278	23.1	7.9	14.2	20.4
2152	22.6	6.7	13.3	19.4	2346	23.2	7.6	17.0	20.9
2244	22.6	7.5	13.8	20.0	2193	23.3	9.6	17.9	21.8
2273	22.6	8.0	15.2	20.7	2220	23.3	9.7	17.1	20.7
2150	22.7	8.0	15.5	19.9	2285	23.3	9.8	17.1	21.4
2186	22.8	9.2	15.6	20.3	2300	23.3	9.8	15.5	20.6
2227	22.8	9.3	17.1	21.0	2338	23.3	8.3	16.5	22.2
2345	22.8	7.5	13.8	20.6	2375	23.3	7.6	16.1	21.1
2214	22.9	9.8	15.3	20.7	2149	23.4	8.4	16.8	21.6
2357	22.9	7.8	14.9	20.0	2173	23.4	8.3	15.9	21.6
2376	22.9	8.5	16.4	21.0	2189	23.4	10.6	17.6	21.2
2163	23.0	6.5	15.2	20.7	2310	23.4	6.5	13.8	20.6
2190	23.0	7.7	14.0	20.6	2335	23.4	10.8	16.9	21.3
2237	23.0	8.3	14.7	20.7	2355	23.4	8.4	15.3	21.2
2249	23.0	8.4	13.9	19.7	2147	23.5	7.6	14.8	20.6
2286	23.0	8.3	15.0	20.3	2160	23.5	10.1	17.0	21.5

SAMPLE 9 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
2174	Cm.				2302	Cm.			
2207	23-5	8-4	17-5	21-6	2317	24-1	7-5	14-5	21-0
2243	23-5	10-5	16-7	21-3	2385	24-1	8-9	18-2	22-2
2271	23-5	5-8	13-7	20-8	2204	24-2	5-7	14-4	21-0
2276	23-5	9-0	14-9	21-4	2209	24-2	9-2	16-2	21-8
2159	23-6	7-4	15-8	21-6	2212	24-2	11-7	19-0	23-0
2290	23-6	10-1	17-0	21-2	2220	24-2	9-4	17-5	21-9
2306	23-6	8-4	16-9	21-3	2222	24-2	9-8	19-3	22-9
2334	23-6	7-1	14-7	20-8	2234	24-2	9-9	16-5	21-9
2391	23-6	4-4	13-1	21-1	2316	24-2	7-9	14-9	21-2
2156	23-7	9-3	17-0	21-8	2331	24-2	9-8	16-9	22-0
2213	23-7	8-4	15-7	21-8	2210	24-3	8-4	15-4	21-7
2263	23-7	10-9	17-9	21-9	2311	24-3	8-6	16-9	22-4
2281	23-7	8-9	16-2	21-3	2383	24-3	7-6	17-7	22-1
2350	23-7	8-8	16-7	21-2	2364	24-3	10-8	17-1	22-4
2352	23-7	7-4	14-1	20-2	2265	24-3	6-9	15-5	21-8
2367	23-7	9-7	16-2	21-6	2157	24-3	10-5	17-0	22-2
2379	23-7	8-8	15-7	21-3	2332	24-4	8-5	16-9	21-9
2161	23-8	8-5	15-7	21-4	2188	24-4	9-2	17-9	23-0
2202	23-8	9-2	16-1	21-7	2258	24-5	12-1	18-1	22-4
2223	23-8	8-9	17-2	21-8	2284	24-5	7-3	15-7	21-7
2253	23-8	7-6	17-7	22-0	2291	24-5	6-3	16-3	21-8
2255	23-8	7-0	14-2	20-9	2298	24-5	8-7	16-3	21-9
2279	23-8	7-5	16-2	21-8	2320	24-5	8-2	18-2	23-0
2287	23-8	7-9	15-1	21-5	2340	24-5	9-3	16-3	22-3
2296	23-8	7-9	18-0	21-9	2377	24-5	11-4	18-6	22-8
2304	23-8	10-7	18-5	22-4	2148	24-6	7-5	14-9	21-7
2307	23-8	7-9	16-9	21-7	2228	24-6	10-4	16-9	22-0
2372	23-8	6-4	15-6	22-0	2266	24-6	7-6	15-2	21-7
2192	23-9	8-4	14-9	21-4	2315	24-6	7-2	15-3	22-1
2251	23-9	5-9	15-4	21-7	2369	24-6	8-2	18-3	22-7
2252	23-9	7-3	15-1	21-4	2196	24-6	9-3	18-4	22-9
2309	23-9	10-6	17-3	21-9	2389	24-7	9-7	15-9	21-8
2366	23-9	6-7	14-0	21-1	2268	24-7	8-8	18-0	22-4
2164	24-0	8-3	16-6	22-2	2297	24-7	10-3	17-8	22-3
2165	24-0	10-7	17-4	22-2	2318	24-7	8-1	15-7	22-7
2198	24-0	8-2	17-8	22-2	2324	24-7	9-4	17-3	22-0
2218	24-0	9-9	17-7	22-3	2349	24-7	10-0	17-6	22-6
2231	24-0	10-9	16-4	21-7	2289	24-8	9-1	15-8	22-2
2232	24-0	9-5	18-5	22-5	2341	24-8	10-8	17-0	22-3
2235	24-0	10-1	17-3	21-9	2374	24-8	12-3	18-6	22-5
2303	24-0	11-1	16-6	22-2	2216	24-9	9-9	18-1	22-9
2354	24-0	9-5	16-1	22-1	2181	25-0	11-7	19-0	23-0
2362	24-0	7-7	17-8	21-8	2219	25-0	7-1	13-8	21-7
2368	24-0	8-7	14-1	21-8	2229	25-0	9-2	16-3	22-8
2381	24-0	8-7	16-6	21-5	2242	25-0	8-3	17-6	23-2
2389	24-0	9-3	16-4	21-5	2257	25-0	8-3	16-7	22-2
2155	24-1	8-0	15-2	21-8	2347	25-0	6-0	13-3	22-8
2158	24-1	8-4	16-7	22-3	2360	25-0	8-5	18-4	23-2
2197	24-1	7-7	15-5	22-0	2363	25-0	10-7	20-0	23-6
2239	24-1	6-6	15-5	21-8			9-0	17-7	22-4
		9-2	16-2	21-9			7-2	14-3	22-8

SAMPLE 9 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2378	25.1	10.9	18.7	23.1	2371	25.5	10.9	18.2	23.4
2170	25.2	12.6	19.3	23.3	2200	25.6	11.2	19.3	24.0
2215	25.2	10.8	16.6	23.0	2295	25.6	8.8	17.4	22.4
2339	25.3	8.2	16.9	22.8	2312	25.7	9.2	17.7	23.1
2344	25.3	12.9	18.7	23.0	2326	25.7	9.3	16.7	22.2
2145	25.4	8.0	18.1	23.0	2330	25.7	9.4	18.6	23.1
2201	25.4	11.0	18.5	23.0	2314	25.9	12.4	20.8	24.3
2269	25.4	10.8	16.5	23.0	2390	26.3	9.9	17.2	23.8
2199	25.5	11.5	20.1	23.5	2370	26.5	10.4	19.1	24.0
2245	25.5	11.2	19.2	23.4	2143	26.8	8.5	17.9	24.5
2343	25.5	13.0	19.4	23.7	2388	26.9	12.3	20.7	24.7
2361	25.5	10.6	18.8	23.5					

SAMPLE 9 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2267	22.2	8.7	14.2	17.8	20.5	2236	25.4	8.7	15.0	21.0	23.7
2151	23.8	8.6	16.1	20.2	23.0	2191	25.6	7.2	13.9	18.0	23.3
2180	24.0	9.2	16.5	20.2	22.8	2206	25.7	10.0	17.4	22.4	24.8
2313	24.4	9.5	15.7	21.2	23.6	2288	25.8	7.3	16.0	22.1	24.5
2293	24.6	8.4	15.8	21.2	23.4	2325	25.8	9.0	16.4	21.8	24.6
2172	24.7	8.8	15.5	19.9	23.1	2154	26.0	11.3	19.8	22.7	25.0
2233	24.7	8.1	15.8	20.8	23.5	2292	26.3	9.5	17.7	22.1	24.8
2254	24.7	7.7	17.3	21.4	23.7	2358	26.5	12.0	20.3	23.5	25.5
2319	24.7	9.2	15.1	19.6	22.6	2203	26.6	7.5	15.3	20.7	24.5
2205	24.8	9.0	16.3	21.8	23.8	2248	26.9	12.1	20.2	23.6	26.1
2185	24.9	9.0	16.1	20.5	23.5	2183	27.0	10.1	19.2	23.1	25.6
2337	25.0	6.6	14.0	18.6	22.4	2144	27.5	11.3	19.5	23.9	26.2
2308	25.1	6.3	13.2	20.5	23.8						

SAMPLE 9 Continued.—WINTER RINGS, 5 to 8.

No.	Size.	1	2	3	4	5	6	7	8
	Cm.								
2142	24.1	9.3	17.2	21.0	22.5	23.5	—	—	—
2261	24.3	7.4	15.1	19.3	22.6	23.6	—	—	—
2359	24.8	5.9	15.3	20.6	22.6	24.2	—	—	—
2348	25.3	8.1	15.8	19.7	22.6	24.6	—	—	—
2195	25.5	6.6	13.2	20.2	23.2	24.8	—	—	—
2153	26.4	8.4	17.4	21.4	23.7	25.4	—	—	—
2179	26.4	7.6	15.9	20.6	23.5	25.4	—	—	—
2373	26.5	7.5	14.0	20.0	23.2	25.7	—	—	—

SAMPLE 9 Continued.—WINTER RINGS, 5 to 8.

No.	Size.	1	2	3	4	5	6	7	8
	Cm.								
2274	26.9	8.1	15.1	21.7	24.5	26.2	—	—	—
2328	27.4	10.4	19.0	23.5	25.6	26.9	—	—	—
2141	29.4	9.0	17.6	23.7	26.9	28.7	—	—	—
2365	24.4	6.1	13.3	18.2	20.8	22.6	23.8	—	—
2182	26.5	8.8	15.2	21.7	23.9	25.0	25.9	—	—
2217	26.5	8.4	15.0	20.6	23.3	24.5	25.3	26.0	—
2327	28.7	8.3	16.5	21.9	25.2	26.7	27.7	28.3	—
2323	27.7	8.1	16.2	21.6	24.4	25.7	26.3	26.9	27.3

2175	23.3	} Age uncertain.
2294	24.3	
2342	24.0	

SAMPLE 10.—WINTER RINGS, 1 and 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
2399	20·2	13·4	—	2476	22·4	11·8	18·7
2519	20·5	14·3	—	2427	22·5	11·0	19·8
2398	21·0	13·9	—	2455	22·5	10·5	19·1
2496	21·1	15·0	—	2603	22·5	9·0	19·1
2403	21·9	13·5	—	2419	22·6	9·7	19·5
2562	20·1	7·5	17·0	2479	22·6	11·9	19·6
2460	20·4	9·6	17·2	2407	22·7	10·9	20·5
2464	20·6	9·0	17·3	2422	22·7	10·5	19·0
2480	20·8	9·6	16·6	2453	22·7	10·1	18·6
2392	21·0	9·8	17·4	2397	22·8	13·0	20·6
2409	21·0	7·5	16·9	2404	22·8	11·5	19·3
2423	21·2	8·2	17·5	2417	22·8	10·2	18·3
2454	21·3	9·8	17·9	2443	22·8	12·1	20·0
2470	21·4	10·8	17·8	2444	22·8	12·1	20·2
2486	21·4	8·5	17·7	2458	22·8	11·4	19·7
2497	21·5	7·0	18·6	2571	22·8	7·8	18·4
2402	21·6	8·5	17·2	2594	22·8	11·1	18·8
2405	21·6	8·7	17·9	2414	22·9	11·6	20·2
2465	21·6	10·0	19·3	2552	23·0	9·6	19·3
2490	21·6	7·7	16·8	2583	23·0	10·8	19·3
2424	21·7	12·0	19·0	2600	23·0	13·5	20·1
2548	21·8	6·9	17·3	2629	23·0	11·6	19·3
2396	21·9	9·4	18·0	2484	23·1	12·3	20·2
2520	21·9	9·8	18·5	2587	23·1	5·1	15·0
2581	21·9	8·3	17·7	2597	23·1	13·3	20·1
2439	22·0	9·6	19·6	2634	23·1	10·6	19·0
2487	22·0	6·1	17·7	2410	23·2	11·6	19·2
2515	22·0	8·1	17·8	2593	23·2	13·6	20·3
2450	22·1	6·4	18·6	2489	23·3	12·2	19·4
2452	22·1	10·0	18·3	2586	23·3	10·6	19·6
2517	22·1	9·4	19·0	2418	23·5	10·4	19·7
2440	22·2	10·3	19·0	2596	23·6	10·6	18·5
2446	22·2	10·5	18·8	2483	23·7	11·7	20·5
2425	22·3	8·2	18·0	2555	23·8	13·4	20·7
2463	22·3	9·4	18·9	2412	24·1	9·1	20·7
2595	22·3	10·3	19·0				

SAMPLE 10 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2393	21·1	6·9	13·2	18·1	2498	22·0	6·3	13·2	19·8
2394	21·5	8·7	14·7	19·8	2507	22·0	9·5	17·3	20·2
2456	21·5	6·2	14·7	19·3	2510	22·0	7·9	15·2	20·5
2429	21·6	5·3	12·2	18·7	2561	22·3	8·7	15·6	20·4
2509	21·6	8·3	16·2	19·7	2474	22·5	7·1	16·2	20·4
2521	21·8	7·3	14·1	19·4	2408	22·5	7·8	14·5	19·9

SAMPLE 10 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size	1	2	3
	Cm.					Cm.			
2457	22.6	8.6	17.4	21.3	2591	23.9	9.8	17.8	21.9
2477	22.6	9.0	16.3	21.2	2514	24.0	9.6	17.8	22.3
2513	22.6	7.3	14.7	21.2	2598	24.0	9.0	17.5	22.0
2411	22.7	7.5	16.5	20.4	2625	24.0	12.2	18.8	22.5
2415	22.7	7.4	14.0	20.2	2630	24.0	9.0	16.5	21.9
2421	22.7	7.8	14.0	19.9	2428	24.2	7.5	15.7	22.0
2430	22.7	7.0	15.1	20.8	2635	24.2	9.6	16.5	21.9
2467	22.8	7.3	15.8	21.0	2416	24.3	8.2	16.7	22.3
2549	22.8	10.6	17.3	21.2	2438	24.4	9.5	19.3	23.0
2466	22.9	7.1	17.0	21.8	2504	24.4	9.0	16.8	22.4
2471	22.9	9.6	17.1	20.9	2554	24.4	9.1	18.4	22.4
2420	23.0	9.7	18.3	21.9	2556	24.4	7.9	17.9	22.3
2468	23.0	11.1	16.9	20.3	2590	24.4	7.2	15.2	21.4
2472	23.0	9.0	17.2	21.2	2589	24.5	9.3	19.2	22.9
2585	23.0	9.8	17.3	21.2	2442	24.6	9.9	17.7	22.8
2627	23.1	8.5	16.2	21.4	2493	24.6	12.2	19.0	23.0
2566	23.1	11.4	18.1	21.8	2533	24.6	11.9	19.8	22.9
2601	23.1	8.0	15.3	20.3	2577	24.6	10.6	18.6	22.7
2462	23.2	11.4	17.1	20.8	2632	24.6	8.6	17.7	22.3
2473	23.2	8.1	17.3	21.3	2639	24.8	10.8	19.6	23.2
2502	23.2	9.5	17.5	22.0	2475	24.9	11.9	19.8	23.1
2602	23.2	8.1	16.0	21.2	2527	24.9	12.7	20.0	23.2
2445	23.3	9.6	17.5	21.5	2551	24.9	7.3	15.6	22.8
2469	23.3	8.1	15.5	21.3	2599	24.9	7.6	17.1	22.4
2560	23.3	8.5	17.7	21.8	2641	25.0	6.7	15.3	22.0
2578	23.3	7.1	14.2	21.1	2500	25.1	10.7	18.2	22.3
2570	23.4	8.0	14.6	21.9	2534	25.1	9.1	16.2	22.1
2481	23.5	7.4	14.8	21.3	2553	25.1	8.9	16.6	23.2
2557	23.5	8.8	17.3	21.7	2622	25.1	10.3	17.7	23.0
2559	23.5	7.6	14.3	20.1	2523	25.2	8.0	16.1	23.6
2516	23.6	8.5	16.9	21.4	2637	25.2	10.6	18.4	23.1
2579	23.6	9.2	16.5	22.0	2575	25.5	10.3	18.9	23.4
2435	23.7	10.3	18.3	22.4	2631	25.5	9.1	17.4	23.3
2499	23.7	8.6	16.6	21.7	2568	25.7	8.6	17.7	23.0
2633	23.7	6.9	16.4	22.0	2542	25.8	10.6	19.4	23.5
2400	23.8	9.7	16.7	21.8	2564	25.8	9.6	20.0	24.1
2461	23.8	10.1	17.4	21.6	2617	26.0	8.7	17.1	22.7
2511	23.8	11.0	18.2	22.4	2623	26.2	11.1	19.8	24.2
2512	23.8	11.7	18.8	22.5	2539	26.3	10.9	19.5	24.5
2550	23.8	10.0	19.0	22.5	2426	26.5	12.6	20.9	24.6
2580	23.8	9.3	18.0	22.2	2607	26.6	12.5	21.0	24.5
2626	23.8	10.7	18.2	22.6	2540	27.3	13.4	22.0	26.0

SAMPLE 10 Continued.—WINTER RINGS, 4

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2547	23.3	5.9	15.7	20.1	22.2	2608	25.7	7.1	15.3	21.6	24.2
2636	23.6	10.1	16.6	20.0	22.5	2620	25.7	9.4	17.4	22.2	24.7
2431	23.7	8.7	15.2	19.7	22.3	2526	25.8	12.4	21.0	23.5	24.9
2544	23.9	8.1	15.4	20.2	22.8	2618	25.8	10.0	19.5	22.9	24.9
2508	24.2	8.7	16.2	20.1	23.0	2491	25.9	11.1	18.3	22.4	25.2
2615	24.3	7.9	16.5	20.6	23.0	2528	25.9	10.2	18.1	22.8	24.6
2569	24.5	8.6	15.0	20.1	23.1	2584	25.9	8.7	15.8	21.0	24.4
2434	24.6	9.8	17.0	21.4	23.7	2432	26.0	10.3	19.2	23.0	25.0
2437	24.7	9.8	18.1	21.6	23.8	2505	26.0	8.8	17.8	22.5	24.9
2482	24.7	10.2	16.3	20.4	23.5	2525	26.0	8.7	18.5	22.5	25.1
2494	24.7	10.0	17.1	21.2	23.7	2545	26.0	7.9	16.4	21.8	24.7
2492	24.8	8.3	16.8	22.1	24.1	2609	26.1	8.0	16.4	21.8	25.0
2640	24.9	10.2	17.7	21.7	24.0	2613	26.3	12.4	20.3	23.3	25.2
2441	25.0	10.5	16.8	21.7	23.6	2436	26.4	10.2	17.8	23.4	25.6
2535	25.0	8.1	18.6	22.4	24.2	2485	26.4	10.3	18.2	22.6	25.2
2614	25.0	10.8	19.0	22.2	24.0	2501	26.4	11.2	20.5	23.7	25.6
2530	25.1	8.9	18.5	22.4	24.2	2536	26.4	10.0	19.5	23.3	25.3
2567	25.1	9.4	17.6	21.5	24.1	2588	26.4	10.3	16.5	22.5	25.4
2543	25.2	9.6	17.5	21.4	23.9	2531	26.5	11.3	20.1	23.2	25.5
2619	25.2	9.2	17.5	21.9	24.3	2610	26.5	11.3	18.3	22.6	25.1
2488	25.4	8.9	17.1	21.4	23.9	2503	26.6	9.8	20.9	24.2	25.8
2565	25.4	10.3	17.8	22.0	24.2	2541	26.6	11.1	18.7	22.9	25.6
2611	25.4	9.7	19.8	22.3	24.2	2612	26.6	12.2	19.9	22.8	25.2
2522	25.5	8.8	18.5	22.4	24.5	2532	27.2	11.8	20.9	23.9	26.2
2524	25.6	10.4	18.1	21.7	24.5	2573	27.2	12.3	20.5	23.8	26.2
2624	25.6	6.8	16.0	21.7	24.4	2606	27.9	9.0	17.3	22.4	26.5
2538	25.7	8.5	18.6	22.8	25.0						

SAMPLE 10 Continued.—WINTER RINGS, 5 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
2638	23.6	7.4	14.2	19.3	21.6	22.8	—	—	—	—
2395	24.0	7.7	15.2	20.2	21.9	23.3	—	—	—	—
2459	24.6	10.2	17.0	21.8	23.1	24.1	—	—	—	—
2506	25.0	9.4	16.0	21.4	23.3	24.5	—	—	—	—
2592	25.0	8.6	14.7	20.6	22.7	24.2	—	—	—	—
2448	25.1	7.6	15.0	19.6	22.2	24.1	—	—	—	—
2413	25.5	8.7	16.2	20.7	23.3	24.8	—	—	—	—
2478	25.5	8.8	18.7	22.0	24.1	25.1	—	—	—	—
2447	25.6	9.1	14.0	20.4	23.2	24.9	—	—	—	—
2621	25.6	9.7	18.9	21.9	23.8	24.9	—	—	—	—
2546	26.0	7.9	15.9	21.3	23.7	25.3	—	—	—	—
2574	26.4	6.9	14.6	21.2	23.8	25.5	—	—	—	—
2440	26.5	7.6	17.1	22.4	24.5	25.8	—	—	—	—
2628	26.5	9.8	16.8	21.7	24.2	25.8	—	—	—	—
2495	26.8	11.1	18.6	23.0	24.7	26.3	—	—	—	—

SAMPLE 10 Continued.—WINTER RINGS, 5 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
2451	27.2	10.2	20.0	23.6	25.3	26.6	—	—	—	—
2605	27.3	11.8	20.4	23.4	25.2	26.7	—	—	—	—
2401	26.0	8.6	16.8	21.7	23.6	24.8	25.6	—	—	—
2576	26.4	9.1	17.5	21.0	23.3	24.9	25.9	—	—	—
2533	26.4	6.9	15.3	21.5	23.8	25.0	26.0	—	—	—
2433	27.2	9.3	17.9	22.1	24.8	25.7	26.6	—	—	—
2529	27.4	6.7	14.7	21.5	24.0	25.7	26.7	—	—	—
2518	28.0	9.7	17.4	22.6	25.2	26.4	27.4	—	—	—
2616	28.2	13.5	21.2	23.8	25.4	26.7	27.4	28.0	—	—
2604	29.8	8.7	14.5	21.0	25.2	28.0	28.8	29.5	—	—
2537	27.3	7.6	14.5	19.8	23.0	24.8	25.7	26.2	26.7	27.0

246	22.3	} Age uncertain.
2555	23.7	

SAMPLE 11.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
2731	23·0	11·3	19·7	2832	25·0	12·6	20·7
2835	23·8	8·9	20·1	2691	25·6	13·1	21·4
2717	23·8	9·8	19·4	2791	25·6	14·5	22·4
2774	24·1	9·9	21·0	2796	25·6	12·3	21·7
2843	24·4	11·7	21·2				

SAMPLE 11 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2675	22·8	7·3	14·8	21·0	2643	25·1	12·5	21·2	24·0
2651	23·0	8·2	15·0	20·7	2645	25·1	12·5	18·7	24·3
2776	23·1	8·3	15·8	20·8	2671	25·1	6·8	13·7	21·8
2777	23·2	7·4	13·8	20·0	2711	25·1	7·3	14·2	21·6
2663	23·4	8·9	14·8	20·2	2742	25·1	9·9	16·9	22·7
2686	23·4	8·4	16·8	20·8	2689	25·2	8·2	15·0	22·8
2789	23·5	9·7	16·4	21·0	2693	25·2	9·0	17·2	23·8
2658	23·6	8·6	16·8	22·2	2795	25·2	11·6	19·0	23·0
2778	23·6	7·2	14·2	21·3	2834	25·2	8·7	18·0	23·0
2743	23·7	7·1	13·3	20·9	2741	25·3	7·9	17·5	23·7
2719	23·8	7·7	14·6	22·5	2790	25·3	13·0	20·0	23·6
2773	23·8	10·3	17·4	21·3	2646	25·4	8·7	16·5	23·6
2642	23·9	5·2	13·3	21·2	2650	25·4	11·0	18·2	23·1
2841	23·9	8·5	16·9	21·6	2783	25·4	6·7	15·2	22·4
2690	24·0	11·4	19·3	22·4	2814	25·4	10·1	17·5	23·5
2784	24·0	7·8	16·4	21·6	2836	25·4	9·0	18·9	23·3
2713	24·2	6·0	13·8	22·1	2715	25·5	10·5	16·8	23·0
2829	24·2	8·0	16·0	22·1	2817	25·5	7·7	15·6	22·8
2688	24·3	9·3	18·3	22·7	2844	25·5	11·3	17·0	22·6
2712	24·3	8·0	14·9	22·7	2656	25·6	10·8	21·2	24·5
2728	24·3	7·1	15·7	22·7	2758	25·6	9·4	16·4	22·7
2779	24·3	6·5	15·1	22·0	2674	25·7	10·1	19·0	23·2
2666	24·4	8·1	16·7	22·7	2685	25·7	10·2	18·0	23·2
2677	24·4	10·9	17·9	22·3	2707	25·8	11·4	19·2	24·0
2687	24·5	6·9	14·7	22·5	2765	25·8	9·7	18·6	24·0
2710	24·5	7·9	15·1	22·6	2828	25·8	10·5	17·8	23·3
2775	24·5	8·8	17·2	22·2	2767	25·9	11·4	19·6	23·9
2827	24·5	11·6	17·3	22·5	2648	26·0	8·3	15·5	23·5
2660	24·6	11·7	20·7	23·4	2681	26·0	10·0	18·7	23·7
2662	24·6	8·2	17·6	22·5	2833	26·0	8·8	18·8	24·0
2744	24·6	8·9	19·1	22·7	2644	26·2	12·8	21·1	24·3
2794	24·6	6·3	15·3	22·4	2653	26·2	13·9	22·2	25·2
2705	24·7	7·3	14·7	22·7	2668	26·2	8·4	18·4	24·2
2672	24·9	9·5	17·3	22·8	2727	26·2	12·4	20·7	24·6
2684	24·9	6·5	13·4	22·7	2760	26·2	10·0	15·6	24·1
2815	24·9	8·3	17·2	22·7	2786	26·2	12·4	18·4	23·6
2735	25·0	8·7	15·7	23·0	2792	26·2	11·0	19·5	23·5
2745	25·0	12·3	19·0	23·4	2657	26·3	7·5	18·6	23·9

SAMPLE 11 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2756	26.3	12.5	19.1	24.1	2738	26.7	11.0	20.4	25.3
2782	26.3	8.1	16.4	24.2	2748	26.8	12.4	19.4	25.0
2676	26.4	12.0	17.9	24.3	2704	27.0	12.6	18.1	24.2
2720	26.4	13.1	19.4	24.5	2708	27.0	7.9	19.0	24.9
2840	26.4	9.6	18.0	24.2	2749	27.0	12.3	20.7	25.0
2747	26.5	12.0	19.0	24.4	2768	27.0	8.0	19.5	25.3
2770	26.5	9.0	18.0	24.8	2659	27.2	13.8	21.5	25.4
2805	26.5	12.8	21.2	24.7	2838	27.2	12.7	20.7	25.5
2682	26.6	9.0	18.8	24.5	2725	27.5	9.4	19.8	25.0
2753	26.6	11.8	19.5	24.1	2755	27.6	10.5	21.6	25.4
2724	26.7	13.1	19.4	24.3	2733	27.8	12.6	21.1	26.1
2736	26.7	10.0	21.3	24.9	2825	27.8	12.4	21.6	26.1

SAMPLE 11 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2798	24.5	10.2	15.8	19.3	22.7	2821	26.3	11.1	19.3	22.5	24.8
2766	24.6	8.8	14.7	20.9	23.3	2746	26.4	9.9	14.8	21.9	24.9
2678	24.8	7.3	13.7	18.2	22.1	2655	26.5	11.5	17.6	22.2	25.2
2734	24.9	7.8	17.2	20.7	23.6	2780	26.5	11.0	19.0	23.5	25.5
2820	24.9	10.1	18.5	21.7	23.7	2822	26.5	8.3	18.7	22.6	24.9
2809	25.1	10.8	17.8	21.2	23.7	2826	26.5	9.4	16.6	21.0	24.4
2654	25.2	10.5	17.3	21.2	23.6	2714	26.6	7.2	13.5	19.9	23.6
2664	25.5	9.0	17.2	21.2	24.2	2837	26.6	9.8	17.0	21.8	25.2
2730	25.5	12.3	18.5	22.1	24.4	2647	26.7	8.6	18.0	23.0	25.6
2652	25.7	8.3	14.2	22.0	24.3	2706	26.7	7.9	16.7	23.2	25.5
2680	25.7	8.7	17.9	21.5	24.1	2804	26.8	10.1	18.9	23.9	25.9
2718	25.7	9.3	16.3	21.9	24.8	2679	26.9	7.5	16.1	22.1	25.2
2721	25.8	8.4	16.3	22.2	24.9	2703	26.9	8.8	16.2	21.6	25.5
2739	25.8	9.2	16.2	20.6	24.0	2761	27.0	12.7	19.7	22.8	25.7
2772	25.8	8.6	17.2	21.6	24.3	2763	27.0	9.5	19.1	23.2	25.3
2818	25.8	9.5	16.1	21.3	24.3	2781	27.2	10.1	19.3	23.8	26.2
2737	26.0	8.7	16.7	21.4	24.6	2807	27.2	11.6	19.9	23.2	25.5
2683	26.1	9.2	17.2	22.1	24.8	2839	27.4	9.9	16.8	22.6	26.2
2695	26.1	9.8	17.9	20.5	24.1	2649	27.5	9.8	22.5	25.1	26.5
2692	26.2	8.8	16.9	22.7	25.4	2697	27.5	9.9	17.7	23.0	26.3
2709	26.3	9.5	16.6	21.9	24.7	2806	27.7	11.3	20.2	23.5	26.0
2726	26.3	8.9	17.2	21.5	24.6	2700	27.8	10.9	19.0	23.8	26.5
2740	26.3	9.1	18.2	23.0	25.0	2797	28.2	9.4	18.0	22.8	27.1
2771	26.3	8.9	16.0	21.2	24.6	2752	29.2	13.1	21.6	24.7	27.5

SAMPLE 11 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
2754	25.6	9.5	15.2	20.1	23.2	24.8	2787	27.4	11.1	20.5	24.2	25.6	26.8
2769	25.8	7.9	15.0	20.6	23.8	25.1	2831	27.4	10.1	19.6	23.7	25.8	26.9
2759	26.3	10.8	16.4	21.9	24.0	25.6	2698	27.5	8.6	19.5	22.6	25.0	26.7
2757	26.4	10.0	16.5	22.7	25.0	26.0	2751	27.6	8.8	17.7	23.3	25.4	26.7
2823	26.5	8.8	16.3	21.2	24.1	26.0	2762	27.6	8.8	15.9	22.2	21.8	26.3
2670	26.6	8.8	17.3	22.5	24.6	25.8	2723	27.9	10.4	18.6	23.9	25.5	26.9
2722	26.6	8.9	15.3	21.9	24.3	25.9	2729	27.9	12.1	20.5	24.3	26.3	27.5
2696	26.8	6.9	13.7	20.8	24.0	25.6	2702	28.2	14.2	20.8	24.0	26.6	27.6
2701	27.0	10.0	18.8	23.1	25.0	26.3	2830	28.2	7.8	16.3	22.1	25.1	27.2
2803	27.0	5.8	13.4	21.2	23.5	25.5	2732	28.3	7.8	16.5	23.4	25.8	27.2
2819	27.0	7.2	13.2	19.9	23.5	25.7	2673	28.4	5.7	15.7	22.3	25.7	27.5
2669	27.1	6.6	13.3	21.2	23.8	26.2	2694	28.7	8.8	16.4	22.3	25.4	27.8
2750	27.3	10.7	18.9	23.6	25.2	26.5	2699	29.1	10.7	20.6	24.7	26.7	28.2
2764	27.4	8.7	17.1	23.7	25.3	26.6	2667	29.3	10.0	16.8	22.2	25.5	28.0

SAMPLE 11 Continued.—WINTER RINGS, 6 to 9.

No.	Size.	1	2	3	4	5	6	7	8	9
	Cm.									
2813	26.0	8.0	16.4	20.5	22.8	24.6	25.5	—	—	—
2793	26.1	8.0	14.4	21.3	23.2	24.5	25.6	—	—	—
2842	28.2	8.0	16.7	22.8	25.2	26.5	27.5	—	—	—
2816	29.1	10.7	19.5	24.0	26.1	27.5	28.5	—	—	—
2812	29.6	10.5	19.6	24.1	26.0	27.4	28.8	—	—	—
2716	28.3	8.4	15.4	21.2	24.5	26.0	27.1	28.0	—	—
2785	28.3	10.0	19.0	23.0	25.5	26.6	27.4	27.9	—	—
2824	28.7	7.9	15.8	23.2	25.3	26.6	27.5	28.2	—	—
2661	29.2	11.0	18.4	23.3	25.9	27.2	28.1	28.9	—	—
2801	29.8	8.0	17.0	21.9	24.6	26.9	28.2	29.2	—	—
2811	30.2	10.3	19.8	25.5	27.3	28.7	29.4	30.0	—	—
2810	28.1	8.1	14.6	21.2	23.8	25.3	26.4	27.2	27.8	—
2802	28.4	6.8	15.6	21.0	23.6	25.6	26.5	27.3	28.0	—
2808	27.9	7.7	15.0	21.0	23.6	25.1	26.2	26.8	27.2	27.6

2665 ? Fish damaged.

SAMPLE 12.—WINTER RINGS, 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
2920	20·8	8·1	16·8	2957	23·2	12·4	20·2
2992	20·9	8·6	16·6	2900	23·5	13·0	20·6
2931	21·0	7·6	17·0	2983	23·9	10·3	20·1
2080	21·5	9·8	18·8	2908	24·6	13·0	21·8
2923	22·5	10·3	18·8	2999	25·0	12·2	22·0
2969	22·7	10·3	17·4				

SAMPLE 12 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
2892	23·3	7·9	16·6	21·3	2868	24·5	9·0	15·8	22·7
2917	23·3	8·3	15·0	21·3	2883	24·5	7·6	15·7	21·9
2878	23·5	9·7	16·9	21·3	2901	24·5	10·5	13·1	22·7
2953	23·5	8·9	16·1	21·1	2898	24·7	7·6	14·7	22·0
2974	23·5	7·8	14·7	20·8	2921	24·7	9·5	16·7	22·2
3002	23·5	10·4	18·9	21·5	2915	24·9	11·8	19·6	23·4
2850	23·6	11·4	17·8	21·2	2902	25·1	12·0	20·5	23·5
2853	23·6	8·5	17·0	21·3	3012	25·2	10·9	21·2	23·7
2873	23·6	9·0	17·4	21·5	3026	25·2	9·3	18·3	22·7
2881	23·7	10·3	18·2	22·1	2879	25·3	7·7	15·8	22·3
2886	23·7	10·6	16·0	21·6	2941	25·3	11·1	20·7	23·9
2904	23·7	8·4	14·5	21·4	2865	25·4	12·1	19·5	23·9
2947	23·7	8·4	16·2	21·8	2919	25·4	12·0	17·8	23·0
2870	23·8	9·6	17·5	22·2	2945	25·7	11·4	20·3	23·9
3004	23·8	9·0	17·9	21·8	2967	25·8	12·0	19·0	24·4
2985	24·0	8·5	16·6	22·2	2929	25·9	9·5	18·8	23·7
2891	24·1	10·5	18·2	22·4	3023	25·9	9·3	16·7	23·2
3013	24·1	6·4	13·0	21·8	2871	26·0	12·4	21·0	24·0
2854	24·2	11·0	17·8	21·6	2894	26·0	9·3	19·1	24·3
2910	24·2	7·8	16·7	22·4	2977	26·1	9·0	18·4	23·8
2866	24·3	9·5	18·9	22·6	2896	26·6	9·1	21·2	24·8
2968	24·3	8·0	17·7	22·6	2981	26·8	11·6	20·6	25·1

SAMPLE 12 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
2861	23.9	10.1	17.0	21.1	23.1	2930	25.5	11.2	18.2	22.5	24.7
2863	24.2	9.2	16.0	19.9	23.1	2875	25.8	12.5	20.2	23.2	24.7
2885	24.3	8.6	14.9	20.5	23.1	2880	25.8	9.2	17.5	22.0	24.5
2995	24.3	8.4	18.0	21.5	23.5	2905	25.8	11.3	18.5	21.8	24.1
2924	24.6	8.0	17.5	21.9	23.9	2864	26.0	10.0	18.4	22.8	25.1
2933	24.7	12.0	19.7	22.3	24.0	2872	26.1	10.6	18.6	22.7	24.9
2959	24.8	10.4	18.5	21.8	23.8	2922	26.2	9.9	19.9	22.8	25.0
3005	24.8	10.6	19.7	22.1	24.0	2987	26.2	8.8	16.4	22.3	25.0
2986	24.9	10.8	19.4	21.8	23.7	3018	26.2	8.8	16.7	21.7	25.2
3033	24.9	9.7	17.8	21.8	24.0	2932	26.4	13.1	20.2	23.7	25.7
2916	25.0	10.6	19.3	22.0	24.0	2942	26.5	8.6	16.2	22.1	25.2
3001	25.0	8.3	17.1	21.1	23.8	3020	26.5	8.9	18.1	22.8	25.4
2849	25.2	9.2	17.0	22.4	24.1	2951	26.6	9.0	15.7	20.9	24.3
2851	25.4	8.6	15.6	22.2	24.8	3010	26.6	11.3	19.8	23.1	25.4
2882	25.4	9.4	17.3	22.4	24.4	2948	26.9	11.4	20.0	24.0	26.0
2937	25.4	10.2	16.6	22.0	24.6	2906	27.2	8.8	18.6	24.3	26.4
3034	25.4	13.1	21.3	23.3	24.7	3027	27.2	9.2	15.9	22.6	25.8

SAMPLE 12 Continued.—WINTER RINGS, 5.

No	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
2925	24.0	6.9	15.8	21.2	22.5	23.5	2976	26.2	7.4	15.5	20.5	23.5	25.2
2926	24.0	9.9	16.9	20.0	22.4	23.5	2943	26.3	9.7	18.7	22.8	24.6	26.0
2903	24.2	12.6	17.8	21.6	22.9	23.7	2862	26.4	9.3	18.0	22.7	24.7	25.8
2971	24.6	9.1	17.6	20.9	22.9	24.1	2869	26.4	8.0	16.4	21.1	24.2	25.7
2940	25.0	9.0	15.6	20.6	23.0	24.3	3030	26.4	8.9	16.5	22.6	24.5	25.6
2944	25.0	10.1	15.6	20.4	22.6	24.0	2913	26.5	8.7	15.2	21.1	23.8	25.7
3022	25.2	7.5	14.5	19.8	22.2	23.9	2909	26.6	11.4	19.3	22.7	24.5	25.9
2989	25.3	8.2	14.8	20.9	22.9	24.4	2997	26.6	11.2	17.6	22.9	24.8	26.0
3008	25.4	7.8	14.8	21.8	23.5	24.7	2856	26.7	8.6	16.2	22.9	25.0	26.2
2907	25.5	9.5	17.8	20.8	22.7	24.5	2884	26.7	8.7	15.4	21.7	24.2	26.0
2966	25.5	9.7	16.9	21.5	23.4	24.7	2984	26.7	9.4	18.7	22.6	24.6	26.1
2990	25.5	8.2	14.6	20.0	22.7	24.5	3031	26.7	9.8	19.0	23.0	24.8	25.8
2911	25.6	6.3	16.3	22.7	24.3	25.2	2876	26.8	7.7	14.9	20.6	24.0	26.0
2939	25.6	7.1	14.8	19.3	23.3	24.9	3011	26.9	9.4	18.1	23.0	25.0	26.1
2958	25.7	8.0	14.7	21.6	23.8	25.2	2895	27.0	10.0	19.4	24.5	25.6	26.4
2912	25.8	8.3	15.1	21.2	23.3	24.7	2867	27.0	10.8	19.3	23.2	25.0	26.3
2952	25.8	11.5	18.9	21.7	23.9	25.3	2890	27.1	9.8	18.7	23.1	25.5	26.7
2954	25.8	10.1	18.2	22.6	24.0	25.1	2960	27.2	9.8	18.8	23.3	25.7	26.7
2965	25.8	7.7	16.5	22.0	24.5	25.4	2899	27.3	10.6	16.9	21.9	25.0	26.4
3042	25.8	10.2	15.7	21.2	23.7	25.1	2946	27.4	7.7	15.4	21.7	25.1	26.8
2858	25.9	9.5	16.3	22.2	24.1	25.3	3044	27.4	10.1	19.9	23.2	25.5	26.6
2889	25.9	9.8	18.2	22.2	24.1	25.3	3021	27.5	13.1	21.4	25.0	26.2	27.0
2893	25.9	10.3	17.5	22.4	24.3	25.3	2860	27.6	11.5	17.7	23.6	25.9	27.1
2938	25.9	9.7	15.0	20.0	23.6	25.3	3017	27.6	8.5	16.8	21.9	24.9	26.9
2970	25.9	8.6	14.2	19.5	22.9	24.9	2996	27.7	10.5	18.0	23.2	25.9	27.1
2874	26.0	10.1	18.9	22.7	24.6	25.5	3041	27.7	11.4	19.2	23.1	25.6	27.0
3032	26.0	7.2	15.9	20.0	23.3	25.2	3029	27.8	8.3	15.3	20.3	24.1	26.6
3037	26.0	9.0	16.3	21.7	24.1	25.4	2988	27.9	9.6	17.4	23.4	25.5	27.0
2949	26.1	8.3	15.0	21.6	23.8	25.5	3048	27.9	11.0	20.3	24.3	26.0	27.1
2991	26.1	8.5	15.7	21.5	23.9	25.3	2859	28.0	8.1	15.8	21.9	25.0	26.9
2888	26.2	8.1	15.6	21.3	23.7	25.3	2914	28.0	10.2	19.5	24.2	26.1	27.3
2935	26.2	8.9	16.3	22.3	24.4	25.6	2897	28.2	9.1	17.4	23.6	25.9	27.4
2950	26.2	8.0	14.9	20.4	23.1	25.2	3024	28.8	9.4	18.0	25.3	27.2	28.3

SAMPLE 12 Continued.—WINTER RINGS, 6.

No.	Size.	1	2	3	4	5	6
	Cm.						
3028	25.3	6.2	12.8	19.0	21.8	23.4	24.7
2972	25.6	7.6	16.1	20.9	22.8	24.0	25.1
2957	25.7	7.4	16.7	20.8	23.3	24.4	25.4
2936	25.9	7.8	15.6	21.5	23.5	24.5	25.5
3003	25.9	7.8	14.7	19.3	22.6	23.7	25.1
2956	26.1	7.5	16.2	21.5	23.4	24.6	25.5
2963	26.2	9.7	18.1	21.9	23.5	24.8	25.7
2934	26.3	10.7	16.0	22.1	24.0	25.0	25.9
3007	26.3	8.8	15.0	21.2	23.7	24.6	25.7
2979	26.4	9.9	16.9	22.5	24.1	25.2	26.0
3016	26.9	7.0	14.5	20.5	23.8	25.5	26.4
2928	27.1	8.1	16.1	23.3	24.6	25.6	26.5
3025	27.1	12.5	21.2	23.8	25.1	26.0	26.8
2962	27.2	9.8	17.0	20.5	24.2	25.5	26.7
3038	27.2	7.0	15.8	21.3	24.0	25.4	26.6
3019	27.3	8.0	16.4	21.0	23.7	25.6	26.6
2961	27.4	7.9	17.4	22.4	24.5	25.7	26.7
2982	27.5	6.3	14.1	21.0	24.5	25.9	26.9
2955	27.6	9.5	17.0	23.3	25.7	26.5	27.2
3047	27.6	10.8	17.0	21.0	23.7	25.2	26.8
2855	27.7	6.7	13.8	20.4	24.1	25.8	27.0
3035	27.7	8.7	16.1	21.7	24.3	25.9	27.2
3045	27.7	8.7	17.3	22.0	24.8	26.2	27.0
2852	27.9	10.3	18.7	23.6	25.9	26.7	27.5
2978	27.9	9.3	18.5	23.1	25.4	26.4	27.4
2887	28.2	8.4	18.7	22.9	25.8	26.8	27.8
3006	28.2	9.0	17.1	22.4	25.0	26.7	27.6
3036	28.7	8.3	15.7	21.7	25.5	27.3	28.3

SAMPLE 12 Continued.—WINTER RINGS, 7 to 10.

No.	Size.	1	2	3	4	5	6	7	8	9	10
	Cm.										
3046	27.0	8.7	15.5	20.1	22.0	24.4	25.5	26.4	—	—	—
3015	27.1	7.3	16.5	21.4	23.8	25.2	26.0	26.8	—	—	—
2964	27.5	9.7	14.8	20.0	23.1	24.8	26.0	27.2	—	—	—
3039	27.5	7.9	15.1	21.3	24.2	25.4	26.4	27.1	—	—	—
3040	27.5	8.8	17.4	21.9	24.4	25.7	26.5	27.2	—	—	—
3043	27.9	10.4	17.7	22.9	24.7	26.0	26.8	27.5	—	—	—
3014	28.3	9.1	17.5	21.9	24.4	25.8	26.9	27.9	—	—	—
2918	28.4	8.2	14.6	20.3	23.3	25.4	27.0	27.9	—	—	—
3009	30.0	10.1	19.4	23.8	26.7	27.8	28.8	29.6	—	—	—
2877	27.3	10.5	17.0	21.2	23.3	24.8	25.6	26.3	27.0	—	—
2994	28.4	8.4	16.9	22.4	24.6	26.0	26.8	27.4	28.0	—	—
2975	28.8	9.7	15.4	20.0	23.2	25.0	26.2	27.0	27.8	28.5	—
2993	27.7	8.9	17.1	21.9	23.8	25.1	25.9	26.2	26.8	27.2	27.5
2927	29.6	11.9	20.6	23.9	26.1	26.9	27.6	28.1	28.5	28.9	29.3

2973 26.0
 2998 29.1
 3000 26.6

} Age uncertain.

SAMPLE 13.—WINTER RINGS, 1 and 2.

No.	Size.	1	2	No.	Size.	1	2
	Cm.				Cm.		
3229	20.0	11.4	—	3166	22.5	10.0	18.8
3134	21.2	12.9	—	3177	22.7	12.0	19.7
3207	21.4	13.9	—	3210	22.8	13.0	20.0
3208	21.8	12.2	—	3085	23.6	11.5	21.1
3149	19.7	6.9	14.2	3088	23.8	13.1	20.7
3189	21.2	8.3	17.2	3141	24.0	12.3	19.1
3121	21.3	7.5	17.1	3235	24.1	12.7	21.0
3112	21.4	6.5	15.9	3171	24.3	8.2	19.5
3205	21.5	8.2	17.7	3082	24.8	13.3	21.7
3161	21.8	8.6	17.2	3099	25.0	14.3	23.2
3058	21.9	10.1	16.9	3100	25.0	13.9	22.8
3168	22.0	7.9	17.2	3081	25.5	13.0	21.9
3056	22.2	10.7	19.2	3055	26.6	12.9	22.9
3192	22.3	7.2	17.0				

SAMPLE 13 Continued.—WINTER RINGS, 3.

No.	Size.	1	2	3	No.	Size.	1	2	3
	Cm.					Cm.			
3195	20.7	7.4	14.0	18.6	3102	24.9	11.6	18.9	22.9
3197	21.7	7.1	17.5	20.6	3180	24.8	11.0	18.7	22.7
3186	22.1	6.8	12.8	18.2	3185	25.0	8.4	16.9	21.6
3154	22.2	9.3	17.0	20.5	3083	25.1	9.2	19.2	23.5
3191	22.4	9.3	17.5	20.8	3170	25.1	10.1	19.4	23.4
3220	22.7	9.3	16.8	21.3	3217	25.1	7.5	16.5	22.9
3226	22.8	8.9	16.3	21.0	3078	25.2	10.8	19.3	23.6
3227	22.8	7.8	17.0	21.1	3206	25.2	10.0	18.2	22.8
3187	22.9	8.8	16.3	20.3	3232	25.2	6.7	15.4	22.5
3188	22.9	6.5	14.9	20.7	3126	25.3	11.8	19.5	24.0
3237	23.1	8.2	15.8	20.3	3214	25.3	8.8	17.3	22.5
3219	23.3	10.5	18.3	21.6	3071	25.4	9.6	17.3	23.3
3053	23.4	9.2	18.1	21.7	3116	25.4	11.3	20.3	23.8
3079	23.5	7.8	15.7	21.4	3130	25.4	9.3	18.5	23.1
3243	23.5	9.2	17.3	22.4	3176	25.7	10.0	20.2	23.6
3181	23.6	9.6	16.7	21.8	3054	25.8	8.5	17.0	23.4
3155	23.9	7.4	17.0	22.0	3107	25.8	15.2	21.6	24.7
3151	24.0	8.2	16.9	21.7	3073	25.9	9.4	18.9	23.5
3179	24.0	7.7	15.8	21.6	3108	26.0	9.8	18.5	24.0
3109	24.1	8.9	19.0	22.5	3156	26.0	13.3	21.0	24.8
3160	24.4	7.2	13.6	21.6	3143	26.3	14.0	20.7	24.7
3190	24.4	9.9	17.0	22.8	3066	26.4	8.7	18.2	24.2
3203	24.4	10.5	18.7	22.7	3224	26.5	12.9	20.8	24.7
3080	24.5	7.0	15.7	22.1	3091	26.6	11.5	21.2	24.8
3157	24.6	8.7	19.8	22.9	3075	26.8	12.5	20.2	25.7
3169	24.6	9.2	17.3	23.0	3077	26.9	12.2	20.0	24.7
3064	24.7	8.4	17.8	22.3	3158	26.9	11.4	19.1	24.3
3234	24.8	8.5	17.9	23.1					

SAMPLE 13 Continued.—WINTER RINGS, 4.

No.	Size.	1	2	3	4	No.	Size.	1	2	3	4
	Cm.						Cm.				
3204	23.8	8.0	14.9	19.0	22.3	3213	26.1	13.5	21.0	23.4	25.3
3120	24.3	8.1	14.5	20.6	23.2	3230	26.1	10.0	19.5	22.9	25.3
3216	24.6	9.4	16.0	21.3	23.8	3115	26.2	9.3	16.8	21.8	25.1
3245	24.7	8.3	15.5	21.8	23.8	3162	26.3	9.4	18.4	22.0	25.1
3196	24.8	8.3	15.7	21.4	23.9	3093	26.4	9.5	19.2	22.9	25.3
3146	25.2	8.1	14.9	20.8	24.0	3135	26.4	7.3	14.7	22.2	24.8
3193	25.2	9.0	16.3	21.9	24.1	3225	26.6	11.0	19.7	23.3	25.6
3230	25.3	10.3	18.4	22.2	24.6	3231	26.6	7.5	16.3	22.7	25.5
3052	25.6	7.5	16.9	21.8	24.3	3113	26.9	10.0	15.2	22.6	25.5
3153	25.7	9.5	15.6	20.2	23.8	3125	27.3	9.2	18.2	23.9	26.4
3094	25.8	12.2	22.0	23.7	25.2	3070	27.4	10.1	18.8	23.5	26.4
3105	25.8	9.1	15.8	20.8	24.5	3238	27.4	12.9	20.7	24.5	26.5
3067	25.9	10.0	20.0	22.9	25.3	3114	27.7	11.5	19.0	23.4	26.4
3202	26.0	8.6	17.6	21.1	24.3	3050	28.2	12.4	22.0	24.5	27.0
3092	26.1	10.8	19.1	22.7	25.1	3084	28.2	11.9	21.2	25.7	27.4

SAMPLE 13 Continued.—WINTER RINGS, 5.

No.	Size.	1	2	3	4	5	No.	Size.	1	2	3	4	5
	Cm.							Cm.					
3246	25.2	9.8	16.8	21.4	23.3	24.7	3069	27.0	8.8	17.2	22.5	24.9	26.5
3159	25.3	7.1	13.8	20.0	22.7	24.5	3119	27.0	11.2	19.4	23.7	25.7	26.6
3174	25.7	8.8	16.7	21.9	23.8	25.1	3244	27.0	10.6	17.5	22.2	24.5	25.9
3183	25.8	9.2	17.3	21.0	23.6	25.1	3163	27.1	6.6	14.4	21.6	24.7	26.3
3182	25.9	7.7	16.2	20.8	23.3	25.0	3063	27.2	11.6	21.4	24.2	25.4	26.4
3133	26.0	11.5	17.2	21.3	23.6	25.4	3199	27.2	8.3	15.7	23.0	25.1	26.5
3062	26.2	7.1	14.4	21.0	23.3	24.9	3131	27.3	10.3	20.0	22.9	25.4	26.7
3103	26.2	6.9	13.8	20.5	22.9	25.1	3175	27.3	10.2	18.0	22.8	25.0	26.6
3132	26.2	7.9	16.4	22.4	25.2	25.9	3173	27.4	9.1	17.1	22.6	25.7	26.5
3144	26.2	8.7	17.0	21.9	24.3	25.5	3240	27.4	9.2	18.7	22.6	25.0	26.5
3152	26.2	9.9	16.1	21.2	23.8	25.5	3164	27.5	7.6	14.7	22.6	25.4	26.8
3236	26.3	8.2	15.2	21.7	24.0	25.7	3172	27.5	11.8	19.0	23.1	24.9	26.3
3201	26.4	10.5	17.5	23.4	24.9	25.8	3136	27.6	9.8	17.2	23.8	26.0	27.0
3147	26.5	9.6	18.3	22.3	24.5	25.7	3178	27.6	9.9	18.5	23.8	25.9	27.0
3211	26.5	8.9	16.0	22.0	24.3	25.7	3059	27.7	10.5	19.3	23.0	25.2	26.9
3140	26.6	10.3	18.7	22.7	24.8	26.0	3061	27.7	8.6	19.1	22.3	25.3	26.7
3241	26.6	6.7	14.0	20.0	23.3	25.8	3104	28.0	9.6	17.8	23.2	25.6	27.4
3096	26.7	6.4	18.2	22.0	24.2	25.8	3233	28.0	12.2	19.8	24.4	26.4	27.5
3124	26.7	7.7	14.3	22.0	24.8	26.0	3148	28.1	11.1	18.0	23.5	26.6	27.7
3139	26.7	9.5	18.9	22.8	24.6	26.0	3098	28.2	8.6	17.2	24.4	26.2	27.3
3145	26.7	7.0	16.6	21.8	25.1	26.2	3215	28.5	12.0	19.2	24.6	26.5	27.8
3209	26.7	12.5	20.5	23.6	25.3	26.2	3076	28.7	7.6	18.5	23.4	26.2	27.5
3228	26.7	8.9	16.6	21.9	24.3	25.8	3223	29.0	9.8	17.8	23.8	26.6	28.3
3242	26.9	13.7	19.4	23.8	25.3	26.3	3247	29.3	13.0	20.4	25.3	27.3	28.8
2068	27.0	7.7	18.2	21.7	24.4	26.2							

SAMPLE 13 Continued.—WINTER RINGS, 6 and 7.

No.	Size.	1	2	3	4	5	6	7
	Cm.							
3127	25.6	7.8	14.9	20.1	22.9	24.2	25.2	—
3184	26.0	7.9	16.9	21.2	23.3	24.8	25.5	—
3218	26.4	5.8	13.3	21.6	24.0	25.0	25.8	—
3167	26.8	8.6	17.4	21.7	24.4	25.6	26.4	—
3089	27.2	8.0	16.8	21.3	23.6	25.1	26.4	—
3087	27.3	8.4	17.5	23.1	25.1	26.2	26.9	—
3123	27.3	8.3	15.1	21.9	24.8	26.0	26.8	—
3049	27.7	7.2	15.8	21.9	24.5	25.8	26.9	—
3248	27.8	8.9	17.3	23.7	25.1	26.0	27.0	—
3222	27.9	12.1	20.3	23.9	25.6	26.7	27.5	—
3090	28.1	9.2	19.2	24.3	25.7	26.8	27.5	—
3200	28.3	10.2	18.0	23.0	25.2	26.4	27.5	—
3074	28.5	12.3	21.3	24.7	26.2	27.2	27.9	—
3072	28.8	10.0	19.9	25.0	26.7	27.6	28.4	—
3051	27.4	9.8	17.2	21.9	24.7	25.7	26.4	27.0
3117	27.6	7.3	16.0	21.4	23.9	25.3	26.4	27.2
3165	27.6	8.6	17.2	22.3	24.7	26.1	26.8	27.3
3194	28.1	11.3	20.3	22.8	24.5	26.0	27.0	27.6
3110	28.3	8.7	15.9	21.6	24.8	26.3	27.1	27.8
3122	28.5	9.5	17.9	22.4	25.2	26.5	27.5	28.2
3097	29.1	8.8	17.2	22.1	24.9	26.3	27.6	28.6

SAMPLE 13 Continued.—WINTER RINGS, 8 to 13.

No.	Size.	1	2	3	4	5	6	7	8	9	10	11	12	13
	Cm.													
3137	26.7	9.0	16.6	20.2	22.6	24.0	25.0	25.9	26.4	—	—	—	—	—
3101	27.8	7.1	14.6	20.8	23.8	25.4	26.2	26.9	27.5	—	—	—	—	—
3086	27.9	7.1	15.6	21.9	24.1	25.3	26.5	27.0	27.5	—	—	—	—	—
3095	28.3	10.0	16.5	21.2	24.0	25.8	26.7	27.3	28.0	—	—	—	—	—
3128	28.5	9.5	16.4	21.1	23.8	25.3	26.6	27.5	28.1	—	—	—	—	—
3138	28.5	9.8	18.6	22.3	24.5	26.0	27.1	27.8	28.2	—	—	—	—	—
3111	29.0	11.5	19.0	23.7	25.2	26.4	27.7	28.2	28.7	—	—	—	—	—
3221	28.7	8.9	18.4	22.3	24.0	25.6	26.5	27.3	27.9	28.4	—	—	—	—
3129	29.2	12.2	20.2	23.5	25.3	26.4	27.3	28.0	28.5	29.0	—	—	—	—
3142	29.4	11.1	19.2	22.8	24.8	26.0	27.1	28.1	28.7	29.1	—	—	—	—
3057	29.6	10.9	19.2	23.1	24.9	26.5	27.5	28.2	28.7	29.3	—	—	—	—
3150	28.0	7.7	15.7	20.0	22.6	24.2	25.2	25.7	26.5	27.0	27.6	—	—	—
3060	28.3	7.9	15.0	20.3	22.8	24.1	25.1	26.0	26.7	27.4	27.9	—	—	—
3212	30.5	11.1	18.6	22.8	24.5	26.0	26.9	27.9	28.6	29.4	30.0	30.3	—	—
3198	29.4	8.1	15.7	21.6	24.0	25.4	26.5	27.2	27.9	28.3	28.6	28.9	29.2	—
3065	28.8	9.0	16.1	20.8	23.0	24.3	25.3	26.1	26.6	27.2	27.7	28.1	28.3	28.6
3106	29.6	10.7	20.3	24.5	26.1	26.8	27.4	27.8	28.2	28.4	28.7	28.9	29.2	29.5
3118	29.9	10.8	17.2	21.8	24.0	25.0	25.7	26.4	27.1	27.6	28.1	28.7	29.2	29.5

NOTES ON THE AGE AND GROWTH OF FISH.

 BY B. STORROW.

BALLAN WRASSE, *Labrus bergyllta*.

In the report for the year ending June 30th, 1916, an account was given of a young ballan wrasse which came from a rock pool at Cullercoats, and was kept in the Laboratory tanks. The fish was from two to three centimetres in length when captured in August, 1915. A size of eight centimetres was attained by 17th January, 1916, and the scales of the fish, photographs of which were given in the report for 1916, showed two summer growths, with a stoppage of growth between. More scales were taken from the fish on 24th May, 1916, when the length was still eight centimetres, and the scales gave no indication of growth having begun for the summer of that year.

The accompanying photographs show the scales taken from this fish on 10th August, 1916, and 20th August, 1917, the length of the fish being 8.9 and 12.2 cm. respectively. The winters intervening between the summer growths are clearly marked, and the scales gave a reading which coincides with the known age of the fish.

It will be observed that the growth made for the third summer was small compared with those of the second and fourth summers. During this period the laboratory attendant frequently reported that the fish was not feeding as it had done, and attempts were made by introducing mysids and amphipods into the tank to provide conditions somewhat similar to those found in the sea near low water, but no improvement in feeding was observed.

Three scales were taken from the fish on 10th August, 1916, and these when expressed in terms of the length of the fish give the following average growth :—

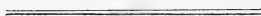
Length.	First.	Winters.	Second.
8.9	3.6	...	7.8

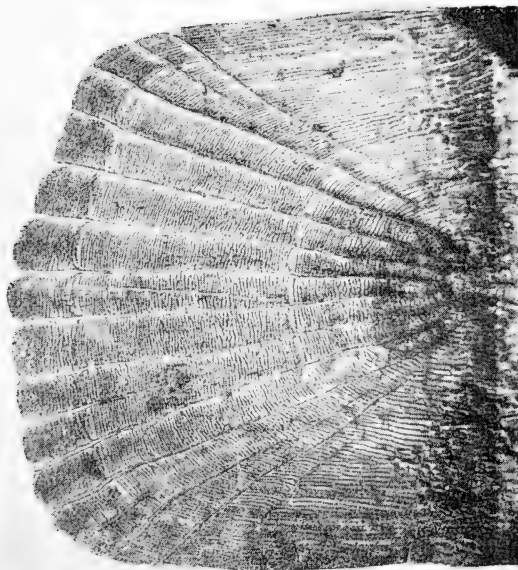
On 20th August, 1917, seven scales were taken, and they gave the following growth :—

Length.	Winters.		
	1	2	3
12.2	3.6	7.7	9.2 average.
...	3.3—3.9	7.4—8.0	8.8—9.5 range.

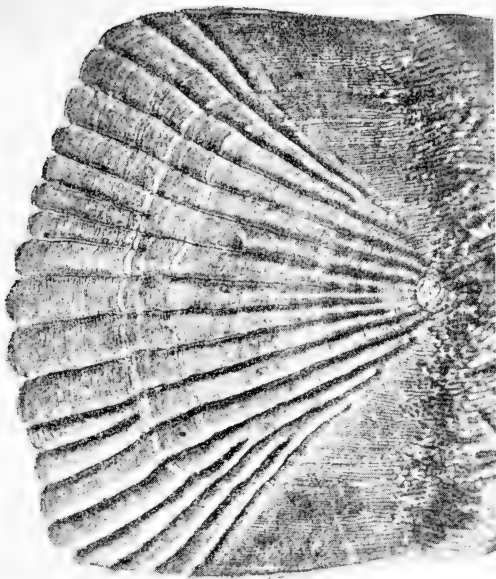
When previously reporting on this fish it was stated that 3.7 cm. was the growth for the first year as determined from the scales. It is known also that on 17th January, when growth for the second winter was stopped, the length of the fish was 8 cm. From this it would appear that the growth of the fish as calculated from the scales is approximately correct, providing a number of scales is examined, and the average taken.

A small ballan wrasse, 12 cm. long, was taken in a rock pool at Cullercoats, 8th June, 1918, and is of interest in that its scales show a similar growth to the young fish which was kept in the aquarium tanks. A photograph of a scale from this fish is here given.



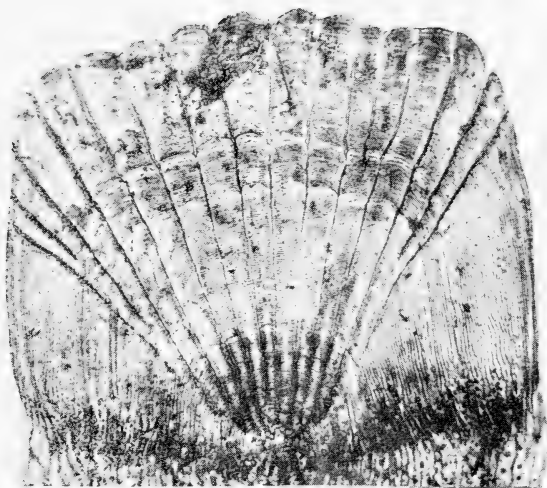


1.—8.9 cm., 10th August, 1916.



2.—12.2 c.m., 20th August, 1917.

SCALES OF BALLAN WRASSE.



SCALE OF BALLAN WRASSE.

Rock pool, Cullercoats, 8th June, 1918, 12 cm.



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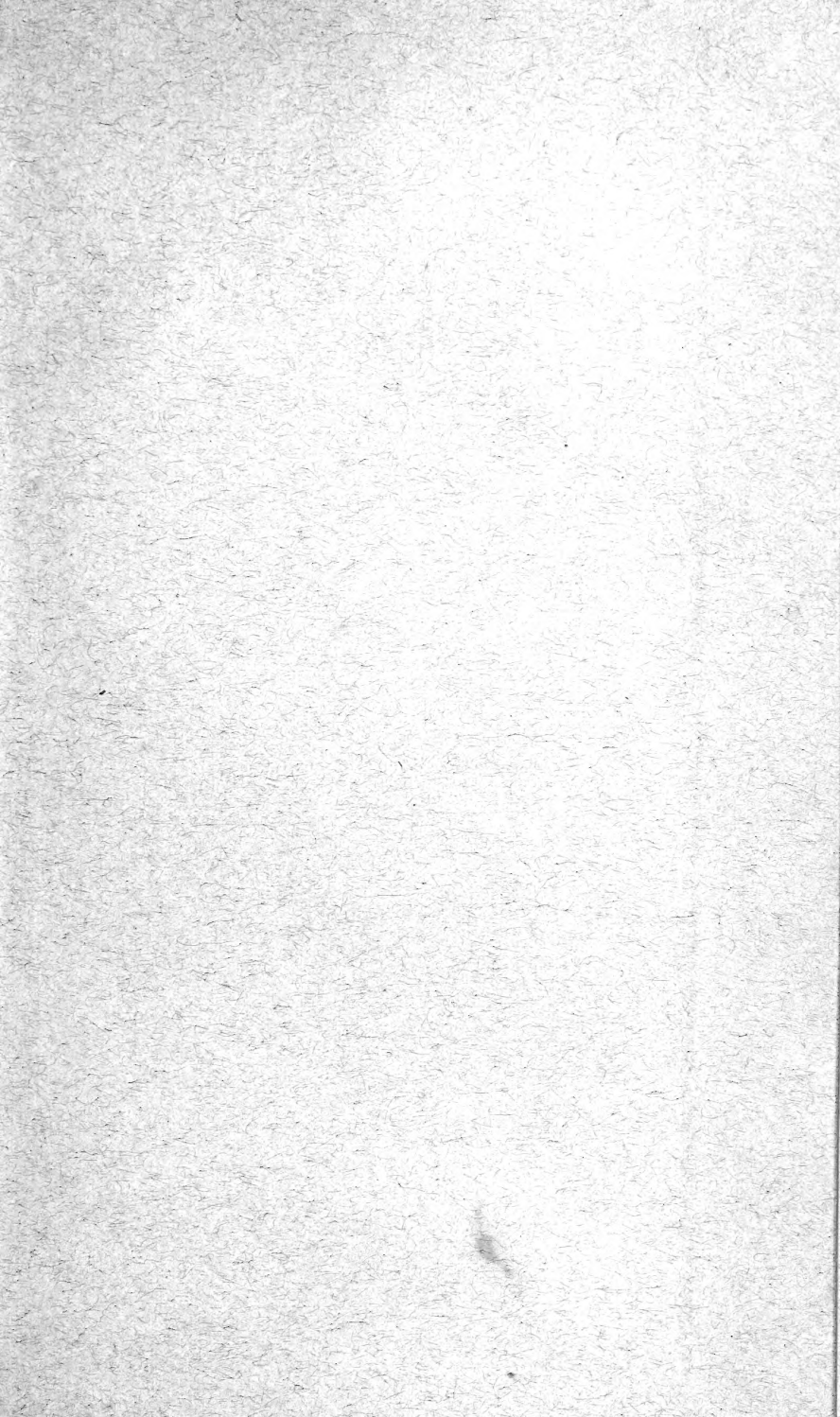
By ALEXANDER MEEK,

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