



ANIMAL + LIFE

· ON · THE · SHORES ·

OF THE

CLYDE + AND + FIRTH.

BY J. ROBERTSON, GOUROCK.



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The kind regards of her Cousin

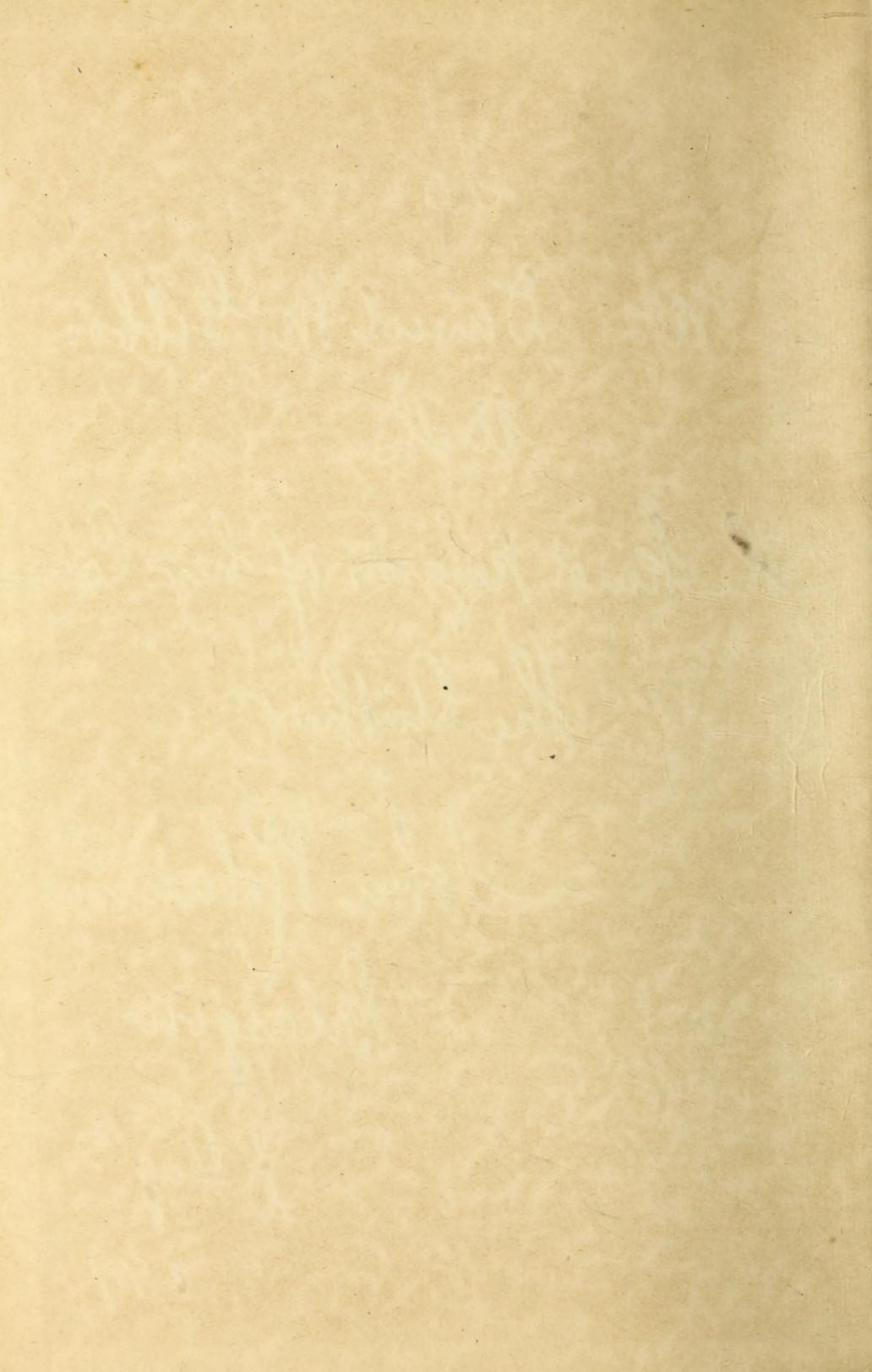
The Author

John Robertson

Glasgow

7 Aug<sup>h</sup>

1893



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OF THE

CLYDE AND FIRTH.

BY

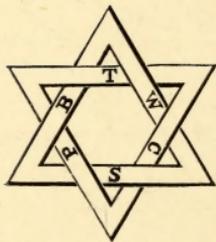
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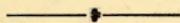
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## P R E F A C E .



**I**N writing this little work and placing it the hands of the public, the Author had three distinct motives in view.

The first was to do what in him lay, by observation and study, to add a little more to the very scant knowledge we possess of this much-neglected branch of Natural History.

The second was to pen the results in as plain and intelligent a manner as his abilities could accomplish.

And the third, to satisfy the desire of imparting to his fellows the information gained by the study.

Regarding the first motive, the Author is convinced, through research, that much has been already done to classify and make known the creatures of the deep, but he is also convinced, through long and patient observation, that even with the little creatures we trample over on the beach, we have not yet learned a tithe of their habits, histories, and beauties; and it is not too much in the Author to say that, during his travels, not one individual

in a thousand is to be met with who can speak on the subject at all.

In the second motive, plainness of diction may be a necessity in an author whose education lacks the knowledge of even a smattering of the Classics ; and, possibly through this want, he has to confess that he could never see the utility of using a dead language in saying what he could say in his mother-tongue. He has therefore avoided, as much as he possibly could, the use of technicalities and classical names in imitation of classical writers.

In the third and last motive the reader may possibly see, veiled in the confession of "a desire to impart information," a hidden thirst for authorship ; but stay thy criticism, gentle reader, until thou find out the joy that is created in the breast of him or her who, through the love of Nature, has discovered a new fact or a new trait of character in anything in the animal or vegetable worlds worth communicating.

In conclusion, the reader is informed that in the excursive style adopted, little or no attention has been paid to continuity in the parts, nor to the order of classification of the creatures, the idea of the work being rather that of a guide to the shore. While the Author is sensible that some of his conclusions may need fuller explanations by illustration, he hopes he has presented to the reader something worthy of perusal.

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# ANIMAL LIFE

ON THE

SHORES OF THE CLYDE AND FIRTH.

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## CHAPTER I.

### THE COMING STORM.

**H**O! we cry, for the enchantments of the sea shore. Gazing out upon the far-stretching waters, how sublimely grand is the spectacle of beholding its various moods and motions. Basking in the golden glitter of the morning sun, like a covert lake in the security of its dreamy stillness, how peacefully it lies, as calm and harmless as a sleeping child; but suddenly, far away in the distant horizon, where sea and sky converge, the calm morning blue is changed into a steely grey, and a darker fragment of cloud, no bigger than a man's hand, widens and thickens into impenetrable gloom, and rolls bank upon bank of cloud towards the zenith of the heavens. Yonder, at the dark outline of the ocean's verge, we distinctly discern a heaving agitation, and the penetrating rays of the mighty sun, struggling through the gloom, send forth a watery, soul-chilling light, which faintly battles to dispel the gathering strife, but quickly sickens and dies.

These be the heralds of the coming storm king, and woe to the weak ones who meet him. A gale from the south-west is upon us, outstripping the speed of the tempest.

A long, unbroken wave rolls in upon the shore, and breaks with a peculiar murmur in the shingle at our feet. Quicker and quicker they come; the wind breathes, then puffs, and freshens into strength, and far out the advancing waves are jumbling and tossing their uplifted heads into snowy foam. Onward they come, in the might of their terrible grandeur, surging and raging; they rush upon the land, and burst with the roar of deafening thunder along the sounding shore. The wind shrieks and moans, and yonder at the headlands, the angry sea swishes and dashes against the iron-bound cliffs, and returns again and again to the charge, till the foam of its awful wrath is sputtered over the dizzy heights and borne far inland on the wings of the howling storm.

#### A MARINE CANNIBALISTIC WAR.

But the wrath of the tempest is appeased, and the calm of the sea has come again. Out upon the glassy surface, about sixty yards or so from where we stand, a flock of sea-gulls flutter and scream and dash down upon the sea, and, from the numerous little splashings and breakings of the calm, an agitation of some sort seems to be going on amongst the finny tribes of the deep. Let us cautiously push out our little bark and ascertain. As we drift quietly out, over the gunwale of the shady side we recline, and in the clear blue water between us and the white sandy bottom we note the frequent darting here and there of fish of a considerable size. Gradually they increase in numbers, till we arrive at a dark object stretching six feet from the surface to a depth of about fifteen feet in five fathoms of water. On closer inspection we find this object to be a complete column, about six feet in diameter, stretching to the depth already mentioned, composed of a compact body of little fishes between two and three inches in length.

A cannibalistic war is going on below ; the old ones are endeavouring to devour the young, and the column is on its defence. From top to bottom the little things crowd together and close up every spot where a head can fill the space ; a solid front of heads bristle all around in as well disciplined order as an army of trained bayonets, and as faithfully do the little things stick to their posts as the most valorous regiment of the British Army. The object of the bigger ones is to break the column up. Furiously they dart and dash in their attacks, but the column stands its ground, and if a breach is made, it is instantly filled up from within. Attack and defence is persisted in and steadily maintained with doubtful certainty, but the ranks of the assailants greatly increase, and the column is hemmed in and attacked from every point, still the little things maintain their ground, and still the gaps of the fallen are as gallantly filled up. Suddenly, however, as if by word of command, a simultaneous rush is made all round, the ranks of the little things yield to the heavier body, the discipline of the column is broken, and a general scramble is made to the surface in order to gain the safety of the shallower water of the shore. For yards and yards around the retreat of the little things is marked by their tracking the deep with an agitation similar in appearance and sound to the descent of a heavy downpour of hail.

Now begins the cannibalistic work of the larger ones, who devour and gorge themselves with dozens each of their younger brethren. At this particular juncture the sea-gulls, watching their opportunity, also dash down and feed upon them with avidity. At one such onslaught millions of the little things are devoured, and the prolificness of the race alone saves them from total annihilation.

## CHAPTER II.

## ON THE SHORE.

Down on the stony, pebbly shore,  
On the verge of the silvery brine,  
O'er sandy bays, through fairy caves,  
Where the mermaids were wont to dine.

O what a world of wonders there,  
All unheeded, we trample o'er;  
Nor know a tith of the glories  
Of God's kingdom down on the shore.

Like a fall of glistening hailstones  
Whitening rocks and stones everywhere;  
Balanus in countless millions,  
With neighbour Serpula, is there.

In their self-built castles of stone,  
Dressed in habits of gorgeous sheen,  
Each feasting and living at will,  
Far beyond the life of a queen.

On the sheltered far-ebbing bay  
Lives the cockle, queen of the sands,  
And vieing in beauty of outward robes  
Is Venus adorned in her bands.

Self-anchored for life to the shore  
The mussel contentedly dwells,  
With fishermen's purses of gold  
Locked up in their blue-coated shells.

There the dog-wilk goes ploughing along,  
Intent on his cannibal ways,  
Even down through his neighbour's hard shells  
With his wonderful wimble he preys.

The cleanly wee winkle is there,  
On the pasturage tender and young,  
Rasping his vegetarian food  
With the sweep of his silicate tongue.

But go for yourselves now and see  
The wonders of thousand tribes more,  
And ask was't for naught such work was made  
On the crawling things of the shore.

OUR present purpose, however, is not the study of the finny tribes; let us then turn shoreward and endeavour to pry into the modes and habits of life of the various tribes of little creatures that inhabit our sea shores.

Walking along the beach on a beautiful summer evening, had we ears sharp enough to detect the sounds emitted by the various forms of life dwelling there, it is just quite possible that our ears would tingle with the sounds of the sweetest of music; and had we eyes capable of beholding the beauties that in reality do exist, we would be transported with the joy of beholding a world of exquisite wonders. But as they do present themselves to our view, few indeed stoop to recognise them other than the superfluous adjuncts of a useless creation, and even familiarity with the outward forms do not take away the stigma.

Standing recently on one of the quays at Port-Glasgow, watching the mussel-fishers discharging a cargo of these bivalves newly arrived from the banks, I picked up an empty shell and began to examine it. One of the men engaged observed my action, and possibly misinterpreting the motive, with a twinkle of sly fun lurking in his eye, exclaimed, "Od, sir, is that an empty ane ye ha'e fan?" "It is indeed, sir," was my reply. "Man, that's a wonder, isn't it?" he added with a pauky smutter. "Yes," I rejoined, "it is really a wonder; but I was wondering how

its death came about. Can you tell?" Evidently bent on taking a rise out of the innocent, he was rather taken aback at the question, and remained silent for a time, but at last exclaimed, "Weel, I ha'e been working amang them since I wis a boy, an' there were aye empty anes; an' a' that can be said aboot it, is just that it's an empty shell."

Wordsworth says of his "Peter Bell" that—

"A primrose by the river's brim,  
A yellow primrose was to him;  
And it was nothing more."

And, like our mussel-fisherman, how many thousands view the shell simply as an empty shell and nothing more. After all, even through years of devoted study, how infinitesimally little do we know of the creative power of that great being who holds the universe in the hollow of His hand; His mysteries do not forbid us to enquire into and repel us from His works; a glimpse of the glory of His handiwork brings us more humbly to His footstool and nearer to Himself. Let us then approach the subject in order to learn that He has—

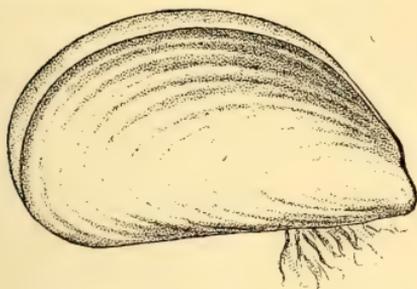
"Tongues in trees, sermons in stones,  
Books in running brooks, and good in everything."

#### THE MUSSEL.

The incident of the mussel-fisherman suggests the introduction of that mollusc, and with it let our studies begin. In a state of spawn, the mussel, a frail speck from the parent bed, is liable to be buffeted about hither and thither, far and near, at the mercy of the tide and waves. Swept into a crevice in a passing ship's bottom, or washed upon the ruffled surface of a beam or pile of timber on a wharf, it readily adheres to the spot, and the work of development quickly begins. Freed from the encumbrance of the embryo

state before final adhesion takes place, no bigger than a small caraway seed, it is again liable to break adrift and become once more a waif upon the waters, just like a human waif cast upon the sea of life to seek for itself sustenance and a home. Being provided, however, with very inadequate means of locomotion, viz., a very small conical-shaped foot, with which it lays hold of objects and drags itself along, the wanderings of necessity are confined, slow and wearisome, and very early it takes up its abode in the bed or rocks of its native beach.

The walking process of the young mussel is a most interesting sight to see. When inclined to move, the foot is



THE MUSSEL.

protruded from its place in the interior, and, according to requirements, can be elongated to fully the length of the shell; it is then thrown out along the surface of the plane or incline on which the creature lies, to which it adheres in a suction fashion; the foot is then drawn into the interior, and the whole body thus dragged along.

If in a frisky mood, it is amusing to see the back jerk it is able to perform, and whether inclined to take the perpendicular or oblique, it always maintains its equilibrium. By what is called the byssus, it attaches itself to its life-long position, and defies the strength and fury of the fiercest storms to uplift it from its place. The byssus springs from

a cavity at the base of the foot, and is composed of a bunch of silky filaments, which are capable of being reproduced if destroyed.

A difference of opinion exists amongst naturalists regarding the propagation and nature of these filaments. Some contend that the byssus is simply a bunch of silken threads woven by the foot of the mollusc, others that it is an assemblage of muscular fibres dried up in one part of their extent, still contractile and in a living state at their origin, a condition which they enjoyed their whole length at the period of attachment.

From recent observation, I am of opinion that the filament is due to a gelatinous amber-coloured liquid, capable of being exuded from the body when required through the orifice of the byssus, having no life nor power in any part of its length. When the object to be attached is reached by the liquid, guided by the foot, the exudation, being dammed back, instantly ceases to flow, and adhesion at once begins, and through the chemical action of the water, the whole length of the filament is quickly converted into the tough fibrous substance it is found to be.

In a small aquarium in my possession I recently dropped a mussel, denuded of its byssus, in order to watch the reproduction and growth, having previously deposited a purple-lip, or dog-wilk, and a common black winkle. Next morning, after an interval of eight or ten hours, I was astonished to observe the mussel floating, or suspended, within two inches of the surface; but how it had gained the position, and remained there, I was at first puzzled to know; ultimately, however, I had the mystery explained. The dog-wilk, wearied of its lowly position, mounted the glass and travelled upwards until its foot rested clear of the water, and there remained. The winkle followed suit; but

if a race was determined on, he found himself heavily handicapped, having a fine silky filament attached to his shell, and in his upward course was obliged to drag the mussel along with him. If, however, master winkle was left far behind through his heavy burden, he was not content until he reached the top, and triumphantly perched himself upon the back of the victor, who was now obliged to sustain the weight of both his captive brethren.

From a microscopical observation of this filament, a gradual tapering from the middle towards the base was observable, with a staved-up appearance at the point of the attachment, which, I am inclined to think, goes to prove the original liquid condition before the drying-up process begins. Since these observations were penned, I had an opportunity of witnessing the creature's mode of byssus spinning. First, the foot is thrown out to whatever length required, and that in the first instance may or may not be to its entire length, the tip is then placed upon the object to be attached, and from that point to the base at the valves the membrane, conical-shaped, rises in a diagonal line, and for a short space of time remains perfectly motionless. Examining the under side of the foot, it will be found to be composed of contractile muscles, giving it the capacity of forming two edges along the whole length with a groove between; and when both edges are brought together the groove is formed into a sort of pipe or conduit. When the tip is attached to the object, the byssus fluid is allowed to flow down the conduit; and when it is completely filled the edges are again parted, and out falls the waxy-like thread, and the hardening process begins. The tip is again fixed upon another spot and the operation repeated; and so speedily is the work accomplished, that I have seen as many as four threads, about an inch each in length, spun in the space of fifteen

minutes. When the threads are thrown out from the conduit they appear in a somewhat slack and unfinished state, but this is very quickly and marvellously rectified. As soon as the number of threads required at the time are set down, the foot is completely withdrawn within, and, in sailor fashion, the slackened gear is speedily hove taut, and the heaving is as perceptibly accomplished as the action of a set of tars upon a tackle fall.

The strength of a single filament is surprising, being capable of bearing in atmospheric pressure the strain of five times the weight of a matured mollusc.

The byssus in some species is long and of a very fine texture, capable of being woven into cloth. This is the case with a particular species that inhabits the Mediterranean, but the fabric is only to be found occasionally, and sold as a curiosity.

In our cold northern waters the mussel takes from twelve to eighteen months to come to maturity; and its well-known tendency in the choice of the most open and exposed situations is simply an instinctive provision of the creator's, in guiding it to where it can procure its food in the greatest abundance.

Living upon the numerous little particles of animal matter that everywhere float about the sea where a sweeping tideway exists, it loves to set down its perpetual anchor fixings, and, slightly opening its valves, sets in motion its wonderful fishing implements, which we will hereafter endeavour to describe, and thus procures its food and feasts upon its prey at will. The mussel is one of the most common, yet the most useful, of all our molluscs. By some it is used in the making of an excellent sauce; others, after washing well in fresh water, to free it from sand, and boiling in the usual fashion, make of it a savoury fry for an

evening's meal, prepared with buttered crumbs of bread. The boiling should be done with as little water as possible, adding little or no salt, as the valves contain in themselves a sufficient quantity of saline liquid. The soup thus obtained is of a most delicious kind, being largely impregnated with the phosphorescent substance shellfish are known to so abundantly possess. It is of great value to delicate people, and can be partaken of with very much advantage by those afflicted with bronchial and chest diseases.

This, of course, is characteristic of all the edible shellfish of our shores, and the soup obtained, even from a promiscuous gathering, in the hands of one skilled in cookery, will be found to be of a most agreeable and palatable nature.

#### POISON IN SHELLFISH.

As an article of food, however, great care should be taken in the gathering of shellfish. Some writers declare the mussel to be poisonous at particular periods of the year. I cannot, however, agree with the assertion. Like the finny tribes in their spawning seasons, all classes of shellfish get out of order and become somewhat unhealthy.

In the months of May, June, July, and August—or as old fishermen say, the months that have no "R" in their spelling—there is a greater quantity of the edible shellfish of our shores consumed as food than during the other eight put together. Yet in these very months they are spawning, and generally out of order, and not in good condition for eating. Still it is seldom we hear of the bad effects of the extensive indulgence of their use as an article of food during that period. Poisoning from the eating of shellfish has undoubtedly occurred, and many cases of dangerous illness, particularly amongst children, during the watering or coast season in our seaboard towns,

could be attributed to the same cause, but it must be traced to other sources than an inherent poison in the mollusc itself.

Shellfish in the vicinity of towns should be strictly avoided, particularly where common sewers and decaying refuse are liable to spread filthy, unhealthy matter along the shore. Care should also be taken that they should never be gathered from pieces of cast-ashore wreckage strewn along the beach, as many kinds of timber contain deadly poison; nor off the tops of metal articles, so numerous on town shores, which may be brass or zinc, and liable to throw off verdigris and other poisonous substances. From these causes alone do shellfish become poisonous and dangerous to the eater; and as I am convinced that these facts are not so widely known as they might be, for the health's sake of the thousands of shellfish-seekers who annually spread themselves along the shores of our far-stretching firth, I commend them to the special notice of my readers.

As an article of commerce, however, the mussel outstrips all its compeers. To it we are almost exclusively indebted for the thousands of tons of round fish, fresh and cured, that flood the markets and streets of every town and hamlet in the land. From John O'Groats to Land's End it is the favourite bait for long-line fishing, and for that purpose alone it is of inestimable value.

East Coast fishermen greatly prize it, and jealously guard from depredators their mussel-beds, which are generally imported from far-distant quarters.

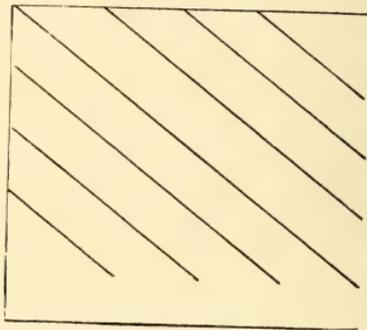
Some notion of the importance of the mussel in this respect may be gathered from the following, published by the Fishery Board in answer to several questions addressed to them by Her Majesty's Secretary for Scotland, May,

1888, anent the mussel-beds of the East and West Coasts : —“The mussel fishing in the Greenock district may be said to rank in Scotland next to Montrose in value. The chief beds are situated in the river Clyde on the north side, between Helensburgh and Dumbarton, the space fished being about three miles in length by about one in breadth. A small portion of this ground belongs to the town of Greenock, who got it by charter in 1816. This portion extends from the Tail of the Bank eastward to Garvel Point at the east end of Greenock. In the ground above that, however, and opposite Port-Glasgow, which is the most prolific part, no one seems to have any vested rights. Nearly all the mussels fished are sent to the East Coast, and the quantity despatched in the year 1887 was 3850 tons.” These figures, however, do not include what were taken away otherwise than by rail, and it is safe to say that the annual shipment of mussels from the Port-Glasgow and Greenock banks exceeds 4000 tons.

#### MUSSEL-FISHING.

The mode of mussel-fishing is very simple. Two men with a stout rowing-boat set out for the banks, each provided with a long-toothed close-set iron rake, wire-netted round the ends and back, which is attached to a pole about twenty feet in length. This is let down to the bottom diagonally—a man standing on each side of the boat—and drawn in to the perpendicular, with the hands then raised to the surface, and the contents emptied into the boat. From twelve to fifteen shillings per ton free on rail at Port-Glasgow is procured for the cargoes, and for nearly eight months in the year. Before the present depletion of the banks was brought about, as many as twenty boats were employed in the trade. How important

then is the fishing to the families more immediately employed, and how wide-spread are the benefits derived from the mussel crops of the Clyde. In conjunction with this trade, I have long held the opinion that the gathering of shellfish and sending them to the markets of our large towns would be a profitable employment to many families living on sea-coast districts where it can be carried on. From the islands of our Western Highlands alone, thousands of tons of all kinds of shellfish could be annually sent into market, and all that is required to send them with profit—cancelling, of course, the erroneous claim of



MUSSEL WATTLES.

landowners—is a reduced freight tariff both by steamer and rail; and I am convinced, when once fairly introduced, the demand would exceed the supply.

The above allusion to the present depleted condition of the mussel crops of the Clyde opens up a matter that is to be deplored, but like many more results of man's greed, it is preventible. First, I would suggest that a supervision of the banks, in the interests of the people, should be taken by the Crown at once, and a close time instituted. Then, for the propagation of the young, the most suitable portions of the ground should be selected and formed into

squares of wattles or wicker work, say a quarter of a mile each way. The top line, or, in other words, that portion of the square looking up the river, in each case should be left open to allow the down current of the river an easy flow through, and a number of diagonal lines, as shown (p. 26), should be placed in the interior for the purpose of intercepting the spat or spawn, and giving the young a better chance upon the bottom, and a ready hold upon the wattles to mature. The squares could be placed at intervals, and set down and taken up at various times, so that a matured stock could always be found on the ground. From such a system I believe that the crops could be easily doubled annually, and although a small royalty was enforced from fishers, the country in the end would be much more benefited. A fresh water species of the mussel is to be found in several rivers in Scotland, notably the Clyde, and the Earn in Perthshire, being much sought after for the pearl the shell is sometimes found to contain.

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### CHAPTER III.

#### THE MYTILIS MODIOLUS.

**A**T the lower ebb reaches of our shores another branch of the mussel family is frequently to be met with, viz., the *mytilis modiolus*, as it is classically called, and though not so numerous, nevertheless, in comparison to the common mussel, it attains a very large size, measuring

often as many as six inches in length and as many in circumference.

This shellfish is well known along our Western shores by the name of the "Horse Mussel," or by the more familiar name of the Clappie Doo; but how this last appellation has originated we have never heard intelligently explained. We suspect, however, that the shyness of the creature in clapping up or closing its valves when it finds itself approached, along with the shape of the shellfish, and the black, white, and lead coloured markings of the shoulders of the valves, particularly the dead ones, resembling very much some of the species of the domestic pigeon, has something to do with the matter. Before the light of intelligent observation had penetrated into many of the now known secrets of the creatures of the deep, it was very common to associate, both in name and origin, what was observed in the sea to have a resemblance to the things and creatures of the land. In the Barnacle, for example, we have the fabled origin of the goose or sea fowl of that name, from which it was long supposed to spring, believing it to be the embryo of the goose, from the fancied resemblance of the movements of the fish in the shell to the embryo of the bird in the egg. An ancient writer declares it to be "a thing of form like lace or silk, finely woven as it were together, which is the first thing that appeareth when the shell gapeth open; next follows the legs of the bird hanging out, and at last the bird, increasing in size, hangeth only by the bill, and in a short space thereafter it cometh to full maturity and falleth into the sea, where it gathereth feathers and groweth to a fowl bigger than a millard, and lesser than a goose." For generations this notion enjoyed a wide-spread belief. I myself have, in my boyhood, heard it discussed and

maintained as a sound fact, but the absurd delusion has long ceased to obtain credence in the minds of intelligent men.

#### THE BARNACLE.

The Barnacle is an easily-distinguished shellfish, being pedunculated or suspended on the tip of a brown leathery-like stalk measuring from one inch to in some cases nearly a foot in length. The valves, the upper portion of which are firmly but neatly bedded in the stalk, are of rather an



BARNACLE AND PEDUNCLE.

elegant appearance, somewhat heart-shaped, and in colour of a milky whiteness, sometimes tinged with a light cobalt blue or a delicate roseate hue. As seen in the accompanying drawing, a curious incision, however, mars the symmetry of the shell, which takes the form of a notch running in a diagonal line close upon the tip across the whole breadth, just as if it had received the impression in a soft state from the pressure of a square blunt tool. On pressing the tip with the finger, we find that it is hinged at the junction of the incision with the main body of the

valves; and springing from the root of the peduncle, a sheath-like appendage, something like the form of the closed crust of the cockatoo, overlaps both edges, and runs well down on the point. This is a wise and beautiful arrangement in the creature's economy. If the peduncle be removed from the base of the valves a cavity is formed, giving the shell the appearance of a bishop's mitre. Looking into the cavity, we find the root of the sheath attached to the inner organs, which, when moved downwards, withdraws the pressure of the shell or V-shaped friction strap on the edges of the shells, and an opening on the opposite edges is instantly formed for the protrusion of the creature's beautiful fishing plumes. With the withdrawal of the plumes again the opening is closed, and the leverage of the sheath applied against the intrusion of devouring enemies.

Vessels returning from long voyages, or lying at anchor for lengthened periods in salt water, invariably have their bottoms well bestudded with the barnacle and its compeers, the balanus and mussel. However inviting these shellfish may appear in such places, they should be avoided as one would avoid the most deadly poison. Nurtured as they are on ship's bottoms, they take into their bodies the verdigris and poisonous substances of the copper or paint, and are sure to become dangerous, if not fatal, to any one who may thoughtlessly or ignorantly use them as food. Too much care cannot be exercised in avoiding shellfish in such places, and this warning is applicable to seafaring men as well as landsmen, the former of whom should be very careful in eating fish caught in distant waters, the nature of which they may have no conception of. I knew several of a steamer's crew who only, after sharp handling, escaped with their lives from the first-named danger; and

in connection with the latter, the authenticity and striking nature of the following narrative, the relator of which was well known to the author, is the only excuse for its insertion here:—"I was once coming home from Calcutta, mate of a trig little barque bound for London. Our boatswain was a Glasgow man like myself. We had run well down on the Cape, when one fine morning, during my watch on deck, I was sitting on the poop rail buried in the pages of an interesting book. Looking up, I noticed the boatswain beckoning me towards him where he stood at the waist of the ship. I went, and looking over the bulwark to where he pointed, I at once observed a large fish with a curious round-shaped head, furnished with two large eyes as big as a common tea-cup saucer. The news of the presence of the brute soon went over all hands, and by the skipper's orders a hook was baited with a piece of pork, and we soon had him a secure captive dangling to our yard-arm. We had men on board who had sailed the world over, but no one could tell what species it belonged to; and with the aid of his natural history the skipper was also baffled to tell, and he ultimately handed it over to the crew. It was some hundreds of pounds in weight, plump and inviting in appearance. 'I'll have a piece of it,' cried one. 'So will I,' said another. 'I would like to see it tried first,' cried a third; and as the sequel will show, well for the crew that this last suggestion was acted upon. Accordingly the cook cut out a pretty large piece, and placed it in his coppers, along with two silver spoons, in order to detect the inherent poison that might be in the fish. It was speedily prepared, but on inspection, the spoons, he thought, did not show a sufficient quantity of discolouration to justify him in pronouncing it poisonous. However, before he would risk serving it out to the crew—

there being a cat, a dog, and a pig on board—he resolved trying its effects on the animals. The cat was first served with a small piece, which she devoured with seeming relish. The dog was next served with a larger piece; and the remainder, the greatest quantity, was given to the pig. For the first hour no bad symptoms were observed in any of the animals, but in the course of the second, the cat began to show signs of uneasiness. First she began to mew piteously and start running an erratic course along the deck as if suffering great pain, and impelled by some unseen power in its career. Then frothing at the mouth ensued, and in three hours she was running about the deck stark mad, and during the darkness of the night ran through the poop netting overboard, and was seen no more. In about three hours the dog was also seized with illness, but lay very quietly, and next morning was found dead in a corner. The pig, on the contrary, for two days showed no signs of distress, but on the morning of the third day, to the astonishment and amusement of all, he was seen to go grunting along the deck on his tiptoes, and for more than a week continued like a dancing-master tripping it on the light fantastic toe, but gradually resumed his wonted health and habits. After this experience the skipper ordered the carcass to be preserved as well as possible. Strange to say, it kept well during our passage through the warmer latitudes, but as soon as we reached the humid atmosphere of the English Channel it melted almost into pulp, and smelled so badly that we were obliged to pitch it overboard. Our skipper reported the matter to the Naturalist Society of London, but no one there ever saw or heard of such a fish. It was a queer one, and you may guess that it was a lesson no man in that ship will ever forget.”

## CHAPTER IV.

THE FISHING IMPLEMENTS OF THE MYTILIS  
AND MUSSELS.

THE Mytilis, as already mentioned, is an extremely shy creature. It takes months of confinement in a tank to familiarise it to the surrounding objects, and if it does venture to open up its valves, so timid is it that a passing shadow flitting across the glass is sufficient to cause it to clap up as quickly against the supposed danger; by and by, however, it gains more confidence, and opens up to view its wonderful interior, but cautious and smooth movements must be observed to procure the view for any length of time.

Like its lesser brother, the mussel, it feeds upon the little animals or animal matter the water contains, and the organs of both being somewhat similar, the feeding movements are identical, and a most interesting sight to see.

Here is a clump of mussels close to the glass of our tank, with a mytilis on the left. The mussels seem to be completely closed and motionless, but the mytilis shows a very slight opening of the valves. Before we apply the lens, let us stir up the water, and set the particles in the tank in motion. As soon as the agitation of the water has subsided, our eyes are cast upon the clump of mussels, and we observe that as the particles descend near the bottom, in front of one little fellow they take a gentle curve inward, then with a sweep they dash into the lower front of the valves and are lost to view. Those again descending and approaching a particular spot on the top edge, about a third of the shell's length from the front, we see are quickly shot upwards, and rising like sparks flying from the blowing of a smith's fire.

It will thus be seen that a continuous flow of water is drawn with the speed of a mill race into the creature's interior, and after being stripped of its animal matter, is ejected on the top with the same force. Turning to the mytilis, we observe the same movements going on; and as the valves are now considerably widened, we have an opportunity of viewing the organs that perform this wonderful operation. First we observe a cream-coloured belt or band running round the inner edges of the valves; this is called the fringe or mantle, and is capable of being compressed like the human lips, or extended from both sides until it hangs down like a drapery or curtain. It can be twisted into any position, or the edges can be brought straight together, and an opening or mouth formed in any part of the fore-front for the purpose of admitting the water in whatever quantity or direction the creature wills. Further in, again, hanging from the centre, there are four lobe-shaped, dark flesh-coloured valves or organs, which can be separated considerably apart, or brought close together from the middle to the tips, and another mouth formed at the roof between each pair. The outer surface of these organs, when minutely inspected, will be seen to be very finely corded across the whole length; and in these cords, which are armed with numerous microscopical hair-like appendages, scientifically called cilia or eye lashes, lie the secret of the creature's wonderful feeding apparatus. When the mouth at the mantle is opened for the admission of water, these cords are set in motion and revolve, or; as it were, run upwards in a chasing fashion like so many little rollers or connected parallel shafts, and these acting like buckets, rise the water towards the filtering web above, which, rushing through, is stripped of its animal particles, and escapes by an oval-shaped opening of the outer web through the upper

edges of the valves. Should extraneous matter be admitted at any time, it adheres to the cords, and is rolled from one to another, till it reaches a sort of triangular web, from which it is cast into the current of the outgoing water and carried to the outside beyond the reach of returning. Seeing, we adore; and adoring, praise the inscrutable wisdom of Thy works, O God.

## CHAPTER V.

### ON THE CLOCH SHORE.

**P**IERCING the Northern shore of our lovely firth at Helensburgh, and following up the deeply-indented line round the seven intervening lochs from that point to the Kerry coast on Loch Fyne, the traveller beholds as magnificent a panoramic view of Nature's wildest grandeur as any same stretch of miles in Europe can boast of. Crossing over again to the opposite shore, beginning with Kempoch Point, Gourock, we have, on the contrary, almost an unbroken *bee*-line of wood, clothed and cultivated heights, and pasture land stretching far down into the south of Scotland. The Northern shore has more attractions to the shellfish-seeker, having the requisite rough and smooth shores in greater abundance for the propagation of all kinds of specimens; but the South shore, which we have chosen for this occasion, has sufficient for our present purpose. Sauntering through Kempoch or Western Gourock, immediately above the sea line, we soon reach the beautiful villas

of Ashton, stretching away in rows, or clustering on the rocky heights above, peering out here and there from a wealth of sylvan grandeur, like the inaccessible abodes of the sea fowls of the cliffs.

The time of the year is early June ; the primrose, still in vigorous clusters, bestuds the sheltered nooks of the tufted rocks, and on the short-cropped lawns the variegated hues of the rhododendron throw pleasing tints of beauty over the prevailing green. The time of the day is early afternoon. A flood of golden sunshine burnisheth the face of the deep like the gospel sea of St. John. Here and there, coming and going, we have great and small specimens of our noble river triumphs of steam. Yonder is the well-known colour of an "Allan Liner" steaming majestically up. From the pine boarding of her bulwark we can see she is freighted with a cargo of cattle for our markets from the prairies of far-distant America. Her deep-toned, far-sounding horn is announcing her presence and speedy arrival at the port beyond. And here, steaming down with the tide, is an "Anchor Liner," bound for the "Land of the West," apparently with a goodly number of passengers, some of whom are returning the waving adieus of recognised friends on shore ; while flitting hither and thither are our smart tidy little river steamers, with their long trails of ascending smoke clouds scattering away in air, and leaving behind them on their churning way broad tracks of curdled foam. Pleasant sights, like an agreeable companion by the way, is half the journey ; and as we have now stretched beyond the Cloch, we will descend to the shore and see what can be found for our information and study.

Here on the verge of the beach we light upon a beautiful little stretch of gravel, into which our footfalls sink with a musical crunch, crunch. The stones and pebbles, one and

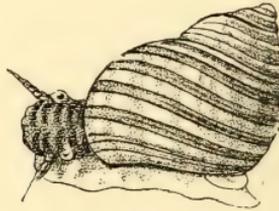
all, are rounded and smooth, some of them wearing as fine a touch of polish as the laboured gems of the lapidary. This is the handiwork of the rolling waves beating from time to time upon the pebbles of the shore, and in the might of their fury pitching them to the highest altitudes of their reach. And what a galaxy of shells for the amusement of the collector, some of them crumbling into the "dust of ages" under the touch; others are as hard as adamant, and still as perfect in the colour and symmetry of their native beauty.

All these at one time were the impervious abodes of creatures that enjoyed life and accomplished the respective tasks Nature's great designer intended them to perform. About thirty feet or so further seaward is a bed of larger stones; from its appearance and position we would suppose it to be a splendid nursery for the whelk tribes. These molluscs, being egg producers, instinctively select the most advantageous spots on the shore for the propagation of their young. Did they deposit their ova on a gravel bed, such as this on which we stand, the rolling and surging of the waves would quickly pound it into jelly; but the stones beyond being large and firmly wedged together, and not so easily surged about, afford safe protection in the numerous crevices beneath. Yes, it is indeed a perfect nursery; every stone is dotted over with dozens of the little creatures adhering to it in various stages of growth. Let us pick up one of the smaller stones and carry it to yonder boulder for microscopical inspection. From a scrutiny with the naked eye we can count upwards of two dozen, but under the influence of the glass we can easily double the number. The numerous little black dots scattered about, little bigger than the point of a sharp steel pen, are creatures already in a perfect state of form. In a crevice

here to the right is a cluster of four belonging to the common black whelk species, so well known along our shore.

#### BLACK WHELK.

During mild winters this and some other species sometimes propagate their young. In the course of six months these little things will have reached to fully the size of a garden green pea; and in six months more will be in the adult state. Let us detach them from their positions and deposit them in our phial of clear sea-water. No sooner do they reach the bottom, and feel themselves under the influence of their native element, than from inanimate objects they quickly turn to things in active life. One



COMMON BLACK WHELK.

little fellow has fallen upon his back, and it is interesting to observe his mode of recovering his natural position. Cautiously he lifts the well-fitting operculum, as it is scientifically called, or leathery-like covering of its abode, and reconnoitres the position, then protruding the foot over the outer lip of the shell, he bends downwards, and reaching the glass with the faintest touch of the outer edge of the foot, like the needle to the lodestone, he instantly adheres, and quickly flattening the whole foot, drags his stony castle over upon his body with a jerk. The progressive gait of the creature is very slow, resembling the rollicking motion of a person carrying a heavy burden on the back. The movement is not the most graceful, but to our taste there is

far more grace in the creature's motions than in those of the belles of fashion of the present day with their artificial shells bobbing behind them to every airt of the compass. But one of our captives has now reached the side of the glass, and is now working his way upwards, thus affording us a good chance of viewing the construction. The white cartilaginous-like membrane in front is called the foot, not unlike the shape of the foot of the elephant, upon which is a distinctly marked line running down the centre from top to bottom dividing it in two, one-half of which moves upwards, while the other retains its hold, then *vice versa*, and so on. It will thus be seen that the creature is actually provided with two feet performing the same functions as the legs and feet of a human being, and may be properly enough styled a biped of the sea. The outside lining of the foot is mottled all over, generally of a dark transparent brown colour, sometimes tinged with a light blue, giving it a beautiful appearance. Well down in front protrudes the two horns, stripped with the semblance and beauty of the zebra. At their base they present a bluff, oval appearance, which continues to about half the distance up, where it terminates on the outside margin with a sort of knee or knuckle, on which are perched the eyes, then they assume a more graceful taper and curve to the end. Between the horns is the head or mouth, resembling very much in shape the bottom of the proverbial black bottle, the mouth being in the centre, running up and down, and opening towards the sides with an almost continual action. These creatures being graminivorous, the continual gnawing-like motion of the mouth, similar to that of the horned creatures of the land when chewing the cud, suggests the same notion. On closer observation, however, we see that the action is due to the creature's mode of procuring its food.

When opening the mouth, a belt-like instrument rises and sweeps upwards from the lower extremity with a curving stroke, then disappears within the gullet, and time after time the movement is repeated. This instrument is provided on the top side with a set of small sharp silicate membranes, like the teeth of a saw, with which it rasps or grinds into powder the herbage of the shore on which it subsists. Hence the continual gnawing of the mouth.

The whelk is a cleanly creature, and being graminivorous, is a dainty morsel to the palate, and will do no harm to the most fastidious stomach. Age, however, as with the creatures of the land, blunts the teeth and reduces the rasping power, the consequence of which is that the body becomes hardened and to some extent loses its flavour.

There is no authentic means of ascertaining to what extent our markets are supplied with this favourite shellfish, but it is well known that thousands of bushels annually find their way into our large centres of population.

From Kilcreggan shore to the Mull of Kintyre on the one side, and from Kempoch Point to the Mull of Galloway on the other, the traveller is familiar with the bent form of the whelk-gatherer, on every rocky creek or bay where the creatures are to be found, prosecuting his or her calling. Issuing from the adjacent towns or villages, or squatting upon the shore in their little huts, or dwelling in the caves of the rocks, or improvising a place of shelter in a convenient nook, these people toil for more than half the year and live in seeming contentedness. They are invariably of Irish extraction. Those in possession of a little tent or hut are usually an old pair up in years, or incapacitated, through some other cause, from following the more active and strength-imposing pursuits of life. Few, indeed, amongst them are to be

found who have the slightest knowledge of the habits of life of the creatures they handle. The marketable value is the all-absorbing thought, and the invariable answer to the question, "How long do they take to grow?" is, "Sure they don't grow at all; they are just as we find them."

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## CHAPTER VI.

### THE DOG WHELK.

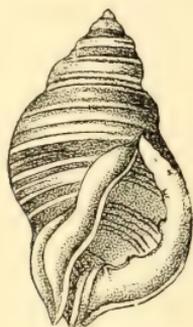
**S**CANNING the rough surface of the boulders of the shore, or drawing aside the brown fronds of their tangled drapery in order to get a peep of the numerous crevices beneath, amongst the many forms seen there is a group of straw-coloured capsules, numbering from five to as many as thirty, about the size of a small pile of corn, and very much the same shape. These are the eggs of the dog whelk, scientifically called the *purpura lapilis*. Standing upright on a level crevice, or straight out from the perpendicular, they are firmly gummed or rooted to their respective positions. Some of them are open at the exposed point, the young animals having already escaped to their active life along the shore. Others are still full, and the hatching of the progeny is going on.

According to Dr Carpenter, who made these capsules a particular study, "each one contains 500 or 600 globules, but only from twelve to thirty of these are developed into young animals, and after the development of the earliest is accomplished, the embryo turn upon the other

globules and greedily devour them." Thus, as we shall afterwards see, beginning in the embryo state, the very nature which controls their after life.

After the tide has receded, these creatures are generally to be found at the base of the rocks, gathered in great clusters, seemingly in a state of profound repose. Some, however, are active, and ambling about in their own ungainly fashion.

From the edge of this little pool we trace a zig-zag track for several feet along the sands, at the end of which we find a white adult specimen of this family furrowing



DOG WHELK.

his way along. Taking him up in our hand, we see the white of the shell is showing a tinge of grey, a sign of approaching age, and a deep notch is sunk through the outer edge of the fore lip, which is characteristic of all the families of the tribe; and wherever seen, is an indication that the creature is carnivorous, and belongs to one of the many tribes of cannibals that inhabit our shores.

Throughout all the branches of this family the mode of attacking their prey is the same. Travelling along the shore numerous mussel and other shells can be picked up, with a small hole pierced through them in almost as

complete a circle as the legs of the compasses can describe. Is this by accident? Oh, no; it is the work of the dog whelk, which we shall presently see, performed by a most complete and wonderfully-constructed tool the Great Designer has specially provided it with for the purpose. A few steps further southward and we are into harder ground. Here the creatures are more numerous. One large yellow-tinged fellow, at our feet, is making for the clump of mussels hard by—the pace is slow, but no obstacle in his way bars his progress. His broad white foot we see is beautifully speckled with a vandyke brown colour; and through the notch of the shell a dark horn-like instrument protrudes, turned upwards in swan-neck fashion, and is waving from side to side like the head of a horse labouring under a heavy burden. Some naturalists maintain that this is the creature's wimble. Oh, no; the wimble is quite a different instrument. This is simply a feeler or feeder that can be formed on, or protruded from, a particular spot on the fringe or mantle that encircles the inner portion of the foot. On inspection we find this instrument running to a point or snout, something like a duck's neb reversed; and following the under-side of the bend, we see two distinct edges running together till the notch in the shell is reached, where it widens gradually into a gutter, and at the touch of the finger, as the animal withdraws, the instrument within the tube-like appearance spreads into the web, and can only be traced there by the black round edge assuming the shape of a miniature meal scoop.

I am of opinion that this instrument acts in the water as a feeder in sucking or gathering in whatever animal or vegetable matter may come its way. I have mentioned vegetable matter, for I believe though these creatures are

carnivorous, they also feed upon decaying vegetables if required; and in proof of this, I may mention that for six months I had a purple lip, the species from which the famous mollusc dye was extracted, with nothing to live upon that I could trace but vegetable matter, and when, at the end of that period, liberated from the tank and placed once more on its native beach, it seemed as healthy and active as ever.

There are no grave-diggers in the sea—then what becomes of all the carcasses of the animals, great and small, that die? To rid the ocean of the putrefaction of death, and keep its waters sweet, and guard against overproduction, has not been neglected by the Creator in his infinite wisdom, and in both these departments this family in its various branches performs an active part. But our specimen has now reached the clump of mussels, and is settling down upon the broad side of one of them. For a full quarter of an hour we watch the creatures, but both animals remain as motionless as the stones. Stooping down, we see the whelk is still holding on with a firm or vacuum grasp of the foot; but plucking him up, which requires some little force, we find that he has already drilled through the stone-protected covering of his victim, and feasted upon the savoury flesh within. Taking up the mussel, and holding it between us and the sun, the beautiful ultramarine colour of the shell fills the eye, streaming through the sucked-out cavity within. The spot selected for attack is invariably near the middle of the shell, an instinctive reason no doubt in the animal to guard against the seizure or injury of its wimple should the valves of his victim happen to open and close; likewise as the spot within that contains the most easily extracted food.

In his attacks on the common black whelk he never

exhibits such care. Often I have found him with his wimble through the *univalves operculum*, or the tough brown scale that protects the opening of its abode. But what about the drill itself? Well, we must confess that it is somewhat difficult to see, for no sooner do you lift him off his victim than he quickly draws it within. A sun-shining day is best, with lens in hand, and standing in a position to get the benefit of the sun's rays. If satisfied the animal has been settled upon his victim long enough to have his wimble well inserted, pluck him up quickly, and at the same instant, turning up the mouth, apply the lens, and before he has time to withdraw it within the sheath you may have a very fair sight. That mode might satisfy the anti-vivisectionist, but it will in nowise do for accurate description. The next and most humane way, then, is to crack the shell as gently as possible, and, relieving the entire animal, lay him out to die, which will take place in a few minutes. Entering the knife then exactly between the horns, and making a deep cut, a gut-like membrane pops out, resembling very much in colour and shape the stone of the date, but with no incision on the side, and tapering a little towards the top. This is the sack or sheath that contains the wimble we are in search of. We split it open, and there lies beneath the gaze of our lens the wonderful instrument.

#### DOG WHELK WIMBLE.

In colour, it is a beautiful transparent amber; in form, it is longitudinal, divided by two angled or **V**-shaped gutters connected at the base, forming it into three distinct bars or divisions, the outer edges of the right and left of which are capable of being drawn towards the back by the contraction of the fleshy muscle on which the instrument is

mounted, and thereby constructed into a half-round, first acting one way, then turning back, completes the circle in the opposite direction. The middle bar is intersected by regularly-divided transverse lines, on each of which are placed a row of downward pointing sharp flinty teeth. The side bars, on the other hand, are armed with sets of teeth, placed in a triangular fashion, pointing in the same direction, and like the centre bar, have them running along the edges, while each of the tips are pointed with sharp piercers to begin the work. Some affirm that no lubrication is needed by the creature in performing his work, but I am inclined to think from the limy nature of the shells acted upon, if no lubricating substance was applied, the heat or friction produced would quickly destroy the fine barbs of the instrument. How proud is man in the boast of his own works, but the proudest of them sink into paltry insignificance when compared to the beauty, the wisdom, and the glory of the work expended by God on the meanest of His creatures.

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## CHAPTER VII.

### THE SHORES OF BUTE.

**F**OR the specimen collector, no better hunting-ground on the Firth of Clyde can be found than the shores of Bute, and it matters not from what direction the wind may blow on one or other of the numerous bays that indent the island. At the expense of a few miles' drive, or a smart walk of an hour or two, a profitable time can always

be spent. Boarding the steamer, then, at Gourock's now spacious Railway Wharf, on our way to "Scotland's Madeira," we are soon cutting through the ozone-laden breezes of the firth, and in about an hour or so, without going into the town of Rothesay, we land at the pier of Craigmore.

The ripening hand of August has already thrown the roseate tints of Autumn over the face of nature. The day is calm and clear, and in the midst of the yellow corn-fields, stretching up the gentle slopes, we see and hear the whirring reaping machine levelling the ripened grain, and the busy reapers in its wake binding together the golden sheaves. The mineral well, close by the pier, is still the same spot it was in the days of our boyhood. We scarcely miss a stone from the old haunt. But what a change has come over the face of the landscape above. Beautiful villas occupy the ground along the shore, from the verge of the beach to the beetling crags behind. In an odd villa here and there we recognise an old land-mark, but through intercepting high stone walls and the thick foliage of tree and shrub-planted lawns, we can only get an occasional glimpse of the towering cliffs behind, whose once sheltering caves we have seen the undisputed abodes of wandering Highland gipsies.

Proceeding along the shore we soon reach Millhole, a romantic little spot, where in our own day a little wool-carding mill was in operation. Perched upon the rocks, on the very verge of the beach, it was a beautiful little picture, with its water wheel spinning round, and the foaming waters dashing down the rocks to the sea below. In ten minutes more we reach our desired haven, the charming little bay of Ascog. The state of the tide is not yet favourable for operations, but a ramble round the

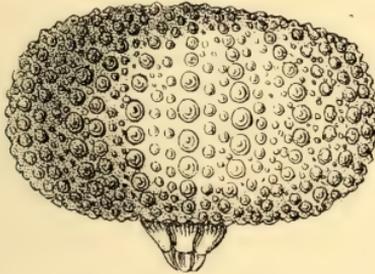
green promontory to the right will amply repay the loss of time. From the bosom of a thicket of a surrounding green and yellow furze, a little square-built church, due to Disruption times, rears its unassuming belfry. The magnificence of architecture and swelling grandeur of religious pomp and wealth are absent here, but, far better, in the midst of the calm and holy repose of the surrounding solitude, the worshippers within can attune their hearts to the communings of nature without in the moan of the murmuring waves or the piping joy of the warblers. A more fitting place for the erection of the sanctuary of God could scarcely be found. On the green sward that surrounds the humble walls, one solitary spot alone marks the resting-place of the dead. This is the grave of Montague Stanley, who, in his younger days, was an actor—known on the boards of the old Dunlop Street Theatre, Glasgow, but who, from religious convictions, forsook the stage and betook himself to the life of an artist. From the very spot where rests his mouldering dust he delineated on canvas the bold rocky shore before us stretching away southward, with the dark towering woods of Mount Stuart in the background.

So much was he attached to the lovely, lonely spot when health forsook him, and he found death approaching, that he expressed the wish of being there laid to rest—a desire kindly granted by the then proprietor. Sauntering round by the west we come upon the ruins of the old Salt Pans, where, in past ages, that precious commodity for the use of the islanders was extracted from the briny deep under the supervision of a tax-imposing Excise.

A few steps further seaward bring us to the rocky promontory that juts out into the left jaw of the bay, forming the boldest feature of the landscape. Round the spacious pools, and over the jagged ridges and deep gulleys,

we tread our way to the furthestmost point of the rocks, passing at various points many specimens of lovely creatures.

Gazing down the precipitous grey rocks to the verge of the blue water beneath, we observe a number of round objects here and there adhering to the rocks nearly as large as a man's fist, presenting a jagged, thorny-like appearance. These objects, both from colour and shape, give to the uninitiated the notion that they are so many full-blown poppy-heads transferred to the sea from the garden beds of the villas above. But what are they? Cautiously moving down the declivity, we take one up in our hand, and find it to be the hedgehog's prototype of the sea, viz., the sea urchin.



SEA URCHIN.

Rising from the deepest depths of the beetling cliffs that overhang the sea, these creatures are to be found, particularly in the adult state, in the nooks and crevices of the rocks left bare by the receding tide basking in the sunlight and air of, to them at least, another world; they peacefully await the return of their native element, seemingly wrapped in a state of sound repose. Who knows not their world of dream-land! Their most frequented spots, however, are the banks immediately adjoining the lower ebb reaches of the shore, and the shore itself at that point, amongst the boulders and stones, where in the spring time they deposit their ova;

and in early summer the young, from less than the size of a barley pile to that of a walnut, are to be found in goodly numbers beneath the larger stones.

How they are able to squeeze themselves into such unlikely places without injuring their protruding spines may be something of a puzzle ; but these are their birth-places and homes for a time, and there they can generally find abundance of food in worm life, sand jumpers, and numerous other little animals, to suit the requirements of all stages, until they are fit for the migratory life of the shore.

Our captive is rather large for depositing in our clear glass bottle of sea water ; but here is one, happily, crawling across the bottom of this little pool at our feet. Lifted from his native element, the rosy-tipped spines become as rigid as the stones, and the creature instantly seems a thing without life ; but dropped again into the water in the bottle, he very speedily exhibits the array and splendour of his wonderful exterior.

Laying the bottle on its side, without allowing the water to escape, and gradually raising it to its upright position, the creature can be placed adhering to the side in a good position for viewing. Applying the lens, then, like a vast forest of bare poles, the spines all over the shell are seen rocking about in every direction, each one having a separate and distinct motion of its own. After a little study it will be seen that the spines in ten separate bands stud the whole sphere, running from centre to centre in curving lines.

These bands are of two sizes, five each, one being about two-thirds larger than the other, while on each side of the smaller ones an almost plain strip of shell, about half the size of the lesser band, pierced with multitudinous holes, also runs from top to bottom. From these small holes, almost imperceptible to the naked eye, even in the largest size, a

forest of long flesh-coloured arms protrude, and, like the spines, wave about in all directions, and are furnished on the tip with a cup-like sucker, by which they lay hold of objects and use in locomotion. The united strength of the vacuum of these suckers is very great. I have seen them stand the lash of tremendous waves, and ere they relax their hold the arms will be torn from the cups, which will still retain in their severed state the hold of the object they are adhered to.

If our captive is hungry, by dropping into the bottle a very small crab, we will have a good chance of witnessing his mode of progression; or, if he shies at the crab, the little chiton, a favourite bite, will entice him. Rolling himself into a ball, as the cunning little chiton always does when captured, we drop him to the bottom. The moment master urchin gets his eyes upon him, a downward movement is begun; and how interesting it is to watch the slow, almost imperceptible glide of the creature's motion. First we see the arms at the lower edge relax their hold, then, reaching further down, adhere again, while those immediately above follow suit; and so on to the top. Such is the order of progression, and if the pace is slow it is sure, and there is never no stumbling; nevertheless it is amazing how speedily the bottom is reached, where the chiton, still in a doubtful state regarding his own safety, deems himself yet more secure within the folds of his shelly armour.

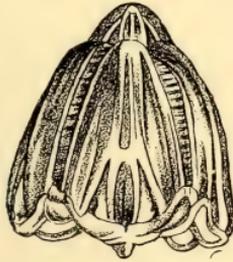
Across the bottom a straight track is made until the arms come within grasping length of the victim, which is quickly seized by the inexorable suckers, and a retreat is then made to the side, dragging the poor helpless chiton along without a struggle. While the urchin is travelling, the position of the captive remains unchanged, but the instant the side is reached, a movement towards the mouth begins, and when that point is gained the pressure of the

whole body is thrown upon the victim in order to open up the tardy but powerful jaws, and the whole carcass gradually disappears from view ; and after the ruminating, or rather in this case excavating, process of the curiously constructed mouth is undergone, the shell, stripped of every particle of the dainty morsel, is contemptuously ejected. While this is going on, the little crab is making frantic efforts to escape, having seemingly no desire for the light ; but possibly the presence of such a powerful foe is troubling him not a little. Hold there, master crab ! You are going the wrong way. Ah ! you have done for yourself, we fear. You have ran into the arms of your Philistine. One, two, three suckers are upon him, and now he struggles. See how he strains his crab legs to be free ; a sudden jerk, and the hold of the half-formed vacuum of one arm is undone ; another jerk, and a second is gone, and with a third and supreme effort he is free. The attention paid to the swallowing of a neighbour saved master crab ; catch him now going within the reach of harms way. Oh, no ; he has learned a lesson he will remember better than very many human beings. Warily he turns away when nearing the enemy on either side, and at times pauses for a moment as if to throw epithets at the hated foe, then beats a precipitate retreat.

The structure of this creature is one of the wonders of the deep. The mouth, situated on the centre of the under side of the shell, is an instrument of the most elaborate mechanism. So difficult is it to describe, that even with the help of the accompanying diagram, scant justice can only be done to the intricate and beautiful construction.

In the five lesser bands stretching from the vent on the crown to the mouth below the holes through which the sucker arms protrude, run across in pairs of three in a diagonal line, each alternate band having their holes cast at

the opposite angle. In a shell presently in my possession, measuring eleven inches in circumference, there are about 420 holes in each band, giving in the ten the vast number of 4200, all proportionally set, and as beautifully rounded as though done by a practised hand with the point of the finest needle. On the same shell the spines number about 2300. The tips of these appendages are invariably coloured similar to the shell, which may be dark red, senna brown, rose or purple tint, with the lower portion adorned with a lustrous coating of dark or sap green. From tip to base they are marked all round with regularly divided fluted



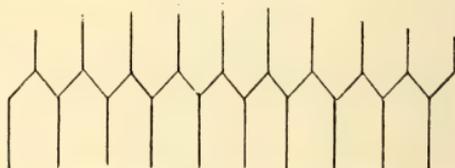
THE MOUTH OR MILL OF URCHIN.

incisions, which add much to the handsomeness of their well-proportioned symmetry.

A number of erroneous suggestions have been put forth regarding the use of the spines, but, as far as I am aware, no one has yet been able to determine their actual work; but more of this hereafter. Piercing into the interior of the shell, it is found to be largely composed of a dark brown liquid, chiefly sea water, while several very fragile vascular tissues surround the jaws, from the top of which the stomach stretches to the vent on the crown above, giving the creature the peculiarity of having its food ascending to that organ, instead of descending; just like a person swallowing their food standing upon their head. The infant urchin, bursting

from the egg, comes forth the pretty round shell we see it to be in the adult state. Unlike most other crustaceans that cast their shells at various stages of growth, the urchin retains its original shell, which grows and expands with the body of the creature while life remains. It is not very difficult to understand how the whelk enlarges its abode by depositing layer upon layer of secretions upon the outer and inner lip, like a mason raising and expanding a spiral structure, but how different, how wise, nay, how marvellous, is the plan of expanding this all but perfect ball.

Looking at the inner surface of the large spine bands, a great many polygonal lines are seen running from top to bottom, as shown below.



SECTION OF URCHIN'S SHELL PLATES.

With the aid of a good lens, these lines are found to be composed of a fibrous tissue dipping from the outer surface, where it unites in one continuous web, enveloping the whole ball. Thus we see, by the means of this dipping skin, each surrounded space of shell is created into a distinct plate separate from each other, which in two rows run in sizes according to their positions on the curve, making 48 plates, and giving in the five larger bands the number of 240. Turning to the smaller bands, we can easily discern with the naked eye that they are intersected by nearly twice the number of lines the former are, being actually divided into 126 plates, giving in the smaller bands the number of 600, making in the entire ball no less than 840 plates. To quote Philip Henry Gosse in his "Year at the Shore," the theory

of the growth of this shell will be plainly understood. He says each of these symmetrical pieces of shell, which he numbers at only 600, is enveloped in a layer of living flesh, a vascular tissue of exceeding thinness, which passes up between the joints, where one meets another on every side; and not only so, but actually spreads itself over the whole exterior surface. This being so, the glands of the investing fleshy tissue secrete lime from the sea water, which holds it in solution, and constantly deposit it after a determinate and orderly pattern on every part of the surface of each shelly piece; the inner face, the outer face, and each angle of the polyhedron grow together, and all so evenly, that while the dimensions increase both of thickness and superficies, the form characteristic of that individual piece is maintained with immutable mathematical precision. Thus, the volume and capacity of the box grow with the growth of the individual segments, and it ever keeps the globose shape at first imposed upon it. By this theory, which holds the credence of well authenticated facts, this fleshy tissue is exalted to the high position of being from first to last the sole constructor of this wonderful shell; in other words, it is labourer, tradesman, and architect all rolled into one. At the risk of being designated presumptuous, or having the ire of an offended F.R.S. brought down upon my devoted head, I hereby humbly beg to intrude my disbelief in the theory, and say that it is not at all the true solution.

That the glands of the investing fleshy tissue, through another agency, do "secrete lime from the sea water which holds it in solution," I hold to be perfectly correct, but they lack the power or force in themselves of depositing secretions on portions where they cannot reach, and actually, though covering over, do not even touch, and that is a by

no means small portion of the shell. Let us turn to the spines. Were they placed there by the Designer for the sole purpose of adorning still further what he had already made handsome in colour and complete in form at every point? While Nature is lavishly profuse in adornments, and forgets not the meanest of her works, she wastes no time in the production of useless designs and idle forms. The spines have their work to do. Gosse, while uttering not a word on the point himself, attacks Professor Agassiz for supposing them to be organs of locomotion, and wonders whether the Professor ever saw a living urchin in motion. Had he, as he should have done, "looked before he leaped," he would have found that Agassiz was partly right, for under certain circumstances the spines are used in locomotion. If, for instance, the creature is cast upon a sand bank, as is often the case, each sucker arm can only lay hold of an atom of sand which has no holding power to sustain the dragging strain required, and in such a contingency, if the spines could not stilt the creature along, it would be left completely helpless. The rollicking motion observable in these appendages is due to their construction at their base, as seen in accompanying wood-cut. The interior is scooped out like a saucer, in the centre of which a cavity dips to the form and dimensions of a tubercle or round pivot raised upon the surface of the shell, on which it sits and works like a jointed ball socket, being held in its position by the investing fleshy tissue. The edges fitting the round of the shell travel like a wheel in a considerably extended circuit round each pivot, thus keeping free from the touch of the tissue more than half the entire shell. Up the spines again the tissue only reaches to something less than a fifth of the whole height. Nature is no bungler; her unalterable physiological laws

always place the power of resistance, leverage, and motion in the proper place. If, indeed, the tissue was the constructor of the spines, it would require to reach the top in order to lay down the deposits required for growth and strength, like the bark of a tree conveying the sap upwards, and in that case we would have a skin-bound motionless spine as unable to move as the mast of a ship bound down to her bulwark by the shrouds. Turning from the spines for a moment, with the assistance of a lens, a great army of little jelly-like arms, far more numerous than the spines themselves, are seen also waving about in all directions. The head of these is designated by some as "threbbled-headed pincers," or forceps, but they are of two distinct patterns—one having the three sections of the branches very much like the shape of the leaf of the shamrock; while the other, when stretched out to its full length, is a branched web, with the branches stretching out in a triangular fashion, and uniting in a curve near the centre. These are classically called

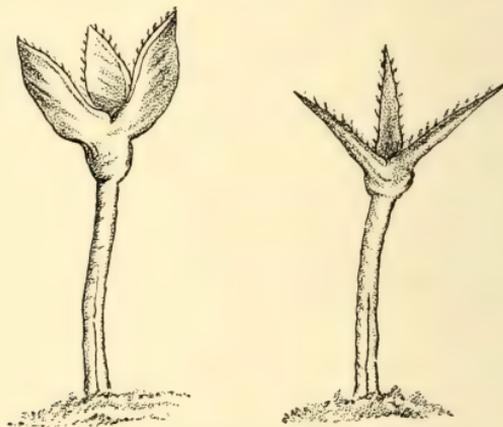
#### PEDICELLARÆ,

and at one time were supposed to be parasites living upon the skin of the creature, but are now believed to be distinct organs; but their work is unknown. Some supposed them to multiply the means of progression; others, that they acted as the creature's police, in expelling intruders that entered in amongst the spines; others, again, that they acted in laying hold of nervous matter, which was conveyed from one to another till it reached the mouth. The branches are something of a silicate nature, armed on the edges with a row of teeth, and from their extremities to the centre of the throat are intersected by numerous little cells.

In the hither and thither motion of these appendages

they describe quick sweeping circles, and every now and again close and open their branches. This latter feature is more characteristic of the small or young ones, which seem from their activity to have the largest portion of the work to perform; the motion of the larger ones being much slower and only partially close their branches, particularly the round ones.

Having thus observed the forms and motions of the exterior organs, the following important problems present themselves for solution. First, What is the work of the



PEDICELLARIÆ.

pedicellariæ? Second, What are the uses of the fleshy tissue or the skin? Third, What is the work of the spines, and how are they produced and those lopped-off by accident replaced?

Before reverting to the first problem, let us for a moment submit the pedicellariæ to the scrutiny of the microscope.

From the first glance, then, we notice that the extended portions of the branches are clear and silvery in appearance, but following into the middle we see the cells in the throat present a cloudy look, and are filled with a watery-

coloured gelatinous mass. Tracing still further down the interior, from a close and careful study we discover in the centre of the bulb or root of each branch a little globular sack also filled with a gelatinous substance, but presenting to the eye more of the colour of the limy material of the spines and shell, and these sacks are each furnished with a little tube leading into the interior of the larger one below. Into the large tube itself we next turn our gaze, and at once observe the interior dotted over with little crimson spots, which are evidently corpuscles, but the colour of these as they approach the skin change into a darker tint interspersed with an orange hue. From these observations, and our knowledge of the construction of these organs, it is plain that in their sweeping gyrations and closing up process, the object is to fish or gather in the nervous matter required by the skin, of which, when the sacks are full, by bringing the branches together or nearly so, the interior skin, pressing against the sacks acting like a force-pump, send the corpuscles and fluid substance down the tube into the skin below.

In the second place, What are the uses of the skin? Having traced the source from whence the fleshy tissue receives its life-sustaining food, it is again plain that its work is simply to supply the working movements of the pedicellariæ and spines, and maintain its own existence between the segments, having not the power necessary in itself to force the expansion of the ball, and send deposits beyond the surface of the shell. That the skin, however, is a storehouse of great vitality, I have no doubt. Recently I cut a living urchin into sections, after cleaning out the interior of one section, leaving not a particle of matter on the shell. I deposited it in a vessel of salt water, and soon saw the spines and pedicellariæ in active motion;

next morning they were as active as ever, and continued so for four days ; on the fifth morning, however, all was still. The oosing-out process at the broken edges of the skin was too much for the over-wrought pedicellariæ, and the consequence was exhaustion and death.

In the third place, What is the work of the spines ? First, let it be explained that the spines and shell are of a very porous nature. If a mouthful of water be taken, and the shell held to the lips, every drop of the water can be easily blown into it.

Well, then, the skin, being the absorber only of the nervous matter brought down to it by the pedicellariæ, cannot retain the lime of that substance, which, still in a fluid state, must also find a store-house, which is readily found between the skin and the socket or basin of the spines in each segment where it continually accumulates ; and as the spines revolve in their circuit, acting also like the force-pump of the pedicellariæ, the fluid, with its lime deposit, is forced with an equal pressure on all sides up the spine and into the segment, which retain the lime and allows the water to flow inward, which accounts for the large quantity of sea water always found in the interior of the urchin.

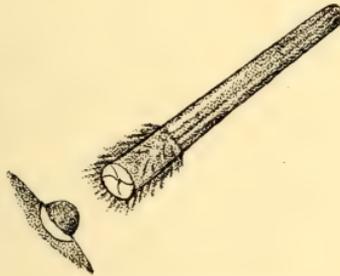
This theory seems to me to be more in keeping with the fixed laws of nature. The skin of the human being has its particular functions to perform ; and we know that the heart, acting like a force pump, sends the blood to the extremities, and conveys to even the nails of the toes and fingers the substance for building them up.

#### THE YOUNG SPINES.

Nevertheless the formidable appearance of the spines, they are indeed tender members. Even after a careful

handling, I have seen as many as a dozen at a time litter the floor of the tank. In their prowling life among the rocks and stones of the shore, they are continually liable to sustain injury and loss, a contingency carefully considered and amply provided for by the Divine Designer. Let us then see how the replacement is accomplished.

Did they spring from the skin or shell they would certainly be found, from the size of a mere point piercing upwards through the skin, in their various stages of growth towards the adult state, but searching over the whole ball of the shell, no young spine can be found beneath a



SPINE AND PIVOT.

considerable size and a well-defined form. It cannot be that Nature abruptly shoots them forth at once to the height and perfect condition we find them in. They must have a beginning and process of development; and this let us now endeavour to trace. With the assistance of a lens, a numerous host of small white stalks, from the thickness of the finest cotton twist to that of the most delicately-produced silken thread, are discovered springing from the skin in the interstices of the spines, also waving about in all directions. After long and careful study, these, I am inclined to believe, are the young spines in process of development, and if the larger ones are easily destroyed,

how much more so are those delicate things ; but this again has not been overlooked, for a careful scrutiny with the glass reveals the facts that they are actually incased within the tube of the pedicellariæ. Thus, we see, in addition to its other work, the pedicellariæ acts as the protector of the young spine, but it is at the expense of its own existence ; for when the spine arrives at a size too large for the tube, its rapid revolutions put a cork-screw twist upon the inner lining, thereby choking up the passage, then the whole tube speedily dissolves and leaves the young spine free.

When within the tube, the casual observer is apt to be deceived by the appearance and size of these tender things, and suppose them to be something else ; but extract them from the tube, and place them under a powerful microscope, and the identity is indisputable.

When immediately extracted from the skin, owing to the soft condition of particularly the upper portion of the stalk, it is very liable to break away ; but when left for a few minutes to the exposure of the air, it hardens into the white limy condition of the adult spine. Examining their construction carefully, the characteristics of the spine are easily traced in the interior rings and fluted columns, and at the base the socket is always found in a perfect state. These are quite discernible, even when within the tube ; but if the somewhat difficult task of making a clean extract can be accomplished, the characteristics are more apparent. The somewhat bell-mouth top has a connection with the tube, but at the dissolution of partnership this is taken away. During this process the threbbled-headed ones droop their branches very much, and very often get fixed upon the nearest spine, like the legs of a fork. This is a position I have not yet observed in the round ones, but I have seen the heads of these fly off and shoot through the water like a rocket

through the air. We may mistake and we may misinterpret, but blunt is the mind and dull are the eyes that even in this despised creature can doubt the guiding touch of the finger of God.

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## CHAPTER VIII.

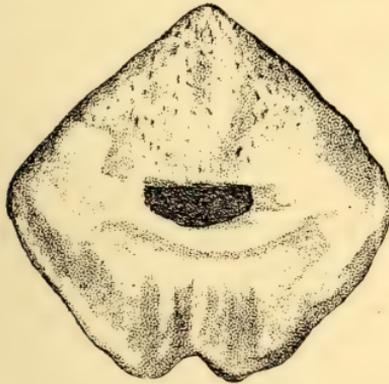
### ON ASCOG BAY.

“**B**ARREN as the sands of the sea shore,” is a phrase not always correct, for very many stretches of sandy beach are literally teeming with life, and barren indeed are the sands that are destitute of life of some description. To the former category the little bay which we were exploring in our last chapter belongs. Descending to the water’s edge of the semicircle, we find the yellow sand to have a firm and pleasant tread under our feet, and so numerous are the indications of life, we are almost at a loss to know where to begin.

The inhabitants of the rocky, stony shore are entirely different creatures from the families of the sandy beach. The former spend their lives almost exclusively amongst the rocks and stones, finding sustenance and protection in the numerous little crevices there overhung by waving herbage, and into which they invariably can retreat for safety from the approaching foe. When the receding tide has left those places bare, it is only after a careful and diligent search that an occasional capture of a prize specimen can be made. The sand families, on the other hand, are all burrowers; and both when the water is over them and

when the sands have been left bare, their places of abode and the species of the creatures are easily known to the familiarised eye by marks on the sands, and other infallible indications of their presence. If provided with a pair of fishing stockings, or resorting to the good old boyish practice of stripping the boots and buckling the trousers pretty well up and taking the water for it, where such a practice can be resorted to, we find to be one of the most enjoyable modes of marine zoologising we have yet experienced. On this day the rays of the sun, following up for the last six hours the receding tide, are heating to a pleasant warmth the sandy stretch and the shallow waters on its verge, and the wading hunt proves to be an invigorating exercise. From the glassy bay, as calm as a parlour mirror, the incoming waters are now advancing, and the numerous tribes of little creatures that only venture the length of the verge of the deep, upon the receding tide are sailing in again on its flow, and darting about in all directions as if frisking, frolicking, and rejoicing in a young and enjoyable life. The denizens of the sands, on the other hand, as soon as the flow of the first inch of clear water has gone over their heads, are busily employed discharging the heated water retained in their valves, and preparing to feast again upon the unseen infinitesimal particles of life-sustaining food abundantly brought within their reach; and were it possible that our eyes could take in at a glance the working machinery of the various creatures that are then set in motion, our wonder and admiration would rise to the praise and glory of the Maker. Well, when fairly in the water and the search begun, we are not long wanting an object of interest. First our eyes light upon the darting movements of the little sand lance, and not far from the spot where he has at last so quickly and effectually made his exit

by burying himself in the sand, we discover two neat little round holes, with a little sand bridge between, stretching about a quarter of an inch in length. This is at once suspected to be the abode of some creature, but do not abruptly poke the finger down into the sand, as we are invariably inclined to do, or a sudden collapse or bursting through feeling will be the result. Beginning the excavating process about two inches away, and gradually tapering inwards at a depth of from two to four inches, we come



SAND OR HEART URCHIN.

upon a beautiful specimen of the sand or heart urchin, or sea egg, as it is commonly called; a lovely creature it is, but not so globose in shape as his thorny, bristling brethren. The shell is extremely thin and easily broken, and the spines, wearing a light straw tint or a beautiful lustrous canary yellow, are closely-set hairy-like appendages; and when out of the water lie as smoothly over upon the shell as the well combed tresses of a fair young lady. Most writers in dealing with the urchin speak of the specimens as being known as the sea egg; but this is a fallacy as far as the prickly urchin is concerned, which in its living state as much resembles an egg as does the hedgehog.

The name of "sea egg," in my opinion, entirely refers to the smooth specimen, not on account of its structure, which is not exactly egg-shaped, but rather to its smooth appearance, and particularly to its habit of always being found nestling in the sand. The burrowing proclivities of this creature must be for some particular purpose, but what that is I have not yet been able to discover. I suspect, however, it is for the purpose of feeding upon the warm life below.

Taking the creature up in our hand, the question very naturally suggests itself, how can such a round, headless, footless object accomplish the feat of burrowing in the sand? Placing it ashore upon the dry beach it remains as motionless as a stone. Under the atmospheric pressure the sand of the beach becomes to it as hard as adamant, and as impossible to penetrate; but the moment the water flows over it the circumstances are changed, and the creature, being no lover of the light, very soon shows symptoms of life in getting down into his dark abode. Examining the spines on the under portion of the shell, an almost triangular band will be observed extending from the inner angle at the mouth near the middle to the square on the outer edge. This band suggests to the beholder the appearance of a brush, so regularly set are the rows of spines; and when these objects are examined with the lens they are found to be constructed like a little paddle, almost identical in shape to the round-mouthed, curve-shaped drain shovel of the navy. These are the creature's diggers, having the blades swerving to the side in contradistinction to the very slender spines of the other bands, which all point or incline to an opposite direction. Thus, we see, the particles of sand are raised by the one set of brushes and thrown in upon the others, which, in turn, working in an opposite direction, cast

the particles away, and always keep the passages free from obstruction.

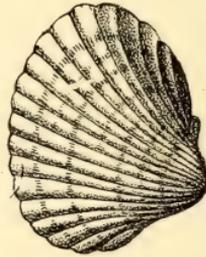
In the observation of this interesting operation, the first thing we see is a settling down process, then gradually a little ring of sand gathers round the outer edges, which continues to enlarge until half the creature is buried, and when it is finally out of sight, all trace of its whereabouts is gone; but when deep enough the two breathing vents appear, which sometimes run into one when the tide leaves them bare.

The sucker arms and pedicellariæ of this species are not so numerous as in the case of the other. The former protrude or pierce the thin fragile shell in the form of a four-pointed star-fish, and possibly this is the reason why some writers have suggested the idea of a connection with the star-fish families.

#### THE COCKLE.

Amongst the numerous little punctures in the sands, indications of life below, we find another double vent, but the size is much less than that of the urchin; and here it is at our toe, the abode of the *cardium edule* or common cockle. No shellfish is better known than the cockle. The denizens of the streets and lanes of our crowded inland towns who have never seen the sea are quite familiar with its appearance, and very few sandy stretches on the estuaries and bays of our northern coast but contained them in more or less abundance. The Rev. J. G. Wood, in his "Common Objects of the Sea Shore," in speaking of the cockle says: "The cockle is a capital delver, and armed with his natural spade digs for himself a hole in the sand nearly as fast as a man can dig with a spade of metal." Philip Henry Gosse again speaks of it in this fashion: "Like all the rest of its

beautiful tribe, this species is a dweller in the deep sand, into which it can penetrate with considerable power and rapidity. In order to do this, the foot is strengthened and the sharp point thrust perpendicularly down into the wet sand. The muscular force exerted is sufficient to penetrate the soft sand to the whole length, when the point is suddenly bent sideways, thus obtaining a strong holdfast. The whole organ is now strongly contracted in length, and the animal and shell are dragged forcibly to the mouth of the burrow, the edges of the valves downward, and piercing the sand a little way. The straightened point is then pushed an inch or two further down again, hooked, and another pull is



THE COCKLE.

made. The shell descends a little further into the yielding sand, and the same interchange of process goes on till the animal is sufficiently buried; and when in full vigour and thoroughly alarmed, disappears into his sandy fortress so fast indeed that you must be very alert to overtake him, and prevent his descent if you have no appliances but your hand."

Let me again say that it may seem presumptuous in me to call in question such authority, but from my own observations of the creature I venture to say that neither writer witnessed the burrowing operation, or he would not have allowed the interesting sight to go unrecorded. Let

us turn for a moment to the structure of the creature. The strong-ribbed, powerful valves form the source of protection for the delicate and beautiful interior; the pale white mantles that surround the corrugated edges guard against depredating intruders, and as they open up their parting edges the elegant foot is exposed within. To this instrument, which is less than a fourth of the size of the shell, is ascribed the sole power of burrowing.

Suppose, then, we take the relative proportion of the foot to be a fourth of the size of the entire shell; if we put the simple mathematical problem, can the fourth of a whole excavate a cavity large enough to hold three times its own size? The question seems somewhat ridiculous, and on these grounds, to the minds of the writers mentioned, so might also the process above described. But this is not the solution. If the cockle is found upon the ebb'd beach, it is simply there like a stranded vessel, perfectly unable to move until the next tide brings it a sufficient quantity of water to enable it to do so. Like the urchin, it is quite impossible for him to drag his bulky valves below until the water completely covers him over, then, lying upon his edge, with the beaks parallel with the sand, he sets the foot down its whole length into the sand below, and taking in by the mantle on the opposite edges above a sufficient quantity of water, sends it with force enough down the sides of the foot to its tip below, which instantly causes an explosion of the particles of sand, and these rising like a cloud of dust up the outer surface of both sides of the valves, allows the whole shell to drop into the cavity as far as the explosion has gone. In this manner the process is repeated until the creature has gone as far down as it wishes to go, which is seldom as deep as three inches. During the months of May, June, and July, these shellfish are much sought after

by coast visitors, but it is then in a soft, not very healthy state, owing to the spawning condition which takes place during these months. I have seen eager searchers puddling in the half-mud half-sand town shore, in the neighbourhood of gas works and filthy sewers, where the cockle is sometimes found, but in such places the creatures are anything but healthy, and should be avoided. Many times do we see quantities of the shellfish exposed for sale stained more than half over with a dirty, dark lead colour, which is indicative of the state of the bank on which they are bred; and although I am not prepared to say the stain is always an indication of unhealthiness, still my choice for purity would be those whose valves bear the colour of the pure sands of their native beach.

Wonderful stories are told of the cockle's power of leaping. Some writers go the length of asserting that it has been known to leap from the bottom of a boat over the gunwale. For my part, I have never been privileged to witness anything like such an interesting sight. I have certainly seen him leap, but the acrobatic performance, done by pressing the foot suddenly against the sand, is simply turning a somerset and rolling two or three turns along the sand.

A popular notion amongst sea-side residents, when they find the cockle lying bare upon the sand, is that it is on account of having got into an unhealthy condition. Such, however, is not the case; for it is quite a natural thing for him, like all other shore-frequenting creatures, to be caught napping, and left high and dry for a tide. If compelled by any cause to come to the surface, which is often the case, they must of necessity remain for some length of time, and travel considerable distances away. I have in my possession a fine specimen of the *cardium*

*rusticum*, or spiny cockle, which was taken up with a fisherman's long line fifteen miles east of the Bell Rock, exactly thirty miles from the nearest Scottish coast out in the bed of the German Ocean. It is quite possible, however, that the bank there may be a favourite resort of this species; but in this particular case the specimen must have been travelling on the surface of the ground, for it actually had the bait and hook firmly closed up within its valves, and in this condition was brought on board, and was afterwards taken from that position at my own request. The cockle in its season is a healthy shellfish, and when properly prepared makes a savoury dish of food. Thousands of bushels annually find their way into the markets of our large centres of population, the gathering in of which is a trade that might be greatly developed. Very few sandy bays and nooks on the Firth of Clyde but had at one time this shellfish in abundance, and are yet capable of breeding millions of them annually; but a constant scraping and raking of the sands during the spawning season has stunted the breed, and year by year is making the cockle a very scarce commodity indeed upon our shores.

From twelve to eighteen months the cockle takes to come to maturity; and if the savoury morsel is to be preserved upon the shores and bays of our Firth, it will only be through the enforcement of a closed time, which certainly should be the case.



## CHAPTER IX.

## ON THE WAY TO ARRAN.

SEEKING the shores of the Alpine peaks of Arran, our chosen route is with the famous *Ivanhoe*, through the classic Kyles of Bute. Several years have passed away since last our eyes rested on the beauties of the lovely Kyles. Then, as now, the balmy winds of August rustled through the heather bells that rose in purple floods to the very mountain tops, interspersed with patches of sombre green and yellow. The indelible beauty of the scenery is enhanced to-day by the calm resplendent light of sky and sea; but it is with something of a feeling of sadness we witness the slopes on the right entrance denuded of the splendid pine forests whose variegated colours and tracings of old were said to represent the plan of the battle of Waterloo. The beauty of the Scotch spruce and silver firs, stretching away on the braes in their respective positions, was the admiration of every passer-by, but now upon the bare hillside scarcely a tree is left to mark the whereabouts of the once famous sylvan grandeur.

The rights of property shall have no discussion here, but the lover of nature can very well be excused were he to ask the question, "Is it right that such a soulless possessor should have the power of such destruction?" He, at least, cannot plead the poverty of the crofter or cottar, and in this we have enough of disquieting reflection until we reach the "Narrows." To view the gorgeous scenery of this particular point aright, the traveller must ascend to the mountain top on the Bute shore, where one of the most magnificent views that Scotland can boast of spreads out

before the admiring eye. Stretching away to the right, between the green and purple hills, are the blue waters of the inner Kyles, sparkling in the sunshine like a majestic river in its flow. Away down in front is placid Loch Reddan running into the base of the hills beyond. On its right shore rise the grounds of Colintrave, with an occasional white-washed thatch-covered cot sending forth its blue wreaths of smoke amongst the clustering hazel and natural woods that adorn the district. To the left, the huge mountains rise to the sky-line in bare broad shoulders and jagged beetling crags. Swerving seaward again, near the entrance, the primeval woods rise in graceful folds of dark and olive green far up the mountain side, and yonder, at the base of the woody cliffs, on the very lip of the loch, are the rounded turrets of Glencaladh, the splendid residence of Stephenson, the representative and relative of the great engineer of that name; and in the midst of all, guarding the entrance to the loch, is the group of romantic little islets, giving a fairy-like enchantment to the lovely spot. But the speed of our steamer is quickly leaving behind the passing scenes. Yonder on the left, on the Bute shore, stretching up the barren hill-side, is an oblong oasis, on which are seated the famous "Maids of Bute," two stones which, when observed from a particular angle approaching from the inner Kyles, very much resemble two women seated upon the hill-side surveying the scenery before them.

Some would-be improver of nature has attempted to adorn them with a painted dress, but the attempt only mars the beauty and resemblance, and should be left to nature's own seasonable moss coatings of modest green and grey. Very speedily we gain the magnificent scenery of the outer Kyles, with the beautiful villas and wooded mountain

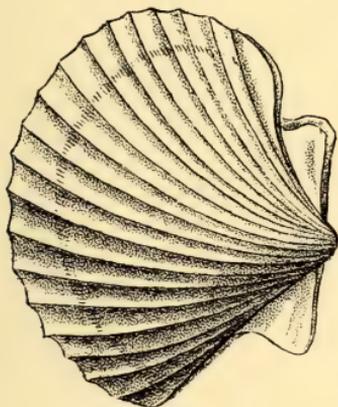
slopes of Tighnabruaich on the right, and the green hills and cultivated fields of Bute stretching away on the left. Through the deep blue waters of the Sound we forge our charming way, and skirting the rugged shore of Arran, are soon landed at our desired haven, the little pier of Brodick. The south shore of the bay has little protection, but the north is well guarded by the ample form of Goatfell, where that proud monarch lifts his stony crown far up into the snow-white clouds; and near the base of the mountain, on a beautiful green knoll, surrounded by a splendid forest of pines, rise the ivy-mantled turrets of the ancient castle. Descending to the sands of the bay, we quickly discover numerous signs of life. Yonder is the deserted abode of the purple lip; with the rolling on the sands by the action of the waves, the shell is polished into a smooth milky whiteness. Here is the spiral top of the graceful wentletrap, and there in abundance lie the *litorina obtusata*, or common yellow whelk, always an attractive little shellfish upon our shores.

For the discovery of active life, we strain our eyes a foot or so into the lip of the receding tide. There, sailing quietly past, is a frail specimen of one of the round fish families, and almost alongside is the lively little sand jumper leaning over in its forward career like a swift little cutter on the starboard tack. Higher game we would like, and by a stroke of rare fortune we discover it within our grasp, for almost at our toe, about to take its gyrating flight, lies a tiny specimen of one of the rarest bivalves now found upon our banks and shores. Taking the creature up, we find the valves a fan-like shape, corrugated in graceful ridges, running up and down the shells in sweet and regular curves. The under valve is nearly flat, but the upper is nicely rounded, or rather capped, and tinted all over the

white ground with a delicate rose-pink. Our captive is a beautiful little specimen of the pecten or

#### SCALLOP,

known on the English coasts as the squin, but better known on our Scottish shore as the clam. How this name has originated I have never heard intelligently explained; but in passing, it may be mentioned that shoemakers use a tool of that name for holding their leather in boot-closing purposes. The construction of the tool certainly resembles the shell-



THE SCALLOP.

fish in its essential parts; but the get-up is such a primitive idea that it must have been in use amongst shoemakers many generations ago, and the probability is that some philosophically inclined village souter named the shellfish after the familiar tool. Through some now mysterious fashion this shellfish was said to have had some connection with the name of Saint James, cousin of our Lord. In the days of the Crusaders, and at subsequent periods, pilgrims to the Holy Land and the shrine of the Saint wore the scallop shell upon their hats, as an indication of the pilgrimage; and

something of a representation may still at times be seen worn upon the hats of the coachmen of the nobility. These creatures are sometime scalled the "Butterflies of the sea;" not only on account of their swimming progress through the water, resembling the here-away, there-away flights of these insects, but also on account of the beautiful and variegated colours of the shells. But these outward tints, when contrasted with the beauty of the interior organs, are as the blighted colours of the herbage of early winter compared to the gorgeous flowery robes of summer.

Let us immerse our specimen in our clear glass bottle of sea water. Soon he finds himself at home, and the edges of the valves begin to part asunder. In a few minutes the opening is wide enough to enable us to see to the extremity of the interior, where, at the opposite or hinge portion, the light is streaming in. With the first glance of the lens, the various colours, which vary in every specimen, at once fill the eye, and strike the beholder with wonder and admiration. O what grandeur! is the exclamation. Cleopatra, with all the bejewelled splendour at her command, was no match for this.

#### THE INTERIOR ORGANS.

Amongst the gaily caparisoned organs, the most conspicuous is in the centre, stretching out like a lustrous blood-red carnelian interspersed with flaky tints of grey as soft as a summer cloud. From the light streaming in beyond, the great muscle is spreading a tint of white throughout a field of gold. Nearer the edges two beautifully corded organs, one above and another below, wear a tinge of pink, overcast with a haze of blue, as transparent as the ether on the hills; and almost on the lip of the white enamelled ground of the comb-toothed shells, stretching

round their entire circumference, lie the mantles on which are set on a fleshy ground a row of little beads shining with the colour and brightness of little emeralds, receiving the effulgence of their beauty from a hidden light within. These are the creature's eyes, and it is only now after recovering from the wonderment of such beauty we begin to observe the construction and uses of the organs before us. The mantles are composed of fibrous tissues that run round the entire shell to the hinge where they are attached to the body of the creature near the mouth. The work they perform is, in the first place, to protect the delicate interior, and act as a rudder in steering the creature along its erratic course, by ejecting the water at any point required, and again to throw out whatever extraneous matter may happen to be drawn in.

It is a fine sight to witness this operation performed. Looking at the mantles when lying inward a little, both appear like two attached webs, rising and falling in an angular fashion, but in reality each one is an entire organ, capable of being wrought from the centre like a hinged flap. Between the rows of eyes a double line of tentacles are seen protruding on the outer edge, some of which are double the size of the others; and on the inner edge these tentacles are again seen, but at this point they are smaller than the others. In watching the movements of these tentacles, they will be seen to suddenly start inward and grow considerably less in bulk and length, when instantly the inner half of the mantle makes an eccentric movement, and that portion coming out with a swing, sends the watery refuse beyond the lips with a dash. Between the sinking of the tentacles and the movement of the flap there is about a moment of a pause, so that this seems a pretty certain sign that the tentacles are wrought from the extremities by

continuous cords, somewhat in the fashion of the opening and closing cords of a venetian blind.

The scallop is a splendid swimmer. When wishing to rise from the bottom, he opens wide the valves, the upper one alone moving, which is accomplished by the expansion and contraction of the great muscle; the valve is then brought down with great force, which has the effect of raising him to a considerable height, then rapidly opening and closing the valves the water rushes in, and is as quickly beaten out, which, with the hinge portion of the shells in front, sends him on with an amazingly speedy propulsion along his erratic course. Sometimes they move in large bodies in this fashion. A fisherman of my acquaintance on one occasion had his nets shot off Dunoon shore, near the surface, in about twenty fathoms of water, when, to his dismay, instead of an eye of herrings striking his nets, he found it to be a shoal of clams, which spoiled his night's work, and took him and his mate most of the following day to rid them from the meshes. The scallop is amongst the finest of our edible molluscs, being little inferior to the oyster. About twenty years or so ago it was to be found in plenty on both shores of the Firth of Clyde from Gourock to Pladda. The ground between the Cumbraes used to be a favourite resort. They were also plentiful in Largs Bay, and on the banks near the Gantock Rocks off Dunoon; and many times the writer has seen his father's nets bring in large quantities not a quarter of a mile from Rothesay Quay. Now, however, few of the lovely creatures are to be found in all these stretches, the cause of which is surely a subject worthy of our investigation. Who should know the cause better than fishermen themselves, we should think? and here on Brodick shore is one at hand to begin with. Showing our little specimen for an introduction, our

first question is, "Can you tell what that is?" "Oh, yes, sir; that is the clam." "Is it plentiful here about?" "I can mind twenty years ago when ye couldna' put oot a trawl net in that bay without takin' in barrow-loads o' them, but noo ye'll scarcely see such a thing." "Can you give any reason for the disappearance?" "Well, no; but I think it's thae nasty star-fish sookin' at them." I have heard fishermen affirm this in other quarters also, but the star-fish, though one of the most voracious cannibals of the shore, preys more upon the dead than the living; and not being provided with an instrument to pierce the hard shell of the ever wary clam, the sucking delusion must be dismissed, and the cause sought for in another direction.

#### THE CAUSES OF THE SCARCITY OF THE SCALLOP.

Between forty and fifty years ago, when the pollution of the Clyde, by the wealthy rulers of Glasgow making it the cheap and easy receptacle of their ever-flowing, ever-increasing sewage, had not yet fully wrought its baneful influence upon the animal life of the river, it was an easy matter for fishermen to take in of a morning, in any frequented quarter of the Firth, almost as many stones of fine trout in their season as they can now bring in of pounds. The reason of this is that the pollution stopped the healthy flow of the river's run, and cut off the supply of stock fish from the breeding grounds of the upper reaches, thus demonstrating to the poor fishermen below the result of man's thoughtless greed and selfish expediency, even on the resources of Nature.

But it will be said, What has this got to do with the scallop? Well, if we go to the animal and insect worlds, we find that Nature always provides for the keeping down of vampires by the creation of special enemies, and the

same rule is carried out in the sea. Feeding upon the inner grounds of the shore, on the very spots where the scallop frequents, as the trout always does in keeping down the vampires of the shore, as he is certainly known to do both in the embryo and in a more advanced state, he was of yore a far greater agent than he is now in his greatly diminished numbers. This is the first point maintained in the combination of causes that go to make up for the general disappearance of the scallop from the waters of the Firth.

The conversion of the Clyde from a paltry stream to the capacity of a noble river, is an engineering feat the people of Glasgow and Scotland at large have reason to be proud of ; and the numerous fleets of steamers that proudly float upon her breast have certainly brought incalculable blessings, particularly here in the west, in the distribution of the wealth that follows in their wake ; but in the second place, we have to draw attention to these very steamers, not to take exception to their presence, but to the results of the style of their management. Taking a retrospective glance of the last half-century, how vast must have been the fleet of steamers that have passed up and down the river in pursuit of commerce. In the same space of time, again, taking the up and down daily runs of river passenger steamers to and from all quarters of the coast, what a host would they number ; and although a more recent introduction the ever-plodding, ever-puffing coast-lighters would vastly swell the figures.

Well, in engendering the steam power of all these vessels within the compass of the river alone, how vast must have been the quantity of coal consumed, and how great must have been the amount of refuse extracted from their furnaces. In the river proper, during all these years, not a pound of that refuse was allowed to be thrown over-

board there ; but from the "Tail of the Bank" downwards, the law ceases to exist. The consequence is, that the shores and bays and bed of the channel, from Gourrock to Pladda, have been over and over again strewn with layers of hard-pointed, bristling, calcined refuse, which, with the thousands of tons of barge-deposited mud that has annually been dropped into the sea at Loch Long mouth—authoritative reports, nevertheless, to the contrary—have completely changed the nature of the bottom, and made it an unhealthy abode for the flat fish and mollusc families. Put out a dredge net in any of these quarters, and ample evidence of the facts will be brought up in the shape of a bag full of slimy rubbish, composed largely of the refuse mentioned. The evil effects, however, do not spring from the larger pieces of that refuse, but from its crumbling, overspreading nature. The following description of a clam, brought up from the Skermorlie Bank with a fisherman's long line, and which was brought to me recently, may serve to show somewhat the condition the bottom is in. This creature was a very large one, the sandy ground of the upper valve was stained all over with a coal-tar like substance, which no amount of brushing with soap and water would remove. Across the corrugated surface an accumulation of foreign substance was adhering, which, at first sight, seemed to be a malformation of itself, and the first touch of the finger confirmed the idea, but with a firmer pressure the interior proved to be of a softer nature. In a transverse position from the ridges, in the midst of this mass, a number of tube-like constructions reached across the entire length, which, on closer inspection, was found to contain animal life. Breaking away the fringe of the gummy-hardened crust, I drew out from the mass a curious worm-shaped animal. Stretching it out to its full length, it measured about two

inches, tapering to a point at one end and terminating at the other with a blunt double-headed end. In appearance, it was like a string of sixteen cucumbers joined together, each with a head on each side of the joints resembling that of the seal. With the aid of the lens, no feet nor outward means of propulsion were observable; but as the creature exerted itself towards any particular point, a fluid, which was seen through the thin flesh-coloured skin, ran in the direction required, and working itself in worm fashion, the fluid was kept oscillating between the two extremities.

Under microscopical inspection, when beneath the water, the outward aspect of the substance presented a wonderful appearance. From a heterogeneous mass of particles, largely composed of black, sprinkled over with white and grey, the most magnificent little walls and caves of grotto work were seen, polished and rounded, and shining with a seeming varnish of the finest lustre. But after all, the delusive mansions were composed of fine particles of cinders and coal, and the calcined refuse already mentioned, besprinkled over with the dust of crumbling shells. From the presence of the ingrained matter on the shell, no doubt the effects of being exposed for some years to the influence of the substance, and from the accumulation of dust and coal particles upon its back, fit for the engendering of worm-life, it is evident that the creatures, in the upper reaches of the Firth at least, are now doomed to plod over a foul bottom that can be anything but a healthy element for their existence.

The last, and probably the most culpable of the causes for the disappearance of the scallop, in my opinion, is the "beam trawl." Wherever this destructive implement goes, no living thing will escape that is large enough to come up in the bag of its meshes; and trawling as it does all the

year round, with its heavy ground rope stretched taut across between its ploughing irons, the tender spawn of all kinds, the scallop included, deposited upon the sands is either crushed to pulp and destroyed, or disturbed and set adrift from its bed to become an unproductive mass. No computation can be made of the destruction of all kinds of fish by this instrument. Before its introduction our shores and bays swarmed with large and well-filled flat fish, but every creek and bank and bay of the river and Firth has been dragged and scraped as bare almost as a deserted street, and the labours of the poor fishermen have long been unproductive. I am told, in particular quarters it is no uncommon thing to take up hundredweights of spawn at one drag from the banks, which, of course, must be returned to the sea; but being once rooted up from its nestling place, it is ever after driven about hither and thither with the tides, and the chances are that not a third of the spawn so disturbed will ever come to maturity. It is time the Legislature was wakened up on this subject. No beam-trawl, in my opinion, should be allowed to work within miles of the spawning banks of any estuary or fishing ground. And to begin with our own, a prohibitive line should be fixed, stretching on the one side from Corsal Point in Galloway to the Mull of Kintyre on the other, inside of which it ought to be punishable to cast a beam-trawl.\* If these measures were adopted, in conjunction with the cleansing of the Clyde, and prohibiting the throwing overboard of the refuse already mentioned within a given boundary, I am persuaded that the scallop would not only return, but all kinds of fish, including the trout, would

\* This has been partly established; but, through some miscarriage of the law, the practice is still continued from the Cumbræ to the Tail of the Bank. If it is injurious in one quarter, it must be so in another.

become as plentiful as of yore ; and the sportsmen on the upper reaches of the river's banks would, as of old, return to the fishing-rod with the zest of old Izaak Walton, and the practical fishermen of the lower reaches of the Firth, with their legitimate nets and lines, would be able to maintain themselves and families in a far greater degree of comfort.

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## CHAPTER X.

### ON THE CARRICK-CASTLE SHORE.

**J**UNE has come round again. The hedgerows are ablaze with the fragrant hawthorn blossom, the blue-bell and campion in opposing colours deck the shady nooks of the green lanes, the whin and broom paint the braes with the liberal spread of their golden blossoms, and the lovely woods everywhere resound with the songs of the full-throated warblers.

Carnival days of the botanist scouring the woods and glens with light step and eager eyes, and returning with joyful heart through the trophies of a well-filled satchel. But the pleasures of the botanist in these lovely days are no more intense than that of the zoologist of the shore. Come, then, my readers, and through our favourite study let us endeavour to cull a pleasant hour or two from the weary round of worldly care. Our chosen place of research, on this occasion, is the shores of Carrick-Castle on Loch Goil. Our point of embarkation again is Gourock. Boarding, then, our steamer, we are soon skirting the pleasant shores of Kilreggan and Cove, and stretching across the mouth of

Loch Long, we land a few passengers at the pier of Blairmore ; then stretching along that shore, with its green hills studded with beautiful villas and pleasant woods, we soon reach the romantic and famous clachan of Ardentinny. Viewed from the deck of the steamer, the scenery of this spot is magnificent. Close to a rounded jetty of rock that overhangs the shore stands the neat little white-washed inn ; while the half-dozen or so houses that compose the place here and there uplift their lowly fronts in the same snowy attire. Immediately behind, a rising glen cuts into the hill, clothed at the base with thick folds of spreading verdure. On the right, what was once a magnificent forest of pines stretches now in a somewhat straggling fashion to the hill-top ; and a little to the left the primeval woods also stretch far up ; but higher still, and yet in the midst of the prevailing green, several deep scars of red earth show the strength of the descending winter floods that occasionally tear their way adown the brawny mountain. The place is still approached from the steamer by a small rowing boat, and if there has been no retrogression, there has certainly been little improvement since, according to Hugh M'Donald, nearly a hundred years ago, a band of Paisley weavers landed at the place, with the poet Tannahill amongst them. We cannot regret the continued seclusion in the midst of the utilitarian spirit of the age. Times, places, and customs have changed since then, but this place, amid the many surrounding changes, is still

“Far lane among the Highland hills,  
'Midst nature's wildest grandeur.”

The charming beauty of our mountains, straths, and glens has been often the theme of the unrivalled songs and stories of our poets and writers. Through the reading of these has not the very Cockney come with gaping mouth

and staring eyes to view the depicted scenes, and went away filled with admiration and praise? But what has been the influence of his presence and the outcome of our contact with him? Nothing but the imitation by our young men of the Billingsgate slang of his music-halls, couched in the gutter poetry of "Along the Strand with Nancy." Seldom now do we hear, along with many others, the sweet strains and beautiful words of Tannahill's "Lass o' Arranteenie." Slowly but surely the frivolous poetic taste of our English neighbours is casting out of sight the poetic grandeur of our Scottish songs. The leaders of fashion have much to do with this. It is but a short time ago since we heard the son of a knight of the realm, whose father's lordly mansion is within four miles of the birthplace of Tannahill, delighting the ears of a fashionable audience with this fulsome trash, singing about his "Jermima falling upon her stern-sheet;" and this "elegant sentence" was actually applauded by a minister of the gospel lustily clapping his hands. Alas! alas! how lowly has our poetic taste fallen? Listen to this, ye dames of fashion—

“ Yon mossy rosebud down the howe,  
Just opening fresh and bonnie,  
Blinks sweetly 'neath the hazel-bow,  
And 's scarcely seen by ony ;  
Sae sweet amang her native hills,  
Obscurely blooms my Jeanie ;  
Mair fair and gay than rosy May,  
The flower o' Arranteenie.”

Is not this a contrasting picture of unassuming modesty worthy of being preserved, and worthy of imitation? But excuse this digression, gentle reader. Our poetic ardour possibly has carried us too far. The clatter of our steamer's paddles again brings us to our path. We are now skirting

the mouth of the beautiful little bight in front of a wooded plain stretching in amongst the hills, whereon stands the mansion of the lord of the manor, "Glenfinart House," with its garden and greenhouses hard by. Close upon the left of this spot is a beautiful forest of pines stretching from the lip of the sea far up the mountain. The rising cones, reaching away in tapering graceful folds of dark and olive green, is a picture for the poet's eyes to feast on. The beauty of the passing scenery of mountain, wood, and glen rivets our attention until we reach the mouth of Loch Goil, and we are then speedily landed at our destination.

The wharf is close to the walls of the castle, and on landing we immediately set about viewing the ancient stronghold. At one time it must have been completely surrounded by the sea, or at least the landward portion of its walls was subject to the conditions of the ebb and flow of the tide. The structure never was of an imposing nature, but like all others of its ancient compeers, the quality of strength was not neglected—the walls in some places being immensely thick, and what must have been a ramparted court-yard is still seen facing the sea. The village is a beautiful retired spot, nestling on the brink of the sea at the foot of the hills. On the road fronting the inn, several magnificent plane trees lift on high their umbrageous arms; and we observe in the grounds of a villa hard by, a towering monarch oak, whose sapling leaves must have been shed several hundreds of years ago. We often hear the locality cited as the scene of Campbell's "Lord Ullin's Daughter," but we have seen it somewhere else disputed in favour of another loch of the same name in the Island of Mull, in the Western Highlands, where Campbell spent several years in retirement. Be that as it may, the locality has enough of romantic scope and beauty

for the poetic fancy to revel in. Across the placid waters of the loch, little more than a mile away, the southern end of the mountain range that divides these waters from Loch Long lifts its broad shoulders and beetling crags to the sky line in a coat of lovely green. From the hazel bowers clustering at its feet comes the sonorous voice of the cuckoo, echoing across the still waters with clear and distinct tones; but clearer still, from the mountain side above, comes the shrill bark of the sheep-dog, and the correcting voice of his master directing him in his work amongst the bleating flocks. This particular spot bears the name of

“THE DUKE OF ARGYLL’S BOWLING-GREEN,”

but how the appellation originated is something of an enigma. Hugh M'Donald characterises it as “a stroke of quiet Celtic humour,” which may be understood if, in contradistinction, the towering crags and green knolls are as a bowling-green, compared to the many other stupendous mountain ranges laid claim to by that favoured son of Adam's race.

The shores of the loch are narrow, often jutting round precipitous crags into water dipping many fathoms deep; but on the right of the castle the beach stretches out to a beautiful little sandbank, and here let us begin our operations. The surface of the water is as smooth as a sea of glass, affording us a good chance of eschewing for a time our fishing stocking and wading process, and betaking ourselves to a suitable small boat, which is here to be had on hire, and over the gunwale of which we can recline and observe what is going on below. But on our way, what is this we pick up on the lip of the tide; a specimen of the *carcinus mænus* or common green crab. The creature seems entire in body and limbs, but shows no signs of life. Placing

the edges of the *carapace*, or upper part of the shell between the forefinger and thumb, and allowing the legs to drop, the body will at once be seen to work as if wrought with a hinge. Inspecting it thoroughly, we find immediately beneath the edge of the upper part, or what we may term the lid of the shell, an incision running round about two-thirds of the circumference, and so finely is the cut executed that it seems to have been done by a sharp-edged tool ; and looking into the interior, we find it to be an almost entirely empty box, destitute of its original contents. How this has come about we will presently have every chance of seeing. Boarding, then, our smallboat, we push her out on the sand-bank till we attain a depth of about two or three feet of water, then casting out the anchor, the full broadside of the boat is held by the oars to the sun, the effect of which is to allow the light to stream through the water beneath the boat to the opposite side, where the dark shadow allows the watchers to see the bottom as clear almost as a newspaper in the hands. Steady now, with as little movement as possible, for while the crab may be styled the fox of the shore, and a most pugnacious creature, he is, nevertheless, extremely timid and easily frightened into hiding. Yon patch of *algæ*, with its outlying stems and broad brown fronds as motionless as the leaves of a cabbage garden is a splendid cover. Keep your eyes upon it. Presently the fronds begin to quiver, but are soon as still as before ; again they are agitated, but this time with greater vigour, and the tossing and quivering plainly tells that a struggle is going on. Now our curiosity is aroused, but still we see nothing to indicate the species of the creatures nor the nature of their movements. Ha ! there is the first sight of our wished-for object—a specimen of the above-mentioned class of crabs, about the size of the palm of the hand,

plying energetically his great nippers and legs in making for a particular point in the *algæ*, or bunch of wrack. What is his object, we wonder? No other than the capture of a weaker brother, and making a lordly feast of his own kith and kin. Will the cannibal succeed in his design? For a time, at any rate, he seems to be foiled; but he is again lost beneath the fronds in pursuit of his prey. On the far off side, the hunted little fellow emerges and runs a foot or two out into the sand, but he speedily finds himself unsafe, and quickly returns to his hiding. He will elude the enemy if he can; but here he emerges again, this time on our side, and is actually making tracks towards us with as much speed as he can command. Ha! but he is followed by the ruthless pursuer, and the race for life is evidently a hopeless one, for the speed of the larger one is fast overtaking him; the small one, however, bravely maintains his pace. But see, exactly beneath our faces, he has made a sudden stop, and allows himself to be captured without a struggle. Pouncing upon him like a cat jumping on a mouse, the larger one surrounds the little thing with his eight great legs, and inserting his murderous nippers beneath the edge of the upper shell or lid, proceeds to split him open, and make a sumptuous supper of the tender interior of his fellow; and this explains the reason why so many little crabs in this condition are found along our shores.

During the months of spring and early summer these creatures are to be found carrying about with them a load of spawn or eggs, immediately beneath the flap or cover of the abdomen, very often called the pouch. These eggs are encased in a sort of bag or thin capsule, where they grow to about the size of the roe of the haddock, and as they increase in size, they are forced out of the capsule, and spread themselves along the flap of the pouch, where they

remain until the young escape ; then they (*i.e.*, the young) take up their abode amongst the rubble and beneath the flat stones of the shore, and remain there until they are fit to contend with the exigencies of their rough and roving life. In common with the crustacea order, these animals cast their shells. The process, however, is not periodical, but simply as the creature finds the interior carcass or body becoming too large for the case or shell it is cast off and a new one taken on ; and should the creature formerly have lost a leg or a number of toes, new ones then take the place of the missing ones. During the time of change, or moulting, so to speak, they are in a sickly, half-dormant condition ; and if taken up in the hand immediately after the old shell is dispensed with, the body has a soft, pulpy feel, but the action of the water very soon hardens the new substance, and in the course of a few days he is himself again.

The term "fox of the shore," as we have applied to the crab tribes in general, is no misnomer. Here in sight, coming beneath our boat from the sunny side, is a red specimen of the same tribe. From his slow crawling movements he is after some prey, possibly something near at hand. Yes, it is evidently yonder buckie, or winkle as it is called in most parts of England, in pursuit of his own food ; the buckie is plodding along, earnestly looking ahead for what he can find. The crab, on the other hand, is stealthily following up, studiously keeping in a straight line behind the big shell, thereby keeping himself from the creature's view. All at once he makes a dash forward, but he stops as suddenly in his career, and throwing himself upon his edge, in an instant he is buried out of sight in the sand. Casting our eyes now upon the buckie, we notice that he also has withdrawn within his stony castle, having discovered the enemy in his dangerous approach. The foxy

crab knows he has been discovered too soon, hence his sudden and mysterious exit below ; but while he is there it might be supposed he is ignorant of what is going on. Oh, no ; he is fully alive to every movement ; for while his body is completely buried, his eyes are thrust above the sand, perched upon the top of his stalks, and there they revolve in all directions, viewing, unseen, the whole scene around him. This is certainly a most convenient and handy arrangement for the crab, but he has yet another foxy trick to accomplish before he can capture his prey. The simple buckie soon forgets his danger, and throwing out his eyes, which, like his lesser brother, the purple lip, are also placed upon the horns, but only about half-way up, reconnoitres the position, and finding, as he thinks, the coast clear, comes out of his shell again, and renews his plodding search. Calmly and motionless master crab remains within his burrow, and views, no doubt with satisfaction, the buckie out again to its fullest extent. Well he knows that the least false or hasty move on his part will produce the hiding tactics of both over again ; but watch how slyly he goes about his work. Waiting until the buckie's eyes are again directly down in front of his own big shell, consequently keeping out of his own sight anything that may be in a straight line behind, master crab slowly emerges from his burrow, and raising himself straight up, his upper shell is completely covered over with sand, then with this covering, like a setter dog, he very cautiously advances, and when within springing distance, he makes a dash upon his prey, and this time, before the poor buckie has time to withdraw within his shell, the nippers of the crab are bedded to the hilts in the soft body of his victim, and a lordly feast is there and then begun.

Although the crab displays much cunningness in circum-

venting his prey, he is, nevertheless, himself subject to be suddenly pounced upon, and made a feast of by swiftly flying members of the finny tribes. I have taken as many as three and four crabs, as large as an ordinary man's hand, out of the stomach of the cod at one time. The gastric juice, or, otherwise, power of dissolving the hard shell possessed by that fish is wonderful. When the stomach contains four or more crabs, the lower one will be found to be so soft and pulpy that under the slightest touch it will crumble into fragments. The others, in turn, are easily marked by their state of advanced softening, and generally the top one is as fresh as when swallowed. It is thus safe to say that the hard shell-covered crabs, devoured by the cod fish for breakfast, are dissolved and passed through his stomach long before he goes to bed at night. Everybody knows of the good joke of the lobster running away on the tail of the shepherd's dog; but very few will know that the crab has been used as a poacher, but with what amount of success we will not say; however, here is the process as described to the writer by a knowing one. With a crab of an ordinary size, and the nets, of course, you proceed to the rabbit warren, and after blocking up all the holes, except an entrance one and an escape one, you place the nets on the escape hole. Next, a small piece of candle, about an inch in length, is lighted, and by melting the bottom with the same match, it is fixed upon the crab's back; then the creature is sent inward, with the light shining around him, lighting up his darksome way. The rabbits within, of course, see the light, and the strange thing advancing towards them. Consternation takes hold of the warren, a retreat or stampede takes place, but finding only one passage open they rush through it, and a good haul is said to be the result. After this revelation

and explanation, we expect to hear of the landed proprietors laying hold of the crabs as their own property, and their gamekeepers setting up aquariums in their kennels for the raising of good stocks of hunting crabs.

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## CHAPTER XI.

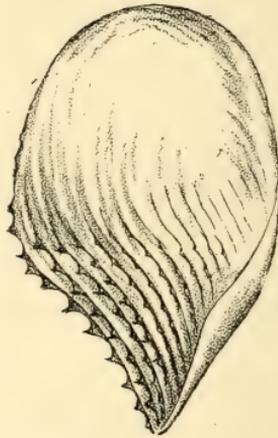
### ON LUNDERSON BAY.

WE are on the southern bight of Lunderson Bay, immediately beneath the kennels of Ardgowan House. The crops have been gathered in, the fields are grey and bare, the leaves in serried masses give forth their crisp musical rustle beneath the tread of our feet, and where their green verdure so recently delighted the eye, the grim arms of the monarchs of the woods are showing their naked forms.

The day is calm and clear, with only a chill of winter's breath to tell us of the change and of what is coming. The blue wreaths of smoke across the Firth are lazily rising from the quiet villas of Innellan; the green, low-lying hills of Bute seem quite at hand through the rarified air, and away in the far background, high over all, Arran's Glen Sannox and Glen Rosa plainly present their grey cliffs and red scars. Turning our faces to the woods the red sandstone rocks rising above the road skirting the bay, burst prominently forth here and there amongst the bare, blackening arms of the trees. Along the whole coast these rocks every now and again crop up, rising to a height of from 50 to

100 feet; and time was when the ancient Briton paddled his log canoe along their base. How long that may be since can only be conjecture, but it is no idle dream to say that such was the case. Very recently, in a cutting for the construction of the Gourock Railway, Inverkip Street, Greenock, a bed of shells was discovered at an elevation of about 40 feet above the present sea level; and when these creatures were in life, the whole valley of the Clyde was assuredly beneath the tide. In Bute, again, I remember my father, who was for some years waterman at the old cotton mills, with a squad of men, unearthing a bed of the very same shells from the bottom of the old dam. During dry seasons, when the water was exhausted, advantage used to be taken to clean and deepen the lade that runs through the dam from Loch Fad above, and it was during one of these operations the shells were discovered, at a distance of nearly two miles from the sea. Looking, then, at the Island of Bute, and the changes that must have taken place, the present island in all probability was composed at one period of four different islands, being intersected by bays and channels at Port-Bannatyne, Rothesay, and Kilchattan Bay. Several thousands of years have in all probability elapsed since those days; nevertheless, it will be interesting to know that the same specimens found, which came under my notice, are still to be had alive in plenty. Amongst them were the *mytilis modiolus*, or common horse mussel or "Clappie Doo," as previously mentioned, and the *ciprina*. This latter shellfish is something of the Lady Fish species, but grows to a very large size, and although seldom found alive on the shore, it is a sand burrower on the banks that only ebb on extremely rare occasions, where they still exist in plenty. For several months I had a pair of this species in my tank, brought up from the ground alongside

Gourock railway wharf by the dredging machine buckets from a depth of 12 or 14 feet. But now to our specimen-hunting. Crossing the sands, and leaning well down the south jaw of the bay, we come upon the clean red sandstone of the district cropping up here and there in beds and layers. Following on nearer the lowest ebb-reach we cross occasional beds of pure sand, from which is issued now and again the spout of a sand burrower. On one of these beds our attention is directed to a brown-tipped, chrome-tinted



THE PHOLAS. SINGLE VALVE.

stalk, elegant in appearance, protruding from the sand between two and three inches. This is the syphon of some creature, and laying hold of it, an attempt is made to extract it from the sand, but without avail. The excavator is instantly applied, but to the astonishment of the operator he comes upon the hard rock at a depth of three or four inches. This was not expected, but after clearing away the sand, the rock is found to be perforated by a hole about an inch in diameter. Pushing the finger down into the hole

the water within bilges up, and the soft feel of the syphon seen above the sand is felt below. Continuing the clearing, we find, as far as we go, the rock is completely honeycombed with those holes, and we now know that we have struck upon an abode of the pholas, a shellfish of very ancient fame.

But how are we able to procure a specimen? A little patient quarrying with the hammer and chisel at the place of our first discovery might reward us; but let us follow up the layers in the shelves, of which we will have a better chance. There, within a dozen steps from us, is what we want. A few good strokes with the hammer alone sunders about a superficial square foot of the rock, and in this piece we are fortunate in securing a number of splendid specimens, and breaking the stone into several sections, we lay open the wonderful creature to view. The lower half of the valves, we notice, is somewhat triangular in shape, and the top half is a very nice oval. These are bound together at the back by a ligament, or hinge, of an elastic nature, and they do not cover one half the milk-white body of the creature, which greatly protrudes in front and both ends. The pholas is mentioned by Pliny, and seems to have been a favourite on the tables of the epicure of his day. A belief existed amongst them that the creatures can secrete a luminiferous fluid, which causes everything on which it falls to shine with a pale phosphorescence; and those who eat the animals raw, in the dark, appear in a most awe-inspiring fashion to be breathing flames.

It was also said that the same light-giving property accompanied the creatures in their living state down in their dark abodes in the rocks below; but during many months of patient watching of their habits in my tank, I could never detect a single spark of phosphorescence emitted from them

nor could I detect it in their dead bodies even up to the putrid stage.

The creature's mode of performing its

#### ROCK-BORING OPERATION

was long a disputed point amongst naturalists. Some maintained that the animal secreted an acid which had the power of dissolving stone, and other substances in which the excavations are made ; others maintained that the edges of the mantle and foot were the instruments employed, which were said to have crystals of flint thickly deposited in their substance ; others held that currents of water thrown upon the stone by a vibratile cilia with which the creature was thought to be provided was the agent ; lastly, it was maintained that by the animal rotating on its own axis, the rough rasp-like points, produced by the transverse and longitudinal lines of the shell acting upon the stone, ground the particles into powder, which was carried away from the interior by injections of water thrown in by the creature itself, and this latter theory of the mode of action is generally allowed to be the correct one. John Harper, one of the very first discoverers of the true mode of action, after describing the expansion of the creature's body in placing the valves in boring position, says—"The next act, on the part of the animal, is to place his foot firmly at the base of the hole." Now, while it is only just to say that Harper was a keen observer and a true interpreter of the creature's movements, I venture to say that in this assertion he has made a mistake. Suppose the foot is placed at the base of the hole, the valves of necessity would be obliged to scoop round the foot ; consequently, where the foot rested would be left untouched, and a core in the interior would certainly be the consequence. Looking at the construction of the tool—for the valves are

simply the creature's boring tool—as already mentioned, and as shown in illustration (p. 96), the lower portion will be seen to be somewhat triangular in shape.

Well, placing the outer edges of this portion in line, we have a replica of the counter-sinking drill, the exact work for which it is designed. This simple fact in itself is sufficient to set the enquiring mind into thinking and observation; and it is very soon discovered that, in order to give the drill its proper position to work in, instead of the foot being placed upon the base of the hole it is placed upon the side, and then the lateral movement required is more easily accomplished. From an inspection of the holes in the stone, it will be observed that the top or entrance is not exactly spherical. Why this should be found from a rotating movement seems at first somewhat inexplicable, but as has been already observed, the top portion of both valves are oval-shaped, and these influencing the shape of the syphon-tube, particularly near the base, which, when thrown out from time to time, shapes the stone accordingly. The interior again is sometimes marked with lines and little ridges, but this is due to the fact of the creature's valves having considerably grown during an inactive period; and when the new portion of this chamber is completed, the top of the enlarged valves striking against the base of the former chamber, when the syphon is thrown out for feeding purposes, leave the lines and irregularities observable within. In their boring progress, should the angle at which they began lead them into the chamber of another, as is often the case, no stoppage is made. When the growth of the shell demands more room, the boring is renewed, even though it should be through the body of a neighbour. How the creature gets quit of the particles rasped from the sides and bottom of its chamber is a subject on which naturalists widely differ.

Dr. Carpenter, Philip Henry Gosse, and others, explain it in this fashion: "The syphon being distended with water, the animal suddenly contracts it, and thus a jet is produced through the anterior orifice, which washes out the part of the cavity occupied by the animal; but as many of the particles expelled by it are deposited before they reach the mouth of the hole, the passage is found to be lined nearer its entrance by a soft mud." Harper, again, who declares himself to have been in a position to speak with some degree of certainty, says:—"During the period in which the pholas was actually engaged in boring, it continually threw out from its smallest syphon fine threads of apparently pulverised rock. These produced a very strange effect. Had my favourite been totally embedded, I should naturally have supposed, as Mr. Ostler does, that in order to free itself from the soft particles that eluded its orifice, it would contract its syphon, then suddenly extend it, at the same time blowing away the debris, and thus clearing the cavity. But such could not possibly be the case in this specimen, for the rock was shaped so that, as I have before stated, the whole of the syphons and part of the valves were always exposed, and never at any time entirely covered, even with the softened particles produced by the boring operation. This phenomenon, therefore, evidently admit of no other explanation than that there must be some pedal opening through which the creature draws in whatever collects at the base of the cavity, and expels it as above-mentioned, and this without any filtration whatever; but," he adds, "I candidly confess that I have never been able to discover any pedal orifice."

The first theory might stand good were the creatures always working in hard clay or soft chalky rock, where the entrance is always wider than required; but, I fear, it is impracticable in the hard rock. In a piece of stone in my

possession, pierced by, at least, six holes, I find they measure, on an average, an eighth and sixteenth of an inch at the top and half an inch at the bottom, through two inches of stone. In such a position, were the syphons distended by water, as described in this theory, and the tube partly exposed, as of necessity it would have to be, it would become swollen beyond its normal size, and, consequently, would press in the inside against the tapering hole, and in the outside against the outlet; and the top of the tube being closed, the consequence would be that the creature's effort would stultify itself by the swollen tube blocking up the passage. The fact of the passage being lined with fine particles of mud is no proof of the correctness of the theory. During the course of my observations I have noticed the mantle coming out with a sudden splash, and send the particles in the water dancing round, and this I believe to be partly the cause of the mud deposits in the passage. However, it must be borne in mind that the syphon tube, being lined at the base by a coarse epidermis or skin, is quite liable to gather mud on the outside, and, of course, it will be carried with it to the inside, and there deposited. But the field of observation is free, let us enter it also. Examining the foot then minutely, we neither can find any trace of an orifice; but splitting it open at the base, out pops a round, gristly, water-coloured membrane, beetle-shaped at the base, but rounding to a point at the upper end. This is a distinct membrane with no seeming point of attachment to any other part of the body; but what its work is I have not yet been able to learn. At first sight, its shape suggests the idea of a spile or stopper for some internal valve leading from the supposed orifice; but while the base of the foot is fibrous enough, the upper portion takes the shape and consistency of that organ in other

molluscs which does the work of the liver, and is far too soft and pulpy for the seat of a stone and water ejecting valve.\*

Wearied of speculation and conjecture, we turn another way. With the upper sides of the foot well separated from the surrounding mantle, we have a favourable opportunity of turning our eye further inward. There, encircling the shoulders and hanging from the base of the syphon tube, we see a number of very thin fringes, something like the texture of those of the scallop, and these are evidently armed with numerous and powerful cilia. Again we notice a long tongue-like instrument. There are two of these, one on each side, of the same material, coming down the cavity with a sweep, and returning again. On steady and close observation, we notice, attached to the tips of this tongue, the very threads spoken of by Harper. Like the line thrown by the deft hand of the rod fisher, the thread is cast to the base of the foot, then quickly withdrawn straight up out of sight. We have thus gained two important points in the field of our research, but a third is needed to complete the chain. Casting our eye along the base of the valves, we here observe the surface of the foot gathered up like a thin ring encircling the round of the shells. Taking the creature up to the surface of our glass of water, we press the foot with our finger until it withdraws pretty well within, and then replace it to watch the result.

\* Since the above observations were penned, from a further tracing of the bed of this instrument, I find that it occupies a chamber in the heart of the foot, lined with soft tissuey lining, and at its base is much larger than that of the instrument. This chamber, I am of opinion, is a store-house for the gummy liquid which makes the threads spoken of by Harper, and the instrument itself is the creature's spinning distaff. In support of this, I may mention that the point of the instrument has a half turn bend which fits into a sort of double-edged screw worm, composed of a tough scaly substance, very much harder than the surrounding material, and immediately behind the bend, and adhering to it, I noticed a fixed watery-coloured material through which the liquid threads seem to be pressed to the outside for use.

Slowly we see the ring diminishing at the edges and spreading out in a web towards the centre, and the spreading continues until the whole posterior is covered over like the head of a drum, except a neat little round hole in the centre. Here we have, in the first place, the cilia, as in other cases, the motive power for raising the water from below; next we have the tongues with their gummy threads raising the larger dust particles the force of the incoming current is unable to lift higher than the base of the foot; and, lastly, we have the posterior mantle making and regulating the size of the orifice to admit the nett quantity of water the cilia are capable of lifting; and this may be either when the foot is on its place upon the rock or when withdrawn within, as we have just observed in this case.

If these observations are not the solution of the points, it may not be counted egotistical to say that they at least point to the leading strings.

The excavating habits of the pholas families have had a powerful influence in altering the aspect of many portions of sea-board. They, of course, do not individually go more than from three to six inches deep; but one generation after another working in the same fashion, with the aid of the sea washing in and out, and wearing and tearing away bit by bit the remaining portions of the honey-combed rock, must, since their formation, have levelled and scattered vast beds of rock; and still the excavations are going on. The boring habit in the young animal is early begun; indeed, it may be said to be immediately after escaping from the spat, or egg. The smallest hole I have yet detected was about the size of a barley pile; but the creature itself must have been much less in size. How wonderful it is, then, that such a tiny object, provided with a boring tool as thin as a wafer, can, with ease, excavate for itself a home out of the flinty rock.

## CHAPTER XII.

## EARLY IMPRESSIONS OF THE BEAUTIES OF THE CREATURES.

WE have heard it maintained that people brought up in rural districts near the sea, generally have a far keener appreciation and a deeper knowledge of Nature than those brought up in inland towns. There are decidedly facilities and contact to be met with in the one locality that are not afforded in the other, which we believe to have something to do with the matter. Reflecting on the point, I cannot remember a single companion of my boyhood who could not name every tree in the woods and every bird that nestled there, even by its chirp. If "the boy is father to the man," my companions of those days who are yet alive must be Nature's children still. Dead and gone, and scattered over the face of the earth, as many of them are, one notable instance still remains in the old town. Over mountains and moors, through woods and through glens, Hugh Blair was the constant companion of those days. Poor Hugh, though robust and manly in person, had never very strong eyesight, through an early affliction of the disease of cataract, and for a number of years back he has been almost in total darkness. But go to his quiet little home in the town of Rothesay, he will still be found surrounded by the birds he loves so well, delighting him in his lonely hours with the piping strains of their sweet little voices. How tenderly and lovingly he feels his way amongst them in their breeding season when administering to their wants; and amongst his numerous flock no trait of character nor point of beauty in any one of them is missed in his descriptions of them. Hugh's joy in those early days

amongst the birds is his joy still ; and in the pleasures of our favourite study, how well do I remember, then, when receiving my first lessons, and that unknowingly, with what enthusiasm I followed my father with his fishing crew, trawling the sand-banks and shores of my native bay. Standing by the back rope of the net, with the risk of a good sousing to my little breeches, with mingled feelings of fear, amazement, and joy, I saw, for the first time, a promiscuous gathering of the living creatures of the deep come sailing in upon the wings of the net, and stretching away down into the capacious bag. What curious things of beauty were there! "Here is this, and there is that," I heard the men say ; and "This is such and such," localised names, I afterwards learned, of various creatures. In silence I got my first impressions, but many times after, in my anxiety to learn something of the strange things I saw and got hold of, my questions, I fear, partook too much of the hinderment of the work, and were not always treated with politeness.

The style of bank trawling is simply the salmon-fishers' drag system, launching forth with a long rope into the deep. The net being attached to it is shot in a half-circle, and sinks in that fashion to the bottom, through lead weights attached to the sole rope, and buoyed up to its full depth by corks attached to the back rope. The boat then returns to the shore with another rope the same length, and both sides being dragged in evenly, the net is landed high and dry upon the beach, with whatever it contains. Life is dear to every living creature, and the most insignificant of living things, both in land and sea, seem to have a dread of suffering and death. With a good shot of fish in the net, I have seen the creatures make frantic efforts to escape when they found themselves hemmed in, particularly

the round fish, some of which would leap completely over the back rope and corks ; others I have seen dash furiously against the net, and if one managed to make or find an opening, a continuous stream followed, and sailed out, rank and file, in good order, without any human-like scrambling as to which would be first. Flat fish, however, do not seem to possess the same amount of intelligence as round fish ; when imprisoned in a net they do not exhibit the same anxiety to escape, and most of them, even then, will greedily devour whatever food may come their way. In the midst of an imprisoned shoal, dashing and darting about in all directions looking for a means of escape, I have seen the common angler place himself against the back of the net, and there stow a round dozen of splendid fish into his capacious wallet, without the least concern for his own safety. The bank trawl is a complete store-house of curiosities ; and although it is now many years since we witnessed the operation, and the style, through a combination of causes, is almost obsolete here in the west, we will endeavour to satisfy the reader regarding what might be expected from such a haul.

In the near neighbourhood of the shore there are creatures who seldom trust themselves to the easily-disturbed and more broken waters of the ebb and flow ground of the beach, but constantly keep in the deep, where the surf and surge of the waves above pass over them, and cannot harm them. These are the specimens generally brought in by the trawl ; and for their capture we will now launch our small boat, and, provided with a little dredge and a forty-fathom rope, proceed to Ashton Bay in our neighbourhood.

Our boat is firthy and of steady beam—fit for the lumpy waters of this October afternoon. Reaching the bay, and

avoiding the thick bank of shells that occupies the ground a little to the south of the burn, we drop our dredge and net in about fifteen fathoms of water; and paying out the line to the angle of forty-five, with the tide in our favour, we pull towards Kempoch. With the rope in our hand, we feel she (that is, the dredge) is dragging a little roughly—sticking now and again, and then going freely; but now she sticks altogether, and seems a dead hold-fast. A little more strength to the oars, boys, and away she goes. Easing her now and again with a lift, we feel she is pretty heavy; and having now travelled about a hundred yards we ship our oars, and proceed to raise the gathered contents to the surface. Heave oh, boys! the haul is a heavy one, but we may be richly rewarded. Haul away! haul away! till here she comes! But, see what a thick white cloud of vapour she is throwing around her. Ha! we have struck upon a thick bed of slime, and we have a mass of slime-besmeared contents to inspect. Tin pans, old boots, broken crockery, and a large proportion of cinders and heavy masses of slag from steamers' furnaces are what we find; while a few urchins are the only living creatures.

But Ashton Bay is not yet filled up with such rubbish, and, like the beasts of the fields, the creatures will stick to their old haunts while they are able to live in them. Down she must go again; and this time, we hope, with better luck. There is no such thing as luck, says the unbeliever, but do not go to the fisherman with the denial. Returning to our starting point, a boat length or two further shoreward, we cast again, and this time, with an easier sweep, we soon overshoot our former distance. Heave up again, boys! haul away! and we have her soon on board. What are the contents this time? A good deal of the former rubbish, but apparently more animal life. Bit by bit we throw

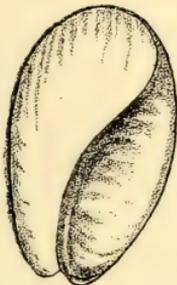
out the larger pieces of slag, cinders, and other rubbish, including an old shoe. Taking a passing glance of the inside of the latter before throwing it away, we discover, snugly ensconced near the toe of the wrinkled interior, a fine specimen of the spiky scallop or pecten—a curious repository for such a treasure. This is the first deposit for our preserving bucket of sea-water. Amongst the smutty gravel we next pick up the pelican's foot, a name derived from the resemblance the creature's shell has to the broad web-foot of the water-fowl of that name. Then comes its neighbour, the graceful wentletrap, with its beautiful shell tapering to a point in twelve finely-rounded swells, and running away as evenly and proportionately as though done by an accurately prepared chasing tool or comb. In the midst of the *debris* we pick up the *bula lignaria*, a mollusc that protrudes its soft, milk-white body out of a beautiful fragile shell, which is capable of covering only about a fourth of the sluggish creature. These are the contents of this drag; and now for a third.

With a repetition of our former tactics we soon have the dredge on board again, when amongst a number of fine starfish we lay hold of a beautiful specimen of the *portunus puber*, a crab better known by the name of the velvet fiddler. Fortunate we are this time, for here we have a fine prize in the delicate but beautiful *lima hians*, and a number of cloak anemones, with their ever-accompanying hermit crab. But, strange to say, here is a cloak without the crab. Where is the little rascal? Ha! here he is beneath those blades of sloke. He has actually deserted his companion in the hour of trouble in the hope of escaping himself; but we will see by-and-by if he does not recognise his old friend. Homeward we now steer our course, and deposit these specimens in our tank for future study.

## CHAPTER XIII.

## AT THE TANK.

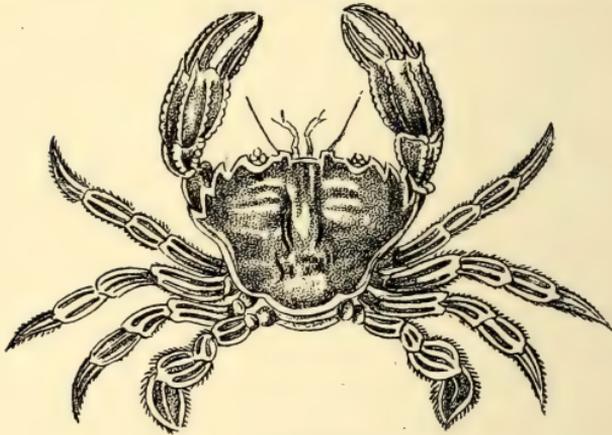
**T**WENTY-FOUR hours have elapsed since we dropped our specimens into the departments of our tank allotted for them at the time. All seem healthy, and have voluntarily taken up positions for themselves, but nowhere can we find our *bula lignaria*. Where can he have gone to? He is not of such small dimensions that he can have hidden himself in a



BULA LIGNARIA.

crevice out of the way. Ha! yonder, in the corner, is the rascal fiddler; and see, he is stowing, with both hands, the last particles of the poor thing down his greedy throat. It could scarcely be believed, but he has actually devoured, in this instance, fully a square inch of soft matter, and the pretty shell of the creature is all that is left behind on the floor of the tank, scooped out as clean as if done by the lancet of the chiropodist. It is dangerous, at all times, to leave any of the crab tribes with their weaker neighbours, for they are sure, at some time, to devour them, and none more so than the fiddler. He is the most pugnacious of the tribe; nevertheless, from his dress and other qualifications,

he is the gentleman of his race—the “aristocrat,” as some one calls him. Armed, on the one side, with a pair of sharp, powerful nippers—in which he seems to have great confidence—and on the other, having three legs, on each side, between, with a pair of beautifully constructed paddles, with which he can raise himself from the depths below, and, leaving his envious brethren behind, skim along the surface of the sunny sea. His flight through the water, in an upward course, very much resembles the flutter of the butterfly; but in his diagonal downward course his motion



VELVET FIDDLER.

is as graceful and smooth as the flight of the swallow. Here, in a convenient spot in front of the glass, our beautiful *lima* affords us an interview. How such a fragile creature escapes the devouring jaws of the numerous cannibals it lives amongst is something of an enigma. To the naked eye its beauty is apparent; but let us apply the lens. The slightly corrugated valves, which are of a light grey colour, and shaped something like those of the mussel, are surmounted all round, when closed, by a beautiful thick fringe of tentacles or arms. These are insectioned through-

out their whole length, and used in swimming or locomotion purposes. Turning over on its back, a position in which it seems to have the greatest amount of freedom, the valves have the power of opening to a very wide capacity, and then the tentacles, stretching out to their fullest extent, hang gracefully all round and over the valves like stalks of waving rye. In this position the beauty of the creature is very fairly seen; beneath the tentacles, the mantle also protrudes beyond the valves, and shows a surface as soft and mellow as the cheek of the peach. Deeper in are the interior organs, some of which very much resemble those of the scallop, and these are lined with the crimson and pink blush of the rose. In the swimming movements of the creature, the arms are thrown forward and drawn back with a sweep towards the side, in the very same fashion as the movements of the arms of a human being when swimming. The insectioned condition of the arms, just as if cut in a lathe with a comb, facilitates the movement, and it is wonderful the speed that is attained. At every stroke the creature is sent fully twice its own length upwards and onward, but sometimes in a circuitous course. Altogether the *lima* is a wonderful creature, and a most interesting object in the tank; but, like the fragile flowers of the field, confinement soon blights its beauty, and brings it early death.

Turning now for a look at the scallop, our friend of the old shoe, we are surprised to find him sticking upon the perpendicular end wall of the tank, about three inches from the bottom. What keeps him suspended there? and how did he manage to climb to the point? Fortunately for the first problem, we are able, from his position, to ply the lens without interfering with him, and we at once see that he is actually held in his place by a byssus of three or four

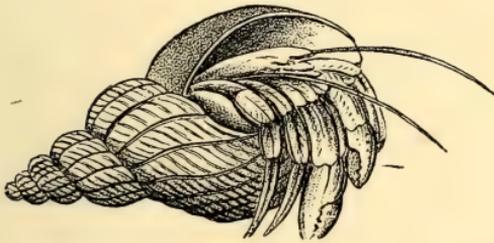
threads, far stronger and as flexible as those of the mussel. With the hinge portion of the valves upwards, and hanging slightly diagonal, we see the threads are attached to the shell in the little orifice on the side of the square, close to the hinge. Hitherto I have not observed this peculiarity in the scallop, and whatever may be said of the other branches of the family, this one, at least, is decidedly a byssus spinner. Regarding the second problem, viz., how did he climb to the point? I may mention that, after detaching him from his position and placing him on the bottom near the same spot, the only movement I could detect was a slight opening and closing of the valves; the opening being accomplished very slowly, and the closing in the usual quick fashion, just as if for the purpose of surveying the coast, or, in turn, taking stock of the movements of the watcher. For hours the shy fellow would not move; but next morning I found him again suspended to the old spot, and, on the morning of the second day, had broken himself adrift and lay again upon the floor of the tank. In spite of all my vigilance he baffled me out of the secret, but I suspect that, with the aid of his tentacles or arms, some of which are elbowed and furnished at that point with something like a sucker, he is capable of dragging himself even up the surface of high submerged perpendicular rocks, and fixing himself with his byssus in any position he pleases, and again breaking himself adrift at will.

Looking now to the condition of our

#### HERMIT CRABS,

we notice one large fellow, who has taken up his abode in a goodly sized buckie shell, scampering about in an uneasy, suspicious fashion. He is brewing mischief for his fellows; but for the preservation of our more valuable specimens, we

will set him free once more in the depths of his native element. Taking him down the rocks, to the verge of the sea below, to give him a better chance of getting beyond harm's way, we give him an easy pitch out. This is a new experience for master crab, but he does not relish it—an aerial flight inspires him with mortal terror; in his plight he knows he is in no way bodily attached to his temporary home. Unfixing then his claw-hold of the interior apex of the shell, he springs out of the horrid place, and drops like a stone into the sea, while the shell falls half-a-dozen yards beyond. This is rather a tragic parting with his shelly



HERMIT CRAB IN SHELL.

protector; will he have any chance of recovering it? This question reminds us that we have another crab and a cloaklet separate in our tank, which we found in our dredge contents. Let us now bring them together, and wait the result.

While thus engaged, we have a favourable opportunity of viewing the crab's construction. On the right we notice he is armed with a long, powerful nipper, and on the left with another of the same construction, but not half the size of the former; these are his war implements, and behind them, on both sides, he has a pair of legs which he uses exclusively for locomotive purposes. On the top of his

head, perched upon the summit of two stalks of considerable height, are his two large revolving eyes, capable of turning in any direction. On a line with these are two very long amber-coloured tapering feelers, regularly jointed, and furnished between the joints with a number of ciliate barbs. Beneath, again, and immediately between the eye stalks, are two arms, or rather hands, for the extremities of these very much resemble the four fingers of the hand enclosed in a fingerless glove, while the thumb is free and stretches to about the length of the middle finger. Beneath these again, springing from the long jaws on each side, are a pair of branched arms, furnished on the tips with fringes of bristles; and beneath all are the two long half-doubled up jaw feet, also furnished with a set of bristles or brushes. Looking into the interior, we see the jaws are armed with a single row of sharp teeth, resembling in shape those of the shark, about twelve in number. Beneath the rows of teeth, on each side, is a thick fringe of fine hairs, something like the fine gills of a small fish; and under these again is another row of teeth, far more delicate than the upper ones. And, lastly, running the same length as those above, is another fringe of hairs, showing a still greater degree of fineness. Beyond the legs and arms is the tapering soft body, the extremity of which is provided with a calcareous chisel-pointed tip, with two membranes, resembling the claws of a bird.

Turning to the cloaklet, we see it presents the appearance of a miniature wren's nest, with an entrance hole exactly similar, but it is composed of a tough, skinny substance. On the top, its colour is a dull brown, but sinking away below, it brightens into a soft milky whiteness, while all over it is transpersed with spots of a pretty light crimson. Beneath, in the centre of the white, near the

edge of the entrance hole, is the anemone, with its projecting disc encircling its white waving tentacles ; and at the opposite side the cloak encircles the outer lip of a common black whelk, which is so neatly and firmly attached that it seems the termination of a complete whole.

We have now gone the round of the construction of both, and the crab still shows no signs of recognising the cloaklet. Perhaps the quiet life of the tank has weaned him into indifference ; but we will try the effect of pushing the cloaklet a little nearer. Ah ! the movement has scared him to the opposite direction, but he quickly returns and stops short by the side of his old friend ; he then makes a slow circle round, as if inspecting the security of his old abode, and this time stopping at the mouth of the hole, he elevates his hinder part, and with an adroit jerk of the legs, launches backwards into the cavity, and in a twinkle the whole body follows.

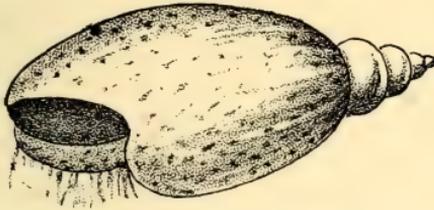
Now that the union is once more completed, we will fence the crab into the corner next the glass, where we can have a view of him through the lens. The first thing that attracts our attention is a strong current of water flowing in towards the breast of the creature immediately above the branches of the foot jaws. Tracing the source of the current, we find it to originate from the two branched arms at the roots of the jaws, which are plied up and down at a great velocity, in the same fashion as two switches in the operation of carpet-beating. These two arms, furnished as we have already described, with fringes of strong hairs, beating the water with such velocity, send it down through the fine hairs of the gills below ; and each pair stopping and beginning alternately keep the current going, which serves the double purpose of feeding the respiratory organs, and sweeping round the chamber behind, escapes at the top with whatever

*debris* may accumulate within. Next, our attention is drawn to the two hands. On a more minute inspection of the formation of these, we notice the arms are furnished with shoulder and elbow joints, which enable them to stretch up or down, out or in, or in any direction whatever. Looking at the hands again, what we have likened to a fingerless gloved-hand is a double-fringe of fine hairs; and these, when extended, form an eclipse opening or cavity, surrounded by a perpendicular wall of hairs arranged in mathematical order. The movements of these appendages next engage our attention. With a sudden twitch they are now thrown out right in front and as quickly drawn in. Again they shoot out like a dart above, next they flash to the right, now to the left; then for a time, with little movement of the arms, they jerk, jerk forward, similar to the action of the head of hungry barn-door fowls when picking up the scattered piles of corn thrown to them.

And what is the meaning of all this? Each movement, we can see, is accompanied with the opening and closing of the hand, as if laying hold of some object. The particles in the water observable to us are not the objects, for they fly past with the current in all directions, but go by unheeded. What, then, can it be? Evidently animalcules; and we see that when the hand gathers a sufficient quantity it sweeps down into the jaw feet brushes, and after being stripped of its cargo returns to its work again. I think, therefore, the wonderful mechanism of the hands, in conjunction with their movements, puts it beyond dispute that their chief work is the capture of animalcules, and possibly those of a particular kind, and for a particular purpose; and the feelers, armed with their barbs, seem to perform the same work, for, while they are constantly moving about, occasionally they are thrown out to particular points, like

a line from a fishing-rod, then quickly drawn in, and also stripped through the brushes below.

From these observations one thing, we know, is certain, and that is, that this crab is possessed of a wonderful power of vision. The eyes, perched upon the top of their stalks, overlook the situation ; and seeing the objects advancing in the current, directs the hands to the point of capture. This, of necessity, must be the case, for the eyes, in the movements, can be the only guide, and each eye seems to guide the action of its respective hand. How great, then, must be the power of sight, when these minute objects are so plainly seen, which, even with the aid of a powerful lens, we are ourselves unable to discover.



CLOAKLET AND WHELK SHELL.

The connection of this specimen with the cloaklet is confined entirely to itself ; and when the attached shell becomes too small, and necessitates a removal to a larger house, the intelligence displayed by the crab is most wonderful. The cloaklet is first induced, by some means, to relax his hold and leave the old home, and is then carried to the new one. The claws, or nippers, of the crab, then lay hold of the fringe of the cloak, and place it on the inner lip of the new shell ; and when the adhesion begins, it runs round the inner lip, then, doubling over the edge, fixes on the outer lip with a firm and permanent grasp. The shell is selected out of a knowledge of its fitness for the require-

ments ; but sometimes the cloak develops as rapidly as the crab, and the small shell is retained, as shown in the accompanying illustration.

In this case it was the common black whelk, but it served the two purposes for which the univalve is chosen, viz., to allow the crab to insert the claws of its soft hinder body into the interior screw passage of the shell, thereby giving it a purchase to withdraw itself within the cloak when danger approaches ; and when being dragged along the rough, stony bottom, to keep the cloak from wearing into a hole, thereby preserving the soft body from being exposed to the danger it otherwise would be. The foregoing sketch conveys to the reader only a very imperfect description of the intelligence, beauty, and intricacy of the mechanism of this creature. He is the prettiest of his race, but there are others equally interesting.

Travelling along the shore, we often see in the clear pools of salt water, in the basins of the rocks, what appears to be the little yellow whelk, startled by our shadow, go scampering across the bottom, making for the sheltering *algæ* on the sides. These shells are often less than the size of a pea, but instead of the occupants being the original *litorina*, it is another branch of the same crab family as the above, known by the name of the bernard. From the occupancy of these small shells they flit from time to time, as the growth of the body requires, into larger ones, until they reach the size of the largest buckie shell. The selection is invariably those that have been recently occupied by the original inhabitant ; and if an empty one cannot be found at hand, a living occupant is victimised, and his garments appropriated. Like all others of the crab tribe, he is one of the great army of scavengers, whose carnivorous natures may be said to be the wisely-established permanent

machinery of the sanitary department of the shore. The intelligence of the bernard is equal to that of the others, but he is extremely timid, and easily frightened into his shell. With all his cunning, however, he is often caught napping, and becomes the prey of his quicker moving neighbours.

The idea of using the crab as a living bait for the capture of the cod, which so readily devours it, is possibly not a new one. In putting the idea into execution, here is the experience of a Gourock fisherman of keen, observing habits, and thoroughly experienced in fishing matters:—“After extracting the bernard out of his shell, which is sometimes done at the expense of drawing him to pieces, so great is his hold within, with great care,” said the fisherman, “I fixed the crab to the hook of my hand-line with as little injury as possible, and sent him down to the bottom. For a time I waited for the coming nibble. Once or twice I felt it faintly, and raised my hand in the usual striking fashion. No indication, however, of a fish being hooked came until my patience became exhausted, and I then raised it from the bottom. On examining the crab, I found it as before; but, to my astonishment, I observed that of the three strong gut-hairs twined together that bound him to the hook, he had cut through two of them. A short time longer would have been sufficient to set him free, and how his escape was effected would have been a mystery to me.” It is said that instinct and reason are the two boundary lines between man and the brute. The impulse and promptings of Nature undoubtedly direct the actions of the brute; but, as in reason, where a means is used towards an end, as it decidedly was in this case, it is difficult to perceive the distinction.

## CHAPTER XIV.

## ON THE UPPER REACHES OF THE CLYDE.

**I**N pursuit of his study, the zoologist of the shore is occasionally lured from the beach to the banks of the streamlet, where many curious creatures are also to be found to take up his attention. Some insect life he may there see, while the summer sun is beaming, rise from the depths of the stream into the air like little winged sprites. Some curious forms he will observe lolling in eddying nooks, waiting the development of a more perfect life. Other strange looking things he will see, like Jack in the box, with their comical little heads popping in and out of small tubes of vegetable material, in which they are nestling, and rolling now and again along the bottom like so many little merryandrews down a sunny brae. Up the stream he is intuitively led with the minnows and the trouts, ever discovering new objects of admiration, and gaining to him a hitherto unknown knowledge of other creatures in this teeming world of ours. So far we have already wandered from our old paths along the sea shore, but while our footsteps, on this occasion, lead us inland, we may be none the less profited by the short digression.

To the lover of the picturesque grandeur of Nature, few localities throughout the length and breadth of bonnie Scotland can have greater attractions than the upper reaches of the Clyde, where we now find ourselves. It is prime July, the smoke-begrimed denizens of the great city, yonder behind, have been let loose for the enjoyment of their well-earned holidays, and a number of them are here. Perched upon the side of the little woody eminence on the

mouth of the Bonnington Linn, what a picture is before us! Yonder, 'neath the green banks beyond, on the verge, and even out in the middle of the yet unbroken breast of the amber coloured stream, we watch the movements of a number of fishers busily plying the rod, and basketing an occasional trout. On comes the rolling river till it sweeps in bend and curl, over the broken shelves in front. Here is the photographer setting his camera for an impression of the scene. There is the artist, with pallet and brush, fixing on his canvas the tones that Nature's training alone can give. Past us, on the right and on the left, the surging waters rush and dash with deafening din over the foaming falls.

It is hard to believe, as some assert, that there has not been a throbbing in the heart of Nature and a rending of rocks here, as witnessed in those towering adamantine walls of that awful chasm, whose giddy crown is clothed in peaceful woods, and at whose base, a hundred feet below, the river steals its downward way, gathering strength as it goes for the leap of the Cora Linn beyond.

“Men may come, and men may go,  
But I go on for ever.”

Such is the ceaseless roar of those great falls, while the breath of their deafening voice, rising in veils of vapour, spreads a fresher tint of green over the towering folds of verdure surrounding the romantic but dangerous rocky heights. Onward, through charming woods, we note the course of the stately stream till Stonebyres Falls renew the ceaseless roar. From this point, through the Eden of Scotland, the Clyde meanders on her seaward way; but near at hand, by the quiet, dreamy village of Hazelbank, let us now see what can be found for our instruction.

Descending to the bank we step out into the river upon a little shelf of rocks, whose rounded ridges, just now, here and there, rise above the surface of the flowing stream, and hold within their keep a few quiet pools of clear water. The quick running ripple of the river has no living thing to reveal to us that we can see, and we turn to the pools. Lined as they are with a coating of dark-green herbage and moss, to the casual visitor there is nothing else to discover in them, but the practised eye of the zoological student, with a little attention, soon descries the familiar form of the *litorina*, or common yellow whelk of the shore, in his little fresh-water brother the *paludina vivipara*. The shell is a little larger than the garden green pea, but is found in other waters very much larger, and possibly may be so in other parts of the Clyde. The shell is very brittle and extremely thin, and is of a dark skin-colour, tinted with a light tinge of sap green, consequently, on the spots it frequents, it is not very easily seen; but it seems to be plentiful here, for a handful can be gathered in a few minutes. Let us now take the creature up, and placing him in our glass of water, apply the lens. First we note the absence of the *operculum*, or lid, as in others of the same family, and also those of our salt-water tribes; and if there be anything of the kind, it must partake very much of the colour and consistency of the creature's body. We have not long to wait for him coming out of his shell, and applying the lens, we see, as shown in the accompanying illustration, that the foot is somewhat heart-shaped, and of a sickly white colour. Immediately above the centre of the top edge of the foot is the mouth, which is the same shape, and opens in the same fashion as his salt-water brothers, showing the rasping tongue sweeping round the herbage on which he browses. To the right and left are the cheeks,

surmounted by a semicircular ruff, which recede to the head proper; and we notice that the head is furnished with a pair of small bead-like eyes, placed considerably apart, and near the roots of the horns. These latter appendages, though properly enough called horns, are more like the ears of the owl in shape, and from particular points of view, the head altogether very much resembles that of the antic appearance of that member of the feathered tribes. All the specimens of these creatures I examined I found the ruff surmounting the face to be adorned with what appeared to be a row of tender tentacles of a very active nature, but



THE PALUDINA VIVIPARA.

on a closer watching of these they are found to be parasites, living upon the tender body of the creature, for each in turn will be seen to leave his upright position and wriggle away to another part, where a hold is made again, and the same posture taken up as before. From some cause or other, whether permanent or not, these whelks seem to be the prey of those worm-like parasites, for from the body of one specimen I saw a parasite emerge, as if boring itself out, and fall in a helpless condition to the bottom of the glass, where it continued to live for a time.

Like his brother of the shore, the *paludina* is an egg-producer, and these tender and minute things are wonder-

fully preserved and propagated. Attached to the inner portion of the shell, and streaming out like the end of a plaid flung over the shoulder, is a fleecy, transparent sack, which contains from eight to a dozen beautifully elongated eggs, and each of these again, also almost as transparent as the water, contains a living creature in a state of incubation. The attachment of the sack to the shell is a wise provision of the Creator's, to provide for the safety of the young in this state from being swept away and destroyed by the strict running current or lashing of the waters through storms in which they live, which otherwise undoubtedly would be the case.

Having nothing else to attract our attention here we now step ashore, and with aimless intent saunter towards a row of cottages a little further down the bank. An assortment of stones and other curios upon the outside sill of a window is a common enough thing, indeed, but there is something in this gathering here—on this one in front of us we have now arrived at—that instinctively draws us to it.

“What are these, ma'am, you have got there?” is our first question to the lady of the house, who is drawn to the door by the appearance of the stranger.

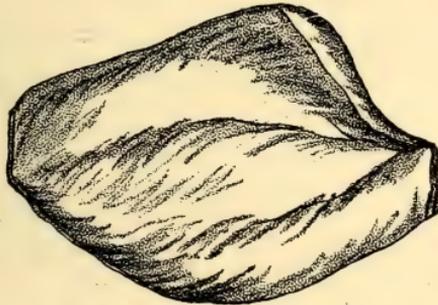
“Thae are stanes, sir, ma husban' brocht hame frae the pit up by,” is the frank reply.

We are now joined by a young, burly son of the mine, seemingly anxious to have a share in the conversation. Reaching forth his hand, and picking out from the heap a round stone several pounds in weight, “Isna that a caerious ane?” quoth he. “Whaur dae ye think it cam' frae?”

“Well, it is not a native of this locality. It is simply a chip of the grey granite from some far away hill; and if it was not brought here by the hands of man, it was by

another agency many thousands of years ago. Its round, polished appearance is due to the action of water, and it is quite possible that may have been by the salt sea waves."

This explanation is evidently taken as a bit of romance. But here our conversation ceases, for at this moment our eyes are again cast upon the stones, and to our great astonishment we discover, amongst other trophies from the mine, about a dozen fossil specimens, in splendid order, of the *anthricosa acuta*—one of the families commonly called gurrachans here in the west; but the shells are smaller and more triangular in shape than those presently found



FOSSIL ANTHRICOSA ACUTA.

upon our shores. "Would you part with one or two of these?" is our request from the good lady. "Ye can tak' them a', if ye like," is her smiling reply, without even a hint of dropping a copper to the interested urchins who now surround us. But our prize is too great a one not to keep the urchins in remembrance of it, so we secure it in triumph by possessing ourselves of three of the most perfect specimens of the lot. Trifling in themselves do these fossil shells appear; but what a story of old, old Scotland do they bring us from the depths of the mine—of old, old Scotland through the misty ages of antiquity. Hugh Miller, in his "Cruise of the Betsy," says:—"Judging from its

components, the Long Island, like the Lammermoors and the Grampians, may have been smiling in the sun when the Alps and Himalaya mountains lay buried in the abyss ; whereas, the greater part of Skye and Mull must have been, like these vast mountain chains of the Continent, an oozy sea-floor, over which the ligneous productions of the neighbouring lands, washed down by the streams, grew heavy and sank, and on which the belemnite dropped its spindle and the ammonite its shell." Speaking in the same strain, the geological account of Taylor's *Pictorial Scotland* says :—"Twelve hundred feet on the slope of the Lomonds, or high up among the sources of the Nith, near Cumnock, and we tread the shores of a former sea—the shells, corals, and drift-leaves, all embedded in its sands, and all still as perfect and beautiful as when washed and stranded up by the last ripple of its waves. Thus

‘Earthquakes have raised to heaven the humble vale,  
And gulfs the mountain’s mighty mass entombed ;  
And where the Atlantic rolls, fair continents have bloomed,’

is not to be regarded as the mere exaggerations of the poet, but the warrantable deductions of the man of science."

On the shores of the Clyde's once inland sea, these shells lived and moved and had their being ; and that very possibly may have been long before the "Fossil Grove of Whiteinch" spread a green leaf to the summer's sun. Throughout these countless ages they have lain entombed with the rich deposits of the carboniferous system, while these deposits were preparing and consolidating for the use of God's creature—man. Yet how strange the story—by the power of self-made laws, one man here and another there, even in this enlightened age, dare to claim them as their own.

## CHAPTER XV.

## ON THE GIRVAN SHORE.

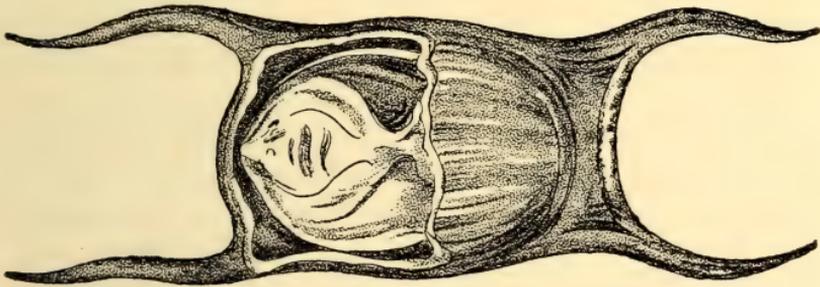
WE have journeyed to the quiet old town of Girvan, well down the Ayrshire coast. Few towns in the west afford the zoologist of the shore, and the naturalist in general, a better chance of studying Nature in her many phases (including the creatures of the deep) than Girvan. Situated as it is on what may be termed the very mouth of the receding ocean, its fisher inhabitants have no lack of fishing-ground to select from on that great bank, reaching from Pladda in the north to many miles beyond the Craig on the south, from where, in their respective seasons, all kinds of fish are brought to the port for disposal. In the summer months the herring fishing is prosecuted successfully. The turbot is also caught with long shallow ground nets. The stake nets along the shore also indicate the presence of the "king of the seas," the salmon; and when the long-line fishing begins, the common victims of the hook—the haddock, whiting and cod, with the numerous concomitants, large and small, capable of seizing a bait—are here in plenty, and always with a curious and interesting stranger or rare specimen in their midst. Sauntering down to the beach, on the south of the little narrow harbour, immediately behind the jetty, we see from the distance of the ebb that the rough, stony ground there is a good hatchery for the whelk tribes and other shore specimens. Amongst the large wrack-covered stones and pools our attention is drawn to a young lady, with a neat little basket in her hand, diligently searching for something. What is the object of her search? As we approach

we notice her little basket is half filled with sea weed, and we now see she is selecting particular specimens of the vegetation of the shore. Her choice seems to be centred very much in the pretty little *bryopsis* and the common caroline, little feathery branching plants which, when preserved in a clear glass bottle of sea water, present a beautiful appearance. Our young lady has found a healthful occupation and also a useful one. Her object is the preservation of the plants in the same fashion as the flowers and ferns of the fields are preserved in the flower albums of the lovers of Nature. Commendable pastime. Would that our coast-going young ladies would emulate it more. It would, at least, give their cheeks a ruddier glow.

Continuing our course down the long sandy stretch, almost the only traces of life we find are the little rope-coils of sand sent up to the surface by the worms below. A few shells and the scattered limbs of a crab are all we meet with on the surface of the clean, firm sand; but see, there, rolling on the lip of the gentle ripple, is the complete body of a weakling, namely "the sea adder." Something possibly he has devoured has sickened him to death, and he has sought the shore to die. This is a strange peculiarity in the creatures of the deep; when they find death approaching they make for the shore. The reason no doubt is when they become ill and unfit for the competition of their active life, they seek an obscure nook in the quiet waters of the shore, to be beyond the molesting jaws of their fellows, in which to die in peace. When the creatures of the deep become ill they have very little sympathy from the strong and healthy, but are tossed aside or torn to pieces and devoured. Even in the quiet waters of the tank I have seen the dying weakling tossed about by the strong ones like an old shoe, just as if for sport; but sometimes I have

thought they were actuated by the desire of putting the sufferer quicker out of pain.

On such a beach as this some of the rare curiosities of the deep are frequently to be met with, and now we are fortunate in securing one of them. What sort of strange thing is this? From the accompanying representation it will be seen to be shaped something like a little hand-barrow, with the four arms stretched out to a taper, and the body bilged like a cushion or purse. The colour is nearly black, and the texture is a tough, leathery substance, about three inches over all. This is the egg of the skate



SKATE'S EGG.

or ray, a fish that attains a pretty large size, particularly the thornback species. For many years the outlines of a specimen of this tribe, measuring about eight feet in length from the tip of the tail to the snout, were to be seen portrayed upon the boards of a boat-shed on the shore of Ascog Bay, Bute. This specimen was captured by the late Sir William Murray of Auchtertyre, Perthshire, a gentleman who indulged in the pastime of deep-sea fishing, and was the occupier of Ascog Hall at the time. When taken with a hook and line it is sometimes very difficult to raise this fish. When they feel themselves being drawn up, they flatten upon the bottom, and with the aid of their fringes

of wings and the flat under-surface of their body, they are able to form a cavity which acts as a vacuum, and which often defies the strongest hook and line gear to unloose. Sir William's plan was to drop a heavy sharp-pointed iron weight, attached to a line, upon the animal's back; but from the information of my late father, the plan was not a successful one, the weight being invariably carried off its mark by the current of the tide through which it had to travel.

We have now reached the southern end of the bay, where the rocks of the district begin to protrude their rough forms. The largest one, which no doubt is in possession of a district cognomen, attracts our attention. From its approach we notice it is inaccessible during high tide, and when we get upon its top, we at once see it is a fine study for the geologist. From the depths of the sea the trap dyke rises like a wall, several feet in thickness; and the same arrangement prevails on the shoreside, enclosing within a conglomerate mass, mixed with pudding stones, black, brown, and grey, that had been rolled smooth by the sea on some unknown shore thousands of years before; and these, interspersed with nuts of jasper, rise to the very crown of the height. Being exposed to the action of the sea breaking over it, the whole mass presents an extremely aged appearance.

The incoming tide now debars our further progress, and only leaves us time, before retreating, to note the objects of the surrounding scenery. From the south, the mountain range before us, stretching away inland, rises to the sky line in beautiful green knolls and pleasant braes. At their base lies the fertile valley of the Girvan, with the smoky chimneys of the dreamy old town on the verge of its bosom. Over the peaceful sea, far away in the western horizon, rise

the blue peaks of Arran. And out yonder, on our left, are the sea-begirt crags of Ailsa Craig, for our voyage to which we now hasten to prepare.

#### TO THE CRAIG.

It is easy to procure the services of a boatman in Girvan to make the voyage to the Craig. But since the lighthouse has been established upon it, a regular boat service, once a week, is kept up with the place. By this means we secure a passage, and now, under the care of two hardy seamen, we are paddling our way adown the little narrow harbour towards the open sea. Our craft is a powerful skiff, provided with an ample spread of mainsail and jib, which, with a puff of the indispensable breeze, is capable of landing us at our destination in something less than an hour and a-half. The sea is as calm as glass, but well out from the land we have hopes of getting our sails filled; the air, however, flattens down to not a single breath, and our hoisted mainsail hangs as dead as a wall, save from the movement of the vibrating swing of the oars. "Whistle on the wind, Johnnie," in imitation of the superstitious sailor's belief, is the jocular advice of skipper Girvan to his little son, who happens to accompany us, and is seated at the tiller; but no amount of hornpiping is capable of invoking a breath to our aid. Under a broiling sun we are doomed to tug the whole distance with the oars, and while sympathising with the sweating labouring wights before us, we are selfish enough to console ourselves with the thought of having the luck of being here on such a day, rather than that on which we might be considered something of a Jonah on board. Under such labours the distance, about ten miles, is a long, weary fetch, but gradually the cliffs of the mighty rock become more visible, the birds on the water

and in the air more plentiful, and, at last, we are permitted to stretch our stiffened limbs on the wild shores of

## AILSA CRAIG.

Across the sunlit sea, ten miles away,  
'Mid sweltering heat we've rowed our bark to-day,  
And now we stand on Ailsa's shattered shore,  
Her wild stupendous grandeur to explore.  
When down the mists of time, a younger world,  
From out her fiery heart, great mountains hurled  
Beneath these watery depths, a vast abyss,  
'Mid the volcano's awful boom and hiss,  
A steaming pyramid, thou hadst thy birth.  
Great Ailsa Craig, shot up from ancient earth,  
Sheer from the sea those awful cliffs arise  
In crags and shelves, high towering to the skies,  
Where nestling seabirds, scream in hideous din ;  
Whose aerial flight obscures the noonday sun ;  
Home of those winged wanderers of the sea,  
From far-off oceans they return to thee.  
When those broad shoulders of thy ample form  
Of yore were veiled in gloom amidst the storm ;  
The mariner, save by the breaker's roar,  
Knew not thy wild, inhospitable shore ;  
But now, through dangerous mists of night or day,  
The Craig's foghorn proclaims the perilous way,  
And through the darkest inky veil of night  
The sailor sees thy flashing, friendly light.  
Fixed is thy ocean throne, until that day  
When earth and sea, great rock, shall melt away.

Our landing-place is at the north point, where the Lighthouse Commissioners have erected a little wooden jetty. Immediately above this is the tenant's house, and a little further on is the gaswork of the lighthouse ; and the lighthouse itself as far seaward as it could in safety be placed. This is almost the only spot of level ground the shores of the Craig contain—some acres in extent, but a perfect

wilderness of stones. At one period of its existence the perpendicular cliffs of the whole rock were entirely surrounded by the sea, as they still are at some places during high tide, nevertheless the visitor, with much trouble and caution, can travel round the entire shore, which is about two and a quarter miles in circumference.

Taking our course down the eastern shore, we are saved the laborious trouble of picking our way over the wilderness of sharp-pointed stones by taking the little cindered path, made smooth by the lighthouse folks, as far as the south foghorn. Passing along the base of the beetling crags, we come upon occasional small colonies of birds nestling and flitting among the rocks above; but when we come to where the foghorn is placed, we are brought to a stand in wonderment and awe at the sight of the great towering crags before us, and the huge masses of fallen rock that overhang the sea, where, as thick as they are able to stand on the smooth crowns of these great rocks, are myriads of antic-looking puffins, sitting bolt up, and looking at us as comical like as little clowns, and seemingly quite unmindful of our presence. Below, sitting on the rocks and stones, and paddling about in the sea, are immense flocks of white-breasted gulls—young and old, great and small. A stone thrown in the water amongst them sends them into the air, accompanied with the puffins—a thick cloud of fluttering, screaming things, hiding, for an instant, the very sun before us. At the base of the cliffs, along the stony path, up and down, we still pursue our way, until we arrive at what is called the Main Craigs; and here the great hatchery of the eastern side is reached. “What a fearful place!” is our silent ejaculation: giddy precipices of perpendicular wall; square, massive, towering pillars, rising hundreds of feet, up, and up, and up; deep rents and chasms, projecting

shelves and squares, and sheltered crannies and nooks. All over these, where a pair of birds can find space for planting a nest, there they are in countless numbers, nestling or standing beside their mates, or feeding their young, while thousands are flying and circling in the air overhead, coming with their captured prey from near and distant parts of the sea, and returning for more. And what a volume of deafening sounds commingling in hideous clamour! But in the midst of the confused din the voice of each species of bird can be distinctly noted—from the shrill squeak of the gull to the hoarse croak of the puffin—while most conspicuous of all is the speaking voice of the kitiwake, crying out its own name in as many syllables, and repeating it time after time. Turning away from the scene, our ears are still followed with the curious medley of sound, and more than once we are brought to a stand, and compelled to look back to discover the dog that is barking after us, and the person who is calling our very name.

Looking at the great mass of fallen rock between us and the sea, then gazing up on the overhanging, toppling-like crags above us, from whence these masses came, we are inspired with an uncomfortable feeling of insecurity. They have fallen before, and others will fall again, but our silent prayer is, may we view the fall thereof at a respectable distance. Continuing our course, we pass two caves of considerable dimensions. The first is called MacMall's Cave, after a famous smuggler of that name, who is said to have used it as a hiding-place for his contrabrand goods. It runs into the rock a distance of 113 feet. The next, a little further round, is named the Mermaid's Cave, extending to its innermost recess a distance of 142 feet, while its height, in the middle, is 36 feet.

Round the rough, stony path we plod our perilous way,

until we arrive at what is called the West Craigs, the highest pinnacles of these fearful rocks, which rise to about the same height as Tennant's stalk in Glasgow. Here the cliffs may be said to be literally alive with birds, including all the species of sea fowl that frequent the place—the kitiwake and other gull tribes, the gannet or solen goose, cormorant, gillimot, puffin, razor bill, and the little stormy petrel or mother Carey's chicken. We are informed by our boatmen friends that the birds begin to come back between February and March; and by the end of October, of all those vast family flocks, only a wandering gull is to be seen here and there. But what wonder! for the high, bare, shelterless rocks are so exposed to the wintry blasts that no living thing could find rest upon them. From the same source we learn that a number of years ago the present possessor, the Marquis of Ailsa, imported into the island a number of badgers and racoons, and since then it is alleged that the birds, particularly on the Main Craigs, have greatly diminished in numbers. The badgers are said to be now extinct, but the racoons are still in existence, and being fearless crag-speelers, during the nesting season their well-known proclivity for eggs will have ample opportunity of being satiated, hence the alleged diminishing of the birds.

Rounding the cindered path of the north foghorn, we speedily arrive again at our starting point. Looking up the precipitous breast of the ascending steep, a little beyond the keeper's house, we notice a footpath tracking up the rocks towards an old castle. What on earth the object of its founders was in planting the ancient keep in such an inaccessible spot is, to us, in those peaceful times, a source of wonderment. Like an eagle's eyry, half-hidden in the clouds, it suggests the idea of a prison rather than that of a fortress or a place of residence.

Casting our eyes above to the crown of the height, 1114 feet from sea-level, we see a motley flock of birds circling and wheeling in the clear afternoon air, little bigger than swallows, in the distance. Our time will not permit of a visit there, to view the far-stretching scenery from that vantage point, and afford us a peep at the flock of wild goats that browse upon the crags and occasional green patches of herbage that are to be met with above. For these, and a more detailed account of other matters that would be foreign to these pages, we commend our readers to a little work on Ailsa Craig recently published by the Rev. R. Lawson, Maybole.

We must now direct our attention to the creatures of the shore, but where the ebb is so precipitous, few spots, indeed, can be found suitable for the work of our enquiries. With this object in view, we step upon the little landing-stage stretching out a few yards upon the lip of the deep, blue abyss of waters beyond. Scanning the bottom as far down as we can, we see no signs of any living thing; but here, in about six feet of water, we discover a fine specimen of the five-rayed starfish, which we can easily bring up with the boat-hook; and very close at hand we also notice the prickly urchin. These two creatures are said, by some authorities, to be very closely allied, on account, we suppose, of the sucker-arms of both being somewhat similar. But in the same sense so might it also be said of many widely-different species of the finny tribes; besides, the one is a crustacean and the other is not. Their mode of travelling, however, is somewhat similar, stretching out their sucker-arms, and laying hold of objects and dragging themselves along. The starfish is one of the great scavengers of the sea, refusing no kind of garbage that comes his way, and a most voracious creature.

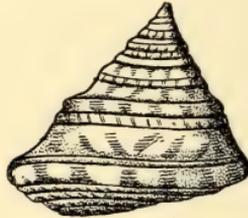
Some time ago I had a beautiful thirteen rayed sunstar in my tank, beside which I deposited a razor-fish, for convenience, for a time. Soon I saw the hand over hand movements of the starfish begin, and, in a few minutes, the poor razor-fish was in the clutches of the enemy. Taking the top point of the long valves, he wound himself round and down the shells until he clutched them, just in the same fashion as the hand grasps a round-headed walking stick. The poor thing very soon felt the wicked fangs inserted into its savoury flesh or body, and made great efforts to escape, but it was out of its native sands, and the powerful hood-shaped foot had nothing to burrow in and drag itself free. The round, sharp, calcareous mouth and jaws cut like a circular saw; and it matters not what sort of prey comes his way, dead or alive, if he can settle upon it, he will have his satisfaction. Out of his capacious stomach I have taken a specimen of his neighbour here, the prickly urchin, as large as an ordinary sized plum, swallowed entire, without the rejection of a prickle, these, along with the broken shell, always being ejected after having been separated from the soft parts. Besides being the good scavenger he is, the starfish is one of the fixed provisions of providence for keeping down the overproduction of other vampires. Nevertheless he is himself, when very young, preyed upon for the same purpose by the flounder, haddock, whiting, and other ground fish; hence the need of keeping, by law, the inner waters of our seas and estuaries from being depleted of those fish by beam trawlers, otherwise the starfish will become the pest of our seas, and particularly the coast line of our bays and channels.

Prosecuting our search, we cross over again to the shore, south of the lighthouse, keeping as near to the lip of the sea as the rocks and boulders will permit. Near the

landing stage we observed a sprinkling, in a sheltered nook, of the common black periwinkle, but in this part we are unable to find a single member of that family. Strange to say, however, that the pearly top is here in plenty; nowhere else, indeed, have we seen it in such numbers. The limpet is also plentiful, but the majority of them are very old stagers, and these, with a few scattered purple lips, are all the living creatures we can find. But the

#### PEARLY TOP

is an interesting creature. Let us immerse him in our glass of water and have a peep at him with the lens. The peach-coloured oblong foot very soon adheres to the glass, and we see, as in the case of his black brother, the periwinkle,



PEARLY TOP.

that the foot is divided into two parts, working in the same fashion. The foot of the top, however, displays a beautiful arrangement of muscular fibres, set in rows from top to bottom; and these, when in motion, follow each other like the waves of the sea, and with these he clings to the stone with such tenacity that it needs some little force to pluck him from his place. On both sides of the foot there are three long zebra-striped feelers, which keep continually waving backwards and forwards but what their work is we have been unable to ascertain. Immediately behind

the top end of the foot is the bottle-nosed head, with its mouth opening and closing, and showing the same silicate rasp as his black brother—being also a vegetarian. Down at the nape of the neck are another pair of feelers, more muscular than the others, and which, in this case, may be termed the horns. These, however, unlike the horns of the former, are destitute of eyes; but close by the roots, one on each side, we discover these orbs perched upon the top of two little flesh-coloured stalks.

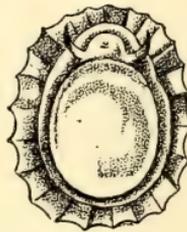
Turning now to the shell itself, we see the turbanated form overcast with a dark purple coating; and shining through this are the grey lines of the ground beneath, which shew in the dead shell cast up on the beach a beautiful silvery appearance. But turning up the mouth, we see, at its entrance, the enamel of the interior, whose shining pearly lustre vies with the tints of the rainbow. Looking at the edge of the *operculum*, or lid, we notice a small hole leading into a cavity in the middle of the shell; and tracing this cavity we find it a complete cone, piercing through and through.

To give the reader an idea of the work this little creature has to perform in building himself a house to live in, we will endeavour to illustrate. Suppose, then, we set a child's trumpet on end, and, beginning at the top, twist a turban-shaped chamber, open at the inner edge, round the structure, widening as it goes till it ends at the base in an oblong, horn-shaped mouth, and we have a very fair notion of the performance. But what is the use of the cone-shaped cavity? it will be asked. Well, the designer saw it was needed. Tracing the cone to the top, we see that near this point it communicates with the interior chamber, and now we find it is the storehouse for the secretions of the creature through which the matter passes.

Let us now turn our attention for a short time to

THE LIMPET,

whose familiar shell needs no description. Everybody knows his peculiarity of so firmly adhering to the rock. One smart tap with a suitable stone, without giving him previous warning by molestation, is sufficient to unloose him ; but if a second or third be needed, in all likelihood he will be smashed to pieces before he suffers himself to be captured. Some authorities declare that this power of adhesion is due to a very strong glue, which can be secreted at the creature's will. We have secured a pretty large



LIMPET.

specimen, and now let us have a view of his construction. Round the rim of the valve we see a line of tentacles, similar to those of the scallop, springing from the mantle, which also encircles the shell, and moves at any part, up or down, as required. In the centre is the oval-shaped foot, and at its margin, the head, similar in shape to that of the top described above, now begins to make its appearance. When he opens his mouth we notice he also is furnished with a rasp, being likewise a vegetarian ; and well down the head are his pair of well-shaped, muscular horns, at the outside base of which are the two very small, black, bead-like eyes. When the head is stretched out to its full length, we notice, in the middle of a cavity leading into the

interior, that the neck springs from the muscles of the foot, which are attached to the shell, and surrounds the whole interior like a wall; and these muscles, particularly at the neck, shew a proportional strength five thousand times greater than that of the bull. If we strip the creature of its conical house, we notice that the soft, lustrous, round back, surmounted on the crown by a dark-brown pigment, and round the sides and base by a neutral tint, has no attachment to the shell, and seems to contain the liver and kindred organs. If we remove this portion, we find the stomach immediately beneath; and this organ, to our astonishment, we see, occupies at least three-fourths of the entire area of the foot. Beneath the stomach and the sole of the foot no other organs intervene, and we have thus failed to discover from whence comes the supposed glue to supply the foot with adhesion. In piercing the soft back, however, we must admit that in the escaping brown fluid we detected the presence of a gummy substance, equal in strength to that very faint presence found on the foot; but we fear that the intervention of the large area of the stomach with its contents, exactly in the middle, annihilates the idea of this organ being the source of supply. Let us look at the foot itself.

Taking the creature out of the water, and placing it on its back in the sun, we notice, with the aid of the lens, an innumerable host of little golden darts flying in rapid succession over the face of the soft, watery foot. We are not prepared to say that these are the reflections of actual organs. While they may be such, otherwise they may be ocular delusions; but we know their source. Watching the foot, we see a muscular wave rising at the far edge, and, crossing over, expends its force at the other. Another comes, and yet another; and from these muscular waves we

see arise the little golden darts. But continuing our observations, we notice the foot has other peculiarities. Here we see a portion of it rising into a little insular height; on the other side we notice an opposing indentation. There it cuts into a ridge, here into a hollow; and all over its surface it twists and contorts itself into all sorts of inconceivable shapes and positions. Place it again in the water in a position to adhere and we observe the same contortions. The high portions are adhering to the glass, while the lower ones are not. Press the shell down with the finger, and though there is at first a very little slip, we instantly feel the resistance of the adhesion. Nevertheless the contortions in the foot remain the same, and continue in that condition until the creature finds it convenient to change its position.

Under these circumstances, we see that adhesion is not due to a vacuum of the whole foot, and we think we may also safely infer that the glue theory is not the correct one. If the force of resistance depended upon glue, then there has been, on the part of the Maker, an unnecessary expenditure of muscle-power in this creature—a circumstance that never occurs; and we know that in the case of the bivalves the muscles are the only source of resistance against opening. My opinion, therefore, is that the sole of the foot of the limpet is a living mass of minute sucker organs, each one capable of forming a vacuum in itself; and were the whole foot cut into sections while on its place on the rock, each section would be capable of retaining its hold, while the muscles above possessed their tension power to draw them up. In the foot of all the top families the same law of strong adhesion is observable; and the presence only of these two specimens in such numbers here is a verification of Nature's inexorable law of the "survival of the fittest;" for amongst the migratory tribes of the shore few others can be found

to live with the same ease amid the rough, wild, sea-lashed shores of Ailsa Craig.

Our boatmen friends are now beckoning us to be away, and we are soon skimming across the sea again on our homeward way.

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## CHAPTER XVI.

### WITH THE HERRING FISHERS OF LOCH FYNE.

“When ye are sleepin’ on your pillows,  
 Dreamed ye ought o’ our pair fellows,  
 Darkling as they face the billows,  
 A’ to fill our woven willows?  
 Wha’ll buy my caller herrin’?  
 They’re no brought here without brave darin’—  
 Buy my caller herrin’,  
 Ye little ken their worth.  
 Wha’ll buy my caller herrin’?  
 O, ye may ca’ them vulgar farin’:  
 Wives and mithers, maist despairin’,  
 Ca’ them lives o’ men.”

**F**EW indeed who hear the familiar cry of the herring hawker on the street, prosecuting his or her calling, think of the truths contained in the words of this popular song. Too often, alas, is the realisation of the last line of the quotation accomplished on the stormy seas of our rugged northern coasts; and not a season passes without one or other of our fishing villages having not a few “wives and mithers” left despairing for the return of those loved ones they will never see more. The pathetic tale of one of

these bereaved ones we once heard, in the sweet tones of her native doric, welling from her breast of bitter remembrance. Through tearful eyes she gazed across the meadow, and pointing to the old churchyard, began thus:—"Ower yonder, in the cauld mools, they laid my bonnie lassie, the idol o' my heart; nor could I ever after pass here without the sorrows o' my aching heart fixing a fond, lingering look on the spot—I ken whaur she lies; but, alas! alas! how sune were the thoughts o' my heart and the gaze o' my een to be turned out ower yonder to the cruel sea, whaur my guidman an' my braw son, ae fearfu' nicht, were baith engulfed in its treacherous depths; an' whaur they lie noo, the ever-greedy sea will never tell." Nevertheless the loss of brave men and the sorrows of bereaved wives and mothers, the harvests of the sea must be reaped; and, as the reader will perceive by the title of this chapter, we propose making ourselves familiar with the operation by a visit to the Loch Fyne and Firth of Clyde herring fisheries.

We have already penetrated the waters of the Kyles of Bute and left its beautiful scenery behind, and are now skirting the north shore of Loch Fyne, along the rugged coast of Otter. The winds of August are fanning a gentle ripple over the wide expanse of waters before us, and the glow of the afternoon sun, away in the north, is burnishing the purple flood of heather-bloom on the breasts of the far-reaching peaks of Glendernal. An occasional silver strand or small pebble bay along the shore relieves the monotony of the wild, rocky coast; and near those pleasant breaks we can mark the abodes of the fishermen, with their net-drying poles at hand.

We are, indeed, scarcely entered the famous loch until, by the numerous fishing-boats seen everywhere, we are reminded of the great trade of the district, through the

capture of the denizens of the deep. Even the little island before us appeals to our attention to this in the name of the Skate—a most appropriate appellation; for, in the distance, its smooth outlines, rising above the surface of the sea, present to the eye the exact appearance of the fish of that name. Stretching across the mouth of the loch, with the island of Arran away in the south and the bold coast of Skipness in the west, we soon reach the south shore, and are speedily landed at Tarbert—the cradle of herring trawling in Loch Fyne.

The entrance to the bay of Tarbert, and the bay itself, is interspersed with a number of small islands which, under certain winds, must be dangerous obstacles to encounter, particularly to strangers making for the port in the night-time; but the harbour within is safe and commodious, and capable of holding a large fishing fleet. The little town of Tarbert is completely modernised, having few of the old thatch-covered cottages still in existence, of which the place was originally composed. Our modern sanitation is undoubtedly the foe of disease, but why should it be made the pretext for becoming the evictor of our pretty Highland cot, under whose comfortable, unpretentious roofs the sturdiest and bravest of our race had transmitted to them, in their mother's milk, the strength of their forefathers. Like the Duke of Argyll's heart warming to the tartan, our heart warms to the little straw-thatched cot, with its white-washed front and its windows smothered over with roses, or peering through a thicket of ivy. But the pride of our modern notions spurn it, and is only pleased to see it adorn the canvas of the painter.

Mounting the rising steep on the left, we are soon on the grounds of the ancient castle. The old structure, now crumbled into a ruin, seems to have been originally a place

of considerable size, and, from its architecture, we would suppose it to be coeval with Carrick Castle on Lochgoil. The surrounding grounds, however, which are still plainly traceable, were much larger than those of the former; and a spot is still pointed out where, it is said, stood the ramparted barrack for the reception of troops. From the altitude of the place a good view of the loch in front is obtained, and this is sometimes taken advantage of by the fishermen when on the outlook for the arrival and presence of the herring shoals, which they can tell from the working of the sea-birds, and other signs with which they are familiar. The information of the fisherman is not always accurate and reliable; nevertheless, in our sea-side rambles, our favourite expedient is to engage his conversation whenever it can be found, and, fortunately for our present purpose, we stumble upon two of these men, who are quietly contemplating the scene before them from the castle's rocky height.

"You have an extensive view of mountains and sea here, friends," is our introductory remark.

"Oh, yes," is the quiet reply of the elder of the two, a burly, middle-aged Highlander, with his head capped in the familiar Tam o' Shanter, and his body clothed in the warm, heavy, blue favourite fabric of his class.

"What is the depth of the loch out yonder?" is our first question.

"From sixty to a hundred fathoms," said the same man; "but," continued he, "there is a place out there on the left where there's a hole that has no bottom at all."

The secret, however, of this startling information seems to lie in the fact that one may try for a whole week to find the fearful pit, and even then be disappointed in finding it. Our desire, we frankly confess, is not to find the bottomless

pit in Loch Fyne, but would rather accompany them on a herring trawling expedition, a request readily granted, when we at once descend to the bay and prepare to embark on our journey.

Herring trawling in Loch Fyne is conducted with two boats, and two crews of four men in each boat. The net used stretches sometimes over 100 fathoms in length, and to as many as twenty fathoms in depth. The sole, or under rope, to which the net is attached is mounted with lead sinkers; and the back, or top rope, is furnished with corks, lashed on at particular distances to float the net from the surface, like a perpendicular wall, and to both ends a hauling rope is attached, which stretches to the distance of as many as 300 fathoms.

With the fishing gear shipped, and the crews in their respective places, we now pilot our stout commodious skiffs out of the narrow harbour into the waters of the far-reaching loch. The evening is clear, and the sea calm and motionless, as down the bold Skipness coast we paddle our way; but as the moon is in the early part of her first quarter, the twilight is speedily gone, and we are soon under the darkening shadows of the night. Darkness, however, is most appreciated by the trawlers, particularly when, as they say, "the burning is in the water." This phenomenon begins to be observed in August, and continues until the frost of winter sets in. Its cause is generally ascribed to the decay of the incalculable hosts of animalcules that inhabit the water, giving place through death to a new and more active life during that particular period of the year. The phenomenon is a familiar one throughout the seas and oceans of the world, and during its prevalence, when the water is disturbed, a luminous flame spreads all round the seat of disturbance, marking, from the surface to

many fathoms below, the presence of a body of fish, or the track of a single wanderer from the shoal.

We are now favoured by these circumstances, and our active crews, eager for the work, are keeping a sharp outlook for this familiar sign of the presence of the fish. Sometimes, resting at a goodly depth, the shoal will not be disturbed by the splashing of the oars; but the trawlers have learned that the fish have acute ears, and can hear from the surface, even away down there, and for the purpose of making them start a bit, the men keep knocking on the stem of the boat, or on the anchor, producing a sharp, penetrating sound, which invariably has the desired effect. Resorting to these tactics on this occasion, the efforts of our crews are at last successful in discovering an eye of fish fully half a mile from shore. All hands are now in active motion. The anchor of one boat is quickly dropped to the bottom, and the other, with the net on board, strikes out for the deep, the anchored boat the while paying out their net-connected rope. When the distance required is reached, the net is shot in a circle, and when this is accomplished the boat returns with the other rope, and both crews at once begin to haul shoreward. Gradually the tedious draught is brought near, and we soon see by the agitation of the fish in the luminous waters, that within the compass of the net a vast shoal is confined. To make the capture complete, both ends of the net are brought close together, and the whole body dragged as far shoreward as possible. This is generally the plan adopted with a heavy "take;" for when the net rests upon the ground of the shore, it prevents the weight of the fish in the great bag from rending it asunder, thereby causing the loss of tons of fish which not infrequently occurs. To secure the fish, large baskets are used, which are let down into the water amongst them, then lifted

into the boat with the contents. Little bag-nets are also brought into requisition for the same purpose, mounted on iron rings, and wrought with a shaft or handle.

Altogether the herring trawl is a deadly instrument in the hands of experienced men; and as we have now witnessed the most general practice of the operation performed, we will now introduce the reader to the

#### DRIFT-NET FISHING,

and mark the contrast between the two systems. At one period the herring trade of Loch Fyne was almost exclusively in the hands of French merchants, and fishermen of that nationality were also annually seen plying their calling in the waters of the Kyles of Bute and Loch Fyne, but the International Fishery Laws of both countries forbade the foreigner to fish within three miles of their respective coasts, consequently the Frenchman has been long banished from our waters.

It is, however, almost certain that the old drift-net plan of fishing has been copied from the French, which, from time immemorial, has been wrought with little deviation. The train of the drift-net is composed of so many pieces, or barrels, as they are sometimes called, each measuring about thirty-six yards in length and two yards deep, and, according to the capacity of the boat used, the trains run from twenty to forty pieces in length. Like the trawl, the sole rope of the drift-net is furnished with lead sinks, but instead of corks being attached to the back rope, at stated intervals, stout cords of what is called "bow string" are tied on (being of great length, they are capable of being shortened or lengthened at will), while their opposite ends are fastened to buoys made of calf or dog-skin. By this means the nets are sunk to whatever depth the judgment

of the skipper of the boat deems sufficient. This is an expedient experience has taught the drift-net fishermen to handle with great care, for the fish are found swimming at various points of depth between the surface and the bottom.

When the water is burning, both classes of fishermen can tell the depth the fish are swimming at when seen ; but otherwise it is only guess-work. To obviate the difficulty of guessing, the following good expedient is sometimes resorted to:—The end of the net is spread over the gunwale, and bit by bit let down to the bottom, and allowed to remain for a time in this upright position. It is then drawn up, and where it is seen the fish have struck the net, to that depth will it be let down by the bow strings. The net is shot in nearly a straight line, and when it is all out it is made fast to the boat, which is allowed to drift with the wind or tide till the following morning, when the net, with whatever it contains, is again drawn into the boat.

While the trawling system is by far the most laborious, and undoubtedly, on the whole, the most lucrative, more strength of muscle than ingenuity is required in its prosecution. On the other hand, to be successful with the drift-net principle, the men employed in it must display a greater amount of intelligence. Instinctively, or rather intuitively, they must be able to tell, even out in the wide deep sea, where, and to what depth, they must cast their nets; and like the bloodhound following on the scent, able to follow, night after night, the day wanderings and altered positions of the shoals. This shifting of the fish is in itself an interesting study. While the moon is in its first quarter, and darkness “broodeth over the face of the deep,” the fish, after their day’s wanderings, rest at night near the shore—sometimes, indeed, they are seen in amongst the rocks—but as the moon advances in brightness they shift further

seaward, and by the time the orb is in its fulness, they are as far scattered as the middle of the Sound. It is obvious, then, that the men who make this natural trait of the fish an object of particular study will be the most successful—and we are aware that not a few of these hardy, daring men are cognisant of the fact—and more than one instance amongst them of the keeping of a diary of several years' duration on the important subject can be traced, a practice which, if adopted on board of each boat as a log-book, would immensely repay the trouble.

Formerly herring fishing in Loch Fyne was permitted by Act of Parliament to be carried on from about the end of June till the 1st of January, and strict enactments were in force prohibiting the trawling system of capturing the fish. Now, however, the trawl has the same liberty of action as the drift-net, and the period of operation is extended from the 1st of June to the 15th of March. In the regulation of this important industry, employing, as it does, some thousands of men, and supplies the wants of their families, much controversy has existed in the past. It could not be expected that the trawlers, who were at first almost exclusively confined to Tarbert, would look with complacency on laws they deemed unjust, and debarred them from prosecuting their favourite system, consequently the law was set at naught by them, even to the shedding of blood amongst them.

Alluding to this matter, our old friend made bitter reproaches against the conduct of the men of Her Majesty's ship "Jackal," which was in charge of the fishery at the time. "Ay," said he, "armed coward's they were, who could shoot down defenceless men, and come in the middle of the night, when we were all asleep, and steel away our boats and nets, and thereby," he added, with a sarcastic grin of contempt,

“add another prize-wreath to the laurels of Her Majesty’s navy.” The prohibition law against trawling, however, was not maintained through the selfish cry of a few interested individuals, but by the unanimous voice of the drift-net fishermen of Scotland. It was asserted, with some show of reason, that the system of capture broke up the shoals, and when practised at the mouth of the loch, prevented the fish from ascending to their old quarters. The same reasoning was applied to the Kyles of Bute. In that quarter, at Tighnabruaich, we have heard an old experienced fisherman say: “Well, suppose you place a set of trawlers over yonder on the Bute shore, and another set here, they are able, with their enormous nets and ropes, to sweep the entire distance, and capture or frighten back every fish that attempts to advance. And this is the reason that our once famous Kyles of Bute fishery is now unknown.”

But there were other reasons of a more damaging nature advanced. It was stated that the most experienced trawler could not tell the size of the fish before he had them captured, consequently great quantities of immature fish were bound to be encircled and destroyed. Next, it was said that both in-shore and with the “ringing system” out in the deep, that with such vast multitudes that are captured, it is utterly impossible to secure the entire draught; therefore, out of the encircled host, as many tons of dead fish go to the bottom as are secured, where they go to feed and accumulate dogfish and other vampires that constantly follow in the wake of the shoals. Again, it was stated that the trawl system deteriorates the marketable value of the fish, by sending into the market a class of fish that will not keep for any length of time, even in the cured state.

Of all the objections stated this last one is certainly the most damaging; and, unfortunately for the system, is

generally admitted to be true. When the fish caught during the warm weather are boxed up and shipped for the market, if not sold on the second day after capture, turn extremely soft, and very soon get into the putrid state. The richness of the fish has, of course, a good deal to do with this; but, as we have already noticed, when they find themselves confined within the net they dart about seeking a means of escape, and thereby collide and smash each other to such an extent, that when taken out of the water they are found to be almost destitute of scales; and having died with the blood in their bodies, they are in the same state as the flesh of a smothered animal is found to be in immediately after death. This is the sole cause of the undoubted softness and quickly-decaying nature of the fish caught by the trawl, and the reason they can never be properly cured—showing always in the latter state, when cooked, the vertebra, or back-bone, covered with the black, uncured, corroding mass of unescaped blood.

Herrings caught by the drift-net are, however, both in the fresh and cured state, of quite a different nature. Lying as the nets do, with their meshes extended to the fullest capacity, the fish swimming across their path strike them, and finding themselves entangled, they make a backward movement, which has the effect of opening their gills and killing them almost instantly, every drop of blood in the body the while escaping through the open gills. Being allowed time to stiffen, the scales on the body are intact, and the fish, of a pure natural colour, will, in its fresh state, keep much longer than the other, and, in its cured state, for any length of time, showing the bone as pure as when taken out of the water. Of the two systems, we are inclined to favour the drift-net principle as being the one calculated to give the public the steadiest supply, and by

far the best class of fish; and employing the greatest number of men, consequently distributing the wealth of these harvests of the sea over a greater number of individuals. It is plain that were the whole fishing population turning to the trawl-net principle, from the great hauls taken, while the shoals lasted, the markets would become glutted and prices unremunerative, and one-half of those employed would require to seek employment elsewhere. In the regulation of this most important industry, much requires yet to be done by the Legislature. The "trawling system" and the "closed time" have again need to be taken into consideration; and what undoubtedly is one of the most destructive permissions of the trade, and should be immediately discontinued, is what is known as the winter fishing on the Ballantrae and Girvan banks. For six weeks in the beginning of the year, when the fish resort to these banks for the purpose of spawning, an active fishing is pursued by a large fleet of boats from all quarters, and hundreds of tons of fish captured all in a state of spawn. A more suicidal proceeding could scarcely be conceived. What great shoals of fish would spring from the spawn thus destroyed; but kill the mother and kill the young seems to be the aim of the men who continue the practice year by year. This is truly the selfish greed of the present, and destroying the certain prosperity of the future. We believe it is the duty of the Legislature to step in with prohibition, and teach the waiting lesson to "cast thy bread upon the waters and thou shalt find it after many days."





