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WONDERS
OF MARINE LIFE

WITH NINETY-FIVE ILLUSTRATIONS



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PREFATORY NOTE.

NATURE-STUDY not only opens to the young reader and investigator a rich and fascinating field for exploration, but affords the most effectual means for training the mind to habits of correct observation and discriminating judgment of objects and things noted.

The importance of a proper cultivation of the observing powers of the young, and the development of sense-perceptions in obtaining a knowledge of the visible and tangible properties of objects in Nature, can not be overestimated. It affords a mental discipline that is essential to sound education, and for which there is no proper substitute. The constantly increasing demand for books of information and guides to Nature-study in the varied departments of animate and inanimate life shows that its importance is recognized.

It is believed that these chapters describing some of the strange denizens of the sea, many of which are unfamiliar to the majority of readers, will prove a welcome addition to the list of books designed to impart to young readers information of an instructive and interesting character.

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THE WONDERS OF MARINE LIFE.

CHAPTER I.

LOWEST FORMS OF ANIMAL LIFE.

The lowest forms of ocean life.—The sponge, and its existence as an animal.—The amoeba, which eats, drinks, and reproduces its kind without bodily organs.—The jelly-fish, and the marvels of its life.—Portuguese man-of-war, medusæ, etc.

EVERYWHERE the eye turns throughout the universe it finds food for overwhelming amazement at the wonders of the natural world. Whether it is the stars which burn over our heads as they roll in their vast orbits ; the earth beneath our feet, which is the grave of countless numbers and races of extinct creatures, from those tiny as a pin's head to monsters terrible in their size and ferocity ; or the seemingly vast waste of the ocean, which is yet the home of a most varied and prodigious life, thought is equally dazzled by the multitude of interests offered to its study. No fairy legend or romance is so interesting as the genuine marvels which science has slowly unfolded to the knowledge of man, specially so during the last hundred years, during which time science has made its most remarkable advances.

Throughout the kingdom of nature, there is no division which more powerfully attracts the imagination, stimulates the curiosity, and gratifies the research of man than the ocean. The vast body of waters, occupying about two thirds of the earth's surface, is the highway of nations, over whose heaving surface great fleets of vessels are constantly passing, bearing back and forth rich products

from one people to another. There is nothing which appeals to the fancy more potent in arousing the emotions of beauty and terror than the phenomena of the sea. The grace and charm of its surges, breaking in white foam on the sand ; the tumultuous splendor of its vast waves, chasing each other for thousands of miles between distant continents ; its beauty and variety of color, continually offering a fresh feast to the eye ; the sublimity of its rage, when it heaves itself, seemingly, to the eye of the terrified voyager, half way to the clouds which lower above it ; the pitiless power with which it swallows up the stoutest handiwork of man and man himself—all these phases of the ocean seize the imagination with irresistible force.

But the ocean has another source of interest not inferior to these. Its vast abysses swarm with the most curious and fascinating forms of life, from delicate animals which it is difficult to distinguish from plants—as, indeed, until within a very recent period, science had not yet been able to establish any definite separation—to monsters of a size such as the land, with all its productiveness, fails to breed. In a recital of some of the wonderful things offered by Nature to the contemplation of man, a study of the denizens of the sea may properly be considered first, for the wonders of life began in the sea.

Among the lowest forms of life in the world, the sponge is that which first attracts attention. This marine animal, which, as a production of nature, has been known from early antiquity, was a puzzle to the ancient naturalists, who could not make up their minds whether it was animal or vegetable. The curious fact was perceived that the sponge would shrink from the hand that grasped it, and that it clung to the rocks on which it was fixed with much tenacity, seeming to be endowed with an almost voluntary force. The ancient observers of nature also distinguished males from females among the sponges, but still they could not make up their minds about its exact place as animal or plant. It was not till the studies of the great Swedish naturalist Linnaeus threw so much light on many previously debated questions that the sponge

was finally decided to be an animal. Sponges live at the bottom of the sea, at various depths, among the clefts and crevices of rock,

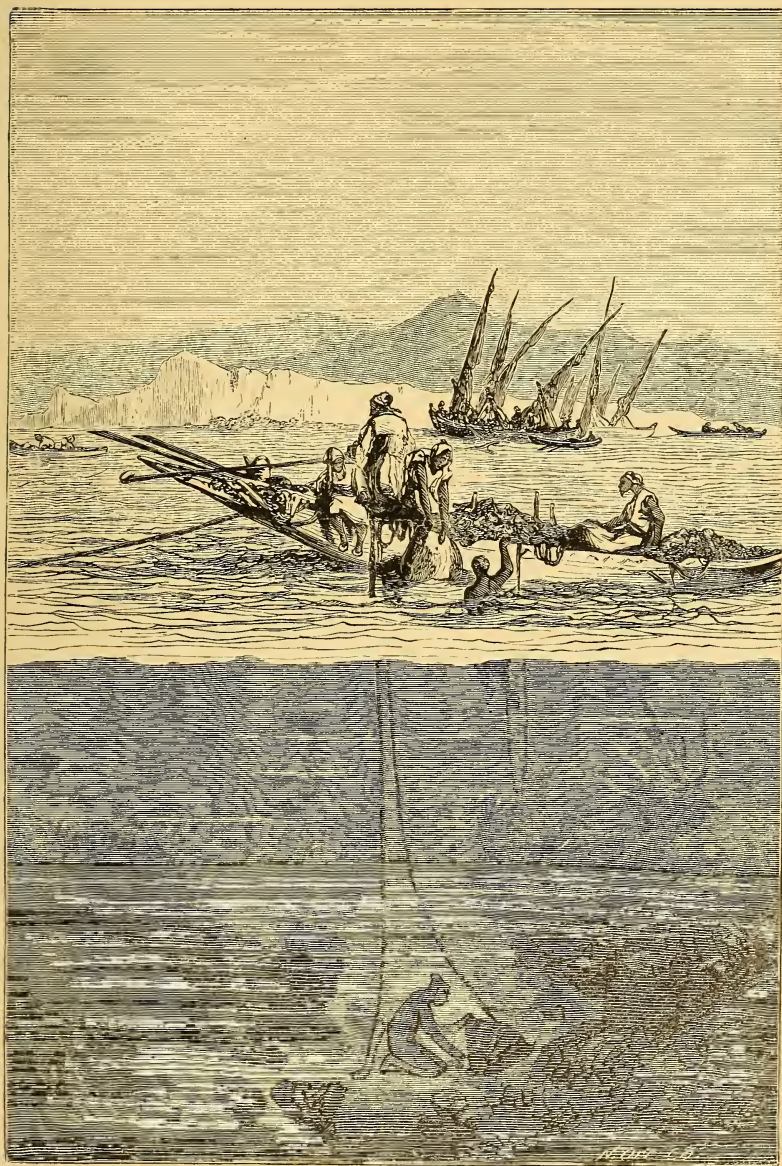


SPONGE, HALF THE NATURAL SIZE, ATTACHED TO ITS ROCKY BED.

adhering not only to inorganic bodies but to seaweed and animals, spreading either erect or hanging, according to the body which supports them.

In the months of April and May sponges develop ova or eggs, round, yellow, or white, from which soon proceed embryos, furnished at one end with delicate vibrating cilia or feelers. These are carried off by the currents, or swim around the parent sponge, seeking a place to which they may attach themselves. They soon fix themselves to some foreign body, and become henceforth immovable, no longer giving signs of either sensibility or contractibility, while in their enlargement they are completely transformed. The substance is soon riddled with holes, and the sponge is formed. Professor Milne Edwards considers each sponge to be an individual by itself; and, as his opinions about this queer sea animal have become generally accepted, we shall briefly give his ideas. The innumerable canals by which the substance of the sponge is traversed are at once its lungs and its stomach. The water passes into the numerous little openings into the canals, and is the respiratory fluid. It traverses all the different channels, and escapes by spiral openings. The currents of water passing into the sponge not only furnish breathing fluid, but also food, and carry off the excrement. The walls of the canals offer a large absorbing surface, which separates the oxygen necessary for life, and throws off the carbonic-acid gas.

Some sponges form masses of a light, elastic tissue, which is at the same time resistant. The number of different species is supposed to be about four hundred, and they are found of every diversity of size and shape—in some cases three or four feet in diameter. In many cases the skeleton of sponges consists of horny or siliceous fibers, and hard mineral bodies are found in them. On buying a sponge as prepared for the market, it will be noticed that at first the substance is full of these little foreign bodies, which were brought with it up from the deep-sea bottom. At the present time sponge fishing takes place mostly in the Grecian Archipelago and the Mediterranean Sea. Sometimes the eye will discover a hundred vessels in sight during the fishing season, which is from the first of June to the first of November. There are about a thousand fishing vessels engaged in the gathering of sponges. The operations of the



SPONGE-FISHING ON THE COAST OF SYRIA.

fishermen may be briefly described. The inferior sponges are sought for in shallow water in the crevices of the shore rocks, from which they are detached by three-pronged harpoons. This, however, injures the sponge more or less. The finer sponge is found in deep water, and is brought up by divers, who detach the sponge from its rocky base by carefully cutting with a knife. This life is accompanied by extreme danger, as the sponge diver, like the pearl diver, is not only short-lived, in consequence of the extreme fatigue and exposure of his labors, but subject in a still more terrifying degree to the attacks of that tiger of the sea, the shark, which grows in these regions to a great size, and exhibits a corresponding ferocity. Every sponge fleet which returns with its hard-earned harvest has to report the horrible death of not a few of the wretched divers, whose laborious life is thus encompassed with double perils.

The Archipelago furnishes for the most part the coarser sponges, while the finer grades are found on the coast of Syria and off Barbary. In the latter region sponges of great fineness are also found of great size. Some attempts have been made to naturalize the different varieties of sponges on the coasts of France and Algeria with a fair degree of success, and this culture promises to be a profitable one in the future. The more the sponges advance toward the north in their habitat, the finer they become, the warm tropical seas being rather favorable to the growth of the coarser species. The fine Syrian sponge is distinguished for its lightness, its flaxen color, its cup-like form, and the fineness of its texture and orifices. This is specially used for the toilet, and its price is very high. The heavy and reddish Barbary sponge is also valuable for domestic use on account of the facility with which it absorbs water and its great strength. Sponges are found in different portions of the world, but those of the Mediterranean Sea are considered the most valuable.

Rising a little higher in the scale of animal life, we come to what are known as the root-footed animals, or rhizopods, as they are called in science. These are of the simplest organization, and can extend or contract themselves at will. These strange creatures

push a part of their bodies out into a fin or a foot, and make themselves into a stomach, according to need. Their instability is incessant, changing into great varieties of size and form, like the fabled Proteus. Let us examine one of these wonderful animals, the



THE COMMON AMŒBA.

amœba, under the microscope. At first it looks like a transparent, immovable drop. Suddenly it puts forth a false foot, which glides along the covering glass, and fixes itself to a point, whither it drags the whole of its bulk, presenting an utter change of shape. These *pseudo-pods*, or false feet, are continually being projected and withdrawn again into the parent bulk, and it is by this marvelous function of change that the creature performs all its offices of movement, digestion, and reproduction. The amœba, when it eats, simply folds itself around its prey, which consists of almost invisible algæ or fragments of sea plants, and absorbs it, the gelatinous mass soon swallowing them, and leaving only the indigestible portions. These creatures are tinted green, red, or blue, often showing under the microscope wonderful changes of color, and it is said that the brightness of the color determines the healthiness of the animal. Reproduction of kind is effected simply by parting with a portion of the body substance, which instantly takes on a new life of its own. Thus, without mouth, legs, fins, lungs, stomach, or any other organ, the amœba eats, drinks, digests, swims, and re-

produces its kind, the closest analysis all the while discovering nothing in this mass of protoplasm but a sort of quivering jelly. Yet it performs all the functions of life without any perceptible organism. So true is it that some of the greatest marvels of Nature are found among her lowest and simplest forms.

The visitor to the seashore will rarely fail to find among the growing seaweeds little plant-like clusters, which at first appear to be vegetable, but they are really the curious little sea animals called hydroids or jelly-fish. From each little plant there arise buds, which soon enlarge, float away, and become beautiful jelly-fish. There are other hydroids, in the shape of bells, and some which appear like miniature trees with all their foliage massed at the top, and from beneath which there depend bunches, as it were, of grapes or other fruit. These fruit-like clusters are jelly-fishes that stick fast, instead of detaching themselves and



LIVING HYDROZOA.

a, natural size; *b*, enlarged.

becoming free jelly-fishes, as in some other varieties. In the Gulf of Mexico are communities of these jelly-fish so organized that they seem to constitute but one animal. Such is the well-known "Portuguese man-of-war." This community consists of a beauti-

fully crested air sac, only a few inches in length, floating on the water, from which stream a great number of long and curiously constructed appendages. Agassiz says the different parts are so many different kinds of members in this queer animal community, all filling different functions. Some catch and eat food, others produce buds, and others are the locomotive or swimming members, having tentacles in some cases thirty feet in length. The colors are very vivid, showing blue and purple, green and crimson, for the most part, but melting into a great variety of iridescent hues.

This miniature marine galley is not, however, to be rudely tampered with. The French naturalist Le Blond, in his "Voyage aux Antilles," gives his experience as follows: "One day I was bathing with some friends in a bay in front of the house where I dwelt, while my friends fished for sardines for breakfast. I amused myself by diving, in the manner of the native Caribbeans, under the wave about to break. Having reached the other side of one great wave, I had gained the open sea, and was returning on the top of the next wave to the shore. My rashness nearly cost me my life; a physalia ("Portuguese man-of-war"), many of which were stranded on the beach, fixed itself on my left shoulder at the moment the wave landed me. I promptly detached it, but many of the filaments remained glued to my skin, and the pain I experienced was so great that I nearly fainted. I seized an oil flask near at hand, and swallowed one half, while I rubbed my arm with the



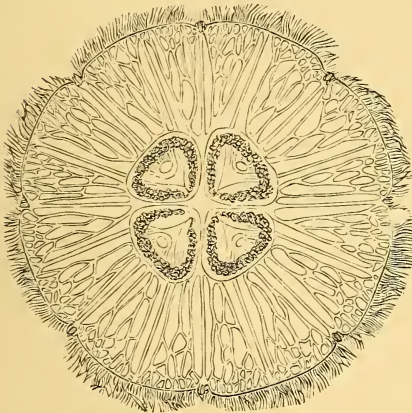
PORTUGUESE MAN-OF-WAR
(*Physalia arethusa*).

other. This restored me to myself, and I walked toward the house, where two hours of repose relieved the pain, which disappeared entirely during the night."

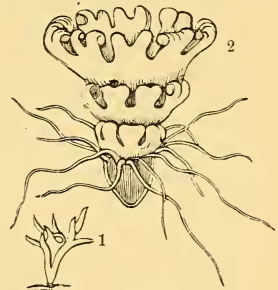
The French traveler Fredol tells a story of a young sailor who jumped overboard to secure a magnificent specimen of the "galley," as it is called in the West Indies. He seized it, but the irritated creature surrounded the person of its assailant with its thread-like tentacles, and the swimmer was instantly overpowered. On being rescued, he became insensible and for some time his life was despaired of. Oftentimes in the tropical seas the water will be seen covered with fleets of these beautiful but treacherous creatures as far as the eye can reach. They seem to be gregarious in their habits, herding together in shoals, carried along by winds and currents, and dragging behind them their thin long appendages, conspicuous by their rich coloring, from pale crimson to deep blue. "Certainly," writes a well-known French naturalist, "we can readily conceive that a poetical imagination might well compare the graceful form of the physalia to the most elegant of sailing vessels, even if it careened to the wind under a sail of satin, and dragged behind it deceitful garlands which struck with death every creature which suffered itself to be attracted by its seductive appearance." The creature darts out its tentacles swiftly as a flash of light, winding around the body like a serpent, and benumbing the victim with its poisonous stings, each tentacle being armed with thousands. It will kill fish of considerable size, and both the herring and cuttle-fish are oftentimes its victims.

Another interesting form of the jelly-fish is the "sunfish," known in scientific books as the *aurelia*. This is disk-shaped, and acquires a size of from six to twelve inches. It appears in large schools on the surface of the water, and sails along with a sort of swimming motion, like the opening and shutting of an umbrella. The sunfishes are also remarkable for their stinging properties, and are, therefore, called sea-nettles or *acalephæ*. Toward the close of summer, the sunfish lays numerous eggs, and perishes in the autumn. The eggs hatch into little oval bodies, which swim about

by minute hair-like appendages. After a while they attach themselves to rock, shell, or seaweed, and develop into what look like plants. As growth goes on, the creature divides itself into horizontal segments, which become more and more marked and sepa-



ADULT JELLY-FISH (AURELIA).



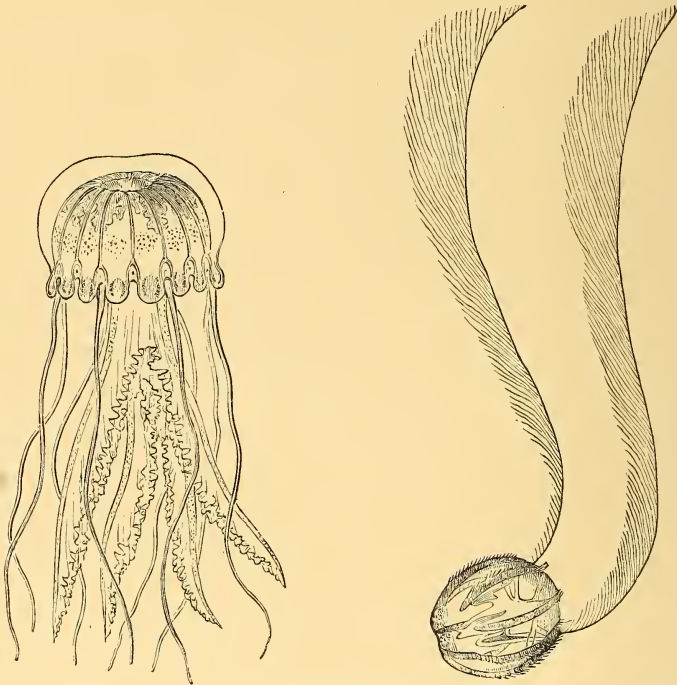
AURELIA.

1. Early stage of the animal;
2. Jelly-fish ready to be detached and form the adult.

rated, till each one respectively detaches itself from the others, and floats off a fully developed sunfish. Thus each single egg produces a number of the adult creatures. The jelly-fishes of the disk shape are very numerous and varied in details of structure, form, and size. Some have the appendages around the mouth and margin greatly prolonged, while others resemble miniature muskmelons, the bodies ribbed into separate parts by rows of locomotive fringes, and projecting into two most extraordinary tentacles, which wave above the water in all manner of beautiful forms, curve and spiral.

The name *medusa* is applied to the most numerous, remarkable, and beautiful varieties of the jelly-fish. These graceful animals may be observed anywhere in our summer waters, generally not far from the shore. Seeming to the careless sight to be mere floating plants, a closer inspection discovers in them animal forms of the rarest beauty of form and color, that sail hither and thither, and apparently have even a certain power of controlling their move-

ments against the set of wind and current. The general name of the medusa was applied to this animal on account of the snake-like filaments which it possesses, highly suggestive of the serpent locks of the Greek Medusa, one of the Gorgons; perhaps, also, from the danger of contact which all too-curious observers incur. The property common to nearly all the jelly-fish—that of a most severe and painful sting—is in some of the medusæ a paralyzing



JELLY-FISH.

power against which the strongest men stand no chance. It is believed by scientific men that many of the cases of the sudden drowning of experienced swimmers is owing in as large degree to the attack of these beautiful and inoffensive-looking sea creatures as to cramp.

“Floating on the bosom of the waters,” says Fredol, “the me-

dusa resembles a bell, an umbrella, or, better still, a floating mushroom, the stalk of which has been separated into lobes more or less divergent, sinuous, twisted, shriveled, fringed, the edges of



MEDUSA.

the cup being delicately cut, and provided with long thread-like appendages, which descend vertically into the water like the drooping branches of the weeping willow.”

The gelatinous substance of which the body of the medusa is formed is sometimes as clear as crystal, sometimes opaline, and sometimes bright blue or pale rose-color. Indeed, almost every color of the solar spectrum is represented in these little creatures. The shining tissue, decked out in the finest tints, is so fragile that,

when washed up on the beach, it disappears in the sun without leaving a trace behind. Yet these living soap-bubbles of the sea make long voyages, and in some parts of the ocean abound in such enormous quantity that they make the principal food of the greatest of sea animals, the whale. They swim by their long tentacles and by contraction and dilatation of their bodies ; and the ancients, from this peculiar movement of the medusæ, named them *sea lungs*. Wandering over the seas in immense battalions, if an obstacle arrests them or an enemy touches them, the umbrella contracts, the tentacles are folded up, and the timid animals sink into the depths of the ocean.

The medusæ are furnished with a mouth, placed habitually in the middle of the umbrella-like head ; a mouth, too, which is rarely empty, for the animal is voracious in the extreme, devouring even shell-fish, and attacking successfully fish four or five inches in length. In respect to size the medusæ vary immensely, some being very small, while others attain more than a yard in diameter. They breathe through the skin, and the organs of digestion are very peculiar. The walls of the stomach are furnished with a great multitude of vibrating hairy appendages, which secrete a juice supposed to decompose the food and make it digestible. Scientists also assert that these creatures have a distinct circulation, organs of sense, and something like a nervous system. The medusæ, for the most part, reproduce themselves in the manner already described in the allied form of the aurelia, or sunfish. Few fishes are more marvelous in their construction, more beautiful and graceful in form, than the medusa, and there is none which can be more easily studied by the frequenter of the seaside.

CHAPTER II.

THE HOUSE-BUILDERS OF THE OCEAN AND THEIR RELATIVES.

The coral polyp and its works.—The precious coral, and how it is obtained.—The mass and extent of coral formations.—The coral polyp an animal.—Description of this wonderful house-builder.—Its methods of reproduction.—How it works.—Different forms of coral.—The part the coral has taken in building the earth.—Different coral islands and their distribution.—The sea anemone the cousin of the coral polyp.—Its exquisite beauty, its structure, and habits.—Descriptions and anecdotes by different naturalists.

AMONG the polyps, or “many-footed” denizens of the ocean, to which all of the lowest orders of marine life belong, there is none which evokes a more active and curious interest than the minute animal which builds greater architectural piles than the genius and wealth of man have ever raised on the land. Laying the foundation deep in the abysses of water, it builds its solid masonry inch by inch till it rises above the spray and becomes an island. Disintegration of the coral surface, subject to the winds and rains and the heat of the sun, at last makes a light soil, and the birds and winds fetch seeds to this prepared garden which quickly germinate, and soon the coral island is covered with greenery and fit to sustain the life of man. Straightway the mind stops to think of this mighty fact in the processes of nature, it is filled with awe and amazement. Even trifles become marvelous when we meet them in a mood of fresh and receptive thought. How much more so such a work as a coral island, laid thousands of feet in the ocean depths, and rearing above the waste of waters its fan-like plumes of cocconut and rich greenness of verdure.

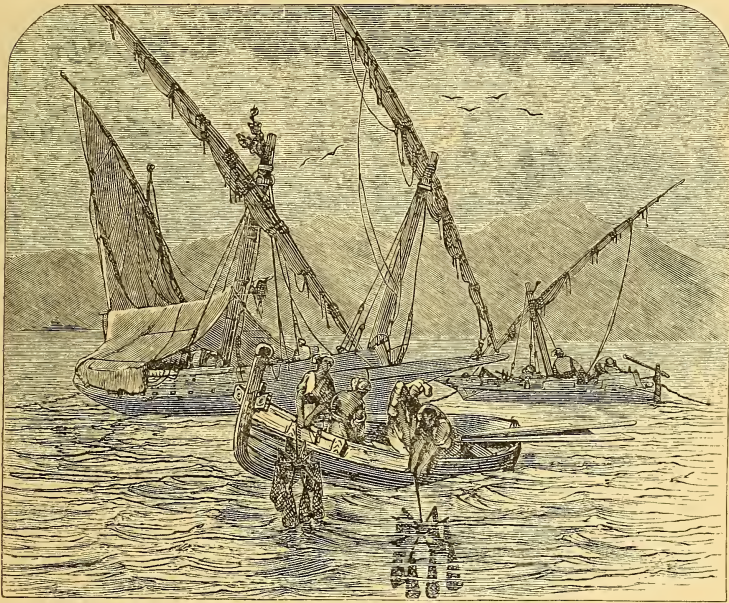
The product known as coral has been celebrated from time immemorial. As far back as the songs of Orpheus, there is recognition of it, and the ancient savage tribes, who lived by the shores of the

ever-sounding sea, were wont to decorate their persons and weapons with it. But it has taken twenty centuries of groping in the dark to reveal the true nature of this wonderful product. The red or precious coral is a branched polypus trunk, as hard as the most compact rocks and susceptible of a beautiful polish. When withdrawn from the sea, where it is found at great depths, it looks like a bush. The branches seem to be covered with a rose-colored bark, and in it are small holes where live the builders. These are polyps, which, when expanded, wear the appearance of pretty little white flowers, with eight divisions spread out like rays, and the borders of which are ornamented with a fringe of ciliæ, or feelers. It was owing to this appearance that the celebrated traveler, Tournefort, spoke of the coral as "a marine or fluviatile plant, the flowers and fruits of which are generally unknown." It was not till the early part of the eighteenth century that Peyssonnel, a French physician, who was traveling on the coast of Barbary, made a closer examination, and announced the animal nature of the coral. This discovery was at first laughed at, but the French Academy of Sciences appointed a committee of savants, who confirmed the physician's views.

The precious coral, which is for the most part of a rose-color, is fished for in various parts of the Mediterranean Sea, and gives occasion to the employment of many men and vessels. It is found in nearly all shades of red from a light pink to a deep crimson, the former color being in most esteem in Europe, while the Orientals prefer the darker tints. It can only be secured by extreme labor, as the machinery for tearing the coral from its ocean bed is of the most primitive sort. Simple dredges are thrown overboard into the depths of the sea, and, as the coral is very firmly attached, it is only by great effort that it can be wrenched away. Another species is the black coral, which is also used for the manufacture of trinkets, though it is far less common than the rose coral. The beautiful colors of this coral, which give it value for purposes of ornament, are supposed to be the result of something peculiar in the waters of the Mediterranean Sea, as it is only found in this marine region. The coral polyp gets its food from the sea-water

solely, and it is reasonable to suppose that qualities of color may be transmitted in this way. Such is the only explanation which naturalists make of the glowing tints of the Mediterranean coral.

But, great as is the interest in the precious coral which is manufactured by the jeweler into such beautiful ornaments, it is the other coral animals whose works are the most fascinating to the imagination. Could the ocean be suddenly drained dry, it would



FISHING FOR CORAL.

reveal forests and gardens of almost boundless extent. Stately tree-like structures, and a multitudinous shrubbery, delicate in form, make a world of life and beauty in the abysses of the sea, where the eye of man can now never penetrate. It is principally in the South Pacific that the constructions of these polyps mostly abound. At the approaches to the Maldiv Islands they form extraordinary masses as large as the Alps. Dana says that the larger coral islands are about two hundred and ninety in number, with a

total area of twenty thousand square miles, equal, perhaps, to an eighth part of the surface of all the other islands of this vast sea of the Southern Pacific. Professor Owen thus sums up the immensity of their labors: "The prodigious extent of the combined and unintermitting labors of these little world architects must be witnessed to be adequately conceived. They have built a barrier reef along the shores of New Caledonia for a length of four hundred miles, and another, which runs along the northeast coast of Australia, one thousand miles in extent." This represents a mass, compared with which the walls of Babylon and the Egyptian Pyramids are but the toys of children. And it must be recollected that these edifices of a minute animal have been reared in the midst of the ocean waves and in defiance of tempests which quickly annihilate the proudest works of man. The submarine coral structures rival in extent and grandeur the noblest mountain scenery on land. The tiny animals, innumerable in number, have been working through countless ages, until they are now ranked as among the most effective agencies by which the crust of the earth has been shaped and modified.



FRESH-WATER HYDRA.

Multitudes of islands, hundreds and thousands of feet above the surface of the ocean, and multitudes of others sunk thousands of feet below it; stony reefs, along which the navigator may sail hundreds of miles; the mass of rock through which Niagara is gradually carving its way, and extensive beds of limestone scattered over the world—all have been extracted from sea-water and secreted by the jelly-like coral polyp. No more vivid illustration can be fancied of the silent forces which have wrought such wonderful changes in the earth than the work of the minute sea animal which we are now considering.

The coral polyp is now known to be as much of an animal as a cat or a dog. The apparent flower is a little sac-like creature, and the

wreath of colored petals its arms or tentacles. Not all the coral-making creatures, however, are polyps, as some of the lowest tribes of mol-

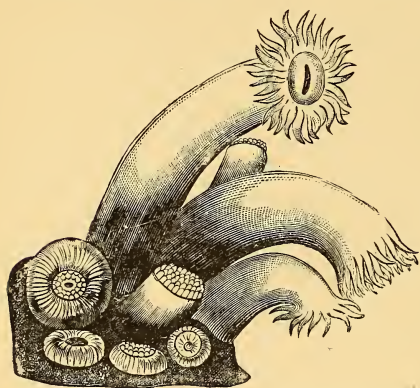


PLUMULARIA; A CORAL SPRIG MADE BY HYDROIDS, ONE-FIFTIETH OF AN INCH LONG.

lusk, and even seaweeds, have the power of secreting a kind of coral.

The fresh-water hydra, which may be seen attached to the un-

der side of plants, has this power of coral secretion to some degree, and some of the other hydroids also have the same function. One of them produces a work which looks like a plant, and is called, in allusion to its delicate plumes, the *plumularia*.



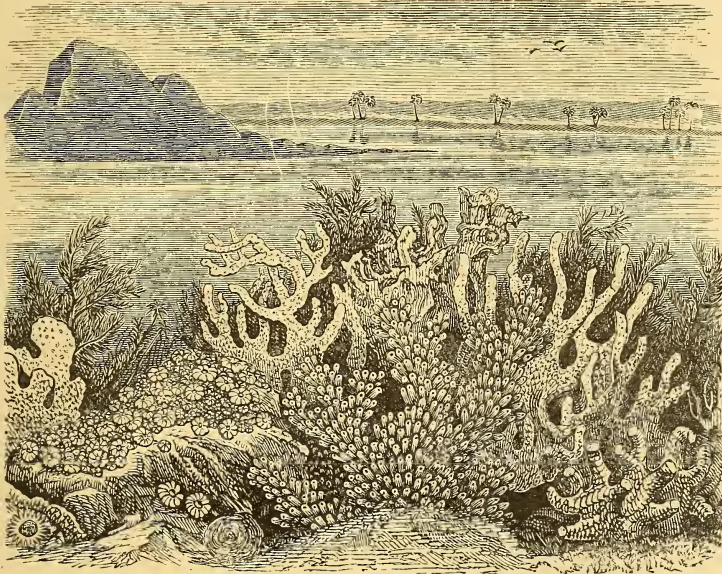
CLUSTER OF CORAL POLYPS IN VARIOUS STAGES OF EXPANSION.

The true polyps are divided into those that secrete coral and those that do not, the latter having soft, leathery bodies and living attached to substances on the sea bottom. They have the power of locomotion by contracting and expanding the muscles of the disk. But the coral-making animals are fixed to the stone which they

create, and which is a part of themselves. The polyp is the living part of the coral, the gelatinous mass which fills the cells on the coralline surface. The animal consists of a sac or stomach and an enveloping membrane, an opening from the stomach being the mouth. This mouth is surrounded by tentacles, by which food is taken in and the solid matters out of which it constructs its shell-like tomb. Fleshy folds extend throughout the animal, and give the polyp the appearance of a little balloon of tissue paper crumpled up, when out of the water. The coral polyp is formidably armed in the stinging barbs which cover its tentacles, mouth, and stomach, and produce torpor and death in any small animal touched by them. The little cells in which these stings are lodged are called lasso cells, and measure from $\frac{1}{350}$ of an inch to $\frac{1}{5000}$ of an inch in length. The lasso is darted from these sheaths or hiding-places, and is capable of inflicting painful injury even on the human hand.

Between the fleshy folds of the coral polyp's body are thin shell-like plates. These with the other hard portions make up the coral skeleton, which is formed just as an oyster forms its shell.

When we speak of the architecture of the coral-building animal, we do not therefore imply outside mechanical work, such as the bee performs in making its comb, but the mere operation of a vital function like that of the higher animals in forming or secreting their skin and nails. Professor Dana says: "This process of secretion is one of the first and most common of those that belong to living tissues. It belongs eminently to the lowest kinds of life. These are the best stone-makers, for in their simplicity of con-

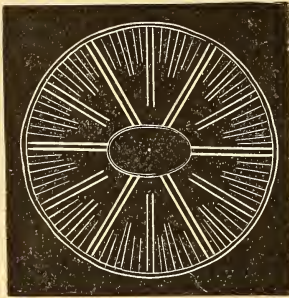


VARIETIES OF CORAL.

struction they may be almost all stone and still carry on the processes of nutrition and growth."

In the reef-building species the young polyp is reproduced by a sort of budding from the parent animal. The bud, we are told by Professor Dana, commences as a slight prominence on the side of the parent. The prominence enlarges, a mouth opens, a circle of tentacles grows out around it, and the young polyp increases till it attains the size of the parent. In this species the young do

not separate from the parent, but form a compound group. In other species there is a spontaneous division of the parent polyp, so that the new one begins life side by side with the other in the same cell. Among the reef-building corals some of the principal groups are worthy of special description. The *Astræas*, named

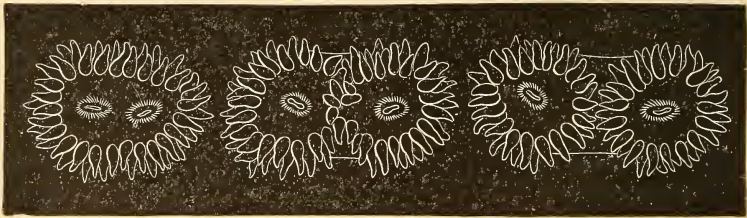


AN HORIZONTAL SECTION OF A POLYP,
Showing the Internal Arrangement of the
Folds and Compartments.



CORAL FROM THE WEST INDIES,
Showing the Structure of the Cells.

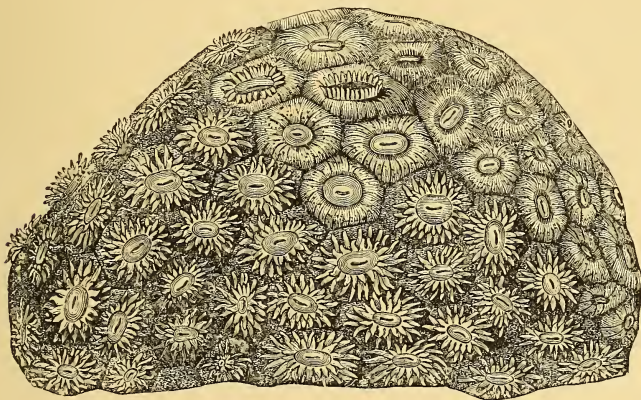
from their star-shaped cells, grow in great hemispherical masses twenty feet or more in diameter. The brain coral is so named from its furrows and ridges—convolutions, as it were. The *Porites* are very massive and branched, being covered with exceedingly



MULTIPLICATION OF POLYPS BY SPONTANEOUS FISSION.

minute cells. Most of the West India reefs, known as the Millipores coral, are not the product of a coral, but of a certain sort of jelly-fish. Both the Madrepore and the Aleyonoid coral are beautifully branched. The latter coral is flexible, and sways with the moving waters. In some cases it hangs down in gorgeous clusters

of scarlet, purple, and crimson. In all these cases each cell is inhabited by an individual polyp. The diameter of the tentacles of the polyp is about an eighth of an inch, and such a resemblance do they form to the petals of a flower that they are oftentimes called coral flowers. The *Astræas* have sometimes nearly a hundred petals or tentacles to a single animal. The rays or tentacles readily fold inward, and at the slightest alarm the waving tentacles close, and all evidence of life disappears. In some masses of coral, not more than twelve feet in diameter, Professor Agassiz estimates there were not less than 14,000,000 polyps. Each mature polyp, when fixed in

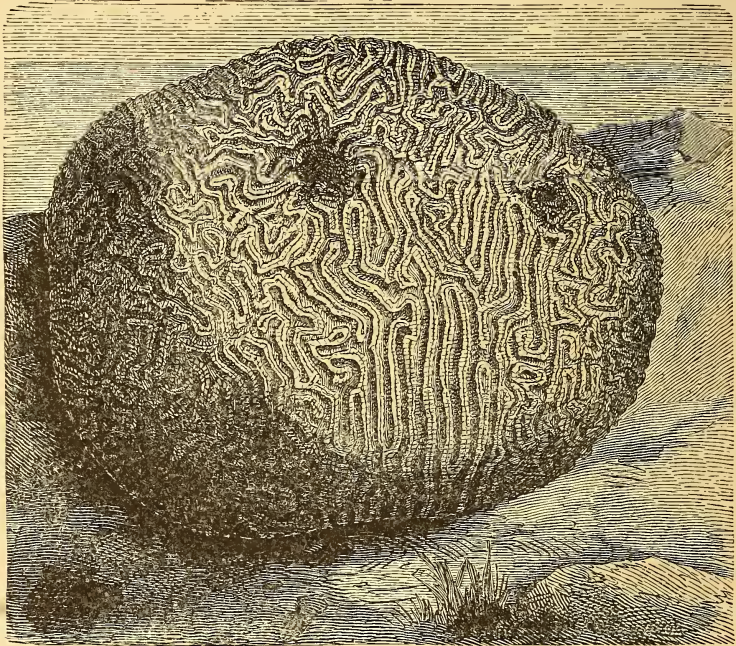


CORAL FROM THE FEEJES, CALLED *ASTRÆA*, FROM THE STAR-SHAPED CELLS.

its cell, may be considered as resting on the tombs of its ancestors ; and when it dies its descendants will repeat the process over its remains, and its own body, within which its share of coral has been secreted, will be the base for a fresh descendant and its operations.

Mr. Damon, a well-known American naturalist, thus writes of the coral formation : "The large, massive forms of coral, whether of the dome, reef, or tree-like shape, would never reach the magnificent proportions that they do were it not for that peculiar provision of Nature in regard to the zoöphytes, of life and death both proceeding simultaneously and successively ; each, combined and singly, aiding in one and the same object. This curious condition

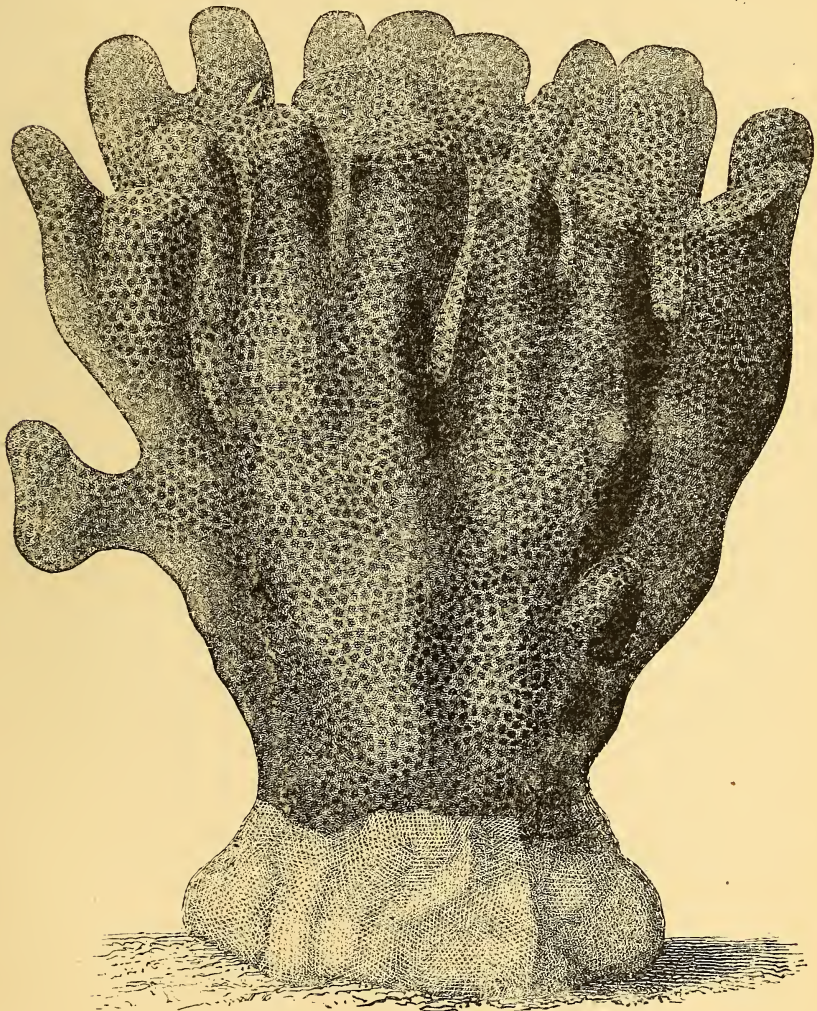
of growth favors the coral aggregation by allowing the living polyp, as it secretes the calcareous matter, to mount upward on that which it has already secreted and deposited. From the suc-



BRAIN CORAL

cessful execution of this ascending process, we are led to infer either that the creature has the power of indefinite elongation, or that it must desert the precipitated portion of the corallum as growth proceeds; and, in fact, this last is what actually occurs. In some instances a polyp of only an inch in length, and even less, has been found at the top of a stem many inches in height; for the whole substance of what is called 'living coral' is in reality dead, excepting the extreme surface or point of each branch occupied by the little animal. The living tissues which once filled the cells of the lower portion of the corallum have been consumed by natural processes, and have disappeared as growth went on above. . . .

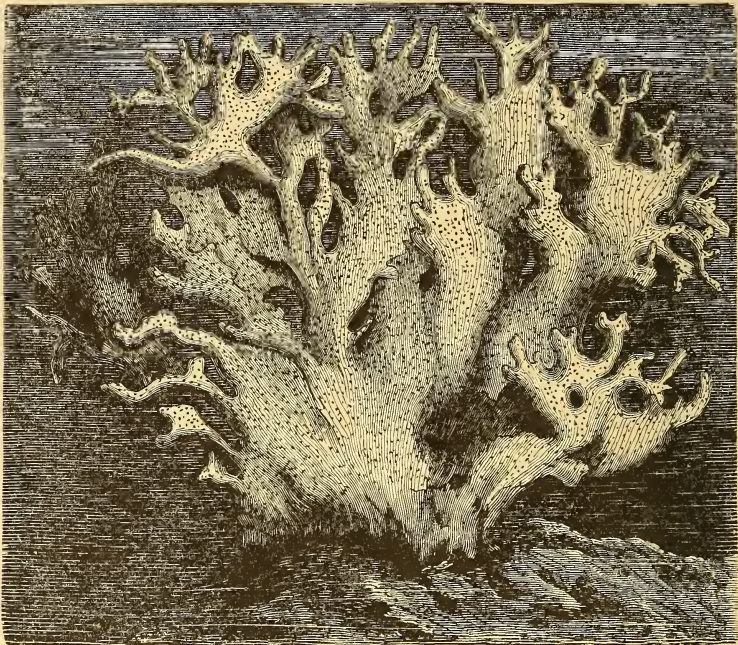
The final solidification of the coral mass is aided by the increased secretion by the polyp shortly before its death, filling all the pores with this stony matter in proportion as the vital tissues occupying them shrink and dwindle. This last deposit greatly aids in



PORITES FROM THE FEEJES; CELLS EXCEEDINGLY SMALL.

strengthening those tree-like or branched coral growths which, though so slender of form, are really very strong.”

When first born the young larvæ are worm-like in form, and are very agile, darting about in all directions, and apparently enjoying themselves greatly. But this life of freedom soon comes to an end ; their base becomes attached to some stationary object ; and their gay youth is exchanged for a sedentary life, with no other



MILLIPORES ; CORAL SECRETED BY JELLY-FISH.

changes than those of eating and digesting their food. “There are few natural objects,” says Mr. Damon, “more pleasing than an association of these corallets ; for, as the polyps rise above their cells and extend their fine, long tentacles, resembling threads of pure white silk, waving them to and fro, like the radiated petals of a fairy flower swayed by a gentle zephyr, or, again, like a minute feather fan slightly concave at the edge, they present an exceedingly animated

and elegant appearance. Sometimes, when nearly at rest, and the filaments are more contracted, they suggest the appearance of a dense frost settled upon a bed of moss."

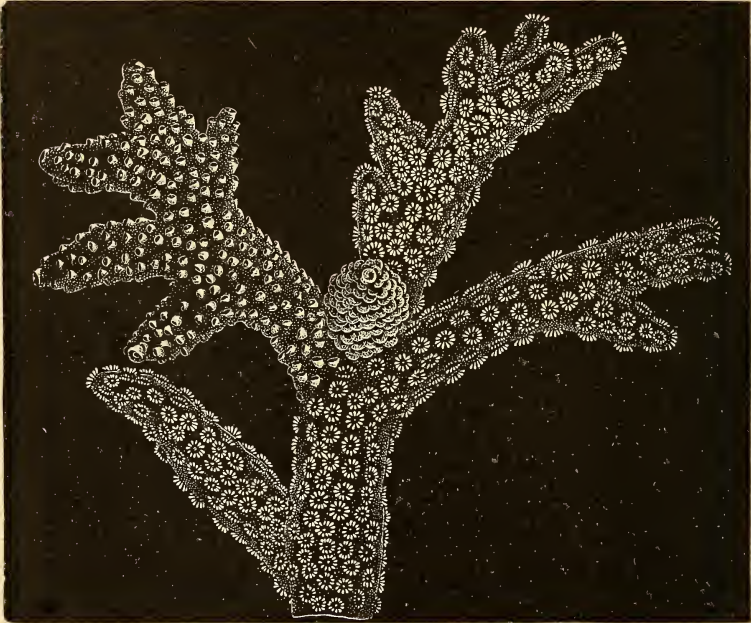
Coral formations, however huge in their masses, are dead and deserted throughout, except a thin crust on the surface, not more than an eighth of an inch thick, which constitutes the living portion where the work goes on. This resembles the process of growth



ALCYONOID POLYPS; "GAYEST AND MOST DELICATE OF CORAL SHRUBS."

in the higher order of trees, where the inner portion of the trunk is dead, while fresh concentric living layers are continually being added. The increase of the coral goes on without limit until the dome reaches the top of the water, when the animal dies, and then growth only takes place on the sides. When the coralline mass sinks by the subsidence of the land, growth goes on, and reefs of enormous mass and thickness are created.

The dead coral is always more or less porous until all the polyp cells get filled with carbonate of lime, and by chemical changes the mass finally becomes solid coral rock and compact limestone with



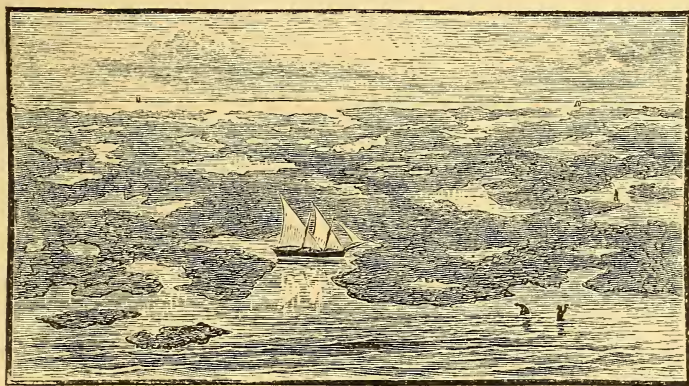
MADREPORE; BRANCHING FROM LATERAL BUDS.

but few traces remaining of structure. As coral masses increase in size, of course there is a corresponding increase in the number of the coral animals. In fact, a great coral dome, larger than any building on earth, may have arisen from the fecundity of a single coral polyp. It bewilders the imagination to think what an inconceivable number of animals, during the long period of growth of a great coral formation, must have lived, builded, and died during the tens of thousands of years required in raising these colossal edifices from the depths of the ocean.

Professor Agassiz says of the coral reef at Key West, that it indicates about six inches increase in one hundred years. "If we

allow twice that rate of growth, not less than seven thousand years would be required for the formation of the great reef at that place, and hundreds of thousands of years for the coral growths which form the peninsula of Florida." It is a reasonable calculation that more than one million years have elapsed since the foundations were laid for some of the great Pacific reefs. It is an interesting fact that no important reef-building coral polyp lives at a depth greater than one hundred and twenty feet. Above that, all the work of coral manufacture is carried on. How, then, can the occurrence of coral masses four thousand feet thick be explained?

Mr. Charles Darwin probably gives the answer in the gradual subsidence of the lands and ocean bed. The subsidence has often been at the same slow rate at which the coral reefs were increasing on top. As the coral animal flourishes only in warm waters, it is in the tropical seas that we find the finest specimens of his work. The greatest reefs abound and grow in the zone of greatest heat. Surrounding most of the tropical islands are two principal reefs—one fringing the shore, and the other, called the "barrier reef," lying

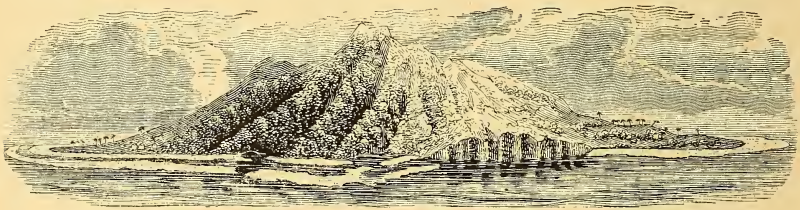


CORAL HEADS OFF THE BRAZILIAN COAST.

seaward, sometimes fifteen miles away. The intervening space is filled with minor reefs and a gorgeous wealth of coral vegetation.

Here are grand platform reefs, a shell of coral, covering the

bottom beneath the shallow waters. West of the two large Feejee Islands are three thousand square miles of reef ground. On these outer reefs the waves break with tremendous force and fury ; and here, where the plunge and roar of the surf are greatest, the polyps flourish with most vigor, and open their richly colored petals to the life-giving waters, as thirsty flowers to the welcome rain. Outside the reefs again there are curious coral growths, in isolated patches, called coral heads, looking like enormous mushrooms. One near Turk's Island stands in water fifty feet deep. The trunk is about fifteen feet in diameter, and supports a tubular mass one hundred feet in diameter, whose top is bare at low tide. In many places the tops of adjacent trunks have joined together, forming a coral floor resting on arches and pillars built without axe or hammer. Some-



HIGH ISLAND, WITH BARRIER AND FRINGING REEF.

times these united coral heads cover large areas. A sight magnificent in the extreme would greet the human eye, if a recession of the sea should leave the arches and columns of these gorgeous temples of the ocean exposed to the human vision, such a vision as no works of human genius presents.

The outer side of coral reefs is usually perpendicular, while the inner side is a gentle declivity. The cause of this will be quickly apparent in following the development of a reef from the bottom. The reef-builders attach themselves to a floor of sand or rock, at a depth of one hundred and twenty feet, and begin to grow. The reef rises, but, as the corals grow most rapidly in pure waters, the inside wall is more precarious and uncertain, the wash of the land and perhaps the discharge of streams tending to foul the sea-water and interfere with the health of the coral workers. This cause

tends to modify the form of the reef, but such a reef always encircles the land ; and, as long as a subsidence of the sea bottom may be going on, the growth of the reef continues.

With this sinking of the land, it is perfectly obvious the area of the island must diminish until it disappears. Then we have a lagoon over the former site, surrounded by a fringe of coral reefs, for the tireless architects have never ceased their building labors. At last over the land where once grew the most luxuriant tropical vegetation a coral floor is formed. Such, perhaps, has been the history of thousands of islands in the Pacific alone, and the vast reefs, from which the ocean sends up a thunderous roar without ceasing, are the monuments of this ocean cemetery. It is believed by scientists now that the depression of the sea bottom in the Pacific Ocean has long since ceased, and the opposite force of gradual elevation commenced. The encircling reefs, with the shallow lagoon of which we have spoken, are called an *atoll*. The force of the waves breaks off fragments of the coral rock and hurls them on the reef. In this way beaches ten or twelve feet above the ocean have been formed, composed of coral sand made fine and drifted by winds and waves, fragments of shells, bones of fishes,



CORAL ISLAND, OR ATOLL.

and similar matters drifted by the sea, the flotsam and jetsam of old Neptune.

Professor Dana describes the beauty of a coral atoll in the following language : “ When first seen from the deck of a vessel, only a series of dark points is descried just above the horizon. Shortly

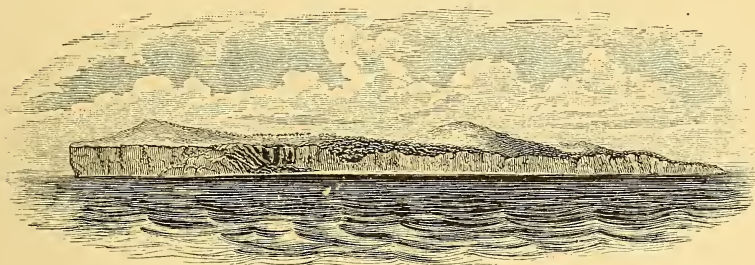
after the points enlarge into the plumed tops of cocoanut-trees, and a line of green, interrupted at intervals, is traced along the water's surface. Approaching still nearer, the lake and its belt of verdure are spread out before the eye, and a scene of more interest can hardly be imagined. The surf, beating loud and heavy along the margin of the reef, presents a strange contrast to the prospect beyond. There lie the white coral beach, the massy foliage of the grove, and the imbosomed lake with the tiny islets. The color of the lagoon water is often as blue as the ocean, although but ten or twenty fathoms deep; yet shades of green and yellow are intermingled. Sometimes there is a ship channel through the reefs into the lagoon, then again only a shallow channel, and sometimes none at all."

Near the ocean side of some of the great reefs there is found enormous depth of water. Just off one of the Panmotus group, bottom was not found at 6,870 feet. Again, not more than a cable's length off Peacock Island, no bottom was found at 1,800 feet. In fact, deep soundings in the vicinity of the Pacific coral islands are universal. Should these submerged islands ever be again elevated, an immense area of the Pacific would be converted again into an archipelago; not of verdure-covered land as formerly, but of huge hills and towering mountains of coral rock, bristling with crags and precipices.

The coral-bearing area of the Pacific Ocean extends from the southern side of the Hawaiian Islands to Pitcairn's Island to the southeast; thence, two thousand miles broad and six thousand miles long, to the Pelew Islands, north of New Guinea, in the Polynesian seas, being as large as the continent of Africa, or of Europe and North America combined. In many instances Pacific coral islands have been elevated since reefs were formed on them, the elevations in a few instances reaching six hundred feet. Metia or Aurora Island, one of the Panmotus group, has walls of coral limestone two hundred and fifty feet high, resembling the Hudson Palisades, and falling in an almost perpendicular line to the ocean. Along the outer margins of these elevated islands are deep caverns, wrought

by the erosive action of the waves. The Bermuda Islands are remarkable for these caverns, the coral-made land being, in some instances, two hundred and fifty feet from the sea-level. On the island of Oaka is one where the explorer may wander nearly a mile through splendid stalactitic caves.

On the coral islands may be found much beauty, but little



METIA, OR AURORA ISLAND.

variety. About a dozen different varieties of plant life are found, and no animals higher than fishes, except a few migratory birds, unless in cases where animals have been introduced by man. The coral-made land was born of the ocean, its palm groves planted by the waves, and here man, too, is found in his most savage, filthy, and ignoble condition. Held by physical conditions with relentless bonds, he transmits his inheritance of degradation to his children. Alternately he gorges himself, like a wild beast, and starves, and is driven to infanticide for self-protection. It is in the land of the elm and oak, the beech and hickory, that we must look for the conditions that mold manhood to its higher estate, rather than beneath the shade of the pandanus and cocoa-palm. To quote from Professor Dana : "A coral island, even in its best condition, is but a miserable place for human development, physical, mental, and moral. There is poetry in every feature, but the natives find this a poor substitute for the bread-fruit and yams of more favored lands. How many of the various arts of civilized life could exist in a land where shells are the only cutting instru-

ments, fresh water barely enough for household purposes, no streams, nor mountains, nor hills? How much of the poetry and literature of Europe would be intelligible to persons whose ideas had expanded only to the limits of a coral island, who had never conceived of a surface more than half a mile in breadth, of a slope higher than a beach, of a change in seasons beyond a variation in the prevalence of rain?"

Such are the coral islands, beautiful gems of the waves, fascinating in their aspects, both from the picturesque and scientific standpoint. At one time the coral animals swarmed in the immense seas which rolled their tumultuous surges over almost all the lands now covered by cultivated fields and great cities. Most of the continent of Europe, indeed, rests on a vast cemetery of corals, and it may be safely asserted that these little creatures have played the most important part in the architecture of the great world on which we live.

Nearly allied to the coral polyp is the beautiful marine animal known as the sea-anemone, though this creature is not an architect, nor has it played an important part in the great changes of the ocean bottom, and thus indirectly in the formation of the planet. In beauty of tint and form these inhabitants of the sea rival the most exquisite products of the floral kingdom. But, in addition to loveliness of form and color, they have the superior attraction of vitality. These sea flowers are living animals, breathing, eating, digesting, and capable of changing their forms at will. A pink would be more curious if it could walk, a rose awaken greater interest if it could reach after its necessary nourishment and take care of its own buds. This is what the flowers of the sea do. Supported by a solid base and cylindrical stem, the observer sees them terminate like the corolla of a flower, as in the petals of the anemone which gives the animal its name. These charming and timid creatures are also called *actinia*, as indicating their tendency to form rays or stars, from the Greek word *aktin*, a ray.

The body of these animals is cylindrical in form, terminating beneath in a muscular disk, which is generally large and distinct,

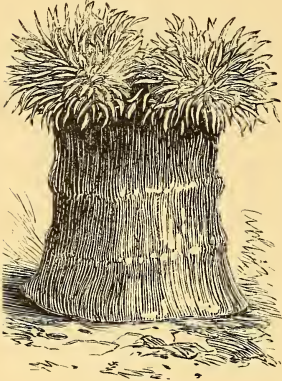
enabling them to cling vigorously to foreign bodies. It terminates above in an upper disk, bearing many rows of tentacles which differ from each other only in their size. These tentacles are often deco-



ANEMONES, OR SEA-FLOWERS.

rated with brilliant colors, forming a species of collarette, consisting of tubes which can be contracted and extended, pierced at their points by an orifice, whence water can be drawn in or ejected at the will of the animal. Arranged in multiples of circles, they distribute themselves with perfect regularity around the mouth. These are the arms of the zoöphyte. The mouth of the sea-anemone, oval in form, is among the tentacles, and communicates with the stomach by a short tube. This stomach performs a variety of offices, for it

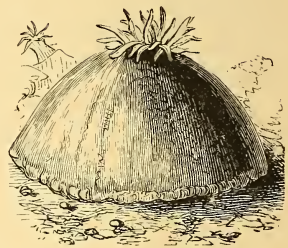
is the digestive organ, the lungs, and from it are projected the young of the creature. The *ova*, or eggs, are held in the tentacles or feelers, and are fecundated in the month of September, when the embryos are developed. These then pass into the stomach, being afterward ejected from the mouth with the rejected portions of the food. So we see that it is the stomach that breathes, and the mouth which is the organ of birth.



FRINGED ACTINIA, EXPANDED.

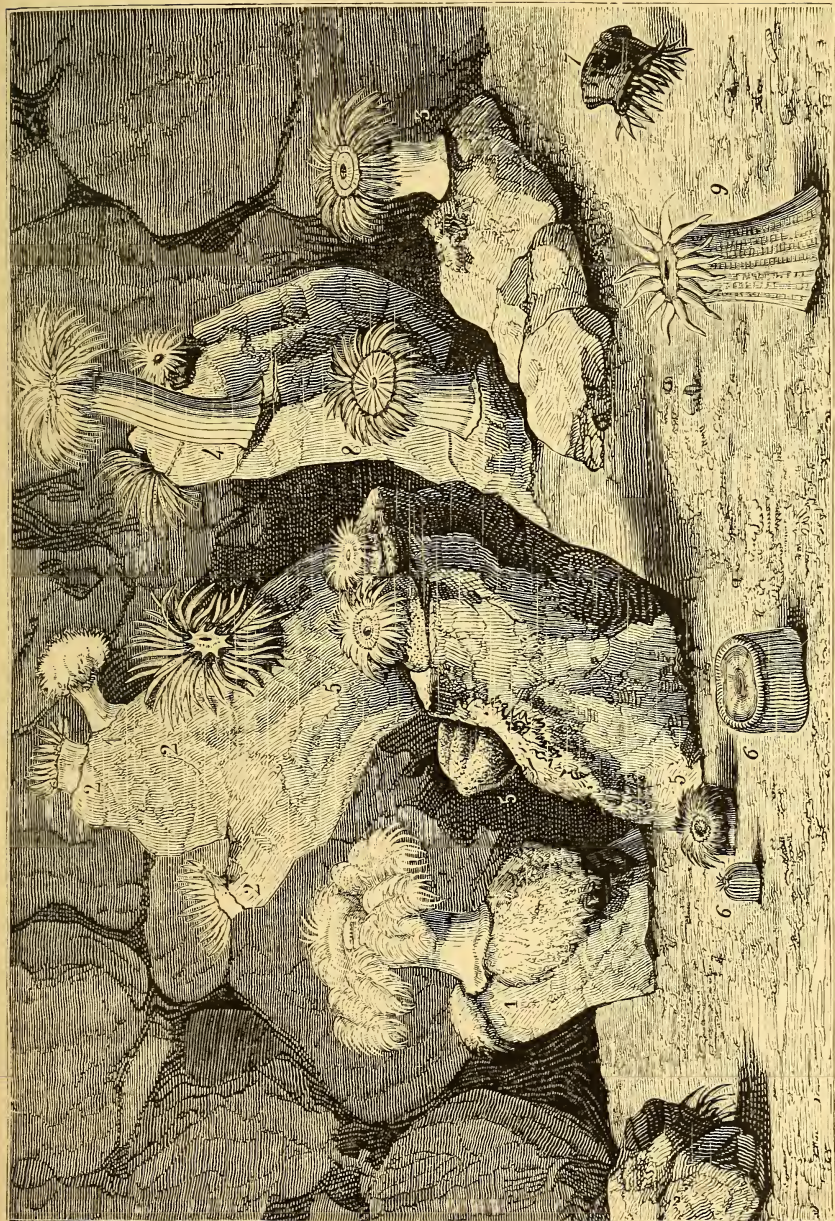
The sea-anemones multiply their species in another manner, similar to the process already described in the coral polyp. Bud-like excrescences appear on the edge of the base, which finally detach themselves from the mother and become separate animals. In fact, in some species there is still another method,

which is thus described by Mr. Hogg, the naturalist. Wishing to detach an anemone from the aquarium, he only succeeded by violent efforts in tearing off the lower portion of the creature, six partly separated portions remaining attached to the glass. At the end of eight days it was noticed that these fragments of the animal seemed to have distinct contractile powers, and that each had a row of tentacles. They developed shortly into six perfect anemones. Every part of these strange creatures thus became a living creature, while the mutilated mother continued to live as if nothing had happened. In short, sea-anemones may be cut limb from limb, divided and subdivided. Each part of the body is quickly replaced. Cut off the tentacles, and they are renewed in a very short time.



FRINGED ACTINIA, CLOSED.

The sea-anemones vary in their habitat from pools near low-water mark to eighteen or twenty fathoms of water, whence they



SEA-ANEMONES.

Varieties of sea-anemones shown above: 1, *Actinia dianthus*; 2, *Cereus gemmaceus*; 3, *Actinia bicolor*; 4, *Sagartia viduata*; 5, *Cereus papillosus*; 6, *Actinia pieta*; 7, *Actinia equina*; 8, *Sagartia rosea*; 9, *Sagartia coccinea*.

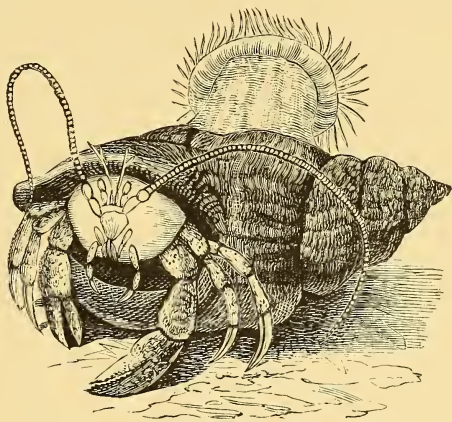
have been dredged up. "They adhere," says Dr. Johnson, "to rocks, shells, and other extraneous bodies by means of a glutinous secretion from their enlarged base; but they can leave their hold and remove to another station whensoever it pleases them, either by gliding along with a slow and almost imperceptible movement (half an inch in five minutes, as is their usual method), or by reversing the body and using the tentacles for feet, or, lastly, by inflating the body with water to make themselves buoyant, and allowing themselves to be driven by the random motion of the waves. They feed on shrimps, small crabs, whelks, and similar mollusks, and probably on all animals brought within their reach whose strength or agility is not sufficient to extricate them from the grasp of their numerous tentacula."

The sea-anemone passes nearly its whole life fixed to some rock, section of coral, the back of a crab or other crustacean. There it lives a sort of unconscious and obtuse existence, gifted with an instinct so obscure that it is not even conscious of the prey in its vicinity until it is actually in contact, when it seizes it in its mouth and swallows it. One naturalist tells the story of a large actinia who took a notion to swallow a scollop which it had captured. After much stretching it got the bivalve down into its stomach, and in due time the mollusk was digested. The problem then was to get rid of the shell. It was a double disaster: the scollop had been taken in, and so was the sea-flower. It was the same as if a guest at the table should swallow a tea-saucer. The anemone, however, proved equal to the emergency. It literally changed its base by dividing itself into two animals attached to the scollop shell as a foundation, each part becoming a perfect animal.

When free, the anemone swims backward, till its base encounters a firm object, and then it fixes itself by suction. There are two specimens which show a marked preference for the back of crabs and similar animals. One is called the parasite anemone, and its favorite home is on the hard shell of the hermit-crab. As these crabs are great travelers, and frequently vacate their domiciles by

taking possession of other empty shells, this species of anemone sees more of life than his cousins.

The sea-flowers differ greatly in size, form, and color, and also in special peculiarities of development and function ; so that a large collection would have the appearance of an animated flower-garden composed of carnations, china-asters, dahlias, daisies, etc "The beauty of many species," says Mr. Damon, "is greatly enhanced by the fact that several colors are combined in individual specimens. Thus sometimes the main body or



HERMIT-CRAB WITH SEA-ANEMONE ON ITS SHELL.

column will be green with white or golden tentacles, and the base buff with a pink disk or tips, or crimson with azure spheroids ; sometimes the whole animal will be of one color, varied by different tints and shades. Down below, in the caves of the sea, these wonderful creatures have for untold ages anticipated our modern 'combination suits,' and have appeared dressed in all the glory of scarlet and gold, pink and gray, blue and white, green and crimson ; their exquisite taste always selecting accords or pleasing contrasts, and avoiding all discordant shades which would clash or 'kill' each other, such as we sometimes see in human productions."

The column-shaped body of the anemone is soft, but usually tough and tenacious, and consists of a simple sac or cavity, commonly broadened at the base and open at the top or mouth. The upper chambers of the cavity are prolonged into tentacles or feelers which extend in a number of rows around the mouth, forming, when they are all extended, a beautiful crown. "If these tentacles or feelers are touched, or if the creature is in any way alarmed,

they are instantly contracted, and all the parts sink down and are drawn together into a compact mass. This is effected by the exudation of water from the cavities or chambers through a series of openings connected with the central cavity. Expansion takes place by the reversed action, filling these cells with water." Sometimes the power which they possess of altering their shape appears to be exercised for the mere pleasure of the thing. Now they will contract themselves into balls, partially elongated and expanded; then they will stretch out their fringes or tentacles to their widest extent, like a many-petaled flower in full bloom; and again they will encircle themselves with belts or girdles, drawn more or less tight and shifting up and down, involving changes of form every minute.

"In addition to the tentacles," says the author last quoted, "these curious creatures are armed for attacking their prey with what we may call fine thread-like lassos, of arrow-like sharpness, called *cnidae* (from a Greek word meaning a nettle), from which is transmitted a powerful stinging and numbing sensation, deadly to small prey, the victim being affected as by a shock of electricity. This I know by experience, for, some years ago, when in Bermuda, while attempting to take a large actinia from a rock, one of these soft-looking beauties gave me a shock which disabled my arm for hours. It will easily be understood that this concealed battery enables the sea-anemones to conquer much larger and stronger creatures than they could hold simply by the tentacles; they often seize large shrimps and crabs far beyond their own size. Occasionally, however, if one of these finds an anemone weakened from any cause, it will take up a position upon the edge of its mouth, keeping it distended, and with its claws pluck out the food from the victim's sac and appropriate it to its own use. Sometimes, when such an attempt is made, a combat ensues, and then woe to the marauder if he has mistaken the strength of the sea-anemone! He will surely fall into his own trap."

A naturalist tells the story of the self-protective power of the actinia in the following sprightly manner: "Let me invite you to a sight I have many times beheld. I have in captivity a hungry

sea-flower. Knowing well what suits its palate, I take a delicate morsel like a pillule and let it fall in the water. It descends on the waving petals or tentacula, on the point of one of which the pretty creature has caught it in an instant. How delicate the adjustment upon its more than fairy fingers! For a few minutes it is balanced with the nicest poise on that dactylic petal. Ah! a voracious and unmannerly little bummer of a minnow sees the delicious morsel, and makes a rapid dash to snatch it from my pet. Good, good! Well done, my bonny! I did not see the slightest motion of that indignant flower creature; yet assuredly there was a movement, and an effectual one too, for the zoöphyte had shot one of its invisible shafts, and the ichthyic thief dashes off like one frantic with pain. Is he hurt? Likely. He is stung in the snout. See how he seems to shake his nose. He actually seems to sneeze again, and conducts himself much like a puppy that, uninvited, has thrust his nose into a basin of not soup. Ah, ha! He is rubbing his fishy proboscis against a frond of sea-lettuce. Perhaps the salad may cool his burning pain." Sometimes, however, the insatiable stomach of the sea-flower is made to give up its prey. Among the successful robbers, shrimps are foremost. The shrimp, seeing the anemone devouring its food, will dash on it from a distance, and sometimes even extract the swallowed morsel from the stomach itself. Seating itself on the extended disk of the sea-flower, with its small feet it prevents the approach of the tentacles at the same time that it inserts its claws into the digestive cavity and seizes the food. In vain the anemone tries to contract its gills and close its mouth. Sometimes the conflict between the zoöphyte and crustacean becomes serious. When the former is strong and robust the aggression is repelled, and the aggressive shrimp makes the dessert for the sea-flower's repast."

If the actinia is voracious, it has also great powers of fasting. These creatures have been known to live two and three years without any nourishment. They are said to be delicate eating, and to be in considerable favor for the table in Southern France, Italy, and Greece, the taste resembling closely that of the crab or lobster.

CHAPTER III.

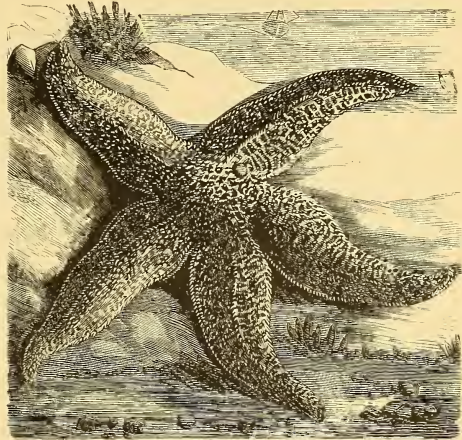
THE SWINE OF THE OCEAN.

Curious analogies between the inhabitants of land and sea.—The echinoderms or “hedgehogs” of the ocean.—The starfish, and its curious habits.—Remarkable power of self-production.—The scavengers of the sea.—Its ravages on the oyster-beds.—The sea-urchin, how it lives, moves, and has its being.—A salt-water porcupine.—Marvels of its shell.—Methods of defense.—A choice article of food.—The sea-cucumber.—The gynapter.—The Chinese fishing for these animals.

THE almost infinite life of the sea offers analogies to the life of the land in a thousand forms, and among them there is none more curious than what may be called the swine of the ocean. The curious order of sea animals known as echinoderms derives the name from two Greek words indicating an animal bristling with spines like the hedgehog. These creatures are sometimes free, sometimes attached by a stem, flexible or otherwise, and radiating after the manner of a circle or star, or again of the shape of a star with more or less elongated arms, which secrete shell-like plates, and are covered with spines, scales, etc. The most common of the echinoderms is the starfish, which no one who has ever lived long on the seashore has failed to observe. Like most of the lower animals, particularly the inhabitants of the sea, the starfish has the power of reproducing any limb which may be destroyed, and the habit of fishermen, who cut them up and throw them overboard, hoping to free their oyster-beds from this destructive pest, only augments their number many fold and increases the evil sought to be prevented.

When one sees a starfish stranded on the shore, the first notion is that it is immovable. But, so far from this being the case, it

moves along the sea bottom with great ease. It is, in fact, provided with a special apparatus for locomotion. The upper portion of the starfish (a misnomer, for it is no more a fish than the bee or the caterpillar), or the "five-fingered Jack," as sailors call it, is rough and tuberculous, armed with spine-like projections, while the under side is soft, containing all the organs of life and movement. The rays or arms of the starfish are usually kept on the same level, but the creature has the power of raising any of them to pass over an obstruction. It thus ascends elevations with the same ease apparently with which it moves on



STARFISH ON A ROCK.

a level. The rays are perforated by membranous tubes which issue from apertures. These are the feet of the animal, and consist of two parts, a bladder-like portion placed within the body, and the tubular part projecting outside and terminating in a disk-shaped sucker. The feet are thus muscular cylinders, hollow in the center and very extensible. In progression the animal extends a few of its feet, attaches its suckers to the rocks or stones, and then, by retracting its feet, draws the body forward. The mode of movement is something like that of a ship dragging its anchor. The pace is slow, but, like that of the tortoise, it is sure, and the most singular fact is that it must perceive obstructions, for it immediately prepares to surmount them.

In addition to its organs of digestion and movement, the starfish has blood-vessels, a breathing apparatus, and a nervous system, though the latter must be of a very low order, if we may judge by its apparent capacity of suffering vivisection without pain. One of

the most interesting traits about this lowly organized creature is its instinctive devotion to its young. The eggs are contained in little pouches placed at the base of the rays ; and, when emitted through an opening, the mother star, instead of abandoning them, gathers them together, and forms a kind of protecting arch over them, like a hen brooding over her chickens. If the eggs are accidentally scattered, they are brought together again with great care. The experiment has frequently been tried in an aquarium, and the mother will be seen to travel the whole distance of the tank till she finds and recovers the scattered ova.

Power of reproduction, though, is not limited to eggs. In common with some of the other marine orders previously noticed, the starfish has the strange capacity of detaching one or more of its rays, and each of the cast-off members becomes by and by a perfect creature of its kind ; while a new ray will grow in the place of the one lost, equipped with all the complete organs necessary. It takes from twelve to fifteen weeks for the star thus to reproduce a lost part ; but, in the mean time, the animal seems to be perfectly contented, and not to know the difference. As starfishes are found upon the shore, they often appear to be quite dead when they are really alive ; they are the opossums of the sea. "Take up one of these fellows who is lying perfectly still, and put him into fresh sea-water, and he will very likely soon be traveling about as well as ever. However, as the dead and living, when left stranded by the tide, present so nearly the same appearance, it may be well to have some test by which to make sure of their true condition. There are two modes of ascertaining this with a reasonable degree of certainty. If, on taking up a starfish, it hangs loose and limp, it *is* dead ; but, however dead it may look, if on touching it there are a firmness and consistency in the substance, it is only 'playing 'possum,' and will revive in the water. The other mode of trial is to lay our starry friend on its back, when, if it is alive, you will soon see a number of semi-transparent globular objects beginning to move, reaching this way and that, as if feeling for something ; these are the locomotory organs, or *ambulacra*, seeking to

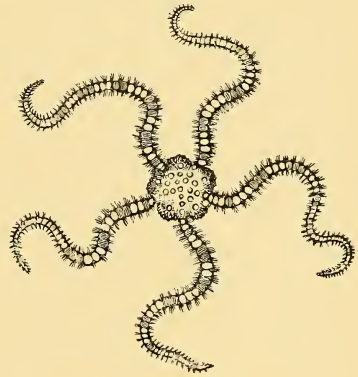
regain their normal position. If there is no movement of these, you may conclude that it is an extinguished star."

Like all the other inhabitants of the sea, the starfish has an appetite which is never satiated, and a dinner is always welcome. Its sole occupation is to feed itself, and it is a sea scavenger which keeps up an incessant chase after all kinds of dead animal matter. So it is probable that these creatures contribute largely to keeping the waters of the ocean in a pure state. But they do not confine themselves to decaying matter. Any kind of mollusk is a favorite tidbit, from the humble whelk, only about five eighths of an inch long, to the lordly and luscious oyster. The oyster-beds have no more inveterate ravagers and brigands to disturb their serene existence, man excepted, than the starfishes.

This little being, formed of five arms, and with no other apparent organ, accomplishes a work which man, unaided, is quite unable to execute: it opens an oyster neatly and effectively without an oyster-knife, and then swallows

the flesh of the bivalve in the same manner as the human being at the oyster-shop. If man had no other means of subsistence than oysters, and were without a knife to open them, it would most assuredly puzzle him, with all his genius, to get at the savory morsel shut up in its obstinate shell.

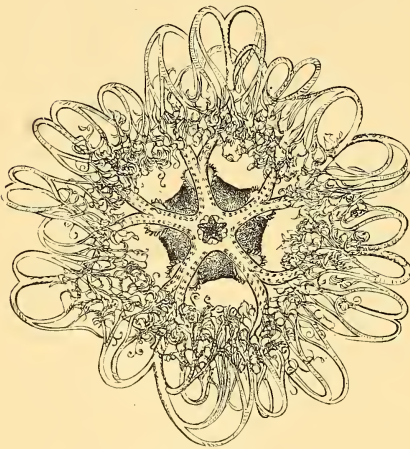
It was formerly believed that the starfish waited for the moment when the oyster would open its valves to introduce one of its rays into the opening. It was imagined that, having thus put one foot into the other's domicile, it soon got the other four in, and finished by devouring the inhabitant. This view is not now held. In order to obtain possession of and swallow an oyster, it appears that the starfish begins its approaches by bringing its mouth to



SERPENT, OR BRITTLE STARFISH.

the closed edges of the oyster shell. This done, with the assistance of a particular liquid, which its mouth secretes, it injects a few drops of an acid liquid between the shells, which forces the oyster to open its valves. The robber then crawls in and eats his dessert. Professor Rymer Jones explains the process differently. According to him, the oyster is seized between the rays of the ravisher, and held under the mouth by the aid of the suckers. The *Asteria*, or starfish, then everts or turns its stomach inside out, and envelopes the whole oyster in its interior recesses, doubtlessly distilling a poisonous liquid which causes the shell to open. The incredible number of oysters destroyed by starfishes is well known to oystermen, though they do not know that their own barbaric ignorance is largely to blame. Starfishes drawn up in rakes, nets, and dredges in large quantities are tied in bundles, and the cord drawn so tight as to cut through the pile. The result is that all the pieces, when thrown overboard, become new and perfect starfishes.

Belonging to the same group as the starfishes are the brittle



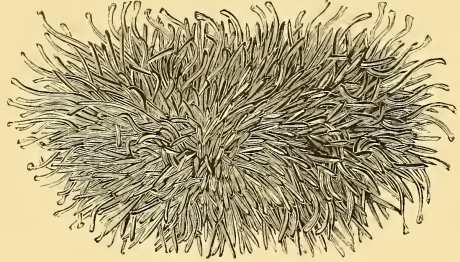
BASKET-FISH.

starfish and the basket-fish, both of them being found all along the Atlantic coast, as well as in other waters. The former has long, slender arms, nearly cylindrical in form, attached to a small, disk-like body. The arms are very loosely connected with the body, and are thrown off when the creature is frightened. Indeed, the fragility is such that it will crumble up in the fingers when taken out of the

water. All of the starfishes appear to have the power of breaking themselves to pieces, or committing suicide, when frightened, though, if the pieces are immediately thrown back into

the ocean water again, the separate parts all live and thrive as individuals.

One of the most curious and beautiful among the echinoderms is the basket-fish. The development of the arms is so complex and intricate, interlacing each other in so many ways, and dividing up again into so many thousand slender appendages, that, as it floats on the ocean, it appears to be a delicate piece of lace moving in beautiful festoons over the tossing waves. Its thousands of waving filaments constitute thread-like weapons,



SEA-EGG, OR SEA-URCHIN.

intended to seize and close on the animals which serve as its prey. The arms are sometimes sixteen inches long, and from the curious interlacing of these is derived the name of basket-fish.

From the starfishes let us pass to the sea-urchin, one of the queerest of sea animals in appearance, from the bristling armature of spikes which covers the body. In order to see the sea-urchin with its spines in full relief, it is necessary to see it as it lives, which, of course, must be for the most part in an aquarium. It is then that the sea-urchin can be seen as he is, bristling with prickles, and offering that formidable look which is his greatest protection.

In these curious creatures the upper parts are protected by a kind of shell more or less dome-shaped, but extremely variable in form. The shell is one of the most marvelous structures in the animal kingdom, and the mechanical difficulties overcome in its formation of no ordinary kind. The shell is nearly globular, and increases in size with the age of the animal, but without altering its exact shape—a problem of no little difficulty. The shell is composed of a vast number of separate pieces, whose junction is only evident in the interior, being otherwise hidden from view by the projections on the outer surface. These are of an hexagonal shape, with a slight

curve, and having mostly two opposite sides much longer than the others. With the growth of the animal, deposits of chalky matter are made on the edges of these plates, which thus keep their shape while the size enlarges. When a fresh specimen is examined, the surface is seen covered with short, sharp spines, thickly set like a hedge. Each spine is movable at will, and works in a perfect ball-and-socket joint, the ball being a round, globular projection on the surface, and the socket sunk into the base of the spine. When the creature is dead the spines fall off at a touch, but when living it can use these sharp-pointed thorns with powerful effect, as the rude intruder quickly finds.

The sea-urchins appear to be destitute of sight. They hollow out places for themselves in the rock, even the hardest material, such as granite and sandstone, yielding to their strong teeth. The *débris* is removed with their spines, which they use as picks and shovels. When the hole is large enough, our prickly friend intrenches himself, presenting a phalanx of fierce, threatening pikes to his enemies, and most rash assailants pay the penalty of interfering with the peace of this cunning little water-hog. It is only a few of the echinoderms which have the power to hollow out rocks, most of them seeking shelter under rocks and heavy marine plants. The species having the spines slender and the shells thin bury themselves in the sand, with which they cover themselves entirely, leaving only a breathing place. "The urchin's relationship to the starfish," says Mr. Damon, "may be illustrated by supposing that we bring all the five points of the star together, filling up the interstices with a similar substance; we have then a complete urchin minus the spines. Or, take the peel whole off of an orange, divide it into fifths, and bring the points up together, sticking needles in to simulate the spines, and we have an urchin, at least in shape." The color of the sea-urchin is usually reddish-brown or black, and, while the body or ball part is not larger than a hen's egg (which it much resembles in shape), the spines are sometimes a foot long. "These animals," to quote Mr. Damon again, "are voracious vegetarians, eating off large fronds of the sea-lettuce and other plants, and clean-



SEA-URCHINS LODGED IN THE ROCKS THEY HAVE EXCAVATED.

ing a tank of every vestige of vegetation in a very short time. Their motion in swimming is slow, and when walking on the side of a glass tank, which they do with perfect ease on their long, slender legs (which are terminated by cup-shaped disks, constructed on the same principle as a surgeon's cupping instrument), and aided by the spines, they certainly are an attractive sight, especially when all their spines and pedicles are in motion."

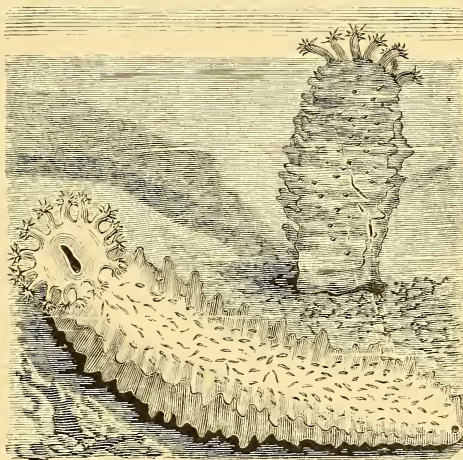
The sea-urchin fully grown has not less than twelve hundred prominent spines, as well as many more subsidiary ones. They attach themselves to any object by means of suckers. They travel with equal ease and rapidity on their backs or on their stomachs, and sometimes advance by turning on themselves like a wheel in motion. To see this bristling creature in movement, one might fancy a chestnut bur on its travels. The mouth, placed underneath the body, is armed with five sharp teeth, and makes a truly formidable apparatus, competent to eat through the hardest rock, and to grind up crustaceans, such as crabs and shrimps, as easily as sea-fronds. Almost impervious to attack, the sea-urchin is voracious and aggressive, and is a terror to the small fish, crabs, mussels, etc., with which it comes in contact ; for, like the land hog, which it resembles, it is equally partial to flesh and vegetable food.

Sea-urchins are found in every sea, dwelling in sandy bottoms and on rocky ground. They are caught with wooden pincers, or may be taken with a thickly gloved hand. Like the crab, which it resembles in taste, the sea-urchin becomes red when boiled. It is also eaten raw, like the oyster, the flesh being taken out with a spoon. When it is dressed by boiling, the flesh may be eaten from the shell with a spoon, like an egg ; hence the name of sea-eggs.

Sea-eggs were a choice dish upon the tables of the Greeks and Romans ; they were then served up with vinegar or hydromel, with the addition of mint or parsley. When Lentulus feasted the priest of Mars—the Flamen Martialis—this formed the first dish at supper. Sea-eggs also appeared at the marriage feast of the goddess Hebe. "Afterward," says the poet, "came crabs and sea-urchins, which do not swim in the sea, but content themselves by traveling

on the sandy shore." "For my own part," says Figuiet, in the "Ocean World," "I have only once partaken of sea-urchin, and it appeared to me to be food fit for the gods; but perhaps the circumstances sufficiently explain this dash of culinary enthusiasm. The Reserve Restaurant at Marseilles has not always been the vast stone edifice we now behold, backed majestically by the mountain, and fronting the sea on the promenade of the Corniche du Prado. In 1845 it rose quite at the entrance of the port, a small glass cage, suspended as it were by a magic thread between the heavens and the sea. From this aërial dwelling, overhanging with unheard-of audacity the waters which surrounded it on all sides, we gazed on the most wonderful prospect in the world, and reposed ourselves, while enjoying this intoxicating scene, during which the ships were continually entering the port, passing under our very feet. It was in this enchanted palace that sea-urchins were served up, supported by the traditional bouillabaisse."

Another sea creature belonging to the same order is the sea-cucumber, for in its shape it is remarkably like that well-known vegetable. It presents the shape of an elongated and worm-like cylinder, with variable dimensions, from two to thirty inches in length. The skin is armed with projecting hooks, which serve alike as weapons



SEA-CUCUMBER.

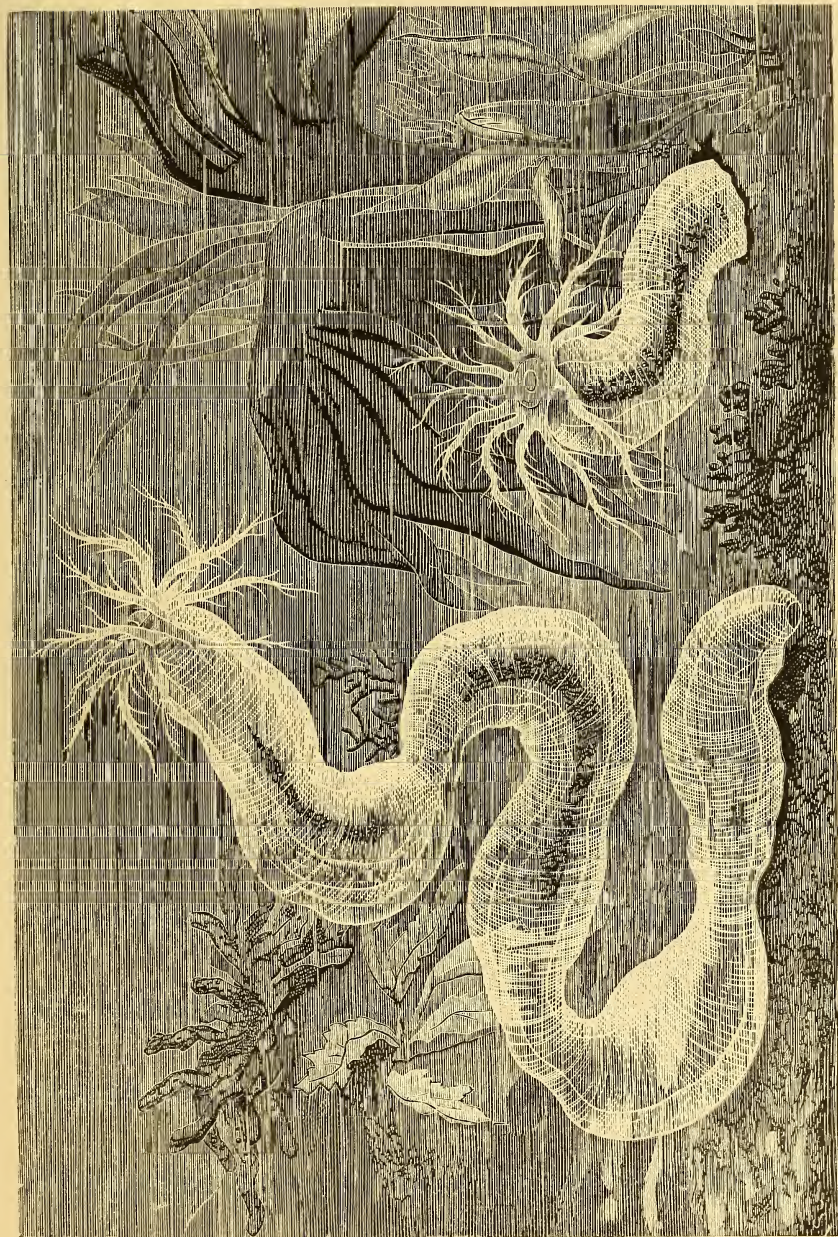
and supports, for they have suckers at their ends. The mouth is at the end of the body, and it is crowned with a row of brilliantly colored tentacles, which make it look like the corolla of a flower. These are extended at will for the purpose of grasping

food and conveying it to the mouth ; but, the food being brought within reach, only one of these feelers is occupied in actually introducing it within the orifice, while the others remain passive, and appear to be waiting their turn to do the same service. Mrs. Agassiz has likened this group of tentacles in the sea cucumber to some of the " delicate seaweeds, for their fineness of structure and the richness of their colors." These animals, besides the curious power of multiplying themselves by fissure, have the still more remarkable capacity of emptying themselves of nearly all their internal organs, and after a brief time of reproducing them and living on as comfortably as ever. The sea-cucumber is a favorite article of food among the nations of the East, and the fishery plays an important part in the commerce and industry of China. Thousands of junks are annually equipped for the "trepane" (so the sea-cucumber is called when prepared as food) fishery. The importance of the industry is indicated by the fact that Madagascar alone sends two hundred vessels to the fishery.

The *Synapta* is closely allied to the sea-cucumber, but is distinguished from the others by the absence of feet, and by the fact that it unites both sexes in the same individual.

"Imagine," says M. Quatrefages, "a cylinder of rose-colored crystal, as much as eighteen inches long and more than an inch in diameter, traversed in all its length by five narrow ribbons of white silk, and its head surmounted by a living flower, whose twelve tentacles of purest white fall behind in a graceful curve. In the center of these tissues, which rival in their delicacy the most refined products of the loom, imagine an intestine of the thinnest gauze gorged from one end to the other with coarse grains of granite, the rugged points and sharp edges of which are perfectly perceptible to the naked eye.

"But what most struck me at first in this animal was, that it seemed literally to have no other nourishment than the coarse sand by which it was surrounded. And then, when, armed with scalpel and microscope, I ascertained something of its organization, what unheard-of marvels were revealed ! In this body, the walls of



THE SYNAPTA.

which scarcely reach the sixteenth part of an inch in thickness, I could distinguish seven distinct layers of tissue, with a skin, muscles, and membranes. Upon the tentacles I could trace terminal suckers, which enabled the synapta to crawl up the side of a most highly polished vase. In short, this creature, denuded to all appearance of every means of attack or defense, showed itself to be protected by a species of mosaic, formed of small calcareous shield-like defenses, bristling with double hooks, the points of which, notched like the arrows of the Caribbeans, had taken hold of my hands."

If one of these synaptas is preserved alive in sea-water for a short time, and subjected to a forced fast, a very strange thing will be observed. The animal, being unable to feed itself, successively detaches various parts of its own body, which it amputates spontaneously. A great compression or ring is first formed, and then the separation of the condemned part takes place quite suddenly. "It would appear," says M. Quatrefages, "that the animal, feeling that it had not sufficient food to support its whole body, was able successively to abridge its dimensions, by suppressing the parts which it would be most difficult to support, just as we should dismiss the most useless mouths from a besieged city."

This singular mode of meeting a famine is employed by the synapta up to the last moment. After a few days all that remains of the animal is a round ball surrounded by tentacles. In order to preserve life in the head, all the other parts of the body have been sacrificed.

CHAPTER IV.

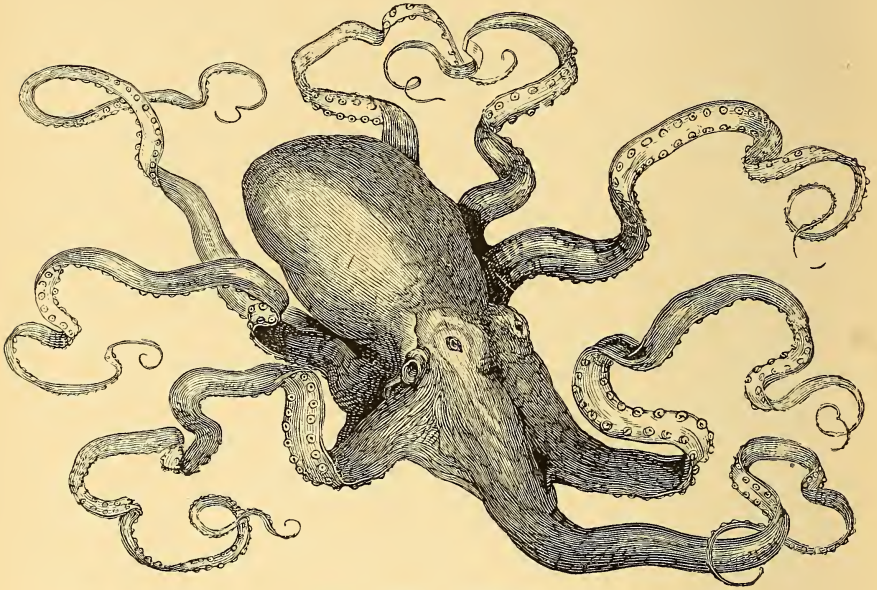
THE OCTOPUS, CUTTLE-FISH, ARGONAUT, ETC.

A curious and dangerous sea animal.—Victor Hugo's description of the "devil-fish."—Early traditions of the kraaken.—Huge cephalopods seen of recent years.—Description of the octopus.—Character, habits, food.—Method of seizing its prey, etc.—Anecdotes of adventures with the octopus.—Different varieties of the octopus.—The cuttle-fish, and its peculiarities.—Something about the argonaut or paper nautilus.

AMONG the widely diversified class of marine creatures known as mollusks, there is none so interesting and captivating to the imagination as the cuttle-fish, squid, and other cephalopods, as they are called in science, from two Greek words, which in their combination mean "feet proceeding from a head," the most common form of which in our own seas is the octopus. Victor Hugo, in his remarkable novel of "The Toilers of the Sea," gives us a picturesquely terrible narrative of a conflict of his hero with one of these grewsome monsters of the deep. That portion of it which describes the octopus, under the name of *pieuvre*, or the "devil-fish," the titles given by the fishermen of the Channel Islands to this formidable creature, is worthy of quotation in this connection, though the poetic exaggeration of the novelist, justified by art purposes, can hardly be indorsed by science. M. Hugo thus writes :

"To believe in the existence of the devil-fish, one must have seen it. Compared to it, the ancient hydras were insignificant. Orpheus, Homer, Hesiod, only imagined the chimæra, Providence *created* the octopus. If terror was the object of its creation, it is perfection. The devil-fish has no muscular organization, no breast-plate, no horn, no dart, no tail with which to hold or bruise, no cutting fins or wings with claws ; no prickles, no sword, no electric

discharge, no venom, no talons, no beak, no teeth. It has no bones, no blood, no flesh. It is soft and flabby, a skin with nothing inside of it. Its under surface is yellowish, its upper earthy. Its dusty



EIGHT-ARMED CUTTLE-FISH.

hue can neither be imitated nor explained. It might be called a beast made of ashes which inhabits the water. Irritated, it becomes violet. It is a spider in form, a chameleon in coloration. . . . Seized by this animal, you enter into the beast, the hydra incorporates itself with the man ; the man is amalgamated with the hydra. You become one. The tiger can only devour you ; the devil-fish inhales you. He draws you to him, into him ; and, bound and helpless, you feel yourself slowly emptied into the frightful sac, which is a monster. To be eaten alive is more than terrible ; but to be drunk alive is inexpressible.”

Before the publication of Victor Hugo’s description, which, making allowance for certain inaccuracies and overwrought notions, is sufficiently just to convey some true idea of the octopus,



GIGANTIC SQUID, CAPTURED BY THE STEAM CORVETTE ALECTON.

the knowledge of this animal among scientific men was limited. It had been known in a vague way since the time of Aristotle, but



THE GIANT SQUID.

the remarkable stories which have come down to us had been treated by modern scientific men with contempt, as being mere legends, unworthy of credence or even of investigation. Pliny relates that

an enormous cuttle-fish was taken on the coast of Spain which measured thirty feet long in its arms, and the body of which weighed seven hundred pounds. Olaus Magnus and Denis de Montfort, naturalists during the Middle Ages, described a gigantic animal of the Northern Seas, under the name of the kraaken, which often made ships founder by its attack. Pontoppidan, Bishop of Bergen, in one of his books assures us that a whole regiment of soldiers could easily manœuvre on the back of the kraaken, which he compares to a floating island.

In 1853 a colossal octopus was stranded on the coast of Jutland, whose body, being dismembered, made a great many wheelbarrow loads, its pharynx, or back part of the mouth, being as large as the head of an infant. Another extraordinary and apparently well-authenticated account is given by Lieutenant Bayer, of the French steam corvette *Alecton*, and M. Berthelot, the French consul at the Canaries, to whom the report was made, and who forwarded it to the French Academy.

The steam corvette *Alecton* was between Teneriffe and Madeira when she fell in with a gigantic calamar or squid, not less—according to the account—than fifteen metres (fifty feet) long, without reckoning its eight formidable arms, covered with suckers, and about twenty feet in circumference at its largest part, the head terminating in many arms of enormous size, the other extremity in two fleshy lobes or fins of great size, the weight of the whole being estimated at four thousand pounds; the flesh was soft, glutinous, and of reddish-brick color.

The commandant, wishing in the interests of science to secure the monster, actually engaged it in battle. Numerous shots were aimed at it, but the balls traversed its flaccid and glutinous mass without causing it any vital injury. But after one of these attacks the waves were observed to be covered with foam and blood, and, singular thing, a strong odor of musk was inhaled by the spectators. This musk odor is peculiar to many of the cephalopods.

The musket-shots not having produced the desired results, harpoons were employed, but they took no hold on the soft, impal-

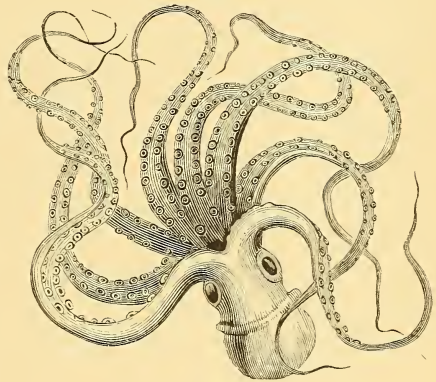
pable flesh of the marine monster. When it escaped from the harpoon, it dived under the ship, and came up again at the other side. They succeeded at last in getting the harpoon to hold, and in passing a bowling hitch round the posterior part of the animal. But when they attempted to hoist it out of the water the rope penetrated deeply into the flesh, and separated it into two parts, the head with the arms and tentacles dropping into the sea and making off, while the fins and posterior parts were brought on board : they weighed about forty pounds.

Rev. Mr. Harvey, of Newfoundland, published an account a few years ago of the adventure of two fishermen in Conception Bay. Their boat passed near what appeared to be a floating bale of goods, which was presumed to be flotsam from some wreck. One of them struck the mass with the boathook, when it instantly opened, like a gigantic umbrella without a handle, and a huge head, with fiery, threatening eyes that protruded ominously, and a long, curved beak, raised itself from the surface. While they stood paralyzed with fear, the monster flung at them a tentacle of livid, corpse-like hue thirty feet long, which went far beyond the boat, or they would have been engulfed. One of the fishermen seized a sharp hatchet, and by a well-directed blow severed this terrible lasso before another one could be used, on which the savage apparition of the sea swiftly darted backward, and was lost to sight amidst the ink-like discharge with which it blackened the waters. The tentacle was given to Mr. Harvey, and the fishermen avowed there must have been at least ten feet more of it next the body of their assailant. In this case, as in all the accounts of gigantic cephalopods, it is probable that the creature belonged rather to the squid species, than what is properly known as the octopus.

The existence of these gigantic cephalopods—for such is the name which science gives to sea animals of this class—became a matter of interest to scientific men after the publication of Victor Hugo's romance ; and it has now become definitely established that the great squid is not only a verity, but one of the most formidable, in its equipment of attack and defense, produced by the immeas-

urable fecundity of the sea. If it existed in the same numbers as the shark, that ferocious and ravenous fish would be obliged to yield its prominence as the most dreadful denizen of the ocean waters. The octopus, and all its congeners, unlike other sea creatures, kill not merely for food, but appear to delight in killing for its own sake. True aquatic brigands, they are aggressive and daring to an extreme degree, though their favorite mode is to lie in wait for their victims. Nature, however, applies to them the law of retaliation. All the cuttle-fishes, from the smallest to the largest, are favorite food of the whale and dolphin, which attack them with impunity. Michelet says: "These lords of the ocean are so delicate in their taste that they eat only the heads and arms, which are tender and easy of digestion. The coast at Royan, for example, is covered with thousands of these mutilated cuttle-fish. The porpoises take most incredible bounds, at first to frighten them and afterward to run them down; in short, after their feasts they give themselves up to gymnastics."

Within a few years some very large specimens of the octopus have been captured. Professor Spencer Baird says that the large specimen which was preserved in the New York Aquarium is only an infant compared with the gigantic squid of the Pacific Ocean, that on which the sperm-whale is known to feed. One was



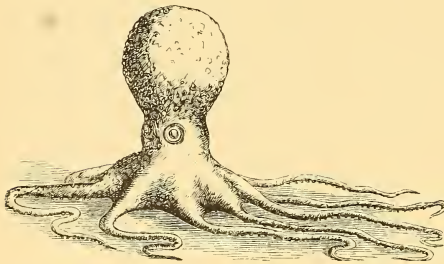
OCTOPUS, OR DEVIL-FISH.

cast ashore at Newfoundland, some years ago, with arms fifty feet long. One was observed in Beaufort Harbor, in 1862, which measured thirty feet. Any one who has seen such a monstrous creature can readily conceive how it seizes its prey. The arms, eight, and in other cases ten, in number, form powerful pincers at their extreme

ends, and are furnished the whole length with two rows of perfect sucking disks, or some two thousand air-pumps. The edges are also cut into sharp, saw-like teeth, hard as steel, which bury themselves in the flesh of the victim. Such a sized octopus as those described above could throw these terrible lassos at least twenty-five feet, and draw the body of a man to the mouth, when, with its iron-like beak, it could crush the helpless form and swallow, or drink it down, to use Victor Hugo's words.

The vulnerable portion of the octopus is the neck, and fishermen and others, who know their habits when attacked, always strive if possible to seize them by the throttle-valve, when they are easily killed. This is comparatively easy on land, but nearly impossible in the water. The locomotion of the devil-fish is as easy on land as in the water. They have been known frequently to run up perpendicular cliffs, two hundred feet high, as easily as the fly runs up a wall, the machinery of attachment being very similar. They are said to move on land as fast as a man can run, and frequently pursue their prey out of the sea, though on the land they are far more timid than in their marine haunts.

The long appendages are used both as arms and legs. All of



AN OCTOPUS RUNNING.

the octopods swim freely at will, and associate in numbers, but the larger ones, as they become older, fly from community life and retire into the clefts and hollows of the rocks which have been worn by the waves, generally in places only a few

feet below the level of low water. There, with one arm clasped close to the wall of its dwelling, the watchful savage extends the others, alert, like the boa constrictor, for the approach of prey, and no less deadly in the crushing force of its folds. Its movements in seizing its victims are swift as an arrow. When the animal is swim-

ming, its long tentacles would be in the way if extended or left pendant, so they are drawn close alongside and allowed to float behind, where they act as the tail to a kite. Motion in the water is gained by drawing in and expelling water from the locomotory tube. The octopus thus swims backward instead of forward. Its food consists of crustaceans, fishes, and other mollusks ; every kind of animal, in fact, which comes within its reach. But it disdains carrion flesh, and feeds only on living victims. The general life of the octopus, as of the other cuttle-fish, is about five or six years ; and it lays eggs, which are large and generally found in clusters. Fishermen call them sea-grapes.

One singular peculiarity the cuttle-fish, in its different varieties, shares with man. It changes color with anger, passing through various tints, and only resuming the usual hue when the emotion has ceased. Not only does the octopus change color, but covers itself with pustules and excrescences when in a rage, increasing the repulsiveness of its appearance tenfold.

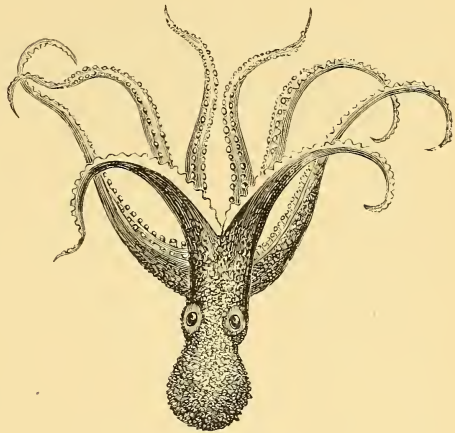
Unpleasant adventures with "devil-fish," as they are popularly but erroneously called, are not uncommon. Major Newsome, R. E., was stationed on the African coast, in 1856-'57, and undertook one day to bathe in a pool. As he swam, something took hold of his ankle, and he could not detach himself till some fellow-bathers came to his assistance. He says : "As the grasp of an ordinary-sized octopus, holding to a rock, is not less than thirty pounds, while the floating power of a man is not more than five or six pounds, I believe, if I had not kept in mid-channel, it would have been a life-and-death struggle between myself and the beast on my ankle. In the open water I was the best man ; but near the bottom or sides, which he could have reached with his arms, but which I could not have reached with mine, he would certainly have drowned me."

Mr. Beale, the naturalist, describes an adventure with a small octopus. He had been searching for shells among the rocks on Bonin Island, and was much astonished to see at his feet a most extraordinary-looking animal, crawling back toward the surf which

it had just left. It was creeping on its eight legs, which, from their soft and flexible nature, bent considerably under the weight of its body, so that it was just lifted by an effort above the rocks. It appeared much alarmed, and made every attempt to escape. Mr. Beale endeavored to stop it by putting his foot on one of his tentacles, but it liberated itself several times in spite of all his efforts. He then laid hold of one of the tentacles with his hand, and held it firmly, and the limb appeared as if it would be torn asunder in the struggle. To terminate the contest, he gave it a powerful jerk ; it resisted the effort successfully, but the moment after the enraged animal lifted a head with large projecting eyes, and, loosing its hold of the rocks, suddenly sprang upon Mr. Beale's arm, which had been previously bared to the shoulder, and clung to it with its suckers, while it endeavored to get the beak, which he could now see between the tentacles, in a position to bite him. Mr. Beale describes its cold, slimy grasp as extremely sickening, and he loudly called to his friends, who were also searching for shells, to come to his assistance. They hastened to the boat, and he was released by killing his tormentor with a boat-knife, when the arms were disengaged bit by bit. Mr. Beale says that this cephalopod must have measured across its expanded arms about four feet, while its body was not bigger than a large hand clenched. It was the species called the rock-squid by whalers.

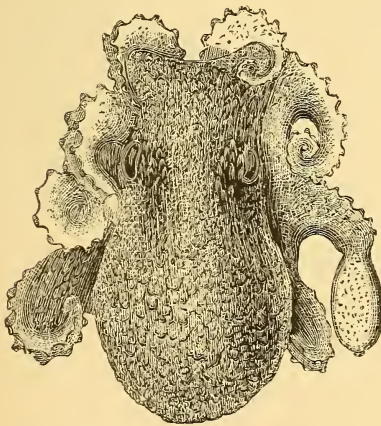
The species known as the *octopus tuberculata*, from its being covered with repulsive excrescences, not dependent on the will of the animal, is found in the Mediterranean, and is prized for food in the markets of Smyrna and Naples. It is said to make a delicious soup, something in taste like the green turtle, and the head is served as a separate dish. Another variety of peculiar form has been discovered by Professor Verrill, of Yale College, in the Bay of Fundy, and named by him *octopus Bairdii*, after Professor Baird, of the Smithsonian Institution. The latter animal has only short, broad tentacles, and appears not to grow to a large size, but is in all other respects in organization and habits like the common octopus.

Like so many of the orders of marine life, the octopus will reproduce any portion of its arms at whatever point it may be severed, and some female specimens which have been examined show the loss and reproduction of all the eight arms. When it grows too large for its skin, it sheds it like the crab, and the existence of these remains is nearly always indicative of the presence of the octopus.



OCTOPUS TUBERCULATA.

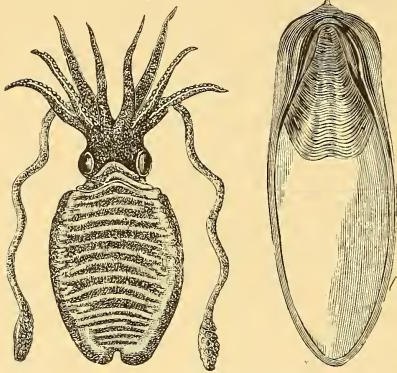
The reproductive functions of this animal are exercised in a way no less peculiar than the animal is in other respects. At certain times there appears on one of the arms of the male octopus a queer sort of bunch. When Mr. Octopus would a-wooing go, he offers his hand in marriage to a lady octopus, who literally takes it and walks away with it. This singular outgrowth contains the generative quality, which serves the purpose of propagation.



OCTOPUS BAIRDII (LIFE SIZE).

The female watches her eggs with the greatest care and devotion, and woe be unto the creature who approaches, if it be her own mate, who, by the way, has a sneaking fondness for devouring his own offspring. The number of eggs laid is immense, there being often fifty thousand in a single bunch. It is singular that the egg, when

nearly ready to give exit to the young octopus, displays the little creature under the microscope alive, swimming in the shell, and showing

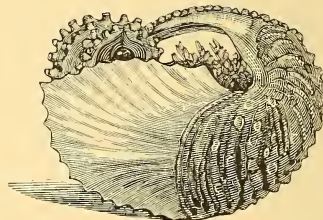
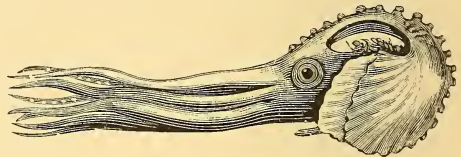


SEPIA OFFICINALIS AND SHELL.

the same phases of chameleon color when disturbed noticeable in the parent. The period of incubation is about fifty days, and it is not uncommon for the mother to die from exhaustion during the time.

The nearest relations of the octopus are the *sepia officinalis*, or cuttle-fish, and the common squid, which resembles

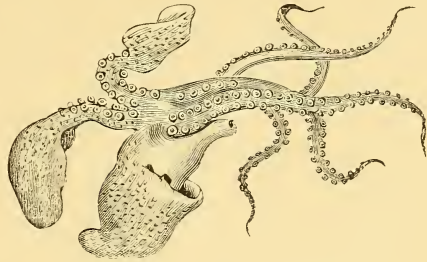
the cuttle-fish in having ten arms instead of eight and the possession of the ink bag. It is the cuttle which produces the peculiar bone so much in demand for captive birds and the coloring fluid known as sepia ink. The cuttle, instead of having only eight arms, has ten, eight short and two long, and is far less treacherous and dangerous. Instead of springing like a tiger from its jungle lair, it seeks its prey boldly in the open sea. It is, however, very voracious, and fishermen dread its presence in their nets, for it bites and mutilates the other fish savagely. It



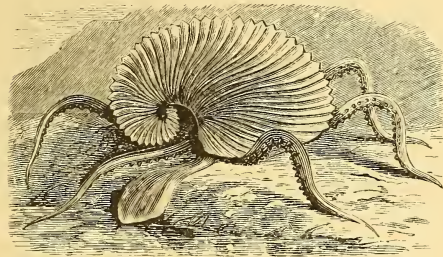
PAPER NAUTILUS.

is far less formidable than the octopus, however, and uses as its principal means of defense the sepia bag, from which it ejects a copious discharge which discolors the water and allows the creature

to escape. An English officer at Brighton, England, some years ago, having dressed for dinner, spent the brief interval before the hour of his engagement in walking on the beach. Seeing a curious animal in the hollow of a rock, he watched it, while the cuttle stared at him with big projecting eyes. Suddenly a huge jet of inky fluid was directed against him, completely spoiling the white trousers which he wore as summer uniform. Sepia ink is an indestructible color, and is used in many of the industrial arts.



ARGONAUT WITHOUT THE SHELL.



ARGONAUT WITH THE SHELL.

The eyes of the cuttle are so solid as to be almost calcareous. They are exceedingly beautiful, and reflect light with a splendid play of color, like an opal. They are used for necklace beads in Italy, and are highly valued objects for the jeweler's art. The squid resembles both the octopus and cuttle-fish, having much of the ferocity of the former and the ink bag of the latter. It is of a broad oval form with two plainly defined necks, one inserted within the other, so that the head is not unlike that of the turtle. In many countries the squid and cuttle-fish are regarded as delicate articles of diet, though modern gastronomers have been unable to cultivate a taste for them. In both ancient Greece and Rome they were regarded as tidbits, and much prized for luxurious dinners.

Another cousin of the fierce and ugly "devil-fish" is the beautiful argonaut, or paper nautilus. This little animal has been the

prolific source of poetic fables, and the ancient naturalists, by their descriptions, sanctioned the idea that the nautilus, rising to the surface of the water, spread its sails, and like a fairy ship glided before the passing zephyr. But modern discoveries have destroyed



THE ARGONAUT.

this pretty fiction. The argonaut is a cephalopod, having eight arms, like the octopus, covered with a double row of suckers. Of these tentacles, six are narrow and tapering, while two expand toward the extremity in the form of wings or sails. The body

itself is contained in a white fragile shell, which is oval, flattened on the exterior, but rolled up on a large spiral in the interior, the last turn of the shell giving it something of the form of a beautifully shaped shallop. It is singular that the body of the animal does not penetrate the interior, nor is it attached by any muscular ligament. Respiration is effected by the passage of the water over the double rows of gills or suckers, and the fluid is then ejected through a long tube or siphon; and it is the passage of the water through this tube by which action of movement is effected, exactly as in the case of the octopus. The argonaut, though very timid, is almost as dangerous an animal to handle as the formidable cousin of whom we have spoken at length. It represents familiarity in the most unmistakable fashion.

The shell of the argonaut is not, like that of the hermit-crab, a home which it has picked up, but a part of the creature itself, though the body is completely separate. The miniature shell has been seen in the embryo when examined under the microscope. This shell is the beautiful cradle in which the mother carries her young, and in which they are rocked by the waves. It is only the sea-voyager who ever sees the argonaut, for they are denizens of the open deep. They live in flocks hundreds of miles from shore, and their fairy barks are generally only seen at sunset or by moonlight, as they appear to shrink from the garish light of the sun. The ancient mariners regarded this little creature as a favorable omen of serene weather, as a tutelary divinity who guarded the navigator in his course, and under its lead would boldly sail far away from land on the open sea. The classic poets are full of graceful allusions to the fact.

It is not uncommon for the sailor to observe a fleet of a hundred of these beautiful creatures sailing over the calm sunset seas and decked in a thousand brilliant colors. At the slightest alarm, they fold their sails and sink down to the bottom of the seas. All lovers of English literature are familiar with Holmes's charming poem entitled "The Nautilus," wherein he describes the appearance of this interesting little navigator of the ocean tides.

CHAPTER V.

SOME QUEER WANDERERS OF OCEAN AND RIVER.

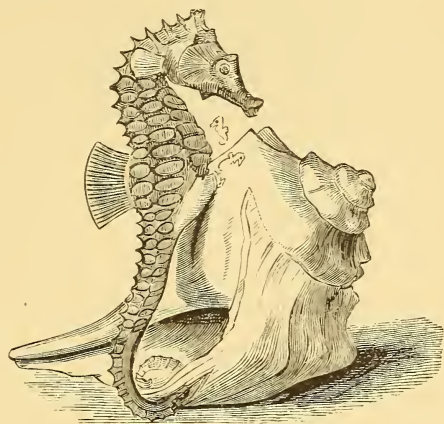
The strange fish forms.—Sea-horse and its habits.—Some of the most bizarre shapes of ocean life.—The electric fishes, torpedo, gymnotus, etc.—The turtles.—Seals, their habits and characteristics.—How they are hunted.—The walrus.—Their importance to the Esquimaux.—The pursuit of this animal.—Narwhals.—The sea-cat.—The tiger of the ocean.—The white shark, the most terrible scourge of its kind.—Character and habits.—Shark fishing.—Hammer-headed shark.—The saw-fish and sword-fish.—The whale, the larger denizen of the seas.—The right or baleen whale.—Sperm-whale.—Whale fishing, and the method of capture.—The manatee and dugong.

THE vast and boundless ocean is fascinating to the imagination of man in all its external phenomena ; but to the scientific thought it is equally attractive in the wonderful abundance of life hidden under its blue waters. We have already called attention to some of the interesting forms of animal life which, with an infinite variety of form and color, make up such a wonderful world. Let us now find instruction and amusement in considering some of the more curious and interesting fishes which inhabit the waters.

The sea-horse, scientifically known as the *hippocampus*, is a unique little creature which rarely attains a length of more than six inches, and gets its popular name from the fact that the structure and pose of the head and neck bear a striking resemblance to the horse. The ancients, who found so much of their theogeny in the sea and its creatures, believed that this animal was the embryo of the horses of Neptune. The parts of the sea-horse which most resemble the real horse are totally different in structure and function. Following the outline of the fish, we discover that the part of the head which resembles the jaw of the horse is in reality the breathing apparatus or gills of the fish, and the nostrils, instead of being at the end of the snout, are close below the eyes, while the

mouth opens upward instead of lengthwise. Along the back is a structure looking like a mane, but this is really the fin, which is the only means of progression for the little fellow, as it has no caudal fin.

Yet, though in one sense a fish, the sea-horse differs from all other fishes in one important particular, for, properly speaking, it has no tail such as is found in all other fishes. The object of the tail in other fishes is to act as a rudder or sculling-oar, but in the sea-horse, while the tail has the same bony and muscular structure, it is prolonged far backward and curved in a downward direction,



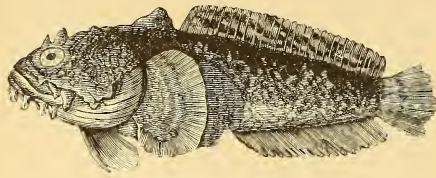
THE SEA-HORSE.

Father of the family turning adrift his baby colts.

being as prehensile as the caudal appendage of a ring-tailed monkey. The sea-horse has only a single fin on the back, and a pair of fins on the side of his head, and it moves about by the aid of these imperfect propellers with an even, gliding motion. Owing to the place of these fins, the sea-horse always swims in an horizontal position. The prehensile tail is used to clasp around objects, and it seizes hold of almost anything, such as weeds or other floating substances, and supports itself. The little sea-horse, instead of being ridden like his earthly namesake, thus gets a good many free rides for nothing. It uses the tail on the same principle by which the monkey is actuated, or the elephant in using his proboscis. This delicate creature is very docile and intelligent, too, and there is something almost human in the brightness of its eyes, especially as it has the power of moving the head and eyes independently of the body, which gives a peculiar kind of knowingness to its glance.

While the sea-horse produces its young from eggs, it is quite

exceptional among the fishes, that it hatches them in a pouch consisting of a double fold of skin on the abdomen, bearing in this



AMERICAN TOAD-FISH.

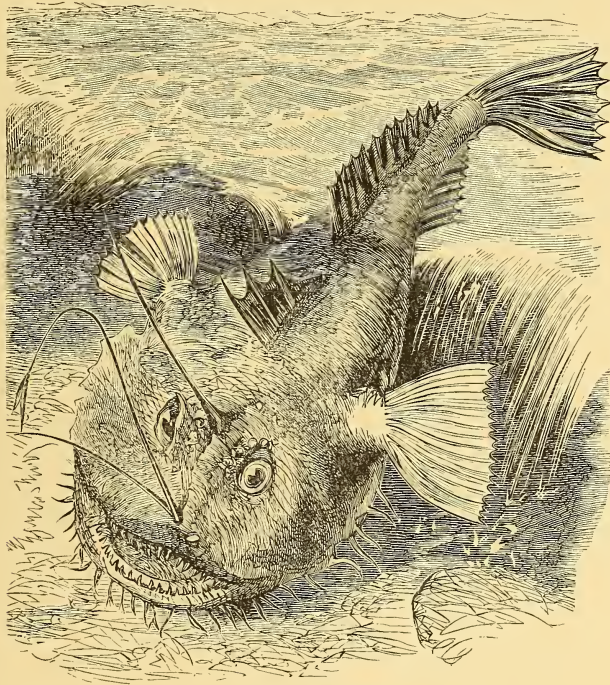
respect some likeness to the kangaroo and opossum. They are carried here till the little fellows are able to swim and look out for themselves. But, singular to say, it is the male and

not the female which performs this interesting function. Once emancipated, however, the infant sea-horse does not return to its shelter. The nearest approach to the sea-horse is a species of flying fish, which somewhat resembles it in shape.

There are few uglier denizens of the sea than the toad-fish, and, seen on the shore, it might almost be mistaken for the reptile from which it is named, if one didn't see the body and fins. It is almost all head, a very unprepossessing head too, and the olive color mottled with green adds to the repulsiveness of its appearance. The flesh is said, however, to be of a delicate flavor, though most fishermen throw them away on account of their uninviting looks. The toad-fish is found in all the Atlantic waters from Maine to the Gulf of Mexico, and presses its attentions on the fishermen as if it regarded itself as a most desirable catch. This fish is so careful of its eggs that it deposits them on stones and sticks, and cements them fast in regular order to prevent their being washed away. The parent watches very devotedly till the fry is hatched out. One of the most interesting facts in the study of all the lower orders of animal life is the strong development of the parental instinct.

Ugly as the toad-fish is, however, it must yield the palm of hideousness to the angler-fish. This villainous-looking creature is about four feet long, and is blessed with a large head and an enormous mouth, a provision very comfortable to itself and very annoying to other fishes, for the angler-fish has an omnivorous appetite, and is perpetually dining. A great variety of names have been given to it, as, for example, "fishing frog," "sea-devil," the

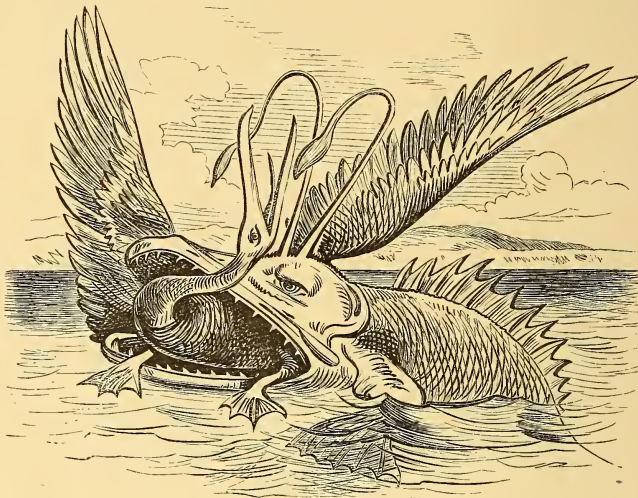
“bellows,” “goose,” “monk-fish,” etc. One of the most curious facts about the angler-fish is that which gives occasion to the name. This cunning hypocrite has projecting from the upper part of his snout a curiously long, flexible, curved spine, tipped with a bit of glittering membrane which looks like the shiner on the end of a fishing-line. Burying itself in an ambush of mud or sand, this



THE ANGLER-FISH.

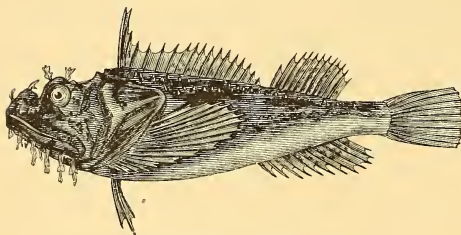
fish, turned fisherman, lies in wait as patiently as Izaak Walton, until some unwary small fish nibbles at the seemingly dainty morsel. Then snap! go the great jaws, and the little fellow is swallowed. The immense voracity of the “angler” is one reason why he is sought by fishermen, who desire him not for the sake of himself but of the small fish which cram his stomach till it is puffed out of all due size. The angler-fish’s fishing-line is a unique con-

trivance. It is one of several movable spines rising from the back of the head, arranged somewhat on the plan of a hook and staple, and it can be swayed in any direction at the will of the fish. So,



THE ANGLER-FISH CATCHES A LOON.

if it is tired and lazy, the fish does not need to go prowling and hunting for a meal, but takes it easy in the ambuscade of mud in which it hides, and waves the bait temptingly back and forth.



COMMON SEA-RAVEN.

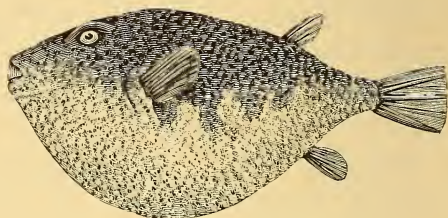
The beautiful adaptation of nature in this bony apparatus to help the ugly fellow to a dinner without putting him to any trouble is a most curious fact. The angler-fish is only found north of the capes of the Delaware.

Another big-headed, truculent-looking fish is known as the sea-raven. It always looks as the traditional Paddy might in the days of Donnybrook Fair just after a tough bout with the blackthorn.

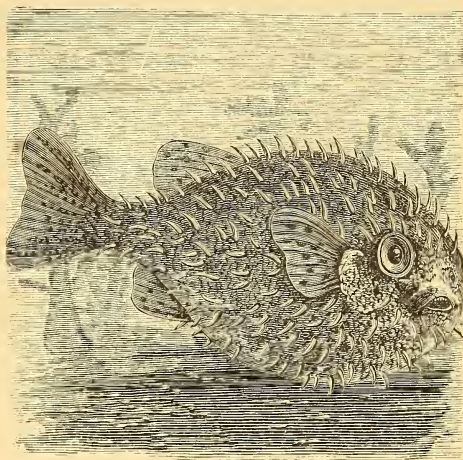
The fins and head always look torn and disfigured, but in beauty of color this fish is quite remarkable. The skin is of a rich velvety texture with spots of white and brown. Mr. Damon humorously describes it as "reminding one strongly of some of those astonishing Japanese works of art in the shape of dragons, and, like these latter, the sea-raven is *principally* mouth! like the end man in a negro-minstrel show." This fish is valuable for the aquarium, not only on account of its odd appearance and fine coloration, but it is very hardy and can be easily raised.

Under the name of the skate or ray are included many varieties, such as the clear-nose, the spotted, the whip, the prickly tailed or sting ray, and the smooth skate. They are rarely eaten, as the substance of the meat is gelatinous and the flavor not agreeable, but they are caught and hung up for show, as they have a most quaint and amusing expression, almost like that of a pouting child. This resemblance to the human face has often been observed by naturalists, but certainly there is no further analogy, for the ray is one of the most stupid fish that swims the seas. The whip ray is named for the use it makes of its long narrow tail, from five to six feet in length, which is quite a formidable weapon in time of need, as the ray wields it like a flail. The tail of the sting ray is beset with fine sharp spines which are capable of giving a severe wound. In Southern waters the great quantity of these sting rays sometimes makes it unpleasant for bathers, for the fish is prone to make acquaintance with the naked skin of man in a way more impressive than agreeable. The smooth ray is distinguished by an entire absence of this prickly exterior, and is a harmless fish. One of the most curious facts connected with the ray or skate is in the shape of the eggs. Unlike other fish, they produce eggs of an oblong shape with four ribbon-like threads attached to each corner. With these ribbons, assisted by a mucus secreted for the purpose, the parent skate attaches the eggs to algæ, stones, or rocks. Persons often pick up these empty shells on the seashore, after the young rays have been hatched, and they are sometimes called sailor's purses.

There are several very curious fishes known under the head of the sea-porcupine, which are by no means beauties, though they puff themselves out with as much importance as if they were the "swells" of the ocean world. The skin is thick, leathery, and armed with spines in every direction when the body is inflated by filling the stomach with air. When thus distended the fish loses all command over its fins, and floats about, belly upward, at the command of the winds and waves, and it is some time before it can expel enough air to get full control of its movements again. The flesh of some of them is poisonous, and there is a very disagreeable odor, which clings to them



PUFFER, OR SWELL-FISH.

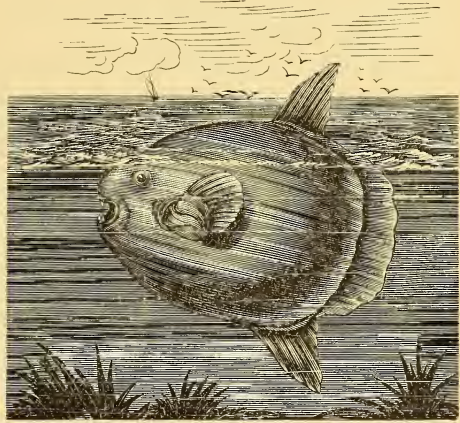


BALLOON-FISH.

even when they are preserved in spirits. Several fishes of this order, classified as balloon-fish, are found on the coast of the United States, while some are only found in tropical waters. The spines of the balloon-fish are very long and sharp, and they inflict a poisonous wound. Another fish nearly allied is the puffer-fish. These fish, in all their varieties, sometimes grow three feet in length,

and fishermen dread to get them on the hook or in the net, as they are very ugly customers to handle. The puffer-fish has shorter spines than the "balloon," but they are no less sharp.

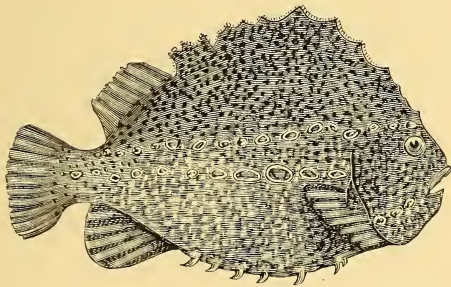
An exceedingly comical-looking customer is the great sunfish, for it is almost circular in shape, looking as if it had been cut off behind the dorsal fin, and the stump rounded off with a broad dorsal fin. A lady's handkerchief bag, with two wings spread out on the sides, would be a fair representative of the shape of the sunfish. It grows sometimes five feet in length by four feet in depth, and weighs several hundred pounds. The oil of the liver is much valued by sailors as a panacea for bruises and other wounds. It is one of the most brilliant of the



COMMON SUNFISH.

phosphorescent fish, and at night, when it approaches the surface, the body flashes like a ball of living fire as it darts in irregular zigzag movements through the water.

During the daytime it is very sluggish in its movements, and often sleeps on the surface of the waves. This fish is very much infested by parasites both internally and externally.

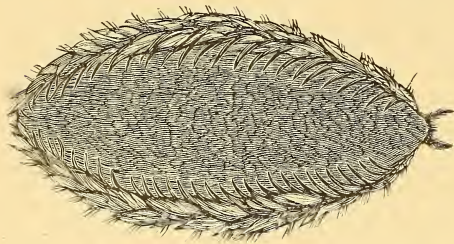


LUMP-FISH.

The lump-fish or lump-sucker is the hunchback of the seas, and has about as ugly a shape as any of his fellow-inhabitants of the water ; but it makes up for this by the extreme beauty of color and marking, and its grotesqueness is forgotten in the splendor of the hues. This is particularly the case

just before spawning-time, when all the tints of the painter's palette seem to be splashed on its body. It grows from eight to twenty inches in length, and not unfrequently attains a weight of eighteen pounds. A peculiarity of this fish is that by the ventral disk, which is concave, it can adhere closely to rocks, floating sticks, timbers, etc., and can even attach itself to other large fish with the tenacity of a vise. The lump-fish in this way can vary his experiences by traveling as a "dead-head," and he is not indisposed to use this privilege. Large fish have frequently been caught with the lump-fish attached to the back or belly. There are scattered tubercles, running posteriorly from the eyes, and these protuberances burn and glow with peculiarly rich colors during the time of its submarine nuptials. The lump-fish is very voracious, and swallows crabs and such mollusks as the oyster, clam, and muscle whole; but this somewhat solid food by no means appears to disturb the digestive apparatus of the fish.

The sea-mouse belongs to the sea centipedes, scientifically known as nereids, and looks more like a gigantic insect or a small reptile



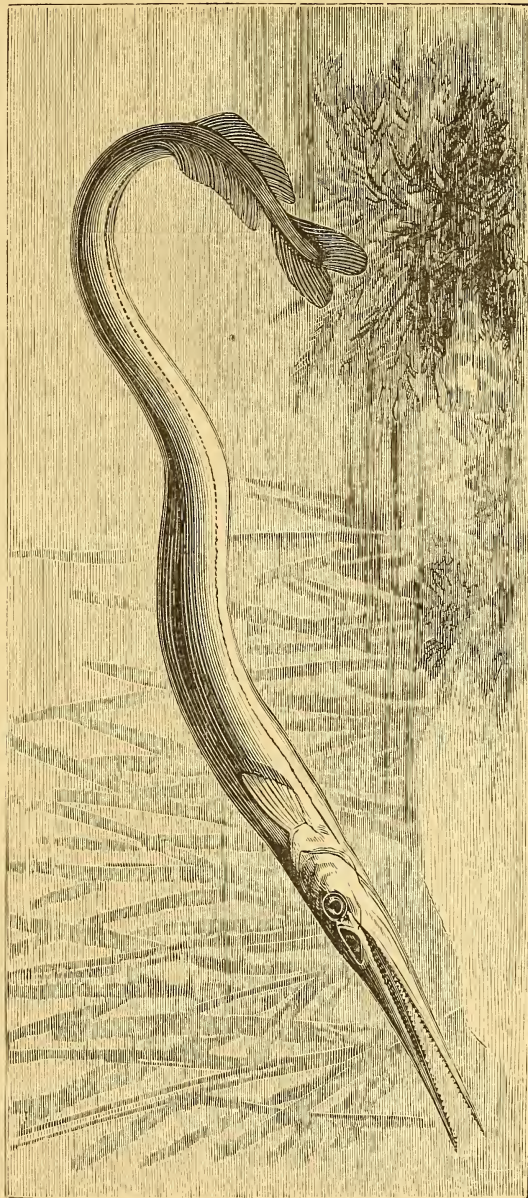
COMMON SEA-MOUSE.

than a denizen of the sea. The body is like that of a centipede with many joints, and the creature both crawls and swims with great facility. The snout is armed with jaws and a pair of fine-fringed tentacles, with which the

sea-mouse feels for its prey, which consists of living and dead animal substances, such as marine worms, etc. The feet are numerous, each one having two tubercles and two bunches of bristles. These queer creatures live in crevices of rock, in sponges, corals, deserted shells, or sometimes burrow in mud or sand. The tropical species is vividly phosphorescent, and indeed the sea-mouse, everywhere it is found, is very beautiful. The back is covered with a flax-like substance, in which are mixed spines and soft bristles, the latter

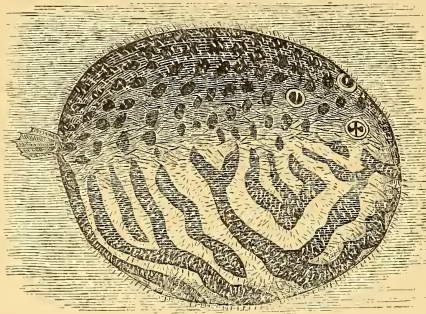
shining with all the hues of the rainbow, and rivaling in its colors the luster of the humming-bird or the sparkling of the most brilliant gems. There is great difficulty about preserving the sea-mouse in the aquarium, or it would be in great demand for this use, as its curious shape and habits combine with its matchless beauty of color to make it a most interesting object.

The curious fish called the gar is also known as the sea-needle and mackerel guide. It is a fish about two feet long, somewhat resembling the eel in shape, but covered with



THE GAR-FISH.

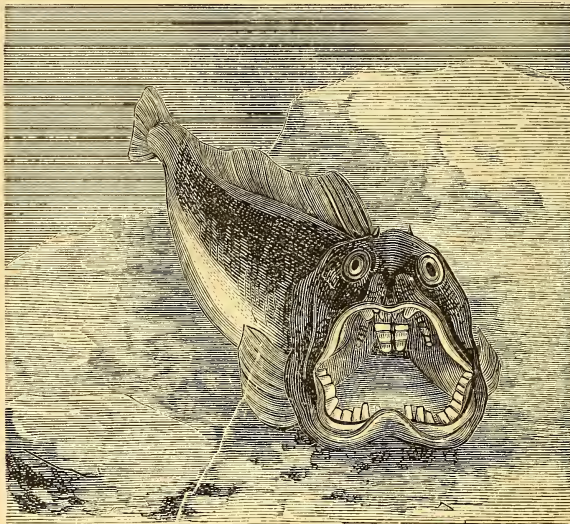
gleaming scales, the back being of a bottle-green, the sides and the belly white. The brilliancy of this metallic armor is hardly to be



GLOBE-FISH.

described. One peculiarity of the fish is that its bones are green, and another that the head is supplied with a great beak like that of a woodcock. Each jawbone of this beak has two rows of keen teeth turning backward, with which the fish snaps fiercely everything that approaches, and not only is the beak thus armed,

but the entrance to the stomach is also paved with teeth. The gar-pike is one of the most voracious fish of the ocean.



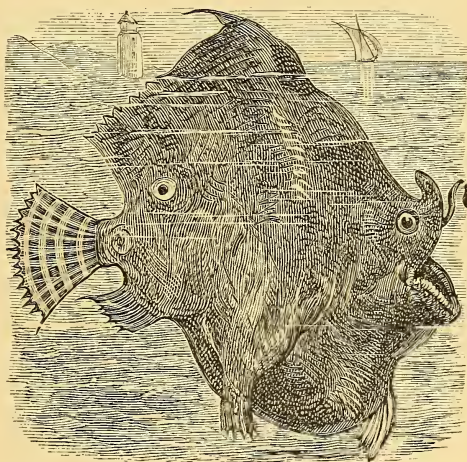
WOLF-FISH.

The globe-fish belongs to what are called the sea-porcupines, and is very strange in its shape and markings. Like the balloon and

puffer fishes, to which it is nearly related, it has the power of swelling itself up with wind, and thus floating about on the waves without the effort of swimming.

The fierce-looking wolf-fish inhabits the Northern Atlantic, and its appearance does not belie its character, which is savage, voracious, and ugly to a degree which makes it a dread of fishermen, who often get it in their nets. It grows to the length of four feet, and the slimy skin covered with tubercles, the gaping, powerful jaws, sharp teeth, give the fish a hideous appearance. It swims swiftly along the bottom, and its ferocity and ability to live a long time out of the water make it difficult to subdue when caught. In spite of the ugliness of appearance, the flesh is excellent, though few are able to overcome the repugnance caused by its forbidding aspect. Among the Icelanders the wolf-fish is so much esteemed that it is salted for winter use. This fish lives on crabs, mollusks, and sea-urchins, and cracks the shells with its sharp teeth without difficulty.

The "fishing frog," whose ungainly outline is singularly repulsive, belongs to the same family as the angler-fish, before described, and is armed with the same appendages growing out of the upper lip, wherewith it beguiles fish into its

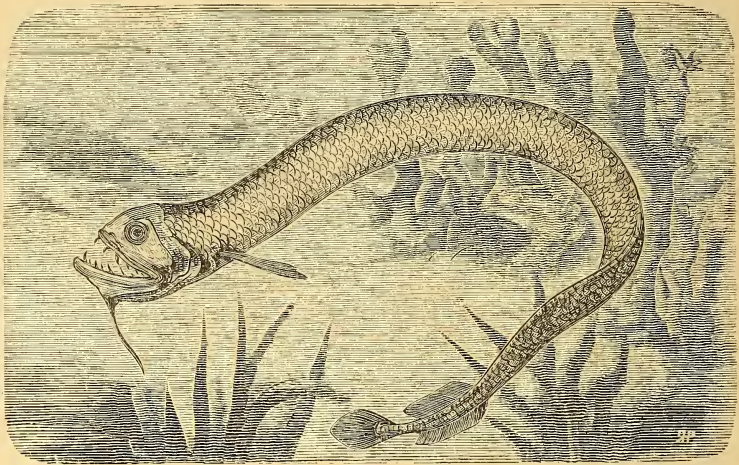


FISHING FROG.

mouth while it lies in ambush in the mud. It is a slow, weak swimmer, and nature has enabled it to make up in craft what it lacks in strength. But in boundless appetite it can compare with the hungriest fish that swims in the seas.

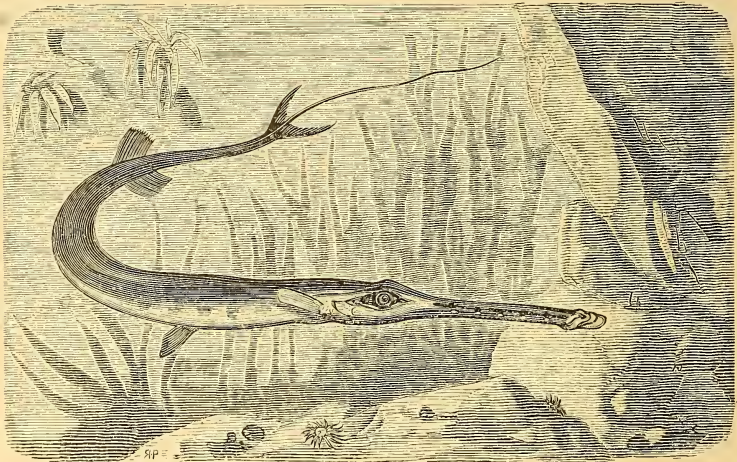
The *stomias boa* is a long serpent-shaped fish, and is found only

in the Mediterranean, though a fish of allied appearance and habits is a native of the Atlantic. In appearance it more nearly re-



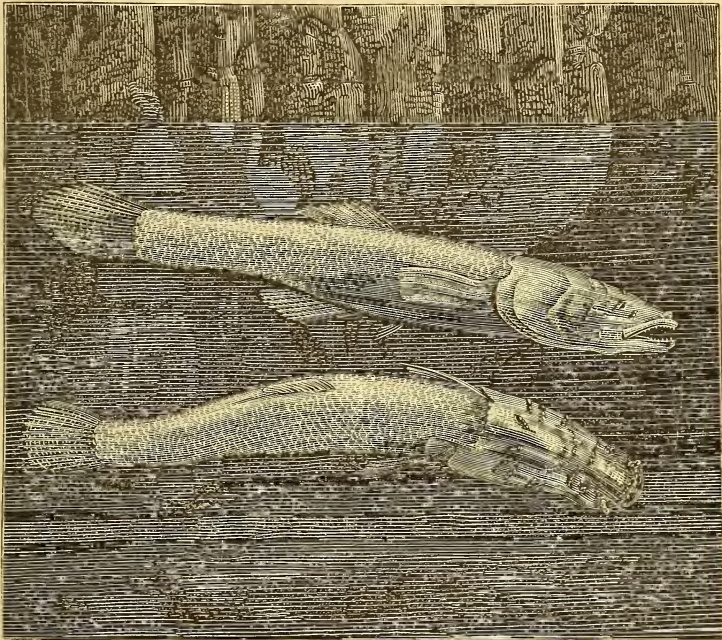
STOMIAS BOA.

sembles the serpent of the land than any other fish, its head, scales, and coloring making a very close analogy to the poisonous reptile, though it is harmless in character so far as known.



PIPE-FISH.

The tobacco-pipe fish, whose queer presentment is given in the illustration, is an inhabitant of American waters, and lives on crabs, mollusks, sea-worms, insects, and the roe of fishes. The male fish takes the young in a sort of pouch, which is contained by two soft flaps of the abdomen, and protects and feeds them while they are small. It is interesting to notice that, whenever among fishes unusual attention is given to the young, this care is always bestowed



BLIND FISH OF MAMMOTH CAVE.

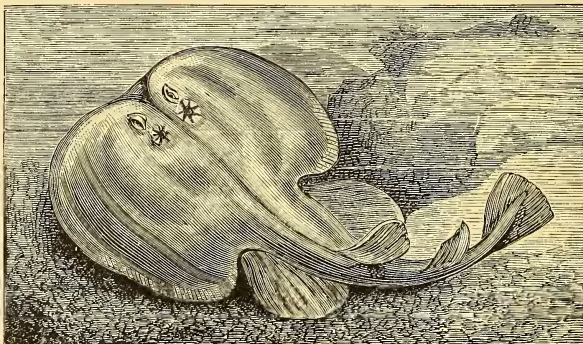
by the male fish. A singular peculiarity of the pipe-fish is that the projecting eyes move independently of each other, and can be turned nearly half way around, enabling the fish to see behind as well as in front.

Not the least curious of fishes is the blind fish of the Mammoth Cave, Kentucky, found in that gloomy body of water, buried far beneath the earth, and called the Dead Sea. This fish has scales,

but the embryonic eyes are not susceptible to light. Another variety of fish found in the same subterranean home has no place for the eyes whatever. These facts suggest that curious provision of Nature under which she never wastes her forces, but provides means only as there is an end to be attained. The waters of the Mammoth Cave, enveloped in Stygian darkness, offer no use of light for the fish that swim in these depths of gloom, and they are thus without the power, as they are without the necessity of light.

It is in the electric fishes that the curious mind finds, perhaps, more to interest thought and investigation than in almost any of the finny inhabitants of the water. These strange creatures are not armed with spines, with sharp and dangerous teeth, with tentacles covered with blood-sucking disks, with sharp, sword-like snouts, nor with powerful tails that strike like thrashers' flails. They are armed with invisible lightning, and they stun their enemies or their prey with a discharge none the less certain in its effects because their medium is invisible.

The most widely scattered of the electric fishes is the torpedo, which belongs to the rays or skates. The body is smooth and rounded, the tail short and thick, cylindrical at the end and keeled



THE TORPEDO.

on the sides. The torpedo, take it all in all, is an innocent-looking fish, and the quizzical expression of its face adds to the harmlessness of its aspect. But *noli me tangere* is the motto of the torpedo, and

woe be unto man or animal which ventures to trench on its dignity ! The electrical apparatus is arranged in two masses, one on each side of the skull. It is composed of a multitude of perpendicular columns, in the shape of eight-sided prisms, separated by walls of membrane containing a fluid freely supplied with blood, and laced with an immense number of nervous filaments. This apparatus is something like the galvanic pile. John Hunter counted twelve hundred columns in a very large fish, and about one hundred and fifty plates to the inch. In one specimen, Professor Wyman estimated the number of plates in an American torpedo, a species which sometimes reaches a length of four and one half feet, and a width of three feet, at the enormous number of three hundred thousand, the prisms being about two inches in height and containing one hundred plates to the inch. The intervals between the plates were filled with an albuminous fluid, mostly water, but containing salt in solution. In the torpedo the shock is most powerful when connection is made between the back and the abdomen. Actual contact with the fish, however, is not necessary, as it is well known by the Neapolitan fishermen that the shock is felt when the water is dashed on it, the electric current passing up along the stream, the circuit being completed through the earth to the stomach of the fish. That the discharge of this fish is the same as that of common electricity is shown by the fact that it renders the needle magnetic and decomposes chemical compounds, while by it heat is evolved and the electric spark obtained. The torpedo never uses its power for aggressive uses, as it is rather a timid fish ; but it makes itself dreaded by other fish, which soon learn to let this living electric battery alone. It lives on small fish, and keeps near the bottom, preferring a muddy bed to any other. There are about twenty species of the torpedo found in the different seas of the world.

Another species of electric fish, the *malapterurus*, is found in the Nile, Senegal, and other rivers of Central Africa. The existence in the Nile of a fish with benumbing powers has been known for the last three hundred years, but it is only about a quarter of a

century since that it has been definitely known to science. The structure of the electric organs is very similar to that of the torpedo, though it is set further back in the body. The shock given by the *malapterurus* is comparatively feeble, and is only felt when the head is touched. It is a shapely and beautifully spotted fish, and the Arabs, who call it *raash* (thunder), prize its flesh for food purposes. It reaches a length of not more than twenty inches, and is said to be a favorite tidbit for the crocodile, as well as for the stork and ibis, which do not seem to be disturbed by the thunderbolts it carries.

Another small electrical fish is found in the lagoons of the Pacific, growing to a length of seven or eight inches; but its electric powers are quite feeble, though distinctly perceptible. All of the electric fishes have no scales or spines. It is the electric eel, the terrible and dreaded gymnotus of the South American rivers, which is the king of this kind of fishes. The discharge is so great that it is computed by Professor Faraday as equal to that of fifteen Leyden jars of three thousand five hundred square inches surface.

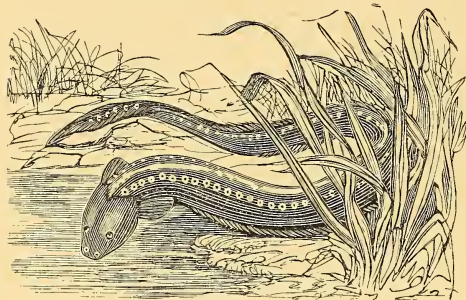
The gymnotus differs from other eels in the completeness of its jaws and the possession of ribs. The skin is smooth and scaleless, and the head flat and oval, like that of a venomous serpent. Though it has more than a hundred sharply pointed teeth in its jaws, it is not known that it bites, except for eating its food. Its one weapon of attack and defense suffices, and, though neither voracious nor fierce, it uses this against its numerous enemies with powerful results. The electric eel is mostly found in the northern rivers of South America, and is of a brown and yellowish color, growing to a length sometimes of six feet. According to Humboldt, whose account has since been verified by that of other travelers, the Indians of South America capture these eels by driving herds of wild horses into the streams inhabited by them. The enraged eels, aroused by the trampling of the beasts in the muddy bottom where they live, expend their electric powers on the animals, and the Indians then wade into the river and spear the eels without risk or inconvenience. After some five or six discharges the gym-



CAPTURING ELECTRICAL EELS BY MEANS OF HORSES.

notus is exhausted, and needs a period of rest before he can again exercise his peculiar energy.

The electric apparatus of this strange creature occupy a large portion of the length of the body, and are four in number, two on each side. They consist of an assemblage of membranous, horizontal plates, intersected by delicate vertical plates, and the cells thus formed are filled with a glutinous matter. Each inch in length of the gymnotus contains, according to Hunter, two hundred and forty cells. There is thus an enormous surface of the electric machinery. Curious to say, the electric eel seems to be a mere appendage to the battery for moving it about, as the other organs occupy but little space. This creature is rather sluggish in its movements, and

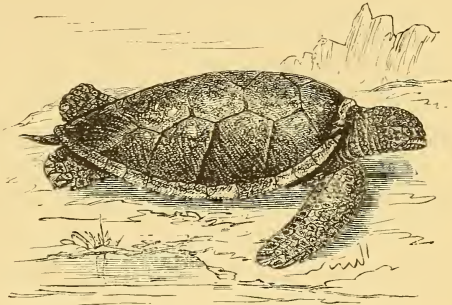


ELECTRICAL EEL.

is only dangerous when disturbed by interference. There are many amusing stories of persons, ignorant of the peculiar characteristics of the eel, attempting to grasp it. One, which recently passed the rounds of the papers, was of a self-sufficient negro fisherman of Hilton Head, who boarded a sailing-vessel bound home from South America, with fish for sale. A good deal of chaff passed between the "darker" and the mate of the ship, and finally a bet was made that the gentleman of color, much as he knew about fishing, could not hold an eel which was kept in a tank on board. The tank was brought on deck, and the rash experimenter bared both arms and made a plunge for the eel. He finally succeeded in getting one hand on the captive fish, and was chuckling over the prospect of winning five dollars as he seized the gymnotus by the tail with the other hand. The *dénouement* was unexpected by the fisherman. He felt as if he had been struck by lightning, and gave a yell of dismay, for to his ignorant mind it was as if he had some demon in his grasp. Once again he tried, but the shock was so terrible that he leaped overboard. Professor Faraday, who

first made scientific experiments with the gymnotus, had many amusing scenes in his class, where various curious persons sought to test his facts and theories by taking hold of the eel which presented so harmless an aspect.

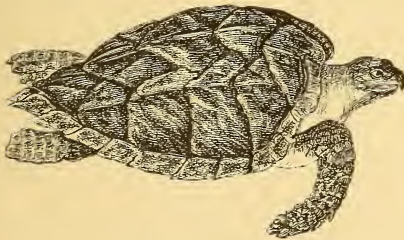
There are several of the marine turtles which offer curious characteristics. These sea reptiles are the only representatives of the giant testaceous creatures which swarmed in the seas of the Jurassic period,



GREEN TURTLE.

reaching a size which is almost incredible to the modern mind. All the marine turtles come on shore toward the end of spring to lay their eggs on the sandy beaches above high-water mark. They select desert islands or keys, on a still moonlight night, and dig a trench in the sand with their hind legs, about a foot and a half deep, in which they deposit about a hundred eggs at each of their layings, with an interval of two or three weeks between them. The eggs are lightly covered by sand, and are hatched out by the heat of the sun. If the turtles are undisturbed, they return to the

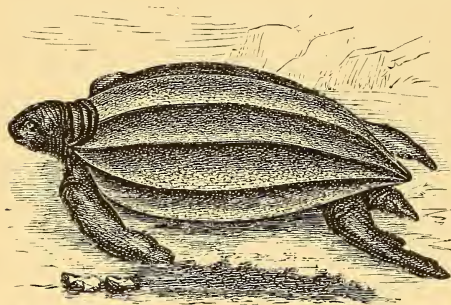
same spot year after year. They are caught by the fishermen on the shore by being turned over on their backs, in which position they are helpless, owing to the flatness and width of the shell. They are also harpooned and taken in nets, and in the In-



HAWK'S-BILL TURTLE.

dian seas are captured by means of the sucking-fish, which, growing to a considerable size and weight, embarrass their movements by clinging fast to their shells.

The hawk's-bill turtle is one of the most curious and valuable, though its flesh is not fit for food. It is from this variety that tortoise-shell jewelry is made. The plates of the shell are heart-shaped, pointing backward and overlapping each other, and are reduced by steaming and pressure, being so welded together that they appear to be homogeneous. The feet of the hawk's-bill turtle are so shaped that they are perfect oars, and it is often found hundreds of miles from land, as much at home in the vasty deep as the shark or the whale. No animal is valuable for its shell unless it weighs at least a hundred and fifty pounds, as otherwise the shell is too thin. In ancient Rome the carapace of the hawk's-bill was used as a cradle and bath-tub for the children, and as a shield for warriors.



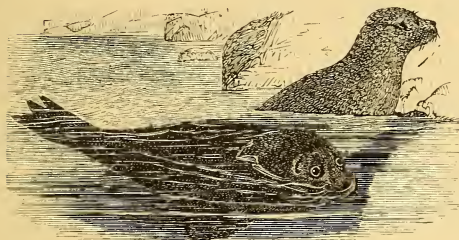
TRUNK TURTLE.

The largest of the turtles is the trunk turtle, which reaches the length of eight feet and a weight of nearly a ton. The shell is used along the Mediterranean for making small boats and drinking troughs for animals.

It is the green turtle, however, which is most widely known, as it furnishes a favorite article of food for epicures. Green turtles of six hundred pounds weight are not unfrequently found, and the catching of these highly-prized animals furnishes employment for thousands of men in the West Indies and the southern coasts of our own country. A favorite resort for this turtle is the Tortugas Islands, where they come ashore by the thousands during the breeding season, and this is the golden opportunity for the turtle catchers. They are kept in confinement for months in pens or crawls to meet the demands of the market, and different flavors may be communicated to the flesh according to the food given them. Rarely is any epicurean dinner given without turtle served either in the shape of soup or cutlets

as one of the principal dishes, and the demand for this animal from all the capitals of the civilized world is increasing every year.

There are few if any animals which live in the seas more inter-

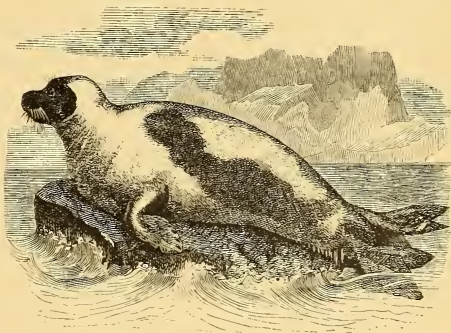


COMMON SEAL.

esting than the family of seals, scientifically known as *phocidae*. They are widely spread through the colder regions of the ocean, both in the Arctic and Antarctic regions, and it is not uncommon to find them wandering on the coasts of temper-

ate latitudes. Long before science and commerce lent their interests to the seal, its exceeding intelligence and docility, as also the almost human interest of its face, gave it a high place in the folklore of the northern nations. Scotland and its adjacent islands and the Scandinavian peoples gave birth to many charming legends, based on the popular notion that seals could transform themselves

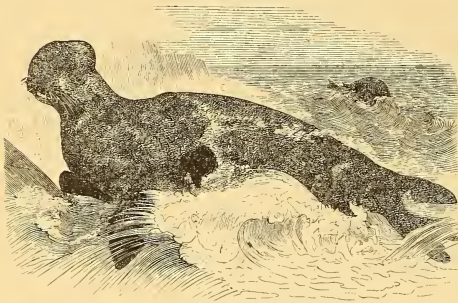
at will into creatures of human shape and sympathies; and that, by stealing the seal-skin which was doffed when these merry people of the sea gambled on the beach at night, the cunning bystander could secure the services of the despoiled one. Seal wives and seal servants play no unimportant part in Scottish



GREENLAND SEAL.

legend, and more than one noble family of northern Scotland traces its mythical descent from some beautiful sea-maiden, who had thus been robbed of her swimming robe and subdued to earthly conditions.

This quaint light of fancy long since passed away from the popular idea of the playful *phoca*, but the animal has become one of considerable interest on account of its value as a fur-bearing creature and its general characteristics. For the last ten years no fur has been in so much demand in the United States and Europe as the seal-skin, which is justly a great favorite on account of its beauty. The principal seal fisheries are on the North American coast from Newfoundland to Greenland, and that of Alaska, the latter country, since its accession to the United States, having furnished a large portion for American use. Few animals are more tenacious of life, and great cruelties used to be employed in their capture. Now the larger



HOODED SEAL.

ones are generally killed by a lance-thrust through the back, and the smaller ones by a blow on the nose with a long-handled hammer. It is not uncommon for one man, during the height of the seal-fishing season, to kill a hundred of these timid and inoffensive animals,

though there are cases where they fight with great ferocity and imperil the lives of their captors.

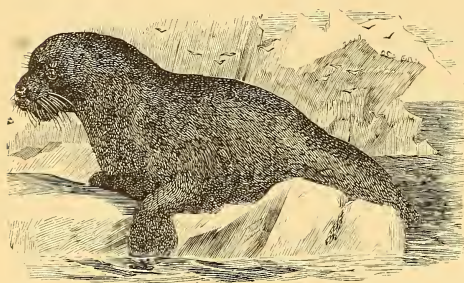
The Esquimaux hunt them in light boats with lances, or spear them at holes in the ice when they come up to breathe. To the resident of the Arctic regions the seal supplies food, oil for light and warmth, skins for clothing, boots, utensils, tents, boats, sinews for threads and lines, and membranes for under garments and window covering. The oil, when fresh, is a not unpalatable food, and the seal is thus a creature indispensable to human life in the cold zone. To be successful as a seal hunter is the highest ambition and the most honorable distinction of the Esquimaux, and the rude songs of this people signalize the daring and craft of this hero of



ESKIMAUX SPEARING SEALS.

the ice-floe and kayak, as other rude nations celebrate deeds of warrior enterprise.

The seal is a mammal, bringing forth its young and nursing them with the most touching devotion. Gregarious and migratory, great herds of them travel from spot to spot in search of food, leaving the coldest regions in winter for milder waters. Fond of crawling out of water on rocks, beaches, and ice-floes, they keep a vigilant outlook for danger. Playful and gentle, they yet bite fiercely, and the wounds they make are not easily healed. This is specially so in breeding season, when the males have furious contests with one another, antagonists being sometimes killed in the fierceness of the duels. The seal has a cry which is like the snapping bark of a dog, and it can be heard at a great distance. Expert divers and swimmers, they can remain under water at least twenty minutes, and the Esquimaux hunter who fails in his first lance thrust, when he hunts them in the open sea, has his pains for his trouble. The cunning seal when it rises from its dive may be two or three miles away.



SOUTHERN SEA-LION.

These animals are very docile and affectionate, and soon learn to have a great attachment to their keepers. Indeed, pet seals, which are as free of the house as dogs, are no uncommon accessories of cottage life on the coasts of Scotland and Norway. Those confined in zoölogical gardens are often taught to sit erect, bow, kiss the hand, pretend to be asleep and snore, turn the crank of an organ, fire a gun, and even go through the manual of arms, shake hands, and perform other similar tricks. The story is told of a pet seal belonging to a Scotch peasant which rescued two of its master's children from drowning on hearing their cries in the water.

The Newfoundland fisheries furnish about seven hundred thousand skins to commerce annually, while the Alaska product is only about one hundred thousand, though the fur of the latter is much more fine and valuable. The taking of fur seals in Alaska is mostly confined to the Pribyloff Islands, which lie just off the coast of North Alaska. The use of these great seal rookeries is farmed out to a corporation by the United States, and is regulated by act of Congress.

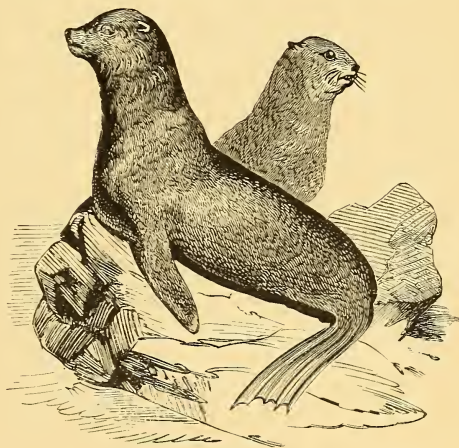
The seal divides into a number of varieties, differing according to the seas where it lives. The common seal is noted for its finely

shaped head, which contains as finely an organized brain as that of the most intelligent monkeys.

It is frequent in the European and American seas, and attains a size not greater than six feet in length. The Greenland or harp seal is somewhat larger and different in color, the males being grayish-white, and the females brown with black spots. They are

mostly found off the coast of Greenland in herds floating on ice-floes, and rarely venturing near the shore. This is the most important of all to the Esquimaux, who harpoon it from their kayaks or pursue it on the ice.

The leopard seal, or sea-leopard, grows to a length of ten feet, and is beautifully spotted. It frequents the frozen seas of the southern hemisphere about the South Shetland and South Orkney Islands, and is frequently the object of pursuit on the part of whaling crews, when they find their cetaceous prey scarce. The white-bellied or monk seal grows to about the same size and has a shining



SEA-BEAR.

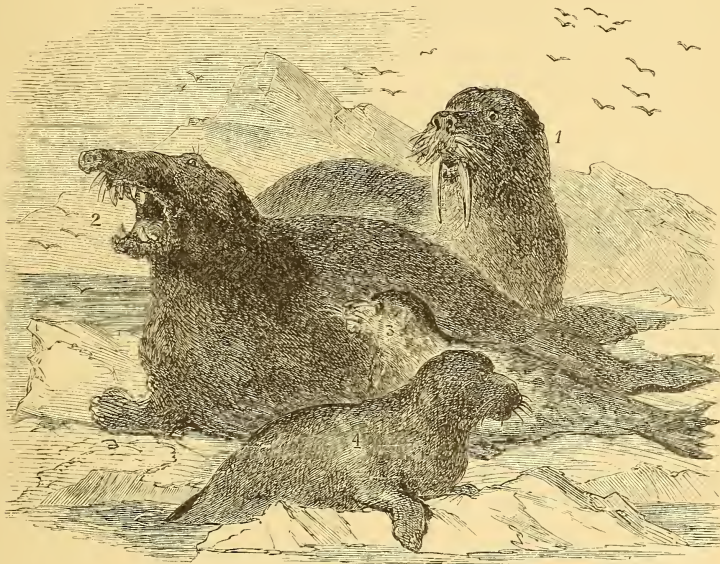
dark-brown fur. The eyes are large and ox-like, and it has a very intelligent and affectionate disposition. This seal is found in the Mediterranean, and was well known to the ancients. Its skin was believed by the Romans to be a preventive against lightning. The hooded or crested seal differs from all the others by a membranous hairy sac on the head. This can be inflated with air, and constitutes a reservoir, which enables the animal to remain under water a long time. It is the most fiercely pugnacious of all the seals, and is found on the ice islands of high northern latitudes, coming down sometimes to the coasts of Labrador.

The bottle-nosed seal or sea-elephant deserves this appellation on account of its great size, as it frequently grows twenty-five feet long. It is nearly half as large as the Greenland whale, and very much larger than the largest elephant. The skin has very little fur value, but the animal supplies a great quantity of oil blubber which is equal to that of the whale in value. These creatures are found in large herds on the islands of the Antarctic seas, where they are hunted by whalers with great profit. They have become comparatively scarce on account of the indiscriminate slaughter practiced on them.

The family of eared seals differs from those just described, as is indicated by the title. The most common of these are known as sea-lions and sea-bears. The former name is given to species of seals in both hemispheres on account of their savage appearance, roaring voice, powerful canines, and maned neck, though these formidable externals are contradicted by timidity of nature. The ursine seal, or sea-bear, with a less ferocious aspect, has a far greater fierceness of disposition, and grows to about eight feet in length. This is the celebrated Alaska seal, from which the most valuable furs are obtained. The ears are nearly two inches in length, and the soft reddish wool under the long coarse hair is the beautiful fur so much in vogue in the fashionable world.

The "rookeries" of the Pribyloff Islands contain several millions of seals. The males begin to arrive about the 1st of May,

and the females about the middle of June, giving birth to their young soon after landing. The bachelor seals, as those under six year olds are called, have separate haunts. Nearly all leave the islands about the 1st of November, and the males do not go into



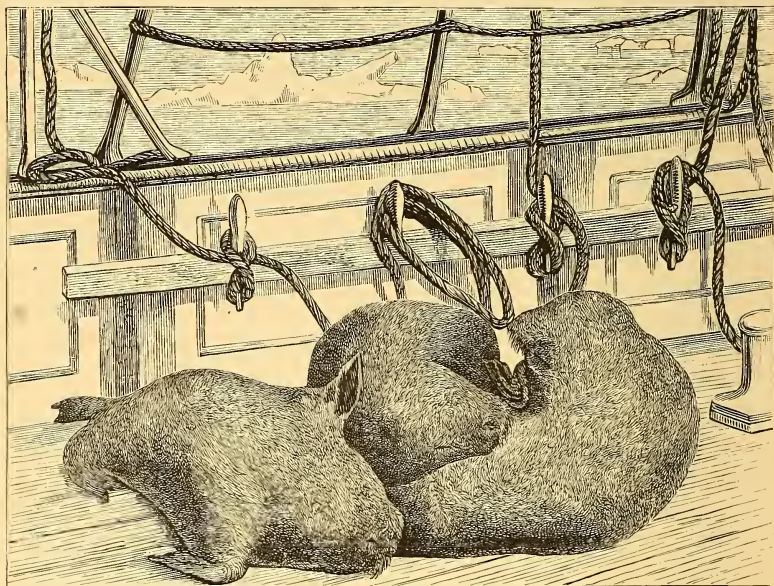
WALRUS AND SEALS.

1, Walrus; 2, Sea-elephant; 3, Sea-leopard; 4, Sea-lion.

the water during the whole of this period from the time of landing, living by absorption of their own fat. They watch the young seals while the mother goes off to seek food to supply her needs during the prolonged period of lactation or nursing. Only the bachelor seals are allowed to be captured by law, though this is constantly violated by the fur-seekers. The capture of the seals for the market commences with their first landing on the islands, and ends with August, when the animals begin to shed their fur. The weapon of destruction used is a heavy iron-shod club, which obviates the necessity of cutting or tearing the fur.

The walrus is a marine arctic animal somewhat resembling the

large seals in appearance, yet differing from them in structure. The lips are covered with a thick mat of bristles, and from these project downward two long bulky tusks, which the sea-horse, as the walrus is often called, is capable of using with tremendous effect when battling for life against human or animal foes, though it is under ordinary conditions an inoffensive animal, in spite of its truculent aspect. Walrus sometimes attain a length of twenty feet, and a circumference of half that length, weighing fully a ton. The walrus are rapid swimmers, but are very awkward on land, whither they go to rest, bring forth and suckle their young. Not afraid of man unless they are hunted, they bravely defend their young and their wounded companions. They often have furious



YOUNG WALRUSES ASLEEP.

combats with the polar bear on the ice, and with the narwhal and other carnivorous fishes in the water. Walrus meat is a favorite tidbit with the giant bear of the north, and he will travel many miles on the chance of making such a luxurious meal, in spite of

the fact that he not unfrequently gets worsted in the battle. Large herds of the walrus will lie together in their resting-places like swine, and their loud roarings when disturbed can be heard for miles. The tusks, which furnish ivory of the finest quality, are used as weapons, for climbing on the ice, and for tearing up the sea plants on whose attached bivalves they largely feed. The capture of the walrus is a dangerous sport, and not very remunerative except for food purposes, though the tusks are valuable. The Esquimaux are very fond of their flesh, and Dr. Kane and other Arctic voyagers have given testimony that it makes a toothsome and palatable dish, whether eaten raw or cooked, though it is doubtful whether the epicure of New York and Paris would altogether relish a dish made from this meat.

The weapon with which the Esquimau hunter attacks the seal and walrus is to him what the rifle is to the American backwoodsman, the sword to the Agageer, the lasso to the South American, the sumpitem to the Dyak, or the boomerang to the Australian savage. It is a harpoon of ingenious make, with a long wooden shaft and a float attached to it. Owing to the great scarcity of wood, the Esquimau is obliged to fashion the shaft from a great number of pieces strongly lashed together. The head is made of walrus or narwhal ivory lashed with iron, and it is so contrived that it loosens from the shaft when the blow is struck. The long line of seal-skin is coiled around the hunter's neck, there often being several hundred feet of this seal rope looped and ready to play the quarry. To manage this line is a matter of great dexterity with the hunter, for, unless he casts it instantly free when the great walrus feels the quiver of the lance-head in his body, he would either be choked to death or dragged into the sea and drowned. There is also great need of keeping the coils from tangling, or the game would certainly be lost. Extraordinary skill and promptness of movement are thus essential to walrus harpooning. Instantly the blow is struck, the hunter jerks the coils free of his neck, and then he is prepared to play the walrus like a salmon, till the exhausted beast can be brought near enough to receive the fatal thrust from a spear.

There is also an ingenious way of conducting a *battue*, or wholesale slaughter, which is not unfrequently used on occasion. The



SPEARING THE WALRUS.

Esquimaux hunters espy a number of animals sleeping on a sheet of ice, and, looking out themselves for a small ice fragment, they paddle their canoes to it, lift the canoes on it, and make their har-

poon lines fast. They then gently paddle the whole raft of ice, men, boats, and all, to the drowsy animals, who do not suspect anything from a piece of floating ice. Each man selects his victim, and, at a given signal, all the harpoons are hurled. The herd instantly roll themselves into the sea, the wounded ones being attached to the ice raft, which they pull hither and thither till exhausted. Then the hunters launch their canoes and kill the walruses with the greatest ease.

A denizen of the same seas as the seal and walrus, the sea-unicorn, better known as the *narwhal*, from the Gothic, signifying "beaked whale," is no less interesting. The head of the narwhal is round and convex in front, the lower jaw being without teeth, while from the upper jaw springs the curious weapon which gives this animal its world-wide reputation. It is only in the male that this strange beak is developed, it being merely the development of the left tusk, which increases rapidly till it becomes a long, spiral, tapering rod of ivory, sometimes attaining the length of ten feet. Speculation as to the purpose of the narwhal's horn has been baffled, though that it is employed in some definite task is evident from the fact that the tip is always smooth and polished, however rough and encrusted it may be toward the base. It is probable that it is a weapon of attack, for narwhals have been often seen to joust and playfully charge each other, fencing with their long ivory lances as they churn up the sea in swift charges. So it is probable that the narwhal horn is analogous to the tusk of the boar and the horn of the deer.

The ivory of the narwhal's horn is remarkably hard, solid, close in fiber; perhaps a better article than the tusk of the walrus or the elephant. It has, therefore, a very considerable commercial value. In former times the entire tusk was believed to be of incalculable value. Supposed to be obtained from that fabled animal, the unicorn, it had, it was imagined, magical qualities, among which was that of transforming the deadliest poisons into harmless potions.

This antidotal quality was necessary to the unicorn, who was supposed to live in deserts among loathsome beasts and poisonous

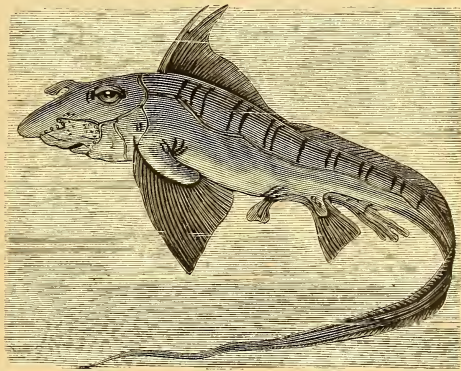


FISHING FOR NARWHALS.

reptiles. When the unicorn went to the springs and pools which had been poisoned by the contact of other venomous mouths, the simple dipping of his horn in the water made it pure again. Thus, in those days when kings suspected poison in every wine chalice, the possession of this supposed unicorn's horn eased their royal minds not a little.

The narwhal is held in great esteem in Greenland, for, independent of its value, it is a harbinger of the coming of the whale. The ivory of the tusk is put to a great variety of uses, and many a narwhal perishes by means of the tooth which has been extracted from some near kinsman. It is easily slain, as it possesses no great power of diving. It seldom descends over two hundred fathoms below the surface, and when it rises the animal is so tired as to be easily killed by a spear thrust. Whaling ships are always on the outlook for narwhals, on account of both the oil and the ivory, and lances are used to capture the playful animals, which seem to have but little fear, and gather around the fatal boats with great curiosity. As they congregate in large herds, a very large catch is often a matter of only a few hours.

The sea-cat is a fish of curious shape and appearance, and fiercely carnivorous. The relentless ferocity with which it pursues shoals of herrings, mangling thousands which it can not

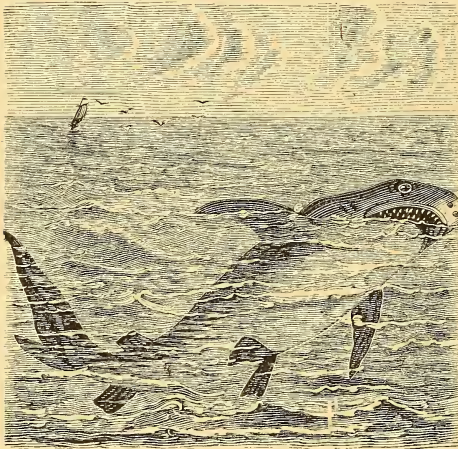


NORTHERN SEA-CAT.

eat, has given the animal the name of the "king of the herrings"—a title partly owing, it may be also, to the fact that it has a fleshy protuberance, with serrated edges, somewhat resembling a crown, between the eyes. A conical snout, a long, shark-like body, greenish eyes that shine at night like those of a cat, and two large, wing-

like fins, give this fish a peculiarly repulsive and dangerous appearance, though it is not known that it ever attacks man. It is between the sturgeon and the shark in construction, and has all the rapacity of the latter fish. It is most commonly found in the colder waters of the ocean, though not infrequent in more temperate latitudes.

There is no denizen of the sea more familiar to the popular mind, and yet more replete with the kind of interest which connects itself with horror and dread, than that tiger of the ocean, the shark. Purely carnivorous, the shark ranks in ferocity and



WHITE SHARK.

powerful weapons of destruction with the lion and tiger, the condor and the eagle, on the land; and it may be doubted even whether the most formidable inhabitant of the earth or air is equal in offensive weapons to this monster of the ocean world. Abounding in the waters of every zone, though less dangerous in the colder seas, the shark stands, perhaps, for the most striking animal type

of what is fierce, crafty, relentless, and cruel. All the different varieties of sharks are noticeable for their elongated yet stout bodies, terminating in a powerful tail, which is the principal organ of locomotion, their large heads opening on the under side with a huge mouth, and their several rows of formidable cutting teeth. There are about a hundred species of sharks known, mostly in northern waters and the Eastern hemisphere, some being cosmopolite and others limited in their distribution. Of these, we shall only glance at two or three of the most prominent.

The most terrible of the shark family is that known as the white

shark, which sometimes reaches a length of thirty-five feet and a weight of two thousand pounds. The color is ashy brown above and whitish below, the head huge, the gape enormous, and the teeth form such a perfect cutting apparatus that the body of a man might easily be divided by a single snap of the mighty jaws. It has been seen near Calcutta to swallow a bullock's head, and horns attached, at one gulp. This is the true man-eater shark, about which so many stories have been circulated, and human remains have not infrequently been found in its stomach. Gluttonous, savage, and bold, no food comes amiss to its omnivorous maw. It is the terror of sailors, who lose no opportunity of fishing for it with a huge iron hook baited with a piece of pork. The white shark frequently follows a ship for days, feeding on the garbage thrown overboard ; and sailors have a superstitious fear, when they thus see the huge dorsal fin following the ship's wake. The adult shark has six rows of murderous teeth, and seizes everything which comes near him, but human flesh it loves with all the affection of the gourmand. According to some writers, it even manifests a preference for some races—the white over the yellow races, and the latter over the blacks. Still, whatever the color, it seeks eagerly for human flesh, and haunts the neighborhood where it hopes to find the precious morsel.

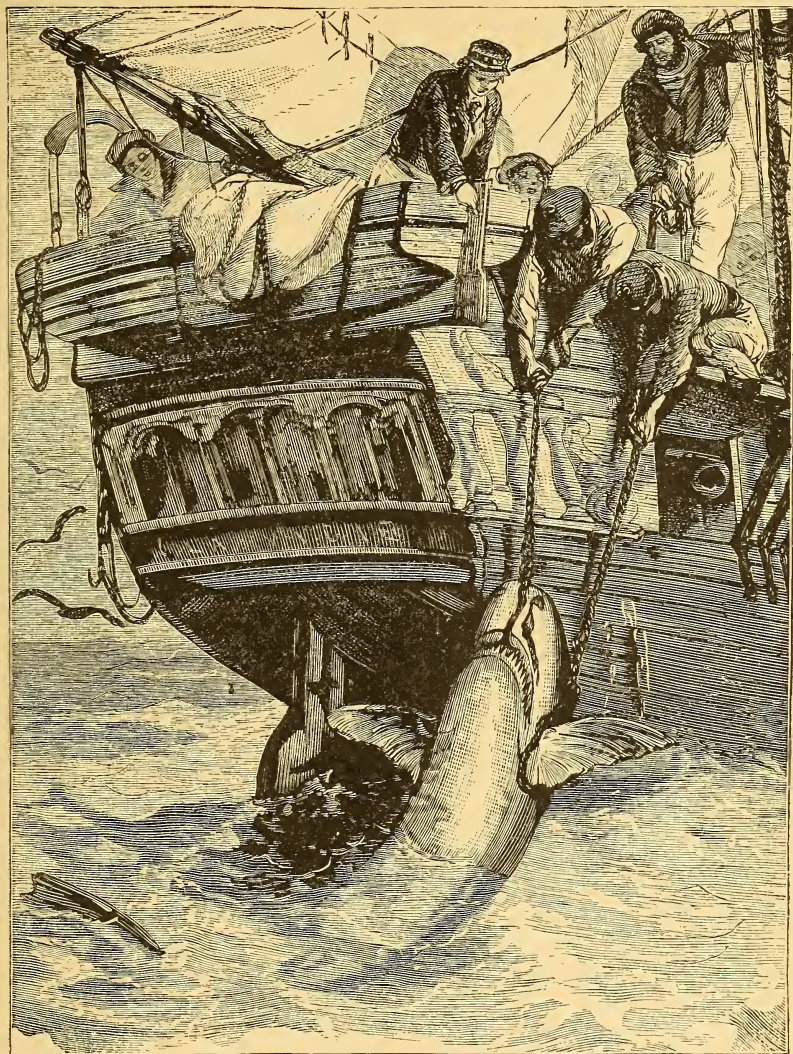
The shark follows the ship in which its instinct tells it the morsel is to be found, and makes extraordinary efforts to reach it. It has been known to leap into a boat in order to seize the frightened fishermen ; it throws itself upon the ship, cleaving the waves at full speed, to snap up some unhappy sailor who has shown himself beyond the bulwarks. It followed the course of the slaver, watching for the horrors of the middle passage, ready to engulf the negroes' corpses as they were thrown into the sea. Commerson relates a significant fact bearing on the subject. The corpse of a negro had been suspended from a yard-arm twenty feet above the level of the sea. A shark was seen to make many efforts to reach the body, and it finally succeeded in seizing it, member after member, undisturbed by the cries of the horror-stricken crew assembled

on deck to witness the strange spectacle. In order that an animal so large and heavy should be able to throw itself to this height, the muscles of the tail and posterior parts of the body must have an astonishing power.

The mouth of the shark being placed in the lower part of the head, it becomes necessary for it to turn itself round in the water before it can seize the object which is placed above. It meets with men bold enough to profit by this peculiarity, and chase it, formidable and ferocious though it is. On the African coast the negroes attack the shark in its own element, swimming toward him, and seizing the moment when it turns itself, to rip up its belly with a sharp knife. This act of courage and audacity can not, however, be said to be shark-fishing. The fishing operation is conducted as follows: Choosing a dark night, the fisher prepares a hook by burying it in a piece of fat pork, and attaching it to a long and solid wire chain; the shark looks askance at this prey, feels it, then leaves it; tempted by withdrawing the bait, the shark follows, and swallows it gluttonously. It now tries to sink into the water, but, checked by the chain, it struggles and fights. By and by it gets exhausted, and the chain is drawn up in such a manner as to raise the head out of the water. Another cord is now thrown out, with a running knot or loop, in which the body of the shark is caught about the origin of the tail. Thus bound, the captured shark is soon hoisted on deck. On the quarter-deck of the ship it is put to death, not without great precaution, however, for it is still a formidable foe, from its terrible bites and from the still dangerous blows of its tail. Moreover, it dies hard, and long resists the most formidable wounds.

On the coast of Guinea the shark is worshiped as a god by the negroes, and its maw is considered the straightest way to paradise. Mothers at annual festivals throw their infants to these monsters, as the Hindoo mothers sacrifice theirs to the Ganges crocodile.

But the shark, with all his ferocity, is not without some dangerous foes. The enormous sperm whale, which makes effective war on the great squid, also attacks the shark successfully, and never



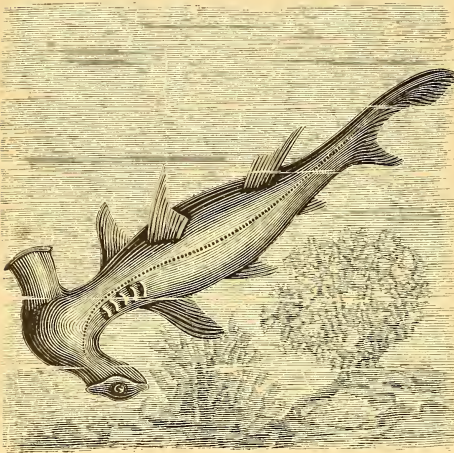
CAPTURING A SHARK.

hesitates to take some risk to secure a banquet of shark-meat. The great number of small sharks devoured by the sperm whale, whose jaws are sometimes twenty-five feet long, makes the huge cetacean

a blessing to the seas, as the warfare reduces the number of this marine scourge. The fins of the shark make a favorite Chinese delicacy, for which the gourmets of the Celestial land pay high prices.

Passing over the small sharks or dogfish found in large numbers on the North Atlantic coast, which rarely grow more than five or six feet long, the mackerel shark, of somewhat larger size, also common in our waters, which is a scourge to the mackerel- and cod-fishermen, the great basking shark of the northern seas, which sometimes attains a length of fifty feet, but which, though the largest, is the least ferocious of its family, and the other varieties known in different parts of the ocean world, let us come to the most curious of the shark race, the dreaded hammer-headed shark.

The distinctive peculiarity of this fish is the singular shape of



HAMMER-HEADED SHARK.

the head. It is flattened horizontally, and the sides are prolonged transversely, giving it the appearance of the head of a hammer. The eyes are placed at the extremity of these prolongations, and when the animal is at all irritated they become like flame. The semicircular mouth, which is underneath, is armed with four rows of teeth, and the body reaches the length of

eleven or twelve feet. Its boldness, voracity, and craving for blood are more remarkable than its size. If the hammer-head has not the strength and size of the white shark, it even surpasses it in fury, and can not be easily driven from its prey. It frequently haunts the vicinity of ships lying in roadsteads or off the coast, and

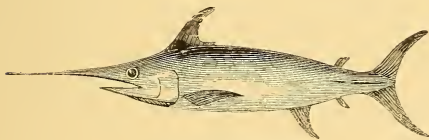
there is none of the shark race more hated and dreaded by Jack Tar than this ferocious and monstrous-shaped animal.

Nearly related to the shark is the sawfish, easily distinguished from all others by the formidable weapon which grows out of its snout, consisting of a long, straight, sword-like bone, flat on both sides but armed on the edges with strong teeth of considerable length. Thus armed, the sawfish, which is often fifteen feet long, attacks the most formidable inhabitants of the sea, measuring its strength



COMMON SAWFISH.

even with the whale, and generally winning the victory. Another desperate enemy of the giant of the seas is the swordfish, which carries a sharp spear from six to eight feet long growing out of the head. It darts with indescribable fury on all large moving objects, and seems to be animated by a pure love of destruction. The timbers of ships are often perforated by the swordfish. Some years ago a ship came home from the tropical seas, was placed in the dry dock, and the carpenters found the sword of a swordfish which had penetrated through the metal sheathing deep into the solid oak. To drive a pointed iron bolt so far would have taken many blows of a thirty-pound hammer. The swordfish attacks all



COMMON SWORDFISH.

other fish, and is the Ishmaelite of the ocean. The flesh of both the sawfish and swordfish, when young, is white, delicate, and of excellent flavor, and the fishery in the Mediterranean

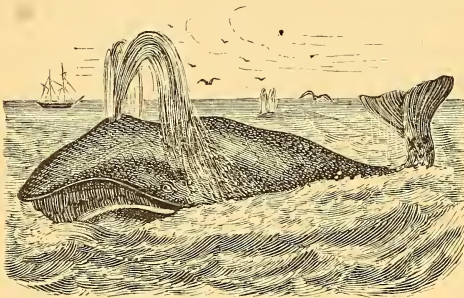
is actively pursued to supply the markets. The swordfish has frequently been caught twenty feet in length, and its swimming speed is said to reach the fearful velocity of a mile a minute. It is this charging speed which gives its sharp lance such terrible force.

By far the largest known inhabitant of the ocean world is the

whale, which, on account of its fish-like shape, is usually thought of as belonging to the fish creation. But the whale (including under this name the baleen, or right whale, the sperm whale, and the dolphin family, which covers the porpoise, grampus, and narwhal) is a carnivorous mammal, which has warm blood, and brings forth and suckles its young as much as the cow or the sheep. The right and the sperm whale both attain an enormous size, a length of seventy-five feet being by no means uncommon.

Before the discovery of mineral oil, the whale fisheries were so actively carried on from England and America that the extirpation of this great creature was threatened. About the year 1854 there were nearly seven hundred vessels which plowed the seas in every direction, from the frozen zones to the warm waters of the Pacific, engaged in hunting this huge game, and the product of a single year reached nearly half a million barrels of oil. Now that the demand for whale oil has so far decreased, the whale, which is far less hunted, has increased again and will probably soon reach its former standard of numbers.

The head of the whale constitutes about one third of its length, and it is from this part that the blubber is extracted. The mouth

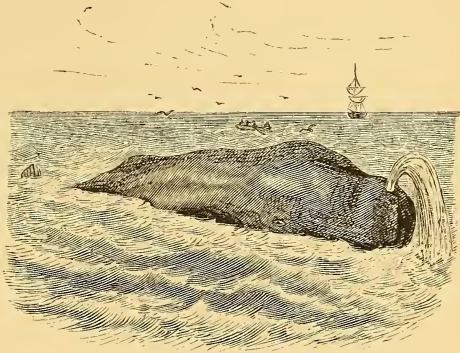


RIGHT WHALE.

is of enormous width, and the jaws are armed with plates of whale-bone, as in the case of the right whale, or with sharp conical teeth, as in the case of the sperm whale, which is mostly found in the tropical or semi-tropical waters of the Pacific. The pres-

ence of the whale is generally made known, even when the animal is under water, by the blowing of huge jets of water in the air. This is caused by the expulsion of the volume of water, which the whale takes in in swallowing its food, through the blow-holes in the

top of the head, and has nothing to do with the proper function of breathing, as has been sometimes supposed. It is from the baleen, or right whale, mostly found in the Arctic and Antarctic regions, that the whalebone is derived; this network of elastic material acting as a strainer for its food, which consists of small swimming mollusks and fish. Though the cavity of the mouth is large enough to take in a ship's long-boat, the gullet is not larger than a man's fist, and can not pass anything much larger



SPERM WHALE.

than a herring. The Greenland whale, which is the largest of the baleens, has a tail about six feet long and twenty-five feet wide. This is the animal's weapon, and it is used with terrible effect, frequently crushing a whaleboat like an egg-shell. This whale swims ordinarily just below the surface at the speed of about five miles an hour, though capable of far greater velocity. Often they throw themselves entirely out of water in sport, and one of their playful tricks is to immerse the body perpendicularly, flapping the tail on the water and making a noise perceptible for several miles.

This animal can remain in the ocean depths for half an hour, and when it comes to the surface it stays several minutes blowing off the water. This is the time utilized by the whale-hunters, whose knowledge of the creature's habits enables them to calculate the time and place of his appearance very closely. All whales show an extreme tenderness for their young, and during nursing roll gently from side to side, so that each of the offspring may have time to breathe. The southern variety of the right whale does not quite reach the size of its Arctic cousin.

In the sperm whale we find, instead of the whalebone plates,

a large number of sharp conical teeth in the lower jaw which fit into cavities in the upper jaw. The spermaceti, which is the most valuable find of the whale-fisher, is an oily fluid contained in the enormous head, and on exposure to the air it instantly hardens. In addition to the spermaceti, and the oil, which often amounts to eighty barrels in a single take, this whale yields the ambergris, a peculiar product of the bowels, which is in so much demand by the perfumers.

The sperm-whale fishery is far more dangerous than that of the right whale. The sperm whale is not only armed with an enormous tail, the stroke of which has the force of a Nasmyth hammer, but its formidable jaws are supplied with sharp teeth, with which it literally chews a boat into splinters. A whole shoal will sometimes come to the rescue of a wounded companion, and then woe betide the unlucky whalers in such an unequal fight, for flight is useless before the rush of these enraged monsters of the deep.

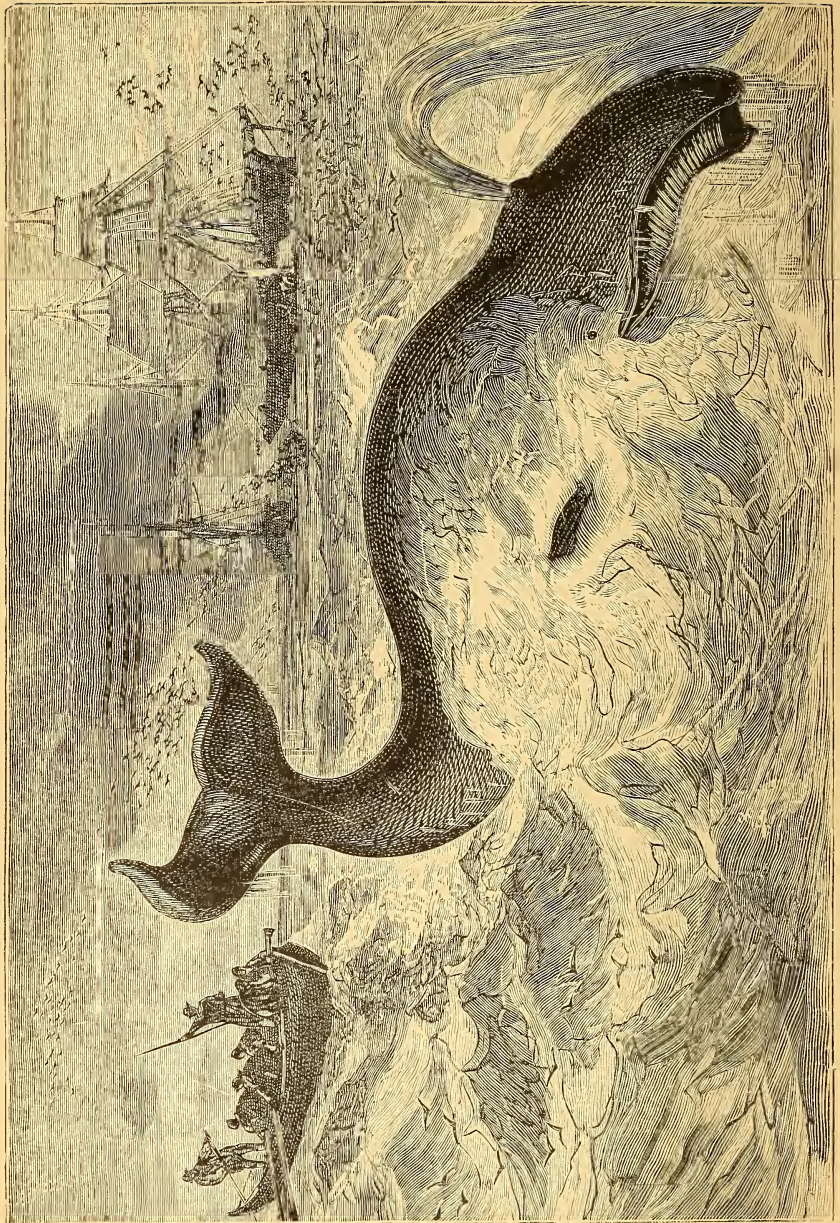
The accidents of the sperm-whale fishery furnish a gloomy record, and there are well authenticated cases of ships having sprung a leak and suffered wreck from the headlong charge of the sperm whale against its sides. Herman Melville's fascinating sea-story of "Moby Dick" is based on a sailor's legend of a gigantic sperm whale which had long defied capture, and become a sort of conscious and deliberate avenger of the destruction inflicted on its kind.

The sperm whale is distributed through all the seas, but his home is principally in the South Pacific. Schools of them, consisting of from twenty to fifty females and their young, with one or two old males or bulls, are common. The males during the time of breeding fight savagely, as their broken and distorted jaws frequently testify. They find their choicest food in the huge squids which abound in the southern seas, and bite off the head as the choice morsel. They also attack large sharks without fear, and by their courage as well as their vast size justify their right to be called the kings of the ocean. In the times when whale-fishing was such an important industry, only the largest and most heavily

manned ships were sent in pursuit of the sperm whale, for its capture was justly recognized as the most dangerous and difficult of seafaring trades, as indeed it was also the most remunerative. Whale-fishing has been so often described that it is scarcely worth while to repeat the familiar story, except very briefly.

Instantly the lookout sings "There she blows!" the crews rush to the boats, which are promptly lowered, each man taking his place with the regularity of machinery. The boat-steerer, who is also the harpooner, sits in the stern with his trusty weapon in hand, the fathoms of line attached to it coiled away in a tub at his feet. On approaching the whale he rises, and, seizing the coil in his left, hurls the harpoon with his right hand at the most vulnerable part of the huge animal. Away the line goes like lightning as the stricken whale dives into the depths, and so swift is the paying out of it that water has to be poured on to keep it from setting the boat on fire. More than once a sailor's leg, caught in the whizzing coil, has been cut off as with a cleaver.

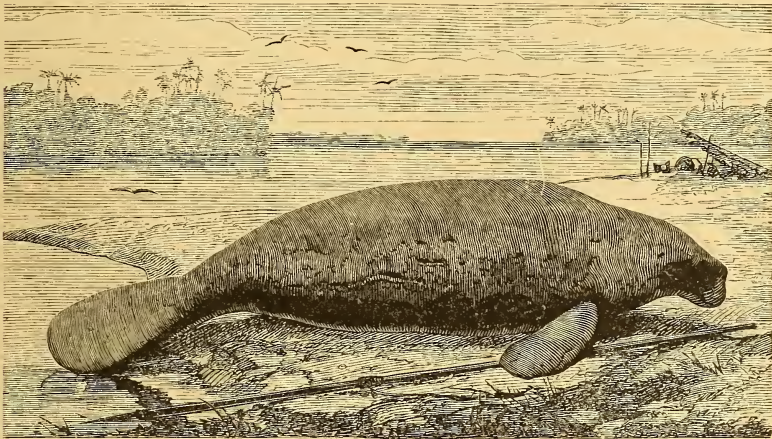
When the whale rises again, comes the time of special danger. The harpooner again hurls the sharp steel, and the infuriated whale, with blows of the terrible tail or snaps of the no less terrible jaws, seeks to destroy its human foes. Unless the order "Stern all!" is instantly obeyed by backing the boat out of near vicinity when the harpooner makes his throw, the crew find themselves in the water, some of them perhaps crushed or mangled to death. Oftentimes the whale descends several hundred fathoms, and remains under water half an hour. The signal of victory is when the huge creature begins to spout great jets of blood or bloody foam. The whaleman then knows that the death agony is not far off, and puts an end to the struggle by a thrust of the keen, slender lance in a vital part. In addition to harpoon and lance, the harpoon-gun is sometimes employed, this weapon being used from a greater distance. There is still another weapon, more deadly than the others, the bomb-gun. The projectile in this case is so contrived that it explodes inside the doomed whale. A few seconds after it is discharged, a dull, rumbling sound is heard, the whale makes a



FISHING FOR THE WHALE WITH EXPLOSIVE BALLS.

convulsive somersault, oftentimes entirely out of the water, and frequently dies almost instantaneously. The whale is often lost to its captors by sinking in its last agonies. If not, the body is towed to the side of the ship, and the disgusting work of butchering the animal, cutting out its blubber, and trying out the oil begins. One whale is generally thus disposed of before another attack is made, though there may be large numbers in daily view.

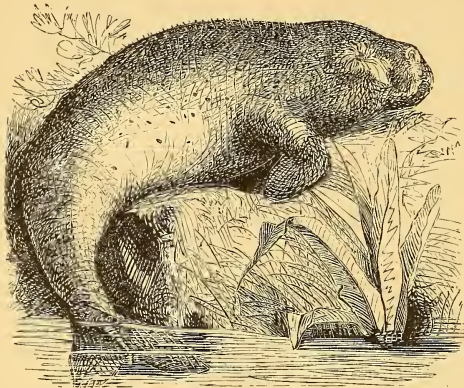
Closely allied to the whale, though presenting some important differences of structure, is the manatee, also known as the lamantin or sea-cow. The manatee inhabits the sea-shore close to the mouths



MANATEE.

of rivers and the rivers themselves, feeding on algæ and aquatic plants. When it is seen supporting itself in a semi-erect position in the shallows, it presents, in the distance, something of a human appearance, the resemblance being heightened by the distinct lips, the long whiskers in the male, and the well-formed, rounded breasts of the female. The largest known is that which frequents the rivers and coast regions of Florida and other regions on the Gulf of Mexico and the West Indies. It here reaches a length of from twelve to fifteen feet. Harmless and gentle even when attacked, the manatees are seen generally in small groups, associated for the

defense of their young. The South American manatee, which is not quite so large, is not uncommon in the great rivers of Brazil and Guiana, ascending several hundred miles in these streams,



DUGONG.

and living even in small fresh-water lakes. Easily captured, the flesh is good and wholesome, and, as it is considered by the Roman Church as fish, it is in great demand during Lent in these countries.

Though the manatees are tropical, they are not found in the Pacific or Indian Ocean, their place being taken

by a similar animal called the dugong, which is still more like the whale in many particulars, especially in the shape of its tail, which divides into large flukes. The dugong browses like a cow on the marine vegetation, and the Malays value its flesh very highly. It is generally speared at night, when the timid animal is feeding in the shallows of rivers, or in the sea disporting itself near the shore.

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