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AQUATIC PRODUCTS IN THE ARTS AND INDUSTRIES

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Ink, oil, gloves, glue, furs, "feathers," gems, gelatin, isinglass, soap, buttons, shoestrings, and suspenders are among the many commodities manufactured from products of the fisheries; and their commercial production has created vast industries in the United States.

The man-in-the-street thinks primarily of food or sport when fish and the fisheries are mentioned, although from prehistoric times fishery products have served many other purposes. Amber, corals, pearls, and shells of many kinds were used by ancient man for barter. Wampum, consisting of beads which were usually made from conch shells, was used by the North American Indians as money, ceremonial pledges, and ornaments. Teeth of porpoises and sharks also have served as mediums of exchange in some of the islands of the Pacific. The Egyptians and Assyrians obtained dyes from certain species of molluscs. The "royal purple" of the period of Roman Empire was so obtained, and factories for its production were scattered throughout Italy and Greece. Sepia also was obtained from the ink sac of a mollusc.

Many products that at one period seemed highly essential in satisfying human needs have been replaced by more recent inventions and discoveries. With the development of the Argand burner in 1784, whale oil became the principal illuminant for homes, streets, lighthouses, etc., and was commonly used until about 1835. Whalebone was used extensively for making umbrella and parasol ribs, for the manufacture of hoops for the dresses our grandmothers wore, and for stays for the corsets which were worn in the days when our mothers were young. Sharkskins were used as abrasives for polishing wood, ivory, and the like, but have been replaced by sandpaper, emery cloth, and crocus cloth.

With the exception of choice pearls and corals, ambergris was at one time the highest priced product of the fisheries, selling for upwards of $640 a pound; and the "take" from a single whale has sold for as high as $60,000. Its principal use was as a fixative in the preparation of fine perfumes. Synthetic substances have become available at a fraction of the cost, however, and the use of ambergris in recent years has decreased until it has sold for as little as $128 a pound.

While many of the early fishery products have been discarded, the number of such products catering to our present needs and vanity is greater than at any time in the history of the world. Figuratively speaking, the modern woman might dive into the water and emerge completely clothed and adorned with aquatic products. She would be wearing a dress of artificial silk made from the shells of crabs, lobsters, or other crustaceans; an evening frock covered with bonefish scales, like shingles on a roof; a fur coat of otter, sealskin, or beaver, with mink or muskrat trimmings; shoes of sharkskin with mussel-shell buckles. The buttons on her coat and dress would be of pearl derived from fresh-water mussels, abalone, or artificial pearl. On special occasions she would wear a string of natural pearls, and would have a duplicate set of imitation pearls for ordinary use. In her alligator leather handbag she would carry a small cake of soap made from fish oil; cold cream from whale oil; a bottle of perfume in which ambergris was the fixative; a hand lotion made from sea moss; and gloves of cod skin or woven from the fine, hairlike excrescence of a Mediterranean shellfish. Coral earrings and a tortoise-shell comb would complete her outfit.

On her way home she could purchase a rotogravure which was covered with fish glue before etching, a beaver hat adorned with an aigrette made from whalebone, a toilet set trimmed with artificial pearl made from fish-scale essence and containing a sponge, an amber-stemmed pipe for her husband, a bottle of cod-liver oil and a package of agar agar to be made into gelatin for the youngsters, and a piece of cuttle bone for the canary.

In North America genuine pearls are found in the pearl oysters of the Gulf of California, the abalone of California and Lower California, the queen conch of the Gulf of Mexico, and the fresh-water mussels of the Mississippi River system, although these fisheries are now relatively unimportant. The production of cultured pearls is confined to Japan, where the output has been valued at $600,000 annually.

About 1656 Jaquin, a French rosary maker, noted that the water in which a small minnow had been washed contained a highly lustrous substance which, when concentrated, closely resembled pearl. By applying the concentrate to small globes of alabaster, Jaquin produced excellent imitations of pearls. The substance which gives this lustrous appearance is found on the scales of many fishes.

From the seventeenth century the European minnow used by Jaquin continued to be the chief source of supply of fish-scale essence, and became the basis for a large industry. When the European supply was cut off during the World War, research with other fishes resulted in the developing of new sources of supply in this country and the building up of a new and important industry. The American supply is obtained chiefly from the herring of New England.

At the present time, 2,440,000 pounds of fish scales are used annually in the production of fish-scale essence, from which imitation pearls and

LIFE ACTIVITIES

In spite of its simple structure, the sponge performs many of the life processes of higher animals. Its whole body might be thought of as a sort of net-work or sieve designed to strain minute food organisms out of the surrounding sea water. Even a small sponge strains a considerable amount of water, although the currents pass slowly through the many canals of its body. A sponge only about 4 inches high and less than half an inch in diameter has been estimated to pass nearly 24 quarts of water through its body in a day. The water brings the sponge food and oxygen, and presumably carries away carbon dioxide and nitrogenous excretory products. The food is picked up by the collar cells lining the canals and digested in food vacuoles within these cells, or perhaps within the large wandering cells called amoebocytes.

The ability of sponges to react to touch or other stimuli is very limited. The osculum appears to be the most sensitive part of the body. Since they have no nerve cells, their limited responses to stimulation must be of the same order as those of protozoa, and depend on the reactiveness of all protoplasm or living substance.

Sponges reproduce both by asexual and sexual means. They are capable of many different forms of vegetable reproduction. For example, any piece that contains some of the flagellated cells and a part of the canal system is able to regenerate an entire sponge. Because of this fact, growers are able to propagate sponges by cutting them into pieces with a sharp knife and attaching them to cement discs or to stones. Attachment protects the cutting from injury by silt or sand, and keeps them from being swept away in the currents.

Even when a sponge is experimentally crushed by passing it through a fine screen, some of the cells are able to come together again and form a complete animal. All fresh-water and some marine sponges regularly form asexual reproductive bodies, called gemmules. These are thick-celled spheres containing specialized cells from which a new sponge may be formed. Gemmule formation by fresh-water sponges takes place in the fall, and since the gemmules can survive freezing, drying, and other undesirable conditions, they produce a new crop of sponges in the spring.

All sponges at times reproduce sexually by forming egg and sperm cells. Most individuals are capable of producing both male and female cells, but apparently form only one type of reproductive cell at any given time. Sperm produced by sponges functioning as males is carried in the water currents into other sponges to fertilize the egg cells produced within their tissues. In time the fertilized eggs hatch into larve equipped with thread-like processes or flagella for swimming. The larve work

out of the tissues of the parent sponge into the canal system and leave the parent by way of the osculum. They swim freely about in the water, and after a time (the length of the swimming period is not known) they attach themselves to some hard object and grow into adult sponges. There are surprising differences in the life-span of sponges. While some, especially those that live in fresh water, die off each autumn, others, like some of the large bath sponges, are believed to live as long as 50 years.

RELATIONS TO OTHER ANIMALS

Since their lives are spent attached to the botton or to some hard object like a wharf pile, or a rock, sponges do not prey actively on any of their neighbors on the sea floor. Sometimes, however, they may smother other sessile animals such as shellfish by forming a dense growth over them. One type of sponge kills oysters, clams, barnacles, and certain other animals by boring into them and gradually destroying their shells.

The rough exterior of most species, and the unpleasant odor or taste of the slime exuded by others, serves to repel a great many animals that might otherwise eat sponges. Some shell-less mollusks and perhaps some crustaceans feed on them, but fishes seldom if ever do. For this reason the cavities of sponges form excellent hiding places for many small animals. Probably every sponge has its share of inhabitants. One large loggerhead sponge at Tortugas was found (by Pearse) to contain 16,352 shrimps of a noncommercial species.

One group of sponges usually grown on snail shells occupies by hermit crabs. In time the sponge grows completely around the shell, except for its opening, and eventually dissolves it, so that the crab lives in a smooth, coiled cavity within the sponge. This strange relationship probably benefits both crab and sponge, for the crab is protected from fish and other enemies, while the sponge receives whatever benefit may result from transportation from place to place.

THE SPONGE FISHERIES

The United States occupies third place among the countries of the world in total production of commercial sponges. Cuba is the largest producer, while the Bahama Islands rank second, Italy fourth, Libya fifth, and Greece sixth. Egypt and Turkey produce smaller quantities. The sponge fisheries of the United States catch is sold at auction at Tarpon Springs. The accompanying table lists the quantity and value of the four principal commercial species sold at Tarpon Springs during certain years during the period 1913-1940. Between 1913 and 1934 more than 90 percent of the total United States production was sold at Tarpon Springs, and between 1935 and 1940, 95 percent.

Although sponges are, perhaps, best known to the general public through their houshold uses, they are vastly more important in the arts and industries. They are used in applying a glaze to fine pottery and in the dressing of leather; they are used also by jewelers, silversmiths, cane makers, hatters, lithographers, painters, bricklayers, and tilelayers. The qualities of softness, durability, resiliency, and absorptiveness which make the sponge peculiary valuable for such uses are found in no other natural or synthetic product.

The chief commercial species of sponges are sold under the common names "sheepswool," "velvet," "yellow," "grass," and "wire" sponges. These species differ considerably in tecture, softness, elasticity, and durability. These qualities, in addition to the color, determine the market value. Even within one species there are marked differences in quality, depending on the locality in which the sponges grow.