THE AMERICAN SHAD

by GERALD B. TALBOT

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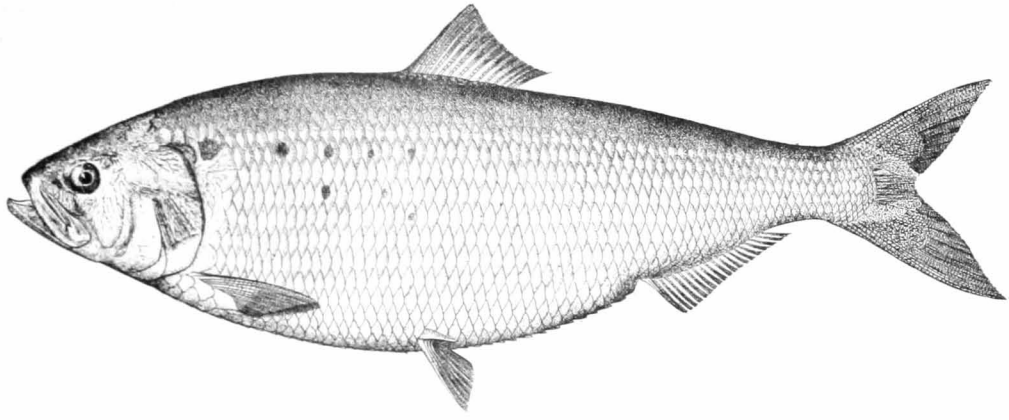

The American shad (Alosa sapidissima) is one of the best known fishes of the Atlantic coast. Its natural range extends from St. Lawrence River in Canada to the St. Johns River in Florida. The fish is the largest member of the herring family in North America; a mature fish is about 18 to 24 inches long. It is silvery in color with a bluish green metallic luster on the back and a dark spot at the shoulder, followed by several smaller spots. The meat is delicious, delicate, and moderately oily, but the shad is most noted for its highly prized roe.

LIFE HISTORY

Shad live most of their lives in the ocean but return to the freshwater streams of their birth for spawning. It is during the spawning migration that the major part of the commercial catch is made by pound nets, gill nets, and haul seines. Mature male shad average between 2 and 3 pounds in weight while the females' average weight is between 3 and 4 pounds. In the early years of shad fishing some fish were recorded as weighing as much as 15 pounds, but fish over 9 pounds have been extremely rare in recent years.

Note.--Gerald B. Talbot, Laboratory Director, Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Beaufort, North Carolina.

Spawning runs begin as early as November in the St. Johns River in Florida, but the major part of the run enters the river in January. The runs occur progressively later northward, usually beginning in late January or February in other southern streams; during March in Chesapeake Bay tributaries; April in the Hudson River; May in the Connecticut River; and late May or June in the St. Lawrence River.

It was formerly thought that a relation between river and ocean temperatures stimulated the beginning of a shad migration into a river. Usually the fish do enter the rivers and spawn a few days earlier than average during warm periods and a few days later when cold weather prevails during the spawning run. They appear, however, to enter streams at various temperatures, between 40° and 73° F.; and since they migrate from great distances in the ocean and arrive at the mouths of streams about the same time each year, it appears that their migrations are primarily related to time, with stream temperature playing only a minor role in the timing of their river migrations. There is usually a preponderance of males in the early part of the run. Later the sexes are about equal or females are most numerous.

Spawning occurs in the fresh water portions of a river at water temperatures between 53° and 75° F. Heaviest spawning apparently takes place in the evening. In deep rivers, such as the Hudson, shad are never seen except when taken from the water in nets. In streams where they can be observed, spawning appears to be accompanied by erratic swimming movements of the female followed by several males.

The eggs are shed loosely into the water where they are fertilized by the males. The numbers of eggs produced each year by each mature female ranges from 116,000 to 660,000, depending upon the size and age of the fish as well as the stream in which spawning occurs. The eggs absorb water and increase in size from about 1/16 to 1/8 inch in diameter. Being slightly heavier than water they sink to the bottom where they are carried by the current. The eggs hatch into a larval stage in 6 to 8 days at about 63° F., and develop into their final form in another 4 or 5 days.

MIGRATIONS

Adult shad in streams south of Chesapeake Bay and particularly south of North Carolina die after spawning. Those that spawn in streams from Chesapeake Bay northward leave the river after spawning and migrate to the Gulf of Maine where they feed on the abundant plankton found there. Because of this, large concentrations of shad are found in the Gulf of Maine each summer. In the fall these fish head south and presumably spend the winter in the middle Atlantic

area. In the spring they move inshore and migrate either north or south to their native streams to spawn, repeating this cycle each year that they escape their natural enemies and the fishermen.

The young shad live in the rivers during their first summer and usually migrate to sea in the fall, at which time they are 3 to 6 inches in length. They probably spend the winters in the middle Atlantic area and are known to migrate to the Gulf of Maine each summer as do the adults. When mature they return to their native streams to spawn. At this time the male shad are usually 3, 4 or 5 years old, while the females are usually 4, 5 or 6 years old.

TRANSPLANTATIONS

In 1871 shad were introduced to the Pacific coast when 12,000 fry from the Hudson River, New York, were planted in the Sacramento River, California. One of these fry was observed after growth to a mature adult fish in the Sacramento River 2 years later in 1873. In 1874 adults were numerous. Other transplants were made in subsequent years to the Sacramento and Columbia Rivers. These fish spread to other Pacific coast streams and became well established. They are now found from San Diego, California, to Kodiak Island, Alaska.

DECLINE OF FISHERIES

During the early years of the fishery the shad was the most highly prized fish along the Atlantic coast, second only to cod in value and catch. Since it was widely distributed along the coast it became a very important food source for the early settlers and was fished intensively. The fishery reached a peak of production in 1896 when a catch of over 50 million pounds was landed. High productivity was maintained between 1889 and 1901, and over 40 million pounds were caught each year during this period. The catch then began to decline rapidly and by 1912 was less than 20 million pounds. Since that time there has been a gradual decline with small fluctuations until in 1958 only 8 million pounds were caught.

Causes for the decline of the Atlantic coast shad fishery have not all been documented. It is known, however, that the building of dams for industry, navigation, and hydroelectric power has been a major factor in some streams. These have kept shad from their natural spawning grounds and have reduced or entirely eliminated them in many streams. Pollution has occurred to some extent in all streams and in many rivers it is extremely serious and responsible for drastic reduction in shad production. Overfishing

has also occurred and was probably the main cause of the disastrous decline in catch between 1901 and 1912.

On the west coast of the United States shad usually are caught incidentally to the catch of salmon. Most of the shad have been shipped to the east coast since other fish native to the west coast are preferred in local markets. Therefore, catches of this species on the west coast do not reflect abundance. During the past 40 years the Pacific coast shad catch has ranged between 1 million and 5 million pounds with a downward trend in recent years to 545,000 pounds in 1958.

HATCHERIES

Artificial propagation of shad was begun in the late 1800's as a supplement to natural production in the hopes of maintaining or increasing production. Between 1880 and 1910 more than a billion larvae were released from hatcheries along the Atlantic coast. These did not prevent depletion of the fisheries and all artificial shad hatching has now been discontinued. Recent studies on shad hatchery operations and natural fecundity of shad have disclosed that artificial shad propagation as practiced could have been, at best, of slight benefit to shad production and in many cases had a deleterious effect.

MANAGEMENT

Recent research on this species has shown that at the present low levels of production, fluctuations in abundance are caused primarily by overfishing and underfishing the population. For instance, the stocks of shad in the Hudson and Connecticut Rivers were reduced to low levels shortly after the turn of the century. They remained low probably because of overfishing. During the depression years between 1930 and 1942 the rate of fishing was generally low and fishing was restricted to certain days each week. As a result, the size of the shad populations increased. During the war years that followed, the demand and price for shad was high and the amount of gear and days allowed for fishing increased so that fewer shad escaped the nets to spawn. As a result the population size decreased and catches were poor. Fishing on these two streams was reduced after the war and the shad populations of these streams are now near their former peak of abundance. It is now possible to manage these fisheries to produce optimum yields each year.

The shad fishery of eastern Canada has also recovered from a low of about 145,000 pounds in 1922 to a production of over a million pounds each year since 1933. A reduction in the amount and

type of gear fished, area of fishing, and days allowed to fish has apparently allowed the shad populations to increase so that larger catches are made despite the restrictions on fishing.

SPORT FISHERY

A recent development is a sport fishery for shad. Since adult shad feed by straining microscopic plant and animal life from the water with their gills, it was previously supposed that they would not strike a lure. It has been found, however, that during their spawning run they will strike at artificial flies, small metal spoons, and plain hooks garnished with colored beads. A sizable sport fishery for shad first developed in the Connecticut River where it is gaining in popularity as a sport fish each year. As the size of the shad population increased during recent years sport catches have also increased. The catch in 1958 was 38,600 fish and in 1959 it was 45,600 fish.

Other sport fisheries for shad have developed in the Susquehanna River below Conowingo Dam; the Edisto River in South Carolina; the Ogeechee River in Georgia; and the St. Johns River in Florida. In the latter stream shad catches by hook and line amounted to over 68,000 fish in 1959.

ECONOMICS

During the early years of the fishery the wide distribution, ease of capture, and method of preservation made this species a low-cost source of nourishing protein food. The fish were sold whole and eaten fresh or salted or smoked for later use. Modern living and marketing practices, however, are not compatible with these methods. Packaged food products which can be quickly and easily prepared are in demand, while the majority of the shad are still marketed as whole fish which require considerable effort on the part of a homemaker in preparing them for table use. Demand for this fish has, therefore, decreased. Several progressive fish dealers are now producing deboned fillets of shad, neatly packaged, which can be easily handled by modern marketing methods. Shad roe is also packaged and sold in this manner. These products have proved very popular, but as yet only a very small fraction of the catch is sold in this manner. The future success of this fishery will probably depend to some extent upon industry's willingness to produce a modern food product that is widely acceptable to the modern shopper.

Shad catch by area in North America from 1895 to 1955
by 5 year intervals (in thousands of pounds)

Year	Eastern Canada	New England	Middle Atlantic	Chesapeake Bay	South Atlantic	Pacific Coast	Total
1895	1,920	1,389	18,163	15,915	10,743	500	48,630
1900	1,650	1,398	20,988	11,895	10,417	1,000	47,348
1905	1,230	1,261	6,174	10,562	9,211	800	29,238
1910	1,150	1,224	4,144	8,764	7,434	3,000	25,716
1915	800	1,066	2,437	6,169	4,594	7,478	22,544
1920	300	855	730	9,161	3,010	2,000	16,056
1925	642	473	839	7,364	3,148	3,712	16,178
1930	393	201	450	7,181	2,541	3,044	13,810
1935	1,012	727	1,329	3,683	2,000	2,414	11,165
1940	1,633	574	4,746	3,257	1,344	2,646	14,200
1945	1,104	818	5,800	5,916	2,065	3,455	19,158
1950	1,640	296	1,802	4,474	1,651	2,893	12,756
1955	1,599	259	1,973	4,964	1,403	1,229	11,427

Note.--Where data were not available for the specific year listed, catch data were estimated by interpolation between the previous year and the next year for which data were given.

U. S. data from Bureau of Commercial Fisheries.

Canadian data from Leim (1895-1915) and from Canada Department of Fisheries of Nova Scotia and New Brunswick only (1925-1955). Do not include small catches in Quebec, Prince Edward Island, or inland water of New Brunswick.

For additional reading the following publications may be consulted:

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