Year	Canada	New England States	Middle Atlantic States	Chesapeake Bay	South Atlantic States	Total Atlantic Coast	Total Pacific Coast	Grand Total
1911	—	1,192	3,802	8,245	6,866	20,105	4,175	24,280†
1912	—	1,161	3,460	7,726	6,289	18,645	5,002	23,647†
1913	—	1,129	3,119	7,207	5,730	17,185	5,827	23,012†
1914	—	1,098	2,778	6,688	5,162	15,726	6,652	22,378†
1915	800*	1,066	2,437	6,169	4,594	15,066	7,478*	22,544†
1916	—	1,035	2,096	6,767	4,026	13,924	5,981	19,905†
1917	—	1,003	1,755	7,365	3,458	13,581	4,484	18,065†
1918	—	972	1,414	7,963	2,889*	13,238	2,987	16,255†
1919	—	940*	1,073	8,562	2,949	13,524	2,183	15,707†
1920	—	855	731	9,161*	3,010	13,757	2,025	15,782†
1921	321*	770	390*	3,070	3,070	13,267	1,483	14,740†
1922	145*	685	502	8,378	3,130	12,840	1,736*	14,576†
1923	340*	600	615	8,040	3,191*	12,806	1,778*	14,871†
1924	647*	516*	727	7,702	3,170	12,762	2,715*	15,477†
1925	642*	473	839	7,364*	3,148	12,466	3,712*	16,178†
1926	509*	431	952*	7,904	3,126	12,922	2,938*	15,860†
1927	299*	388	842	8,445	3,104*	13,078	5,946*	19,024†
1928	752*	346*	732	8,985	4,446*	15,261	3,948*	19,209†
1929	633*	461*	622*	9,526*	3,346*	14,588	3,280*	17,868†
1930	393*	201*	450*	7,181*	2,541*	10,766	3,044*	13,180†
1931	523*	401*	660*	8,487*	1,788*	11,859	2,505*	14,364†
1932	719*	232*	643*	6,515*	1,882*	9,991	1,889*	11,880†
1933	968*	386*	834*	6,191*	2,189	10,568	1,606*	12,174†
1934	1,154*	556	1,081	4,990*	2,497	10,278	1,949*	12,327†
1935	1,012*	727*	1,329*	3,683*	2,497	9,248	2,414*	11,662†
1936	1,480*	385*	2,838*	2,185*	1,868*	8,756	2,995*	11,751†
1937	1,232*	445*	4,394*	1,218*	1,318*	10,880	1,213*	12,093†
1938	1,473*	503*	3,591*	4,208*	1,418*	11,193	1,793*	12,991†
1939	2,028*	530*	4,131*	4,184*	1,232*	12,105	2,375*	14,480†
1940	1,633*	574*	4,746*	3,257*	1,344*	11,554	2,646*	14,200†
1941	1,176*	486*	3,750*	2,659*	1,488	9,559	1,076*	10,635†
1942	1,158*	568*	6,429*	3,155*	1,632	12,942	3,590*	16,532†
1943	1,300*	941*	5,617*	4,265*	1,777	12,900	3,111*	17,011†
1944	1,118*	1,211*	6,485*	5,376*	1,921	16,111	3,908*	20,019†
1945	1,104*	818*	5,800*	5,916*	2,065*	15,703	3,455*	19,158†
1946	1,401*	1,448*	1,107*	4,318*	2,030	10,304	3,582*	13,886†
1947	1,065*	1,151*	2,909*	4,954*	1,320	11,399	2,571*	13,970†
1948	1,171*	661*	3,299*	4,210*	1,155	10,496	1,614*	12,110†
1949	1,326*	490*	2,363*	3,884*	902	8,965	2,200*	11,165†

* Figures were obtained by actual canvass carried out by authorities of Federal or State agencies.
† Grand total represents both the actual collected statistics, the calculated interpolations, and, in a few cases, is based on incomplete records such as those for 1941.

Certain qualifications for the statistics are as follows:

(1) Source of the general summary of statistics from 1887-1935, excluding Canada (see report on Canada for explanation of records), is from Johnson (1938).

(2) Data for other years than those with definite statistics have been supplied by interpolation; that is, by assuming the increase or decrease during the elapsed period between those years for which data are available was in the same ratio for each successive year during such period. In addition, interpolations based on percentage of the shad catch for each of the South Atlantic States (1880-1945) were calculated from available statistics in order to obtain an estimation of the subsequent trend from 1946-1949 for this section.

(3) For a more accurate index of the statistics upon which the trends are based, see the catch records for each State in the respective reports. Note also the source of individual records. Some are more reliable than others. In general, the methods and degrees of effort in collecting catch data have varied from year to year, census-takers for fishery statistics have often changed from year to year, and information may be gathered in more complete form in some years than in others. In some cases, the reported catches are but a small portion of the actual landings.

(4) It is obvious that unusual fluctuations in those years for which data are lacking will not be recorded in the above treatment; however, for the purpose of

indicating the general trends the results should be satisfactory.

(5) Commercial statistics can not be interpreted accurately to show the natural abundance of shad. They show fishing intensity and they indicate periods of decline and increase in commercial production. Sudden changes in the records that are not economic in nature may reflect natural fluctuations in shad, if such phenomena occur; but they more probably indicate how available shad are to fishermen.

SUMMARY

SHAD FISHERIES OF NORTH AMERICA

(1) *Introduction.* During the past 50 years the relative productivity and value of the shad fisheries of North America decreased as reflected in the record of the commercial catches. The United States catch of shad aggregated almost 50,000,000 pounds in 1897, at which time it was a growing, valuable industry. However, the catch had dwindled by 1935 to 8,000,000 pounds, and the fisheries ranked 21st in volume and 11th in value among the Atlantic coast fisheries. The shad fisheries in 1949 ranked 38th in volume (about 11,000,000 pounds), and 26th in value (about $1,636,000). The reasons for the decline in production are due to many conditions that are biological and socio-economic in nature.

(2) *Natural History.* The American shad, *Alosa sapidissima* (Wilson), is the largest, best known, and one of the most valuable members of the herring family. The female is larger than the male, the average difference in weight being more than a pound. Males average about three pounds, while females average four and one half pounds in weight. On the Pacific Coast, where shad were introduced from the Atlantic Coast, they are said to average a pound or more heavier than on the Atlantic. Shad are distributed from the Gulf of St. Lawrence to Florida, being in greatest abundance from North Carolina to Connecticut. On the Pacific Coast, they are found from southern California to southeastern Alaska.

The annual migrations of adult shad, upon which the seasonal fisheries are founded, from the sea to fresh water in coastal rivers, is for the purpose of reproduction. The fish ascend waterways suitable for spawning above tide-water and occupy several weeks in depositing and fertilizing their eggs. The young hatch and remain in fresh water until autumn, after which time, when they are three to five inches, they descend streams to the ocean. They do not return to fresh water until they are three, four, or five years old. Shad are believed to return to spawn in the stream in which they were hatched. Tagging and scale studies have generally substantiated this belief. The life of shad in the ocean is little-known, although off the Gulf of Maine they congregate in summer and early fall in large numbers, presumably for feeding. Young shad possess teeth in their jaws, whereas adults do not. The former feed upon microscopic crustaceans and insects, while the latter feed upon minute crustaceans, and, rarely, upon worms, small fishes and large organisms. The adult is considered a plankton-feeder, but in fresh water feeding is restricted, although they readily strike at artificial lures. As a result, they have become the object of a sports fishery. Age, growth, and condition of shad can be determined in certain circumstances by the study of the pattern of ridges and grooves on scales. In addition, a fresh water mark is visible and spawning marks can be discerned on scales.

(3) *Methods of Fishing.* The commercial production of shad depends on three principal methods of capture: (a) gill-nets, which account for about one half of the catch of North America; (b) pound nets, which account for about one third of the catch; and (c) haul seines which account for most of the remainder. All of these gears operate during the spring migrations; some catch shad incidental to other species. Pound nets are used in open waters, such as Chesapeake Bay, while gill nets and seines are used in rivers. Purse seines, used primarily in New England mackerel fisheries, take considerable quantities of small shad during the summer. Among other types of gear that take shad are: floating traps, fyke nets, weirs, dip-nets, and otter trawls.

(4) *Florida.* The shad fisheries of Florida are supported by two rivers: St. Johns and St. Marys. The season opens during mid-December and extends until mid-April, during which time shad are taken by drift gill nets. A sport fishery for shad has developed around DeLand. Shad production has declined in recent years to almost one seventh of the catch of the fisheries 50 years ago. Shad

fry have been stocked in the rivers, but without success. No factor has been proved as responsible for the decrease. Aside from regulations controlling the size of mesh, there is no specific management program for restoring the shad in the State.

(5) *Georgia.* The shad rivers of Georgia, which include the St. Marys, Satilla, Altamaha, Ogeechee, and Savannah, have remained relatively unchanged during the past half century, although a sharp decline in production has occurred in recent years. Up to 1936 hatchery-reared shad fry were stocked in various rivers, but no beneficial results were observed. Aside from certain general laws, a weekend rest period during the open season is the only management measure enforced. There is no closed season on taking shad by rod and reel on the Ogeechee River.

(6) *South Carolina.* The bulk of the shad taken in South Carolina is caught in the Winyah Bay area, although Combahee, Ashepoo, Santee, Savannah, Edisto, Black and Sampit rivers also figure in the fishery. In recent years the annual production of shad has been about one fourth of that of 50 years ago. Investigations indicate, though somewhat inconclusively, that overfishing has been responsible for the decline, particularly so in the unpolluted and unobstructed Edisto River. Spawning marks are said to be lacking on South Carolina shad scales, indicating that there may be only one spawning migration. Although a controlled-catch shad management program was recommended to the State, the weekend rest period is the only important restoration measure now in force.

(7) *North Carolina.* At one time the shad fisheries of North Carolina were among the most important on the Atlantic coast. At present shad are taken in the Cape Fear, Neuse, Tar-Pamlico, Roanoke, and Chowan rivers, but the most important fishery is in Albemarle and Croatan sounds, the shad being taken by means of gill nets, pound nets, fyke nets, and haul seines. They are reported to use the Goldsboro fishway located on the Neuse River. Shad are caught from February and March until late spring. In recent years they have declined to about one eighth of the production of 50 years ago. The factors responsible for the decline have not been demonstrated. Artificial propagation did little, if anything, to stem the decline. There is a Sunday interdiction against fishing during the open season period.

(8) *Virginia.* The commercial yield of shad in Virginia is obtained mainly in Mobjack Bay, in the James, York, Pamunkey, Mattaponi, Rappahannock and Potomac rivers, and in lower Chesapeake Bay, the shad making their appearance in early March. In the upriver fisheries, the fishermen seem to work only on a part-time basis. Some sport fishing for shad occurs in the Chickahominy River. The production of shad recently has declined by about one third. Investigations have suggested that overfishing is responsible for the decline, but some observers feel that perhaps natural fluctuations in abundance may be responsible. The limited operation of shad hatcheries, which is still carried on, has not proven their value to date. A cleanup campaign on polluted rivers, and enforcement of present regulations are the only management measures carried on at present.

(9) *Maryland.* Shad are harvested in Maryland waters in essentially the same areas in Chesapeake Bay and its tributaries as 50 years ago. The lower central region of the Bay is the location of the most valuable pound net fishery. The Choptank and Potomac rivers are among the most important fishing areas. Shad are taken principally by drift gill and stake gill nets, fykes, bow-nets, and haul seines. In addition, shad are taken by the sport fishermen (in the Susquehanna, Potomac, and Patuxent rivers), and by unlicensed, small-scale fishermen at the heads of rivers. Shad have declined to one fourth of their former high yields within the last 70 years; the factors that are responsible are not well defined, although injury to nursery areas, overfishing, and, to some little extent pollution may be responsible in specific cases. Hatchery-reared shad fry have been stocked in Maryland streams since 1871, and they are still being planted each spring. The measure has not had noticeable effect on restoring the fishery. Actually, there has been a decline during the stocking period. In 1942 there was put into effect a controlled-catch fish management plan. It was designed primarily to restore the runs of shad through stabilizing the fishing rate by limiting the number of fishermen and gear. Coincident with the plan's enforcement a slight upward trend in production has taken place.

(10) *Delaware.* The locations of the current shad fisheries of the State of Delaware are but slightly changed from the industry of 50 years ago. They are prosecuted principally in the Nanticoke, Delaware River and Bay, and tribu-

taries entering them. Fishing begins from mid-March to the first of April. Pollution from industrial areas is suspected as being responsible for a decline in production which is less than 10 percent of the peak of 50 years ago. Stocking of shad fry was carried out from 1881 to1923, but with no beneficial effects. The only recent attempt to restore the fishery has been by cleaning up pollution in the Delaware River. A week-end rest period from fishing is enforced by State authorities.

(11) *New Jersey.* The New Jersey shad fisheries are divided between the Delaware and Hudson rivers, the bulk being taken in the latter river. However, some are taken in the Atlantic coast bays and rivers. Gill nets, pounds, haul seines, and otter trawls all take a portion of the catch. Although overfishing has been suggested (1938-1948) as being responsible for the decline in the rivers, later investigations indicated that pollution in these rivers was responsible for curtailment of the supply of shad, through causing a deficiency of oxygen which inflicts a heavy mortality on eggs and young shad during and after the spawning period. Recent studies, in the Hudson River, indicate that 85 percent of the fluctuations in abundance result from the numbers of shad allowed to spawn. An intensive cleanup campaign in the rivers is being carried out at present. The stocking of shad fry from 1875 to 1941 was unsuccessful in stemming the decline in production. During the last few years the Delaware River shad management act, a controlled-catch plan to be enforced by New Jersey, Pennsylvania, Delaware and New York, has been advocated as a restoration measure, but not all of the states have adopted it. Three or more dams have been proposed for the Delaware River, one to be 150 feet high. Government fishery authorities have recommended that construction plans include fishways for all three dams.

(12) *Pennsylvania.* The shad fisheries of Pennsylvania have been located in the Susquehanna and Delaware rivers and their tributaries. After the construction of Conowingo Dam in 1928 shad were not able to enter the Pennsylvania portion of the Susquehanna. Although shad are still caught in Delaware River, the Pennsylvania portion of the catch is so small that it is not reported in Federal statistics. Except for the lower Delaware River the shad size, importance, and socio-economic significance are difficult to assess. This section, however, produced over 75 percent of the reported total catch for the State; there was a severe decline after 1920, due largely to failure in spawning. In the spring of 1952 shad were released above the dams now located in the Susquehanna River in a pilot study to determine the feasibility of restoring shad to the river by transportation around obstructions. The Interstate Commission on the Delaware River has considered shad management as an element in its plans for the rehabilitation and development of that stream.

(13) *New York.* Most of the shad from New York is obtained by haul seines, gill nets, and pound nets, from the Hudson River, which is divided into the upper and lower fishing areas, the latter embracing New York City. Some shad are taken from Long Island Sound by otter trawls. Most New York shad enter the fishery in early April. The yield of shad in the years 1880-1901 averaged over 3,000,000 pounds, but in the period 1904-1935 it averaged 270,000 pounds. There was a spectacular restoration of the fishery between 1936 and 1943, when the average annual production was 3,200,000. Some biologists attributed the upsurge to the principle of controlled-catch in effect. A slump occurred from 1944 to 1949, when the average annual yield was only 1,700,000 pounds. Overfishing was at first blamed for the decline, but pollution was demonstrated to kill eggs and young shad in large numbers, so that the decline was then said to be due to a large scale failure in the survival of the young. Recent studies hold that most of the fluctuations in abundance result from the numbers of shad allowed to spawn. Some observers believe that the conditions may be due to natural fluctuations in shad populations.

(14) *Vermont.* Shad have not been reported from Vermont waters for more than 100 years, the small fisheries on the Connecticut River in this State being the earliest destroyed by dam construction. The Holyoke Dam, in Massachusetts, built in 1849, cut off upstream migration of shad.

(15) *Connecticut.* The principal fisheries for shad in Connecticut are located between the mouth and a point 10 miles above Hartford on the Connecticut River. Shad are reported in the fishery about mid-April. The harvest is taken by drift gill nets and haul seines; a few pound nets are located near the mouth. In recent years boned shad has become an important commodity along the river, causing a considerable change in the economic conditions of the fishery. An

important sport fishery is located at Enfield Rapids and at Holyoke, Massachusetts. No definite information is available on the factors causing successive periods of scarcity and abundance of Connecticut River shad; there has been no spectacular decline in production for Connecticut shad as in other states. Recent studies hold that 83 percent of the fluctuations in production of shad result only from the numbers of shad allowed to spawn each year. Shad fry were stocked from 1890 to 1938 without apparent effect on the fishery. Despite this, shad fishermen requested in 1950 that a hatchery for shad be constructed. The major management measure is a weekend rest period written into the law by commercial fishermen in 1949.

(16) *Rhode Island.* In Rhode Island waters shad are caught incidentally in apparatus set for other species, except in Warren River where shad are taken in pound nets. Thus shad are reported from box and floating traps, and otter trawls. Dams and pollution are held responsible for the shad decline. From 1874 until 1904, shad fry were stocked in various rivers, but the measure did not aid the fishery. No further efforts have been made to improve the fishery.

(17) *Massachusetts.* Shad are harvested on the coast of Massachusetts, the catch being incidental to other ocean species. At one time shad were taken in quantities in the Merrimack and Connecticut rivers in the State, but dams have cut off the migratory movements, particularly in the latter river. In the Merrimack River shad are known to pass a fishway in the Essex Company dam at Lawrence, but are halted by another dam at Lowell. The new fishway has been constructed on the Holyoke Dam on the Connecticut River; an older one built in 1940 was not used by shad. Small, immature "fat" shad about 13 inches long are sometimes taken in weirs in the Atlantic Ocean in early summer. Other shad are caught in gill nets, pound nets, purse seines, haul seines, floating traps, and otter trawls, the spring migration beginning about mid-April. The annual yields show rather erratic fluctuations.

(18) *New Hampshire.* Shad have not been reported in New Hampshire inland waters for more than 50 years, although they are taken off the coast in the ocean incidental to other species. The production has been negligible.

(19) *Maine.* The inland shad fisheries of Maine, although never extensive, were largely eliminated by dams. The Kennebec River, where shad are caught beginning in May, continued to flourish for many years after shad had all but become extirpated in other rivers. The offshore fishery is made up of (a) "fat" immature shad in spring, (b) adult spawned-out "fall" shad in autumn, and (c) a small catch of small shad with herrings in summer in offshore weirs. At present a small stream is being improved for shad; otherwise no effort is being made to rehabilitate the shad fisheries.

(20) *Eastern Canada.* The shad fisheries of Eastern Canada are found chiefly near the mouths of four rivers tributary to the Bay of Fundy, on the Atlantic Coast of Nova Scotia, and to a lesser extent in Quebec and in Prince Edward Island. Shad are caught in spring in drift gill nets, while in autumn they are taken in weirs and drift nets at other locations. The production of shad has shown a peak, a decline, and a succeeding peak. Whether such fluctuations are due to differences in the size of the migration or to other factors is not known. Dams on certain rivers are considered important reasons for the decline in production. A weekend rest period from fishing, in addition to other laws, in most eastern Canadian areas are rigidly-enforced management measures.

(21) *Pacific Coast.* Shad were introduced into the Sacramento River from the Atlantic in 1871. By 1904, they were recorded in Alaska, and by 1918 were found as far south as San Diego, ranging along 3,000 miles of coast line.

(22) *Alaska.* Shad are not taken in Alaska in quantities sufficient to rank as an important commercial species. They have been recorded at Karlak on Kodiak Island, and at Kasilof on Cook Inlet.

(23) *British Columbia.* Shad were taken in British Columbia as early as 1876. At present they are taken in the Fraser River by means of gill nets, and in numbers off Vancouver Island in purse seines. As yet they are not so abundant as to be reported in the commercial fishery.

(24) *Washington.* Shad were first recorded in Washington State in 1876. They had increased by 1892 to the point that commercial catches were recorded, mostly from Puget Sound, Gray's Harbor, and the Columbia River, from gill nets, otter trawls, and dip bag nets. Minor sport fisheries for shad are located in rivers where spawning occurs. A slight rise in production occurred during the past 50 years, but definite fluctuations (at both high and low levels of production) have occurred. Shad meat and roe are canned; at one time iced shad was shipped

to the eastern coast of the United States. Floods are known to render shad fishing impossible, thereby cutting production.

(25) *Oregon.* The shad fisheries of Oregon began in 1882; since then, considerable runs are recorded in the Umpqua, Coos, Siuslaw, Coquille, and Columbia rivers, the last being shared with Washington. Gill nets are the only legal gear used at this time for taking shad, although Indians are allowed to use dip bag nets. A certain amount of sport fishing for shad takes place in the Columbia River. In the latter river the commercial production of shad is incidental and supplemental to the salmon fisheries, which are marketed at higher prices. In recent years shad have increased to an all-time high. Despite the high production, it has been the policy of the State to stock shad fry in rivers as late as 1948. Among the laws controlling fishing is a weekend rest period.

(26) *California.* The shad is a minor commercial species in California. Fishing centers are located in the San Francisco Bay, Sacramento and San Joaquin rivers, and along the ocean front. The salmon net fishery fleet of about 225 gill net boats conduct all of the commercial shad fishing in State waters coincidentally during the spring salmon run. Sport fishing occurs in almost every spawning river. Little effort is spent on management of shad. Reclamation irrigation projects in certain rivers may destroy eggs and young shad and certain other species, hence efforts are being made to construct a juvenile fish-collecting system and a by-pass at these locations. The production of shad has maintained a high level, with a slight decline in recent years.

(27) *Decline.* The decline in the shad fisheries has been attributed to four principal causes; (1) pollution of rivers, which act chiefly through the killing of eggs and young fish; (2) siltation of rivers which destroys spawning areas and smothers eggs; (3) dams, which cut off favorable freshwater areas from approach by adult fish in some rivers; and (4) overfishing, which may lower the population below an effective breeding potential. While fair to conclusive cases can be built up for any one of these causes on one or more selected river-systems, none of them singly and perhaps not all of them collectively can be made to account for the general decline in Atlantic Coast shad fisheries. For this reason a natural biological cycle has been postulated to account for the observed facts, but there is no evidence for the hypothesis. Natural catastrophes, parasites, predators, and other minor factors affecting fish populations have not been considered as important to the shad problem by responsible biologists.

(28) *Management.* Shad fishery management is the attempt to regulate the stocks of fish by such means as limiting the number of fishermen and gear, setting fishing periods, stocking fry and fingerlings, and manipulating environmental and artificial conditions to insure a greater production of fish. The stocking of shad fry has proved not to be a success in rehabilitating shad runs. Cleanup of pollution, and rehabilitation and development of optimum conditions in the environment, gives promise of restoring shad runs in certain rivers. Setting of seasons presumably has allowed some escapement of brood stock. A few fishways have perhaps saved runs on a limited scale above dams which would otherwise have destroyed them. The "controlled-catch" shad management plan attempts to control the fishing rate by restricting the number of fishermen and gear by a licensing system. Since the plan has been in use in Maryland for only ten years, the effects of the measure have not been fully evaluated.

(29) *Artificial Propagation.* The artificial propagation of shad began in 1848 and was intensively carried out during the late 1800's. It was then generally regarded as the principal means for augmenting shad production, although its effects were never formally tested. Over the years the stocking of fry and fingerlings has not perceptibly increased shad runs in any of the rivers in which the fish were stocked. It appears that the hatchery effort, even in peak years, is of small magnitude when compared with natural reproduction in rivers.

(30) *Fishways.* Fishways are not considered to be greatly successful despite the passage of shad at Bonneville Dam in Oregon and Washington, at the Essex Company at Lawrence, Massachusetts, at Holyoke Dam in Massachusetts, and the Goldsboro dam in North Carolina. At Bonneville Dam the fishway consists of (a) a collecting system, (b) an auxiliary water flow, (c) a fish ladder, (d) a fish lock, and (e) special fingerling bypasses. The Lawrence fishway consists of (a) a rounded fishway entrance, (b) low velocities of water, (c) absence of jump at entrance, and (d) easily negotiable ladder. The Mugnier fishway at Holyoke Dam, Massachusetts, is a pressure duct type connecting tailwater below the dam to headwater above. Any future fishways at existing or proposed dams

must be designed according to conditions existing at a given dam site. A full study of the long range economic soundness of such fishways must be carried out before making any final decision at installation.

(31) *Socio-Economics.* The socio-economic picture of the shad fisheries was early conditioned by the demand of settlers for a cheap, readily available source of nutritious protein. As the population of the United States increased, fisheries expanded. A commercial fishery developed with the passing of frontier conditions and the rise of towns and cities. Markets, transportation, and numbers of fishermen and gear increased in a direct ratio. Technical progress in the shad fisheries has lagged behind, and gear and fishing methods have not changed much in the last 100 years. Economic incentives have become weaker and restrictions in fishing have become stringent. Declining popularity among consumers, and competition with other seafoods have contributed in recent years to the decrease in marketing of shad.

(32) *Trend of Production.* The trend of shad production in North America depends to a big degree on the demand at a price and the profit motive associated with the shad fisheries. It probably reflects changes in fishing intensity as well as changes in availability of shad. From 1887-1910, the period of high production, the average annual catch was 38,000,000 pounds, but from 1911-1949, the period of low production, the average annual yield was roughly 10,000,000 pounds. The period of high production was accompanied by few legal restrictions and by intensive fishing pressure, and was spurred on by a strong demand for shad, by high profits, and by newly-developed means of transportation. Conversely, the low production period was accompanied by legal restrictions, and particularly by a decline of shad due to various factors and by the loss of fishermen from the shad fisheries to the highly industrialized, high-paying, and more secure occupations on the Atlantic Coast.

(33) *The United States Fish and Wildlife Service* in 1950 began an intensive six-year study of shad in the Atlantic coastal states under a special Congressional appropriation secured through the initiative of the Atlantic States Marine Fisheries Commission. The Shad Investigations Group, a part of the Middle and South Atlantic Fishery Investigations section, is seeking to answer the following basic questions: (a) what are the underlying causes of the decline of shad; (b) what ecological and economic conditions favor the recovery of runs; and (c) what basic information is required for the scientific management of the fishery leading to a maximum yield? The lack of sufficient funds has restricted activity to the Hudson River (1950), Connecticut and Delaware Rivers (1951), Chesapeake Bay (1952), and rivers of the southern states (1953). Preliminary studies in the Hudson and Connecticut rivers indicate that a large portion of the fluctuations in production of shad results from too few fish being allowed to spawn. Recommendations for management of the fishery have been made and, if put into effect, they will eventually result in better catches. Such conclusions were made possible by a detailed analysis of catch statistics obtained by the states bordering the rivers. Statistics of total catch by species and value, and of the numbers and kinds of gear used to make the catches, are necessary for such interpretations. In general, the objective approach and intensive effort by the U. S. F. W. S., with some cooperation of state agencies, promise to provide reliable and useful answers to the problem of the shad fisheries.

(34) *Prognosis.* There does not appear to be any known method of immediately restoring the former magnitude of the shad fisheries, in spite of the vast assemblage of miscellaneous knowledge about shad. The prognosis of the industry generally does not appear to be promising. It is doubtful that shad production can be restored to the status of the late 19th century in the near future despite management measures and other devices.

BIBLIOGRAPHY OF AMERICAN AND FOREIGN SHADS

The following list of references on shad is based on a careful assemblage of recent contributions appearing in the many technical journals and in publications of state and federal agencies. Most of them are cited in the preceding report. However, certain of them were unobtainable for reference purposes. The bibliography is also based upon the compilations of Dean (1916-1923), MacDonald (1921), and Leim (1924), the last at one time representing the most complete bibliography of shad extant. In addition, the annual series of *Biological Abstracts, The Zoological Record, Der Zoologische Bericht, Readers Guide to Periodical Literature,* and the *New York Times Index,* were consulted.

An attempt was made to obtain all references pertinent to the biological and economic aspects of the American shad, as far as was practicable. Important references on river herrings and alewives, *Pomolobus*, are included. Unfortunately, it was not possible to examine the annual reports for all state fishery agencies from their inception to the present. Thus, the bibliography is incomplete from this viewpoint. Nor was it possible to examine but a fair segment of the local newspapers and popular magazines where many important notices and articles concerning shad runs and the fisheries have appeared.

It is believed that the consultation of the intensive foreign studies of anadromous clupeoids may provide a key to the better understanding of the problems relating to the American shad. This necessitates, therefore, that the shad investigator negotiate the various language barriers. Consequently, emphasis was also placed on the listing of the important references relating to:

(1) European shads, *Alosa* and *Paralosa* (see especially works of Barbieri, D'Ancona, Ehrenbaum, Hoek, Leonte, Lestage, Mazzarelli, Pouchet and Bietrix, Roule, Vutskits, Zompolas, and Fontaine).

(2) Caspian shad, *Caspialosa* (see especially the works of Chajanova, Calikov, Chumaevskaya-Svetodivova, Kazanova and Khaldinova, Kisselewitch, Nedozhivin and Tichij, Perceva, Pertzeva, Somova, Stroganov, Sushkina, Talin, Thougounova, and Zamakhaev).

(3) Indian shad, *Hilsa* (see especially the works of Devanesen, Hora, Hora and Nair, Job, Jones, Jones and Menon, Kulkarni, and Prashad.

BIBLIOGRAPHY

ABBOTT, C. C. 1868. Fishes. *In* Rept. State Geol. New Jersey, App. E: 806-830.

——— 1878. Notes on some fishes of the Delaware River. Rept. U. S. Fish. Comm., for 1875-76,

ACKERMAN, E. A. 1941. New England's fishing industry. Univ. Chicago Pr.

ALEXANDER, M. M. 1946. The commercial shad fishery of Connecticut. Unpub. MS., Conn. St. Brd. Fish and Game, 1-50, 16 fig.

——— 1946. A report of the shad investigation conducted during the summer of 1946. Unpub. MS., Conn. St. Brd. Fish and Game, Pp. unnumbered, 1-18, ill.

ALLEE, W. C., EMERSON, A. E., PARK, O., PARK, T., AND K. P. SCHMIDT. 1949. Principles of animal ecology. W. B. Saunders & Co., Phila., xii-837, ill.

AMERICAN REVIEW OF REVIEWS. 1923. Run of shad in spring. May, 67: 554-555.

ANDERSON, A. W., and E. A. POWER. 1946. Fishery statistics of the United States, 1942. U. S. Fish and Wildlife Service, Wash., 1-248.

——— and ——— 1947. Ibid., 1943. Ibid, Stat. Dig. (14): 1-241.

——— and ——— 1948. Ibid., 1944. Ibid, Stat. Dig. (16): 1-283.

——— and ——— 1949. Ibid., 1945. Ibid, Stat. Dig. (18): 1-372.

——— and ——— 1950. Ibid., 1946. Ibid, Stat. Dig. (19): 1-265.

——— and ——— 1950. Ibid., 1947. Ibid, Stat. Dig. (21): 1-285.

——— and ——— 1951. Ibid., 1948. Ibid, Stat. Dig. (22): 1-305.

ANDERSON, G. A. 1876. Report on shad fishing in New Jersey. Rept. U. S. Fish Comm., 1873-1875. 3: 327-328.

ANONYMOUS. 1889. Decrease of shad in Connecticut. [a discussion]. Trans. Amer. Fish Soc., 18: 35-36.

——— 1894. Shad and fishways. [a discussion]. Trans. Amer. Fish. Soc., 23: 20-21.

——— 1907. Ripening of penned shad. Trans. Amer. Fish. Soc., 36: 113-118.

——— 1912. Resolution urging adequate control and development of shad fisheries. Trans. Amer. Fish. Soc., 42: 43.

——— 1919. Resolution urging protection and improvement of shad fishery industry. Trans. Amer. Fish Soc., 48: 97-98.

——— 1926. Decline and conservation of shad. [a discussion]. Trans. Amer. Fish. Soc., 48: 117-120.

ANTIPA, G. 1906. Die Clupeinen des westlichen Teiles des Schwarzen Meeres und Donaumündungen. Denkschr. Ak. Wiss., Wien. 78: 1-57, 3 pl., 6 fig.

——— 1929. *Alosa pontica, nordmanni. In* Faune et flore Mediterranea, Paris.

APLIN, J. A. 1947. The effect of explosives on marine life. Calif. Fish & Game, 33(1): 23-30.

ARNOLD, D. J. 1907. Zur Biologie der Kaspischen Finte, *Clupea caspia* Eichw. Arb. Kaspischen Exped., St. Petersburg, 1: 222-242, 2 pl. (In Russ., German summ.)

ASCROFT, R. L. 1900. Note on the American shad. Rept. Lancashire Sea-fish Lab. for 1899. 14: 173-174.

ATKINS, C. G. 1868. Report of the commissioners of fish and game of the state of Maine for the year 1867.

——— 1887. The river fisheries of Maine. *In* Fisheries and Fish industries of the United States. ed. by G. B. Goode. Sect. 5, 1: 673-728.

ATKINSON, C. E. 1950. Notes on the fishways and rehabilitation of the Susquehanna shad fishery. Unpub. Memorandum in answer to an inquiry from Joint Legislative Committee of State of Pennsylvania, Beaufort. December, 1-5.

——— 1951. Feeding habits of adult shad (*Alosa sapidissima*) in fresh water. Ecology, 32(3): 556-557.

ATKINSON, C. E., R. C. HAMMER, and W. A. VAN ENGEL. 1951. The importance of catch records in the management of the fisheries of Virginia with recommendations for the establishment of a fishery statistical laboratory. *In* Va. Council Comm. Fisheries' Report on the commercial fisheries of Virginia. Adv. Council Va. Econ., Richmond, 17-28.

ATLANTA JOURNAL. 1936. Seventy-five acre fish hatchery built in Bryan County, [Georgia]. March 3.

——— 1938. Shad season is cut in State to help build supply. Atlanta, Georgia, Jan. 14.

ATLANTIC STATES MARINE FISHERIES COMMISSION. 1943A. Rehabilitation of the shad fisheries of the Chesapeake Bay watershed. A Committee report. Mimeo., 1-11, Balto.

——— 1943B. Second annual report to the Congress of the United States and to the Governors and legislators of the . . . compacting states, 1943. White Plains, 1-9.

——— 1945. Fourth annual report . . . 1945, 1-27.

——— 1947. Sixth annual report . . . 1947, 1-39.

——— 1949. Eighth annual report . . . 1949, 1-48.

——— 1950A. Ninth annual report . . . 1950, 1-68.

——— 1950B. Progress of shad study. *In* Minutes of the ninth annual meeting, June 8-9, 1950, Old Point Comfort, Va., (1): 12-16, (3): (4): 2-4, (5): 2.

——— 1951. Tenth annual report . . . 1951, 1-48.

AUDUBON, J. J. 1876. Notes on shad and trout. Forest and Stream, 6: 216, 285.

BABCOCK, W. C. 1885. Report of shad operations conducted at Fort Washington, Maryland, in the spring of 1883. Rept. U. S. Fish Comm., 1883, 11: 1035-1042.

——— 1886. Report of operations at Fort Washington, Maryland, for the purpose of collecting shad eggs during the season of 1884. Ibid., 12: 189-197.

BAGG, A. M. 1938. Fish, fisheries, and fishways of old at Hadley Falls. Holyoke Daily Transcript and Telegram, Jan. 22: (MS): 1-9.

BAILEY, J. R. & J. A. OLIVER. 1939. The fishes of the Connecticut watershed. *In* Biological Survey of the Connecticut watershed. New Hampshire Fish and Game Comm., Surv. Rept., (4): 150-189, ill.

BAILEY, R. M. 1938. The fishes of the Merrimack watershed. *In* Biological Survey of the Merrimack watershed, [New Hampshire], N. H. Fish and Game Dept., Surv. (3): 149-185, 12 fig.

BAIRD, S. F. 1871. Spawning of herring. Ann. Rec. Sci., 1871-1872, 207.
——— 1872. Planting shad in the valley of the Mississippi and the lakes. Ann. Rec. Sci., 1872-1873, 410.
——— 1873A. List of fishes collected at Wood's Hole. Rept. U. S. Fish. Comm., 1871-1872, 1: 823-827.
——— 1873B. Alleged occurrence of shad in the Mississippi. Ann. Rec. Sci., 1873-1875, 448.
——— 1873C. Shad in California waters. Ann. Rec. Sci., 1873-1875, 449.
——— 1873D. Shad in the Sacramento River. Ann. Rec. Sci., 1873-1875, 449.
——— 1873E. Shad in the Altamaha River. Ann. Rec. Sci., 1873-1875, 450.
——— 1873F. Shad in the Alleghany River. Ann. Rec. Sci., 1873-1875, 462.
——— 1873G. The fish of the Caspian Sea. Ann. Rec. Sci., 1873-75, 459.
——— 1873H. The fresh-water fisheries of India. Ann. Rec. Sci., 1873-1875, 465.
——— 1874A. The shad. *In* Report of the Commissioner, Rept. U. S. Fish Comm., 1872-1873, 2: 48-59.
——— 1874B. Food of the shad. Ann. Rec. Sci., 1874-1875, 310.
——— 1874C. Shad in the Gulf of Mexico. Ann. Rec. Sci., 1874-1875, 338,
——— 1874D. First efficient steps in artificial propagation. Rept. U. S. Fish Comm., 1872-1873, 52-53.
——— 1874E. A fish worthy of cultivation. Rept. U. S. Fish. Comm., 1872-1873, 48-49.
——— 1875. Prof. Baird's report. Comparative value of anadromous and other fishes. Forest and Stream, 3: 356.
——— 1876A. Connecticut River shad for California. Forest and Stream, 7: 66-67.
——— 1876B. Shad in the Mississippi. Ann. Rec. Sci., 1876-1877, 406.
——— 1876C. Propagation [of shad] by the U. S. Commission of Fisheries. Rept. U. S. Fish Comm., 1873-1875, XVII-XXII. See also 1875-1876 (1878), 20–21; 1877 (1879), 29-31; 1878 (1880), XXXV-XXXIX; 1879 (1882), XXXIII-XXXV; 1880 (1883) XXXI- XXXIV; 1881 (1884), XLVIII-L; 1882 (1884), LXXIII-LXXVII; 1883 (1885), LXXXIII-LXXXIV; 1884 (1886), LVIII-LXI; 1885 (1887), LXXXIX-XCV; 1886 (1889), XLII.
——— 1876D. Potomac River fisheries. Ann. Rec. Sci., 1876-1877, 388.
——— 1877. Genuine white shad in the Ohio. Forest and Stream, 8: 280.
——— 1879A. Is it herring spawn? Forest and Stream. 12: 5.
——— 1879B. Transportation of alewife eggs. Forest and Stream, 12: 229.
——— 1880. Striped bass and shad in California. Forest and Stream, 14: 410.
——— 1883. Inducements offered fishermen to furnish shad eggs for the U. S. Commission of Fish and Fisheries. Bull. U. S. Fish Comm., 1882, 2: 289-291.
——— 1887. Experiments in raising shad in carp ponds in Washington. *In* Report of the Commissioner. Rept. U. S. Fish Comm., 13: 94-95.
BAKER, C. L. 1937. The commercial, game, and rough fishes of Reelfoot Lake. Rept. Reelfoot Lake Biol. Stat., 1: 9-54, ill.
BALTIMORE EVENING SUN. 1938A. Shad reported in the Bay 3 weeks ahead of time; early arrival attributed to mild weather—three lean years laid to nets stretched across the Lower Chesapeake. Balto., Feb. 24.
——— 1938B. Thoughts on shad. Editorial Page, Balto., Feb. 25.
——— 1940. Three states [Maryland, Virginia, and North Carolina] conducting joint shad studies. Balto., Jan. 4.
——— 1943. Shad fishing limitation proposed. Balto., Oct. 13.
——— 1944. Susquehanna shad run held best in 20 years. Balto. Apr. 20.
——— 1950A. Dam held no bar to shad's love [at Portland, Oregon], Balto. Feb. 16: 3.
——— 1950B. Those dam fish ladders failed back in 1910. Balto. July 12.
——— 1951A. Vertebrae of shad basis of population study. Balto., Feb. 7.
——— 1951B. Pound-net fishery yield declines. Balto. June 27.
——— 1951C. Two states asked to aid in Bay shad study. Balto. Dec. 31.
——— 1952. Operation shad—professional boner opposes dissolving. Balto., April 18: 33.
BALTIMORE MORNING SUN. 1936A. Russian scientist will bare private life of Bay's fish. Balto., May 24.
——— 1936B. Carolina shad come to Baltimore. Balto., Dec. 19.
——— 1937A. Bigger shad haul foreseen by Earle. Balto., Feb. 23.
——— 1937B. Conserving shad held urgent need; Dr. Truitt suggests state curtail capture of soft roe type. Balto., Aug. 19.
——— 1938. Tydings seeks $275,000 as first step to rehabilitate seafood industry . . . $100,000 laboratory at College Park . . . for extension service to increase use of fish. Balto., Sept. 30.
——— 1939. Susquehanna hatchery for shad is announced. State Conservation Commission announces plan to establish small plant on Garrett Island. Balto., Jan. 17.
——— 1940A. Loss of shad for Bay region set at $500,000 yearly. Balto., Jan. 18.
——— 1940B. Step taken to restore fish industry . . . shad and herring named specifically at Solomons Island parley. Balto., July 17.
——— 1945A. Fish by tons die in [Bush River]. Many fish die mysteriously in Chesapeake. Balto., Aug. 19-20.
——— 1945B. Fish deaths here laid to 'biology' [supersaturation of CO_2]. Aug. 21.
——— 1950A. Local shad smart as any others. Balto., Feb. 13.
——— 1950B. Roanoke River fishing easy, machine eliminates need for bait or line. Balto., May 24.
——— 1950C. Study of shad problem asked; State unit debates use of 'ladders' on Susquehanna. Balto., July 7.
——— 1950D. Shad shortage blame placed. Balto., Aug. 1.
——— 1951A. Virginia water board investigates fish kills [from Richmond]. Aug. 14.
——— 1952A. Right now shad are running. Editorial Page., Balto. Apr. 11.
——— 1952B. When the shad start running inland. Balto., Apr. 11.
BALTIMORE SUNDAY SUN. 1909. Baltimore markets show the finest fresh fish in the world ['shad is king, . . . next comes the herring']. Balto., Apr. 18.
——— 1936. The end of the purse-net industry. A long fight to save the Bay fish yields fruit of victory Balto., Oct. 18.
BANNER, E. 1950. $100,000 shad elevator planned at Holyoke. Boston Sunday Globe. April 23.
——— 1952. New fishway to send shad up past Holyoke, novel project will let fish climb dam blocking Connecticut River 105 years. Boston Daily Globe. June 25: 4.

BAPAT, S. V. & D. V. BAL. 1950(?). The food of some young clupeids. Proc. Indian Acad Scie., 32(B): 39-58.

BARBIERI, C. 1907. Le Alose del Mediterraneo e gli agoni dei laghi Lombardi; studio prelimare. Rev. Mens. Pesca, Milano, 9: 69-82, 125-143, ill.

——— 1908A. La alimenzione naturale degli agoni [*Alosa finta*]. Rev. Mens. Pesca, Milano, 10: 237-242.

——— 1908B. Gli agoni dei laghi dell' Italia settentrionale, ed alcune brevi considerazioni intorno all loro origine. Rev. Fisca. Matem., Scie. Nat., Pavia, 18: 278-286.

BARFURTH, D. 1875. Ueber Nahrung und Lebenweise der Salme, Forellen und Maifische. Arch. für Naturgeschichte. 41: 122-158.

——— 1876. The food and mode of living of the salmon, the trout and the shad. (translation of the above by O. Jacobson). Rept. U. S. Fish Comm., 1873-1875, 3: 735-759.

BARNEY, R. L. 1924. Confirmation of Borodin's scale method of determining age in shad. Trans. Amer. Fish. Soc., 54: 168-177.

——— 1925. A confirmation of Borodin's scale method of age determination of Connecticut River shad. *In* A report of . . . shad . . . in Connecticut, by P. H. Mitchell and Staff, 52-63, ill.

BATTALGIL, F. 1941. Türkiyenin tatli au baliklari. Les poissons des eaux douces de la Turquie. Coll. de l'Institut de Zoll. de l'Univ. d'Istanbul, Rev. Fac. Scie. Univ., Istanbul, 5(B6): 170-186.

BAUGHMAN, J. L. 1947. An annotated bibliography for the student of Texas fishes and fisheries with material on the Gulf of Mexico and the Caribbean Sea. Texas Game, Fish and Oyster Comm., Rockport, 1-240.

BEAN, B. A. 1890. Delaware River shad hatching. Shooting and Fishing. May 22.

——— and A. C. WEED. 1912. Notes on a collection of fishes from Java, . . . with a description of a new species [figures scales of *Alosa sapidissma*]. Proc, U. S. Nat. Mus., 42: 587-611, 3 pl.

BEAN, T. H. 1883. Notes on fishes observed at the head of Chesapeake Bay in the spring of 1882; and upon other species of the same region. Proc. U. S. Nat. Mus., 6: 365-367.

——— 1881. Movements of young alewives (*Pomolobus* sp.) in Colorado River, Texas. Bull. U. S. Fish Comm., 1881, 1: 69-70.

——— 1884. On the occurrence of branch alewife in certain lakes of New York. *In* Fish and Fisheries of the United States, Ed. by G. B. Goode, (1): 588-594.

——— 1887. Report on examination of clupeoids from carp ponds. Bull. U. S. Fish. Comm., 1886, 6: 441-442.

——— 1890A. Millions of shad. Forest and Stream, 35: 325.

——— 1890B. New Hampshire fish-culture. Forest and Stream, 35: 293.

——— 1892. The fishes of Pennsylvania, with descriptions of the species and notes on their common names, distribution, habits, reproduction, rate of growth, and mode of capture. Rept. Penn. Comm. Fish., 1889-91, viii-149, 35 pl.

——— 1896. Report on the propagation and distribution of food fishes. Rept. U. S. Fish Comm., 1894, 20: 20-80.

——— 1901. The fishes of Long Island, with notes upon their distribution, common names, habits, and rate of growth. Sixth Ann. Rept. N. Y. Forest, Fish & Game Comm. 1900. 375-478, 6 pl.

——— 1903. Catalogue of the fishes of New York. N. Y. State Mus., Bull. (60): 1-784.

——— 1911. Dead alewives in Lake Ontario. Forest and Stream, 36: 429.

BEATTY, R. C. & W. J. MULLOY. 1940. William Byrd's natural history of Virginia or the newly discovered Eden . . . Dietz Pr., Richmond, 1-95, 1-109.

BEREGOV, R. 1938. Poissons fossiles du Pliocene inferieur des environs de Vidin (Bulgarie du Nord-Ouest). Geol. Balkan. Sofia, 3: 18-22.

BERG, L. S. 1913. A review of the clupeoid fishes of the Caspian Sea, with remarks on the herring-like fishes of the Russian Empire. Ann. Mag. Nat. Hist., London, 11: 472-480.

——— 1915. Compte-rendu preliminaire sur les harengs collectionnes dans la mer Caspienne par 'l'Expedition Caspienne de l'annee 1913. Mat. Pozn. Russk. Rybolov. Petrograd., 4(6): 1-8, 3 pl.

——— 1932. Les poissons des eaux douces de l' U R S S et des pays limitrophes. [*Caspialosa caspia aestuarina*]. 3-e Ed. Revised, 1: 88. 94 fig.

BESANA, G. 1908. La questione della pesca degli agoni [*Alosa finta*] con la canna nel lago di Como. Rev. Mens. Pesca, Milano, 10: 152-158.

BERTIN, L. 1941. Mise au point sur quelques especes de Clupeides. Bull. Soc. Zool. France, 66: 18-25.

BIGELOW, H. G. 1926. Plankton of the offshore waters of the Gulf of Maine. Bull. U. S. Bur. Fish., 40(II): 1-509, 134 fig.

——— & W. W. WELSH. 1925. Fishes of the Gulf of Maine. Bull. U. S. Bur. Fish. 40 (I): 1-567, 278 fig.

BILY, M. D. 1938. L'influence de la temperature sur l'alimentation et la croissance de la peche. Trav. Stat. Hydrobiol., Kiev, 16: 99-129.

BLACKFORD, C. M. 1916A. The toothsome shad. In Seventeenth Ann. Rept., Va. Comm. Fish., 60-62.

——— 1916B. The shad—a national problem. Trans. Amer. Fish. Soc., 46: 5-14. [also in Eighteenth Ann. Rept., Va. Fish. Comm., 25-29, with a note on porpoises schooling shad.]

BLACKFORD, E. G. 1879. Peculiar features of New York fish market Chicago Field, 10: 331. Also in Trans. Amer. Fish. Soc., 1878: 77-82.

——— 1884. Carp in an instalment of shad from James River. Bull. U. S. Fish Comm. 4:112.

——— 1887. Catch of shad in the Hudson River for 1885. Bull. U. S. Fish Comm., 6: 294.

BLAKE, J. H. 1870. The habits and migrations of some of the marine fishes of Massachusetts. Amer. Nat., 4: 513-521.

BLAKESLEE, M. A. 1874. Shad in Alleghany River. Forest and Stream, 12: 228.

BLANCHARD, EMILE. 1880. Les poissons des eaux douces de la France. Librairie J. B. Bailliere et Fils, Paris, 1-656.

BLATCHLEY, W. S. 1938. The fishes of Indiana. Nat. Pub. Co., Indianapolis: 3-121, ill.

BOGHACHEV, V. V. 1929(?). *Caspialosa praecursor* [fossil]. Sci. Notes., Journ. Azerbaijan Oil Ind., 1-4, 1 fig.
——— 1933. Material for the study of the Tertiary fish-fauna of Caucasus. Trud. Azerbaidzh. Neft. Issled. Inst. (Geol. Otd.), Baku, 15: 1-62, 11 pl. 3 g.

BOHM, B. 1942. Beiträge zur tertiären Fisch. fauna Ungarns. Geol. Hungarica Ser. Biol. (19): 1-14, 4 pl., 8 fig.

BONAPARTE, C. L. 1832. [Italian shads]. In Iconografia della fauna Italica per le quattro classi degli animali vertebrati. Pesci. Volume III.

BORCEA, I. 1933. *Livoneca pontica* nov. sp., Cymothoide parasite des Aloses et Sardines de la Mer Noire. Ann. Scie., Univ. Jassy, 17: 481-502, 4 pl., 9 fig.
——— 1936A. Les Caspialoses de la Mer Noire. C. R. Acad. Scie. Roumanie, Bucuresti, 1: 26-28.
——— 1936B. Nouvelle note sur la systematique et la biologie des Caspialoses des eaux roumaines. Ibid., 1: 216-217.
——— 1936C. Les Clupeids de la region littorale roumaine de la Mer Noire et des eaux interieurs. Ann. Sci., Univ. Jassy, 222: 306-344.

BORNE, M. V. D. 1878. Shadfischzucht in Maryland. Circul. Deutsch. Fisherei Ver. 91-93.

BORODIN, N. A. 1896. Note on the *Clupea* of the Caspian and Black seas. Ann. Mag. Mus. Zool., Acad. St. Petersburg, 1: 81-94. (In Russ.).
——— 1904. Untersuchungen uber die Lebensweise und die Fortpflanzung der Kaspiharinge.. Vest. Rybopromysl., St. Petersburg, 19: 167-198. (In Russ., Eng. summ.).
——— 1905. Eine Relichtenform von *Clupea cultiventris* im System der mittleren Wolga. Ibid., 20: 282-283, (In Russ., German summ.).
——— 1906. Eine neue Art Kaspischer Herringe, *Clupea engrauliformis* n. sp. Ibid., 21: 197-204, 1 pl., 2 fig. (In Russ., German summ.).
——— 1924A. Age of shad as determined by scales. Trans. Amer. Fish. Soc., 5: 178-184.
——— 1924B. Age of shad estimated from examination of scales. Science, 60: 477.
——— 1925. Age of shad (*Alosa sapidissima* Wilson) as determined by the scales. *In* A report of . . . shad . . . in Connecticut, by P. H. Mitchell and Staff, 46-51, 6 fig.
——— 1927A. Revision of the genera of *Alosa* Cuvier and *Pomolobus* Rafinesque. Copeia. (159): 175-176.
——— 1927B. Revision of the shad and shad-like fishes of North America (genera *Alosa* Cuvier and *Pomolobus* Rafinesque). Zool. Jahrb. Abt. Syst. Oekol. u. Geogr., 53(1/3): 1-22, 3 fig.

BORRAS, P. 1935. The Madrillon serves you boned shad. Restaurant Madrillon, Wash., D. C., ill.

BORTNER, R. L. 1947. Statement of Pennsylvania Water and Power Company and Safe Harbor Water Power Corporation in re: *Fishways,* presented at hearing before the Joint State Government Commission of the General Assembly, Harrisburg, Pennsylvania, Nov. 19, 1947. Pa. Water and Power Co., Holtwood, 1-17, ill.

BOUNHIOL, J. P. 1917. Sur la biologie de l'Alose finte (*Alosa finta* Ouv.) des cotes d'Algerie. Comp. Rend. Soc., Biol., Paris, T-80: 480-483.

BOYER, J. 1909. Les Aloses et leur peche. Cosmos, Paris, N. S., 61: 235-239.

BREDER, C. M., Jr. 1948. Field book of marine fishes of the Atlantic Coast. Rev. Ed., G. P. Putnam and Sons, N. Y., 1-332, 8 pl., 403, fig.
——— and R. F. NIGRELLI. 1936. Winter movements of the landlocked alewife, *Pomolobus pseudoharengus* . (Wilson). Zoologica, N. Y., 21: 165-175, 6 fig.

BRICE, J. J. 1898. The fish and fisheries of the coastal waters of Florida. Rept. U. S. Fish Comm., 22: 263-342.

BRIGHTMAN, B. F. 1872. Condition of the shore fisheries of Massachusetts and Rhode Island in 1871. Rept. U. S. Fish Comm., 1: 70-71.

BRINLEY, F. 1873. Condition of the shore fisheries of Massachusetts and Rhode Island in 1871. Rept. U. S. Fish Comm., 1: 9.

BROADHEAD, J. M. 1873. Upon the abundance of fish on the New England coast in former times. Rept. U. S. Fish Comm., 1: 169-170.

BROOKS, J. W. 1943A. Susquehanna shad unparalleled sport on a fly rod. Rally Sheet, League Md. Sportsmen. 1(1): 8.
——— 1943B. Firpo of the brackish waters. Ibid., 1(4): 2.

BROOKS, W. K. 1889. The artificial propagation of sea-fishes. Pop. Sci. Monthly, 35(3): 359-367.

BROOKS, W. K. 1893. Fish and fisheries. *In* Maryland, its resources, industries and institutions . . . by member of Johns Hopkins University, Balto., 239-263.

BRYAN, P. and H. H. HOWELL. 1946. Depth distribution of fish in lower Wheeler Reservoir, Alabama. Rept. Reelfoot Lake Biol. Stat., 10: 4-9.

BULGAKOFF, G. P. 1927. On the systematic of the Caspian herrings. A trial of employing the anatomical method. Bull. Univ. Tachkent, 16: 123-124, (Russ., Eng. summ.).

BULGAKOV, G. P. 1926A. To knowledge of Caspian herrings. A new species of the genus *Caspialosa.* Bull. Univ. Asie Cent. Tachkent. 13: 27-39, 1 pl. (Russ., Eng. summ.)-
——— 1926B. Some results of the ichthyological expedition to southeast shores of Caspian Sea in summer 1923. Ibid., 14: 17-45. (Russ., Eng. summ.).

BURCH, C. N. 1931. Pollution and the shad industry. *In* Ann. Rept., N. J. Brd. Fish and Game, Trenton. 20.

BURKENROAD, M. D. 1948. Fluctuations in abundance of Pacific halibut. Bull. Bingham Oceanogr. coll., 11: 81-129, ill.
——— 1951. Some principles of marine fishery biology. Pub. Inst. Marine Sci., Univ. Texas, 2(1): 177-212.

BUSSER, P. 1953. Shad stocking program [in Susquehanna River, Pa.] here said failure; work to be resumed but check shows no spawning resulted. Lancaster Intelligencer, April 9, 1953.

CABLE, L. 1942(?). Spawning of June run of shad in Chesapeake Bay non-productive. Unpub. MS., Md. Dept. Research & Ed., Solomons, Md. 1-5.

——— 1943. Rehabilitation of the shad fisheries of the Chesapeake Bay watershed. Unpub. MS., U. S. Fish and Wildlife Serv., prepared for Atlantic States Marine Fish. Comm., 1-16; also Mimeo. Ed., 1-11.
——— 1944A. Conservation to increase production of shad in South Carolina. U. S. Fish and Wildlife Srv., Mimeo., 1-9.
——— 1944B. Shad [investigations in South Carolina]. *In* Marine Fishery Resources of South Carolina, S. C. State Planning Brd., Charleston, 13-22.
——— 1944C. Scale markings an index to fishing intensity in the Virginia and Maryland shad fisheries. U. S. Fish and Wildlife Srv., Mimeo. Rept., 1-11, 5 fig.
——— 1948. Recent decline of shad in the Hudson River due to failure in reproduction, not to overfishing, seek cause through science. U. S. Fish and Wildlife Srv., Mimeo. 1-4.
——— 1950. A cheek tag for marking fish, with semi-automatic pliers for application of tag. Journ. du Conseil Internat. pour l'Explor. de la Mer, 16(2): 1-4.
——— and E. H. HOLLIS. 1946(?). Value of various methods for improving the shad fisheries of Virginia. U. S. Fish and Wildlife Srv., Mimeo. 1-6.
——— and ——— 1949(?). A survey of the shad fisheries of Virginia with recommendations for improving their condition. Unpub. MS., U. S. Fish and Wildlife Serv., 1-67.
——— and W. C. NEVILLE. 1946. Summary outline of the results of the shad study in the Chesapeake Bay and the features of continued study with special reference to Maryland. U. S. Fish and Wildlife Srv., Unpub. MS., 1-6.

CALIFORNIA FISH COMMISSION. 1871. Report of Commissioners of fisheries of the State of California for 1870-71 [record of shad introduction].

CALVERT INDEPENDENT. 1952. Danger of fish depletion [in Chesapeake Bay]. Prince Frederick, March 6: 7.

CAMP, R. R. 1952A. Striped bass slaughter stirs Jersey to protest at shad netters' harvest. Wood, Field and Stream, N. Y. Times, Feb. 28.
——— 1952B. Shad fishing at Enfield Dam starting April 19 offers change of pace. Wood, Field and Stream, N. Y. Times, Apr. 4.

CANADA DEPARTMENT OF FISHERIES. 1951. British Columbia catch statistics, 1951. Bay area and type of gear. Pacific Area, Vancouver (processed): 1-117.

CANADA GAZETTE. 1949A. Shad. Fisheries act—Special fishery regulations for the province of Nova Scotia. Ottawa, (2): 11-12.
——— 1949B. Shad. Fisheries act—Special fishery regulations for the province of New Brunswick. Ibid., (2): 16-17.

CARL, G. C., and W. A. CLEMENS. 1948. The fresh-water fishes of British Columbia. British Columbia Prov., Mus., Dept. Ed., Handbook (5): 1-132, ill.

CARSON, R. L. 1936. It'll be shad-time soon, and Chesapeake fishermen hope for better luck this season. Balto. Sunday Sun, Mag., March 1, (1): 1.
——— 1939. Shad catches declining as the 1939 season opens. Once undisputed king of city markets now in fourth place among fish sales. Ibid., March 26, (1)): 1.
——— 1943. Food from the sea: fish and shellfish of New England. U. S. Fish and Wildlife Srv., Conserv. Bull. (33): 1-74, ill.
——— 1944. Fish and shellfish of south Atlantic and Gulf Coasts. Ibid. (37): 1-45.
——— 1945. Fish and shellfish of the Middle Atlantic Coast. Ibid, (38): 1-82.
——— 1952. Under the sea-wind. Oxford Univ. Pr., N. Y., 1-271, ill. [first pub. in 1939].

CARY, H. H. 1885A. Shad in Georgia waters. Bull. U. S. Fish Comm., 5: 100-101.
——— 1885B. The Saint John's River as a shad stream. Ibid., 5: 422.
——— 1886. Increase of shad due to propagation, (quoted by Baird). Rept. U. S. Fish Comm., 1884, LXXII.

CATING, J. P. 1953. Determining age of Atlantic shad from their scales. U. S. Fish and Wildlife Serv., Fish. Bull. (85): 187-199, ill.

CHABANAUD, P. 1935(?). Les poissons de mer exotiques aux Halles Centrales de Paris. Remarques sur diverses especes, notamment *Solea senegalensis* Kaup et *Hilsa reevesi* H B. Bull. Mus. Hist. Nat., Paris, 8(2): 61-64.

CHACKO, P. I. 1950. A biometrical study of *Hilsa ilisha* (Ham.) in the Gadavari River. Journ. Bombay Nat. Hist. Soc., 49: 315-316.
——— ZOBAIRI, A. R. K., and B. KRISHNAMURTHI. 1948. The radii of scales of *Hilsa ilisha* (Hamilton) as an index of growth and age. Current Sci., Bangalore 17: 158-159.

CHAJANOVA, L. A. 1940. The feeding of *Caspialosa caspia* (Eichev.). Trans. Inst. Marine Fish. and Oceanog. U. S. S. R., 14: 211-237. (In Russ., Eng. summ.).

CHALKER, R. B. 1887A. Catch of shad in Connecticut for 1885. Bull. U. S. Fish Comm., 6: 439-441.
——— 1887B. Catch of shad in Connecticut for 1886. Bull. U. S. Fish Comm., 6: 297-298.
——— 1889. Catch of shad in Connecticut for 1887. Bull. U. S. Fish Comm., 7: 112.

CHALMERS, T. 1879. Eels, bass and shad. Chicago Field, 12: 229.

CHAMBLISS, P. C. 1948. Death of fish complicates mystery of Bush River. Balto. Even. Sun, March 2.
——— 1951. Fisherman's luck. ['. . . long, cool spring made the shad slow coming up the Bay.']. Balto. Even. Sun, June 21.

CHAPMAN, P. 1884. Habits of the shad and herring as they appear in the Potomac River to one who has watched them for fifty years. Bull. U. S. Fish Comm., 4: 61-64.

CHAPMAN, W. M. 1942. Alien fishes in the waters of the Pacific northwest. Calif. Fish and Game, 28(1): 9-15.
——— 1944A. The comparative osteology of the herring-like fishes (Clupeidae) of California. Calif. Fish and Game, 30(1): 6-21, 18 fig.
——— 1944B. The latent fisheries of Washington and Alaska. U. S. Fish and Wildlife Srv., Fish. Leaflet 95.
——— M. KATZ, and D. W. ERICKSON. 1941. The races of herring in the State of Washington. Wash. State Dept. Fish., Biol., 38A: 1-36, ill.

CHASE, D. M. 1876. Record of shad hatching operations conducted at Bristol, Maryland, on the Patuxent River, from April 27th, 1875, to May 30th, 1875, on account of the State of Maryland. Rept. Comm. Fish. Maryland, 53.

CHENEY, A. N. 1896. Shad of the Hudson River. *In* First Ann. Rept., New York State Comm. of Fish., Game, and Forests, 1895, 125-134.

——— 1898. Fishways, their construction and use. *In* Third Ann. Rept., Ibid., 222-233, 7 pl.

——— 1900. Shad culture in the Hudson River. *In* Fifth Ann. Rept., Ibid., 241-247.

CHUMAEVSKAYA-SVETOVIDOVA, E. V. 1937(?). Age and growth of *Caspialosa caspia salina* Svetovidov, of the northwestern part of the Caspian Sea. Trav. Comm. Mer Casp. Acad. Scie., U R S S. 2: 23-33, (Russ., Eng. summ.).

CLAPP, A. F. 1893. The Susquehanna; its past, present, and future. Trans. Amer. Fish. Soc., 1892: 135-137.

CLARK, F. N. 1885. Notes on experiments in penning shad and taking eggs at Battery Station, Havre de Grace, Maryland, in 1883. Rept. U. S. Fish Comm., 1045-1050.

——— 1884. Report of experiments for determining the smallest amount of water in which young shad and eggs can be kept. Rept. U. S. Fish Comm., 783-786.

CLEAVER, F. C. (Editor). 1951. Fisheries statistics of Oregon. Oreg. Fish Comm., Contrib. (16): 1-176.

CLEMENS, W. A. and G. V. WILBY. 1946. Fishes of the Pacific Coast of Canada. Fish. Reseach Brd. Canada, Bull. (67): 1-368, ill.

CLIFT, M. 1874. Report of shad hatching operations (in 1872). Rept. U. S. Fish Comm. 1872-1873, 2: 403-405.

CLIFT, W. 1872. Shad culture. Proc. Amer. Fish. Cult. Asso., 21-28.

CLINTON, D. W. 1824. Description of a new species of fish from the Hudson River [*Clupea hudsonia*]. Ann. Lyceum Nat. Hist., N. Y., 1: 49-50, ill.

CLOTHIER, C. R. 1950. A key to some southern California fishes based on vertebral characters. California Division Fish and Game, Fish. Bull., (79): 1-83.

COBB, J. N. 1906. Investigations relative to the shad fisheries of North Carolina. N. C. Geol. Surv., Econ. Pap. (12): 1-39.

COCKERELL, T. D. A. 1910. The scales of the clupeid fishes. Proc. Biol. Soc. Wash., 23: 61-63.

COKER, C. M. 1947. Maryland commercial fish hatchery operations, 1946 and 1947. Md. Dept. Research and Ed., Ed. Ser. (15): 1-14.

——— 1949. Maryland's commercial fishing gears. I. The fin-fish gears. Ibid., (18): 1-37.

——— 1950. Report of the Maryland Department of Research and Education to the Chesapeake shad committee. Solomons, Unpub. MS., 1-3.

——— and E. H. HOLLIS. 1950. Fish mortality caused by a series of heavy explosions in Chesapeake Bay. Journ. Wildlife Manage., 14(4): 435, 1 pl.

——— and T. H. MISTER. 1952. Maryland commercial fish hatchery operations, 1950-1951. Md. Dept. Research and Ed., Ed. Ser. (32): 1-16, ill.

COKER, R. E. 1929. Keokuk Dam and the fisheries of the Upper Mississippi River. Bull. U. S. Bur. Fish., 45; 87-139, ill.

——— 1930. Studies of common fishes of the Mississippi River at Keokuk. Bull. U. S. Bur. Fish., 45: 141-225, ill.

COLEMAN, N. 1872. Another note on the same. Change of temperature in water containing recently fertilized shad eggs. Amer. Nat., 6: 493.

COLLINS, A. S. 1871. Shad eggs. Amer. Nat. 5: 441.

COLLINS, G. B. 1951A. The fishway at Lawrence, Massachusetts: A fishway that shad ascend. U. S. Fish and Wildlife Serv., Spec. Scie. Rept., Fish. (65): 1-17, ill.

——— 1951B(?). The Bournedale fishway at Cape Cod Canal. Div. Marine Fish., Mass. Dept. Conserv., 1-8.

——— 1952. Factors influencing the orientation of migrating anadromous fishes. U. S. Fish and Wildlife Srv., Fish. Bull. (73): 375-395, ill.

COLLINS, J. W. 1883. Shad taken in mackerel gill nets (From a letter to Prof. S. F. Baird). Bull. U. S. Fish Comm., 1882, 2: 95.

——— 1887A. Delaware and its fisheries. *In* The Fish and fishery industries of the United States, ed. by G. B. Goode, (9): 407-419.

——— 1887B. Shore fisheries of southern Delaware. *In* Ibid., 1(5): 527-541.

——— 1895. Commercial fisheries of Pennsylvania. *In* Rept. Penn. Fish Comm. for 1892, 1893, 1894, Harrisburg, 343-450.

COMMERCIAL FISHERIES REVIEW. 1951. Shad investigators in the Hudson and Connecticut Rivers. Wash., 13(6): 40-41.

CONNECTICUT COMMISSIONERS OF FISHERIES AND GAME. 1906. Report [of the extensive history of the shad hatchery work in the state]. Hartford, 1-6.

CONNECTICUT STATE BOARD OF FISHERIES AND GAME. 1946. Shad. Division of fish restoration. *In* Twenty-sixth Biennial Rept., Hartford, 38-39.

——— 1947. Connecticut fish and game laws revised to October 1, 1947. Hartford, 70-71.

——— 1951. New laws and amendments . . . 1949 and 1951 . . . fisheries and game: shad nets. Hartford, Chapter 246: 435.

COOPER, M. A. 1874. [Letter referring to experiments of W. C. Daniell, M. D., in introducing shad into the Alabama River]. Rept. U. S. Fish. Comm., 1872-1873, 2: 389-390.

COPE, E. D. 1873. Sketch of the zoology of Maryland. *In* Walling and Gray's new topographical atlas of Maryland. O. W. Gray., Phila., Pa. 16-18.

——— 1883. The fisheries [fishes] of Pennsylvania. Rept. Penn. Fish Comm., 1881-1882, 103-194, figs. 26-44.

COREY, P. 1947. Shad haul. Wm. Morrow & Co., N.Y., 1-218, ill.

CORNISH, T. 1867. Allice shad [*Alosa alosa*] in Mount's Bay. Zoologist, 2: 916.

——— 1868. Allice shad at St. Ives. Ibid., 3: 1463.

CORSON, A. 1951. Shimmering shad. Fla. Wildlife, 4(11): 4-6, 25, ill.

COXE, F. 1884. Opening the Broad and other rivers of North Carolina to shad, bass, etc., Bull. U. S. Fish Comm. 4: 232.

CRAIG, J. A. and R. L. HACKER. 1940. The history and development of the fisheries of the Columbia [River]. Bull. U. S. Bur. Fish., 49(32): 133-216, 16 fig.

CRAIGIE, E. H. 1926. A preliminary experiment upon the relation of the olfactory sense to the migration of the sockeye salmon (*Oncorhynchus nerka* Walbaum). Trans. Ray Soc. Canada, 20: 215-224.

CUNNINGHAM, J. T. 1895. Notes on rare or interesting specimens [*Alosa alosa*]. *In* Experiments and observations made at the Plymouth Laboratory. Journ. Mar. Biol Assoc., 1893-1895, 3: 247-277.

CURRAN, H. W. and D. T. RIES. 1937. Fisheries investigation in the Lower Hudson River. *In* A biological survey of the Lower Hudson Watershed. Suppl. 26th Ann. Rept. N. Y. State Conserv. Dept., 1936, 124-142.

DADO, S. H. 1926. Canned, cured and manufactured fishery products of California for the year 1924-1926. Calif. Fish and Game, Biennial Rept., 113-124.

——— 1927-1936. Statistical reports on fresh and canned fishery products, 1926 to 1935. Calif. Fish and Game. Circulars (1-10), issued annually.

D'ANCONA, U. 1925. Richerche sull' accrescimento e sulla maturita sessuale dell' ***Alosa finta*** **(Cuv.).** Rend. Accad. Lincei. 1(ser. 6a): 43-46.

——— 1926. Richerche sulla riproduzione dell' "*Alosa finta* (Cuv.)." Atti. Rev. Accad. Naz. Lincei, Rend. Cl. Sch. Fisica., 4(7/8): 333-335.

——— 1927A. Notizie sulla biologia dell' *Alosa finta* (Cuv.) del bacino del Tevere. Notas Res. Min. Marina. Madrid, 19(2): 1-19, 1 pl.

——— 1927B. L'accrescimento dell' alosa del Tevere. Rendiconti Acc. Naz. Lincei. 5(ser. 6a): 214-219, 1 fig.

——— 1927C. Sul valore sistematico delle unita morfologiche di numero variabile ed in particulare sulla sistematic dell Alose mediterranee. Monitore Zool. Ital. 38(8): 187-191.

——— 1928. La biologica dell' Alosa de Tevere in confronto a quelle di altre regioni, con considerazione generali sulle differenze morfologiche ed ecologiche tra lo razze mediterranee e nord-europee delle specie ittiche. Internat. Rev. Hydrobiol. und Hydrograph, Leipzig. 20(5/6): 430-455, 1 map, 12 fig.

——— 1937. La croissance chez les animaux Mediterranees. Rapp. Comm. Internat. Mer Medit., 10: 163-224.

——— 1952. The struggle for existence. Bibliotheca Biotheoretica, E. J. Brill, pub. Leiden, (6): 1-276, 63 graphs.

DANIELL, W. C. 1866. On the introduction of the American shad into the Alabama River. Proc. Acad. Nat. Sci. Phila., 236-237.

——— 1874. Letters referring to the experiments of W. C. Daniell, M. D., in introducing shad into the Alabama River. Rept. U. S. Fish Comm., 1872-1873, 2: 387-389.

DAVID, L. R. 1946. Upper Cretaceous fish remains from the Western border of the San Joaquin Valley, California. Contrib. Paleont. Carneg. Inst. Wash. (551): 83-112, 170, 8 pl.

DAY, F. 1880-1884. The fishes of Great Britain and Ireland. London, two vol., 179 pl.

——— 1885. On the rearing, growth, and breeding of salmon in fresh water in Great Britain. Bull. U. S. Fish Comm., 1885. 5:307.

——— 1887. Experiments with salmon in Scotland. Ibid., 1886. 6:56.

DAYE, V. L. 1950. An old Minudie game [shad] . . . Canada Bus., May, 23: 50-51, 83.

DEAN, B. 1916-1923. A bibliography of fishes. Amer. Mus. Nat. Hist. N. Y., three vol. 1: 1-717; 2: 1-701, and 3: 1-707.

DEEP RIVER NEW ERA. 1952. First shad run is good. Connecticut. Apr. 24.

DeKAY, J. E. 1842. Zoology of New York, Part IV. Fishes [The American shad, *Alosa praestabilis*]. Xv-415, Albany.

DELAWARE BOARD OF GAME AND FISH. N. D. Delaware fish. Mimeo. Dover, 1-18.

——— 1951. Game and fish laws . . . 1951. Dover, 1-105.

DeLOACH, D. B. 1939 The salmon-canning industry Oreg. State Mono., Econ. Stud. No. 1.

DeLURY, D. B. 1951. On the planning of experiments for the estimation of fish populations. Journ. Fish. Research Brd. Canada, 8(4): 281-307.

DEMPSEY, W. 1887. Shad in the Saint John's River, Florida. Bull. U. S. Fish Comm., 1886, 6: 96.

DENMEAD, T. 1934. Fly fishing for shad. Md. Conserv., 11(3): 14-15.

DERJAVINE, A. N. 1918. Nutrition des Harengs (*Caspialosa caspia* Eichw., *C. caspia volgensis* Meissn., *C. kessleri* Gr. *C. brashnikovi* Bor., *C. sapostunikov* Gr. Trav. Lab. Ichth. Astrachan, 4(fasc.3): 1-32. (In Russ., French summ.).

DERSCHAU, W. V. 1894. Zur Frage der Maifisch-Erbrütung. Allgem. Fischerei-Zeitg. 19: 34-36.

DEVANESEN, D. W. 1942. Weirs in South India and their effect on the bionomics of the Hilsa in the South Indian rivers—the Godavari, the Kistna, and the Cauvery. Current Sci., Bangalore. 11: 398-399.

DIKSON, B. 1905A. Ueber das Auffinden von jungen *Clupea kessleri* im Ueberschwemmungegebiet der Wolga oberhalb Saratov. Vest Rybopromysl, St. Petersburg. 20: 117-119. (In Russ.).

——— 1905B. Ueber die Ernährung des Ziehenden-herings (*Clupea kessleri* Gr.) in der mittleren Wolga. Ibid., 20: 276-282. (In Russ.).

DIXON, B. I. 1913. Ueber morphologische Merkmale der ersten Stadien der Jungfische von *Clupea kessleri* Gr. Arb. Biol. Wolga Stat. Saratov, 3(4): 1-17. (In Russ. Germ. summ.).

DMITRIEV, N. A. 1947. Some data on the biology of *Caspialosa caspia knipowitschi* Iljin. Zool. Journ. Moscow, 26: 559-560. (In Russ.).

DOTTRENS, E. 1953. Poissons d'eau douce. II. Des Silurides aux Cyprinides. Delachaux & Niestle, S. A., Paris, and Neuchatel., ill.

DOWNMAN, R. H. 1888. Shad, herring, etc., excluded from Rappahannock River by dams. Bull. U. S. Fish. Comm., 3: 392.

DRIENSKI, P. 1934. *Alosa bulgarica* nov. sp., ein bis jetz unbekannter Fisch aus den Flüssen der Bulgarischen Küste des Schwarzen Meeres, südlich von Burgas. Izvest. T. Sarskit. Prirodonau. Inst., Sofia (Mitteil. K. Naturw. Inst., Sofia), 7: 79-87, 2 fig. (In Bulgar., German summ.).

DYMOND, J. R. 1932. Records of the alewife and steelhead (rainbow) trout from Lake Erie. Copeia, G. 32-33.

EARLE, S. 1926. Decline and conservation of shad. Trans. Amer. Fish. Soc., 46: 210-212.
——— 1928. Fish hatchery operations. Md. Conserv., 5(3): 12.

EARLL, R. E. 1887. The herring fishery and the sardine industry. *In* The Fisheries and fishing industries of the United States. By G. B. Goode, et al., Section V 1(pt. 6): 419-524.

EASTON STAR DEMOCRAT. 1926. Greatest herring (alewife) plant of this country in this [Talbot] County. Easton, Maryland. April 24.

ECKARDT, R. 1879. The experiments in propagating maifische (*Alosa vulgaris*) in 1876. Rept. U. S. Fish Comm., 1877., 853-866.

EDDY, S. and T. SURBER. 1947. Northern fishes with special reference to the Upper Mississippi Valley. Rev. Ed., Univ. Minn. Pr., 1-276, ill.

EDWARDS, T. 1866. Occurrence of the Allice shad (*Alosa communis* [= *A. alosa*]) on the Aberdeenshire Coast. Zoologist. 1: 349.

EHRENBAUM, E. 1894. Beiträge zur Naturgeschichte einiger Elbfische [*Alosa finta*]. Wiss. Meeresunters. Kiel (Abt. Helgoland), N. S. 1(1): 35-79, 3 pl.

ELLLIOT, J. 1830. Historical sketches of the . . . District of Columbia; with . . . a description of the River Potomac, its fish and wildfowl, &c., Wash., 1-554.

ELLIOTT, R. P. 1950. Information sources for students of commercial fisheries. U. S. Fish and Wildlife Srv., Fish. Leaflet (362): 1-20.

ELLIS, M. M., WESTFALL, B. A., and M. D. ELLIS. 1946. Determination of water quality. U. S. Fish and Wildlife Srv., Research Rept. (9): 1-122.
———, ———, MEYER, D. K., and W. S. PLATNER. 1947. Water quality studies of the Delaware River with special reference to shad migration. U. S. Fish and Wildlife Serv., Spec. Sci. Rept. (38): 1-?

ENCYCLOPEDIA BRITANNICA. 1911. Shad. *In* 11th Ed., Cambridge Univ. Pr. N. Y. 757-758.

ERASMO, G. D'. 1930A. L'ittiofauna fossile di Senigallia. Atti. Acc. Scie. Fisica, Matem. Napoli, 18(1): 1-83, 4 pl. 13 fig.
——— 1930B. L'ittiofauna fossile del Gabbro. Ibid., 18(6)L 1-118, 4 pl.

ERKKILA, L. F., MOFFETT, J. W., COPE, O. B., SMITH, B. R., and R. S. NIELSON. 1950. Sacramento-San Joaquin Delta fishery resources: effects of Tracy Pumping Plant and Delta Cross channel U. S. Fish and Wildlife Srv., Sci. Rept., Fish. (56): 1-109.

ETHERIDGE, R. B. 1937. Shad regulations. Unpub. MS. N. C. Dept. Conserv. and Dev., 1-5.

EVERMANN, B. W. 1896. Description of a new species of shad (*Alosa alabamae*) from Alabama. Rept. U. S. Fish Comm., 1895, 21:203-205.
——— 1902A. Description of a new species of shad (*Alosa ohiensis*) with notes on other food fishes of the Ohio River. Rept. U. S. Fish Comm., 1901, 273-288.
——— 1902B. A new species of shad. Sports Afield. 29: 63-66.
——— 1902C. The American species of shad. Abstract in Science. N. S. 15: 1032.
——— 1902D. A new species of shad from the Ohio River. Forest and Stream, 58: 408-409, 6 pl.
——— 1906. Shad decreasing rapidly. Shields' Mag., 3: 184.
——— and E. L. GOLDSBOROUGH. 1907. The fishes of Alaska. Bull. U. S. Bur. Fish., 26: 219-360, ill.
——— and S. F. HILDEBRAND. 1910. On a collection of fishes from the Lower Potomac, the entrance of Chesapeake Bay, and from streams flowing into these waters. Proc. Biol. Soc. Wash., 23: 157-164.
——— and W. C. KENDALL. 1896. An annotated catalogue of the fishes known from the state of Vermont. Rept. U. S. Fish Comm., 1894, (20): 579-604.
——— and S. E. MEEK. 1898. A report upon salmon investigations in the Columbia river basin and elsewhere on the Pacific Coast in 1896. Bull. U. S. Bur. Fish., 1897, 17: 15-84.

FAIRBANKS, W. L. and W. S. HAMILL. 1932. The fisheries of Maryland. Md. Dev. Bur., Balto. Assoc. Commerce, 1-198, ill.

FARRAN, G. P. 1944. The "Goaske" in Ireland. Irish Nat. Journ., Belfast, 8: 145-147.

FATIO, V. 1868. [Swiss shads]. Faune des vertebres de la Suisse. Geneve.

FEDERAL SECURITY AGENCY. 1951A. California drainage basins; a cooperative State-Federal report on water pollution. U. S. Pub. Health Srv., Water Pollution Series, (5): 1-90.
——— 1951B. Pacific northwest drainage basins . . . Ibid., (7): 1-148.
——— 1951C. New England drainage basins . . . Ibid., (7): 1-148.
——— 1951D. North Atlantic drainage basins . . . Ibid., (10): 1-137.
——— 1951E. Southeast drainage basins . . . Ibid., (13): 1-236.
——— 1951F. Potomac River basin . . . Ibid., (28): var. pp., maps.

FELDSTEIN, S. H. 1934. Ancient fish legislation [rest days from fishing in Patuxent River, Maryland, from Saturday to Monday, according to 1768 laws]. Md. Conserv. Summer Issue.

FENTON, H. J. 1884. Shad hatching in Connecticut in 1884. Bull. U. S. Fur. Fish., 4: 310-311, also 319-320.
——— 1887. Shad hatching and distribution in Connecticut in 1886. Bull. U. S. Fish Comm., 6: 405.

FERGUSON, T. B. 1877. Report of the Commissioner of fisheries of Maryland, January, 1877, Annapolis, 1-56.
——— 1878. Report . . . Commissioner of fisheries of Maryland, January, 1877. 1-40.
——— 1881. Report . . . Commissioner of fisheries of Maryland, January, 1881, I-CXIV.
——— 1884. Extracts from a report of investigations of the shad fisheries and rivers south of

Charleston, South Carolina, with a view of establishing stations for artificial propagation. Bull. U. S. Fish Comm., 4: 244-248.
——— and P. W. DOWNES. 1876. Report of the Commissioners of Fisheries of Maryland. Annapolis, 1-52.
——— and T. HUGHLETT. 1879. Report of the Commissioners of fisheries of Maryland. January, 1879. Annapolis, I-LXXVIII.
——— and ———. 1880. Report of the Commissioners of Fisheries of Maryland, January, 1880., I-LXXVIII.
FERRERO, L. 1946. Studio comparativo sulle cheppie del Mediterraneo e gli Agoni delle acque interne d'Italia. Boll. Pesca Piscicolt. Idrobiol. Roma, 22: 54-55.
FIEDLER, R. H. 1935. Fishery industries of the United States, 1934. Rept. U. S. Comm. Fish., App. II: 1-330.
——— 1936. Ibid., 1935. Ibid., 1-348.
——— 1938A. Ibid., 1936. Ibid., 1-276.
——— 1938B. Ibid., 1937. 1-460.
——— 1940. Ibid., 1938. Ibid., 1-554.
——— 1941. Ibid., 1939. Ibid., 1-554.
——— 1943. Ibid., 1940. U. S. Fish and Wildlife Srv. Stat. Dig. (4): 1-225.
——— 1944. Ibid., 1941. Ibid., (7): 1-174.
FIELD. 1916. Shad fishing in California. London, Dec. 30: 998.
FIELD, G. W. 1914. Alewife of Massachusetts. Trans. Amer. Fish. Soc., 1913: 143-152.
FILIPPO DE FILIPPI. 1847. Nouvelles recherches sur l'embryogenie des Poissons. Ann. des Sci. Nat. 3rd, Ser. Zool. 7: 65-72, ill.
FINLEY, C. I. 1884. Shad in Oregon waters—a new salmon hatchery. Bull. U. S. Bur. Fish., 4: 88.
FINLEY, B. 1952. The relative productivity and value of the fisheries of the United States and Alaska. U. S. Fish and Wildlife Srv, Fish. Leaflet (108): 1-10, ill.
FINSCH, F. H. O. 1876. Der amerikanische Shad (*Alosa praestabilis*) und der erste Versuch seiner Einführung nach Deutschland. Ein naturgeschichtlich-ökonomische Darstellung dieses wichtigen Nutzfisches, mit Beziehung auf unseren Maifisch. Circul. Deutsch. Fischerei Ver. 1875. 1(6): 327-344.
FISHERY COUNCIL MARKET LETTER. 1944. Freak fish featured in met papers: unusual shad goes to Museum. May 26: 2.
FISHERY STATISTICS OF THE UNITED STATES. 1880-1947. Federal fishery statistics have been collated and published by a number of agencies, including U. S. Fish Commission, U. S. Bureau of Fisheries, U. S. Fish and Wildlife Service, and U. S. Bureau of Census. For a complete listing of these publications see Section 15: 280-285, Stat. Dig. (21): U. S. Fish and Wildlife Srv., Wash., 1950.
FITZGERALD, D. B. 1895. On a shad-float. Lippincott's Mag., 55: 692.
FLACK, H. E. 1945. Tidewater fishing laws of Maryland and Virginia; comparative analysis as of December, 1945. Research Div., Legis. Council, State of Md., 1-18.
FLORIDA FISH COMMISSION. 1903. Report of the Fish Commission . . . for the years 1901-1902, Tallahassee.
FLORIDA SHELLFISH COMMISSION. 1918. Third biennial report of the . . . Commission . . . 1917-1918. Tallahassee, Shad. 35-37.
——— 1932. Tenth biennial report of the shellfish division of the Department of Agriculture, 1931-1932. Tallahassee.
FLORIDA STATE BOARD OF CONSERVATION. 1935. First biennial report to the State Board of Conservation, December 31, 1934. Tallahassee.
——— 1951 (?). Biographies of Florida's important food fish and their nutritive value: shad. Tallahassee, 20.
FONTAINE, M. 1951. Facteurs externes et internes regissant les migrations des poissons. Annee biol. 27: 569.
——— and J. LELOUP. 1950. Sur l'iodemie de deux Teleosteens migrateurs potamotoques *Salmo salar* L. et *Alosa alosa* L. au debut de leur montee reproductrice. C. R. Acad. Sci., Paris, 230: 775.
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS: FISHERIES DIVISION. 1949. Herring and allied species, 1920-1948, a commodity study. First progress rept., 1-66.
FORBES, S. A. and R. E. RICHARDSON. 1920. The fishes of Illinois (Second edition). Ill. Nat. Hist. Surv. 3: cxxi—357, ill., Atlas of maps.
FORD, E. 1946. Vertebral variation in teleostean fishes. III Isospondyli. Journ. Marine Biol. Assoc., U. K., 26: 390-397.
FOREST AND STREAM. 1875. Great mortality of shad in St. Lawrence. 3: 276.
——— 1876A. Shad in the Delaware River. 6: 6.
——— 1876B. The shad fishery of the Potomac. 6: 266.
——— 1877. Shad in Lake Ontario. 9: 226.
——— 1906. Failure of our shad fisheries. 67: 17.
FOWLER, H. W. 1906. The fishes of New Jersey. Ann. Rept., N. J. State Mus., Part II, 1905, Trenton, 36-477, 103 pl., fig.
——— 1907. A supplementary account of the fishes of New Jersey. Ann. Rept., N. J. State Mus., 1906, Part III, 251-384, 52 pl., 44 fig.
——— 1909. Notes on New Jersey fishes, amphibians and reptiles. *In* Ann. Rept., N. J. State Mus., 1906, Part III, 251-384, 52 pl., 44 fig.
——— 1911A. The fishes of Delaware. Proc. Acad. Nat. Sci. Phila., Jan. 3-16.
——— 1911B. Notes on Clupeoid fishes. Ibid., 1911-1912, 63: 204-221.
——— 1912. Hermaphroditic shad in the Delaware. Science. N. S., 36: 18-19.

——— 1915. An annotated list of the cold-blooded vertebrates of Delaware County, Pennsylvania. Proc. Del. Co. Inst. Sci. 7(2): 1-13.
——— 1919. A list of the fishes of Pennsylvania. Proc. Biol. Soc. Wash., 32: 49-73.
——— 1937. Shad runs near Philadelphia. Frontiers Mag. Nat. Hist., 1(4): 124-125.
——— 1945. A study of the fishes of the southern Piedmont and Coastal Plain. Acad. Nat. Sci. Phila., iv-408, 313 fig.

FRANCE, BULLETIN DE LA SOCIETE D'ACCLIMATION DE 1873. Introduction de l'alose (*Alausa praestabilis*) en California. 2nd Ser. 10: 302.

FREDIN, R. A. 1954. Causes of fluctuations in abundance of Connecticut River Shad. U. S. Fish and Wildlife Srv. Fish. Bull. (88): 247-259.

FREEMAN, B. O. 1950. A study of the shad fisheries in the Welaka area of the St. Johns River. Unpub. MS., presented at the 1950 annual meeting of the American Fisheries Society.

FRY, F. E. J. 1943. A method for the calculation of the growth of fishes from scale measurements. Univ. Toronto Stud., Biol. Ser. (51): 1-18, ill.

G.———V. 1876. Phenomenal run of herrings in the Taunton and Nemasket Rivers. Forest and Stream. 6: 234.
——— 1877. A new foe of shad. Ibid., 8: 223.

GALLWEY, E. 1939. Pisces [shad]. Naturalist, London. (984): 8-9.

GAY, J. 1892. The shad streams of Pennsylvania. *In* Rept., Penn. Comm. Fish. for 1889, 1890, 1891, Harrisburg, 157-187.

GENT, J. J. 1873. Upon the abundance of fish on the New England coast in former times. Rept. U. S. Fish Comm., 1: 149-154.

GEORGE. A. F. 1900. The fish and fisheries of Maryland. Trans. Amer. Fish. Soc., 1899: 49-54.

GEORGIA DEPARTMENT OF GAME AND FISH. 1913. Report and recommendations of the State Game and Fish Commission. 1912-1913.
——— 1950. Shad fish regulations. Publ. Inf. Bull. 1949-1950.

GEORGIA WILDLIFE. 1931. Great decline in shad production. Ga. Wildlife Conserv. Bull., May.

GHARRETT, J. T. 1950. The Umpqua shad fishery. Oreg. Fish Comm., Research Briefs, 3(1): 8-13.

GILL, T. 1861. On the pertinence of the *Alosa teres* DeKay to the genus *Dussumiera* Val. Proc. Acad. Nat. Sci. Phila., 1860: 21-22.
——— 1862A. Synopsis of the subfamily Clupeinae with description of new genera. Proc. Acad. Nat. Sci. Phila., 1861: 33-38.
——— 1862B. Catalogue of the fishes of the eastern coast of North America from Greenland to Georgia. Proc. Acad. Nat. Sci. Phila., 1861, Suppl., 1-63.
——— 1866. Pisciculture with reference to American waters. U. S. Dept. Agric., Ann. Rept. 1866, 394-423.
——— 1873. Catalogue of the fishes of the east coast of North America. Rept. U. S. Fish. Comm., 1871-1872, 1: 779-822.
——— 1878. Pisciculture. The Balto. Mirror. 2: 1-6.

GILPIN, J. B. 1870. On the food fishes of Nova Scotia. No. 6. The shad. Trans. Nova Scotian Inst. Nat. Sci. 1867-70, 2(2): 17-20.

GILPIN, J. 1786. On the annual passage of herrings. Trans. Amer. Phil. Soc., 2: 236-239.

GLADWIN, C. O. 1876. Shad netting in the Connecticut River near Higganum. Forest and Stream. 6: 234.

GOODE, G. B. 1874A. The shad and the shad fishery of the St. Johns River, Florida. Rept. U. S. Fish Comm., 1872-1873, 2: XLVIII-XLIX.
——— 1874B. The experiments with young shad. Amer. Sportsman, 4: 376.
——— 1878A. Confusion in the names of some of the American fishes of the herring family. Forest and Stream, 10:82.
——— 1878B. Migration of fishes. Trans. Amer. Fish-cult. Assoc., 1878: 27-64.
——— 1879. The two kinds of river herring. Rept. Va. Fish. Comm., 14.
——— 1880. How to distinguish the two species of herring. Chicago Field. 22: 341.
——— and T. GILL. 1903. American fishes; a popular treatise upon the game and food fishes of North America. Second Ed., L. C. Page, Boston, 1-562, ill.
——— and others. 1884-1887. The fisheries and fishery industries of the United States. Prepared through the cooperation of the commissioner of fisheries and the superintendent of the 10th census. Five sections, 547 pl., Wash. [see Dean, 1916, for a complete collation.]

GOURAND, A. H. 1895. Shad's annual pilgrimage. Pop. Sci., April, 46: 818-827.

GRABILL, J. R. 1887. Report of operations at the shad hatching station on Battery Island, near Havre de Grace, Md, during the season of 1886. Bull. U. S. Fish Comm., 1886, 6: 361-368; and Rept. U. S. Fish Comm., 1886 (1889), 14: 807-814.

GRANT, I. H. 1883. Movements of menhaden; and catch of herring. Bull. U. S. Fish Comm., 3: 470.

GREELEY, J. R. 1935. Fishes of the watershed with annotated list. *In* A biological survey of the Mohawk-Hudson watershed. Suppl. 24th Ann. Rept., N. Y. State Conserv. Dept., 1934, 63-101, 4 pl., 5 fig.
——— 1936. Fishes of the area with annotated list. *In* A biological survey of the Delaware and Susquehanna. Suppl. Ann. Rept., N. Y. Conserv. Dept., 25 (1935): 45-88, 10 fig., 4 pl.
——— 1937. Fishes of the area with annotated list *In* A biological survey of the Lower Hudson watershed. Suppl. 26th Ann. Rept. N. Y. State Conserv. Dept., 1936, 45-103, 3 fig., 4 pl., 10 ill.
——— 1939A. The freshwater fishes of Long Island and Staten Island with annotated list. *In* A biological survey of the fresh waters of Long Island. Suppl. 28th Ann. Rept., N. Y. State Conserv. Dept., 1938, 29-44.
——— 1939B. Fishes and habitat conditions of the shore zone based upon July and August seining investigations. *In* A biological survey of the salt waters of Long Island, 1938. Part II. Suppl. 28th Ann. Rept., N. Y. State Conserv. Dept., 72-91, ill.

——— 1940. Fishes of the area with annotated list. *In* A biological survey of the Lake Ontario watershed. Suppl. 29th Ann. Rept., N. Y. State Conserv. Dept., 1939, 42-81.
——— and S. C. BISHOP. 1933. Fishes of the Upper Hudson watershed with annotated list. *In* A biological survey of the Upper Hudson watershed. Suppl. 22nd Ann. Rept., N. Y. State Conserv. Dept., 1932. 64-101, 9 fig., 12 pl.
——— and C. W. GREENE. 1931. Fishes of the area with annotated list. *In* A biological survey of the St. Lawrence watershed . . . Suppl. 20 Ann Rept., N Y State Conserv Dept., 1930, 44-94, 12 pl.

GREEN, S. 1869. Shad and shad spawn destroyed by warmth of water in Connecticut River. Rept. Conn. Comm. Fish., 7.
——— 1874A. Report on shad hatching operations . . . 1872. Rept. U. S. Fish Comm., 1872-1873, 2: 405-406
——— 1874B. Report on shad hatching operations . . . 1873. Ibid., 406-408.
——— 1874C. Device for hatching the spawn of fishes. Ibid., 579-580.
——— 1874D. Seth Green on shad and black bass and on hybrid fish. Amer. Sportsman, 3: 378.
——— 1874E. Catching shad with fly. Amer. Sportsman, 4: 89.
——— 1874F. The growth of shad. Forest and Stream. 2: 276.
——— 1874G. Shad in Lake Ontario. Ibid., 292.
——— 1874H. Hatching of shad eggs. Trans. Amer. Fish. Soc., 18: 75-76.
——— 1876. Propagation of fish. Trans. Amer. Fish-cult Assoc., 5th Ann. Meet., 8-13.
——— 1880A. How the first shad were hatched. Forest and Stream, 15: 128.
——— 1880B. The alewife in fresh water. Ibid., 15: 167.

GREENE, C. W. 1937. Stocking policy for the Lower Hudson area and discussion of some fish management policies. *In* A biological survey of the Lower Hudson watershed. Suppl. 26th Ann. Rept., N. Y. Conserv. Dept., 1936, 20-44

GRIFFIN, L. E. 1938. When salmon meet Bonneville Dam. Amer. Forests. Oct., 1-4.

GRIFFINI, A. 1908. Ittiologia italiana, descrizione del pesci di mare e d'acque dolce. Milano., x-475, ill.

GRIFFITH, W. 1883. Result of planting shad in the Ohio River. Bull. U. S. Fish. Comm., 1882, 2: 12,

GRIMM, O. 1901. Die Häringe des Azov'schen Meeres. Nikolsk Fischzucht. St. Petersburg, (4): 17-31, also in Vest. Rybopromysl. St. Petersburg, 16: 57-70.

GRISWOLD, C. D. 1876. Experiments with a view to transporting shad a few months old. Rept. U. S. Fish Comm., 1873-1875, 3: 370-372.

GRUBE, A. E. 1870. Ueber eine in der Oder gefangene Alse, *Clupea alosa* L. als neu für die schlesische Farine.. Jahreber. Schles. Ges., Breslau, 1869. 43-44.

GUNTER, G. 1942. A list of the fishes of the mainland of north and middle America recorded from both fresh and sea water. Amer. Midland Nat., 28(2): 305-326.
——— 1945. Studies on marine fishes of Texas. Pub. Inst. Marine Sci., Univ. Texas, 1(1): 1-190.
——— 1947. Differential rate of death for large and small fishes caused by hard cold waves. Science, 106(2759): 472-473.
———, WILLIAMS, R. H., DAVIS, C. C. and F. G. W. SMITH. 1948. Catastrophic mass mortality of marine animals and coincident phytoplankton bloom on the west coast of Florida, November, 1946 to August, 1947. Ecol. Monogr. 18: 309-324, ill.

GUNTHER, A. C. L. G. 1859-1870. Catalogue of the fishes of the British Museum. Eight volumes, London. (see Dean, 1916, for a complete collation).
——— 1868. Observations on the various species of *Clupea* found on the British coasts. Proc. Zool. Soc. London, 377.

H. . . ., J. D. 1879. Tennessee shad and salmon. Forest and Stream. 12: 185.

HALL, C. C. (Editor). 1910. Narratives of early Maryland, 1633-1684. Scribner's Sons, N. Y., ix-460, map.

HALLOCK, C. 1894. When shad were a penny apiece; cheapness and abundance of shad in Colonial days. Trans. Amer. Fish. Soc., 23: 18-20.

HAMLEN, W. 1884. Reconnaisance of Florida rivers with a view to shad hatching. Bull. U. S. Fish Comm., 4: 206-208.
——— 1885. Report of shad hatching operations at Battery Station, Havre de Grace, Md., season of 1885. Bull. U. S. Fish Com., 5: 401-410.
——— 1886. Report of operations at the Battery Island shad hatching station, Havre de Grace, Md., during the season of 1884. Rept. U. S. Fish Comm., 1884. 12: 199-208.
——— 1889. Report on the shad work of the steamer *Halcyon* during the season of 1887. Bull. U. S. Fish Comm., 1887, 7: 111.

HAMMER, R. C. 1942. The homing instinct of the Chesapeake shad, *Alosa sapidissima* (Wilson), as revealed by a study of their scales. Unpub. M. of S. Thesis, Univ. Md., College Park, 1-45, 8 fig.
——— 1946. Maryland commercial fish hatchery operations, 1944 and 1945. Md. Dept. Research and Ed., Ed. Ser. (11): 1-20.
———, HENSEL, H. A., and R. E. TILLER. 1948. Maryland commercial fisheries statistics 1944-45. Md. Dept. Research and Ed., Pub. 69: 1-48
——— and R V. TRUITT. 1941. Control of fishing intensity in Maryland. Trans. Amer. Fish. Soc., 71: 144-148.

HANSON, H. A., ZIMMER, P. D., and I. J. DONALDSON. 1950. Injured and dead fish in the vicinity of Bonneville Dam. U. S. Fish and Wildlife Srv., Spec. Sci. Rept., Fish. (29): 1-41, ill.

HARDING, C. W. 1882. Inquiries concerning the propagation of American smelt and shad, and notes on the fisheries of the Wash in England. Bull. U. S. Fish Comm., 1881, 1: 428-429.

HARPERS WEEKLY. 1894. Shadding in New York harbor. May 5, 38: 423.

HARRIS, G. 1883. Total amount of shad and herring caught on the Potomac river during the spring of 1882. Bull. U. S. Fish. Comm., 3: 477.
——— 1884A. Report upon the shad and herring fisheries of the Potomac river for 1883. Ibid., 4: 13. Also for 1884, Ibid., 4: 221.

——— 1885. Ibid., 1885. Ibid., 5: 192.
——— 1887. Ibid., 1886. Ibid., 6: 202.

HARRIS, G. 1941. New steps to save the shad. Balto. Sunday Sun Mag., June 1:: 1.

HARRISBURG PATRIOT. 1952. Shad-trucking experiment starts today. Harrisburg, Penn., May 5.

HARTSHORNE, H. 1872. Change of temperature in water containing recently fertilized shad eggs. Amer. Nat., 6: 202.

HASLER, A. D., and W. J. WISBY. 1951. Discrimination of stream odors by fishes and its relation to parent stream behavior. Amer. Nat., 85(823): 223-238, 1 fig.

HATTON, S. R. 1940. Progress report on the Central Valley fisheries investigations, 1939. Calif. Fish and Game, 26: 334-373, 6 fig., 1 map, 14 tables.

HAYS, A. N. (Compiler). 1952. David Starr Jordan. A bibliography of his writings, 1871-1931. Stanford Univ., Libr. Stud., 1: 1-195.

HEAPE, W. 1931. Emigration, migration, and nomadism. Cambridge Univ. Pr., xii-369.

HECHT, S. 1916. Form and growth in fishes. Journ. Morphol., 27: 379-400.

HEINHOLD, G. 1950. [Sport fishing for] Shad. In The Fisherman's encyclopedia, ed. by I. N. Gabrielson, and F. La Monte, Stackpole and Heck, Inc., Harrisburg, 549-551.

HENRY, F. 1947. Underwater lightning; the homecoming shad. The Balto., Sunday Sun, Features, May 4: 1.
——— 1950A. The fish you scale with a hoe. Balto. Sunday Sun Mag., 5-7.
——— 1950B. The industry a hurricane built. The Balto. Sunday Sun Mag., 5-7.

HENSEL, H. A., and R. E. TILLER. 1952. Maryland commercial fisheries statistics, 1946-1950. Md. Dept. Research and Ed. (95): 1-53, ill.

HERRINGTON, W. C., and R. A. NESBIT. 1943. Fishery management. U. S. Fish and Wildlife Srv., Spec. Sci. Rept., (18): 1-69.

HERRINGTON, W. C. 1943. Some methods of fishery management and their usefulness in a management program. *In* Fishery management, by W. C. Herrington and R. A. Nesbit, U. S. Fish and Wildlife Serv., Spec. Sci. Rept. (18): 3-22.

HESSE, R. 1940. Osmoregulation [in *Alosa* spp.] als Energieverbrauch. Jahrb. Preuss. Akad. Wiss., Phys.-Math., Kl., 79-80.
———, ALLEE, W. C., and K. P. SCHMIDT. 1937. Ecological animal geography. John Wiley and Sons, Inc., N. Y. xiv-597, 135 fig., [new edition pub. in 1951].

HEYDECKER, W. D. 1947(?) The shad program in its relation to INCODEL'S integrated water project. Atlantic States Marine Fish Comm., Mimeo., 1-5.

HIGGINS, E. 1934. Fishery biology; its scope, development and application. Quart. Rev. Biol., Sept.
———, 1941. Can the fisheries supply more food during a national emergency? U. S. Fish and Wildlife Srv., 1-16.

HILDEBRAND, S. F., and W. C. SCHROEDER. 1928. Fishes of Chesapeake Bay., Bull. U. S. Bur. Fish., 43: 1-366, 211 fig.

HITCHCOCK, F. R. M. 1887. Preliminary notes on the osteology of *Alosa sapidissima*. Amer. Nat., 21: 1032-1033.
——— 1888. Preliminary paper on structure of *Alosa sapidissima*. Proc. Amer. Assoc. Adv. Sci., 1887. 36: 259-260.
——— 1889. Further notes on the osteology of the shad (*Alosa sapidissima*). Ann. New York Acad. Sci., 1887-1889. 4: 225-228.

HOAR, W. S. 1953. Control and timing of fish migration. Cambridge Univ. Biol. Rev. 28: 437-452.

HOEK, P. P. C. 1895. Zur Hebung der Maifischzucht im Rhein. Allgem. Fischerei Zeitg. 20. Jahrg. 216-228.
——— 1897. De statistische methode en de "elftjes en fintjes" [the statistical method and the little shad, and allice shads]. Lecture del. before 6th Nederlands Nature en Geneeskundig Congress. Delft, Verh. 6 Natuur- en Geneesk. Congress [Utrecht]. 1-4.
——— 1899. Neuere Lachs- und Maifisch-Studien. Tijdschr. Nederl. Dilerk, Ver., 2(5): 156-242, 5 pl.
——— 1912. Les clupeides (Le hareng excepte) et leurs migrations. Conseil. Perm. Internat. Explor. Mer, Rapp. and Proc., Verb 14: 1-40.

HOGG, J. 1870. Notes on local fishes [*Alosa finta*]. Trans. Nat. Hist. Soc. Northumb., 3: 175-176.

HOLBERTON, W. 1892. Shad-fishing on the Susquehanna River. Harpers Wkly., Apr. 16, 36: 372-379.

HOLLIS, E. H. 1948. The homing tendency of shad. Science. 108(2804): 332-333.
——— 1952. Variations in the feeding habits of the striped bass, *Roccus saxatilis* (Welbaum), in Chesapeake Bay. Bull. Bingham Oceanogr. coll., 14(1): 111-131.
——— and C. M. COKER. 1948. A trematode parasite of the genus *Clinostomum* new to the shad, *Alosa sapidissima*. Journ. Parasit., 34(6): 493-495, 1 fig.

HOLMES, H. B. 1939. The success of the Bonneville fishways during their first year of operation. Prog. Fish Cult., 45: 1-16, ill.
——— 1940. The passage of fish at Bonneville Dam. Stanford Ichthy. Bull. Spec. Symposium Issue, 1(6): 185.

HOLT, J. 1945. Spring feast of shad. N. Y. Times Mag., April 15: 30.

HOLYOKE DAILY TRANSCRIPT-TELEGRAM. 1952. Shad arrive in Holyoke; bass using new fishway. May 31:1.

HOOVER, E. E. 1938. Biological survey of the Merrimack watershed [New Hampshire]. N. H. Fish and Game Dept., Surv. Rept. (3).
———, et al 1930. Report on chemical and biological investigations on the Connecticut River and its tributaries with the object of determining locations where shad larvae may be advantageously planted. Wesleyan University. Unpub. MS.

HOPKINS, F. S. 1938. The Chesapeake fisherman gets ready; nets for shad and herring. Balto. Sunday Sun Mag., Feb. 26.

HOPPER, G. L. 1929. Pilots necessary for fish to reach head of the Bay spawning grounds. Md. Conserv., 6(4): 23-24.

HORA, S. L. 1938. A preliminary note on the spawning grounds and bionomics of the so-called Indian shad, *Hilsa ilisha* (Hamilton), in the River Ganges. Rec. Ind. Mus., Calcutta, 40: 147-158, 2 fig.
——— 1940. Life history and wanderings of *Hilsa* in Bengal waters. Journ. Roy. Asiatic Soc., Bengal. Sci. (6): 93-112, 8 fig., 5 pl.
——— and K. K. NAIR. 1940A. Further observations on the bionomics and fishery of the Indian shad, *Hilsa ilisha* (Hamilton) in Bengal waters. Rec. Ind. Mus. Calcutta, 42: 35-50.
——— and ——— 1940B. Observations on the seaward migration of the so-called Indian shad, *Hilsa ilisha* (Hamilton). Ibid., 42: 529-552, 1 pl. 1 fig.
——— and ——— 1940C. The Jatka fishery of eastern Bengal and its significance in the fishery of the so-called Indian shad, *Hilsa ilisha* (Hamilton). Ibid., 42: 553-565.
HOWELL, S. 1837. Notice of the shad and shad fisheries of the river Delaware. Amer. Journ. Sci., 32: 134-140.
HUBBS, C. L., and K. F. LAGLER. 1947. Fishes of the Great Lakes region. Cranbrook Institute of Sci., Bloomfield Hills, Mich., 1-186, ill.
HUGHLETT, T 1882. Report of a Commissioner of fisheries of Maryland, January, 1882. Annapolis, 1-32.
——— and G. W. DELAWDER. 1883. Report of the Commissioners of fisheries of Maryland. January, 1883, Annapolis, 1-32.
HUNTINGTON, C. E. 1948. Report on pollution and fisheries in the Connecticut River. Conn. St. Brd. Fish and Game, unpub. MS.
HUNTSMAN, A. G. 1918. The scale method of calculating the rate of growth in fishes. Trans. Roy. Soc. Canada., 12(3): 47-52.
——— 1919. The growth of scales in fishes. Trans. Roy. Can. Inst., 12: 61-101.
——— 1922. The fishes of the Bay of Fundy. Contrib. to Canadian Biol., 1921, 51-72.
——— 1923. Natural lobster breeding. Bull. Biol. Brd. Canada, (6): 1-11.
——— 1944. Fishery depletion. Science. 99(2583): 534-535.
——— 1945. Freshets and fish. Trans. Amer. Fish. Soc., 75: 257-266.
——— 1946. Heat stroke in Canadian maritime stream fishes. Journ. Fish. Res. Brd. Canada. (7): 476-482, 2 fig.
——— 1948. Salmon and animal migration. Nature, 161: 300-305.
——— 1950. Factors which may affect migration; some examples from Canadian fish. Salmon and Trout Mag., Sept. 227-239.
HUSKE, C. J. 1883. Shad work in South Carolina. Bull. U. S. Fish Comm. 3: 446.
——— 1884A. Report on the shad work in South Carolina in 1883. Transportation of shad eggs on trays. Bull. U. S. Fish Comm., 4: 161-164.
——— 1884B. Shad fishing on the Edisto River, Ibid. 4: 165.
HUTCHENS, L., and G. E. HALL. 1951. Occurrence of the Ohio shad, *Alosa ohiensis* Evermann, in Eastern Oklahoma. Copeia. (1): 83-84.
HUYLER, A. J. 1876. Shad as shrimp eaters. Forest and Stream. 6: 233.
IL'IN, B. S. 1927. A new species of herring from the Southern Caspian. Festschr. fur Knipowitsch, Moscow, 69-75, ill. (In Russ.).
JACKSON, C. E. 1934(?) George Washington—the fisherman. U. S. Bur. Fish. Mimeo. 1-11.
——— 1939. Shad conservation; memorandum to state fishery administrators U. S. Bur. Fish., Mimeo., 1-6.
——— 1940. Relationship between commercial and sport fishermen. U. S. Bur. Fish., 1-10.
——— 1944. Chesapeake fisheries; history and outlook. Excerpts from remarks before Md. Conserv. Forum, Balto., Mimeo. 1-9.
JACKSON, H. W. 1952. I remember . . . shad bakes on the river floats. Balto. Sunday Sun Mag., April 20: 2.
JACOBSON, H (translator only). 1876. Living shad on their way to the Weser. From Weser Zeitung, Aug. 28, 1874. *In* Rept. U. S. Fish Comm., 1873-1875, 3: 330-335.
JAMES, M. 1950. Fishery management methods. *In* The fisherman's encyclopedia, Ed by I. N. Gabrielson and F. La Monte, Stackpole & Heck, Inc., Harrisburg, 345-381.
JANN, P. F. 1887A. Catch of shad in the Delaware River for 1885. Bull. U. S. Fish Comm., 1886. 6: 301.
——— 1887B. Ibid., 1886. Ibid., 6: 301-302.
JARVIS, N. D., and R. W. HINES. 1945. Salting river herring (alewives in Chesapeake Bay). U. S. Fish and Wildlife Srv., Fish Leaflet (26),
JENKINS, J. T. 1902. Altersbestimmung durch Otolithen bei den Clupeiden. Wiss. Meersuntersuch. Kiel, N. F., 60: 81-122.
JEWETT, E. 1872. Occurrence of shad and salmon in the Connecticut River. Rept. U. S. Comm. Fish., 1871-1872, 1: 137.
JOB, T. J. 1942. *Hilsa* investigations in Bengal waters. Sci. and Culture, Calcutta, 7: 427-429.
JOHANSEN, A. C., and A. KROGH. 1914. The influence of temperature and certain other factors upon the rate of development of the eggs of fishes. Conseil Internat. Explor. Mer., Publ. de Circonstance. (68): 1-44.
JOHNSON, F. F. 1938. Marketing of shad on the Atlantic Coast. U. S. Bur. Fish., Investigat. Rept. (38): 1-44, ill.
JONES, S. 1950. Bibliography of breeding habits and development of fishes of inland waters of India. Journ. Zool. Soc. India., 2: 109-125.
——— 1951. Bibliography and breeding habits and development of estuaries and marine fishes of India. Journ. Zool. Soc. India., 3(1): 121-139.
——— 1952. A bibliography of the Indian shad, *Hilsa ilisha* (Hamilton). Journ. Zool. Soc. India., 4(1): 89-99.
——— and P. N. G. MENON. 1950. Spawning of *Hilsa ilisha* (Hamilton),) in the Hooghly River, Sci. and Culture, 15: 443-444.
——— and ———. 1951. Observations on the life-history of the Indian shad, *Hilsa ilisha* (Hamilton). Proc. Indian Acad. Sci., 33: 101-125, ill.

——— and K. H. SUJANSINGANI. 1951. The hilsa fishery of the Chilka Lake. Journ. Bombay Nat. Hist. Soc, 50(2): 264-280, ill.

JORDAN, D. S. 1905. A guide to the study of fishes. Henry Holt & Co., N. Y. 1: xxvi-624, 393 fig., 2: xxii-599, 506 fig.

——— 1916. The first shad taken in the Columbia [River, Oregon]. Calif. Fish and Game, 2(3): 152,

——— 1922. The days of a man; being memories of a naturalist, teacher, and minor prophet of democracy. World Book Co., N. Y. I: xxviii-710, 2: xxviii-906, ill.

——— and B. W. EVERMANN. 1896-1900. The fishes of North and Middle America. Bull. U. S. Nat. Mus., (47- in 4 parts): 1-3313, 392 pl.

——— and ———. 1902. American food and game fishes. A popular account of all the species found in America north of the Equator, with keys for ready identification, life histories and methods of capture. Doubleday, Page and Co., N. Y. 1-573, 66 pl., 221 fig.

———, ——— and H. W. CLARK. 1930. Check list of the fishes and fishlike vertebrates of North and Middle America north of the northern boundary of Venezuela and Colombia. Rept. U. S. Comm. Fish., 1928. Pt. 2, iv-670.

——— and A. C. HERRE. 1906. A review of the herring-like fishes of Japan. Proc. U. S. Nat. Mus., 31: 613-645.

KAZANOVA, I. I., and N. A. KHALDINOVA. 1940. A report on the grounds and conditions of spawning of clupeids in the Volga Delta as shown by distribution of eggs and larvae. Trans. Inst. Marine Fish. and Oceanogr. 14: 77-108, 16 fig. (In Russ., Eng. summ.)

KENT, A. 1876A. Record of shad hatching operations conducted at Coppage's Landing on the Chester River, Md., from May 6th, 1875, to June 14th, 1875, on account of the State of Maryland. Rept. Comm. Fish. Md., 54.

——— 1876B. Journal kept of shad hatching camp on Chester River. Ibid., 71-79.

KESSLER, K. T. 1877. Fishes of the Aralo-Caspio-Pontine region. Trudy Aralo-Caspian Exped., pt. 4: 1-360. (In Russ.).

KIRTLAND, F. 1879. Shad spawning in October. Forest and Stream. 12: 5.

KISSELEWITCH, K. A. 1923. Materials on the biology of the Caspian herrings; 1. The fertility of the Wolge-Caspian herrings. Rept. Ichthy. Lab., Astachan, 5(1): 15-55, 6 pl. (In Russ., Eng. summ.).

KISSELWITZ, K. 1923. The clupeids of the Caspi-Volga District. Part I. Systematic. Brd. Fish. Moscow (Results Astachan Scie. Exped., 1914-1915), 1-155, 5 pl. (In Russ., Eng. summ.)

KLYKOV, A. A. 1940. Some idea concerning the biology of the black-backed herring. Bull. Acad. Scie., U R S S Biol., 717-740, (In Russ., Eng. summ.).

KNIGHT, J. T. 1874. Presence of shad in the rivers tributary to the Gulf of Mexico. Rept. U. S. Fish Comm., 1872-1873, 2: 391.

KNIGHT, W. 1883. A bill proposed to the Maryland legislature at the session of 1876, and entitled, "An act to regulate the catching and to provide for the preservation of fish in the waters of the State and of the Potomac River." Bull. U. S. Fish Comm., 1882, 2: 265-272.

KROGH, A. 1914. On the influence of the temperature on the rate of embryonic development. Zeitschr. für allgem. Physiol., 16: 163-177.

KUHNE, E. R. 1939. Guide to the fishes of Tennessee and the Mid-South. Div. Game and Fish., Nashville, 1-124, ill.

KULKARNI, C. V. 1950. Breeding habits, eggs and early life history of the Indian shad, *Hilsa ilisha* (Hamilton), in the Narbada River. Proc. Natl. Inst. Sci. India., 16: 169-176.

——— 1951. Hilsa fisheries in Narbada River. Journ. Bombay Nat. Hist. Soc. 49(4): 614-623.

KUNTZ, A., and L. RADCLIFFE. 1918. Notes on the embryology and larval development of twelve teleostean fishes. Bull. U. S. Bur. Fish., 1915-1916, 35: 87-134.

KUZNETZOV, I. D. 1894. On the spring migration of *Clupea caspica*. Journ. Fish. Ind., St. Petersburg, 9: 147-165. (In Russ.).

——— 1904. Zur Biologie der Wolgahäringe. Vest Rybopromysl. St. Petersburg, 19: 629-640.

LAGLER, K. F. 1949. Studies in freshwater biology. Edwards Bros., Ann Arbor, Mich., 1-231, 74 fig. [Rev. ed. pub. 1951].

LAGORCE, J. O. 1939. Shad. *In* Fishes and fisheries of our western seaboard. The book of fishes. Revised and enlarged, Nat. Geo. Soc., Wash., 1-94, ill.

——— [ed.]. 1952. The book of fishes. Nat. Geog. Soc., Wash., 1-339, ill.

LAIGHTON, C. 1882. The capture of shad at Isles of Shoals, New Hampshire Bull. U .S. Fish Comm., 1881. 1: 421.

LANCASTER NEW ERA. 1952A. Doubt shad can survive three dams. Lancaster, May 6.

——— 1952B. Shad returned to Susquehanna after 40 years; 'Taxiing' experiment begun today is first in Nation. Lancaster, May 5: 1.

LANG, W. 1879. Pacific Coast Shad. Forest and Stream. 12: 487.

LANKFORD, C. M., JR. et al. 1949. Report of the Commission of fisheries. *In* 50th and 51st Ann. Rept. Va. Comm. Fish., 9-10.

LANMAN, C. 1874. The shad and gaspereau or alewife of New Brunswick and Nova Scotia. Rept. U. S. Fish Comm., 1872-1873, 2: 461-462.

LATROBE, F. C. 1935A. The waters and mountains of Maryland 200 years ago. Md. Conserv. Fall issue.

——— 1923B. Maryland's depleted fisheries. Balto. Sunday Sun Mag., (1): 10, Sept. 8.

——— 1936. Sorrow in the seafood industry. Winter ice and spring rains make the season's prospects dismal. Balto. Sunday Sun Mag., Apr. 26: (1): 1.

———, DENMEAD, T., and E. L. LeCOMPTE. 1936. Shad battery island on the Susquehanna flats. Md. Conserv., 13(4): 22, 25.

LAWRENCE, G. W. 1874. Presence of shad in the rivers tributary to the Gulf of Mexico. Rept. U. S. Fish Comm., 1872-1873, 2: 392-393.

LEACH, G. C. 1923. Propagation and distribution of food fishes, 1922. U. S. Bur. Fish. Doc. 941: 1-116 (Contains shad hatching reports, 53-55), App. 17, Rept. U. S. Fish. Comm., 1922.

——— 1925. Artificial propagation of shad. *In* U. S. Bur. Fish. Doc. 981, App. VIII, Rept. U. S. Comm. Fish., 1924. 459-486, 8 fig.
——— 1936. Shad operations—North Carolina. Memorandum for the Commissioner. U. S. Bur. Fish., Unpub. MS. 1-3.

LEBEDINTSEV, A. A. 1905. Der Kaspische Hering (*Clupea ponto-caspica* var. *braschnikowii*) des Frühlings-und Herbstfangs des Jahres 1904 nach der chemischen Analyse. Vest Rybopromysl. St. Petersburg, 20: 238-240 (In Russ.).

LEGALL, J. 1950. Biologie des Clupeides (Le Harenge excepts) publie avec l'aide de Jean LeGall. Off. Sci., et Techniq. des Peches Maritimes, Paris. Mem. (scp. spec.) (14): 1-125, ill.

LEHMAN, B. A. 1953. Fecundity of Hudson River shad. U. S. Fish and Wildlife Srv., Research Rept. (33): 1-8, ill.

LEIDY, J. 1857. A synopsis of entozoa and some of their ectocongenera observed by the author. Proc. Acad. Nat. Sci. Phila., 1856, 8: 42-58.
——— 1862. Remarks on the food of shad. Proc. Acad. Nat. Sci. Phila., 1861, 2.
——— 1868. Remarks on shad brought to our markets during the late autumnal months which were caught in salt water, and their food. Proc. Acad. Nat. Sci. Phila., 228.
——— 1878. On parasitic worms in the shad (*Filaria capsularia*). Proc. Acad. Nat. Sci. Phila., 171.
——— 1888. Parasites of shad and herring. Journ. Compar. Medic. and Surg., 9: 211-217.

LEIM, A. H. 1924. The life history of the shad, *Alosa sapidissima* (Wilson), with special reference to the factors limiting its abundance. Contr. Canad. Biol., N. S., 2(11): 163-284, 45 fig.

LEMON, J. M., and R. V. TRUITT. 1941. Seafood and the diet. Md. Dept. Research & Ed., Pub. (42): 1-11

LENNURT, J T. 1883. Catch of spawning shad in the Potomac above Georgetown. Bull. U. S. Fish Comm., 3: 440.

LEONTE, V. 1943. Einige bemerkungen zur Biologie des spezies *Alosa nordmanni* Antipa. Anal. Inst. Cercet. Pisc. Romaniei, 2: 273-279.

LESTAGE, J. A. 1934. Notes de limnobiologie V. L'industrialisation de la parthenogenese artificielle chez l'Agone (Clupeidae: *Paralosa lacustris larina* Pir.). Ann. Soc. Zool. Belge. 64:: 69-74.

LIFE MAGAZINE. 1951. Life goes to a shad harvest; it is galloping race against 28-foot tide. N. Y., 152-156.

LILLEY, G. M. 1951. Shad time on the Susquehanna. Field and Stream, April.

LIN, S. Y. 1938. The *Hilsa* herring; notes on the life history of *Hilsa reevesii* (Richardson). Hong Kong Nat., 8: 245-248, 14 ill.

LINTON, E. 1901. Parasites of fishes of the Wood's Hole region. Bull. U. S. Fish Comm., 1899, 19: 405-492.

LITERARY DIGEST. 1937. Herring's kin. May 1: 123: 38.

LOCKINGTON, W. N. 1880. On the Clupeidae of the Pacific Coast. Amer. Nat., 14: 518-519.

LOMBARDO, A. C. 1884. La morfologia della Colonna vertebrale dei Clupeidi. Nat. Sicil. 3: 336-339, 2 pl., 4: 37-40.

LONG ISLAND FISHERMEN'S ASSOCIATION. 1949. Artificial propagation [of shad]. West Sayville. 17(7): 7.

LONN, E. 1924. Conservation of the products of Chesapeake Bay. Central (Balto.) Dist. Md. Fed. Women's Clubs, 1-28.

LOW, W. F. 1885. Report of operations at Havre de Grace shad hatching station during part of the season of 1883. Rept. U. S. Fish Comm., 1883, 11: 1043-1044.

LOZANO-REY, L. 1950. Itude systematique des Clupeides . . . de l'Espagne, du Marco et du Sahara Espagnols. Rapp. Cons. Explor. Mer. Copenh. 126: 7-20, ill.

LUCAS, F. A. 1901. [Notice of] Barton W. Evermann's paper on "The American species of shad," at the 357th meeting of the Biological Society of Washington. Science, 1901, N. S. 15: 1032.

LUGGER, O. 1877. Additions to list of fishes of Maryland, published in report, January 1, 1876. *In* Rept. Md. Fish. Comm., 1877, 57-94.
——— 1878. Additions to list of fishes of Maryland, previously published. *See* Rept. Jan. 1, 1876, and Jan., 1877. *In* Rept. Md. Comm. Fish., 1878, 107-125.

[LUNZ, G. R.] 1950. Summary of shad laws—south Atlantic states. Bears Bluff Lab., Wadmalaw Island, S. C. ,1.
——— 1951. Progress report, number 7, January through March, 1951: shad studies. Bears Bluff Lab., Wadmalaw Island, S. C., 1-2.

LUNZ, G. R., PENNEY, J. T., and T. P. LESESNE. 1944. Special study of the marine fishery resources of South Carolina. S. C. State Plan. Brd., Charleston, Bull. (14): 1-61.

MACDONALD, R. M. E. 1921. An analytical subject bibliography of the publications of the Bureau of Fisheries, 1871-1920. Rept. U. S. Fish Comm., for 1920, App V. 1-306.

MACKAY, H. H. 1934. Record of the alewife from Lake Huron. Copeia. (2): 97.

MAKARENKO, A. A. 1902. Der Edelfischefang auf dem Angaraflusse. St. Petersburg. 10 fig., 6 maps.

MANNING, J. R. 1931A. Fish and shellfish for food. U. S. Bur. Fish., Spec. Memo, No. 2256-B,
——— 1931B. Fish meal in animal feeding, with bibliography. Rept. U. S. Fish Comm., for 1930 (1931), App. XII, (1090): 371-407.

MANSUETI, R. 1950. An ecological study of the fishes of the Patuxent River drainage system, Maryland. Unpub. MS. Thesis, Univ. Md., College Park, 1-131, maps, graphs.

MARR, J. C. 1951. On the use of the terms abundance, availability, and apparent abundance in fishery biology. Copeia. (2): 163-169.

MARSHALL, N. 1949A. Report from the Virginia Fisheries Laboratory . . . for . . . 1947 . . . , through 1949. *In* 50th and 51st Ann. Rept. Va. Comm. Fish., 28-35.
——— 1949B. Conflicting interests in marine fisheries. Trans. 14th N. A. Wildlife Conf., 429-440.

MARSTON, P. M. 1939. Notes on the Connecticut River system *In* Biological survey of the Connecticut watershed. N. H. Fish and Game Comm., Surv. Rept. (4): 228-241, ill.
——— and M. GORDON. 1938. Notes on fish and early fishing in the Merrimack river system

In Biological survey of the Merrimack watershed. N. H. Fish and Game Comm. (3): 186-195.
MARYLAND CONSERVATIONIST. 1928. Fish ladders on dams. Md. Conserv., 5(4): 12.
MARYLAND DEPARTMENT OF RESEARCH AND EDUCATION. 1948. Effects of underwater explosions on oysters, crabs, and fish—a preliminary report. By Staff of Chesapeake Biological Laboratory. Pub. 70: 1-43, ill.
——— 1950A. Scientists study fish X-rays. Info. Release, Solomons, 1.
——— 1950B. Shad pond-reared at Solomons, to be tagged and released. Ibid., 1.
——— 1950C. Shad yield in Maryland on increase. Ibid., 1.
——— 1951. Fish culturists to distribute 18,000,000 shad fry in Maryland waters. Ibid., 1.
MARYLAND DEPARTMENT OF TIDEWATER FISHERIES. 1944. Annual Report. *In* First Ann. Rept. Md. Brd. Nat. Resources., 32-58.
———, VIRGINIA COMMISSION OF FISHERIES, and UNITED STATES FISH AND WILDLIFE SERVICE. 1940(?). Instructions for collectors of length measurements and scales of shad. Mimeo. 1-2.
MARYLAND SPORTSMEN, LEAGUE OF. 1948. Seagoing shad return to Chesapeake Bay. Rally Sheet. 6(6): 3.
MARTIN, D. E. 1947. Shad in the shadow of skyscrapers. Nat. Geog. Mag., March, 91: 359-376.
MASON, J. 1876. Record of shad hatching operations conducted at Freestone, Va., on the Potomac River from May 15th, 1875, to May 25th, 1875, on account of the United States Fish Commission. Rept. Comm. Fish. Md., 56.
MASSACHUSETTS CONSERVATION DEPARTMENT. 1944. [Shad using fishway at Lawrence]. Ann. Rept., Div., Marine Fish., June 30.
MASSMANN, W. H. 1951. Report to the Chesapeake Bay shad committee. Va. Fish. Lab., Unpub. MS, 1-2.
——— 1952. Characteristics of spawning areas of shad, *Alosa sapidissima* (Wilson), in some Virginia streams. Tran. Amer. Fish. Soc., 81: 78-93, ill.
——— and E. C. LADD. 1952. Variation in numbers of fishes seined before and after a storm. Copeia. (1): 40.
———, ———, and N. H. McCUTCHEON. 1952A. A surface trawl for sampling young fishes in tidal rivers. Trans. 17th N. A. Wildlife Conf., 386-392, ill.
———, ———, and ———. 1952B. A biological survey of the Rappahannock River, Virginia. Va. Fish. Lab., 2 parts: 1-221 (Mimeo.).
MATHER, F. 1876A. Voyage to Bremerhaven, Germany, with shad. Rept. U. S. Fish Comm., 1873-1875, 3: 328-330.
——— 1876B. Apparatus for hatching shad ova while en route to new waters. Ibid., 3: 372-376.
——— 1877A. A shad question. Forest and Stream, 9: 27.
——— 1877B. Those young shad. Ibid., 9: 68.
——— 1878. Another shipment of shad to California. Chicago Field, 9: 308.
——— 1881. Comparison of German and American shad (a discussion). Trans. Amer. Fish. Soc., 10: 5.
——— 1885. The shad fisheries of the Hudson. Bull. U. S. Fish Comm., 5: 177-180.
MAXFIELD, G. H. 1950. Maryland commercial fish hatchery operations, 1948 and 1949. Md. Dept. Research and Ed., Ed. Ser., (24): 1-12.
MAZZARELLI, G. 1905. Richerche sulla epizoozia degli (*Alosa finta*) manifestatasi nel lago di Lugana negli anni 1904 e 1905. Acquicolt. Lombarda, Milano, 7: 143-189, 2 pl.
——— 1907. La pesca degli agoni con la canna durante il periodo di frega covero su l'eterna quisatione del lago di Como. Considerazioni. Rev. Mens. Pesca, Milano, 9: 271-278. Ibid., 10: 105-110; 181-183. 1908.
——— 1909. L' epizoozia degli agoni del lago di Lugano nella primavera del 1908. Contributo alla conoscenza della pseudodifterite. Riv. Mens. Pesca, Napoli. 11: 79-100.
——— 1929. Agone [shad]. In Enciclopedia Italiana di Scienze, Lettere ed Art, Milano, 1: 903.
——— 1904. La mortalita degli agoni (*Alosa finta* Cuv.) nel lago di Lugano. Relazione. Acquicolt. Lombard., Milano, 6: 157-167.
McATEE, W. L. 1918. A sketch of the natural history of the District of Columbia . . . Bull. Biol. Soc. Wash., (1): 1-142, 5 maps.
——— and A. C. WEED. 1915. First list of the fishes of the vicinity of Plummers Island, Maryland. Proc. Biol. Soc. Wash., 28: 1-14.
McBEE, A. 1938 Tilghman Island ready for summer visitors. Herring fishing at Tilghman's. Balto. Sunday Sun Mag., May 22: (1): 1, 7 photo. Rotogravure.
McCULLOCH, A. R. 1911. . . . Fishes obtained . . . on the coasts of New South Wales, Victoria, South Australia, and Tasmania. Part I. [contains descr. *Clupea* (*Pomolobus*) *bassensis*]. 1-87, 16 pl.
McCULLY, H. 1949. Shad. *In* The commercial fish catch of California for the year 1947 with an historical review, 1916-1947. Calif. Fish and Game. Fish Bull. (74): 49-51, ill.
McDONALD, M. 1879. Annual report, Commissioner of Fisheries of the State of Virginia, 1879. 1-23, 3 fig., Richmond.
——— 1880. Our fisheries. *In* Report upon the fisheries and oyster industries of tidewater Virginia. . . . Richmond, 5-18.
——— 1882A. Annual report, Commissioner of fisheries [of Virginia], 1882. Richmond, 1-17, 4 fig.
——— 1882B. Transportation of shad eggs. Trans. Amer. Fish. Soc., 11: 11-13.
——— 1883. History of the experiments leading to the development of the automatic fish-hatching jar. Bull. U. S. Fish Comm., 1883. 3: 183-192; also in Trans. Amer. Fish. Soc., 1883 (1884): 34-36, 5 fig.
——— 1884A. Natural history of shad and alewives. *In* The fisheries and fishery industries of the United States, ed. by G. B. Goode, Sec. 1: 579-609, 8 pl.
——— 1884B. Distribution of shad through the central station by the United States Fish Commission in 1882. Rept. U. S. Fish Comm., 1882, 10: 899-902; also 881-883.
——— 1884C. Shad eggs sent to Cold Spring Harbour, New York, to be hatched. Bull. U. S. Fish Comm., 4: 198.
——— 1884D. A new system in fishway building. Trans. Amer. Fish. Soc., 1883 (1884): 57-74, 12 fig.

——— 1885A. Effect of waste products from Page's ammoniacal works upon young shad fry. Bull. U. S. Fish Comm., 5: 313-314.
——— 1885B. Report of shad propagation on the Potomac River during the season of 1885. Ibid., 5: 369-385.
——— 1886. Some objective points in fish-culture. Trans. Amer. Fish. Soc., 1885 (1886): 72-76.
——— 1887A. Distribution of shad fry during 1886. Bull. U. S. Fish Comm, 6: 302.
——— 1887B. Report of shad distribution for 1886. Ibid., 6: 427-432.
——— 1887C. Report of shad propagation on the Potomac River during the season of 1886. Ibid., 436-438; and Rept. U. S. Fish Comm., 1886 (1889); 14: 815-817.
——— 1887D. The rivers of eastern Florida, Georgia and South Carolina. *In* The Fisheries and fishery industries of the United States, by G. B. Goode, Sec. 5, 1: 613-625.
——— 1887E. The rivers and sounds of North Carolina. Ibid., 1: 625-637.
——— 1887F. The fisheries of Chesapeake Bay and its tributaries. Ibid., 1: 637-654.
——— 1887G. The fisheries of the Delaware River. Ibid., 1: 654-657.
——— 1887H. The fisheries of the Hudson River. Ibid., 1: 658-659.
——— 1887I. The Connecticut and Housatonic rivers and minor tributaries of Long Island Sound. Ibid., 659-667.
——— 1887J. Virginia and its fisheries. Ibid., Sect. 2, 449-473.
——— 1889A. Report of shad distribution for the season of 1886. Rept. U. S. Fish Comm., 14: 801-806.
——— 1889B. Report of shad propagation of the Potomac River . . . 1886. Ibid., 14: 815-817.
——— 1891. Report of the Commissioner. Rept. U. S. Fish Comm., 1887. 15: I-LXIII. (Contains: Notes on species propagated and distributed, the shad. XLII-XLIV; Rearing shad in ponds. XLVII-XLIX; Propagation of shad. XLIX-LI; Introduction and acclimatization of new species, the shad. LI-LII).
——— 1892. Report of the United States Commissioner of Fish and Fisheries for the fiscal year ending June 30th, 1889. Rept. U. S. Fish Comm., 1888. 16: IX-XXXIX. (Contains: Investigations relative to shad in California. XII: Fish ponds, Washington, D. C. XXVIII).
——— 1893. Report of the United States Commissioner of Fish and Fisheries . . . 1889-1890 and 1890-1891. Rept. U. S. Fish Comm., 1889-91 17: 1-96. (Contains: Shad hatching reports and experiments. 28-35; Fish ponds, Washington, D. C. 35-36; Aquaria at Central Station. 55).
——— 1894. Report of the United States Commissioner of Fish and Fisheries . . . 1892. Rept. U. S. Fish Comm., 1892. 18: VII-LXXXVII. (Contains: Shad hatching reports. XXVIII-XXXVII; Fish ponds, Washington, D. C. XXXVIII; Aquaria at Central Station. LXI-LXII).

McHUGH, J. L., and L. E. FITCH. 1951. An annotated list of the clupeoid fishes of the Pacific Coast, from Alaska to Cape San Lucas, Baja California. Calif. Fish and Game, 37(4): 491-495.

McLEOD, A. M., and P. NEMENYI. 1940. An investigation of fishways. Univ. Iowa, Stud. Eng. Bull. (24): 1-64, ill.

McNALLY, T. 1952A. [Hickory shad, *Pomolobus mediocris*]. *In* Water and Woods. Balto. Even. Sun., Balto., Apr. 6.
——— 1952B. Ample [hickory] shad seen for contest Sunday. Ibid., April 18: 39.
——— 1952C. Williams' shad take honors in Oliver event. Ibid., Apr. 21: 25.
——— 1952D. Good catches of hickory shad made in Susquehanna. Ibid., May 1: 52.
——— 1952E. [Hickory shad fishing in Maryland]. Ibid., May 25: 9D.

MEEHAN, W. E. 1881. Shad work on Delaware River. Trans. Amer. Fish. Soc., 36: 105-113.
——— 1893. Fish, fishing and fisheries of Pennsylvania (Pennsylvania's fish exhibit at the World's Columbian Exposition, Chicago, 1893), Harrisburg, 1-106, ill. Also reprinted in Rept. State Comm. Fish Penn., 1892-94 (1895), 257-392. Ibid., 1896 (1897), 313-449.
——— 1907. The shad work on the Delaware River in 1907 and its lessons. Trans. Amer. Fish Soc.,
——— 1902. The common food fishes of Pennsylvania. Rept. Fish. Comm. Penn., 1902, 125-154. 36th Ann. Meeting. 105-113.

MEEK, A. 1916. The migrations of fish. London, xx-427, ill.

MEISSNER, V. I. 1933. Commercial ichthyology. Snabtech., Moscow and Leningrad, 1-192, (In Russ.).

MELA, A. J. 1903. *Alosa finta* in Raumo. Lvonnon ystava. 9: 226. (In Finnish).

MEYER, J. T. 1945. Report of Superintendent of hatcheries, 1944-45. *In* 46th and 47th Ann. Rept., Va. Fish. Comm., Richmond, 14-15.
——— 1947. Ibid., 1946-1947. *In* 48th and 49th Ann. Rept., Ibid., 20-21.
——— 1949. Ibid., 1948-1949. *In* 50th and 51st Ann. Rept., Ibid., 23-24.

MIKHAILOVSKAYA, A. A. On form-building in the Caspian herring, *Caspialosa brashnikovi* (Borodin). C. R. Acad. Sci., Moscow, N. S., 30(6): 563-566. (In Russ.).

MILLER, R. R., and J. R. ALCORN. 1945. The introduced fishes of Nevada, with a history of their introduction. Trans. Amer. Fish. Soc., 73: 173-193.

MILNER, J. W. 1874A. Report on the propagation of the shad (*Alosa sapidissima*) and its introduction into new waters by the U. S. Fish Commission in 1873. Rept. U. S. Fish Comm., 1872-1873, 2: 419-451.
——— 1874B. The progress of fish culture in the United States. Ibid., 2: 523-558.
——— 1874C. Shad in fresh water, being a section of Prof. Baird's forthcoming report. Amer. Sportsman, 4:86.
——— 1876A. Operations in the distribution of shad in 1874. Rept. U. S. Fish Comm., 1873-75, 3: 323-326.
——— 1876B. Report of the *Triana* trip. Ibid., 3: 351-362.
——— 1876C. Experiments with a view to transporting shad in sea water. Ibid., 3: 363-369.
——— 1877. Cultivation of shad. Trans. Amer. Fish. Soc., 4: 70-72.
——— 1878A. The propagation and distribution of shad in 1877. Rept. U. S. Fish Comm., 4: 901-909.
——— 1878B. Hatching of shad eggs. Trans. Amer. Fish. Soc., 7: 87-89.
——— 1879A. The propagation and distribution of shad in 1877. Rept. U. S. Fish Comm. 5: 847-852.
——— 1879B. The work of shad hatching on the head waters of Chesapeake Bay. Trans. Amer. Fish. Soc., 1878. 87-89.
——— 1880A The propagation and distribution of shad in 1878. Rept. U. S. Fish Comm., 1878. 6: 611-628.

——— 1880B. The shad and the alewife. Harper's Mag., 60: 845.
——— 1880C. How anadromous fishes may return to their birthplace. Chicago Field, 13: 205.
——— 1880D. How fish find their own rivers. Chicago Field, 14: 220.
——— 1882. Summary of the fishing records for shad and alewives kept at Willow Branch fishery, North Carolina from 1835 to 1874. Bull. U. S. Fish Comm., 1881, 1: 396-400.

[MILNOR, W. JR.]. 1889. A history of the Schuylkill fishing company of the State of Schuylkill (Pennsylvania), 1732-1888. Pub. by members of Schuylkill Fishing Company, Phila., 1-446, ill.

MITCHELL, R. H., and Staff. 1925. A report of investigations concerning shad in the rivers of Connecticut . . . to the State Board of Fisheries and Game. Conn. State Brd. Fish. and Game, Hartford, 1-63.

MITCHELL, S. L. 1815. Memoir of ichthyology. The fishes of New York described and arranged. Trans. Lit. and Phil. Soc., N. Y., 1: 355-492; and Amer. Month. Mag. Crit. Rev., N. Y., 1817-18, 2; 241-248; 321-328.

MOHR, E. W. 1927. Bibliographie der Alters- und Wachstums-Bestimmung bei Fischen. Journ. du Conseil Internat. Explor. Mer., 2( ); 236-258; Ibid., 1930. 5(1): 88-100.
——— 1941. Stint und Maifisch. Demoll und Maier's Handbuch der Binnenfischerei Mitteleuropas. 3(7): 504-551, 29 fig.

MOORE, E., GREENE, C. W., et al. 1936. A biological survey of the Delaware and Susquehanna watersheds. Suppl. 25th Ann. Rept. N. Y. Conserv. Dept., (10): 1-356.
———, ———, ——— 1937. A biological survey of the Lower Hudson River watershed. Suppl. 26th Ann. Rept., N. Y. State Conserv. Dept., 9-18.

MORAN, J. A. 1943. Compromise is reached on fish-net bill. Agreement is concluded with Warfield, Woodfield announces. Revisions would limit scope of measure to 1942 licenses. Balto. Morn. Sun, March 23.

MORDECAI, E. R. 1860. Food of the shad of the Atlantic coast of the United States (*Alosa praestabilis* DeKay); and functions of the pyloric coeca. Bull. U. S. Fish Comm., 1: 277-282.

MORROW, J. E., JR. 1948. Schooling behavior in fishes. Quart. Rev. Biol., 23(1): 27-38.

MOSELEY, A. 1877. Annual report, Fish Commissioner of the State of Virginia for 1877, Richmond, 1-60.

MOSS, D. D. 1945. Preliminary studies of the shad migration in the Lower Connecticut River, 1944. Unpub. MS., Conn. State Brd. Fish and Game, Hartford 1-53, 10 fig. [also contains, "Supplemental explanation of two formulae used in text of manuscript," 1-2].
——— 1946. Preliminary studies of the shad (*Alosa sapidissima*) catch in the Lower Connecticut River, 1944. Trans. 11th N. A. Wildlife Conf., 1946, 230-239.
——— 1950A. The Connecticut River shad. Mimeo report, 1-6. Conn. State. Brd. Fish and Game, Hartford.
——— 1950B. Table showing shad catch and associated data, State of Connecticut.Ibid., 1.
——— 1951. Shad hatching and plants [in Connecticut waters]. Unpub. MS., Ibid., 1-5.

MUGNIER, A. D. 1950A. Herring run at Bournedale, [Massachusetts], May 23 and 24, May 29-June 1, and June 28-29, 1950. Unpub. Memorandum, Holyoke Water and Power Co., 1-4, and 1-4.
——— 1950B. Observations of shad trapped in tailrace at Holyoke, Massachusetts; observations of shad at Windsor Locks, Connecticut. Unpub. MS., Holyoke Water and Power Co., 1-6.
——— 1951. Report of the investigations for and tentative design of the fishway at Holyoke, Massachusetts. Unpub. MS., Report of Project Engineer, Holyoke Water and Power Co., 1-64, ill.

MUGNIER, A. D., and A. H. SWARTZ. 1951. Report of the investigations for and tentative design of the fishway at Holyoke, Massachusetts. U. S. Fish and Wildlife Srv., 1-47, ill.

MUNSELL, W. W. 1880. History of Luzerne, Lackawanna, and Wyoming Counties. . . . N. Y.

MURPHY, T. E. 1947. Here come the shad. Sat. Eve. Post, March 22, 219: 34-35.

MYERS, G. S. 1949. Usage of anadromous, catadromous, and allied terms for migratory fish. Copeia. (2): 89-96.

NAIR, K. K. 1939. On some early stages in the development of the so-called Indian shad, *Hilsa ilisha* (Hamilton). Rec. Ind. Mus. Calcutta, 41: 409-418, 1 pl.

NASH, C. W. 1908. Check list of the fishes of Ontario. *In* Vertebrates of Ontario. Ontario Dept. Ed., Toronto, 1-122, 8 fig., 32 pl.

NATIONAL GEOGRAPHIC SOCIETY. 1924. The book of fishes: game fishes, food fishes, shellfish and curious citizens of American ocean shores, lakes and rivers. Nat. Geog. Soc., 1-243, 92 col. pl. 134 fig., [Enlarged, revised edition issued in 1939]. [See LaGorce, J. O.]

NEDOZHIVIN, A. J. 1912. Zur Entwicklungsgeschichte der Schwimmblase der *Clupea kessleri*. Trd. Obsc. Jest., Saratov, 6(1): 19-32, 3 pl.
——— and M. TICHIJ. 1913. The determination of the age of *Clupionella caspica* typ. Eichw. Contri. to Knowl. of Russ. Fish., 20(6): 17-38, 3 pl., 4 fig. (In Russ.).

NEWENYI, P. 1941. An annotated bibliography of fishways; covering also related aspects of fish migration, fish protection and water utilization. Univ. Iowa. Stud. Eng., Bull. (13): 1-64, ill.

NESBIT, R. A. 1933. A new method of marking fish by means of internal tags. Trans. Amer. Fish. Soc., 63: 306-307.
——— 1934. A convenient method for preparing celluloid impressions of fish scales. Conseil Internat. pour Explor. de la Mer. 9(3): 373-376.
——— 1939. How shad can be brought back in Chesapeake Bay and North Carolina. Mimeo. rept., U. S. Bur. Fish., (84052): 1-7. [also presented before Tri-State meeting of conservation officers of Maryland, Virginia, and North Carolina, at Richmond, Dec. 7.]. [reprinted in Md. Conserv., 17(1): 12, 24.].
——— 1940(?). The problem of conservation of the Hudson River shad. U. S. Fish and Wildlife Serv., Unpub. MS., 1-6.
——— 1940. Suggestions for allowing more shad to spawn in Chesapeake Bay and North Carolina. Delivered at a meeting of Fish Commissioners of North Carolina, Virginia, and Maryland, at Washington, D. C., Jan. 8. Mimeo. U. S. Fish and Wildlife Srv., 1-7.
——— 1942(?). Shad conservation in Chesapeake Bay. U. S. Fish and Wildlife Srv., Unpub. MS., 1-19.

——— 1943A. Biological and economic problems of fishery management. *In* Fishery management, by W. C. Herrington and R. A. Nesbit.. U. S. Fish and Wildlife Srv., Spec. Sci., Rept. (18): 23-54, ill.
——— 1943B. Maryland's fisheries lab. Balto. Morn. Sun, March 23.
——— and L. A. CABLE. 1943. The shad fishery of the Atlantic Coast of the United States with recommendations for its development and conservation. Hearings before the select committee on conservation of wildlife resources, House of Representatives, 77th Congress of the United States, Nov. 17-19, 1942. Washington: 85.

NEW CASTLE JOURNAL-EVERY EVENING. 1952. Shad are back at New Castle but not in their old numbers; pollution eases up enough to bring some fish but only enough to remind old-time rivermen of better times many years ago. New Castle, Delaware. Apr. 19: 1.

NEWCOMBE, C. L. 1945. Fishery statistical program. *In* 1944-1945 Ann. Rept., Va. Fish. Lab., in 46th and 47th Ann. Rept., Va. Comm. Fish., Richmond, 28-29.

NEW JERSEY COMMISSION OF FISHERIES. 1871. First annual report. Trenton.

NEW JERSEY BOARD OF FISH AND GAME COMMISSION. 1912. Annual report. Trenton, 1-32.
——— 1913. Shad and sturgeon. *In* Annual Report. Ibid., 25-28.
——— 1914. Annual Report. Ibid., 1-34.

NEW JERSEY DIVISION OF FISH AND GAME. 1949. Hudson river shad. *In* Ann. Rept., 29.
——— 1952. Compendium of New Jersey fish laws . . . Trenton, 1-3.

NEWSWEEK. 1937. Big-city publicity helps to sell small-town fish [alewives]. May 1: 9: 36.

NEW YORK COMMISSION OF FISHERIES. 1870. Annual Report. Senate Doc. 69.

NEW YORK CONSERVATION DEPARTMENT. 1952. New York fish and game syllabus. Albany, 1-32.

NEW YORK FOREST, FISH AND GAME COMMISSION. 1908. Thirteenth Annual Report. Albany, 194.

NEW YORK TIMES. 1931. Season for shad in Georgia extended. Apr. 4, 3(5): 6.
——— 1932. New York State Conservation Department planted 3,000,000 young shad in Hudson River. Aug. 23, 21: 4.
——— 1933. Shad fishing season opens in Georgia. Jan. 8, 4(8): 4.
——— 1935A. Catching shad in Hudson River. Feature article, May 26, 11(27): 1.
——— 1935B. Abundance of shad in Connecticut River draw fishermen as sport is revived. July 2, 23: 3.
——— 1936. Good catch of shad expected as floods cleanse Delaware River of pollution. March 23, 12: 2.
——— 1937A. Newport News, Virginia, fishermen strike against reduction in dealers' price for shad. March 13, 9: 3.
——— 1937B. Hudson river shad fishing. Feature article. May 2, 7(18): B.
——— 1938. U. S. Fisheries Bureau report on Hudson River shad catch. Spring, 1938. Aug. 8, 15: 3.
——— 1939. Hudson River shad fishing to be curbed for U. S. Navy fleet visit. March 4, 19: 7.
——— 1943A. Hudson River shad run affected by cold weather. April 7, 27: 4.
——— 1943B. G. Kotze blames poor run on moon phase, not cold weather. April 18, 38: 1.
——— 1943C. New York State War Council suspends 36-hour net lift period; extends netting of shad until June 15, to aid food supply. April 30, 22: 3.
——— 1945. U. S. Fish and Wildlife Service reports on biologist L. Cable's shad studies. May 6, 35: 4.
——— 1946A. Hudson river shad fishermen prepare for early run. Feb. 23, 25: 6.
——— 1946B. W S A clears Hudson River for shad fishermen. April 17, 31: 2.
——— 1947A. Cold weather blamed for poor season, Hudson River shad run. May 12, 27: 7.
——— 1947B. Fisheries group to study decline of shad in Hudson River. July 19, 15: 7.
——— 1948A. Hudson River shad season ends; reported poorest in 50 years, May 25, 30: 2.
——— 1948B. U. S. Fish and Wildlife Service report on tagging. Aug. 16, 21: 5.
——— 1950. New York State Conservation Department concerned over small Hudson River catch; factors cited. May 17, 58: 7.
——— 1951A. Shad start spring run; fishermen expect to supply the market (at Edgewater, N. J.). April 5.
——— 1951B. Hudson River season ends; reported poorest on record. May 19, 18: 6.
——— 1951C. Small fish found hardy; trout and salmon withstand 1,000 pounds [water] pressure [in experiments conducted at Scripps Institute of Oceanography]. Aug. 19, 100(34): 175.
——— 1952A. Striped bass run up Hudson again. March 26.
——— 1952B. Fishermen's feud ended at Montauk. April 20.

NEW YORK, STATE OF. 1947. An act to amend the conservation law, in relation to licensing commercial fishing operations for food fish. Introduced by Mr. Barrett. In Assembly No. 2861, Int. 2623, 1-11.

NICHOLS, J. T. 1918. Fishes of the vicinity of New York City. Amer. Mus. Nat. Hist., Hdbk. Ser. (7): 1-122, 1 pl. 51 fig.
——— and C M. BREDER. 1927. The marine fishes of New York and southern New England. Zoologica, 9(1): 1-192, 261 fig.

NIDEVER, H. B. 1916. Shad in California. Calif. Fish and Game. 2(2): 59-64, ill.
——— 1937. Shad. *In* The commercial fish catch of California . . . 1935. Calif. Fish and Game, Fish. Bull. (49): 54-56.

NOBRE, A. 1895. A pesca do savel (*Alosa vulgaris*) e da sardinha (*Alosa pilchardus*) na bahia do Douro. Ann. Scie. Nat., Porto, 2: 179.

NOEL DE LA MORINIERE, S. B. J. 1801. On the means to be employed for multiplying fish [Refers to the experiments of B. Franklin and observations of Liancourt on the herring of the Potomac, Hudson, Delaware and Elk rivers]. Phil. Mag., 10: 159-165.
——— 1810. Memoire sur la feinte, ' *Clupee feinte* (*Alosa picta auctorum*). Mag. Ges. Naturf. Freunde, Berlin, 4: 310-314.

NORDQVIST, O. F. 1894. Shadodlingen i Amerika. Fiskeritidskr. Finl., 3: 21-24.

NORRIS, T. 1865. The shad. *In* The American Angler's Book . . . E. H. Butler & Co., Phila., 171-174.

——— 1902. Brut von *Clupea alosa* var. *finta*. Ibid., 11: 150 [In Swedish].
——— 1868A. American fish-culture, embracing all the details of artificial breeding and rearing of trout; the culture of salmon, shad and other fishes. H. T. Coates and Co., Phila., 1-304, ill.
——— 1868B. Plea for shad and the alewife. Lippincott's Mag., 3: 448.
——— 1874. Shad by fishing, the why and the wherefore. Forest and Stream, 2: 172.

NORTH CAROLINA DIVISION OF COMMERCIAL FISHERIES. 1949. . . . Regulations . . . relative to the commercial fisheries . . . Raleigh, 1-71.

ODELL, T. T. 1934. The life history and ecological relationships of the alewife, *Pomolobus pseudoharengus* (Wilson) in Seneca Lake, New York. Ph.D. Thesis, unpublished, Cornell Univ., Ithaca, N. Y.

O'MALLEY, H. 1928. Giving the fish a lift. Outdoor America, Aug.

OREGON FISH COMMISSION. 1948A. Tagged shad caught after year at sea. Fish. Comm. Research Briefs. 1(1): 23.
——— 1948B. Shad tagging in the Umpqua River, Ibid., 1(2): 40.
——— 1948C. Shad caught at Celilo Falls on the Columbia River. Ibid., 1(2): 9.
——— 1949. Biennial Report of the Fish Commission. State of Oregon, 35.

ORR, C. B. 1952. Try shad. Tackle Box, Chesapeake Skipper, 10(4): 11

OSBORN, J. H. 1882. Notes and suggestions concerning the Florida shad fishery. Bull. U. S. Fish Comm., 1881. 1: 351.
——— 1883. Shad fishing on the Saint John's River. Ibid., 1882, 2: 132.

OUTDOOR GEORGIA. 1945. Poor catches of shad lift prices high. Savannah. March 1, 5(28): 2.

OUTDOORS ILLUSTRATED. 1951. Fish out of water; shad are caught by horse-and-cart fishing in Nova Scotia. 3(4): 34-39, ill.

OUTLOOK. 1903. Shad-fishing. April 25, 73: 955-956.

PACIFIC MARINE FISHERIES COMMISSION. 1848. Shad fisheries. *In* History and development of the Commission. Coordinated plans for the management of the fisheries of the Pacific Coast by the research staffs of California, Oregon, and Washington. Portland, Oregon, 54-56.

PAGE, G. S. 1881. Proposed introduction of shad into British and Irish Rivers. Trans. Amer. Fish. Soc., 10: 3-4.
——— 1882. Cultivation of shad. Ibid., 11: 16-18.

PAGE, W. F. 1885. Effects of sunlight upon shad eggs. Bull. U. S. Fish Comm., 5: 308.

PALMER, G. H. 1873. The food fishes of the New England coast Rept. U. S. Fish Comm., 1871-72, 1: 88-103.

PANCOAST, J. 1951A. State to study shad spawning habits in upper Susquehanna. Phila. Even. Bull., April 19.
——— 1951B. Study of Susquehanna shad authorized by State Bill. Ibid., June 11.
——— 1951C. Shad's fight against big dam disheartening to sportsmen. Ibid., June 13.

PARSONS, J. S. 1917. The fisheries of Chesapeake Bay and the co-operation of Maryland and Virginia for their conservation. *In* 18th Ann. Rept., Va. Fish. Comm., Richmond, 18-24.

PATTISON, H. A. 1874. Presence of shad in rivers tributary to the Gulf of Mexico. Rept. U. S. Fish Comm., 1872-73, 2: 394-395.

PAUCA, M. 1931. *Alosa nordmanni* Antipa aus dem Pontien von Targu-Jiu. Bull. Acad. Roumaine, Bucaresti. 14: 106-107, 2 pl.
——— 1934. [Fishes]. *In* Die fossile Fauna und Flora aus dem Oligozän von Suslanesti-Muscel in Rumänien. Anu. Inst. Geol. Roman., Bucaresti. 16: 597-642.
——— 1935. Poissons fossiles du Pontien de l'Oltenie. Bull. Soc. Romaine, Geol. Bucaresti, 2: 98-103, 2pl.

PEARCE, S. 1866. Annals of Luzerne County . . . from the first settlement in Wyoming Valley to 1866. 2nd Ed. Phila., J. B. Lippincott, 1-564.

PEARSON, J. C. 1932. Winter trawl fishery off the Virginia and North Carolina coasts. U. S. Bur. Fish., Invest. Rept. 10: 1-31.
——— 1938. Rearing young shad in ponds. U. S. Fish and Wildlife Serv., Unpub. MS., 1-9.
——— 1944. Shad. *In* 38th Ann. Rept. S. C. State Brd. Fish., 1944, 14-16.
——— 1949. Experiments on hatching shad eggs in water of varying salinities. Unpub. MS., U. S. Fish and Wildlife Serv., Beaufort, Sept.
——— 1952. Rearing young shad in ponds. Prog. Fish-cult. 14(1): 33-36.

PEIRCE, M. P. 1880A. Shad hatching and shad laws. Forest and Stream. 15: 67.
——— 1880B. How the first shad were hatched. Ibid., 15: 166.
——— 1880C. Shad hatching and carp. Ibid., 15: 386.

PELL, R. L. 1859. Edible fishes of New York, their habits, and manner of rearing and artificial production. Ann. Rept. N. Y. State Agric. Soc. Trans., 18: 334-397

PEL'TZAM, E D. 1886. Biologische Uebersicht ueber die Kaspischen Heringe [From the Volga Expedition, 1885]. Naturf. Ges. Kasan, 15(5): (In Russ.)

PERCEVA, T. A. 1939. The development of the Caspian shad, *Caspialosa caspia* (Eichw.) Trans. Inst. Marine Fish. and Oceanogr., Moscow, 8: 27-65, 14 fig. (In Russ., Eng. summ.)

PENNSYLVANIA FISH COMMISSION. 1890. Report for . . . 1887 and 1888. The laws of Pennsylvania relating to fish and fishing. Harrisburg, 1-4, 1-91.
——— 1892. Report for . . . 1889, 1890, 1891. Ibid., 3-5.
——— 1895. Report for . . . 1892, 1893, 1894. Ibid., 5-6, 257-392.
——— 1896. Report for 1895. Ibid., 5.
——— 1898. Report for . . . 1898. Ibid., 6-13.
——— 1900. Report for . . . 1899, Ibid., 15-32, 82-83, 156-159, 222-224.
——— 1901. Report . . . 1900. Ibid., 15, 17-20, 23-26, 103.
——— 1902. Report of . . . 1902. Ibid., 99, 111-124, 125-154.

PENNSYLVANIA DEPARTMENT OF FISHERIES. 1916. Annual Report, Harrisburg, 1-198.
——— 1917. Annual Report . . . 1915 . . . 1916. Ibid., 1-163.

PENNSYLVANIA BOARD OF FISH COMMISSIONERS. 1940. Biennial Report . . . ending . . . 1940. Harrisburg, 1-130.

——— 1950. Combined biennial report . . . 1950, Ibid., 1-168.

PENNSYLVANIA JOINT STATE GOVERNMENT COMMISSION. 1949. Susquehanna river fishways. A report . . . to the General Assembly of the Commonwealth of Pennsylvania. Harrisburg, 1-59.

PENNSYLVANIA WATER AND POWER COMPANY. 1949. Hydroelectric power development of the Susquehanna River. Holtwood. 1-47.

PERKINS, Mrs. G. A. 1870. Early times on the Susquehanna [shad in the New York State portion]. Malette and Reid, Print., Binghamton, 1-290.

PERLEY, M. H. 1851. Catalogue (in part) of the fishes of New Brunswick and Nova Scotia. *In* Report upon the fisheries of the Bay of Fundy. Fredericton, 118-159.

——— 1852. Reports on the sea and river fisheries of New Brunswick. 2nd Ed., Fredericton, 1-294.

PERTZEVA, E. A. 1940. The spawning of the Caspian shad as shown by the distribution of eggs and larvae. Part I. *Caspialosa caspia* (Eichw.). Trans. Inst. Marine Fish. and Oceanogr. U. S. S. R, Moscow, 14: (in Russ., Eng. Summ.).

PETERS, W. C. H. 1875. Ueber die Unterschiede der nordamerikanischen Alse oder Shad, *Clupea praestabilis*, von der europäischen, *Clupea alosa*. Circul. Deutsch. Fischerei-Ver. 1874 (1875). 1(5): 198-199.

PHILADELPHIA EVENING BULLETIN. 1953. Five-day week for shad. April 15.

PHILIPS, B. 1874A. Shad in Ohio rivers. Forest and Stream. 2: 136.

——— 1874B. Why shad have not been found above the Holyoke dam. Ibid., 2: 356.

——— 1878A. Confusion in the names of some of the American fishes of the herring family. Forest and Stream, 10: 82.

——— 1878B. Fish for the Susquehanna. Ibid., 10: 195.

——— 1878C. The nonsense about shad. Ibid., 10: 238.

——— 1878D. Herring, shad, and eels in the Potomac. Ibid., 10: 462.

PIEPMEYER, L. W. 1885. Report of the operations of the United States Fish Commission steamer Fish Hawk, in shad hatching, on the Delaware river, season of 1885. Bull. U. S. Fish Comm., 5: 395-399.

PINKETT, H. T. 1951. Maryland as a source of food supplies during the American Revolution. Md. Hist. Mag., 46(3): 157-172 [163].

POLK, B. H. 1878. Arkansas shad. Forest and Stream. 10: 296.

POLL, M. 1947. [Shads]. *In* Faune de Belgique. Poissons Marins. Bruxelles, 1-452, 267 fig.

POLLARD, I. W. 1874. Presence of shad in rivers tributary to the Gulf of Mexico. Rept. U. S. Fish Comm., 1872-73, 2: 391-392.

POLLEN, F. P .L. 1872. De elft [*Alosa alosa* Linn.]. Alg. Visscherij.-Courant, Nos. 6, 7, and 10.

POPOVICI, Z. 1942. Betrachtungen ueber das Vorkommen des Sonenbasches (*Eupomotis aureus* P. im Küstensee "Tabacaria," am Schwarzen Meere. Anal. Inst. Cercet. Pisc. Romaniee. 1: 59-65.

PORTER, B. B. 1878. Shad in California. Chicago Field. 6: 229.

PORTER, L. S. 1921. Shad. Harper's Mag., July, 143: 256-258.

POUCHET, C., and E. BIETRIX. 1889A. Sur le developement de l'Aose et de la Feine. Journ. Anat. Physiol., Paris. 25: 628-639.

——— and ———. 1889B. Sur l'oeuf et les premiers developpement de l'Alose. Comp. Rend. Acad. Sci., Paris. 109: 951-953.

POWERS, E. B. 1939. Chemical factors affecting the migratory movements of the Pacific salmon. Amer. Assoc. Advance. Sci., Pub. (8): 72-85.

——— 1941. Physico-chemical behaviors of waters as factors in the "homing" of the salmon. Ecology. 22(1): 1-16.

PRASHAD, B., HORA, S. L., and K. K. MAIR. 1940. Observations on the seaward migration of the so-called India shad, *Hilsa ilisha* (Hamilton). Rec. Ind. Mus. Calcutta, 42: 529-552, 1 pl., 1 fig.

PRATT, J. H. (Compiler). 1906. Report of Committtee appointed by Governor R. B. Glenn to investigate the fishing industries in North Carolina. N. C. Geol. Surv., Econ. Pap, (13): 1-75.

PRIME, W. C. 1876. Fly fishing for shad. Forest and Stream. 6: 138-139.

PRINCE, E. E. 1903. The hatching of shad. 35th Ann. Rept. Dept. Marine and Fish., Ottawa, 1902. LXXXII-LXXXVI.

——— 1907. The eggs and early life history of the herring, gaspereau, shad and other clupeoids. Contrib. Canad. Biol., 1902-1905, 95-110; also suppl. 39th Ann. Rept. Dept. Marine and Fish., Ottawa.

——— 1912. The shad fishery of Canada and its restoration. Sea fisheries of eastern Canada. Canada Comm. of Conserv., 120-136.

———, MELANSON, S., and S. F. MORRISON. 1910. Dominion shad fishery commission. 1908-10. Report and recommendations. Ottowa, I-LIII; 1-115.

PRITCHARD, A. I. 1929. The alewife (*Pomolobus pseudoharengus*) in Lake Ontario. Univ. Toronto Stud., Ont. Fish. Research Lab. (38).

PUTNAM, F. W. 1872. On the alewives and other fishes collected in the Wenham lake. Bull. Essex Inst., 3: 88-90.

QUITTMEYER, C. L. 1950. The marketing of Virginia seafood. Committee of Fisheries and Markets, Advisory Council on the Virginia Economy, Richmond, 1-70, ill.

RADCLIFFE, L., and W. W. WELSH. 1917. Notes on a collection of fishes from the head of Chesapeake Bay. Proc. Biol. Soc. Wash., 30: 35-42.

RADFORTH, I. 1944. Some considerations on the distribution of fishes in Ontario. Contr. Roy. Ontario Mus. Zool. (25): 1-116, ill.

RANEY, E. C. 1951. [Hickory shad, Ohio shad, and American shad]. *In* The Wise Fishermen's Encyclopedia . . . Ed. by A. J. McClane. W. H. Wise and Co., Inc., N. Y., 542-543, 810-811, and 1043-1044.

——— 1952. The life history of the striped bass, *Roccus saxatilis* (Walbaum). Bull. Bingham Oceanogr. Coll., 14(1): 5-97, ill.

RAVENEL, W. DEC. 1889A. Report of operations at Battery Station, Havre de Grace, Md., for the year ending December 31, 1886. Rept. U. S. Fish Comm., 1886, 14: 761-763.
——— 1889B. Ibid., 1887. Bull. U. S. Fish Comm., 7: 95-100.
——— 1896. Report on the propagation and distribution of food fishes. Rept. U. S. Fish Comm., 1895. 31: 6-72. (Contains: shad hatching reports, 22-24; Fish ponds, Washington, D. C. 24; Aquaria, Central Station. 27).
——— 1898. Ibid., Ibid., 1896, 22: 11-92. (Contains: Shad hatching reports. 33-40, 44-47; Carp ponds, Washington, D. C., 44).
——— 1899. Ibid., Ibid., 1898. 24: XXXI-CXXII. (Contains: Shad hatching reports, LVI-LXII; Fish ponds, Washington, D. C., LXIV-LXVI).
——— 1901. Ibid., Ibid., 1900. 26: 25-118. (Contains: Shad hatching reports, 49-51, 53, 57-59; Fish lakes, Washington, D. C. 52-53).
——— 1902. Ibid., Ibid., 1901. 27: 21-110. (Shad hatching reports, 42-44, 46, 50-51; Fish lakes, Washington, D. C., 45).

REDDING, B. B. 1879. Grand success of shad and salmon culture. Chicago Field, 11: 277.

REES, W. 1950. Yearly migrations of shad at Bonneville. Unpub. MS. U. S. Fish and Wildlife Srv., Beaufort.

REDEKE, H. C. 1938. Ueber den Bastard *Clupea alosa finta* Hoek. Arch. Neerl. Zool. 3 (suppl.): 148-158.

REGAN, C. T. 1911A. The air-bladder of the clupeoid fishes. Science, N. S. 24: 684.
——— 1911B. The freshwater fishes of the British Isles. Methuen, London, xxv-287, 37 pl.
——— 1912. The Twaite shad in Killarney lakes. Irish Nat., Dublin. 21: 63.
——— 1916. The British fishes of the sub-family Clupeinae and related species in other seas [new descr. of *Alosa africana, Alosa finta killarnensis,* and *Alosa algeriensis*]. Ann. Mag. Nat. Hist., 18: 1-19, 3 pl.
——— 1917. A revision of the clupeoid fishes of the genera *Pomolobus, Brevoortia,* and *Dorosoma* and their allies. Ann. Mag. Nat. Hist., London, 19(8): 297-316.
——— 1932. Guide to the British fresh-water fishes exhibited in the Department of Zoology, British Museum (Natural History). 2nd Ed., Cromwell Rd., London, 1-38, 23 ill.

REIDEL, W. 1894. Zur Frage der Maifische-Erbrütung. Allgem. Fischerei Zeit. 19: 59:60.

REPPERT, R. 1952. Shad that flash 50-cent fins. Balto. Sunday Sun Mag., April 27: 12-13, 18, ill.

REY, D. L. L. 1929. Los Clupeidos de la Peninsula Iberica y del Rif. Mem. Soc. Esp. Hist. Nat. Madrid, 15: 647-666, 2 pl.
——— 1947. Peces ganoideos y fisostomos. Mem. R. Acad., Madrid, 11: 1-839, 20 pl.

RICE, H. J. 1878. Notes upon the development of the shad, *Alosa sapidissima.* Rept. Comm. Fish. Md., 95-106.
——— 1884. Experiments upon retarding the development of eggs of the shad, made in 1879, at the United States shad hatching station at Havre de Grace, Md., Rept. U. S. Fish Comm., 1881. 9: 787-794.

RICHMOND, FEDERAL RESERVE BANK OF, 1951. Inventory of economic research studies in the fifth Federal Reserve District . . . Richmond, two parts.

RIDEWOOD, W. G. 1891. The air-bladder and ear of British clupeoid fishes. Jour. Anat. Physiol., London. 2(6): 26-42, ill.
——— 1905. On the cranial osteology of the clupeoid fishes. Proc. Zool. Soc. London, (1): 448-493, 25 fig.

RIVAS, L. R. 1949. Checklist of the Florida game and commercial marine fishes. Marine Lab., Univ. Miami, Coral Gables. Ed. Ser. (4): 1-39.

ROBISON, R. S. 1948. Commercial fishing. *In* 1948 Ann. Rept. Washington State Dept. Fish., 86-153.
——— 1949. Statistics, licenses, and tax division. Ibid., 1949, 112-168.

ROEDEL, P. M. 1948. Common marine fishes of California. Calif. Fish and Game. Fish. Bull. (68): 1-153, ill.
——— 1953. Common ocean fishes of the California coast. Ibid., Fish Bull. (91): 1-184, ill.

ROELOFS, E. W. 1951. The edible finfishes of North Carolina. *In* Survey of marine fisheries of North Carolina, by H. F. Taylor and associates, Univ. N. C. Press, Chapel Hill, 109-140.

ROOSEVELT, R. B. 1875. The Fish Commission and New York shad. Forest and Stream. 4: 390.
——— 1878. On early work of the New York Fish Commission. Trans. Amer. Fish. Soc., 1877 (1878): 45-48.
——— 1881. [Shad] Hybrids. Trans. Amer. Fish. Soc., 1880: 8-13.
——— 1885. Fertility in hybridization. Proc. Amer. Ass. Adv. Sci., 33: 510-515.

ROSTLAND, E. 1952. Freshwater fish and fishing in native North America. Univ. Calif. Press, 9: 1-314, 47 maps.

ROULE, L. 1920A. Les especes d'Aloses du bassin de la Seine. Bull. Mus. Nat. D'Hist. Naturelle, Paris. 26: 610-611.
——— 1920B. La croissance de l'Alose finte d'apres les ecailles. Comp. Rend. Soc. Bio. Paris. 83: 1542-1544.
——— 1922. La migration reproductice et la protandrie de l'Alose finte (*Alosa finte*). Ann. Scie. Nat. (Zool.). Paris, Ser. 10, T. V.: 61.
——— 1923. Notes sur les Aloses de la Loire et de l'Aquitaine. Bull. Soc. Cent. Aquicult. Peche. Paris. 30: 14-22.
——— 1924. Le thermotropisme dans la migration de l'Alose. C. R. Soc. Biogeogr. Congr. Liege, 6-9.
——— 1933. Fishes, their journeys and migrations [The shad and their love of warmth. 114-127]. W. W. Norton and Co., N. Y. 1-270.

ROUNSEFELL, G. A., and W. H. EVERHART. 1953. Fishery Science: its methods and applications. J. Wiley and Sons, N. Y., 1-444, ill.

ROUNSEFELL, G. A., and J. L. KASK. 1944. How to mark fish. Trans. Amer. Fish Soc, 73: 320-363.

RUSSELL, E. S. 1942. The overfishing problem. Cambridge Univ. Press. 1-130, ill.

RUTTER, C. 1908. The fishes of the Sacramento-San Joaquin basin, with a study of their distribution and variation. U. S. Bur. Fish., Bull., 27: 105-152.

RYAN, L. F. 1952. Shad now passing over Holyoke Dam toward Northampton. Daily Hampshire Gazette, Mass., June 29: 1.

RYDER, J. A. 1882A. On the retardation of the development of the ova of the shad (*Alosa sapidissima*) with observations on the egg fungus and bacteria. Bull. U. S. Fish Comm., 1881, 1: 177-190; and Rept. U. S. Fish Comm., 1881 (1884): 9: 795-811.

——— 1882B. The protozoa and protophytes considered as the primary or indirect source of the food of fishes. Bull. U. S. Fish Comm., 1881, 1: 236-251; and Rept. U. S. Fish Comm., 1881 (1884): 9: 755-770.

——— 1882C. Additional observations on the retardation of the development of the ova of the shad. Bull. U. S. Fish Comm., 1881. 1: 422-424.

——— 1882D. Notice on an extraordinary hybrid between the shad and striped bass. Bull. U. S. Fish Comm. 2: 187.

——— 1883A. Observations on the absorption of the yelk, the food, feeding and development of embryo fishes, comprising some investigations conducted at the Central Hatchery, Armory Building, Washington, D. C., in 1882. Bull. U. S. Fish Comm., 1882. 2: 179-205.

——— 1883B. Report of the abnormal appearance of shad eggs from a fish kept in confinement at Havre de Grace, Maryland. Bull. U. S. Fish Comm., 3: 440.

——— 1887. On the development of osseous fishes, including marine and fresh water forms. Rept. U. S. Fish Comm., 1885. 13: 489-604, 30 pl. [Shad, 523-533, pl. 14-22].

——— 1890. The lateral line organs and the hyaline tissues of the head of the shad. Trans. Amer. Fish. Soc., 1889, 20-22.

RZEHAK, A. 1881. Ueber das Vorkommen und die geologische Bedeutung der Clupeidengattung. Brünn. pl.

——— 1887. Die Clupeidengattung. Brunn. pl.

SABINE, L. 1853. Report on the principal fisheries of the American seas, prepared for the Treasury Department of the United States. Wash., 1-317.

SALISBURY TIMES. 1950. Proof of shad ladders' use asked by Truitt. Salisbury, Md., July 7.

——— 1951. Virginia legislators fear losses in seafood industry. December 4.

SALMON ROE (pseudonym), 1879. Mississippi shad and salmon. Forest and Stream. 12: 264.

SALTER, G. H. C. 1876. Fish-culture on the Yang-Tse-Kiang—The samli or Chinese shad. Trans. Amer. Fish Soc., 1875 (1876): 34-38; also in Forest and Stream, 1875, 4: 100.

SAMAKHAEV, D. F. 1944. A contribution to the taxonomy of transitory Caspian herring. Zool. Journ., Moscow. 23: 65-81. (In Russ., Eng. summ.).

SANDMAN, J. A. 1905. Fangst af sallsyntare fiskarts [*Belone vulgaris* und *Alosa finta* in Finland gefangen]. Fiskeritidskr. Finl., 14: 38.

SCARBOROUGH, K. 1926. Fisherman's wail on Susquehanna. Old time hauls from river reached staggering size, but catches of 40,000 shad have dwindled to tragic extent. Balto. Sunday Sun Mag., Feb. 7: (1): 5.

SCATTERGOOD, L. W. 1948. Notes on some Gulf of Maine fishes. Copeia. (2): 142-144.

SCHAEFER, M. B. 1951. Estimation of size of animal populations by marking experiments. U. S. Fish and Wildlife Ser., Fish. Bull. 69: 191-203.

SCHAEFER, J. W. 1944. Shad for tomorrow by Maryland plan. Balto. Sunday Sun Mag., May 7, (1): 1.

SCHEER, B. T. 1939. Homing instinct in salmon. Quart. Rev. Biol., 14(4): 408-430.

SCHEURING, L. 1929-30. Die Wanderungen der Fische. Ergebnisse der Biol., Berlin. Erster Teil, 5: 405-691; Zweiter Teil, 6: 4-304.

SCHMIDT, P. J. 1936. Migrations of fishes. State Pub. House Biol. Medic. Lit., Moscow and Leningrad, 1-327. (In Russ.).

SCHNAKENBECK, W. 1932. [Clupeidae] in Faune Ichthyologie Atlantic Nord. Conseil Internat. pour l'Explor. de la Mer, Copenhagen, 9-11.

SCHNEIDER, G. 1908. Die Clupeiden der Ostsee. Conseil Internat. pour l'Explor. de la Mer, Rapp. & Proc. Verb., 9: 66-120, 4 fig. map; also in Baltische Wochenschr., 46: 149-150.

SCHONING, R. W., MERRELL, T. R., JR., and D. R. JOHNSON. 1951. The Indian dip net fishery at Celilo Falls on the Columbia River. Oreg. Fish Comm., Contr. (17): 1-43.

SCIENCE. 1923. Shad investigations in Connecticut. N. S., 57: 735.

SCIENCE DIGEST. 1951. Fish pouring faucets explained [alewives discussed]. Jan., 29: 66.

SCOTT, G. C. 1875. The shad. *In* Fishing in American waters. Amer. News Co., N. Y., 324-325, ill.

SECRETARY OF THE INTERIOR. 1945. Fishery resources of the United States. U. S. Gov. Print. Off., 79th Congr., 1st Sess., Senate Doc. 51: 1-135, ill.

SEMMES, R. 1937. Captains and mariners of early Maryland. The Johns Hopkins Pr., Balto. xvi-856.

SENIOR, H. D. 1909. The development of the heart in shad (*Alosa sapidissima*, Wilson) with a note on the classification of teleostean embryos from a morphological standpoint. Amer. Journ. Anatomy. 9: 211-262.

SHADOW (pseudonym). 1880. Fly fishing for shad. Forest and Stream. 15: 8-9.

SHAPOVALOV, L. 1936. Food of the striped bass. Calif. Fish and Game. 22(4):

——— 1940. The fresh-water fish fauna of California. Sixth Pacif. Sci. Congr. Proc., 3: 441-446.

——— and W. A. DILL. 1950. A check list of the fresh-water and anadromous fishes of California. Calif. Fish and Game, 36(4): 382.

SHARP, B. F. 1909. History of Greenwich, New York. The Commonweal Pr., Greenwich, N. Y.

SHEBLEY, W. H. 1917. History of the introduction of food and game fishes into the waters of California. Calif. Fish and Game, 3: 3-12, 2 fig., 1 pl.

SHELDON, H. P. 1918. Green Mountain shad. Outing. Aug., 72: 301-303.

SHELFORD, V. E., and E. B. POWERS. 1915. An experimental study of movements of herring and other marine fishes. Biol. Bull. 28: 315-334.

SHOEMAKER, H. W. 1932. The last run of shad. Transplants. Harrisburg, Mimeo., 1-11.

SIDES, R. 1952. Susquehanna shad, vanishing migrant. Penn. Angler, Feb., 12-15, 19.

SILLIMAN, R. P. 1951. Fluctuations in abundance of marine fishes; their measurement, causes, and prediction. *In* Marine products of commerce, by D. Tressler, et al., 2nd ed., Reinhold Pub. Corp., 181-190.

SIMMONS, L. 1951. Browsin' around with the outdoor sportsmen [former occurrence of shad at Columbia Dam in Susquehanna River]. Columbia News, Penn.

SLACK, J. H. 1874A. Report on shad hatching operations in 1873 in the Delaware River. Rept. U. S. Fish Comm., 1872-73, 2: 409-412.

——— 1874B. Notes on the shad as observed in the Delaware River. Ibid., 2: 457-460.

SLADE, E. 1883. Dates of the appearance of herring, shad, bass, tautog, scup, frostfish, fish-hawks, kingfishers and Greenland seal in the Taunton River from 1871 to 1883 inclusive. Bull. U. S. Fish Comm., 3: 478.

SLOAT, J. W. 1951. [Letter regarding shad at Bonneville Dam from District Engineer, U. S. Army Corps of Engineers], Sept. 20. 1-2.

SMILEY, C. W. 1883A. Result of planting shad in the Muskingum River. Bull. U. S. Fish Comm., 1882, 2: 32.

——— 1883B. Planting and catch of shad in the Coosa River, Alabama. Ibid., 3: 200.

——— 1884A. Statistics of the shad hatching operations conducted by the United States Fish Commission in 1881 and 1882. Rept. U. S. Fish Comm., 1881, 1107-1119; 1882 (1884), 903-913.

——— 1884B. Notes on the shad season of 1884, with reference to other species. Bull. U. S. Fish Comm., 4: 337-341.

SMIRNOV, N. A. 1924. Einige Bemerkungen ueber die Anadromie der Fische. Russ. Hydrobiol. Zeitschrift, Saratov, 3: 130-138. (In Russ., German summ.).

SMITH, E. 1889. Results of planting shad in the Kennebec River. Bull. U. S. Fish Comm. 1887. 7: 16.

SMITH, H. M. 1892. Notes on a collection of fishes from the lower Potomac River, Maryland. Bull. U. S. Fish Comm., 10: 63-72, 3 pl.

——— 1893A. Report on a collection of fishes from the Albemarle region of North Carolina. Ibid., 11: 185-200.

——— 1893B. Fish acclimatization on the Pacific Coast. Science. 22: 88-89.

——— 1896A. Report of the division of statistics and methods of the fisheries. [The shad fishery. 123-124; Shad on the Pacific Coast. 149]. Rept. U. S. Fish Comm., 20: 116-175.

——— 1896B. A review of the history and results of the attempts to acclimate fish and other water animals in the Pacific States. Bull. U. S. Fish Comm., 1895. 15: 379-472.

——— 1899A. Report on the inquiry respecting food fishes and the fishing grounds. [Shad in Ohio River basin. CXXXVII; Studies of young shad in the Potomac River, CXXXVIII-CXXXIX]. Rept. U. S. Fish Comm., 1898. 24: CXXIII-CXLVI.

——— 1899B. Notes on the extent and condition of the alewife fisheries of the United States in 1896. Ibid., 24: 31-43.

——— 1906. The failure of our shad fisheries. Forest and Stream. 67: 17. (Pub. anonymously).

——— 1907. The fishes of North Carolina. N. C. Geol. and Econ. Surv., Raleigh, 2: 1-453, 21 pl. 187 fig.

——— 1910. Federal fish farming; or planting fish by the billion. Nat. Geog. Soc., 21: 418-446, 22 ill.

——— 1916. Shad and alewife industry of Chesapeake Bay and tributaries. *In* Report of the Commissioner of Fisheries for . . . 1916. U. S. Bur. Fish, Doc. 836: 1-114.

——— and B. A. BEAN. 1899. List of fishes known to inhabit the waters of the District of Columbia and vicinity. Bull. U. S. Fish Comm., 1898 (1899), 18: 179-187.

——— and W. C. KENDALL. 1898. Notes on the extension of the recorded range of certain fishes of the United States coasts. Rept. U. S. Fish Comm., 22: 169-176.

SMITH, J. A. 1885. Report of shad catching operations by the steamer *Lookout*, season of 1885. Bull. U. S. Fish Comm., 5: 386-395.

——— 1887A. Report of the work of the United States Fish Commission steamer *Lookout* for the year . . . 1885 [also 1886]. Rept. U. S. Fish Comm., 13: 97-101; Bull., U. S. Fish Comm., 6: 289-293; and Rept. U. S. Fish Comm., 14: 819-823., Bull., U. S. Fish Comm., 6: 295-297; and Rept. U. S. Fish Comm., 14: 825-827.

——— 1889. Report of operations of the U. S. Fish Commission steamer *Fish Hawk* for . . . 1886 [also 1887]. Ibid., 14: 693-697; Bull. U. S. Fish Comm., 7: 83-89.

SMITH, S. H. 1950. Upper Sacramento River sport fishery. U. S. Fish and Wildlife Srv., Spec. Sci. Rept., Fish. (34): 1-44.

SMITH, W. E. 1948. Columbia River investigation. *In* Ann. Rept. 1948, Washington State Dept. Fish., 34-38.

SNYDER, B. 1949. [Sport fishery for shad in the St. Johns River]. Fla. Wildlife, 2(11).

SNYDER, J. P. 1917A. Report of fisheries and fish cultural conditions on the Eastern Shore of Maryland. Md. Conserv. Comm., 1-31.

——— 1917B. Extracts from report on fisheries and fish cultural conditions on the Eastern Shore of Maryland. 2nd Ann. Rept., Md. Conserv. Comm., 56-63.

——— 1918. Report of fish hatcheries, 1918. 3rd Ann. Rept., Md Conserv. Comm., 47-64.

——— 1919A. Ibid., 1919. 4th Ann. Rept., Md. Conserv. Comm., 50-64.

——— 1919B. Outlook for the shad industry. Trans. Amer. Fish Soc., 48: 113-118.

SOLLERS, A. A. 1951. How to get more sea food by fishery management. Balto. Even. Sun, Edit. Page, May 18.

SOMOVA, S. G. 1940. The development of *Caspialosa kessleri* Gr. Trans. Inst. Marine Fish. and Oceanogr. U S S R, Moscow, 14: (In Russ., Eng. summ.).

SOUTH CAROLINA AGRICULTURAL AND MECHANICAL SOCIETY. 1869. Proceedings of the annual convention [shad discussed]. Columbia, S. C., Nov. 10-12: 572-574.

SOUTH CAROLINA SANITARY ENGINEER. 1944. Pollution. *In* 38th Ann. Rept. S. C. State Brd., Fish., 1944, 22-24.
——— 1945. Anti-pollution needed in South Carolina. *In* 39th Ann. Rept., Ibid., 12-14.
SOUTH CAROLINA STATE BOARD OF FISHERIES. 1933. Shad and shad hatcheries. *In* 27th Ann. Rept., 1933. 8-10, 2 fig.
——— 1934. Shad. *In* 28th Ann. Rept., Ibid., 1934, 7-9.
——— 1942. Ibid., *In* 36th Ann. Rept., 5-7.
——— 1944. Ibid., *In* 38th Ann. Rept., 1949, 14-16.
——— 1945. Ibid., *In* 39th Ann. Rept., 9-12.
——— 1946. Ibid., *In* 40th Ann. Rept., 10-12.
——— 1947. Ibid., *In* 41st Ann. Rept., 15-16.
——— 1949. Ibid., *In* 43rd Ann. Rept., 6.
SOUTHERN FISHERMEN. 1953. [White shad caught by angler in Wicomico River, Md.] May, 13(5): 113.
SOUTHERN MARYLAND TIMES. 1945. Shad follows homing instinct in spawning. Annapolis, May 25.
SOUTHERN OUTDOORS. 1946. Fly fishing for shad popular in Bay area. Atlanta, Ga., (20): April 15.
STARKS, E. C. 1918. The herrings and herring-like fishes of California. Calif. Fish and Game. 4(2): 58-65, ill.
STANSBY, M. E. 1945. Opportunities for small business in the fisheries of the Pacific northwest and Alaska. U. S. Fish and Wildlife Srv., Fish. Leaflet (107).
STECHE, O., FRANZ, V., and A. BREHM. 1914. Die Fische [shads included]. *In* Brehm's Tierleben, 4th Ed., Leipzig and Wien, 3: 1-590, 63 pl., 172 fig.
STEVENSON, C. H. 1898. The restricted inland range of the shad due to artificial obstructions and its effect on natural reproduction. Bull. U. S. Fish Comm., 1897. 17: 265-271.
——— 1899. The shad fisheries of the Atlantic coast of the United States. Rept. U. S. Fish Comm., 1898. 24: 101-269.
STILWELL, E. M. 1874. On shad hatching operations by the Commissioners of the State of Maine. Rept. U. S. Fish Comm., 1872-73, 2: 417-418.
STIMPSON, W. A. 1902. Catching shad for the market. Outing. July 40: 464-468.
STOMMEL, H. 1950. The gulf stream; a brief history of the ideas concerning its cause. Sci. Monthly. 70(4): 242-253, 3 fig.
STONE, L. 1872. Age of young shad. N. Y. Citizen and Round Table, 9: July 6.
——— 1874A. Report on the transfer of shad from the Hudson River to the Sacramento. Rept. U. S. Comm. Fish., 1872-73, 2: 413-416.
——— 1874B. The introduction of eastern fish into the waters of the Pacific slope together with an account of operations at the United States salmon breeding establishment on the McCloud River, Califoria. Forest and Stream. 2: 100-102.
——— 1876. Report of operations in California in 1873. [Overland journey with shad. 390-402]. Rept. U. S. Fish Comm., 1873-75, 3: 377-429.
——— 1880. How the first shad were hatched. Forest and Stream. 15: 186.
——— 1898. Some brief reminiscences of the early days of fish-culture in the United States. Bull. U. S. Fish Comm., 1897. 17: 337-343.
STORER, D. H. 1839. Reports on the fishes, reptiles and birds of Massachusetts. Boston, 1-426, 4 pl.
——— 1846. A synopsis of the fishes of North America. Mem. Amer. Acad. Arts Sci. Boston, 2: 253-550.
——— 1847. *Alosa syancoton* and *A. lineata*. Proc. Boston Soc. Nat Hist., 2: 242-243.
STOREY, M. 1938. West Indian clupeid fishes of the genus *Harengula* with notes on *H. thrissina* from the Pacific coast. [Contains a key to all clupeoids of Atlantic drainage]. Stanford Ichthy. Bull., 1(1): 3-56.
STRATTON, J. M. 1915. Decrease of shad. *In* Ann. Rept. N. J. Brd. Fish and Game Comm., Trenton, 10-11
——— 1916. The state shad industry. Ibid., 20-21.
——— 1917. Shad. Ibid., 17-18.
——— 1920. Shad. Ibid., 25.
STRATTON, J. W. 1921. Shad. *In* Ann. Rept. N. J. Brd. Fsh and Game Comm., Trenton, 30-31.
——— 1927. Shad census. Ibid., 36.
——— 1928. Shad hatchery. Ibid., 36.
STROGANOV, N. S. 1938. The survival capacity of sperm in the Volga herring (*Caspialosa volgensis*) under various external conditions. Zool. Journ., Moscow, 17: 316-336. 2 fig. (In Russ., Eng. summ.).
SUMNER, F. B., OSBORN, R. C., and L. J. COLE. 1913. A biological survey of the waters of Wood's Hole and vicinity. Bull. U. S. Fish Comm., 31(1&2): 1-794.
——— et al. 1940. Dams and the problem of migratory fishes. Stanford Ichthy. Bull., 1(6): 173-215, ill.
SUPINO, F. 1908. Note biologiche sugli agoni (*Alosa finta* var. *lacustris*). Riv. Mens. Pesca, Milano. 10: 218-221.
——— 1914. Idrobiologia applicata. U. Hoepli, Milan, 1-283, ill.
——— 1916. I pesci d'acqua dolce d'Italia. Milano, 1-87, ill.
SURBER, T. 1913. Notes on the natural hosts of fresh-water mussels. Bull U. S. Bur. Fish., 32: 101-116.
SUSHKINA, A. P. 1940. The feeding of the larvae of anadromous shads in the Volga River. Trans. Inst. Marine Fish. and Oceanogr. U S S R, Moscow, 14: (In Russ., Eng. summ.).
——— 1942. Feeding of one year old of *Caspialosa kessleri* in the region of Saratov. Bull. Acad. Sci. U S S R, Ser. Biol., 334-348, 10 fig., 10 fig. (In Russ., Eng. summ.)).
SVETOVIDOV, A. N. 1936A. On a new herring from the Caspian Sea, *Caspialosa caspia salina* subsp. n. C. R. Acad. Sci., Moscow. 1: 51-52. (In Russ., Eng. summ.).

——— 1936B. The fishes of Mertvyi Kultuk and Kaidak Bays. Trav. Comm. Casp. Acad. Sci., U S S R, Moscow. 1: 1-212, 3 pl. (In Russ., Eng. summ.).
——— 1943. On the clupeoid fishes of the Caspian and the Black seas (genera *Caspialosa* and *Clupeonella*) and on the conditions of their development. Zool. Journ. Moscow, 22: 222-233. (In Russ., Eng. summ.).
——— 1950. On the parallel alterations of some features in Caspian and Black-Sea-Azovian forms of *Caspialosa caspia*. C. R. Acad. Sci. Moscow. N. S. 72: 421-423 (In Russ.).
——— 1950. Peculiarities in the structure of air-bladder in *Clupeidae*. C. R. Acad. Sci., Moscow. N. S. 74: 643-644. (In Russ.)

SWAN, J. G. 1883. Shad in Puget Sound. Bull. U. S. Fish Comm., 2: 152.

SWARTZ, A. H. 1950. Selected and annotated bibliography on senses of fish and fish behavior. U. S. Fish and Wildlife Srv., Unpub. MS., Boston, 1-19.

SWEET, F. H. 1930. Planting the ocean; artificial propagation [of shad]. Catholic World. Feb., 130: 580-582.

SWIFT, E. S. 1952. John Smith, old-time shad man doesn't like regulations. Deep River, New Era, Connecticut. April 24.

SYKES, J. E. (Executive Secretary). 1950. Minutes of the organization meeting of the Chesapeake shad research committee. Feb. 6. Unpub. MS. 1-7.
——— 1950. A method for transporting fingerling shad. Prog. Fish-cult. 12(3): 153-159.
——— 1951(?). Survey report of the Chesapeake and Ohio Canal, Potomac River, from Georgetown to Great Falls, Maryland. U. S. Fish and Wildlife Serv., map. Unpub. MS.
——— 1951. The transfer of adult shad. Prog. Fish-cult., 13(1): 45-46.

TAFT, A. C. 1940. A summary of the present status of dams versus migratory fishes on the Pacific Coast with especial reference to problems in California. *In* Special Symposium issue: Dams and the problem of migratory fishes. By F. B. Sumner, et al. Stanford Ichthy. Bull., 1(6): 205-212.

TALBOT, G. B. 1953. Passage of shad at the Bonneville fishways. U. S. Fish and Wildlife Srv., Spec. Sci. Rept., Fish. (94). 1-30, ill.
——— 1953.. [Progress of shad investigations group of United States Fish and Wildlife Service]. Fisheries Yearbook, 1953, National Fish. Inst., Inc., 119.

TALIN, D. S. 1936. The propagation of *Caspialosa pontica*. Sci. Mem. Univ. Perm. Moscow. 2(4): 71-107, 3 pl. (In Russ., Eng. summ.).

TANASSIYCHUK, N. P. 1940. A new variety of anadromous herring in the Caspian Sea (*Caspialosa volgensis bergi*). C. R. Acad. Sci., Moscow. N. S., 26: 103-105. (In Russ., Eng. summ.).

TAYLOR, C. C. 1951. A survey of former shad streams in Maine. U. S. Fish and Wildlife Srv., Spec. Sci. Rept., Fish. (66): 1-29, ill.

TAYLOR, F. W. 1883. An analysis of artesian well water from the shad hatching station at Havre de Grace, Md., Bull. U. S. Fish Comm., 3: 348.

TAYLOR, H. F. 1951. Economics of the fisheries of North Carolina. *In* Survey of Marine fisheries of North Carolina, by H. F. Taylor and associates. Univ. N. C. Press, Chapel Hill, 289-475.

TAYLOR, K. 1941. Spring brings us the shad. N. Y. Times Mag., March 30: 18.

THOMPSON, W. F. 1936. Conservation of the Pacific halibut, an international experiment. Smithson. Inst. Rept. for 1935, (3366): 361-382, 2 pl.
——— 1950. The theory of the effect of changed mortality rates on the stocks of fish. Trans. Fifteenth N. A. Wildlife Conf., 455-460.

THOMPSON, Z. 1842. History of Vermont, natural, civil, and statistical. Three parts. Burlington. 200 ill.

THOUGOUNOVA, N. I. 1940. Methods of growth studies of *Caspialosa saposhnikovi* (Grimm.). Trans. Inst. Marine Fish. and Oceanogr., U S S R, Moscow. 14: 21-46, 2 fig.

THROCKMORTON, S. R. 1873. Remarks on the introduction of shad into the waters of California. Proc. Calif. Acad. Sci., 1873, 5: 85.
——— 1874. Shad in California. Forest and Stream. 3: 229.

TILLER, R. E. 1944A. The Maryland fishery management plan. Md. Dept. Research and Ed., Ed. Ser. (1) :1-6.
——— 1944B. The Maryland management plan and the rock industry. Md. Dept. Research and Ed., Ed. Ser. (2): 1-7.
——— 1944C. The Maryland management plan and the shad industry. Md. Dept. Research and Ed., Ed. Ser., (5): 1-6.
——— 1945. Fisheries management plan productive. Md. Dept. Research and Ed., Ed. Ser., (6): 1-8.

TITCOMB, J. W. 1904. Report on the propagation and distribution of food fishes [Shad hatching reports. 39-42; Fish lakes, Washington, D. C., 43; Edenton Station. Notes on shad. 47-481] Dept. U. S. Fish Comm., 1902. 28: 22-110.

TONER, G. C. 1934. Notes on the alewife. Canadian Field-Nat. 48: 51-52.

TORTONESE, E. 1951. Intorno al Clupeidi dell' ittiofaune italiana. [The Italian clupeids]. Boll. Pesca, Piscicolt. e Idrobiol. 6(2): 134-137.

TOWNES, H. K., JR. 1937. Studies of the food organisms of fish. *In* Biological Survey of Lower Hudson River. Suppl. 26th Ann. Rept. N. Y. St. Conserv. Dept. 217-228.

TOWNSEND, C. H. 1902. Statistics of the fisheries of the Mississippi River and tributaries. Rept., U. S. Comm. Fish and Fish., 1901, 659-740.

TRACY, H. C. 1906. The common fishes of the herring family. 36th Ann. Rept. Comm. Inland Fish. Rhode Island. 100-102, 6 pl.
——— 1910. Annotated list of fishes known to inhabit the waters of Rhode Island. 40th Ann. Rept., Ibid., 35-176.
——— 1920. The clupeoid cranium in its relation to the swim bladder diverticulum and the membranous labyrinth. Journ. Morphol., 33: 439-483.

TRESSELT, E. F. 1952. Spawning grounds of the striped bass or rock, *Roccus saxatilis* (Walbaum), in Virginia. Bull. Bingham Oceanogr. Coll., 14(1): 98-110.

TRESSLER, D. K., and J. M. W. LEMON. 1951. Marine products of commerce; their acquisition, handling, biological aspects and the science and technology of their preparation and preservation. Reinhold Pub. Corp., N. Y., 1-782, ill.

TREWAVAS, E. 1938. The Killarney shad or Goureen (*Alosa fallax killarnensis* Regan (1916). Proc. Linn. Soc. London, 150: 110-112.

TROSCHEL, F. H. 1852. *Alausa vulgaris* und *A. finta*, verschiedene Arten. Arch. Naturgesch., 18. Jahrg. 1: 228-233.

TROTT, H. 1942. Alewives are running. Current Sci. Monthly Mag., May 23: 4.

TRUE, F. W. 1887. The pound-net fisheries of the Atlantic States. *In* The fisheries and fishery industries of the United States, Ed. by G. B. Goode. Sect. 5, 1: 595-610, 3 pl.

——— and W. A. WILCOX. 1887. The river fisheries of Massachusetts and New Hampshire. *In* Ibid., 1: 667-673.

TRUITT, R. V. 1932. Scientific fisheries work in Maryland. Trans. Amer. Fish. Soc., Also Md. Dept. Research and Ed., Pub. (5).

——— 1936. Report of the Chesapeake Biological Laboratory, 1936. *In* 14th Ann. Rept. Conserv. Dept. Md., 46-52.

——— 1937. Ibid., *In* 15th Ann. Rept., Ibid., 49-52.

——— 1939A. Ibid., *In* 17th Ann. Rept., Ibid., 42-46.

——— 1939B. Our water resources and their conservation. Md. Dept. Research and Ed., Pub. (27): 1-103, ill. [Includes, Fish and fishing of Chesapeake . . . 1-30].

——— 1940. Report of the Chesapeake Biological Laboratory. *In* 18th Ann. Rept., Conserv. Dept. Md., 38-45.

——— 1941A. Annual Report, Chesapeake Biological Laboratory. Pub. (40): 5-12.

——— 1941B. Shad depletion. Chesapeake Biol. Lab., Unpub. MS., 1-7.

——— 1943. Socio-economics of fisheries and fishermen of Chesapeake Bay. Ibid., Unpub. MS., 1-4.

[———] 1944A. Young shad. Md. Tidewater News. 1(1): 3.

[———] 1944B. Commercial hatcheries. Ibid., 1(2): 1, 3.

[———] 1944C. Fish scales count; [shad aging]. Ibid., 1(7): 1, 3.

——— 1944D. Annual Report, Maryland Department of Research and Education. *In* First Ann. Rept. Brd. Nat. Resources, 88-99.

——— 1945. Ibid., *In* Ibid., 54-66.

——— 1946. Ibid., *In* Third Ann. Rept., Ibid., 53-63.

——— 1947A. Ibid., *In* Fourth Ann. Rept., Ibid., 109-137.

[———] 1947B. Is the bass black? Md. Tidewater News. 3(8): 1.

[———] 1947C. Predator study. Ibid., 4(2): 2.

——— 1947D. [Restoration of the shad fisheries; report to the Atlantic States Marine Fisheries Commission]. Md. Dept. Research and Ed. Mimeo., 1-3, 2 Tables.

——— 1948A. Annual Report. *In* Fifth Ann. Rept., Md. Brd. Nat. Resources. 103-137.

[———]. 1948B. Young shad tagged. Md. Tidewater News, 4(8): 3.

[———]. 1948C. Shad tag returns. Ibid., 5(6): 3.

——— 1949A. Annual report. *In* Sixth Ann. Rept., Md. Brd. Nat. Resources, 91-125.

[———]. 1949B. Shad study. Md. Tidewater News. 6(1): 5.

[———]. 1950A. Shad researchers organize. Ibid., 6(10): 4.

[———]. 1950B. Shadways. Ibid., 7(1): 5-6.

[———]. 1950C. Hatchery program. Ibid., 6(11): 4-5.

[———]. 1950D. Shad on fly. Ibid., 6(11), 3.

——— 1950E. Annual Report. *In* Seventh Ann. Rept., Md. Brd. Nat. Resources.

——— 1951. Annual Report. *In* Eighth Ann. Rept., Ibid., 1-33.

———, BEAN, B. A., and H. W. FOWLER. 1929. The fishes of Maryland. Md. State Conserv. Dept., Bull. (3): 1-120, 62 fig., 3 pl.

——— and V. D. VLADYKOV. 1936. The importance of sport fishing in Maryland. Trans. Amer. Fish Soc., 66: 225-226.

——— and D. H. WALLACE. 1941. Maryland commercial fish hatchery operations, 1940. Md. Dept. Research and Ed., Pub. (40): 1-12.

TUNISON, A. V., MULLIN, S. M., and O. L. MEEHEAN. 1949. Survey of fish culture in the United States. Prog. Fish-cult., 11(1): 31-69.

TURNER, W. E. 1874. Presence of shad in rivers tributary to the Gulf of Mexico. Rept. U. S. Fish Comm., 1872-73, 2: 394.

UHLER, P. R., and O. LUGGER. 1876. List of fishes of Maryland. Rept. Md. Fish. Comm., 68-176.

UNITED NATIONS FOOD AGRICULTURE ORGANIZATION. 1949. Herring and allied species, 1920-1948. A commodity study. First progress report. Fish. Div., Wash., D. C. 1-66.

UNITED STATES ARMY CORPS OF ENGINEERS. 1947. Power, navigation and fish facilities on the Columbia River at Bonneville Dam, Bonneville, Oregon and Washington. War Dept., 1-22, ill.

——— 1948. Annual report: passage of fish over Bonneville Dam, Columbia River, Oregon and Washington. Office of Dist. Eng., Portland, 6-7, ill.

——— 1949. Ibid., Ibid., 5-8., ill.

——— 1950A. Ibid., Ibid., 1-32, ill.

——— 1950B. Bonneville Dam, Oregon and Washington. Portland, 1-10 (Folder).

——— 1951. Annual report: Passage of fish over Bonneville Dam, Columbia River, Oregon and Washington. Office of Dist. Eng., Portland, 9-11.

UNITED STATES BUREAU OF THE CENSUS. 1911. Fisheries of the United States. 1908. Special Reports U. S. Dept. Commerce and Labor, 1-324.

UNITED STATES BUREAU OF CENSUS. 1951. Fisheries. *In* Statistical abstract of the United States. 72nd Ed., U. S. Gov. Print. Off., 1-1047, 1045 tables.

UNITED STATES BUREAU OF FISHERIES. 1874. Shad hatching or floating boxes. (Descriptions of improved apparatus in fish hatching). Rept. U. S. Fish Comm., 1872-73, 2: 578-579.

——— 1898. Investigations of spawning grounds of the shad. Ibid., 1897, XXXVIII-XXXIX.
——— 1909. Fisheries. *In* Report of the Conservation Comm. of Md., for 1908-1909. 155-165.
——— 1935. Shad. Doc. 981: 459-486, ill.
——— 1936. Statistical data on the shad fishing of the entire Atlantic coast. Mimeo. 1-129.
——— 1938A. Progress report on shad production problems in North Carolina [Edenton shad hatchery observations]. Unpub. MS., 1-17.
——— 1938B. The distinguishing characters of the common shad and the river herrings. 1-59: 1-3, ill.
——— 1938C. Do you know your fish? The Atlantic coast shad. Wash., 14.

UNITED STATES DEPARTMENT OF AGRICULTURE. 1952. Survey report: Lower Susquehanna River watershed [Pennsylvania and Maryland]—program for runoff and waterflow retardation and soil erosion prevention. Wash., (38): 1-24, ill.

UNITED STATES FEDERAL POWER COMMISSION. 1951. Recommended decision in the matter of the Delaware River Development Corporation; project No. 2039 [Effective July 1, 1951], 1-33, and 1-6.

UNITED STATES FISH AND WILDLIFE SERVICE. 1945A. Homing instinct of shad. Info. Serv., Wash., May 16, 12.
——— 1945B. News release on shad. Info. Serv., May 16: 1-2.
——— 1949A. Pacific coast states fisheries, 1949. Branch of Comm. Fish., C. F. S., (653): 1-5.
——— 1949B. New England fisheries, 1949. Ibid, (692): 1-5, ill.
——— 1949C. Middle Atlantic fisheries, 1949. Ibid., (693): 1-5, ill.
——— 1949D. Fisheries of the United States and Alaska, 1949. Ibid., (703): 1-11, ill.
——— 1950A. Florida landings. Ibid., (681): 1-4; also 1951 (728): 1-3.
——— 1950B. Maine landings. Ibid., (623): 1-11; also 1951 (733).
——— 1951A. Annual report, Branch of fishery biology, for fiscal year 1951. Middle Atlantic and South Atlantic fishery investigations; shad. Wash., Dec., 9-14.
——— 1951B. Progress report, shad investigation program, March 1950—February 1951, Beaufort. 1-5.
——— 1951C. Firms canning shad or shad roe. Serv. Leaflet: (106): 1-
——— 1952 [Winyah Bay, S. C.; Delaware River, N. J., Penn., and Del.; Hudson River, N. J. and N. Y.; Connecticut River, Conn.]. Mimeo Beaufort, N. C., 1-5.

UNITED STATES SENATE. 1936. Economic studies of the fishery industry. *In* Hearing before the committee on commerce, 74th Congress, 1-100.

VAN OOSTEN, J. 1935. First record of the alewife. *Pomolobus pseudoharengus*, for the State of Michigan. Copeia, (4): 194-195.
——— 1949. A definition of depletion of fish stocks. Trans. Amer. Fish. Soc., 76: 283-289.

VIRGINIA FISHERIES COMMISSION. 1916. The fishing industry; the shad. *In* 17th Ann, Rept., Richmond, 23-30.
——— 1947. The 48th and 49th Annual Report. Richmond, 1-27.
——— 1949. The 50th and 51st Annual Report. Richmond, 1-35.

VIRGINIA COUNCIL COMMITTEE ON FISHERIES. 1951. The commercial fisheries of Virginia. Advisory Council on the Va. Econ., Div. Plan. Econ. Dev., Richmond, 1-46.

VIRGINIA ADVISORY LEGISLATIVE COUNCIL. 1951. The seafood statutes and the rehabilitation of the seafood industry. Va. Div. Purchase and Print., Richmond, 1-15.

VLADYKOV, V. D. 1936. Occurrence of three species of anadromous fishes on the Nova Scotian banks during 1935 and 1936. Copeia, (3): 168.
——— 1948A. Movements of Quebec shad as demonstrated by tagging. Canad. Fisherman., Nov., 35(11): 10-11.
——— 1948B. Alose de Quebec et ses deplacements. *In* Rapp. du Biologiste. Rapp. Ann. Dept. Pech., Quebec, 1947-48, 50-53.
——— 1950. Movements of Quebec shad (*Alosa sapidissima*), as demonstrated by tagging. Contr. Quebec Dept. Fish., 77(30): 121-135, 4 fig.
——— and D. H. WALLACE. 1937. Remarks on populations of the shad (*Alosa sapidissima*) along the Atlantic coast region. Trans. Amer. Fish. Soc., 67: 52-66, ill.

VUTSKITS, G. 1914. Az Al-Duna halfaunajarol [*Alosa pontica danubii*)]. Allat. Közlem. Budapest. 13: 29-45.

WADE, J. H., and S. J. TWILLEY. 1911. Report . . . of the Commissioners of fisheries of Maryland for 1910-1911. Annapolis, 1-39.

WALBURG, C. H. 1954. Experimental transportation of live shad past Susquehanna River dams. U. S. Fish and Wildlife Serv., Spec. Sci. Rept. Fish. (114): 1-13.

WALFORD, L. A. 1951A. Re: shad studies at Bonneville. Memorandum to . . . Atlantic States Marine Fisheries Commission. File 800. Jan. 17-31, 1951: 1-2.
——— 1951B. Federal Power Commission Project No. 2039, Delaware River [Memorandum on the restoration of shad in the Delaware River to the Atlantic States Marine Fisheries Commission, from the United States Fish and Wildlife Service]. Jan. 25: 1-5.
——— and W. D. HEYDECKER. 1951. Federal Power Commission Project No. 2039, Delaware River [Shad fishery of the Delaware River]. U. S. Fish and Wildlife Serv., Memorandum, 1-3.

WALKER, E. T. 1950. Tagging operations; egg collection, larvae, and predation of eggs; pollution and fishing intensity [of shad in Connecticut River]. U. S. Fish and Wildlife Srv., Unpub. MS., 1-6.

WALLACE, D. H. 1939. Variations in certain species of Clupeidae possessing a wide environmental distribution. Bull. Nat. Hist. Soc. Md., Balto., 9(10): 86-87.
——— 1951. A new approach in fishery management—the Maryland Management Plan. *In* Va. Council Comm. Fisheries' Report on the commercial fisheries of Virginia. Adv. Council of the Va. Econ., Richmond, 35-41.
——— and R. V. TRUITT. Progress of the rock and shad research work at the Chesapeake Biological Laboratory. Trans. Amer. Fish. Soc., 68: 364-368.

WALLEM, F. M. 1878. Om de Amerikanske Fiskerier. Christiania. Rept. U. S. Fish Comm. [Translation "Report on the American fisheries," in Report], 6: 75-115.

WARFEL, H. E., and Y. H. OLSEN. 1947. Vertebral counts and the problem of races in the Atlantic shad. Copeia. (3): 177-183.

———, et al. 1939. Biological survey of the Connecticut watershed. N. H. Fish and Game Comm., Surv. Rept. (4): 1-256, ill.

WARFIELD, E., JR. 1943. Bay fisheries and the war. Balto. Morn. Sun, Feb. 21.

WARNER, E. N. 1941. Studies on the embryology and early life history of the gizzard shad, *Dorosoma cepedianum*, Le Sueur. Ph.D. Thesis, Unpublished, Ohio State Univ.

WASHINGTON POST. 1951. Potomac called 'open sewer'; small fish die by thousands. Wash., D. C., Aug. 14.

WASHINGTON STATE DEPARTMENT OF FISHERIES. 1948. Annual Report. Seattle, 1-163, ill.
——— 1949. Annual Report. Ibid., 1-182.
——— 1950. Annual Report. Ibid., 1-143.
———, OREGON FISH COMMISSION, and UNITED STATES FISH AND WILDLIFE SERVICE. 1948. Columbia river fisheries. Unpub. Mimeo. Rept., 1-50, 9 fig., Portland.

WAY, D. L. 1884. The shad fisheries of Lake Monroe, Florida. Bull. U. S. Fish Comm., 4: 219.

WEBBER, S. 1878. Salmon and alewives in the Merrimac. Forest and Stream. 10: 358.

WEBER, M. 1876. Ueber die Nahrung der *Alausa vulgaris* und die Spermatophore von *Temora velox* Lilj. Arch. fuer Naturgesch., 42: 169-178.

WEILER, W. 1932. Die Fischfauna der unteren und oberen Meersmolasse Oberbayerns. N. Jahrb. Min., 68B: 305-352, 34 fig.
——— 1933. Zwei Oligozane Fischfaunen aus dem Konigreich Ungarn. Geol. Hungarica, Budapest. Pesth. 11: 1-53, 3 pl. 23 fig.
——— 1938. Neue Untersuchungen auf Mitteloligozänen Fischen Ungarns. Geol. Hungar, Ser. Palaeont., Budapest. 15: 1-31, 6 pl., 2 fig.

WELANDER, A. 1940. Notes on the dissemination of shad, *Alosa sapidissima* (Wilson), along the Pacific coast of North America. Copeia. (4): 221-223.

WENGEN, . . . v. d. 1877. Ueber den Transport von Shad Brut. Circul. Deutsch. Fischerei-Ver. 1876. 1: 30.

WHITE, Father A. 1633. A relation of the colony of the Lord Baron of Baltimore, in Maryland near Virginia, . . . Forces Coll. Hist. Tracts. 4(12): 16-17.

WILCOX, W. A. 1895. The fisheries of the Pacific coast. Rept. U. S. Fish Comm., 19: 143-304.
——— 1898. Notes on the fisheries of the Pacific coast in 1895. Ibid., 22: 575-659.
——— 1902. Notes on the fisheries of the Pacific coast in 1800. Ibid., 27: 501-574.
——— 1907. The commercial fisheries of the Pacific coast states in 1904. U. S. Bur. Fish. Doc. 612: 1-74.

WILKINS, J. T., JR. 1894. The fisheries of the Virginia coast. Bull. U. S. Fish Comm., 13: 355-356.

WILKINSON, J. B. 1872. The annals of Binghamton and of the country connected with it from earliest settlement. Pub. Times Assoc., Binghamton, [Orig. pub. in 1840.].

WILLEY, A. 1923. Notes on the distribution of free living Copepoda in Canadian waters. Contrib. to Canad. Biol., N. S., 1: 303-334.

WILLLIAMS, M. L. 1940. Eating your shad and having it too. Balto. Sunday Sun Mag., May 31, (1): 1.
——— 1941. Conserving Bay shad. Balto. Sunday Sun Mag., March 16, (1): 1.

WILLIAMSON, H. C. 1910. Experiments to show the influence of cold in retarding the development of the eggs of the herring (*Clupea harengus* L.) plaice (*Pleuronectes platessa* L.) and haddock (*Gadus aeglefinus* L.). 27th Ann. Rept. Fishery Brd. Scotland, 1908. (3): 100-128.

WILLIS, H. 1882. Shad fisheries of the Susquehanna river fifty-six years ago. Bull. U. S. Fish Comm., 1881. 1: 261-263.

WILSON, A. (prior to 1812). Ree's New Cyclopedia [Original description of American shad, *Alosa sapidissima* (Wilson)]. Vol. 9. Quoted by McDonald (1884A).

WILSON, C. B. 1905. North American parasitic copepods belonging to the family Caligidae. Part I. The Caliginae. [*Caligus rapax* recorded from shad, 573]. Proc. U. S. Nat. Mus., 28: 479-672.

WILSON, E. R. 1876. Shad in land-locked waters. Forest and Stream. 6: 85.

WOOD, W. M. 1884A. Report of operations of the United States Fish Commission steamer *Lookout* from March 31, 1881 to November 20, 1882. Rept. U. S. Fish Comm., 10: 35-37.
——— 1884B. Report of operations at the Navy-yard shad hatching station in Washington, D. C. during the season of 1882. Ibid., 10: 891-897.
——— 1884C. Report of an examination of the shad fisheries in Georgetown, S. C. Bull. U. S. Fish Comm., 4: 140-141.
——— 1884D. Report of a trip made by the *Fish Hawk* to the lower part of Chesapeake Bay to ascertain the character of the fisheries for shad, herring, etc., in the spring of 1884. Ibid., 4: 199-200.
——— 1884E. Report of a trip by the steamer *Fish Hawk* to the Saint Mary's and Saint John's rivers to hatch shad. Ibid., 4: 241-242.
——— 1884F. Reconnaissance of the shad fisheries of Winyaw Bay and its tributaries by the Steamer *Fish Hawk*. Ibid., 4: 242-243.

WOODFIELD, A. 1940. Shad and herring conservation in Maryland. Comm. Fish. Advisory Committee, Md., Rock Hall, Unpub. MS., Dec. 6: 1-6.

WORRALL, J. 1875. The fishways of Pennsylvania. Trans. Amer. Fish. Soc., 1874: 38-44.
——— 1876. One of the Pennsylvania fishways. Ibid., 1875: 40-41.

WORTH, S. G. 1883A. Shad hatching and carp culture. Bull. U. S. Fish Comm., 2: 26-27.
——— 1883B. A poor season for shad hatching in North Carolina. Ibid., 2: 54.
——— 1893. The spawning habits of the shad. Bull. U .S. Fish Comm., 11: 201-206.
——— 1895. Report on the propagation and distribution of food fishes [Shad hatching reports, 90-94; Fish ponds, Washington, D. C., 96-97]. Rept. U. S. Fish Comm., 19: 78-138.

WORTH, S. G. 1898. The shad. Rept. U. S. Fish Comm., 1897. 23: 133-158. (Also issued at a

separate "Artificial propagation of the shad and pike perch," by the U. S. Gov. Print. Off., 1908; also in "Manual of fish-culture," rev. ed., 1900, 121-145.
——— 1910. Possible expansion of shad hatchery work. Bull. U. S. Fish Comm., 1908, 29(2): 789-793.

WRIGHT, C. E. 1951. Shad fishing, a new Florida sport. The New York Times, Dec. 2.

WRIGHT, H. 1882. Report of a committee of the Wyoming Historical and Geological Society on the early shad fisheries of the north branch of the Susquehanna river. Bull. U. S. Fish Comm., 1881, 1: 352-379.
——— 1884. On the early shad fisheries of the north branch of the Susquehanna River. Rept. U. S. Fish Comm., 1881. 9: 619-642.

WYMAN, J. 1856A. On the development of the dorsal chord in the alewife. Proc. Boston Soc. Nat. Hist., 1854-56, 5: 394-395.
——— 1856B. Some account of the habits of the alewife in depositing eggs, as observed in Fresh pond, in Cambridge. Proc. Boston Soc. Nat. Hist., 1854-56, 5: 355.

YARRELL, W. 1829. On the supposed identity of whitebait and shad. Zool. Journ., London, 4: 137-144.

YARROW, H. C. 1874A. Report of a reconaissance of the shad rivers south of the Potomac. Rept. U. S. Fish Comm., 1872-73, 2: 396-402.
——— 1874B. Notes on the shad as observed at Beaufort Harbour, North Carolina and vicinity. Ibid., 2: 452-456.
——— and J. W. MILNER. 1874. The shad and alewife (species of Clupeidae) of North America. Washington, D. C.

YORK DISPATCH. 1948. Century-old controversy over annual runs of river shad drawing to close. York, Penn., July 31.

ZACHARIAS, E. O. 1905. Heringe in Süsswasser [bei Husum]. Fischerei Zeitg., Neudaam, 8: 332-333.

ZAMAKHAEV, D. T. 1940. Spawning marks in the scales of some Caspian shads. Trans. Inst. of Marine Fish. and Oceanogr., U. S. S. R., Moscow, 14: 3-21.

ZIGGIOTTI, A. 1927. Studio morfologico sul cranio dell' agone e della cheppia. Natura, Milan, 18(3): 81-94.

ZOMPOLAS, G. 1939. Contributo allo studio dell' alimentazione dei pesci *Clupea finta* Cuv. Boll. Pesca Piscicot. Idrobiol., Roma, 15: 708-714.

INDEX

Acknowledgments 3
Age of shad 19-20, 151-152, 164, 165, 176, 197
Alabama shad 3, 4, 22, 195
Alaska 195-196, 255
Albemarle Sound 44, 45, 46, 49, 50, 51, 226, 227
Alewife 5, 82
Algae 200
Altamaha River 29
Allen, J. H. 3
Allis shad 3
Alosa 3
Alosa alabamae 3, 4, 22, 195
Alosa alosa 3, 258
Alosa finta finta 3, 10, 258
Alosa finta killarnensis 3
Alosa ohiensis 3, 5
Alosa sapidissima 3
American shad 3
Anderson, A. W. 3, 70
Annapolis River 186-187, 189
Appomattox River 54, 55
Appoquinimink Creek 102
Artificial propagation 225-230, 256
  Florida 24-26
  Georgia 34-35
  South Carolina 40-41
  North Carolina 49-51
  Virginia 62-63
  Maryland 80-82, 84-85, 86, 87-89, 226
  Delaware 101, 104-105
  New Jersey 107, 117-118, 123
  Pennsylvania 131-135, 139
  New York 151
  Connecticut 161-164, 170-171, 215
  Rhode Island 173
  New Hampshire 180-181, 182
  Eastern Canada 191
  Washington 197
  Oregon 201
  California 206
Ashepoo River 35, 45
Atkinson, C. E. 3, 5, 12, 129, 134
Atlantic coast shad 3
Atlantic Ocean 11-12, 73, 98, 110, 112-113, 148, 171, 172, 175-176
Atlantic shad 3

Backer shad 149
Bay of Fundy 186-187, 188, 191-192
Beaven, G. F. 3, 71
Battery shad 65, 66, 125
Behavior 7, 111-112, 232-233, 236-237
Bibliography 2, 259-288
Blueback shad 149
Boned shad 169-170, 245
Bonneville Dam 231-233, 239
Bortner, R. L. 3, 124, 128
Brandt, B. B. 3, 51
British Columbia 195, 196-197, 255
Broad Creek 101, 103
Broadkil Creek 101, 103, 105
Bromley, A. W. 3, 151, 154
Buzzards Bay 175
Byrd, W. 55

California 3, 195-196, 204-209, 256
Canada, Eastern 3, 8, 9, 186-194, 247, 255
Canned shad 196, 197-198, 204, 246
Cape Cod 8, 78, 175, 176
Cape Fear River 44, 45-46, 50
Carbon dioxide tension 10
Carquinez Straits 204
Casco Bay 182
Caspian shad 258
Catch records 250-251
  Florida 29
  Georgia 35
  South Carolina 43
  North Carolina 52
  Virginia 63-64
  Maryland 100
  Delaware 107
  New Jersey 123
  Pennsylvania 142
  New York 155-156
  Connecticut 170-171
  Rhode Island 174
  Massachusetts 178
  Maine 185
  Canada, Eastern 194
  Washington 199
  Oregon 204
  California 209
Cating, J. 3, 20
Charleston Harbor 36, 37
Chesapeake Bay 8, 9, 53-54, 55, 57, 60-61, 64-67, 71-72, 87-88, 98-99, 166-167, 210
Chesapeake Bay Institute 214
Chesapeake Bay states 249, 250-251
Chester River 64-65, 66, 69, 70, 76, 84, 93
Chickahominy River 55, 56, 57, 62-63
Choptank River 65-66, 68, 69-70, 71-72, 74, 76, 83, 95
Chowan River 44, 45, 49
Christiana Creek 102
Chunker shad 149
Chunkhead shad 149
Clubtail shad 143
Coker, C. 3, 19, 92, 93
Columbia River 195-196, 197, 199-200, 203, 231-233, 239
Connecticut 3, 156-171, 254-255
Connecticut River 156-157, 160, 161-164, 181-182, 210, 211
Conowingo Dam 74, 77, 78, 89, 92, 124-126, 127, 128, 129, 131, 134-136
Controlled-catch plan 218, 221-224, 225
Conversion factor of weight 5, 43, 107, 171, 174, 201
Combahee River 35, 37
Coos River 199, 200
Coquille River 199-200
Courtship 13
Creaser, E. P. 3, 22, 23, 34
Cronin, L. E. 3

Daiber, F. C. 3
Dams 211, 217, 230-240
  Georgia 32
  South Carolina 36
  North Carolina 48, 51
  Virginia 61, 62
  Maryland 67, 75, 77, 134-136
  Delaware 104, 105
  New Jersey 109, 117, 119-120
  Pennsylvania 124-129, 134-135, 136-137, 140-141
  New York 145-146
  Vermont 179
  Connecticut 157, 158, 159-160, 167-168
  Rhode Island 171, 172-173
  Massachusetts 175, 177, 178
  New Hampshire 179-181
  Maine 182-184
  Canada, Eastern 191
Decline, factors causing 1, 209-217, 256
  Florida 28
  Georgia 32
  South Carolina 38
  North Carolina 47
  Virginia 59
  Maryland 75
  Delaware 103
  New Jersey 113-117
  Pennsylvania 126-131
  New York 150-151
  Connecticut 159-161
  Rhode Island 172-173
  Massachusetts 177-178
  Vermont 179
  New Hampshire 179-181
  Maine 184
  Canada, Eastern 188-191
  Washington 198
  Oregon 200
  California 205, 206

Deforestation 212
Delaware 3, 100-107, 253-254
Delaware Bay 78, 95, 101, 103, 104, 108, 112, 115, 117, 119, 121
Delaware River ..... 80, 95, 101, 103, 104, 108-110, 112-114, 115, 116, 117-122, 136-142, 145, 151, 211-213, 226.
Delaware River Shad Protection Act 105-106, 119-120, 220-221
Depletion 209
Dequine, J. F. 3
Description of shad 4, 151-152
Destruction of juveniles 113-114, 131-132, 138-139, 153-154, 181, 212-213
Dickson, F. J. 3, 31
Distribution 6, 195-196
Donaldson, I. 3
Dow, R. L. 3, 183
Downrunner shad 10
Dredging 28
Duck Creek 102
Duryea, P. B. 3

Economics 240-252, 257
Florida 23
Georgia 32
South Carolina 41
North Carolina 46
Virginia 57
Maryland 94
New Jersey 121-123
Pennsylvania 124-126
New York 143-144, 154-155
Connecticut 158-159, 168-170
Rhode Island 173-174
Massachusetts 175-176, 178-179
New Hampshire 180-182
Maine 183-185
Oregon 200, 202-204
Edisto River 35-36, 38-39, 43, 63
Eels 71, 215-216
Egg abundance 39, 163, 210
Elk River 66, 70-71
Elser, H. 3
Escapement of brood stock 12-13 75, 91, 153, 164-166, 202, 210-211, 221
Essex Company Dam 230, 233-234, 239
European shads 258
Everhart, W. H. 3
Explosions 213

Fall shad 182-183
Fat shad 11-12, 175, 182, 183, 184, 187
Farmington River 156, 157-158
Fingerling by-passes 232
Fingerlings 18, 40, 87, 93, 94, 160, 191, 228, 232-233
Fish-collecting system 206, 207
Fish kill 214-215
Fishing mortality 12, 59, 90191, 164-166, 202, 210-211
Fishing rate 12, 59, 90-91, 164-166, 223
Fish screens 206-207, 236, 237
Fish screen by-passes 206-207, 237
Fishways 67, 75, 92, 105, 124, 127-129, 134-135, 136, 140-141, 145-146, 157-158, 167-168, 180, 182, 230-240, 256-257
Floods 162, 198, 200, 212
Florida 3, 20-29, 58, 252-253
Food of adults 18
Food of young 18
Fraser, E. D. 3, 191
Fraser River 195, 196-197
Fredin, M. 3, 166
Freeman, B. O. 22, 28
French, C. E. 3
Freshets 162, 198, 200, 212
Frozen shad 245-246
Fry, D. H., Jr. 3
Fuller, W. W. 3
Fundy, Bay of 188
Fungus disease 114

Gadsden, D. H. 3
Gardiner Bay 144-145
Gear 213-214, 243, 252
Florida 20-21, 22-23, 23-24
Georgia 29-21
South Carolina 35-37
North Carolina 44-45
Virginia 53-57
Maryland 64-74
Delaware 100-103
New Jersey 108, 113
Pennsylvania 138-139
New York 146, 149
Connecticut 158
Rhode Island 172
Massachusetts 176
Maine 184
Canada, Eastern 188, 190-192
British Columbia 196-197
Washington 197
Oregon 199-200, 201
California 204
Georgia 3, 29-35, 253
Glut herring 5, 82
Golden shad 149
Gravesend Bay 144
Gray's Harbor 197
Great Falls fishway 75
Great shad subterfuge 121
Great South Bay 144, 148
Greeley, J. 3, 7, 12, 148, 151
Greenback shad 149
Green, Seth 80, 132, 161, 181, 225
Growth of shad 19-20, 151-152, 207
Gulf of Maine 9, 184
Gulf shad 3
Gunpowder River 68, 75, 81

Halibut fishery 221-224
Hammer, R. C. 3, 91
Harmic, J. L. 3, 103
Hatcheries 225-230
Florida 24
Georgia 34
South Carolina 40-41
North Carolina 49-50
Virginia 62-63
Maryland 80-89
New Jersey 111, 117-118
Pennsylvania 132-133, 139-140
New York 151
Connecticut 161-164, 226
Rhode Island 173
Canada, Eastern 191
Oregon 201
Hatchery methods 81-82, 227-228
Heat stroke 214
Hensel, H. 3, 71
Hermaphroditic shad 111
Hickory shad 4-5, 74, 82, 149, 172
Hoffert, E. R. 3, 130
Hollis, E. 3, 7, 8, 56, 57, 61, 93, 184, 213
Holyoke Dam 234-237, 239, 256
Homing instinct 10-11, 79, 91-92
Housatonic River 158
Hudson River 39, 58, 60, 89, 112-113, 116-117, 123, 145, 147-148, 149-154, 210, 216, 221-224
Huntsman, A. G. 3, 10, 214
Hurricane 216

Indian shads 258
Interstate Commission of Delaware River Basin 105, 119-120, 140-141
Introduction 1
Irrigation 206, 238

Jack shad 149
Jackson, C. F. 3, 182
James River 53, 54, 56-57, 61, 91
Jefferson, T. 53
Johnson, D. R. 3, 197

Kennebec River 182, 183, 184
Killarney shad 3
Kippered shad 245

Lake Ontario 150
Laws 219-221
Florida 28-29

Georgia 35
South Carolina 43
North Carolina 51
Virginia 63
Maryland 98-99
Delaware 106
New Jersey 117-119, 121-122
New York 154
Connecticut 166, 168
Canada, Eastern 192-193
Pacific Coast 196
Oregon 202-203
California 207-208
LeFever, P. 3, 131
Lehman, B. 3, 14
Leim, A. H. 3, 5, 7, 13, 18, 186-191, 257
Leipsic Creek 102, 104
Life history 3-20, 252
Little Neck Bay 145
Locust shad 149
Long Island Sound 145, 147, 156, 158
Lunz, G. R. 3, 37, 39, 40, 42

Maine 3, 182-186, 255
Management of shad ..... 40, 59, 61, 80-94, 117-121, 151-154, 164-168, 191, 196, 200-202, 205-206, 217-225, 256.
Marketing of shad 246-247 91-92, 96-98, 100, 105-106, 218, 221-224, 256
Maryland 3, 59-60, 64-100, 253
Maryland Fish Management Plan ..... 40, 59, 60-61, 80, 91-92, 96-98, 100, 105-106, 218, 221-224, 256.
Massachusetts 3, 78, 175-179, 255
Massachusetts Bay 175
Massmann, W. 3, 56, 62, 63
Mattaponi Indians 23, 58
Mattaponi River 55-58, 62, 91
McHugh, J. L. 3, 62, 204
Merrimack River 176, 177, 179-182, 233-234, 239
Middle Atlantic States 250-251
Migration 7-11, 78, 81, 92-93, 165-166, 184, 188, 189, 195, 202
Miramichi River 189
Mispillion River 102, 103, 104, 105
Mobjack Bay 54, 56
Mortality 39, 60, 61, 90, 95, 164-166, 187-190, 202, 206-207, 214-215, 222-224, 228, 231-233
Moss, D. D. 3, 20, 62, 160, 162, 164, 168, 215, 229
Movements of young 18, 40, 87, 93, 94, 160, 191, 228, 232-233
Mugnier, A. D. 3, 159, 167, 177, 234-237
Mugnier Fishway 234-237, 239
Murderkill Creek 102, 104, 105

Nanticoke River 66, 68-69, 72, 95, 101, 103, 105
Narragansett Bay 171, 172, 173
Natural catastrophes 214-216
Natural fluctuations 61, 166-167, 216, 244
Natural history 3-20, 252
Natural mortality ..... 39, 60 61, 90, 95, 164-165, 189-198, 201-202, 205, 206-207, 214-215, 222-223, 256.
Nelson, J. 3, 45
Nelson, T. 3
Neuse River 44, 45, 48, 230
New Brunswick 186-193
New England States 250-251
New Hampshire 3, 179-182, 255
New Jersey 3, 107-123, 254
New River 45, 46
New York 3, 125-126, 143-156, 254
New York Bay 111, 144
Nissequague River 145, 148
North Carolina 3, 7, 8, 44-52, 92, 230, 253
Northeast River 65, 71, 93
Nova Scotia 78, 186-193
Number of eggs 14, 163, 191
Nutritious value of shad 246

Ocean, shad in 11-12, 18, 78, 175, 176, 182, 183, 184, 189
Ocmulgee River 30, 31
Oconee River 30, 31
Ogeechee River 30, 32, 33-34
Ohio shad 3
Oregon 3, 9, 195, 196, 199-204, 256
Oregon Inlet 45
Otoliths 164
Overfishing 210-211
Florida 28
Georgia 32
South Carolina 39
North Carolina 47, 50
Virginia 60, 61
Maryland 75-86, 90, 95-96
Delaware 104
New Jersey 115-116
Pennsylvania 135
New York 150-153, 210
Connecticut 159-160, 162-166, 210
New Hampshire 180-181
Pacific Coast 196
California 206
Ovulation 13-14, 163, 191

Pacific Coast 195-209, 227, 231-233, 255-256
Pacific Coast area 250-251
Pacific Coast Halibut Management Plan 221-224
Pacific Coast shad 3, 195
Pamlico Sound 44, 45, 46, 50
Pamlico-Tar area 44, 46
Pamunkey River 55-58, 62, 91, 93
Paralosa 258
Parasites 19, 215-216
Parent-stream theory 7-10, 11, 79, 91-92, 195
Patapsco River 64, 68
Patuxent River 64, 66, 67, 72, 74, 80, 81-83, 88-89, 92-93, 94
Pawcatuck River 171
Pee Dee River 36, 37, 40
Pennsylvania 3, 5-6, 124-143, 254
Perlmutter, A. 3
Petitcodiac 187, 214
Pink shad 149
Penobscot River and Bay 183
Planking of shad 111
Pocomoke River 66, 68, 72, 91
Pollution 211
Florida 28
Georgia 32
South Carolina 39
North Carolina 48
Virginia 61
Maryland 74, 76
Delaware 103-104
New Jersey 114-115
Pennsylvania 129-131, 135, 141-142
New York 151, 154
Connecticut 159-160
Rhode Island 172-173
New Hampshire 182
Maine 184
Pomolobus 4-5, 74, 82, 149, 172, 258
Population analysis 153-154, 165-167, 201-202, 210-211, 219
Porpoises 19
Potomac River ..... 53-54, 56, 57, 62, 63, 64-65, 67, 73, 74, 75, 79, 85, 89, 91, 93-94, 95, 98, 225, 226-228.
Predators 19, 21, 48, 65, 71, 74, 79, 132, 161, 188, 189-190, 215-216
Procedure 2
Prognosis of shad fisheries 257
Providence-Blackstone River 171
Puget Sound 197-198

Quebec 8-9, 187, 194
Questionnaires 2

Racer shad 14
Races of shad 7-8, 78, 91-92, 93, 166-167, 188
Range, geographical 6-7, 195-196
Rank of shad fisheries 1, 252
Rappahannock River 53, 56, 57, 61, 91
Raritan Bay 110, 112
Raritan River 110-111
Rattler device 103, 104
Razorback shad 132
Rebel shad 149
Redfin shad 149

Red tide 214-215
Regulations (see laws)
Rehabilitation of shad
Florida 24-26
Georgia 34-35
South Carolina 40-41
North Carolina 49-51
Virginia 62-63
Maryland 80-94
Delaware 104-106
New Jersey 117-121
Pennsylvania 134, 135, 143
New York 151-154
Connecticut 161-168
Rhode Island 178
New Hampshrire 182
Maine 184-185
Canada, Eastern 191
Oregon 200-202
California 205-207
Repeater shad 12-13, 90, 91, 165, 222
Reproduction of shad 12-18, 22-23, 38, 39, 49, 77, 111, 114, 115, 116, 131-132, 160-163
Rheotropism 10, 85
Rhode Island 3, 171-174, 255
River herrings 4-5. 74, 82, 149, 172, 258
Rivers, shad in 12, 226
Roanoke River 44, 46, 50, 51
Roe of shad 13-14, 198, 245
Roedel, P. M. 3
Roelofs, E. 3, 45, 46, 47-48
Rotten-ripe eggs 13

Saco River 182
Sacramento River 195, 204-205
Saint Jones Creek 102
Saint John River (Canada) 186-187, 189, 192
Saint John River (Florida) 20-21, 22-23, 24, 25-28, 37, 58
Saint Lawrence River 8-9, 186, 187, 188, 189, 194
Saint Marys River 21, 22, 24, 29, 31, 34-35
Salmon 195-196, 199-200, 203, 204, 205-206, 208
Salmon River 215
San Joaquin River 195, 204-205
Sandy Hook Bay 110, 113
Santee River 36, 37
sapidissima, Alosa 3
Sargeant, F. W. 3
Sassafras River 70, 71, 74, 98
Satilla River 29, 31, 34
Savannah River 30, 32, 37
Scales of shad 12-13, 19-20, 38-39, 90
Schroeder, W. C. 3, 5, 82
Scope of Report 2
Seabrook, A. 3, 37
Sea Shad 11, 18, 78, 175, 176, 182, 183, 184, 189
Seitz, M. V. 3
Senning, W. C. 3
Sensory mechanisms 10-11, 111-112, 232-233, 236-237
Severn River 68, 71
Sexual maturity of shad 12-13
Shad
Alabama 3, 4, 22, 195
Allis 3
American 3
Atlantic 3
Atlantic coast 3
Backer 149
Blueback 149
Boned 169-170, 245
Canned 196, 197-197, 204, 246
Caspian 258
Chunker 149
Chunkhead 149
Clubtail 143
Downrunner 10
European 3, 9-10, 258
Fall 182-183
Fat 11-12, 182, 183, 184, 187
Frozen ..... 245-246.
Golden 149
Greenback 149
Gulf 3
Hickory 4-5, 74, 82, 149, 172
Jack 149
Killarney 3
Kippered 245
Locust 149
Ohio 3, 5
Pacific 3
Pink 149
Racer 14
Razorback 132
Rebel 149
Redfin 149
Repeater 12-13, 90, 91, 165, 222
Sea 11, 18, 78, 175, 176, 182, 183, 184, 189
Smoked 245
Spent 14, 111, 132, 149
Throwback 132
Twaite 3
Virgin 12-13, 60, 91, 165, 222
White 3
Shad battery 65, 66, 125
Shad bed 132
Shad float 65, 66, 125
Shad fishery management 224-225
Shadine 149
Shad Investigations Group (United States Fish and Wildlife Service) 2, 3, 5, 8, 59, 94, 134-135, 154, 165-166, 211, 226, 257
Shad wallows 13, 132
Shark 19
Shingle device 104
Shoemaker, H. E. 3, 6, 132
Shrimp fisheries 42
Shubenacadie River 78, 167, 186, 191, 192, 214
Silliman, R. P. 3, 216
Siltation 212
Siuslaw River 199, 202
Size of shad 5-6
Slabs 39
Sloat, J. W. 3, 232
Smoked shad 245
Socio-economics of shad fisheries 237-238, 240-252, 257
Sources of supply 245
South Atlantic States 250-251
South Carolina 3, 35-43, 253
Spawning ..... 12-18, 22-23 38, 39, 49, 77, 111, 114, 115, 116, 131-136, 148, 160-163, 191, 200-201, 212.
Spawning grounds 13, 132, 148, 200-201
Spawning mark 13, 19-20, 90, 152, 164, 211
Spent shad 14, 111, 132, 149
Sport fishing for shad:
Florida 23
Georgia 32
Virginia 57
Maryland 74
New Jersey 111
Connecticut 159
Massachusetts 177
Oregon 200
California 204
Stackhouse, H. R. 3
Statistics (see catch records)
Stearns, J. 3
Steelhead Salmon 195-196
Stocking (see artificial propagation)
Stringer, L. D. 3, 172
Striped bass 19, 82 119, 121, 131, 191, 196, 224, 238
Suisun Bay 204
Summary 252
Survival ..... 39, 60, 61, 90, 95, 164-166, 187-190, 202, 206-207, 211-212, 214-215, 222-224, 228, 231-233.
Susquehanna River ..... 65, 66, 68, 71, 74, 77, 82, 83, 87, 88, 91-93, 94, 98, 124-136, 212, 213, 226.
Sykes, J. 3, 7

Tagging 7-10, 78, 92-93, 135, 166, 167, 184, 202, 223
Talbot, G. 3, 51, 211, 232-233
Taunton River 175, 176
Thames River 157, 158
Throwback shad 132
Tilefish 215

Tiller, R. E. 3, 71, 92
Transportation of shad 7, 134-135, 228
Trend of production 1, 247-252, 257
Florida 26-28
Georgia 33
South Carolina 41-42
North Carolina 51-52
Virginia 58-59
Maryland 99-100
Delaware 106-107
New Jersey 122-123
New York 154-155
Connecticut 168-170
Rhode Island 173-174
Massachusetts 178-179
Maine 185
Canada, Eastern 193-194
Washington 198-199
Oregon 203-204
California 208-209
Truitt, R. V. 3, 8, 74, 76, 77, 79, 89, 93, 184
Turner, R. E. 3
Twaite shad 3

Umpqua River 199, 200, 201-202
Underhill, J. H. 3
United States Corps of Engineers 231-233
United States Fish and Wildlife Service 257
(See Shad Investigations Group)
Urban, G. K. 3, 126, 130

Vathis, G. 3
Vermont 179, 254
Vertebrae of shad 78, 93, 166-167
Virginia 3, 53-65, 253
Virgin shad 12-13, 60, 91, 165, 222

Waccamaw River 36-37
Walburg, C. H. 3, 135
Walker, E. 3, 9, 19
Wallace, D. 3, 78, 89, 166
Wallows, shad 13, 132
Warren River 171, 173
Washington 3, 196, 197-199, 255-256
Washington, G. 53, 95
Water hyacinth 4
Weaver, R. N. 3, 126
Weights 5-6, 111, 149, 197, 205
Westman, J. R. 3
Whaley, C. 3
White, A. 64
White shad 3
Wicomico River 69, 73, 76, 95
Willamette River 199, 200, 201
Wilson, A. 3
Winter kill 214
Winyah Bay 36, 38, 41

Yarrington, W. F. 3
Yellowback shad 143, 146
Yerger, R. W. 3, 22
York River 53, 55, 91
Young shad ..... 14-19, 40, 91-92, 148, 176, 177, 180-181, 186-187, 189-190, 191 206-207, 212-213, 228, 232.