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AMERICAN SHAD STOCKS ALONG THE ATLANTIC COAST

by

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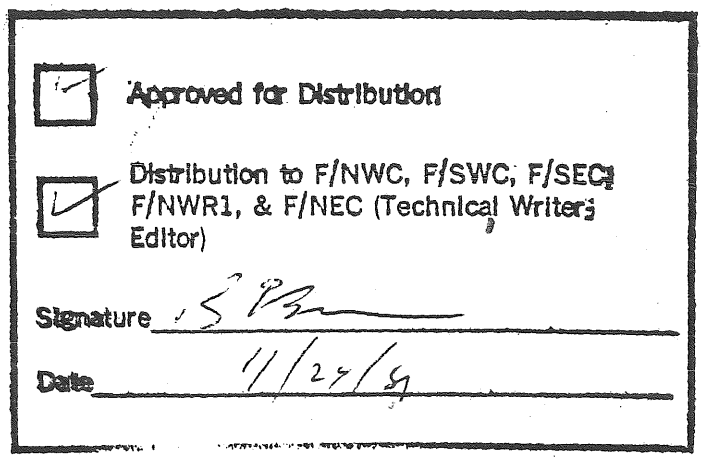

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INTRODUCTION

The American shad, Alosa sapidissima (Wilson), is an anadromous member of the family Clupeidae (herrings). Along the Atlantic coast, its range extends from southeastern Labrador (Hare and Murphy 1974) to northern Florida (Bigelow and Schroeder 1953). American shad were successfully introduced on the Pacific coast in the late 1800's and are now established from Alaska to southern California (McHugh and Fitch 1951). Svetovidov (1963) noted the presence of American shad along the eastern shore of Kamchatka, USSR.

American shad have been subjected to intensive exploitation for their flesh and roe. Commercial landings along the Atlantic coast surpassed 50 million pounds in 1896 (Walburg and Nichols 1967), but currently average less than 3 million pounds per year. Overharvest, dams, and pollution have been blamed for the decline in landings levels (Cheney 1896; Blackford 1916; Talbot 1954; Chittenden 1969; Klauda et al. 1976).

The purpose of this document is to present an assembly of available information on the life history and fisheries of the Atlantic coast stocks of American shad. Furthermore, key information needs and monitoring requirements will be discussed.

LIFE CYCLE

The American shad is anadromous with a strong homing tendancy (Hollis 1948; Nichols 1960; Dodson and Leggett 1973). Virtually every major coastal river along the Atlantic seaboard has, at one time, supported a stock. A generalized life cycle is shown in Figure 1.

Spawning

The spawning run begins in November in Florida (Hildebrand 1963) and February in Maryland (Mansueti 1955). Peak spawning activity occurs in Maryland streams during April (Mansueti and Kolb 1953), during May and June in the Delaware River (Chittenden 1969), and as late as July in the more northern localities (Cheek 1968).

Jones et al. (1978) summarize spawning activity as occurring between noon and midnight (night in clear water and all day in turbid water) generally at temperatures between 12°C and 21°C. Spawning occurs mostly in tidal freshwater (Jones et al. 1978) usually in river areas dominated by extensive flats (Massman 1952). Spawning also occurs over sandy or pebbly shallows (Hildebrand 1963) and frequently near mouths of creeks (Mansueti 1955). The number of eggs per spawning female varies from 50,000 (Roy 1969) to 650,000 (Walburg 1960). Davis (1957) and Leggett (1969) noted that the ova production by size of female generally decreased with increasing latitude along the Atlantic coast. Most of the adults south of North Carolina die after spawning, which Leggett (1972) attributes to increased use of fat reserves during spawning in the warmer climate. Repeat spawning is a common observation in the more northern rivers.

Chittenden (1969) found that the sex composition of the spawning population in the Delaware River varied considerably (23 - 99 percent males). Relative year class strength appeared to be responsible for the variation. Talbot (1954) found a sex composition of 43 percent males in the 1950 and

1951 spawning populations in the Hudson River, and Jones et al. (1976) found the sex ratio in the Connecticut River was close to 1:1 in 1976.

Early Life History

Eggs of American shad are demersal (Mansueti 1955), although Marcy and Jacobson (1976) found eggs throughout the water column in the Connecticut River. Hatching occurs in 2-17 days, depending on water temperature, and the yolk is completely absorbed by the larva in 4-7 days (Boreman 1979). Transformation into the full adult complement of fin rays occurs 3-4 weeks after yolk absorption (Ryder 1887). Leim (1924) determined that the optimal conditions for egg development were at temperatures near 17°C and a salinity concentration of 7.5 ppt. Leggett and Whitney (1972) found that the maximum hatch and survival of eggs and larvae occurred in a temperature range of 15.5°C - 26.5°C.

Leim (1924), Stira and Smith (1976), and Boreman (1979) noted an abrupt downriver shift in the spatial distribution of early juvenile shad, compared to earlier life stages. Leim (1924) attributed his observation to the pelagic behavior of larvae, indicating they could have easily been carried downriver by water currents.

Most juvenile shad migrate to coastal waters by their first winter. Chittenden and Westman (1967) and Leggett and Whitney (1972) noted a coincidence between peak downriver movement of juvenile shad and a decline in water temperature below 15.5°C. A similar observation was made by Boreman (1979) for Hudson River shad.

Non-Spawning Adults

Talbot and Sykes (1958) found that adult shad tagged in estuaries from

Chesapeake Bay to the Connecticut River migrate to the Gulf of Maine to spend the summer and fall. Tagging evidence also indicated that adult shad overwintered in the deep waters along the Middle Atlantic coast, moving closer to their natal rivers as spawning season approached. Leggett and Whitney (1972) noted that inshore coastal migrations followed the 13°C - 18°C isotherm northward to the Gulf of Maine in the summer and southward to the Middle Atlantic region in the winter.

Offshore (>15 fm) distribution and movement patterns of American shad were summarized by Neves and Depres (1979) from catch data collected during bottom trawl surveys between the Gulf of Maine and Cape Hatteras by the National Marine Fisheries Service and cooperating foreign countries. They found that offshore movements were limited to areas and depths with near-bottom temperatures between 3°C and 15°C, and most frequently in offshore areas of 50-100 m depth. In summer and early autumn shad were found in the Gulf of Maine and south of Nantucket Shoals. During the winter the shad congregated between southern Long Island and Nantucket Shoals. The spring and fall offshore distributions of American shad are shown in Figure 2.

Trophic Relationships

Juvenile American shad feed on crustaceans and aquatic and terrestrial insects (Walburg 1956; Massman 1963; Davis and Cheek 1966; Levesque and Reed 1972). Some freshwater feeding by adult shad has also been documented (Hatton 1941; Atkinson 1951; Chittenden 1976), although it is not a common observation. In the ocean, adults consume a broad spectrum of marine plankton, primarily mysid shrimp, copepods, and euphausiids (Bigelow and Schroeder 1953 Hildebrand 1963 Leim and Scott 1966 Scott and Crossman 1973). Predation on shad is poorly documented; potential predators include seals, bluefish, striped bass, and weakfish.

Pathobiology

American shad do not appear to be severely infected by parasites (Scott and Crossman 1973). Leim (1924) noted the presence of nematodes and distomes in the alimentary tracts of three young shad in a sample of over 40 from the Shubenacadie River, Nova Scotia, and distomes, nematodes, and Acanthocephala in adult shad captured in Scotsman Bay, Nova Scotia. Hoffman (1976) listed the larval form of the trematode Clinostomum marginatum, and the crustacean Argulus canadensis. Young-of-the-year American shad are susceptible fo IPN (infectious pancreatic necrosis), a viral infection commonly found in menhaden (M. Newman, NMFS-Oxford, pers. comm.).

FISHERIES

Fishing has been blamed for declines in landings of American shad in the Hudson River (Talbot 1954; Burdick 1954), the Connecticut River (Fredin 1954; Walburg 1963), in Maryland rivers (Walburg 1955), in North Carolina rivers (Sholar 1976), and in the St. Johns River, Florida (Williams and Bruger 1972). Recent commercial landings reported for states along the Atlantic coast have been the lowest on record (Table 1).

Commercial Fisheries

Drift gill nets accounted for 46 percent of the reported commercial landings of shad on the Atlantic coast in 1896, followed by pound nets and weirs (23 percent), haul seines (16 percent), and stake gill nets (14 percent). In 1960, stake and anchor gill nets accounted for 35 percent of the reported landings, followed by drift gill nets (28 percent), pound nets (16 percent), haul seines, bow nets, and rod and reel (each 4 percent). Other gear used included fyke nets, otter trawls, traps, and fish wheels.

Gear have remained relatively unchanged; however, Walburg and Nichols (1967) cite several improvements in fishing methods that have had effects

on the landings. These improvements included conversion from cotton and linen to nylon for gill nets; adaptation of nets to the bottom contours, currents, and local conditions of the area in which used; replacement of tar as a preservative and antifouling compound with copper paint in the Chesapeake Bay pound net fishery; widened spacing of stakes which support stationary nets; and use of continuous lengths of netting to replace single panels hung from stakes in some localities.

For the period 1929-1980, the Atlantic coast states with the highest yearly average of reported commercial landings were Virginia (2,987,000 pounds per year), New Jersey (1,158,000 pounds per year), Maryland (986,000 pounds per year), and North Carolina (818,000 pounds per year). A comparison of the 1929-1970 yearly average to the 1971-1980 yearly average (Table 2) reveals that all states except South Carolina have experienced a decline in the past ten years. The increase in the South Carolina landings was due to a change in the landings data collection procedure that added additional sources since 1978; a decline would also be evident in South Carolina if the old procedure was used during 1978-1980 (B. McCord, S.C. Wildl. and Mar. Res. Dept., pers. comm.). Appendix I contains the reported annual landings of American shad for each Atlantic coast state from 1929 to 1980.

To examine the long-term trends in reported landings, simple linear regression analyses were performed between the state landings (dependent variable) and years (independent variable). Results (Table 3) indicate that five states (New York, New Jersey, Virginia, North Carolina, and Florida) exhibited a significant decline in reported landings between 1929 and 1981 (1977 for Florida). Residuals of the linear regressions were used to detect correlations in annual fluctuations of the reported landings to avoid overriding effects of long-term trends. Based on the results of the correlation analyses (Table 4),

the coastal states can be divided into two groups of similar annual variability. One group includes Maine, Connecticut, New York, New Jersey, and Delaware, and the other group includes all the states south of Delaware. These relationships indicate that conditions affecting reported landings are similar from Maine to Delaware and distinct from the conditions that affect landings from Maryland to Florida. Conditions that may affect reported landings include stock abundance, fishing effort, and markets (price per pound).

Recreational Fisheries

Recreational landings, like commercial landings, have declined in recent years. Rhode Island, Delaware, and Maryland reported to the Atlantic States Marine Fisheries Commission that recreational harvests have declined to virtual non-existance since 1970 (L. King, ASMFC, pers. comm.). In fact, Maryland closed its recreational (and commercial) fishery in 1980 and 1981 to protect the stock, which is at an extremely low level.

Of the five marine recreational fishery surveys conducted by the National Marine Fisheries Service and its predecessor, only the 1965 and 1970 surveys listed American shad as a separate species group (Deuel and Clark 1968; Deuel 1973). No members of the herring family (except Pacific herring) were included in the 1960 survey (Clark 1962), and American shad were lumped with other herrings and smelt in the 1974 survey (Deuel, pers. comm.) and lumped with other herring in the 1979 survey (U.S. Department of Commerce 1980). The 1965 survey estimated 2 million shad weighing a total of 4.7 million pounds were caught by 104,000 anglers along the Atlantic coast (Deuel and Clark 1968). In 1970, 1.7 million shad weighing a total of 4.9 million pounds were caught by 69,000 anglers (Deuel 1973). Landings in the recreational fisheries in 1965 and 1970 were 61 and 65 percent, by weight, of the Atlantic

coast commercial landings for those years. The most popular waters for sport fishing include the Connecticut River, Chesapeake Bay and its tributaries, and rivers along the southeast coast. Interestingly, the Hudson River, which supports a sizeable population of shad, is not a popular location for sport fishing.

Foreign Fisheries

Bulgaria, East Germany, Ireland, and Japan have landed American shad in waters off the Atlantic coast from Maine to Cape Hatteras (NAFO Subareas 5 and 6) in the past ten years (Table 5). Foreign vessels have accounted for less than 3 percent of the total landings of American shad between 1970 and 1980.

MANAGEMENT

Management of the shad fishery along the Atlantic coast is done at the state level. Management measures in effect are net lift periods, fishing seasons, gear restrictions, and prohibition of fishing on spawning grounds. States have instituted all, some, or none of these measures. In many states (e.g., Georgia, South Carolina, Delaware, and New York) management is through legislative action (laws and statutes). Other states manage shad through their fishery agencies (e.g., North Carolina).

Several states (Maine, New Hampshire, Massachusetts, Vermont, Rhode Island, Connecticut, New York, New Jersey, Delaware, and Pennsylvania) are currently involved in restoration of American shad runs to their rivers. The principal restoration methods are transplantation of adults from other rivers (O'Brien and Stolgitis 1976; Squiers et al. 1981) and through pollution abatement (Flagg 1976). Interstate cooperative programs have been established to help coordinate shad restoration. The Connecticut River Anadromous Fish Restoration Program (members: Massachusetts, Connecticut, Vermont, New Hampshire, USFWS, and

NMFS) is attempting to increase the level of shad and Atlantic salmon stock abundance in the Connecticut River. Massachusetts, New Hampshire, USFWS, and NMFS are cooperating in a shad restoration program for the Merrimac River. A shad management plan is currently being prepared by the Delaware River Basin Fish and Wildlife Management Cooperative (members: New Jersey, New York, Delaware, Pennsylvania, USFWS, and NMFS).

DISCUSSION

Effective management of American shad stocks along the Atlantic coast, with the objective of restoration to former levels of abundance, requires continued research in several areas. A research plan for coastwide stock restoration should be designed to answer the following questions: (1) To what extent is each stock subjected to exploitation within and outside its natal river? (2) What factors other than exploitation are inhibiting successful shad production, and how do these factors affect the parent/progeny relationship? (3) What mitigative measures other than control of fishing mortality might be used to restore the stocks and how effective would they be? (4) What monitoring is necessary to determine the success or failure of management measures?

Understanding the mechanisms that control year class strength and the stock/recruitment relationship should be a major thrust of any research plan. The observed decline in landings may have been caused by increased exploitation, but was more likely caused by the reduced ability of the stocks to withstand additional stress, i.e., a reduction in the stock's "compensatory reserve" (Goodyear 1977). Dams and pollution are two other stresses that have been blamed for stock reduction; however, more subtle stresses may have gone undetected. Klauda et al. (1976) identified several biotic and abiotic factors

which could influence year class strength of American shad in the Hudson River. Biotic factors are spawning stock characteristics (abundance, age composition, sites, sterility, and zygote quality), food quality and quantity, predators, cannibals, and epizootics. Abiotic factors include freshwater inflow, temperature, salinity, dissolved gases, nutrients, turbidity, contaminants, and entrainment and impingement at cooling water intakes of industrial facilities.

Once management measures designed to increase stock levels are taken, a monitoring program would be necessary to evaluate their effectiveness. At a minimum, the monitoring program should include collection of data pertinent to determining year class strength, on a relative or absolute scale, and identifying the age, sex, and stock composition of riverine and coastal landings. Depending on the type of management measures taken, variables such as dissolved gases, freshwater inflow, turbidity, and contaminant and pathogen levels may also be monitored.

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Table 1. Reported Commercial Landings (000 pounds) of American Shad along the Atlantic Coast

Year	North Atlantic[1]	Middle Atlantic[2]	Chesapeake[3]	South Atlantic[4]	Total
1880	2,096	5,093	6,946	3,933	18,068
1887	1,622	12,775	7,856	7,377	29,630
1888	1,398	12,745	11,925	7,869	33,397
1896	1,833	20,605	16,712	11,349	50,499
1908	1,285	4,827	11,251	8,572	25,935
1929	461	622	9,526	3,346	13,955
1930	201	450	7,181	2,541	10,373
1931	401	660	8,487	1,788	11,336
1932	232	643	6,515	1,882	9,272
1937	445	4,393	3,491	1,317	9,647
1938	503	3,592	4,207	1,418	9,720
1939	530	4,132	4,183	1,230	10,075
1940	574	4,788	3,257	1,345	9,964
1945	818	5,900	5,916	2,065	14,699
1950	296	1,802	4,474	1,651	8,223
1951	492	1,254	4,849	1,882	8,477
1952	577	2,240	5,643	2,061	10,521
1953	431	1,230	4,502	1,636	7,799
1954	308	1,588	4,670	2,102	8,668
1955	259	1,973	4,964	1,403	8,599
1956	924	2,032	5,283	1,433	9,672
1957	2,556	2,014	5,274	1,525	11,369
1958	893	1,667	4,154	1,472	8,186
1959	1,789	1,726	3,255	1,430	8,200
1960	432	1,237	2,682	1,614	5,965
1961	547	1,026	3,144	1,612	6,329
1962	470	841	3,796	2,167	7,273
1963	325	744	3,139	1,734	5,942
1964	320	721	3,541	1,687	6,269
1965	380	635	4,298	2,379	7,692
1966	279	379	3,564	1,736	5,958
1967	754	387	3,005	1,562	5,708
1968	218	379	3,508	2,052	6,157
1969	201	342	3,540	1,904	5,987
1970	186	314	5,151	1,851	7,502
1971	283	222	2,473	1,452	4,430

Table 1 (cont'd).

Year	North Atlantic[1]	Middle Atlantic[2]	Chesapeake[3]	South Atlantic[4]	Total
1972	264	375	3,014	1,091	4,744
1973	261	308	3,033	685	4,287
1974	257	294	1,789	655	2,995
1975	319	337	1,321	518	2,495
1976	417	322	1,006	320	2,065
1977	358	520	1,541	416	2,835
1978	294	616	1,321		
1979	231	251	1,040		
1980	358	502	996		

Source: U. S. Department of Commerce, Current Fishery Statistics

[1]ME, NH, MA, RI, CT

[2]NY, NJ, DE, PA

[3]MD, VA

[4]NC, SC, GA, FL

Table 2. Average annual reported landings of American shad in the commercial fishery along the Atlantic coast.

State/Region	Average Landings (000 Pounds)		
	1929-1980	1929-1980	1971-1980
Maine	68	81	14
Massachusetts	143	177	2
Rhode Island	8	8	8
Connecticut	357	375	279
New England[1]	576	641	304
New York	643	759	156
New Jersey	1,158	1,392	177
Delaware	53	52	42
Middle Atlantic[2]	1,853	2,206	375
Maryland	986	1,144	325
Virginia	2,987	3,358	1,428
Chesapeake	3,973	4,502	1,753
North Carolina	818	935	325
South Carolina	121	118	124
Georgia	267	277	224
Florida[3]	440	496	104
South Atlantic	1,670	1,826	734
Atlantic Coast[3]	8,351	9,174	3,407

[1] Includes New Hampshire (1976-1980)

[2] Includes Pennsylvania (1929-1972)

[3] 1978-1980 not included

Table 3. Results of Simple Linear Regressions of Commercial Landings (Dependent Variable) vs Years

State	Intercept	Slope	r^2-value
Maine	241	-3.2	0.08*
Massachusetts	183	-0.7	0.00
Rhode Island	15	-0.1	0.04
Connecticut	469	-2.1	0.03
New York	1,775	-20.8	0.25*
New Jersey	3,448	-42.0	0.27*
Delaware	24	0.5	0.04
Maryland	1,469	-8.9	0.06
Virginia	6,907	-71.9	0.53*
North Carolina	1,773	-16.8	0.51*
South Carolina	114	0.1	0.00
Georgia	142	2.3	0.07
Florida	860	-7.9	0.25*

*$P < 0.05$

Table 4. Signs of Correlation Coefficients[1] Between Residuals of Linear Regressions of Commercial Landings (Dependent Variable) vs Years

State	ME	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA
MA	0											
RI	0	0										
CT	+	0	0									
NY	+	0	0	+								
NJ	0	0	0	+	+							
DE	0	0	0	+	0	0						
MD	0	+	0	0	-	-	0					
VA	0	0	0	0	0	-	0	0				
NC	0	0	0	0	0	-	0	+	+			
SC	0	0	0	-	-	-	0	0	0	+		
GA	0	0	0	0	-	-	0	+	+	+	+	
FL	0	0	0	0	0	0	+	0	+	0	0	+

[1] 0 = no significant correlation ($P>0.05$)

Table 5. Landings of American Shad (000 Pounds) in ICNAF Areas 5 and 6 by Foreign Vessels

Year	Nation				
	Bulgaria	E. Germany	Ireland	Japan	Total
1970	0	0	0	0	0
1971	0	0	0	0	0
1972	5	0	0	0	5
1973	0	308	0	0	308
1974	0	0	0	0	0
1975	0	0	1	0	1
1976	0	0	0	5	5
1977	0	0	0	0	0
1978	0	0	0	0	0
1979	0	0	0	0	0
1980	0	0	0	0	0

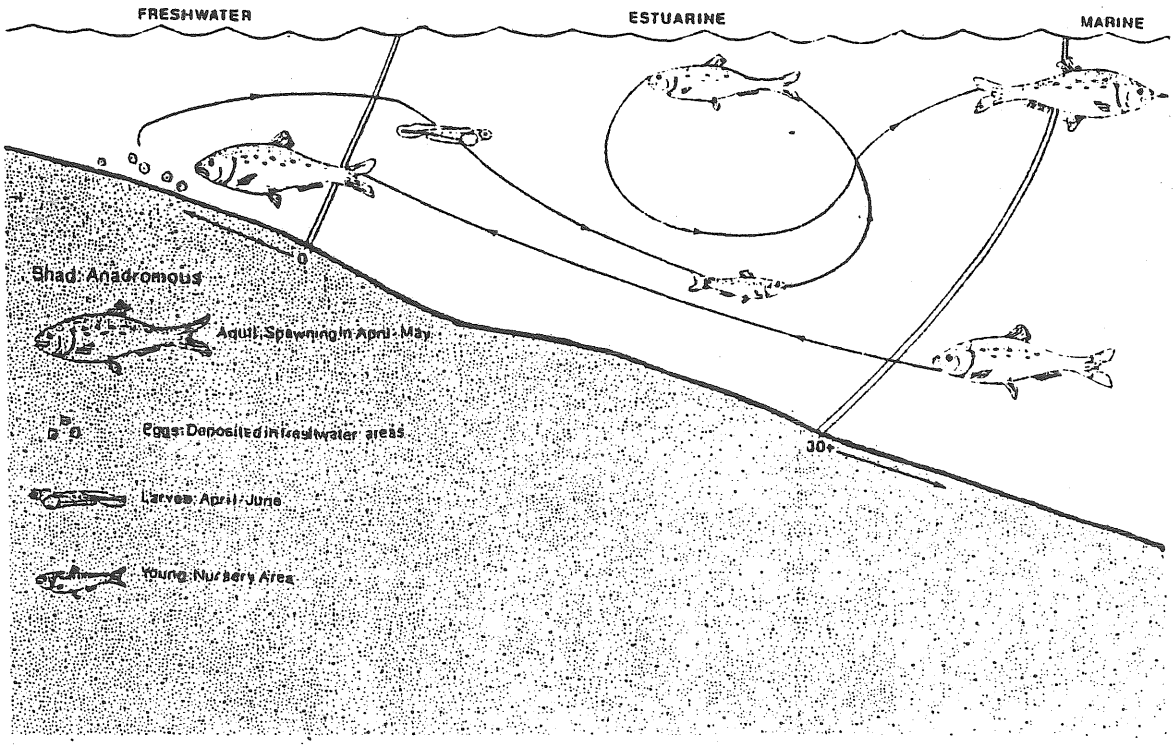

Figure 1. Generalized life cycle of American shad in the Hudson River (adapted from McFadden 1978).

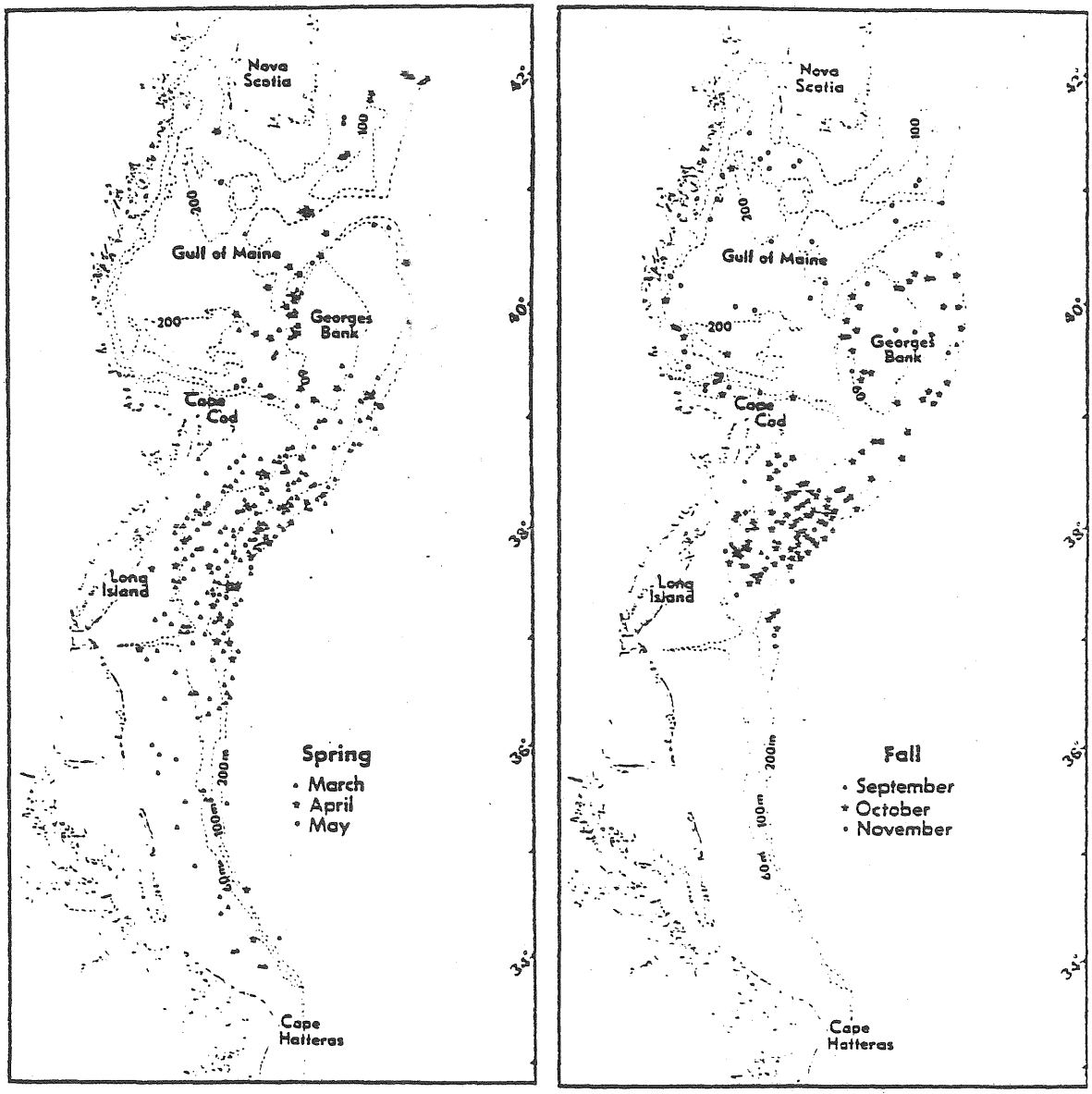

Figure 2. Capture locations of American shad in the spring and fall offshore bottom trawl surveys conducted by the National Marine Fisheries Service (from Neves and Depres 1979).

Appendix I. Reported commercial landings of American shad in states along the Atlantic coast, in thousands of pounds.

DATE	ME	NH	MA	RI	CT	NY	NJ	DE	PA	MD	VA	NC	SC	GA	FL
1929	36.00	0.00	93.00	15.00	318.00	168.00	342.00	94.00	22.00	1549.00	7977.00	1913.00	260.00	472.00	701.00
1930	89.00	0.00	54.00	4.00	54.00	169.00	224.00	54.00	5.00	998.00	6183.00	1172.00	214.00	275.00	880.00
1931	158.00	0.00	150.00	18.00	75.00	357.00	257.00	39.00	7.00	1196.00	7291.00	883.00	152.00	132.00	621.00
1932	108.00	0.00	46.00	8.00	71.00	401.00	224.00	16.00	2.00	1667.00	4848.00	925.00	123.00	288.00	546.00
1933	179.00	0.00	63.00	11.00	133.00	352.00	458.00	22.00	2.00	1374.00	4817.00	1100.00•	166.00•	260.00•	664.00
1934	96.00•	0.00•	185.00•	9.00•	268.00•	414.00•	638.00•	24.00•	6.00•	885.00	4105.00	1274.00	209.00	232.00	782.00
1935	13.00	0.00	306.00	6.00	403.00	476.00	818.00	25.00	10.00	800.00	2883.00	1185.00•	193.00•	234.00•	532.00•
1936	11.00•	0.00•	177.00•	6.00•	393.00•	749.00•	2079.00•	23.00•	12.00•	570.00	1615.00	1095.00	177.00	236.00	282.00
1937	9.00	0.00	48.00	5.00	383.00	1021.00	3340.00	20.00	13.00	405.00	3086.00	698.00	138.00	193.00	288.00
1938	12.00	0.00	55.00	10.00	427.00	1072.00	2492.00	14.00	14.00	600.00	3607.00	1032.00	59.00	98.00	229.00
1939	9.00	0.00	85.00	28.00	409.00	1378.00	2699.00	44.00	11.00	624.00	3559.00	859.00	42.00	75.00	254.00
1940	65.00	0.00	95.00	54.00	359.00	1382.00	3365.00	31.00	10.00	446.00	2811.00	801.00	50.00	150.00	344.00
1941	113.00•	0.00•	64.00•	28.00•	366.00•	1482.00•	4096.00•	23.00•	9.00•	534.00	2126.00	823.00•	59.00	164.00•	444.00•
1942	161.00	0.00	33.00	1.00	373.00	1582.00	4826.00	14.00	7.00	725.00	2430.00	845.00•	66.00	179.00•	543.00•
1943	272.00	0.00	114.00	2.00	553.00	2245.00	3348.00	24.00	0.00	718.00•	3548.00•	868.00•	73.00	193.00•	643.00
1944	441.00	0.00	20.00	4.00	747.00	2130.00	4314.00	41.00	0.00	711.00	4665.00	890.00•	81.00	208.00•	742.00
1945	15.00	0.00	29.00	3.00	772.00	2850.00	2917.00	133.00	0.00	617.00	5299.00	912.00	89.00	222.00	842.00
1946	1107.00	0.00	10.00	3.00	1146.00	1744.00	2246.00	101.00	0.00	719.00	3599.00	950.00•	86.00	214.00•	733.00
1947	304.00	0.00	52.00	2.00	793.00	1267.00	1574.00	68.00	0.00	868.00	4086.00	987.00•	83.00	205.00•	624.00
1948	3.00	0.00	34.00	2.00	622.00	1393.00	1853.00	53.00	0.00	1004.00	3206.00	1025.00•	79.00	197.00	516.00
1949	5.00	0.00	11.00	3.00	471.00	900.00	1407.00	57.00	0.00	1083.00	2801.00	1062.00	76.00	188.00	407.00
1950	2.00	0.00	28.00	2.00	264.00	628.00	1072.00	102.00	0.00	1443.00	3031.00	1100.00	73.00	180.00	298.00
1951	76.00	0.00	72.00	6.00	330.00	462.00	602.00•	110.00	0.00	1554.00	3295.00	1244.00	96.00	206.00	336.00
1952	51.00	0.00	49.00	5.00	474.00	773.00	1402.00	65.00	0.00	1636.00	4007.00	1479.00	136.00	243.00	203.00
1953	27.00	0.00	40.00	4.00	360.00	491.00	679.00	60.00	0.00	1448.00	3054.00	1188.00	110.00	214.00	121.00
1954	2.00	0.00	9.00	2.00	295.00	707.00	826.00	55.00	0.00	1501.00	3169.00	1445.00	196.00	180.00	281.00
1955	7.00	0.00	37.00	5.00	210.00	615.00	1326.00	32.00	0.00	1464.00	3500.00	649.00	88.00	158.00	508.00
1956	2.00	0.00	724.00	1.00	197.00	704.00	1316.00	12.00	0.00	2092.00	3191.00	773.00	116.00	168.00	376.00
1957	8.00	0.00	2214.00	5.00	329.00	627.00	1384.00	4.00	0.00	2356.00	2918.00	837.00	80.00	247.00	361.00
1958	10.00	0.00	425.00	2.00	456.00	644.00	964.00	59.00	0.00	1900.00	2254.00	493.00	71.00	319.00	589.00
1959	2.00	0.00	1383.00	3.00	401.00	672.00	1026.00	28.00	0.00	1481.00	1774.00	419.00	80.00	391.00	540.00
1960	0.00	0.00	29.00	3.00	400.00	418.00	781.00	38.00	0.00	1333.00	1349.00	507.00	106.00	533.00	468.00
1961	0.00	0.00	80.00	4.00	463.00	303.00	633.00	90.00	0.00	1815.00	1329.00	673.00	110.00	404.00	425.00
1962	0.00	0.00	7.00	7.00	456.00	243.00	480.00	118.00	0.00	1575.00	2220.00	765.00	115.00	527.00	760.00
1963	0.00	0.00	22.00	2.00	301.00	202.00	442.00	100.00	0.00	827.00	2312.00	693.00	120.00	331.00	590.00
1964	0.00	0.00	39.00	3.00	278.00	141.00	430.00	150.00	0.00	890.00	2651.00	640.00	120.00	314.00	613.00
1965	0.00	0.00	24.00	4.00	352.00	133.00	392.00	110.00	0.00	1343.00	2955.00	1069.00	176.00	376.00	758.00
1966	2.00	0.00	12.00	23.00	242.00	81.00	242.00	56.00	0.00	1133.00	2431.00	701.00	119.00	386.00	530.00
1967	0.00	0.00	509.00	5.00	240.00	113.00	248.00	26.00	0.00	867.00	2138.00	777.00	132.00	334.00	319.00
1968	2.00	0.00	2.00	2.00	212.00	126.00	241.00	12.00	0.00	958.00	2550.00	842.00	110.00	569.00	531.00
1969	0.00	0.00	5.00	6.00	190.00	136.00	188.00	18.00	0.00	1292.00	2248.00	719.00	177.00	618.00	390.00
1970	0.00	0.00	1.00	12.00	173.00	106.00	195.00	13.00	0.00	1039.00	4112.00	953.00	148.00	532.00	218.00
1971	0.00	0.00	0.00	42.00	241.00	73.00	141.00	8.00	0.00	953.00	1520.00	680.00	99.00	420.00	253.00
1972	0.00	0.00	1.00	14.00	249.00	103.00	263.00	9.00	0.00	957.00	2057.00	468.00	159.00	344.00	120.00
1973	0.00	0.00	1.00	2.00	258.00	157.00	143.00	8.00	0.00	597.00	2436.00	321.00	26.00	239.00	99.00
1974	0.00	0.00	3.00	7.00	247.00	164.00	122.00	8.00	0.00	220.00	1569.00	369.00	24.00	162.00	100.00
1975	35.00	0.00	2.00	6.00	276.00	196.00	122.00	19.00	0.00	184.00	1137.00	241.00	62.00	182.00	33.00
1976	15.00	2.00	0.00	3.00	397.00	186.00	100.00	36.00	0.00	110.00	896.00	167.00	32.00	93.00	28.00
1977	22.00	3.00	0.00	1.00	332.00	247.00	198.00	75.00	0.00	73.00	1468.00	121.00	80.00	118.00	97.00
1978	24.00	3.00	0.00	1.00	266.00	308.00	238.00	70.00	0.00	87.00	1234.00	402.00	287.00	238.00	
1979	18.00	2.00	3.00	1.00	207.00	8.00	148.00	95.00	0.00	47.00	993.00	278.00	197.00	250.00	
1980	28.00	8.00	8.00	2.00	312.00	114.00	292.00	96.00	0.00	23.00	973.00	199.00	271.00	189.00	

Source: U.S. Department of Commerce, Current Fishery Statistics
Dots indicate interpolated values