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Bluefish (*Pomatomus saltatrix*)

Species Profile 52 pp

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Narragansett Bay Estuary Program

**BLUEFISH (Pomatomus saltatrix) SPECIES PROFILE**

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**#NBP-91-57**

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## FOREWORD

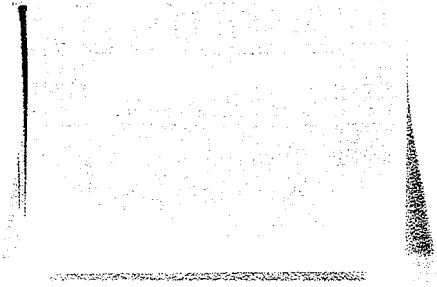
The United States Congress created the National Estuary Program in 1984, citing its concern for the "health and ecological integrity" of the nation's estuaries and estuarine resources. Narragansett Bay was selected for inclusion in the National Estuary Program in 1984 and designated an "estuary of national significance" in 1988. The Narragansett Bay Project (NBP) was established in 1985. Under the joint sponsorship of the U.S. Environmental Protection Agency and the Rhode Island Department of Environmental Management, the NBP's mandate is to direct a five-year program of research and planning focussed on managing Narragansett Bay and its resources for future generations. The NBP will develop a comprehensive management plan by December, 1991, which will recommend actions to improve and protect the Bay and its natural resources.

The NBP has established the following seven priority issues for Narragansett Bay:

- \* management of fisheries
- \* nutrients and potential for eutrophication
- \* impacts of toxic contaminants
- \* health and abundance of living resources
- \* health risk to consumers of contaminated seafood
- \* land-based impacts on water quality
- \* recreational uses

The NBP is taking an ecosystem/watershed approach to address these problems and has funded research that will help to improve our understanding of various aspects of these priority problems. The Project is also working to expand and coordinate existing programs among state agencies, governmental institutions, and academic researchers in order to apply research findings to the practical needs of managing the Bay and improving the environmental quality of its watershed.

This report represents the technical results of an investigation performed for the Narragansett Bay Project. Funding was provided by the State of Rhode Island as part of Cooperative Agreement #CX812768 with the United States Environmental Protection Agency with an additional award provided by the National Marine Fisheries Service. It has been subject to the Agency's and the Narragansett Bay Project's peer and administrative review and has been accepted for publication as a technical report by the Management Committee of the Narragansett Bay Project. The results and conclusions contained herein are those of the author(s), and do not necessarily represent the views or recommendations of the NBP. Final recommendations for management actions will be based upon the results of this and other investigations.



Bluefish Pomatomus saltatrix

SPECIES PROFILE

BY

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## EXECUTIVE SUMMARY

This bluefish profile is the second document in a series intended to provide background necessary for cooperative management of important finfish species in Rhode Island waters.

Bluefish is one of the most popular recreational marine sportfish, ranking number one in weight and numbers since 1970 all along the Atlantic coast. The U.S. commercial fishery for bluefish peaked in 1983 and has fluctuated through 1988 with no apparent trend in abundance. The commercial fishery accounted for only 10% of the total annual bluefish catch between 1979-1987.

This review of the biology of bluefish, Pomatomus saltatrix, includes nomenclature, taxonomy, ecology, stock description, range, abundance in Rhode Island waters, life history, habitat requirements, migration and movements. Also included are reproduction, growth and development, food and feeding, predators, disease and parasites. In addition to the commercial and recreational value of the fishery a summary of Rhode Island regulations is also included.

Bluefish is a migratory pelagic species that schools in groups of like size fish. Bluefish eggs, larvae and juveniles are found to be closely associated with the water surface. Adult bluefish become sexually mature at age two with a fork length averaging 35 cm.

The Mid-Atlantic Fishery Management Council (MAFMC) in cooperation with National Marine Fisheries Service (NMFS), New England and South Atlantic Fishery Management Councils, and the Atlantic States Marine Fisheries Commission (ASMFC) completed a bluefish Fishery Management Plan (FMP) in 1984. Although this plan was rejected, the Fishery Management Councils and the ASMFC agreed to proceed jointly on the development of a new bluefish management plan containing compatible management measures that could be enacted in both federal and state waters. This cooperative venture signified a new approach for managing interjurisdictional fisheries. On 01 APRIL 1991 a bag limit was placed on the recreational bluefish fishery.

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Species Profile: Bluefish  
Pomatomus saltatrix

Common Name: Bluefish  
Scientific Name: Pomatomus saltatrix  
Author: Linnaeus 1758

Other Common Names: blue, tailor, snapper, elf, fatback, snap mackerel, skipjack, snapping mackerel, greenfish, skip mackerel, chopper and Hatteras blue (Bigelow and Schroeder 1953; Wilk 1977; Pottern et al. 1989).

#### Classification

Phylum: Chordata  
Subphylum: Vertebrata  
Class: Osteichthyes  
Superorder: Acanthopterygii  
Order: Perciformes  
Suborder: Percoidei  
Family: Pomatomidae  
Genus: Pomatomus  
Species: saltatrix

#### VALUE

##### Commercial:

The U.S. commercial fishery for bluefish peaked in 1983 at 7,600 metric tons (mt) and has fluctuated between 5,800 mt in 1984 to 6,200 mt in 1988, with no apparent trend (Table 1) (United States Department Commerce (USDC) 1989). The commercial fishery accounted for only 10% of the total annual bluefish catch between 1979-1987 (Terceiro 1987; USDC 1988). Commercial bluefish landings in Rhode Island steadily increased from 1979-1984. Landings peaked in 1985 and have since fluctuated through 1989 (Figure 1). From 1976 to 1987, a coastwide average of 73% (range of 65% to 90%) of all bluefish commercially harvested were caught within state territorial waters. However, in 1987, commercial fishermen from Rhode Island, Maine, New Hampshire, South Carolina and Georgia caught more bluefish in Exclusive Economic Zone (EEZ) waters than in waters 0-3 nautical miles from shore (Atlantic States Marine Fisheries Commission (ASMFC-FMP No.14, 1989).

In 1987, 77% of the total commercial landings came from five states: North Carolina (31%), New Jersey (17%), New York (11%), Virginia (10%), and Rhode Island (8%). From 1976 to 1978, more bluefish were harvested in Virginia than any other state, with North Carolina predominating from 1979-1987 (ASMFC-FMP No. 14, 1989).

Coastwide, otter trawls are the predominant gear used to harvest bluefish, although they are also captured by a variety of other commercial gears, such as gill nets, pound

nets, haul seines and hand lines (Wilk 1977; ASMFC-FMP No.14, 1989).

#### Recreational:

Bluefish is one of the most popular marine sportfish all along the Atlantic coast (Bigelow and Schroeder 1953; Wilk 1977; Scott and Scott 1988; Pottern et al. 1989).

Recreational fishermen take bluefish by a variety of methods such as: from boats while trolling, chumming, casting, live-bait fishing, jigging, still fishing and drift fishing; from shore while casting, still fishing, live-bait fishing, jigging and chumming (Wilk 1977).

Bluefish has ranked first among marine sportfish in the Mid-Atlantic region and in the United States overall in numbers and weight since 1970 (ASMFC-FMP No. 14, 1989; Pottern et al. 1989). Contribution to the total United States recreational bluefish catch in the area from Massachusetts to North Carolina has increased from 70% of total catch in the 1960's to 90% in the 1980's (Pottern et al. 1989).

In terms of total numbers of fish landed from 1981 to 1989, bluefish ranked first among sportfish caught in Rhode Island waters (Marine Recreational Fish Survey unpublished data; Karlsson 1990). Average length and length/weight relationship are shown in Figures 2 and 3, respectively, for the recreational fishery for bluefish in Rhode Island (Marine Recreational Fish Survey unpublished data; Karlsson 1990).

#### **STOCK DESCRIPTION**

Based upon the number of gill rakers, there appear to be at least six stocks of bluefish along the Atlantic Coast of the United States. These stocks are denoted by geographical areas in which they are found during the warmer months: (1) Massachusetts-Rhode Island-Connecticut-New York; (2) New Jersey; (3) Delaware; (4) Chesapeake Bay to Cape Lookout, North Carolina; (5) Cape Lookout, North Carolina to perhaps Georgia; and (6) Florida (Lund 1961).

#### **RANGE**

##### Overall:

Bluefish occur in temperate and tropical waters on the continental shelf and in estuarine habitats around much of the world (Figure 4). In North America, bluefish occur along most of the Atlantic seaboard from Nova Scotia, south around the tip of Florida, and along the Gulf coast to northern Mexico. Their worldwide range also includes Bermuda, the Bahamas, the northern coast of Cuba, Venezuela, southeastern Brazil, Uruguay, the Azores, the Mediterranean Sea, the Black Sea, northwest Africa, Angola, southern Africa, Madagascar, the Malay Peninsula, Tasmania, and all along the coast of Australia (Bigelow and Schroeder 1953; Wilk 1977; Pottern et al. 1989).



#### Within Narragansett Bay:

Bluefish utilize Narragansett Bay and its tributaries, and Mt. Hope Bay and its tributaries. Bluefish can also be found in Little Narragansett Bay and the Pawcatuck River, coastal ponds, and throughout the territorial waters; all serve as nursery areas for juveniles in summer and fall. Adult bluefish also utilize these same waters as they migrate along the coast (Lynch T., cited in ASMFC-FMP No. 14, 1989).

#### **ABUNDANCE IN RHODE ISLAND WATERS**

The Rhode Island Coastal Fishery Resource Assessment program has annually collected bluefish from June through October during its fall assessment (Lynch 1990; pers. comm.). cursory examination of length frequency data from trawl surveys indicates that bluefish less than (<) 25 cm (0-1 year old; Young-of-Year (YOY)) comprised virtually the entire catch from 1979-1989 (Figure 5) (Lynch 1990; pers. comm.). Figure 6 shows the mean percent of YOY bluefish from 1979-1989 captured in the trawl survey. Indices of relative abundance (since 1979) are provided in Figure 7. Figure 8 illustrates the annual mean fork lengths (FL) of bluefish < 25 cm (Lynch 1990; pers. comm.).

Juvenile bluefish seasonal abundance and distribution in Narragansett Bay has been monitored annually at 15 stations since 1986 by the R.I. Division of Fish and Wildlife (Figure 9). Juvenile bluefish enter Narragansett Bay in June at lengths of 4.0 cm (1.5 in) and grow to lengths that exceed 20.0 cm (7.9 in) before they exit Narragansett Bay in October (Powell 1990). Powell (1990) concluded from length data that all bluefish collected were young-of-the-year (YOY). He compared monthly distribution of juveniles over the three year survey and concluded that peak abundance of juvenile bluefish is in July and August (Figure 10). He also found, based on length frequency distribution, that both spring and summer cohorts of juvenile bluefish were present in Narragansett Bay during 1988 (Figure 11), but in previous years those cohorts were absent.

#### **LIFE HISTORY**

Bluefish is a migratory pelagic species that schools in groups of like size fish forming large aggregations that may extend over tens of square miles along the coast (Wilk 1977). Kendall and Walford (1979) found eggs, larvae and juveniles to be strongly associated with the surface.

Tagging studies by Lund and Maltezos (1970) and the NMFS, Sandy Hook Marine Laboratory (Wilk 1977) and ichthyoplankton surveys by Clark et al. (1969), Norcross et al. (1974), and Kendall and Walford (1979) have established spawning areas, migration routes, and the existence of distinct spring and summer spawning populations (Pottern et al. 1989). In general, adult bluefish migrate northward in spring and summer and southward in fall and winter.

## HABITAT REQUIREMENTS

### Type/Substrate:

#### Eggs and larvae:

Along the Atlantic Coast of the United States, bluefish spawn pelagic eggs over most of the continental shelf (30 to 100 nautical miles from the shore) (Deuel et al. 1966; Norcross et al. 1974). Kendall and Walford (1979) found that eggs and larvae have a strong association with the surface, and that larvae complete development near the surface. Studies by Norcross et al. (1974), Kendall and Naplin (1981), Powles (1981), and Collins and Stender (1987) confirm this conclusion.

#### Juveniles:

Young bluefish appear to lead a pelagic life for 1 to 2 months depending on season, water temperatures, currents and other environmental variables (Clark 1973). At the end of this pelagic stage, they begin to reach the beaches, moving through inlets and entering the estuaries (Clark 1973). According to Kendall and Walford (1979), it appears that juvenile bluefish depend chiefly on estuarine habitat for the early life stages. These investigators found that this dependence is determined by the time and place of spawning. Those from the spring spawners spend most of first summer in estuaries, while those from the summer spawning spend at most about a month there.

#### Adults:

Adult bluefish utilize a vast array of habitats as they migrate along the coast, from coastal rivers to the open sea.

### Temperature/Salinity:

#### Eggs/larvae:

Norcross et al. (1974) published ranges and means of surface temperatures and salinities from stations in Virginian coastal waters where bluefish eggs were present or absent in collections (Table 2). The minimum temperature and salinity at which eggs occurred was 18°C at 26.6 o/oo and maximum values of 26.3°C (79.3°F) at 34.9 o/oo. Kendall and Walford (1979) found that larvae in the South Atlantic Bight were caught in water temperatures of 20°C (68°F) - 26°C (78.8°F) with salinities ranging from 35 o/oo - 38 o/oo. They also found that larvae from the Middle Atlantic Bight occurred in waters of 18°C (64.4°F) - 26°C (78.8°F) at 30 o/oo - 32 o/oo. Clark (1973) found a maximum density of larvae in an area 30 - 80 miles east of the New Jersey coast within a temperature range of 20°C (68°F) - 22°C (71.6°F), but did not mention the salinity range. Powles (1981) found larvae concentrated on surface waters at the 180 m contour, off the southeastern USA, at relatively high salinities (greater than ( $\geq$ ) 35 o/oo) and temperatures ( $\geq$  24° C) throughout the year. He attributed this to the presence of the northerly-flowing Florida Current.

Temperature/Salinity (con't):

Juveniles:

Kendall and Walford (1979) found juvenile bluefish in water temperatures greater than (>) 15°C (59°F) in April and early May and in water temperatures > 18°C (64.4°F) in late May and June. Wilk and Silverman (1976) found juveniles inhabiting inshore and estuarine areas in temperatures ranging from 18°C (64.4°F) to 26°C (78.8°F). Juveniles appear to be able to tolerate salinity ranges between 17 - 35 o/oo (van der Elst 1976; Powell 1990).

Juvenile bluefish clearly demonstrate the capability of behavioral thermoregulation (Olla et al. 1985). Laboratory experiments conducted by Olla et al. (1985) showed that decreasing temperatures resulted in increased activity, and once a thermal gradient had stabilized, the fish were able to avoid cold water and activity decreased. Also, juveniles made downward excursions from warm to cold water, engaging in exploratory behavior enabling them to recognize changing thermal boundaries. During this exploratory behavior, these fish were capable of successfully ingesting food and returning to warmer water before functional impairment.

Adults:

Bluefish off the east coast of the United States are most abundant in water temperatures of 20°C (68°F), but have been found in temperature ranges from 8.8°C (48°F) - 30°C (86°F) (Bigelow and Schroeder 1953; Olla and Studholme 1971; ASMFC-FMP No. 14, 1989). Adult bluefish can tolerate salinities that range from 9 - 48.5 o/oo (van der Elst 1976).

Olla and Studholme (1971) investigated the behavioral changes of six adult bluefish subjected to gradual temperature variations. They acclimated the bluefish at 19.9 °C (68°F) with a light regimen similar to the natural photoperiod. They found that the swimming speed of bluefish increased as temperature either increased or decreased from acclimation temperatures. Also, swimming speeds increased by 3½ times at low temperature stress of 11.8°C (53°F) and by 1½ times at a high temperature stress of 30.4°C (86.7°F). The speed increase with increasing temperature probably was less than that at decreasing temperature because the initial average speed was high due to the seasonal effect of longer photoperiods (Olla and Studholme 1972; cited in Olla and Studholme 1971). They correlated their findings of high speeds at temperatures below 15°C (59°F) with Lund and Maltezos (1970) findings that when water temperatures fall below 15°C (59°F) adult bluefish begin their fall migration.

In addition, bluefish also exhibited decreasing daily rhythm of swimming patterns, food ingestion and increasing night schooling behavior at stress temperatures, with normal activity returning toward acclimation temperatures. They concluded that the nature of the response to low and high temperature extremes serve to move the animals out of areas of adverse temperature.

## MIGRATION AND MOVEMENTS

Bluefish eggs are thought to be transported south and offshore by prevailing surface currents (Norcross et al. 1974). This is confirmed by Collins and Stender (1987) who indicate a southward movement of bluefish larvae, suggesting that the southerly countercurrent located shoreward of the Gulf Stream may be the mechanism for this movement. Norcross et al. (1974) suspected that the single most important factor determining the fate of each year class is the circulation of the continental shelf waters.

Fisheries data suggest that most North American bluefish are migratory, spending their summers from New England to Cape Hatteras, N. C., and their winters around Florida and the Gulf Stream, with spawning occurring in pulses as they travel northward (Pottern et al. 1989). According to Wilk (1977), based on the number of tag returns, the southerly migration in the fall is closer to the shore than the northerly migration in the spring. Almost all recaptures one year after tagging were from the general area where the fish had been tagged, indicating that bluefish probably return to the same coastal areas for one or more years. This also was confirmed by a tagging study in and near Long Island Sound by Lund and Maltezos (1970), as more than 75% of the returns from fish at large more than one season returned to the general area of Long Island Sound.

The spatial distribution of bluefish varies with size, with the majority of smaller fish (up to 50 cm) found along the shore or in bays, and the larger fish (>50 cm) usually exhibiting an inshore-offshore migration pattern (Lund and Maltezos 1970). Exceptions to this occur during the spring and fall migrations and during a portion of their first year (Lund 1971; cited in Lund and Maltezos 1970). Three migrating groups of bluefish were observed offshore of New Jersey: (1) inshore contingent (bluefish ranging 0.45-1.36 kg (1-3 lbs)), (2) mid-shelf contingent (bluefish ranging 1.36-4.54 kg (3-10 lbs)), and offshore contingent (bluefish > 2.72 kg (> 6 lbs)) (Freeman and Turner 1977).

## REPRODUCTION

### Mode:

Bluefish are heterosexal, and fertilization is external; eggs and sperm are shed into the open ocean without any further parental care (Pottern et al. 1989).

### Spawning Factors:

Bluefish "spawn bimodally" in the South Atlantic Bight (SAB) from March through at least November in depths > 40m, with the primary spawning peak in spring and the secondary peak in late summer (Collins and Stender 1987). Kendall and Walford (1979) found two main spawning concentrations of bluefish: one near the western edge of the Gulf Stream in the SAB during the spring and the other over the continental shelf of the Middle Atlantic Bight during the summer (Figure 12). In the northern Gulf of Mexico, spawning occurs in the fall and spring with the possibility of an protracted spawn also occurring (Barger et al. 1978).

According to Norcross et al. (1974) the continental shelf waters off the Virginia-North Carolina coast are major spawning grounds for bluefish. They found the optimum temperature and salinity for spawning (based on the presence of eggs) was 25.6°C (78°F) at 31 o/oo, with the majority of bluefish spawning when water temperatures reach 22°C (71.6°F). Also, their analysis of the developmental stages suggested that peak spawning activity occurred in early evening. According to these investigators abundance and distribution of eggs was related to temperature and salinity, with eggs most numerous at temperatures > 22°C (71.6°F) and salinities of 30 o/oo or higher.

#### Reproductive Capacity:

Morse (cited in Boreman 1983) indicated that a linear relationship exists between fecundity (No. of eggs/female) and body length (FL) for bluefish in the 56-80 cm size range (Figure 13).

#### Rhode Island Spawning Season/Locations:

There has been no documentation of bluefish spawning in Narragansett Bay, Block Island Sound or Rhode Island Sound, although a single larva was found by Herman (1963) in Narragansett Bay.

### GROWTH AND DEVELOPMENT

#### Egg:

Bluefish eggs are buoyant, have a smooth spherical membrane, and diameters ranging from 0.825-1.20mm (Deuel et al. 1966; Norcross et al. 1974). The egg capsule is colorless and thin but tough; the yolk is pale amber and the single oil globule is deep amber with a 0.25-0.30mm diameter. The width of the perivitelline space is 1/6 the radius of the egg (Deuel et al. 1966).

#### Embryonic Stages:

Deuel et al. (1966) described the development of bluefish eggs maintained at a temperature of 20.0° C and a salinity of 32.5 o/oo (Figures 14-15):

- 1) 02 hrs - 64 cell and early morula stages.
- 2) 05 hrs - Early morula.
- 3) 09 hrs - Late morula.
- 4) 14 hrs - Blastoderm enveloped 1/3 of the yolk; oil globule generally under blastodermal tissue; germ ring present but small.
- 5) 16 hrs - Blastoderm extended halfway around the yolk; the blastocoel, germ ring and embryonic shield are apparent.
- 6) 17 hrs - Embryo defined; oil globule opposite the developing embryo with the germ ring still visible around the lip of the blastophore.
- 7) 19 hrs - Ten or more myomeres are distinct.

- 8) 20 hrs - Notochord present; first recognizable development of eyes; blastophore closes, if still open, is small; forebrain appears and germ ring still distinguishable around blastophore.
- 9) 21 hrs - Tail free stage; 20 myomeres; embryo half-way around yolk with oil globule on opposite side; three brain sections visible and nasal pit is formed; black pigmentation appears on oil globule, and in two rows along each side of the notochord and encircles the eyes.
- 10) 34 hrs - Heart has developed and begins to beat.
- 11) 37 hrs - Finfold well developed; 30 myomeres are distinguishable with oil globule located near anus; row of melanophores appears along ventral aspect of tail; free tail curves either right or left, with regular twitching movements.
- 12) 40 hrs - Tail lengthens but not extending around yolk to reach the head; eyes unpigmented, but fully formed with choroid fissure; auditory vesicles appear; finfold is enlarged and flattened.
- 13) 42 hrs - Convulsive movements evident on whole embryo; tail twisting and rotation of whole embryo. Oil globule golden in preserved material.
- 14) 46-48 hrs - Mass hatching occurs.

#### Larval Development:

Deuel et al. (1966) described the development of bluefish after hatching (Figure 16). Length at hatching varies from 2.0-2.2 mm. The yolk sac is more than  $\frac{1}{2}$  the length of the larva extending to within  $1\frac{1}{2}$  segments of the anus. The oil globule is now  $\frac{1}{3}$  the length of the yolk sac and is located at the extreme posterior of the yolk sac. Two rows of stellate melanophores appear dorsally and are widely separated on the head but then converge posteriorly. No visible pigmentation on yolk sac or globule (in preserved specimens).

Day one after hatching the larvae grow to ca. 2.9 mm with  $\frac{1}{2}$  of the yolk sac being absorbed, and distinct enlargement of the finfold. Melanophores are larger, but remain in same position as at hatching. Eyes unpigmented. Yellow and yellow-green pigment spots appear on dorsal and ventral fin margins.

On day two the pectoral fin buds and urogenital duct appear. Melanophores (fewer in number) become more distinct and extend out to the margins of the finfold. Black pigmentation appears on oil globule and yolk sac. Stellate melanophores disappear from dorsal surfaces and the yellow-green remains.

By day four, at 3.08 mm, pigment spots on the body are dark and distinct, with eyes becoming darkly pigmented.

The head enlarges and the body contour becomes more elongate. Incipient caudal fin rays are distinct and flattened pectoral fin buds form. The yolk is nearly consumed and only fragments of the oil globule and yolk sac remain.

After yolk sac absorption, bluefish larvae tend to have a large head with a slender body, but as development continues the body becomes deeper and the head proportionally smaller, with the eyes becoming spherical (Norcross et al. 1974). According to Norcross et al. (1974) at 3 mm the gas bladder is visible until musculature conceals it by 10 mm. These investigators describe changes in morphology and the sequence of ossification as follows:

At 3.00 mm the cleithrum, parasphenoid, maxillary, dentary, preopercle, opercle, symplectic and parts of the gill arches begin ossification. Preopercle spines develop as small serrations on the upper part of the distal preopercular margin.

By 4.00 mm the hyomandibular, branchiostegal rays and teeth begin to ossify. At 4.3 mm the teeth are well developed. Ossification of three preopercular spines (two on distal, one in center) and in the neural spines of abdominal vertebrae is complete at 4.5 mm.

At 5.00 mm the eye becomes spherical after being elliptical. Caudal fin begins formation with the urostyle turning dorsal. The interopercle, subopercle, posttemporal, supracleithrum, pterygoid, and quadrate begin ossification. Neural spines of caudal vertebrae, hemal spines and centra begin to ossify.

Ossification proceeds anterior to posterior except for the ultimate vertebra which ossifies between 5.5 mm and 6.0 mm, before the penultimate centrum. The 17 principal rays of caudal fin are also ossified between 5.5 mm and 6.0 mm.

At 6.0 mm seven branchiostegal rays have ossified. The third preopercle spine appears on the distal margin. A total number of 26 centra, including urostyle (11 abdominal, 15 caudal) complete ossification. Secondary rays begin ossification. The second group of dorsal rays emerge between myomere 13 and 17. Anal fin rays form between myomere 12 and 16. Pelvic fin buds appear.

Between 6.0 mm and 6.5 mm a total of 8-9 first dorsal spines appear, with their position directly anterior to the second dorsal fin. At 6.5 mm ossification of the pectoral rays begin. Development begins dorsally and proceeds ventrally.

At 7.0 mm a full complement of 23-28 second dorsal rays is obtained. Pelvic fin rays start ossification. By 7.5 mm a total of two spines and 24-29 anal fin rays is attained.

At 8.5 mm pelvic fin rays complete ossification.

At 12 mm seven preopercle spines complete ossification.

At 13 mm ossification is complete of 8-10 dorsal and ventral secondary rays.

At 14 mm the left pectoral has a total of 16-18 rays and this is the last fin to complete ossification. After completion of fin formation at 13-14 mm bluefish are now considered juveniles.

#### Juvenile Development:

Adult appearance and full fin counts are attained by 13-14 mm, with the head being proportionally larger than in adults (Lippson and Moran 1974). In juveniles >13 mm pigmentation intensifies dorsally and laterally behind the eye and operculum, upper and lower jaws, snout and under the head (Norcross et al. 1974). According to Norcross et al. (1974) by 16 mm to 17 mm the concentration of dorsal pigment appears heavier than ventral pigment. They also found that in juveniles at 17 mm, three postanal pigment lines remain visible, but are less conspicuous because of the increase in pigmentation of entire postanal region. At 17 mm, the preopercle is serrate, caudal peduncle is stout, and anal fin is equal to the second dorsal fin (Lippson and Moran 1974; Norcross et al. 1974).

Young fully developed bluefish (40-50 mm (4.0-5.0 cm)) are the product of a spring spawn, and in early June they move into northern bays where they spend the entire summer (Wilk 1977). Summer spawned juveniles spend only a month in the bays. The growth rate is very rapid, for the spring spawned fish, with fish attaining lengths of 175-200 mm (17.5-20.0 cm) by late September (Wilk 1977). According to Clark (1973) bluefish from the spring spawn range in length from 75 mm (7.5 cm) to 125 mm (12.5 cm) and may reach lengths of 240 mm (24.0 cm) or larger before the end of the summer, when bluefish from the summer spawn range in length from 30 mm (3.0 cm) to 100 mm (10.0 cm).

#### Adult Development:

Bluefish become sexually mature in their second year at a fork length averaging 35 cm (Wilk 1977). Wilk (1977) concluded that male bluefish matured slightly before females of similar size.

Richards (1976) analyzed age and growth from scales of 64 bluefish taken from Long Island Sound. She found ages ranging from 2+ to 7+ with fork lengths (FL) that ranged from 44 to 76 cm with no differences between the sexes (Table 3). Also, 3+ fish had a length range that completely overlapped the 2+ fish, which she attributed to rapid growth during these years. She concluded that bluefish almost double their length in the second year with growth remaining rapid during the third and fourth year.

#### **FOOD AND FEEDING**

A study conducted by Kendall and Naplin (1981) found that food items of larval bluefish consisted of various life stages of copepods, cladocerans and invertebrate eggs. They found that the maximum proportion of larvae with food



in their guts were taken between 0600 hrs and 1800 hrs, and that between 0000 hrs and 0300 hrs, none of the larvae contained food showing a marked diel pattern (Figure 17).

The diet of juvenile bluefish during its use of littoral zone nursery habitats in Sandy Hook Bay, New Jersey consisted of a variety of polychaetes, crustaceans and fish prey. Opposum shrimp Neomysis americana, sand shrimp Crangon septemspinosa, grass shrimp Palaemonetes vulgaris, bay anchovy Anchoa mitchilli, striped killifish Fundulus majalis and Atlantic silverside Menidia menidia dominated the diet in terms of biomass and frequency of occurrence in the three year study (Friedland et al. 1988).

Wilk (1977) reported that food items of bluefish consisted of 31 families of vertebrates and 11 families of invertebrates (Table 4). He found that among the fishes most frequently observed in bluefish stomachs were butterflyfish Peprilus triacanthus, round herring Etrumeus teres, menhaden Brevoortia tyrannus, sand lance Ammodytes sp., silverside, Atlantic mackerel Scomber scombrus, anchovy, Spanish sardine Sardinella aurita, small weakfish Cynoscion regalis, spotted seatrout Cynoscion nebulosus, Atlantic croaker Micropogonias undulatus and spot Leiostomus xanthurus. Among the invertebrates found were shrimp Penaeus sp., lobster Homarus americanus, squid Loligo sp., crabs (family Portunidae), mysids Mysid sp. and sand worms Neris virens. Oviatt (1977) calculated the percent of occurrence of food items found in bluefish stomachs, caught in Rhode Island waters in 1975 and 1976 (Figure 18). Richards (1976) reported that bluefish in east-central Long Island Sound ate squid Loligo peali, menhaden, bay anchovy, alewife Alosa pseudoharengus, round herring, juvenile silver hake Merluccius bilinearis, juvenile butterflyfish and juvenile bluefish.

#### PREDATORS

According to Wilk (1977) only larger predators such as shark, tuna, swordfish and wahoo could prey on bluefish. This has been confirmed by studies conducted by Kohler and Stillwell (1981); Stillwell and Kohler (1982) and (1985). These investigators found bluefish in stomach samples collected from blue sharks. They also found bluefish was the major inshore food item (in an area from Cape Hatteras, N.C. to Georges Bank) of the Shortfin Mako constituting 77.5% of their diet. Also, they found that bluefish ranked fourth based on number and third in volume in the stomachs of swordfish that were caught off North Carolina in the spring.

#### COMPETITORS

Bluefish migrations follow the pattern of striped bass and because they have similar food preferences, they may be formidable competitors with striped bass Morone saxatilis (ASMFC-FMP No.4, 1990). Oviatt (1977) found that abundance patterns suggested that striped bass move out of Narragansett Bay, Rhode Island, when more aggressive

bluefish become abundant, therefore avoiding competition for food and resources. Because of the predacious nature of bluefish, they may be in competition with other higher predators such as Spanish mackerel Scomberomorus maculatus, king mackerel Scomberomorus cavalla, and large weakfish (Wilk 1977). Safina and Burger (1985) observed that bluefish were in direct competition with common terns, preying on the same fish simultaneously. Because they are a top predator and seasonally very numerous, it is probable that bluefish perform a role in structuring communities of prey species (Pottern et al. 1989).

**DISEASE**

Mahoney et al. (1973) reported fin rot in bluefish in the New York Bight. These investigators concluded that pollution from lower New York Harbor had a primary role in the disease. Mears and Eisler (1977) found concentrations of trace metals (Cd, Cr, Cu, Fe, Mn, and Zn) in the livers of bluefish. They concluded that future comparisons for trace metals, which may vary as a function of size, should be made only among fish of the same length.

High levels of PCB's were found in bluefish sampled in coastal and estuarine waters of New Jersey (Belton et al. 1982; cited in ASMFC-FMP No. 14, 1989). This resulted in notices by the New Jersey Office of Cancer and Toxic Substances Research which warned that bluefish should not be consumed by humans, or if eaten, cooked in a manner to eliminate as much oily tissue as possible. The Massachusetts Director of Public Health also prohibited the taking of fish, including bluefish, from New Bedford Harbor because of PCB contamination.

**PARASITES**

Bluefish is host to numerous parasites, and these are summarized in Table 5.

Licenses:

Rhode Island General Law 20-2(26,27,28,28.1.)

Season:

Year-round

Fee:

**Non-Commercial**

(resident or non-resident)

None

**Commercial Fishing**

Fish Traps \*

License

\$100.00

Plus \$10.00/trap

\$ 10.00

Gill Nets

\$100.00

Rod and Reel (includes diving)

\$100.00

Individual (without boat)

\$100.00

**Commercial Vessels (finfish only)**

Commercial residents vessels \*

Up to 50' LOA

\$100.00

50' to 99' LOA	\$125.00
over 99' LOA	\$ 10.00/ft.
Mult. purpose(good for all above)	\$150.00
Plus \$10.00 for a gill net license	\$ 10.00
Non-resident otter trawler	\$ 5.00/ft.
* RESIDENTS ONLY	

Expiration of licenses:

Commercial licenses expire annually on December 31.  
(Rhode Island General Law 20-2-14).

Obtaining licenses:

All marine licenses are issued by the licensing section of the Department of Environmental Management, 22 Hayes St., Providence, R.I. 02908. Tel. No. 401-277-3576.

Rhode Island Game Fish Award Program:

In August of 1981 the state record for bluefish was set by Drew Deziel of Woonsocket, R.I.. The official weight and size of this bluefish was 26 lbs. at 39 in.

**RHODE ISLAND BLUEFISH MINIMUM SIZE REGULATION**

None

**RECREATIONAL BLUEFISH REGULATIONS IN RHODE ISLAND**

On 26 JUNE 1990 the Rhode Island Marine Fisheries Council held a public hearing on the proposed recreational possession limit for bluefish. The following was passed and implementation will begin at the start of the 1991 bluefish season:

No person shall possess more than ten (10) bluefish unless she/he has a permit meeting the requirements of Rhode Island General Law 20-2-26, 20-2-27, 20-2-28, 20-2-28.1 (See License section). Compliance on board vessels will be determined by dividing the number of recreational fisherman on board a vessel by the number of bluefish on board said vessel.

**MANAGEMENT OF THE BLUEFISH FISHERY**

A fishery management plan (FMP) for the bluefish fishery was prepared jointly by the Atlantic States Marine Fisheries Commission (ASMFC), Mid-Atlantic Fishery Management Council, in cooperation with the New England and South Atlantic Fishery Management Councils. The major goal of the management plan is to conserve the bluefish resource along the Atlantic Coast. Five major objectives have been adopted to achieve this goal:

1. Increase understanding of the stock and the fishery.
2. Provide the highest availability of bluefish to U.S. fishermen while maintaining, within limits, traditional uses of bluefish(defined as the commercial fishery not exceeding 20% of the total catch).
3. Provide for cooperation among the coastal states, the various regional marine fishery management councils, and federal agencies involved along the coast to enhance the management of bluefish throughout its range.

4. Prevent recruitment overfishing.
5. Reduce the waste in both the commercial and recreational fisheries.

Federally implemented regulations and management measures for the Atlantic bluefish fishery is presented in Appendix I.

## ACKNOWLEDGEMENTS

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## BIBLIOGRAPHY

- Anderson, H. G. Jr. 1970. Annotated list of parasites of the bluefish, Pomatomus saltatrix. U.S. Bur. Sport Fish. Wildl. Tech. Pap. No. 54.
- Anderson, R. D. 1978. Feeding and spawning of bluefish. *Sea Front.* 24(6):335-338.
- (ASMFC) Atlantic States Marine Fisheries Commission. 1989. Fishery management plan for the bluefish fishery. 81 p.
- Baird, S. F. 1873. Natural history of some of the more important food fishes of the south shore of New England. II. The bluefish, (Pomatomus saltatrix) (L.). Rep. U.S. Fish. Comm. for 1871-1872:235-252.
- Barger, L. E., L. A. Collins and J. H. Finucane. 1978. First record of bluefish larvae (Pomatomus saltatrix) in the Gulf of Mexico. *Northeast Gulf Sci.* 2(2):145-148.
- Bigelow, H. B. and W. C. Schroeder. 1953. Fishes of the Gulf of Maine. U. S. Fish and Wildlife Serv., Fish. Bull 53, 577 p.
- Boreman, J. 1983. Status of bluefish along the Atlantic Coast, 1982. NMFS, Woods Hole Lab. Ref. Doc. 83-28. 35 p.
- Clark, J. R. 1973. Bluefish. Pages 250-251 in A. L. Pacheco editor. Proceedings of a workshop on egg, larval and juvenile stages of fish in Atlantic Coast estuaries. NMFS, Middle Atlantic Coast Fisheries Center, Technical Publication 1, Highlands, N.J.
- Clark, J., W. G. Smith, A. W. Kendall, Jr., and M. P. Fahay. 1969. Studies of estuarine dependence of Atlantic coastal fishes. Data report I: Northern Section, Cape Cod, MA. to Cape Lookout N. C.. U.S. Bur. Sport. Fish. Wildl. Tech. Pap. No. 59. 97 p.
- Collins, M. R. and B. W. Stender. 1987. Larval king mackerel (Scomberomorus cavalla) and bluefish (Pomatomus saltatrix) off the southeast coast of the U.S., 1973-1980. *Bull. Mar. Sci.* 41(3):822-834.
- de Sylva, D. P. 1976. Attacks by bluefish (Pomatomus saltatrix) on humans in south Florida. *Copeia*: 196-198.
- Deuel, D. G., J. R. Clark and A. J. Mansueti. 1966. Description of embryonic and early larval stages of bluefish, Pomatomus saltatrix. *Trans. Amer. Fish. Soc.* 95(3):264-271.

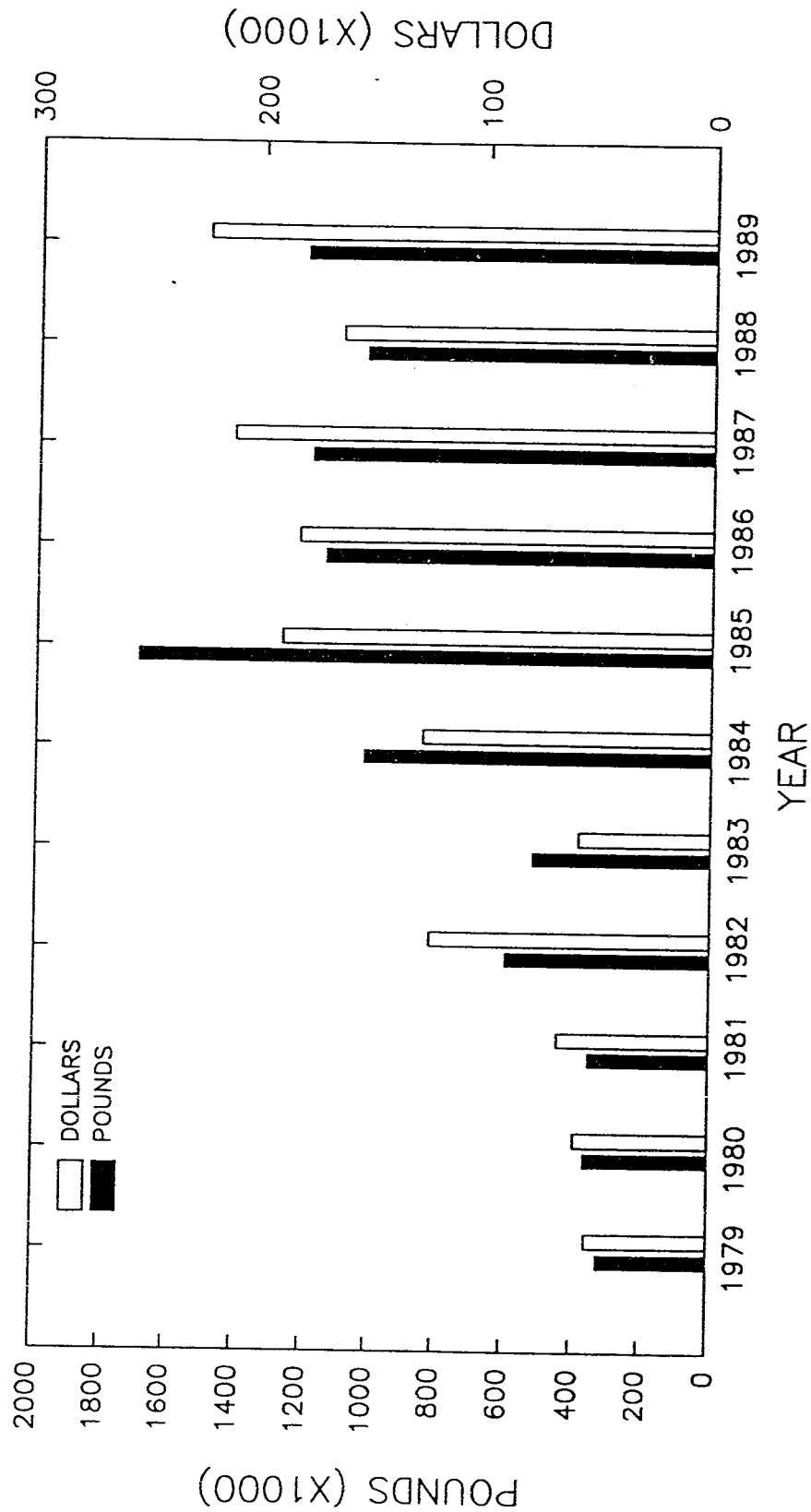
- Freeman, B. L. and S. C. Turner. 1977. The effects of anoxic water on bluefish (Pomatomus saltatrix), an actively swimming fish. NMFS, NEFC Sandy Hook Lab. Tech. Ser. Rept. No. 3: 431-450.
- Friedland, K. D., G. C. Garman, A. J. Bejda, A. L. Studholme and B. Olla. 1988. Interannual variation in diet and condition in juvenile bluefish during estuarine residency. Trans. Amer. Fish. Soc. 117:474-479.
- Herman, S. S. 1963. Planktonic fish eggs and larvae of Narragansett Bay. Limnol. Oceanogr. 8:103-109.
- Karlsson, J. D. 1990. Marine Recreational Fish Survey; Unpublished data.
- Kendall, A. W., Jr. and L. A. Walford. 1979. Sources and distribution of bluefish, Pomatomus saltatrix, larvae and juveniles off the east coast of the United States. Fish. Bull. 77(1):213-227.
- Kendall, A. W. Jr., and N. A. Naplin. 1981. Diel-depth distribution of summer ichthyoplankton in the Middle Atlantic Bight. Fish. Bull. 79(4):705-726.
- Kohler, N. E. and C. E. Stillwell. 1981. Food habits of the blue shark (Prionace glauca) in the northwest Atlantic. Int. Council Explor. Sea, Pelagic Fish. Comm., C. M. 1981/H: 61.
- Lippson, A. J. and R. L. Moran. 1974. Manual for identification of early developmental stages of fishes of the Potomac River estuary. Martin Marietta Corporations Environmental Technology Center. PPSP-MP-13, 282 p.
- Lund, W. A., Jr. 1961. A racial investigation of the bluefish, Pomatomus saltatrix (Linnaeus) of the Atlantic coast of North America. Boletín del Instituto Oceanográfico, Venezuela 1(1): 73-129.
- Lund, W. A. Jr., and G. C. Maltezos. 1970. Movements and migrations of the bluefish, Pomatomus saltatrix, tagged in waters off New York and Southern New England. Trans. Amer. Fish. Soc. 99(4):719-725.
- Lynch, T. R. 1990. Personal communication.
- Mahoney, J. B., F. H. Midlidge, and D. G. Deuel. 1973. A fin rot disease of marine and euryhaline fishes in the New York Bight. Trans. Amer. Fish. Soc. 102(3):596-605.
- Mears, H. C. and R. Eisler. 1977. Trace metals in liver from bluefish, tautog and tilefish in relation to body length. Chesapeake Science 18(3):315-318.

- Norcross, J. J., S. L. Richardson, W. H. Massmann, and E. B. Joseph. 1974. Development of young bluefish (Pomatomus saltatrix) and distribution of eggs and young in Virginian coastal waters. *Trans. Amer. Fish. Soc.* 103(3):477-497.
- Olla, B. L. and A. L. Studholme. 1971. The effects of temperature on the activity of bluefish, Pomatomus saltatrix (L). *Biol. Bull.* 141:337-349.
- Olla, B. L., A. L. Studholme and A. J. Bejda. 1985. Behavior of juvenile bluefish Pomatomus saltatrix in vertical thermal gradients: influence of season, temperature acclimation and food. *Mar. Ecol. Prog. Ser.* 23:165-177.
- Oviatt, C. A. 1977. Menhaden, sportfish, and fishermen. Rhode Island Sea Grant, Univ. Rhode Island, No. 60. Narragansett, R. I.
- Pottern, G. B., M. T. Huish and J. H. Kerby. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (mid-Atlantic)-bluefish. U.S. Fish Wildl. Serv. Biol. Rep. 82(11.94) U.S. Army Corps of Engineers, TR EL-82-4. 20p.
- Powles, H. 1981. Distribution and movements of neustonic young of estuarine dependent (Mugil spp., Pomatomus saltatrix) and estuarine independent (Coryphaena spp.) fishes off the southeastern United States. *Rapp. P.-v. Reun. Cons. int. Explor. Mer*, 178: 207-209.
- Powell, J. C. 1990. Juvenile fish survey. Performance Report. Rhode Island Division of Fish and Wildlife. F-26-R-2366 p.
- Richards, S. W. 1976. Age, growth, and food of bluefish (Pomatomus saltatrix) from east-central Long Island Sound from July through November 1975. *Trans. Amer. Fish. Soc.* 105(4):523-525.
- Richkus, W. A. 1990. Source document for the supplement to the striped bass FMP-Amendment #4. Atlantic States Marine Fisheries Commission, Fisheries Management Report Number 16.
- Safina, C. and J. Burger. 1985. Common Tern foraging: seasonal trends in prey densities and competition with bluefish. *Ecology* 66(5):1457-1463.
- Scott, W. B., and M. G. Scott. 1988. Atlantic Fishes of Canada. *Can. Bull. Fish. Aquat. Sci.* 219: 731 p.



- Stillwell, C. E. and N. E. Kohler. 1982. Food, feeding habits, and estimates of daily ration of the Shortfin Mako (Isurus oxyrinchus) in the Northwest Atlantic. Can. J. Fish. Aquat. Sci. 39:407-414.
- Stillwell, C. E. and N. E. Kohler. 1985. Food and feeding of the swordfish Xiphias gladius in the western North Atlantic Ocean with estimates of daily ration. Mar. Ecol. Prog. Ser. 22:239-247.
- Terceiro, M. 1987. Status of Atlantic Coast Bluefish - 1987. Woods Hole Lab. Ref. Doc. 87-10. NMFS, NEFC, Woods Hole, MA. 02543. 54 p.
- (USDC) United States Department of Commerce.  
 1988. Status of the fishery resources off the Northeastern U.S. for 1989. NOAA, NMFS-F/NEC-63.  
 1989. Status of the fishery resources off the Northeastern U.S. for 1989. NOAA, NMFS-F/NEC-72.
- van der Elst, R. 1976. Game fish of the east coast of southern Africa. Part I: The biology of the elf (Pomatomus saltatrix) in the coastal waters of Natal. Oceanogr. Res. Inst. (Durban) Invest. Rep. 44:1-59 p.
- Wilk, S. J. 1977. Biological and fisheries data on bluefish, Pomatomus saltatrix (Linnaeus). NMFS, NEFC, Sandy Hook Lab. Tech. Series Rept. No. 11. 56 p.
- Wilk, S. J. and M. J. Silverman. 1976. Fish and hydrographic collections made by the research vessels Dolphin and Delaware II during 1968-1972 from N.Y. to FL. NOAA Tech. Rep. NMFS SSRF-697.

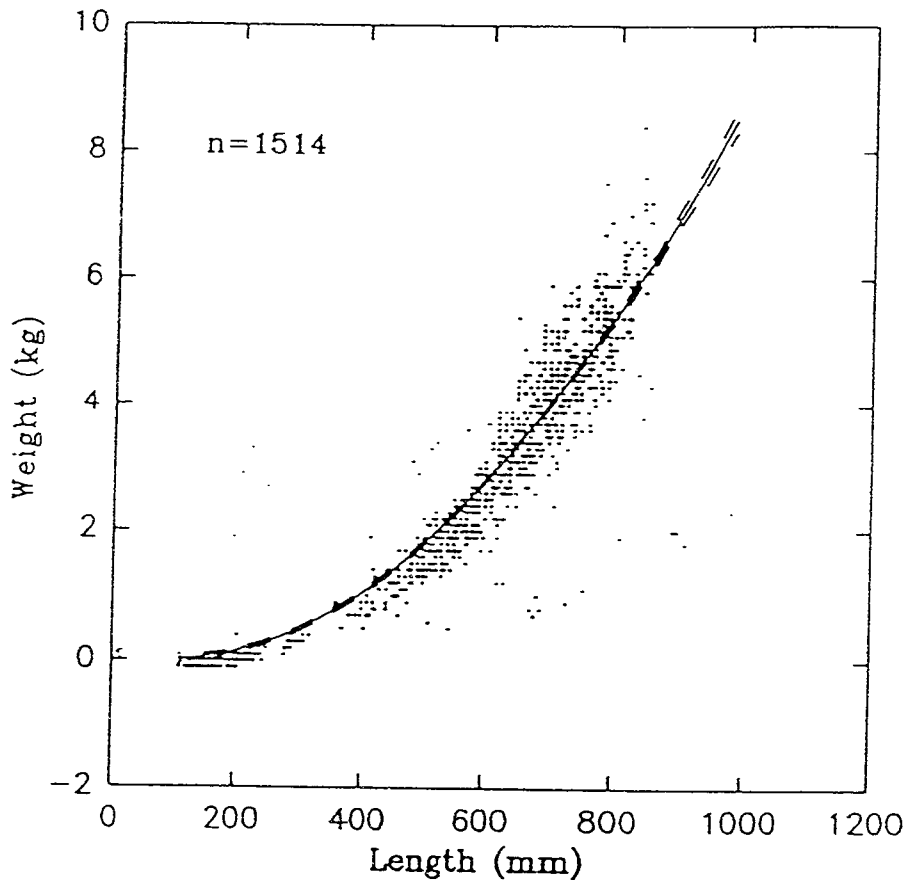
FIGURE 1  
 RHODE ISLAND COMMERCIAL LANDINGS  
 BLUEFISH (1979 - 1989)



Data Source: National Marine Fisheries Service Statistics Section

FIGURE 2

LENGTH/WEIGHT RELATIONSHIP  
RHODE ISLAND RECREATIONAL FISHERY  
BLUEFISH, 1981-1989

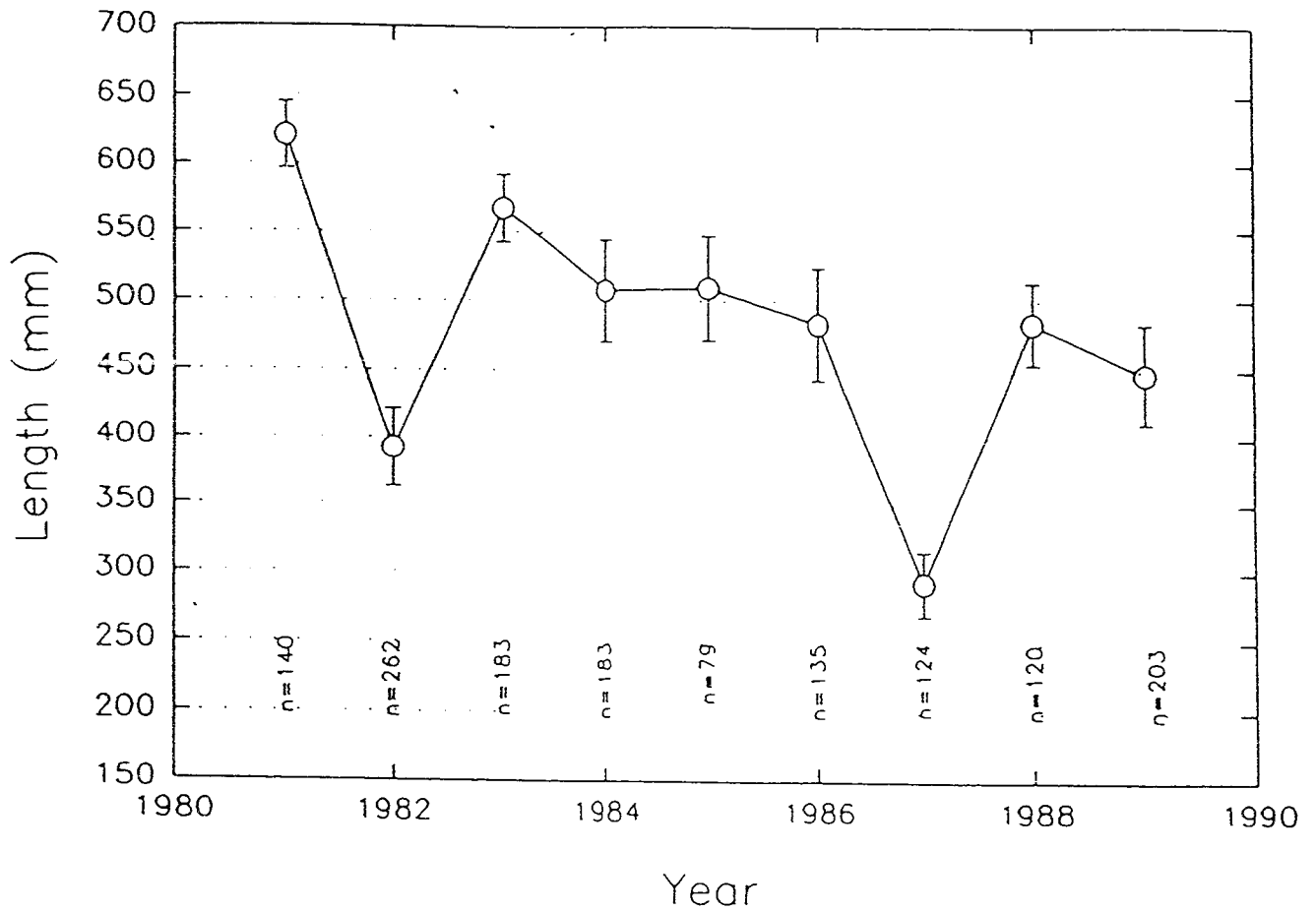


Key: ----- second order regression calculated  
as  $W=0.0860 - 0.012L + 0.00001L^2$   
( $R = 0.83$ )  
- - - 95% confidence interval

Source: Marine Recreational Fish Survey  
Unpublished; Karlsson 1990.

FIGURE 3

BLUEFISH AVERAGE LENGTH  
RHODE ISLAND RECREATIONAL FISHERY



Key: Error bars indicate 95% confidence intervals.

Source: Marine Recreational Fish Survey  
Unpublished; Karlsson 1990.

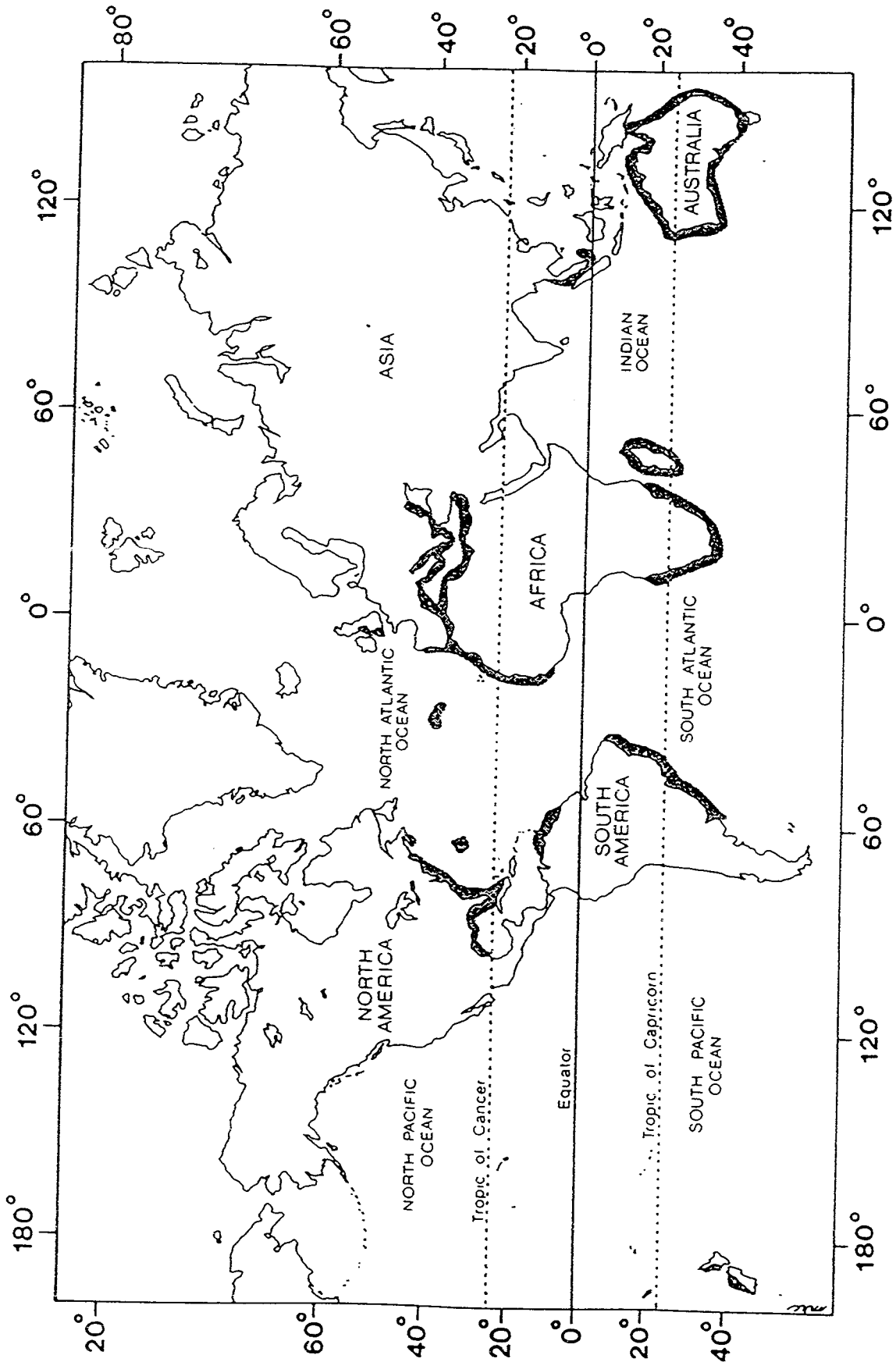
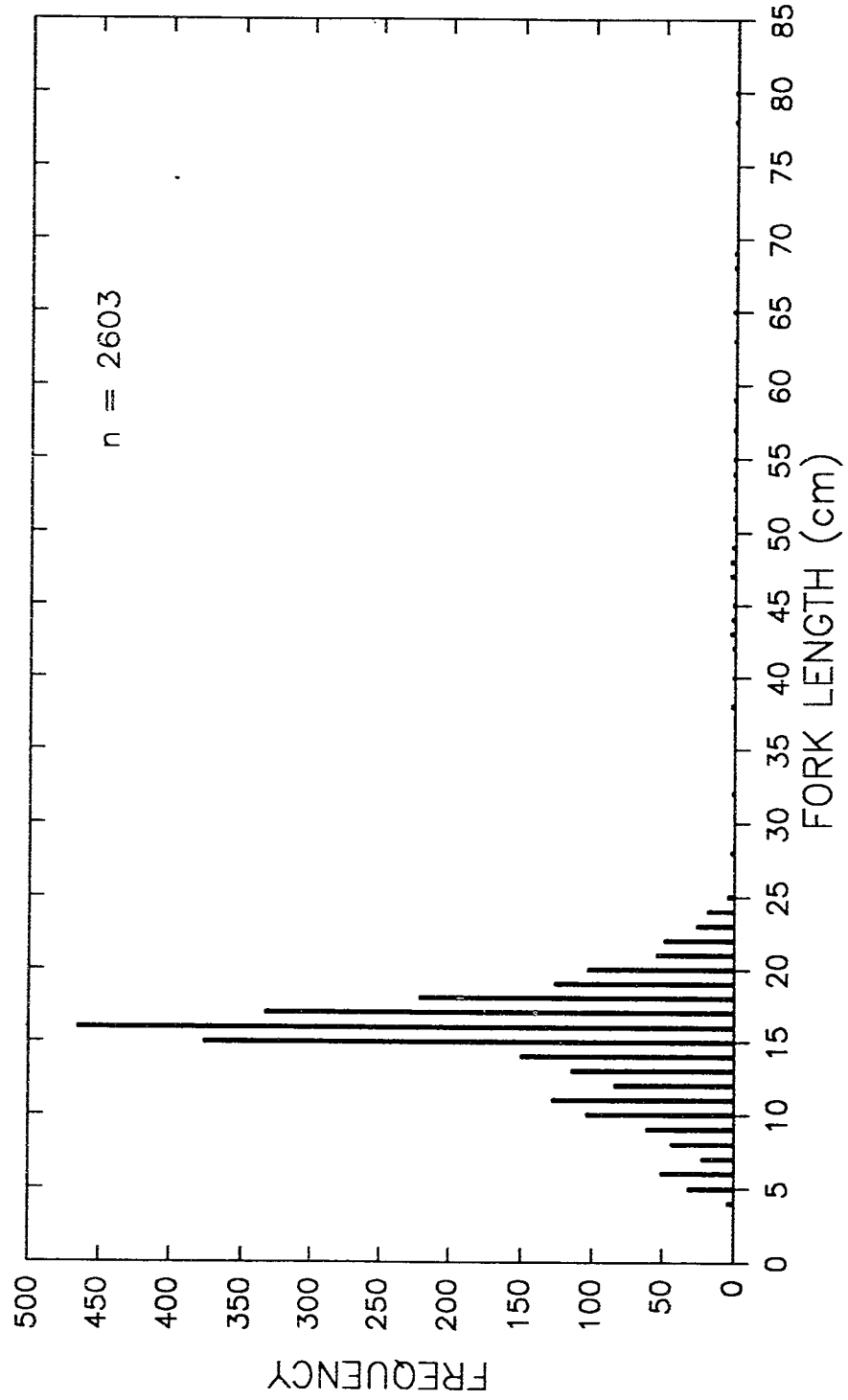


FIGURE 4

*Pomatomus saltatrix* = World Distribution of Bluefish, *Pomatomus saltatrix*, As Reported In Literature (from Wilk, 1977)

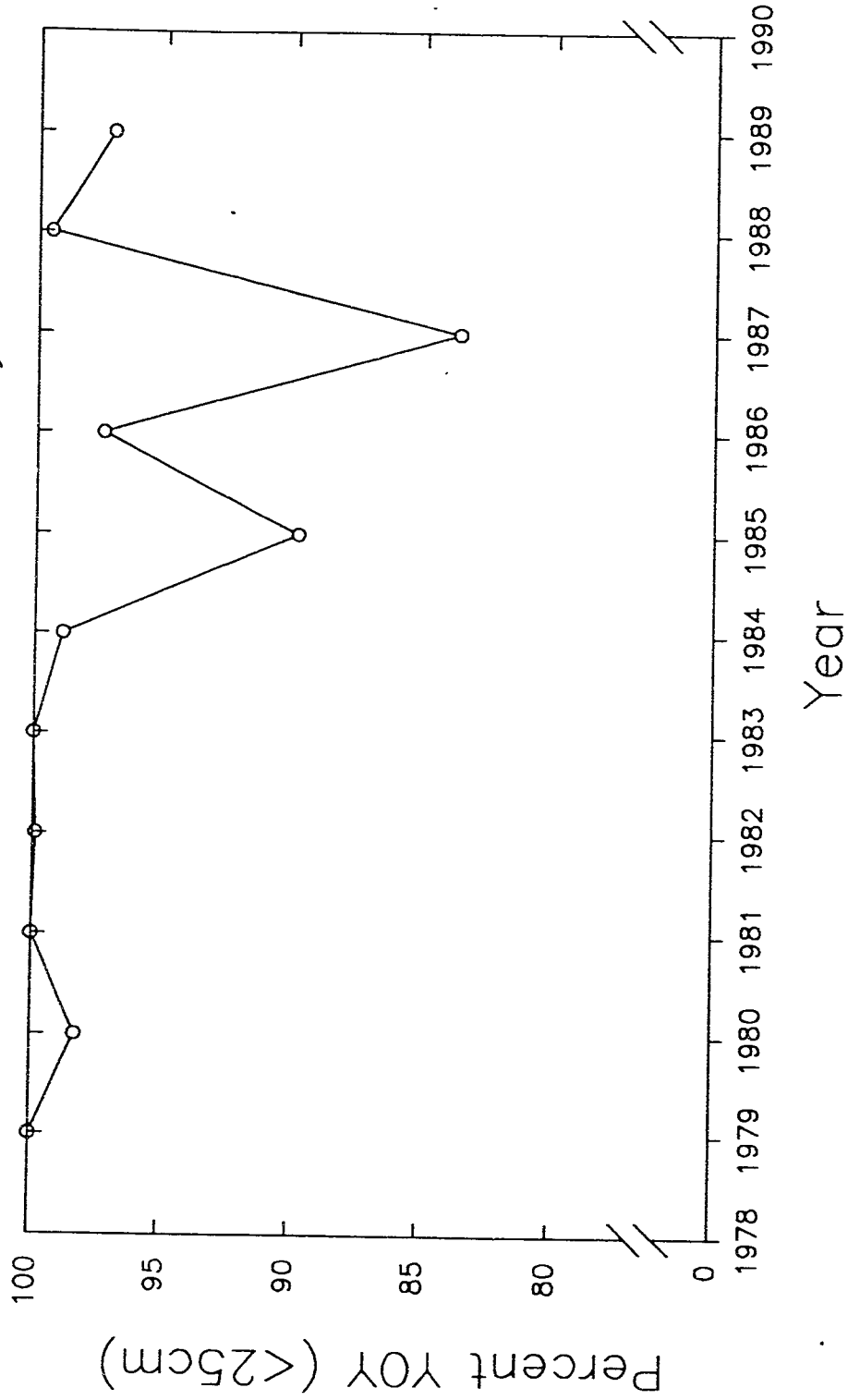
FIGURE 5  
LENGTH FREQUENCY FOR BLUEFISH  
FROM RHODE ISLAND WATERS 1979 -- 1989



Data Source: Coastal Fishery Resource Assessment (R.I. Div. Fish & Wildlife)

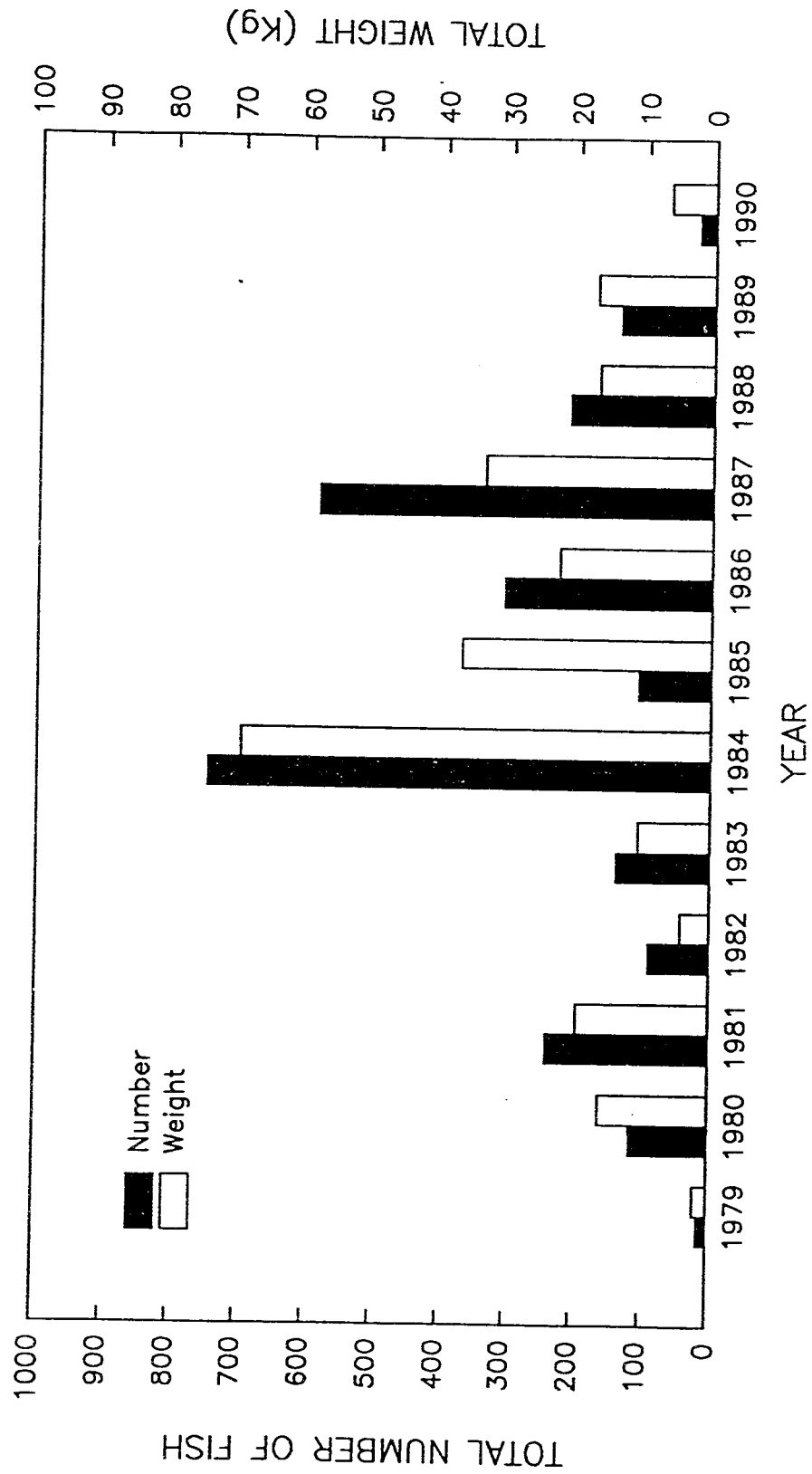
FIGURE 6

Percent of YOY (<25 cm) Bluefish, Pomatomus saltatrix  
Captured in Rhode Island Trawl Survey, 1979-1989.



Data Source: Coastal Fishery Resource Assessment (R.I. Div. Fish & Wildlife)

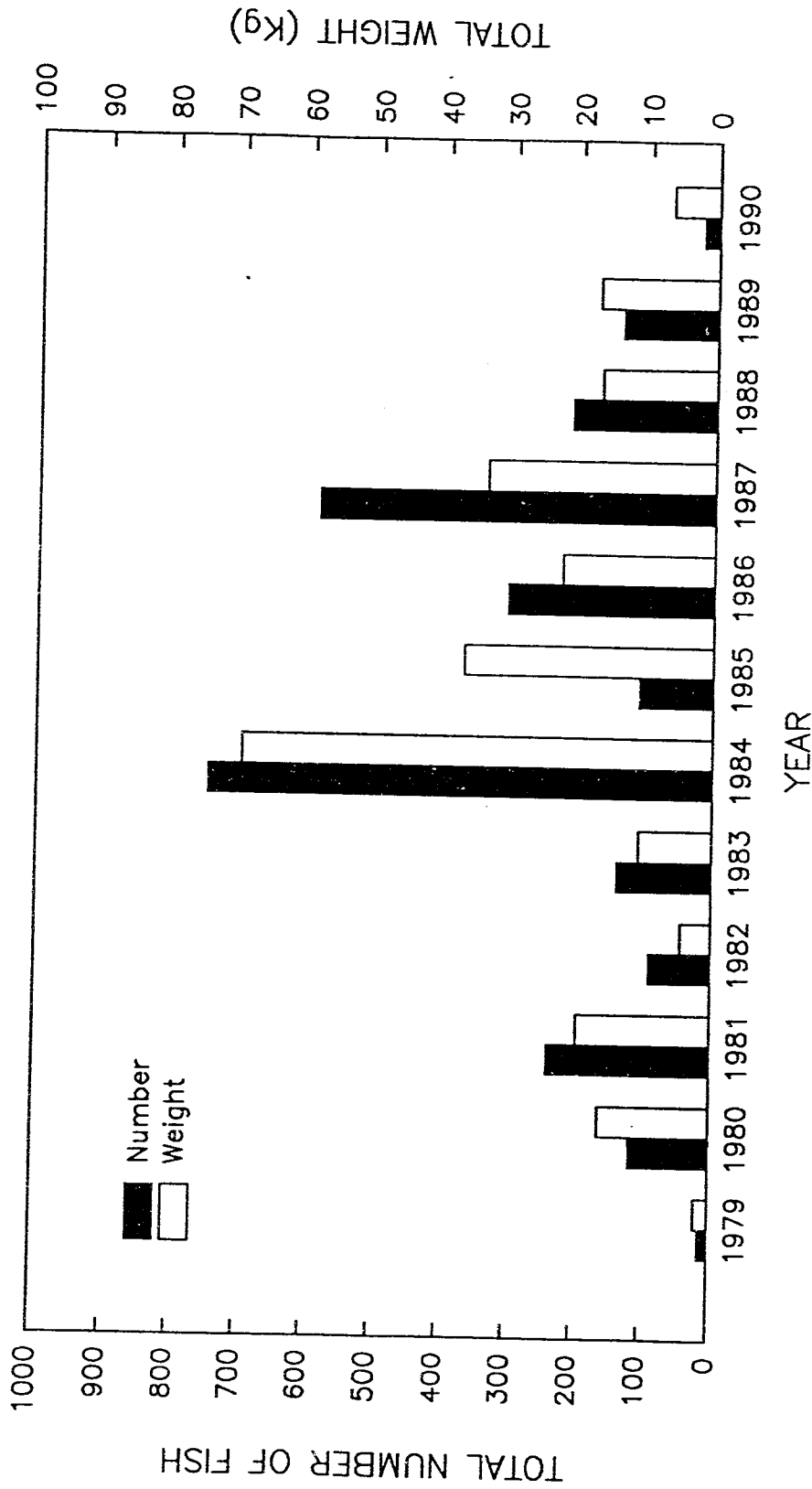
FIGURE 7  
 TOTAL WEIGHT AND TOTAL NUMBERS FOR BLUEFISH  
Pomatomus saltatrix



Data Source: Coastal Fishery Resource Assessment (R.I. Div. Fish & Wildlife)



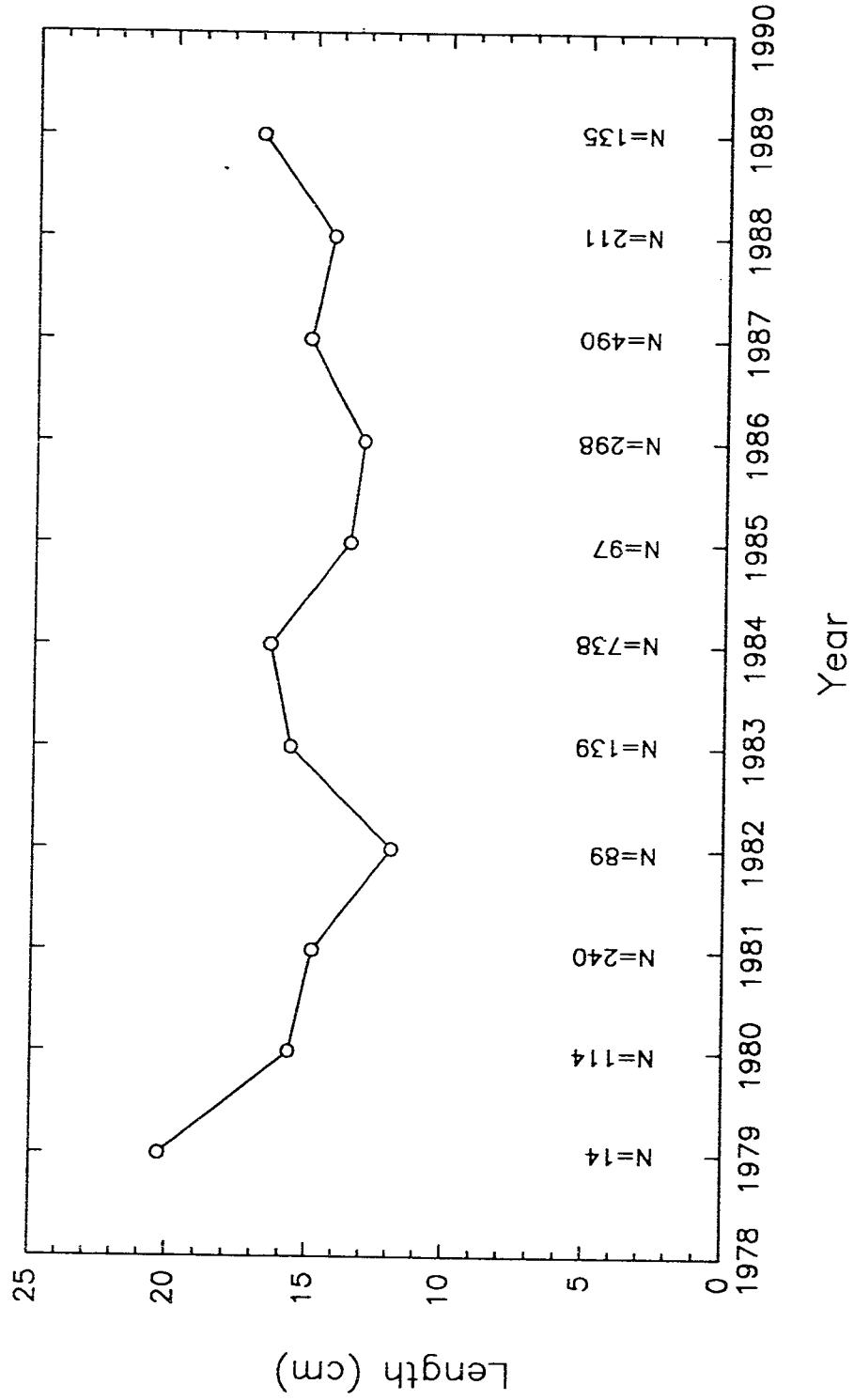
FIGURE 7  
 TOTAL WEIGHT AND TOTAL NUMBERS FOR BLUEFISH  
Pomatomus saltatrix



Data Source: Coastal Fishery Resource Assessment (R.I. Div. Fish & Wildlife)

FIGURE 8

Mean Fork Length (cm) For YOY (<25cm) Bluefish, Pomatomus saltatrix.



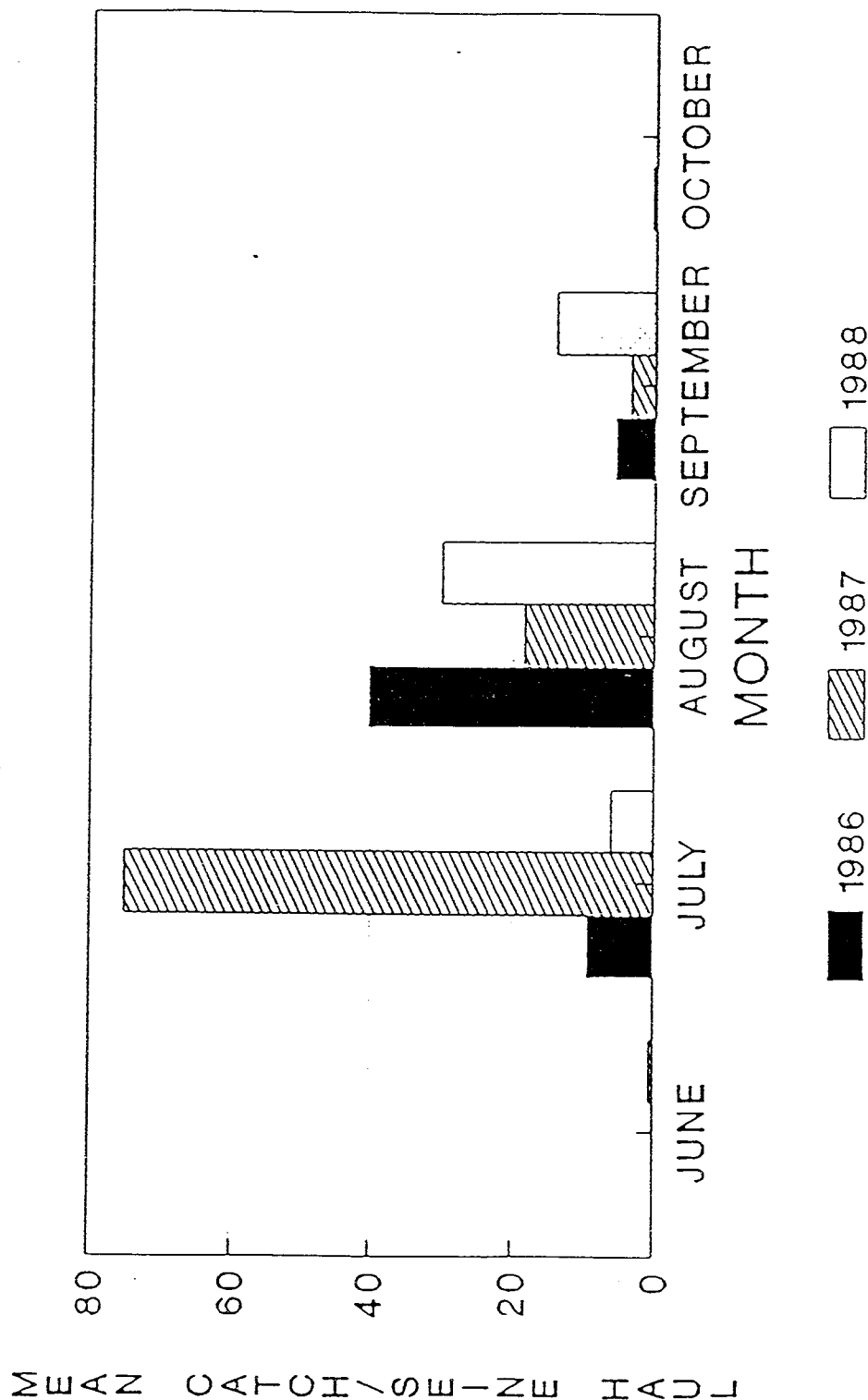
Data Source: Coastal Fishery Resource Assessment (R.I. Div. Fish & Wildlife)



FIGURE 10

# Juvenile Bluefish

## Monthly Abundance 1986, 1987 & 1988.

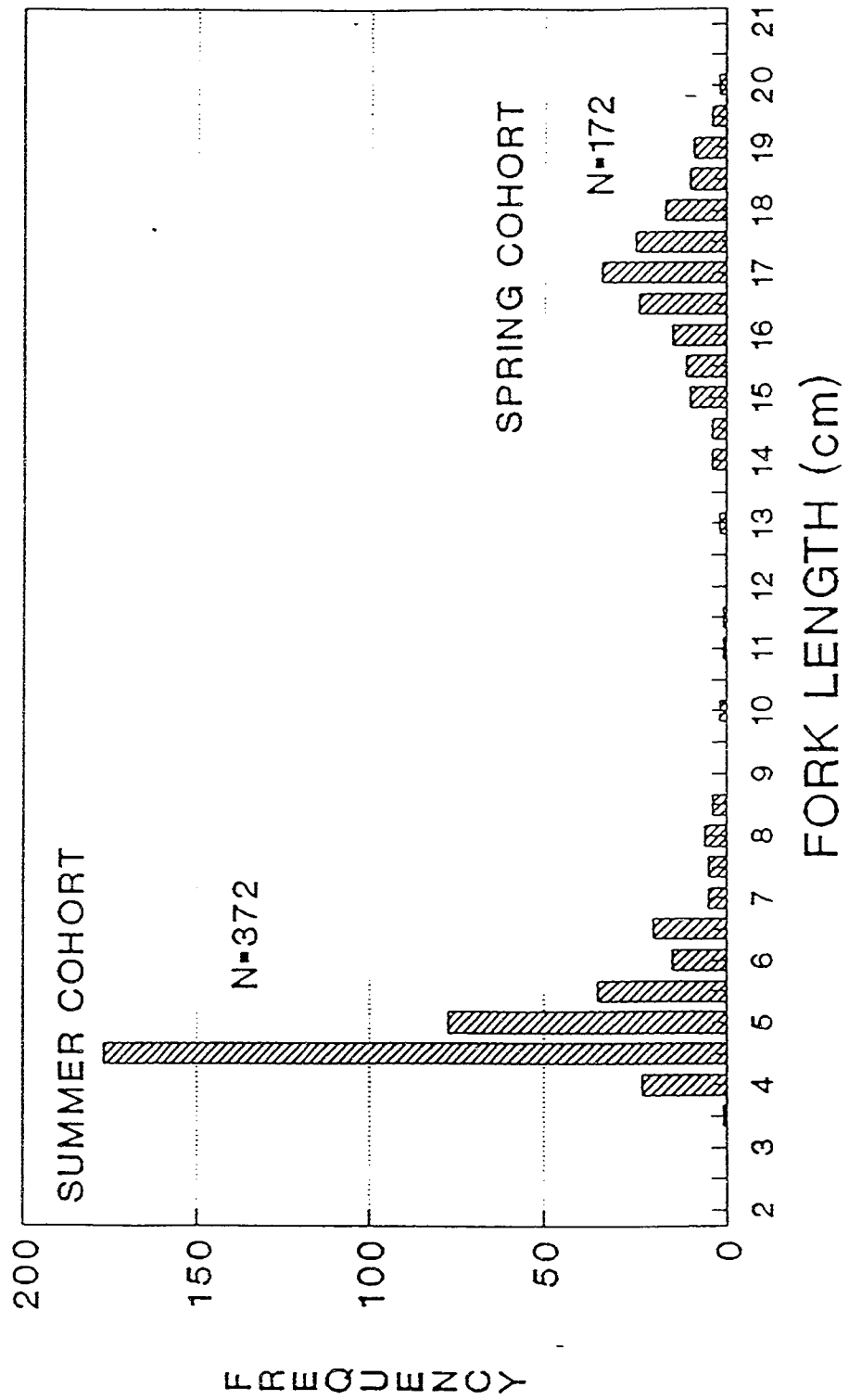


EACH STATION ONLY SAMPLED TWICE IN 1986.

Source Powell 1990.

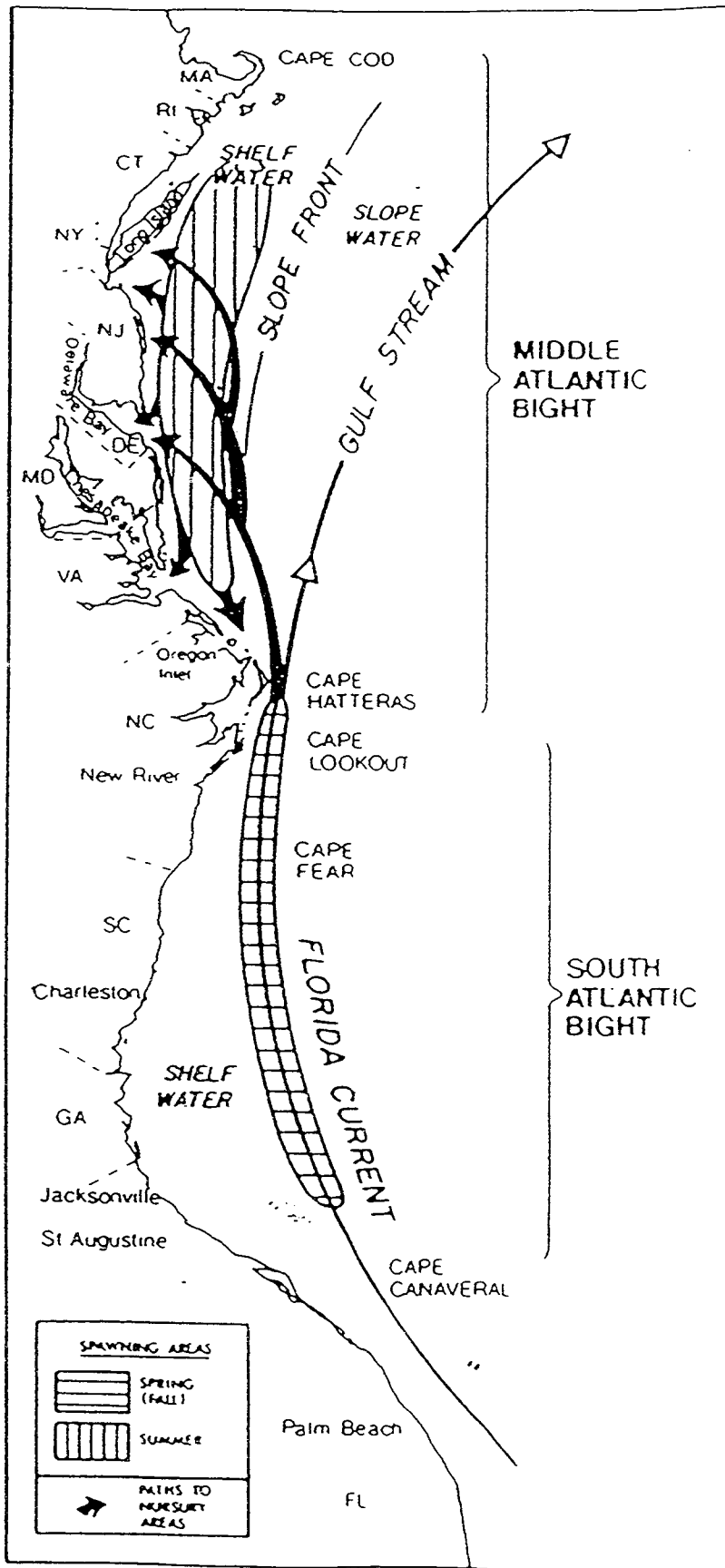
FIGURE 11

# Juvenile Bluefish Length Frequency - August 1988.



Source Powell 1990.

FIGURE 12.



Major features of surface waters and bluefish larval and juvenile distribution off the U.S. east coast.

Source Kendall and Walford 1979.

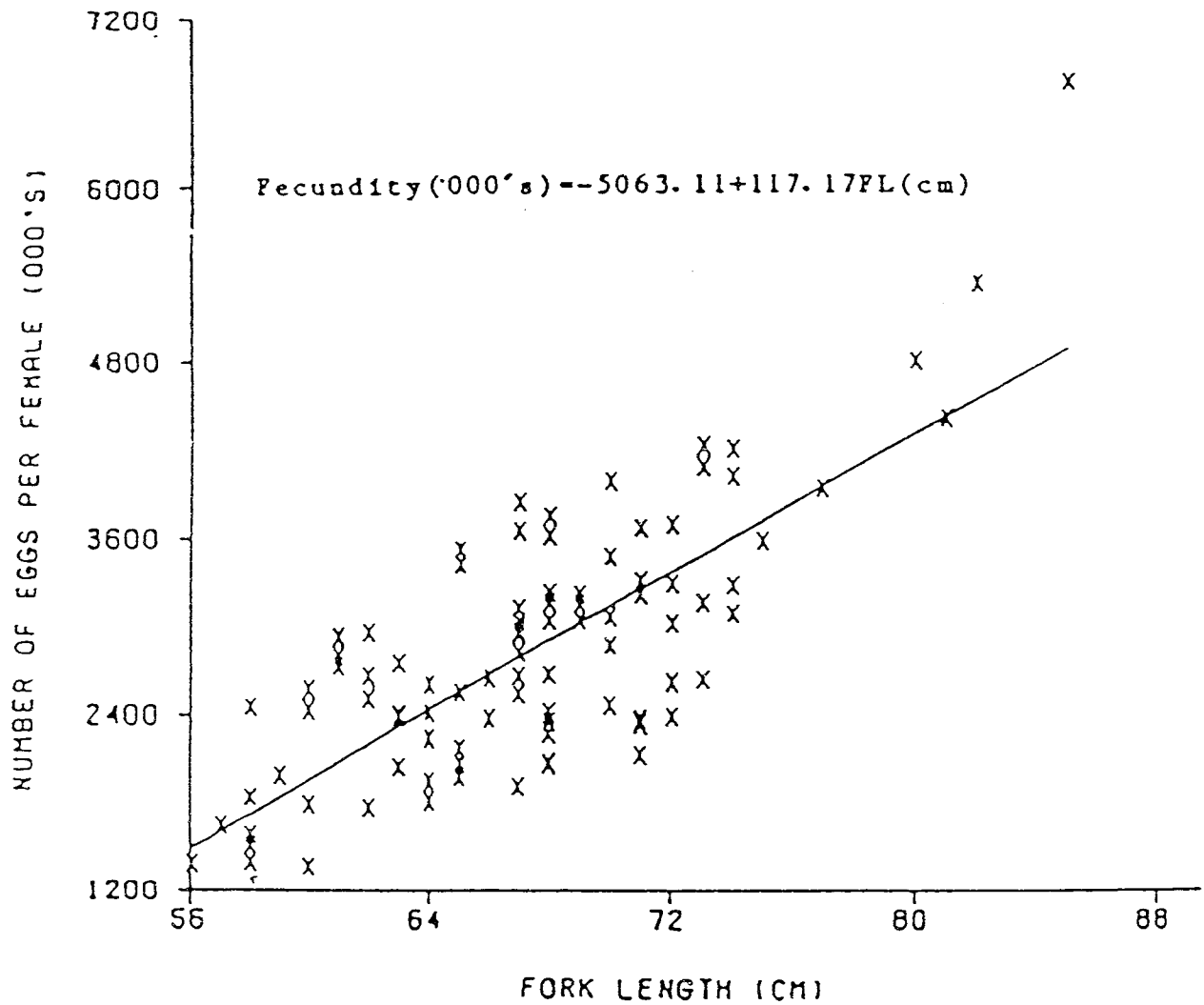
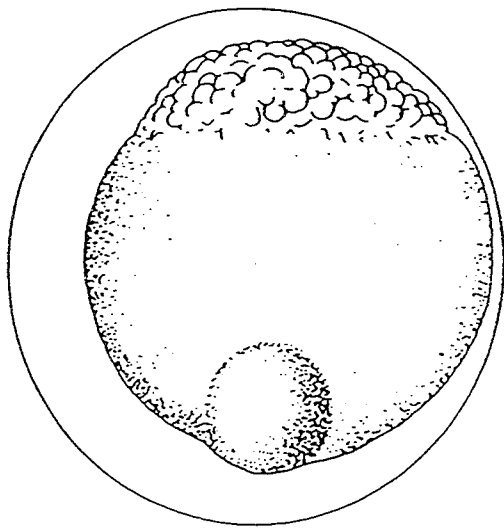
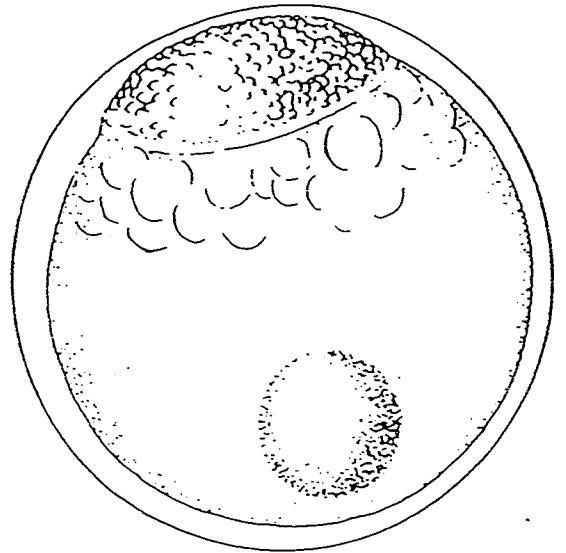


FIGURE 13. Relationship between fecundity and body length for bluefish captured in waters off New Jersey in 1978.

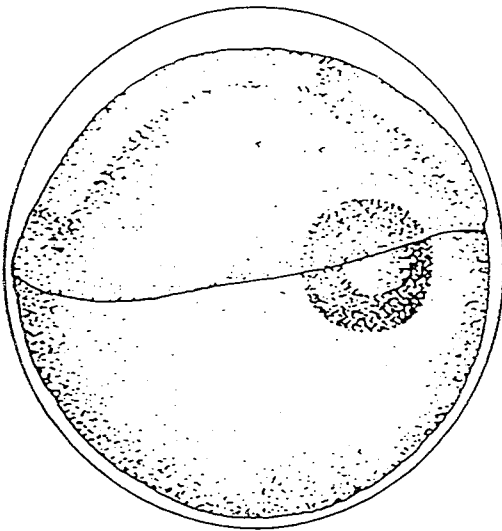
Source Morse(cited in Boreman 1983).



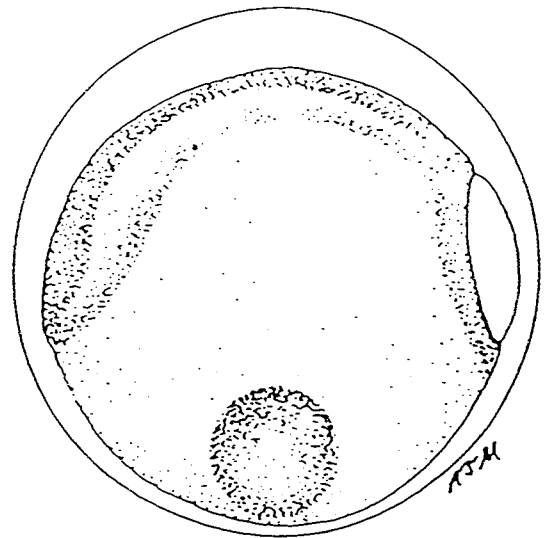
a.



b.



c.

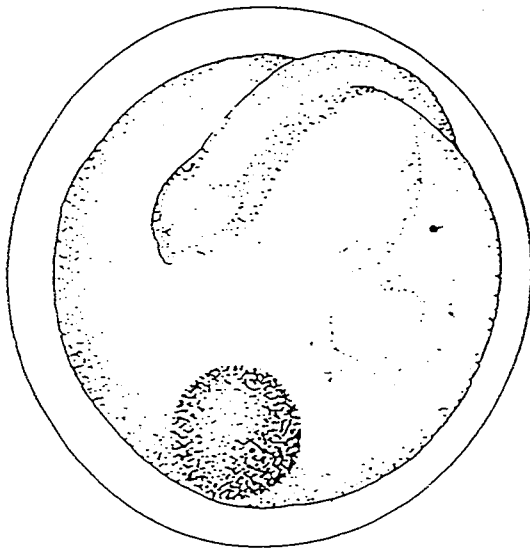


d.

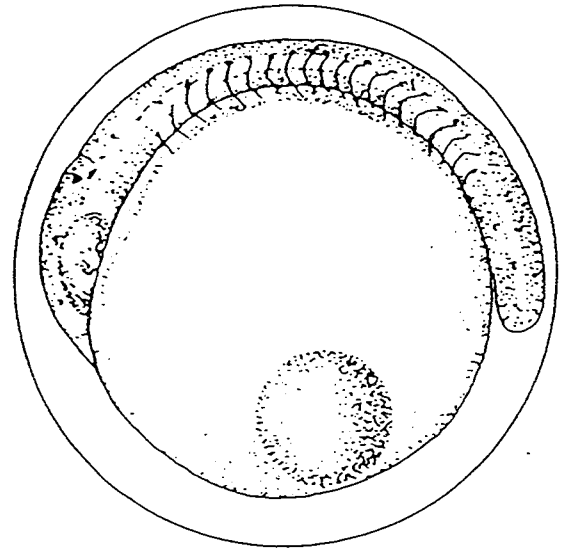
FIGURE 14. Stages in the development of bluefish eggs at various periods following fertilization: a. early morula, 5 hrs; b. late morula, 9 hrs; c. gastrula, 16 hrs; d. embryonic axis, blastopore open, 17 hrs.

Source Deuel et al. 1966.

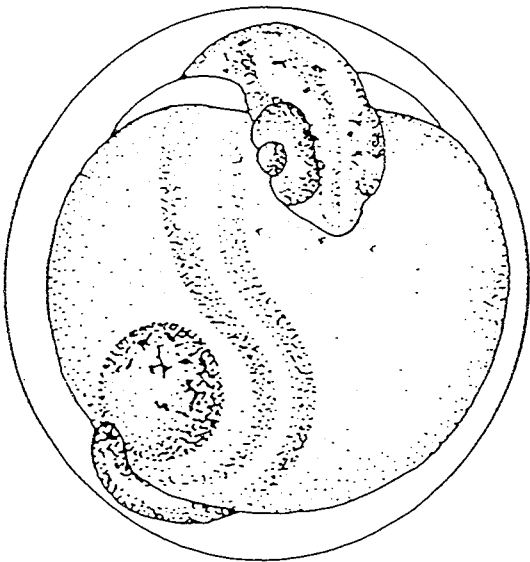




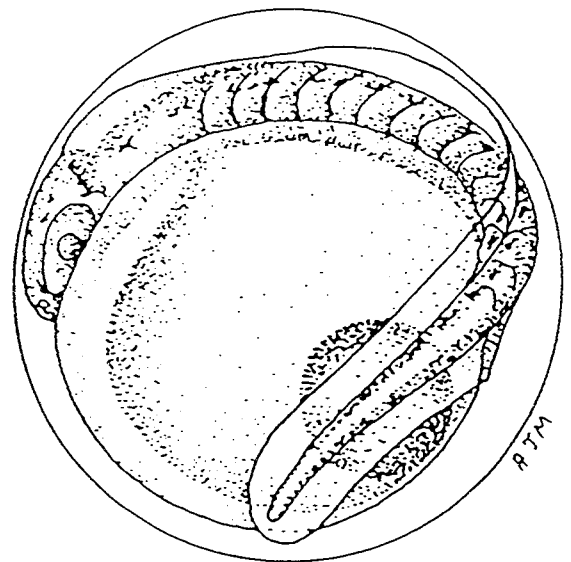
a.



b.



c.



d.

FIGURE 15. Stages in the development of bluefish eggs at various periods following fertilization: a. embryo with notochord and anlagen of eyes, 20 hrs; b. tail-free stage, 20 myomeres, 21 hrs; c. advanced embryo, 30 myomeres, 37 hrs; d. embryo just before hatching, finfold present (but not seen in this view), 45 hrs.

Source Deuel et al. 1966.

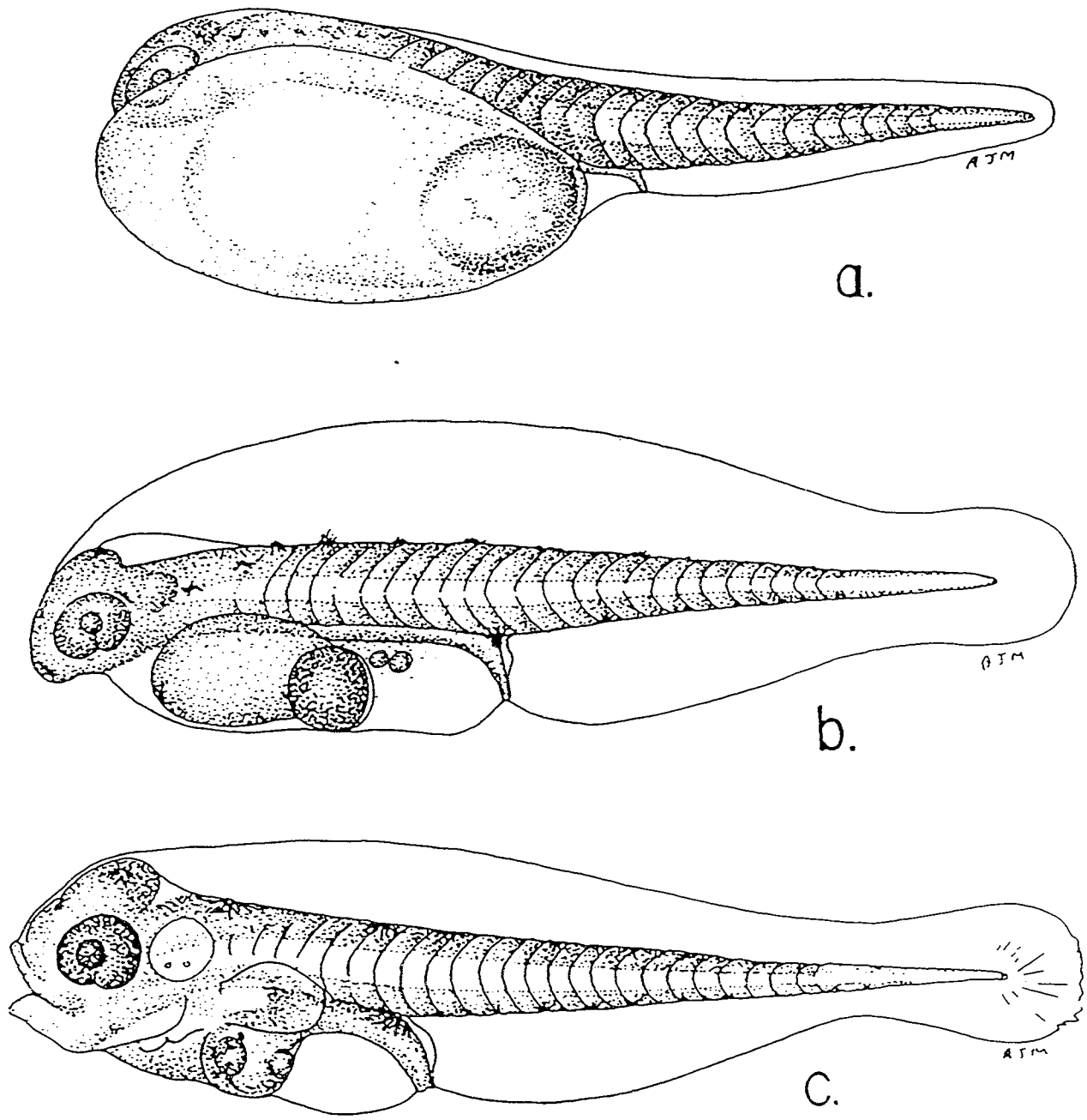
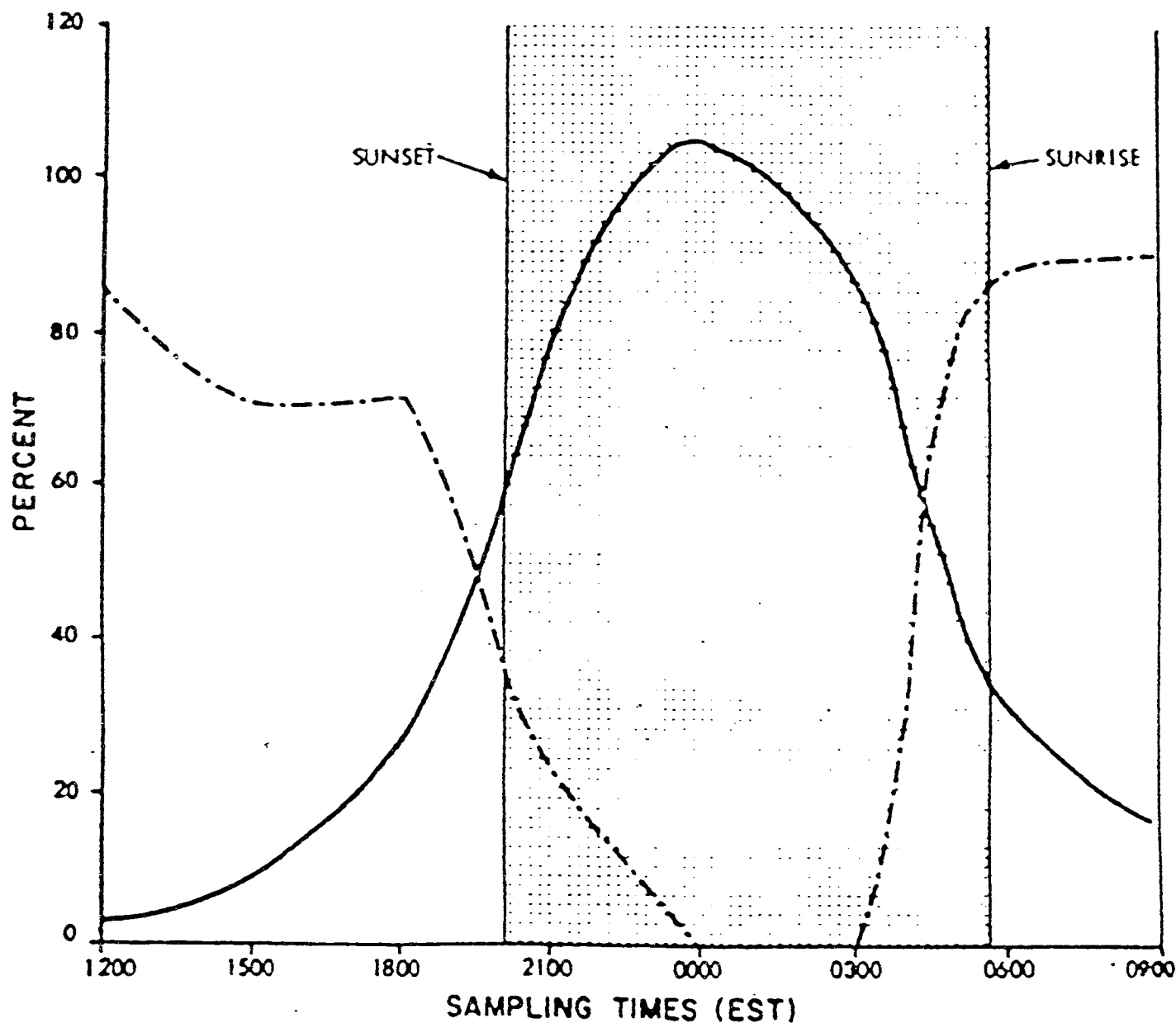


FIGURE 16. Stages in the development of bluefish larvae at various periods after hatching. a. recently hatched, 2.15 mm (total length); b. 2.76 mm, 1 day and 8 hrs; c. 3.08 mm, 4 days and 4 hrs.

Source Deuel et al. 1966.

FIGURE 17.



Mean percentage (surface/4m) of bluefish larvae in the 4m tow relative to those in 0m tow (solid line) and percentage of bluefish larvae with food in their guts (dashed line) by time of day from the vertical distribution study of ichthyoplankton in the Middle Atlantic Bight, July 1974.

Source Kendall and Naplin 1981.

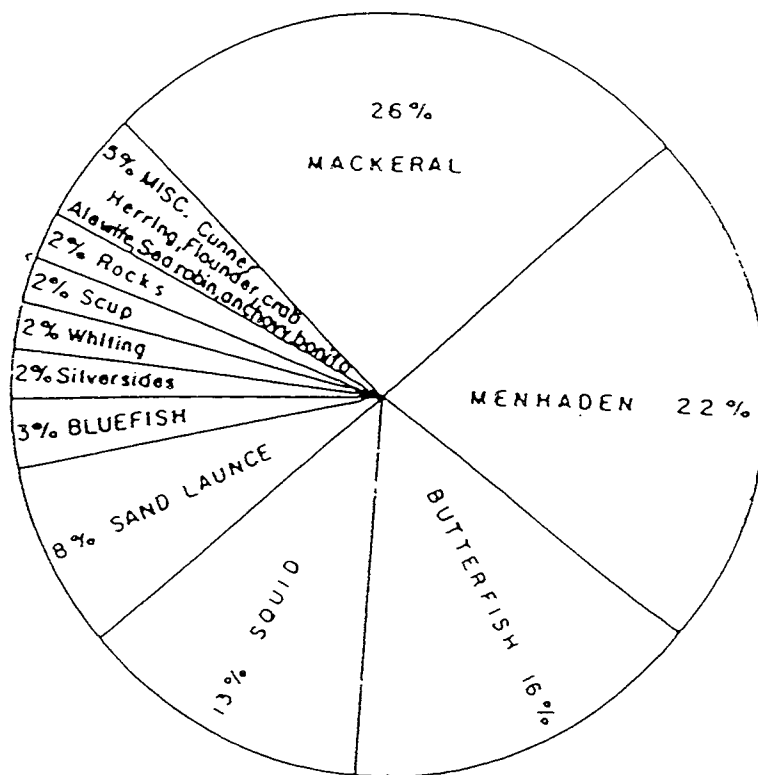
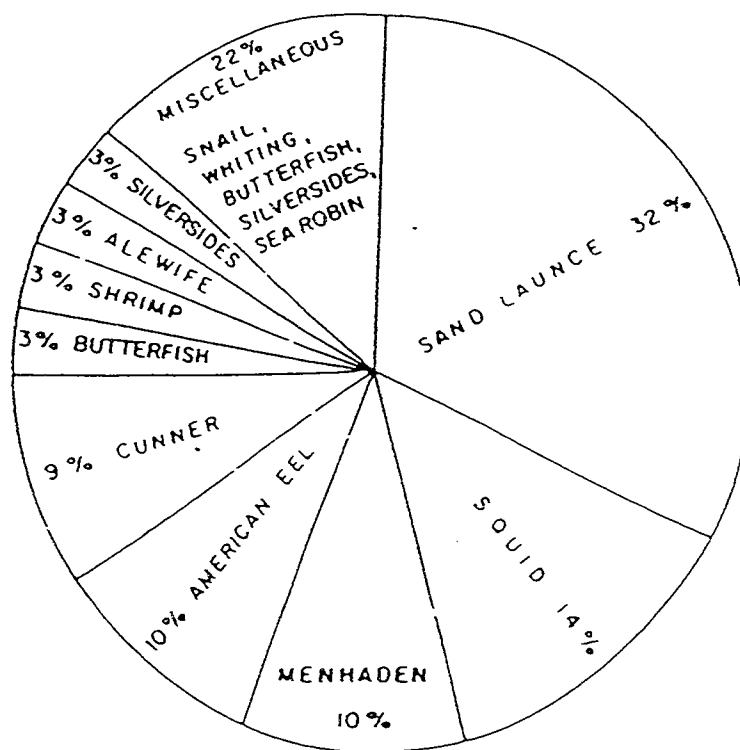
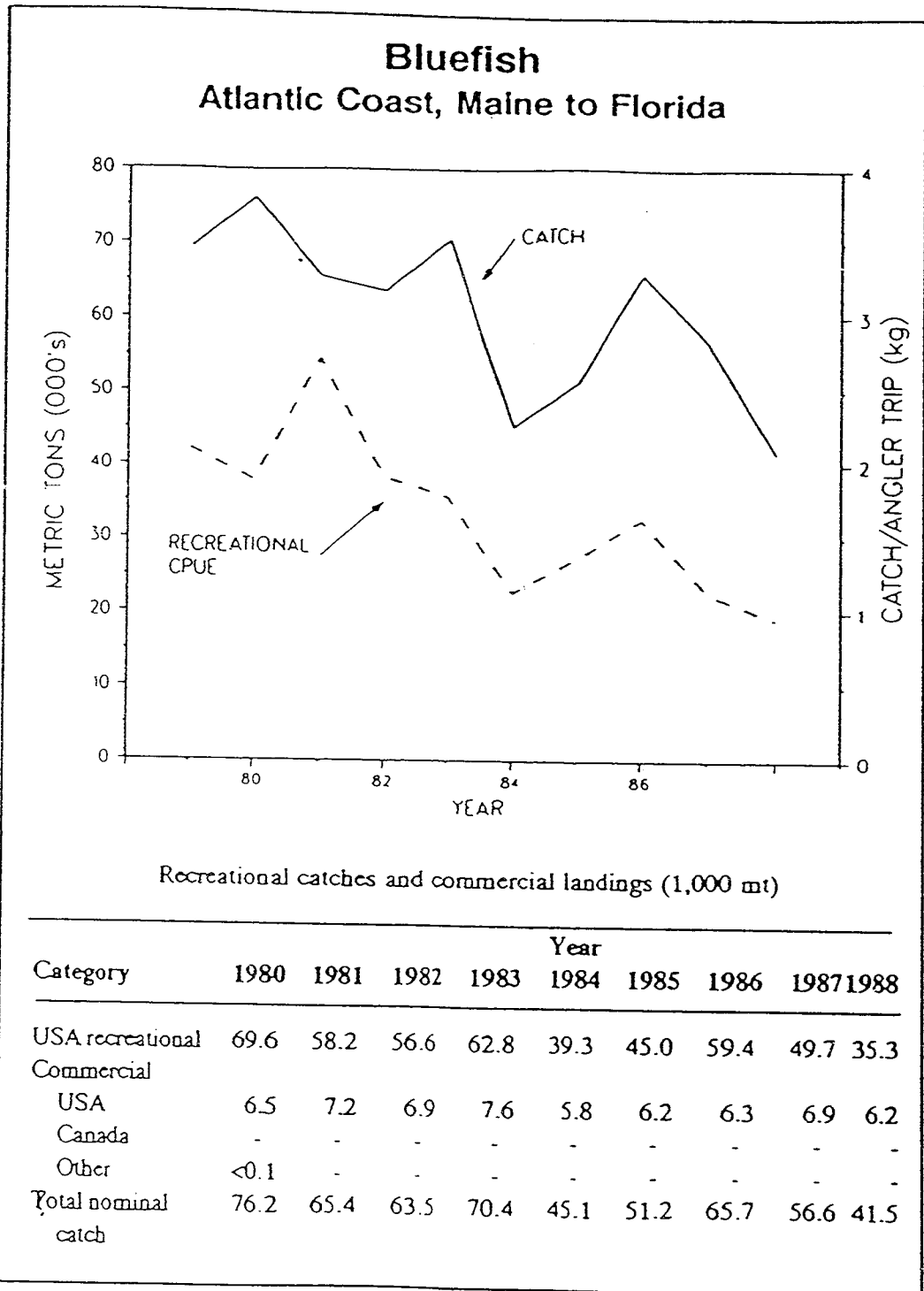


FIGURE 18.

Percent occurrence of food items in bluefish stomachs caught in Rhode Island waters in 1975 (above) and 1976 (below).

Source Oviatt 1977.

TABLE 1



Source: National Marine Fisheries Service (1989).

TABLE 2. Ranges and means of surface temperature and salinity of stations where bluefish eggs were present or absent in collections

	Present				Absent			
	Temperature (C)		Salinity (‰)		Temperature (C)		Salinity (‰)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean
May 1960					15.5-20.0	17.5	21.9-31.7	29.5
1961					11.8-19.5	15.1	21.5-30.7	27.0
June 1960	21.3-23.0	22.3	28.5-31.5	30.1	21.1-23.5	22.2	24.1-30.9	29.4
1961	18.0 <sup>a</sup> -21.5	20.0	26.6 <sup>b</sup> -31.7	29.3	17.0-21.0	18.9	26.4-31.9	30.0
July 1960	24.8-26.3	25.6 <sup>c</sup>	28.9-33.6	31.1 <sup>d</sup>	23.3-25.5	24.5	26.7-31.5	29.4
1961	23.0-24.0	23.5	29.9-31.0	30.0	22.0-23.0	22.8	27.1-30.9	29.3
1962	20.7-23.2	22.1	31.4-34.9	32.4	21.5-24.0	22.8	29.6-31.4	30.7

- <sup>a</sup> Minimum temperature at onset of spawning.
- <sup>b</sup> Minimum salinity at onset of spawning.
- <sup>c</sup> Average temperature at maximum of spawning.
- <sup>d</sup> Average salinity at maximum of spawning.

Source Norcross et al. 1974.

TABLE 3. Number, ages, actual and back-calculated fork lengths in centimeters, and weights in grams of bluefish from Long Island Sound from July through mid-November 1975, and comparisons with bluefish from New Jersey (dates unknown), and Woods Hole, Massachusetts in October 1961.

Age when caught	Long Island Sound							New Jersey (Lyman 1974)		Woods Hole (Backus 1962)		
	Number of fish	Mean weight	Fork length				Fork length mean	Weight mean	Number of fish	Fork length		
			Actual		Back-calculated					Mean	Range	
			Mean	Range	Mean	Range						
1+	0					23	15-31	20	227	21	38	26-43
2+	4		51	49-52	40	30-49	35	908	9	44	38-51	
3+	21	1,816	51	44-59	49	37-61	46	2,338	1	61	61	
4+	12	3,178	58	53-63	58	46-66	55	2,724				
5+	11	4,086	66	60-69	64	55-71	62	3,632				
6+	14	4,540	71	64-76	69	59-74	69	4,744				
7+	2	5,448	74	73-75	71	71	73	4,994				

Source Richards 1976.

TABLE 4. Food items of bluefish, Pomatomus saltatrix, along the Atlantic coast.

INVERTEBRATES:

Nereidae  
Nereis virens - sand worm  
Mysidacea  
Mysid sp. - mysids  
Peneidae  
Penaeus sp. - shrimps  
Homaridae  
Homarus americanus - American lobster  
Hippidae  
Hippa (America) taloida - sand bug  
Canceridae  
Cancer irroratus - rock crab  
Cancer borealis - northern crab  
Portunidae  
Portunus sp. - portunus crabs  
Callinectes sapidus - blue crab  
Ovalipes ocellatus - calico crab  
Carcinides maenas - green crab  
Ocypodidae  
Uca pugnax - fiddler crab  
Loligidae  
Loligo pealii - common squid  
Loligo brevis - short-bodied squid  
Ommastrephidae  
Ommastrephes illecebrose - short-finned squid  
Scutellidae  
Echinarachnius parma - sand dollar

VERTEBRATES:

Petromyzontidae  
Petromyzon marinus - sea lamprey  
Carcharhinidae  
Mustelus canis - smooth dogfish  
Squalidae  
Squalus acanthias - spiny dogfish  
Rajidae  
Raja sp. - skates  
Anquillidae  
Anquilla rostrata - American eel  
Clupidae  
Alosa aestivalis - blueback herring  
Alosa pseudoharengus - alewife  
Alosa sapidissima - American shad  
Brevoortia tyrannus - Atlantic menhaden  
Clupea harengus harengus - Atlantic herring  
Etrumeus teres - round herring  
Opisthonema oglinum - Atlantic thread herring  
Sardinella anchovia - Spanish sardine  
Engraulidae  
Anchoa hepsetus - striped anchovy  
Anchoa mitchilli - bay anchovy  
Engraulis mordax - northern anchovy  
Synodontidae  
Synodus foetens - inshore lizardfish  
Gadidae  
Merluccius bilinearis - silver hake  
Microgadus tomcod - Atlantic tomcod  
Pollachius virens - pollock  
Urophycis chuss - red hake  
Urophycis regius - spotted hake  
Ophidiidae  
Rissola marginata - striped cusk-eel

Zoarcidae  
Macrozoarces americanus - ocean pout  
Exocoetidae  
Hemiramphus brasiliensis - ballyhoo  
Hyporhamphus unifasciatus - halfbeak  
Cyprinodontidae  
Cyprinodon variegatus - sheepshead minnow  
Fundulus heteroclitus - mummichog  
Fundulus majalis - striped killifish  
Atherinidae  
Menidia beryllina - tidewater silverside  
Menidia menidia - Atlantic silversides  
Syngnathidae  
Hippocampus erectus - lined seahorse  
Syngnathus fuscus - northern pipefish  
Serranidae  
Centropristis striata - black sea bass  
Pomatomidae  
Pomatomus saltatrix - bluefish  
Carangidae  
Caranx crysos - blue runner  
Caranx hippos - crevalle jack  
Chloroscombrus chrysurus - Atlantic bumper  
Decapterus macarellus - mackerel scad  
Decapterus punctatus - round scad  
Selar crumenophthalmus - bigeye scad  
Selene vomer - lookdown  
Trachurus lathamii - rough scad  
Vomer setapinnis - Atlantic moonfish  
Pomadasyidae  
Orthopristis chrysoptera - pigfish  
Sparidae  
Diplodus holbrookii - spottail pinfish  
Lagodon rhomboides - pinfish  
Stenotomus chrysops - scup  
Sciaenidae  
Bairdiella chrysura - silver perch  
Cynoscion nobilissimus - spotted seatrout  
Cynoscion nothus - silver seatrout  
Cynoscion regalis - weakfish (gray seatrout)  
Leiostomus xanthurus - spot  
Menticirrhus saxatilis - northern kingfish  
Micropogon undulatus - Atlantic croaker  
Labridae  
Tautoga onitis - catoag  
Tautoglabrus adspersus - cunner  
Mugilidae  
Mugil cephalus - striped mullet  
Mugil curema - white mullet  
Ammodytidae  
Ammodytes americanus - American sand lance  
Scombridae  
Scomber scombrus - Atlantic mackerel  
Stromateidae  
Peprilus alepidotus - harvestfish  
Peprilus triacanthus - butterfish  
Triglidae  
Prionotus sp. - searobins  
Bothidae  
Paralichthys dentatus - summer flounder  
Pleuronectidae  
Limanda ferruginea - yellowtail flounder  
Cynoglossidae  
Symphurus plagiusa - blackcheek tonguefish  
Tetraodontidae  
Sphoeroides maculatus - northern puffer

Source Wilk 1977.



Table 5. Parasites of bluefish  
(From Anderson 1970)

<u>Parasite</u>	<u>Location</u>	<u>Distribution</u>
Phylum Protozoa		
Class Mastigophora		
Order Dinoflagellata		
Family Gymnodinidae		
<u>Oodinium ocellatum</u>	Gills, skin	Atlantic Ocean
Phylum Platyhelminthes		
Class Trematoda		
Family Capsalidae		
<u>Benedenia melleni</u>	Skin	Atlantic Ocean
Order Monogenea		
Family Microcotylidae		
<u>Microcotyle pomatomi</u>	Gills	Atlantic Ocean, Black Sea
Order Digenea		
Family Allocreadiidae		
<u>Opecoeloides vitellosus</u>	Stomach, Intestinal chyme	Atlantic Ocean
<u>Lepocreadium pyriforme</u>	Intestine	Atlantic Ocean
Family Hemiuroidae		
<u>Brachyphallus crenatus</u>	Liver	Atlantic Ocean
<u>Sterrhurus monticelli</u>	Stomach chyme	Atlantic Ocean
Family Bucephalidae		
<u>Rhipidocotyle transversale</u>	Viscera	Atlantic Ocean
<u>Bucephaloides arcuatus</u>	Intestinal caeca	Atlantic Ocean
Family Acanthocolpidae		
<u>Stephanostomum dentatum</u>	Kidneys	Atlantic Ocean, Tortugas
<u>Stephanostomum tenue</u>	Kidneys	Atlantic Ocean
Family Unknown		
<u>Distoma fenestratum</u>	Heart, Kidneys	Atlantic Ocean

Table 5. Parasites of bluefish (pg. 2)  
(From Anderson 1970)

<u>Parasite</u>	<u>Location</u>	<u>Distribution</u>
<b>Class Cestodea</b>		
<b>Order Tetrathyllidea</b>		
<u>Scolex pleuronectis</u>	Cystic duct, gall bladder, intestine	Atlantic Ocean, Bermuda
<b>Order Trypanorhyncha</b>		
Family Lacistorhynchidae		
<u>Lacistorhynchus bulbifer</u>	Viscera, intestinal wall	Atlantic Ocean
Family Tentaculariidae		
<u>Nybelinia bisulcata</u>	Viscera	Atlantic Ocean, Bermuda, Japan
Family Dasyrhynchidae		
<u>Callitetrarhynchus gracilis</u>	Viscera	Atlantic Ocean, Bermuda
Family Obothriidae		
<u>Obothrium dipsacum</u>	Viscera	Atlantic Ocean
<u>O. crenacolle</u>	Stomach mucosa, mesenteries, viscera	Atlantic Ocean, Bermuda, Tortugas
Family Pterobothriidae		
<u>Pterobothrium filicolle</u>	Viscera	Atlantic Ocean, Tortugas, Indian Ocean
<u>P. malleum</u>	Mesenteries, viscera	Atlantic Ocean, Indian Ocean
<b>Order Pseudophyllidea</b>		
Family Ptychobothriidae		
<u>Clestobothrium crassiceps</u>	Intestine	Atlantic Ocean
Family Bothriocephalidae		
<u>Bothriocephalus sp.</u>	Viscera	Atlantic Ocean
<b>Phylum Nematoda</b>		
Superfamily Drancunculoidea		
Family Philometridae		
<u>Philometra globiceps</u>	Ovaries	Atlantic Ocean, Italy

Table 5. Parasites of bluefish (pg. 3)  
(From Anderson 1970)

Parasite	Location	Distribution
<u>Phylum Acanthocephala</u>		
Order Palaeacanthocephala		
Family Pomphorhynchidae		
<u>Pomphorhynchus proteus</u>	Intestinal wall	Atlantic Ocean
Family Rhadinorhynchidae		
<u>Telosentis tenuicornis</u>	Intestinal wall	Atlantic Ocean
Family Polymorphidae		
<u>Corynosoma incrassatus</u>	Intestinal wall	Atlantic Ocean
Family Gorgorhynchidae		
<u>Serrasentis socialis</u>	Body cavity, mesenteries	Atlantic Ocean
<u>Phylum Arthropoda</u>		
Subclass Copepoda		
Family Caligidae		
<u>Caligus schistonyx</u>	Oral and gill cavity	Atlantic Ocean
Order Isopoda		
Family Cymothoidae		
<u>Livoneca ovalis</u>	Gills	Atlantic Ocean
Family Lernaeidae		
<u>Lernaeenicus radiatus</u>	Skin (various parts)	Atlantic Ocean
<u>L. longiventris</u>	Skin	Atlantic Ocean
Family Dichelesteiidae		
<u>Lernanthropus pomatomi</u>	Gills	Atlantic Ocean

APPENDIX I

PART 628-ATLANTIC BLUEFISH FISHERY

Subpart A-General Provisions

Sec.

- 628 1 Purpose and scope.
- 628 2 Definitions.
- 628 3 Relation to other laws.
- 628 4 Permits and fees.
- 628 5 Prohibitions.
- 628 6 Facilitation of enforcement.
- 628 7 Penalties.

Subpart B-Management Measures

- 628.20 Fishing year.
- 628.21 Possession limit.
- 628.22 Catch monitoring commercial  
controls and gear restrictions.
- 628.23 Closure of fishery.  
Authority: 16 U.S.C. 1801 et seq.

Subpart A-General Provisions

628.1 Purpose and scope.

The regulations in this part implement the Fishery Management Plan for the Bluefish Fishery, which was prepared and adopted by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission in cooperation with the New England and South Atlantic Fishery Management Councils. These regulations govern the conservation and management of Atlantic bluefish in the EEZ.

628.2 Definitions.

In addition to the definitions in the Magnuson Act and in 620.2 of this chapter, the terms used in this part have the following meanings:

**Bluefish** means Pomotomus saltatrix. Bluefish for the purposes of this part, refers to bluefish in the Atlantic EEZ from the eastern coast of Florida to Maine.

**Charter or party boat** means any vessel that carries passengers for hire to engage in fishing.

**Commission** means the Atlantic States Marine Fisheries Commission.

**Committee** means the Bluefish FMP Review and Monitoring Committee of the Council.

**Council** means the Mid-Atlantic Fishery Management Council.

**Fishery Management Plan (FMP)** means the Fishery Management Plan for the Bluefish Fishery and any amendments thereto.

**Fishing trip** means a period of time during which fishing is conducted, beginning when the vessel leaves port and ending when the vessel returns to port.

**NEFC** means the Northeast Fisheries Center. NMFS, Water Street. Woods Hole. MA 02543

**Pair trawl** means a net attached to and towed by two vessels.

**Person who receives bluefish for commercial purposes** means any person (excluding representatives of governmental agencies) engaged in the sale, barter, or trade of bluefish received from a fisherman, or one who transports bluefish from a fisherman.

**Purse seine** means a floating and weighted net that is closed by means of a draw string threaded through rings attached to the bottom of the net.

**Regional Director** means the Director. Northeast Region, NMFS, 1 Blackburn Drive, Gloucester, MA 01930, telephone 508-281-9243, or a designee.

**Regulated fishery** means any fishery of the United States which is regulated under the Magnuson Act.

**Runaround gillnet or encircling gillnet** means a rectangular net placed upright in the water column in a circular fashion with an opening equal to or less than 1/4 the length of the net or with an opening greater than 1/4 the length of the net if the opening is obstructed in any fashion.

**Vessel length** means that length specified on State registration or U.S. Coast Guard documentation.

### 628.3 Relation to other laws.

(a) The relation of this part to other laws is set forth in 620.3 of this chapter and paragraph (b) of this section.

(b) Additional regulations governing fishing for bluefish by foreign vessels in the EEZ are set forth in 50 CFR part 611, subparts A and C.

### 628.4 Permits and fees.

(a) General. (1) Any person selling bluefish harvested in the EEZ must have either a valid permit issued under this part or a valid State of landing permit to sell bluefish.

(2) Any person who applies for a permit under this section, or who uses a valid state permit to sell fish harvested from the EEZ, must agree as a condition of using either permit that his/her bluefish catch and gear (without regard to whether fishing occurs in the EEZ or landward of the EEZ and without regard to where such bluefish or gear

are possessed, taken, or landed) will be subject to all the requirements of this part. All such catch and gear will remain subject to any applicable State or local requirements. If a requirement of this part and a conservation measure required by a state or local law differ, any person issued a permit under this section or using a valid State permit sell bluefish harvested from the EEZ must comply with the more restrictive requirement.

(b) Application. (1) An application for a permit under this part must be signed by the applicant on an appropriate form obtained from the Regional Director and submitted at least 30 days prior to the date on which the applicant desires to have the permit made effective.

(2) An applicant must provide all the following information:

(I) The name, mailing address, including zip code and telephone number of the applicant:

(II) The height, weight, hair color, and eye color of an individual applicant:

(III) If the applicant represents a corporation, the certificate of incorporation:

(IV) Percentage of annual income derived from the sale of bluefish: and

(v) Any other information required by the Regional Director.

(3) Upon receipt of an incomplete or improperly executed application, the Regional Director will notify the applicant of the deficiency in the application. If the application fails to correct the deficiency within 21 days following the date of notification, the application will be discarded.

(4) Any change in the information specified in paragraph (b)(2) of this section must be submitted by the applicant in writing to the Regional Director within 15 days of the change.

(c) Fees. The Regional Director may charge a fee consistent with the Magnuson Act for the issuance of the federal permit.

(d) Issuance. The Regional Director will issue a permit to the applicant no later than 30 days from the receipt of a completed application.

(e) Duration. A permit will continue in effect until December 31 of each year unless it is revoked, suspended, or modified under 15 CFR part 904.

(f) Alteration. No person may alter, erase or mutilate any permit. Any permit which has been altered, erased, or mutilated is invalid.

(g) Replacement. Replacement permits may be issued by the Regional Director when requested in writing by the applicant, stating the need for replacement and the fishing permit number assigned. An application for a replacement

permit will not be considered a new application. The Regional Director may charge a fee consistent with the Magnuson Act for the issuance of the replacement permit.

(h) Transfer. Permits issued under this part are not transferable or assignable. A permit will be valid only for the person for which it is issued.

(i) Display. A person issued a permit under this section must be able to present the permit for inspection when requested by an authorized officer.

(j) Suspension and revocation. Subpart D of 15 CFR part 904 (Civil Procedures) governs the imposition of sanctions against a permit issued under this part.

### 628.5 Prohibitions.

In addition to the general prohibitions specified in 620.7 of this chapter, it is unlawful for any person to do any of the following:

(a) Possess in or harvest from the EEZ Atlantic bluefish in excess of the daily possession limit specified in 628-21, unless that person has a permit meeting the requirements of 628.4(a);

(b) Possess, have custody or control of, ship, receive, barter, trade, transport, offer for sale, sell, purchase, import or export any bluefish taken, retained, or landed in violation of the Magnuson Act or any regulation or permit issued under the Magnuson Act;

(c) Fish under a permit meeting the requirements of 628.4(a) in violation of a notice of restriction published under 628.22;

(d) Fish in the EEZ under a permit meeting the requirements of 628.4(a) during a closure under 628.23;

(e) Fail to report to the Regional Director within 15 days, any change in the information in the application for a permit under 628.4;

(f) Fail to present any permit meeting the requirements of 628.4 (a) upon request of an authorized officer;

(g) Sell any Atlantic bluefish harvested from the EEZ unless that person has a permit that meets the requirements of 628.4(a);

(h) Make any false statement, written or oral, to an authorized officer concerning the taking, catching, harvesting, landing, purchase, sale, possession, or transfer of any Atlantic bluefish; or

(i) Violate any other provision of this part, the Magnuson Act, or any regulation or permit issued under the Magnuson Act.



## **628.6 Facilitation of enforcement.**

See 620.8 of this chapter.

## **628.7 Penalties.**

See 620.9 of this chapter.

### **Subpart B-Management Measures**

#### **628.20 Fishing year.**

The fishing year is from January 1 through December 31.

#### **628.21 Possession limit**

(a) Possession limit. (1) No person shall possess more than ten bluefish unless he/she has a permit meeting the requirements of 628.4(a).

(2) Bluefish caught while in possession of a permit meeting the requirements of 628.4(a) must be kept separate from the pooled catch and in the possession of the permit holder at all times.

(3) If Atlantic bluefish are filleted into two or more sections, such fillets shall be deemed to be whole Atlantic bluefish using a ratio of 1:2 (two fillets to one whole fish). If Atlantic bluefish are filleted into a single (butterfly) fillet, such fillets shall be deemed to be whole Atlantic bluefish.

(4) Atlantic bluefish harvested from party and charter boats or other vessels carrying more than one person may be commingled. Compliance with the daily possession limit will be determined by dividing the number of Atlantic bluefish on board by the number of persons on board, provided, however, that if a person or persons on board are fishing under a permit meeting the requirements of 628.4(a), his/her catch shall not be counted for determining compliance with the possession limit if it is maintained in the possession of such person(s). If there is a violation of the possession limit on board a vessel carrying more than one person, the violation shall be deemed to have been committed by the owner and/or operator.

(b) Adjustment of the possession limit. The Secretary may adjust the possession limit within a range of 0 to 15 Atlantic bluefish based on a recommendation of the Council and Commission. The Secretary will publish a notice of any proposed adjustment, together with the basis for such adjustment in the Federal Register. The public may comment on the adjustment for 15 days after the date of the publication. After consideration of public comments, the Secretary may publish a notice of any adjustment in the possession limit in the Federal Register.

**628.22 Catch monitoring, commercial controls, and gear restrictions.**

(a) The Committee will review bluefish catch statistics, a projection of the commercial share for the next fishing year, and the most recent stock assessment prior to August 15th of each year. The Committee will report to the Council and the Commission.

(b) The Council and the Commission will review the report of the Committee. If the report indicates that the commercial catch for the next fishing year will equal or exceed 20 percent of the total catch (recreational catch plus commercial landings) of Atlantic bluefish, the Council and Commission will propose the commercial controls to be implemented at the start of the upcoming year. If the report indicates that the commercial catch will be greater than 17 percent but less than 20 percent of the total catch of Atlantic bluefish, or that the commercial share for the last full year is 50 percent greater than the previous year's commercial share, the Council and Commission will determine whether commercial controls are necessary. In making such a determination the Council and Commission will consider:

- (1) The most recent catch data;
- (2) Trends in the fishery; and
- (3) Any other relevant factors.

(c) If the catch in the commercial fishery is projected to equal or exceed the 20 percent limit during the upcoming year, then a State allocation system will be implemented. This will entail the use of landings data from the most recent 10-year period for each State, to determine the average percentage of each State's coastwide commercial landings. These percentages will be used to determine the amount of the coastwide quota allocated to each State. Quotas will apply to landings in each State, regardless of where the bluefish were caught.

(d) If whole Atlantic bluefish are processed into fillets at sea, then fillet weight will be converted to whole weight at the State of landing by multiplying fillet weight by 2.5. If whole Atlantic bluefish are headed and gutted at sea, then the conversion is accomplished by multiplying headed/gutted weight by 1.5.

(e) If the Council concludes that the increase in the commercial catch, is attributable to the use of purse seines, pair trawls, or encircling (runaround) gillnets, then it will propose restrictions applicable to that gear type. In determining what restrictions are necessary to control the catch of Atlantic bluefish by commercial fishermen using these gear, the Council may consider:

- (1) Trip limits;
- (2) Area closures;

- (3) Banning the use of these gear types; or  
(4) Any other measures it deems appropriate.

The Regional Director will review any gear restriction(s) proposed by the Council. If the Regional Director concurs that the proposed gear restrictions are consistent with the goals and objectives of the FMP, the national standards, and other applicable law, the Regional Director will recommend that the Secretary publish a notice of the proposed restriction in the Federal Register with a 30 day public comment period. After consideration of public comments, the Secretary may publish a notice in the Federal Register specifying the final restriction(s).

(g) The Secretary may rescind a notice of restriction in the Federal Register if he finds, based on the advice of the Council through the process set forth in paragraphs (a) and (b) of this section, that the restriction is no longer necessary.

#### **628.23 Closure of Fishery.**

The Regional Director shall close the commercial fishery for Atlantic bluefish in the EEZ if the commercial fisheries for Atlantic bluefish have been closed in all Atlantic coastal States.

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