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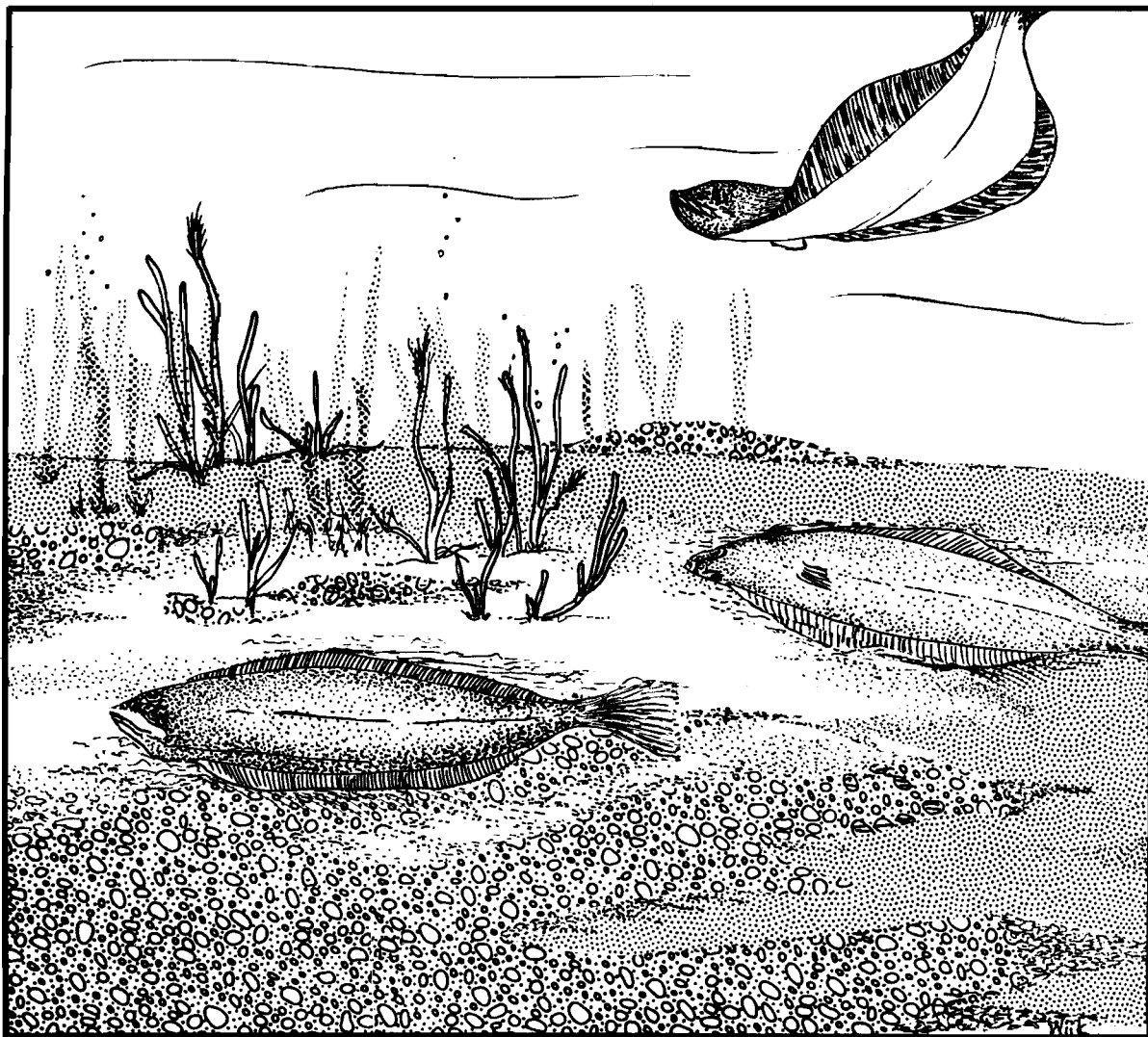
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August 1989

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## Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (Mid-Atlantic)

### SUMMER AND WINTER FLOUNDER



Fish and Wildlife Service  
U.S. Department of the Interior

Coastal Ecology Group  
Waterways Experiment Station  
U.S. Army Corps of Engineers

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of Coastal Fishes and Invertebrates (Mid-Atlantic)

SUMMER AND WINTER FLOUNDER

by

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Vicksburg, MS 39180

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## PREFACE

This species profile is one of a series on coastal aquatic organisms, principally fish, of sport, commercial, or ecological importance. The profiles are designed to provide coastal managers, engineers, and biologists with a brief comprehensive sketch of the biological characteristics and environmental requirements of the species and to describe how populations of the species may be expected to react to environmental changes caused by coastal development. Each profile has sections on taxonomy, life history, ecological role, environmental requirements, and economic importance, if applicable. A three-ring binder is used for this series so that new profiles can be added as they are prepared. This project is jointly planned and financed by the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service.

Suggestions or questions regarding this report should be directed to one of the following addresses.

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U.S. Army Engineer Waterways Experiment Station  
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## CONVERSION TABLE

### Metric to U.S. Customary

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
millimeters (mm)	0.03937	inches
centimeters (cm)	0.3937	inches
meters (m)	3.281	feet
meters (m)	0.5468	fathoms
kilometers (km)	0.6214	statute miles
kilometers (km)	0.5396	nautical miles
square meters (m <sup>2</sup> )	10.76	square feet
square kilometers (km <sup>2</sup> )	0.3861	square miles
hectares (ha)	2.471	acres
liters (l)	0.2642	gallons
cubic meters (m <sup>3</sup> )	35.31	cubic feet
cubic meters (m <sup>3</sup> )	0.0008110	acre-feet
milligrams (mg)	0.00003527	ounces
grams (g)	0.03527	ounces
kilograms (kg)	2.205	pounds
metric tons (t)	2205.0	pounds
metric tons (t)	1.102	short tons
kilocalories (kcal)	3.968	British thermal units
Celsius degrees (°C)	1.8(°C) + 32	Fahrenheit degrees

### U.S. Customary to Metric

inches	25.40	millimeters
inches	2.54	centimeters
feet (ft)	0.3048	meters
fathoms	1.829	meters
statute miles (mi)	1.609	kilometers
nautical miles (nmi)	1.852	kilometers
square feet (ft <sup>2</sup> )	0.0929	square meters
square miles (mi <sup>2</sup> )	2.590	square kilometers
acres	0.4047	hectares
gallons (gal)	3.785	liters
cubic feet (ft <sup>3</sup> )	0.02831	cubic meters
acre-feet	1233.0	cubic meters
ounces (oz)	28350.0	milligrams
ounces (oz)	28.35	grams
pounds (lb)	0.4536	kilograms
pounds (lb)	0.00045	metric tons
short tons (ton)	0.9072	metric tons
British thermal units (Btu)	0.2520	kilocalories
Fahrenheit degrees (°F)	0.5556 (°F - 32)	Celsius degrees

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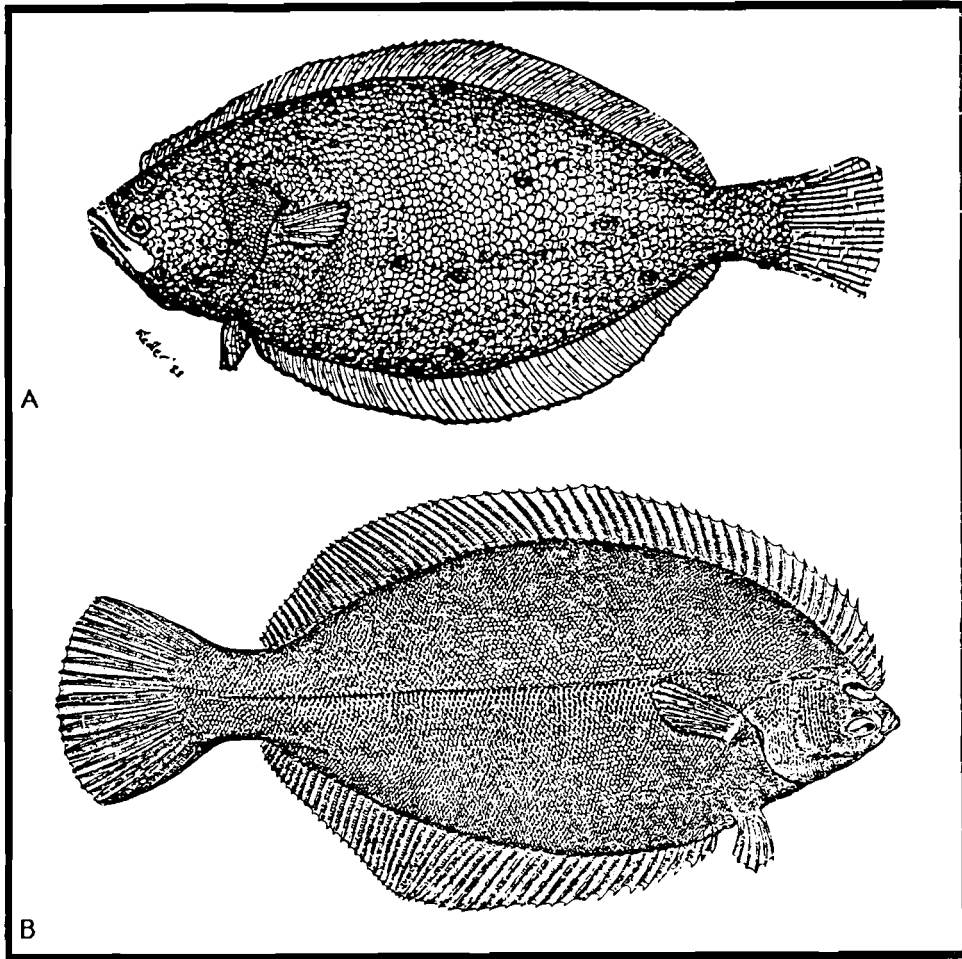


Figure 1. A. Summer flounder (Powell 1974), B. Winter flounder (Martin and Drewry 1978).

SUMMER AND WINTER FLOUNDER

NOMENCLATURE/TAXONOMY/RANGE

Summer Flounder

Scientific name.....Paralichthys dentatus

Preferred common name.....Summer flounder (Figure 1A)

Other common names.....Flounder, fluke, plaice fish, plaice, plaice, splaice, chicken halibut, flounder of New York, common flounder, brail,

turbot, flatfish, longtoothed flounder

Class.....Osteichthyes

Order.....Pleuronectiformes

Family.....Bothidae

Geographic range: The summer flounder prefers estuarine and shelf waters of the Atlantic Ocean. It is found between Nova Scotia and the southeastern coast of Florida but is most abundant from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina (Hildebrand and Schroeder 1928). Distribution in

the mid-Atlantic region is shown in Figure 2.

Winter Flounder

Scientific name.....Pseudopleuronectes americanus

Preferred common name.....Winter flounder (Figure 1B)

Other common names.....Flatfish, blackback, Georges Bank flounder, lemon sole, flounder, sole, rough flounder, plie rouge, carrelet, halibut, holibut, dab.

Class.....Osteichthyes

Order.....Pleuronectiformes

Family.....Pleuronectidae

Geographic range: The winter flounder has a broad range, occurring from Buttle Harbor and Windy Tickle, Labrador, to Beaufort, North Carolina, but is most common in estuaries between the Gulf of St. Lawrence and Chesapeake Bay. Distribution in the Mid-Atlantic Region is shown in Figure 2.

MORPHOLOGY/IDENTIFICATION AIDS

Summer Flounder

The body of the summer flounder is laterally flattened; a margin of the preopercle is free; and the eyes are on the left side. The bases of both pelvic fins are short. The ocular side of the fish ranges from tan to dark brown and has numerous ocellated spots. Five prominent spots are arranged in two triangles with a common apex on the lateral line; however, this configuration is generally lacking in larger specimens. The fish are able to blend into their background by adapting to the texture and color of the substrate on which they live.

**Meristic characteristics:** Dorsal rays, 80-98; anal rays, 63-78; pectoral rays, 10-13; vertebrae 40-43 (Smith and Daiber 1977); gill rakers on lower limb of first arch 14-19. Average head length and average upper

jaw length are contained 3.96 and 2.05 times, respectively, in standard length (SL) (Hildebrand and Schroeder 1928). The scales are ctenoid. Late postlarvae of summer flounder have a well-defined band of black pigment along the anterior two-thirds of the anal fin and a similar band along the anterior four-fifths of the dorsal fin (Figure 3d) which are lacking in the southern flounder (Paralichthys lethostigma) and the gulf flounder (P. albiquitta). Summer flounder postlarvae typically have 40-42 total vertebrae while southern flounder postlarvae have 37 or 38 and gulf flounder postlarvae have 36-38. Summer flounder postlarvae have 81-94 dorsal rays and 61-74 anal rays, while gulf flounder postlarvae have 72-82 dorsal rays and 53-63 anal rays (Deubler 1958).

Winter Flounder

The winter flounder's body is ovate and laterally compressed. The eyes are on the right side, separated by a narrow scaled ridge; the upper eye is near the edge of the head. The mouth is of moderate size and the length of the maxillary on the blind side is less than one-third that of the head. Winter flounder are olive green to reddish-brown in color and sometimes have a few rusty spots. The lateral line is nearly straight. The dorsal fin originates opposite the forward edge of the eye and is of nearly equal height throughout its length.

**Meristic characteristics:** Dorsal rays 56-81; anal rays 47-54; pectoral rays 10-11; gill rakers on lower limb of first arch, 7-8; vertebrae, 36. Average head length is 4.0 cm (Hildebrand and Schroeder 1928; Pierce and Howe 1977). The scales are ctenoid.

REASON FOR INCLUSION IN SERIES

The summer flounder is an important commercial and recreational

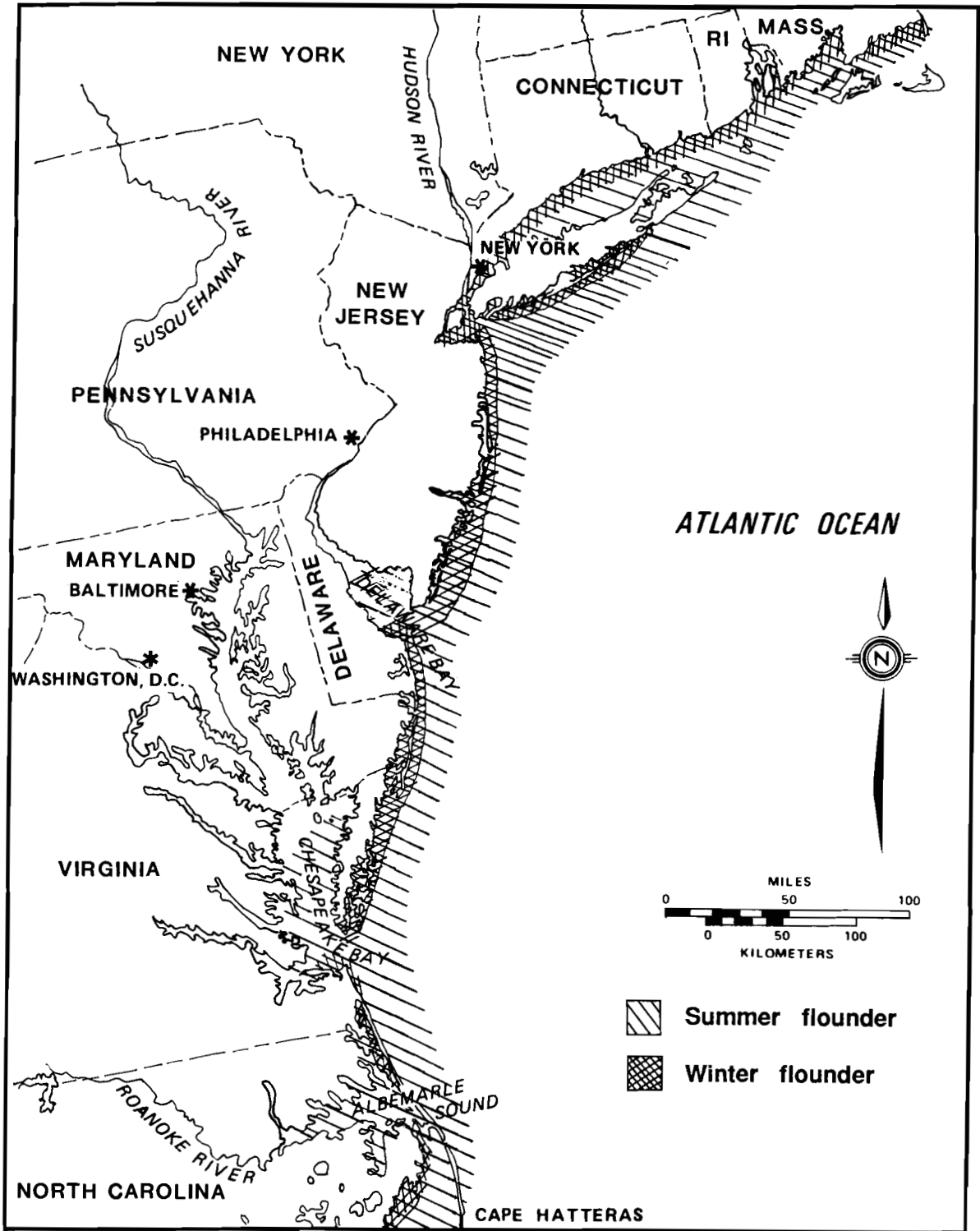


Figure 2. Distribution of the Summer and Winter flounder in the mid-Atlantic region.

species along the Atlantic seaboard of the United States and is the major recreationally caught flounder of the mid-Atlantic inshore waters. There are three major commercial fisheries: the inshore summer fishery; the offshore winter fishery; and a fall and winter trawl fishery inside the 20-fathom (36-m) contour that developed on the Virginia and North Carolina coast in the 1960's (Hildebrand and Schroeder 1928; Scarlett 1981).

## LIFE HISTORY

### Reproductive Physiology/Strategy

Adult female summer flounder, on the average, are 60 mm longer (in total length, TL) than males at first attainment of sexual maturity in the Mid-Atlantic Bight (Morse 1981). The summer flounder appears to become sexually mature by the age of II (Morse 1981). Gonads of summer flounder ripened from mid-August through November in the Delaware Bay; the fish moved offshore to spawn in the winter (Smith and Daiber 1977). Morse (1981) reported that summer flounder have a protracted spawning season of variable duration with early maturation, high fecundity, serial spawning, and extensive migrations across the continental shelf. Life history parameters are determined by local genetic and environmental factors.

The number of maturing ova in summer flounder is highly correlated with weight and length. Fish in the Mid-Atlantic Region between 366 and 680 mm TL have an estimated 0.46 to 4.19 million ova (Morse 1981).

Total egg count of winter flounder ranged from 0.435 million for an age-III fish to 3.329 million eggs for an age-V fish captured off Massachusetts (Topp 1968). The regression equation for the relationship of fecundity to fish

weight for winter flounder was as follows:

$$\ln F = 0.1605 + 1.0659 \ln W \quad (N = 30)$$

where W is weight in grams.

South Atlantic Bight (Smith 1973). Adult summer flounder move back inshore to estuaries or coastal waters in the winter and spring (Wilk et al. 1980).

### Spawning

In the South Atlantic Bight, spawning times and habitats of summer flounder are poorly documented. Based on collections of newly hatched larvae, commercial catch rates, and generalized coastal and shelf trawling surveys, seasonal migration patterns of adult fish have been deduced. It is known that summer flounder migrate offshore during cooler months. In late fall, winter, or early spring they spawn near the bottom of shelf waters 30-200 m deep. The genetically distinct populations north and south of Cape Hatteras may behave differently.

Between Cape Cod, Massachusetts, and Cape Lookout, North Carolina, spawning of summer flounder began in September (Smith 1973). In the survey by Smith (1973), spawning continued through December in the northern part, and through February to the south. Spawning in the Mid-Atlantic Region continues into February and March in some years and probably begins north of Chesapeake Bay and progresses southward in a cycle that ends in the South Atlantic Bight (Smith 1973). Adult summer flounder move back inshore to estuaries or coastal waters in the winter and spring (Wilk et al. 1980).

Spawning times of the winter flounder are variable, like those of the summer flounder; spawning occurs first in the southern part of the

range and progressively later towards the north in keeping with water temperatures. Spawning occurs inshore from November through June from Newfoundland to Delaware. Male winter flounder in northern (Canadian) waters showed spermatogenesis and gonad development 6 months before the spawning season (which was in May to June). Oocytes may take three years to mature. Nonreproductive individuals occur in the spawning season, but condition factors are less in these fish. They may be conserving resources to spawn after a later feeding season with abundant food where their condition factor is higher (Burton and Idler 1984).

Saila (1961) showed with tagging studies that winter flounder returned to the tagging locality with high frequency over one year of recovery data. Fish dispersed from the breeding grounds in summer and returned in winter. The same breeding area was not always successfully located (Saila 1961).

Winter flounder spawn in shallow inshore waters (Jeffries and Johnson 1974). Spawning occurs at night (Breder 1922). In observations by Breder (1922) in the laboratory, spawning is preceded by extensive swimming in spirals. The females extrude eggs in wide counterclockwise spirals due to the centrifugal force (Breder 1922).

### Eggs

Eggs of the summer flounder are pelagic. Incubation time in the laboratory was 9 days at 5 °C and 2-3 days at 21 °C. Mean diameter of mature unfertilized eggs is 0.98 mm. Yolk occupies about 95% of the egg volume (Johns et al. 1981).

Winter flounder eggs are minute, demersal, and adhesive, sinking to the bottom (Breder 1924). The adhesive eggs averaged 0.81 mm (Breder 1924) or 0.61 mm (Topp 1968) in modal diameter.

They clump together after fertilization, thus often becoming distorted and ovoid in shape (Breder 1924).

### Larvae

Notochord length of summer flounder was about 3.0 mm at hatching in the laboratory and was about 3.6 mm when yolk-sac absorption was complete (Johns et al. 1981). Growth until the absorption of the yolk sac is complete is not temperature dependent. Larvae that hatch at both 11 °C and 21 °C grow to about 3.6 mm notochord length within 6 days after hatching (Johns et al. 1981). No data on larval feeding habits is available.

Larvae of summer flounder are transported to estuarine nursery areas by currents. Greater densities of young fish were found in or near inlets, and greater numbers were captured during periods of the full moon (Williams and Deubler 1968).

In larval winter flounder (7 mm TL), the digestive tract is completely developed; the eyes are pigmented; and the mouth is fully functional (Sullivan 1914).

Sullivan (1914), who described the winter flounder larva from hatching to the end of the second month in the laboratory, divided its larval history into four stages which he selected to show diagnostic characteristics for identification.

Stage I - A group of dark pigment spots on the posterior half of the body is the most important character for identification. The notochord is present as a straight tube. Yolk absorption is gradual and varies with temperature.

Stage II - Yolk absorbed, age 12 days, length 5 mm.





























