some type of water chamber (McMahon and Rigler 1963). For many studies, these methods are undesirable because of the confinement of the animal to a small volume of medium or because of the solid boundaries nearby, both of which affect the flow of water and possibly the movement of limbs or other behavior by the animal (Lowndes 1935). Whenever the animal must be placed within a relatively large volume of water, other methods must be used. In a study of mate-seeking behavior, Katona (1973) tethered female copepods by means of fine stainless steel wires looped about their bodies. While this method allows the subsequent release of the animals unharmed, the restraining wire can interfere with limb movements.

I have found a relatively simple method for restraining small crustaceans in large volumes of water for extended periods of microscopic examination. A short segment (1-2 cm) of nylon monofilament fishing line of small diameter relative to the organism is mounted in a dissecting needle holder or pin vise. The free tip of the monofilament is then cut off square with a razor blade. The animal is placed dorsal side up in a small drop of water on a microscope slide or watch glass. The tip of the monofilament is dipped in a fresh droplet of "instant" drying polymer glue (such as Dixon Duradix)[2] and quickly applied and held to the center line of the dorsal surface of the animal for about 5 s. The organism can then be lifted from the slide and placed in the test vessel, with the dissecting needle holder mounted in a micromanipulator or other type of clamping device. The rapid filming over of the glue and its tendency to spread when placed on the wet animal sometimes makes a neat attachment difficult and several attempts may be needed before a satisfactory mount is achieved.

Organisms restrained in this way appear to carry out swimming movements in a natural manner and live for several days on the mount. Removal of the animal from the monofilament usually results in its death. To make limb movements easier to observe, organisms can be vitally stained with neutral red prior to mounting (Dressel et al. 1972).

I have since found a description of this mounting technique given by Scourfield (1900) in which he regrets that no satisfactory cement could be found. The polymer glues appear to solve the problem.

[2]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

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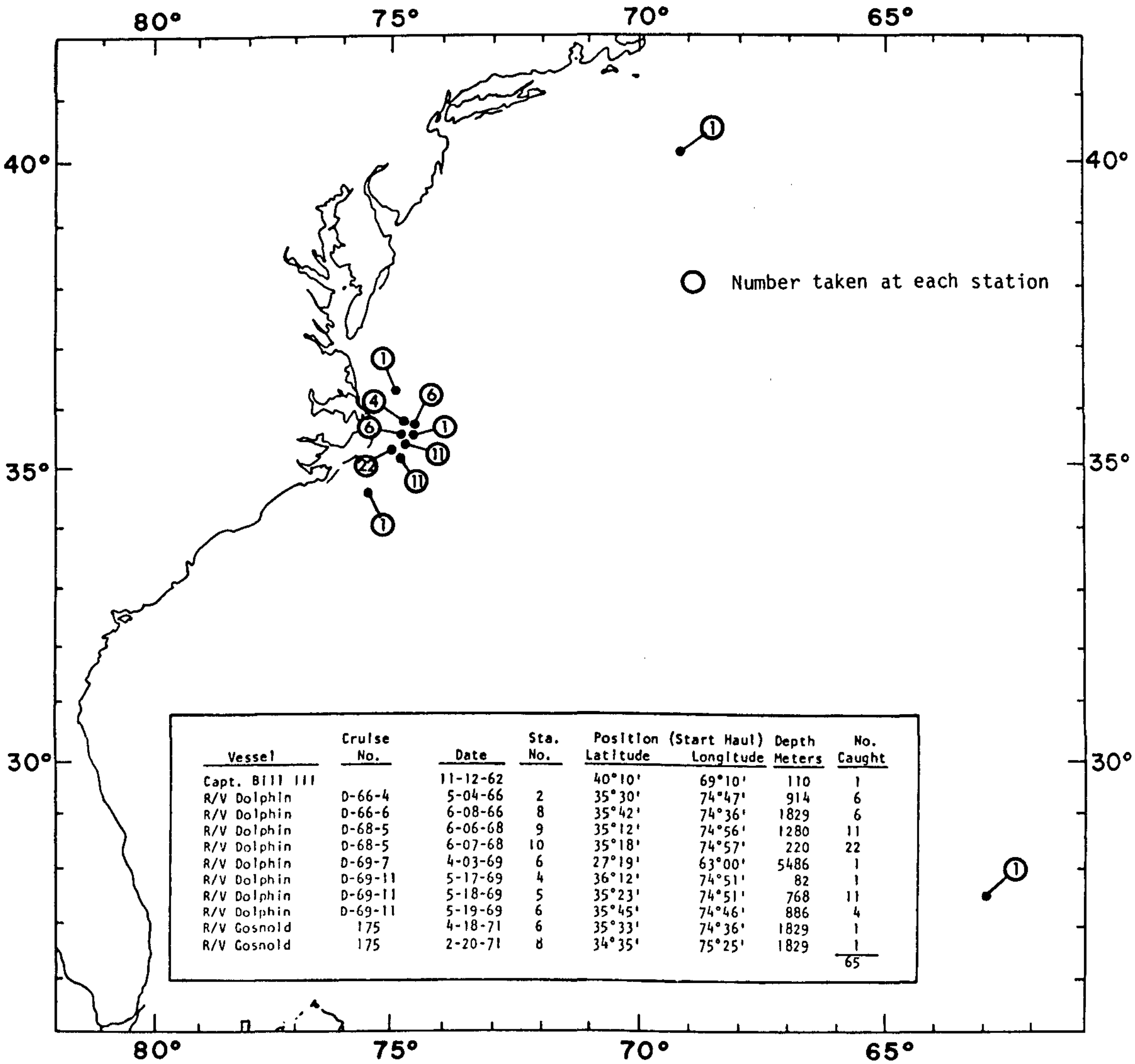
OBSERVATIONS ON THE BIGEYE THRESHER SHARK, *ALOPIAS SUPERCILIOSUS*, IN THE WESTERN NORTH ATLANTIC

Thresher sharks of the genus *Alopias* are distributed throughout the tropical and warm temperate zones of the world's oceans. Of the two species reported from the western North Atlantic, the thresher shark, *A. vulpinus*, is commonly found in coastal waters of the middle Atlantic states (Bigelow and Schroeder 1948). The second member of the genus, the bigeye thresher, *A. superciliosus*, is a little known offshore resident of the continental slope and open sea.

Lowe first described the bigeye thresher in 1840 from a specimen taken off the island of Madeira (Bigelow and Schroeder 1948). The species was not reported again until 1941 when Springer (1943) documented the occurrence of a gravid female taken near Salerno, Fla. Records of other bigeye threshers from the Atlantic include a gravid female, two embryos, a juvenile male, and an 18-foot specimen all taken from the north coast of Cuba in the late 1940's (Bigelow and Schroeder 1948); an adult female from Nassau in 1962 and an adult male from Cape Hatteras, N.C., in 1963 (Fitch and Craig 1964). Bigelow and Schroeder (1948) reported proportional measurements from two individuals taken off Cuba; Strasburg (1958) and Fitch and Craig (1964) reported similar data from two Pacific specimens.

We report observations of *A. superciliosus* taken on pelagic longlines aboard the commercial fishing vessel *Cap'n Bill III*, in 1962, the RV *Dolphin* of the Sandy Hook Laboratory in 1966-69, and the RV *Gosnold* of the Woods Hole Oceanographic Institution in 1971. All previous evidence suggests *A. superciliosus* is not abundant anywhere in its range. However, our data, together with anecdotal information from experienced commercial longliners, show that concentrations of bigeye threshers occur during April-June off Cape Hatteras. Other sharks and teleosts occurring in the area with *A. superciliosus* included blue shark, *Prionace glauca*; short fin mako shark, *Isurus oxyrinchus*; scalloped hammerhead, *Sphyrna lewini*; bignose shark, *Carcharhinus altimus*; night shark, *Hypoprion signatus*; dusky shark, *C. obscurus*; and silky shark, *C. falciformis*, along with swordfish, *Xiphias gladius*; and yellowfin tuna, *Thunnus albacares*. Additional



Vessel	Cruise No.	Date	Sta. No.	Position (Start Haul) Latitude	Position (Start Haul) Longitude	Depth Meters	No. Caught
Capt. Bill III		11-12-62		40°10'	69°10'	110	1
R/V Dolphin	D-66-4	5-04-66	2	35°30'	74°47'	914	6
R/V Dolphin	D-66-6	6-08-66	8	35°42'	74°36'	1829	6
R/V Dolphin	D-68-5	6-06-68	9	35°12'	74°56'	1280	11
R/V Dolphin	D-68-5	6-07-68	10	35°18'	74°57'	220	22
R/V Dolphin	D-69-7	4-03-69	6	27°19'	63°00'	5486	1
R/V Dolphin	D-69-11	5-17-69	4	36°12'	74°51'	82	1
R/V Dolphin	D-69-11	5-18-69	5	35°23'	74°51'	768	11
R/V Dolphin	D-69-11	5-19-69	6	35°45'	74°46'	886	4
R/V Gosnold	175	4-18-71	6	35°33'	74°36'	1829	1
R/V Gosnold	175	2-20-71	8	34°35'	75°25'	1829	1
							65

FIGURE 1.—Location of *Alopias superciliosus* longline catches in the western North Atlantic.

species taken occasionally, included sandbar shark, *C. milberti*; oceanic white tip, *C. longimanus*; and porbeagle, *Lamna nasus*; bluefin tuna, *Thunnus thynnus*; white marlin, *Tetrapturus albidus*; sailfish, *Istiophorus platypterus*; dolphin, *Coryphaena hippurus*; and lancetfish, *Alepisaurus* sp.

All longline sets resulting in catches of bigeye threshers were made between 0000 and 0300 with gear retrieval beginning after 0700. The depth at which the gear was fished ranged from near surface to a maximum of 65 m and was controlled by float lines of varying length. Temperature-depth profiles obtained from bathythermograph casts were routinely used to determine the optimum depth for the gear. The best catches of bigeye threshers were made in areas where the water regime ranged from 16° to 25°C at the surface to a minimum of 14°C at 75 m.

A total of 65 *A. superciliosus* were hooked at 11 longline stations (Figure 1); of these, 7 broke free as they were being held alongside the vessel, 23 were tagged and released, and 35 (15 females and 20 males) were brought aboard for examination. Length measurements and internal examination of stomachs and reproductive organs were made on all sharks brought aboard. Total lengths (TL) for the 15 females ranged from 233 to 399 cm ($\bar{x}$ = 312 cm); the 20 males ranged from 155 to 352 cm ($\bar{x}$ = 307 cm).

Morphometric measurements from eight males and four females, summarized in Table 1 as percents of fork length, were collected following the methods of Bigelow and Schroeder (1948). Fork length (FL) measurements were used as a primary growth parameter in the morphometric relationships in order to discern more accurately any changes occurring in body proportions with increasing size. The same accuracy could not be expected if total lengths were used because of the difficulty in obtaining precise length measurements due to the extreme size and shape of the caudal fin.

Proportional data from Table 1 shows that allometric growth is reflected in several characters. The most obvious change associated with increasing fork length is a proportionately shorter head length resulting in a decrease in the ratios of snout to: eye, nostrils, mouth, first gill, and pectoral fin. The relative size of the eye and mouth also decrease as the body lengthens. Characters that increase allometrically with growth include height of first dorsal, length of claspers in males, and interspaces between fins except in females

TABLE 1. — Proportional dimensions of body parts in percent of fork length for 12 *Alopias superciliosus*.

Body part	Male 1	2	3	4	5	6	7	8	Female 1	2	3	4
Total length (cm)	155.0	307.0	315.0	331.0	332.0	342.4	351.7	339.0	257.5	340.0	355.0	399.0
Fork length (cm)	100.0	188.0	192.5	197.0	197.0	207.0	212.5	217.0	167.0	207.0	210.0	221.0
% of total length	64.5	61.2	61.1	59.5	59.3	60.4	60.4	64.0	64.9	60.8	59.1	55.3
Distance from snout to:												
eyes	9.0	6.4	7.4	6.3	6.3	7.5	6.7	7.4	6.7	6.8	6.2	7.2
nostrils	6.5	5.3	6.0	5.6	5.2	6.0	6.0	5.5	5.7	5.5	5.0	5.2
mouth	9.5	7.8	8.2	7.9	7.7	7.9	7.8	8.3	8.0	7.5	7.4	7.9
first gill (base)	25.5	21.2	23.6	23.4	20.6	22.7	22.3	22.6	22.4	22.9	22.1	21.7
pectoral	29.0	24.1	28.2	27.2	24.4	26.1	25.7	24.0	25.6	26.3	24.3	25.8
first dorsal	57.0	55.4	52.5	51.8	55.1	55.5	53.2	53.0	51.2	52.2	51.0	52.3
second dorsal	82.0	82.2	79.2	80.5	81.7	82.1	80.5	80.2	79.9	82.6	79.5	80.5
pelvic	66.0	65.2	66.2	66.0	64.5	66.9	65.2	64.1	65.3	64.4	64.3	66.0
anal	87.0	88.0	87.6	87.3	86.3	87.9	87.8	85.7	83.5	85.0	83.3	86.0
upper caudal pit	90.5	90.8	89.7	89.3	90.4	90.6	89.7		88.8	91.8	90.0	90.5
Interspace between:												
1st & 2nd dorsal	16.8	17.8	16.4	17.0	19.8	16.6	17.2	18.0	18.9	18.4	17.9	18.1
2nd dorsal & caudal	7.2	7.8	8.6	8.8	8.8	8.1	8.3	9.2	7.7	7.9	8.2	
pelvic & anal	9.5	12.2	13.0	12.9	11.3	11.8	13.2	12.9	7.2	8.2	7.4	8.1
anal & caudal	3.2	3.6	3.4	4.3	4.6	3.6	3.3	3.2	6.0	4.8	4.3	5.0
nostrils (proximal)	4.5	2.5	2.7	2.7	2.5	2.9	2.6	2.8	2.4	2.7	2.4	2.5
Height of:												
first dorsal	10.0	11.5	13.0	11.5	11.9	11.7	11.6	12.4	11.8	13.5	12.8	14.0
free tip	1.5	1.6	1.7	2.0	2.0	1.9	1.8		1.8	1.8	1.9	1.3
second dorsal	.8	.9	.8	.8	.8	.8	.8	.7	1.1	1.3	1.0	1.8
free tip	.2	2.1	2.9	2.5	2.5	2.4	2.6	2.8	2.7	3.4	2.5	4.3
Diameter of eye[1]												
horizontal	3.5	2.5	2.6	2.4	2.4	2.9	2.5	3.5	2.8	2.8	2.8	3.2
vertical		4.0	4.2	4.2	4.2	4.5	4.4		4.4	3.8	3.8	
Right clasper	3.0	12.4	13.0	12.9	11.9	12.4	10.8	12.0				
Left clasper	3.1	12.4	11.4	12.9	11.7	12.1	11.6	12.0				
Width of mouth	9.0	6.2	7.3	7.0	7.0	7.7	7.7	8.3	7.6	7.5		8.1
Height of mouth	5.0	4.5	4.7	4.8	4.4	4.3	5.0		3.6	4.7	4.3	4.5
Max length pectoral fin	32.3	31.2	33.6	32.0	32.1	31.6	31.8	31.8	32.3	35.5	32.4	33.5

[1]Orbit.

where the distance between anal and caudal fin decreases.

The length-weight relationship for this species (Figure 2) was derived using data from 5 females and 11 males. To determine the regression line, the equation, $\log Y = 11.1204 + 2.99269 \log X$ was calculated using the nonlinear least squares method of Pienaar and Thomson (1969).

Clark and von Schmidt (1965) noted that adult and juvenile males of several species of sharks can be distinguished by the differences in the relative size and rigidity of the claspers. This characteristic applies to *A. superciliosus*. Of the males examined, the claspers of all but five individuals were large (10.8-13.0% of their FL), heavily calcified, and quite obviously mature. Internal examinations of the larger males revealed the presence of sperm in the epididymis and spermatophores in the lower ductus deferens. The smallest male positively identified as mature was 307 cm TL. A smaller individual however of 289 cm TL had testes in a relatively advanced state of development. Female *A. superciliosus* apparently mature at a larger size than males. Of the 13 females examined (233-355 cm TL) only the largest was mature. Ovaries of immature individuals were 10-13 cm long and 3-5 cm wide and contained thousands of white opaque follicles from less than 1 to 5 mm diameter. The oviducts were firm, ribbonlike tubes 0.5 to 2.5 cm in diameter. The 355-cm female differed in that the ovary was 30 cm long and 10 cm wide and contained yellow ova up to 10 mm in diameter. Also the oviducts in this individual were considerably larger (10 cm in diameter) and more flaccid and similar in appearance to the post gravid condition of other species we have seen. We suggest *A. superciliosus* males may mature at 290-300 cm TL, but females are not mature until they reach 350 cm.

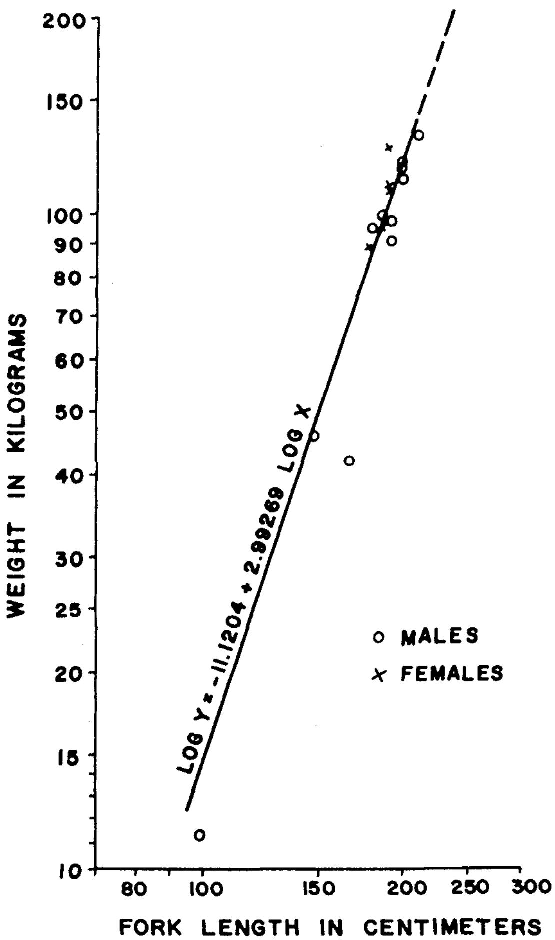


FIGURE 2.—Length-weight relationship for *Alopias superciliosus*.

Examination of the stomachs showed 17 (48.5%) were empty. Of the 18 that contained food the most common items were squid (66%) and scombrid remains (27%). One stomach contained remains of 5 lancetfish; another, 30 small (5-10 cm) herringlike fishes; and a third had parts of a small billfish, tentatively identified as an istiophorid. The occurrence of two or more whole longline baits in stomachs was not uncommon and suggests they had been dislodged from hooks elsewhere on the line. *Alopias superciliosus* may utilize its tail to herd or stun its prey in the manner described for *A. vulpinus* (Bigelow and Schroeder 1948; Strasburg 1958). Several individuals including some of those lost at the rail were foul hooked in the tail.

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EPIZOITES ASSOCIATED WITH *BATHYNECTES SUPERBUS* (DECAPODA: PORTUNIDAE)[1,2]

The only known documentation of epizoites occurring on *Bathynectes superbus* (Costa 1853) is that of Capart (1951), who noted a stalked barnacle, *Scalpellum* sp., on specimens from the South Atlantic coast of Africa. This note describes epizoites present on *B. superbus* from the western North Atlantic Ocean.

Crabs were obtained from several cruises along the eastern coast of North America (lat. 36°33′N-39°38′N to long. 73°00′W-74°43′W): RV *Columbus Iselin* (cruise 73-10) from 252 to 335 m; RV *Dan Moore* (73-030) from 122 to 232 m; RV *Albatross IV* (74-4) from 236 to 300 m; and RV *Eastward* (E-2-74) from 280 to 350 m. Gills, branchial chambers, and external surfaces of 172 crabs were examined. Crabs often supported more than one epizoite.

Crabs were most heavily fouled (65%) with a "*Perigonimus*"-like hydroid. Quotations are present around the name "*Perigonimus*" because the genus is not valid and is a representative of a poorly known group, the systematics of which need revision (D. R. Calder, pers. commun.). The "*Perigonimus*"-like hydroid was most frequently found associated with setae along the ventral anterolateral border and on the ecdysial suture line. *Trilasmis (Poecilasma) kaempferi inaequilaterale* Pilsbry (Cirripedia: Scalpellidae) was found on 13% of the *B. superbus* examined. It was present on all exposed regions of the carapace, pereopods, and abdomen. An eastern Atlantic specimen in the U.S. National Museum collections (*Geronimo*-2-203) had approximately 100 *T. k. inaequilaterale* on the dorsal carapace, pereopods, eyes, and mouthparts. *Anomia aculeata* (Pelecypoda) was relatively abundant (14%) and frequently occurred in indentations of the dorsal carapace and on the carinae of pereopods. Other organisms on the carapace were calcareous tubes of an unidentified polychaete (<1%) and *Stegopoma plicatile*, a thecate hydroid (<1%). The latter were found along the ventral anterolateral surface of the carapace. No organisms were found within the branchial chamber.

Figure 1 shows the occurrence of epizoites on *B. superbus* according to sex, size group, and molt stage. Size groups of short carapace width (≤35 mm, 36-45 mm, 46-57 mm, ≥58 mm) are based on arbitrarily chosen modes from a size-frequency distribution (Lewis 1975).

Crabs were assigned to molt stages described by Drach and Tchernigovtzeff (1967): anecdysis (C_1-C_4), proecdysis (D_1-D_4), postecdysis (A_1-B_2).

There is apparently no preference of epizoites for male or female crabs, but there is an association with molt stage and size. As expected, crabs in anecdysis are more heavily fouled than those which have recently molted (A_1-B_2). Larger crabs (>46 mm) supported a variety of epizoites while those ≤35 mm were colonized by *Perigonimus* only. This may be attributable to the greater surface available for epizoite set on larger crabs and the lower frequency of molt for these crabs.

The epizoites are inhabitants of the shelf-edge upper slope habitat within the bathymetric range of *Bathynectes*. *Trilasmis (Poecilasma)* has a known range along the western Atlantic from Martha's Vineyard, Mass. to Key West, Fla., having been recorded at depths from 21.6 to 1,733 m, chiefly on the carapace of the brachyurans *Geryon*

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