YOUNG OF THE ATLANTIC SAILFISH, *ISTIOPHORUS PLATYPTERUS*[1]

BY JACK W. GEHRINGER, *FISHERY BIOLOGIST*
BUREAU OF COMMERCIAL FISHERIES BIOLOGICAL LABORATORY
BRUNSWICK, GA. 31520

ABSTRACT

One hundred fifty-four Atlantic sailfish, 26.1 to 216 mm. in standard length, were dip netted on cruises of the Bureau of Commercial Fisheries charter vessel *Silver Bay* off the south Atlantic Coast of the United States in 1960 and 1962. This group of specimens (larger than any previously available collection of sailfish of similar size) was examined to determine changes during development. Thirty-four eastern Atlantic specimens 13.8 to 238 mm. in standard length that were dip netted in 1968 on a cruise of the Bureau's vessel *Undaunted* in the Gulf of Guinea were compared with the specimens from the western Atlantic.

Five western Atlantic specimens are illustrated. Loss of larval characteristics and development of fins and fin rays and pigmentation are discussed. Correlations of numbers of fin rays and statistics describing relationships of measurements of selected body parts for western Atlantic specimens are presented. Principal differences between eastern and western Atlantic specimens are the slightly longer pectoral fin, snout, and head in eastern Atlantic specimens.

Collections of the young stages of Istiophoridae that include a sufficient number of larvae and juveniles for detailed studies of developmental stages are rare. The literature on young Atlantic sailfish, *Istiophorus platypterus* (Shaw and Nodder),[2] is primarily on small larvae and has information on only 21 specimens longer than 25 mm. SL (standard length)—(Voss, 1953, 4 specimens 29.5–208 mm.; Gehringer, 1957, 16 specimens 27.4–101 mm.; and de Sylva, 1963, 1 specimen, 167 mm.).

This paper is based primarily on a collection of 154 sailfish from the western Atlantic Ocean, 26.1 to 216 mm. SL. They were collected at dip net and nightlight stations on cruises of the BCF (Bureau of Commercial Fisheries) charter vessel *Silver Bay* off the southeastern coast of the United States in June and July 1960 and September and October 1962. Subsequent to my examination of the western Atlantic specimens and preparation of a draft of a manuscript describing them, I examined 34 specimens, 13.8 to 238 mm. SL (all but 1 over 25 mm. SL), collected by dip net at nightlight stations on a cruise of the BCF vessel *Undaunted* in the Gulf of Guinea, off the west coast of Africa, in April 1968.

For western Atlantic specimens I include detailed line drawings of a developmental series, statistics showing the relationships of measurements of selected body parts, and discussions of dorsal and anal fin rays and changes during their development. I compare eastern and western Atlantic specimens of similar size and include in my discussion of western Atlantic material those variations I found in eastern Atlantic material.

METHODS AND DATA

MEASUREMENTS

Measurements were made with dial calipers calibrated in 0.1-mm. units and are recorded to the nearest 0.1 mm. if less than 100 mm. or to the nearest millimeter if 100 mm. or greater.

DEFINITIONS OF TERMS

I consider all specimens in this study to be juveniles, by definition of the juvenile stage as sexually immature specimens whose numbers of fin rays are within the ranges for the adult.

Measurements

Standard length, head length, snout length, pectoral and pelvic fin lengths, eye diameter, and

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[2] In using the name *Istiophorus platypterus* (Shaw and Nodder), I follow Morrow and Harbo (1969).

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pterotic and main preopercular spine lengths are as defined by Gehringer (1957). Trunk length is the distance between the posteriormost margin of the orbit and anterior point of emergence of the upper keel on the caudal peduncle on specimens 85 mm. SL or longer (de Sylva, 1957). On specimens smaller than about 85 mm. SL, which lack keels, the posterior point for this measurement is the insertion of the leading edge of the finfold of the dorsal lobe of the caudal fin. This point is directly above the anterior edge of the caudal keel on larger specimens. Body length is the distance between the tip of the mandible and the tips of the midcaudal fin rays (Rivas, 1956). Body depth is a vertical measurement at the insertion of the first pelvic fin ray. Pelvic fin to anal fin is the distance between the insertion of the first pelvic fin ray and the insertion of the first anal fin ray.

Fin Rays

The dorsal and anal fins are single fins in the larval and juvenile stages, but in the adult the terminal six or seven rays of both fins are separated from anterior portions of these fins to form second dorsal and anal fins. The fins are not divided in the largest specimens in this study, 216 to 238 mm. SL, although the anal fin is nearly divided. Even on my smallest western Atlantic specimen (26.1 mm. SL), the shape and size of the terminal six or seven rays distinguish them from the few, less robust, more widely spaced rays immediately ahead of them (which are overgrown with tissue in the adult). I recorded ray counts separately for the anterior and posterior portions of both dorsal and anal fins. The terminal ray in the dorsal and anal fins though divided to its base, is recorded as one ray.

STUDY MATERIAL

Western Atlantic specimens are from *Silver Bay* cruises, all taken by dip net at the surface, under a nightlight: Sta. 2139: 29°55′ N., 80°38′ W. (about 35 nautical miles E. of St. Augustine, Fla.); 2045–2245 hours, June 12, 1960; 33 m., surface temperature 25.6° C.; 3 specimens, 81.9 to 155 mm. SL. Sta. 2172: 35°00′ N., 75°19′ W. (about 20 nautical miles SE. of Cape Hatteras, N.C.); 2200–0250 hours, July 18–19, 1960; 146 to 366 m., surface temperature 27.3° C.; 10 specimens, 67.1 to 216 mm. SL. Sta. 2201: 34°34′ N., 75°40′ W. (about 50 nautical miles E. of Cape Lookout, N.C.); 0030–0400 hours, July 24, 1960; 146 to 165 m., surface temperature 28.9° C.; 135 specimens, 26.1 to 167 mm. SL. Sta. 2268: 32°36′ N., 78°30′ W. (about 70 nautical miles E. of Charleston, S.C.); 0115–0300 hours, July 29, 1960; 190 to 198 m., surface temperature 28.9° C.; 4 specimens, 37.1 to 91.1 mm. SL. Sta. 4326: 28°32′ N., 80°03′ W. (about 25 nautical miles E. of Cape Kennedy, Fla.); 2310–0115 hours, September 3–4, 1962; 70 m., surface temperature 27.8° C.; 1 specimen, 137 mm. SL. Sta. 4403: 28°56′ N., 80°25′ W. (about 30 nautical miles N. of Cape Kennedy, Fla.); 2345–0145 hours, October 4–5, 1962; 24 m., surface temperature 28.9° C.; 1 specimen, 169 mm. SL.

Eastern Atlantic specimens are from *Undaunted* Cruise 6801, all taken by dip net at the surface, under a nightlight: Sta. 126: 00°11′ S., 08°39′ E.; 2000–2400 hours, April 16, 1968; 1,080 m., surface temperature 28.8° C.; 1 specimen, 104 mm. SL. Sta. 132: 00°38′ N., 07°21′ E.; 1900–2400 hours, April 17, 1968; 2,664 m., surface temperature 29.6° C.; 3 specimens, 29.9 to 49.8 mm. SL. Sta. 138: 01°20′ N., 07°55′ E.; 2030–0230 hours, April 19–20, 1968; 2,400 m., surface temperature 28.6° C.; 13 specimens, 13.8 to 147 mm. SL. Sta. 152: 02°25′ N., 06°29′ E.; 2200–0200 hours, April 23–24, 1968; 1,520 m., surface temperature 28.9° C.; 1 specimen, 47.9 mm. SL. Sta. 158: 04°52′ N., 05°34′ E.; 0000–0215 hours, April 25, 1968; 240 m., surface temperature 28.8° C.; 16 specimens, 29.5 to 238 mm. SL.

All study material is cataloged in the fish collections of BCF Tropical Atlantic Biological Laboratory, Miami, Fla.

DEVELOPMENT AND GROWTH

My discussion of changes during development and growth concerns loss of larval characteristics, pigmentations, fin rays, and relations of measurements of various body parts.

LOSS OF LARVAL CHARACTERISTICS

Within the size range represented here, head spines are lost, scales undergo changes, caudal keels develop, and changes occur in the dorsal, anal, and pelvic fins.

Head Spines

In an earlier paper on the Atlantic sailfish (Gehringer, 1957), I reported pterotic and preopercular spines on a 101-mm. SL specimen. Voss

(1953) stated that these spines were not present on a 208-mm. SL specimen. In the present large series of western and eastern Atlantic sailfish, pterotic spines are present only as traces on some fish as short as 100 mm. SL, are present on all fish up to 150 mm. SL, and are absent on specimens longer than 150 mm. SL. Preopercular spines are present on all specimens but the largest, 216 to 238 mm. SL—they are probably lost at about this size.

Scales

Scale spines are first discernible on the dorsolateral surface of the body on sailfish about 30 mm. SL. Specimens about 50 mm. SL have spines on the cheeks and most of the body, except for the area on the side covered by the depressed pectoral fin and on the back along the anterior portion of the dorsal fin. Scales on the largest specimens, 216 to 238 mm. SL, are cycloid and differ from the illustration and description of scales on a 101-mm. fish (Gehringer, 1957) as follows: shape more elliptical than round, spine relatively shorter and weaker, and concentric ridges greater in number. On all specimens longer than 30 mm. SL the spine tips protrude through the skin and give a feeling of roughness.

Development of Caudal Keels

Two keels on each side, extending from the base of the caudal fin onto the caudal peduncle, develop at about 84 to 92 mm. SL. The smallest sailfish with keels is 83.8 mm. SL, and the largest without keels is 91.4 mm. SL. The upper keel apparently develops first as it is the only one present on the few fish 85 to 90 mm. SL with but one keel.

Development of Dorsal and Anal Fins

As discussed under definitions of terms, the last six or seven rays of both dorsal and anal fins form distinct second fins in the adult. The dorsal and the anal fins on all specimens in the present series are single and continuous. On larger specimens the few anal rays immediately forward of the terminal six or seven rays are small and weak; these rays are weak and overgrown with skin in the adult. Dorsal rays in this relative position are not so weak, but are less robust than those immediately ahead or behind which do not become overgrown with skin. On most specimens over 80 mm. SL, the distal portion of the anal ray immediately ahead of the terminal six or seven rays is depressed, overgrown with tissue, and nearly adnate to the base of the succeeding ray.

Pelvic Fin

The first and second rays of the pelvic fin, which in the adult are fused into one robust bony ray, are nearly fused on the largest specimens, 216 to 238 mm. SL—the first ray appears as a short, triangular-shaped segment of the leading edge of the second ray. The third ray is separate and distinct at all sizes.

PIGMENTATION

Pigmentation of Atlantic sailfish larvae, juveniles, and adults has been described by several authors, including Voss (1953), Gehringer (1957), Robins and de Sylva (1963), and de Sylva (1963). My comments here on pigmentation of fins and body bars supplement these accounts for specimens 26 to 238 mm. SL and apply to both eastern and western Atlantic specimens.

Fins

The pectoral fins are clear except for a few melanophores at the bases of the first few rays on the largest specimens.

The pelvic fins are lemon-yellow with a few melanophores on the membrane between the second and third rays on sailfish over 155 mm. SL.

Pigment on the anterior portion of the dorsal fin is uniformly dusky to dark except for two to several large, dark spots scattered in a nonuniform pattern over the fin (figs. 1–5). On some fish the first few dorsal rays are less densely pigmented than the rest of the fin. Pigment extends posteriorly on the fin to the 34th to 40th ray—the last few rays of the anterior portion have no pigment. The posterior portion (terminal six or seven rays) of the fin is clear except for pigment on the bases of the fin rays and fin membrane on specimens longer than about 135 mm. SL.

The anal fin is clear on all specimens.

The smallest sailfish with pigment on the caudal fin is 44.2 mm. SL; the largest without pigment on the caudal fin is 51.7 mm. SL. A group of a few melanophores is present on the lower lobe of the caudal fin of a series of fish 44.2 to 60.0 mm. SL, and a similar group of melanophores is also on the upper lobe of a series of specimens 50.0 to 64.0 mm. SL. The melanophores are coalesced into blotches on several fish 53.2 to 67.0 mm. SL, and, though

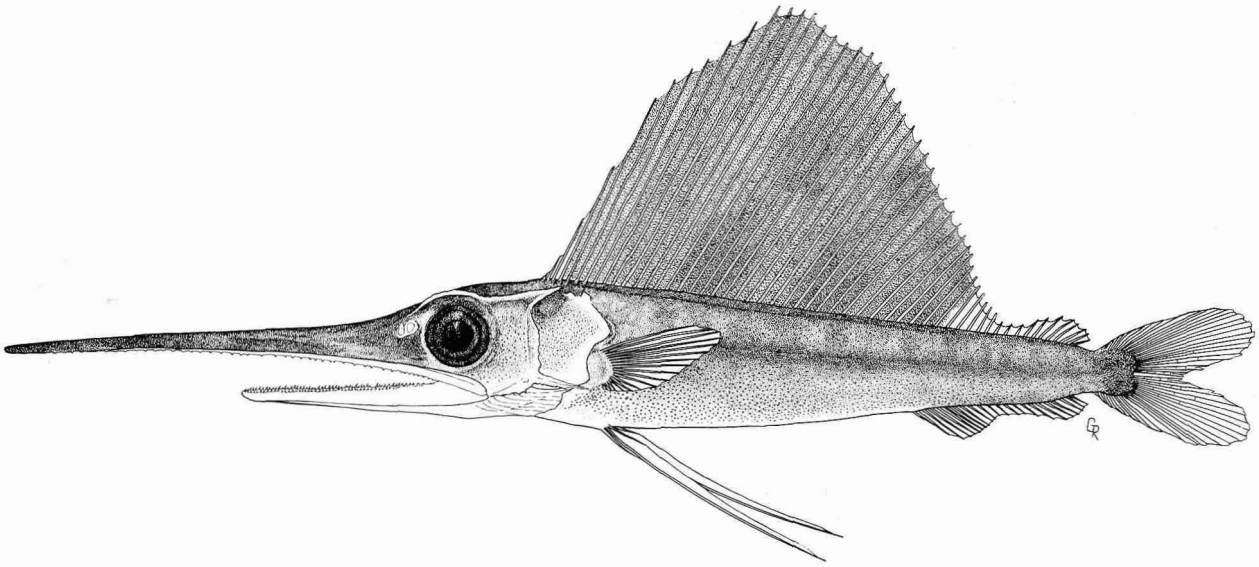

FIGURE 1.—Juvenile sailfish, 37.1 mm. standard length, *Silver Bay* Sta. 2268.

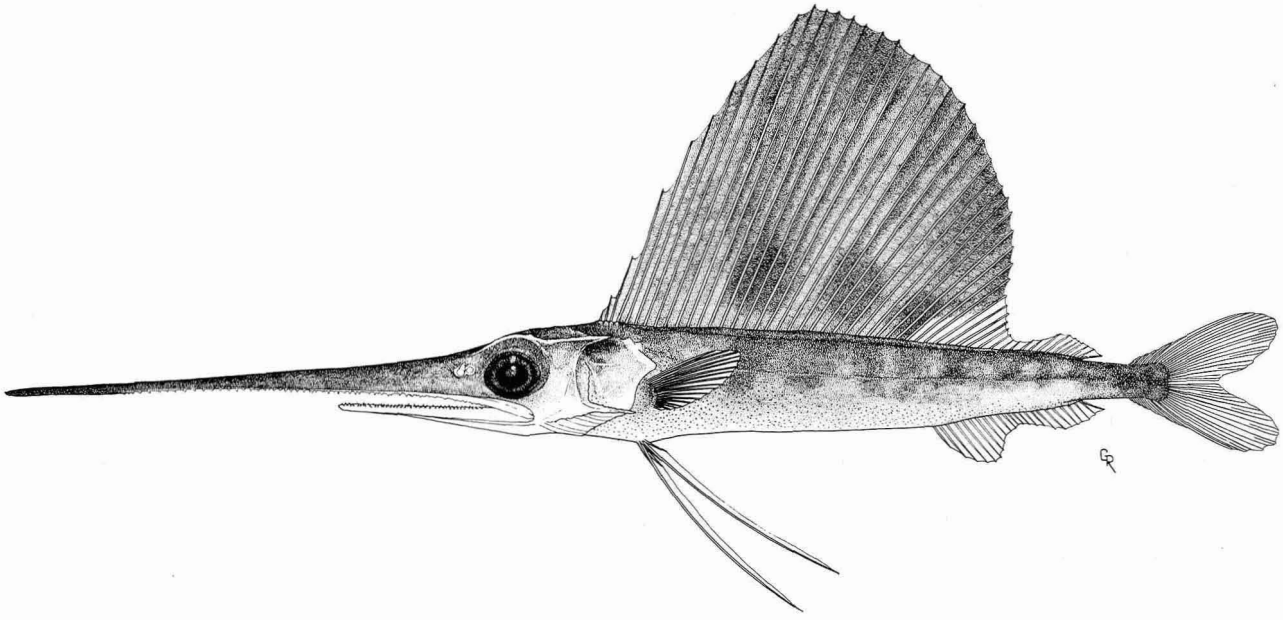

FIGURE 2.—Juvenile sailfish, 55.1 mm. standard length, *Silver Bay* Sta. 2268.

larger and covering more of the fin lobes, the blotches are distinct on a series of specimens 101 to 119 mm. SL. On a 190-mm. SL sailfish, pigment spreading posteriorly from the base of the fin joins that spreading anteriorly on the lobes and covers the fin except for the distal half of the middle seven caudal rays and ray membrane, which remain clear. On the largest specimens, 216 to 238 mm. SL, the clear area of the middle part of the caudal fin is reduced to the distal third of the middle six caudal rays and ray membrane, the lobes of the caudal fin are dusky, and the tissue covering the bases of the rays is densely pigmented.

Body Bars

Pigment on the sides of the body is concentrated in five to seven bars on fish of about 30 mm. SL. Bars are not discernible on smaller specimens. Sail-

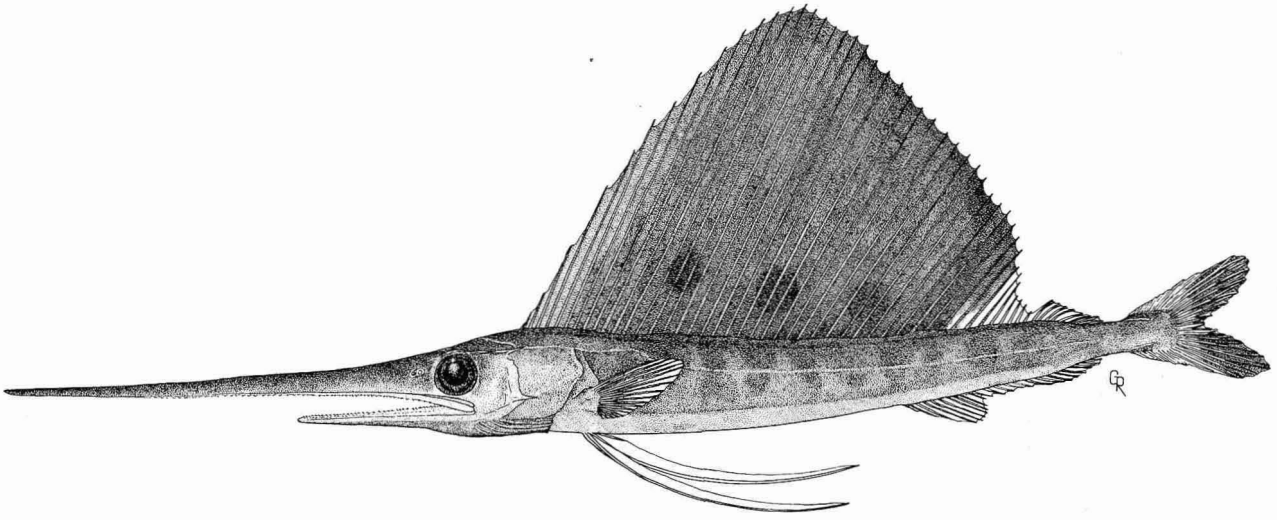

FIGURE 3.—Juvenile sailfish, 98.9 mm. standard length, *Silver Bay* Sta. 2201.

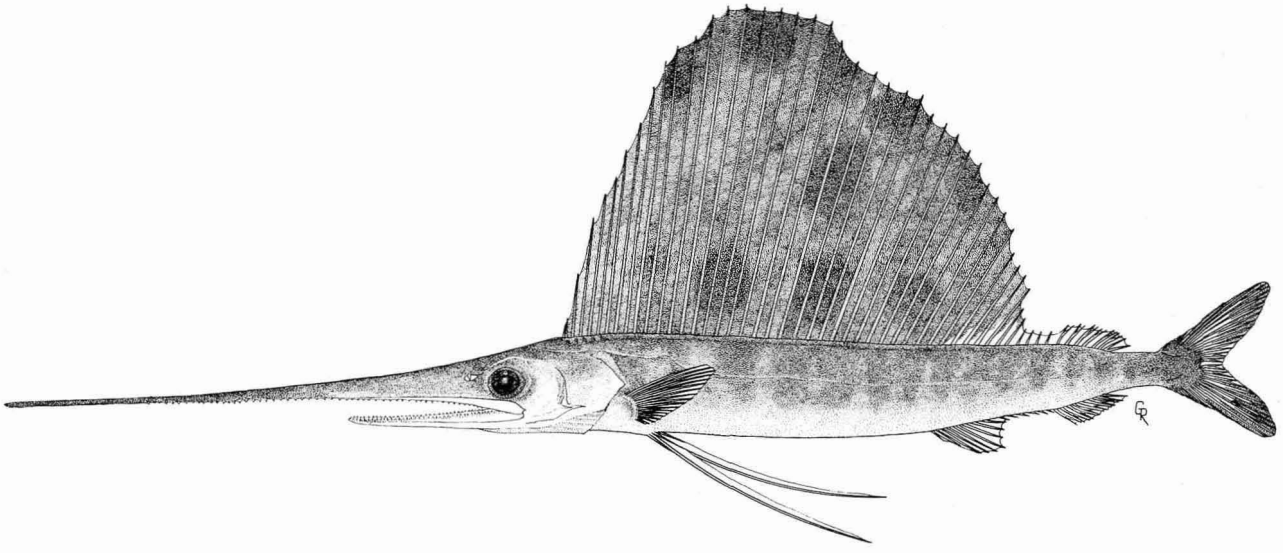

FIGURE 4.—Juvenile sailfish, 155 mm. standard length, *Silver Bay* Sta. 2139.

fish about 100 mm. SL have 7 to 12 bars, and the few specimens between 150 and 200 mm. SL have 12 to 14 bars. The largest western Atlantic specimen, 216 mm. SL, has 22 bars. Throughout the size range examined here the bars are distinct on some fish but indistinct on others and arranged in pairs on some specimens but not on others.

FIN RAYS

The numbers of fin rays for western and eastern Atlantic specimens with undamaged fins are within the adult complements. I prepared tables of numbers of fin rays for western Atlantic specimens only. The fins of a number of eastern Atlantic specimens were damaged, and too few counts are available to make useful tables. The numbers of fin rays for eastern Atlantic specimens are within the ranges for western Atlantic specimens, except for a few differences which are mentioned in the discussions.

The total number of dorsal fin rays ranges from 47 to 56 (mean, 51.6) for 142 western Atlantic

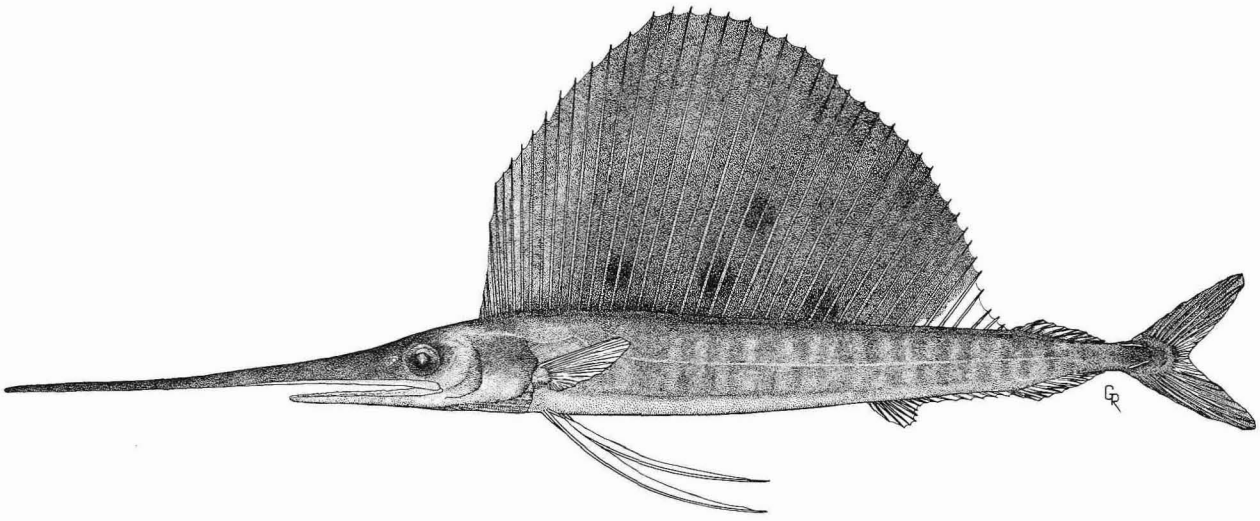

FIGURE 5.—Juvenile sailfish, 216 mm. standard length, *Silver Bay* Sta. 2172.

specimens[3] (one eastern Atlantic specimen has 57), and the total number of anal fin rays ranges from 21 to 25 (mean, 23.6) for 143 fish (one eastern Atlantic specimen has 20). Table 1 shows the total numbers of dorsal and anal fin rays for 139 western Atlantic sailfish.

Table 2 shows the numbers of rays in the anterior and posterior portions of the dorsal fin for 142 western sailfish. The range for the anterior portion is 43 to 50 (mean, 45.0) for 46 specimens (32.4 percent) with six rays in the posterior portion (51 for one eastern Atlantic specimen), and 40 to 49 (mean, 45.0) for 96 specimens (67.6 percent) with seven rays in the posterior portion. The mean of total number of rays in the dorsal fin is 51.0 for western Atlantic specimens with six rays in the posterior portion and 52.0 for those with seven rays in the posterior portion.

Table 3 shows the numbers of rays in the anterior and posterior portions of the anal fin for 143 western Atlantic sailfish. The range for the anterior portion is 15 to 19 (mean, 17.3) for 66 specimens (46.2 percent) with six rays in the posterior portion (14 for one eastern Atlantic specimen), and 14 to 18 (mean, 16.8) for 77 specimens (53.8 percent) with seven rays in the posterior portion. The mean of total number of rays in the anal fin is 23.3 for western Atlantic specimens with six rays in the posterior portion and 23.8 for those with seven rays in the posterior portion.

Table 4 shows the numbers of fin rays in the posterior portions of the dorsal and anal fins for the western Atlantic sailfish. Nearly half (46.8 percent) of 141 specimens have seven rays in this

[3] The numbers of fish shown in tables 1 to 4 are not the same. Of the 154 western Atlantic specimens, 139 had complete (undamaged) dorsal and anal fins, the rest had a complete dorsal or anal fin, or complete anterior or posterior portions of these fins. To take advantage of the greatest number of specimens for correlations, I used all sailfish with counts for desired fins or portions of fins. The same fish were not always involved.

TABLE 1.—*Number and (in parentheses) percentage of sailfish with different combinations of dorsal and anal fin rays, in a series of 139 specimens from the western Atlantic*

Anal fin rays	Dorsal fin rays									
	47	48	49	50	51	52	53	54	55	56
Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
21				1 (0.7)		1 (0.7)				
22			4 (2.9)	3 (2.2)	4 (2.9)	1 (0.7)				
23		1 (0.7)	7 (5.0)	9 (6.5)	9 (6.5)	10 (7.2)	8 (5.8)	3 (2.2)	1 (0.7)	
24	1 (0.7)		3 (2.2)	7 (5.0)	14 (10.1)	11 (7.9)	9 (6.5)	8 (5.8)	2 (1.4)	1 (0.7)
25			2 (1.4)	1 (0.7)	1 (0.7)	5 (3.6)	5 (3.6)	6 (4.3)		1 (0.7)

TABLE 2.—*Number and (in parentheses) percentage of sailfish with different combinations of fin rays in the anterior and posterior portions of the dorsal fin, in a series of 142 specimens from the western Atlantic*

Posterior portion fin rays	Anterior portion fin rays										
	40	41	42	43	44	45	46	47	48	49	50
Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
6	----------	----------	----------	10 (7.0)	9 (6.3)	11 (7.7)	10 (7.0)	2 (1.4)	3 (2.1)	----------	1 (0.7)
7	1 (0.7)	2 (1.4)	5 (3.5)	11 (7.7)	18 (12.7)	19 (13.4)	21 (14.8)	15 (10.6)	3 (2.1)	1 (0.7)	----------

TABLE 3.—*Number and (in parentheses) percentage of sailfish with different combinations of fin rays in the anterior and posterior portions of the anal fin, in a series of 148 specimens from the western Atlantic*

Posterior portion fin rays	Anterior portion fin rays					
	14	15	16	17	18	19
Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*
6	----------	1 (0.7)	11 (7.7)	27 (18.9)	23 (16.1)	4 (2.8)
7	1 (0.7)	4 (2.8)	20 (14.0)	33 (23.1)	19 (13.3)	----------

portion of both fins, 24.8 percent have six rays in each, 20.6 percent have seven dorsal and six anal rays, and the rest (7.8 percent) have six dorsal and seven anal rays. Twenty (about 75 percent) of 27 eastern Atlantic specimens have six rays in both fins.

The number of pectoral fin rays ranges from 17 to 20; 10 (6.9 percent) of 145 western Atlantic specimens have 17, 126 (86.9 percent) have 18, 8 (5.5 percent) have 19, and 1 (0.7 percent) has 20. Fifteen of 28 eastern Atlantic specimens have 17 rays, 12 have 18, and 1 has 19.

All specimens have nine upper and eight lower principal caudal rays. Counts were 11 or 12 upper and lower secondary caudal rays for several specimens (40–216 mm. SL) which were cleared and stained or X-rayed.

TABLE 4.—*Number and (in parentheses) percentage of sailfish with different combinations of fin rays in the posterior portions of the dorsal and anal fins, in a series of 141 specimens from the western Atlantic*

Anal fin rays	Dorsal fin rays	
	6	7
Number	*Number*	*Number*
6	35 (24.8)	29 (20.6)
7	11 (7.8)	66 (46.8)

Fin-ray counts given by Robins and de Sylva (1963) for adult *Istiophorus platypterus* are: dorsal spines, 40 to 49; second dorsal rays, 6 to 8 (1 of 59 fish had 8 rays); anal spines, 12 to 17; second anal rays, 6 to 8 (1 of 59 fish had 8 rays), pectoral rays, 18 to 21. The difference between their range of 40 to 49 dorsal spines and my range of 43 to 50 rays in the anterior portion of the dorsal fin and their range of 12 to 17 anal spines and my range of 14 to 19 rays in the anterior portion of the anal fin may reflect degeneration of several rays immediately ahead of the second dorsal and anal fins and their overgrowth by skin in the adult. A comparison of the percentages of my fish with six and seven rays in the posterior portions of the dorsal and anal fins with the information given by Robins and de Sylva is interesting. Roughly, one-third of their and my (western Atlantic) fish (32.2 percent and 32.4 percent, respectively) had six second dorsal fin rays and two-thirds (66.1 percent and 67.6 percent, respectively) had seven second dorsal fin rays (they recorded one fish with eight second dorsal rays, I had none). They recorded these same percentages of sailfish for numbers of second anal rays; 32.2 percent with six, 66.1 percent with seven, and one with eight rays. My counts are different; they show 46.2 percent with six rays, 53.8 percent with seven, and none with 8 in the posterior portion of the anal fin.

REGRESSIONS OF BODY PARTS ON TRUNK LENGTH

Comparisons of the changes in various body parts of fishes during development have been variously based on standard, fork, or total length. The snout and caudal rays are so frequently damaged in the billfishes that measurements involving one or both of these parts may be inaccurate. Body length, recommended by Rivas (1956) as the preferred base length for billfishes, is the distance between the tip of the mandible and the

tips of the middle caudal fin rays. This measurement involves fin rays that are fragile and frequently damaged on small specimens. The base length that I selected for my comparisons is the trunk length, defined by de Sylva (1957) as the distance between the posterior margin of the orbit and the anterior insertion of the caudal keels. This length involves neither the snout nor the caudal rays.[4]

[4] See definition for trunk length in section on methods and data for determination of posterior point for this measurement of sailfish without caudal keels.

Initially, individual measurements of selected body parts of the western Atlantic sailfish were plotted against trunk length on arithmetic paper (figs. 6–12). The distribution of the data suggested that the relatively fewer specimens with trunk length greater than 60 mm. should be treated separately. Two regression lines were calculated—one for those with trunk length less than 62 mm. and one for longer specimens. The regression equation is $Y=a+bX$ (table 5). Inspection of the graphs with the calculated regression lines added suggests that the location of point of inflection varies some-

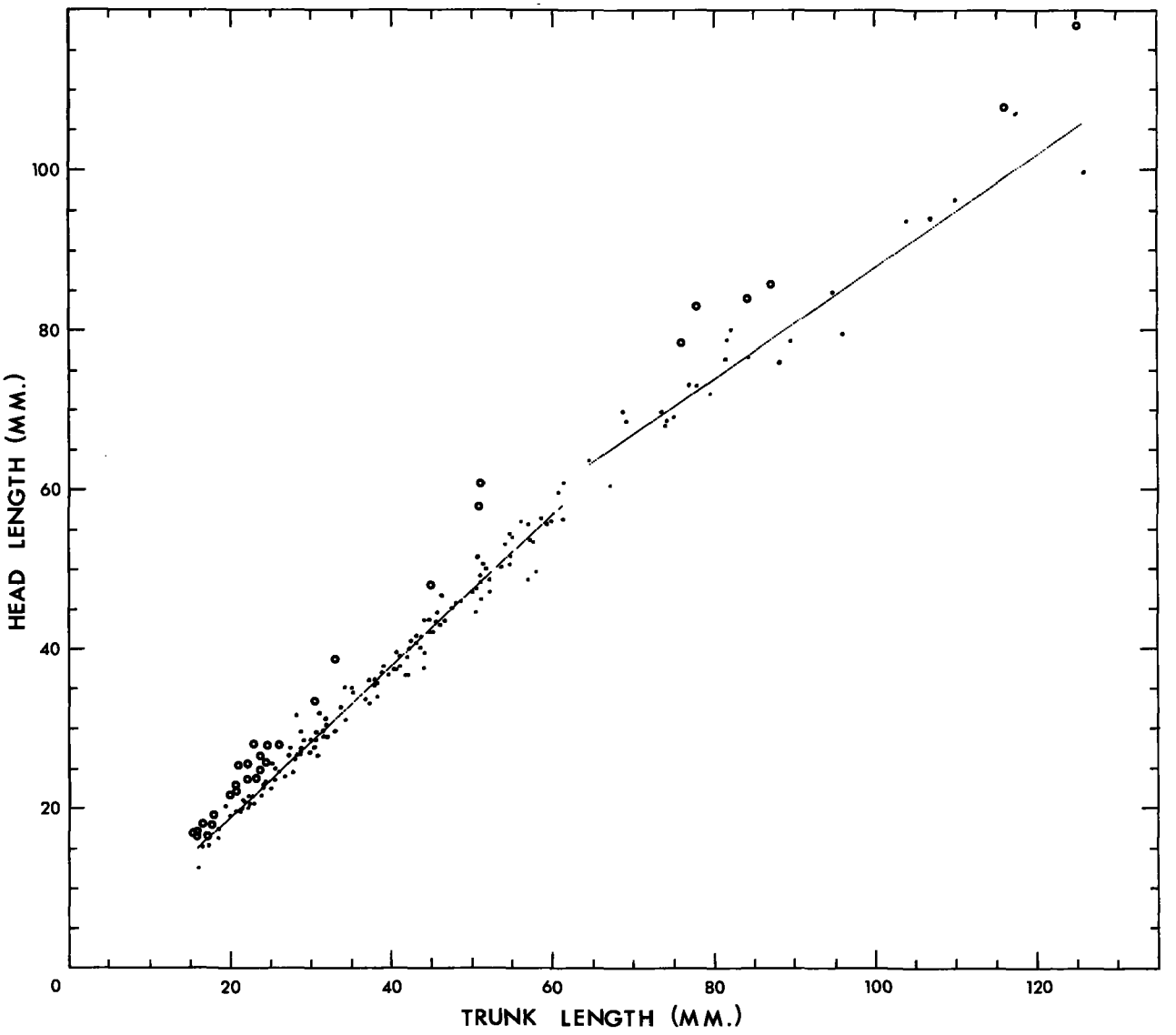

FIGURE 6.—Relation of head length to trunk length in sailfish. Small dots represent western Atlantic specimens; open circles, eastern Atlantic specimens. Regression lines represent western Atlantic data only.

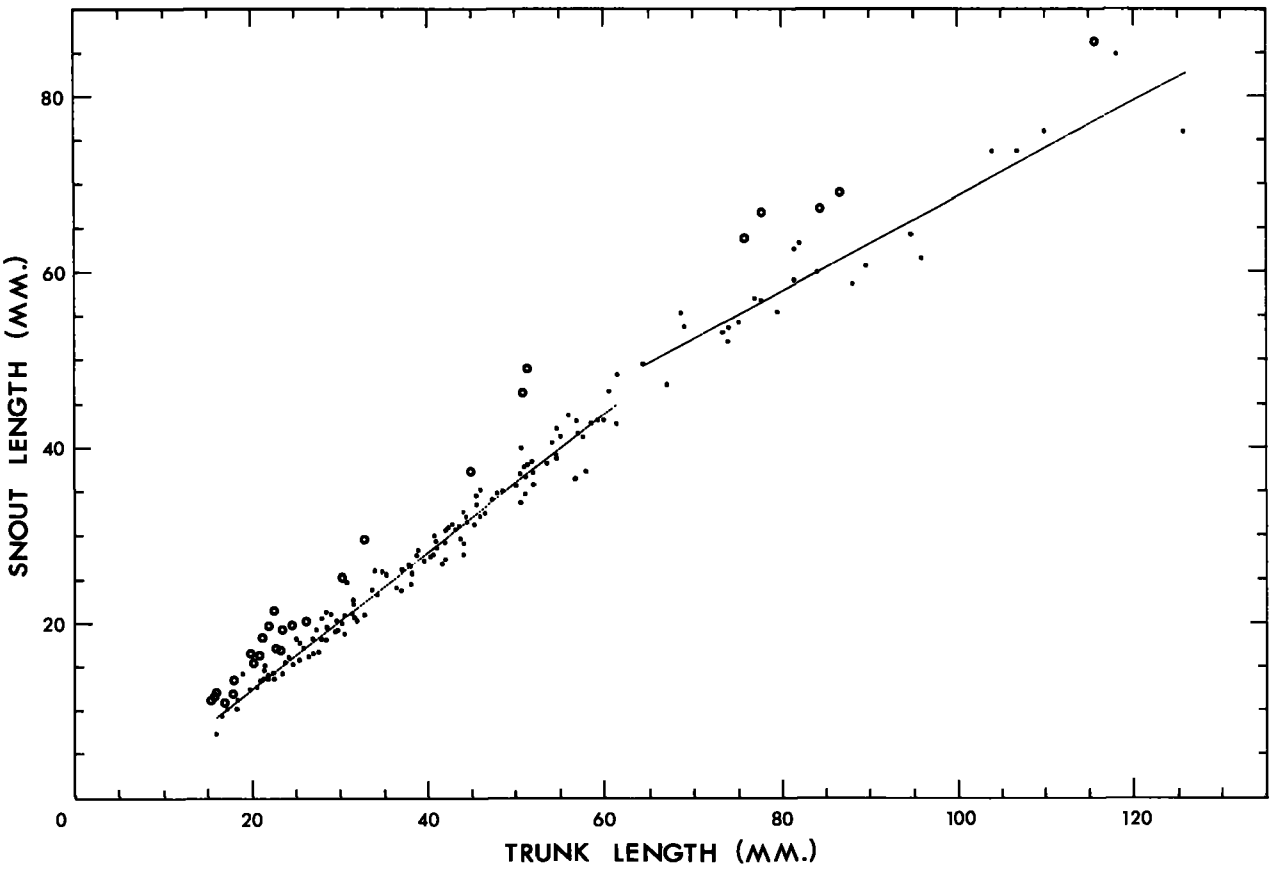

FIGURE 7.—Relation of snout length to trunk length in sailfish. Small dots represent western Atlantic specimens; open circles, eastern Atlantic specimens. Regression lines represent western Atlantic data only.

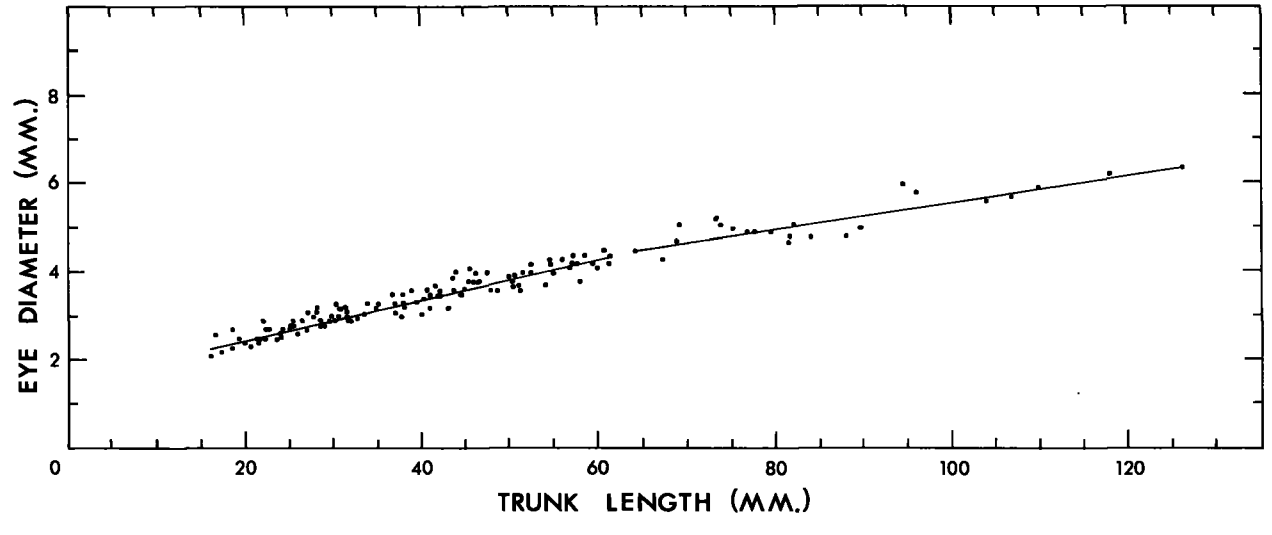

FIGURE 8.—Relation of eye diameter to trunk length in sailfish from the western Atlantic.

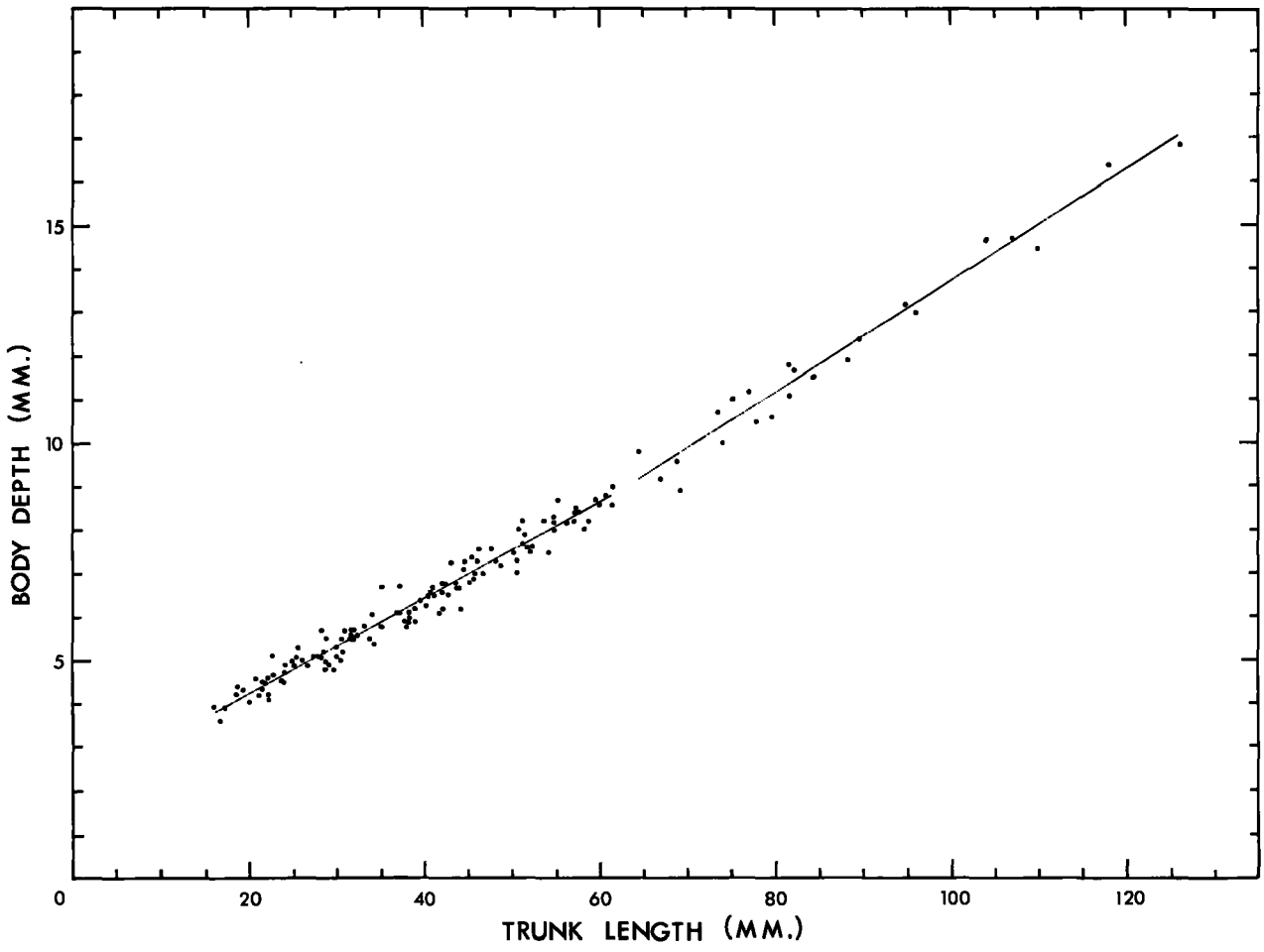

FIGURE 9.—Relation of body depth to trunk length in sailfish from the western Atlantic.

TABLE 5.—*Statistics describing regressions of body parts on trunk length, or body length, for sailfish from the western Atlantic*

[$\bar{x}$, mean of values of X; $\bar{y}$, mean of values of Y; N, number of specimens; b, slope of regression line; a, Y-intercept of regression line; Sy.x, standard deviation from regression (standard error of estimate)]

Independent variable X and specimen size [1]	Dependent variable Y	$\bar{x}$	$\bar{y}$	N	b	a	Sy.x
Trunk length:							
Small	Head length	37.92	35.87	130	0.942	0.142	1.610
Large	do	86.04	78.32	24	.694	18.592	3.263
Small	Snout length	37.92	26.37	130	.782	−3.279	1.517
Large	do	86.04	60.94	24	.538	14.619	3.209
Small	Eye diameter	37.65	3.30	121	.045	1.626	.111
Large	do	86.56	5.19	23	.029	2.677	.273
Small	Body depth	37.92	6.20	130	.109	2.067	.273
Large	do	86.04	11.92	24	.127	.997	.367
Small	Pectoral fin length	37.92	5.82	127	.109	1.678	.372
Large	do	83.85	9.99	18	.078	3.421	.444
Small	Pelvic fin length	37.26	15.04	124	.405	−.042	.937
Large	do	83.85	33.40	18	.348	4.237	1.499
Small	Pelvic fin-anal fin	37.92	18.64	130	.486	.227	.510
Large	do	86.04	41.32	24	.477	.282	.923
Body length:							
Small	Trunk length	52.87	37.58	124	.786	−3.961	.981
Large	do	114.38	85.79	22	.796	−5.204	1.377

[1] Small, 16.0–61.5 mm. trunk length; large, 64.5–126 mm. trunk length.

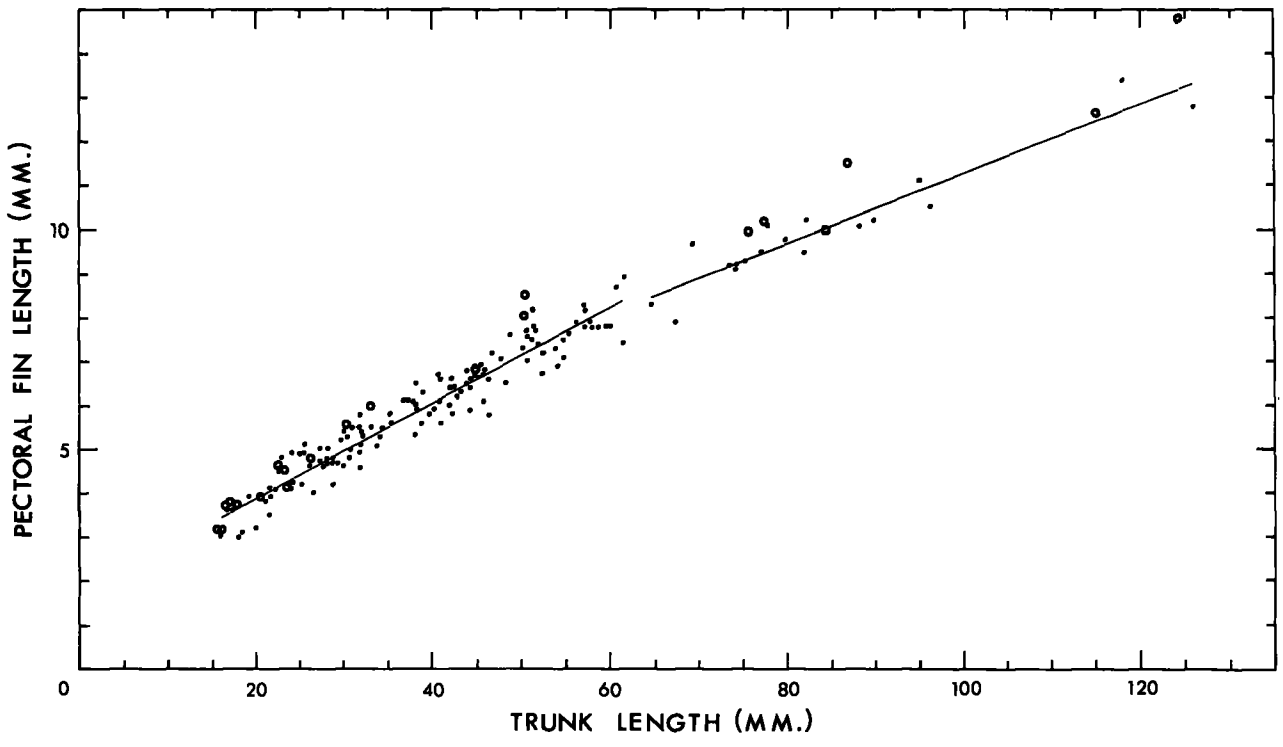

FIGURE 10.—Relation of pectoral fin length to trunk length in sailfish. Small dots represent western Atlantic specimens; open circles, eastern Atlantic specimens. Regression lines represent western Atlantic specimens only.

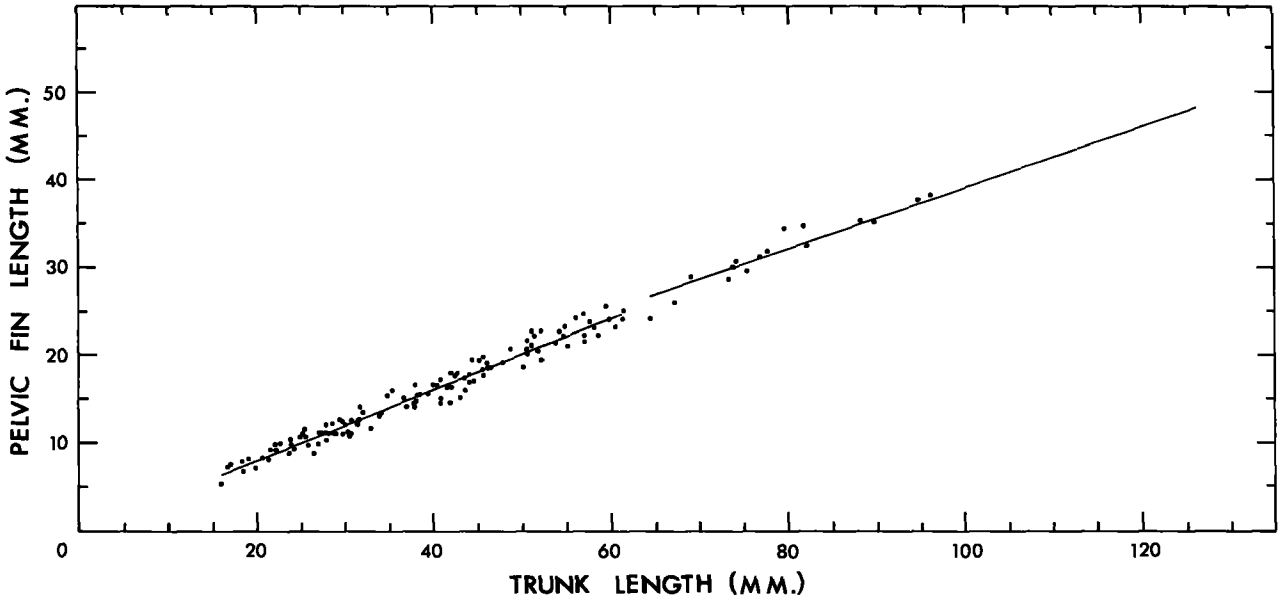

FIGURE 11.—Relation of pelvic fin length to trunk length in sailfish from the western Atlantic.

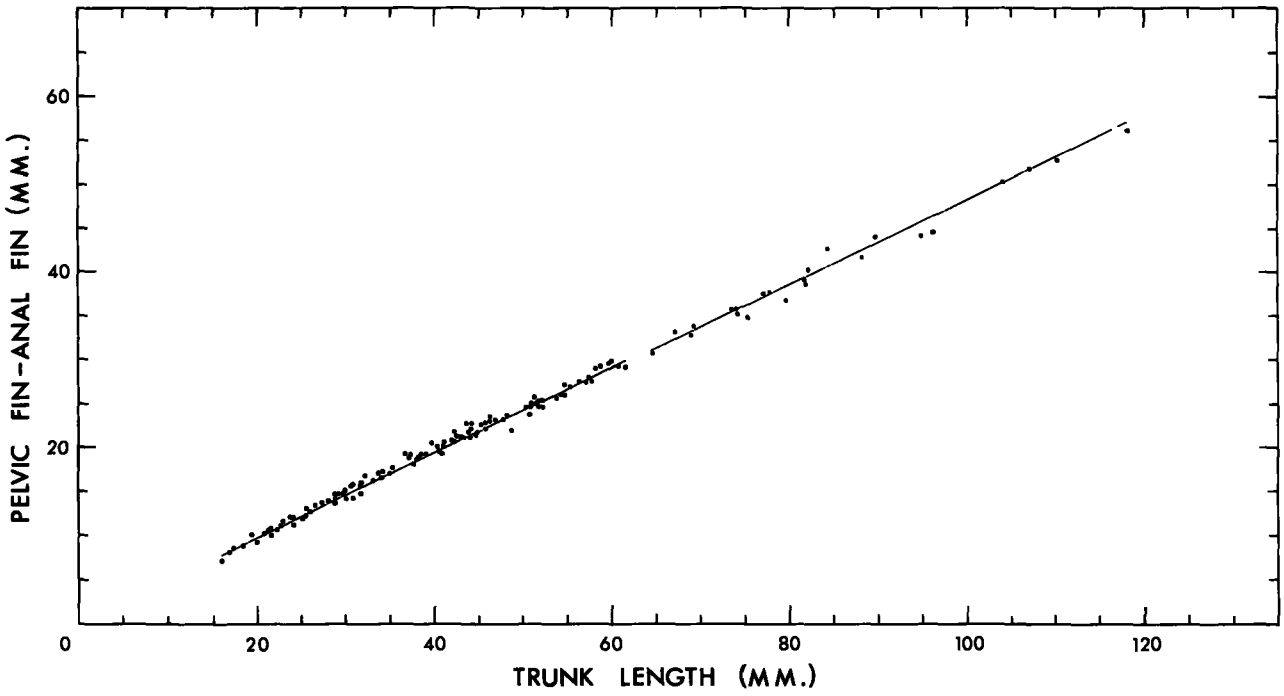

FIGURE 12.—Relation of the distance pelvic fin-anal fin to trunk length in sailfish from the western Atlantic.

what with body part and that some parts have little or no inflection. Figure 13, which illustrates the regression of trunk length on body length, is included to show that this relation is rectilinear throughout the size range; the calculated regression line for specimens with trunk length greater than 62 mm. has the same slope (b) and is merely an extension of that for smaller fish.

Subsequent to preparation of plots of data and calculation of regression lines for western Atlantic sailfish, I obtained measurements from 34 eastern Atlantic fish and plotted them on graphs. The data from the eastern Atlantic are too meager, however, for making calculations of regressions—the number of specimens is too small and the size distribution is poor. Because the greater numbers of western Atlantic specimens might possibly hide differences between the two groups if the data were combined, I plotted them separately on the same graph, distinguishing the two groups. I shall limit my comments to differences this simple comparison suggests.

The individual plots of data for eastern Atlantic sailfish generally lie within the ranges for fish from the western Atlantic for eye diameter, body depth, pelvic fin length, and distance from pelvic fin to anal fin; these data are, therefore, not shown on the figures showing these relations (figs. 8, 9, 11, and 12, respectively). Measurements of snout length, head length, and pectoral fin length, however, generally lie higher on the graphs for fish from the eastern Atlantic than for those from the western Atlantic (figs. 6, 7, and 10). The longer head (fig. 6) is attributable to the generally longer snout (fig. 7). The pectoral fin is also generally longer in eastern Atlantic sailfish (fig. 10).

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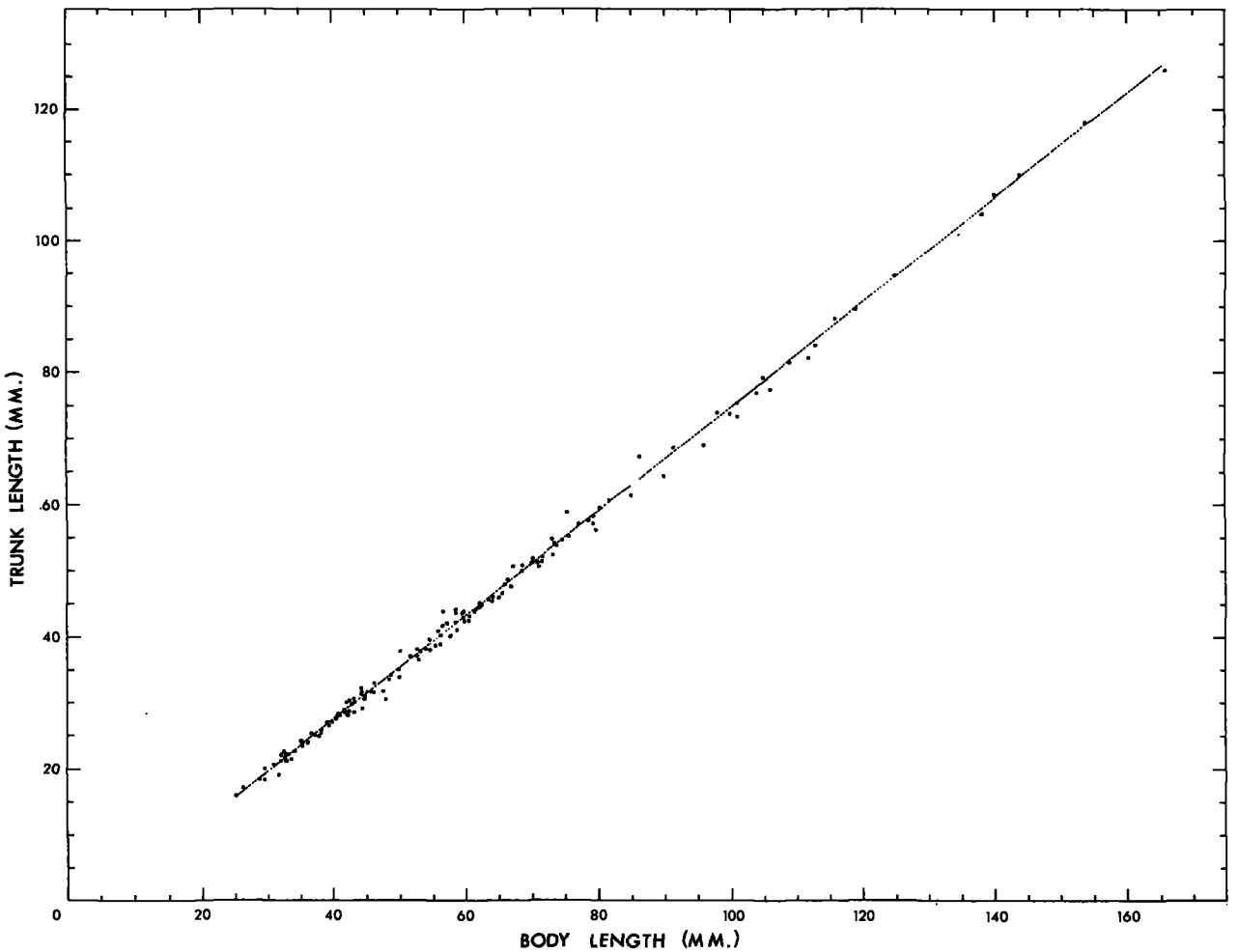

FIGURE 13.—Relation of trunk length to body length in sailfish from the western Atlantic.

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