DEFINITIONS OF BODY DIMENSIONS USED IN DESCRIBING TUNAS

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FISHERY BULLETIN 47
From Fishery Bulletin of the Fish and Wildlife Service
VOLUME 51

UNITED STATES DEPARTMENT OF THE INTERIOR, J. A. Krug, *Secretary*
FISH AND WILDLIFE SERVICE • Albert M. Day, *Director*

UNITED STATES GOVERNMENT PRINTING OFFICE • WASHINGTON: 1949

For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. . . . . Price 5 cents

DEFINITIONS OF BODY DIMENSIONS USED IN DESCRIBING TUNAS

Opportunities have recently been afforded us to collect biological data on several species of tunas in various regions of the Pacific Ocean. The problem of whether there exists in each species one or more populations has been of major interest. It is important to know for any commercially utilized species, and especially for pelagic species of wide distribution such as the tunas, whether exploitation at any point in their range bears upon the whole stock, or whether exploitation at one point will not affect the stock at another point. The classical method of distinguishing subpopulations in systematic and fisheries work is that of comparing series of meristic counts and morphometric characteristics among samples taken at different localities throughout the range of the species. Due to the improbability of one or two individuals being able to examine an adequate series of tunas over a broad area within a reasonable period of time, our data are being made available as soon as possible, so they may be used by other workers. One such report has already appeared (Schaefer 1948). In order to facilitate the use of our data, the methods used are defined here. Many of them have been given by Godsil and Byers (1944), but some have been modified by Schaefer (1948), and additional ones will be used later. It seems worth while that, for convenience, they be set forth in one place.

Originally, a comprehensive list of meristic and morphometric characters was drawn up, but field experience demonstrated the unwieldiness of such an extensive list. The characters used were selected (1) with a view to choosing those that would be likely to show possible differences; (2) because of facility in counting or measuring; and (3) because of their use by previous workers. There is, of course, no assurance that these particular characters will be of value in identifying discrete populations, if such exist. In all probability the list will have to be modified and expanded from time to time.

In collecting our data, an effort has been made to examine fish in the entire size range available at any one locality. This permits the various body proportions to be expressed as the regression of one dimension on another, such as the regression of head length on total length. The necessity for the comparison of regressions rather than ratios arises from the fact that the different parts of the body grow at different rates, as has been shown for *Neothunnus macropterus* by Schaefer (1948) and for *Thunnus thynnus* of the Atlantic by Frade (1931a). Most of the morphometric data on tunas both from the Atlantic-Mediterranean region (Anon. 1933; Frade 1929, 1931a, 1931b; Heldt 1928, 1931) and from the Pacific (Godsil and Byers 1944) have been in the form of ratios of one dimension to another. These data are of small value for comparing the fish from one region with those of another, because of the differential growth rate of different parts of the body. It is important that researchers in different parts of the world publish either the original measurements or the statistics describing the regressions with the ranges of size to which they apply, or, preferably, both.

The specimens examined by us were all fresh-caught. It is desirable that measurements of fresh-caught fish form the basis of comparisons until such time as the effects of freezing or chemical preservation on the body proportions have been determined to have constant effects and those effects are firmly established. The natural variability of most dimensions is relatively small (Schaefer 1948) so that the effect of preservation on differential shrinkage or expansion of different body parts might lead to spurious results if samples of preserved fish from one region were compared with samples of fresh fish from another, or if samples of fish from two different regions had undergone different preservative treatment. Of course, this does not apply where countable characters rather than measurements are concerned.

The measurements described are all made in metric units with calipers (of the type mentioned by Godsil and Byers 1944) or dividers, depending upon the size of the fish and the distance to be measured. All distances are straight line. The tip of the fixed arm of the calipers (or one point of the dividers) is applied to the first point mentioned and the tip of the sliding arm of the calipers (or the other point of the dividers) is applied to the second point mentioned. Where a choice of sides is involved, all measurements and counts are made on the left side of the fish.

Total length.—The distance from the tip of the snout (most anterior point on upper jaw), with jaws closed, to the cartilaginous median part of the caudal fork (seating the sliding arm of the caliper firmly and thus depressing the small fleshy flap extending posteriorly).

Head length.—The distance from the tip of the snout to the most posterior point on the margin of the subopercle (depressing the fleshy flap extending posteriorly).

Snout to insertion first dorsal.—The distance from the tip of the snout to the insertion of the first dorsal. The insertion of the first dorsal is the intersection of the anterior margin of the first dorsal spine, when the fin is held erect, with the contour of the back. This point is identical with the most anterior point of the first dorsal fin slot.

Snout to insertion second dorsal.—The distance from the tip of the snout to insertion of the second dorsal. The insertion of the second dorsal is not so clearly defined as the insertion of the first dorsal, particularly on larger fish, but is the intersection of the anterior margin of the second dorsal, when the fin is held erect, with the contour of the back. When the second dorsal is raised, the determined point should be marked with thumbnail or scalpel.

Snout to insertion anal.—The distance from the tip of the snout to the insertion of the anal. The insertion of the anal is determined in the same manner as the insertion of the second dorsal.

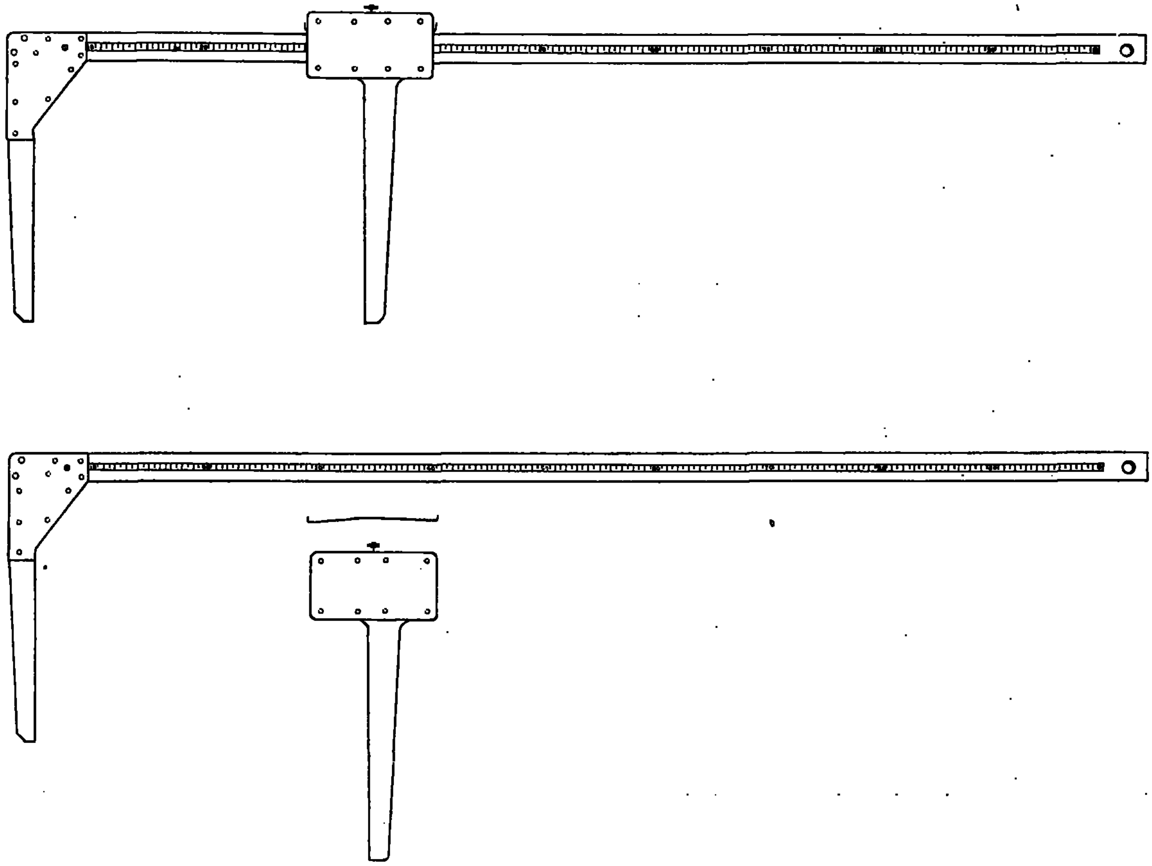

FIGURE 1.—Calipers used in measuring tunas; above, assembled; below, unassembled.

Snout to insertion ventral.—The distance from the tip of the snout to the insertion of the ventral. The insertion of the ventral is the intersection of the anterior margin of the ventral, when the fin is extended, with the contour of the body.

Greatest depth.—The greatest vertical distance between the dorsal and ventral contours. The measurement is taken from the dorsal body contour to the ventral body contour, with the first dorsal fin depressed in its slot. It is oriented by reference to the dorsal spine, the insertion of which is at or nearest the upper end of the vertical. Dorsal spines are counted posteriorly, the most anterior spine being the first.

Length pectoral.—The distance from the insertion of the pectoral to the most posterior point, taken with the pectoral fin extended posteriorly and opposed to the side. The insertion of the pectoral is the intersection of its dorsal margin with the body.

Pectoral insertion to insertion first dorsal.—The distance from the insertion of the pectoral fin to the insertion of the first dorsal.

Length base first dorsal.—The distance from the insertion of the first dorsal to the insertion of the second dorsal.

Length base second dorsal.—The distance from the insertion of the second dorsal to the intersection of the posterior margin of the second dorsal with the contour of the back. Note that this includes any finlet that is attached to the second dorsal. Because of the difficulty in determining whether or not a finlet is "attached" (i. e., contiguous with the second dorsal) it is not a very good character.

Spread caudal.—The distance between the dorso-posterior extremity of the caudal and the ventro-posterior extremity of the caudal. This measurement is accurate only if the caudal extremities are not frayed, the fish has not been handled extensively by the tail, and the fish has not been out of the water long enough for the caudal to dry (and possibly shrink).

Length longest dorsal spine.—The distance from the insertion of the longest spine to its distal end. The insertion of the spine, with the fin held erect, is the intersection of its anterior margin with the contour of the back.

Length first dorsal spine.—The distance from the insertion of the first dorsal spine to its distal end.

Length second dorsal.—The distance from the insertion of the second dorsal to its distal end, with the fin in a normal position. Note that this fin is often extended in a long filament, especially in large *Neothunnus*, and care should be taken to notice if this extension is frayed.

Length anal.—The distance from the insertion of the anal fin to its distal end, with the fin in a normal position. Remarks under "length second dorsal" apply here.

Length longest dorsal finlet.—The distance from the insertion of the longest dorsal finlet to the end of its posterior filament. The insertion of the finlet is the intersection of its anterior margin with the contour of the body. Dorsal finlets are identified by number. They are numbered anteriorly, the most posterior one being the first.

Diameter of iris.—The greatest diameter measured to the margin of the yellow iris and the adjoining black tissue. This is generally not on a line parallel to the median line of the body.

Length maxillary.—The distance from the tip of the snout to the posterior end of the maxillary.

Least depth caudal peduncle.—The least vertical distance between the dorsal and ventral contours of the caudal peduncle.

Greatest width caudal peduncle at keels.—The greatest horizontal distance between the lateral contours including the keels. Note that the keels may be broken or shrunken (due to drying).

Number of first dorsal spines.—The total number of spines discernible with the first dorsal held erect and with no dissection. The most posterior spine may be completely subcutaneous and is then not counted.

Number of dorsal finlets.—The number of finlets following the second dorsal. The most posterior one is counted as the first, and finlets attached to the second dorsal are counted separately. For example, 9=9 free finlets; 8+1=8 free finlets plus 1 finlet attached to the second dorsal. It is often difficult to decide whether or not a finlet is attached, and consequently this character may be of little use.

Number of anal finlets.—The number of finlets following the anal fin. Counted in the same manner as the dorsal finlets.

Number of gill rakers.—The number of anterior rakers on the most anterior gill arch on the left side of the fish (some species also have posterior rakers on this same arch). The counts of the rakers on the two arms of the arch are kept separate. For example, 10+20=30 gill rakers with 10 on the upper arm and 20 on the lower. The counts include all rakers that can be seen or felt with a dissecting needle. We have encountered no difficulty in assigning rakers near the angle of the arch to one arm or the other.

Sex.—Determined by inspection. Very immature males and females may be difficult to distinguish. Ovaries, which are tubular, may often roll between the fingers, while testes, which are solid, will turn over. The testes of ripening or ripe males are enlarged, solid, white bodies, not round in cross section. The ovaries of ripening or ripe females are enlarged, turgid, pink or yellow-orange bodies, round in cross section. Ova may often be distinguishable with the naked eye. The testes of spawned-out males are less turgid, tougher, and pinker than those not spawned, and are difficult or impossible to distinguish from maturing testes in early stages. The ovaries of spawned-out females are hollow, more or less flabby, sac-like tubes.

Weight.—This has been determined in pounds on spring balances. Metric units would be more desirable, and experience has shown that a counterpoise style of balance, such as Chatillon No. 160, is more satisfactory, since the calibration of a spring balance is subject to change due to corrosion.

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