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Pelagic Fish (Southern) Committee

Possible Anomaly in Bluefin Tuna

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Summary

In the 1974 season observers reported Atlantic bluefin tuna that appeared to be distinctly different from "normal" bluefin tuna, particularly with abnormally long second dorsal (and other) fins, and being extremely heavy for their length.

A comparison with available random samples fails to substantiate the theories that two distinct groups of Thunnus thynnus thynnus were present in the Atlantic in 1974, or that the 1974 "unusual" fish were significantly different from fish of early eras. The observations could, instead, easily be the result of sampling and measuring error, selection of nonrandom specimens, or the fact that very large specimens are known to possess disproportionately long second dorsal (and anal) fins.

I. Introduction

Recently, observers have contended that they have seen some Atlantic bluefin tuna (Thunnus thynnus thynnus) that differ in form from normal specimens. R. Sara noted that some of the fish landed in Italy in the 1974 season appeared "strange;" with unusually long second dorsal, anal, and pectoral fins; and heavier in relation to their length (Mather, 1974). Ms. L. Despres of Northeast Fisheries Center, NMFS, in July 1974, noticed off Maine that some fish seemed to possess longer second dorsal and anal fins than normal.

II. The Problem

The questions undertaken were: Is there a group of large Atlantic bluefin tuna that differs significantly with respect to fins (or other characteristics) from (a) "normal" fish, or (b) from fish in earlier years?

III. The Data

1. The "Unusual" Fish. Unfortunately, very few of the "abnormal" fish were measured. In the Western Atlantic, fins were measured on only two fish. These were fin lengths (second dorsal) of 50.0 cm for a 246 cm fish (fork length--straight line measurement), and a 61.0 cm fin for a 238 cm fish. However, length and weights of 9 other "abnormal" fish were recorded. In Europe, fin lengths of 5 "strange" fish ranged from 53 to 55 cm for fish of 250-260 cm length. Individual weights were: 485, 479, 406, 362, and 461 kg.

2. "Normal" Fish of the 1974 Season. For comparison, we had random samples amounting to only 103 fish (Table 1) for Western Atlantic, none from European waters.

3. "Normal" Fish - Earlier Era. Of earlier era fish, for both Western and Eastern Atlantic, there were unpublished diverse records of fin length and length-weight relationships provided by F. J. Mather III and the author.

IV. Analysis

A. Length of Fin

1. It was established in 1950 by Mather and Schuck that the relationship between length of second dorsal and length of fish is not a straight line but is curvilinear--with larger fish having relatively longer second dorsals than smaller specimens (Mather, 1964). Thus, if 1974 fish are larger than average (which they are), one would expect them to have relatively longer fins than fish generally observed in the past.

2. Early work (Mather and Schuck, unpublished) also shows the scatter of points around the regression line to be greater for large fish than for small (Figure 1). This fact offers another possible explanation for occasionally very long second dorsals (as well as very short dorsals) being encountered, especially if one is looking at larger fish than usual.

3. Figure 2 shows the sample of randomly selected 1974 Western Atlantic fin lengths. There is no evidence of two types of fish--instead, a gradation from relatively very short to relatively very long fins.

4. Ratios ("relative" fin lengths) of the random samples are plotted in Figure 3. Again, no evidence of a two-modal distribution of relative fin lengths.

5. The two Western "abnormal" fish are also shown in Figure 2 (circles) and in the histogram of ratios (Figure 3). One fish (ratio = .203) is not substantially longer than many others of the "single mode" random distribution. The other (ratio = .256) lies beyond the limits of all previously measured second dorsals. If this fish had been selected randomly, and if this value represented an average of several, then a significant difference would be indicated. But these conditions do not prevail.

6. The European "abnormal" fish are also plotted on Figure 2 (large box). They certainly do not possess significantly larger fins than many of the single-modal random sample.

7. Fish of 1974 are compared to earlier years in Figure 2 by matching the 1974 points (the 1974 fish) with the line (which represents the 1950 data). It is doubtful that a line of better fit to the 1974 points could be found than the 1950 line.

B. Relative Heaviness

1. Early work of Mather and Schuck (Schuck, manuscript) established that the relationship between weight and length is not only highly curvilinear, as expected, but that it differs markedly between seasons of the year. The difference can be over a hundred pounds for fish of exactly the same length. Thus valid comparisons of relative heaviness can best be made only between fish taken in the same season. In addition, the conditions which apparently cause the large seasonal differences (spawning, long migration to the feeding grounds, fattening up prior to winter, and then wintering preparation to spawning) do not occur on both sides of the Atlantic in the same months of the year.

2. With all these constraints, there is very little valid data to test the hypothesis that the "abnormal" fish are heavier than the usual fish taken in 1974, or heavier than prior-era fish.

3. In Figure 4 are compared Western Atlantic fish classified as abnormal (long-fin), and those classified as normal (short-fin). There is obviously no significant difference in the relative heaviness.

4. We lack lengths and weights for a random sample of 1974 European fish with which to compare the 5 unusually heavy fish of Sara's. Visual comparisons with 1974 Western Atlantic fish, and with early-era Western Atlantic fish, shows the 5 to be exceptionally heavy. However, these 5 were all immediately pre-spawning fish--and the Western data do not include any fish in that season, or enough fish of Sara's very large sizes to establish what are normal weights of very large pre-spawners in the Western Atlantic. Thus a valid comparison is not possible with available data.

V. Conclusions

1. Larger bluefin tuna possess relatively longer second dorsal fins than do smaller fish. Thus, as one examines unusually large specimens one must expect this fin to appear out of proportion to the rest of the body (as judged by the familiar appearance of lesser-sized tuna).

2. Presently available data do not support the contentions that two separate, recognizable groups of Thunnus thynnus thynnus were present in 1974, or that the so-called "unusual" group differs significantly in body proportions from fish of earlier years.

3. The observed phenomenon could, instead, be explained by a combination of: (a) chance variation within a single-mode population; (b) actual selection of the longest-finned fish as the samples to be measured; (c) measuring errors, especially in measuring total fish length; (d) the fact that larger-sized bluefin tuna are known to possess "disproportionately long" second dorsal fins; and (e) the fact that dispersion of points both above and below the fin-fish regression line can occasionally be very great in super-large individuals.

4. It is still possible that, when large samples of randomly selected fish become available for analysis, the hypothesis of two distinct "types" of fish can be substantiated. But for now, the theory is unproven.

5. Until two discernible types are demonstrated beyond reasonable doubt, there seems little to be gained speculating as to the cause of such a possible phenomenon-- such as a hybrid with another species (e.g. bigeye tuna, Thunnus obesus), a mutant, a subpopulation not normally present in the areas sampled, an age effect (appearing in only very old fish), or a growth form in response to perhaps rapidly decreased population density of the species (which is occurring) and a resultant effect of decreased competition for food or space. Sexual dimorphism would appear unlikely as a possible explanation.

VI. Acknowledgments

Credit is due to Frank J. Mather III, of Woods Hole Oceanographic Institution, who provided background data used in this study.

References

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Table 1. Random samples of 1974 Western Atlantic Bluefin tuna -
Relative Fin Lengths.

Fork lg. (cm)	2nd dorsal (cm)	Fork Lg. (cm)	2nd dorsal (cm)	Fork lg (cm)	2nd dorsa (cm)
235	37.0	263	39.0	259	44.0
263	34.0	234	35.5	256	43.0
244	44.8	262	39.5	246	36.0
249	39.0	249	39.0	260	41.0
255	39.7	256	38.0	263	42.0
235	41.5	263	41.5	261	44.0
244	42.5	250	49.0	251	49.0
253	44.0	258	49.5	263	57.0
248	43.0	264	51.5	240	41.0
259	50.5	259	42.0	250	43.0
216	36.5	253	36.5	269	42.0
243	41.0	247	44.5	246	42.0
262	38.5	264	36.0	253e	45.0e
259	40.5	251	42.0	263e	44.0e
257	41.5	278	44.5	265e	43.0e
269	49.0	262	47.0	242e	42.0e
210	34.0	278	39.5	255e	41.0e
259	44.0	193	26.0	270e	41.0e
266	41.5	212	34.5	248e	38.0e
238	41.5	246	40.5	243e	36.0e
243	40.5	261	53.0	258e	36.0e
263	37.0	254	35.0		
270	42.5	257	53.0		
246	38.5	264	46.0		
217	35.0	271	39.0		
265	45.0	254	47.0		
252	42.0	266	46.0		
262	56.0	266	40.0		
261	41.0	259	40.0		
251	41.0	284	47.0		
218	37.5	257	37.0		
241	38.5	239	37.0		
265	46.5	267	50.0		
265	43.0	277	47.0		
258	47.0	277	51.0		
240	35.5	255	46.0		
243	35.5	258	37.0		
259	42.0	279	49.0		
237	40.0	271	42.0		
256	39.0	258	42.0		
262	49.5	251	41.0		

e = estimated

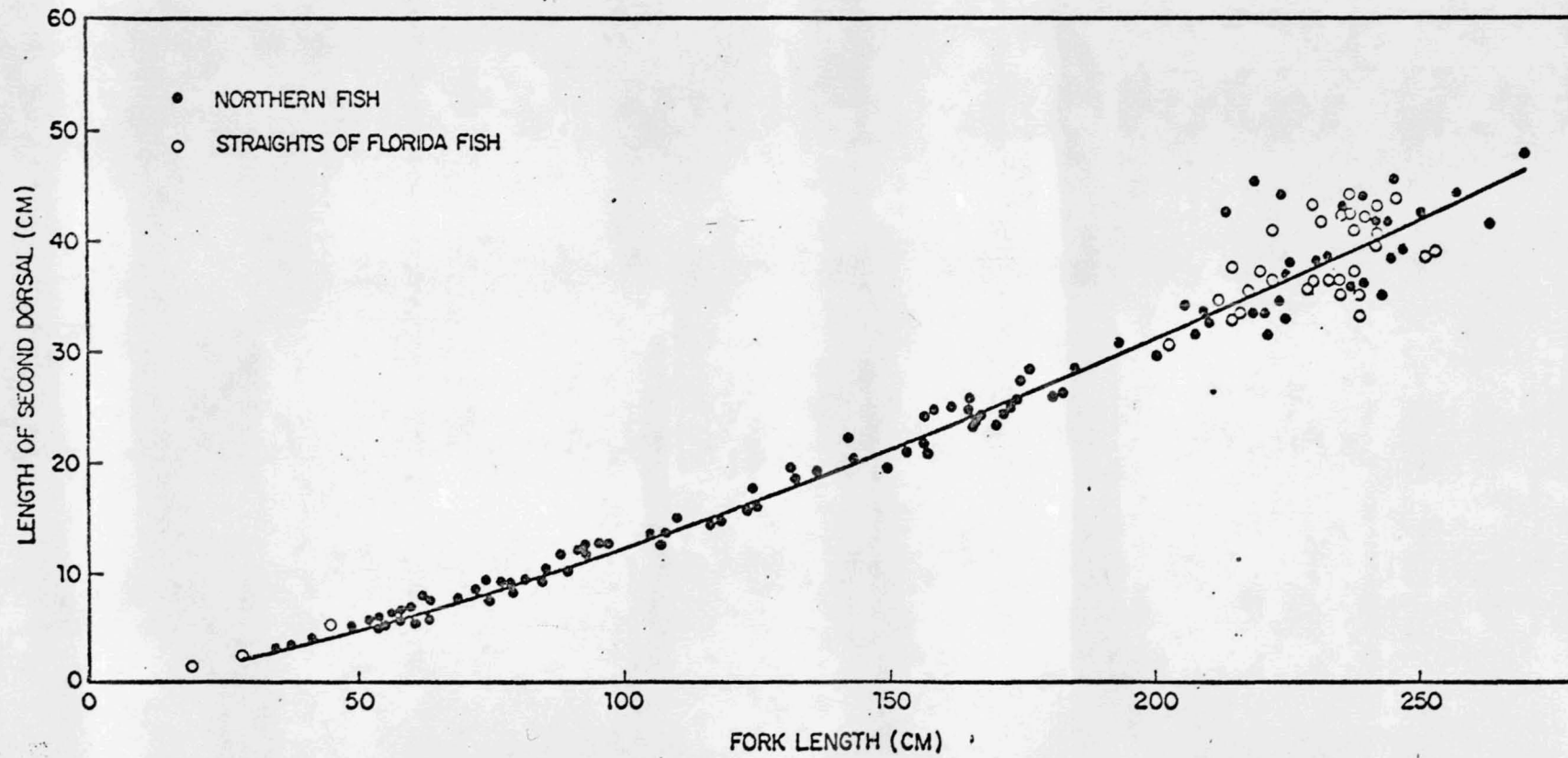


Figure 1. Relationship of 2nd dorsal to total length--
1950 era fish.

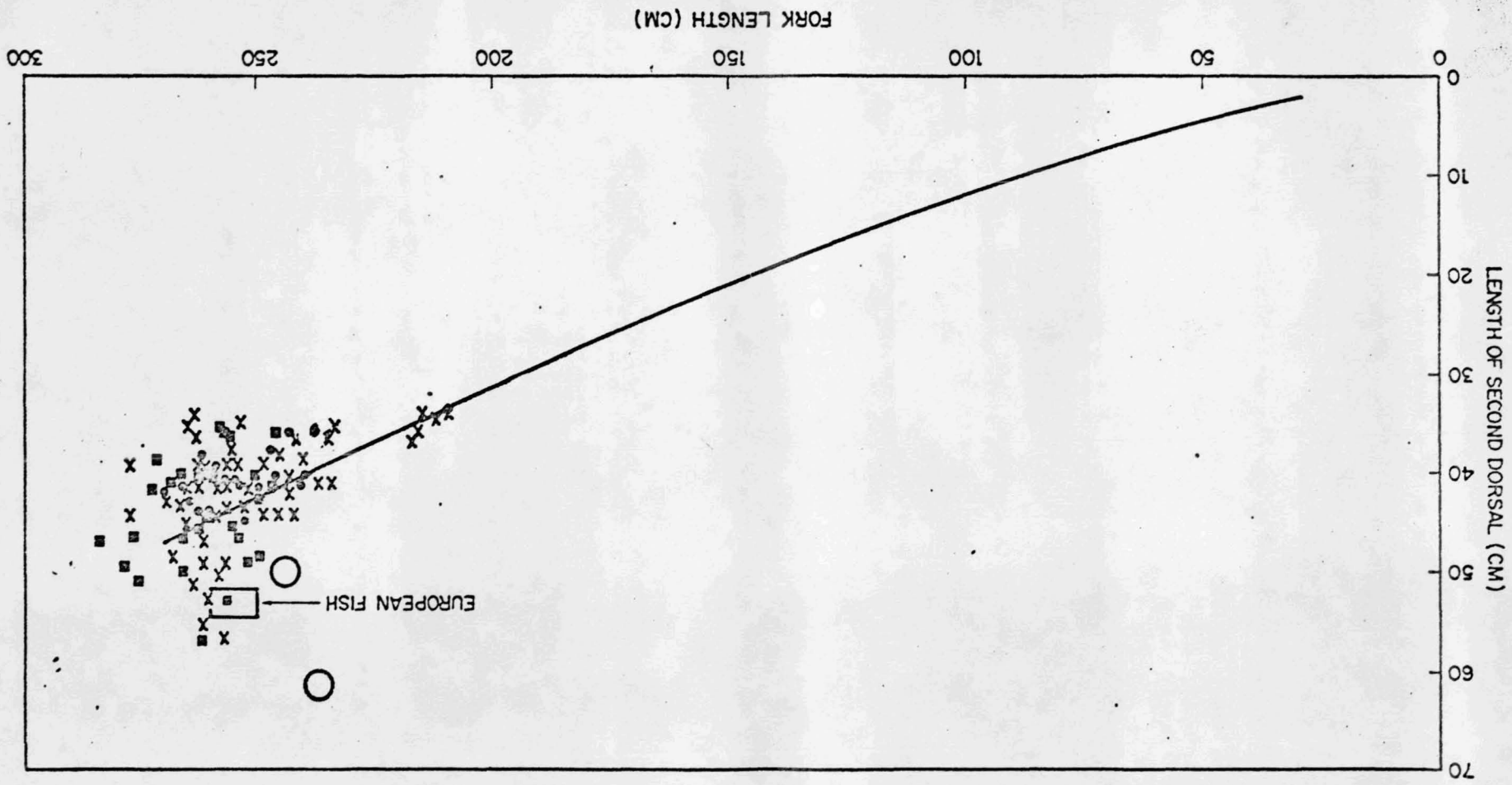


Figure 2.--All 1974 Western Atlantic data on fin length.

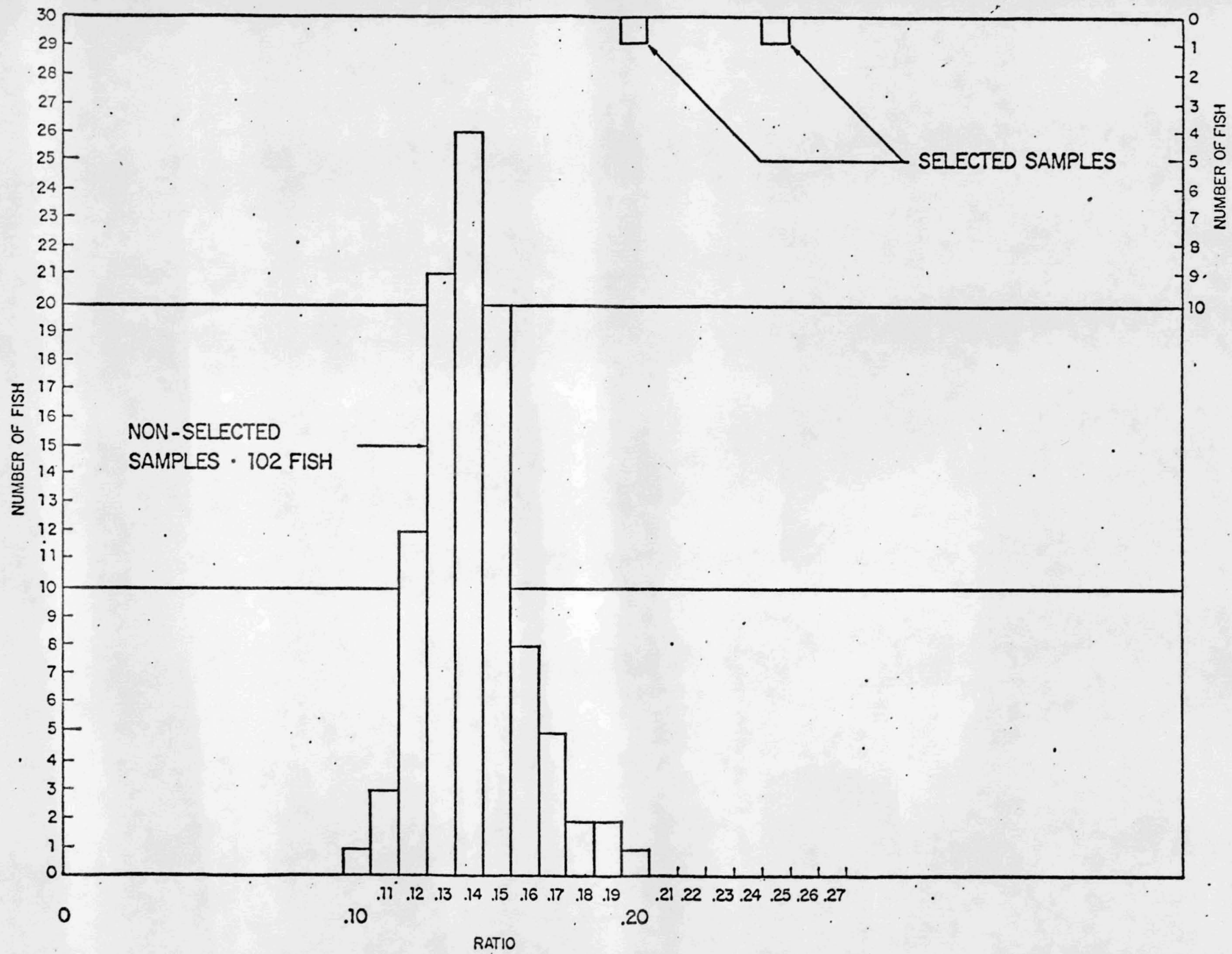


Figure 3. Ratios of 2nd dorsal to total length--1974 fish.

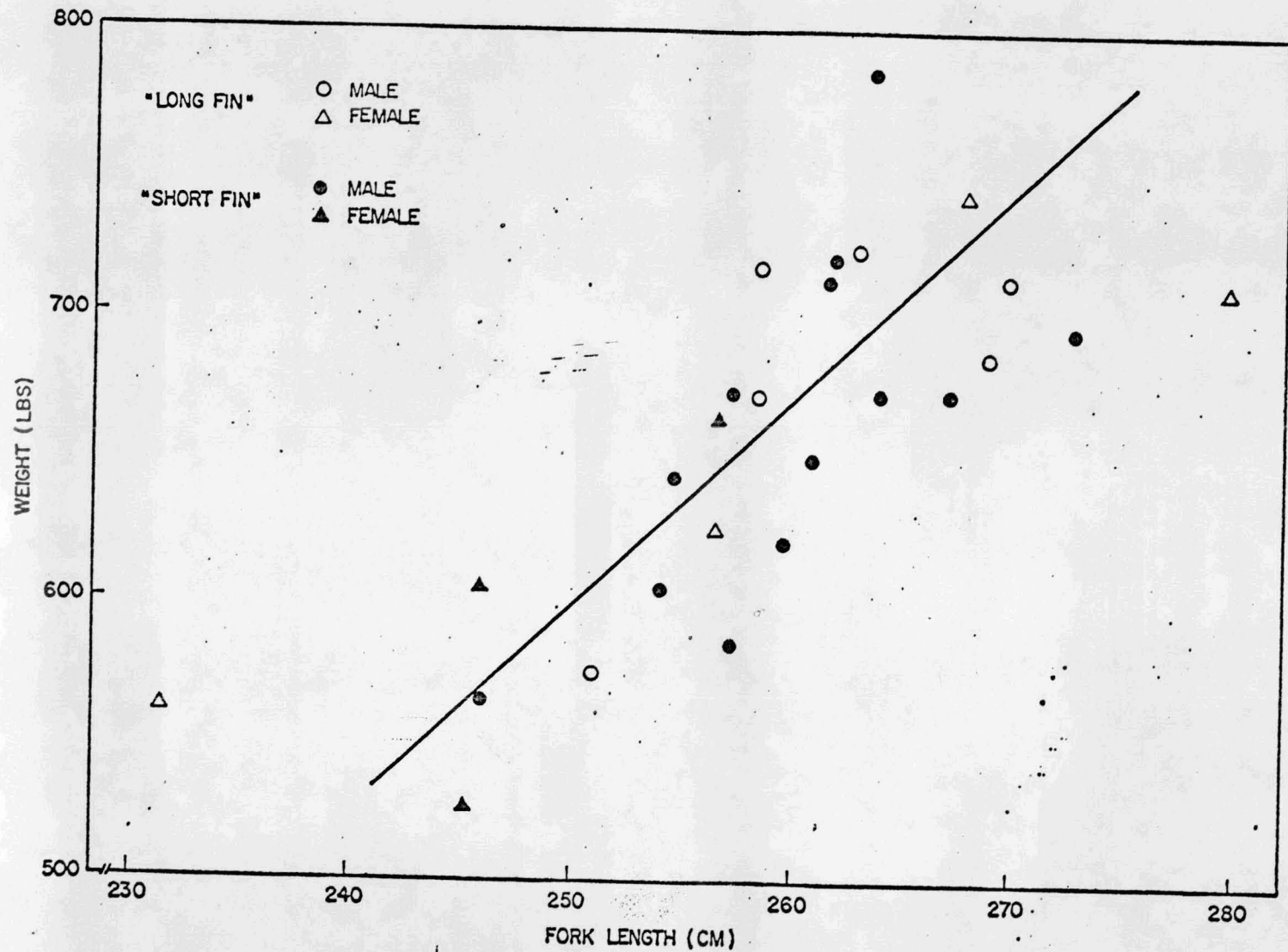


Figure 4. Relative heaviness--Bailey Island, Maine tournament.