

14 and 38 days. At the end of 38 days, four clams were missing and fourteen had moved an average of 2.15 inches with a maximum of 6 inches. One blunt clam was reported moving 7 inches in 24 hours. Belding noted all the movements in one experimental bed were in the direction of the retreating (ebb) tide with no difference in the distance migrated between the 28 millimeter and 41 millimeter clams. Belding concludes that the hard clam leads practically a sedentary life.

The present studies have shown that clams do crawl and that the distance traveled is in general correlated to growth rate and size of the clams. In general, the smaller clams were more active in their movements. This was true for the plantings at the Institute beach and in the tidal pond. In the soft mud bottom area the movements were limited to a few individuals usually not more than three clams and in some months only one clam had moved from the original position.

Since the experimental clams had been disturbed in planting it was suspected this may have influenced their movements although several times native clams were found which had migrated into the experimental plots. Thirty clams, 17 along the Institute beach and 13 in the mud bottom, were located in shallow water by their extended siphons while feeding and a numbered wire placed beside each clam. At the Institute beach one clam traveled a distance of 26 inches in 34 hours and four other clams moved from 6 to 8 inches in three months, March through May. None of the clams in the soft mud bottom showed any change in position. All these clams located in their natural position were found to be large clams from nine to eleven centimeters in length, when they were measured after the three months of observations. Since the studies in the experimental plots have shown that the tendency among large clams is to exhibit but little migration, these results with the undisturbed clams are in accord with the observations in the planted areas.

#### BIBLIOGRAPHY

- BELDING, DAVID L., 1912. *A report upon the Quahaug and Oyster Fisheries of Massachusetts*. Boston: Wright & Potter Printing Company, 134 p.
- HASKIN, HAROLD H., 1949. *Growth Studies on the Quahaug, Venus mercenaria*. National Shellfisheries Association meetings, Old Point Comfort, Va. June, 1949, pp. 67-75.
- KELLOGG, JAMES L., 1903. *Feeding habits and growth of Venus mercenaria*. New York State Museum, Vol. 10, No. 71, pp. 3-28.
- SUMNER, F. B., R. C. OSBURN, and L. J. COLE, 1913. *A Biological Survey of the Waters of Woods Hole and vicinity*. Bull. U. S. Bur. of Fish. Vol. XXXI, Part I. 1911 (1913), pp. 11-441.

---

## Sexual Dimorphism in Weight and Length Relationships of the Bermuda Spiny Lobster

EDWIN P. CREASER

*Biology Department, Hofstra College, Long Island*

DURING THE MONTHS of January and February 1950, the writer and associates\* at the Bermuda Biological Station measured and weighed more than 1,000 spiny lobsters (*Panulirus argus*) retained in pounds in Bermuda. These specimens essentially represent a random sampling of the commercial catch of the

\*The author gratefully acknowledges the assistance of Dr. Louis Hutchins, Mr. Tommy Gleason, Mr. Brunell Spurling and the facilities of the Hofstra College Biology Department in these investigations.

Colony. The following account reports sexual differences in weight-length relationships, carapace-abdomen proportions and length frequencies as determined from this material. For the smaller size groups (below 90 mm. carapace length) specimens collected from other areas have been used. Previous work on similar problems have been presented for Florida and Caribbean specimens by Crawford and De Smidt (1922) and Smith (1948 and 1951).

Measurements were taken of the carapace from the anterior margin between the rostral spines to the posterior border. The length of the abdomen was also recorded. The weight was recorded in pounds and ounces. In the linear measurements the accuracy of the carapace length is within one millimeter. The abdominal length measurement is subject to considerable error as the segments are flexible allowing varied readings. The telson also becomes frayed or torn and the curvature of the abdomen is also a source of error on the ab-

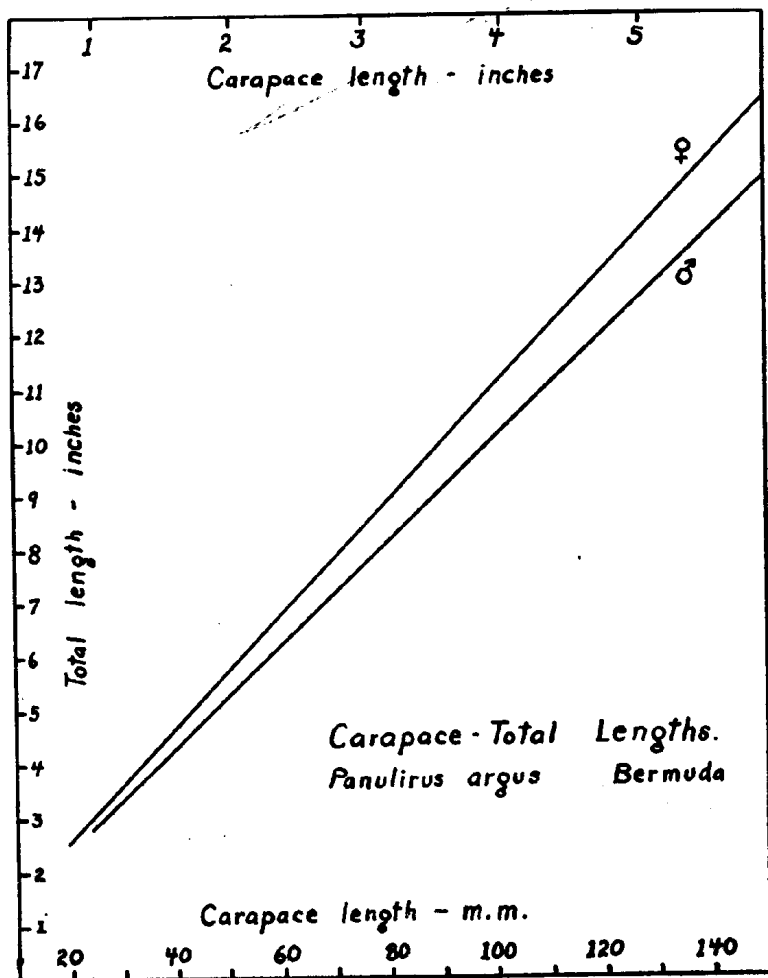


Fig. 1. Total length—carapace length relationship of spiny lobsters in Bermuda, by sexes.

dominal measurement. Weight computations are subject to several sources of error. Appendages very frequently become lost. This is particularly true of the antennae which break off when the lobsters are pulled from the pots.

A notable feature of these studies is the sexual dimorphism with respect to body proportions. In female specimens the tail comprises a greater proportion of the total length than in the males. A female 10 inches long, for example, has a carapace length of about 3½ inches (90 mm.). A male of corresponding total length has a carapace nearly 4 inches long (100 mm.). Similarly, a female with a carapace 4 inches long has an abdomen about 7½ inches long. A male with a carapace 4 inches long has an abdomen 6 inches long. (See Fig. 1 and Fig. 2). The important question remains then as to whether males and females of the same total length are of the same age. A sexual difference exists also in length-weight relationships in the Bermuda spiny lobster. In the graph (Fig. 3) weight differences between the sexes appear in the total length-weight plotting. The sexual difference is most apparent in the larger size ranges.

A five pound female lobster is about 400 mm. (15¾ inches) long while a five pound male would average 370 mm. long. Similarly, two pound female lobsters are about 285 mm. long (11¼ inches), while two pound male lobsters are about 275 mm. long. A six pound female lobster is about 425 mm. long and a six pound male is about 390 mm. long.

The maximum lengths obtained, however, are approximately the same for the two sexes. The largest female examined was 437 mm. long and only three

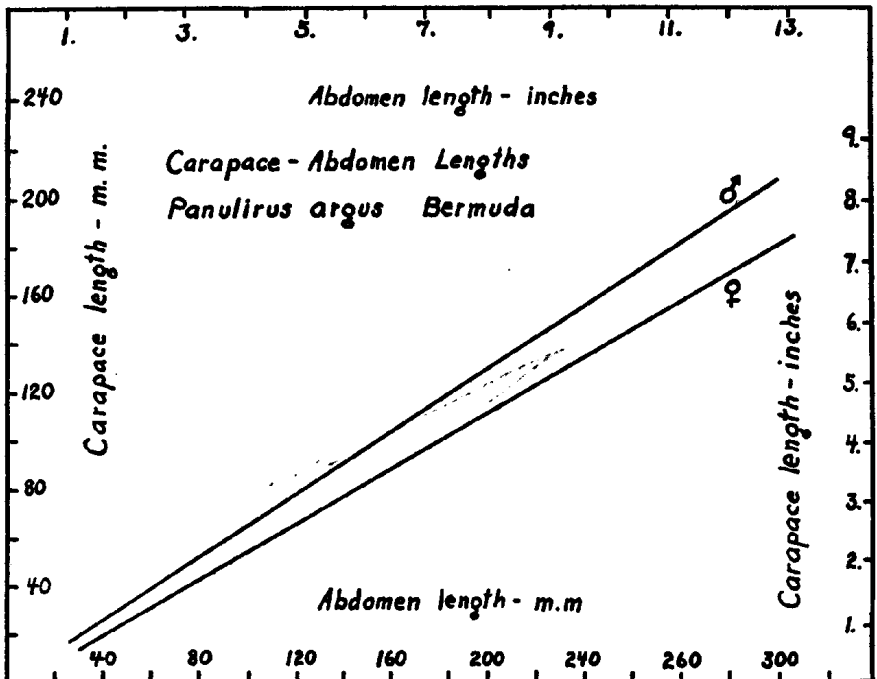


Fig. 2. Carapace length—abdomen length relationship of spiny lobsters in Bermuda, by sexes.

males over that length were observed. The large female weighed 6 pounds and 12 ounces. A male of the same weight was 404 mm. long. The males have a greater carapace girth than the females. In large male individuals the carapace appears inflated. However, this greater visceral mass in large individuals does not completely explain the difference in length-weight relationships as it is evident to some extent in even one pound individuals. Males of this weight average 215 mm. long while the females average 225 mm. It appears that for a given total length male spiny lobsters are heavier, and that this is due in part to a greater weight of the visceral portion.

A length-weight curve based on both sexes has been given by Smith (1948) for Caribbean lobsters. Bermuda results are similar. However, such graphing is probably a composite curve in view of the foregoing results from graphing the sexes independently.

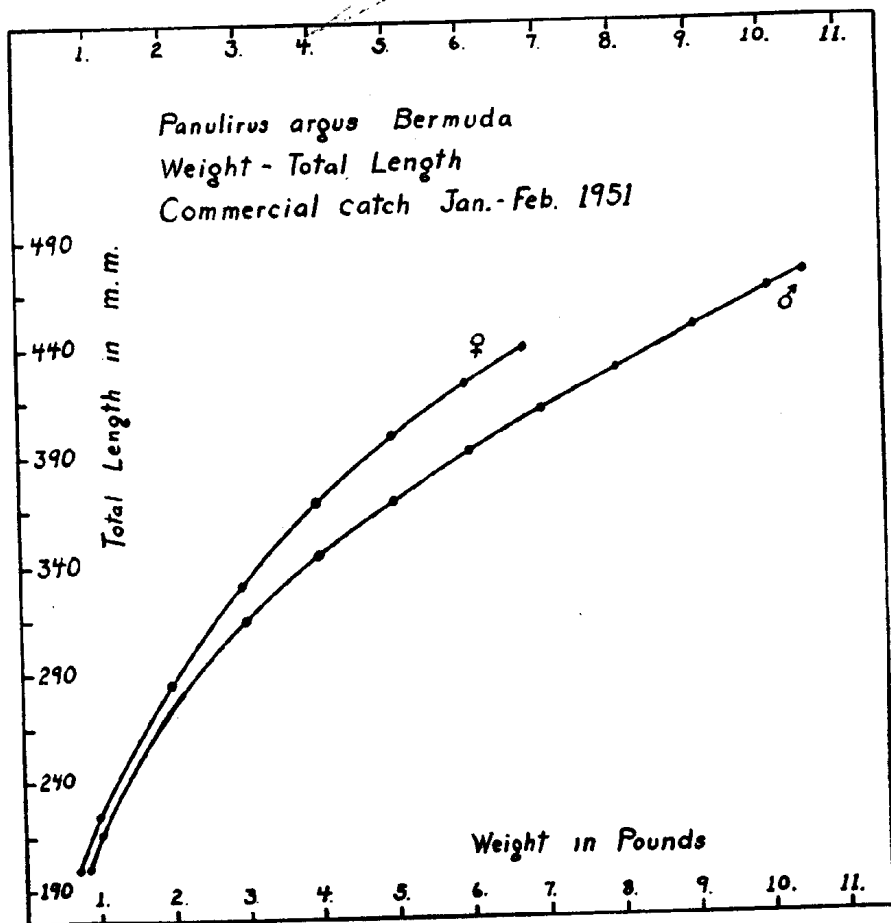


Fig. 3. Weight—total length relationship of spiny lobsters in Bermuda, by sexes.

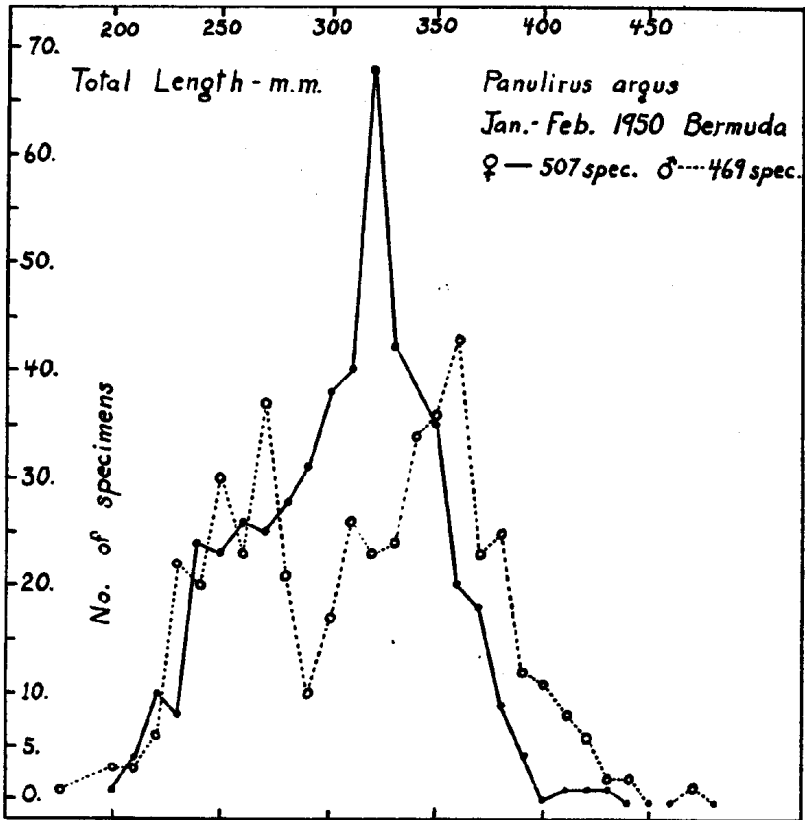


Fig. 4. Length frequency of spiny lobsters in Bermuda, by sexes.

### REFERENCES

- CRAWFORD, D. R. AND DE SMIDT, W. J. 1924. *The Spiny Lobster, Panulirus argus, of southern Florida. Its Natural History and Utilization.* Bull. U. S. Bur. Fish. (1922) 1924, Vol. 38, pp. 281-310.
- CREASER, E. P. AND TRAVIS, D. 1950. *Evidence of a Homing Instinct in the Bermuda Spiny Lobster.* Science, Vol. 112, No. 2902, pp. 169-170.
- CREASER, E. P. 1950. *Repetition of Egg Laying and Number of Eggs of the Bermuda Spiny Lobster.* Proc. Gulf Caribb. Fish. Inst. (1949) 1950, pp. 30-31.
- DAWSON, C. E. 1949. *Florida Crayfish Research.* Proc. Gulf Caribb. Fish. Inst. (1948) 1949, pp. 21-28.
- DAWSON, C. E. AND IDYLL, C. P. 1951. *Investigations of the Florida Spiny Lobster, Panulirus argus (Latreille).* Florida Board Con. Tech. Ser. No. 2. Univ. Miami, 1951.
- MARSHAL NELSON 1948. *The Molting without Growth of Spiny Lobsters, Panulirus argus, Kept in a Live Ca.* Trans. Amer. Fish. Soc. Vol. 75 (1945) Pub. 1948.
- SMITH, F. G. W. 1951. *Caribbean Spiny Lobster Investigations.* Proc. Gulf Caribb. Fish. Inst. 1951, pp. 128-134.
- SMITH, F. G. W. 1948. *The Spiny Lobster Industry of the Caribbean and Florida.* Caribb. Comm. Caribb. Res. Coun. Fish. Ser. No. 3, pp. 1-49.