SOME OBSERVATIONS ON THE KENYA LOBSTER FISHERY

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(Accepted for publication in November, 1979)

For many years crustacea have been exploited along Kenya's coast. The most important crustacea here are prawns (Penaeidae) and the spiny lobsters (Palinuridae). Some shrimps (caridae) and crabs (Portunidae) are landed but these are much less important.

Spiny lobsters (or Kamba wakubwa (swahili)) have been exploited since about 1954 and the fishing pressure gradually increased with growing demand for gourmet food in restaurants and hotels. The crustacea in general and lobsters in particular sell for much higher prices than other fishery products. The attraction this poses to the fishermen, unfortunately, leads to unduly high fishing effort. Spiny lobsters are relatively easily overfished unless exploitation is checked in order to keep it in pace with resource abundance. It was considered necessary to investigate the possible occurrence of such overfishing and to advise on its avoidance. I therefore decided to examine the catch landed by the commercial fishermen right at the landing sites. The main fishing groups for lobsters are the coral reefs that fringe most of Kenya's coastline. Some lobsters are also caught among seaweeds and rock piles near sand banks. These are areas which are rough and would tangle nets quite easily so most lobstering is still done by goggling and diving. I found use of this method was efficient enough to catch mature lobsters but also to lead to harvest of many immature individuals of inferior commercial value.

In this discussion I consider this overfishing and suggest a lower size limit that I hope would allow females to reproduce before being caught.

METHODS AND MATERIALS

Samples of spiny lobsters in the commercial catch were examined from 1975 to 1978. Trips were taken to the major landing stations for this purpose (see Figure 1). Special attention was paid to centres in Mombasa town and the all important Lamu-Manda-Pate archipelago in the north.

Carapace lengths of all lobsters in the samples were measured while the lobsters were fresh (measurements were taken to the nearest millimetre). Female lobsters were examined for sexual maturity. This was based on the condition of the gonads, presence of eggs (berry) and/or spermatophoric mass.

Subsamples of the most important species namely *Panulirus ornatus*, were taken. These subsamples were "tailed" and the "tails" weighed (to the nearest gram) in order to obtain the carapace length: "tail" weight relationship. This was calculated using the linear regression method (Figure 5). This is because it is the "tail" (or abdomen) which is important as a source of meat. It is the females in these subsamples which were examined for gonad condition after "tailing".

Condition of the exoskeleton was noted in the case of lobsters which were found with other than the usual hard shell (soft exoskeleton being considered an indication of active or recent moulting). The individuals in most have a high water content in their flesh and consequently poor meat quality. These require protection against fishing until the exoskeleton has hardened and meat quality improved. Wherever possible the nature of the habitat was also noted.

RESULTS AND DISCUSSION

Spiny lobsters (Palinuridae) are landed at many stations along the Kenya Coast (Figure 1). The most important fishing grounds are in the north around the islands of Lamu, Manda, Pate and Kiwayu. This is the region rich in fish as well, an area of generally high productivity. Lobster fishing is done by active hunting by skin diving fishermen. This is the same method used in Zanzibar (Hall, 1960; Mutagyera, 1972, 1973, 1975) and other areas further south. East African Palinurid lobsters do not enter traps readily. Although other methods such as the trammel net, have been found effective (Brusher, 1971) active diving remains the main method in use. This is partly because most lobster fishing is done along the reefs. In

Fig. 1. The chief lobster landing stations of the Kenya Coast.

Fig. 2. *Panulirus ornatus* catches.

these areas coral heads make it difficult to work nets due to inevitable tangling.

Lobsters comprising the commercial catch of Kenya were found to belong to the genus *Panulirus*. Important species were found to be *P. ornatus* (Fabricius), *P. longipes* (A. Milne-Edwards), *P. dasypus* (A. Milne-Edwards), *P. versicolor* (Latreille), *P. homarus* (Linnaeus) and *P. penicillatus* (Oliver). *P. ornatus* comprised the bulk of the catch (usually over 80 percent and often 100 percent of the landings) (Figure 2). The other species follow each other in importance in roughly the above order. The order was found to change gradually northwards with *P. dasypus* and *P. homarus* replacing *P. longipes* at Kizingitini. *P. penicillatus* is generally uncommon in all areas. Only two specimens of this species were seen during the study. This composition is similar to that of Zanzibar insofar as the importance of *P. Ornatus* goes (Mutagyera, 1975). *P. homarus* and *P.*

dasypus are rare in Zanzibar however (Mutagyera, 1975). As *P. ornatus* is so very important, considerations in this discussion are particularly relevant to this species.

Carapace length frequency distributions are shown in Figure 3 for *P. ornatus* females and Figure 4 for *P. ornatus* males. The mean carapace length for *P. 55.1* of the female catch. 42.5 percent of the *ornatus* females was 74.5 mm and 71.1 mm for males. Corresponding lengths for *P. versicolor* were 65.0 mm and 64.0 mm. For *P. longipes* these were 66.6 mm and 74.3 mm. *P. ornatus* females which lay below the mean comprized *P. ornatus* males were also below the mean for males. Mean carapace length of "berried" *P. ornatus* females was 98.9 mm with none below 80 mm. This compares closely to the situation observed in Zanzibar (Mutagyera, 1975). 88.6 percent of all *P. ornatus* females landed were found to be below this size. The smallest

Fig. 3. Female *Panulirus ornatus*. *ornatus* carapace length frequency distribution.

Fig. 4. Male *Panulirus oratus* carapace length frequency distribution.

female was found to measure 35 mm in carapace length and the smallest male 25 mm.

In a lobster, the important part, as far as meat recovery is concerned, is the abdomen or "tail". A sample of *P. ornatus* abdomens were weighed and correlated with the respective carapace lengths by linear regression. The regression relationships were to be as follows:

For *P. ornatus* females $y = -764.7 + 12.09x$

P. ornatus males $y = -586.6 + 9.80x$

Where x is the carapace length in millimeters and y is the "tail" or abdominal weight in grams. These relationships are also represented in Figure 5.

From the carapace length "tail" weight relationship a *P. ornatus* female of mean carapace length of 74.5 mm would yield 136.0 g of recoverable meat. A male of carapace length of 71.1 mm (the mean for the catch examined) would yield 110.0 g of recoverable meat. With a high proportion of *P. ornatus* females in the catch (88.6 percent) being smaller than the mean, it is considered that overfishing is evident. This was found to be particularly true in the Kizingitini area. This is an area of shallow banks around Pate Island where young fishermen catch the lobsters relatively easily. Meat recoverable from these small lobsters is only a small amount and of little commercial value. For conservation of this resource, it is suggested that a lower size limit of 90 mm carapace length be adopted. This would include 30.5 percent of the *P. ornatus* females and 34 percent of the *P. ornatus* lobsters currently in the commercial catch. This size limit is intended to give the females a chance to have bred. A *P. ornatus* female of this size would be expected to yield 323.4 g of recoverable meat. A *P. ornatus* male would yield 295.4 g of meat.

The mean carapace length of *P. longipes* females found in "berry" was 65.9 mm. With the overall mean of *P. longipes* females at 66.6 mm, it was considered that *P. longipes* was not being overexploited for small females. This calculation was not done for the other species as the numbers of females was small.

Breeding, as evidenced by "berried" females and those found with a spermatophoric mass intact, were found in the catch throughout the year. There is however a peak from February through June. This is similar to the breeding

season of lobsters in Zanzibar waters (Mutagyer, 1975). This is the time when water temperature is highest (average temperatures October 25.6°C, December 28.0°C, March 29.1°C) (Newell, 1957).

CONCLUSIONS AND SUGGESTIONS

- (i) Commercial lobsters of Kenya belong to the family Palinuridae (genus *Panulirus*). The important species are *P. ornatus* (Fabricius) *P. longipes* (A. Milne-Edwards) *P. dasypus* (A. Milne-Edwards) *P. versicolor* Latreille. *P. homarus* (Linnaeus) and *P. penicillatus* (oliver) are much less important. Only two *P. penicillatus* were found during the investigation period. The order of importance changes in a northward direction. *P. versicolor* and *P. longipes* which are very important in the South around Zanzibar (Mutagyer, 1975) and Dar es Salaam (Bwathondi, pers. comm.) are gradually overtaken towards Kiwayu and Kizingitini by *P. dasypus* with *P. versicolor* almost disappearing from the catch. *P. ornatus* constitutes over 80 percent of the catch in all areas.
- (ii) The mean carapace length of *P. ornatus* is well below the mean carapace length of the sexually mature females. Overfishing is therefore considered to exist especially in the shallow grounds around Kizingitini in the north where individuals of carapace length as short as 42 mm were found in the catch. Regulation is considered advisable, hence a lower size limit of 90 mm carapace length is suggested.
- (iii) Breeding occurs all year round with a peak season from February through June. This is similar to the breeding season found in Zanzibar (Mutagyer, 1975). This is the season during which the fishermen should watch out for "berried" females to avoid landing them—a step that would let reproduction add to the stocks.

It is the opinion of the writer that the purpose of the size limit be explained to the fishermen. This is because some wondered in which way our work related to their operations. This can be arranged with the Fishermen's Co-operatives through which they market their catch. The fisherman's co-operation is all-important once he is made aware that the limits are in his

Fig. 5. Correlation between "tail" weight and carapace length of *Panulirus ornatus*

continued benefit insofar as they prevent the depletion of "his" resources. It will also be advisable to seek the co-operation of dealers so that they reject undersize lobsters. This would further encourage fishermen to land only mature ones.

When the lobster is in moult (established easily by the softness of the animal's body) it should be returned to the water because its meat at the time is of poor quality due to high water content. These are relatively vulnerable and need protection.

It is also the opinion of the writer that lobstering by diving is a considerably effective method as applied to the stocks. Harpooning should be actively discouraged as the harpooned individuals would die even if they were returned to the water.

SUMMARY

The spiny lobsters (Palinuridae) are among the most important fishery products landed by Kenya fishermen. The chief commercial lobsters all belong to genus *Panulirus*. Species available are *P. ornatus*, *P. versicolor*, *P. dasyopus*, *P. homarus*, *P. longipes* and *P. penicillatus*. The last of these is uncommon. Lobsters from other genera including *Puerulus* (represented by *Puerulus angulatus* Bate in deep water) are landed by trawlermen but these are much less important to the fishery. Fishing is done by skin divers who hand-catch the lobsters thus landing most of them alive. Like other crustacea, the spiny lobster is relatively easily overfished. The purpose of this account is to discuss the issue of possible overfishing for spiny lobsters and to suggest a lower size limit regulation which would exempt immature lobsters from being caught.

The present study found overfishing to occur. This was particularly serious in the northern areas of the coast, around Pate and Kiwayu Islands where lobsters of carapace length shorter than 50 mm were found in the catch studied. The all-important species *Panu-*

litus ornatus (comprising over 80 percent of the catch) was found to mature sexually at a mean carapace length of 98.9 mm. None of the mature females of this species were found under 80 mm carapace length. A lower size limit of 90 mm is suggested. A *P. ornatus* female of this size would be expected to yield 323.4 g of recoverable meat. A *P. ornatus* male would be expected to yield 295.4 g of meat (see carapace length: "tail" weight relationship under results section).

Exemption from being landed is also suggested for berried females as well as all lobsters in moult.

ACKNOWLEDGEMENTS

I wish to thank Mr. Steve Nyambu, Mr. Ed. Kuyah (Kenya Marine Fisheries Research Institute) and Mr. Omari of the Kenya Fisheries Department, Kizingitini for their help with the collection of data.

Gratitude is also due to Mr. Samuel O. Allela, Director of Kenya Marine Fisheries Research Institute, Mombasa for his untiring encouragement throughout the study.

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