

SHRIMP POTENTIAL OF THE EASTERN GULF OF GUINEA

By Alan R. Longhurst*

ABSTRACT

Recent surveys by commercial interests off the Nigerian coast have confirmed earlier research surveys which indicated the presence of two main species of commercially important shrimp in the eastern Gulf of Guinea. Of the two, the large *Penaeus duorarum* occurs mainly offshore in 15-25 fathoms; the smaller *Parapenaeopsis atlantica* occurs in larger numbers closer to the coast in 5-15 fathoms. Neither species penetrate into the cold water below the thermocline, at which depths other but less important species occur. It is shown from a short review of published data that this situation is similar to that which occurs throughout the tropical Gulf of Guinea wherever shallow-water deposits are suitable for shrimp.

INTRODUCTION

Recent explorations by American and Norwegian interests of the shrimp stocks of the Bights of Benin and Biafra have given encouraging results (Anon 1965) and the first commercial shipments have been made to New York City by a Lagos cooperative. These results seem to confirm the earlier suggestions that a shrimp stock of potentially great value exists in the eastern Gulf of Guinea (Longhurst 1961). A review of available information about that resource--mostly in the form of mimeographed reports, difficult of access--seems desirable.

As in other places in tropical West Africa, the fleet of small otter trawlers which has worked for some years out of Lagos (fig.1) has landed small quantities of shrimp incidental to the catch of croaker, drum, grunt, threadfin, catfish, and other species which have made up the major part of the landings. Shrimp landings totaled only 15.9 metric tons in 1961 as compared with total landings of 3,480 tons of fish. Much of the shrimp was sold at very low prices for local consumption, with only a small proportion sold at a good price in the local "supermarket" trade. On many vessels the shrimp landed was simply considered the perquisite of the trawler crews and their friends.

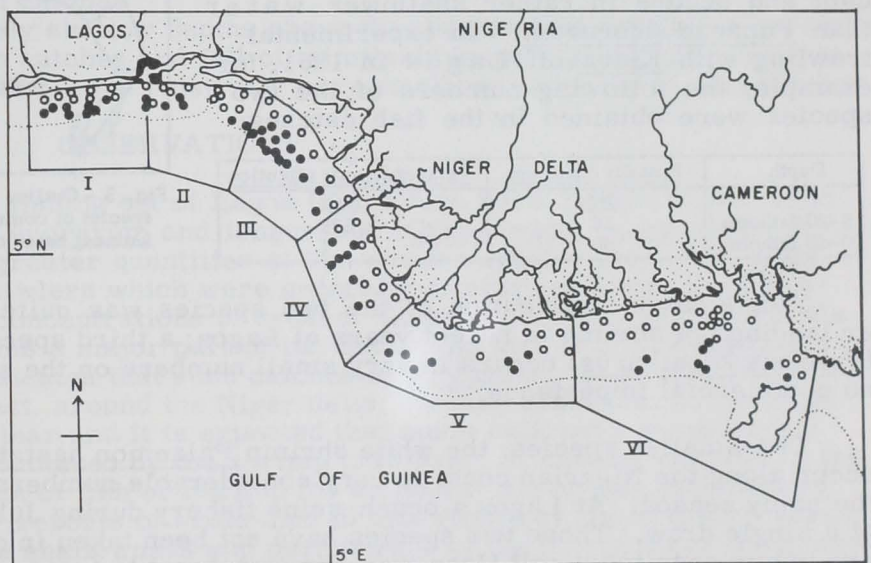


Fig. 1 - The coastline of the eastern Gulf of Guinea from Nigeria to the Cameroons. Shows the locations of trawl hauls made during the 1961-63 surveys by Federal Fisheries Service. The solid circles represent stations at which the sub-thermocline fish fauna was found; the open circles are stations at which the shallow above-thermocline fauna was found. The distribution of commercial shrimp corresponds to the distribution of the latter fauna.

SURVEY OF RESOURCES

Preliminary surveys of the crustacean resources carried out in 1961-63 by the Federal Fisheries Service of Nigeria with the research vessels *Kingfisher* and *Kiara* (fig. 2) showed what species were present and what was their approximate distribution. The commercially important shrimp consisted of two species which inhabited muddy bottoms from close to the beach out to the depth of the thermocline at about 20-25 fathoms, but did not penetrate deeper into the cold water below.

*Formerly Principal Fisheries Research Officer, Federal Fisheries, Service, Nigeria; presently Assistant Research Biologist, Scripps Institution of Oceanography, University of California, San Diego, Calif.



Fig. 2 - The research vessel *Kiara* of the Federal Fisheries Service of Nigeria; an all-steel stern trawler equipped also for oceanographic survey and fisheries biology work. She was built in Great Britain for the Nigerian Government.

These two species (fig. 3) are the pink shrimp, *Penaeus duorarum* (which occurs also in the Gulf of Mexico) and a smaller, redder species, *Parapenaeopsis atlantica*, that has no common name and which is more abundant and occurs in rather shallower water than *Penaeus duorarum*. In experimental trawling with *Kiara* off Lagos in 1961, for example, the following numbers of the two species were obtained in the fish catches:

Depth	<i>Penaeus duorarum</i>	<i>Parapenaeopsis atlantica</i>
	No.	No.
5-20 fathoms	66	2,693
20-40 fathoms	50	1

Such a catch distribution of the two species was quite typical of the incidental trawler landings of shrimp in recent years at Lagos; a third species, the striped or tiger shrimp (*Penaeus kerathurus*) occurs in very small numbers on the same grounds, and by itself is of no commercial importance.

Two smaller species, the white shrimp *Palaemon hastatus* and *Hippolytina hastatoides*, occur along the Nigerian coast in very considerable numbers just outside the surf-zone during the rainy season. At Lagos a beach-seine fishery during July and August may take half a ton at a single draw. Those two species have not been taken in depths workable by a trawler and are in any case too small (less than one inch long) to be of any value to a mechanized fishery, though they are an acceptable item on the indigenous markets.

In deeper water, below the thermocline and below the range of *Penaeus duorarum* and *Parapenaeopsis atlantica*, another species, *Parapenaeus longirostris* (fig. 3), occurs in small numbers probably as far as the continental edge in 100 fathoms.

Along the 100-fathom line and down to 200-300 fathoms there is found, as in the Gulf of Mexico, a completely different fauna of bright red shrimp of the genera *Plesionika*, *Systellaspis*, and *Heterocarpus*, some of which perhaps have a commercial potential if the problem of working shrimp trawls at such depths on the very steep Continental Slope can be solved satisfactorily.

During 1963, the *Kiara* systematically surveyed the demersal fish stocks (table 1), from the Dahomey border to the Cameroons and made about 120 one-hour hauls with a 40-foot otter trawl on the Nigerian continental shelf (fig. 1). During that survey, the occurrence of shrimp in the trawl catches was, of course, noted. The main results (Anon. 1963) showed, as had been

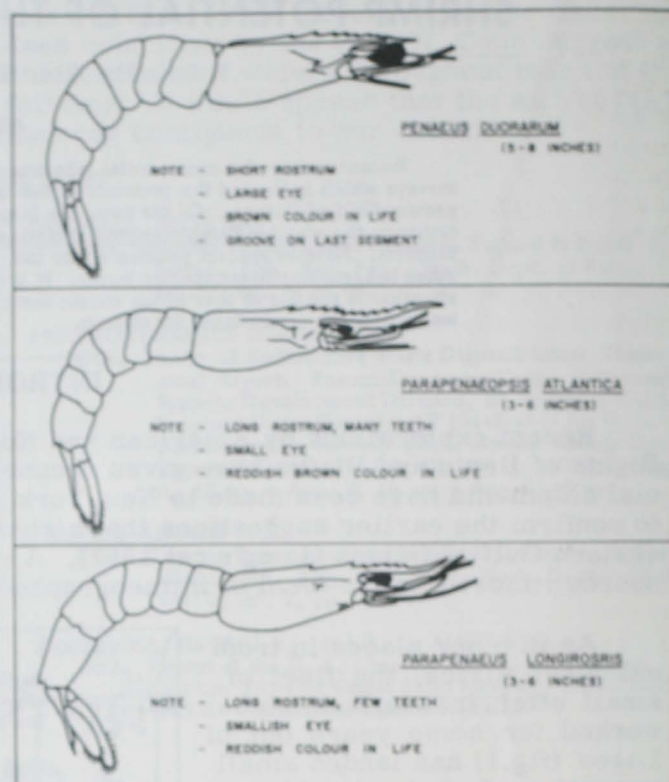


Fig. 3 - Outline drawings and characteristics of the three main species of commercially important shrimp in the eastern Gulf of Guinea; based on a figure in Crosnier 1964.

Fathoms	Areas					
	I	II	III	IV	V	VI
 (Kilograms Per Hour)					
0-10	43.7	60.5	64.7	132.1	77.6	20.2
10-20	116.1	35.7	69.0	50.5	125.2	7.0
20-30	36.6	34.3	211.0	48.6	24.0	1.0
30-40	14.0	73.5	12.3	45.0	16.4	1.0
40-50	-	-	-	35.0	-	1.0
> 50	-	12.3	39.9	-	-	-

expected from earlier surveys elsewhere on the tropical West African coastline (e.g., Postel 1955; Salzen 1958; Longhurst 1963), that two main fish faunas were present: in the tropical surface water above the thermocline, on muddy deposits, a fauna dominated by croaker, spade-fish, threadfin, grunter, catfish, and tonguesole; in colder water below the thermocline a fauna of reddish, rather small fish, dominated by bream, snapper, gurnard, flathead, and small horse mackerel. The greatest concentrations of shrimp were taken in the same hauls as the warm water, muddy deposit fish fauna, and those shrimp were entirely Penaeus duorarum and Parapenaeopsis atlantica along the entire coastline. Only very occasional specimens of Parapenaeus longirostris were taken, always with the deeper fish fauna.

Shrimp were taken in recordable quantities in all areas except in area I (table 2), which was predominantly sandy deposits to the west of Lagos.

The data (which are summarized from detailed station data in Anon. 1963 and Longhurst 1965b) illustrate the main characteristics of the shrimp resources: that catches are higher and shrimp easier to locate to the east of Lagos and are particularly abundant off the great Niger delta; that good catches are virtually restricted to relatively shallow depths above the thermocline and follow the same pattern of abundance as do the fish catches and fall off similarly below the thermocline; that the fish catches in the Bight of Biafra were relatively very small, as were the shrimp catches.

Table 2 - Occurrence of Shrimp by Area
During the 1963 Kiara Survey

Area	Total No. of Stations	No. of Stations with Shrimp	Depth Range ¹ / (Fathoms)	Max. Catch Rate/Hour (Kilograms)
I	20	0	- -	-
III	15	4	18-60 (30)	134
III	21	12	14-80 (21)	103
IV	19	10	14-41 (20)	501
V	17	3	19-40 (20)	86
VI	12	12	7-42 (12)	c. 100

¹/Figure in parentheses = depth of maximum catch.

OBSERVATIONS

The few shrimp trawlers now fishing out of Lagos (Kaufmann, pers. comm.) have found commercial quantities of Penaeus duorarum and tonguesole (Cynoglossus canariensis) at about 20 fathoms and are landing greater quantities of that shrimp species than of P. atlantica. This is unlike the earlier trawlers which were generally fishing shallower depths (around 7-10 fathoms) in search of concentrations of croaker (that fish species follows the distribution of P. atlantica which forms a major part of its diet). The data from the Kiara survey summarized in this article indicates that such catches of P. duorarum will be found to extend at least 250 miles to the east, around the Niger delta; farther eastward, in the Bight of Biafra, the situation is not so clear and it is expected that much relatively unproductive mud in shallow depths will be encountered by the shrimp trawlers. At several stations in the Bight the Kiara had almost no catch of fish or shrimp for an hours' haul under satisfactory conditions, recalling much earlier reports of azoic mud in that region by the research vessel Cape St. Mary, probably due to the shallowness and permanence of the thermocline (Longhurst 1965b). The results (Williams, pers. comm.) of the Guinean Trawling Survey of C.C.T.A., recently completed, do not appear to confirm this poverty of catches in the Bight of Biafra, however, and the actual situation may be more complex than the above statement suggests.

Some further observations about the future fishery may be useful at this time of exploration and development. Oceanographic surveys off Nigeria completed by the Federal Fisheries Service in 1961-62 (Longhurst 1964) showed that there is very little seasonal fluctuation in the depth at which the thermocline occurs during a normal year off that coast and that consequently there is no strong likelihood that the depth at which the main population of Penaeus duorarum occurs will fluctuate during the year; the strong coastal upwelling off Ghana and Ivory Coast which would complicate this situation reaches Nigeria only in exceptional years and in any case hardly extends eastward of Lagos. It is known from Gulf of Mexico studies that Penaeus duorarum requires the presence of estuarine or lagoon systems in which the larvae settle, grow through the juvenile stages, and then as subadults return to the sea after perhaps 6 or 8 months of growth. In Nigeria, Penaeus duorarum juveniles are found in the lagoons behind Lagos, and in the Port Harcourt area (Sivalingham, pers. comm.) while Parapenaeopsis atlantica does not appear to enter those brackish waters -- this suggests that concentrations of adult populations of P. duorarum may be expected off the entrances to such brackish-water areas during

the dry season (November to May) while heavy concentrations of subadults may be expected at the first flushing out of those areas with the onset of the rains in June and July.

CONCLUSIONS

Thus, it seems certain that along much of the Nigerian coastline there exists a resource which, if properly managed, could form a valuable export trade for the country. The recent survey of West African shrimp by Monod (1964) and the recent trawling survey of the Cameroons continental shelf (Crosnier 1964) by the O.R.S.T.O.M.^{1/} vessel Ombango (based in the Congo Republic) have shown that considerable resources of the same two species occur along the tropical West African coast from Senegal to the Congo wherever a muddy continental shelf and an extensive lagoon or estuarine exist.

Penaeus duorarum, which from its size will probably remain the prime commercial shrimp of the Gulf of Guinea, has been shown to occur in depths similar to those in which it is being found off Nigeria in a number of tropical West African localities: off Casamance, where a shrimp fishery is developing at Zinguinchor (Monod 1964); off Sierra Leone to the south of Freetown (Longhurst 1958); off the Ivory Coast, where the Abidjan trawlers land incidental quantities (Monod 1964); in the Cameroon Republic sector of the Bight of Biafra, where Crosnier (1964) shows that Penaeus duorarum is abundant on muddy deposits at 20-30 fathoms; off the Congo mouth and as far south as the Angola border, Rossignol and Repelin (1962) show that the species is abundant between 20 and 25 fathoms, but suggest that during the annual coastal upwelling of cold water over the continental shelf in that area the species is forced to congregate much closer to the coast (as do related Penaeid shrimp in the Gulf of Panama under similar oceanographic conditions).

Unfortunately, the development of these shrimp resources will inevitably result in conflicts of interest with existing fisheries, at least off Nigeria; the fresh fish supplies for Lagos come primarily from the catches of the small fleet of trawlers operating on much the same grounds as the shrimp trawlers will be interested in, and it is to be feared that the activities of an enlarged fleet, working with fine-meshed trawls primarily for shrimp, will rapidly destroy the stock of demersal fish which is already heavily and dangerously exploited. It seems very probable that some form of legislation will be needed to conserve the fish stocks in the future. The canoe fishermen, already hard hit by the existing trawlers, have been seeking in recent years to fish grounds so far unused by the trawlers, and have been fishing to a much greater extent than formerly for the deep Cynoglossus canariensis on the 20-fathoms grounds off Lagos -- and it is just those same grounds which appear to interest the shrimp trawlers most.

LITERATURE CITED

ANNONYMOUS

1965. U. S. Firms Plan African Fishing Ventures. Commercial Fisheries Review, vol. 27, no. 4 (April), pp. 78-79.

CROSNIER, A.

1964. Fonds de Pêche le Long de la République Fédérale du Cameroun (présentation provisoire). Office de la Recherche Scientifique et Technique d'Outre-Mer (mimeographed).

LONGHURST, ALAN R.

1958. An Ecological Survey of the West African Marine Benthos. Fisheries Publications (Colonial Office, London), no. 11, pp. 1-102.
1961. Report on the Fisheries of Nigeria. Government Printer, Lagos (mimeographed), pp. 1-42.
1963. The Bionomics of the Fisheries Resources of the Eastern Tropical Atlantic. Fisheries Publication (Colonial Office, London), no. 20, pp. 1-66.

- 1965a. Bionomics of the Sciaenidae of Tropical West Africa. Journal du Conseil, vol. 29, no. 1, pp. 93-114.

- 1965b. The Fish Resources of the Eastern Gulf of Guinea. Journal du Conseil, vol. 29, no. 3 (in press).

MONOD, Th.

1964. Crévettes et Crabes de la Côte Occidentale d'Afrique. In Conference of Specialists on Crustacea, Zanzibar, April 1964; of the Commission for Technical Cooperation in Africa, Lagos (mimeographed), pp. 1-62.

POSTEL, E.

1955. Facies Bionomique des Côtes de Guinée Française. Rapports et Procès-Verbus (International Council for the Exploration of the Sea), no. 137, pp. 5-6.

ROSSIGNOL, M., and R. REPELIN

1962. La Crévette Brésilienne des Côtes Ouest-Africaines. Etude Bionomique des Populations du Cameroun, du Gabon et du Congo. Cahiers O.R.S.T.O.M., no. 2, pp. 157-174.

SALZEN, EROC A.

1957. A Trawling Survey of the Gold Coast. Journal du Conseil, vol. 23, no. 21, pp. 72-82.

^{1/}French "Office de la Recherche Scientifique et Technique d'Outre-Mer."

