

OBSERVATIONS ON THE LOBSTERS OF MINICOY ATOLL

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ABSTRACT

The rock-lobsters *Panulirus penicillatus*, *P. homarus* and *P. versicolor* occur in Minicoy. *P. versicolor*, now the most common, is possibly a recent arrival as this species has not been previously recorded from here. The spatial distribution, social behaviour, local migration on the reef flats, specific habitat selection and juvenile recruitment of the species in the atoll are discussed.

P. versicolor, though present all over the reefs in the atoll, shows a marked preference to the leeward side. The species is the most common during November-January, when it seems to migrate on to the upper reef flats. The dominant length range then is 160-180 mm. From the length-frequency distribution during this period, it is estimated that the species has a growth rate of about 6 mm TL per month for the first three years, after which there is an apparent retardation of the rate of growth to 4-3 mm per month. It is estimated by extrapolation that *P. versicolor* may take 10 to 11 years to attain a length of 460 mm, the maximum the species is known to reach.

INTRODUCTION

The lobsters of Minicoy Atoll in Lakshdweep (Long. 73°E. Lat. 8° 17' N., Fig. 1) were not hitherto a subject of study in any detail. Prasad and Tampi (1968) and later Nair et al (1973) had reported *Panulirus penicillatus* and subsequently Meiyappan and Kathirvel (1983) had reported *P. homarus*, along with one Slipper lobster *Parribacus antarcticus*, from the atoll. With a view to obtaining information on the composition, distribution and ecology of the lobsters here, the present study was made on the upper and midlittoral reef flats from 1981 to 1984 mostly during November-January, which is the season of their availability. The observations presented herein are based on day-time sampling. For collection of samples no special type of gear was used. The suspected reef rocks and boulders were carefully searched at low tides for dens and, if lobsters were located, the boulders were covered with a cast net and the animals were driven out with a stick to get caught in it and then removed. The smallest juveniles were hand-picked during November-December period at low tides from the surfaces and tiny crevices of the windward groove-and-spur system overgrown with algae (Fig. 2).

COMPOSITION

The following three species of rock lobsters in varying numbers and one Slipper lobster were collected from Minicoy atoll:

The double-spine rock lobster, *Panulirus penicillatus* (Oliver 1791).

The green scalloped rock lobster, *P. homarus* (Linnaeus 1793).

The painted rock lobster, *P. versicolor* (Latreille 1804; Fig. 3).

The Slipper lobster, *Parribacus antarcticus* (Lund 1793).

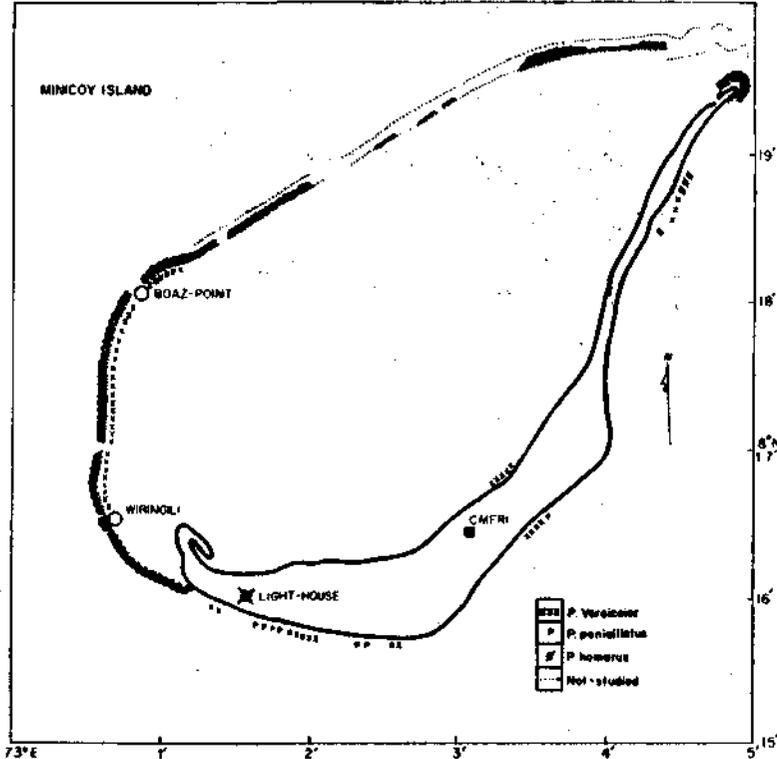


FIG. 1. Map of Minicoy Atoll showing spatial distribution and relative abundance of lobsters.

Panulirus versicolor is the most dominant lobster at present in Minicoy. On a total of 26 field trips, each extending several hours, during 1981 to 84, 104 specimens of lobsters were collected including two specimens of *P. homarus* reported to have been brought from Kodi Point, the northern tip of the atoll. On a percentage basis, *P. versicolor* constituted 93% of the collection and *P. penicillatus* and *P. homarus* formed 5% and 2% respectively.

The Slipper lobster, *Parribacus antarcticus*, of the family Scyllaridae, formed if at all a very minor element of the lobster population as our collection

included only a single specimen (female) that was caught on a hook from the eastern reef flat. The earlier record of this species by Meiyappan and Kathirvel (1983) was also based on a single specimen. This species is therefore not dealt with in detail in this communication.



FIG. 2. The windward reef flat at the north-eastern side showing the exposed groove-and-spur system. On the spur thick coat of encrusting algae and stunted *Sarcosium* are seen. (a) spur; (b) grooves.

DISTRIBUTION

Minicoy Atoll, a relatively small geographic area widely separated from the mainland of India and from other Lakshadweep atolls, has several ecologically distinct macro- and microhabitats with characteristic faunal and floral assemblage (see Pillai 1971). The distribution and relative abundance of lobsters, too, displayed this general trend.

Our sampling indicated that the pattern of distribution of lobsters was both seasonal and species-specific. *P. versicolor*, which was now the commonest species, (according to Meiyappan and Kathirvel 1983, *P. penicillatus* was the most common species here by late seventies) was distributed both on the leeward and windward reef flats. The species was also met with under boulders at certain places along the lagoon beach. A preponderance of the species was seen from Wringili to Boaz Point during November-January. The first recruitment of the species, as indicated by the smallest juveniles recorded here, was noticed during November-December period probably brought in by the strong current prevalent at the time, showing their stochastic nature. *P. penicillatus* seemed to have some preference to the wave-beaten windward reef flats though they were no less at home on the protected side. This species generally inhabited at the lower

littoral reef-flat boulders where there was greater wave action, and were comparatively more common on the eastern side of the atoll than on the western side. On the specific habitat preference of *P. homarus* little can be said since the specimens we had analysed were not collected by ourselves.

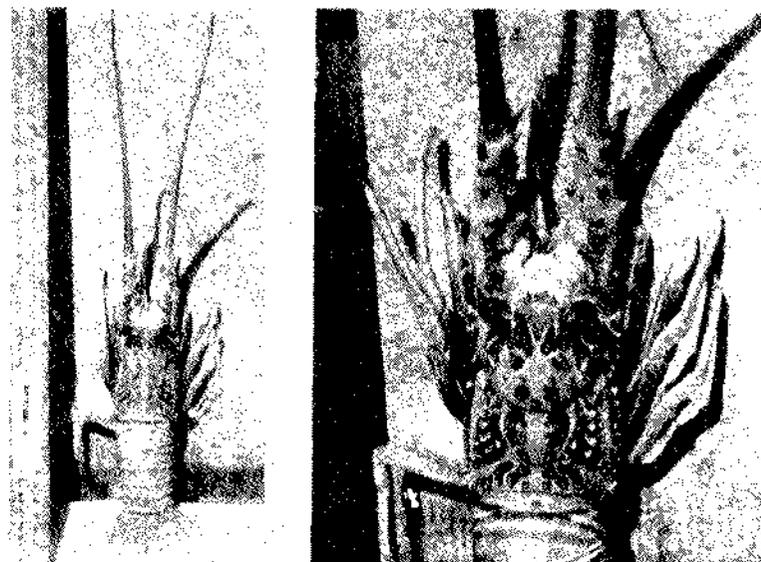


FIG. 3. *Paulinia versicolor* from Minicoy Atoll.

P. versicolor, stated to be characteristic of the fragile coral thickets elsewhere in the Indo-Pacific (George 1974), was rarely observed on the ramose corals of the lagoon. Since we had no opportunity to investigate the reef fronts and deeper zones it was not possible to know the situation in those environments.

HABITAT SELECTION AND SOCIAL BEHAVIOUR

The numerous crevices and interstices of the innumerable boulders (see Fig. 4) scattered on the reef flats provided ideal dens for lobsters. During day time their presence in the dens could be detected without difficulty as their antennae generally protruded out. There seemed to be some correlation between the size of the dens and the number of lobsters in them. *P. versicolor*, based on which most of this report is written, was usually found in singles under smaller boulders of 20-30 cm spread. But, under larger boulders of the mid-littoral reef flats 2 to 4 of them, all large, could be seen in a single den, particularly during November-December. These adults seemed to have migrated onto the flats in association with lunar cycle, probably aided by the tidal movements, for greater numbers were seen in and around the Full moon.

P. versicolor found isolated under smaller upper littoral boulders ranged from 80 to 100 mm in TL. The larger ones of 160 mm TL and above, seen under midlittoral boulders, were in groups probably to mate and breed. The paucity of berried females in the collection indicated that the females after



FIG. 3. The reef flat boulders and dead lagoon *Acropora* thickets. Upper figure shows the upper littoral boulders of the leeward side. Middle figure shows a closer view at low tide of a large boulder at the mid littoral that harboured many lobsters. The lower figure shows a dead thicket of *Acropora* slowly getting buried in lagoon sand.

mating resorted to deeper waters, perhaps to protect the eggs either from the shallow-water predators or from the rapid fluctuations of the physical environment to which the reef flats are prone. In fact only very little information is available on the seasonal and daily migration of lobsters in Minicoy. The available data, however, suggested that during November-December period local vertical migration to and from the mid- and upperlittoral reef flats took place as stated above.

JUVENILE RECRUITMENT

Recruitment of early juveniles to the reef flats took place during late October to early December, i.e., during the N.E. monsoon period, as was evident from the presence of smallest juveniles. This is more or less the time when

settlement of many reef fishes are also taking place (see Pillai et al 1983). The smallest juveniles were first observed on the groove-and-spur system of the windward reef flat at the northeastern side. They ranged from 18 to 21 mm in TL. Of the 16 specimens collected on 8-11-1983, eight were transparent, indicating that they had molted soon after settlement. The settlement site was characterized by heavy encrustation by calcareous algae, seaweeds such as *Turbinaria*, encrusting sponges, sea anemones and holothurians. The upper reef flat and rock pools that were devoid of vegetation and marine animals in the same area were also devoid of juvenile lobsters.

BIOLOGICAL OBSERVATIONS

Length Frequency

Since it was felt that the total length (TL) might give a better measurement of the animal, it was followed instead of carapace length (CL). A ratio of about 1 : 2.8 for CL : TL was observed in *P. versicolor*. Deductions from Thomas (1972) and Nair et al (1981) had also shown more or less a similar ratio respectively in *P. penicillatus* and *P. homarus* and, therefore, this ratio was adopted here for the interpretation of the rate of growth.

The juveniles of *P. versicolor* at the time of recruitment were 18 to 21 mm TL (*vide supra*). During April-May a few specimens of the length range 35 to 45 mm were observed. The samples in November-January (Fig. 5) consisted of different ranges up to 240 mm TL with distinct peaks, which were indicative of the population being consisted of the different age groups. In the percentage analysis, as shown in Fig. 5, however, the smallest juveniles were not taken to consideration. The highest percentage was that of the size range 150-180 mm TL. Although the species has been reported to attain a maximum TL of 460 mm elsewhere, no specimens above 240 mm TL was in our collections, because the species might have colonized the atoll relatively recently, which also explains why the species was not recorded from here by the previous observers.

Age and Growth

The data on which age and growth were derived, though inadequate for a definite conclusion, are plotted in Fig. 6. The earliest juveniles we collected from the reef during November-December with an average TL of 20 mm are assumed to be the first recruits and, therefore, one-year olds, as it has been in general agreement that all panulirid lobsters are first recruited when they are one year old (Kanciruck 1980). On this basis, the few specimens we collected during April-May, about 6 months after settlement, with a TL of 45-55 mm were one-and-half year old. This showed a monthly increase of 5 to 6 mm TL. The next range observed in November was between 80 and 100 mm TL, which represented a stock settled in the previous year during the same season and should be two years old. The range of 150 to 170 mm TL (average 160 mm)

might have been reached at the end of the third year (two years after settlement). This indicates that the animals attained an average monthly growth of 6 mm till the end of the third year, when they reached an average size of

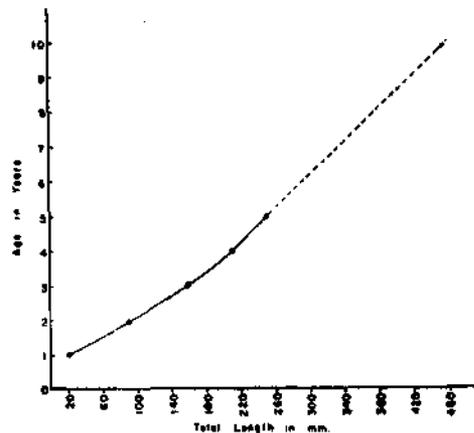


FIG. 5. Length frequency and percentage of *P. versicolor* collected during November-April, 1981-1984. The smallest juveniles at first settlement are not taken to consideration.

about 160 mm TL. The fourth year group was represented by individuals of 200-220 mm TL (average 210 mm). The largest specimens collected of 240 mm TL should be completing the fifth year. This indicated a retardation of growth after the third year to the rate of 3-4 mm per month. As pointed out by Aiken (1980), the retardation might be due to the general tendency prevalent among rock lobsters to increase intermolt stages and decrease rate of growth as age increased. George (1973), based on earlier works, has mentioned that *P. versicolor* reaches a maximum size of 460 mm TL. Extrapolating the above growth rate it is found that it may take 10 to 11 years for the species to attain this size in Minicoy.

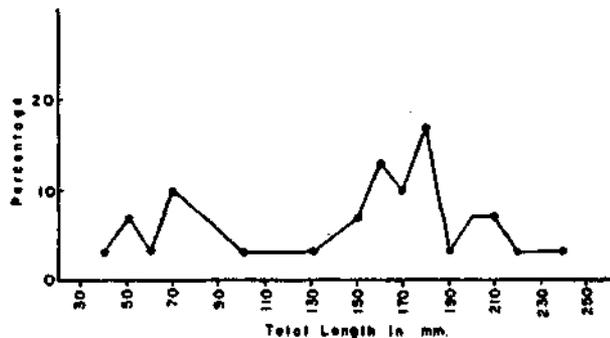


FIG. 6. Total length and age of *P. versicolor* based on natural population from reef flat. (Data on specimens above 240 mm TL not available).

Kuthalingam et al (1980) had shown that *P. versicolor* in controlled conditions registered a monthly rate of growth of 7.8 mm TL in its early stage (25-59 mm TL) (calculated based on the ratio CL: TL = 1 : 2.8). Nair et al (1981) obtained an average monthly rate of growth of 4.06 mm in *P. homarus*, in experiments covering 69 to 553 days on lobsters of the size 120 to 160 mm TL (average for both sexes). Radhakrishnan and Vijayakumaran (1982), on the other hand, got results to show an average monthly increase of 2 to 8 mm (average 6 mm TL) in experimentally reared juveniles of *P. homarus* without eye ablation. We have however not made any attempt to estimate the growth rate separately in females and males. The monthly growth rate estimated based on field observations in the present study was more or less in agreement with the results obtained in the above laboratory experiments.

DISCUSSION

George (1974) had stated that lobsters in general were more common in islands and coasts exposed to strong currents and surf, within which the species showed specificity in habitat selection; for example, *P. penicillatus* inhabited reef areas characterized by surf, algal ridges and groove-and-spur system, whereas *P. versicolor* inhabited sheltered waters and ramose coral thickets of the lagoon. He had the support of Jonklass (1967) from the Maldives. In the light of this suggestion on the habitat preference of *P. penicillatus* and *P. versicolor* a few words become necessary on the particular situation observed at Minicoy. In Minicoy, as stated earlier, *P. versicolor* is dominantly a reef flat dweller. We have not observed it anywhere in the lagoon shoals with ramose or massive corals in spite of the fact that we had been surveying the lagoon intensely for several years in connection with other studies. The only locations where we could see them in the lagoon were among the dead coral boulders piled along the shore near the jetty and under the stones and cement blocks beneath it. Pillai (1983) in a detailed report has pointed out the recent mass mortality of corals in the Minicoy lagoon due to the deleterious effect of sedimentation (Fig. 4c). Whether this fast deteriorating environmental condition alone is the factor that prevents the habitation of *P. versicolor* in lagoon shoals and ramose coral thickets (mostly dead now) in Minicoy remains to be ascertained.

The earlier records of *P. penicillatus* and *P. homarus* from Minicoy appear to be based on specimens collected from the windward reefs. The two specimens of *P. homarus* we have studied are also from the windward northern reef. Judging from the dead skeletons and live specimens of *P. penicillatus* we have obtained from the eastern side of the atoll, it is possible that these two species are comparatively more common on the surf-beaten windward side of the atoll than on the relatively calm western leeward side. True, *P. penicillatus* occurs along with *P. versicolor* in leeward side also. However, adult specimens

of *P. versicolor* are very common at the southern half of the atoll at leeward side, but they are rarely seen on the windward side, though the first settlement of the juveniles most probably takes place there.

Variations in the intensity of the lobster population, coupled with species diversity, even within a limited geographic area, have been demonstrated in the past. Nair et al (1973) observed a notable difference in the percentage occurrence of *P. ornatus* and *P. homarus* between the southern and northern sides of the small islands in Gulf of Mannar near Mandapam. Jonklass (1975) observed a preponderance of *P. japonicus* over *P. penicillatus* and *P. versicolor* in the Maldives. He has also mentioned that *P. versicolor* is diurnal in habit while the other two are nocturnal.

The comparative abundance of lobsters on the lagoon reef (leeward) of Minicoy may be due to: (1) behavioural adaptations of various species of lobsters, (2) morphological diversity of reef flats; and (3) biological characteristics especially the availability of food in the environment. The behavioural adaptations include the preference to calm or surf-beaten habitat, diurnal or nocturnal habit and local vertical migration are correlated with breeding or social behaviour such as crowding. As is pointed out by earlier workers, *P. versicolor* may be primarily a lagoon form preferring calm waters and ramose coral thickets. Their paucity in Minicoy lagoon may be due to the peculiar situation prevailing. Most of the corals are dead and are slowly getting buried in sand and, as such, crevices and interspaces for dens are becoming scarce. The death of corals have also caused the dwindling of the reef-associated sedentary animals, which may restrict the food resources. Under these circumstances, *P. versicolor* may naturally have opted for the next best available habitat, the protected reef flat or out of it where there is a profusion of ramose corals in deeper waters. Our samplings were done during day time, when *P. versicolor* is stated to be active (Jonklas 1976), which may partly account for their greater numbers since they migrate upwards on the reef flat during day time. Fluctuations of populations at the same place can occur either due to seasonal migration or nomadism (Balasubramaniam et al 1960, Herrnkind 1980), which may be true in Minicoy. The recruitment of *P. versicolor* in Minicoy is mostly taking place at the northeastern side, from where they have to make a slow south and southwest movement as they grow if they are to get concentrated between Wiringili and Boaz Point, as it was the case. A seasonal upward migration of the adults on the reef flat takes place during November-January period. This may be a mating migration since larger ones are always found in groups.

The variations in the physiographic and morphological characteristics of the windward and leeward reef flats may also account partly for the relative abundance of lobsters on the leeward side. On the eastern windward side, where heavy waves often break, there are few loose boulders. What few are exposed

at low tides are mostly cemented reef rocks with little interspaces or crevices. Comparingly, the western leeward side has the upper and midlittoral reef flats strewn with loose boulders that offer plenty of living space for many kinds of animals including lobsters.

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