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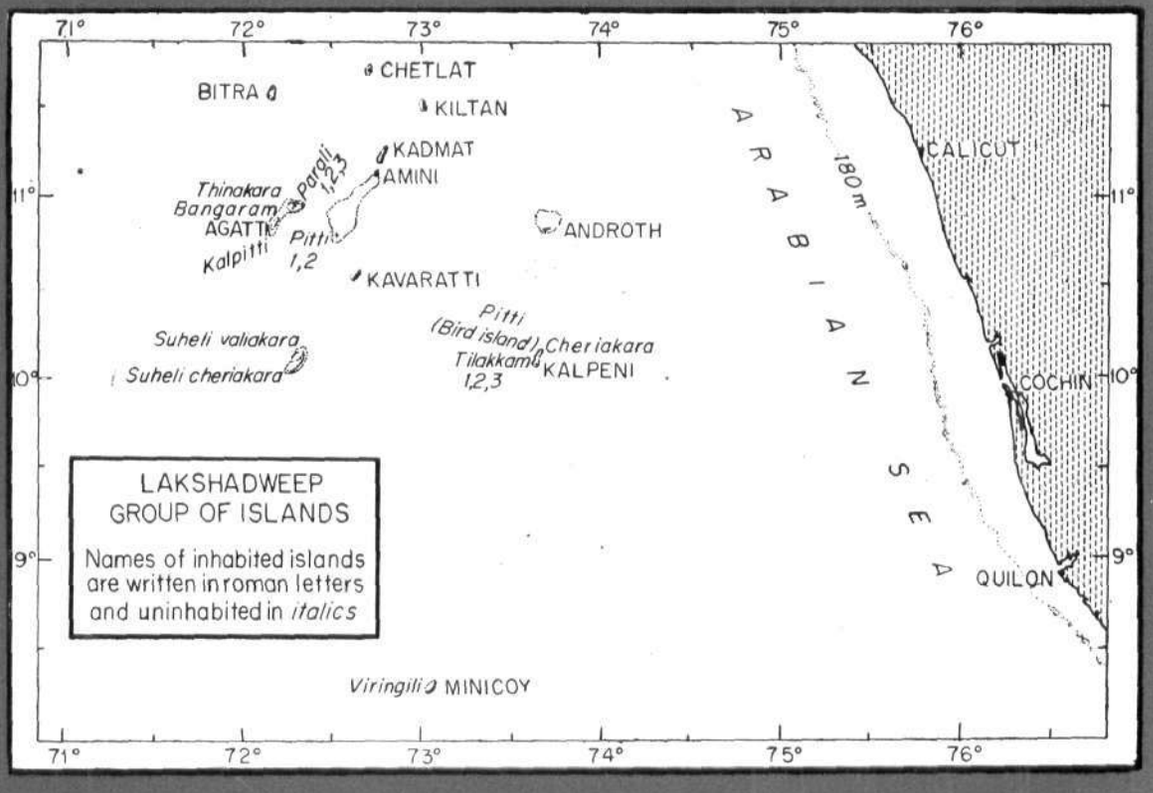

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ECOLOGICAL STRESS IN MINICOY LAGOON AND IT'S IMPACT ON TUNA LIVE-BAITS

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Introduction

Pioneering works on the faunal composition and exploitation of tuna live-baits of Lakshadweep, especially of Minicoy Island are those of Jones (1958, 1960a, 1960b, 1964a) Jones and Kumaran (1980) and Thomas (1964b). subsequently Pillai (1971a, 1971b, 1983 and 1985) and Nair and Pillai (1972) have described the microhabitats, distribution of corals, ecological stress and primary production in the Minicoy lagoon, a major habitat for live-baits. Though, Jones (1964) listed 45 species of reef associated fishes divided among 18 families from Lakshadweep which are used as live-baits, only about 10 species are of common use (Thomas, 1964b). Inspite of all these earlier works, many aspects of the ecology and biology of reef fishes from Lakshadweep remained unknown. In the present communication the authors make an attempt to throw more light on the above aspects especially on the impact of ecological stress in the Minicoy Lagoon on the tuna live-baits.

Major reef fish habitats in Minicoy

The major habitats for reef fishes in Minicoy include the reef flat, reef front, inner lagoon reef, lagoon shoals and sand flat. The reef fronts of Minicoy or any other atoll of Lakshadweep provide rich ground for both small and large fishes. The littoral reef flats have been recently studied for their fin fish and shell fish resources (Pillai *et al.*, 1984). The microhabitats on both windward and leeward reef flats include dead coral boulders with or without algal coating and live corals. The upper and midlittoral reef flats present significant variation in the structure and composition of resident fishes. The rock pools form the primary settling sites for many reef fishes during November to April. Both herbivorous and carnivorous fishes make diurnal migration over the reef flat along with the tide. These fishes move to the upper littoral flats at high tide and feed on the rich source of food items and return along with the receding tide. The live corals on the reef flats also harbour many resident reef fishes as in the lagoon. A relative paucity of fish fauna on the windward reef flat was also observed during the present observation. Pillai *et al.*, 1984 explained this as due to relative absence of living habitats by way of dens and crevices at the protected side.

The lagoon possesses two ecologically distinct habitats, viz, coral shoals and sand flats (Pillai, 1971). The former provides habitat for many important live-baits belonging to the families Pomacentridae and Apogonidae and form the traditional site of live-bait fishery. The southern half of the lagoon has a vast sand flat with smaller shoals and live coral isolate. The arborescent corals of the genus *Acropora* once dominated in this area. Except for *Spratelloides* the area is not important as a site of fishery.

Live-baits and their microhabitats in lagoon

The lagoon fishes in general can be classified into either resident or migrants. Those that are found on coral heads are resident, while those that sporadically appear in the lagoon waters are migrants.

Fig. 1. A Reef flat in Minicoy. Beneath the waves there is a profusion of fish life.

Live coral associates

The association between coral reef fishes and corals is more or less specific. The growth-form of corals

seems to be a controlling factor. Inherent and physiological factors may also be involved. Only important live-baits and their specific habitats are considered herein:

a) **Corymbose, pedicellate corals with reticulately coalescent branches**

The common species with this growth-form belong to the genus *Acropora* and include *A. corymbosa, A. hyacinthus A. efflorescens* and *A. granulosa.* The following are the common live-baits found in these corals.

Family: Apogonidae

The genera *Apogon, Pristiapogon* and *Archamia* constitute the largely exploited fishes. Yet another species that is found along with them is *Spratelloides japonicus.*

Archamia fucata (Local name 'Rybodi'): The species is found either hiding among the coral colonies or swimming close to them. Probably their settlement on corals along with other apogonids takes place soon after the monsoon. Exploited stock during January to April include post-larvae and juveniles.

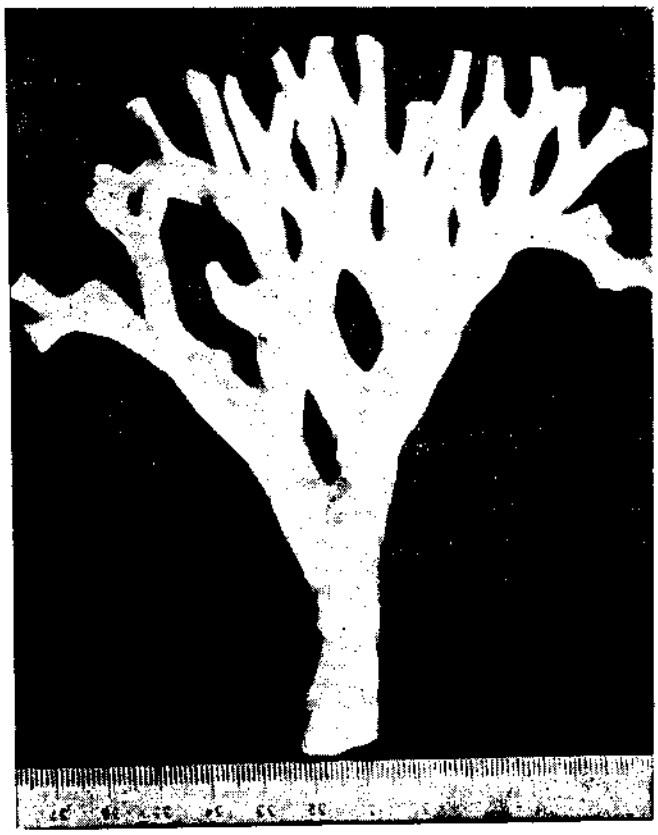

Fig. 2. Millipora – a hydroid coral.

Apogon sangiensis and *A. leptacanthus* (Local name: 'Rybodi'): Though both the species are found along with *Archemia,* of recent these are found on live massive corals also. Whether this is an adaptation in response to deteriorating primary habitat is yet to be assertained. It is known that for example, *Dascyllus aruanus,* may

Fig. 3. *Heliopora caerulea* a very dominant coral.

opt for dead corals in the absence of live corals. Both the species are planktivorous and exploited stock constitutes juveniles.

Pristiapogon fraenatus (Local name 'Murakibodi') and *P. synderi* (Local name: 'Bodu bodi'): The habit and habitat of these two species is almost similar to that of *Apogon* spp.

b) **Ramose arborescent and flabellate corals**

The dominant species of corals with the above growthform include, *Acropora formosa, A. teres, A. aspera, A. palifera, A. humilis, Stylophora pistillata, Pocillopora damicornis, Porites andrewsi, P. minicolensis* and *Heliopora caerulea.* The blue coral *H. caerulea* is essentially an inner lagoon reef form while the rest thrive in the south and central part of the atoll often forming large thickets. The important associated fishes of this habitat belong to the family pomacentridae.

Family: Pomacentridae

Chromis caeruleus (Local name 'Nilamahi') and *Dascyllus aruanus* lead a co-existing life on ramose arborescent corals (Pillai *et al.*, in press). While the former serve a steady supply of live-baits in Minicoy, the latter is not of any value. *Pomacentrus pavo* is yet another species found along with *C. caeruleus* especially in the central part of the lagoon. This is also fished along with *C. caeruleus*, a strictly resident species with a pelagic post-larval life.

c) The surface waters of the lagoon

A few species of small fishes enter the lagoon at sporadic intervals as juveniles and are caught if and when available. None the less, they form a major component of the live-baits of Lakshadweep though their appearance is unpredictable and there is a lot of inconsistence in their recruitment to the fishery. Often their massive recruitment is coupled with a bumper catch of tunas. It is likely that tunas follow this group of fishes along with the oceanic current. Though tunas never enter the lagoon, the live-baits make their way into the calm lagoon waters along with the water current. The following are the major species listed under this category.

Family: Emmelichthyidae

Dipterygonotus leucogrammicus (Local name : 'Dandimugurang') is the most common species of this family. Some observations on the habit and habitat of this species were already made by Thomas (1964b.) and Jones and Kumaran (1980). This fish enter the lagoon between December and April. The first recruits are juveniles or post larvae. The adult habitat around Lakshadweep needs further investigation.

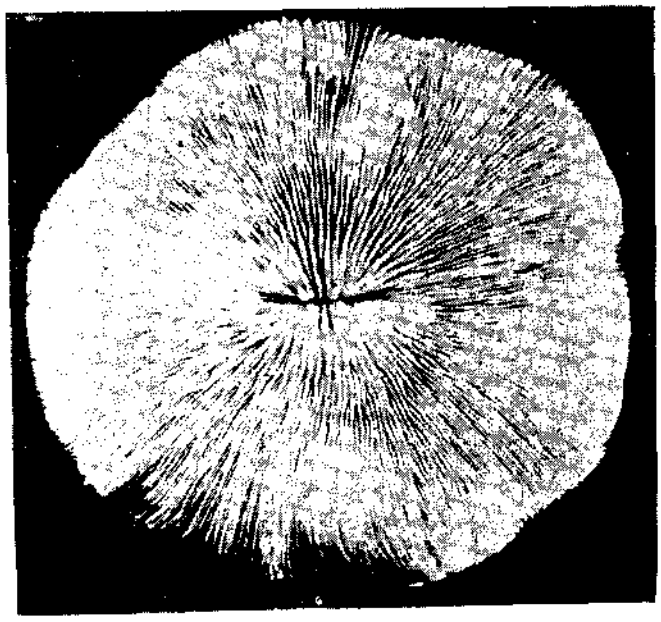

Fig. 4. *Fungia fungites*, a solitary coral-oral view

Family: Caesiodidae

Caesio chrysozona and *C. caerulaureus* (Local name: 'Furrua') are among the important caesiodids that enter the lagoon as juveniles and fished as live-baits.

Family: Pomacentridae

While *Chromis caeruleus* of this family is a strictly resident form, *Lepidozygus tapeinosoma* (Local name: 'Bureki') is almost a pelagic migrant soon after the monsoon season. There was a paucity of this species at Minicoy during 1981–'84 period.

The statement in early literature that most of these pelagic forms disappear from the lagoon after April needs confirmation. Generally, the lagoon remains choppy after May, and till end of November there is no fishing activity in the lagoon. Hitherto no effort has been made to survey the lagoon all through the year. Madan Mohan was able to collect some fully matured spratelloids from the near shore area during the monsoon which indicates that these pelagic forms of live-baits also may not altogether disappear from the lagoon soon after the tuna season or at the onset of monsoon.

d) Sand flat - lagoon bottom

Spratelloides delicatulus (Local name: 'Hondeli') of the family Dussumieriidae lives on the sandy bottom of the lagoon. Some times they swim to the surface and when scared make gliding movements in the air. The species is a planktivorous one and form an important source of live-bait. There is a preponderance of this species near Boaz Point (Ragandi Is.) and Viringili Island.

Ecological stress and its impact on live-baits

The lagoon environment of Minicoy has undergone visible changes in the last decade due to both natural and artificial factors (Pillai, 1983, 1985). The current prevailing feeling among the fishermen is that the live-baits are on a declining trend and the available stock is insufficient to meet the local demand. There are several factors responsible for this crisis of which the visible changes brought about in the environment are of prime importance.

Environmental deterioration

At present the lagoon of Minicoy is a modified ecosystem compared to that of a decade ago. Corals

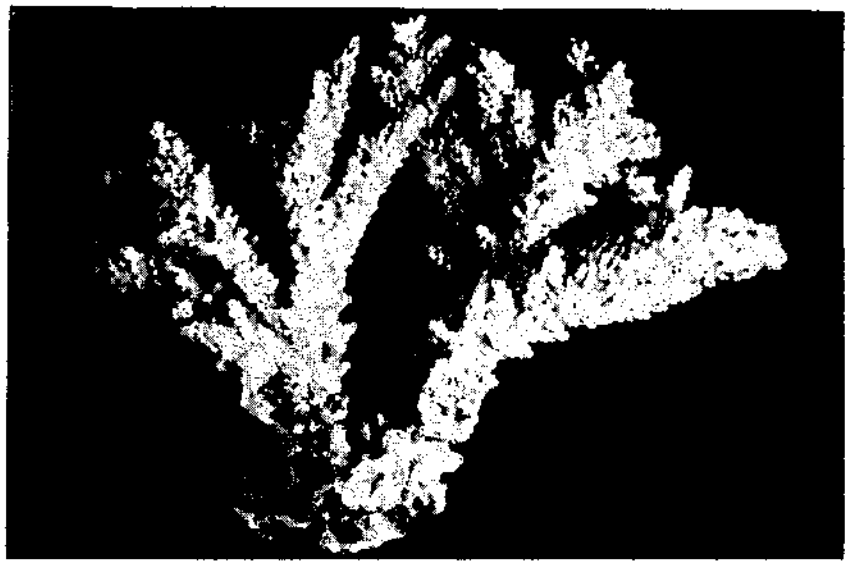

Fig. 5. *Acropora abrotanoides* an arborescent coral predominant in the lagoon.

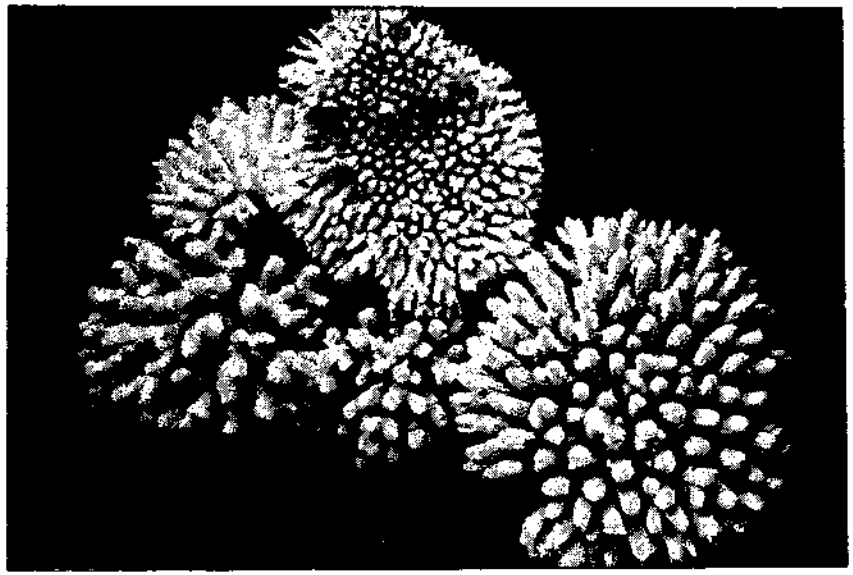

Fig. 6. A few common *Acropora* spp. corals from Lakshadweep that form the microhabitat for the resident reef fishes including the live-baits.

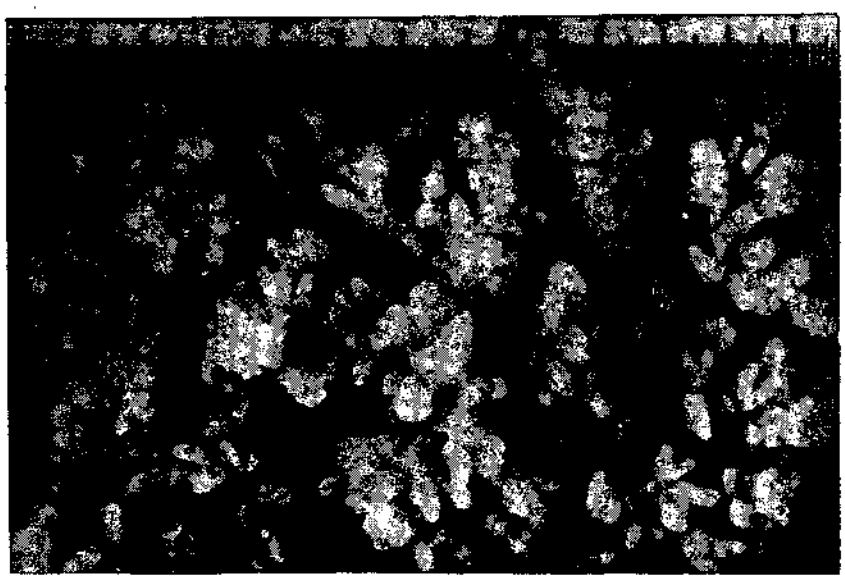

Fig. 7. *Pocillopora damicornis* – the most common Indo-Pacific coral that thrives both on reef flat and lagoon.

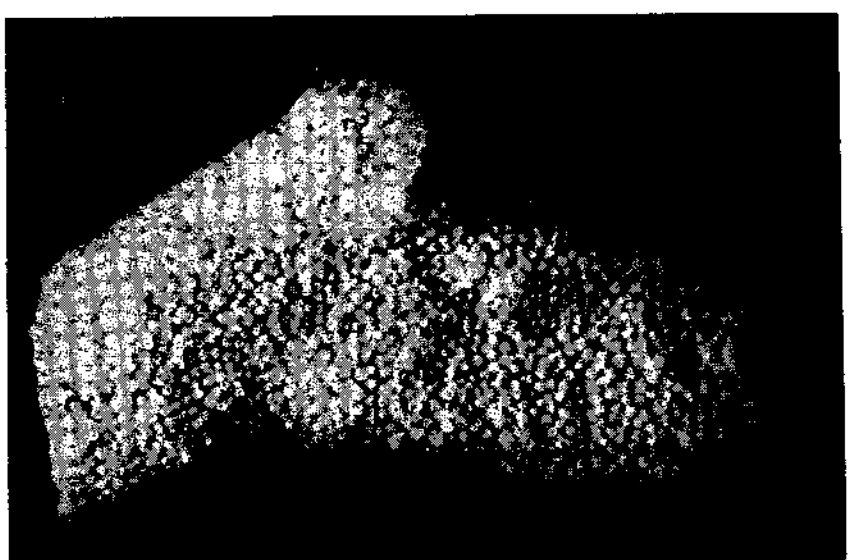

Fig. 8. *Acropora palifera.* Once this species dominated in the lagoon but now mostly dead due to siltation.

of all genera and species have suffered mass mortality during the last five or six years (Pillai, 1983). The large number of *Acropora* thickets that formed the habitat of many reef fishes including live-baits are all dead and are getting disintegrated. The lagoon bottom is strewn with dead branches and is slowly getting covered by sand. The major reason for this mass mortality of corals is undoubtedly excessive siltation. The blasting

Fig. 9. *Acanthaster planci* — a star fish which feeds on the polyps of corals and destroys them (Photo courtesy: D. B. James)

of the reef and lagoon shoals as well as dredging the lagoon to deepen the boat channel have caused stirring up of sand and its transportation towards the southern half of the lagoon from the north along with the water current. At the southern half of the lagoon at least there is fresh deposit of 50 cm thick sand as estimated from the height of *Acropora palifera* colonies measured in 1968 which are at present buried intact.

Sea erosion is rampant and the blasting of the reef and deepening of the lagoon bottom at the northern entrance has certainly permitted greater influx of water into the lagoon. A greater degree of accretion is evident near the Light House area. The lagoon at the southern half is getting filled up rapidly. The dead ramose corals are efficient sediment trappers which aid the filling up of the lagoon. Small polyped corals like *Acropora* are very sensitive to the smothering effect of sediments and are easily killed (Pillai, 1971b).

In 1980, *Acanthaster planci* was also recorded in fair numbers among the *Acropora* thickets and several patches of freshly killed corals were observed (Murty *et al.*, 1980). The mass mortality of corals has adversely affected the resident ichthyofauna. The dominant resident species such as *Chromis caeruleus, Pomacentrus pavo* and *Dascyllus aruanus* have deplorably dwindled in the lagoon and the present lagoon looks depopulated when compared to a decade ago.

Habitats and recruitment of pelagic species

Fluctuation in the rate of recruitment of reef fishes to specific habitat is an established phenomenon. The settlement of fish larvae on their specific microhabitat depends on many factors such as breeding season, lunar periodicity in spawning, survival of larvae, species composition of the adult fish assemblage, force and direction of water current and natural tendency for precise microhabitat selection of the species (Sale *et al.*, 1984). At least some of these factors along with the conditions of the habitat are in operation in the Minicoy Atoll.

Except for a single known species of reef fish viz. *Acanthochromis polyacanthus* all reef fishes are believed to have a pelagic larval life (Sale, 1980). The pelagic life varies from two weeks to three months depending on the species and at the end of the pelagic phase they should settle on the specific microhabitat. Some species may be able to prolong their post larval pelagic life and undergo sexual maturity as in the case of *Ctenochaetus strigosus* when failed to get foothold on the reef (Pillai *et al.*, 1984b)

In resident species such as *Chromis caeruleus, Dascyllus aruanus, Apogon* and *Pristiapogon* spp. the major ecological constraint is the dwindling of living space due to mass mortality of corals (Pillai, 1983). Even if the larvae of these resident species enter the lagoon, their precise microhabitat requirement is a major controlling factor in their settlement and growth. Sale *et al.* (1984) have recently shown how some of the pomacentrids settle more profusely on wider live coral coverage than on area with sparse coral coverage. This indicates that intensity of coral growth is a factor that determines the settlement of coral reef fishes including tuna live-baits in many cases.