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Studies on the Feeding Habits of Red Snappers,  
*Lutjanus Sanguineus* and *L. Sebae*

by  
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Abstract

Examination of stomach contents were carried out on 276 *Lutjanus sanguineus* and 129 *L. sebae* in an attempt to study the feeding habits of the two commercially important demersal fishes occurring in the southern South China Sea.

The studies show that although their feeding habits are rather flexible, their diet consists mainly of fishes, crustaceans (especially crabs and stomatopods) and cephalopod molluscs. The result of the present study is in general agreement with the diet of other *Lutjanus* species from different areas as reported by some workers. However, the data presented here are rather different from the diet of *L. sanguineus* in the Tonkin Bay (Vien, 1968)

The feeding habits of both species are well suited for a demersal life, and they occupy the highest niche in the bottom ichthyofauna in the South China Sea.

The reaction between the regurgitation rate and the depth of the fishing ground as well as the regression of stomach length against the total length of fish were also determined.

1. INTRODUCTION

Red snappers hold a very important position in the trawl fisheries particularly in the South China Sea, usually occupying more than 20% of the total catch. Among the red snappers belonging to the genus *Lutjanus*, *L. sanguineus* (Cuvier et Valenciennes) is the most important, often exceeding 70% of all red snappers caught by trawl (Kungvankij, 1971). Its usual size in trawl catch is between 55 and 70 cm in total length and 2 and 4 kg in body weight. *L. sebae* (Cuvier et Valenciennes) is of second importance. Although its average total length is about the same as *L. sanguineus*, it is heavier because of its relatively deeper body.

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While there is considerable literature on ichthyofauna and trawlfisheries of the South China Sea and its adjacent waters, very little deals with the biological and ecological aspects of commercially important fishes. Vien (1968) referred briefly to the feeding habit of *L. erythropterus* Bloch (= *L. sanguineus*) in the Tonkin Bay while Helfrich et al (1968) and some other workers reported the feeding habits of some other species of the genus. In view of the limited information the Marine Fisheries Research Department of the Southeast Asian Fisheries Development Center has drawn up a program to study the various biological aspects of economically important demersal fishes in the Southeast Asian region. The present paper deals with the feeding habits of the two red snappers.

2. MATERIALS AND METHODS

The material fish were collected by the research vessel CHANGI during the period between April and September, 1971, in the southern part of the South China Sea. The stomach contents of 276 *sanguineus* and 129 *sebae* were examined. The stomach was exposed by making a mid-ventral incision in the body wall, usually within 15 minutes after the catch was emptied onto the deck. The stomach was cut off anteriorly from the esophagus and posteriorly from the intestine behind the pyloric valve, removed and tightened at both ends. To each stomach, an index number was attached with thread and preserved in 10% formalin solution to prevent any further digestion and decomposition of the contents. The total length, body weight, sex, sexual maturity of the fish were recorded together with the catch record. Any other non-marketable organisms caught with the fishes as well as parasites infestation were also noted.

Examination of the stomach content was done in both the laboratory and on board CHANGI. After dissecting, the content of the stomach was discharged into a glass

dish and the number and weight of each food item were recorded.

Since age or size may be a factor to be considered in the study of the feeding habits of fish, specimens of *sanguineus* and *sebae*, ranging from 10 to 80 cm in total length, were classified into seven size groups of 10 cm interval.

### 3. RESULT

#### 3.1 Food organisms of *L. sanguineus*

Fig. 1 shows the relative importance of various food categories found in *L. sanguineus* by size groups. The upper half of the figure shows the frequency of occurrence of important food items in the stomachs of fish of each size group. As illustrated in the figure, fish and crabs occurred most frequently in all size groups. Stomatopods were also common although the frequency was not high, while molluscs and ascidian were observed in the stomachs of the two largest size groups. However, shrimps had a surprisingly low frequency of occurrence except in the 20–30 cm size group. Although the presence of shrimp is not shown in the figure its 26.3% frequency of occurrence is considered high.

The lower half of Fig. 1 shows the weight composition

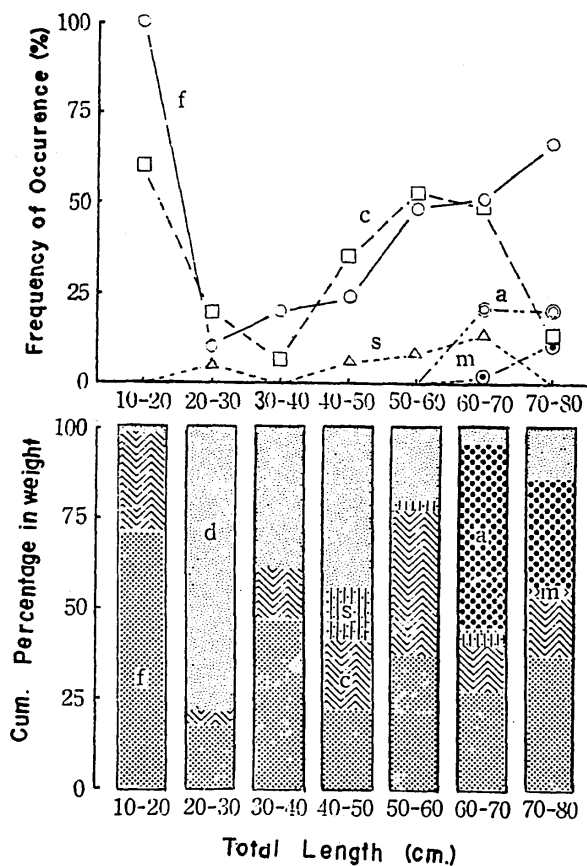


Fig. 1 Relative importance of main food categories in *L. sanguineus* by size groups as expressed by frequency of occurrence (top) and percentage in weight (bottom) of each category. a: crab, d: digested food, f: fish, m: mollusk, s: stomatopod.

of the stomach content in the form of cumulative percentage. Digested food organisms which were impossible to identify often occupied a larger part of the stomach content. Apart from digested food, fish usually predominated as shown by the high value of 72% in the size group of 10–20 cm. Even in the next size group in which 17% of the content was made up of fish by weight the actual percentage of fish as a food item must be higher, since a considerable part of the “digested food” must have been composed of fish. Crabs were next in importance especially in the 50–60 cm size group. Stomatopods occupied a rather significant part of the stomach content in the size group of 40–50 cm, and were of some significance in the subsequent two groups. An ascidian, *Botrylloides* sp., occurred in a surprisingly high percentage in the stomach content of the two biggest size groups. It is, however, a little doubtful whether this species actually constitutes an important part of the food organisms for *L. sanguineus*, since this food item occurred only in the stomachs taken from a single locality during September. Molluscs, composed of *Sepia* and *Loligo* species, showed only a very low percentage in weight in the bigger size groups. Although the frequency of occurrence of shrimp was considerably high at least in the second size group, their individual weights were so small that its percentage in weight was negligible. Some other categories of food items such as anomura, coelenterate, etc. also occurred, but with very low values of frequency of occurrence.

The following species, arranged according to their relative importance by weight, constituted the category “fish” of the food items of *L. sanguineus*: *Caranx leptolepis* (Cuvier et Valenciennes), *Priacanthus tayenus* Richardson, *P. macracanthus* Cuvier, *Saurida undosquamis* (Richardson), a fish of Carangidae, *Nemipterus hexadon* (Quoy et Gaimard), *Trachurops* sp., a fish of Tetraodontidae, *Decapterus* sp., *Caesio chrysozonus* Cuvier et Valenciennes, *Nemipterus* sp., *Saurida* sp., a fish of Monacanthidae, *Saurida tumbil* (Bloch), *Leiognathus* sp., *Upeneus* sp., *Apogon* sp., *Clupea* sp., *Caesio* sp., *Stephanolepis* sp., and some unidentified fishes. As for crabs, the following species were found in the stomachs of the fish; *Charybdis helleri* A. Milne-Edwards, *Portunus pseudoargentatus* Stephenson, *Liagore rubromaculata* de Haan, *Portunus* sp., *Eucrate* sp., *Demania scaberrimus* (Walker), *Charybdis miles* de Haan, *Portunus argentatus* White and *Phalangipus longipes* (Linne); and as for stomatopods; *Carinosquilla carinata* (Serene) and *Harpisquilla annandalei* (Kemp). All crustacean specimens were identified by Dr. R. Serene, the UNESCO expert to Singapore, to whom the present authors express their sincere gratitude.

#### 3.2 Food organisms of *L. sebae*

The main food items found in *L. sebae* (Fig. 2) were nearly the same as in *sanguineus*. Fish, crabs, stomatopods and molluscs constituted the stomach content of the fish. Fish and crabs usually occupied the top positions in frequency of occurrence, although no fish occurred in the second size group. Frequencies of occurrence of stomatopods and molluscs were generally much higher than in

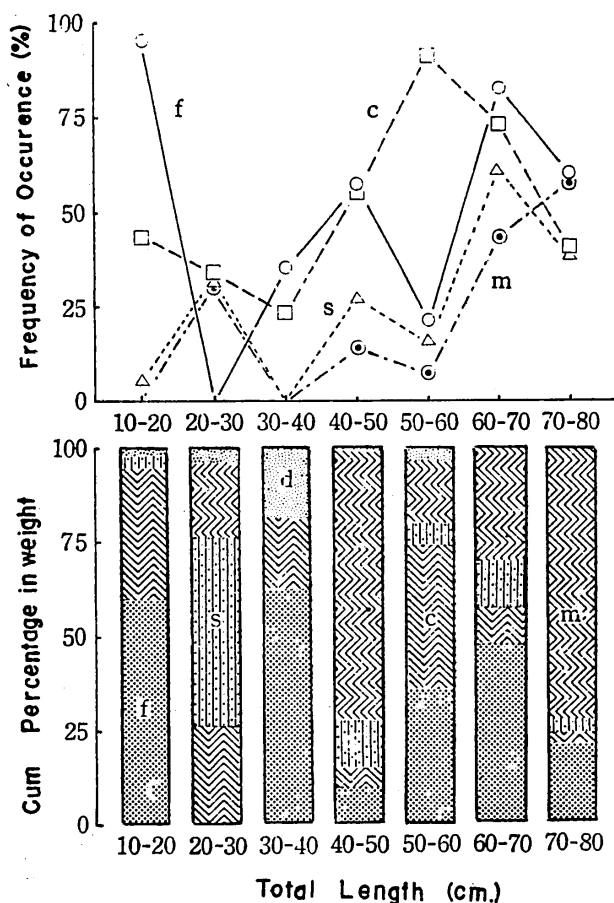


Fig. 2 Relative importance of main food categories in *L. sebae* by size groups as expressed by frequency of occurrence (top) and percentage in weight (bottom) of each category. c: crab, d: digested food, f: fish, m: mollusk, s: stomatopod.

*sanguineus*.

In *sebae*, the percentage of digested food was very low. In four size groups out of seven, fish occupied the largest part of the stomach content. Unlike *sanguineus*, molluscs showed much higher percentage in weight, occupying more than 70% of stomach content in the size groups of 40–50 cm and 70–80 cm. Crabs and stomatopods were also of considerable importance.

The category "fish" of the food items of *L. sebae* includes the following species: *Nemipterus* sp., *Synodus hoshinonis* Tanaka, *Upeneus tragula* Richardson, *Samaris cristatus* Gray, *Decapterus* sp., *Apogon* sp., *Upeneus bensasi* (Temminck et Schlegel), a fish of Tetraodontidae, *Samaris* sp., a fish of Carangidae, *Trichiurus* sp., *Upeneus* sp., a fish of Balistidae, a fish of Monacanthidae, *Aluterus monoceros* (Linné), a fish of Mullidae, a fish of Pleuronectida and some unidentified fish. Crabs which were found in the stomachs of *L. sebae* were as follows (asterisks after certain species show that those crabs were also ingested by *L. sanguineus*): *Portunus* sp., \**Charybdis helleri*, \**Podophthalmus vigil* (Fabricius), *Charybdis* sp., *Myrodes eudactylus* Bell, *Charybdis miles*, \**Portunus pseudoargenteus*, \**Charybdis natator* (Herbst), *Cycloes granulosa* de Haan, *Eucratis* sp., \**Arcania novemspinosa* Adams et White, *Charybdis feriatus* (Linne) and *Phalangipus*

*longipes*\*; and as for stomatopods: *Harpisquilla annandalei*, \**Odontodactylus cultrifer* (White), *Lysiosquilla maculata* (Fabricius) and *Oratosquilla gonypetes* (Kemp).

### 3.3 Regurgitation Rate

One of the difficulties in the study on feeding habit of bottom fishes lies in the fact that the stomachs of a contents are completely regurgitated on surfacing. Thus, in the present study, the fish caught were examined first by opening the mouths and only those fish with the stomachs of an ordinary condition were used as study materials. The regurgitation rate in *L. sanguineus* suddenly increased as the depth of the fishing ground exceeded 65 m. On one occasion, the regurgitation rates were determined for fish caught at various depths. The rates were 0% at 33 m, 31% at 64 m, 58% at 70 m, 78% at 88 m and 89% at 139 m. However, such a phenomenon was not found in the case of *L. sebae*.

### 3.4 Stomach length-body length

The relationship between stomach length and body size was also studied for both species. Such a study is necessary for our purpose especially when stomachs of fish of unknown body length are collected from fish canneries or fillet factories.

The total length of fish and stomach length were measured for 42 *L. sanguineus* (Total length ranging 17–76 cm) and 23 *L. sebae* (12–63 cm). The regressions of stomach length (SL) against total length (TL) for both species were determined by the method of least squares. In general, the regression line fitted the data quite well. In *sanguineus*, the relative stomach length was greater than in *sebae*. The regression lines obtained for *sanguineus* and *sebae* were  $SL = 0.153 TL + 6.1$  (mm) and  $SL = 0.148 TL + 5.0$  (mm) respectively.

## 4. DISCUSSION AND CONCLUSION

The diet of both *L. sanguineus* and *L. sebae* was not restricted to some special food items; rather, they seemed to feed on almost every kind of organisms inhabiting the bottom. The fluctuation in the relative importance of each food item for the various size groups of the predators may, to some extent, be attributed to the insufficiency of the number of fish examined. Nevertheless, it may be safely concluded that the food items of both species of red snappers are mainly composed of fish, crabs, stomatopods and molluscs. *L. sebae* feed on crustaceans and molluscs more intensively than *L. sanguineus* as shown in Figure 2. While more fish species were found in the stomachs of *L. sanguineus*, more crab and stomatopod species occurred in *L. sebae*, even though the number of *sanguineus* examined was more than twice that of *sebae*. Their feeding habits may be considered as quite flexible – even ascidians were found in great quantity in one case.

The feeding habit of *L. sanguineus* in the Tonkin Bay seems to be rather different from the result obtained in the present study. According to Vien (1968), adult individuals in the bay feed mainly on fishes. Neither crabs, stomatopods nor molluscs are important food items,

although the young are reported to feed on shrimps and small fishes, and occasionally on squids.

The diet of other species of *Lutjanus* such as *L. bohar* (Forskål), *L. gibbus* (Forskål), *L. vaigiensis* (Quoy et Gaimard), *L. kasmira* (Forskål), *L. monostigmus* (Cuvier et Valenciennes), *L. griseus* (Linné) and *L. argentiventris* (Peters) from various areas of the tropical Pacific, Indian and Atlantic Oceans has been reported (Longley et al. 1925; Londley & Hilgebrand, 1941; Randall, 1955; Randall & Brock, 1960; Hiatt & Strassburg, 1960; Talbot, 1960; Hobson, 1965; Helfrich et al. 1968). The diet of most of these species is also mainly composed of fishes, crabs, stomatopods and molluscs. Helfrich et al. (1968) classified *L. bohar* and *L. gibbus* in the Line Islands as a euryphagous roving carnivore and a roving, unspecialized carnivore, respectively. Among the food organisms of *L. bohar* in the Line Islands, decapod crab megalops formed the dominant item of crustaceans, especially from November through May, and gastropods made up a larger part of molluscs. These two groups, megalops and gastropods, scarcely occurred in the stomachs of both *L. sanguineus* and *L. sebae*.

Significance of ascidians as a food item has not yet been reported for *Lutjanus* species, although tunicates were important food items for some species of West Indian reef and inshore fishes (Randall & Hartman, 1968).

In the present study, no evidence of cannibalism among *L. sanguineus* or *L. sebae* was found. The present authors have also carried out the study on the feeding habit of 11 other species including several piscivorous fishes such as *Saurida tumbil* (Bloch), *S. undosquamis* (Richardson) and *Rachycentron canadum* (Linne). Neither *L. sanguineus* nor *L. sebae* was found in their stomachs. Therefore, the natural mortality of both species due to the predatory activity of enemies seems to be rather low. Cannibalism does not seem to take place also among lutjanids in the Line Islands. Out of 1790 *L. bohar*, only 2 individuals were found ingesting some unknown species of lutjanid. A possible predator of lutjanids is grouper, since one specimen out of 14 *Epinephelus hexagonatus* (Bloch et Schenider) examined in the Line

Islands contained the remains of a *Lutjanus* species (Helfrich et al., 1968).

Summarizing, it may be said that the feeding habits of both *L. sanguineus* and *L. sebae* are well suited for a demersal life, and both species occupy the highest niche in the bottom ichthyofauna in the South China Sea.

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### Trawl Fishing Grounds in North Andaman Sea

by

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#### Abstract

Experimental trawl operations in north Andaman Sea were carried out by three vessels, T/V JURONG from the Singapore Fisheries Training Center, T/V PAKNAM and

R/V CHANGI from SEAFDEC, from 1971 to 1973.

The results of catch analysis show that the fishing ground is promising. Means of catch per hour ranged from 260 to 690 kg. for the 8 survey cruises, among which 3 cruises yielded more than 500 kg/hr. Croaker, catfish,