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Gut Contents Analysis of Fishes Sampled from the Gulf of Thailand

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Abstract

The Gulf of Thailand is shallow, vast and rich in nutrient. These features appear to sustain the large amount of commercial catch of fish. To understand the fish production system, the gut contents of 25 taxa of 14 families which are important in the fish community of the Gulf of Thailand were examined, and trophic relationships between these fishes and prey organisms were discussed.

Of 25 taxa examined, 5 species were classified as piscivore, 8 species as pelagic plankton feeder, and remaining 12 taxa as benthic animal feeder including 8 taxa of benthic Crustacea feeder, 1 species of Polychaeta feeder, and 3 species of benthic Crustacea and Polychaeta feeder. Shrimps occupied the most important position in the diets of fishes and the contribution of the large demersal productivity to fish resources is noted. It is thought that the leiognathid and engraulid fishes play an important role in the energy flow process from small organisms to larger sized fishes.

1. Introduction

The Gulf of Thailand is shallow with mean and maximum depths of 45m and 80m (ROBINSON, 1974), and rich in nutrient due to large discharge from the Chao Phraya River. The shallow, rich, and vast nature which sustains the large amount of commercial catch of fishes and shrimps in the Gulf of Thailand suggests the specific characteristics of the biological production system based primarily on demersal productivity in this gulf. Hence, the proportion of energy inflow to the fish community from both planktonic production and benthic production is of great interest from a point of view of fisheries science.

Studies on food habits of fishes which are essential to elucidate these subjects are very restricted in the Gulf of Thailand. In the present study, the gut contents of 25 taxa of 14 families which are important in the fish community of the Gulf of Thailand were examined, and trophic relationships between these fishes and prey organisms are discussed herein.

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2. Materials and Methods

Sampling was conducted in the Gulf of Thailand in February, July, and November, 1985. The gut contents of 576 specimens of 25 taxa which were most abundant in fish samples collected were examined. Of these specimens, 292 were sampled from commercial catch by pair trawler, otter board trawler, or shrimp trawler at fishing ports. Ninety-five were caught by hired otter board or shrimp trawler, 183 were caught by an otter board trawl net of R/V Paknam belonging to the Southwest Asian Fisheries Development Center (SEAFDEC), and 6 were caught by a beach seine (Fig. 1). All specimens were fixed in 20—30% formalin-seawater just after collection at a fishing port or on a trawl boat.

After fishes were weighed and measured in standard length (SL) or fork length (FL), the guts were dissected and wet weights of the total contents were measured. Prey items were

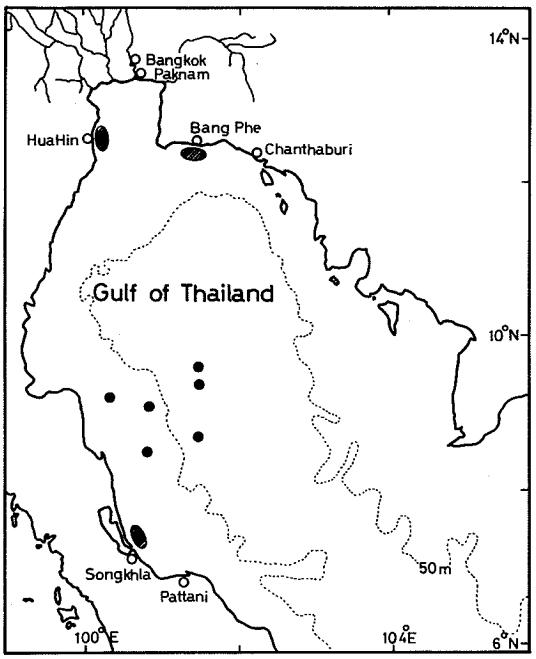

Fig. 1. Sampling stations. Open circles, fishing ports where specimens were sampled from fishing boats; closed circles, sampling stations by R/V Paknam; shaded parts, sampling areas by hired fishing boats. Beach seine sampling was conducted at the coast of Bang Phe.

sorted by taxon. The proportion of each item by volume was expressed on a scale of 0 to 1 using a 0.05 by point method, with total contents were regarded as 1. The weight of each item in the gut of one specimen was calculated by multiplying the total content weight by volumetric scale. Only stomach contents were analyzed in species with a well-defined stomach, while in leiognathid fishes which do not have a well-defined stomach, the stomach and intestine were examined. Because significant seasonal difference in food composition was not found, data from different seasons were combined together.

Ranking index is computed by multiplying the ratio of fish containing the item to the number of fish containing gut contents, by the percentage of that item represented in the diet weight (HOBSON, 1974). In principle the main food items higher than 0.2 of ranking index are listed in order of the index value.

Shrimps of the genus *Lucifer* are listed separately from the other shrimps because they have a typical pelagic nature different from other benthic groups.

3. Results

Family Clupeidae

Dussumieria acuta (Table 1). Of 17 specimens which had food in their stomachs, 15 took *Lucifer* comprising 63.6% of total content weight. Crab megalops and chaetognaths ranked second and third, respectively. Though copepods were found in 7 specimens of 17 containing diets, their weight was negligibly small. This species seems to feed mainly on planktonic crustaceans.

Table 1. Main food of *Dussumieria acuta*; 17 specimens containing diets and 3 empty; 104–120mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Lucifer	63.6	88.2	56.10
Crab megelops	13.0	52.9	6.88
Chaetognaths	20.3	11.8	2.40
Copepods	0.6	41.2	0.25
Shrimps	1.3	17.6	0.23
Other 4 taxa	1.0	41.2	0.41
Unknown	0.2	5.9	0.01

Sardinella sp. (Table 2). All stomachs examined contained copepods consisting dominantly of calanoids, and ranked first comprising 50.8% of total contents on a weight basis. In addition, other pelagic free swimming animals such as ostracods, hyperiid amphipods, and decapod zoeas frequently occurred.

Family Engraulidae

Occurrence of 18 species of engraulid fishes were reported in the Indo-Pacific oceans (WONGRATANA, 1984). But accurate identification of this group is still very difficult due to taxonom-

Table 2. Main food of *Sardinella* sp.; 20 specimens; 95-116mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Copepods	50.8	100	50.80
Ostracods	3.9	65	2.54
Hyperiidean amphipod	4.4	35	1.54
Decapod zoeas	3.0	45	1.35
Shrimps	2.9	35	1.02
Bivalve larvae	1.4	35	0.49
Fish larvae	1.0	20	0.20
Other 9 taxa	2.1	95	2.00
Unknown	30.6	90	27.54

ical confusion. Therefore specimens belonging to the genus *Stolephorus*, which dominates the engraulids catch, were divided into two types, higher and lower body height types. Both types may contain several species.

Stolephorus spp., lower body height type (Table 3). A variety of food items was found in the stomach contents. Stomatopod alima larvae, crab megalops, and gastropods occupied high ranks in order of weight. It is notable that molluscs such as gastropods and bivalve larvae frequently occurred.

Stolephorus spp., higher body height type (Table 4). Similarly to lower body height type of *Stolephorus* a variety of food items was found, and gastropods were ranked the highest in importance. Of 14 specimens having food, only 3 took fish larvae, though this was the most abundant item by weight. One partly digested *Stolephorus* larva was identified.

Both types of *Stolephorus* showed similar food habits. They are thought to be zooplankton feeders which take planktonic molluscs, crustaceans and fish larvae.

Table 3. Main food of *Stolephorus* spp. (Lower body height type); 16 specimens and 1 empty; 65-75mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Gastropods	13.4	56.3	7.54
Stomatopod alimas	20.7	18.8	3.89
Bivalve larvae	4.5	81.3	3.66
Crab megalops	14.6	18.8	2.74
Copepods	6.6	37.5	2.48
Lucifer	3.1	12.5	0.39
Shrimps	4.8	6.3	0.30
Hyperiidean amphipods	4.6	6.3	0.29
Other 3 taxa	1.3	43.8	0.57
Unknown	26.3	56.3	14.81

Table 4. Main food of *Stolephorus* spp. (Higher body height type); 14 specimens; 69-81mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Gastropods	26.0	85.7	22.28
Crab megalops	11.8	64.3	7.59
Fish larvae	34.2	21.4	7.32
Shrimps	13.4	28.6	3.83
Hyperiidean amphipods	3.3	14.3	0.47
Stomatopod alimas	4.5	7.1	0.32
Ostracods	2.0	14.3	0.29
Copepods	1.1	21.4	0.24
Other 3 taxa	2.1	21.4	0.45
Unknown	1.5	7.8	0.12

Family Synodontidae

Saurida micropectoralis (Table 5). Small fishes comprised 98.9% of the total diet weight of this species. Of 33 small fishes recognized in the stomachs, 10 individuals of *Leiognathus* spp., 3

Table 5. Main food of *Saurida micropectoralis*; 21 specimens and 4 empty; 42-180mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Fishes	98.9	95.2	94.15
Shrimps	1.0	19.0	0.19
Polychaetes	+	4.8	−
Mysids	+	4.8	−

of *Acentrogobius criniger*, and 3 of *Stolephorus* spp. were identified. Maximum percentage of stomach contents per predator's body weight was 20.1% for a young specimen with 4.8cm in SL and 0.977g in body weight feeding on an unidentified larval fish.

Saurida undosquamis (Table 6). Of 22 specimens containing stomach contents, 19 fed on small fishes. Same as *S. micropectoralis*, this species exclusively took small fishes making up of 97.0% of total diet weight. Thirteen small fishes comprising 7 individuals of *Leiognathus* spp., 2 *Bregmaceros* spp., 2 *Stolephorus* spp., 2 *Saurida* spp., 1 *Saurida longimanus*, 1 *Dipterygonothus* sp., and 1 *Nemipterus* sp., were identified. Maximum percentage of stomach contents per predator's body weight was 20.2% for an adult specimen with 17.3cm in SL and 55.5g in body weight which contained a lizardfish, *S. longimanus* in the stomach.

Piscivorous habits of lizardfishes are widely recognized (SUYEHIRO, 1942; HIATT and STRASBURG, 1960; RANDALL, 1967; HOBSON, 1974). Shrimps and squids were found as secondary prey items in the predominantly piscivorous diets of these species in the present examination. The diets of these species were essentially the same as those of *S. undosquamis* in Japan (SUYEHIRO, 1942) and of three species of *Synodus* in the West Indies (RANDALL, 1967).

Table 6. Main food of *Saurida undosquamis*; 22 specimens and 1 empty; 145–197mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Fishes	97.0	86.4	83.81
Squids	2.7	13.6	0.37
Shrimps	0.3	4.5	0.01

Family Fistulariidae

Fistularia commersonii (Table 7). This species fed largely on small fishes comprising 63.6% of total contents by weight. Small fishes taken were too digested to be indentified. Although a congeneric species *F. petimba*, was reported to be exclusively piscivorous fish (HIATT and STRASBURG, 1960; HOBSON, 1968; SANO *et al.*, 1984), *F. commersonii* took crustaceans, such as shrimps and mysids to some extent, besides fishes.

Table 7. Main food of *Fistularia commersonii*; 9 specimens and 1 empty; 238–378mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Fishes	63.6	77.7	49.42
Mysids	7.1	55.5	3.94
Crustacean fragments	3.9	33.3	1.30
Shrimps	6.9	11.1	0.77
Unknown	18.4	44.4	8.17

Family Apogonidae

Apogon ellioti (Table 8). Shrimps occurred in all stomachs and were the exclusively dominant food item comprising 98.5% of total contents by weight.

Table 8. Main food of *Apogon ellioti*; 45 specimens; 33–75mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	98.5	100	98.50
Fish larvae	1.5	2.2	0.03

Apogon lineatus (Table 9). The major prey of this species was crustaceans, especially shrimps. All three small fishes ingested by three specimens were *Stolephorus* spp. larvae.

Apogon quadrifasciatus (Table 10). Like *A. ellioti*, this species mainly took shrimps comprising 84.8% of total contents by weight. Four larval fishes in the diet were identified consisting of 3 *Leiognathus* spp. and 1 *Apogon* sp.

Most notable is the similarity of food habits among three species of apogonids examined.

Table 9. Main food of *Apogon lineatus*; 20 specimens and 7 empty; 46–91mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	77.2	75	57.90
Fish larvae	14.8	15	2.22
Crustacean fragments	7.0	25	1.75
Mysids	0.5	5	0.03
Other 2 taxa	0.8	10	0.08

Table 10. Main food of *Apogon quadrifasciatus*; 17 specimens and 3 empty; 10–68mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	84.8	82.4	69.88
Fish larvae	10.2	17.6	1.80
Mysids	2.4	11.8	0.28
Crustacean fragments	1.2	11.8	0.14
Lucifer	0.7	11.8	0.08
Unknown	0.7	11.8	0.08

Shrimps constituted the dominant prey item comprising more than 75% in terms of both weight and frequency of occurrence, followed by other crustaceans and larval fishes. Although many kinds of dominant diets were reported for many species of apogonids (RANDALL, 1967; HOBSON, 1965, 1968, 1974; SANO *et al.*, 1984), such a high proportion of shrimps found in the present study has never been reported.

Family Carangidae

Atule mate (Table 11). Small fishes formed the bulk of stomach contents accounting for 96.1% by weight. Forty one individuals recognized in the stomachs included 25 *Stolephorus* spp., 5 unidentified, and 11 well-digested fish bodies. The remaining items are free swimming crustaceans consisting mainly of crab megalops, decapod zoeas, and stomatopod alima larvae.

Selaroides leptolepis (Table 12). Copepods, mostly calanoids, ranked first in the food items

Table 11. Main food of *Atule mate*; 33 specimens and 6 empty; 92–130mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Fishes	96.1	90.9	87.35
Decapod zoeas	1.5	9.1	1.37
Crab megalops	0.8	6.1	0.05
Stomatopod alimas	0.6	3.0	0.02
Other 4 taxa	0.7	12.1	0.08
Unknown	0.3	6.1	0.02

Table 12. Main food of *Selaroides leptolepis*; 16 specimens and 5 empty; 35–117mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Copepods	23.6	62.5	14.75
Bivalve larvae	4.0	50	2.00
Shrimps	10.5	6.3	0.66
Stomatopods	10.2	6.3	0.64
Crab megalops	9.4	6.3	0.59
Gastropods	1.4	37.5	0.53
Fishes	5.5	6.3	0.35
Other 4 taxa	2.2	43.8	0.96
Unknown	33.2	75	24.90

comprising 23.6% of total food weight. Molluscs such as gastropods and bivalve larvae also occurred frequently in the diets, but small on a weight basis.

The two carangid species showed different food habits. *A. mate* seems to have a piscivorous habit largely taking anchovy, while *S. leptolepis* feeds mainly on planktonic crustaceans and molluscs.

Family Gerreidae

Pentaprion longimanus (Table 13). Polychaetes constituted the major food category in terms of both weight and frequency of occurrence, followed by crustaceans including shrimps, stomatopods and gammaridean amphipods. This species is thought to be a benthic invertebrate feeder.

Table 13. Main food of *Pentaprion longimanus*; 33 specimens; 52–106mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Polychaetes	51.7	72.7	37.59
Crustacean fragments	15.3	45.5	6.96
Shrimps	11.2	30.3	3.39
Stomatopods	13.4	12.1	1.62
Fish larvae	6.0	9.1	0.55
Other 4 taxa	2.0	15.2	0.30
Unknown	0.5	3.0	0.02

Family Leiognathidae

Leiognathus bindus (Table 14). All 25 specimens consumed detritus-like materials and copepods, which constituted the main diets of this species accounting for 52.2% and 39.7% by weight, respectively. Most of the copepods were calanoids mainly *Acrocalanus* sp. and *Canthocalanus pauper*, though cyclopoid, poecilostomatoid and halpacticoid copepods were found in small numbers. It is notable that diatoms, mostly *Coscinodiscus* spp., occurred frequently in the diets. Because detritus-like materials included a large amount of copepod and diatom fragments, these are thought to come from digested both items.

Leiognathus leuciscus (Table 15). This species largely took polychaetes, occurring in 19 guts of 30 specimens and comprising 60.3% in terms of weight. Crustaceans including gammaridean amphipods, copepods, shrimps were the secondary diets for this species.

Table 14. Main food of *Leiognathus bindus*; 25 specimens; 40–58mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Detritus	51.2	100	51.2
Copepods	39.7	100	39.7
Diatoms	5.7	72	4.10
Fish scales	1.1	72	0.79
Other 8 taxa	1.9	36	0.68
Unknown	0.4	72	0.29

Table 15. Main food of *Leiognathus leuciscus*; 30 specimens and 2 empty; 50–83mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Polychaetes	60.3	63.3	38.17
Crustacean fragments	14.4	46.7	6.72
Detritus	11.0	33.3	3.66
Gammaridean amphipods	6.0	30.0	1.80
Brachiopods	5.1	6.7	0.34
Copepods	0.8	26.7	0.21
Other 3 taxa	2.3	23.3	0.54

Secutor indicius (Table 16). Copepods occurred in all stomachs and were dominant food item accounting for 83.8% of total diets by weight. All of 152 copepods examined were calanoids consisting dominantly of 80 *Euchaeta* spp., 38 *Euchaeta concinna*, and 12 *Undinula vulgaris*. The composition of copepods was largely different from that taken by *L. bindus*. In addition to copepods, fish larvae occurred frequently. But most of them were well digested and only 3 leiognathids, 2 gobiids, and 1 *Bregmaceros* sp. of 50 recognizable bodies were identified.

L. leuciscus showed an apparent benthic animal feeding habit. In contrast, *L. bindus* and *S. indicius* feed mainly on copepods. All specimens of *L. bindus* and *S. indicius* examined in this study were caught by otter board

Table 16. Main food of *Secutor indicius*; 22 specimens and 3 empty; 55–77mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Copepods	83.8	100	83.80
Fish larvae	12.7	86.4	10.97
Polychaetes	1.3	36.4	0.47
Chaetognaths	1.3	27.3	0.35
Other 4 taxa	0.9	40.9	0.37

trawl of R/V Paknam in the daytime. According to a large amount of catch of these species with trawl net sampling by R/V Paknam and echo sounder records which showed strong responses of possible leiognathid fish schools near bottom in the daytime, these leiognathid species were thought to reside and feed close to or a few meters above the bottom during daytime.

Family Mullidae

Upeneus sp. (Table 17). The major item of this species was shrimps, and the remaining items were also crustaceans, suggesting this species is a benthic crustacean feeder. SANO *et al.* (1984) found mostly decapods, especially portunid crabs, in the diet of the conspecifics from Okinawa Island.

Table 17. Main food of *Upeneus* sp.; 19 specimens and 1 empty; 77–110mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	93.7	89.5	83.86
Crabs	2.8	15.8	0.44
Crustacean fragments	1.3	26.3	0.34
Mysids	1.5	21.1	0.32
Other 3 taxa	0.7	15.8	0.11

Family Nemipteridae

Nemipterus spp. (Table 18). *Nemipterus* spp. fed mainly on small fishes and shrimps comprising 39.9% and 37.4% in terms of weight, respectively. Of fishes recognized, 2 *Stolephorus* spp. and 1 Gobiidae sp. were identified. Though the weight of shrimps was less than fishes, the former item occurred more frequently in the diets and ranked first. Judging from the composition of food items, these fishes appear to attack dominantly demersal animals.

Scolopsis sp. (Table 19). This species fed mainly on benthic crustaceans consisting of shrimps and crabs. Our findings are largely different from the food habits of *S. cancellatus* from Okinawa Island (SANO *et al.*, 1984) and the Marshall Islands (HIATT and STRASBURG, 1960) which heavily fed on polychaetes.

Table 18. Main food of *Nemipterus* spp.; 19 specimens and 5 empty; 62–149mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	37.4	68.4	25.58
Fishes	39.9	21.1	8.42
Crabs	7.6	21.1	1.60
Gammaridean amphipods	2.5	26.3	0.66
Crustacean fragments	3.3	15.8	0.52
Stomatopods	3.2	10.5	0.34
Mysids	1.4	15.8	0.22
Other 2 taxa	0.9	10.5	0.09
Unknown	4.0	10.5	0.42

Table 19. Main food of *Scolopsis* sp.; 9 specimens and 11 empty; 77–107mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	43.1	33.3	14.35
Crustacean fragments	19.5	44.4	8.66
Crabs	12.9	44.4	5.73
Ophiuroids	9.9	22.2	2.20
Fishes	10.7	11.1	1.19
Unknown	3.9	11.1	0.43

Nemipterids are representative demersal fishes of commercially importance in the Gulf of Thailand. Both taxa examined showed the same tendency of feeding heavily on benthic animals.

Family Priacanthidae

Priacanthus tayenus (Table 20). A variety of food items were found. Shrimps were the most dominant item in terms of both weight and frequency of occurrence. Small fishes were ranked second followed by small abundance of stomatopods (both alima and benthic satges), polychaetes, and squids. Because large part of fishes in the stomachs were in an advanced

Table 20. Main food of *Priacanthus tayenus*; 55 specimens ; 62–152mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	56.6	63.6	36.00
Fishes	24.1	45.5	10.97
Stomatopods	5.4	14.5	0.78
Crustacean fragments	3.1	20.0	0.62
Polychaetes	2.2	20.0	0.44
Squids	3.4	10.9	0.37
Crab megalops	1.8	12.8	0.23
Other 4 taxa	2.7	27.3	0.74
Unknown	0.8	5.5	0.04

stage of digestion, of 38 recognizable, only 4 *Stolephorus*, 3 *Leiognathus*, 2 *Parachaeturichthys polynema*, and 1 gobiid fish were identified. These food data show that this species feeds primarily on benthic animals.

Family Scombridae

Rastrelliger bracysoma (Table 21). Phytoplankton ranked first in terms of both weight (60.0%) and frequency of occurrence (86.4%). At least 12 species of the genus *Bacteriastrum*, *Hemiaulus*, *Rhizosolenia*, *Chaetoceros*, and *Ceratium* were identified. *B. varians* and *B. comosum* constituted major species, followed by *H. sinensis*, *H. membranacas*, and *R. styliformis*. Though free swimming animals such as copepods, fish larvae, squids, and decapod zoeas were also frequently occurred, these items were less important than phytoplankton.

Table 21. Main food of *Rastrelliger brachysoma*; 22 specimens; 130–174mm FL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Phytoplankton	60.0	86.4	51.84
Detritus	23.2	59.1	13.71
Shrimps	3.9	50	1.95
Copepods	2.0	72.7	1.45
Fish larvae	3.8	27.3	1.04
Squids	2.4	18.2	0.44
Decapod zoeas	1.0	18.2	0.18
Other 6 taxa	3.7	40.9	1.51

Family Gobiidae

Acentrogobius criniger (Table 22). Polychaetes and gammaridean amphipods constituted the major food items of this species. Copepods occurred frequently, but were less important than the above two items on a weight basis. One small fish eaten was identified as *Bregmaceros* sp. This gobiid fish is thought to feed mainly on benthic crustaceans and polychaetes.

Table 22. Main food of *Acentrogobius criniger*; 15 specimens and 5 empty; 46–62mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Polychaetes	39.8	60	23.88
Gammaridean amphipods	23.7	86.7	20.55
Copepods	6.1	60	3.66
Bivalves	5.9	26.7	1.58
Stomatopods	5.7	13.3	0.76
Fishes	7.8	6.7	0.52
Shrimps	3.6	13.3	0.48
Other 4 taxa	7.4	20	1.48

Parachaeturichthys polynema (Table 23). Crustaceans consisting mainly of shrimps, crustacean fragments, gammaridean amphipods, and mysids constituted major food items. Though only 3 specimens took polychaetes, it comprised 26.5% of total contents by weight. Like *A. criniger*, this species seems to feed on benthic crustaceans and polychaetes.

Family Platicephalidae

Elates ransonneti (Table 24). Four of 19 specimens contained food items in their stomachs fed on small fishes, making up 62.1% of total contents by weight. And only 1 *Gymnapogon* sp. was identified. Crustaceans, mainly

Table 23. Main food of *Parachaeturichthys polynema*; 19 specimens and 1 empty; 33–65mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Crustacean fragments	16.3	78.9	12.86
Shrimps	30.3	36.8	11.15
Gammaridean amphipods	12.7	73.7	9.36
Detritus	10.9	52.6	5.73
Polychaetes	26.5	15.8	4.19
Mysids	1.2	26.3	0.32
Oather 3 taxa	1.9	15.8	0.30
Unknown	0.1	10.5	0.01

Table 24. Main food of *Elates ransonneti*; 19 specimens and 5 empty; 54–136mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Fishes	62.1	21.1	13.10
Shrimps	17.9	42.1	7.54
Mysids	8.6	68.4	5.88
Crustacean fragments	6.5	26.3	1.71
Crabs	4.9	5.3	0.26

shrimps and mysids, occurred frequently and accounted for 37.9% in terms of weight.

Inegocia japonica (Table 25). Shrimps and crabs formed the bulk of the stomach contents comprising 41.4% and 42.8% in terms of weight,

Table 25. Main food of *Inegocia japonica*; 17 specimens and 3 empty; 40–167mm SL.

Food items	Diet Weight (%)	Occurrence (%)	Ranking index
Shrimps	41.4	70.6	29.23
Crabs	42.8	52.9	22.64
Fishes	15.0	11.8	1.77
Isopods	0.4	5.9	0.02
Crustacean fragments	0.4	5.9	0.02

respectively. Of 4 small fishes eaten by two individuals of this species, one was gobiid fish and the other was callionymids.

Platicephalids are common demersal fishes in the coastal waters of the Gulf of Thailand. Both species examined seem to attack benthic free swimming animals. *E. ransonneti* showed piscivorous tendency.

4. Discussion

As summarized in Table 26, 25 taxa studied were classified into 5 food habit groups based on the results of gut contents examination.

1) Pelagic plankton feeder

This group is composed of 8 taxa of pelagic fishes. Copepods were the most important prey for the 4 species. It is notable that *Lucifer* spp., stomatopod alima larvae, and planktonic molluscs such as gastropods and bivalve larvae, also constituted the important food items. It is also noted that *Rastrelliger brachysoma*, which is abundant and one of the most commercially important fish in the Gulf of Thailand, fed dominantly on phytoplankton.

Table 26. Classification of food habits.

1) Pelagic Plankton Feeder
Dussumieria acuta — *Sardinella* sp.
Stolephorus spp. (lower body height type)
Stolephorus spp. (higher body height type)
Selaroides leptolepis — *Leiognathus bindus*
Secutor indicius — *Rastrelliger brachysoma*

2) Benthic Animal Feeder
1. Crustacea feeder
Apogon ellioti — *Apogon lineatus*
Apogon quadrifasciatus — *Upeneus* sp.
Nemipterus spp. — *Scolopsis* sp.
Priacanthus tayenus — *Inegocia japonica*
2. Polychaeta feeder
Leiognathus leuciscus
3. Crustacea and Polychaeta feeder
Pentaprion longimanus — *Acentrogobius criniger*
Parachaetorichthys polynema

3) Piscivore
Saurida micropectoralis — *Saurida undosquamis*
Fistularia commersonii — *Atule mate*
Erates ransonneti

2) Benthic animal feeder

1. *Crustacea feeder*

All 8 taxa included in this group fed largely on shrimps, and particularly 3 apogonid species and *Upeneus* sp. specialized on this item. Other benthic crustaceans such as crabs and gammaridean amphipods and small fishes formed the second major diet item.

2. *Polychaeta feeder*

Only *Leiognathus leuciscus* fed dominantly on polychaetes.

3. *Benthic Crustacea and Polychaeta feeder*

All 3 species listed in this group fed largely on polychaetes comprising 27–52% of total contents by weight. Combinations of crustacean taxa, mainly shrimps, gammaridean amphipods, and stomatopods, were consumed to the same extent as polychaetes.

3) Piscivore

Five species constituted this group. Two species of *Saurida* which live on the sea bottom fed dominantly on leiognathids followed by other demersal small fishes such as bregmacetrotids and gobiids. In contrast, pelagic piscivorous fish, *Atule mate*, fed mainly on *Stolephorus* spp.

Though the gut contents analysis made in the present study is maybe insufficient, the following specific features can be suggested.

① Shrimps occupied the most important position in the diets for fishes. This may correspond with the great abundance of shrimps in the Gulf of Thailand (SAKURAI, 1979).

② Small fishes occurred in the guts of 20 taxa. Of these taxa, 5 species were categorized to piscivorous, and for other 8 taxa, small fishes constituted the second major food item. Particularly a great part of small fishes attacked is composed of the leiognathids, engraulids, and their larvae which are abundantly present in the Gulf of Thailand. These findings indicate that leiognathid and engraulid fishes are the most important prey fishes in pelagic and demersal fish communities, respectively. Besides, both fishes play an important role in the energy flow process from small organisms to larger sized fishes.

③ Many herbivorous fishes belonging to blennids, scarids, acanthurids, pomacentrids, siganids, monacanthids, etc. were reported from coral reef waters (HIATT and STRASBURG, 1960; HOBSON, 1974; SANO *et al.*, 1984). In contrast, such herbivorous fishes were found in much lower numbers in the Gulf of Thailand probably due to the restricted distribution of coral reefs. For example, out of 196 species reported in a study by SUKHAVISIDH *et al.* (1987) which covered wide area of the Gulf of Thailand, only one blenniid species was discernible as a possible herbivorous coral reef resident.

Of 25 taxa studied in the present paper, 9 species are pelagic organisms feeder including *A. mate* which fed mainly on anchovy, and remaining 16 taxa are benthic animal feeder. Though it might be a matter of course, there was a tendency that pelagic fish usually feeds on pelagic organisms and demersal fish on benthic animals in this study. According to the commercial catch data in the Gulf of Thailand between 1972–1976, average annual landing of demersal fish amounted to 878,000 tons and was more than three times as much as the value of pelagic fish, 250,000 tons (MENASVETA, 1980).

Both the large commercial catch of demersal fish and the result of this study which shows most of demersal fish feeds on benthic animals, appear to support our presumption which emphasizes the high productivity of the demersal ecosystem provided by the shallow and vast structure of the Gulf of Thailand. Detailed studies of food habits for engraulid and leiognathid fishes and other dominant food items for fishes such as shrimps will assist efficiently in our better understanding of fish production structure in the Gulf of Thailand.

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タイ湾産魚類25種の食性

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タイ湾は水深80m以下の栄養塩に富む広大な浅海域である。本湾における豊かな魚類資源の生産構造を研究する一環として，主要魚類14科25種の消化管内容物調査を行った。これらの魚類は食性により，プランクトン食性8種，底生甲殻類食性8種，多毛類食性1種，底生甲殻類・多毛類食性3種，魚食性5種に分類された。底生甲殻類食性8種のすべてはえび類を主食とし，それ以外の多くの魚類でもえび類とその幼生が重要な餌となっており，本湾の豊富なえび類資源が魚類生産にも重要な役割を果たしていることがわかった。カタクチイワシ科及びヒイラギ科魚類は資源量が大きく，多数が大型魚類に捕食されており，これらが小型生物から魚類へのエネルギーフローにおいて重要な役割を果たしていることが推察された。

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