THE FISHFAUNA OF THE ROKAN MOUTH.

By

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I. PREFACE.

The big centre of fisheries, Bagan Si Api Api, is situated at the mouth of the Rokan-river (Sumatra) in Malacca Strait at about 100° E. and 2° N.

The population is chiefly Chinese, with a few Malayans. Bagan Si Api Api and its sister-settlements Seneboei and Panipahan have about 15000 inhabitants. The fisheries are practised by the Chinese only, the number of the native Malayans engaged in it can be neglected. The fishermen as well as the tradesmen are all immigrants from China. They belong all to the clan of the Hok-Kiens from the neighbourhood of Amoy. As they have their own customs and they speak their own language — indeed one needs the help of an interpreter in order to speak with them, — one may imagine oneself, that a little part of China has been transplanted on the Sumatra-Coast.

Bagan Si Api Api is only about fifty years old now. The first immigrants found here some Malayans fishing with the so-called jeremals (for a description see below). The Chinese soon learned to use them and it is to the jeremal, which therefore is a Malayan and not a Chinese invention, that Bagan Si Api Api owes its wealth. The whole sea in front of the Rokan-mouth is covered now by the jeremals which make the navigation in this region very difficult, the more so as only a few narrow channels between the mudbanks can be used by modern traffic.

Seneboei and Panipahan are younger. They owe their existence to economic circumstances, as the poor fisherfolk left Bagan Si Api Api in order to be independent of the richer merchants. They are mainly engaged now in driftnet fishery. In the course of these fifty years the whole region, with Bagan Si Api Api as a centre, has grown out to one of the most important fishery-areas of the world. The value of all the fishery-products together in 1928 totalled to more than seven millions of guilders. The main-products of the fisheries are fish, shrimps and the so-called trassy (made from Sergestes-species together with young shrimps).

Fish and trassy are consumed for the greater part in the Netherlands-Indies (especially Java and the plantation-area of Sumatra) and shrimps are mostly sold to Singapore.

With a so intensive fishery in a relatively small area one cannot wonder that the question of over-fishing has presented itself and that, in connection with this, it was asked whether a supply of the fish population from outside the area occurs or not. Moreover, numerous difficulties have arisen between the fishermen engaged in the different fishing methods, viz. between the jeremal fishery and the driftnet fishery. The government officials had to act as arbiter in such and similar cases but, of course, did not feel quite competent. A more thourough knowledge of the fisheries and the fishery problems proved desirable. This was the reason of the investigation of which the results are presented here.

For the above purpose I visited Bagan Si Api Api from January 13th to February 13th and again October 2nd—4th, 1929.

II. DESCRIPTION OF THE AREA.

The principal way of fishing is by means of immovable fishtraps, the so-called jeremals. The fished area covers the very wide, estuary-like mouth of the Rokan River. It has its greatest breadth in a north-southerly direction of about 20 sea-miles and its greatest length in an east-westerly direction of about 40 sea-miles. The area extends in a western direction as far as the sister-settlements of Bagan Si Api Api, Panipahan, and in an eastern direction as far as Seneboei, situated on the maincoast opposite the island of the same name (See chart). Along the coast the area extends much farther than Panipahan and reaches into the mouth of the next big river, the Panei and even farther than this. I have however, for practical reasons confined myself to the limits given above.

The very wide estuary-like mouth narrows at a short distance upstream of Bagan Si Api Api.

The island Pulu Pĕrdamaran is situated in this neck of the river. A bigger island, Pulu Halang Bĕsar (Great Halang) is found near the western shore of the estuary. A rather deep channel (3—4 m at low tide) separates this island from the maincoast. In this channel a strong ebb- and floodcurrent is found. The channel has become much deeper during the last few years. As what is now the maincoast, was about 10 years ago an island, Pulu Halang Kĕtjil (Little Halang). The water between this island and the old maincoast has silted up now. Of course the tide between the two islands became much stronger and a deep channel was formed in which no mud is precipitated. This fact has a great influence on the fisheries here.

A rather deep channel is also found east of Pulu Halang Bĕsar. It contains water even at neap tide.

A third channel is found along the eastern shore, on which Bagan Si Api Api itself is situated.

Between the two last mentioned channels, a great mud-bank is found, which falls dry at low-tide. This bank has a more or less triangular shape, with its top to the Rokan and with its basis to the sea. This bank continues

under water in a north-western direction to the Aroa-islands in Malacca Strait. The depths down to 8—9 m at low tide are indicated by the situation of the fishtraps.

This central bank consist of a liquid mud of such a soft consistency, that as a matter of fact it is not possible to determine the depth with any certainty by sounding. The sounding lead goes down several meters into the soft liquid matter.

In other places the bottom is muddy also, but there the mud is much harder. The banks in the sea near Seneboei and also near Pulu Halang Bĕsar as well as the submarine continuation of the above named central bank are formed by this clayish mud.

In a direction north-west of Pulu Halang Bĕsar along the coast the bottom becomes harder and harder, as the farther away from the island, the more the mud is mixed with sand. Near Panipahan the bottom consists of pure sand.

Close to the coast, which opposite to Pulu Halang Bĕsar consists of a muddish to clayish matter, but near Panipahan of sand, some small mudbanks are found in front of the mouths of a few small rivers.

The eastern shore near Bagan Si Api Api is muddy also and overgrown with mangrove.

In the neighbourhood of Seneboei we find also mangrove vegetation, which causes the shore-line to shift more seaward. North of Seneboei we find first a muddy bottom but more seaward it gradually passes into a sandy one. The latter is situated outside the fished area and is therefore of less interest for our purpose.

The depth is nowhere very great. Between Pulu Halang Bĕsar and Bagan Si Api Api the Central Bank is found and from here the water becomes gradually deeper. A depth of 8—9 m at neaptide is found near the limits of the fished area in a north-west direction.

III. CURRENTS.

We find in Malacca Strait a flood- and ebbcurrent twice a day. It is not surprising, that in this funnel shaped part of the sea, the differences between high- and low-tide are very great. This difference is about 3—4 m and during the springtides, twice a month, it may amount to 5—6 m. In the rainy monsoon, when the river carries down great masses of water, the level of the water may rise much higher, and the whole land be inundated.

An interesting fact is the occurrence of a small freshwater-lake on the island Pulu Pĕrdamaran. I got information that the fauna is a true freshwater fauna. Twice a day the island is surrounded at high tide by brackish water with a salinity of about 8—10‰. The fauna in this water is a fauna, which can also be found downstreams, e.g. near Bagan Si Api Api in jeremal 592. The above mentioned high floods during the rainy monsoon inundate the island and in this way the lake gets freshwater again, together with its fauna. I regret that lack of time prevented me from visiting this interesting island.

Such great differences in the water-level are, of course, accompanied by strong tidal currents. The whole fisheries in this area depend on these tides. Their maximum rapidity has an average of about 3—4 sea-miles an hour and during the spring-time it is much higher.

The direction of the current is of much importance for the fisheries. The jeremals fish with the ebbtide and their long axis must have the same direction as the current. This is an essential condition for the proper working of the jeremals.

The big V-like wings have to catch up the tide and to lead the fishes, contained in it, into the net, which is spread out behind the jeremal (see below).

The flood-current in Malacca Strait goes in a south-eastern direction and the ebb-current opposite to it in a north-western direction, in the long axis of the Strait. At the beginning of the ebbtide the falling water flows in a fanlike way out of the estuary of the Rokan. It flows therefore in a north-western direction along the coast of Panipahan. Along Bagan Si Api Api it flows in a northern direction, which changes into east near Seneboei (see chart). According to this, the direction of the long axis of the jeremals varies between northwest-southeast and west-east.

Now we see, that 5 à 6 sea-miles north of the central bank and north of Pulu Halang Bĕsar the long axis of the jeremals are not directed to the rivermouth, as one would expect, but that the direction has changed into a west-eastern one. At the beginning of the ebbtide the water here also flows out forming a fan, but after some time the main-current in the Malacca Strait interferes with the current out of the Rokan estuary and causes the latter to deviate somewhat in an eastern direction.

The longer the ebbtide flows out, the more strongly this influence of the main-current manifests itself.

The Nautical Guide (Zeemansgids) of the East Indian Archipelago (Vol. II) expresses itself very correctly in saying, that the ebbtide turns against the sun. If we stay some time on one of the outermost jeremals we see, that gradually the current turns more to the east. At the end of the ebbtide the current changes several times in direction and rapidity, obviously as a consequence of the greater or lesser influence of the main current.

The jeremals in this outer area, of course, cannot fish during the whole ebbtide. Some of them even cannot do so for more than 2 à 3 hours only, unlike the inner jeremals (on the central bank), which can continue fishing for 4 à 5 hours. The handicap of the short fishing time of the outermost jeremals is more than amply compensated by the more valuable catches.

Along the coast near Panipahan we do not have such deviations of the currents, neither do we find them along the coast of Bagan Si Api Api or on the central bank. Here the ebb- and floodcurrents are opposite to each other.

As has been said above the ebb-currents are turned in an eastern direction. From this it follows, that it is not the ebbtide but the floodtide in Strait

Malacca, which causes the deviation of the ebb-currents coming from the Rokan estuary.

When the flood comes in, the Rokan estuary is filled up chiefly by currents which come from the north-west and it is only later, when the maincurrent in Malacca Strait gets stronger (N.B. the tide is falling now again in Malacca Strait!), that currents come in from an easterly direction also. It is therefore the ebbcurrent of Strait Malacca in the Rokan estuary which causes these floodcurrents from an eastern direction.

It appears, that the more we go to the west and the farther away from the rivermouth proper, the earlier the flood comes in. Beyond Pulu Halang Bĕsar near Panipahan high tide is 1 à 1½ hour earlier than near Bagan Si Api Api. The flood already comes in there, when the water is flowing out still between Pulu Halang Bĕsar and Bagan Si Api Api.

It would be of great importance if this currentsystem could be investigated in a more thorough way by an hydrographer. It would be necessary to investigate not only the direction of the currents and how they interfere with each other, but also, in connection with this, the question of how the masses of water mix. Too little is known about this as yet.

I must also draw attention to a curious phenomenon on the Rokan river, which occurs when the flood comes in. Through the quick rising of the water in the sudden narrowing of the river near Pulu Pĕrdamaran, the water is forced up to a tidal wave with an elevation of 1—1.25 m, which moves upstreams with much noise. This fact, known from several other rivers of Sumatra and elsewhere is called here "bĕno" (Malay).

Although the bĕno under normal conditions occurs outside our area, viz. on the river proper, I should like to mention it here, as during my stay in Bagan Si Api Api in October 1929 it was observed much farther out at sea on the central bank, at a great distance from Pulu Pĕrdamaran.

After a long dry period heavy rains had fallen in the region of the upper course of the Rokan. The level of the river had therefore risen considerably. This takes place every year and great masses of soft material, precipitated in the river during the dry period, are carried off and precipitated again in front of the rivermouth in the sea. Owing to this the central bank is not only made higher, but is also enlarged in a seaward direction over a distance of about three sea-miles.

In the afternoon of October 4th I found myself with a motorboat in the narrow channel along the eastern shore (near Bagan Si Api Api). It was neap tide and the water was so shallow, that even small boats went aground in the mud. The place, where my boat had come aground, was about 9 sea-miles north of Pulu Pĕrdamaran. Suddenly a curious streak was seen on the sky-line. The crew thought it was a bĕno. As a matter of fact about 5 minutes later, I saw a wall of water about 1.25 m high approach. This tidal wave was, at the place where we were, horseshoe-shaped, so that at a given moment the boat was surrounded by the waves on three sides. It was evident, that the somewhat

deeper water of the channel had retarded the rising of the běno by 15 à 20 seconds. The běno was visible as far as I could see. Afterwards I got information, that it had been observed near Pulu Halang Bĕsar also. From this it seems to follow that the tidal wave had a total breadth of about 8 sea-miles. Where exactly the tidal wave originated I do not know, but I suppose it must have been on the seaside of the central bank. That is, therefore, 17—18 sea-miles outside the place where it normally arises, near Pulu Pĕrdamaran. It was two days after full moon and therefore in the period of the very high tides. The phenomenon had never been observed before at that place by the skipper of the boat, who had lived ten years already at Bagan Si Api Api. It did not occur again.

The seaward extension of the central bank takes place every year, when after a long dry period, the first rains have come. The extension is afterwards carried away again little by little by the currents so that the central bank finally retains about the same shape.

IV. SALINITY AND COMPOSITION OF THE WATER.

It is evident, that in an area as described above, the salinity may vary very much locally, according to the tides and to the amount of the freshwater carried off by the river. As was said above our knowledge of the salinities is, as yet, very incomplete and closer investigation would be very useful.

At the outermost limits of the fished area the salinity is high and relatively constant. Salinities of 28—31‰ were found. Once I found at low tide even a higher percentage than at hightide! At jeremal 844 the salinity was 28.98‰ at low and 28.82‰ at high tide. Evidently we have had here water of Strait Malacca, only slightly mixed with fresh water.

Near the coast of Panipahan I found similar relatively high salinities.

The fresh water seems to have little influence here. This is to be expected, as only a small quantity of water flows out of the rivermouth along the coast in the direction of Panipahan, as has been pointed out above. Most of the Rokan water is carried off in an eastern direction by the currents in the Straits of Malacca.

In the sea near Seneboei therefore we may find lower salinities and as a fact I found 2½ hours after high tide a salinity of 22.72‰. Lower figures can be expected at low tide. At high tide I found there a salinity of 28.75‰.

Near jeremal 180 I found a salinity of 19.29‰ and near jeremal 602, 17.60‰. In each of the two cases it was three hours after low tide.

On the roadstead of Bagan Si Api Api, I found very varying figures viz. 6.33—17.14‰ at low tide and 11.80‰—21.60‰ at high tide. The lowest figures were found at neaptides (6.33—11.80‰) the highest at springtides (17.14—21.60‰).

Dr. Ir. C. P. MOM, Head of the Proefstation voor Waterzuivering, kindly analyzed for me a sample of water taken 3 sea-miles north of Bagan Si Api Api. It had a salinity of about 15‰. All figures are given in mgr pro liter.

Dry residue	17600,0	Mg.	579,7
Clowing residue	14600,0	Fe.	0,48
Organic matter	27,2	Mn.	absent
NH_3	a trace	HCO_3	73,2
Prot. NH_3	absent	SO_4	1179,8
NO_2	a trace	Cl	8450,0
NO_3	0,5	Si O_2	325,0
Ca.	281,2		

From the above data it follows, that we have here brackish water with a great amount of mud. In the eastern part of the area the muddiness of the water is much greater, than in the western part. Near Bagan Si Api Api the muddiness is sometimes so great, that we can speak of liquid mud. The degree of clearness is zero here. Near Panipahan the water is muddy at low tide only. Near Seneboei and also in the area north of the central bank we find relatively clear water at high tide, which becomes very muddy at low tide. The water between Pulu Halang Bĕsar and the maincoast is also very muddy. It is evident that the degree of muddiness has great influence upon the composition of the fauna.

Further the above figures show that the water is very poor in Ca. Perhaps this is the reason of the poverty of the mollusc fauna, of which I found only two representatives.

The Fe percentage is very great, as is the case with the Si O_2 percentage, whereas the percentage of SO_4 is small only.

It seems evident that these deviations from the composition of normal seawater found their origin in the freshwater from the Rokan.

V. GENERAL REVIEW OF THE FAUNA (FISHES EXCEPTED).

The waters near Bagan Si Api Api are very rich in plancton, but as a consequence of the quantities of mud, it is often almost impossible to make an analysis of it. Obviously even the most muddy water contains many organisms as may be seen from its phosphorescence. The latter is caused mainly by *Noctiluca*.

It is obvious, that an area as described above, will contain a very special higher fauna. Before I deal with the fishes, whose study was the main-purpose of my visit to Bagan Si Api Api, I will give a short summary of the other animals characteristic of this region.

I will begin by mentioning a few birds, which may be observed along the shores.

Along the muddy coast the Indian Marabu (*Leptoptilus javanicus* HORSF.) and the Indian Tantalus (*Pseudotantalus cinereus* HORSF.) can be seen everywhere, sometimes in mixed flocks of about 10 à 20 individuals. *Pseudotantalus* has the curious habit of trampling with its feet in the mud in order to start up the food animals.

During the wintermonths October-March one can see thousands of limicoline birds of different species along those parts of the coast, which are dry at low tide.

They are mostly found on the shores near Seneboei and near Pulu Halang Bĕsar where the bottom is composed of a somewhat harder mud. In places where the mud is soft they are absent altogether.

In the mangrove swamps along the coast one meets regularly little bands of monkeys e.g. *Macaca irus* CUV. and *Pithecus pyrrhus* HORSF. *Macaca*, the common monjet or kra, can often be seen searching for food on the ground on dry parts of the shores. I never saw *Pithecus* do so. In the evening they are to be found in some special trees.

After it has becomes quite dark thousands of fire-flies (*Colophotia brevis* ERN. ? det. LIEFTINCK) appear. They seem to prefer a special species of mangrovetree (*Avicennia*). It is a beautiful sight, when whole stretches of shore glitter and darken rhythmically.

This rhythm maintains until about 11—12 p.m. Afterwards it gets more irregular and after about 3 a.m. only a sporadic flash of a single individual is seen.

Along the whole coast crocodiles (*Crocodilus porosus* SCHNEIDER) are fairly common. Many accidents are caused by these animals. When cruising along the shore, one can often see big specimens starting up and dashing into the water. Once I saw about 20 à 30 animals watching for fish in very shallow water. Every now and then a kind of mullet jumped out of the water, for a reason unknown to me. They were snapped up in the air by a swift jerk of the head.

Everywhere one sees on the mud big specimens of *Periophthalmus chrysospylos* BLKR. They are sometimes caught by the swift current, so that it is not possible for them to reach land again. In that case they seem to drown. At least I found a few times in a certain catch from a jeremal near the coast a dead and stiff specimen, which therefore had died some time before already and had come dead into the net.

Species of *Boleophthalmus* are much less common.

I found only two species of Molluscs, viz. *Arca granosa* L. and *Elisia orbiculata* WOOD. (Det. VAN BENTHEM JUTTING). The latter seems to prefer brackish water. Both species are eaten.

Shore crabs are only sporadically seen. I suppose that the great differences between low and high tide are fatal to all species with a more or less terrestrial habit.

Let us now consider the animals found farther from the shores.

In the water near the shore the big mangrove-crab, *Scylla serrata* FORSK. (Mal. Kĕpiting) is often caught. This species lives especially upstream off Bagan Si Api Api, where the water is chiefly brackish, but it is found elsewhere in the mangrove-swamps also. Farther out in the sea, we find another Decapod, a little swimming-crab, *Charybdella rostrata* MILNE EDWARDS. It is

one of the characteristic animals of the Eastern Border Area. (See below. See chart). It is found regularly in each catch, but never in great numbers.

I found only these two Decapoda brachyura.

In the Eastern Border Area two big Stomatopods are taken regularly, viz. *Squilla raphidea* FABRICIUS and *Squilla interupta* WOOD MASON. I did not find them outside this region.

Shrimp species are found everywhere in the fished area. They are most common in the Eastern Border Area and less common in the Central- and Western Border Area.

The Shrimp-fauna is composed of several species, among which *Penaeopsis*- and *Parapenaeopsis* species are the most common. *Penaeopsis affinis* M. E., *Penaeopsis brevicornis* M. E., *Parapenaeopsis gracillima* NOBILI and *Parapenaeopsis sculptilis* HELLER are the representatives of two genera. Besides these *Alpheus euphrosyne* DE MAN, *Exhippolysmata ensirostris* KEMP and *Mimocaris heterocarpoides* NOBILI are found sporadically. Prof. Dr. H. BALSS was so kind as to determine these species for me. Perhaps more species will be found when thoroughly analyzing a great number of catches, but the species mentioned above are any rate the most important.

Sergestes species are very important from a biological and economical standpoint. They are caught in large quantities on the central bank and in some parts of the Eastern Border Area, especially in the parts situated near the Central Area. Elsewhere in the fished area they are not so common and they are not caught in commercial quantities. Examination of the contents of the stomach shows that *Sergestes* is a very important fish-food.

Sea-snakes are found abundantly everywhere.

They are never or seldom seen, but they are regularly caught by the jeremals. They are especially abundant, where the water is very muddy, as is the case on the central bank. Farther seaward where the water gets clearer they are less common. Curiously enough they are caught very abundantly between Pulu Halang Bĕsar and the coast. A jeremal may catch there about six or seven snakes in a quarter of an hour. I do not know why they prefer this special region.

Unfortunately I have not collected these animals systematically. Determination at the Laboratory showed that the material contained one species only, viz. *Hydrophis torquatus* GÜNTHER. Other species, which eventually may be found, are at any rate not common.

NELLY DE ROOY in "Reptiles of the Indo Australian Archipelago" mentions for Bagan Si Api Api, besides the species named above, also *Enhydrina valakadyn* BOIE.

On the surface of the water *Halobates* is sometimes rather abundant. Where the water is muddy and opaque they are absent, at least I did not see them in that case. Their occurrence, therefore, is confined to the Western Border Area and to the western part of the Eastern Border Area.

This richly developed animal life attracts of course many birds.

Thus one may see on the dry shoals and on the jeremal themselves, sometimes even far out at sea, a number of white herons, an *Aigretta*- or *Demiaigretta*-species. They are especially abundant near Seneboei and Pulu Halang Bĕsar. They are often seen together with a *Sterna*-species.

The common *Haliastur indus* BODD. can be observed everywhere in our area along the coast. In the neighbourhood of Bagan Si Api Api this species is surpassed in numbers by the osprey, *Cuncuma leucogaster* GM. Often one sees no less than 15 à 20 of these big birds together and everywhere in the neighbourhood of the town one discovers their nests in the higher trees.

Their food consists partly of snakes. Several times I found snakes which had been partly eaten and I also saw a few times an osprey grasping a snake out of the water and carrying it towards the land.

As soon as we are somewhat farther away from the coast frigatebirds (*Fregata ariel* GRAY) can be observed regularly.

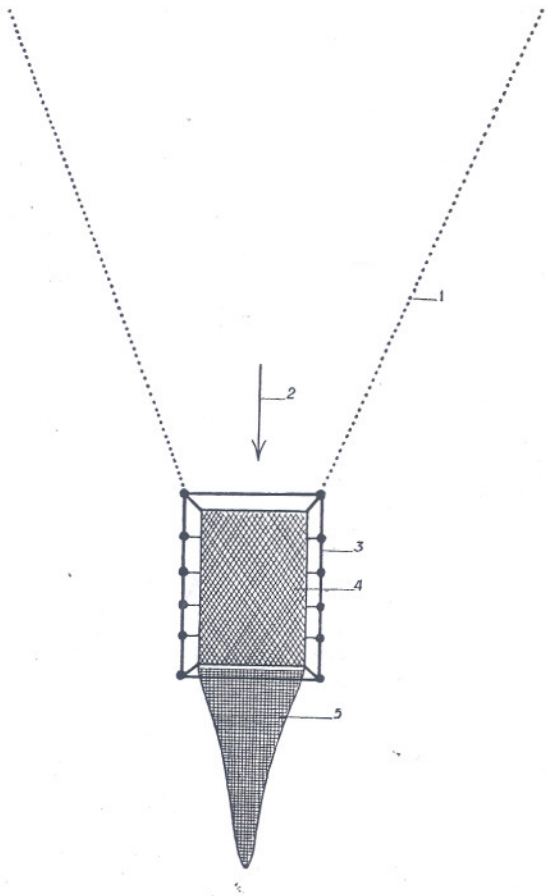

Fig. 1. Scheme of a jeremal.
1 Row of palmstems. 2 Direction of the ebb-current. 3 Wooden paling. 4 Rattannet. 5 Sack of a yute-like material.

VI. METHODS OF FISHING.

In studying the fishfauna I had to make use of analyses of the catches of the different jeremals. A jeremal is composed of two rows of palmstems, which have been driven into the bottom and which are placed in the shape of a big V. The median axis of this V, of which the two wings may have a length of five hundred meter, is placed in the main direction of the ebbtide. The wings of the V converge to a rectangular, wooden paling, in which a fine-mazed net of rattan has been suspended. (See Fig. 1).

This flat rattan net forms an inclined plane. The end turned to the opening of the V rests on the bottom, the other end lies just below the surface of the water. Behind this rattan net is placed a sack, made of rough cloth (something like jute). The fishes which through the force of the current are driven over the back-

edge of the rattan net are caught in this sack. From time to time (about every 20—30 minutes and sometimes even shorter) the sack is hauled up and is emptied. The palmstems, which are placed at distances of about half a meter, are moved to and fro by the strong current. The fishes, which happen to come inside the wings of the V, are frightened by these wobbling stems.

They swim back to the middle of the V again and again, and are driven finally against the net and everything driven against it is caught. Only big fishes, which are strong swimmers may escape sometimes. They may jump over the net or they may swim or jump back against the current.

In general the fisherfolk think that the jeremal will catch anything, that has come between the wings of the V. Yet I doubt if this opinion is quite right.

In the first place the above-mentioned big fishes, once escaped, are not caught again in the sack. They have to swim therefore round one of the wings of the V or they have escaped between the wobbling stems.

In the second place it is possible to catch fish with the hook, behind the palmstems. If the wobbling row of the stems should hold up every living fish, one would expect just behind this row a region practically devoid of them.

In the third place I draw attention to the following curious information, which I got from the fishermen. At the beginning and at the end of a catching period, the same species are caught. Thus at the beginning and at the end of the ebbtide, when the current has not yet reached its full strength and when the strength of the current decreases again. Species are caught then, which in the middle of the catching period, when the current is very strong, are caught in small numbers only or are absent totally.

Although the phenomenom was not very marked, I found some facts, which showed me that the fishermen were not entirely wrong. To verify this, it would be necessary to visit several jeremals and stay there for the whole catching period of 4—5 hours in order to examine carefully the succeeding hauls.

And this should be repeated several times for the same jeremal.

Lack of time prevented me to do this in the same way mentioned above, but I can give here a catch record of jeremal 592, taken on January 18th, 1929.

(This catch record and all others are a recapitulation only of my notes, as I made them on the jeremal during the fishing period. An exact analysis was made only later on at the laboratory. Rare species are therefore often not mentioned in this record, as they are not of interest for the composition of the catches).

Catchrecord of jeremal 592.

8 h. 30 m. About neap tide.

9 h. First haul. It consists chiefly of *Eleutheronema tetradactylum, Harpodon nehereus, Gobioides anguillaris* and *Gobioides cirratus* and many shrimps (*Penaeopsis* and *Parapenaeopsis*). Some young fry.

9 h. 35 m. About the same composition.

Harpodon and shrimps are caught in much smaller quantities.

10. h. 15 m. About the same composition. *Harpodon* and shrimps have nearly disappeared.

10. 40 m. A very big catch. It consists chiefly of *Gobioides*. Further the composition is about the same as before. A few big specimens of *Arius maculatus* and many small ones. A few *Stolephorus baganensis*.

11 h.. About the same composition. A few specimens of *Pangasius polyuranodon* and *Pangasius nasutus*. A small number of *Cryptopterus hexapterus*. A few small specimens of a *Trichiurus* spec. A few *Cyprinids*. *Gobioides* is much less common now.

11 h. 35 m. About the same composition, but which a large quantity of shrimps and *Harpodon*. The strength of the current has much decreased.

Two catches were hauled in after this. The composition remained wholly the same.

From the above data it follows, that at any rate *Harpodon* and also the shrimps are most common at the beginning and at the end of a catching period.

Of course there must be a reason for this. Now it is well known that *Harpodon* as well as shrimps are poor swimmers. *Harpodon* swims clumsily and slowly. The shrimps swim better, but they are by no means long-distant swimmers. I suppose, that this slow swimming is the cause of the curious fact, that these animals are not caught during a strong current. At first sight this seems very paradoxical. When the current is slow, *Harpodon* is scared back by the wobbling palm-stems and may swim back to the middle of the V. In doing so again and again they come at last against the net, which is the fundamental principle of this method of fishing. When the current is strong, *Harpodon* is simply carried away by it and in this case the fishes are dragged through the openings of the row of palm-stems.

It is possible that these slow swimmers bury themselves in the mud when the current is too strong. Yet I hardly believe that this can be the case. Considering the catchrecord of jeremal 521 one is lead to conclude that *Harpodon* is very sensible to the strength of the current, as every time the latter becomes stronger, *Harpodon* disappears out of the catches, to come back again the moment the strength of the current lessens.

Catchrecord of jeremal 521 January 24th, 1929.

I cannot give the whole catchrecord, as I went away at sunset before the end of the catching-period. Jeremal 521 is interesting through the fact that during the fishing the strength of the current changed several times. See also page 84.

4 h. 40 m. The net is lowered.

5 h. The first catch. It consists chiefly of *Harpodon*. Furthermore a few specimens of *Pellona, Trichiurus, Stolephorus baganensis, Dorosoma chacunda* and *Setipinna taty* are found.

5 h. 30 m. The current, which at first became stronger and stronger, now lessens.

In the catch, which is hauled in now at my request, *Harpodon* is rare.

The catch consists chiefly of *Caranx rottleri, Eleutheronema tetradactylum, Stromateus cinereus* and also some *Pellona, Dorosoma chacunda, Trichiurus, Trygon, Stolephorus, Trypauchen* and *Engraulis kammalensis.*

5 h. 50 m. The strength of the current begins to increase again. Thus the catch of the last twenty minutes is taken during a slow current. *Harpodon* is abundant now! For the rest the composition of the catch remained about the same. *Sergestes* is also abundant now.

6 h. 15 m. During the last twenty-five minutes the current was strong. In this catch *Harpodon* is very rare again! The components of the catch are the same as those of the last one. Some young specimens of *Cybium kühlii* are found. Also *Sergestes.*

6 h. 30 m. The current keeps the same strength. *Sergestes* is rather abundant now. The catch consists of the same components. Only *Eleutheronema* is found in greater abundance than in the former catches.

We see in this case that *Harpodon* is found in greater or smaller quantities, depending on the lessening or strengthening of the current. At the same time the other components of the catches remain about the same. (The abundance of *Eleutheronema* in the last catch is caused by other circumstances. See page 123).

If the first explanation of the curious behaviour of *Harpodon* (viz. that *Harpodon* is dragged through the row of stems, when the current is strong and not, when the current is slower) be right, then it has to be explained also, why strong swimmers are caught especially when the current is strong. This can be explained by assuming, that these swift swimmers can escape the net when the current is still slow and in this case they may escape through the row of stems.

The supposition that the fish may escape through the row of palmstems under certain conditions, is supported also by a look of the catches made by the so-called si-tsji-net. A si-tsji is a bag-shaped net with two fine-mazed wings in the shape of a V. The median axis is placed in the direction of the current, just as is the case with a jeremal.

In fact we have here a net, which catches in precisely the same manner as the jeremal, but with wings not consisting of a row of palmstems. The advantage of this over the jeremal is, that it is transportable, although when in use, it is of course, fixed to the bottom by stakes.

Several of these nets are placed in a row side by side and each net has a length of 16 m. between the ends of the wings. Together they catch much more than would be caught by a jeremal with the same width between the ends of its wings. Each net is therefore rather small, as otherwise the mass of the catch would be too heavy and the net be torn up. These big catches are of course a consequence of the fact, that the wings do not allow anything of importance to escape. If the wings of the jeremal could also prevent, that a part of the catch escaped, there would be no difference in the catches. A few of these nets are used near Pulu Halang Bĕsar and in the Strait between the island Sene-

boei and the coast. At other places their use has been forbidden now, as they are considered to do too much harm to the fishfauna.

I have tried to prove experimentally, that fish can escape between the stems. To this end I used a small net, which had about the same model as the above-named si-tsji. The catch of half an hour consisted of some *Sergestes* and shrimps together with young fry of several fish species. One mature specimen of *Setipinna taty* was caught also. This very small catch is caused by the small dimensions of the net, which had a total breadth of 2 m, and a height of 1 m. only. A net of greater dimensions than those of the commercial ones, would no doubt have caught much more. But at any rate this small catch showed that some fish may escape between the stems and the jeremal therefore does not catch everything.

Information, which I got from R. M. Pratomo, physician at Bagan Si Api Api, shows also that the row of stems allows fish to escape and that only certain species of fish may go through the openings. Behind the wings of a jeremal a so-called ambei or bubu was placed. (An ambei is a small net of about the same shape as a si-tsji. It has very fine meshes and it is used for catching shrimps or Sergestes [depending on the size of the meshes]. These nets are used chiefly on the central bank and near Pulu Halang Bĕsar. Of course they may catch an occasional fish also. In this bubu *Eleutheronema tetradactylum* was chiefly caught and in the jeremal itself the catch consisted mainly of *Stromateus cinereus*. If the row of stems did not allow anything to escape, then the bubu would have remained empty of course.

Returning to *Harpodon nehereus*, if this species could behave in the same way as *Eleutheronema tetradactylum* when the current is strong, it would not be necessary to assume, that it has buried itself in the mud, when it is absent in the catches, as we have suggested above.

From the facts given above we see that a jeremal may catch indiscriminately species of fish present in a given area. Jeremalcatches give therefore a very complete insight into the composition of the fishfauna, unlike most other fishnets, which have a more selective action. Quantitatively we can use the catches with some reserve only. The greater or lesser abundance of a given species in the catches depends on certain circumstances also. If a species is rare in a catch, it is not necessary to conclude, that this species is really rare also in the area of that jeremal. Nevertheless this is mostly the case, as there is always a moment when the strength of the current is favourable for the catch of that special species and at that moment we can see whether it is really rare or not.

The jeremalcatch gives a rather good record of the different stages of length of a species in a given area.

The fine meshes of the net do not allow even the young fry to escape and only very big individuals can evade it.

Besides the methods of fishing mentioned above driftnets and lines are also used.

Driftnet fishery is chiefly found outside the jeremalarea (outside the dotted line on the chart). Only big fishes are caught in this way. Hook and line are used all over the estuary. Of course only predatory fishes are caught.

The following are the main species taken by the driftnets:

1. *Chirocentrus hypselosoma.*
2. *Pellona* spec.
3. *Eleutheronema tetradactylum* (The mature specimens).
4. *Polynemus indicus* (This species is commonly caught).
5. *Sphyraena* spec.
6. *Pristipoma guoraca* (Very common)
7. *Proteracanthus sarissophorus.*
8. *Sciaena* spec. (The big specimens).
9. *Sciaenoides microdon* and *brunneus* (Big and mature specimens).
10. *Megalaspis cordyla.* (Not observed by myself).
11. *Scomberoides lysan.*
12. *Cybium kühlii* (Rare).
13. Several species of sharks.

VII. REGIONAL VARIATIONS IN THE CATCHES.

In examining the jeremal catches of various regions we see, that the composition may be quite different. These differences remain practically constant on succeeding days, and only small fluctuations are to be found. During the different seasons the catches remain constant also (a few cases excepted! See below). A comparison of the catchrecords of January and of October shows sometimes so little difference, that they might have been copied from each other.

As an example I give the list of the species caught in jeremal 790 on January 13th and October 3rd, 1929.

	13 January.	3 October.
Septipinna taty	Abundant. Mature.	Abundant. Mature.
Coilia dussumieri	Abundant. Mature.	Abundant. Mature.
Raconda russelliana	Rare, Mature and immature.	Rather rare. Mature and immature.
Kurtus indicus	Rare. Mature.	Rare. Mature.
Harpodon nehereus	———	Rare. Mature.
Sciaena spec. (sp. *Sc. glauca*)	Rare, Mature and immature.	Rare. Mature and immature.
Trichiurus spec.	A few.	A few.
Dussumieria hasselti	———	A few.
Pellona amblyuropterus.	A few.	A few.
Megalaspis cordyla.	A few. Juvenile.	A few. Juvenile.
Stromateus cinereus	A few Immature.	Rare. Immature.
Clupea macrura	———	A few. Immature.
Clupea toli	A few. Immature.	———

Hemirhamphus marginatus.	A few.	A few.
Tylosurus strongylurus.	A few.	A few.
Stolephorus baganensis.	Rare.	Rare.
Muraenesox talabon	———	A few.
Chirocentrus hypselosoma.	A few.	A few.
Carcharias mülleri	A few. Juvenile.	A few. Juvenile.
Cybium kühlii	———	A few. Juvenile.
Setipinna breviceps.	A few.	Rare.
Eleutheronema tetradactylum.	A few.	A few.
Dorosoma chacunda.	A few.	A few.
Stolephorus tri.	A few.	———
Engraulis dussumieri.	A few.	———
Pellona ditchoa	A few.	———
Tetrodon lunaris	A few.	———
Cynoglossus lingua	A few.	———
Gobioides gracilis	A few.	———

All the species named above were to be found in one single catch. It may be seen at a glance, that the most important factors are the same in January as in October and they are found in the same quantitative proportions. The less common species are of course not always to be found in each of the two catches, but this is to be expected from such occasional guests. It is possible that some of the species, which were absent in October would have been found when a more thorough examination was made. In October I examined the catch only superficially and therefore it may be, that some rare species escaped my notice. In January I stayed on the jeremal during the whole catch-period and I had therefore opportunity to find rare species.

When I went to Bagan Si Api Api for the second time in October, I intended comparing the catches of the dry with those of the rainy monsoon.

I regret to say, that this was not possible as a fortnight before I arrived in October, heavy rains had fallen and large quantities of freshwater were coming down the river, just as was the case in January. I cannot say therefore, if there is a difference in the fauna during the dry and the rainy season.

A difference in the composition may be expected as the Rokan river carries off less water in the dry than in the rainy season and the water in the estuary will therefore have a higher salinity. I got information, that some species of fish are found more to the coastward or more to the seaward in the different seasons, according to the difference in the salinity. As I pointed out above, I cannot give any data from my own experience. (Yet I found similar facts in the rivermouths of Borneo).

In analysing the catches of more than eighty jeremals, spread all over the estuary, I concluded that in the fished part of the sea three areas may be distinguished.

I will call these areas:

1. The Central Area.
2. The Western Border Area.
3. The Eastern Border Area.

Besides the more or less gradual differences in the salinity of the water in a rivermouth, the consistency of the bottom also has a certain influence on the composition of the fauna. The bottom may consists of soft or somewhat harder mud or of sand.

The three areas named above coincide with the areas of different bottom-deposits.

The Central Area includes the central bank and its nearest environment.

The bottom consists of soft mud. The water is during the ebb- and flood-tide very muddy.

This area has a special mudfauna of its own. Besides the freshwater species, sometimes descending into the brackish water of the estuary, also saltwater-species are found here, which have come from more seaward parts. Specimens of the first group are mostly found, of course in that part of the area nearest the rivermouth. Specimens of the second group are mostly found in the outer part of the Central Area.

In the Central Area one can also find the fry and young specimens of species, which live in the border area or even farther out in the sea when adult. Many species migrate towards the coast when they are young.

The Eastern Border Area is situated outside the central bank. The bottom consists of a hard mud in all gradations down to the soft mud of the central bank and to sand. The water in this area is very muddy during the ebbtide only and during the floodtide it shows all degrees from opaque to clear.

This area consists of the whole jeremal-area from Seneboei to the coast opposite Pulu Halang Bĕsar which is partly or wholly included in it according to the season. (See below page 154). Further it is limited by the Central Area and by the seaward limit of the fished area. Actually this region is nothing but a submarine continuation of the central bank.

A special fauna is found here too.

This fauna is mixed with inhabitants of the central bank on the one side and with inhabitants of the open sea on the other side. The latter are represented partly by young specimens only. In the western part of this area species, characteristic of the Western Border Area are also caught now and then.

The Western Border Area is situated along the coast in front of Panipahan. It is the smallest and the least important one. The bottom consists of pure sand and the water is much clearer than in the two other areas.

It is obvious from what we have seen above that each of these three areas has its own characteristic species or groups of species.

It is even posible when examining a given jeremalcatch, to say where the jeremal is situated.

The boundaries are of course not very sharply defined and one area passes

into another more or less gradually. In the first place the limits move with the ebb- and floodtide. A jeremal just on the boundary between two areas will catch other species of fish at the beginning than at the end of the ebbtide. And in the second place species characteristic of one area may go astray into the other.

A closer examination of the catches shows that slight differences exist within the areas themselves. These differences however are so small, that it does not seem advisable to split up the areas into several smaller ones.

Of course the fishermen themselves know these differences very well and each region has its own name. Along the coast the parts of the sea are always called by the name of the settlements or of the rivulets emptying into the sea. Thus they speak of the jeremals of Bagan Si Api Api, of Seneboei, or of Soengei Si Andam, etc.

The sea north of the central bank, down to a depth of 2 m at low tide, is called Pak Tau [1]). North of this is situated the Sai Pak Sai. North-east of Pulu Halang Bĕsar the region is called Pah Tang and north of the island the sea is called Pah Tang Sai.

For the sake of convenience I have divided the chart of the estuary into the sections I—VI and each of the latter subdivided into the parts A—J.

VIII. FISHFAUNA.

The fishfauna is by far the most important and every year quantities to the value of millions of money is taken out of the sea.

It is a well-known fact that the fishfauna near the coast and in the neighbourhood of rivermouths is richer than elsewhere in the sea. This is in a high degree the case in the mouth of the Rokan. It is no doubt a consequence of the abundance of food in the water, which is greater than that in most other rivermouths. The accumulation of individuals relates only to a number of definite species, viz. only such species as are adapted to the conditions of life offered by a rivermouth.

The area in front of the Rokan river is very rich in individuals, but the number of species is for a tropical region relatively limited. I counted all in all 149 species, all occasional guests included. This number includes 13 species, which I did not see my self, but which are mentioned by WEBER and DE BEAUFORT in their "Fishes of the Indo-Australian Archipelago" and also two species found by Prof. DELSMAN in a collection made by Mr. DE WAART in 1922.

This total number of 149 species may increase without any doubt by the addition of several more or less occasional guests, but I do not think there will be many of them.

Of these 149 species 80 only are to be found regularly and of these eighty

[1]) Sai = West. Pak = North. Tang = East. Tau = Centre. A look at the chart will explain different names.

species fifty or sixty only are common. Seventy species, the lesser half therefore, are more or less occasional guests.

We may expect, that an area, where the salinity is liable to change so much and where all degrees are found from liquid mud to clear water, will have its own special fauna. This fauna is to be found again modified more or less by the local circumstances, in all big rivermouths of Sumatra.

I will give of each fish a full account of the places, where I got it. Each jeremal has a licence, which is numbered. I used the number [1]) of these licences in indicating the jeremals. As I did not visit all the jeremals the numbering shows big gaps.

When dealing with a certain species I give first the regions in which it is found. Below each region I put down the numbers of the jeremals, situated in it, where the species has been caught.

Behind each number I indicate the abundance. (Very abundant, rather abundant, rather rare, rare, very rare). I give further behind each number the stage of maturity of the fish, as far as it has been determined.

I use the scientific names and the system followed by WEBER and DE BEAUFORT in their "Fishes of the Indo-Australian Archipelago", as far as it has been published. For the families not treated by the above named authors I follow DAY's "Fishes in India". Only for the Carangidae I use the generic- and specific names as given by WAKIYA in his "The Carangoid Fishes of Japan" (Annals of the Carnegie Museum. Vol. XV 1924).

Fam. *Elopsidae.*

1. **Megalops cyprinoides** (BROUSS.).

I only saw a few specimens of this species at the fishmarket of Bagan Si Api Api. I could not get any information as to the exact place where these fishes had been caught. At any rate they are not abundant at all in the sea near Bagan Si Api Api.

Fam. *Clupeidae.*

2. **Chirocentrus hypselosoma** BLKR. (See DELSMAN, HARDENBERG in Treubia Vol. XII 1930).

I D	I E	I F	II B
781 A few.	515 A few.	753 1 specimen.	778 A few.
	844 A few.		

II D	II E	II F	II G	II H
173 A few.	117 1 specimen.	567 1 specimen.	790 A few.	248 A few.
315 1 specimen.		776 A few.		251 1 specimen.
259 1 specimen.				
780 1 specimen.				

II I	III C	III D	III E
774 1 specimen.	84 A few.	68 A single.	218 1 specimen.

[1]) Of the jeremals x_1, x_2, x_3 I do not know the numbers.

Chirocentrus is a fish not living in shoals and is never caught in big numbers. In January I only saw fishes of about 40 cm up to a length of about 80—90 cm, they were all mature. In October I found, side by side with fishes of the same length as given above, rather abundantly also young fishes of about 10—20 cm, which seemed to be lacking totally in January.

I can not give an opinion as to the meaning of this fact. It is evident from the chart, that *Chirocentrus* frequents that part of the sea, which is situated north of a line passing from Soengei Siandam north of Pulu Halang Bĕsar and the central bank to Seneboei. In the very muddy water south of this line Chirocentrus evidently does not occur.

This species is mature at a length of about 40 cm.

3. **Dussumieria hasseltii** BLKR.

I F	II B	II D	II G	III C
753 A few.	778 A few.	780 1 specimen.	686 1 specimen.	546 A few.
			790 1 specimen.	

This species too prefers relatively clear water. It is very rare, a single specimen only was found in the catches from the jeremals 686, 790 and 780. They are most probably all strayed specimens as *Dussumieria* lives in small shoals. In the jeremals in front of the mouth of the Panei river where the water is not so muddy as in front of the Rokan, they are therefore rather abundant.

For the fisheries of Bagan Si Api Api this species is of absolutely no importance. I found it in January as well as in October.

4. **Dorosoma chacunda** (H.B.).

I H	II B	II D
845 A few.	778 A few. Mature.	173 A few. Mature.
		315 Rare. Mature.
		780 A few.

II G	II H
686 A few. Mature.	809 A few.
790 A few. Mature.	248 Rare. Mature and immature.
658 1 specimen. Mature.	521 Rather abundant. Mature and immature.

II I	III E	III F
774 A few.	218 A few. Mature.	171 A few. Mature.
		559 A few.

III G	III I
652 One specimen. Mature.	421 A few. Mature and immature.
562 A few. Mature.	
X_1 A few.	

IV D	IV F
676 A few.	72 A few.

Dorosoma chacunda is found in the whole area and is as a matter of fact missing only in the part of the sea between Poeloe Halang Besar and the maincoast of Bagan Si Api Api. It seems that this species avoids the very muddy regions. As a fact *Dorosoma chacunda* prefers the shallow water along the coasts and is to be found regularly in front of other rivermouths also.

This species is ripe at a length of about 15 cm.

5. **Setipinna melanochir** (BLKR.).

This species is mentioned by WEBER and DE BEAUFORT in their "Fishes of the Indo-Australian Archipelago" for Bagan Si Api Api. I could not get this fish myself.

Most probably they live above Bagan Si Api Api in the river proper. Of the three *Setipinna*'s occurring in the Archipelago this species is the one which is most often found in fresh water, as I could ascertain in other rivers.

6. **Setipinna breviceps** (CANTOR).

I. E.
515 A few. Immature.

I. H.
845 A few. Mature.

II. D.
173 A few.
315 A few. Mature.

II. E.
117 1 specimen.

II. F.
567 A few. Immature.
776 Rare. Mature and immature.

II. G.
658 A few. Mature and immature.
686 A few. Immature.
790 Rare. Immature.

II. H.
809 A few. Mature.
248 Rare. Mostly immature.
521 Rather abundant. Mature and immature.

II. I.
774 A few. Mature and immature.

III. C.
86 A few. Mature and immature.
84 A few. Mature and immature.

III. D.
68 A few. Immature.
69 Abundant. Mature and immature.

III. E.
218 Rare. Mostly immature.
571 A few. Juvenile.

III. F.
171 A few. Mature and immature.
559 A few. Immature.

III. G.
652 A few. Immature.
562 A few.

IV. D.
676 A few. Immature

X_2 A few.
602 Fry. Rather abundant,
IV. F.
104 Abundant. Immature.
310 A few. Immature.
Boeboes before Halang. A few. Immature.

IV. E.
520 A few.

IV. G.
195 Fry. Rather abundant.

V. E.
470 1 specimen. Immature.

This highly esteemed food fish is mostly caught in a few specimens only, and seems to avoid the waters with very muddy bottom near Bagan Si Api Api and the waters with sandy bottom near Panipahan. Most specimens caught are immature and in some jeremals even young fry is found rather abundantly. (Nr. 602 and 195). *Setipinna breviceps* thus propagates in the fished area in front of Bagan Si Api Api. WEBER and DE BEAUFORT also mention *Setipinna breviceps* for this place.

The species is mature at a length of ± 25 cm.

7. **Setipinna taty** (C. V.).

I. D.
781 A few. Mature.

I. E.
515 Rare. Immature.
844. Rare. Mature.

F.
753. Rather abundant. Mature.

I. H.
845 Abundant. Mature.

II. B.
X_3 A few.

II. D.
173 Rare. Mature.
315 Abundant. Mostly mature.
259 Rather abundant. Mature.
780 Abundant. Mature and immature.

II. E.
117 Abundant. Mostly mature.

II. F.
567. Abundant. Mature.
776. Abundant. Mature

II. G.
658 Abundant. Mature.
686 Rather rare. Mature and immature.
790 Very abundant. Mostly mature.

II. H.
809 Abundant. Mature.
404 Abundant. Mature.
248 Abundant. Mostly mature.
521 Rather abundant. Mature, and also some fry.

II. I.
774 Abundant. Mature.

III. C.
546 A few. Mature.
86 Abundant. Mostly immature.
84 A few.

III. D.
68 Abundant. Mature.

III. E.
787 Abundant. Mature.
218 Abundant. Mature and immature.
571 Rather rare. Mature.

III. F.
171 A few. Mature.
103 A few.
559 A few. Mature and immature.
901 A few.
104 Rare. Immature.

III. G.
652 Rather abundant. Immature.
562 Abundant. Mature.
X_1 A few.
602 A few. Immature and some young fry.

III. I.
421 A few. Immature.

IV. D.
X2 Abundant. Mature.
676 Abundant. Mostly immature.

IV. E.
520 Rather abundant. Mature and immature.

IV. F.
72 A few.
310 A few.

IV. G.
195 Fry. Rather abundant.
402 Immature and also much fry.

V. E.
470 A few. Mature and immature.
438 A few. Immature.

V. G.
729 Fry rather abundant.
592 Fry rather abundant and also some immature specimens.

Setipinna taty is of great importance for the fisheries. The species seems to prefer a muddy bottom. From the data given above it follows, that they are lacking in the area with a sandy bottom near Panipahan. On the submarine continuation of the central bank they are very abundant and the specimens are mostly mature, whereas on the central bank itself they are rare and these specimens are immature. Between Pulu Halang Bĕsar and the maincoast they also occur in big numbers as is apparent from the catch of jeremal 520. We can draw a line from the northern point of Pulu Halang Bĕsar to jeremal 571 and from this to jeremal 171 and 602 further along the coast to jeremal 421. Between Pulu Halang Bĕsar and the maincoast this line must be drawn between jeremal 520 and 470. Outside this line *Setipinna taty* occurs in big numbers and the specimens are mature for the greater part. (Except jeremal 521, where I found some fry also). At the inner side of the line *Setipinna taty* is mostly immature and is rare in the various catches and in the jeremals near the maincoast of Bagan Si Api Api young fry is taken in rather large quantities. (i.e. jeremal 602 in III G, 195 in IV G and 729 and 592 in V G). The young *Setipinna*'s evidently prefer the coastal parts of the fished area and especially that part, that is situated near the rivermouth proper.

TABLE I. *Setipinna taty* C. V.[1]).

Length.	N.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.
J. 104	39		4	20	15															
J. 521	75								1	28	29	15	3	1						
J. 571	56							2	10	17	22	4	1							
J. 676	181	2	5	13	30	45	12	5	12	31	15	8	2	1						

In Table I one can see clearly the difference in length and therefore also in maturity of the *Setipinna*'s caught in the jeremals which are situated nearer or farther away from the rivermouth.

In jeremal 104, situated at the coastal side of the line mentioned above, most of the fishes have a length of about 6 cm and in jeremals 521 and 571, situated outside the line, the greater part have a length of about 12—13 cm. Jeremal 676 shows a doubletopped curve. Here mature and immature animals were caught together. Evidently we have here an area where the two stages are mixed together.

Setipinna taty reaches maturity at a length of about 12 cm.

8. **Engraulis kammalensis** (BLKR.).

I. E.
515 A few.

II. D.
315 Rather abundant. Mature and immature.

II. E.
117 Rare. Mature and immature.

II. F.
776 A few. Mature.

II. G.
686 Abundant. Immature.

II. H.
248 Rather abundant. Mature.
521 Rare. Mature.

II. I.
756 A few.

III. C.
84 Rare.

III. D.
68 Rare. Immature.

III. E.
218 A few. Mature.
571 Rather abundant. Mature.

III. F.
171 Very abundant. Mature.
103 Rare.
559 Rather abundant. Mature.
901 Rather abundant. Mature.

III. G.
562 A few.
602 A few. Mature. Some fry.
652 Rare. Mature.

III. I.
421 A few. Mature and immature.

III. J.
Si Tsji Seneboei. A few.

[1]) In this and in the following tables the length of the fishes is given in cm. The numbers 4 means a length of 4 - 4.9 cm, the number 5 a length of 5 - 5.9 cm and so on.

IV. D.	IV. F.	IV. G.
676 Rare. Immature.	104 Rare. Immature.	153 A few. Immature.
	389 Rare. Immature.	195 Fry, rather abundant.
	310 Rare. Immature.	402 Fry, rather abundant.
V. E.	V. G.	
438 Rare. Immature.	729 Fry abundant.	
	592 Fry abundant.	

Engraulis kammalensis, which is often found in front of the rivermouths, has about the same area of distribution as *Setipinna taty,* but is less abundant. This species is absent also along the coast in the neighbourhood of Panipahan, but the boundary line is much more to the south than is the case with *Setipinna taty,* which is frequent at the jeremals 86 and 68 whereas *E. kammalensis* is only rarely caught and moreover the specimens are immature. The main area of distribution is the submarine continuation of the central bank, but the inner limit of the abundant occurrence of ripe fishes is here nearer to the coast than with *Setipinna taty.* This species is caught in abundance for instance in the area of the jeremals 571 and 171, which are situated in the boundary zône of *Setipinna taty.* On the other hand the boundary in section III G seems to lie more seaward, and is to be found somewhere between jeremal 652 and 686, which is also the case in section II H where the line has to be drawn somewhere between jeremal 521 and 248. It is evident that *E. kammalensis* lives in places where the muddy bottom is still relatively soft, as in sections I D, E, F, en H where the mud is much harder, this fish is relatively rare or absent. It is caught therefore only sporadically in the region N. E. of the central bank. Only in the catch of jeremal 248 the species occurs in a somewhat greater quantity. At the inner side of the boundary zône mentioned above *E. kammalensis* is much less common and immature, and the jeremals situated near the coast of Bagan Si Api Api and those in front of the rivermouth take young fry in a relatively great abundance. (i.e. Jeremal 602, 195, 402, 729 and 592).

In October the catches of *E. kammalensis* in general were much smaller as was also the case with the young fry. Young *Engraulis dussumieri* on the other hand was taken in greater quantities.

TABLE II *Engraulis kammalensis* BLKR.

Length.	N.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
J. 571	59						23	32	4			
J. 104	38	4	30	4								

In Table II the difference in size and thus in maturity inside and outside the boundary zône is very clearly to be seen.

This species reaches maturity at a length of about 9.5—10 cm.

9. **Engraulis grayi** (BLKR.).

II. D.
780 One specimen. Mature.

III. E.
571 A few. Mature.

This species is very common in the Archipelago, but at Bagan Si Api Api it seems to be an occasional guest only.

10. **Engraulis mystax** (BL. SCHN.).

III. E.
571 A few. Mature.

III. J.
Si Tsji Seneboei. Rare. Immature.

This species is also very common in the Archipelago, but is practically absent in the fished area of Bagan Si Api Api, where it was caught in small numbers only near Seneboei. It is therefore remarkable that *E. grayi* as well as *E. mystax* were to be found in the catch of jeremal 571.

11. **Engraulis dussumieri** (C. V.).

I. E.
844 A few. Mature.

I. F.
753 A few. Mature.

II. D.
315 A few. Mature.

II. E.
117 A few. Mature.

II. G.
790 A few. Mature.

II. H.
404 Abundant. Mature.
248 Rare. Mature.
521 A few. Mature.

III. D.
68 A few. Mature.

III. E.
218 A few. Mature.
571 Rare. Mature, and immature.

III. G.
602 A few.

This species, rather common in the whole Indo-Australian Archipelago seems to be more or less euryhaline. I found it more than once in front of rivermouths. In January I did not find it in as large a quantity as in October, although even in the latter month it was not common.

In October I found many specimens in the adjacent mouth of the Panei river. Not much can be said about the distribution of this species in the area of Bagan Si Api Api. Anyhow the main area of distribution is lying north and north-east of the central bank and a few specimens had gone astray in the brackish water as far as jeremal 602. In the area with sandy bottom in front of Panipahan I did not find a single specimen.

This species is mature at a length of about 10 cm.

12. **Stolephorus tri** (BLKR.).

II. G.
790 2 specimens. Mature.

This species is very common in front of the rivermouths of Sumatra (e.g. the mouths of the Panei, Indragiri and Moesi).

Off Bagan Si Api Api, however, I did not find more than the two specimens mentioned above. Yet it is evident from the planctoncatches made by Prof. DELSMAN, that the species spawns outside the fishing area of Bagan Si Api Api, as planctonic eggs were found in large numbers. The bulk of the specimens seems to live therefore outside the jeremal area. Why this species lives so far in sea in front of the mouth of the Rokan I do not know. In the other rivers named above the species goes much further upstream.

13. **Stolephorus baganensis** Nov. spec. [1])

I. D.
781 A few. Immature.

I. E.
515 A few. Mature.

I. F.
753 A few.

II. B.
778 A few.

II. D.
780 A few. Mature. Some young fry.
315 A few. Mature and immature.

II. E.
117 Rare. Mature.

II. F.
567 A few.
776 A few. Mature, much immature.

II. G.
658 A few.
686 Rather abundant. Mature and immature.
790 Rare. Mature.

II. H.
521 Rather abundant. Mature, immature, some fry.
404 A few.
248 Rare. Mature and immature.

II. I.
756 A few.
774 Rare. Mature and immature.

III. C.
546 Rare. Juvenile.
86 Rare. Mature and immature.
84 A few.

III. E.
787 Rather abundant. Also some fry.
218 Rare. Mature.
120 A few.
571 A few.

III. F.
171 Rare.
103 A few.
559 Rather abundant. Mature.
901 Rather abundant. Mature and immature.

III. G.
652 One specimen.
562 A few.
X_1 A few. Mature and immature.
602 A few. Mature. Some young fry.

III. I.
421 Rare. Mature.

[1]) A full description will be published in a short time.

III. J.
Si Tsji Seneboei. Rare. Mature and immature.

IV. D.
676 A few.

IV. E.
520 Rare. Mature.

IV. F.
72 A few.
389 Rare.
310 A few. Mature.
104 Rather abundant. Immature and mature.

IV. G.
195 Fry.
298 A few.

V. E.
470 Some mature specimens. Much fry.

V. G.
729 Immature and mature. Some fry.
592 Mature. Some fry.

This species, which is to be found regularly in front of the mouths of the big rivers, occurs in the whole area of Bagan Si Api Api. From investigations not yet published, it appears that two different races can be distinguished in the sea in front of Bagan Si Api Api, races which can be separated also by their planctonic eggs as was pointed out by Prof. DELSMAN. (See Treubia Vol. XIII 1931).

One race (A) proved to live much nearer to the coast than the other race (B) which lives farther out in the sea. I prefer not to separate the two races in the list of catches given above. In the whole area, besides bigger individuals which can be distinguished from each other, smaller individuals are also caught, which cannot be distinguished at first sight. It is practically impossible to separate the young individuals and the fry of the two races. From the plancton investigations by Prof. DELSMAN it appeared that the planctonic eggs of the race B were found farther out at sea than the eggs of the race A. I suppose, therefore, that the young specimens and the fry caught in the whole sections I and II belong mainly to race B and that the young individuals and the fry, which are caught on the central bank, belong to race A. Individuals belonging to race B, as far as they can be distinguished are rarely caught, apparently because the main area of distribution lies outside the fished area. Clearly recognizable specimens of races B were found in the following catches.

I. D.
781 Immature.

II. D.
780 Mature.

III. H.
521 Mature.

III. G.
652 One specimen only.

III. I.
421.

Stolephorus baganensis reaches maturity at a total length of about 7 cm. This holds for both races.

14. **Coilia dussumieri** C. V.

I. D.
781 A few. Mature and immature.

I. E.
515 Rare. Mature and immature.

I. F.
753 Abundant. Mature.

I. H.
845 Abundant. Mature.

II. B.
X_3 Rare.

II. D.
173 Abundant. Mature
315 Rather abundant. Mature.
780 Rare. Mature and immature.
259 A few.

II. E.
117 Rather abundant. Mature.

II. F.
567 Abundant. Mature.
776 Rather abundant. Mature.

II. G.
658 Rather abundant. Mature.
686 A few. Mature.
790 Very abundant. Mature.

II. H.
809 Abundant. Mature.
404 A few.
248 Rather abundant. Mature and immature.
521 Rather abundant. Mature.

II. I.
744 Rather rare in January.
Abundant in October. Mature.

III. C.
546 A few. Mature.
86 Rare. Mature.
84 A few.

III. D.
68 A few.

III. E.
218 A few. Immature.
571 A few. Immature.

III. F.
171 A few. Immature.
559 A few. Mature.

III. G.
652 A few. Immature.
X_1 A few.

III. J.
Si Tsji Seneboei. Rare.
Mostly mature.

IV. D.
X_2 Abundant. Mature.
676 A few. Mature and immature.

IV. E.
520 A few. Immature.

IV. F.
310 A few.

The area of distribution of *Coilia* is about the same as that of *Setipinna taty*. *Coilia* is rare or absent in the part with a sandy bottom near Panipahan. The same is the case on and about the central bank. The species is also rare in the area n.w. of Pulu Halang Bĕsar (III C and D and IV D) where *Setipinna taty* is common. (Only jeremal X_2 shows a larger quantity of *Coilia* in the catch). As a matter of fact only the jeremals in the sections I and II show big catches of *Coilia*. The jeremals in section III mostly catch a few individuals only and south of the line from the northpoint of Pulu Halang Bĕsar to jeremal X_1 and 744 *Coilia* is never caught (except J. 310 in IV F). It seems therefore that *Coilia* avoids the very muddy water above the soft muddy bottom of the central bank.

It strikes one, that the jeremals north of the central bank in section III take mostly immature specimens, as is the case with *Setipinna taty*. I did not find juvenile specimens, smaller than about 5 cm, or young fry, neither in January nor in October.

The young fry of *Coilia* seems therefore to live outside the fished area. Yet it is evident that the spawning area is not far away, considering the big number

of ripe specimens, that is caught every day. Dr. DELSMAN has found the pelagic eggs in great quantities and will shortly publish an article on this subject.

Coilia dussumieri reaches maturity at a length of about 10 cm.

15. **Clupeoides lile** (C. V.).

II. G.	III. C.	III. D.	III. E.
686 A few.	86 1 specimen. Immature.	68 A few.	787 A few. Mature.
		69 A few.	218 Rather abundant. Mostly mature.

III. G.	IV. F.	V. E.
652 1 specimen. Immature.	104 1 specimen. Mature.	470 A few. Immature.
602 1 specimen. Immature.		

V. G.
592 A few. Immature.

This species is of no importance as a component part of the fauna. Mostly a few individuals only are caught and only in the catch of jeremal 218 *Clupeoides* was to be found in a larger quantity. Nothing can be said with certainty about the distribution. Yet it is a remarkable fact, that this species goes into waters with such a low salinity. (V E and G!).

Clupeoides lile reaches maturity at a length of about 8.5 cm.

16. **Clupea toli** C. V.

I. F.	II. B.	II. D.	II. E.	II. G.
753 A few.	X_3 A few.	259 A few.	117 One specimen.	790 2 specimens.
		780 A few.		

II. H.	III. C.	III. D.	III. E.	III. F.
521 A few.	86 1 specimen.	68 A few.	218 A few.	559 A few.
			571 1 specimen.	

III. G.	III. I.	IV. D.	IV. E.	IV. F.
652 1 specimen.	421 A few.	X_2 1 specimen.	520 A few.	71 1 specimen.
602 1 specimen.		676 A few.		310 1 specimen.

IV. G.
298 A few.

This species which furnishes the very important article of trade "troeboek" (fishspawn), is caught only sporadically in the sea off Bagan Si Api Api. I always saw young specimens up to a length of about 20 cm, and never more than a few individuals together. This Clupeid seems to live solitarily, as never more than one individual is caught at the same time. At the fishmarket of Bagan Si Api Api, however, I saw one mature individual, but I could get no information about the exact place, where it had been caught. I can say nothing in particular about the distribution in the fished area. The area in front of the proper rivermouth seems to be avoided.

17. **Clupea macrura** (BLKR.).

II. D.	II. E.	II. G.	II. H.
315 1 specimen.	117 1 specimen.	790 2 specimens.	521 1 specimen.

III. E.	IV. E.
218 1 specimen.	520 1 specimen.

This species, which is much rarer than *Clupea toli*, is also caught in young specimens only and never more than one or two individuals are found in the catch.

Along the whole coast of Sumatra *Clupea toli* is much more common than *Clupea macrura.*

18. **Clupea kanagurta** (BLKR.).

I did not see this species myself. It was found by Prof. DELSMAN in a jeremalcatch near Panipahan. (Collection DE WAART 1922).

19. **Pellona amblyuropterus** BLKR.

II. D.	II. F.	II. G.
173 A few. Immature.	567 A few. Immature.	686 1 specimen. Immature.
		790 A few. Immature.

II. H.	III. G.
521 A few. Mature and immature.	602 A few. Immature.
	562 1 specimen.

III. J.	III. I.	IV. D.
421 A few. Immature.	Si Tsji Seneboei. A few.	676 1 specimen. Immature.

IV. F.
104 Very rare. Immature.

Pellona amblyuropterus is relatively rare. I found never more than a few specimens together in one catch. I think therefore, that this and the other species of the genus *Pellona* are solitary species. *P. amblyuropterus* is of no importance at all for the fisheries. About the distribution I can only say, that the central bank seems to be avoided. All specimens were young (10—15 cm) with a single exception in jeremal 521 (see above). At which length this species is mature I could not ascertain, as I got no transitional stages. *P. amblyuropterus* and *P. ditchoa* are the commonest species of the genus in the sea off Bagan Si Api Api.

20. **Pellona ditchoa** C. V.

I. E.	I. F.	II. E.
844 A few. Mature.	753 A few. Mature.	117 1 specimen. Immature.

II. H.	III. J.
248 A few. Immature.	Si Tsji Seneboei. A few. Immature.

About this species the same can be said as about *Pellona amblyuropterus.*

21. **Pellona pristigastroides** BLKR.

II. H.
521 1 specimen.

III. E.
218 Rare. Immature.

III. G.
652 1 specimen. Immature.

IV. D.
676 1 specimen. Immature.

This species, very rare off Bagan Si Api Api and elsewhere in the Archipelago, is of no importance as part of the fauna. I only saw immature animals.

22. **Pellona dussumieri** C. V.

I. E.
515 2 specimens. Immature.

I. F.
751 1 specimen. Immature.

Very rare species. As was the case with the other *Pellona* species I found young individuals only.

Mature specimens of the genus *Pellona* seem therefore to live outside the fished area.

In the jeremals 602, 195, 103 and 592 I found some fry of *Pellona*. I was not able to make out the species.

23. **Opisthopterus tartoor** (C. V.).

I. F.
753 1 juvenile specimen.

II. F.
567 1 juvenile specimen.

III. E.
787 A few juvenile specimens.

Very rare. I did not find this species in any other rivermouth of Sumatra either.

24. **Raconda russelliana** GRAY.

I. D.
781 Abundant. Mostly immature.

I. E.
844 Rare. Mature.
515 A few.

I. F.
753 Rare. Mature.

I. H.
845 A few. Immature.

II. D.
173 Rare. Mostly mature.
315 A few. Immature.
780 A few. Mature and immature.

II. F.
567 1 specimen. Mature.

II. G.
790 A few in January
Rather abundant in October. } Mature.

II. H.
809 A few.
248 A few. Mature.

III. C.
546 A few. Immature.
84 A few. Immature.

III. D.
68 Rare. Immature. In January.
Rather abundant. Immature. In October.
69 A few.

III. E.
787 A few. Juvenile.
218 Rare. Mature.
571 A few. Juvenile.

III. G.
602 A few.

IV. D.
676 A few. Immature.
X_2 Abundant. Mature.

Raconda is much more common than the allied genus *Opisthopterus* and therefore it is more important as a part of the fauna. The distribution, as a whole, is about the same as that of *Setipinna taty*.

The species is absent in the area with sandy bottom near Panipahan and in the area of the central bank with the soft-muddy bottom. *Raconda* seems to be more susceptible to muddy water, than *Setipinna*. (It is possible, of course, that it is a susceptibility to the salinity also, but this is very difficult to decide in this case, as the water has a lower salinity wherever the muddiness is greater). Therefore the species is absent in IV E and in III F-J. (Except a few astrayed animals in III. G, 602), where *Setipinna taty* is found rather regularly though not in great numbers. The limit for *Raconda* is found more seaward, from jeremal 676 (IV D) to 571 (III. E.) and from there to the sections II. F, G and H. In these regions the species is rather regularly found though seldom in considerable numbers. Nothing can be said with certainty about a regional distribution of mature and immature specimens. Young fry is found sporadically.

This species reaches maturity at a length of about 16 cm.

Fam. Scopelidae.

25. **Harpodon nehereus** (HAM. BUCH.).

I. E.
515 Rare. Immature.
844 Rare. Mature.

I. F.
753 A few. Mature.

I. H.
845 A few.

II. D.
173 Rare. Mature and immature.
315 Rare. Mature.
259 A few.

II. E.
117 Rather abundant. Mature.

II. F.
567 Rare. Immature and mature.
776 Abundant. Mature.

II. G.
658 Abundant. Mature and immature.
686 Rather abundant. Immature.
790 A few.

II. H.
809 A few.
404 A few. Mature.
248 A few.
521 Abundant. Mature and immature.

II. I.
774 A few. Mature

III. C.
546 Rare. Mature.
86 Rather abundant. Mature and immature.
89 A few.

III. D.
68 A few. Immature.

III. E.
787 A few.
218 A few. Immature.
571 A few. Immature.

III. F.
171 A few. Immature.
559 Rare. Immature.
901 A few.
104 Rather abundant. Mostly immature.

III. G.
652 Abundant. Immature.
562 Rather abundant. Mature and immature.
X_1 A few.
202 A few.
602 Rather abundant. Mature and immature.

III. H.
414 A few.

IV. D.
676 A few. Mature and immature.

IV. E.
520 A few. Immature.

IV. F.
72 A few.
389 A few.
310 Abundant. Immature.
Si Tsji Halang.

IV. G.
293 A few.
195 Very abundant. Immature.
122 A few.
298 Abundant. Immature.

V. E.
470 A few. Immature.
438 A few.

V. G.
592 A few. Immature.

Harpodon has little importance for the fisheries. As a consequence of the great percentage of water in the muscles the quantity of salt required for conservation is too great. Yet this species is a very important part of the fauna.

Harpodon is very euryhaline and seems to prefer a muddy bottom. The species is caught throughout the fished area and only in the part with sandy bottom near Panipahan it is wholly absent.

The distribution is rather irregular in the area inhabited and I see no special factor on which this depends. Typical in this regard is for instance the list of jeremals in section IV G (see above). Yet I got the impression, that in the jeremals farther away from the coast, *Harpodon* is rarer, as can be seen in the list of jeremals given above. In examining the different catches I was struck by the fact, that the individuals are bigger when the jeremal is more distant from the coast, and only in the sections I, II and III one can find mature animals (jeremal 676 in IV D expected).

Thus I found in jeremal 521 for 114 specimens lengths from 10—22½ cm but most animals had a length of 16—19 cm. In measuring 76 specimens from jeremal 602 I found lengths ranging from 13—22½ cm and again the majority of the specimens measured from 16—19 cm. In jeremal 104 16 animals were measured and their lengths varied from 9—24 cm but the majority measured 13—15 cm and 38 specimens out of the catch of jeremal 195 had lengths varying from 5—9 cm with a maximum at 6—7 cm. See table III.

TABLE III. *Harpodon nehereus* (HAM. BUCH.).

Length.	N.	4.	5	6.	7.	8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
J. 521	114							1			2	4	7	12	22	37	15	9	3	2			
J. 602	76										1	3	5	8	9	11	23	5	10	1			
J. 195	38			15	16	5	1																
J. 104	76						1	2		4	13	19	14	9	3	7				1		1	

Specimens with lengths below 5 cm were found in small numbers scattered over the central bank.

This species reaches maturity at a length of about 18 cm.

Fam. Siluridae.

26. **Silurichthys phaiosoma** (BLKR.).

This species is mentioned by WEBER and DE BEAUFORT for Bagan Si Api Api in their "Fishes of the Indo-Australian Archipelago". (Vol. II p. 197). I did not see it myself.

27. **Cryptopterus hexapterus** (BLKR.).

V. G.

592 Rather abundant. Immature.

Cryptopterus hexapterus is properly speaking a freshwaterfish, which descends especially at low tide into the estuary. According to the fishermen the jeremals in the river near Pulu Pĕrdamaran often have this highly esteemed food fish in their catches.

Fam. Plotosidae.

28. **Plotosus canius** HAM. BUCH.

II. H.	III. C.	III. G.	V. G
248 A few specimens.	84 1 specimen.	652 1 specimen.	592 A few specimens.

Besides the places mentioned above *Plotosus* is often caught in the river-jeremals near Pulu Pĕrdamaran, from where fresh specimens are brought every day to the fishmarket at Bagan Si Api Api. This species is therefore very euryhaline.

Fam. Pangasidae.

29. **Pangasius nasutus** (BLKR.).

V. G.

592 Some young specimens and a few very big ones (60—70 cm).

This species is properly speaking a freshwaterfish, but descends into the sea at low tide.

These and other riverspecies are mostly caught at the end of the tide when the water has reached nearly its lowest level. When the tide is coming in they ascend the river again. I got information that these species are caught abundant-

ly at neap tide, when there is only a relatively small quantity of seawater mixed up with the freshwater from the river. The same should be the case where after heavy downpours of rain, the river brings large quantities of freshwater down into the sea and when the salinity consequently is very low.

30. **Pangasius polyuranodon** (BLKR.).

III. G.
651 1 specimen. Mature.
562 1 specimen. Mature.

V. G.
592 Some mature specimens.

This is also a freshwaterfish, but it seems that some individuals go into the brackish water and even far out into the sea where I found it at a salinity of 15—20‰ (section III G!). Evidently, then it goes much farther out than *Pangasius nasutus*.

Fam. Ariidae.

31. **Arius argyropleuron** C. V.

This species is mentioned for Bagan Si Api Api by WEBER and DE BEAUFORT. (Vol. II pag. 279). I did not see a single specimen.

32. **Arius maculatus** (THUNB.).

V. G.
592 Rather abundant. Mature and immature.

I found this species in jeremal 592 only, in front of the rivermouth. According to WEBER and DE BEAUFORT this species lives in rivers as well as in the sea and therefore one can expect this species in the jeremals farther in the sea also. A very euryhaline fish.

33. **Arius sagor** (HAM. BUCH.).

II. H.
521 1 specimen.

V. G.
592 Some mature specimens.

This is a very euryhaline species too, as it lives in rivers as well as in the sea.

34. **Arius macronotacanthus** BLKR.

IV. F.
104 1 specimen.

Very rare in the fished area. WEBER and DE BEAUFORT give as habitat "sea and rivers".

35. **Arius caelatus** C. V.

This species, which I did not see, is mentioned by WEBER and DE BEAUFORT (Vol. II pag. 310). It lives in the sea and in rivers.

36. **Arius doriae** VINC.

II. H.
248 1 specimen.

V. G.
592 1 specimen.

This species, hitherto known from Serawak only, is rare in the area. It seems to be very euryhaline too.

37. **Ketengus typus** BLKR.

V. G.
592 1 juvenile specimen.

According to WEBER and DE BEAUFORT a freshwater species, which descends into the brackish water of the estuaries.

38. **Hemipimelodus macrocephalus** BLKR.

I found one specimen at the fishmarket in Bagan Si Api Api. The actual place where it was caught, sea or river, is unknown to me. According to WEBER and DE BEAUFORT it is a freshwater species.

39. **Osteogeneiosus militaris** (L.).

II. H.
248 2 specimens.

III. G.
602 1 specimen.

III. I.
Si Tsji Seneboei. A few.

IV. G.
195 A few.

V. G.
592 A few.

A euryhaline species, which may be found in front of the mouth of other rivers too. According to WEBER and DE BEAUFORT a marine species, which sometimes ascends the rivers.

Fam. Bagridae.

40. **Macrones wolffi** (BLKR.).

V. G.
592 2 specimens.

A river species, sometimes descending into the estuaries.

41. **Macrones nemurus** (C. V.).

V. G.
729 A few.
592 A few.

About this species the same can be said as about *Macrones wolffi.*

42. **Macrones micracanthus** (BLKR.).

This very common freshwater species is mentioned by WEBER and DE BEAUFORT for Bagan Si Api Api. (Vol. II. p. 339).

I did not succeed in getting a single specimen.

Fam. Cyprinidae.

43. **Rasbora argyrotaenia** (BLKR.).

This species is mentioned for Bagan Si Api Api by WEBER and DE BEAUFORT (Vol. III p. 61). I did not see a single specimen, although I got several specimens from the mouths of Borneo rivers.

44. **Leptobarbus hoevenii** (BLKR.).

V. G.
592.

A river species, descending sometimes into the estuaries. It is mentioned also by WEBER and DE BEAUFORT (Vol. III p. 96).

45. **Osteochilus melanopleura** (BLKR.).

V. G.
592.

A river species too, descending sometimes into the brackish waters of the rivermouth.

46. **Osteochilus spilurus** (BLKR.).

V. G.
729.

About this species the same can be said as about *Osteochilus melanopleura*.

47. **Puntius hexazona** (WEBER and DE BEAUFORT.).

This species is mentioned by WEBER and DE BEAUFORT (Vol. III. p. 181). I did not see it.

Fam. Congridae.

48. **Muraenesox cinereus** (FORSK.).

I. E.	II. H.
844 1 specimen.	248 1 specimen.

Muraenesox cinereus is regularly found in the different estuaries of Sumatra, though always a few specimens only. WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol. III p. 253).

49. **Muraenesox talabon** (CANTOR).

II. D.	II. E.	II. G.	III. C.
315 1 specimen.	117 A few.	790 A few.	86 1 specimen.
780 1 specimen.		686 2 specimens.	
III. E.	IV. G		
218 A few.	195 1 specimen.		

Evidently this species is more common than *M. cinereus* and specimens of all lengths are caught from a few dm up to a length of 1.5 m.

It is distributed over the whole area, but the central bank and the proper mouth of the Rokan is avoided. This species is also to be found regularly in front of any other rivermouth.

WEBER and DE BEAUFORT mention this species for Bagan Si Api Api too (Vol. III p. 255).

During my residence in Bagan Si Api Api I thought that only one species of *Muraenesox* occurred in the fished area. Therefore I did not preserve every specimen I got. Thus from my notes it is not possible to decide which of the two species was caught. I found specimens of which I cannot give the species name, in the catches of the following jeremals.

II. D.	II. E.	II. G.	III. C.	III. E.	III. G.
780	117	686	86	218	X_1

Fam. Neenchelidae.

50. **Neenchelys buitendyki** WEBER and DE BEAUFORT.

II. D.	III. G.
315 1 specimen.	602 A few.

A very rare species, which is of no importance at all as a component of the fauna.

Fam. Ophichthyidae.

51. **Ophichthys macrochir** (BLKR.).

II. D	III. E.	IV. D.	IV. F.
315 1 specimen.	787 1 specimen.	676 1 specimen.	310 1 specimen.

Besides the places mentioned above, I found this species at the fishmarket. It is to be found in the mouth of other rivers too. WEBER and DE BEAUFORT mention this fish for Bagan Si Api Api (Vol. III p. 306).

Fam. Belonidae.

52. **Tylosurus strongylurus** (v. HASS.).

II. B.	II. G.	III. E.	III. G.	III. I.
X_3 A few.	790 A few.	218 1 specimen.	652 A few.	421 A few. Juvenile.
		571 A few.	562 A few.	
			602 A few.	

III. J.
Seneboei. Si Tsji. A few.

Tylosurus strongylurus swims in little shoals of about 10—20 specimens, and mostly the whole shoal is caught at once. The species avoids the central bank and seems to frequent the eastern part of the Eastern Border Area. WEBER and DE BEAUFORT mention this species for Bagan Si Api Api (Vol. IV p. 121).

53. **Tylosurus annulatus** (C. V.).

II. B.
X_3 1 specimen.

I got only one specimen of this species, which is widely distributed throughout the Archipelago.

Fam. Hemirhamphidae.

54. **Hemirhamphus georgii** C. V.

II. B.	II. D.	II. E.	II. G.	II. H.	III. C.
778. A few.	173 A few.	117 A few.	790 A few.	248 A few.	546 A few.
	780 A few.				

III E.	III. G.	IV. D	IV. F.
218 A few.	562 A few.	676 A few.	310 A few.
120 A few.	602 A few.		

H. georgii swims in little shoals of about 10—20 specimens. They live in the whole fished area outside the central bank. (Jeremal 310 excepted!). I found this species in front of different other rivermouths of Sumatra and Borneo. This species is euryhaline. WEBER and DE BEAUFORT mention it for Bagan Si Api Api.

55. **Hemirhamphus gaimardi** C. V.

II. G	III. C.	III. E.	III. I.
686 1 specimen.	86 2 specimens.	787 A few.	421 1 specimen.
		571 1 specimen.	

Unlike *H. georgii* this species lives solitarily. This area of distribution is again outside the central bank. This species of the genus *Hemirhamphus* seems therefore to avoid the very muddy water. WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol. IV p. 150).

56. **Hemirhamphus marginatus** (FORSK.).

II. G.	III. C.
790 1 specimen.	86 1 specimen.

Very rare in the area of Bagan Si Api Api.

57. **Dermogenys sumatranus** (BLKR.).

This is a river-species mentioned by WEBER and DE BEAUFORT for Bagan Si Api Api. (Vol. IV p. 139).

58. **Zenarchopterus ectunctio** (HAM. BUCH.).

One specimen caught in the plancton-net in the roadstead of Bagan Si Api Api.

59. **Zenarchopterus buffoni** (C. V.).

III. E.
218 1 specimen.

I found one specimen only, with a reversed colourpattern as the ventral side was dark- and the dorsal side was lightcoloured. I can not say anything about the meaning of this peculiarity.

BEEBE in his "Fishes of Haiti" (Zoölogica Vol. X No. 1) mentions the same fact for young specimens of *Strongylura rhapidoma* (RANZANI).

Fam. Polynemidae.

60. **Eleutheronema tetradactylum** (SHAW).

I. D.
781 A few. Immature.

I. E.
515 A few. Immature.
844 A few. Immature.

II. B.
778 A few. Immature.

II. D.
173 Rare. Immature.
315 Rare. Immature,
1 spec. Mature.
259 A few. Immature.

II. F.
567 A few. Immature.

II. G.
686 Rare. Immature. 1 specimen mature.
790 A few. Immature.

II. H.
248 Rare. Immature.
521 Rare. Immature.

II. I.
756 A few. Immature.
774 A few. Immature.

III. C.
84 A few. Immature.
86 Rare. Immature.

III. D.
68 A few. Immature.

III. E.
218 Abundant. Immature.
571 Rather abundant. Immature.

III. F.
171 Rare. Immature.
559 Rare. Immature.
901 A few. Immature.

III. G.
652 Rather rare. Immature.
562 Rather rare. Immature.
X_1 A few. Immature.
602 Abundant. Immature.
202 Abundant. Immature.

III. H.
414. A few.Immature.

III. I.
421 Very abundant. Immature. 1 spec. mature.

IV. D.
676 Rare. Immature.

IV. E.
520 Rare. Immature.

IV. F.
72 Rather rare. Immature.
104 Rather abundant. Immature.
389 A few. Immature.
310 Rare. Immature.
Boeboes Halang. Rare. Immature.

IV. G.
293 Rather abundant. Immature.
195 Abundant. Immature.
122 Rather abundant. Immature.
298 Rather abundant. Immature.
402 Rare. Immature.
153 Abundant. Immature.
253 Rather abundant. Immature.
153 Rather abundant. Immature.

V. E.
438 A few. Immature.
470 Rare. Immature.

V. G.
592 Rare. Immature.
729 Abundant. Immature .

Eleutheronema tetradactylum is a very important factor of the fauna of the Rokanmouth and therefore very important for the fisheries too. As may be seen from the data given above, all are immature and from time to time only a single ripe specimen is caught in the jeremals far away from the coast. The driftnet-fishermen, who fish outside the area of the jeremals, sometimes do take mature specimens too. Besides I have to draw attention to the fact, that all *Eleutheronema*'s which are caught have a length from about 5 to as much as 25 cm and that the ripe specimens had a length of about 60—70 cm. (One specimen of 42 cm with ripe gonads excepted). Intermediate lengths and lengths below 5 cm were absent altogether. I cannot tell yet whether this phenomenon is due to a periodicity in spawning or to the fact that the missing stadia live elsewhere, outside the fished area. The first supposition is not supported by the fact, that in January as well as in October, the same length-proportions were found.

As to the distribution I could state that *Eleutheronema* is rare in the area with sandy bottom off Panipahan and that the species is very common on and about the central bank only. In the eastern border-area *Eleutheronema* is rather rare, but it is regularly caught there in small numbers. Especially on the eastern part of the central bank this species is common, even so common that 90% of the catch sometimes consists of *Eleutheronema*. Jeremal 421 (III. I) also shows a very high percentage of the species in its catches.

Eleutheronema is common in the sections III. G., IV. F and G and V. G., and it occurs in big numbers in section III. E north-west of the central bank. In the section III. F. which connects III.E. with the other sections named above the species is much less common, but I think this is accidental only.

Eleutheronema seems to prefer water with a special percentage of salinity or mud. At least the jeremals to the seaward of the central bank, as for instance jeremal 218 and jeremal 521 (see p. 92) land the species especially at the end of the ebbtide, when the muddy water flows off from the central bank.

I give as an example the catchrecord of jeremal 218.

This jeremal starts fishing 1 à 1½ hour after the beginning of the ebbtide, at that time only the current flows in the direction of the long axis of the jeremal. Therefore, when at 10 a.m. the first catch was hauled in, the ebbtide had already begun 1½ hour before.

10 h. The catch consists chiefly of *Stromateus cinereus* and *Sciaena* species (*Sciaena vogleri, Sc. belangeri, Sciaena glauca*). *Sciaenoides biauritus* and some specimens of *Clupeoides lile*. Further a few specimens of *Kurtus indicus, Setipinna taty, Eleutheronema tetradactylum, Trichiurus muticus* and *savala, Pellona* spec., *Raconda russelliana, Harpodon nehereus* and *Stolephorus baganensis* were present. I found also one *Otolithus maculatus*, one *Gobioides anguillaris*, one *G. cirratus* and some prawns.

10 h. 55 m. The catch is practically the same with a little school of *Hemirhamphus georgii* (17 specimens), 2 specimens of *Setipinna breviceps,* one *Engraulis kammalensis,* one *Clupea toli,* one *Chirocentrus hypselosoma* and some *Coilia dussumierii.*

11 h. 35 m. On the whole the catch has the same composition. A few *Setipinna breviceps* and *Engraulis kammalensis* and *dussumierii.* Young *Stolephorus baganensis* is rather abundant. Again a few *Clupea toli* and now also *macrura. Stromateus cinereus* is caught in smaller numbers now. The water becomes very muddy.

11 h. 50 m. The numbers of the two species of *Gobioides* increase. More *Trichiurus* and *Sciaena* and *Sciaenoides.* A little school of *Hemirhamphus georgii.* Some young *Stolephorus baganensis* again and a few *Harpodon nehereus.* One specimen of *Muraenesox talabon. Setipinna taty* is rarer now and the specimens are smaller. (Note. This is in agreement with the conclusion drawn from the discussion on *Setipinna taty,* viz. that the young individuals live nearer to the rivermouth. These specimens go seaward with the ebb-flow and approach the coast again at high tide. It is therefore possible that the double-topped curve of the catch from jeremal 672 (see above. Page 104) is due to the fact, that the catches of the beginning and of the end of the ebbtide were mixed together. I did not stay on jeremal 676 during the whole time of catch, but I took only a sample at random). The numbers of *Stromateus* have much diminished.

12 h. 10 m. A good deal of *Eleutheronema* at once. Small *Trichiurus* is rather abundant. As in all catches mentioned above a few small *Raconda russelliana. Setipinna taty* and *Harpodon nehereus* have vanished. The number of *Clupeoides lile* is much smaller.

12 h. 15 m. Many *Eleutheronema.* Only a few *Clupeoides lile* now. One *Stromateus cinereus. Sergestes* is rather abundant at once. *Sergestes* is mixed with small specimens of *Gobioides* and *Cynoglossus monopus.*

Later catches show the same composition. Only the numbers of *Cynoglossus* are increasing.

The catchrecord shows clearly that *Eleutheronema* is more abundant, when the water, flowing off from the central bank, has reached the jeremal. We have seen the same fact with jeremal 521 (see above. Page 92). (Note. *Sergestes* species, which have their main area of distribution on the central bank, increase in numbers at the end of the tide for the same reasons as *Eleutheronema*).

As is the case with other species, the smaller specimens of *Eleutheronema* live nearer the coast and the rivermouth than the bigger ones. See Table IV.

TABLE IV. *Eleutheronema tetradactylum* SHAW.

Length.	N.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15	16.	17.	18.	19.	20.	21.
J. 195	37	6	23	1	4	2	1												
J. 571	15									2	6	2	2	1			1	1	

WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol. IV p. 199).

I could not ascertain at which length the specimens of *Eleutheronema* are mature, as intermediate stadia between immature and mature animals, were absent.

61. **Polynemus indicus** SHAW.

III. E.
571 One young specimen.

This species is rather often caught by the driftnet fishermen outside the jeremal area. I did not see more than the one specimen mentioned above, but I hardly doubt the species will be caught from time to time in the jeremals far away from the coast.

62. **Polynemus dubius** BLKR.

IV. G.
195 A few. Immature.

V. G.
592 Rather abundant. Immature.
729 A few. Immature.

From the data given above it seems that *Polynemus dubius* is a riverspecies as it is only and even rather abundantly caught in the jeremals near the mouth of the river and not in the jeremals farther away. WEBER and DE BEAUFORT, who mention this fish for Bagan Si Api Api. (Vol. IV p. 215), give as habitat "In rivers and sea".

Fam. Sphyraenidae.

63. **Sphyraena** spec.

I saw only one dried specimen in Bagan Si Api Api.

I could not determine the name of the species. Fishermen told me, that it is sometimes caught by the driftnet outside the jeremal area.

Fam. Mugilidae.

64. **Mugil dussumieri** C. V.

II. D.
173 A few.

II. G.
686 A few.

III. E
571 Rare.

III. G
652 A few. Immature.
602 A few.

III. I.
321 A few. Immature.

IV. D.
676 A few.

IV. E.
520 A few.

V. G.
592 Rather abundant. Mature and Immature.

Mugil dussumieri seems to be a very euryhaline species, which perhaps ascends the rivers. I did not find this species near other rivermouths in Sumatra. WEBER and DE BEAUFORT mention the species for Bagan Si Api Api. (Vol. IV p. 235).

This species reaches maturity at a length of about 12 cm.

65. **Mugil cunnesius** C. V.

III. C. IV. D.
86 A few. Immature. 676 A few. Immature.

Rare near Bagan Si Api Api. I did not find mature animals.

66. **Mugil seheli** FORSK.

V. G.
729 1 specimen

After WEBER and DE BEAUFORT, this is a freshwater species, which sometimes descends into the estuaries.

In jeremal 729, 253, 389 and 84 I found a number of very young specimens of a *Mugil*. I could not determine the name of the species with certainty.

Fam. Atherinidae.

67. **Atherina** spec.

I found in Bagan Si Api Api amongst a heap of other fishes one dried specimen. The species of this genus do not seem to occur in the mouth of the Rokan. I cannot guess the reason of this, as in the nearby mouth of the Panei river they are rather common.

Fam. Anabantidae.

68. **Sphaerichthys osphromenoides** CANESTRINI.

WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol. IV p. 349). I did not see it.

69. **Betta anabatoides** BLKR.

I did not see this species either, but it is mentioned for Bagan Si Api Api by WEBER and DE BEAUFORT. (Vol. IV p. 357). I think that the authors got some stray specimens from the river.

Fam. Gadidae.

70. **Bregmaceros maclellandi** THOMPS.

III. III. I. III. J.
86 One specimen. 421 A few. Si Tsji Seneboei.

This species is caught in clear as well as very muddy water.

Fam. Soleidae.

71. **Synaptura commersoniana** (LAC.) CANT.

This species is mentioned by WEBER and DE BEAUFORT for Bagan Si Api Api. (Vol. IV. p. 168). I did not see it.

72. **Cryptops coeca** Nov. spec. [1]).

III. E. IV. G.
571 2 specimens. 253 3 specimens.

1) A description of this new species will be published in a short time.

From this species, which is very strongly adapted to live in the mud (no eyes, tentacles on the finrays, etc.) I found only 5 specimens in total from two different places on the central bank.

73. **Cynoglossus monopus** (BLKR.).

I. E.
844 A few.

II. D.
315 Rare. Mature.
173 Rare. Mature.

II. G.
686 Rather abundant. Mature.

II. H.
248 A few.

II. I.
774 Rare.

III. C.
86 Rare. Mature.

III. D.
69 A few.
68 A few.

III. E.
787 A few.
218 Rather abundant. Mature and immature.
120 Rather abundant. Mature and immature.
571 Abundant. Mature and immature.

III. F.
171 A few.
559 Rather abundant. Mature.
901 A few.

III. G.
652. Rare. Mature.
562 A few.

III. H.
414 Rare. Immature.

III. J.
Si Tsji Seneboei. A few.

X_1. A few.
602 Rare. Mature.

IV. D.
676 Abundant. Mature and immature.

IV. E.
520 Rare. Mature.

IV. F.
72 Rare.
104 A few.
389 A few.
310 Rather abundant. Mature.
Boeboes Halang. A few.

IV. G.
195 Rare. Mature and immature.
298 Abundant. Mature and immature.
402 Very abundant. Mature and immature.
153 Rare. Mature and immature.
253 A few. Mature and immature.

V. E.
470 Rare. Mature.
438 A few. Immature.

V. G.
592 A few. Mature.

This fish which constitutes sometimes an important percentage of the catch, lives principally on the central bank, thus in places with a very soft bottom. In the jeremals situated more to the seaward, on a harder bottom, the number of *Cynoglossus* in the catches diminishes gradually. This species seems to prefer muddy water with a relatively low salinity (15—25‰). As is the fact with *Eleutheronema tetradactylum*, the jeremals north of the central bank catch *Cynoglossus monopus* in big numbers at the end of the ebbtide only.

A definite limit cannot be given for the distribution of this species. *Cynoglossus monopus* is absent only in the area with a sandy bottom near Panipahan.

A boundary between the areas of mature and immature animals can not be given either. In the whole area of distribution one may find mature and immature animals together. Very small specimens and fry are to be found on the central bank only, but here too many specimens of all lengths occur in large quantities.

It is very remarkable, that I did not find *Cynoglossus monopus* in other rivermouths of Sumatra.

WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol IV p. 197).

This species reaches maturity at a length of about 9 cm.

74. **Cynoglossus polytaenia** (BLKR.).

I found this species in the collection of DE WAART made in 1922. I do not know the exact place where it was caught.

75. **Cynoglossus lingua** H. B.

I. E.
515 One specimen.

II. D.
259 A few.

II. E.
117 A few. Mature.

II. F.
686 A few. Immature.
790 One specimen.

III. G.
153 One specimen.

This species is much less common than *Cynoglossus monopus* and lives mainly in the area outside the central bank (except jeremal 153 in III G). This species is therefore very euryhaline. I found *C. lingua* also in other rivermouths of Sumatra and Borneo, always in small numbers.

WEBER and DE BEAUFORT mention this species for Bagan Si Api Api. (Vol. IV p. 203).

Cynoglossus lingua reaches maturity at a length of about 25—30 cm.

76. **Cynoglossus oligolepis** (BLKR.).

This species is mentioned by WEBER and DE BEAUFORT for the sea near Bagan Si Api Api. I did not succeed in getting a single specimen.

Fam. Centropomidae.

77. **Lates calcarifer** (BLOCH).

I saw one small specimen of this species at the fishmarket of Bagan Si Api Api. I did not succeed in getting information about the exact place where the animal had been caught. At any rate the species is very rare. In other rivermouths the fish is very common. Why it is absent here I did not know.

Fam. Serranidae.

78. **Serranus fuscoguttatus** (FORSK.).

III. G.
X_1 One specimen.

I did not see more than this single, very big, specimen.

Fam. Theraponidae.

79. **Therapon theraps** C. V.

II. H.	II. I.	III. G.	IV. G.
248 1 specimen.	756 1 specimen.?	602 1 specimen.	195 1 specimen.?
	774 1 specimen.		

Never did I see more than one specimen in a catch. This species is therefore very rare. At first sight I thought the animals to be specimens of *Therapon jarbua*, which is common everywhere, but examination at home showed, that the three specimens, which I had preserved, all belonged to *Therapon theraps*. Whether *Therapon jarbua* after all occurs near Bagan Si Api Api, I cannot say, but it is not impossible that one or both of the not preserved specimens (from jeremal 756 and 195) belongs to this species.

Fam. Pristipomatidae.

80. **Pristipoma maculatum** (BLOCH).

II. B.

X_3 One specimen.

I did not see more than a single young specimen. In the other rivermouths of Sumatra I did not find the species either, but I got it regularly from the rivermouths of Borneo.

81. **Pristipoma guoraca** (RUSSELL).

This species is rather often caught by the driftnet-fishermen outside the fished area. In the catches of the jeremals I never saw it but the outer ones will undoubtedly catch it from time to time.

Fam. Chaetodontidae.

82. **Scatophagus argus** (L.).

II. G.	II. I.	III. H.
686 1 specimen.	756 1 specimen.	414 1 specimen.

This species, so common elsewhere, seems to be rare near Bagan Si Api Api. It seems to prefer the eastern part of the area.

Fam. Mullidae.

83. **Upenoides sundaicus** BLKR. (?)

III. G.	III. J.
602 1 specimen.	Si Tsji Seneboei.

In each of these two cases I got a young specimen, which probably belongs to the above named species.

I did not see more than this single, very big, specimen.

Fam. Theraponidae.

79. **Therapon theraps** C. V.

II. H.	II. I.	III. G.	IV. G.
248 1 specimen.	756 1 specimen.?	602 1 specimen.	195 1 specimen.?
	774 1 specimen.		

Never did I see more than one specimen in a catch. This species is therefore very rare. At first sight I thought the animals to be specimens of *Therapon jarbua*, which is common everywhere, but examination at home showed, that the three specimens, which I had preserved, all belonged to *Therapon theraps*. Whether *Therapon jarbua* after all occurs near Bagan Si Api Api, I cannot say, but it is not impossible that one or both of the not preserved specimens (from jeremal 756 and 195) belongs to this species.

Fam. Pristipomatidae.

80. **Pristipoma maculatum** (BLOCH).

II. B.

X_3 One specimen.

I did not see more than a single young specimen. In the other rivermouths of Sumatra I did not find the species either, but I got it regularly from the rivermouths of Borneo.

81. **Pristipoma guoraca** (RUSSELL).

This species is rather often caught by the driftnet-fishermen outside the fished area. In the catches of the jeremals I never saw it but the outer ones will undoubtedly catch it from time to time.

Fam. Chaetodontidae.

82. **Scatophagus argus** (L.).

II. G.	II. I.	III. H.
686 1 specimen.	756 1 specimen.	414 1 specimen.

This species, so common elsewhere, seems to be rare near Bagan Si Api Api. It seems to prefer the eastern part of the area.

Fam. Mullidae.

83. **Upenoides sundaicus** BLKR. (?)

III. G.	III. J.
602 1 specimen.	Si Tsji Seneboei.

In each of these two cases I got a young specimen, which probably belongs to the above named species.

Fam. Sparidae.

84. **Crenidens** spec.

III. F.
559 1 specimen. Juvenile.

III. G.
602 1 specimen. Juvenile.

As I did not see older specimens, I could not determine the name of the species. This species is at any rate very rare.

85. **Proteracanthus sarissophorus** CANTOR.

II. I.
774 1 specimen.

Besides the specimen mentioned above, I saw several specimens at the fish-market of Bagan Si Api Api. This species is rare in the mouth of the Rokan, but the jeremals in the mouth of the Panei do take it regularly.

Fam. Scorpaenidae.

86. **Leptosynanceia asteroblepa** BLKR.

III. E.
218 1 specimen.

III. G.
X_1 1 specimen.

V. G.
592 1 specimen.

The species of *Leptosynanceia,* occurring sometimes in the catches, are considered to be very poisonous by the fishermen and they are carefully thrown over board again.

87. **Leptosynanceia** spec.

III. E.
571

I could not see more than a single specimen. I could not determine the species name.

Fam. Kurtidae.

88. **Kurtus indicus** BLOCH.

I. D.
781 Rather abundant. Mature and immature.

I. E.
515 Abundant. Mature.
844 Abundant. Mature.

I. F.
753 Rather abundant. Mature.

II. B.
778 Abundant. Mature and immature.

II. D.
173 Rare. Mature and immature.
315 Rare. Mature and immature.
780 A few. Immature.
259 Rather abundant. Mature and immature.

II. E.
117 A few.

II. F.
567 A few. Immature.

II. G.
686 A few. Immature.
790 Rare. Mature and immature.

II. H.
248 Rather abundant. Mature and immature.
521 Rare. Mature and immature.

III. C.
546 A few. Mature.
86 Rare. Immature.
84 Rare. Immature.

III. D.
68 Rare.

III. E.
218 Rare. Mature.
120 Rare.
571 Rare. Mature and immature.

III. F.
559 Rare.
901 Rare. Immature.

III. G.
652 A few. Immature.
602 Rare. Immature.

III. I.
421 A few. Immature.

IV. D.
X_2 A few.
676 Rare. Immature.

IV. E.
520 Rare. Immature.

IV. F.
310 Rare. Immature.
Boeboes Halang. A few.

IV. G.
153 A few.
253 A few.

V. E.
470 Abundant. Immature.

Kurtus indicus is a very important part of the fishfauna of Bagan Si Api Api. It is regularly caught in great numbers. It is found in the whole fished area, where it is common everywhere. It has no special preference for a region with a sandy or muddy bottom, although it is not caught in the jeremals nearest the rivermouth.

In accordance with this, the number of individuals caught increases the more distant from the coast the jeremal is situated. One finds in the summary given above only the expressions "abundant" or "rather abundant" behind the numbers of the jeremals situated in the sections I and II. These differences in abundancy are perhaps due to the salinity or to the degree of clearness of the seawater.

It is evident also from the summary given above, that the younger specimens live nearer to the coast, than the mature ones. Mature (side by side with immature-) individuals are found in big numbers almost exclusively in the sections I and II.

About *Kurtus* the same can be said as about *Coilia*, viz. that either the young lives outside the fished area or that there is a definite spawning-time, which did not fall in January or October, the two months, when I visited Bagan Si Api Api. The smallest specimens I saw had a length of about 3—4 cm.

This species reaches maturity at a length of about 8,5—9 cm.

Fam. Sciaenidae.

89. **Sciaena vogleri** (BLKR.).

II. G.
790 A few. Mature.

III. E.
218 Rather abundant. Mature and immature.

Besides in the two places mentioned above, I did not find the species with any certainty. It is possible, that I overlooked some individuals in the catches of the jeremals, as most *Sciaena*-species resemble each other very much. I did not find any more specimens in the material collected and preserved of other jeremals. Yet I think it probable that this species can be found more, as in the catch of jeremal 218 it was rather abundant. I have no reason to suppose that the species lives only in that restricted region.

Sciaena vogleri reaches maturity at a length of about 10 cm.

90. **Sciaena albida** (C. V.).

II. G.
790 Rare. Mature and immature.
521 A few. Mature.

III. E.
571 A few. Immature.

III. G.
602 A few. Immature.

III. E.
104 A few. Immature.
72 A few. Immature.

This species may attain a length of a few dm and is caught in the jeremals as well as in the driftnets outside the jeremal-area. The young specimens, which I got, had a maximum length of about 10 cm.

91. **Sciaena belangeri** (C. V.).

II. H.
248 Rare. Mature.

III. E.
218 Rather abundant. Mature and immature.

III. I.
421 Rare. Mature.

I found this Sciaena species, which is very easily to distinguish, only in the three places mentioned above.

The distribution therefore is very scattered. One has to take in account the possibility, that *Sciaena belangeri* lives in shoals. Otherwise it cannot be explained why for instance in jeremal 218 the species is caught rather abundantly and why the other jeremals in the neighbourhood do not catch a single specimen. Perhaps this is also the reason for the scattered distribution of *Sciaena vogleri* (see above). It is very remarkable, that *Sciaena belangeri* as well as *Sc. vogleri* are found abundantly in the jeremal 218. I cannot say yet whether this is only accidental, or whether there is a special reason for it. I am quite sure, that *Sc. belangeri* occurs in the catches only from the places mentioned above, but I am not for *Sc. vogleri*, as was pointed out above (see *Sc. vogleri*).

The real limit of such a species is of course not easy to define as it will be found one day in this and the other day in another region.

The species reaches maturity at a length of about 10 cm.

92. **Sciaena glauca** DAY.

I. E.
515 A few. Immature.
844 A few. Mature.

II. B.
X_3 A few.
778 Rare. Mature.

II. D.
173 Abundant. Mature.
259 A few.
315 A few.

II. E.
117 Rather abundant. Mature and immature.

II. F.
776 A few. Mature.

II. G.
790 Rare. Mature.

II. H.
809 A few.
521 A few. Mature.
248 Rare. Mature.

II I.
774 A few.

III. C.
546 A few.
86 Rather abundant. Mature.

III. D.
69 A few.

III. E.
787 A few. Mature.
218 Rare. Immature.
120 A few.

III. F.
559 A few.
171 Rather abundant. Mature and immature.

III. G.
652 A few. Mature.
X_1 A few.
202 Rare. Mature.

III. J.
Si Tsji Seneboei. A few.

IV. E.
520 A few. Mature.

IV. F.
104 A few.
389 Rather abundant. Mature.

IV. G.
153 Abundant. Mature
122 A few.
293 Rather abundant. Mature.

V. G.
592 Rare. Mature.

Sciaena glauca is the most common species of the genus. Everywhere, on the central bank as well as in the border areas, it is to be found rather regularly. *Sciaena glauca* is very euryhaline, as it is caught in the jeremals near the river-mouth proper as well as in the jeremals far out at sea. Nearly all specimens examined had ripe gonads and there is no evidence that the immature individuals live nearer to the coast, than the mature ones. Yet I sometimes found at a few places on the central bank and its nearest neighbourhood a single juvenile *Sciaena*, but I cannot say to which species it belongs. These specimens may belong to *Sc. glauca* as well as to any other species.

The number of the juvenile specimens, however, is very small and is out of proportion to the number of the ripe ones. The propagation of the various *Sciaena*-species therefore either seems to take place elsewhere or there is a definite spawning time, not coinciding with the months of January and October.

The great numbers of ripe individuals, which I found on each occasion, do not seem to confirm the last supposition. (See also *Kurtus, Coilia* and others).

This species reaches maturity at a length of about 8—9 cm.

93. **Sciaena carutta** (BLOCH).

V. G.
592 A few.

I saw some individuals in the catch of jeremal 592 only.

94. **Sciaenoides pama** (HAM. BUCH.).

III. G.
652 A few. Immature.
602 A few. Immature.

IV. F.
389 A few.

IV. G.
195 A few.
253 A few.

V. G.
592 A few.

This *Sciaenoides* is the rarest of the four *Sciaenoides*-species occurring in the area. It is therefore the least important one.

I did not see a single mature specimen.

95. **Sciaenoides biauritus** (CANTOR).

I. E.
515 A few.
844 A few.

I. H.
845 A few.

II. B.
X_3 A few in October.

II. D.
173 A few.
315 A few.

II. G.
658 A few. Mature and immature.
686 A few. Mature.
790 A few. Immature.

II. H.
248 Rather abundant. Immature.
809 A few.

II. I.
756 Rare.
774 A few. Mature.

III. C.
86 Rather abundant. Mature.

III. E.
218 Rather abundant. Mature.

III. F.
103 A few. Mature.

III. G.
X_1 A few.
202 Rare. Mature.

III. I.
421 A few. Mature.

III. J.
Si Tsji Seneboei. Rare. Mature and immature.

IV. D.
676 A few. Immature.

IV. E.
520 A few. Mature and immature.

IV. F
310 Rather abundant. Mature.
104 A few.

IV. G.
153 Abundant. Mature.
195 Rare. Mature and immature.
293 A few.

V. G.
592 A few. Mature.

The fishermen do not distinguish this *Sciaenoides*-species from the members of the genus *Sciaena* and they are all called "Ikan goelamah". The following can

be said about the distribution. *Sciaenoides biauritus* is rare on the sandy bottom in front of Panipahan, but for the rest this very euryhaline species is found everywhere in the whole area, from the jeremals situated most seaward unto the jeremals situated near the rivermouth proper. There seem to be no special regions which the species prefers. All stages of maturity can be found everywhere.

Unlike *Sciaena glauca, Sciaenoides biauritus* does spawn inside the fished area. As a fact one can find each stage from young fishes of 1,5—2 cm up to mature individuals.

This young fry is found everywhere and does not seem to be restricted to one special region. Yet it is caught in greatest numbers on the central bank.

This species is mature at a length of 12—13 cm.

96. **Sciaenoides microdon** (BLKR.).

III. F.	IV. G.
171 1 specimen.	153 1 specimen.

In each of these two cases I got one single young specimen. The species is regularly caught by the driftnet fishermen. These specimens have a length of 4—5 dm and are mature. Also the outer jeremals may catch it sometimes. *Sciaenoides microdon* together with *Sciaenoides brunneus* and big *Sciaena*'s and *Silurids* are the fishes which furnish the so called fishstomach (= air bladder) of the trade.

97. **Sciaenoides brunneus** (DAY).

I. F.	II. H.
753 1 specimen.	248 1 specimen.
	809 1 specimen.

About this species the same can be said as about *Sciaenoides microdon.* People told me, that *Sc. brunneus* is less common than *Sc. microdon.*

I cannot confirm this from my own experience. The two species are found in front of other rivermouths too.

98. **Otolithus maculatus** (KUHL and v. HASS.).

II. D.	III. E.
259 1 specimen.	218 1 specimen.
	571 1 specimen.

In the area of Bagan Si Api Api this species is rare as is the case in other rivermouths.

Fam. Trichiuridae.

99. **Trichiurus glossodon** BLKR.

I. D.	I. E.	II. B.
781 A few. Immature.	844 A few. Immature.	778 Rather abundant. Mature.
	515 Rare. Immature.	

II. D.
173 Rare. Immature.

II. E.
117 Rare. Immature.

II. F.
567 A few. Immature.

II. G.
790 A few. Mature.

II. H.
521 Rather abundant. Mostly immature.

II. I
774 Rare. Mature and immature.

III. C.
86 Rather abundant. Juvenile.

III. E.
218 Rare.Mature.
120 A few.
787 Rather abundant. Mostly immature.

III. F.
171 A Few.

III. G
602 A few. Immature

III. I
Si Tsji Seneboei. Rare. Immature.

IV. E.
520 A few. Immature.

IV. F.
104 Very rare. Juvenile.

We conclude from the above data that *Trichiurus glossodon* is a rather common animal in the catches. It is found in the whole area on sandy as well as on muddy bottom. It is only on and about the central bank, that the species is absent. As a fact *Tr. glossodon* seems to avoid the relatively fresh and muddy water. I can not say much about the distribution of mature and immature animals. One may observe only that the percentage of mature animals increases in going seaward. Here Prof. DELSMAN found the planctonic eggs (see Treubia Vol. IX, 1926).

I did not find any young fry of the species. The smallest specimens had already a length of about 15 cm.

This species is mature at an approximate length of about 30—35 cm. As a fact the length of these fishes is not easy to be measured. The long pointed tail often varies in length as the end is often bitten of by other fishes. Of course this is the case with all species of *Trichiurus* (and *Coilia* also).

100. **Trichiurus savala** (C. V.).

I. D.
781 Rare. Immature.

I. E.
844 A few. Immature.
515 Abundant. Mature.

I. F.
753 A few. Mature.

II. B.
778 A few. Immature.

II. D.
173 Rare. Immature.
315 Rare. Immature.
780 A few.
250 A few.

II. E.
117 Rather abundant.
Mature and immature.

II. F.
567 A few. Immature.
776 Rare. Mature and immature.

II. G.
686 A few. Immature.
658 A few. Immature.
790 A few.

II. H.
248 Rare. Mature and immature.
521 Abundant. Mature and immature.
809 A few.

II. I.
774 Rare. Mature and immature.

III. C.
86 Rather abundant. Juvenile.
84 A few.

III. D.
68 A few.

III. E.
787 A few. Immature.
218 Rather abundant. Immature.

III. F.
559 A few. Immature.

III. G.
652 Rare. Juvenile.

IV. E.
520 A few. Immature.

IV. F.
310 A few. Immature.
104 Very rare. Juvenile.

V. G.
592 Rare. Juvenile.

This species is much more common than *Tr. glossodon*. The area of distribution is on the whole the same, only the young individuals are found much nearer the coast. (As far as jeremal 592, in front of the mouth of the Rokan!)

The mature specimens live in the area of the outer jeremals, as is to some degree, the case with *Tr. glossodon* also. The smallest specimens of this species had a length of about 15 cm. I did not see the young fry although Prof. DELSMAN found the eggs in the sea outside the outer jeremals.

This species is mature at an approximated length of about 35—40 cm and is therefore somewhat bigger than *Tr. glossodon*.

N.B. I found also some *Trichiurus* in the catches of the jeremals No. 676, 470, X_1, 845 and 253. As I did not preserve these specimens, I cannot say to which species they belong.

As all species of *Trichiurus* resemble each other very much, it is quite possible, that in the area of Bagan Si Api Api there can be found a third or even a fourth species which escaped my notice.

In examining the preserved animals at the laboratory I found only the two species, mentioned above. They are at any rate much more common than any other species, which eventually might be found at some time, or other.

Fam. C a r a n g i d a e.

101. **Megalaspis cordyla** (L.) (*Caranx rottleri* BLKR.).

I. D.
781 A few. Juvenile.

I. E.
515 A few. Juvenile.
844 A few. Immature.

I. F.
753 A few. Immature.

II. B.
778 Abundant. Juvenile.
X_3 A few. Immature.

II. D.
315 Rare. Immature.
780 A few. Immature.

II. E.
117 A few. Immature.

II. G.
790 A few. Immature.

II. H.
404 A few.
521 A few. Immature.

II. I
774 A few.

III. C.
84 A few.

III. D.
69 A few.
68 A few.

IV. D
X_2 Abundant. Immature.
676 A few. Immature.

IV. F
310 A few.

Most individuals of *Megalaspis* were very young animals with a length of 5—6 cm. I have called these specimens "Juvenile", bigger ones "Immature".

I never saw mature specimens, neither in the jeremals nor in the driftnets. The species is to be found on the sandy bottom in front of Panipahan as well as on the muddy bottom outside the central bank. On the central bank I found it only exceptionally in jeremal 310. The species is found therefore in the whole sections I and II and in the sections III. C, III. D, and IV. F, the same area of distribution as have so many species, which are absent on the central bank. It is noteworthy, that this species, which is so common near Bagan Si Api Api was found only very rarely by me in the mouths of other rivers of Sumatra and Borneo.

102. **Caranx (Atule) miyakamii** WAKIYA.

I. D.
781 1 specimen. Immature.

V. G.
592 A few. Immature.

This species must be euryhaline, as can be seen from the data given above. It seems to be very rare. I found also some young specimens in the mouth of the Indragiririver. I did not see a single ripe individual.

103. **Atropus atropus** (BLOCH SCHNEIDER) (*Caranx atropus*).

II. B.
778 A few. Juvenile.
X_3 A few.

II. H.
248 A few. Immature.

III. D.
69 A few.

III. E.
787 A few.
218 A few. Immature.

I did not see mature specimens of this species. As far as can be concluded from the few data, this species lives only in the western part of the area, as well on sandy as on muddy bottom. I found a few specimens also in other rivermouths.

104. **Alectis major** (C. V.) (*Caranx gallus* L.).

I saw only one dried specimen at Panipahan.

105. **Scomberoides lysan** (FORSK) ?

III. E.
218 A few. Juvenile.
120 A few. Juvenile.

I did not get mature specimens of *Scomberoides* in a fresh state, but I saw some in a dried state at Bagan Si Api Api. I got informations, that they are

caught sometimes in the outermost jeremals, but mostly by the driftnets. I am not sure that the young animals mentioned above really belong to *Scomberoides lysan*. It is therefore possible that another *Scomberoides* species may be found in the sea near Bagan Si Api Api.

106. **Platax** spec.

II. H.
248 1 specimen. Juvenile.

I could not determine the speciesname with certainty.

107. **Equula insidiatrix** (BLOCH).

II. B.
X_3 1 specimen.

III. J.
Si Tsji Seneboei. 1 specimen.

In each of these two cases I saw only one specimen. In the sea in front of the mouth of the Rokan this species is very rare. I found it much oftener in other rivermouths, together with other *Equula*-species, which seem to be totally absent in the Rokan mouth.

Fam. Stromateidae.

108. **Stromateus sinensis** EUPH.

II. D.	II. F.	III. C.	III. E.
780 1 specimen.	776 1 specimen.	546 1 specimen.	218 1 specimen.

I saw only a few young specimens of this rare species.

109. **Stromateus niger** BLOCH.

II. F.	III. C.	IV. F.
776 1 specimen.	86 1 specimen.	72 1 specimen.

Stromateus niger is in the sea near Bagan Si Api Api as rare as *Str. sinensis*. Sometimes a single specimen is caught which has gone astray, as *Str. niger* is a pelagic species of the open sea. This specimens, which I got were all young ($\pm$ 10 cm). I saw one mature one in a dried state at Seneboei.

110. **Stromateus cinereus** BLOCH.

I. E.	I. F.	II. B.
515 Rare. Mature.	753 Rare. Mature.	X_3 Abundant. Mature.
844 Rare. Mature.		778 Abundant. Mature.
II. D.	**II. F.**	**II. G.**
173 Rare. Mature.	776 A few. Immature.	686 A few.
315 Rare. Mature.		790 A few. Immature.
780 Abundant. Mature.		
259 A few.		

II. H.
521 Rare. Immature.

II. I.
774 Rare. Immature.

III. C.
546 Abundant. Mature and immature.
86 Rare. Mostly immature.
84 A few. Immature.

III. D
68 Abundant. Mature and immature.

III. E.
787 A few.
218 Abundant. Immature.

III. F.
559 A few. Immature.

III. G.
602 1 specimen. Juvenile.

III. J.
Si Tsji. Some specimens. Juvenile.

IV. D.
X_2 A few. Mature and immature.
676 A few. Immature.

IV. F.
72 A few.
310 A few. Immature.

V. E.
470 A few. Immature.

Stromateus cinereus is very important for the fisheries and the catches of the jeremals on the sandy bottom near Panipahan contain this fish in a very high percentage. The species lives especially in the western part of the fished area. From the data given above it is evident, that the big numbers of ripe specimens are caught in the section I A - F, II A - D and III A - D. In the other sections a few stray, young animals only (Excepted jeremal 218, where they were caught abundantly) occurred in the catches and the more eastward the jeremals are situated the rarer and the smaller are the specimens taken.

The most eastern jeremals catch only a few individuals of a length of about 2—3 cm. On and about the central bank this species is absent. (Except jeremal 310! Why this jeremal shows so many exceptions in its catches I can not say).

Yet the young fry seem to live chiefly outside the fished area, as the small number of juvenile specimens is out of all proportion to the big number of mature fish. Also in front of Panipahan I only saw sporadically young specimens and fry was entirely absent.

It is also possible, that this species spawns chiefly in other months than January and October. Each year the bulk of the ripe fish disappears in July-August and comes back again in October-November. Several fishermen told me this and indeed during my visit during the first days of October I saw *Stromateus cinereus* in small quantities only and they were mostly immature. Whether this migration repeats itself every year and if so, how far the fish goes away, has to be ascertained by future investigations. Of course it is possible, that the fish moves slightly seaward only and so lives chiefly outside the fished area. Yet this supposition would not tally with the statement of the fishermen, who told me, that towards the end of the dry monsoon (August-September) the water has

a higher salinity as the river carries off less freshwater. As a logical consequence of this many species of fish can move more landward. *Stromateus cinereus* which requires a rather high salinity (25—30‰) on the contrary migrates more seaward! (In the rainy monsoon the seawater of course will have a much lower salinity as the river carries down much freshwater and as a fact we see in that case that the bankfauna moves more seaward).

During my second visit in October it had just begun to rain and lasted for a fortnight and great masses of freshwater and mud were carried off into the sea.

In consequence of this, the situation as it was in the dry monsoon, had changed and yet *Stromateus cinereus* had not come back.

Therefore I suppose, in accordance with the facts, that the disappearance of *Stromateus cinereus* is due to some other reason than to a mere change in the salinity of the seawater, which would be opposed to the migrations of the species. What this other reason is, we can only guess now.

This species is mature at a length of 11—12 cm.

Fam. Scombridae.

111. **Scomber neglectus** v. KAMPEN.

Prof. DELSMAN found this species in a jeremal-catch from the area in front of Panipahan (collected by DE WAART 1922). I did not see this species myself.

112. **Cybium kühli** C. V.

I. F.
753 1 specimen. Mature.

II. B.
778 1 specimen. Mature.
X_3 A few. Immature.

II. F.
776 A few. Immature.

II. G.
790 A few. Immature.

II. H.
248 1 specimen. Immature.
521 A few. Immature.

II. I.
779 A few. Immature.

III. C.
84 Rare. Immature.

III. E.
571 A few. Immature.
218 A few. Immature.

Cybium kühli is a Cybiumspecies, which is often found in the rivermouths. It is the most common of the three species found near Bagan Si Api Api.

Mostly young specimens of a length of 10—15 cm are caught and only in the outermost jeremals and in the driftnets a mature specimen is sometimes found. As a rule one can find in a single catch not more than two or three specimens. Jeremal 84 was an exception as I found here 40—50 specimens.

The area of distribution of *Cybium kühli* is situated outside the central bank.

In other rivermouths (Panei, Indragiri), which do not carry such quantities of mud, *Cybium kühli* is found much further inland. The salinity seems to determine the limit of the presence of the species there, whereas in front of the Rokan river this limit is determined by the percentage of mud.

113. **Cybium guttatum** BL. SCHN.

I. E.
515 1 specimen. Immature.

II. B.
778 1 specimen. Immature.
X_3 1 specimen. Immature.

II. D.
780 1 specimen. Immature.

II. F.
567 A few. Immature.
776 1 specimen. Immature.

II. G.
686 1 specimen. Immature.

III. D.
68 A few. Immature.

III. I.
421 1 specimen. Immature.

The distribution is about the same as of *Cybium kühli* but *C. guttatum* is less common than the former. I did not see a single mature specimen, but it is possible that the outermost jeremals and the driftnets sometimes take one.

114. **Cybium lineolatum** C. V.

III. E.
218 1 specimen. Immature.

I saw only this single specimen.

115. **Echeneis naucrates** L.

III. D.
68 1 specimen.

I did not get more than this single specimen.

Fam. Cottidae.

116. **Platycephalus insidiator** (FORSK.).

I saw one mature specimen at Seneboei. This species seems to be very rare, as the fishermen did not know it.

Fam. Gobiidae.

117. **Gobius** spec.

III. I.
421 1 specimen.

I saw only one specimen of this species, the name of which I could not determine.

118. **Apocryptus lanceolatus** (BL. SCHN.).

III. G.
602.

I saw only one specimen of this species.

119. **Periophthalmus chrysospylos** BLKR.

I preserved only one specimen caught in jeremal X_1.

I saw several times in other jeremalcatches a single dead specimen (see

above). I neglected to preserve these specimens and also I omitted to note down their occurrence, as of course they do not belong to the regular fishfauna of the area of that special jeremal. As I did not collect any specimen at the coast, I cannot say whether *Periophthalmus chrysospylos* is the only species of the genus at Bagan Si Api Api.

120. **Eleotris** spec.

II. H.
180 1 specimen.

I could not determine the name of this specimen.

121. **Eleotris** spec.

III. E.
787 1 specimen.

III. J.
Si Tsji Seneboei. 1 specimen.

Of this species also, it was impossible for me to determine the species name.

122. **Gobioides anguillaris** L.

II. D.
315 1 specimen.
173 A few in October.

II. G.
686 Rather rare. Mature.
790 Very rare. Mature.

II. H.
248 1 specimen. Mature.

II. I.
774 A few.

III. C.
86 A few. Juvenile.

III. E.
571 A few.

III. F.
171 A few.
901 Rare (in October).
559 Rare (only at high tides).

III. G.
X_1 Abundant.
652 Rare. Mostly immature.
602 In January a few. In October abundant.
202 Abundant. Mature and immature.

III. J.
Si Tsji Seneboei.

IV. F.
Boeboes Halang. A few.
389 Abundant. Mature and immature.
72 Rather abundant. Mature and immature.
310 Rather abundant. Mature and immature.

IV. G.
293 Abundant. Mature and immature.
195 Rare. Mature.
122 Abundant. Mature and immature.
298 „ „ „ „
402 A few. Immature.
253 Abundant. Mature and immature.
153 „ „ „ „

V. E.
438 Rather abundant in October. None in January. Mature and immature.
470 „ „ „ „ „ „ „ „ „ „

V. F.
413 Rather abundant.

V. G.
592 Very abundant. Mostly juvenile.
729 „ „ „ „

Gobioides is a very important component of the fauna and in some cases it constitutes even 75—80% of the catches.

For human consumption the species is not much esteemed and the catches are for the greater part used as pigfood. *Gobioides* is a typical muddwelling animal, which prefers therefore the parts of the sea with a soft muddy bottom. The animals seem to hide in the mud at low tide, as in the jeremals situated on the part of the central bank, falling dry at ebbtide, one can catch specimens of *Gobioides* in great numbers until the last moment. The very minute eyes are in accordance with the burrowing mode of life. Of course there are also animals, which are dragged away with the tide. This is proved by the fact, that the jeremals farther out at sea, catch more *Gobioides* at the end of the tide, than at the beginning of it. (See the record of jeremal 218 p. 122). Thus for instance *Gobioides* is caught in jeremal 559 at very high tides only when the currents are very strong.

At least I did not see any *Gobioides* there at neaptide whereas a fortnight later, at high tide, there were a few specimens in the catch. The fishermen told me, that this was always the case. I think that the same thing happens in other jeremals in that region. As I had no time to visit them all twice, I cannot say now if this supposition is true.

Gobioides is distributed over the whole fished area, the part with sandy bottom in front of Panipahan excepted. As the jeremals are situated more seaward, *Gobioides* occurs rarer in the catches.

In the whole section I did not see a single specimen and the fishermen of jeremal 844 told me, that *Gobioides* was exceptionally rare in their area.

The region where the species lives in big numbers is the central bank. In this case inside a line, which can be drawn from the southpoint of Pulu Halang Bĕsar to a place north of jeremal 72 and from there over jeremal 202 to the maincoast.

Inside this region *Gobioides* obviously prefers the eastern part near the maincoast of Bagan Si Api Api.

It is to be regretted that in the middle part of the bank there are only very few jeremals. This part is reserved for the shrimpfisheries. It is therefore not possible to discover if the occurrence of *Gobioides* in a western direction becomes gradually more sporadic. One would expect this, as the jeremals near jeremal 72 (section IV F) did not catch the species, when I visited them, whereas jeremal 72 itself caught many of them. Jeremal 298, in the centre of the bank, caught *Gobioides* abundantly.

In October, when the river carried down large quantities of mud and, as a consequence the surface of the bank had increased considerably, the area in which *Gobioides* was abundant had increased also. To the north the boundary line had to be drawn now over jeremal 602 (III G) in stead of over jeremal 202. Accordingly I found in jeremal 901 (III F) some *Gobioides*, which did not occur in January.

Between Pulu Halang Bĕsar and the main coast, where in January I found

a few individuals only, I found them in October in rather great numbers. The area in which *Gobioides* is common has been therefore enlarged in several directions. I got information, that this is the case every year. After some time the extension of the central bank decreases again through the influence of the tides, so that the central bank returned to its old shape. (Of course the central bank, consisting of such soft material is altering continuously its shape, which therefore never has a fixed outline).

In the area of the central bank one can find individuals of *Gobioides* of all lengths. In almost every jeremalcatch one can find also very young individuals (fry) and in the jeremal 529 and 729 (V G) the fry even preponderates.

As I cannot distinguish the fry of the different species of *Gobioides* it seems to me superfluous to give a special list of the places where I found them. After all in nearly every jeremal, which catches the mature *Gobioides* in any considerable number young fry is found also.

This species is mature at a length of about 11—12 cm.

123. **Gobioides cirratus** (BLYTH).

II. D.	II. E.	II. G.
173 A few (October).	117 Rare. Mature.	562 Very rare. Mostly immature.
315 A few.		602 Abundant (in October).
		X_1 Abundant.
		202 Abundant. Mature and immature.

III. J.	IV. E.	IV. F.
Si Tsji Seneboei.	510 Rare. Mature.	72 Rather abundant. Mature.
		310 Rare. Mature and immature.
		389 A few.

IV. G.	V. E.
293 Abundant. Mature and immature.	470 A few in January. Rather abundant in October.
195 Rare. Mature and immature.	
122 Abundant. Mature and immature.	438 Rather abundant in October.
402 Rare. Immature.	
153 Abundant. Mature and immature.	
253 Abundant. Mature and immature.	

V. F.	V. G.
413 Rather abundant. Mature and immature.	592 Rare.
	729 Rare. Mature and immature.

Gobioides cirratus is just as common as *G. anguillaris* and their areas of distribution are about the same.

Where one species is to be found, one can find the other also.

A discussion of the area of distribution of *G. cirratus* and of other particulars is superfluous as in every respect they quite agree with those of *G. anguillaris*.

This species is mature at a length of about 15 cm.

124. **Gobioides rubicundus** (HAM. BUCH.).

II. G.
686 Rare. Mature and immature.

III. G.
562 A few.
X_1 Rare. Mature.
602 A few. Immature.

IV. F.
104 A few.
310 A few.

V. G.
On the roadstead of Bagan in a planctonnet.
729 ? Juvenile.

Gobioides rubicundus seems to inhabit the same area as the two species mentioned above, but it is much rarer. This species may be easily distinguished from the other ones by its short and thick shape and the russet colour. Perhaps I saw young fry for the species in jeremal 729.

This species is mature at a length of about 15 cm.

125. **Gobioides tenuis** (C. V.). ?

IV. E.
520 1 specimen.

I saw only this single specimen. I am not certain of the name.

N.B. I suppose that more species of *Gobioides* will be found if a thorough search is made for them in the catches. All species (except *G. rubicundus*) resemble each other so much that they are not easy to distinguish if one examines them superficially, when the catch is spread out on the deck. It is certain however, that these other species if any must be rare.

126. **Trypauchen vagina** (BL. SCHN.).

II. G.	II. H.	III. D.	III. E.
686 A few.	248 1 specimen.	68 1 specimen.	571 A few.
	521 1 specimen.		

III. G.	III. H.	III. I.	III. J.
X_1 A few.	414 1 specimen.	421 1 specimen.	Si Tsji Seneboei. A few.

Trypauchen vagina is sporadically found in the area with a muddy bottom outside the central bank. This species thus avoids the area where *Gobioides* is common. It is also absent in the area with a sandy bottom and in the area of the outermost jeremals. I did not see a single specimen in the whole section I. At any rate this species is not common. I saw never more than a few specimens in one catch.

127. **Trypauchen microcephalus** BLKR.

III. J.
Si Tsji Seneboei. A few.

This is the only place where I found a few specimens of this very rare species.

128. **Trypauchenichthys sumatrensis.** Nov. spec. [1]).

III. G.

652 3 specimens.

This is the only place where I found this species.

129. **Pseudotrypauchen multiradiatus.** Nov. spec. [1]).

III. G.

602.

Besides the specimen from the catch of jeremal 602 I found a few in the collection DE WAART. (1922).

Fam. Scleroderm i.

130. **Triacanthus breviostris** TEMM. and SCHLEGEL.

II. B.

X_3 1 specimen.

I saw this single specimen only.

Fam. Gymnodontes.

131. **Xenopterus naritus** RICHARDSON.

II. H.	III. E.	III. G.	IV. D.
248 1 specimen.	218 2 specimens.	562 1 specimen.	676 1 specimen.
		602 1 specimen.	

All species of this family are very rare, except *Xenopterus naritus*, which is the most common of them. I found a few scattered specimens. The number of the places, where they were collected, is too small to draw any conclusion regarding the area of distribution.

At any rate it seems that the central bank is avoided.

132. **Tetrodon oblongus** (BLOCH).

III. G.

602.

I saw only one specimen.

133. **Tetrodon fluviatilis** HAM. BUCH.

III. J.

Si Tsji Seneboei. A few small specimens.

This species, which is so common in front of other rivermouths seems to be very rare in the sea near Bagan Si Api Api.

134. **Tetrodon lunaris** BL. SCHN.

II. B.

X_3.

I saw one specimen only.

[1]) A description of this new species will be published in a short time.

Fam. Carchariidae.

135. **Carcharias laticaudus** MÜLL. HENLE.

II. H.
521.

I saw one specimen only.

136. **Carcharias temminckii** MÜLL. HENLE.

I. E	II. D.
515 1 specimen.	780 1 specimen.

Nothing particular can be said about this species.

137. **Carcharias limbatus** MÜLL. HENLE.

III. F.
171.

I saw one specimen only.

138. **Carcharias mülleri** MÜLL. HENLE.

I. D.	I. E.	II. D.	II. E.
781 1 specimen.	515 A few.	259 A few.	117 A few.
	844 A few.	780 1 specimen.	

II. G.	III. C.	III. E.	IV. D.
658 A few.	86 1 specimen.	218 A few.	676 A few
790 A few.			
689 A few.			

Carcharias mülleri prefers the Eastern Border Area. This species is often caught with the hook and also in the driftnets.

Besides, for the jeremals mentioned above, I noted a *Carcharias*-species in the jeremals 470, 652, 171, 571, 809 and 845, of which I did not determine the speciesname. Most probably they belong to *Carcharias mülleri,* which is by far the most common species.

Fam. Scylliidae.

139. **Stegostoma tigrinum** (GMEL.).

IV. G.
195 A few.

This species seems to be very rare. They brought me the animals as a great curiosity.

140. **Chyloscyllium indicum** (GMEL.).

I. F.	II. G.	II. H.	III. F.
753 1 specimen.	658 1 specimen.	248 1 specimen.	171 1 specimen.

This species is only found sporadically.

From the places mentioned above it follows, that the sharks prefer the borderareas. Yet they are caught sometimes on the central bank and I am told that they are caught in the river as far as 40 miles upstream. I do not know to which species this refers. I did not get a single fresh specimen. I saw on several jeremals on the central bank (f.i. No. 592) small specimens caught on previous days and already salted. The fins had always been cut off, but judging from the shape of the head, they belonged at least for the greater part to the genus *Carcharias*.

Fam. Pristidae.

141. **Pristis** spec.

I saw at Seneboei the saw of a young animal. I could not determine the speciesname. The specimen had been caught in one of the jeremals in the neighbourhood.

Fam. Rhinobatidae.

142. **Rhynchobatis djeddensis** (FORSK.).

III. C.
86 1 specimen.

I saw one specimen only.

143. **Rhinobatis halavi** (FORSK.).

I.F.
753 1 specimen.

III. E.
571 1 specimen.

A rare species.

Fam. Trygonidae.

144. **Trygon sephen** (FORSK.).

II. G.
686 1 specimen.

IV. D.
676 1 specimen.

A rare species.

145. **Trygon uarnak** (FORSK.).

III. H.
248 1 specimen.

I saw this single specimen only.

146. **Trygon walga** MÜLL. HENLE.

II. D.
780 1 specimen.

II. G.
686 1 specimen.

II. H.
571 A few specimens.

III. C.
546 1 specimen.
86 A few specimens.

III. E.
218 1 specimen.
571 1 specimen.

III. F.
171 1 specimen.

III. G.
X_1 1 specimen.

III. I.
421 A few specimens.

III. J.
Si Tsji Seneboei. A few specimens.

IV. F. V. E.
72 1 specimen. 470 1 specimen.

Trygon walga is the most common ray and most preserved rayskins, sold on the market, are skins of this species. I was told, that they are sometimes caught on the central bank, but they never seem to ascend the river.

147. **Pteroplatea micrura** (BL. SCHN.).

II. B. II. H.
778 1 specimen. 248 1 specimen.
A rare species.

Fam. Myliobatidae.

148. **Myliobatis maculata** GRAY and HARDW.

I. D. II. G.
781 1 specimen. 658 1 specimen.
A rare species.

149. **Aetobatis narirari** (EUPH.).

II. B.
778 1 specimen.
I saw this single specimen only.

In examining the list of species given above, it appears, that the fishfauna of the sea near Bagan Si Api Api is composed of a restricted number of families only.

In the first place the family of the *Clupeidae* must be mentioned. Its members live chiefly in the two borderareas. Species, represented by a great number of individuals, have their fry in the area of the central bank. To this group belong *Setipinna taty* and *breviceps, Engraulis kammalensis, Stolephorus baganensis* and *Raconda russelliana.* This species belong to that group of fishes, of which I said on page 97, that the mature animals live in the borderarea and the young fry nearer to the coast on the central bank. Every stage of their life is spent within the fished area. Of *Coilia dussumieri,* though occurring in big numbers, I have not yet found the fry.

Besides the ones mentioned above we can find in the borderareas other species in smaller numbers, which do not pass their whole life within the fished area.

These are partly occasional guests as *Engraulis mystax* and *grayi, Clupeoides lile* and others, and partly species, which are typical for the fished area, but which are by no means common. To the latter group belongs for instance *Chirocentrus hypselosoma,* which spawns just outside the fished area and of which young specimens are caught in the borderarea together which some mature ones. *Pellona*-species also are be reckoned among these. These species show the coastward migration of the young specimens very clearly as the fry lives on the

central bank, the young individuals in the border areas and the mature ones mostly outside the fished area. *Dorosoma chacunda* is also regularly found in small numbers, but seems to spawn outside the fished area, as I never found any young fry.

The *Scopelidae* are represented by a single species only, *Harpodon nehereus*. Of this species too, the young specimens live nearer to the coast than the mature ones.

The order of the *Silurids* shows many species, but none of these species is common and most of them are very rare. This group therefore has no influence on the composition of the fauna. Most specimens are caught on the central bank.

They belong for the greater part to species, which are very euryhaline. As a fact many of them live in the river in fresh water and some specimens descend into the more saline waters on the central bank. Others as for instance the species of the genera *Osteogeneiosus* and *Arius* may live in fresh as well as in salt water.

The *Cyprinids* are represented by a few species only, all of which are very rare. They live in the fresh water of the river and sometimes a few specimens descends into the brackish water. They are found only in that part of the central bank, which is situated quite close to the rivermouth. They are of absolutely no importance for the composition of the fauna.

The eels also are not very important. The most common is *Muraenesox talabon,* which lives in the Western Border Area.

I can say nothing in particular of the *Belonidae* and *Hemirhamphidae, Hemirhamphus georgii* is the most common. This species is absent in the Central Area.

The *Polynemidae* are very important. *Eleutheronema tetradactylum* is the most common species. I saw only young specimens. They are found in big numbers in the Central and Western Border Area. Mature animals live chiefly outside the jeremal area. The same is the case with *Polynemus indicus,* but immature specimens of the latter species are seldom caught. Mature individuals of the two species are often taken by the driftnet fishermen.

Polynemus dubius seems to be a freshwater species sometimes descending into the sea.

A sandy bottom is more or less avoided by all species found near Bagan Si Api Api.

The three species of the *Mugilidae* are of little importance. *Mugil dussumieri* seems to be very euryhaline. Specimens of freshwater *Mugils* are occasionally found on the central bank.

The order of the *Heterosomata* is represented by a few species of the family of the *Soleidae* only. Only one of them, *Cynoglossus monopus* is common and this species is a very important component of the fishfauna. In some places it is even predominant. It is one of the typical species of the Central Area.

The *Percidae* (sensu latu) are very rare off Bagan Si Api Api. A few species are present. I found only a few specimens of each. Even a genus with

so many species as *Ambassis* is totally absent, though they are common in other rivermouths.

I cannot give a sound reason for this fact.

The small family of the *Kurtidae* is represented by one species, *Kurtus indicus,* which is typical for the whole fished area and which is caught everywhere in great numbers. I found *Kurtus* regularly in front of other rivers, but never in such large quantities.

The *Sciaenids* are represented by many species and in great numbers. They are caught everywhere, but seem to prefer a muddy bottom. This group is very important for the fisheries. Small individuals of the different genera and species are called "Ikan goelamah" by the fishermen. They are as all other fishes exported in a dried and salted state. The so called „Fishstomach" is made of the airbladder of the bigger specimens.

Two species of *Trichiuridae* are found and each of them is very common. *Trichiurus glossodon* goes further in the brackish water than *Trichiurus savala.*

Carangids are rare and they are chiefly found in the borderareas, in an immature or juvenile stage. The mature specimens live outside the fishing area. *Megalaspis cordyla* is the most common species. It is noteworthy that species of the genus *Equula,* so common elsewhere are practically absent here. I do not know the reason for this.

Stromateus cinereus is the most important species of the *Stromateidae.* It lives in the Western Border Area and in the western half of the Eastern Border Area.

This species seems to migrate at definite times out of the areas mentioned above. The two other *Stromateus*species are of no importance.

The *Scombridae* are represented by a few species of which only *Cybium kühlii* and *guttatum* are of some importance. Nearly all specimens caught in the jeremals are immature, so that these species as a matter of fact live outside the fished area, and only the young specimens, which live near to the coast are caught sometimes.

The *Gobiids* are in some places very important. They prefer the areas with a muddy bottom and especially on the central bank species of *Gobioides* are very common. Species of other *Gobiid*genera are very rare. The rich genus *Gobius* for instance is represented by two species only.

The *Gymnodonts* are rare. *Xenopterus naritus* is the most typical representant of them. *Tetrodon fluviatilis,* elsewhere common in regions like this, is very rare for unknown reasons.

Several families of the *Plagiostomata* are found. The *Carchariidae* with *Carcharias mülleri* and the *Trygonidae* with *Trygon walga* are the most common of them. Yet this group is not important for the fauna as most species are very rare.

It results from what has been said above, that the fishes which form the bulk of the catches, and which are therefore the most important for the fisheries, pass their whole life-cycle inside the fished area.

As these species do not live outside the estuaries in nearly such big numbers or are absent at all (judging from the catches of the fishermen along several points of the coast), is is obvious that the fisheries in the Rokan-mouth depend for the greater part on this special estuarine fauna.

People of Bagan are often inclined to assume a continuous immigration of fish from Malacca Strait into the estuary of the Rokan. If this were right, then, of course, there would be little danger of over-fishing. We have seen, however, that this fresh supply from outside the area cannot be very important.

The species which pass their whole life-cycle inside the fished area, are *Setipinna breviceps* and *taty, Engraulis kammalensis, Stolephorus baganensis, Raconda russelliana, Harpodon nehereus* (for the greater part), *Cynoglossus monopus* and species of *Gobioides*. Species as *Sciaena glauca, Sciaenoides biauritus* and *Stromateus cinereus* belong to also to a certain degree to this group, as they spawn, partly at least, in the fished area.

It is very probable, but not absolutely certain, that *Coilia dussumieri* and *Kurtus indicus,* belong to this group also, as their planctonic eggs have been found, but not the young fry.

Only one species, economically important, forms an exception, viz. *Eleutheronema tetradactylum,* of which only young individuals are found. Spawning takes place outside the fished area, as mature specimens are only caught sometimes at its borders.

IX. REVIEW OF THE DIFFERENT REGIONS.

If we consider now the distribution of the fishfauna over the different regions, we come to the following results.

I. THE CENTRAL AREA.

In the Central Area we find as typical (i.e. to be found in almost all catches) the following species:

1. The species of the genus *Gobioides,* ***Gobioides anguillaris, cirratus*** and the less common *rubicundus*. The related *Trypauchen vagina* is absent here.
2. ***Harpodon nehereus,*** mainly immature specimens.
3. ***Eleutheronema tetradactylum*** only young specimens.
4. ***Cynoglossus monopus***, which is rare outside the central area. All stages are found regularly (perhaps the rare *Cryptops caeca* should be mentioned here also).
5. ***Kurtus indicus***, mostly young individuals only. This species is common in the two other areas too.
6. *Sciaena glauca,* mature as well as immature.

This species is common outside the central area too.

7. *Sciaenoides biauritus*. The same can be said here as about *Sciaena glauca.*

Besides those mentioned above we find here some species descending from the river and which are all rather rare.

In th first place we must mention here several *Silurids,* e.g.

1. *Cryptopterus hexapterus.*
2. *Pangasius nasutus.*
3. *Pangasius polyuranodon.*
5. *Ketengus typus.*
6. *Hemipimelodus macrocephalus.*
7. *Macrones wolffi.*
8. *Macrones nemurus.*
9. *Macrones micracanthus.*

In the second place, we must count among the species descending from the river the Cyprinidspecies. They are all very rare, e.g.

1. *Rasbora argyrotaenia.*
2. *Leptobarbus hoevenii.*
3. *Osteochilus melanopleura.*

WEBER and DE BEAUFORT further mention for Bagan Si Api Api the freshwater species *Osteochilus spilurus* and *Puntius hexazona* and the two *Anabantids* and also *Setipinna breviceps.* The exact place where they had been caught is unknown to me.

The Central Area is also a region where the fry of several species is found. In the first place there is the fry of *Gobioides,* which passes its whole life-cycle within the Central Area, and also of *Cynoglossus monopus* and *Harpodon nehereus,* which have their life-cycle partly outside the Central Area, but within the whole jeremal-area. In the second place the fry of some species from the Eastern Border Area is found. Among these we must count chiefly the following species.

1. *Setipinna breviceps.*
2. *Setipinna taty.*
3. *Engraulis kammalensis.*
4. *Stolephorus baganensis.*
5. *Pellona* spec.
6. *Sciaena* spec. (Rare).
7. *Sciaenoides biauritus.* (This species has its fry in the other areas also).

Sometimes specimens are caught in the Central Area, belonging to fishes which live in the borderareas e.g. species of *Setipinna, Engraulis, Trichiurus, Caranx* and so on.

Sergestes and several species of shrimps are caught in great quantities in the Central Area.

I think, I have sufficiently characterized the fauna of the Central Area by the data given above.

As I have already pointed out (page 98) it is difficult to determine the limits of an area very exactly. The occurrence of *Harpodon nehereus, Kurtus indicus, Sciaena glauca* and *Sciaenoides biauritus* cannot be used, when we wish to give the exact boundary line, as these species are caught in the borderareas

also in large quantities. These species, though they are to be found in each catch, are by no means typical for the Central Area.

Of the remaining species, which I have given above as abundant in the Central Area, we will consider *Eleutheronema tetradactylum* and *Cynoglossus monopus* first. These two species have about the same area of distribution. If we take into consideration those sections only where they are abundant and leave out the sections where they are rare, then we see, that they are numerous in the sections III G, IV F and V E on the central bank and in the section III E and F northwest of the bank. In these latter sections, however, *Eleutheronema* and *Cynoglossus* are caught together with *Setipinna taty* and other species not occurring on the central bank.

The composition of the catches is here quite different from those on the central bank. Thus *Engraulis kammalensis* is found abundantly in section III. F, in section III E *Setipinna taty* also.

Therefore the occurrence of *Eleutheronema* and *Cynoglossus* does not afford a reliable criterion for the boundary of the Central Area.

Gobioides is found abundantly in the sections III. G, IV. F and V G and not in the sections III. E and F.

The limit of the abundant occurrence can be drawn from the coast to jeremal 202 and along jeremal X_1 to 72 and from here south of Pulu Halang Bĕsar to the coast opposite the island. This is the boundary in January.

In October the border of the central bank has moved further seaward. Then the limit of abundant occurrence has moved also and may be traced now from jeremal 602 to 901 and to a point somewhat north of jeremal 72 and from here to Pulu Halang Bĕsar, the southern half of the latter now lies within the area of *Gobioides*, as on the other side of the island the line can be drawn to the maincoast along jeremal 470. I should like to take the lines indicated above as the limits of the Central Area. Within these limits only, the composition of the fauna is characteristic. These limit lines thus may move 2 à 3 seamiles according to the seasons.

Further the area is limited by the coast. I can not indicate the exact boundary line in the rivermouth proper, but it must be somewhere near Pulu Pĕrdamaran.

II. THE EASTERN BORDER AREA.

The Eastern Border Area is the most extensive of the three areas and it is the most important for the fisheries.

We find as typical species:

1. *Chirocentrus hypselosoma.*
2. *Dorosoma chacunda.*
3. *Setipinna breviceps.*
4. ***Setipinna taty.***
5. ***Engraulis kammalensis.***
6. *Engraulis dussumieri.*

7. ***Stolephorus baganensis.***
8. *Coilia dussumierii.*
9. *Pellona* spec.
10. *Raconda russelliana.*
11. ***Harpodon nehereus.***
12. *Hemirhamphus georgii.*
13. *Eleutheronema tetradactylum.* This species is found regularly in smaller numbers, but only in the section III E and F abundantly.
14. *Cynoglossus monopus.* See Eleutheronema.
16. ***Kurtus indicus.***
15. ***Sciaena glauca.***
17. ***Sciaenoides biauritus.***
18. ***Trichiurus glossodon.***
19. ***Trichiurus savala.***
20. *Stromateus cinereus.* This species is found in the western half of the area only and is as a fact the typical species of the Western Border Area.

Only the names printed in bold type refer to species which are found regularly in almost every catch though the other ones are common too.

Furthermore we can find in the Eastern Border Area a great number of less common species, not mentioned above. These are on the one side species typical for the Central Area, as for instance *Gobioides,* and on the other side species from the open sea, as for instance *Polynemus indicus, Pristipoma guoraca, Sphyraena* spec., *Sciaenoides brunneus, Stromateus niger,* several species of the *Plagiostomata* and adult specimens of *Cybium* and *Chorinemus.*

A third group of fishes must be mentioned here for this area, viz. those species, which live always near the coast but do not prefer especially the rivermouths.

The most important seem to me to be:

1. *Engraulis dussumierii, grayi* and *mystax.*
2. *Stolephorus tri.*
3. *Clupeoides lile.*
4. *Clupea toli* and *macrura* (also found in the Central Area).
5. *Plotosus canius.*
6. *Osteogeneiosus militaris.*
7. *Muraenesox cinereus* and *talabon.*
8. *Tylosurus strongylurus.*
9. *Hemirhamphus georgii* and *gaimardi.*
10. *Mugil dussumierii.*
11. *Cynoglossus lingua.*
12. *Therapon theraps.*
13. *Scatophagus argus.*
14. *Sciaena belangeri, albida* and others.
15. *Otolithus maculatus.*
16. *Trypauchen vagina.*
17. *Xenopterus naritus.*

18. *Carcharias mülleri* and others.
19. *Trygon walga.*

and a few rare species, not mentioned here.

Young individuals of species living in the open sea are found also in this area.

In the first place I mention as belonging to this group, *Eleutheronema tetradactylum* (see also above) and several *Carangids* and *Scomberids*, of which *Megalaspis cordyla* (*Caranx rottleri*) and *Cybium kühlii* and *guttatum* are the most common, together with species like *Clupea toli* and *macrura*, *Sciaenoides microdon* and *brunneus*.

The following can be said about the limits of the Eastern Border Area. On the northwestern and northeastern side the line coincides with that of the jeremalarea (see chart). Perhaps this area reaches farther seaward, but I do not possess any data relating to that part of the sea, as there are no jeremals there. On the south side the Eastern Border Area is limited by the coast near Seneboei, by the Central Area and by the coast opposite Pulu Halang Bĕsar. This island is situated wholly or only partly within the Eastern Border Area, according to the seasons (see the limits of the Central Area given above). As the boundary line between this and the Western Border Area I take the line indicating the western limit of the abundant occurrence of *Setipinna taty*. This species is so common in this area (except in III F), that I take it for the most characteristic fish. This western limit must be drawn on the chart from the bend of the line of the jeremalarea along jeremal 546 (south of it) to the coast.

In the Eastern Border Area the components of the fauna are not always the same. One or more components may be absent in the catches. Thus I pointed out already that *Setipinna taty* is rare in section III F and that *Engraulis kammalensis* is rare in II C and D and IV F. *Stromateus cinereus* is found in the western part of the area only and *Trypauchen vagina* in the eastern half only.

Coilia dussumierii is as a matter of fact common in the whole section I and II and it is rather rare in the whole section III. More examples of this kind may be given, but I think these are sufficient.

I do not believe, that too much stress may be laid on these differences and I have treated therefore the Eastern Border Area as one entity and I have not split it up into smaller areas. In that case separate area ought to be made for about every species. These areas would overlap each other for the greater part. It is after all, not one species, but a combination of species, which determines the fauna of a given region. The modifications from common to totally absent are slight and gradual. Therefore it is not easy to make out in what case a species is just common enough or just not common enough to be considered as a characteristic component of some given area.

III. THE WESTERN BORDER AREA.

The Western Border Area is the smallest and the least important for the fisheries. It has a relatively small number of species.

I give as characteristic species:

1. *Stolephorus baganensis.*
2. ***Kurtus indicus.***
3. *Trichiurus glossodon.*
4. *Trichiurus muticus.*
5. ***Stromateus cinereus.***

The names printed in bold type refer to the most important species. Besides the species mentioned above, I found regularly in small numbers.

1. *Coilia dussumierii.*
2. *Hemirhamphus georgii.*
3. *Eleutheronema tetradactylum.*
4. *Sciaena glauca.*
5. *Sciaenoides biauritus.*

Besides these we find from time to time the young individuals of the following species, of which the adults live further out in the sea.

1. *Clupea toli.*
2. *Megalaspis cordyla* (*Caranx rottleri*).
3. *Cybium kühli* and *guttatum.*

As a matter of fact *Eleutheronema tetradactylum* belongs to this group also. But it is found so regularly that I put it in the second group.

The Western Border Area is characterised sufficiently by the species mentioned above.

It is easy now to trace the border line of the Western Border Area. It is limited by the Eastern Border Area (see above), by the coast of Panipahan and seaward by the limits of jeremal area.

This latter limit is of course only artificial. It would be situated probably more seaward if more jeremals were found in that part of the sea. I do not know how far the Western Border Area actually reaches in the directions of the sea, as I have no data of the region outside the jeremalarea. However, it cannot be very far as in that case we get in the deep water of the open sea as the bottom slopes fairly steeply here. Neither can I say precisely, how the limit between the Western and Eastern Border Area changes according to the different circumstances in the rainy and the dry monsoon.

That there are seasonal changes is beyond doubt and these changes will coincide with the changes in the boundary line between the Central- and the Eastern Border Area (see above). The water in the estuary becomes less salt and more muddy when the river carries down much fresh water into the sea and the influence of this will extend into the Western Border Area also.

I do not know how far this Western Border Area extends in a north-western direction along the coast. I did not visit any jeremal beyond Panipahan (from Bagan Si Api Api), as these were too far away from the base.

The fished area extends in a northwestern direction as a narrow stretch along the coast and into the mouth of the Panei river. In the mouth of that

river the fauna is different and therefore there must be somewhere a more or less marked transition.

X. FOOD OF THE FISHES.

From all what has been said above it follows, that a few families only are important as components of the fauna. These families have not only the majority in the number of genera and species, but also in the number of individuals. They are the most important for the fisheries. These species or groups of species obviously are best adapted to the circumstances characteristic of a rivermouth.

In comparing this fauna with the fauna of other estuaries one is struck immediately by the fact, that some important components of the Bagan fauna are absent in the latter and are replaced by others. I do not know what may be the reason for this, but it is evident, that the explanation may be partly found in the chemical composition of the water carried down by the river. This water seems to have in our case components which favour a rich development of the plancton and as a consequence of this of the other fauna. Yet I do not suppose that an eventual lesser abundance of food in other rivers will have great influence upon the relative composition of the fauna. As a consequence of less food the number of individuals will decrease but the relative composition of the fauna will be influenced in a much lesser degree. Of course a change of the foodcomponents will have as a consequence a change in the components of the fishfauna. However, our knowledge of the biological equilibrium of the rivermouth is too imperfect yet to allow us to make any positive statements on this subject. Perhaps further investigations will throw more light on these problems.

The fishfood in the sea near Bagan Si Api Api, where most fishes have a length of below 30 cm, consists chiefly of *Sergestes*species, which are especially abundant on the central bank. (*Sergestes*species are here the object of a special fishery!). All stomachs which I opened, were filled with this little *Crustaceae*. I opened for this purpose the stomachs of about 10—20 specimens of each of the more important species.

Besides *Sergestes* I found sometimes other components which could not be identified and the remains of small *Annelids*, which however, I never saw alive. (Sometimes an *Aphrodite*-like worm is found in the jeremal catches, but this species is too big to serve as food for the small fishes found in these regions).

The predatory fishes, as the whole group of the *Plagiostomata*, mature specimens of *Cybium* and *Chorinemus*, big *Sciaenids*, *Chirocentrus* and others are of course not dependent on *Sergestes*.

It is obvious that the young fry is eaten also by the adult fishes.

XI. FISHERY PROBLEMS.

Two methods of fishing are practised in the area off Bagan Si Api Api, viz. by means of the jeremals and by means of the driftnets. [1])

[1]) The Si-Tsji- and the *Sergestes*- and the shrimpfisheries I do not take into consideration here.

The fishery by means of the driftnets is chiefly practised on the submarine continuation of the central bank and for the greater part outside the jeremal area. The water is not too clear there and it has the required depth of 8—9 m.

The jeremals catch chiefly small fish, with now and then a bigger specimen.

All small fish is salted wholesale, without selecting or cleaning. The result is not very palatable and the dried and salted fish is brought into the trade under the attractive name of Ikan busuk (= rotten fish). This Ikan busuk is one of the main articles of trade of Bagan Si Api Api.

On the drying-floors some species are selected out of the mass and these species are packed and dealt with separately. The remaining part is the true Ikan busuk.

The following species are selected.

1. Ikan Goelamah. Small specimens of *Sciaena* and *Sciaenoides.*
2. Ikan Bilis. *Stolephorus baganensis.*
3. Ikan Biang Biang. *Setipinna breviceps.* Only the bigger specimens.
4. Ikan Senangin. *Eleutheronema tetradactylum.*
5. Ikan Kembung (Selar). *Megalaspis cordyla.*
6. Ikan Trubuk. *Clupea toli.* Only the bigger specimens.
7. Ikan Puput. *Pellona species.* Only the bigger specimens.

Big fishes not mentioned above, as they are caught by the jeremals or by the driftnets, are either consumed fresh or are cleaned and salted.

A quarrel of long standing prevails between jeremal- and driftnet fishermen.

The jeremalfishermen maintain that the driftnets scare away the fish, so that the jeremals get smaller catches. Indeed a policeregulation says, that it is forbidden to have driftnets afloat within a distance of five hundred meter in front of a jeremal. It is difficult, however, in practice, also in relation with the strong currents, to enforce the above named regulation and endless rows are the result.

The driftnet with its meshes of 8 cm cannot catch away the fish of the jeremals. At most the latter will take somewhat fewer big specimens.

How far the statement, that the driftnets scare away the small jeremalfish, is true, is difficult to ascertain. This should be done experimentally.

Yet the loss caused to the jeremals, cannot be very great for it is in the driftnet fishermen's own interest to stay at a proper distance from the jeremals.

When the driftnet is carried away by the current to the row of palmstems, they cannot get it back without damage.

On the other hand driftnetfishermen have a grudge against the jeremals as more and more jeremals are built on the submarine continuation of the central bank in a northwestern direction. Their fishing area is situated in a wide curve round the jeremal area from Panipahan to Seneboei. (These two settlements are chiefly inhabited by driftnetfishers). The driftnets are driven more and more to the seaward and into clearer water by the advancement of the jeremals. The driftnet area is threatened to be cut into two parts by this advance.

The fear of the driftnetfishermen, that they will have smaller catches in deeper and clearer water is probably unfounded, although it is a fact, that elsewhere in the Archipelago driftnets are used with success in deeper and clearer water also. But in general it cannot be denied that fishes are more numerous in the more troubled water along the coast and near the rivermouths.

It is also possible of course, that the catches in deep and clearer water will consists of species not so highly esteemed. In connection with the above we have to consider also the fact, that the submarine continuation of the central bank will become less and less deep in the course of time. This natural factor is the cause, that it is possible for the jeremals to shift their position more and more to the seaward, as their depth-limit (8—9 m) shifts outward at the same rate. For this reason the driftnetfishermen will have to shift their position in the same direction, as the sea will become too shallow for them.

Now it is evident, that in relatively so limited an area, where fishing is carried on so intensively, the question of over-fishing will arise.

The problem of over-fishing has already been examined by Dr. SUNIER who visited Bagan Si Api Api in 1913 and 1914. His conclusions, however, were of a theoretical nature only.

Dr. SUNIER, formerly head of the Laboratory for fisheries at Batavia, mentions, in a report on Bagan Si Api Api; which has not been published, three factors, by which the amount of fishes in a given area may decrease.

These factors are:

1. Natural circumstances; A change in the conditions of life may have lead to a decline of some species or even to their complete disappearance.

2. Over-fishing. Over-fishing will affect first those species, which pass their whole life-cycle within a limited area. As intensive fishing will prevent the animals growing old, the bigger specimens will disappear first out of the catches. If this condition continues the fishes will become smaller and at the same rate the percentage of immature specimens will increase. Species with a wider distribution will have of course a continuous fresh supply from outside the area.

3. An exhaustion of the supply of young fishes by the catch of too much fry. As we have seen above much young fry is caught by the jeremals as well as by the shrimp- and Sergestesnets.

The dealers and sometimes the fishermen also complain of a falling off of the quantity as well as the quality of the fish. Especially big fishes (of more than 30 cm) seems to have been more abundant in former times.

Dr SUNIER paid already some attention to these complaints, which cannot be verified as reliable statistics are absent. We can only judge by the total figures of the annual catches. Now the totals of the annual catches will be influenced not only by natural causes but also by economical factors and they can therefore be used only with much reserve, when considering such questions as over-fishing.

Statistic of the total catches of fish in millions of kg.

1898	12.7	1913	20.4
1899	12.5	1914	19.2
1900	12.0	1915	19.9
1901	18.0	1916	19.1
1902	19.7	1917	19.1
1903	23.8	1918	21.7
1904	25.9	1919	21.7
1905	24.1	1920	22.8
1906	23.8	1921	22.6
1907	23.2	1922	22.5
1908	20.4	1923	21.1
1909	20.0	1924	21.6
1910	18.2	1925	24.0
1911	18.2	1926	25.8
1912	19.2	1927	21.0
		1928	21.2

The table given above, shows a considerable increase until 1904, with 25.9 millions of kg. This increase is caused by the expansion of the fisheries during these first years of the growth of Bagan Si Api Api. After 1904 we see some fluctuations [1]) in the total of the catches, with a minimum of 18.2 in 1910 and a maximum of 25.8 in 1926, a maximum which attains nearly the total of 1904! Fluctuations like these will of course, always occur and are to be found in every branch of fishery. Yet the total catch pro jeremal must have decreased somewhat, as the total number of jeremals has increased.

It is very difficult to decide if we have to do here with over-fishing. This will be impossible as long as the average jeremal-catch pro unit of time is unknown and as long as statistics for each separate species are not available. It is also unknown whether the average length of the different species has decreased or has remained the same. A comparison with the fauna of other rivermouths, in which the fisheries are not so intensive, showed that the different species had about the same average length.

Yet these comparisons may not be overvalued, as too little is known as yet of the biology of a given species and too little is known about the local circumstances in the other rivermouths.

As pointed out above an eventual over-fishing will act first upon species which pass their whole life-cycle inside the fished area, species therefore more or less strictly confined to the rivermouths. However, if we consider now these species in the Bagan-area we find, that the catches show a fairly high percentage of mature individuals, if these catches are taken at places, which are not specially frequented by the young specimens, as e.g. on the central bank. We

[1]) It is unknown, whether these fluctuations concern the fishfauna as a whole or relate to a single or a few species only.

can see this at a glance from the records given for each species and also from the tables given for *Setipinna taty, Engraulis kammalensis* and others. Thus the facts as I found them did not give evidence of over-fishing of the area.

Of course each species will react in its own way upon intensive fishing. The reaction will depend entirely on the rate of propagation of that species.

Species, which spawn outside the fished area, are of course not so strictly confined to a rivermouth. Over-fishing will not have a direct influence on them, as these species will have a continuous fresh supply from regions farther away, where fishing is not so intensive.

It will not be easy to state over-fishing in an area, like that of Bagan Si Api Api, where we find fishing not of one or a few species, but of the fishfauna as a whole. Each species will react in its own way upon an eventual slight alteration of the local circumferences, as is always likely to occur in a region like this. A decrease in the number of individuals and a decrease in the average length needs not necessarily be the result of over-fishing. An extension of the central bank for instance, would cause many species to move more to the seaward and the numbers of mature individuals in the catches would decrease.

The following examples will show, how unfounded complaints about over-fishing sometimes are.

In 1929 I got a letter from the officials of Bagan Si Api Api in which they asked my attention for the complaints of dealers and purchasers, that the goelamah-catches were decreasing rapidly. Now the Ikan goelamah does not consist of a single species, but of several species of *Sciaena* and *Sciaenoides*. Thus it depends upon the biology and upon the rate of propagation, how each species will react upon an intensive fishery. This reaction may be quite different for each different species. It is true that some species as *Sciaena glauca* and *Sciaenoides biauritus* are common and others as *Sciaena belangeri* and *Sciaenoides pama* are rare, which however is not necessarily the result of over-fishing, as nothing is known about their abundance in previous years. It is remarkable for our purpose, that the common species wholly or partly spawn inside the fished area and that the rare species do not do so. This is just the reverse of what might be expected in cases of over-fishing.

Sciaena glauca and *Sciaenoides biauritus*, which form together the bulk of the "Ikan Goelamah" spawn inside the fished area (partly at least). The young fry is mostly found on the central bank and the more seaward jeremals catch chiefly mature individuals. Thus I took out of the catch of jeremal 571 a sample at rondom of 165 specimens of *Sciaena glauca* and only 27 individuals or 22.7% were immature. This fact, does not point to over-fishing. In many other jereamals we can find about the same percentages. (See the record for *Sciaena glauca*).

Now people said, that in the years 1928 and 1929 there had been a shortage of Ikan Goelamah as a consequence of over-fishing. A closer examination showed, that this shortage was probably due to other factors, viz. the following.

Ikan Goelamah is chiefly bought for the tin-mines of Billiton. In 1927 and previous years about 150000 kg. or less were required in total. The total

quantity required in 1928 was about 283000 kg and in 1929 about 204000 kg much higher therefore. In 1928 the shortage amounted to 9000 kg and in 1929 to 6000 kg for which other species of fish were sent. The dealers in Bagan Si Api Api told me that they had sent all the Ikan Goelamah, which they could get i.e. about the total catch of the whole fished area. In the years before 1928 big quantities of Ikan Goelamah were sold elsewhere.

We can shortly assume, that in this case the shortage of Ikan Goelamah was not due to over-fishing but to the sudden increase of the required quantities from 155000 kg in 1927 to 283000 kg in 1928 and 204000 kg in 1929. The total catches of Ikan Goelamah in 1927 and previous years are unknown as the only trustworthy data available are those of the quantities delivered to the tin-mines. It is certain however, that these quantities did not consist of the whole catch. At any rate it is impossible to come to any conclusion about over-fishing from the facts given.

It is true that in 1929 the total quantity was less than in 1928, but I think this must be due to normal fluctuations as it is improbable that over-fishing will produce such a sudden affect as is the case here. (A fall of 25—30% in one year!).

Closer investigations showed me also, that there was only a shortage in the months of August and September. It is obvious, that in these months the species of which the article of trade is composed, have partly migrated out of the fished area. Perhaps we have here a similar phenomenon as with *Stromateus cinereus*.

The fact, that there is a shortage in two months of the year only, does not confirm the supposition of over-fishing either, as in that case, it might be expected, that the shortage would not be restricted to part of the year only.

XII. SUMMARY.

1. The fished-area of Bagan Si Api Api is situated at Strait Malacca in front of the aestuary-like mouth of the Rokan-river. Its greatest breadth is about twenty and its greatest length is about 40 seamiles.

2. Permanent fishtraps, the so-called jeremals form the main method of fishing. These jeremals fish with the ebbtide. A jeremal consists of two long rows (sometimes with a length of 500 m) of palmstems which are placed in the shape of V. The medianaxis of this V lies in the direction of the ebbtide, by which the fish is dragged against the net. This net is hung up in a wooden paling behind the V.

Besides the jeremals driftnets are used, the latter more to the seaward.

3. The ebbtide flows fan-wise out of the funnel-shaped mouth of the river. North of the line Pulu Halang Bĕsar — Seneboei the current is bent to the eastward by the mainstream of Malacca Strait.

4. The jeremal takes all species of fish, which occur in its region. Qualitatively the catches give a good general idea of the fauna, but we can make use of the quantitative proportions with some reserve only.

5. A short outline is given of the most common animals, not belonging to the fishes.

6. 149 species of fish can be found in the area. Only seventy of them are more or less common.

7. The fishfauna is composed of a few families only. Thus the *Clupeids* are rich in species and individuals, and the *Siluridf*amilies are rich in species, but poor in individuals. The *Percidae* (sensu latu) are only seldom found. Species as well as individuals are rare. Of the *Carangids* and *Scomberids* mostly the young animals only occur. The genus *Gobioides* is, as a fact, the only genus of the *Gobiids* which is represented by many specimens. The area off the Rokan-mouth has therefore its own distinct fauna, quite different from what is found more to the seaward.

8. The fishfauna can be divided into the following groups:

a. Species which pass their whole life-cycle in the fished area. The most important are *Setipinna breviceps* and *taty, Engraulis kammalensis, Raconda russelliana, Harpodon nehereus, Cynoglossus monopus* and species of *Gobioides. Sciaena glauca, Sciaenoides biauritus* and *Stromateus* belong also to this group as they spawn, partly at least, in the fished area.
It is probable, that *Coilia dussumierii* and *Kurtus indicus* belong to this group, though the young fry is unknown to me.

b. Species which live in the sea when adult and which live near the coast when young. The most important of this group is *Eleutheronema tetradactylum*. Furthermore the *Carangids* and *Scomberids*.

c. Freshwaterspecies, as for instance a few *Cyprinids* and *Polynemids* and some species of the *Silurids*.

d. More or less occasional guests.

9. The fished area can be divided into three parts:

a. The Central Area. *Gobioides*-species are the most characteristic. The area is situated on the central bank, in front of the rivermouth, between Pulu Halang Bĕsar and the coast of Bagan Si Api Api. Its seaward limit may be extended a little or drawn in according to the seasons. The bottom consists of soft mud.

b. The Eastern Border Area. Especially *Setipinna taty* and in a lesser degree *Engraulis kammalensis* and *Coilia dussumierii* are the most characteristic species.
This area is the largest and the most important one. It is situated in a curve on the outside of the Central Area. Pulu Halang Bĕsar is partly or wholy situated within it during the rainy or dry monsoon respectively.
The bottom consists of a clayish mud.

c. The Western Border Area. This area is the smallest. It is situated on a sandy bottom forming a narrow stretch along the coast of Panipahan. The fauna is here relatively poor, when compared with the two other areas. The most characteristic fish is *Stromateus cinereus*.

10. The accumulation of the individuals in front of the Rokan-mouth is evidently caused by the abundance of food, which is probably the consequence of the composition of the riverwater.

11. The more important species from a zoölogical as well as from an economical standpoint are all species, which spend their whole life-time inside the fished area. Only *Eleutheronema tetradactylum* is an exception to this rule. The fisheries of Bagan Si Api Api depends therefore for the greater part on the special estuarine fish-population.

12. No facts were found thus far, which point to over-fishing.

NAME LIST OF FISHES.

Scientifique name.	Chinese.	Malayan.	Chinese characters.
Chirocentrus hypselosoma.	Sei Toh.	Parang Parang.	刀 西
Dussumieria spec.	Un.	Djapuh.	魚 溫
Dorosoma chacunda.	Bok Hauw.		扣 木
Setipinna breviceps.	Ing Hi.	Biang Biang.	魚 黃
Setipinna taty.	Po Pi.		片 卜
Engraulis kammalensis.	Ang Běl.	Bilis.	尾 紅
Engraulis dussumieri.	Oh Tjit.	Bilis.	鰛 烏
Stolephorus spec.	Tjoh Kang Hi.	Bilis.	魚 江 粗
Coilia dussumierii.	Hong Běl.		鳳 尾
Clupeoides lile.	Koa Pak Kang.	Tjangtjang Rebung.	江 北 闊
Clupea toli and *Clupea macrura.*	Tji Kap.	Trubuk.	壳 刺
Pellona spec.	Lat Hi.	Puput.	魚 叻
Harpodon nehereus.	Si Tjeng.	Nomei.	定 絲
Cryptopterus hexapterus.	Ikan Kuning.	Ikan kuning.	冷 君 干 依
Arius spec.	Sieng Hi.	Dukang.	魚 鰔
Plotosus canius.	Tho sat.	Sěmbilang.	殺 士
Muraenesox spec.	Moa.		魚 鰻
Hemirhamphus spec.	Tjai Tjiam.	Kachang Kachang.	占 水
Eleutheronema tetradactylum.	Ngo Hi.	Sěnangin.	魚 鮜
Polynemus dubius.	Teng Tsjiu Ngoh.	Ikan Djanggut.	鮜 鬚 長
Polynemus indicus.	Sun Hong.	Senohong.	風 順
Sphyraena spec.	Tek So.		德 梭

Scientifique name.	Chinese.	Malayan.	Chinese characters.
Mugil spec.	Tjia Hi.	Bělanak.	魚仔只
Long Flatfishes.	Sin Tjek or Toa Sek.		西塔舌龍
Round Flatfishes.	Pei Hi.		魚鰏
Lates calcarifer.	Tsji Kap.	Kakap.	蛤者
Serranus fuscoguttatus.	Keh Hi.	Kěrapu Matjan.	魚鱠
Therapon theraps.	Pang Mgo.		鮊班
Pristipoma guoraca.	Tay Hiok.	Gĕrut Gerut.	額抬
Scatophagus argus.	Kim Koh.		古金
Proteracanthus sarissophorus.	Tjo Tauw Hi.	Ikan Batu.	魚頭石
Kurtus indicus.	Apien Hi.		魚片亞
Sciaena and *Sciaenoides* spec.	Gulamah or Samgeh.	Gulamah or Samgeh.	仔喃牛芽三
Sciaenoides spec. (big specimens).	Ang Koa.	Kelampei.	瓜紅
Trichiurus spec.	Pei Hi.	Timah or Lajur.	魚白
Megalaspis cordyla.	Gie Bĕl.	Gie Bĕl.	硬尾
Scomberoides lysan.	Sampan Tiau.	Talang Talang.	跳板三
Stromateus cinereus.	Tjiu Hi.	Bawal Puti.	魚鯧
Cybium spec.	Bei Ka.	Tengiri.	加馬
Gobioides spec.	Tjak Kiu.		九赤
Sharks and *Rhinobatis.*	Soa Hi.	Yu.	魚鯊
Rays.	Hang Hi.	Pari.	魚魴

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