IV. OBSERVATIONS ON THE SHALLOW-WATER FAUNA OF THE BAY OF BENGAL MADE ON THE BENGAL FISHERIES STEAM-TRAWLER "GOLDEN CROWN," 1908-1909.

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(Plate iv.)

The investigations carried on by the trawler "Golden Crown" during 1908 and 1909 have thrown some light on the fauna of the upper portions of the Bay of Bengal between the 15- and 30-fathom lines. A few hauls were made in greater and lesser depths, but trawling was mainly carried on within the limits mentioned. The trawl of the "Golden Crown" was of the ordinary commercial type and well calculated to capture any fish or invertebrate living on the bottom or swimming about within seven or eight feet thereof. Occasionally portions of a shoal of pelagic (*i.e.*, non-demersal) fish would be enmeshed when the trawl was being hauled inboard. To this category belong the pomfrets (*Stromateus cinereus*, *niger* and *sinensis*), large hauls of which were made off the Eastern Channel at the entrance to the River Hughli, and the flying gurnard *Dactylopterus orientalis*. The only pelagic fish taken in anything like large quantities was the Silver Pomfret (*Stromateus cinereus*). This species was most abundant in the months from December to April and was met with anywhere between the Mutlah light ship (off the entrance to the Mutlah River) and Puri on the coast of Orissa. It is not infrequently taken in the nets of the local fishermen at the latter place. So far as the "Golden Crown" records show, the pomfret is most abundant in the northern parts of the Bay during the months of January and February, at this time the writer occasionally observed vast shoals of them swimming leisurely past the "Golden Crown" whilst she was going ahead slow with her trawl down. The best catch was made during the voyage which lasted from the 9th to the 15th February, 1909, throughout which period trawling was prosecuted to the south of the Eastern Channel light vessel, the pilot ship of the Bengal Pilot Service being within sight the whole of the time.

A curious feature was that the pomfrets were only caught by daylight. It was customary on the "Golden Crown" to make four hauls *per diem*. The net was shot at 6 a.m., midday, 6 p.m. and midnight and hauled half an hour before those times, so that two hauls were made during darkness (6 p.m. to midnight

and midnight to 5-30 a.m.) and two by day. During the voyage from the 9th to the 15th February, 1909, twenty hauls were made, ten during daylight and an equal number at night. The total weight of pomfrets caught was 2,775 lb., of which only 68 lb. were caught at night. Moreover during the second daylight haul on the 10th February the net was badly torn and a large proportion of the catch, consisting of pomfrets, escaped.

Dactylopterus orientalis was never captured in sufficiently large numbers to be weighed separately as a constituent of the "Golden Crown's" catch. It will be understood that a complete record of the different species of fish captured on each voyage was an impossibility and doubtless many records of this and other species are thus unobtainable. My impression is that *Dactylopterus* was obtained principally off the Madras coast (Ganjam). It is specially recorded in the voyage March 5—16th, 1909, from that locality.

On the whole the explorations of the "Golden Crown" showed that there were four more or less distinct trawling areas or fishing grounds in the northern portion of the Bay. These areas naturally passed gradually into one another, but there are quite distinctive features in each case. These areas (see plate iv) are—

(1) Extending from the Mutlah light vessel down past the entrance to the Eastern Channel to Pilot's Ridge.
(2) Off the Arakan Coast from the South Patches light vessel (entrance to the channel leading to Chittagong) to Oyster Island in the neighbourhood of Akyab.
(3) The coast of Orissa from the mouth of the Devi river to the entrance to Lake Chilka.
(4) The coast of the Ganjam district of the Madras Presidency from Ganjam to Santapilli light-house in the district of Vizagapatam.

The principal characteristics of these areas and the more noteworthy representatives of the fauna are dealt with below:—

Area I. Mutlah light vessel to mouth of Dhumra River.

The bottom in this area consisted entirely of a very fine and soft mud, the product of land denudation brought down by the Ganges and its affluents. So soft is this mud that it was always necessary to keep the trawler going at a good speed when the net was out as otherwise the latter would have sunk in the mud and have been lost. The speed was too high to allow of the use of the ordinary surface tow-net.

The principal feature of this mud was the presence of a large number of empty (dead) shells of *Dentalium eburneum*, Linn.

Peculiar rounded balls of mud were frequently brought up in the trawl and these when opened were found to contain a living Lamellibranch, a species of mussel, *viz.*, *Modiola rhomboidea*. On

the whole the Molluscan fauna of this area was not abundant, though specimens of *Murex tenuispina* were not infrequently met with.

Of the Echinoderms, the Holothurian *Aphalodactyla molpadoides* may be regarded as typical.

Of the Crustacea the two commonest inedible forms were *Thenus orientalis* and *Egeria arachnoides*. Two species of prawn of economic importance were found in this region, as well as an edible crab (*Scylla serrata*).

The prawns consisted mainly of *Peneus semisulcatus* and *Peneus indicus*, but they were not nearly so abundant in this area as off the sandy shores of Orissa (Area III), where large hauls were frequently made.

As a general statement it may be said that the invertebrate fauna of this region was scanty.

The fish-fauna of this muddy area off the Sunderbans is quite distinctive. Although the trawl was not adapted to catch surface-swimming forms, still *Carcharias menisorrah* and *Chiloscyllium indicum* were commonly taken. Of the Batoidei, *Trygon uarnak* and *Trygon bleekeri* were possibly more characteristic of this region than any other species. The former is a large species of "sting-ray" and individuals measuring 5 feet or more across the back were common. On one occasion (Voyage No. 14, December, 1908) nearly 23 per cent. of the total catch of fish in this area consisted of these gigantic Batoids. Nine specimens of *Trygon uarnak* taken near the Mutlah light vessel on this occasion aggregated 1,360 lb., the average weight being 151 lb. and the extremes 118 and 180 lb. respectively. This species seems to prefer a depth of from 24 to 25 fathoms, and in fact our general experience in this muddy area was that the fish-fauna was more abundant at this depth than on deeper or shallower areas.

Two hauls taken close together on the same day in the same locality bring this contrast out very well:—

December 20th, 1908. *Near Mutlah light vessel.*

Haul I,—in 14 fathoms of water: from 11-20 a.m. to 3 p.m.

	Wt.
One *Psettodes erumei*	3 lb.
A few "soles" (*Cynoglossus macrolepidotus*)	5 ,,
Prawns (*Peneus* spp.)	7 ,,
Arius spp., chiefly *dussumieri*	30 ,,
Total weight of catch .	. 45 lb.

Haul II,—in depth of 24 fathoms: from 4-15 p.m. to 11 p.m.

Although the net was torn the catch consisted of—

	Wt.	
Psettodes erumei . .	15	lb.
Otolithus maculatus . .	2	,,
Stromateus cinereus	20	,,
Prawns (*Peneus* spp.) .	30	,,
Sciaenoids, chiefly *S. vogleri* .	80	,,
Muraenesox cinereus ..	70	,,
Arius spp., chiefly *A dussumieri* .	60	,,
"Soles" (*Cynoglossus macrolepidotus*)	20	,,
Trygon uarnak, 4 specimens weighing respectively .	122	,,
	160	,,
	170	,,
	180	,,
Total weight of catch	929	lb.

The weights give one a very good idea of the relative abundance of the different species of fish.

An extract from notes relating to a series of hauls on a purely muddy area, practically within a few miles of the Mutlah light ship, throws some light on the fish fauna of this area during the month of December.

The notes explanatory of the table on p. 55 are:—

Haul I.—Only one basketful of fish. (The baskets used for weighing the fish on the "Golden Crown" were real baskets, holding when full about 60 to 70 lb. weight of Sciaenoids or Siluroids.)

The chief fish this haul were *Cynoglossus* and *Platophrys*, *Stromateus* sp., *Sciaena* sp., *Ephippas orbis*, *Drepane punctata* and *Lynagris japonicus*. Depth of water 25 fathoms. Bottom "oozy." When the trawl was shot at midnight on the 17th December Mutlah light ship bore east about 4 miles.

Haul II.—The fish called "Begti" or "Bekti" by the natives on the "Golden Crown" is not *Lates calcarifer* but *Chrysophrys datnia*. This name was afterwards extended by the European crew to include any large Sparoid or Percoid fish. Other fish this haul were *Muraenesox cinereus*, *Pagrus spinifer* (few), *Cynoglossus macrolepidotus*, Siluroids of the genus *Arius*, various species of *Caranx*, a few *Pellona* and *Psettodes erumei*. Fish that were not sufficiently abundant to be classified and weighed separately were returned as "mixed." These included very different fish. This haul the mixed were almost entirely *Saurida tumbil*.

Inedible fish are not included in the weights in the table. This haul brought up two large *Rhynchobatus djeddensis* not included.

Same ground as in Haul I.

Haul III.—Same ground as before. Mixed fish again = *Saurida tumbil*.

Hauls near Mutlah light vessel. December 1908.

	Haul No.																
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII
		lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Bekti (*Chrysophrys datnia*)	No edible fish in any quantity.	189	65	93			174		..	..			..	..	..		..
Otolithus maculatus ..		7		25	9	..	102	..	18	25	3	..	2	..		..	..
Caranx (various)		50	48	32				82	3	3	8	..	..		3	62	..
Pomfrets ..		7	8	3		5	5			..	5	..	20		9	49	1
"Congers" (*Muraenesox*)		53	..	..	30	..		..	47	43	..		70	30	53	23	115
Psettodes ..		9	8	7	10	2	6	..	9	12	5	3	15	5	3	10	8
Prawns (Peneidae) ..		25	..	9	105	20	28	10	70	45	10	7	30	..	10	..	..
"Soles"		18	18	4	30	5	20	2	32	30	8	5	20	5	8	8	10
Sciaenoids ..		130	88	179	759	110	163	110	447	183	90	..	80	70	70	80	190
Siluroids ..		80	125	130	170	80	140	115	175	88	90	30	60	23	80	177	125
Trygon uarnak, etc.		130		..	505	180		62	..	118		..	632		9	330	..
Mixed ..		7	5	7		..	26	25	..		15	..	..	..	..	19	4

Haul IV.—Same ground as before. Mixed fish = *Trichiurus haumela.*

The fifth and sixth hauls were on the same ground and the catches similar to the above.

Haul VII.—One large *Pristis pectinatus* in net. Net torn. The cause of the net being occasionally torn on these soft grounds is either a large sawfish or a trunk of a tree brought down by the Ganges and waterlogged and sunken. The mixed fish consisted of 20 lb. weight of *Pellora* and 6 of *Saurida tumbil.*

Haul VIII.—The "skates" or "sting-rays" comprised a medium-sized specimen of *Trygon uarnak*, the balance (12 lb.) being *Myliobatis nieuhofii.* The mixed fish included several specimens of *Chirocentrus dorab.* One *Zygaena blochii* was captured but not included in the weights given in the table.

In both the eighth and ninth hauls five specimens of pomfret (*Stromateus cinereus*) were captured; the weights were not included in the table.

Haul X.—The net was badly torn during this haul. It took an hour and a half for all hands to repair it. One specimen of *Thalassochelys caretta* was captured in this haul. The Carangidae comprised during this and the preceding two hauls *Caranx malabaricus*, *C. atropus* and *C. gallus.*

There were also present (Haul XI) in the "mixed" fish:—*Minous monodactylus, Polynemus sextarius, Sebastichthys strongea, Platycephalus* sp., *Therapon jarbua* and *Mene maculata.* The Siluroid which predominated in all the hauls on this ground was *Arius dussumieri.* Day states that *Therapon jarbua* is not uncommon at Calcutta in the tidal Hughli. Hauls XII and XIII are quoted above (p. 55), the former was in from 14 to 15 fathoms of water, the latter back again in 24 fathoms. In Haul XV the small "skate" was *Myliobatis* sp.

Haul XVI was in deeper water, approximately 40 fathoms. The only remarkable fish not recorded in previous hauls was *Chorinemus lysan.*

Haul XVII was made in the direction of (*i.e.*, towards) the Eastern Channel light vessel. The "mixed" fish were *Elacate nigra.*

AREA II. SOUTH PATCHES LIGHT VESSEL TO AKYAB.

The second area trawled over by the "Golden Crown" was that extending from the South Patches light vessel (off the entrance to Chittagong) down past Oyster Island to the vicinity of Akyab. This area is separated by the "Swatch of No Ground" from Area I. The bottom varied considerably. Near the light ship it was mud, further to the south this was replaced in depths from 8 to 17 fathoms by fine glittering sand, with patches of shells at intervals. Off St. Martin's Reef in from 10 to 13 fathoms the bottom consisted of shells and fine gravel. Between St. Martin's Reef and Oyster Island the trawl brought up fossiliferous rocks of

miocene age. The rocky nature of the ground and the consequent damage to the nets led to trawling being abandoned in this area.

The fifteenth voyage of the "Golden Crown" was partly devoted to trawling on this area and details of the hauls are appended.

The first haul was made in muddy grounds in depths varying from 13 to 18 fathoms not far from the South Patches light vessel.

The catch included one very large male *Pristis perottetii*, *Pteroplatea micrura*, *Echeneis naucrates*, *Arius dussumieri*, *Synaptura altipinnis*, *Psettodes erumei*, *Cynoglossus macrolepidotus*, *Pseudorhombus arsius*, *Pellona indica*, Sciaenoids (various), *Pagrus spinifer*, *Ephippus orbis*, *Scomber macrolepidotus*, *Stromateus cinereus*, *Pterois* sp., *Caranx atropus*, *Drepane punctata*, *Saurida tumbil*, *Chirocentrus dorab*, *Dactylopterus orientalis*, *Pristipoma maculatum* and *Diodon hystrix*.

Squilla raphidea was abundant on this ground.

Haul II.—On muddy grounds in same neighbourhood in slightly deeper water (average 18 fathoms). Catch included *Cynoglossus macrolepidotus*, *Arius dussumieri*, *Pteroplatea tentaculata*. Two large and one small *Trygon uarnak*, *Elacate nigra* and one *Limulus*.

Haul III.—Muddy grounds. Depth during haul 18, 19 and 20 fathoms. Fish much as before with one large *Rhynchobatus djeddensis*.

Haul IV.—From 20 to 12 fathoms. Mud to fine sand. *Sphyraena obtusata* in "mixed" fish.

Hauls V and VI were made further to the southward. Haul VII was made 15 miles off Elephant Point which bore E.N.E. when the net was shot. There were 21 *Carcharias menisorrah* in this haul.

Haul VIII was in the neighbourhood of St. Martin's Reef, which at 10 a.m. bore E.N.E. 6 miles away. The bottom varied considerably during this haul. At 8 a.m. the sounding gave 12¾ fathoms, shells. At 10 a.m. 10½ fathoms, shells and small stones, at 10-30 a.m. 9½ fathoms, shells and grit.

Haul IX.—The net caught some obstruction on the bottom and was badly torn, both the foot and head ropes being broken. The cause of the damage was the reef of miocene rocks referred to above. In this haul several specimens of *Callionymus longicaudatus* were taken. In the next haul (X), the net was again badly torn for the same reason and specimens of the rocks were again preserved. Antipatharians were also dredged up this haul, Gorgonids and Alcyonarians as well. Large Percoid and Sparoid fish similar to those found in corresponding localities on the other side of the Bay were taken. Of these the most abundant was *Lutjanus annularis*. In Haul XII there were no edible fish, but one large *Tetrodon stellatus* was present.

On a previous voyage to the Arakan coast somewhat similar results were obtained, except that the hauls were confined to the more northern portions of the area where no rocky ground is

encountered. Good catches of *Polynemus plebeius* and *Harpodon nehereus* (the "Bombay Duck") were a feature of this voyage (on 11th November 1908): also large *Pristis cuspidatus, Zygaena blochii* and *Pristis perottetii. P. cuspidatus* was very prevalent during this voyage.

Rhynchobatus djeddensis common, no less than six large specimens taken in one haul (Haul XIV, November 17th, 1908). Snakes were not infrequent, principally *Enhydrina valakadien.* The fish identified during these hauls were *Chatoessus chacunda, Raconda russelliana, Platophrys pantherina, Synaptura commersoniana, Sillago panijus, Narcine timlei, Hypolophus sephen,* several small *Carcharias laticaudus, Stromateus niger* and *Pellona filigera.*

This area was the only one in which large specimens of the estuarine "Sele" fish (*Polynemus plebeius*) were obtained. They were captured in considerable numbers on muddy grounds near the South Patches light vessel. On this ground the Pristidae were unusually abundant in November.

Two Pleuronectids previously described by Alcock from the "Investigator" collections were obtained from the southern portion of this area. These were:—

Rhomboidichthys azureus, previously recorded from Ganjam and Ceylon; and

Rhomboidichthys valde-rostratus, previously recorded from Ceylon only.

Incidentally it may be noted that this area was less explored than any of the other three.

AREA III. FROM THE MOUTH OF THE DEVI RIVER TO THE ENTRANCE TO LAKE CHILKA.

This area off the coast of Orissa was to a large extent explored by the "Investigator" previously to voyages of the "Golden Crown." Moreover a large number of the fish were known owing to the fact that there is a regular coastal fishery carried on by Telugu fishermen at Puri by means of drift- and seine-nets and also by baited hooks.

Most of the shallow-water trawling of the "Investigator" was in this area and there are a number of papers by Alcock[1] which afford us valuable information, more particularly as to the fish.

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[1] *Vide*—Alcock, *A Naturalist in Indian Seas.*
" "On some undescribed shore-fishes from the Bay of Bengal," *Ann. Mag. Nat. Hist.*, December, 1890, pp. 425—443.
" "List of the Pleuronectidae obtained in the Bay of Bengal in 1888 and 1889, with description of new and rare species," *Journ. As. Soc. Bengal,* vol. lviii, pt. ii, No. 3, 1889, pp. 279—295.
" "Descriptions of some new and rare species of fishes from the Bay of Bengal, obtained during the season of 1888-9," *Journ. As. Soc. Bengal,* vol. lviii, pt. ii, No. 3, 1889, pp. 296—305.

The trawl of the "Investigator" was very much smaller than that of the "Golden Crown" and consequently the larger species of Elasmobranchs would not be captured by it. Apart from these gigantic rays and saw-fish there is a marked similarity in the catches of the two vessels. The predominant feature of the bottom in the area trawled over by the "Golden Crown" was sand and, owing to circumstances which need not be specified here, her trawling was carried out on a much more limited area than that of the "Investigator," which worked in this neighbourhood in depths from shoal water up to 100 fathoms. The latter depth may be taken as the limit in a discussion of shallow-water forms. Consequently the faunistic lists of the "Investigator" (apart from records of large species) are much more complete than those of the "Golden Crown." Not only was the latter vessel compelled to trawl in waters where fish might be expected in quantities sufficiently large to make out a case for commercial fishing, but the net used was designed only to catch fish sufficiently large to be marketable. Invertebrates of any kind (except prawns) were regarded as undesirable débris.

No account, however cursory. of this area can be considered complete which omits reference to the shallow-water forms captured by the catamarans and the masula boats of Puri. From the latter vessels, which fish during the period of the N.E. monsoon, a large seine-net of semicircular "sweep" is used. The catching part of the net is of very small mesh so that forms which would pass through the cod-end (tail-end) of the "Golden Crown's" trawl would be enmeshed by this "bara jāl" of the native fishermen at Puri. Consequently forms like *Clupea kunzei*, which are occasionally captured in immense quantities on the shore, are absent or represented only by isolated individuals in trawl net hauls made further out. Hauls made by the seine-net on Puri beach in December 1908 consisted mainly of this species with a few other forms such as *Scomber microlepidotus*, *Upeneoides vittatus* and *Tetrodon lunaris*. *Elacate nigra*, *Cybium guttatum* and a few "skates" (*Myliobatis nieuhofii*) may also be regarded as typical.

The following list, though not to be regarded as complete, gives one an idea of the species most prevalent at Puri at this time of the year (December):—

Elasmobranchii.

Torpedo marmorata.	Myliobatis nieuhofii.
Trygon walga.	,, ,, var. cornifera.
,, ,, var. imbricata.	

Alcock, "A supplementary list of the Marine Fishes of India, with descriptions of two new genera and eight new species," *Journ. As. Soc. Beng.*, vol. lxv, pt. ii, No. 3, 1896, pp. 301—338.

(The above is not a complete list of Dr. Alcock's papers on Indian marine fish but refers only to those which contain descriptions of or reports on shallow-water species.)

Teleostei.

Clupea kunzei.
Chatoessus nasus.
Engraulis commersonianus (young only).
Saurida tumbil.
Arius jatius.
Arius nella.
Pristipoma maculatum.
Therapon theraps.
Upeneoides vittatus.
Sciaena (species not yet determined).
Sciaena carutta.
Caranx kurra.
,, melampygus.
,, atropus.
,, hippos.
Equula ruconius.
Equula lineolata.
,, insidiatrix.
Chorinemus lysan.
Lactarius delicatulus.
Seriola nigrofasciata.
Scomber microlepidotus.
Cybium guttatum.
Elacate nigra.
Sillago sihama.
Sphyraena obtusuta (also a species not yet identified).
Mugil jerdoni.
Synaptura commersoniana.
Plagusia bilineata.
,, marmorata.
Triacanthus brevirostris.
Tetrodon lunaris.

This list was considerably extended as a result of further observations in March (1909) when fishing, both with the seine-nets in the masula boats and with the drift-nets of the catamarans, was carried on. The pomfrets (both *Stromateus cinereus* and *S. niger*) were present in large numbers. On this occasion these fish were captured in the drift-nets as the weather was too rough for the masula boats. In this net there were also present *Cybium guttatum*, *Trygon gerrardi* and *T imbricata*, *Chiloxyllium griseum*, *Dussumieria acutus* and species of *Minous* and *Trichiurus*.

The sea-snake *Distira robusta* was represented by a specimen 174·5 cms. (68 inches) in length. *Trygon alcockii*, a new species of sting-ray, was captured in a seine-net at Puri at this time.

The "Golden Crown" rarely trawled in muddy ground in this area, though occasionally in deeper water mud was met with; but this mud was invariably of a harder consistency than that in Area I. Off the Black Pagoda (Konarak) there is a reef composed of a recent conglomerate of sand and decomposed shells, and the trawl net was on one occasion lost on this reef. Off the Devi river turtles were unusually abundant, no less than six being taken in one haul of the trawl. The forms represented were *Thalassochelys caretta* and *Chelone imbricata*.

Invertebrates were not uncommon; of the edible species the "prawns" (Peneidae) predominated. The largest hauls made by the "Golden Crown" were made in this area and in Area IV In September 1909 no less than 2¾ tons weight of prawns were caught in seven days fishing. Of other Crustacea probably *Calappa lophos* is the commonest.

Mollusca are more abundant than on the muddy grounds off the Sunderbuns. A spiny species of *Murex* (*M. tenuispina*), several species of *Chama* and *Dolium* are typical. *Astropecten* and

Squilla were typical representatives of the Echinoderms and Crustacea respectively. The typical fish of this area are the Sparoids, the "red flat" of the "Golden Crown" (*Pagrus spinifer*) and particularly large specimens of *Drepane punctata* being obtained. Shoals of *Scomber microlepidotus* were occasionally met with. The Carangidae, too, were unusually abundant in this area. Of other forms the red mullet (*Upeneoides guttatus*) and species of *Triacanthus* were noticeable. The latter was caught in large quantities off the entrance to Lake Chilka, and it is interesting to note that it is also caught right up on the landward side of the lake by the Ooriya fishermen near Balugaon.

It is interesting to compare Alcock's notes [1] on the shallow-water forms obtained by the "Investigator" in this region and Area IV with the "Golden Crown's" collections.

"Four months regular trawling off the Orissa Coast, or rather off the eastern coast of the peninsula between False Point on the north and Gopalpur on the south—a region nearly corresponding with the debouchment of the Máhánaddi delta.

"The physical features here are those of all Indian deltas where the land is making precarious advances on a shoaling muddy sea. Low-lying wastes of drifting sand alternate with still lower-lying estuarine swamps; the coast line presents the unbroken level of a recently formed alluvium, the bed of the sea is an almost imperceptible slope of fine sand and mud, and the more or less turbid waters are consequently so shallow that the twenty-fathom line is distant from five to thirteen miles from shore, while the hundred-fathom line ranges from fifteen to twenty-two miles, as was determined by the "Investigator" in her recent survey. Towards the south, the sea deepens and the bottom becomes sandy.

"The waters of this region swarm with crustaceans and fishes. Penaeidae, Paguridae, and numerous families of the Brachyura exist in the greatest abundance, while the surface waters are crowded with the lower crustacea and with crustacean larvae. The commonest fishes are *Sciaena*, *Kurtus*, *Polynemus*, *Equula*, *Arius*, *Pellona*; *Carcharias*, *Scyllium*, *Trygon*; and, among the Pleuronectids, *Pseudorhombus* and *Cynoglossus*."

If one compared the "Golden Crown" hauls (which were confined to a more limited area) with this, the two leading Pleuronectids would undoubtedly be *Cynoglossus* in the deeper and *Plagusia* in the shallower water. The three leading genera of Elasmobranchs would be *Trygon*, *Pteroplatea* and *Myliobatis*, and the half dozen most abundant Teleosts *Arius*, *Sciaena*, *Caranx*, *Scomber*, *Pagrus* and *Drepane*.

AREA IV THE NORTHERN SIRCARS COAST.

This area extends from the entrance of Lake Chilka to Santapilli (in the Madras Presidency). Trawling was carried on in

[1] "List of Pleuronectidae obtained in the Bay of Bengal in 1888 and 1889," *Journ. As. Soc. Beng.*, vol. lviii, pt. ii, No. 3, 1889, p. 280.

depths of 24 to 35 fathoms off the coasts of the districts of Ganjam and Vizagapatam, but principally off the former. The twenty-four to thirty-fathom grounds off Ganjam, Gopalpur, Sonapur, Baruva and Kalingapatam were thoroughly explored. These grounds were stocked with good edible fish, Percidae for the main part. The net was frequently torn and damaged in these waters owing to the presence of rock-like masses consisting of shells of *Siliquaria cochlearis* and *Spiroglyphus cummingi* interwoven with a Lithistid sponge.[1] One of these reefs was located when hauling off Gopalpur light which bore N.N.E. about 18 miles. The depth of water was 26 fathoms and the reef extended in a W.S.W direction from that point. The solid nature of the ground in this neighbourhood furnishes a holding place for gigantic fan-like Antipatharia. Other typical forms of this area are *Solenocaulon*, *Rhipidogorgia* and *Eunicella*.

The fish of this area are quite distinct from those of the other three areas explored. Of the Trygonidae, for instance, *Trygon kuhlii* and *T zugei* are the most characteristic, the latter apparently not being found further north. *Trygon microps*, the largest of the Indian sting-rays, was frequently taken here. On the 9th March 1909, about half-way between Rati beacon and Pundi one was captured which weighed over 400 lb. The bony fishes serve to differentiate this region from those further north, and whole families are met with here which are only represented by isolated individuals or are entirely absent in the other areas. The Centriscidae, for example, are represented by the curious shrimp-fish, *Amphisile scutata*, which was not obtained in Areas I or III, but was occasionally met with on the Arakan Coast.

The Percidae were far more abundant off the Ganjam district than elsewhere and in particular *Serranus pantherinus* and *S. latifasciatus* were typical. Two others that might be mentioned are *Lutjanus marginatus* and *Scolopsis vosmeri*. The Chaetodontidae were first recorded in the "Golden Crown's" hauls from this area, and in particular *Chaetodon vogabundus* var. *pictus*, *Heniochus macrolepidotus* and *Holacanthus xanthurus* were frequently present. These fish are of small size and bright coloration. They are typical coral-reef denizens.

Of the Sciaenidae, the genus *Umbrina* replaces the genus *Sciaena* of more northern waters. *Umbrina macroptera* was only recorded from this area. The Acanthuridae are also typical, the two leading forms being *Acanthurus punctatus* and *A. gahm*.

Two species of Muraenidae were captured here. Both belonged to the genus *Muraena*, the only species identified being *Muraena punctata*. Other families though not restricted to this area were far more common here than elsewhere. Amongst these may be mentioned the Berycidae with *Holocentrum rubrum* and *Myripristis murdjan*, the Sphyraenidae (Barracutas) with *Sphyraena jello* and

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[1] For a detailed description *vide* Annandale, "Some sponges associated with gregarious molluscs of the family Vermetidae," *Rec. Ind. Mus.*, vol. vi, p. 47.

S. obtusata and the Balistinae with *Ballistes stellaris*, and *Ostracion turritus*.

The predominant Holothurian was *Colochirus violaceus*. The edible spiny lobster (*Panulirus polyphagus* and *P. homarus*), the crabs *Neptunus pelagicus*, *N. sanguinolentus* and *Charybdis cruci-fera* represented the Crustacea. Of the Molluscs species of *Arca*, *Chama*, *Fusus*, *Melina*, *Nassaria* and *Pleurotoma* may be regarded as typical.

In conclusion I have to thank Dr. N. Annandale, Mr. S. Kemp and Mr. B. L. Chaudhuri for much assistance in the identification of species mentioned in this paper.

"GOLDEN CROWN" BIBLIOGRAPHY

FISH.

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,, "Report on the fishes taken by the Bengal Fisheries Steamer 'Golden Crown.' Part I. Batoidei." *Mem. Ind. Mus.*, vol. ii, No. 1.

(Describes one new genus, five new species and a new variety—

Bengalichthys impennis, gen. et sp. nov.
Trygon favus.
,, *alcockii*.
,, *jenkinsii*.
Urogymnus laevior.
Narcine brunnea.
Myliobatis nieuhofii var. *cornifera* nov.)

,, "Report on the fishes taken by the Bengal Fisheries Steamer 'Golden Crown.' Part II. Additional notes on the Batoidei." *Mem. Ind. Mus.*, vol. iii, No. 1.

,, and J T. Jenkins. "Report on the fishes taken by the Bengal Fisheries Steamer 'Golden Crown.' Part III. Plectognathi and Pediculati." *Ibid.*

Jenkins, J T. "Report on the fishes taken by the Bengal Fisheries Steamer 'Golden Crown.' Part IV Pleuronectidae." *Ibid.*

Chaudhuri, B. L. "Description of a new species of saw-fish captured off the Burma Coast." *Rec. Ind. Mus.*, vol. ii, p. 391 (*Pristis annandalei*).

,, "Description of two new species of *Caranx* from the Bay of Bengal." *Rec. Ind. Mus.*, vol. iii, p. 141 (*Caranx guptae* and *Caranx auricoronae*).

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CRUSTACEA.

Annandale, N. "The rate of growth in *Conchoderma* and *Lepas*." *Rec. Ind. Mus.*, vol. iii, p. 295.

" "An account of the Indian Cirripedia Pedunculata. Part I. Family Lepadidae (*sensu stricto*)." *Mém. Ind. Mus.*, vol. ii, No. 2.
(Describes as new, from "Golden Crown" collection—
Oxynaspis celata sub-sp. *indica*.
Dichelaspis grayii var. *pernuda*.)

ECHINODERMATA.

Koehler, R., et Vaney, C. "Description d'Holothuries nouvelles appartenant au Musée Indien." *Rec. Ind. Mus.*, vol. v, p. 89.

" *Les Astéries Littorales du Musée de Calcutta*. Calcutta, June 1910.

MOLLUSCA.

Preston, H. B. "Descriptions of new shells in the collection of the Indian Museum from Burma, Siam and the Bay of Bengal." *Rec. Ind. Mus.*, vol. v, p. 33.
(Contains descriptions of two new species from the Bay: *Dolium varicosum* and *Avicula smithi*.)

" "Descriptions of five new species of marine shells from the Bay of Bengal." *Rec. Ind. Mus.*, vol. v, p. 117.
(*Drillia ganjamensis*, *Nassa ariel*, *Pteronotus annandalei*, *Martesia delicatula* and *Pandora perangusta*.)

COELENTERATA.

Annandale, N. "A pelagic sea-anemone without tentacles." *Rec. Ind. Mus.*, vol. iii, p. 157.
(Specimens of this new form *Anactinia pelagica* were taken on the "Golden Crown.")

SPONGES.

Annandale, N. "Some sponges associated with gregarious molluscs of the family Vermetidae." *Rec. Ind. Mus.*, vol. vi, p. 47.
(Describes as new—
Racodiscula sceptrellifera var. *spiroglyphi*.
Racodiscula sceptrellifera var. *siliquariae*.)