Shark Resources of India, with Notes on Biology of a Few Species

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Abstract

The annual production of elasmobranchs in India during 1982-83 to 1984-85 period was around 59,000 t, of which sharks accounted for 37,500 t (64%). Tamil Nadu, Gujarat, Maharashtra and Kerala together take the bulk of the catch. Of the 65 species reported from Indian waters, over 20 species (families Carcharhinidae and Sphyrnidae) contribute to the fishery. Feeding and breeding habits, intra-uterine embryos and growth characteristics of a few species are described here.

Introduction

Sharks are of great fishery importance the world over, apart from being a significant link in the marine ecology. In India the present annual shark production is around 37,500 t (average for 1983-84 and 1984-85) obtained as a bycatch in a variety of gears. Though they are commercially important, no serious attempts have so far been made at any targetted exploitation of this resource. Our knowledge on the species composition of the shark landings and their relative gear-season and regionwise abundance in the fishery is scanty, except for the gross catch statistics, statewise and on all-India basis available for recent years. Except for some taxonomic studies and fishery aspects, information on the biology and ecology of most species of sharks is meagre. The scope of this paper is to project the present status of the shark fishery in India, to provide a list of all the species recorded from Indian waters and to present the additional data collected by the authors on the biology of a few species.

Material and Methods

The data on the shark landings in India for 1983-84 and 1984-85 are available from published records (Marine Fisheries Information Service, No. 67, Central Marine Fisheries Research Institute). For the earlier years they have been included under the group 'elasmobranchs'. Therefore in this paper the shark landings in India and in the maritime states for the years 1971-83 were calculated on the basis of average values computed from the 1983-85 data. The authors' observations reported here on the biology and fishery of sharks were carried out at Mandapam and nearby areas during 1971-73 and at Bombay during 1971-74. Though some of these results were reported earlier (Nair and Appukuttan, 1973, 1974; Nair *et al.*, 1974; Nair, 1976; Appukuttan, 1978) much remained unpublished; those relating to food, maturity, intrauterine embryos and growth of some species are presented here.

Results and Discussion

Sharks of the Indian seas

Of the many references on the rich selachian fauna of India, the most recent ones are by Talwar and Kacker (1984) describing 35 species and by Compagno (1984a, 1984b) cataloguing the sharks of the world among which 65 species are known to occur in Indian waters. All these species are listed in Table 1. Of these, about 20 species contribute to the shark fishery, and among them 7 species account for the bulk of the landings.

Shark fisheries of India

Among elasmobranchs which contribute over 4% to the marine fish landings in India, sharks amounted to 39,019 t which formed 55% of the elasmobranch landings in 1983-84. The shark landings in India for the years 1971 to 1984-85 are shown in Fig. 1. Over this period the annual landings varied between 26,000 t 39,000 t; since 1974 they were always more then 30.000 t (except in 1976), contributing 2.1 to 2.8% of the total marine fish landings.

Andhra, Gujarat, Karnataka, Kerala, Maharashtra and Tamil Nadu account for about 85% of the shark landings in the country (Fig. 2). About two-thirds of the shark landings (69% in 1983-84, 63% in 1984-85) come from the west coast.

While there are several types of gear that take sharks as incidental catch, the important among them are trawl net and gill net. There are no informations on the gearwise landings of sharks on al all-India basis. However, data available on shark production by machanised boats at major fishing centres show that during 1982-83 to 1984-85 trawl net accounted for 59.6% of the total shark landings, followed by gill net with 38.5%. Purse seine in Cochin and Mangalore, hooks and line in Cochin and Sassoon Docks, 'thangu vala' (bottom-set gill net) in Cochin and 'dol' net in Sassoon Docks take a very small fraction of the catch. New Ferry Wharf and Sasson Docks in Maharashtra, Pudumanai-

kuppam in Andra, Tuticorin in Tamil Nadu and Veraval in Gujarat are centres of good landings by trawl net, Pudumanaikuppam, Cuddalore, Tuticorin, Sakthikulangara, Cochin, New Ferry Wharf, Sassoon Docks and Veraval by gill net.

No clear variation in landings according to seasons is discernible for most of the centres for which data are available. However, at Sakthikulangara and Cochin the catch during the monsoon months (July-September) was the highest for both the years; at New Ferry Wharf and Sassoon Docks the highest catch was in the post-monsoon months (October-December).

Apart from the information available on the distribution of different species of sharks that support the fishery (James, 1973; Rao, 1973; Talwar, 1974), data have been collected on the species composition and abundance of sharks landed at Pamban and Kilakkarai near Mandapam on the southeastern coast of India for 1971-73 period and also from Bombay area (Table 2). A number of species contribute to the fishery at these centres, among which *Carcharhinus limbatus* (Valenceinnes) and *Rhizoprionodon oligolinx* Springer respectively were the most abundant. In Bombay region *Scoliodon laticaudus* Muller & Henle taken in trawl net was the dominent species during 1971-74; among larger sharks landed by gill net and hooks and line *C. limbatus* (Valenciennes) was the most common and others included *C. dussumieri* (Valenciennes), *C. melanopterus* (Quoy & Gaimard), *C. macloti* (Muller & Henle) and *Chaenogalues macrostoma* (Bleeker)

Biology of Indian sharks

1. *Echinorhinus brucus* (Bonnaterre)

One female shark measuring 1.875 m length and weighing 41.9 kg (Pl.I.A) collected on 19-2-1972 at a depth of 265-275 m from the Gulf of Mannar, had half-digested deep sea fishes in the stomach. The specimen was mature with round eggs of 39-70 mm diameter, 11 in the right uterus and 6 in the left (Pl. I.B); nidamental gland was not well developed. This species is ovoviviparous and both the uteri are functional.

2. *Centrophorus uyato* (Rafinesque)

One gravid female shark measuring 930 mm collected from the Gulf of Mannar at a depth of 275 m had one 183 mm embryo in the left uterus and a 42 mm fully yolked egg in the right uterus (Pl. I.C.D.E).

3. *Chiloscyllium griseum* Muller & Henle

This shark is oviparous and deposits the egg in oval egg cases on the sea bottom; mostly feeds on invertebrates. The breeding season is from January to March.

4. *Rhiniodon typus* Smith

According to Compagno (1984a) the maximum total length of this whale shark is uncertain; it may grow upto 18 m but most specimens are less than 12 m. From Indian waters there are only two records of the whale shark measuring over 12 m (Silas, 1986). This species is an omnivorous suction filter-feeder. There is no information on the size at first maturity, mode of reproduction whether viviparous, oviparous or ovoviviparous, and reproductive potential.

5. *Halaelurus hispidus* (Alcock)

This shark feeds on fishes, squids and crustaceans; juveniles prefer crustaceans to fish and squids. Adult males have a size range of 240-260 mm and adult females 220-290 mm. There is no information on the mode of development. Sexual segregation is noticed in this species.

6. *Eridacnis radcliffei* (Smith)

The food of this species is mainly deep-sea fishes, crustaceans and squids. Only the right ovary is functional. This shark is ovoviviparous. During development though a shell membrane is formed in the initial stage, the embryo is found free inside the uterus connected to a fairly large yolksac which is resorbed by the embryo before birth. Only one embryo is found in each uterus (Pl. I.F). The full-term embryos are of great size (101-107 mm) compared to their mother which may become pregnant at 166 mm.

7. *Iago omanensis* (Norman)

This is a viviparous species with yolk-placenta, and feeds on fishes, crustaceans and squids. Adult males are smaller than adult females showing great sexual dimorphism in size.

8. *Chaenogaleus macrostoma* (Bleeker)

This is a viviparous shark with well-developed yolk-sac placenta. Only the right ovary is functional. Mature ova are over 15 mm in diameter. Gestating females of 821-933 mm from the Gulf of Mannar had one embryo in the range 307-445 mm in each uterus. Embryonic store-chamber is well developed. The yolk-sac persists even in advanced stages and gets convoluted and becomes attached to the uterine wall. The umbilical cord has a number of appendiculae, crowded and highly arborescent towards the yolk-sac end (Pl. I.G). Breeding on the southeast coast of India seems to be in November-February. The food of this shark is not known.

9. *Hemipristis elongatus* (Klunzinger)

This is a viviparous shark with yolk-sac placenta. There are 6-8 young per litter. The food of this shark includes anchovies, cat fish, Bombay Duck, mackerel, carcharhinid sharks and butterfly rays (Compagno, 1984a).

10. *Carcharhinus dussumieri* (Valenciennes)

In this shark only the right ovary is functional. Mature ova measure 25 mm in diameter. The yolk-sac placenta is formed by deep convolutions in the uterine wall and the placental connection is pocket type. The placental cord is plain without appendicula (Pl. I.H.) and contains three channels, umblical artery, umblical vein and ductus vitello-intestinalis. The embryo is covered with embryonic membrane even when the placental connection is established. The number of embryos is usually two, one in

each uterus, very rarely four. In the Gulf of Mannar the peak parturition period is March-April.

11. *Carcharhinus hemiodon* (Valenciennes)

Gravid females of this species collected in March from the Gulf of Mannar had a length range of 825-887 mm and had 300-335 mm embryos in advanced stages. The right ovary alone is functional and the diameter of ova is 5-12 mm. Placentation is by interdigitation of uterine and yolk-sac walls. Placental cord is without appendicula (Pl. I.I). There were 1-2 embryos in each uterus.

12. *Carcharhinus limbatus* (Valenciennes)

This shark feeds on a variety of fishes, crustaceans and cephalopods. Right ovary alone is functional. Viviparous with yolk-sac placenta. Mature eggs covered with shell membrane are 25-35 mm in size. Shell membrane store-chamber is noticed in this species. Smaller embryos with functional yolk-sac were found to possess external gill filaments (Pl. II, A.B). Placenta is highly vascularised and the cord is without appendicula. The embryos (70-365 mm) are in uterine compartments, usually 2-4 in each uterus. The gestating mothers ranged from 890 to 1550 mm.

13. *Carcharhinus macloti* (Muller & Henle)

This is viviparous with yolk-sac placenta, having 1-2 embryos to a litter. The male matures at about 69 cm and female at 76-89 cm. One gravid female of 875 mm collected from the Gulf of Mannar had two embryos of 329 and 432 mm in advanced stage. Yolk persisted even at this stage. Placental cord was without appendiculae.

14. *Carcharhinus melanopterus* (Quoy & Gaimard)

Viviparous with yolk-sac placenta, this species has usually 4 young in a litter, one in each uterine compartment. Gestation period is about 16 months. A variety of fishes, cephalopods and crustaceans are the main food items. Males mature at 91-100 cm and females at 96-112 cm. The cord of the yolk-sac placenta (Pl. II.C) is without appendiculae.

15. *Loxodon macrorhinus* Muller & Henle

This is a viviparous shark with yolk-sac placenta. Food includes small bony fishes, cephalopods and crustaceans. In sharks (441-888 mm) collected from the east and west coasts of India the mature egg is 15 mm in diameter. Embryos in early stages have external gill filaments. In most of the specimens observed there was one embryo (142-465 mm) in each uterus. Placental connection with the mother was noticed when the embryo was 142 mm, and its appendiculae characteristic with fleshy ribbon-like lobes as outgrowths enlarged towards the yolk-sac end (Pl. II. D.E). This is a unique taxonomic feature (Nair *et al.,* 1974). Gravid females were collected in July on the east coast, while on the west coast newly born young were obtained in August.

16. *Rhizoprionodon acutus* (Ruppell)

The food of this shark collected from the southeast coast of India consisted mainly of a variety of fishes, among which silverbellies were found to be the most important; other items included crustaceans and cephalopods. This shark breeds almost round the year as evidenced by the females with embryos in various stages of development during January-April, June and October-December on the east coast. Placentation of this viviparous shark begins in the late stage of development by the interdigitation of yolk-sac and the uterine wall. The placental cord has short, highly vascularised and closely packed appendiculae, broad at proximal and narrow at distal ends (Pl. II.F.G).

A curvilinear relationship exists between the placental cord and the intra-uterine embryo (Fig. 3). The relationship is Log W = 0.5587 + 0.6665 Log L where 'w' is the length of placental cord and 'L' the length of embryo. The length of the placental cord varied between 51 and 185 mm, and that of the embryo between 55 and 340 mm.

17. *Rhizoprionodon oligolinx* Springer

This shark feeds on pelagic fish, crustaceans and cephalopods. The males mature at 29-38 cm and the females, which grow larger, at 32-41 cm. The right ovary alone is functional. The mature egg is 15 mm in diameter. The shark is viviparous with yolk-sac placenta. The placental connection of the embryo with the uterine wall is established by the formation of trophonema. Placental cord has highly branched and closely packed appendiculae, each branch being swollen at the terminal end (Pl. I.J). The number of embryos is 3-6 per litter. Gravid females with advanced embryos were observed in January-April, July and October, indicating that this shark also breeds almost throughout the year. The curvilinear relationship (Fig. 4) between the embryo size and the length of placental cord is Log W = 0.6038 + 0.6562 Log L, where 'W' is the length of placental cord and 'L' the length of embryo.

18. *Scoliodon laticaudus* Muller & Henle

The dietary habits of this shark of Bombay waters show that this is a bottom feeder, eating cephalopods, a variety of crustaceans (squilla, prawns and crabs) and fishes (sciaenids, Bombay Duck, threadfins, *Nemipterus* and *Platycephalus*). Incidence of empty stomachs was more in gravid females. Breeding takes place throughout the year.

19. *Eusphyrna blochii* (Cuvier)

This is a viviparous shark with yolk-sac placenta. The placental cord is with appendiculae which are unique in that they are flattened, leaf-like and bilobed or trilobed, becoming smoother towards the yolk-sac end (Pl. II.H). Spent adults were found in the Gulf of Mannar during March-April and gestating females of 150-155 cm during November.

20. *Sphyrna zygaena* (Linnaeus)

This species also is viviparous with yolk-sac placenta. Placental cord is with flattened single-lobed appendiculae. The number of embryos is between 29 and 37 per litter.

The paucity of work on the biology of Indian sharks is probably due to the difficulty in getting adequate samples;

as there is no regular fishery for sharks, their availability is only incidental. Added to this is the unwieldy size of many species. According to Krishnamoorthi and Jagdis (1986), out of 77 publications on elasmobranchs from India, only one deals with the age and growth; the rest are mainly on faunistic and taxonomic studies, apart from some isolated biological details of a few species.

Since whatever is obtained as bycatch is a multispecies catch of sharks in a multigear fishery, no serious effort has been made to assess the catch composition or the species estimates of the landings on an all-India basis or for the major landing centres. In addition to this is the pausity of adequate information on biology, especially growth characteristics of most species. These factors may explain the lack of attempts on population dynamics. The work of Krishnamoorthi and Jagdis (1986) is the only attempt at stock estimation of a shark. Devaraj (1983) estimated the growth parameters (t_O, L $\propto$ and K) for five species of sharks that are of fishery importance, but the estimation of stock is not possible in the absence of any catch and effort data.

Holden (1973) has indicated that the average fecundity is very low, and it might be expected that the elasmobranch stocks would be very susceptible to effects of fishing. In most sharks fecundity varies from 1 to less that 10, rarely more than 10, and the gestation period is generally long. Because of this the natural mortality and the fishing mortality are expected to be high. Discussing the effects of fishing on *squalus acanthias* in British waters, Holden (1974) states that the female part of the stock must be given considerable protection if recruitment is not to be affected. Fortunately, such a situation does not exist for sharks of the Indian waters as the present exploitation is meagre.

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Table 1. Sharks recorded from Indian Waters. (Complied from Compagno, 1984a and 1984b).

Family and valid name of species	Distribution	Habitat	Size at birth (cm)	Maximum size (cm)	Fishery importance
Family: Hexanchidae					
Heptranchias perlo (Bonnaterre)	Southwestern coast	Benthic; shelf and slope	26	137	X
Notorynchus cepedianus (Peron)	? East and West coasts	Benthic; shelf	45-53	290	X
Family: Echinorhinidae					
Echinorhinus brucus (Bonnaterre)	West and south-east coasts	Deepwater; shelf and slope	29-90	310	X

1	2	3	4	5	6
Family: Squalidae					
Centrophorus uyato (Rafinesque)	? East and west coasts	Deepwater; shelf and slope	40-50	100	X
Centroscyllium ornatum (Alcock)	N. Arabian Sea; Bay of Bengal	Deepwater; shelf and slope	..	30	X
Centroscymnus crepidater (Bocage & Capello)	Southwestern coast	Deepwater; shelf and slope	..	90	X
Squalus mitsukurii Jordan & Snyder	West coast	Benthic; shelf and slope	22-26	110	X
Family: Hemiscylliida					
Chiloscyllium griseum Muller & Henle	East and west coasts	Benthic; inshore	..	74	XX
Chiloscyllium indicum (Gmelin)	East and west coasts	Benthic; inshore	..	65	XXX
Chiloscyllium plagiosum (Bennett)	East coast	Benthic; inshore	..	95	XX
Chiloscyllium punctatum Muller & Henle	East coast	Benthic; inshore	..	104	X
Family: Stegostomatidae					
Stegostoma fasciatum (Hermann)	East and west coasts	Inshore	20-36	354	XX
Family: Ginglymostomatidae					
Nebrius ferrugineus (Lesson)	East and west coasts	Inshore	40	320	XX
Family: Rhiniodontidae					
Rhiniodon typus Smith	East and west coasts	Epipelagic; inshore and oceanic	..	1200	X
Family: Odontaspididae					
Eugomphodus taurus (Rafinesque)	West coast	Inshore	95-105	318	X
Eugomphodus tricuspidatus (Day)	East and west coasts	Littoral; inshore and offshore	..	370	XX
Family: Pseudocarchariidae					
Pseudocarcharias kamoharai (Matsubara)	? East coast	Epipelagic; oceanic	41	110	X
Family: Alopiidae					
Alopias pelagicus Nakamura	? West coast	Epipelagic; oceanic	96	330	X
Alopias superciliosus (Lowe)	Southwestern coast	Epipelagic and epibenthic	64-106	461	X
Alopias vulpinus (Bonnaterre)	Southwestern coast	Inshore; epipelagic	114-150	549	X
Family: Lamnidae					
Isurus oxyrinchus Rafinesque	East and west coasts	Epipelagic; inshore and offshore	60-70	394	X
Family: Scyliorhinidae					
Apristurus investigatoris (Mira)	Bay of Bengal	Benthic; deepwater	..	26	X
Atelomycterus marmoratus (Bennett)	East and west coasts	Inshore; in coral reef	..	70	X
Cephaloscyllium silasi Talwar	Southwestern coast	Benthic; continental slope	..	36	X
Halaelurus alcocki Garman	Northwestern coast	Benthic; continental slope	..	?	X
Halaelurus hispidus (Alcock)	Southwestern coast	Benthic; deepwater	..	29	X
Halaelurus quagga (Alcock)	Southwestern coast	Offshore	8	35	X
Family: Proscylliidae					
Eridacnis radcliffei Smith	Southeastern coast	Benthic; deepwater	11	24	X
Family: Triakidae					
Iago omanensis (Norman)	West coast	Benthic; deepwater	17	58	XX
Mustelus manazo Bleeker	East and west coasts	Benthic; inshore	30	117	X
Mustelus mosis Hemprich & Ehrenberg	East and west coasts	Benthic; inshore and offshore		150	XX

1	2	3	4	5	6
Family: Hemigaleidae					
Chaenogaleus macrostoma (Bleeker)	East and west coasts	Inshore	28	100	XXX
Hemigaleus microstoma Bleeker	Southeastern coast	Inshore	26-28	91	XX
Hemipristis elongatus (Klunzinger)	East and west coasts	Inshore	45	240	XX
Family: Carcharhinidae					
Carcharhinus albimarginatus (Ruppell)	? Bay of Bengal	Pelagic; inshore and offshore	63-68	300	X
Carcharhinus altimus (Springer)	Southeastern coasts	Benthic; offshore	70-90	300	XX
Carcharhinus amblyrhynchoides (Whitley)	Southwestern coasts	Pelagic; ofshore, inshore	52-55	140	XXX
Carcharhinus amblyrhynchos (Bleeker)	? West coast	Pelagic; inshore	45-60	233-265	X
Carcharhinus amboinensis (Muller & Henle)	? East and west coasts	Inshore	71-72	280	X
Carcharhinus brevipinna (Muller & Henle)	Southwest coast	Pelagic; inshore and offshore	60-75	278	XX
Carcharhinus dussumieri (Valenciennes)	East and west coasts	Inshore	37-38	100	XXXX
Carcharhinus falciformis (Bibron)	? Southwestern coast	Epipelagic; oceanic	70-87	330	X
Carcharhinus hemiodon (Valenciennes)	East and west coasts	Inshore and river mouths	..	150-200	XXX
Carcharhinus leucas (Valenciennes)	West coast, Hooghly river	Inshore; estuarine riverine	157-226	340	XXX
Carcharhinus limbatus (Valenciennes)	East and west coasts	Epipelagic; oceanic	38-72	255	XXXX
Carcharhinus longimanus (Poey)	East and west coasts	Epipelagic; oceanic	60-65	350-395	XXX
Carcharhinus macloti (Muller & Henle)	East and west coasts	Inshore	45-50	100	XXX
Carcharhinus melanopterus (Quoy & Gaimard)	East and west coasts	Inshore, in coral reefs	33-52	200	XXXX
Carcharhinus plumbeus (Nardo)	West coast	Pelagic; inshore and offshore	56-75	300	X
Carcharhinus sealei (Pietschmann)	Northwestern & southeastern coasts	Inshore		95	XXX
Carcharhinus sorrah (Valenciennes)	East and west coasts	Inshore	45-60	160	XXX
Galeocerdo cuvier (Peron & Lesueur)	East and west coasts	Pelagic; inshore	51-76	550	XX
Glyphis gangeticus (Muller & Henle)	Bengal coast; east and west coasts	Inshore, riverine, fresh water	..	204	XX
Lamiopsis temmincki (Muller & Henle)	East and west coasts	Inshore	40-60	168	XX
Loxodon macrorhinus Muller & Henle	East and west coasts	Inshore	40-43	91	XXX
Negaprion acutideus (Ruppell)	East and west coasts	Inshore	45-80	310	XX
Prionace glauca (Linnaeus)	East and west coasts	Epipelagic; oceanic	35-44	383	XXX
Rhizoprionodon acutus (Ruppell)	East and west coasts	Inshore and offshore	25-39	101	XXXX
Rhizoprionodon oligoling Springer	East and west coasts	Inshore and offshore	21-26	70	XXX
Scoliodon laticaudus Muller & Henle	East and west coasts	Inshore	12-15	74	XXXX
Triaenodon obesus (Ruppell)	East and west coasts	Inshore	52-60	213	XX
Family Sphyrnidae					
Eusphyrna blochii (Cuvier)	East and west coasts	Inshore	32-45	152	XXXX
Sphyrna lewini (Griffith & Smith)	East and west coasts	Pelagic; inshore	42-55	370-420	XXXX
Sphyrna mokarran (Ruppell)	East and west coasts	Pelagic; inshore and semi-oceanic	50-70	550-610	XXX
Sphyrna zygaena (Linnaeus)	Southeastern and southwestern coasts	Pelagic; inshore and semi-oceanic	50-61	370-400	XXX

*Fishery importance: X – Nil; XX – Limitted fishery; XXX – Regular fishery; XXXX – Abundant regular fishery.

Table 2. Shark landings (kg) at Pamban and Kilakkarai during 1971-73

Species	Pamban			Kilakkarai		
	1971	1972	1973	1971	1972	1973
Loxodon macrorhinus	1,393	—	—	—	—	—
Rhizoprionodon acutus	8,492	9,474	5,932	4,779	5,977	4,600
R. oligolinx	8,724	9,366	8,903	3,976	10,009	4,914
Carcharhinus limbatus	15,124	3,030	8,989	6,060	1,475	322
C. sorrah	1,288	860	3,615	1,386	60	1,087
C. melanopterus	335	342	100	..	..	..
C. dussumieri	270	1,333	241	..	..	..
C. hemiodon	767	2,159	9,755	..	..	..
Chaenogaleus macrostoma	444	928	276	..	..	..
Eusphyrna blochii	1,450	2,272	1,577	330	75	..
Sphyrna lewini	1,095	1,504	2,994	873	175	996
S. zygaena	181	715	..	..	..	..
Total	39,975	33,078	43,322	17,537	17,816	11,954

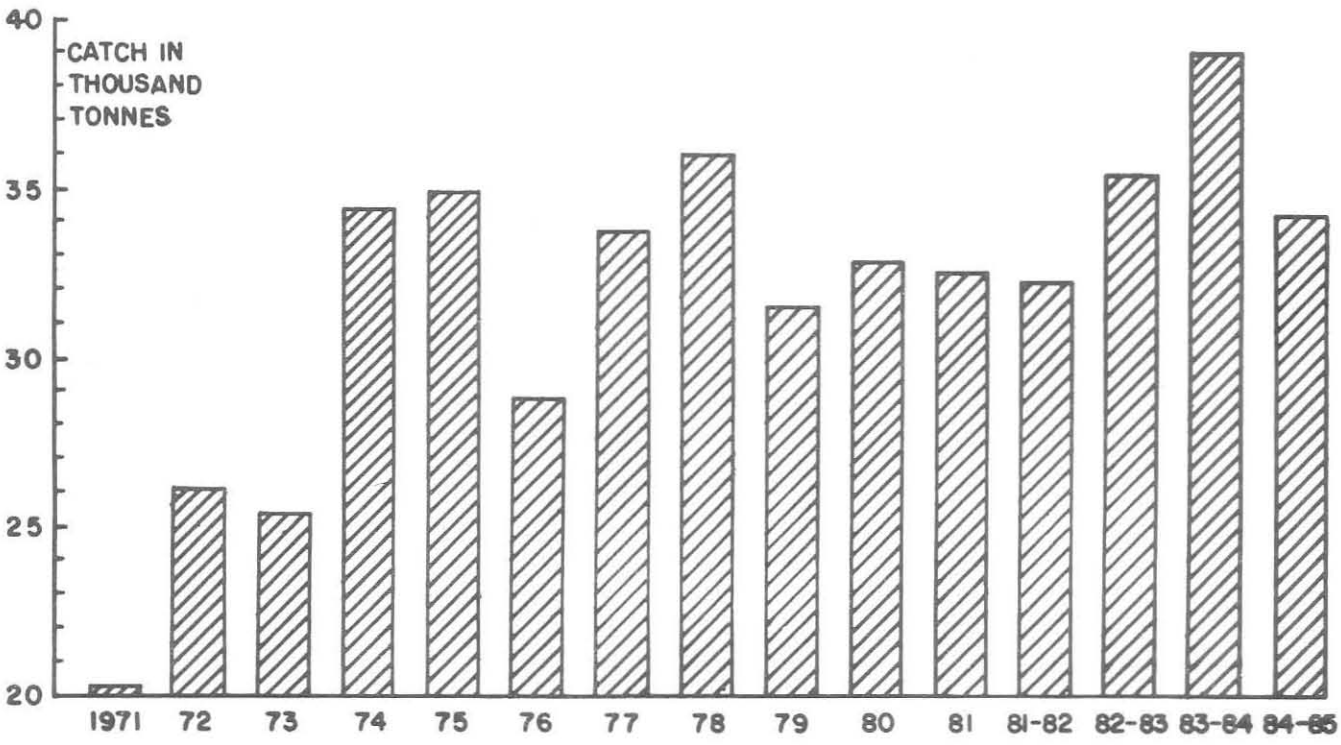

Fig. 1. Shark landings (tonnes) in India, 1971 to 1984-85.

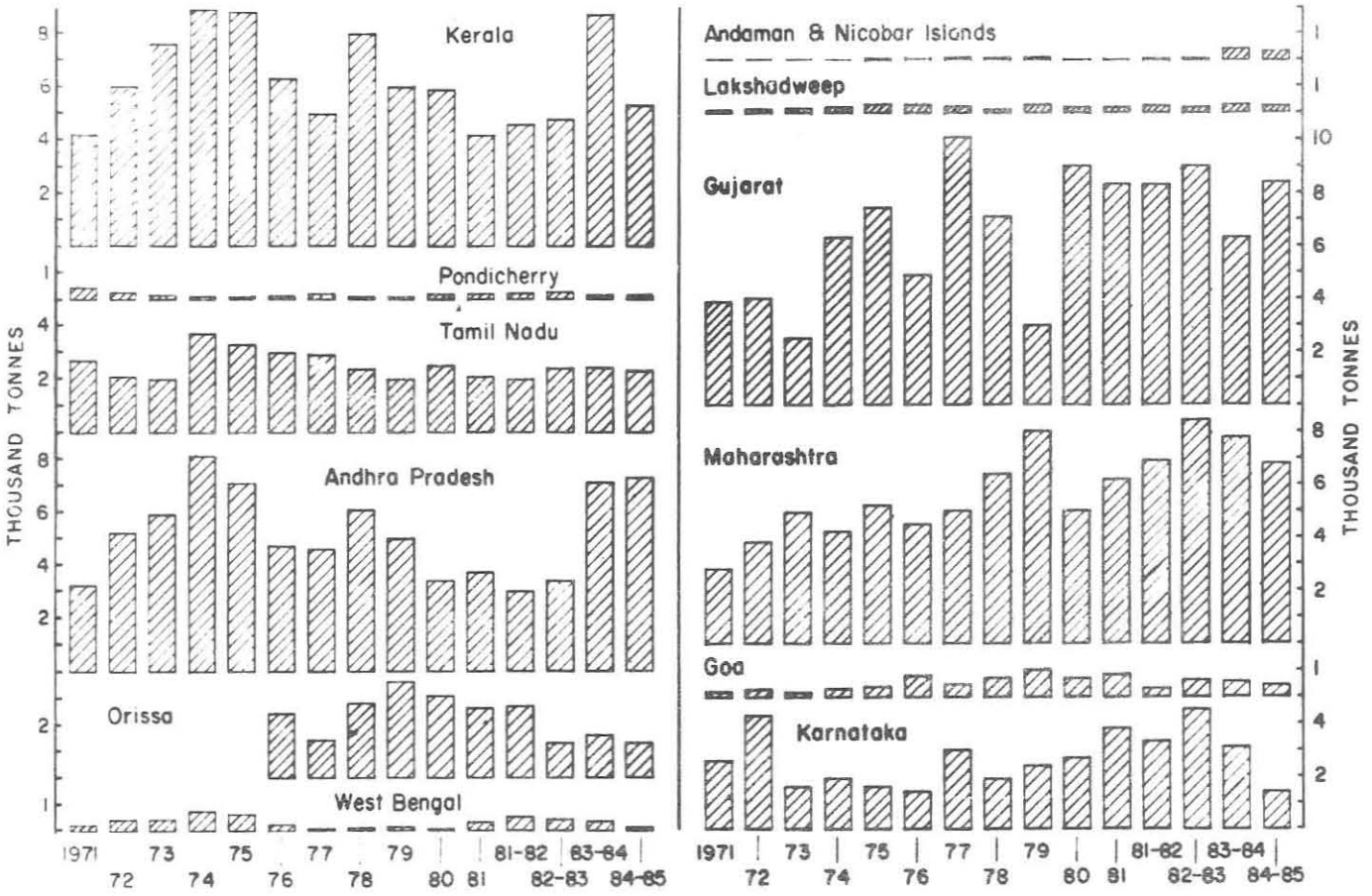

Fig. 2. Shark landings (tonnes) in maritime states of India.

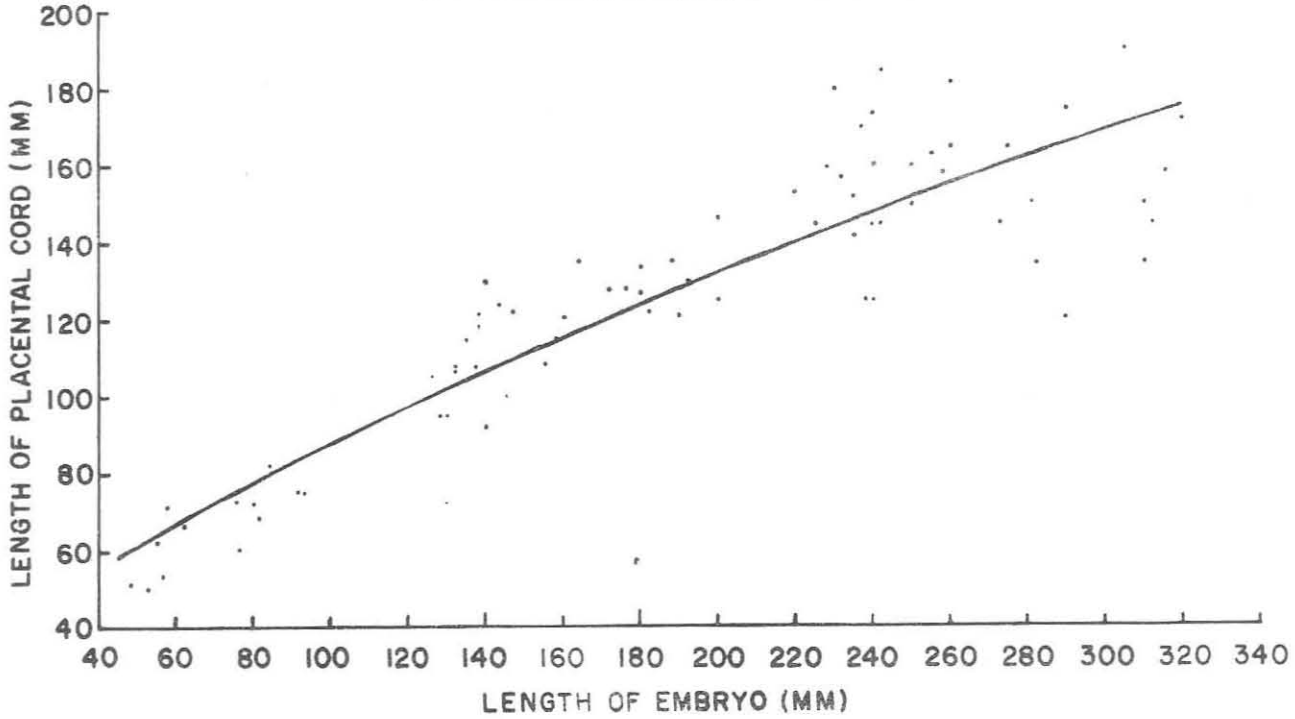

Fig. 3. Relationship between lengths of intra-uterine embryo and placental cord in *Rhizoprionodon acutus*.

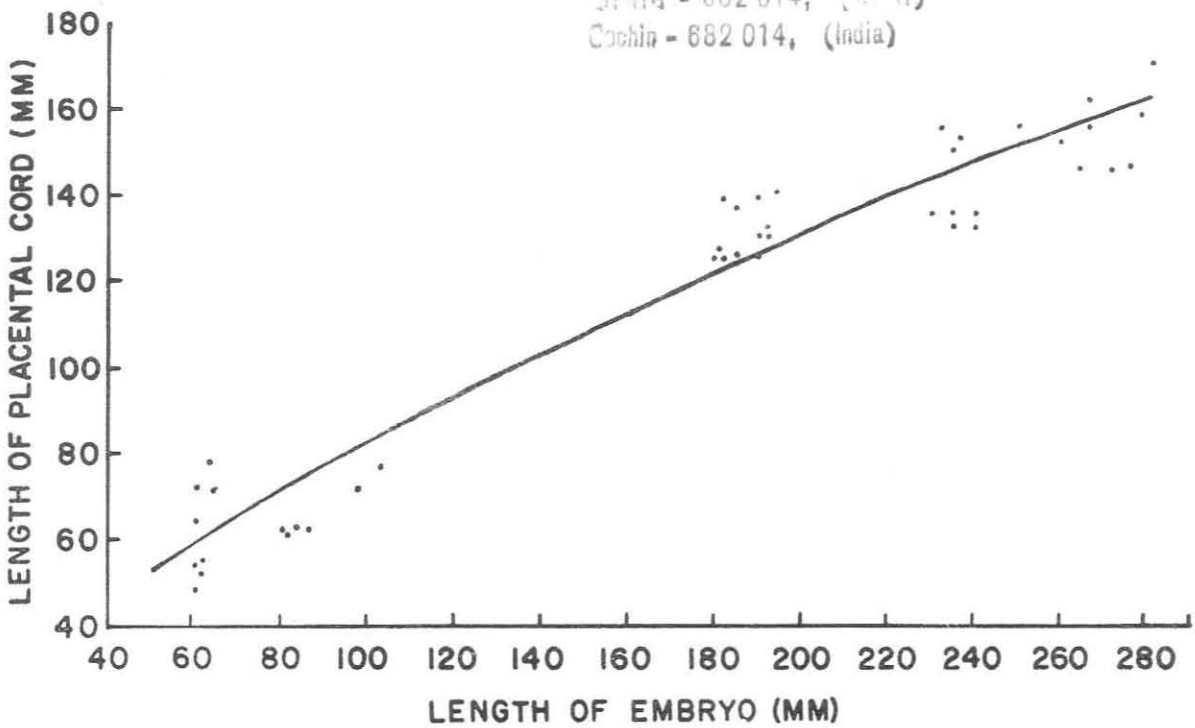

Fig. 4. Relationship between lengths of intra-uterine embryo and placental cord in *Rhizoprionodon oligolinx*.

Legend to Figure 5. Plate – I and Plate – II

Fig. 5. Plate – I

A. *Echinorhinus brucus*
B. *Eggs* of *Echinorhinus brucus*
C. *Centrophorus uyato*
D. Egg of *Centrophorus uyato*
E. Intra-uterine embryo of *C. uyato*
F. Intra-uterine embryos of *Eridacnis radcliffei* – one in each uterus.
G. Intra-uterine embryo of *Chaenogaleus macrostoma*
H. Intra-uterine embryp of *Carcharhinus dussumieri*
I. Intra-uterine embryo of *Cacharhinus hemiodon*
J. Early stages of intra-uterines embryos of *Rhizoprinodon oligolinx*

Fig. 5. Plate – II

A. Intra-uterine embryo of *Carcharhinus limbatus*
B. Early stage of embryo of *C. limbatus* with external gill filaments.
C. Intraputerine embryo of *C. melanopterus*
D. Intra-uterine embryo of *Loxodon macrorhinus* showing the characteristic ribbon-like lobes of appendicula.
E. Intra-uterine embryo of *L. macrorhinus* showing placental attachment.
F. Intra-uterine embryos of *Rhizoprionodon acutus*
G. *Placental attachment of embryos of R. acutus*
H. Placental connection of *Eusphyrna blochii* showing the nature of placental cord.

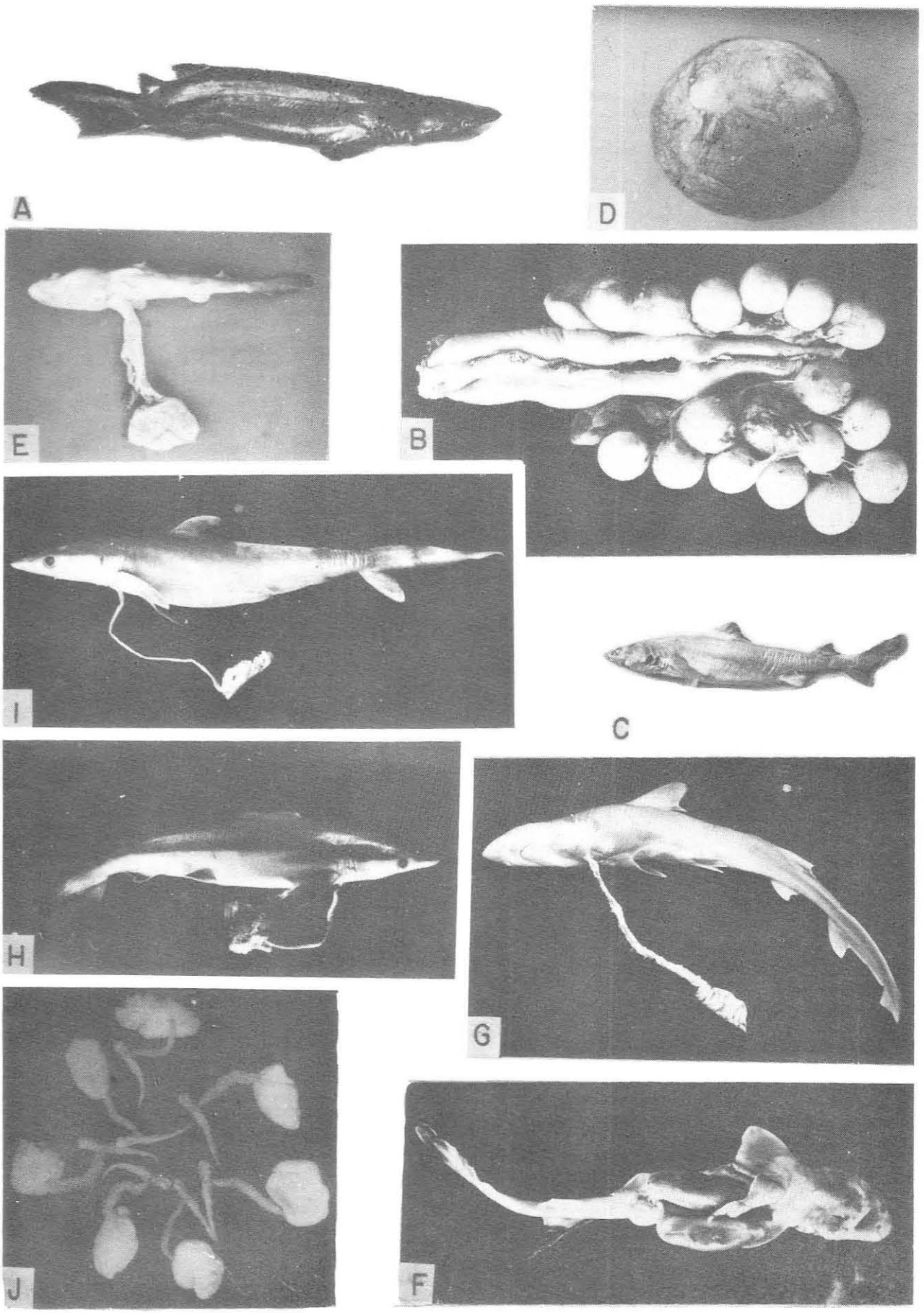

Fig. 5, Plate I

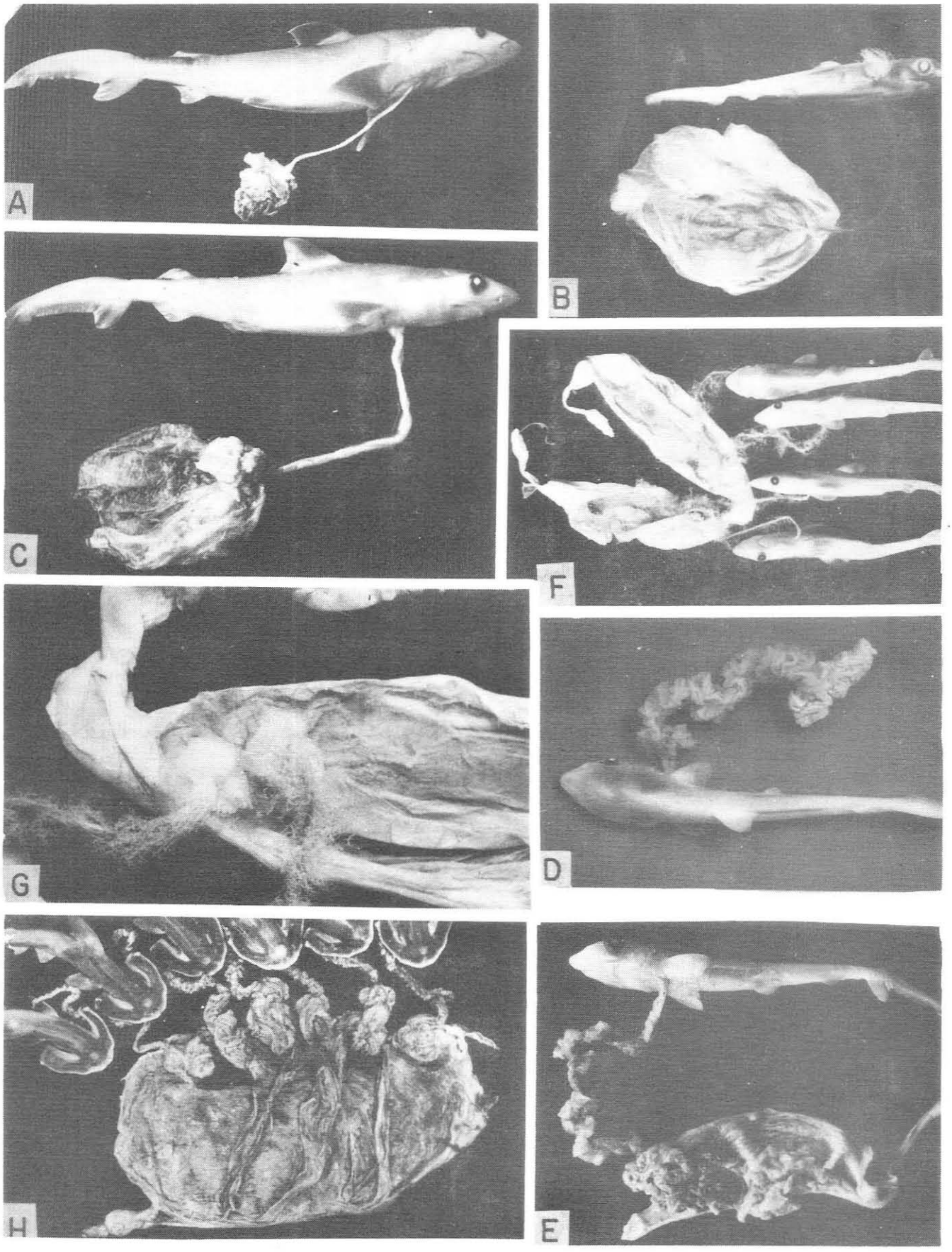

Fig. 5, Plate II