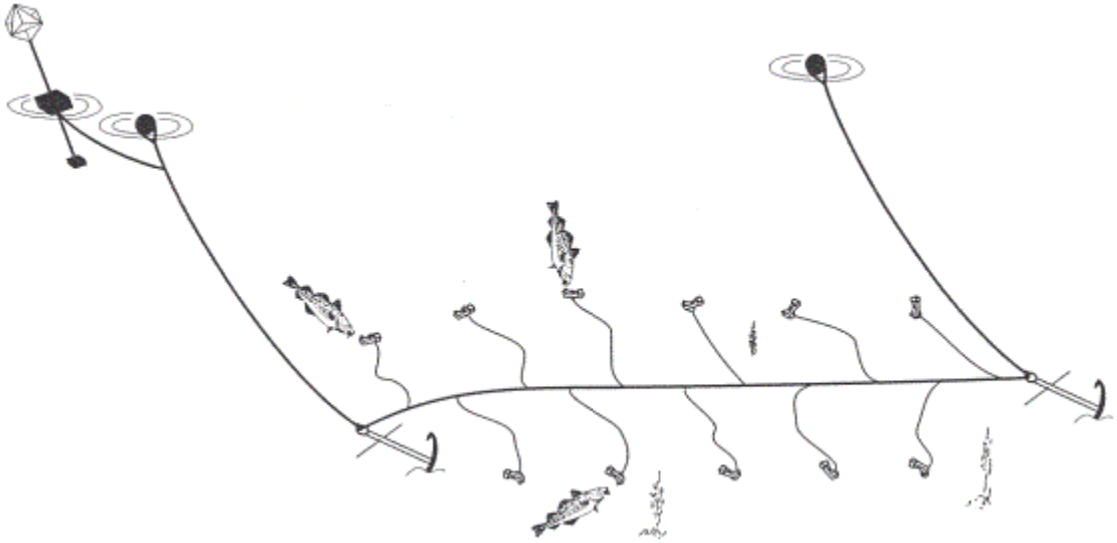
Demersal Finfish Resources Survey
South, South-East, East and North East Coast

Assessment Report



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1. Background

This project is complemented by the component of the International Fund For Agriculture Development (IFAD) funded Post Tsunami Rehabilitation and Management Programme on support to conduct resource surveys and stock assessments and the promotion of participatory fisheries management for selected fisheries /resources in the Tsunami affected districts. The present study focused on demersal finfish resources in the coastal waters in Sri Lanka. This study assists the effort of the government to build and maintain a coastal fisheries resource information base for development planning purposes and ensure sustainable use of resources.

Before introduction of synthetic gillnets the demersal fisheries of Sri Lanka made very significant contribution to fish production and was probably only exceeded by beach seine fishery. Bottom handlining was a very popular method for catching large demersal finfishes like emperor fishes (Lethrinids), groupers (Serranids) and snappers (Lutjanids). Fishing was carried out with large traditional crafts (vallams) towed by mother ships to the fishing grounds close to the continental slope (Medcof, 1956). Bottomset gillnets made of natural fibers and bottom longlining were very common in the Jaffna Peninsula and were occasionally practiced in Trincomatee and Puttalam (Pearson, 1923). Chaplin (1958) reported that beach seining and handlining were the primary fishing methods in Sri Lanka in the mid-50s.

Introduction of the mechanization scheme in late 1950s some of the traditional crafts were equipped with outboard engines and some new crafts with outboard and inboard engines were introduced. With the mechanization, and subsequent introduction of synthetic gillnets resulted the fishing area as well as the efficiency of gear increased and thereby drift gillnet fishing became more popular. The distant water trawl fishery on the Wadge Bank had to be suspended in the late 70s. Since then over the last three to four decades, the

demersal fishery in Sri Lanka has receded to a position of relatively low significance.

Commercial trawl fisheries for demersal finfish have been carryout historically by Sri Lankan fishermen in Wadge Bank and Pedro Bank. The loss of Wadge Bank and two-third of Pedro Bank with the establishment of Indo-Sri Lanka maritime boundary led to the suspension of fisheries in 1976 (Mendis, 1965).. A rich fishing area that has been fished by Sri Lankan fishers for centuries, became a part of the Exclusive Economic Zone of India. Thereby demersal fisheries restricted to the coastal waters.

About 215 demersal species belonging to 55 families have been identified around Sri Lanka but about 10 groups are predominant and commercially important. Of the most important ones are the emperor fish (Lethrinidae), snapers (Lutijanidae), Jacks Trevallies (Carangidae), groupers (Seranidae), grunts sweetlips - (Pomadasidae) and sea catfish (Ariidae). As in other tropical fisheries, in Sri Lanka too, we have a multi species, multigear fisheries. That is in one particular gear more than one species are caught and that more than one gear is used to exploit the same species.

The fish resources around Sri Lanka; “Dr. Fridtjof Nansen” survey, 1978—1980 revealed the availability of sufficient demersal resource potential for increased exploitation. Thereby the Bay of Bengal Programme promoted efficient fishing method, bottom longline enabling to fish in rough bottom areas for large demersal finfish but unable to establish commercial fishery (Pajot and Weerasooriya,1980) .

1.1 Past Demersal Finfish Resource Surveys

A number of surveys on the demersal finfishes have been carried out around Sri Lanka since 1920. Major surveys, exploratory fishing and investigations relevant to

the subject are summarized in Table 1. Specific investigations on the Wadge Bank trawl fishery are not listed because this ground is no longer available for exploitation by Sri Lanka.

	Vessel	Period	Type of investigation	Area surveyed
1	RV Lilla, 126', 249 Gr.T, 500 h.p.	1920—23	Bottom trawl surveys	Around Sri Lanka including Wadge and Pedro Banks
2	RV Canadian 45', 80 h.	1955—56	Bottom trawl survey	Inshore waters around Sri Lanka
3	RV North Star, 45', 80 h.p	1954—57	Handlining, bottom longlining	Inshore waters around Sri Lanka
4	RV Canadian, 45', 80 h.p	1963—67	Prawn trawl	North and east coasts
5	RV Myliddy, 33 m, 240 h.p.	1967	Granton trawl, high-opening traw	North and east coasts
6	RV Optimist	1971	prawn traw, Bottom trawling in deep waters.	Around Sri Lanka, outside territorial waters
7	RV Hoyomaru, 496 tons, 1000 h.p.	1975	Vertical longline	North-west and north-east of Sri Lanka
8	RV Hurulla, 11 m, 96 h.p.; RV Lagga, 8.4 m, 22 h.p.	1975—78	Bottom fish trawl;	Palk Bay & Gulf of Mannar
9	RV Dr. Fridtjof Nansen	1978—80	Bottom trawl and acoustic survey bottom longline	Around Sri Lanka.

Source: Sivasubramanium, 1985

1.2 Demersal Finfish Fishing Grounds

The category demersal fish is used in a broad sense to encompass fish, which are vulnerable to bottom fishing gear, where fishing activities are described as demersal fisheries. These include a wide range of both finfish and non-finfish. The availability of demersal fishery resources are naturally limited as the continental shelf of the country is narrow rarely exceeding 40 km, with the exception of a few areas in the Gulf of Mannar, off Pedro Bank, and southwest of Hambantota, the edge of the shelf falls off rapidly from 100 meters to 1500-3500 meters. Further, major part of the continental shelf is generally rocky, particularly between Colombo and Batticaloa. Thus, fishing with nets is restricted except in the northern part, particularly the Palk Strait, Gulf of Mannar where sea bottom is predominantly muddy or muddy sand. Shrimp trawling is carried out in these areas and the by-catch contains substantial amount of small verities of low value fish (Sivasubramanium and Maldeniya, 1985).

1.3 Current Status of Demersal Fisheries

Demersal finfish fisheries at present are carried out seasonally in a small-scale. Landings are estimated to be about 25,000 t annually, down from 48,000 t year in the 1980s. It was declined mainly due to civil disturbance in the north and east which are the major fishing areas for demersal fisheries.

During the fishing season a variety of crafts, including a few >34 ft inboard powered multiday boats which generally conduct offshore pelagic fishing, 28-34 ft inboard powered day boats, especially outboard powered 18-20 ft boats and motorized or without motorized traditional crafts participate in the fishery but type and number of vessels operating is quite varied regionally.

Fishing methods used to catch demersal finfish include handline, bottomset gillnets, bottom longline, trammel nets, traps and spears. Handline is the traditional method

and is the most popular in all areas. Bottom longline is popular in northwest, west, southwest and south while bottomset gillnet and trammel nets are more popular in north, northwest and south but their main target is crabs in northern areas and lobsters in southern areas.

Demersal catches are highly diverse in terms of number and size of species depending on the gear used and area of operation. Handline and longline fishing are more selective and generally catch large fish than less selective methods such as trammel net, bottom set gillnet and traps. Further, landings of longline and handline are better quality. However, use of longline with small hooks (No. 8,9,10) targeting small demersal finfish varies or juveniles of large species in the shallow coastal waters are getting popular among fishermen as a way of reducing operational cost. This may have some ecological impact on the resources.

Research revealed that demersal fishing is rarely conduct beyond the depth of 50 meters except limited effort targeting groupers, dogfish and red-snappers in the slopes of the shelf during calm season.

2. Present Study

Since continental slope is very abrupt making demersal trawling operations impractical, particularly in waters deeper than 100 m thus resources surveys conducted during the past unable to make precise estimation on the distribution and abundance of demersal finfish resources in the deeper depths.

The present study; exploratory demersal fishery survey in the deeper waters of southern, eastern and northern coastal seas was conducted from March to December 2011 by the National Aquatic Resources Research and Development Agency (NARA), with the financial assistance of International Fund for Agricultural

Development (IFAD) . The project intended to study fisheries potential and chartering of three majorl fishing grounds; Hambantota Bank, Batticaloa and Trincomalee reefs and Pedro Bank covering an area of over 10,000 km^2, which is about one third of the total continental shelf area. Fisheries stock assessment study in Hambantota Bank and Batticaloa and Trincomalee reefs were partially completed but unable to carry out in Pedro Bank but chartering of it was completed. Weather condition, logistics and financial issues constrained continuation of the study.

2.1 Study Objectives

Sri Lanka aims to increase fish production to 686,000 metric tons by 2013 from the present level of close to 400,000 tons to meet the nutrition needs of the people while being mindful of issues like sustainability, traceability and regulation. Many fishery resources in coastal waters appear to have been heavily exploited. Some stocks especially small pelagic resources are believed to have been over exploited. Recent fisheries development activities have been geared to readjust the imbalance in the exploitation of available marine resources..

In this context the government has given high priority to develop fisheries on underutilized or unutilized resources and deepwater-demersal finfish are one of them. Sri Lanka is expected to have significant contribution in the development of demersal fishery resources. Judging the rationale, research needed should have the accountability and sustainability in order to support the development and management strategies of their fisheries.

This study is an attempt to assess the status of deep-water demersal stocks in the light of the present level of exploitation, as a first step in identifying the development possibilities, management measures for demersal resources and the areas requiring future investigations.

The specific objectives are;

1. To investigate the potential resources of economically important demersal species, their distribution and their biology.
2. Delineation of assemblage boundaries or potential fishing zones and relationship of the assemblages to environmental parameters.
3. Identify the fishery resources available for bottom longline and evaluate the effectiveness of bottom longlines in harvesting these resources
4. Identify most productive areas for bottom longlining

3. Methodology

The resource survey was conducted by the Marine Biological Resources Division (MBRD) of the National Aquatic Resources Research and Development Agency (NARA) to provide baseline information on the bottom longline fishery. This information will be extremely useful for sustainable development of fishery.

3.1 Survey Type

An Exploratory Deep-water Demersal Fishery Survey was conducted with community participation. Fishing was done with bottom longline using. Both gear and vessels were hired out with the crew.

3.2 Survey Area and Site Selection

The survey was conducted covering the two main areas of concentration for this fishery: Hambantota Bank, shelves and Batticaloa and Trincomalee reefs (Figure 1).

1. Hambantota Banks, the south coast east of 80°30'E and south of 06°20'N (Rekawa to Sangamkanda) (Zone I)
2. The shelves of Batticaloa and Trincomalee from 06°20'N to 09°30'N, (Sangamankanda to Nilaweli) (Zone II)

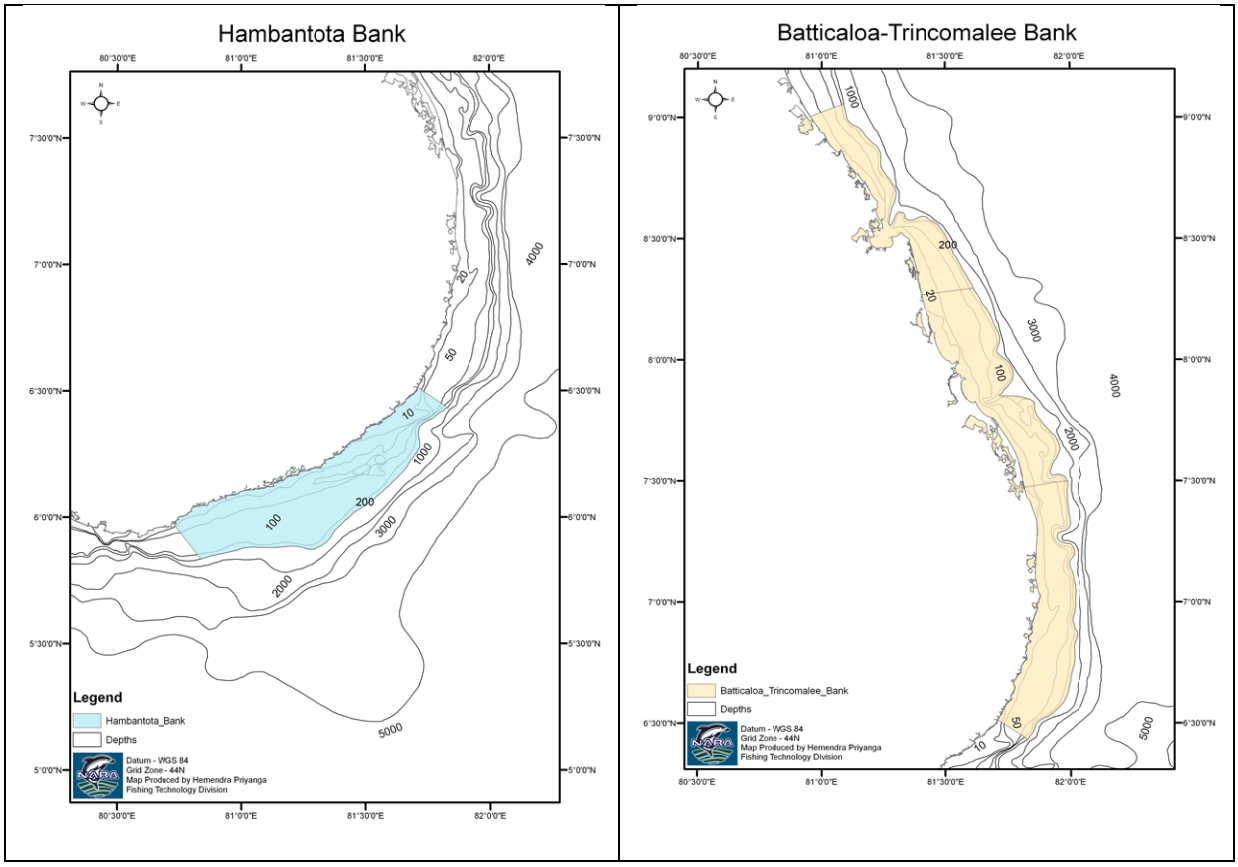


Figure 1: Hambantota Bank (Zone I) and Batticaloa-Trincomalee Banks (Zone II)

a. Sampling Design

Study area was divided into 5x5 sq. kilometer grids and each grid was numbered. The grid numbers were then separated into two groups; within 50 m and outside 50 m and randomly select grids representing 25% from each group. Exploratory fishing was conducted in those selected grids.

3.4 Structure of Fishing Gear

Fishing was carried out with bottom longline (Figure 2). The main line is made out of No. 200 monofilament and a branch line of 1.5 meters of No. 120 monofilament is attached to the main line at 2-3 meter intervals. A 8-10 kg stone is attached to each end of the main line. 2 rigiform buoys of G-7 type or 300x300x150 cm local polystyrene blocks, with a flag are attached to each end of the lone by a 66 mm PP rope. 300 kirbed hooks of No. 7 and 8 were used in this gear. They are the most commonly used size of hook in catching large demersal fish in deeper waters. In Hambantota Bank 97% of operation made using hook No.7 while in Batticaloa-Trincomalee 89% No.7 and 11% No. 8.

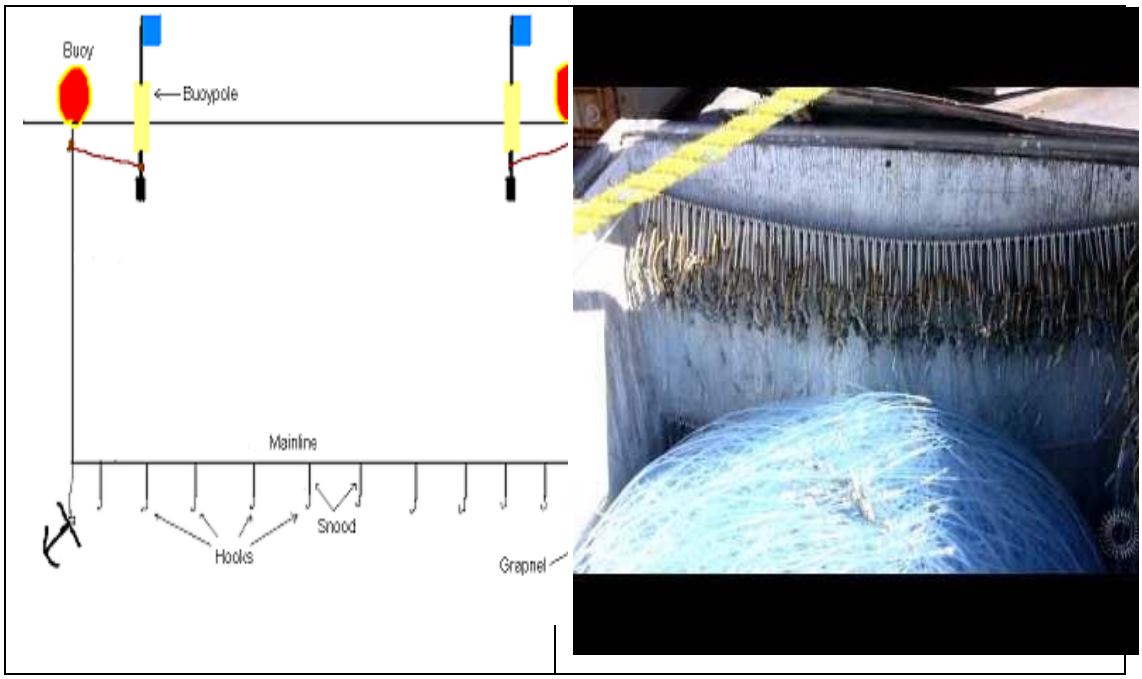


Figure 2: Gear design of bottom longline and how branch lines and mainline stack in a wooden box onboard

3.5 Fishing Vessel and Manning of vessels

Three to four fiberglass reinforced outboard motor boats (FRP-OBM) of 18-22 ft were used for the operation of the gear. Personal on board of each fishing boat included 2-3 NARA staff and 2 killed fishermen including skipper.

3.6 Bait

Natural bait, cut pieces of squids were mainly used as bait but when shot of squids *(Loligo duvauceli, Loligo singhalensis*) sardines (*Sardinella gibbosa, Sardinella finbriata, Sarinella albella*) and herrings (*Amblygaster sirm*) were also used.

3.7 Fishing Operation

Survey vessels leave fishing port at 3.00 - 4:00 am and reach the fishing ground before dawn which has been preselected on random basis. Before each operation, bottom topography was surveyed using portable echo sounder and the fishing position was recorded. Fishing operations were conducted before sunrise and the entire crew of 3-4 (including the captain) was involved in both setting out and hauling the longline and was done manually. The line was deployed by dropping one end overboard. This end had an anchor, float line with float, and flag staff. The vessel moved forward at a slow speed, about 4-7 knots, while one person controlled the speed of the line being released. While the line was being set, one crewman handed the pre-baited branch-line to a third crewman, who snapped them into place at regular intervals on the mainline or groundline.

Retrieval of the line was essentially a reverse of the setting operation. As the groundline was brought in, one person controlled line speed; one person unsnapped branch-lines or gangions from the groundline and handed them to the third person, who placed hooks with fish on them in one area of the deck. Fish caught and bait

remained were removed and gangions were hung in the box for next deployment. Catch then were identified and measured the total length (cm) and weight (g). Vessel speed during retrieval of gear was about or half of deployment speed. Single fishing operation was done in each day.

3.8 Data Collection

One of the research members onboard was maintained log records of fishing; daily information on effort, area, bottom condition, weather, gear, species by weight, size composition of the catch etc. While setting the longline, latitude, longitude, depth, and time were recorded for each group of 100 hooks. During hauling operation, which started about 60-110 minutes after the setting was finished, the time for each group of 100 hooks and the state of each hook as (1) with fish, indicating the species and size; (2) with bait (3) missing bait (4) missing hooks (5) soaking time were also recorded.

Biological studies were conducted after landed the catch. Food and feeding and reproductive studies were conducted.

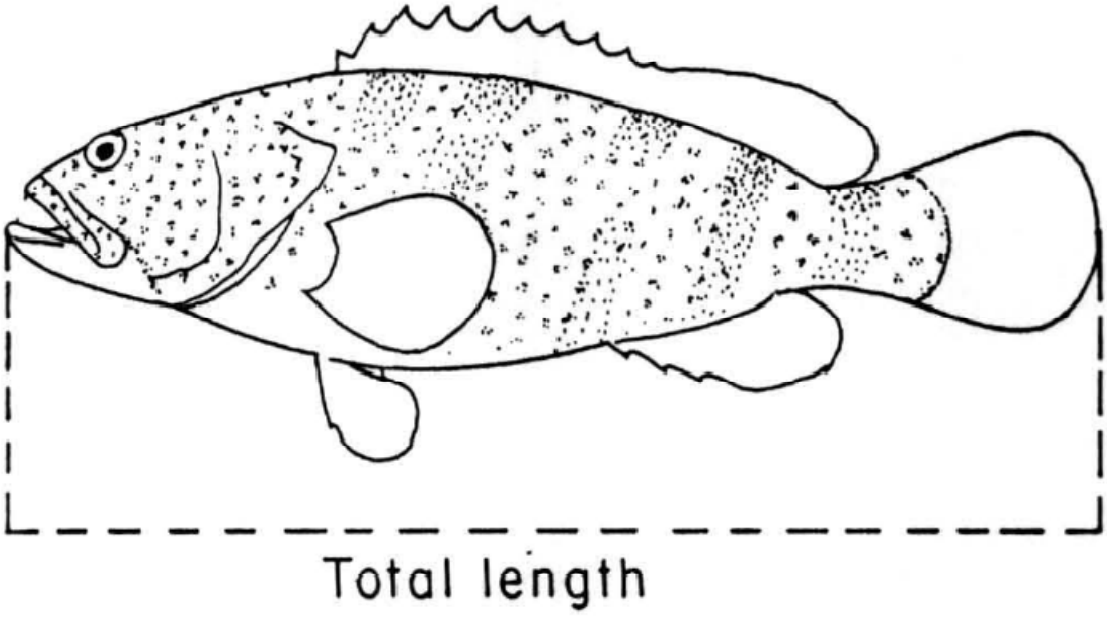
4. Analysis

Fish stock assessments derived information about stock trends from analyses of longline catch and effort records.

The relative abundance index, The catch per unit effort (CPUE) by species (i) was estimated for each fishing operation as the catch in number (C) divided by the product of the mean soaking time ($\bar{t}$, in hours) with the number of hooks set minus missing hooks (a), and multiplied by 1000. The mean soaking time indicates the overall average immersion time of hooks used per fishing operation. In sort, the CPUE by species and fishing operation was expressed as the number of fishes caught per 1000 hooks during 1 h (n/1000 hh):

$$CPUE_i = \frac{C_i}{t \times a} \times 1000$$

Biological characteristics of the fish catch such as length, reproductive and feeding biology are important basic inputs in stock assessment studies. Biological sampling was conducted at landing sites and also at the laboratory. Total length and weight of all fish were measured immediately after landed. Fish were dissected to collect biological data such as sex, maturity stage, gut content etc. All available biological data were recorded in a database.



Length measurements of demersal finfishes; Serranid - *Epinephelus tauvina*

Sex of the individual fish was determined by gross appearance of gonadal structures. Maturity stage of each gonad was recorded on the basis of morphological appearance (macroscopic observations) such as colour, texture and degree of vascularisation in both the sexes. The measurement for gut contents recorded was mainly the occurrence frequency.

	2010													
	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Procurement of boats														
Construction of fishing gear														
Experimental fishing in Hambantota Bank														
Procurement of boats														
Construction of fishing gear														
Experimental fishing in Batticaloa Reef														

5. Results

5.1 Activities- Fishing Trials

Exploratory fishing was first conducted from Hambantota Bank and started in April 2010. There were 43 grids being selected for experimental fishing in Hambantota (Zone I) Bank while 66 were selected in Battlicaloa and Trincomalee reefs (Zone II). Study of Hambantota Bank was commenced in April just before onset of southwest monsoon and before completing the study sea became rough and unable to complete all trial operations. Thereby with the onset of fishing season in the east coast study on Batticaloa and Trincomalee reefs were started in July 2010 based on Kalmunai. Due to limited time and finance single trial was conducted in each grid.

5.2 Fishing Effort

A fleet of bottom longliners consisted of three FRP-OBM boats powered with 15-25 hp were employed for both Hambantota Bank and Balocaloa and Trincomalee Reefs survey. The total fishing effort employed is summarized in Table 1 separately for

Hambantota Bank and Balocaloa-Trincomalee Reefs and the curie details are listed Annex 1.

Table 1: Summery of Bottom Longline Fishing Operations

Study Zone	No. of days fished	No. of Trails scheduled	No. of trails carried out	No. of trails to be completed	Total no. of hooks employed
Zone I	14	42	34	8	16705
Zone II	26	42-Batticaloa 16-Trincomalee	42	0 16	21641

As the sea condition became rough due to onset of South-West monsoon at the end of April 2011 the exploratory fishing activities in Hambantota Bank was halted and moved to the east coast; Batticaloa-Trincomalee Banks. The onset of North-East monsoon started in late October 2011 and thereby ceased the fishing activities in the East coast.

5.3 Catch Rate and Production

A total of 34 fishing trails were conducted in Hambantota Bank (Zone I)of which two operations reported nil catch while in Baticaloa-Trincomalee Banks (Zone II) out of 42 trials nil catches were reported in five occasions. The total average catch rate (CPUE) both by number and by weight estimated for Hambantota Banka showed higher value than estimated for Baticaloa-Trincomalee Banks. This indicates

that relatively larger size fish are encountered in Hambantota Banks (Table 2). Details of catch performance are listed in Annex II.

Table 2: Summery of Catch Rates Realized from Trial Fishing

Study Zone	Total catch by number	Total catch by weight (kg)	Hook rate (No. %)	No. of missing hooks	CPUE No/1000 hooks	CPUE kg/1000 hooks
Zone I	258	406.10	1.54	34	0.182	0.29
Zone II	347	251.43	1.60	27	0.178	0.13

5.4 Catch Rates in Relation to Fishing Depth

The catch rates in different depth ranges prevailing on the Hambantota Bank and Batticaloa-Trincomalee Banks are showed in Table 3.

Table 3: Variation of Catch Rates by Depth

Study Zone	CPUE	0-25 M	25-50 M	>50 M
Zone I	No/1000 hooks	0.175	0.186	0.222
	Kg/1000 hooks	0.215	0.373	0.282
Zone II	No/1000 hooks	0.359	0.205	0.130
	Kg/1000 hooks	0.211	0.160	0.101

In the Hambantota Bank higher catch rate by weight was realized from 25-50 meter range while in number id higher in deeper depths. In Batticaloa-Trincomalee Banks high catch rates both in number and weight was reported from shallow depths; 0-25 meters.

5.5 Catch Composition

5.5.1 Species Size Structure of Catches in Weight and in Number

The distribution of catches in number is shown separately from two Zones in Figure 3. Bimodal size distribution with a distinct mode at smaller size classes was observed in both areas; Zone I and Zone II (Figure 3). This indicates that size selectivity of hook No. 7 and 8 are generally ranged from 30-50 cm size group. Similar pattern of modal distribution was also observed in the weight distribution (Figure 4).

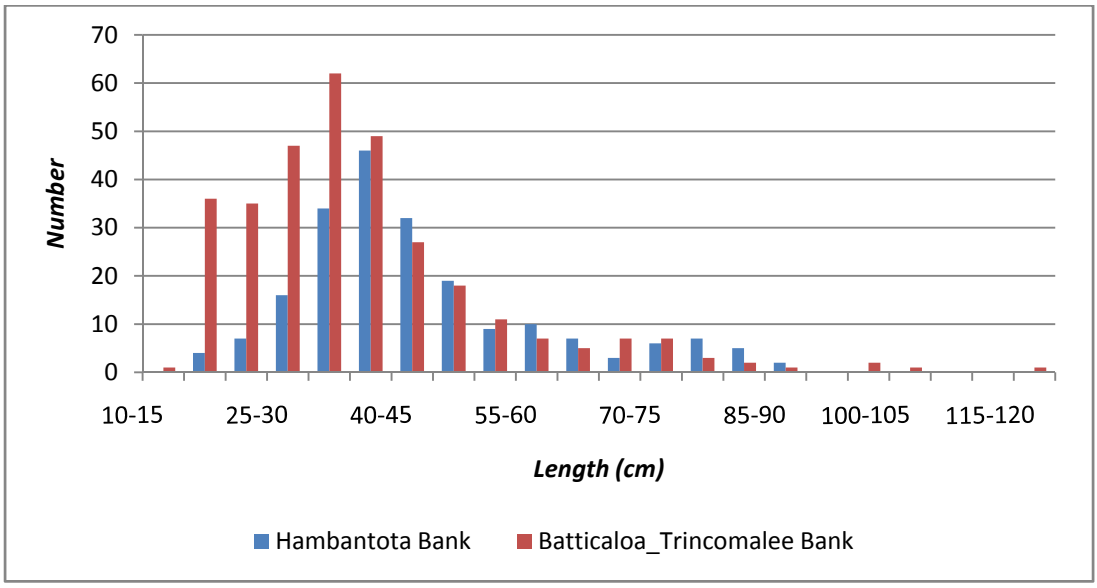


Figure 3: Size distribution of demersal fish catch

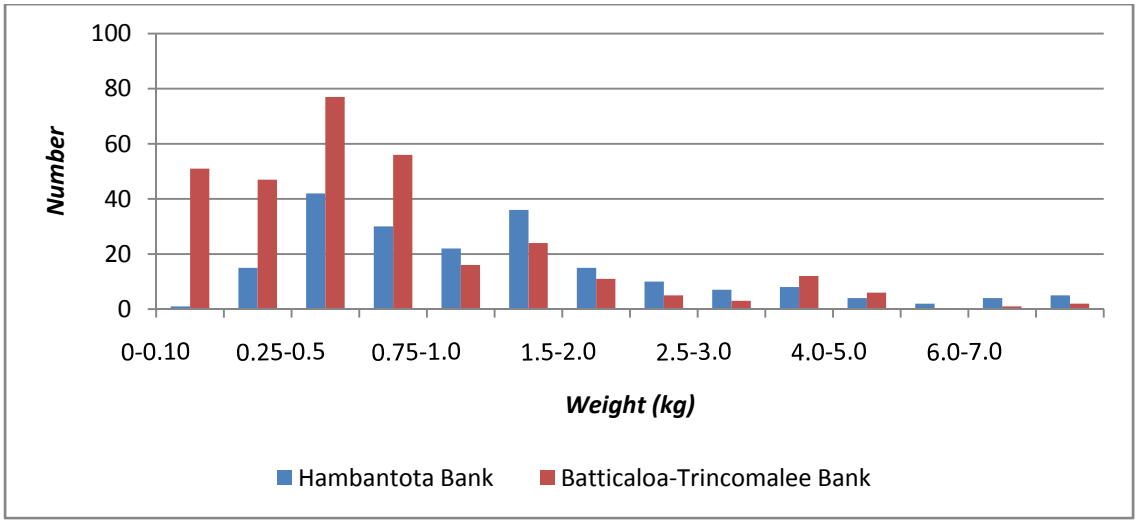


Figure 4: Weight distribution of demersal fish catch

5.5.2 Species Composition

A total of 25 families representing by some 61 species of demersal fishes were identified in the present study. Among 25 families one was represented Cephalopods (Family Spiidae) and other two were represented sharks (Family Carcharhinidae) and rays (Family Myliobatididae). The most common and dominated families represented was Family Serranidae followed by Lutjanidae, Lethrinidae, and Synodontidae. Each of these families contributed over 10% to the catch composition. The checklist of species is listed in Table 4.

Table 4: Species Checklist

Family	Species	Sinhala name	Frequency of Occurrence
Angulidae	*Arius thalassinus*	Thora aguluwa	1
Ariidae	*Arius bilineatus*	Catfish	3
	Carangoides chrysophys	Catfish	3
Balistidae	*Sufflamen fraenatus*	Pothubari	1
	Abalistes stellatus	Divulla pothubari	6
	Sufflamen fraenatus	Kukula	4
	Canthidermis maculatus	Pothubari	1
	Balistoides viridescens	Kukula	1
Belonidae	Strongylura leiura	Habarali	1
	Tylosurus crocodilus	Habarali	1
Carangidae	*Carangoides chrysophrys*	Parawa	1
	Decapturus russelli	Linna	1
	Caranx ignobilis	Atanagul Parawa	7
	Alecis indicus	Kannadi parawa	2
	Carangoides chrysophrys	Parawa	7
	Carangoides fulvoguttatus	Weti parawa	1
	Carangoides malabaricus	Parawa	1
	Scomberoides commersonianus	Kattawa	2
Carcharhinidae	*Rhizoprionodon acutus*	Mora	3
	Rhizoprionodon oligolinx	Milky shark	6
Congridae	*Conger cinereus*	Anjalaya	2
Dasyatididae	*Himantura gerrardi*	Maduwa	1
Echeneidae	*Remora remora*	Sapathtuwa	1
Elopidae	*Elops machnata*	Mannawa	1
Heamulidae	*Diagramma pictum*	Boraluwa	1
	Pomadasys argyreus	Boraluwa	1
Lethrinidae	*Lethrinus mahsena*	Katarathu meewatiya	8
	Lethrinus conchyliatus	Meevatiya	2
	Lethrinus lentjan	Meevatiya	12
	Lethrinus olivaceus	Uruhota	32
	Lethrinus nebulosus	Attissa, Meevatiya	33
	Gimnocaranius robinsoni	Makkuna	3
	Lethrinus ornatus	Meewatiya	2

	Lethrinus microdon	Uruhota	1
Lutjanidae	*Lutjanus rivulatus*	Badawa	4
	Pristipomoides filamentosus	Lomassa	22
	Aprion virescens	Dhiulawa	7
	Lutjanus fulviflamma	Ranna	20
	Aphaseus rutilansp	Kalamiya	11
	Lutjanus gibbus	Ranna	2
	Pristipomoides sieboldii	Kalamiya	52
	Lutjanus leminiscatus	Ranna	1
	Pristipomoides types	Lomassa	5
Myliobatididae	*Aetomylaeus maculatus*	Maduwa	1
	Rhinoptera javanica	Maduwa	3
Psettodidae	*Psettodes erumei*	Pathamadiya	7
Rachycentridae	*Rachycentron candum*	Mudilla	2
Scaridae	*Scarus ghobban*	Girawa	1
Scombridae	*Euthynnus affinis*	Kawakawa	3
Serranidae	*Cephalopholis sonnerati*	Thambuwa	87
	Epinephelus tauvina	Pullikossa	27
	Epinephelus undulosus	Lawaya	25
	Epinephelus malabaricus	Gal kossa	25
	Epinephelus faveatus	Heen kossa	4
Sillaginidae	*Sillago vincenti*	Kalanda	1
Sparidae	*Argyrops spinifer*	Seri	2
Sphyraenidae	*Sphyraena jello*	Jeelawa	4
Spiidae	*Sepia aculata*	Pothu della	1
Synodontidae	*Synodus indicus*	Huna	2
	Trachinocephalus myops	Weligowewa	61
Teraphonidae	*Terapon puta*	Eri bataya	5

The relative distribution of species in Hambantota Bank and Batticaloa-Trincomalee Banks are depicting in Figure 5.

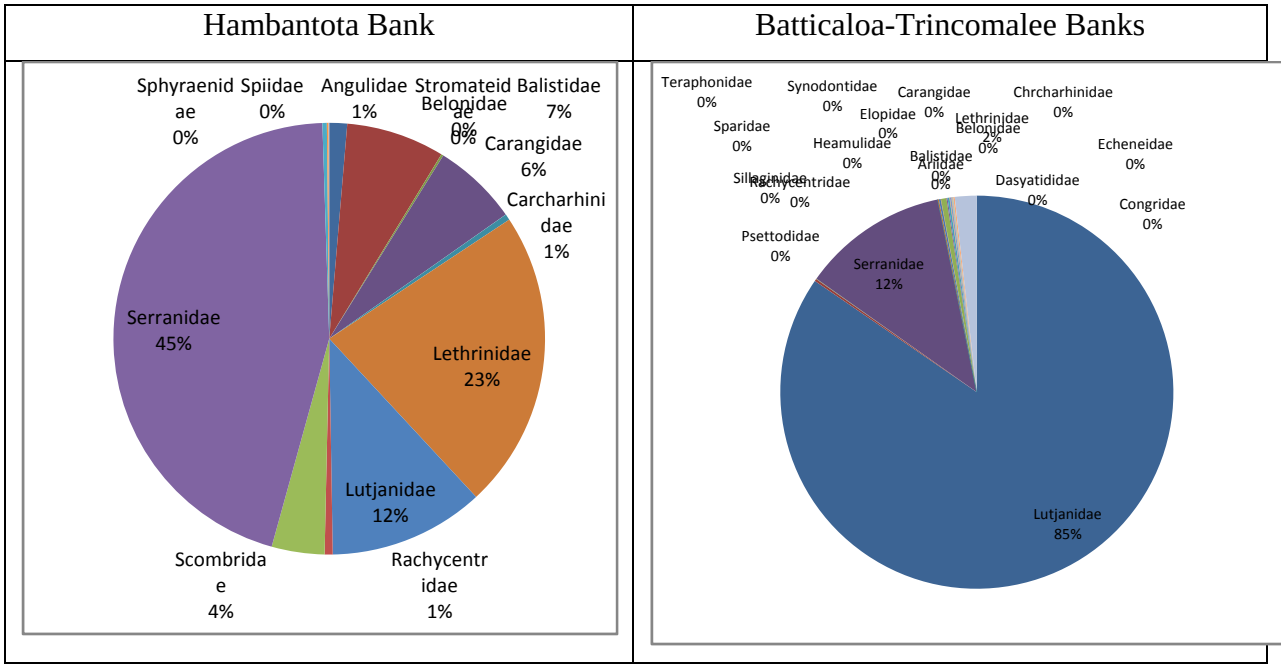


Figure 5: Catch Composition by Weight of Hambantota Banka and Batticaloa-Trincomalee Banks.

The catch composition realized from two banks showed somewhat marked difference. Family Serranidae is the predominant group in Hambantota Bank followed by Family Lethrinidae and Lutjanidae while in Batticaloa –Trincomalee Banks contribution of Family Lutjanidae was significant and Serranids contributed only 12%.

6. Biological Studies

6.1 Sex ratio and Maturity Stage

It is quit highlighting that majority of fish caught with bottom longline were females (70%) males represented 14% and about 16% of fish were too small and sex could not be determined. Overall reproductive status of the catch is shown in Figure 6. Over 62% of the catch was before maturity; 14% virgin, 16% immature and 32%

developing. Details of sex ratio and gonad maturity status by species are shown in Annex III.

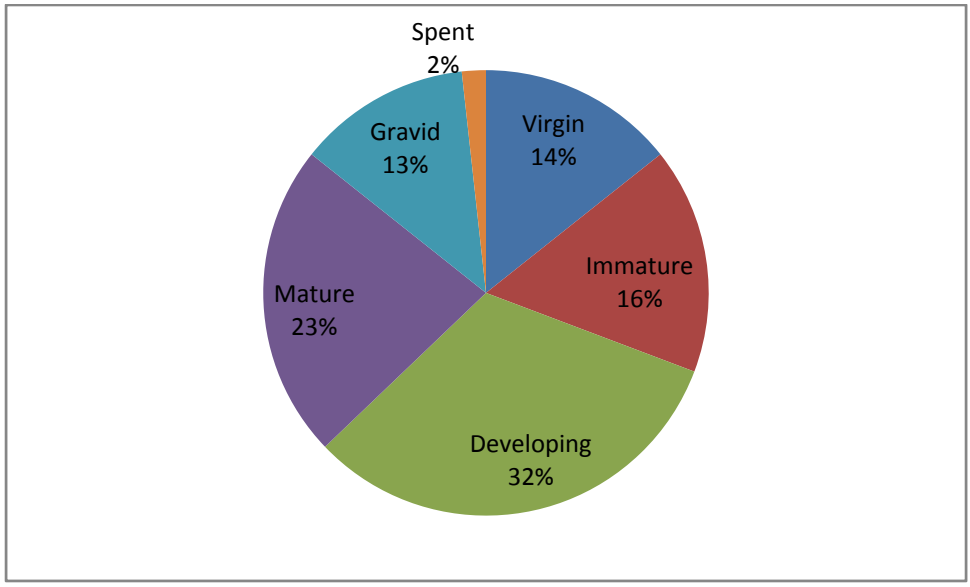


Figure 6: Gonad Maturity Stage of Fish

6.2 Gut Contents

It is highlighting that of the 1032 stock analyzed 78% was empty and partially digested food were observed from 22% and among them bait was reported from 75% and digested natural food was reported from 25%. None of the natural food items was identified to lowest taxonomic level. The most common food reported was juvenile crabs and shells. The detail of stomach content analysis was reported in Annex IV.

7. Discussion and Conclusion

The finding of the present study revealed that extent of the overall catchability performance of the fishery insufficient, consisted of large amount of small size fish. The large fish are rare in the catches because they may rare in the exploited fish community or because their catchability is low for the gears used. Longlines are passive stationary gears that keep fishing while fishes are attracted by the baits. The area of action of the bottom longline depends on the types of target fishes and baits, the soaking time, and the direction and strength of the current (FAO, 1976). This area is variable and cannot be determined with any precision, thus longlines are not adequate to estimate absolute abundance (Gunderson, 1993). Despite this drawback, bottom longlines can be set over most types of habitats and may be useful to prospect the distribution and the relative abundance of fishes that inhabit irregular sea bottoms or are difficult to be caught with net fishing.

In the longline survey CPUE was defined as the ratio between the number of fish caught and the number of hooks times the soak time. This index of abundance ignores the variability introduced by the competition for baited hooks within and between species. The low value of CPUE realized may result of this.

Qualitatively, demersal finfish fauna was quite well represented in the catches and given some insights of species diversity and localized distribution patterns.

In conclusion it is important to highlight that use of nonselective fishing method such as bottom trawl or Aquatic method employing research vessel may provide better results.

7.1 Issues and Constrains

Fishing in Hambantota Bank is influenced by South-West Monsoon (May to September) while Batticaloa-Trincomalee Banks by North-East Monsoon (November to March). Due to monsoonal effect there was a timing difference between the ability of fishing operation and availability of mobilizing resource especially the availability of funds.

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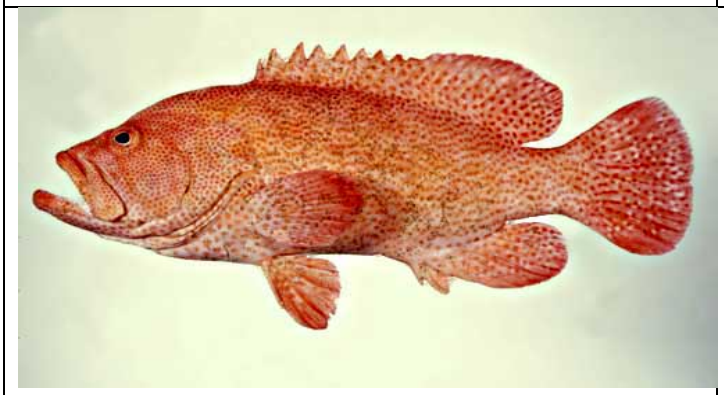
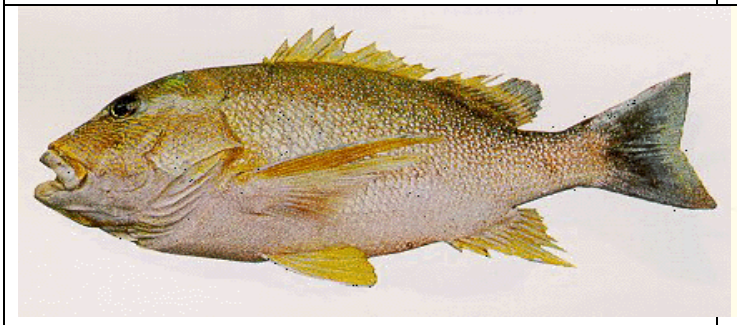
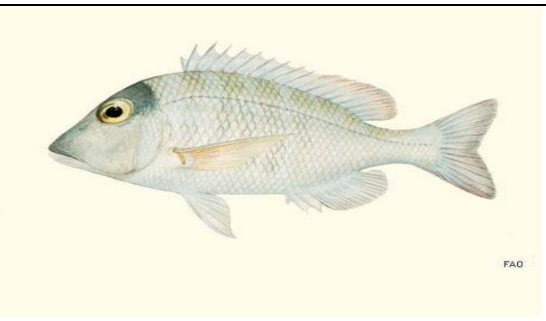
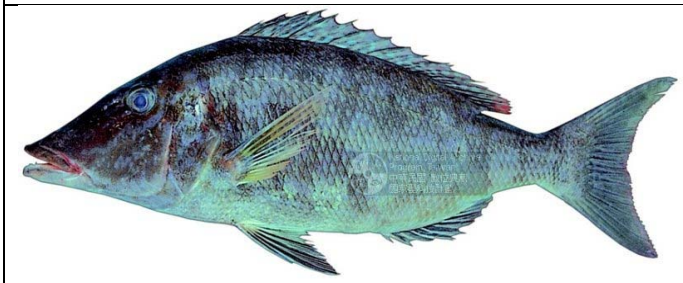
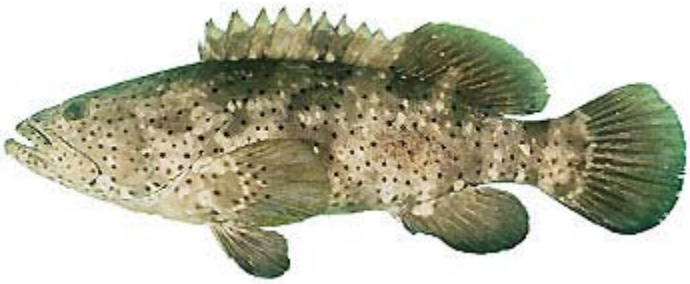
Species catalogue

	
Lethrinus conchyliatus	*Pristipomoides filamentosus*
	
Cephalopholis sonnerati	*Decapterus russelli*
	
Lutjanus rivulatus	*Lethrinus mahsena*

	
Epinephelus tauvina	*Lethrinus lentjan*
	
Lethrinus olivaceus	*Gimnocaranius robinsoni*
	
Sphyraena jello	*Aprion virescens*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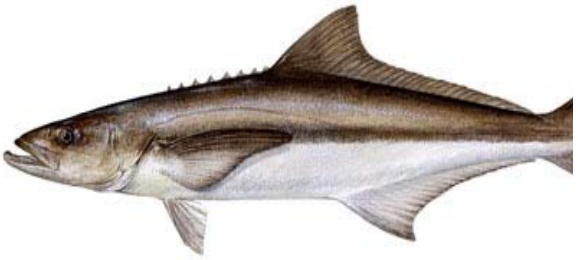
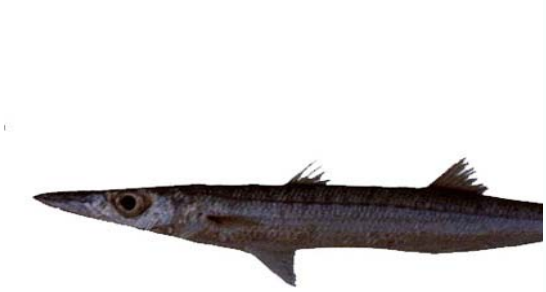
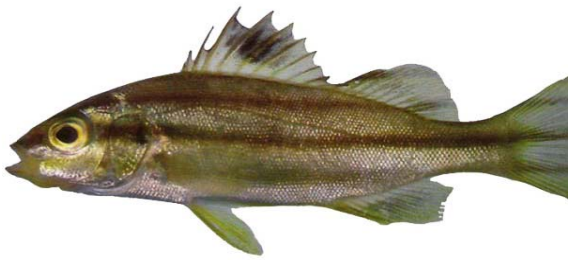
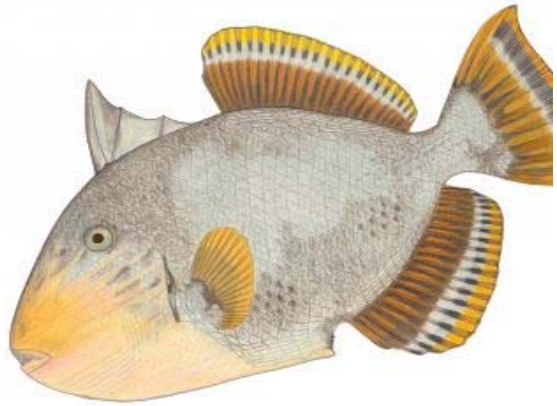
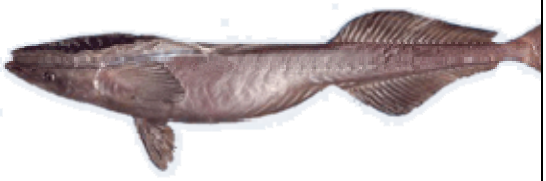
	
Lethrinus nebulosus	*Rachycentron candum*

	
Lutjanus fulviflamma	*Caranx ignobilis*
	
Sphyraena obtusata	*Lutjanus gibbus*
	
Euthynnus affinis	*¬ aurida elongata*

	
Pristipomoides multidens	*Terapon Puta*

	
Balistoides viridescens	*Remora remora*
	
Scomberoides commersonianus	*Psettodes erumei*

Annex I

Table 1: Cruise Details

Sea Area	St. No.	Date	Shooting						Hauling			No. of ho	
			Start			Finish			Start			Finish	
			Time	Lat	Long	Time	Lat	Long	Time	Lat	Long	Time	L
Hambantota	KRD151	4/6/2011	5.10 a.m			5.30 a.m			6.05a.m			6.45a.m	
Hambantota	KRD73	4/7/2011	4.38 a.m			6.00 a.m			6.08 a.m			8.15 a.m	
Hambantota	KRD40	4/8/2011	4.50 a.m	06.15623	081.47346	5.41 a.m	06.15397	081.48004	5.50 a.m	06.15623	081.47346	6.25 a.m	0
Hambantota	KRD38	4/20/2011	4.40 a.m	06.20917	081.55520	5.15 a.m	06.19313	081.05828	6.20 a.m	06.20917	081.55520	7.02 a.m	0
Hambantota	KRD61	4/11/2011	5.35 a.m	06.15623	081.47347	6.15 a.m	06.15397	081.48004	6.45 a.m	06.15623	081.47347	7.40 a.m	0
Hambantota	KRD78	4/21/2011	5.15 a.m	06.04677	081.20370	5.45 a.m	06.05388	081.21382	6.30 a.m	06.04677	081.20370	7.18 a.m	0
Hambantota	KRD50	4/21/2011	5.00 a.m	06.04506	081.18714	5.45 a.m	06.04405	081.18980	7.00 a.m	06.04506	081.18714	8.20 a.m	0
Hambantota	KRD57	4/21/2011	5.30 a.m	06.04677	081.20370	6.10 a.m	06.05388	081.21382	6.45 a.m	06.04677	081.20370	7.35 a.m	0
Hambantota	KRD75	4/22/2011	5.15 a.m			6.00 a.m			6.30 a.m			8.00 a.m	
Hambantota	KRD74	4/22/2011	5.20	06.01978	080.85252	5.50 a.m	06.00888	080.86398	6.20 a.m	06.01978	080.85252	7.30	0

			a.m									a.m	
Hambantota	KRD51	4/22/2011	5.20 a.m	05.56374	080.52667	6.00 a.m	05.57168	080.59414	7.00 a.m	05.56374	080.52667		0
Hambantota	KRD58	4/23/2011	6.20 a.m	06.02873	080.57583	7.05 a.m	06.02873	080.57583	6.45 a.m	06.02873	080.57583	8.00 a.m	0
Hambantota	KRD54	4/23/2011	5.50 a.m	06.00674	080.58665	6.40 a.m	06.01384	080.58496	7.20 a.m	06.00674	080.58665	8.20 a.m	0
Hambantota	KRD53	4/23/2011	5.26 a.m	05.59607	080.59200	7.00 a.m			7.00 a.m	05.59607	080.59200	7.45 a.m	
Hambantota	KRD77	4/24/2011	5.00 a.m	06.04713	081.12229	6.12 a.m	06.04360	081.13705	6.35 a.m	06.04713	081.12229	7.42 a.m	0
Hambantota	KRD55	4/24/2011	5.00 a.m	05.57964	081.08937	5.40 a.m	05.57368	081.09488	6.15 a.m	05.57964	081.08937	7.11 a.m	0
Hambantota	KRD76	4/24/2011	5.00 a.m	06.06121	081.05755	5.29 a.m	06.05494	081.06251	6.30 a.m	06.06121	081.05755	7.45 a.m	0
Hambantota	KRD79	4/26/2011	4.40 a.m	06.20758	081.36655	5.15 a.m	06.20263	081.37960	5.55 a.m	06.20758	081.36655	6.45 a.m	0
Hambantota	KRD80	4/26/2011	4.40 a.m	06.09413	081.23671	5.40 a.m	06.09714	081.25187	6.00 a.m	06.09413	081.23671	7.20 a.m	0
Hambantota	KRD60	4/26/2011	4.40 a.m			5.31 a m			5.55 a.m			6.55 a m	
Hambantota	KRD98	6/3/2011	6.35 a.m			7.22 a.m			8.00 a.m			9.30 a.m	
Hambantota	KRD69	6/3/2011	5.15 a.m	07.32241	081.93755	6.20 a.m	07.32274	081.92575	6.45 a.m	07.32241	081.93755	10.20 a.m	0
Hambantota	KRD109	6/3/2011	6.30 a.m	07.14393	081.56258	8.00 a.m	07.13942	081.55774	9.00 a.m	07.14393	081.56258	12.00 p.m	0
Hambantota	KRD110	6/4/2011	4.54 a.m	07.27497	081.56277	5.39 a.m	07.27921	081.55864	6.39 a.m	07.27497	081.56277	9.27 a.m	0
Hambantota	KRD104	6/4/2011	4.32 a.m	07.43214	081.85645	5.20 a.m	07.43454	081.86581	6.00 a.m	07.43214	081.85645	8.00 a.m	0

Hambantota	KRD107	6/4/2011	4.15 a.m	07.37691	081.91069	5.50 a.m	07.38669	081.89980	6.15 a.m	07.37691	081.91069	8.07 a.m	0
Hambantota	KRD70	6/5/2011	5.22 a.m	07.45817	081.96495	6.00 a.m	07.45552	081.95927	6.50 a.m	07.45817	081.96495	9.30 a.m	0
Hambantota	KRD48	6/5/2011	5.31 a.m	07.32039	081.53855	6.12 a.m	07.31625	081.53639	6.50 a.m	07.32039	081.53855	9.22 a.m	0
Hambantota	KRD102	6/5/2011	4.41 a.m	07.51324	081.82944	5.23 a.m	07.52837	081.82249	6.23 a.m	07.51324	081.82944	8.05 a.m	0
Hambantota	KRD65	6/6/2011	5.14 a.m	07.43859	081.49790	5.51 a.m	07.44320	081.48934	6.31 a.m	07.43859	081.49790	8.42 a.m	0
Hambantota	KRD81	6/6/2011	5.30 a.m	07.64960	081.76991	5.57 a.m	07.65117	081.77644	6.30 a.m	07.64960	081.76991	9.30 a.m	0
Hambantota	KRD103	6/6/2011	5.30 a.m	07.64860	081.82970	6.30 a.m	07.66366	081.82914	6.45 a.m	07.64860	081.82970	8.45 a.m	0
Hambantota	KRD113	6/7/2011	6.25 a.m	07.01323	081.59549	7.12 a.m	07.01346	081.59182	7.55 a.m	07.01323	081.59549	11.25 a.m	0
Hambantota	KRD106	6/7/2011	5.58 a.m	07.04961	081.91017	7.01 a.m	07.04156	081.91393	7.40 a.m	07.04961	081.91017	9.15 a.m	0
Kalmunai	KRD69	6/8/2011	6.12 a.m	07.25013	081.52292	7.29 a.m	07.25704	081.51868	7.40 a.m	07.25013	081.52292	9.40 a.m	0
Kalmunai	KRD48	7/8/2011	5.49 a.m			6.37 a.m			7.00 a.m			8.05 a.m	
Kalmunai	KRD37	7/27/2011	5.15 a.m	07.86543	081.80310	5.59 a.m	07.84966	081.80573	6.33 a.m	07.86543	081.80310	9.54 a.m	0
Kalmunai	KRD82	7/27/2011	6.20 a.m	07.75687	081.83025	7.20 a.m	07.75990	081.83528	6.32 a.m	07.75687	081.83025	10.00 a.m	0
Kalmunai	KRD66	7/27/2011	7.00 a.m	07.67553	081.88425	8.10 a.m	07.67938	081.88313	8.15 a.m	07.67553	081.88425	10.20 a.m	0
Kalmunai	KRC96	7/28/2011	5.18 a.m			6.15 a.m			6.40 a.m			8.20 a.m	
Kalmunai	KRC84	7/28/2011	5.42	07.86562	081.58536	7.03 a.m	07.87541	081.59660	7.20 a.m	07.86562	081.58536	8.45	0

			a.m									a.m	
Kalmunai	KRC89	7/28/2011	5.45 a.m	07.52941	081.42283	6.25 a.m	07.52692	081.42777	6.45 a.m	07.52941	081.42283	8.40 a.m	0
Kalmunai	KRD63	7/29/2011	4.30 a.m	07.81188	081.69420	5.50 a.m	07.82748	081.69550	6.15 a.m	07.81188	081.69420	8.35 a.m	0
Kalmunai	KRD43	7/29/2011	4.08 a.m	07.78438	081.66665	5.20 a.m	07.80007	081.66556	6.14 a.m	07.78438	081.66665	8.42 a.m	0
Kalmunai	KRC87	7/29/2011	4.35 a.m	07.83998	081.63912	5.35 a.m	07.84903	081.64471	5.45 a.m	07.83998	081.63912	7.00 a.m	0
Kalmunai	KRC126	7/31/2011	4.38 a.m	07.97378	081.74907	5.25 a.m	07.96549	081.76230	6.15 a.m	07.97378	081.74907	8.00 a.m	0
Kalmunai	KRC88	7/31/2011	4.20 a.m	08.00114	081.63987	5.05 a.m	07.99803	081.64697	5.30 a.m	08.00114	081.63987	7.16 a.m	0
Kalmunai	KRC94	7/31/2011	4.35 a.m	08.55480	081.640110	5.23 a.m	08.05998	081.65182	6.00 a.m	08.55480	081.640110	6.55 a.m	0
Batticalo	KRC120	9/16/2011	4.40 a.m	08.09905	081.31873	5.20 a.m	08.10999	081.32203	6.10 a.m	08.09905	081.31873	9.00 a.m	0
Batticalo	KRC95	9/16/2011	4.40 a.m	08.13844	081.66764	5.30 a.m	08.14984	081.67416	6.18 a.m	08.13844	081.66764	8.32 a.m	0
Batticalo	KRC86	9/17/2011	5.08 a.m	08.13154	081.35165	5.58 a.m	08.14151	081.35545	6.20 a.m	08.13154	081.35165	7.52 a.m	0
Batticalo	KRC119	9/17/2011	5.11 a.m	08.21981	081.42455	5.52 a.m	08.22201	081.43575	6.19 a.m	08.21981	081.42455	8.32 a.m	0
Batticalo	KRC93	9/18/2011	5.05 a.m	08.22276	081.58569	5.56 a.m	08.28724	081.59245	6.20 a.m	08.22276	081.58569	8.50 a.m	0
Batticalo	66	9/18/2011	5.30 a.m	08.29610	081.49763	6.15 a.m	08.30889	081.50346	7.02 a.m	08.29610	081.49763	8.48 a.m	0
Batticalo	KRC114	9/19/2011	4.55 a.m	08.08374	081.47700	5.45 a.m	08.09455	081.48788	6.10 a.m	08.08374	081.47700		0
Batticalo	KRC85	9/19/2011	4.58 a.m	08.08330	081.58575	5.43 a.m	08.09418	081.59087	6.18 a.m	08.08330	081.58575	7.20 a.m	0

Batticalo	KRC90	9/26/2011	5.05 a.m	08.57216	081.31354	6.27 a.m	08.58372	081.32075	6.45 a.m	08.57216	081.31354	8.38 a.m	0
Batticalo	KRC117	9/26/2011	4.45 a.m	08.54614	081.34238	6.15 a.m	08.56509	081.34874	6.18 a.m	08.54614	081.34238	6.40 a.m	0
Batticalo	KRC115	9/27/2011	4.20 a.m	08.40852	081.47689	5.50 a.m	08.25511	081.29851	6.20 a.m	08.40852	081.47689	8.50 a.m	0
Batticalo	KRC92	9/27/2011	5.34 a.m	08.43670	081.50638	7.15 a.m	08.45132	081.52985	8.20 a.m	08.43670	081.50638	9.10 a.m	0
Batticalo	KRC118	9/27/2011	4.42 a.m	08.40916	081.39614	6.03 a.m	08.41992	081.41312	6.30 a.m	08.40916	081.39614	8.00 a.m	0
Batticalo	KRB132	9/28/2011	4.40 a.m	08.45696	081.13919	6.00 a.m	08.46834	081.14299	6.20 a.m	08.45696	081.13919	8.20 a.m	0
Batticalo	79	9/28/2011	5.05 a.m	08.76256	081.21402	6.29 a.m	08.78224	081.22186	6.45 a.m	08.76256	081.21402	8.45 a.m	0
Batticalo	KRB121	9/28/2011	4.52 a.m	08.81676	081.20466	6.00 a.m	08.82924	081.20977	6.30 a.m	08.81676	081.20466	7.42 a.m	0
Batticalo	KRC116	9/29/2011	4.30 a.m	08.38811	081.14622	6.10 a.m	08.40086	081.15386	6.30 a.m	08.38811	081.14622	8.00 a.m	0
Batticalo	KRB123	9/29/2011	4.40 a.m	08.65527	081.26025	6.15 a.m	08.67667	081.27420	6.25 a.m	08.65527	081.26025	8.15 a.m	0
Batticalo	KRB122	9/29/2011	4.50 a.m	08.73678	081.23328	6.05 a.m	08.75991	081.24478	6.38 a.m	08.73678	081.23328	8.30 a.m	0
Batticalo	KRB141	10/1/2011	4.22 a.m	08.50547	081.07354	6.00 a.m	08.51543	081.08503	6.20 a.m	08.50547	081.07354	8.00 a.m	0
Batticalo	84	10/1/2011	4.40 a.m	08.90801	081.12982	5.40 a.m	08.92539	081.14448	6.05 a.m	08.90801	081.12982	7.00 a.m	0
Batticalo	142	10/1/2011	4.30 a.m	08.83131	081.21027	5.50 a.m	08.84107	081.21320	6.15 a.m	08.83131	081.21027	7.32 a.m	0
Batticalo	KRB139	10/2/2011	5.11 a.m	09.09626	080.99202	6.05 a.m	09.11107	081.00393	6.20 a.m	09.09626	080.99202	7.45 a.m	0
Batticalo	KRB137	10/2/2011	4.30	09.03233	080.95768	5.15 a.m	09.03362	080.96034	5.45 a.m	09.03233	080.95768	6.40	0

			a.m									a.m	
Batticalo	KRB140	10/2/2011	4.05 a.m	08.94917	081.04465	5.33 a.m	08.96496	081.04984	6.00 a.m	08.94917	081.04465	6.53 a.m	0
Batticalo	ABC	10/3/2011	5.10 a.m	08.20969	081.26203	6.35 a.m	08.21136	081.27200	6.38 a.m	08.20969	081.26203	8.36 a.m	0
Batticalo	91	10/3/2011	4.40 a.m	08.44395	081.39960	5.50 a.m	08.44769	081.42319	6.25 a.m	08.44395	081.39960	7.25 a.m	0
Batticalo	New Point	10/3/2011	4.35 a.m	08.50643	081.26778	5.55 a.m	08.50581	081.26817	6.05 a.m	08.50643	081.26778		0

Annex II

Table 2: Details of Fishing Performance

Sea Area	St. No.	Date	No. of hooks	Immersion time Minute	Total No.	Total weight (kg)
Hambantota	KRD151	4/6/2011	250	55	2	0.75
Hambantota	KRD73	4/7/2011	600	90	24	70.66
Hambantota	KRD40	4/8/2011	600	60	15	30.55
Hambantota	KRD38	4/20/2011	500	100	0	0
Hambantota	KRD61	4/11/2011	550	70	4	11.8
Hambantota	KRD78	4/21/2011	580	75	7	19
Hambantota	KRD50	4/21/2011	550	120	2	10
Hambantota	KRD57	4/21/2011	550	75	15	20.15
Hambantota	KRD75	4/22/2011	550	75	9	8.75
Hambantota	KRD74	4/22/2011	500	60	4	8.96
Hambantota	KRD51	4/22/2011	550	100	7	8.43
Hambantota	KRD58	4/23/2011	500	25	6	22.17
Hambantota	KRD54	4/23/2011	500	90	11	16.37
Hambantota	KRD53	4/23/2011	520	84	9	8.43
Hambantota	KRD77	4/24/2011	560	95	4	6.16
Hambantota	KRD55	4/24/2011	520	75	2	2.2
Hambantota	KRD76	4/24/2011	500	90	11	9.65
Hambantota	KRD79	4/26/2011	403	75	5	16.29
Hambantota	KRD80	4/26/2011	550	80	12	10.18

Hambantota	KRD60	4/26/2011	520	75	17	36.14
Hambantota	KRD98	6/3/2011	500	85	4	9.21
Hambantota	KRD69	6/3/2011	500	90	9	10.15
Hambantota	KRD109	6/3/2011	500	150	11	8.8
Hambantota	KRD110	6/4/2011	500	105	1	0.25
Hambantota	KRD104	6/4/2011	500	88	6	7.16
Hambantota	KRD107	6/4/2011	462	120	2	8.15
Hambantota	KRD70	6/5/2011	375	88	6	4.54
Hambantota	KRD48	6/5/2011	500	79	28	13.18
Hambantota	KRD102	6/5/2011	462	102	1	0.6
Hambantota	KRD65	6/6/2011	500	75	0	0
Hambantota	KRD81	6/6/2011	333	60	6	2.48
Hambantota	KRD103	6/6/2011	435	75	6	4.35
Hambantota	KRD113	6/7/2011	500	110	5	13.65
Hambantota	KRD106	6/7/2011	285	100	7	6.85
Kalmunai	KRD69	6/8/2011	500	90	15	10.65
Kalmunai	KRD48	7/8/2011	500	70	9	2.21
Kalmunai	KRD37	7/27/2011	500	75	3	2.49
Kalmunai	KRD82	7/27/2011	500	68	1	0.36
Kalmunai	KRD66	7/27/2011	516	75	0	0
Kalmunai	KRC96	7/28/2011	480	82	2	0.33
Kalmunai	KRC84	7/28/2011	480	100	1	0.21
Kalmunai	KRC89	7/28/2011	480	60	0	0
Kalmunai	KRD63	7/29/2011	480	105	7	2.45
Kalmunai	KRD43	7/29/2011	465	126	11	6.78

Kalmunai	KRC87	7/29/2011	480	70	6	10.58
Kalmunai	KRC126	7/31/2011	477	97	4	1.87
Kalmunai	KRC88	7/31/2011	465	70	4	4.4
Kalmunai	KRC94	7/31/2011	421	85	3	4.62
Batticalo	KRC120	9/16/2011	500	90	4	3.21
Batticalo	KRC95	9/16/2011	500	98	16	7.61
Batticalo	KRC86	9/17/2011	500	72	5	16.59
Batticalo	KRC119	9/17/2011	450	68	4	1.6
Batticalo	KRC93	9/18/2011	460	75	11	5.21
Batticalo	66	9/18/2011	425	92	0	0
Batticalo	KRC114	9/19/2011	450	75	0	0
Batticalo	KRC85	9/19/2011	342	80	2	1.33
Batticalo	KRC90	9/26/2011	550	100	3	1.23
Batticalo	KRC117	9/26/2011	600	93	22	13.14
Batticalo	KRC115	9/27/2011	600	120	9	17.41
Batticalo	KRC92	9/27/2011	590	65	3	0.52
Batticalo	KRC118	9/27/2011	700	108	25	22.62
Batticalo	KRB132	9/28/2011	600	100	6	1.79
Batticalo	79	9/28/2011	590	100	12	10.27
Batticalo	KRB121	9/28/2011	850	98	7	8.28
Batticalo	KRC116	9/29/2011	500	120	3	7.25
Batticalo	KRB123	9/29/2011	590	105	0	0
Batticalo	KRB122	9/29/2011	540	108	7	2.99
Batticalo	KRB141	10/1/2011	500	118	7	6.14
Batticalo	84	10/1/2011	500	85	9	3.54

Batticalo	142	10/1/2011	500	105	17	11.15
Batticalo	KRB139	10/2/2011	500	69	16	16.91
Batticalo	KRB137	10/2/2011	500	75	47	12.64
Batticalo	KRB140	10/2/2011	500	115	6	0.79
Batticalo	ABC	10/3/2011	560	88	10	16.51
Batticalo	91	10/3/2011	500	105	13	4.12
Batticalo	New Point	10/3/2011	500	90	17	11.63

Annex III

Table 3: Details of Reproductive Study

	Sex Status			Gond Matuarity Stage					
Scintific name	Female	Male	Sex Undetermined	Virgin	Immature	Developing	Mature	Gravid	Spent
Abalistes stellatus	4	1				1	2		2
Aetomylaeus maculatus	1					1			
Alecis indicus	2						2		
Aphaseus rutilansp	2	2	7	7	4				
Aprion virescens	5	1			2	4			
Argyrops spinifer	2						2		
Arius bilineatus	3					1	2		
Arius thalassinus	1						1		
Balistoides viridescens	1						1		
Canthidermis maculatus		1					1		
Carangoides chrysophrys	7	4			2	8	1		
Carangoides fulvoguttatus	1						1		
Carangoidesmalabaricus	1				1				
Caranx ignobilis	5	2				2	5		
Cephalopholis formosa		1				1			
Cephalopholis sonnerati	68	11	8			22	46	16	3
Conger cinereus			2						
Decapturus russelli	1					1			

Diagramma pictum	1						1		
Elops machnata	1					1			
Epinephelus faveatus	3					3			
Epinephelus malabaricus	6	4	14	14	8	2			
Epinephelus tauvina	19	4	4	4	14	9			
Epinephelus undulosus	18	3	3	3	7	11	3		
Euthynnus affinis	2	1				3			
Gimnocaranius robinsoni	1	2				3			
Himantura gerrardi		1			1				
Lethrinus conchyliatus	1	1				1			1
Lethrinus lentjan	10	2				2	6	4	
Lethrinus mahsena	9	1	1	1		8			1
Lethrinus microdon	1					1			
Lethrinus nebulosus	23	6	4	4	6	15	7		1
Lethrinus olivaceus	21	7	3	4	9	15	3		
Lethrinus ornatus	2				2				
Lutjanus fulviflamma	16	2	2	2	3	12	3		
Lutjanus gibbus	2					2			
Lutjanus leminiscatus	1					1			
Lutjanus rivulatus	3	1				3	1		
Pampus chinensis	1					1			
Pomadasys argyreus	1					1			
Pristipomoides filamentosus	10	5	7	7	11	4			
Pristipomoides sieboldii	21	6	21	21	12	14	1		
Pristipomoides types			5	5					
Psettodes erumei	4	1	2	2		5			

Rachycentron canadum	2						2		
Remora remora	1							1	
Rhinoptera javanica	2	1							
Rhizoprionodon acutus	2	1							
Rhizoprionodon oligolinx	5	1						6 (F)	
Scarus ghobban	1							1	
Scomberoides commersonianus	2						2		
Sepia aculata									
Sillago vincenti	1							1	
Sphyraena jello	3	1			2	2			
Strongylura leiura		1			1				
Sufflamen fraenatus	5					3		1	1
Synodus indicus	2						1	1	
Terapon puta	4	1				1	4		
Trachinocephalus myops	61					2	20	39	
Tylosurus crocodilus	1							1	

	Sex Status			Gond Matuarity Stage					
Scintific name	Female	Male	Sex Undetermined	Virgin	Immature	Developing	Mature	Gravid	Spent
Abalistes stellatus	4	1				1	2		2
Aetomylaeus maculatus	1					1			
Alecis indicus	2						2		
Aphaseus rutilansp	2	2	7	7	4				
Aprion virescens	5	1			2	4			
Argyrops spinifer	2						2		

Arius bilineatus	3					1	2		
Arius thalassinus	1						1		
Balistoides viridescens	1						1		
Canthidermis maculatus		1					1		
Carangoides chrysophrys	7	4			2	8	1		
Carangoides fulvoguttatus	1						1		
Carangoidesmalabaricus	1				1				
Caranx ignobilis	5	2				2	5		
Cephalopholis formosa		1				1			
Cephalopholis sonnerati	68	11	8			22	46	16	3
Conger cinereus			2						
Decapturus russelli	1					1			
Diagramma pictum	1						1		
Elops machnata	1					1			
Epinephelus faveatus	3					3			
Epinephelus malabaricus	6	4	14	14	8	2			
Epinephelus tauvina	19	4	4	4	14	9			
Epinephelus undulosus	18	3	3	3	7	11	3		
Euthynnus affinis	2	1				3			
Gimnocaranius robinsoni	1	2				3			
Himantura gerrardi		1			1				
Lethrinus conchyliatus	1	1				1			1
Lethrinus lentjan	10	2				2	6	4	
Lethrinus mahsena	9	1	1	1		8			1
Lethrinus microdon	1					1			
Lethrinus nebulosus	23	6	4	4	6	15	7		1

Lethrinus olivaceus	21	7	3	4	9	15	3		
Lethrinus ornatus	2				2				
Lutjanus fulviflamma	16	2	2	2	3	12	3		
Lutjanus gibbus	2					2			
Lutjanus leminiscatus	1					1			
Lutjanus rivulatus	3	1				3	1		
Pampus chinensis	1					1			
Pomadasys argyreus	1					1			
Pristipomoides filamentosus	10	5	7	7	11	4			
Pristipomoides sieboldii	21	6	21	21	12	14	1		
Pristipomoides types			5	5					
Psettodes erumei	4	1	2	2		5			
Rachycentron canadum	2						2		
Remora remora	1							1	
Rhinoptera javanica	2	1							
Rhizoprionodon acutus	2	1							
Rhizoprionodon oligolinx	5	1						6 (F)	
Scarus ghobban	1							1	
Scomberoides commersonianus	2						2		
Sepia aculata									
Sillago vincenti	1							1	
Sphyraena jello	3	1			2	2			
Strongylura leiura		1			1				
Sufflamen fraenatus	5					3		1	1
Synodus indicus	2						1	1	
Terapon puta	4	1				1	4		

Trachinocephalus myops	61					2	20	39	
Tylosurus crocodilus	1							1	

Annex IV

Table 4: Stomach content analysis by species.

Scintific name	Gut Content			Type of food	
	Empty	Partially filled	Full	Natural food	Bait
Abalistes stellatus	4				
Aetomylaeus maculatus	1				
Alecis indicus	2				
Aphaseus rutilansp	9	2			2
Aprion virescens	6				
Argyrops spinifer	2				
Arius bilineatus	1	2			2
Arius thalassinus		1			1
Balistoides viridescens	1				
Canthidermis maculatus		1			1
Carangoides chrysophrys	7	4			
Carangoides fulvoguttatus	1				
Carangoidesmalabaricus	1				
Caranx ignobilis					
Cephalopholis formosa	1				
Cephalopholis sonnerati	78	9			9
Conger cinereus	2				
Decapturus russelli	1				
Diagramma pictum	1				
Elops machnata	1				

Epinephelus faveatus	3				
Epinephelus malabaricus	24				
Epinephelus tauvina	24	3			3
Epinephelus undulosus	21	3		1-crabs	2
Euthynnus affinis	3				
Gimnocaranius robinsoni	2	1			1
Himantura gerrardi	1				
Lethrinus conchyliatus	2				
Lethrinus lentjan	10	2		2-shells	
Lethrinus mahsena	10	2			2
Lethrinus nebulosus	26	7		5-crab, shells	2
Lethrinus olivaceus	28	4		2-shells	2
Lethrinus ornatus	1	1		1-shells	
Lutjanus fulviflamma	16	4		3-shells	1
Lutjanus gibbus	2				
Lutjanus leminiscatus	1				
Lutjanus rivulatus	3	1			1
Pampus chinensis	1				
Pomadasys argyreus	1				
Pristipomoides filamentosus	20	1			1
Pristipomoides sieboldii	47	1			1
Pristipomoides types	5				
Psettodes erumei	7				
Rachycentron canadum	1				
Rachycentron candum	4				
Remora remora	1				

Rhinoptera javanica	3				
Rhizoprionodon oligolinx	6				
Scarus ghobban	1				
Scomberoides commersonianus		2			2
Sepia aculata	1				
Sillago vincenti	1				
Sphyraena jello	4				
Strongylura leiura	1				
Sufflamen fraenatus	5				
Synodus indicus		2			2
Terapon puta	4	1			1
Trachinocephalus myops		62			2
Tylosurus crocodilus					1