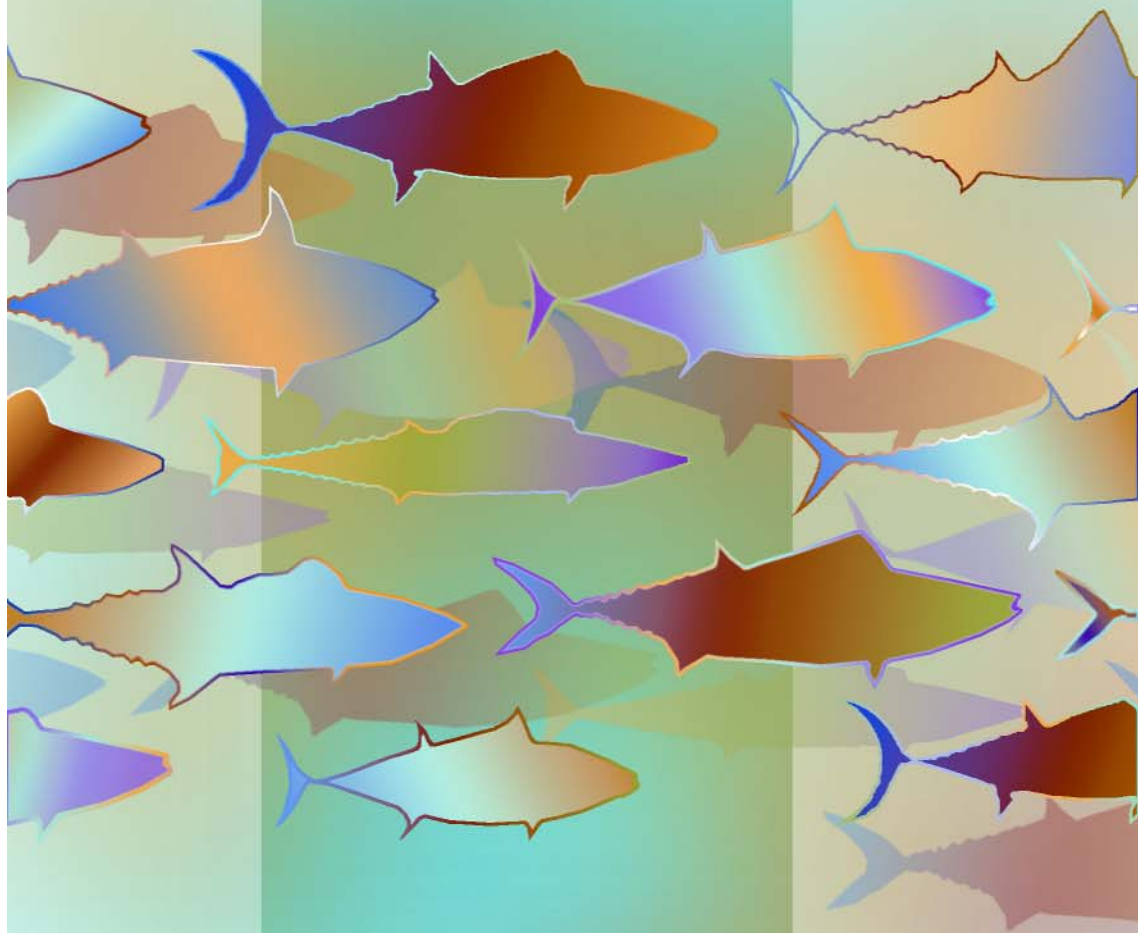


Status of Exploited  
Marine Fishery  
Resources of India



**STATUS OF EXPLOITED  
MARINE FISHERY  
RESOURCES OF INDIA**

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## Ribbonfishes

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### 1. Introduction

The ribbonfishes, also known as hair-tail or cutlass, form a major and abundant fishery resource among the marine pelagic finfishes of the Indian seas. They belong to the family Trichiuridae and are characterised by elongate, compressed and ribbon-like body; prominent canine-like teeth; lack of caudal fin and the silvery colouration. They are essentially marine, but occur in the estuaries too. They have a distribution in the Atlantic and Indo-Pacific regions and in India they are distributed all along the coast with abundance in the northwest and central east coasts. In India, three decades ago, they were low priced fishes and hence were preferred by the poor. Large fishes were consumed fresh and transported even to the interior markets, but the smaller ones, in excess of the local requirements, were usually sun-dried on the beach. Later the marketing scenario of ribbonfishes underwent a drastic change when it gained a position in the export market. Currently large quantities of ribbonfishes are exported in the frozen form to China, Japan and other southeast Asian countries. During the year 1999-2000 (April-March), frozen ribbonfishes contributed up to 18% to the total marine products export of India and among the exported frozen finfish products its share was 48%. In the subsequent year (2000-01) its contribution almost doubled forming 30% and 63% respectively. The frozen ribbonfish exported accounted for 62,942t in 1999-2000 and 1,33,536t in 2000-01, which realized Rs.161.94 crores and Rs.363.37 crores respectively. This shows that the resource play a key role in the marine product export of India. The average annual production of ribbonfish for 1999 and 2000 was 1,53,466t and average frozen product exported was 98,239t. It is evident that nearly 64% of the ribbonfish landed in India are being exported every year as frozen fish while the rest is used in the domestic market either in fresh or dried form. A part of the dried product is also exported.

The ribbonfishes (Fig.1) are known in different vernacular names in the various maritime states. They are called Sagunapatia/Patia/Phitha/Rupapartia/Churi in Bengali; Rupapatis/Savala/Langi in Oriya; Savalla in Telugu; Savalai in Tamil; 'Chunnambu Vala/Pampada/Kasithalayan/Valliathalayan in Malayalam; Pambole in Kannada; Baga/Wagati/Bala/Pitiwagati in Marati and Baga in Gujarati.



Fig. 1. *Trichiurus lepturus*

## 2. Production trends

The ribbonfish landing in India has shown an increasing trend with considerable annual fluctuations. During the years from 1956 to 2000, the landings fluctuated between 16,452t in 1963 to 1,82,383t in 2000 with mean annual landings of 63,669t. The trend over the period showed a 5-8 year cycle in its abundance (Fig.2). Ribbonfishes formed 2 - 6.7% (in 1960 and 2000 respectively) of the total marine fish landings and 4.6 -13.4% (in 1970 and 2000 respectively) of the total pelagic fish landings of India. On an average it formed 4.4% of the total fish landings and

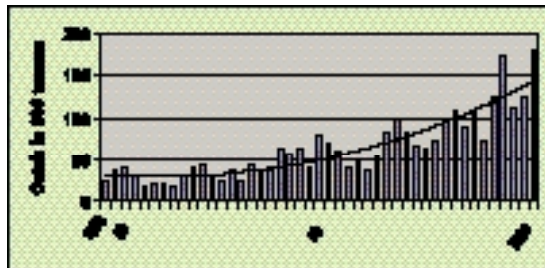


Fig. 2. All India ribbonfish landings during 1956-2000

7% of the pelagic landings. The average annual landing in different decades (1956-2000) and also the percentage growth rate between the decades are given in Table 1. The state-wise as well as all India decadal production and its growth rate is shown in Figure 3. It could be noticed that from 1970 onwards there was definite increase in production, especially during the decades 1971-80 and 1991-2000.

Table 1 The average annual landings of ribbonfishes in different decades during 1956-2000 along with percentage of growth rate between decades

Period	Average Landings (t)	Percentage growth
1956-60	30741	
1961-70	28171	-8.4
1971-80	57147	102.9
1981-90	65360	14.4
1991-00	120461	84.3

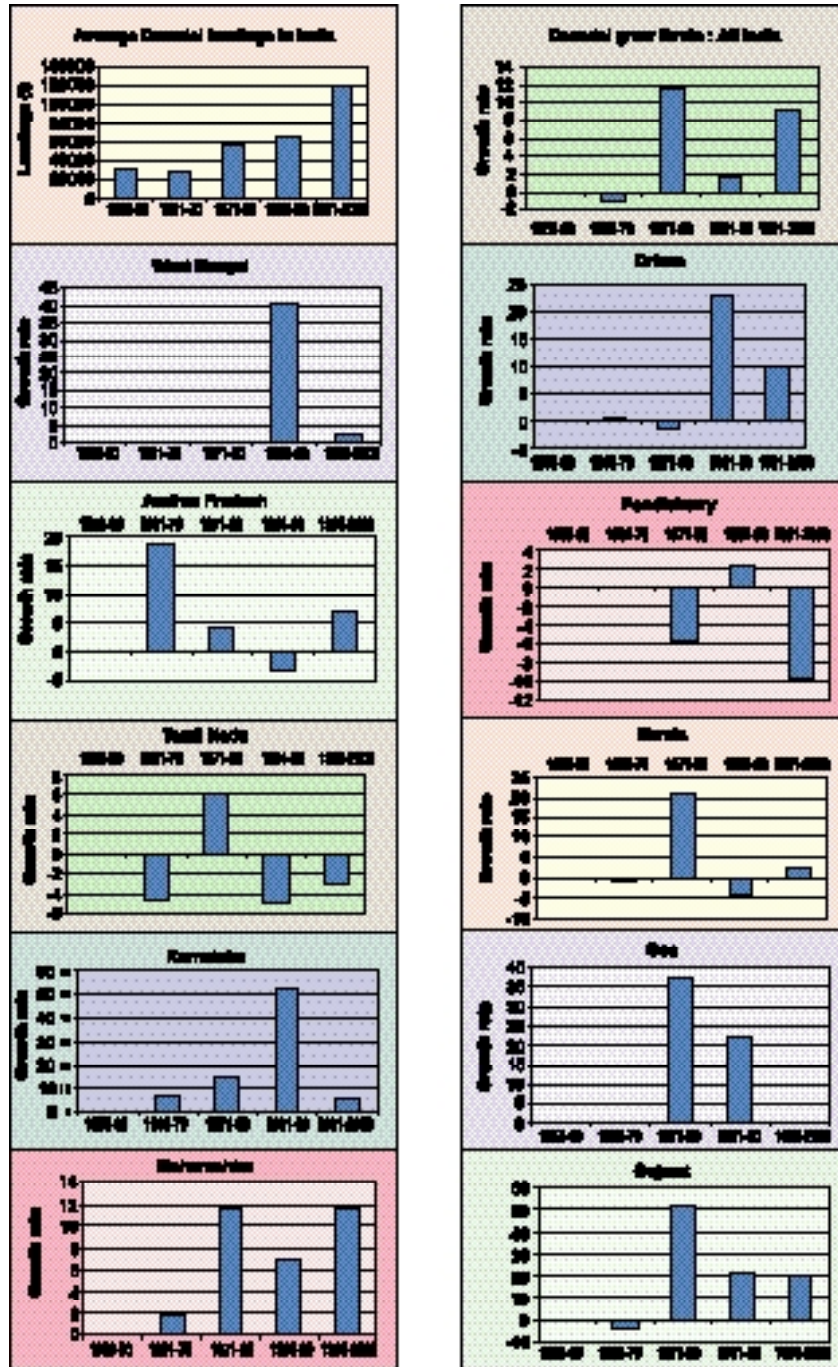
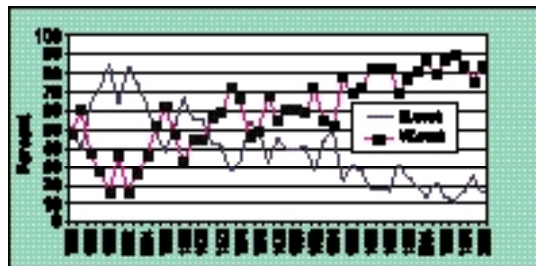


Fig. 3. Decadal growth rate in ribbonfish production: All-India and States/Union

### Regional trend

Ribbonfishes are exploited all along the coast of India and the bulk of the landings during 1956-2000 period came from Gujarat and Maharashtra followed by Kerala, Tamil Nadu and Andhra Pradesh. The contribution by other states was less than 10%. During 1956-76 period the percentage contribution by east and west coasts fluctuated widely and in the east coast it ranged from 28% (1973) to 84% (1960) where as in the west coast it ranged from 16% (1960) to 72% (1973) (Fig. 4). But the scenario totally changed from 1977 onwards and the contribution from west coast considerably increased ranging between 51% (1984) and 89% (1997). The

statewise contribution in different decades shows that in the second half of the fifties Tamil Nadu was the major contributor (50%), but in the subsequent decades, when the fishery started developing in other areas, its contribution steadily declined and was only 5% in the nineties. In sixties also the dominance of Tamil



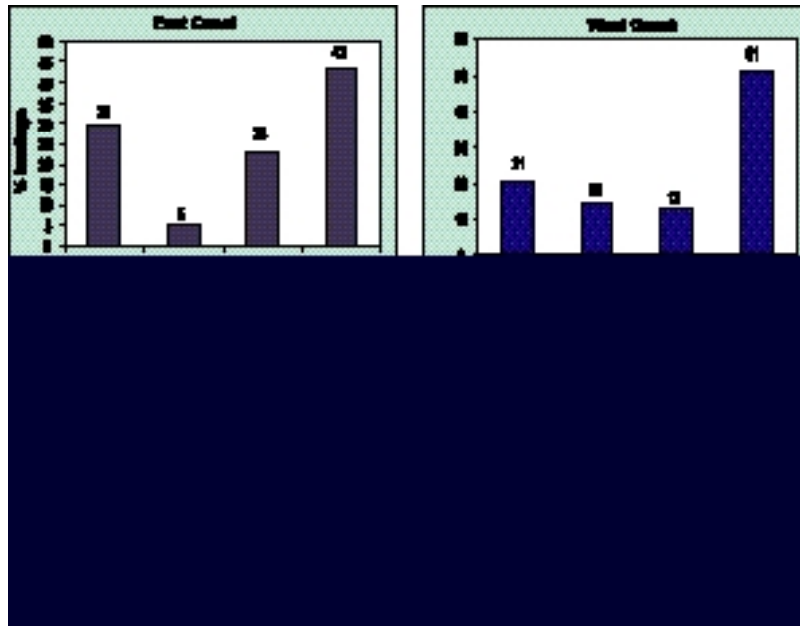
**Fig. 4. Contribution (%) from east and west coasts to ribbonfish production**

Nadu continued with a lesser share of 31%. But the exploitation in Andhra Pradesh, Kerala and Maharashtra increased contributing up to 31%, 22% and 17% respectively. In the seventies Kerala became the major contributor followed by Tamil Nadu, Maharashtra and Andhra Pradesh. In the eighties, Gujarat and Maharashtra emerged as the top contributors whereas Kerala, Tamil Nadu and Andhra Pradesh were lowered to 3, 4 and 5<sup>th</sup> places respectively. The shift in the nineties was drastic. Nearly 39% of the ribbonfish landings came from Gujarat followed by Maharashtra (27%) and Kerala (11%). The contributions by other states were much less, ranging from 1% by Goa to 8% by Andhra Pradesh.

### Temporal trend

The ribbonfishes are landed almost throughout the year in its areas of abundance with peak periods varying from region to region. The peak production in the national level is generally in the fourth quarter (October-December). During the decade 1991-2000, nearly 50% of the average annual landings was realised in the fourth quarter followed by the first quarter (22%) (Fig. 5). During the monsoon period (June-July), the resource enters the fishing ground and the production increases and reaches the peak in the fourth quarter. There after from first quarter onwards the catch decreases and reaches the minimum in the second quarter. The temporal fluctuations along the west coast were almost similar to that of the national trend. Along the east coast the trend was slightly different. Here, though the peak production was in the fourth quarter, it sharply declined in the first quarter. There after decrease was gradual and reached the minimum in the third quarter. The temporal variations

in the fishery along the maritime states are also presented in Fig. 5. The northern maritime states situated north of 15°N (Goa, Maharashtra, Gujarat, Andhra Pradesh, Orissa and West Bengal) exhibited the national trend, but it differed in the southern states (Pondicherry, Tamil Nadu, Kerala and Karnataka). In Pondicherry, maximum landing was in the first quarter followed by fourth quarter. In Tamil Nadu the peak was observed in the third quarter. In Kerala and Karnataka, though the peak landings were observed in fourth quarter, the second peak shifted to the third quarter in Kerala and to the second quarter in Karnataka.



#### Gearwise production

Trawl net is the most effective gear for exploiting ribbonfishes and nearly this gear landed 74% of the catch during 1991-2000. The other gears which landed ribbonfish were dolnet, drift gill net, boat seine, shore seine, etc. The mechanized sector (trawl net, gill net, purse seine and others contributed to 85% during the decade 1991-2000. The rest (15%) came from the non-mechanised (10%) and outboard-motorized (5%) sectors (Fig. 6). The contribution from the mechanised sector was minimum in Pondicherry (35%) and maximum in Maharashtra (98%). In all the states, other than Andhra Pradesh, Tamil Nadu and Pondicherry, 74% of the annual ribbonfish catch came from the mechanised sector. In Tamil Nadu and Andhra Pradesh, the contribution by this sector was 47% each. The contribution by the outboard-motorized sector was nominal in Karnataka, Goa, Maharashtra and Gujarat (1-3%), whereas it was 5% (West Bengal) to 22% (Pondicherry) in other

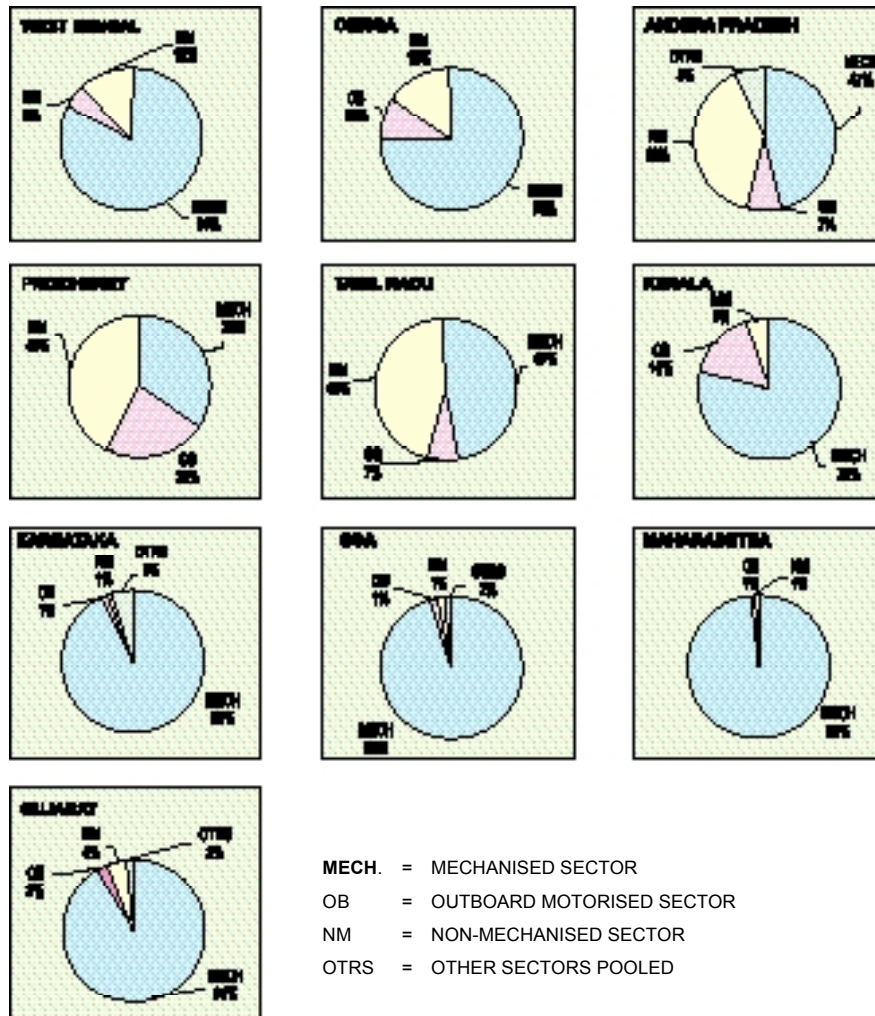


Fig. 8. Ribbonfish landings (%) by different gears, sectors and states (As. 1991-2000)

states. Similarly the contribution by non-mechanised traditional sector too was very little in the west coast (1-5%) but comparatively higher in the east coast (12-43%).

Depthwise distribution

The ribbonfishes move to the inshore areas of the continental shelf during monsoon, remain close to the shore in areas less than 60m depth in the post monsoon period and contribute abundantly to the fishery. This migration is mainly for feeding purposes. During maturation period, they move away from the coastal areas to deeper regions. In area where the continental shelf is narrow and gradient is steep the stock



becomes unavailable to the fishery leading to an off-season. On the other hand in area where the shelf is wider and gradient is low, it always remains in the fishing ground and is accessible to the fishing gears through out the year. So ribbonfishes are landed round the year in both the coasts north of 15°N. In southeast coast and the Gulf of Mannar area the shelf is narrow and hence the fishery is seasonal, restricted to a few months in the monsoon and post monsoon periods.

#### Species composition

*Trichiurus lepturus* is the dominant species among ribbonfishes and supports a fishery all along the Indian coast. It forms more than 95% of the total ribbonfish landings. In fact this is the only species commercially available in most of the centres. Other species noticed in the catches are *T. russelli*, *Lepturacanthus savala*, *L. gangeticus*, *Euplurogrammus muticus* and *E. glossodon*. These are mostly reported from northeast coast (Andhra Pradesh and Orissa) where they together constitute around 14% of the total ribbonfish catch. The contribution by these species to the all India production is only 5%.

#### Length composition

The maximum size attained by the ribbonfishes varies according to the species. Reports indicate that *T. lepturus* grows to larger size and fish measuring more than 1 metre total length (TL) are common along the Indian coast. A fish measuring 1.48m TL and weighing 2.4kg, caught from Kakinada waters in August 1992 was the largest one noticed recently. The size range of the fish in the commercial fishery varied from place to place. The length range, common size and the mean length (ML) in different states during 1994-2000 period are given in Table 2. The average ML during the period was minimum (42 cm) at Visakhapatnam and maximum (69 cm) at Mumbai and Kochi. Fish aged one year and above dominated in the fishery along the west coast and their ML ranged from 58 to 69 cm. In the east coast the fishery depended on 0-year class fish having the ML varying from 42 to 50 cm.

Table 2. The length range and mean length of *T. lepturus* in different states (Average for 1992-2000)

State	Centre	Length range (cm)	Common size (cm)	Mean length (cm)
Gujarat	Veraval	20-130	29-75	61
Maharashtra	Mumbai	26-135	55-77	69
Karnataka	Mangalore	22-112	40-72	58
Kerala	Kochi	20-121	56-82	69
Tamil Nadu	Chennai	10-100	30-56	49
Andhra Pradesh	Kakinada	8-112	34-62	50
	Visakhapatnam	16-99	32-52	42

Table 3. The percentage of juveniles in the total number of ribbonfish landed at different centres (Av. 1994-95 to 2000-2001)

Centres	% of juveniles in total number caught	% Contribution to the total juvenile landings
West coast	4.7	45.6
Veraval	13	42.6
Mumbai	0	0
Mangalore	0.2	1.1
Kochi	2	2.0
East coast	6.7	54.4
Chennai	9	22.8
Kakinada	5	23.8
Visakhapatnam	12	8.5

#### Contribution of juveniles to the fishery

Juveniles of *T.lepturus* measuring less than 30 cm TL caught in trawl net are normally discarded, as they have no market value. Plenty of juveniles could be noticed along with the trash landed by the trawlers during the recruitment season. The percentage of such juveniles was comparatively more in the landings in the east coast than in the west coast as the trawlers operated in the former region brought most of the trash to the shore. Juveniles less than 3 months old are highly pelagic and migrate to the inshore areas and get fished by boat seine and ring seine. The percentage of juveniles measuring less than 30 cm TL in the total number of ribbonfish landed at various centres is presented in Table 3. It is evident that landings of juvenile were higher in the east coast (6.7%) than in the west coast (4.7%). The juvenile landings were more at Veraval where the trash discard was minimal. 45.6% the total juveniles reported during the period were from the west coast and 54.4% from the east coast. The maximum juvenile contribution was from Veraval (42.6%) followed by Chennai (22.8%) and Kakinada (23.8%). In these centres the trash fishes are normally brought ashore.

#### Gears capturing juveniles

The juveniles of ribbonfishes are caught mainly in the code end of the trawl net where the mesh size is mostly less than 10 mm. Small meshed boat seine and ring seine also catch the juveniles as by-catch during monsoon period when these gears are operated maximum. Juveniles have also been observed in the landings of mini-trawls, operated in inshore areas close to the shore.

#### Utilization

Nearly 64% of the ribbonfish landed annually in India are exported in frozen form to China, Japan and other southeast Asian countries. Only undamaged fresh fish are considered for export. They are graded sizewise and are frozen intact without removing the gut or fins. The local people consume large sized fresh fish while the

undersized are sun-dried. In Kakinada and Visakhapatnam, the trawlers engaged in multi-day fishing dry the catch on top of the deck and cabin. The non-fatty and ribbon-like body makes the fish suitable for rapid sun drying. A portion of the dried fish is sold in the interior markets and the rest is exported to southeast Asian countries like Sri Lanka, Malaysia, Singapore, Thailand, etc. The under-sized fish brought ashore goes with the trash and are utilized in fishmeal production.

### 3. Biology

#### Spawning

The breeding grounds of ribbonfishes are outside the usual fishing grounds. Reports indicate that ripe fish, eggs, early embryonic stages and larval forms are not very common in inshore waters. *T.lepturus* is known to have a prolonged spawning in some areas. On the west coast the peak spawning is in April-June. In the east coast it spawns during February to June with peak in May. Another short duration spawning also has been reported in November-December. The size at first maturity of the species has been estimated as 46-47 cm TL when its age is nearing one year. An estimated fecundity up to 1,34,000 ova has been reported for *T. lepturus*, but the actual number varies depending on the size of the fish and the number of times it spawns. In a ripe fish measuring 1.48 m TL and weighing 2.365kg, collected off Kakinada the estimated fecundity was 1,11,626 ova in its ovary having a length and weight of 27.5 mm and 66.43g respectively. According to the available information the eggs of ribbonfishes are transparent, pelagic and range in diameter from 1.70-2.45 mm and the newly hatched larvae measure 4.4-6.6 mm.

#### Recruitment

Juveniles and young *T. lepturus* measuring less than 40 cm are almost continuously recruited to the fishery in almost all centres along the coast of India. The minimum size recorded from trawl at Chennai during 1998-2000 was 10cm noticed in September. The normal recruitment size was 20 to 30 cm. The Juvenile modes during the period ranged from 14 to 36 cm at various centres (Table 4).

Table 4. Recruitment size, month and size of juvenile mode at various centres during 1998-99 to 2000-01

Centres	Parameters	1998-99	1999-2000	2000-01
Veraval	Size &Month	20cm, Feb.	20cm, Mar.	20cm, Mar., Sep. & Dec.
	Juvenile mode	26cm	32cm	32cm
Mumbai	Size &Month	40cm, Apr. & May	49cm, Jul.-Aug.	27cm, Feb.
	Juvenile mode	55cm	57cm	31cm
Mangalore	Size &Month	32cm, Feb.	30cm, Jan.-Feb.	30cm, Jan. & Apr.
	Juvenile mode	36cm	50cm	40cm
Kochi	Size &Month	33cm, Mar.	40cm, Mar.	37cm, Jan.
	Juvenile mode	35cm	41cm	40cm

Centres	Parameters	1998-99	1999-2000	2000-01
Chennai	Size &Month	10cm, Sep.	20cm, Jul., Nov. & Dec.	20cm, May, Jun, Sep., Jan., Mar.
	Juvenile mode	30cm	40cm	40cm
Kakinada	Size &Month	14cm, Aug. & Sep.	10cm, Sep.	20cm, Jul.
	Juvenile mode	40cm	14cm	42cm
Visakha-patnam	Size &Month	18cm, Apr. & Jul.	22cm, Jul.	24cm, Jun. & Jan.
	Juvenile mode	28cm	24cm	34cm

### Food

All species of ribbonfishes are highly carnivorous, predominantly piscivorous and occasionally cannibalistic too. They are voracious feeders, feeding both during day and night. The most favoured food items include a variety of small and medium size fishes, prawns and shrimps. Their predation on other economically important fishes and prawns is noteworthy. The teeth and other oral structures are suitable to hold the prey, bite and devour the same easily. The major food items encountered frequently in the stomach are whitebaits, scads (*Decapterus* spp.), oil sardine, sardines, *Acetes* spp., caridian prawns, shrimps, squids, etc. They also feed occasionally on soles, lizardfishes, *Thryssa* spp., *Nemipterus* spp., silverbellies, mackerel, crabs, ribbonfishes and *Squilla*. Earlier reports have shown several instances of ribbonfish shoals following the whitebait schools as indicated by their mixed occurrence in the trawl net.

### Growth and life span in the fishery

Earlier investigations have shown that *T. lepturus* at Mangalore waters attains a length of 39.1, 58.7, 70.8 and 82.8 cm on completion of I, II, III and IV years of its life respectively (Table 5). Slightly faster growth rate has been reported from Mumbai waters which shows that *T. lepturus* grows to a length of 51.2, 82.5, 101, 112.3 and 119.2 cm at the end of I to V years of its life. This seems to be a reasonable estimate. The commercial fishery along the west coast is mostly constituted by I and II year old fishes. But the east coast fishery is mainly depended on 0-year and 1+ year groups fish. Three year and above old fish are very rarely noticed in the commercial fishery.

Table 5. Total length (cm) at age of *T. lepturus* at different centres

Centre	Age in years					Author
	I	II	III	IV	V	
Mangalore	39.1	58.7	70.8	82.8		James (1978)
Mumbai	51.2	82.5	101.0	112.3	119.2	Chakraborty (1990)
Kakinada	41.6	69.0	88.5			Narasimham (1976)
Maharashtra	67	103	122	135		Thiagarajan (1992)
Vizhinjam	40	67	86	98		Thiagarajan (1992)
East Coast	55	87	105	115		Thiagarajan (1992)

#### 4. Stock assessment

The stock assessment of *T. lepturus* was conducted based on the data collected at Mangalore, Kochi and Kakinada. The growth and mortality parameters estimated for 1999 and 2000 are presented in Table 6. While the estimates for Kochi and Kakinada gave almost identical values they slightly varied at Mangalore. The exploitation rates (E) indicated that the stock was being slightly over fished. The occurrence of large quantities of juveniles and pre-adults in the landings along the east coast also supports this view.

Table 6. The estimates of growth and mortality parameters of *T. lepturus* at three centres (Based on trawl data for 1999 and 2000)

Centres	$L_{\infty}$ (cm)	$K \text{ Yr}^{-1}$	Z	M	F	E
Kochi	127	0.72	4.05	0.98	4.01	0.82
Mangalore	131	0.78	5.98	1.02	4.96	0.83
Kakinada	128.2	0.72	4.36	0.99	3.37	0.76

#### 5. Management

The ribbonfishes are abundant in the coastal waters of depth range 25 to 75metres. Evidently this zone is intensely fished for a variety of fish resources contributing to the bulk of the catch. In all types of trawling that do target fishing the by-catch is an essential component. Hence, in a multispecies fishery it would be impractical to regulate the exploitation of a single resource like the ribbonfishes, for which the major tackling devise is the trawl. The ribbonfish landings have been showing annual fluctuations but still it has been maintaining an increasing trend of slightly higher magnitude in recent years. This is due to resource abundance on one hand and increased exploitation on the other. The export market has paved the way for targeted fishing of this resource recently leading to certain degree of over exploitation in major centres, especially along the east coast. This tendency of over exploitation is to be checked from exceeding the limits so that a sustained production is ensured in successive years. Though many management options like effort regulation, closed season, closed area, gear regulation, mesh regulation, so on and so forth, are normally suggested, none of these are effective in Indian conditions where a multi-species multi-gear fishery exists. So the only possible option is to regulate the effort, especially during the periods of abundance, so that the exploited quota can be restricted for sustained production.

The ribbonfish fishery in India has assumed importance only in recent years. The importance of this resource has largely increased due to the export possibilities and hence has become a targeted group recently. This has created some stress on the stock inviting appropriate management interventions. It is suggested that in the present Indian context a better and practical option would be to control the exploitation during the period of abundance when maximum removal of the stock takes place, through limiting the fishing intensity. This may ensure maximum survival of the brood stock and thereby help the resource to replenish by itself in due course.

As the pace of exploitation is fast changing it is essential to monitor the fishery and biological characteristics of this resource to suggest various regulatory measures.

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