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Distribution, biology and behaviour of the giant trevally, *Caranx ignobilis* – a candidate species for mariculture

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Abstract
Fishery and biology of the giant trevally, *Caranx ignobilis* exploited along the Tuticorin coast of Tamilnadu were monitored during 2001-2006. Fishery occurred round the year with peak landings during April-August. Spawning and recruitment occur almost round the year with peak during November-December. Young ones are abundant in shallow coastal waters and as grows, they move to deeper waters. Growth parameters, L_∞ and K are estimated respectively as 143.6 cm and 0.69/year and 't_o' as –0.0242 year. Estimates show that they grow fast and attain 73, 108, 126 and 134 cm in total length by first, second, third and fourth year respectively. Their weight increment is also fast and attains 5.5 kg, 16.8 kg, 25.9 kg and 33.7 kg respectively during the period. Stock assessment indicated that the stock at present is over exploited and under heavy fishing pressure. Rearing trial in aquarium tank showed that they are compatible to confined rearing conditions. Based on the distribution and biology of the species, their mariculture potential is discussed.

Key words: *Caranx ignobilis*, Mariculture, Fishery

Introduction

Giant trevally is the largest and fast growing carangid available in the Indian waters. They had wide distribution throughout the Indian Ocean and central Pacific. They support round the year fishery and constitute 10% of the total carangid production of the region. However, reports and information on the fishery and biology of the species is very limited. Present study was aimed to generate more biological information for scientific exploitation and management of the resource.

Report on carangid maricuture is very limited, except that of Yellowtail, *Seriola quinqueradiata* cultured in Japan. This is the only finfish species that contributes significantly to marine aquaculture production and its farming is restricted to Japan. Total production of cultured yellowtail was 162,000 ton in 1989 and contributes 90-95% of the total finfish mariculture production of Japan. This paper discusses some aspects of the biology of giant trevally with special reference to their potential as a candidate species for mariculture.

Materials and methods

Catch, effort and size composition data of giant trevally, *Caranx ignobilis* by different gears were monitored during 2001-2006. Food and feeding habits of the species were studied to develop their diet matrices. Growth and recruitment patterns were studied using monthly length frequency distribution of the species in catch. Growth parameters were estimated following ELEFAN and Shepherd's model using ICLARM's FiSAT software (Gayanilo and Pauly 1997) and also through model progression model (Bagenal 1955, Pauly 1982, 1983). Age of the fish at zero length (t_o) was estimated as that in Bertalanffy (1934).

Natural mortality (M) was estimated from the empirical formula proposed by Pauly (1980) and total mortality (Z) from catch curve (Pauly 1984) using FiSAT software (Gayanilo and Pauly, 1997). Exploitation rate (E) was estimated from the equation; E = F/Z as given by Beverton and Holt (1957) and Ricker (1975); where, F is the fishing mortality rate. Length-weight relationship was estimated as in Sparre (1986) following linear analysis by converting the length and weight data in to log values and was subjected to covariance analysis. Maximum sustainable yield (MSY) was estimated as in Corten (1974).

Results

Fishery

Giant trevally was exploited from the entire marine habitat, right from shallow estuaries and coastal waters to deeper waters during different stages of their life, by almost all gears operating along the coast. Juveniles and young ones from estuaries and shallow coastal waters were exploited by mini-trawls, small meshed gillnets and shoreseines. Medium sized fishes were exploited from relatively deeper areas by trawls and large meshed gillnets and large adults from deep, rocky and seaward reef grounds by hooks and line.

Giant trevally formed 10% of total carangid landings of Tuticorin. 648 tons were landed annually during 2001-2006 (Table 1). Trawls contribute 22% of their annual catch, gillnets, 24.5 % and hook & line, 52.8%. About 62% of the carangid catches in the hooks and line is by this species alone. Fishery occurred round the year, with peak during April-August. Catch rate was also high during this period.

Size composition

Mini trawls and shoreseines landed 7.0 to 16 cm fishes. Large meshed gillnets and trawls landed small to sub-adults of 14-45 cm, whereas hooks and line landed sub-adults and adults of varying size from 29 to 136 cm. Annual mean size of the species in hooks and line catch varied between 50 and 52.3 cm.

Table 1. Annual landings (in tons) of giant trevally, *C. ignobilis* by the major gears at Tuticorin during 2001-2006

Period	Gillnet	Trawl	Hook and line	Other gears	Total of the year
2001	154	30	411	4	599
2002	314	44	151	6	515
2003	170	108	439	12	729
2004	74	296	382	7	759
2005	93	213	429	1	736
2006	146	156	239	8	549
Average	159	141	342	6	648

Length-weight relationship

Length-weight relationship were estimated from log values of length and weight and is expressed by the formula, $W = aL^b$, where, W is weight in g, L total length in cm, 'a' constant and is estimated as 0.0279 and 'b' length coefficient, 2.842. Covariance analysis of the relationship showed significance at 5% level.

Growth

Growth parameters, L_{oo} and K were estimated respectively as 143.6 cm and 0.69/year and 't_o' as -0.0242 years. Growth of the fish can be described by von Bertallanffy equation as;

$$Lt = 143.6\ [1 - e^{-0.69\ (t + 0.024155)}]$$

This relation shows that the species grows to 25 cm in total length in three months and 44 cm in six months (Table 2). Length and weight of the one year old fish is estimated as 73 cm and weight of 5.5 kg respectively. It is 108 cm and 16.8 kg respectively for two-year-old fish and 126 cm and 25.9 kg for three-year-old fish. Age of the largest fish (136 cm) recorded in the catch, is estimated as 4.2 years.

Table 2. Estimated growth in length (cm) and weight (kg) of giant trevally by the end of different quarters of their life

Year of growth	Particulars	I Quarter	II Quarter	III Quarter	IV Quarter
Ist year	Length	24.6	43.6	59.4	72.8
	Weight	0.255	1.272	3.813	5.46
IInd year	Length	84	93.4	101.4	108.1
	Weight	8.21	11.11	14.01	16.8
IIIrd year	Length	113.7	118.4	122.4	125.8
	Weight	19.4	21.8	24.0	25.86

Recruitment pattern and juvenile abundance

Recruitment pattern and abundance of young ones in fishery along the coast suggest that this species spawn and young recruits enter the stock almost round the year with main spawning peak during November- December and a small peak in March-April (Fig 1).

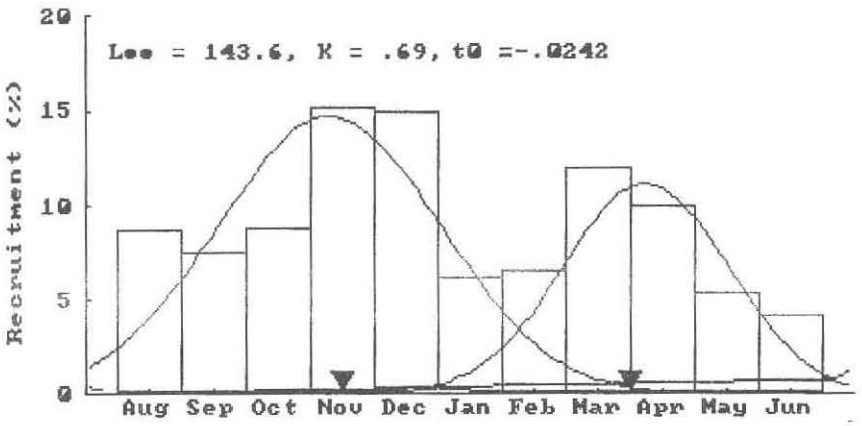

Fig 1. Recruitment pattern of the giant trevally, *C. ignobilis* along Tuticorin coast

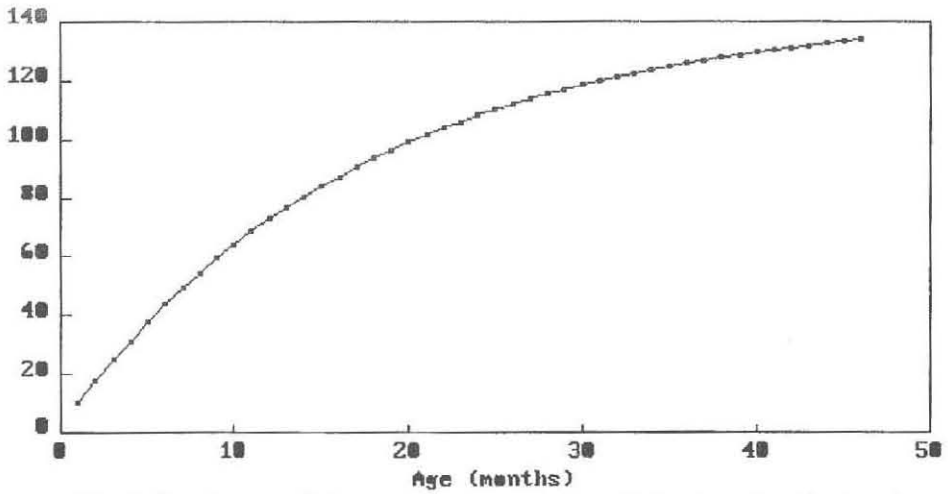

Fig. 2. Growth curve of giant trevally, *C. ignobilis* from Tuticorin region (size in cm)

Spatial distribution of different size groups of the species as indicted by catch in different gears established that, small juveniles move shallow coastal waters and estuaries for feeding. Juveniles were very often encountered in estuarine areas as small shoals. As grows, they move to deeper waters and larger adults were caught mainly from deep rocky beds or seaward reef areas.

Food and feeding habit

Gut content analysis shows that they are carnivorous in feeding. Young ones in shallow coastal waters feed mainly on juvenile of sardines, anchovies and other fin fishes, prawns, crab stars and amphipods. Food of large fishes shows wide variation from individual to individual. Major components of their food are *Decapterus* sp., other carangids, silver bellies, thread fin breams, goat fishes, lizard fishes, crabs and prawns.

Stock assessment

Fishing and total mortality of the species was estimated as 3.18 and 1.88. Estimate of exploitation rate (E) was 0.59 and Emax, 0.52. Average production during the period is 648 ton, more than the estimated maximum sustainable yield (MSY) of 571 ton. These estimates shows that the stock is over exploited and under heavy fishing pressure. However, biomass estimates indicates the existence of a good spawning stock biomass of 503 ton and standing stock biomass of 703 ton.

Consumer acceptability and market price

Carangids of the genera *Caranx* have good consumer acceptability due to their quality flesh without inter-muscular bones. Good local demand prevails for small and medium fishes and from distant urban markets for medium and large sized fishes. They generally fetch Rs. 100-150/kg at landing centres and Rs 120-200/- in the retail markets depending on the season and size of the fish.

Response to confinement

Juveniles collected from shore seine catches were acclimated and reared in 3 x 2 x 1.5 feet aquarium tanks with coral sand and dead coral for refuge for 20 days. Except during the initial phase of stocking, they mostly remain calm during the trial. They were fed with chopped anchovies and sardines. They have shown good feeding response with immediate food acceptance.

Discussion

In the recent years fishing efforts has increased considerably and fishing area was extended to distant waters. As a result, yield of giant trevally increased gradually over the years. Estimates of exploitation rates and MSY showed that the resource is under heavy fishing pressure. With persistent demand for large quality fishes, there are dangers of further increase in fishing pressure over the resource. This necessitates scientific attention to sustain the production at optimum level. Workable alternatives to meet the increasing demand for highly sought after resources is natural stock enhancement through captive breeding, sea ranching of juveniles and mariculture. Since large fishes are being caught by gillnets and hooks and line, chances of getting live mature fishes onboard fishing vessels is relatively high. This provides ample scope for stripping ripe fishes onboard and sea ranching fertilized eggs to augment natural stocks.

Fishing and natural spawning pattern indicated that availability of mature fishes for captive breeding and seed production trials may not be limiting.

Growth estimate showed that they grow faster compared to many other pelagic fin fishes of the Indian waters. Their weight increment is also very fast. Recruitment pattern and abundance of young ones in shallow coastal and estuarine areas suggest that young fishes for capture based rearing trials will be available almost round the year. Moreover distribution of juveniles in the estuarine areas and their response during rearing trials clearly demonstrated that they can be conditioned for confined atmosphere. Since they readily accept locally available trash fishes, in different forms, feeding also may not be a problem. These findings were further supported by the recent report of Giant trevally farming in land based system on small scale in Hawai, (Gefrosh, 2004). The present work and other available information established that this species possess several characters which are considered ideal for a potential mariculture species.

Reliable information on carangid aquaculture is not available, except for that of yellow tail, *S. quinqueradiata* in Japan. World's largest fish production per unit culture area is obtained from their culture. Giant trevally appears to grow faster in the Indian seas than yellowtail in Japan seas. Though, no attempts had been made so far to test their mariculture potential, the present biological and behavioural observations suggested that they are suitable for mariculture.

References

Bagenal, T.B. 1955. The growth rate of the long roughdab, *Hippoglossoides palessoides* (Fab). *J. Mar. Biol. Assoc. UK.*, 34: 297-311.

Bertalanffy, L. von, 1934. Unter suchungen uberdie Gesetzlichkeiten des wasdestums I. Allgemeine Grundlagen der Theorie. *Roux. Arch. Entwicklungsmech. Org.*, 131: 613-653.

Beverton, R.J.H. and S.J. Holt, 1957. On the dynamics of exploited fish populations. *Fish. Inves. Minist. Agric. Fish Food.* G.G. (2 Sea Fish), 19: 533pp.

Corten, A. 1974. Recent changes in the stock of Celtisea herring (*Clupea harengus* L). *J. Cons. Perm. Int. Explor. Mer.*, 35: 194-201.

Gayanilo, Jr. F.C., and D. Pauly, 1997. FAO-ICLARM stock assessment tools (FiSAT). Reference Manuel, *FAO computerised information series (Fisheries)*. No. 8, Rome, FAO. 1997. 262 p.

Gefrosh. J. 2004. Aquaculture hooks into a sustainable future. *Ka Pili Kai, Univ. Hawai'i Sea Grant College Program.*, 1 (1): 3-11.

Pauly, D. 1980. A selection of simple methods for the assessment of tropical fish stocks. *FAO. Fish. Circular No.* 729, *FIRM/129: pp.* 54.

Pauly, D. 1982. Studying single species dynamics in tropical multi-species context. *In: Theory and Management of Tropical Fisheries.* D. Pauly and G.I. Murphy (Eds.). Proceedings ICLARM/CSIRO. *Workshop on the Theory and Management of Mult-ispecies Stocks.*12-21 January 1981, Cronulla Australia, P. 33-70.

Pauly, D. 1983. Some simple methods for the assessment of tropical fish stocks. *FAO. Fish. Tech. Paper* (No. 234), Rome: 1-52.

Pauly, D. 1984. Length-converted catch curves: A powerful tool for fisheries research in the tropics (Part II). *FISHBYTE*, 2 (1): 17-19.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. *Bull. Fish. Res. Bd. Canada.*, 191: 382 pp.

Sparre, P. 1986. Introduction to tropical fish stock assessment. *FAO/DANIDA Project, Training in Fish Stock Assessment,* (I-III Edition).

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