Journal of Veterinary and Animal Sciences. 25 (1994) 72-79

FOOD HABITS AND BREEDING BIOLOGY OF THE STRIPED BARRACUDA, *Sphyraena jello* Cuv. (Perciformes, Sphyraenidae) OF COCHIN REGION*

K.J. Krishnadas[1] and J. Rajasekharan Nair
Department of Fishery Biology, College of Fisheries,
Panangad, Cochin.

Barracudas as a group forms only a small portion of the total marine landings in India. Although not enough information is available on the seasonal and region-wise distribution of the coastal species, *S. jello* Cuv. and *S. obtusata* (Cuv.& Val.) are presently known to be the major contributors to the barracuda catches in India.

Of the two commonly occurring species, *S. obtusata* in Maharashtra waters has been subjected to detailed biological study by Kothare (1973). The present paper deals with feeding and breeding biology of the lesser studied *S. jello* in Cochin waters.

Materials and methods

A total of 141 males (270-943 mm in total length) and 64 females (322-770 mm in TL) were used for the study. Monthly random collections were made during November 1988 to October, 1990, mostly from landings by small commercial trawlers operating from Cochin. Sampling was not possible during certain months when specimens of *S. jello* were not available in the trawl landings. Hence the sampling period was enhanced to two years, so that the gross picture for the two years could be compared. Sex and proper stages of maturity were determined in the fresh condition and the specimens were preserved in five per cent formalin for further analyses.

The morphology of alimentary canal and the relative length of gut (RLG) were studied for understanding the feeding habits. The males and females were classified into two size groups (< 400 mm and > 400 mm in TL) for qualitative and quantitative food analyses. Qualitatively the food items were identified to the lowest systematic level possible. 'Points method' (Hynes, 1950) was adopted for quantifying them in terms of volume. The percentage occurrence of the food items were also noted to calculate the index of preponderance (Natarajan and Jhingran, 1961). The length of prey was measured whenever in tact to bring out the prey predator length relationship.

The maturity stage were quantified using a five stage key (Stage I-Immature virgin; stage II - Maturing virgin; stage III - Ripening/spent recovering; Stage IV - Ripe; Stage V - Partially spent/spent). Monthly percentage occurrence of mature and spent females, the corresponding average gonadosomatic index values (GSI) and condition factor (K) were made use of to delineate the spawning season. Ova diameter measurements were taken to understand the spawning frequency (Hickling and Rutenberg, 1936; Qasim and Qayyum, 1961; Nair and Nair, 1983). Size at first maturity was found out graphically by plotting the percentage occurrence of mature fish (stage III and above) against increasing length classes and absolute fecundity

* Part of the M.F.Sc. thesis submitted by the first author to the Kerala Agricultural University

[1] Present address : Assistant Manager, Matsyafed Fish Farm, Elamkunnapuzha, Cochin

was ascertained using gravimetric subsampling technique. The average monthly gonadosomatic and gastrosomatic indices were compared to understand the spawning - feeding relationship.

To assess whether the condition factor (K) is also influenced by the fat content of fish in addition to maturation of gonads and presence of gut contents, the K values were also calculated using eviscerated weight of the fish (Bhatnagar and Karamchandani, 1970; Jhingran, 1972).

Results and discussion

According to Moyle and cech (1982) the body plan of the barracudas is an interesting compromise between that of the lie-in-wait predator and active predator. The non-protrusible upper jaw is a secondary modification in sphyraenids adapting the fish to their predatory mode of feeding habit (Nelson, 1984). The premaxilla, palatines and the dentaries have strong canines and triangular cutting teeth. Gill rakers are totally absent. The infra and suprapharyngeal tooth pads are present on the ceratobranchials and pharyngobranchials respectively helping in swallowing. The pharynx is followed by a muscular oesophagus and well defined distensible stomach. The relative length of gut is found to be 32.32 ± 3.58% which is typical of a carnivorous predator (Suyehiro, 1942). Reports by De Sylva (1973) and Somvanshi (1989) show that large solitary adults of barracudas are day time feeders while smaller fish forming shoaling groups are nocturnal. Bulk of the specimens in this study are trawl caught shoaling fish (270-553 mm TL).

Qualitative analysis of the gut contents revealed that the principal prey groups are the members of family Engraulidae *Stolephorus* spp., Clupeidae *(Sardinella* spp.) and Carangidae *Decapterus* sp.) which are all pelagic or mid-water shoaling fishes. The presence of fish and fish remains in the gut irrespective of the sex and size during all months is indicative of the predominantly piscivorous nature of *S. jello* as reported by previous authors (Ah Kow, 1950; Legand, 1952; Inger, 1955). Leiognathid larvae and cephalopods were also found occasionally in the gut contents. According to Premalatha and Manojkumar (1990), the food items of *S. jello* in the Cochin area mainly consist of mackerels, horse mackerels, clupeids, lizard fish and cuttle fish.

Table 1 gives the index of preponderance of the various food contents. Invariably the fish and remains ranked first irrespective of the size or sex during the two years of study. Semidigested matter ranking next must in all probability be of fish origin.

The fish and cephalopod prey obtained in the present study mainly belong to the inshore pelagic and mid-water shoaling groups denoting the migratory feeding habit of *S. jello.* The size of the prey ranged from 18.68 to 31.43% (average 24.31) of the total length of predator. Thus the impact of a large predator like *S. jello* on the population of commercially important small sized shoaling pelagic and mid-water fish species like anchovies, sardines and scads is worth a detailed study.

Though *S. jello* is considered to be predominantly involved in ciguatera poisoning in various parts of the world (De sylva, 1973), this species from Indian waters is not reported to be toxic. According to valdes (1980) parrot fishes (Family Scaridae), surgeon fishes (Fam. Acanthuridae) and some tetradontiform fishes are the transmitters of this ichthyosarcotoxin. However, these groups of fishes have not been reported from the gut contents of *S. jello* of Indian waters.

The size at first maturity of males and females of *S. jello* are found to be around 360 mm and 370 mm respectively as illustrated in fig.1. Premalatha and Manojkumar (1990) also found that specimens of *S. jello* above 400 mm collected within a depth range upto 50 meters off Cochin were with maturing gonads.

Table 1 Index of preponderance of the food items in *S. jello*

Size group	Period	Food item	Index of preponderance	
			Male	Female
<400mm in total length	Nov.'88 to Oct.'89	Fish and fish remains	77.27	84.73
		Crustaceans	-	1.42
		Cephalopods	0.39	1.34
		Smidigested matter	22.35	12.51
	Nov.'89 to Oct.'90	Fist and fish remains	56.27	90.00
		Crustaceans	-	-
		Cephalopods	-	-
		Semidigested matter	43.73	10.00
>400 mm in total length	Nov.'88 to Oct.'89	Fish and fish remains	68.94	83.51
		Crustaceans	-	-
		Cephalopods	1.25	2.53
		Semidigested matter	29.81	13.96
	Nov.'89 to Oct.'90	Fish and fish remains	75.07	80.30
		Crustaceans	-	-
		Cephalopods	0.45	-
		Semidigested matter	24.48	19.70

As is evident from fig. 2. the gross picture of ova stock distribution from anterior, middle and posterior regions of a ripe ovary remains almost the same. However, the ripe mode shifts slightly in the posterior region (600-675μ) indicating the presence of increased numbers of larger ova in this region. Growth of ova in the ovary is illustrated in fig. 3. It was also noted that ova above 300 μ in diameter are generally yolked.

In the present study, *S. jello* in Cochin waters is found to have a protracted spawning season extending from April till September/October as depicted in fig. 4. Peak spawning activity as denoted by the period of steep fall in the percentage of mature individuals coupled with steep increase in spent individuals, may be during June - September. According to Premalatha and Manojkumar (1990), the gonad development in *S. jello* starts from November/December and maturing specimens of this species are found from March onwards in Cochin waters.

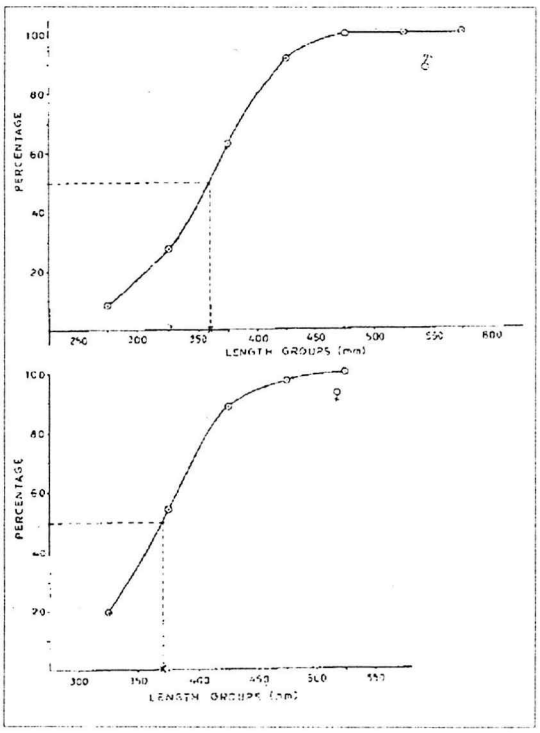

Fig.1 Percentage occurrence of mature fish with increasing size in *S. jello*

Based on distribution of ova stocks, individuals of *S. jello* were found to release eggs more than once during an extended period of spawning. Fig.3 (Stage IV-ripe ovary) shows the presence of only a single distinct mode of ripe eggs, but with range in size of mature ova being more than half the total range in size of the entire intraovarian eggs. This ensures a continuous supply of gradually maturing eggs over an extended period of time. This finding is also supported by the presence of partially spent ovaries during the spawning season. Thus the protracted spawning season in *S. jello* is supported by an asynchronous breeding population. According to Pillai (1981), ovarian development indicated that barracudas may spawn more than once in a season. Walford (1932) in *S. argentia*, De Sylva (1963) in *S. barracuda* and Kothare (1973) in *S. obtusata* have made similar observations. Absolute fecundity of *S. jello* ranged from 82,431 to 1,63,533 in the size range of 400-501 mm standard length, which constitute the recruit spawners.

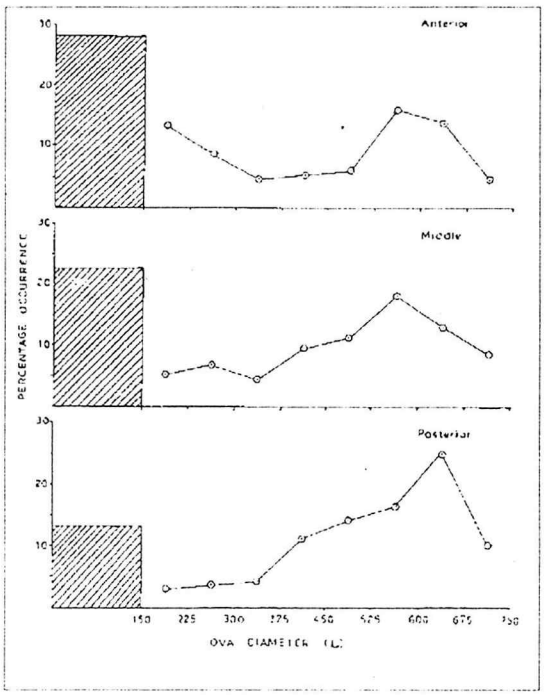

Fig.2 Differential distgribution of ova stocks in a ripe ovary of *S. jello*

Monthly gonadosomatic index values plotted in Fig.5 is showing a sharp decline after June, thus strengthening the inference on peak spawning activity. Absence of spent individuals from November-March coinciding with the low values of GSI denotes the period of no spawning activity

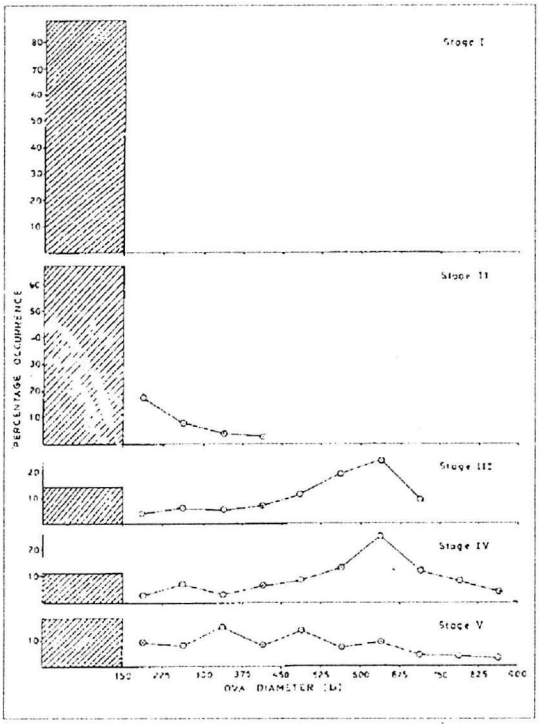

Fig.3 Differential distgribution of ova stocks in the five maturity stages in *S.jello*

By comparing the plots of gastrosomatic index (GASI) in Fig.6 (pooled data for the two years), it can be seen that feeding intensity is higher during the post spawning period. However, *S. jello* does not abstain from feeding during periods of increased spawning activity.

Fig.7 shows a declining trend of the ponderal index (K) coinciding with the spawning season. This is true also for the ponderal index calculated with eviscerated weight (Kev), indicating that the condition of the fish is also closely followed by the accumulation of fat materials in the muscle and other body tissue of the fish, thus being a measure of the true well being of the fish (Qasim, 1957).

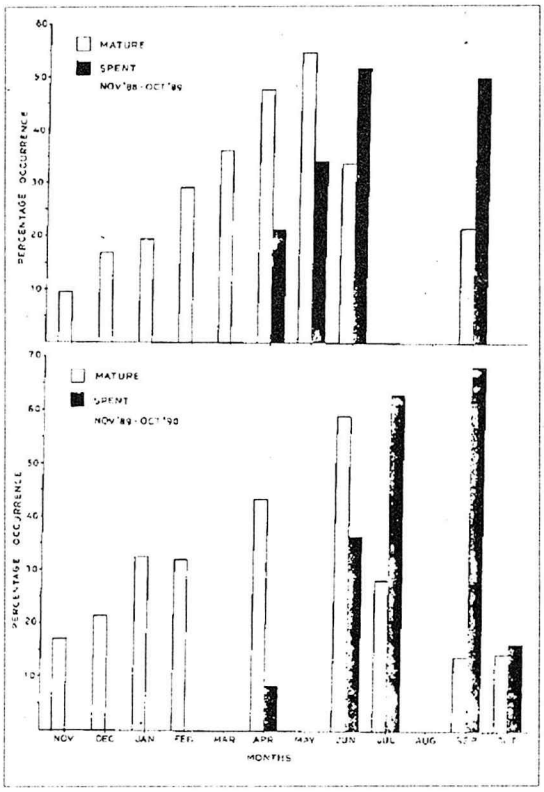

Fig.4 Monthly percentage occurrence of mature and spent female of *S. jello*

Summary

Food habits and breeding biology of the commercially important but lesser studied barracuda, *Shyraena jello* Cuv., of Cochin region is detailed in the present paper.

S. jello is found to be a typical predator and a predominant piscivore. The species feeds on small pelagic and mid-water shoaling fishes like clupeids, anchovies, scads and silverbellies, occasionally consuming cephalopods.

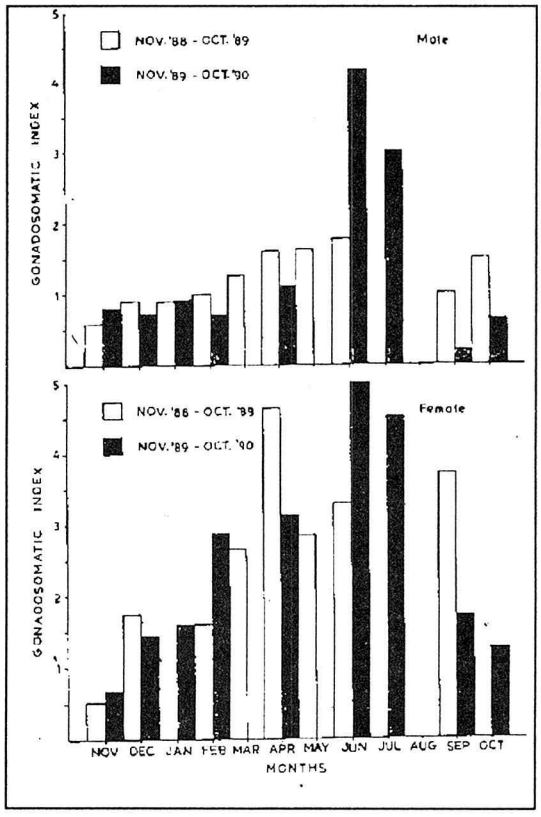

Fig.5 Monthly average Gondadosomatic intex values in *S. jello*

Size at first maturity is found to be 360 mm for males and 370 mm for females. The species exhibits a prolonged spawning season in Cochin region, spanning from April to September/October with increased activity during June-September. Individuals of *S. jello* spawn more than once during this prolonged season. The absolute fecundity of recruit spawners of *S. jello* ranged between 82,431 and 1,63,533.

The intensity of feeding was lower during the period of increased spawning activity and higher during post-spawning period. Fluctuations in condition factor closely followed the spawning cycle and the ponderal index calculated using eviscerated weight of fish provided an index of true well being of the fish.

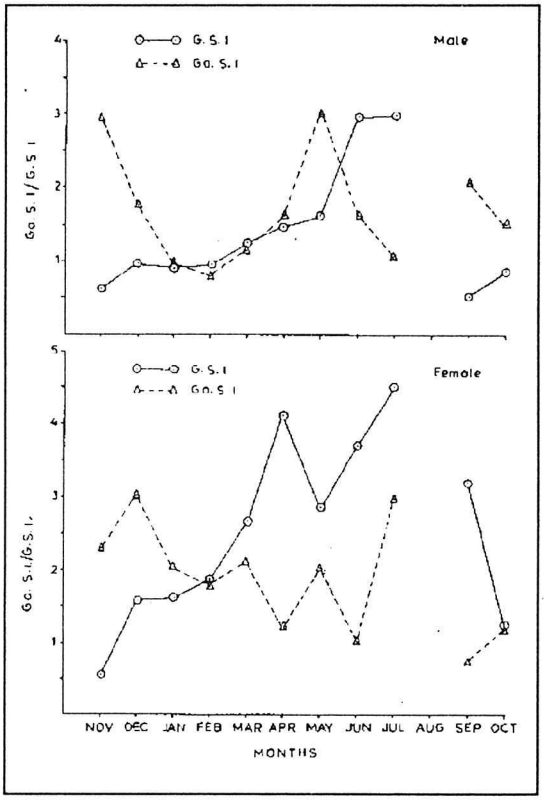

Fig.6 Comparison of monthly Gastgrosomatic (Ga.S.I.) and Gonadosomatic (G.S.I.) index values in *S. jello* (pooled data for the two year period)

Acknowledgements

The authors are grateful to Dr. M.J. Sebastian, Dean, College of Fisheries for providing facilities for carrying out the research work. The ICAR Junior Research Fellowship availed by the first author during the period of work is also thankfully acknowledged.

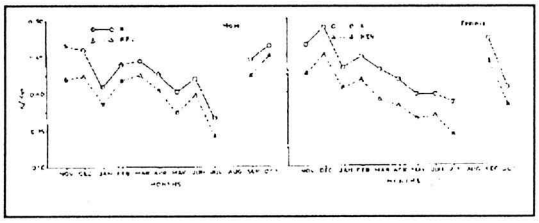

Fig.7 Monthly ponderal index (K) and ponderal index using eviscerated weight (K_{ev}) in *S. jello*

References

Ah Kow, T. (1950). The food and feeding relationships of the fishes of Singapore straits. *Colon. Off. Fish. Publ.* **1**: 35 pp.

Bhatnagar, G.K. and Karamchandani, S.J. (1970). Food and feeding habits of *L. fimbriata* (Bloch) in river Narmada near Hoshangabad (M.P.). *J. Inland Fish. Soc. India.* **2**: 30-50.

De Sylva, D.P. (1963). Systematics and Life History of the Great Barracuda, *Sphyraena barracuda* (Walbaum). *Stud. Trop. Oceanogr. Miami,* **1**: viii+179 pp.

De Sylva, D.P. (1973). Barracudas (Pisces : Sphyraenidae) of the Indian ocean and adjacent seas - A preliminary review of their systematics and ecology. *J.Mar. Biol. Ass. India*, **15**(1):74-94.

Hickling, C.F. and Rutenberg, E. (1936). The ovary as an indicator of spawning period of fishes. *J. mar. biol. Ass.* U.K., **21**: 311-317.

Hynes, H.B. (1950). The food of freshwater sticklebacks (*Gasterosteus aculeatus* and *Pygosteus pungitius*) with a review of methods used in studies of food of fishes. *J. Anim. Ecol.*, **19**: 36-58.

Inger, R.F. (1955). Ecological notes on the fish fauna of a coastal drainage of North Borneo, Fieldiana. *Zool.* **37**: 47-90.

Jhingran, A.G. (1972). Fluctuations in the ponderal index of the Gangetic anchovy *Setipinna phasa* (Ham.). *J. Inland Fish. Soc. India.* **4**: 1-9.

Kothare, P.V. (1973). A study on a barracuda, *Sphyraena obtusata* (Cuv. & Val.). Ph.D. Thesis, University of Bomaby (unpublished).

Legand, M. (1952). Etat actuel et perspectives de l'industrie du poisson dans les territoires francais due Pacifique Sud. *Cybium,* **7**: 1-23.

Moyle, P.B. and Cech, J.J.Jr. (1982). *Fishes : An Introduction to Ichthyology*. Prentice Hall Inc., New Jersey: 593 pp.

Nair, J.R. and Nair, N.B. (183). Studies on the breeding biology of the tropical glassy perchlet *Chanda* (=*Ambassis commersonii* (Cuv. & Val.) (Perciformes : Centropomidae). *Zool. Anz. Jene,* **212:** 240-253.

Natarajan, A.V. and Jhingran, A.G. (1961). Index of Preponderence - a method of grading food elements in the stomach analysis of fishes. *Indian J. Fish.*, **8**(1): 54-59.

Nelson, J.S. (1984). *Fishes of the World,* Wiley INterscience Publication (John Wiley & Sons), New York 2nd Ed. : 523 pp.

Pillai, K.M. (1981). Barracudas. *Mar. Fish. Infor, Serv. T&E Ser.* **31**: 9-10.

Premalatha, P. and Manojkumar, P.P. (1990). Some biological aspects of two species of barracudas from the south west coast of India. *Indian J. Fish.,* **37**(4): 289-295.

Qasim, S.Z. (1957). The biology of *Blennius*

pholis L. (Teleostei). *Proc. Zool. Soc. London.* **128:** 161-208.

Qasim, S.Z. and Qayyum, A. (1961). Spawning frequencies and breeding seasons of some freshwater fishes with special reference to those occurring in the plains of northern India. *Indian J. Fish.*, **8**: 24-43.

Somvanshi, V.S. (1989). Stock assessment of barracuda (*Sphyraena obtusata*) in the Gulf of Mannar off India. *Contributions to tropical fish stock assessment in India.* F.A.O. Publ. FI: GCP/INT/392/DEN/1: 87-101.

Suyehiro, Y. (1942). A study of the digestive system and feeding habits of fish. *Japanese J. Zool.* **10**: 1-303.

Valdes, M.E. (1980). Toxicity and feeding habits of some species of fish suspected to be ciguatoxic. *Inf. Cient. Tec. Inst. Oceanol. Acad. Cienc. Cuba.* **123**: 16 pp.

Walford, L.A. (1932). The California barracuda (*Sphyraena argentia*) I. Life history of the california barracuda. II. A bibliography of barracudas (Sphyraenidae). *Fish Bull. Sacremento*, **37**: 6-132.