Management of Scombroid Fisheries

Editors

N.G.K. Pillai
N.G. Menon
P.P. Pillai
U. Ganga

ICAR

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
Post Box No. 1603, Tatapuram P.O.
Kochi-682 014, India

Tuna live-bait fishes – their exploitation, conservation and management in Lakshadweep

A.K.V.Nasser, M.Sivadas, G.Gopakumar and P.P.Pillai

Central Marine Fisheries Research Institute, Kochi

ABSTRACT

The total annual catch of baitfishes form pole and line fishing areas of Lakshadweep is estimated to be 125 t. At Minicoy, the average annual catch is estimated at 9.1t and at Agatti it is estimated to be 51 t. Data from other baitfish fishing areas such as Suheli, Valiapani and Cheriyapani are virtually non-existent. Management options suggested earlier include the collection of fishery data from more areas, studying the biology and understanding the stock of exploited species, culture of suitable species and maintaining the health of the coral reefs of the islands. Future thrust areas for research to elucidate the factors that determine the baitfish fishery include a full review of the existing fishery and development of a baitfish statistics collection system. At present, there is a big lacuna in our knowledge about the fishery from some of the areas. The catch rates reported will have to be improved based on actual livebait catch weights. Biological studies and stock assessment of livebait resources may be attempted through well-planned research programmes. Finally, the interaction between environmental variations and livebait availability must be monitored extensively.

INTRODUCTION

Skipjack tuna (*Katsuwonus pelamis*) is caught from the Lakshadweep waters by the pole and line fishing method. This method comprises two fisheries: one for the baitfish and the other for tuna. Baitfishes are small fishes exploited from the sandy and coral areas in lagoons and adjacent reefs. Success of the tuna fishery depends on adequate quantities of baitfishes, which are used to attract schools of tuna to the boat, excite them into a feeding frenzy when they are caught by barbless hooks attached to pole and line. In view of the importance of baitfish to the tuna fishery, the Minicoy Research Centre of Central Marine Fisheries Research Institute is actively involved in monitoring the resource and also undertakes research on baitfish biology. Information on the fishery and biology of baitfish is given by Jones (1958), Jones and Kumaran (1959), Madan Mohan and Kunhikoya (1985),Pillai *et al.* (1986), Gopakumar *et al.* (1991), Nasser and James (1999), Nasser (1999) and Sivadas and Nasser (2000). This paper describes the baitfish fishery at Minicoy from 1985 to1999 and at Agatti from 1994 to 1997.

Catch estimates

Pole and line fishing vessels in Lakshadweep conduct only single day fishing trips. They leave the islands for baits fishing in the lagoons or

nearby reefs just before dawn, proceed to tuna fishing grounds in open sea and return with their catch in the evening. Data on the fishery is collected from the information supplied by the fishermen and by joining baitfish fishing trips. Details such as the time spent on baitfish fishing, species caught, quantity of bait caught and used, area of fishing and relative abundance were recorded. Effort is the total number of baitfishing trips made by the boats in a year while catch (in kg) is the total amount of bait caught for the respective effort.

Bait caught in a day was estimated on two occasions when the amounts of bait caught by a boat were weighed. The first catch was of the clupeid, *Spratelloides gracilis* that weighed 2.7 kg. According to the fishermen, it is a poor catch and on a good fishing day three to five times this amount would be caught with less effort. As a first approximation, the daily catch of clupeids at Minicoy varies between 9 and 15 kg. At Agatti, where the bait is exploited is exclusively *S. delicatulus,* the catch rate would be higher ranging from 13 to 20 kg. The estimates for caesionids, apogonids and pomacentrids are from 7 to 14 kg of bait in a day based on the fishing carried out in the second trip. The average annual catch at Minicoy was 9.1 t and at Agatti it is 50.9 t. At Suheli, Bitra and other islands where pole and line fishing is carried out, the bait is *S. delicatulus* and is harvested at a higher CPUE than that at Agatti. Based on the above estimates and the number of units in other areas, the annual bait caught in Lakshadweep would be about 125 t. This preliminary approximation will have to be refined by calculating the exact amount of *S. delicatulus* caught in a day by boats in the northern islands.

Annual catch estimation at Minicoy and Agatti

The Minicoy baitfishery showed an increasing trend in 1985 to 1988 and then declined to 2.8 t in 1991 (Fig.1). The period from 1993 to 1996 has very high catch averaging 13.8 t, which again declined in 1997. At Agatti, the average catch for a four-year period from 1994 to 1997 was 51 t with maximum catch of 59.2 t in 1995. The relationship between catch and effort at both sites was linear. This is due to the dynamics of the tuna pole and line fishery, as baitfish are essential to capture tuna, fishermen will leave baitfish grounds when catches decline and will try other area for bait supply (Dalzell and

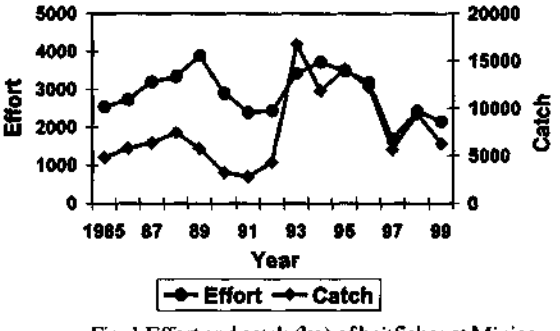

Fig. 1 Effort and catch (kg) of baitfishes at Minicoy

Lewis, 1988). At Agatti, there is a shuffling of sites with catches being rotated chiefly at Bangaram and Perumal Par. A change in the species of baitfish exploited and areas within the lagoon and reef compensates for temporary shortage of bait at Minicoy.

Bait species and their utilization

At Minicoy, a variety of species is used as baitfish (Table 1). The major groups, however are the clupeids, *Spratelloides delicatulus* and *S. gracilis;* caesionids, *Gynmocaesio gymnoptera* and *Pterocaesio tile;* apogonids, *Archamia fucata* and *Apogon thermalis.* Bait fishery in northern islands is targeted exclusively for *S. delicatulus* using encircling nets in shallow, sandy areas of the lagoon. Inter-annual variations in livebait utilization have been attributed by Anderson and Saleem (1995) to: changes in fishing effort causing direct changes in catch and overfishing, variations in baitfishing methods and behaviour of fishermen, fluctuations in meterological and/or oceanographic conditions, degradation of reef environmental conditions and abundance of other livebait species.

Table 1. Percentage composition of bait fish catch by species recorded at Minicoy in 1995 and 1996.

Family	Species	1995	1996
Clupeidae	*Spratelloides delicatulus*	18.8	47.0
	S.gracilis	21.4	11.1
Caesionidae	*Gymnocaesio gymnoptera*	6.6	11.0
	Caesio striatus	0.3	—
	C.caerulaureus	1.9	—
	Pterocaesio pisang	0.8	—
	P.chrysozona	1.9	0.6
	P.tile	5.0	2.4
Apogonidae	*Apogon thermalis*	3.3	7.9
	Archamia fucata	19.2	19.3
Pomacentridae	*Chromis viridis*	10.8	0.1

Tuna catch per unit bait (CPUB)

The average tuna catch at Minicoy during 1985 to 1994 was 810 t and at Agatti during 1994-'97 was 1,280 t. The amount of tuna caught per kg of bait (CPUB) at Minicoy ranged from 53 to 278 kg with a mean of 138 kg. At Agatti, due to the higher use of baitfish, CPUB averaged only 22 with a range of 19 to 27 kg. The CPUB estimates of Minicoy is far greater than those reported for other areas where the range is only 7.5 to 30.4 kg (Maniku *et al.*, 1990).

Conservation

Livebait abundance is influenced by oceanographic changes, modifications of the reef ecosystem and man-made or anthropogenic changes. Protecting the habitat of baitfish is of prime importance in sustaining the fishery. Blasting and dredging operations are carried out in certain islands of Laskhadweep. In spite of the use of traditional methods to preserve the fragile environemt (Haneefakoya and Nasser, 1999), the lagoon at Minicoy is indicating signs of degradation. Baitfishing itself causes damage to coral reefs. During the fishery for cardinal and damselfishes, palm fronds or poles are used to chase the fishes out of the corals. This results in extensive damage to the coral and reduces the habitat of major baitfishes.

Widespread use of other damaging gear such as gill nets and shore seines also cause damage to the habitat of reef fishes. These gears are employed during the monsoon months to catch food fishes belonging to the family Carangidae, Sphyraenidae, Lutjanidae, Holocentridae, Mullidae, Hemiramphidae and Lethrinidae. Gill nets get entangled with corals and in the process of retrieval, branching corals are broken. Shore seines destroy the corals along the shore and also uproot seagrasses, which are important spawning sites. Increasing use of lagoons as a dumping place for non-biodegradable wastes such as plastic and other garbage also endangers the system. Clearing the vegetation for human settlement and development of tourism also leads to increased run off resulting in sedimentation and death of corals.

MANAGEMENT STRATEGIES

Baitfish fishing forms an important component of the pole and line tuna fishery of Lakshadweep and hence has to be monitored regularly for suggesting management measures. Catch and effort data is available continuously only from Minicoy while the information of the structure of fishery from Suheli, Bitra, Cheriapani and Valiyapani are not available. Although data on the skipjack tuna catch is available form these islands, there is no information on the baitfish fishery. Nichols and Rawlinson (1990) outline the steps taken to monitor the baitfishery in Solomon Islands. Baitfish fishing record log sheets are supplied to vessels for collecting information such as name of vessel, date of fishing and fishing grounds, number of times the baitfish net is operated and species of bait caught. Experienced fishermen selected from each vessel may be trained to collect this information in return for a monthly monetary supplement.

Baitfish records now available are based on enquiry which are subject to bias and lack standardization. The baitfish fishing method followed at present cannot quantify the exact amount of bait caught by a boat in a day. Once the baitfish enters the net, it is hauled rapidly to the surface and the

captured bait transferred to the bait tank using a piece of cloth. Instead of the cloth, the bait can be transferred by buckets of 10 or 15 litre capacity. Number of buckets per haul maybe recorded. The wet weight of baitfish in one bucket according to species will have to be determined by undertaking experimental trials. This method would vastly improve the baitfish catch records and pave way for developing a baitfish statistics collection system.

Stock assessment of baitfishes is difficult because fishery – dependent information such as catch per unit effort is often not a good indicator of relative abundance (Wetherall, 1977). Traditional methods may not give a true picture of the fishery (Sivadas and Nasser, 2000) and relatively new procedures such as the egg production method (Somerton, 1990) should be employed. Length-frequency analysis and reproductive biology of major baitfish species is necessary to understand growth, mortality and recruitment patterns. Effects of environmental variations on livebait availability need further attention. The production of tropical clupeids is believed to be strongly influenced by wind and rainfall (Dalzell, 1990; Nasser and James, 1999). Anderson and Saleem (1994) noted that the occurrence of anchovies in some atolls of Maldives is related to the occurrence of *El Nino* Southern Oscillation (ENSO) events.

The baitfishery in Lakshadweep is self-regulatory because of the nature of the pole and line fishery, which requires adequate supplies of bait to go fishing for tuna. At Agatti, it is the availability of alternate sites for fishing while at Minicoy it is the range of species that are available for exploitation. As long as there is no substantial increase in fishing effort for tunas adequate quantities of baitfish will remain for the pole and line vessels to operate efficiently.

REFERENCES

Anderson, R.C. and M.R. Saleem. 1994. Seasonal and regional variation in livebait utilization in the Maldives. *Rasain,* **14**: 162-182.

Anderson, R.C. and M.R. Saleem. 1995. Inter-annual variation in livebait utilization in the Maldives. *Rasain,* **15**: 193-216.

Dalzell, P. 1990. Biology and population dynamics of tuna baitfish in Papua New Guinea. *In* : S.J.M. Blaber and J.W. Copland (Eds.) *Proc. ACIAR Workshop on Tuna Baitfish in the Indo-Pacific Region,* 11-13 December, 1989, Honiara, Solomon Islands, **30**: 100-113.

Dalzell, P. and A.D. Lewis. 1988. Fisheries for small pelagics in the Pacific Islands and their potential yields. *South Pacific Commission Workshop on Pelagic Inshore Fishery Resources,* 14-25 March 1988, Noumea, New Caledonia, 44p.

Gopakumar, G., P.P. Pillai and K.P. Said Koya. 1991. Population Character-

istics of tuna live baits in Lakshadweep. *J. mar. biol. Ass. India*, **33** (1 & 2): 255-277.

Haneefakoya, C.N. and A.K.V.Nasser. 1999. Community participation in reef management : an example of benign "dredging" from India. *Coral Reefs*, **18**: 320.

Jones, S. 1958. Tuna live bait fishery of Minicoy Island. *Indian J. Fish.*, **5** (2) : 300-307.

Jones, S. and M.Kumaran. 1959. The fishing industry of Minicoy Island with special reference to the tuna fishery. *Indian J. fish.*, **6** (1) :30-57.

Madan Mohan and K.K.Kunhikoya. 1985. Biology of the bait fishes *Spratelloides delicatulus* (Bennet) and *S. japonicus* (Houttuyn) from Minicoy waters. *Bull. Cent. Mar. Fish. Res. Inst.*, **36**: 155-164.

Maniku, H., R.C. Anderson and A. Hafiz. 1990. Tuna baitfishing in Maldives. *In*: S.J.M. Blaber and J.W. Copland (Eds.) *Proc. ACIAR Workshop on Tuna Baitfish in the Indo-Pacific Region* 11-13 December, 1989, Honiara, Solomon Islands, No. **30:** 22-29.

Nasser, A.K.V. 1999. Length-weight relationships of tuna baitfish from the Lakshadweep Islands, India. *Naga, The ICLARM Quarterly*, **22**(4) : 42-44.

Nasser, A.K.V. and P.S.B.R. James. 1999. Tuna baitfishery in Minicoy and Agatti Islands of Lakshadweep. *In* : M. Mohan Joseph, N.R. Menon and N. Unnikrishnan Nair (Eds.), *Fourth Indian Fisheries Forum, Proc.,* Asian Fisheries Society (Indian Branch), 24-28 November, 1996, Kochi, p. 353-356.

Nichols, P.V. and N.J.F. Rawlinson. 1990. Development of the pole-and-line fishery in Solomon Islands with reference to the baitfishery and its management. *In*: S.J.M. Blaber and J.W. Copland (Eds.) *Proc. ACIAR Workshop on Tuna Baitfish in the Indo-Pacific Region* 11-13 December, 1989, Honiara, Solomon Islands, No. **30:** 30-44.

Pillai, P.P.,M.Kumaran,C.S.G.Pillai,Madan Mohan,G.Gopakumar, P. Livingston and M. Srinath. 1986. Exploited and potential resources of live-bait fishes of Lakshadweep. *Mar. Fish. Info. Serv., T & E Ser.*, **68**: 25-32.

Sivadas, M. and A.K.V. Nasser. 2000. Tuna livebaits. *In :* V.N. Pillai and N.G. Menon (Eds.), *Marine Fisheries Research and Management*, Central Marine Fisheries Research Institute, Cochin, p. 468-478.

Somerton, D.A. 1990. Baitfish stock assessment using the egg production method: an application to the Hawaiian anchovy or nehu (*Encrasicholina purpurea*). *In*: S.J.M. Blaber and J.W. Copland (Eds.)

Proc. ACIAR Workshop on Tuna Baitfish in the Indo-Pacific Region 11-13 December, 1989, Honiara, Solomon Islands, No. **30:** 152-158.

Wetherall, J.A. 1977. Catch statistics and abundance of nehu, *Stolephorus purpureus*, in Kaneohe Bay. *In*: R.S. Shomura (Ed.), *Collection of Tuna Baitfish Papers, NOAA Technical Report & NMFS Circular,* **408**: 114 – 118.