Length-Weight Relationships of Tuna Baitfish from the Lakshadweep Islands, India

A.K.V. Nasser

Abstract

The parameters a and b of the length-weight relationship of the form $W=aL^b$ were computed for 11 species of baitfish from the pole-and-line fishery at Minicoy and *Spratelloides delicatulus* from the fishery at Agatti, Bangaram and Perumal Par.

Introduction

Length-weight relationships and population dynamics of fishes are studied with the major objective of rational management and conservation of the resource. Effective management of any fishery requires considerable knowledge regarding population parameters such as length-weight, age and growth, mortality and recruitment patterns of the exploited stock. Tuna baitfish by their very nature are only supportive fisheries, and the magnitude and distribution of the baitfishery normally depends on factors in the tuna fishery. Pole-and-line fishers always want to maximize bait catches, either to take advantage of a good tuna fishery or to catch as much tuna as possible when fishing is poor.

Spratelloides delicatulus caught by encircling net is the only species of live bait used in the northern islands while fishes belonging to Clupeidae, Caesionidae, Pomacentridae and Apogonidae caught by lift nets contribute to the fishery at Minicoy. Baitfish and their fishing techniques in the Indian Ocean have been discussed by Silas and Pillai (1982). Varghese and Shanmugham (1983) described the status of tuna fishing in Agatti Island of Lakshadweep. An exhaustive account of the bait fishery at Minicoy is given by Pillai et al. (1986). At Lakshadweep, population studies of baitfish have been restricted to length-weight relationships (Madan Mohan and Kunhikoya 1985; Madan Mohan et al. 1986; Gopakumar et al. 1991). The present study reports the length-weight relationship of 11 species of baitfish from the pole-and-line fishery at Minicoy and *S. delicatulus* from the fishery at Agatti, Bangaram and Perumal Par (Fig. 1).

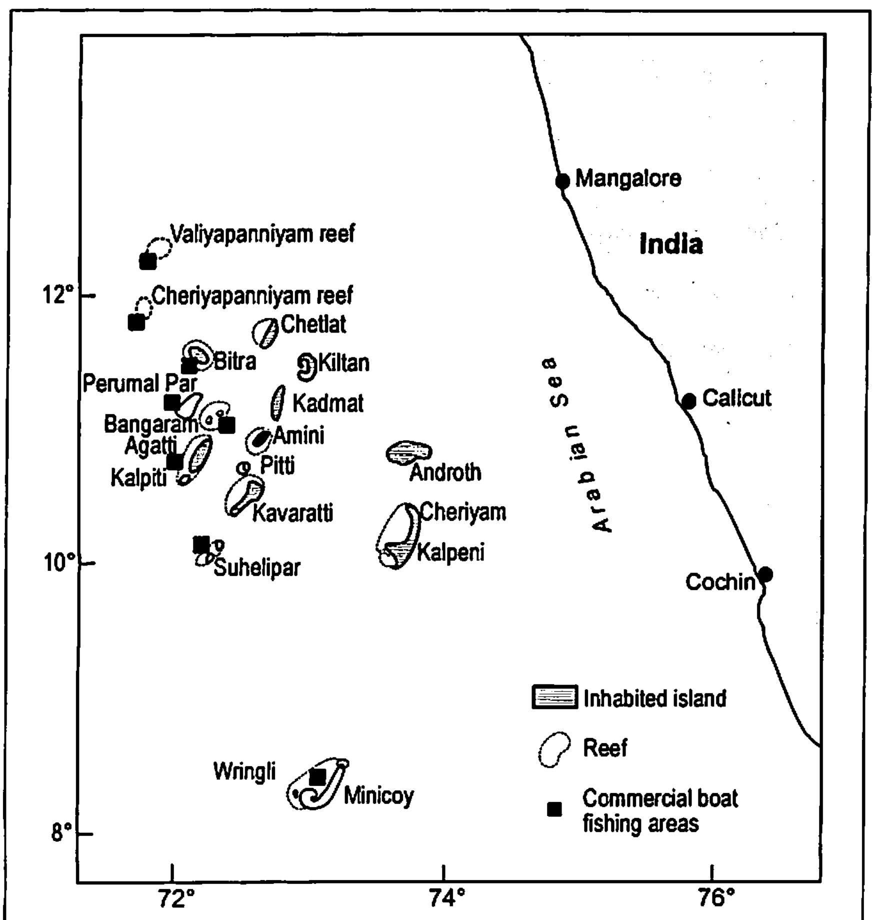

Fig. 1. Fishing areas in the Lakshadweep Islands, India.

Materials and Methods

Bait samples were collected from pole-and-line fishing boats during the 1988-1989 and 1989-1990 fishing seasons at Minicoy and Agatti. Fish length (TL, mm), weight (± 0.001 g) and sex were recorded for all the fishes of the sample collected at Minicoy. A subsample was randomly selected from the total sample of *S. delicatulus* obtained monthly at Agatti. Length-weight relationships were computed by the method of least squares.

Results

The length-weight relationships of the various baitfish at Minicoy are presented in Table 1. While females weighed more than males in the case of *S. gracilis* and all species of caesionids and apogonids, males were heavier than females for *S. delicatulus* and apogonids. Length-weight equations of *S. delicatulus* at the three locations of Agatti are given in Table 2. At Perumal Par, males were heavier than females while at Agatti and Bangaram the reverse was observed.

Table 1. Length-weight relationships of baitfish at Minicoy.

Species	Sex	Equation	r^2	N
Spratelloides delicatulus	M	$W = 8.48 \times 10^{-7} L^{3.53}$	0.98	42
	F	$W = 1.09 \times 10^{-6} L^{3.46}$	0.98	51
Spratelloides gracilis	M	$W = 1.51 \times 10^{-6} L^{3.33}$	0.96	94
	F	$W = 1.34 \times 10^{-6} L^{3.36}$	0.98	107
G. argenteus	M	$W = 1.37 \times 10^{-6} L^{3.39}$	0.96	87
	F	$W = 9.96 \times 10^{-7} L^{3.46}$	0.96	90
C. striatus	M	$W = 2.97 \times 10^{-6} L^{3.25}$	0.96	87
	F	$W = 2.43 \times 10^{-6} L^{3.29}$	0.96	63
Pterocaesio pisang	I	$W = 3.68 \times 10^{-6} L^{3.23}$	0.92	45
Pterocaesio chrysozona	M	$W = 2.81 \times 10^{-5} L^{2.73}$	0.98	9
	F	$W = 6.53 \times 10^{-6} L^{3.07}$	0.94	10
Caesio caeruleus	M	$W = 1.52 \times 10^{-5} L^{2.99}$	0.98	18
	F	$W = 2.19 \times 10^{-5} L^{2.91}$	0.98	29
L. tapeinosoma	M	$W = 2.64 \times 10^{-6} L^{3.41}$	0.94	24
	F	$W = 3.77 \times 10^{-6} L^{3.31}$	0.76	27
Apogon fucata	M	$W = 2.41 \times 10^{-4} L^{2.21}$	0.67	17
	F	$W = 1.65 \times 10^{-5} L^{2.68}$	0.92	25
Apogon thermalis	M	$W = 5.91 \times 10^{-7} L^{3.79}$	0.94	34
	F	$W = 1.91 \times 10^{-7} L^{4.10}$	0.94	35
Rhabdamia gracilis	M	$W = 3.64 \times 10^{-6} L^{3.29}$	0.96	22
	F	$W = 1.22 \times 10^{-6} L^{3.62}$	0.98	13

M = Male, F = Female, I = Indeterminate.

Discussion

Length-weight data are often used to study the indication of fatness, general well being or gonad development. It is also assumed that heavier fish of a given length are in better condition. *S. delicatulus* showed allometric growth at all the sites studied with weight increasing at a relatively faster rate (**b** > 3.0) than other species. Among the sites there was a wide variation with the lowest **b** value at Bangaram. Similar variation between locations for *S. delicatulus* has been reported (Milton et al. 1990). They attributed the reduced weight at one site in the Solomon Islands to the quantity and quality of food available. *S. gracilis* at Minicoy also indicated a faster allometric growth. Dalzell and Wankowski (1980) reported isometric growth for this species at Papua New Guinea and pointed out that whether a radical change in body proportions takes place between juvenile and adult phases is not known. The results of Gopakumar et al. (1991) for juvenile and adult *S. gracilis* from Lakshadweep seem to imply that juveniles have a slower rate of weight gain than adults. The **b** values obtained in this study are higher than those reported for this species from other locations (Dalzell and Wankowski 1980; Conand 1988; Milton et al. 1990; Gopakumar et al. 1991). It is also significant that the values reported earlier from Minicoy for this species (Madan Mohan and Kunhikoya 1985) are much lower than those obtained in this study. This may indicate the influence of changing environmental conditions on the general well being of the fish stock at Minicoy.

The higher **b** values for most caesionids suggest that reefs surrounding coral atolls are highly productive and hence support a higher biomass. Fusiliers are migrant forms (Gopakumar et al. 1991) which are found shoaling in the outer reef areas and temporarily associated with corals inside the lagoon. This migration is mainly a

Table 2. Length-weight relationships of S. delicatulus at Agatti.

Species	Sex	Equation	r^2	N
Agatti	M	$W = 1.40 \times 10^{-6} L^{3.30}$	0.92	70
	F	$W = 5.09 \times 10^{-6} L^{3.63}$	0.86	65
Bangaram	M	$W = 4.92 \times 10^{-6} L^{3.05}$	0.82	208
	F	$W = 3.05 \times 10^{-6} L^{3.18}$	0.94	197
Perumal Par	M	$W = 1.30 \times 10^{-6} L^{3.41}$	0.94	234
	F	$W = 2.80 \times 10^{-6} L^{3.20}$	0.92	238

M = Male, F = Female, I = Indeterminate.

prey avoidance strategy coupled with active feeding. They are in a different category from the other baitfish, with only juveniles used as bait in pole-and-line fishery and growing up to a length of about 25 cm (Carpenter 1984). Except for a few reports (Cabanban 1984; Bell and Colin 1986) there is practically no information on this group of baitfish. Caesionids form an important component of bait fishery at Minicoy during the months that they are available. It is also the most significant group in the tuna bait fishery of Maldives with several species being involved (Maniku et al. 1990). The deep-bodied pomacentrid, *C. caeruleus*, have a slower weight gain with **b** values approaching isometry. This is in agreement with the findings of Madan Mohan et al. (1986) who reported slightly lower values of 2.67 from Minicoy. Similar values were obtained for the relatively deep-bodied apogonid, *A. fucata*, with **b** considerably lower than 3.0. Gopakumar et al. (1991), however, observed values above 3.0 for this species from Lakshadweep.

Acknowledgements

The guidance and supervision of Dr. P.S.B.R. James, Former Director of CMFRI, during the period of this study is gratefully acknowledged.

References

Bell, L.J. and P.L. Colin. 1986. Mass spawning of *Caesio teres* (Pisces: Caesionidae) at Enewetak Atoll, Marshall Islands. Environ. Biol. Fish. 15(1):69-74.

Cabanban, A.S. 1984. Some aspects of the biology of *Pterocaesio pisang* (Bleeker 1853) (Pisces: Caesionidae) in Central Visayas. College of Science, University of the Philippines, Philippines. Ph.D. thesis.

Carpenter, K.E. 1984. Caesionidae. *In* W. Fischer and G. Bianchi (eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean. Vol. I. DANIDA, FAO, Rome.

Conand, F. 1988. Biology and ecology of small pelagic fish from the lagoon of New Caledonia usable as bait for tuna fishing. ORSTOM, Paris. Ph.d. thesis.

Dalzell, P.J. and J.W.J. Wankowski. 1980. The biology, population dynamics and fisheries dynamics of exploited stocks of three baitfish species, *Stolephorus heterolobus*, *S. devisi* and *Spratelloides gracilis* in Ysabel Passage, New Ireland Province, Papua New Guinea. Department of Primary Industry, Port Moresby. Res. Bull. 22:124 p.

Gopakumar, G., P.P. Pillai and K.P. Said Koya. 1991. Population characteristics of tuna live baits of Lakshadweep. J. Mar. Biol. Assoc. India 33:255-277.

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.

Madan Mohan, C.S.G. Pillai and K.K. Kunhikoya. 1986. Biology of the bluepuller, *Chromis caeruleus* (Cuvier), from Minicoy Atoll. Indian J. Fish. 33:457-470.

Maniku, H., R.C. Anderson and A. Hafiz. 1990. Tuna baitfishing in Maldives, p. 22-29. *In* S.J.M. Blaber and J.W.Copland (eds.) Tuna baitfish in the Indo-Pacific region. CIAR Proc. 30.

Milton, D.A., S.J.M. Blaber, G. Tiroba, J. Leqata, N.J.F. Rawlinson and A. Hafiz. 1990. Reproductive biology of *Spratelloides delicatulus*, *S. gracilis* and *Stolephorus heterolobus* from Solomon Islands and Maldives, p. 89-98. *In* S.J.M. Blaber and J.W. Copland (eds.) Tuna baitfish in the Indo-Pacific region, ACIAR Proc. 30.

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. Inf. Serv. Tech. Ext. Ser. 8:25-32.

Silas, E.G. and P.P. Pillai. 1982. Resources of tunas and related species and their fisheries in the Indian Ocean. Bull. Cent. Mar. Fish. Res. Inst. 32, 174 p.

Varghese, G. and P. Shanmugham. 1983. The status of tuna fishery in Agatti island in Lakshadweep. J. Mar. Biol. Ass. India 25:190-201.

A.K.V. Nasser *is from the Minicoy Research Centre of Central Marine Fisheries Research Institute, Minicoy, Lakshadweep 682 559.*