

Collapse of sand lobster fishery in Bombay waters

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ABSTRACT

The sand lobster *Thenus orientalis* started appearing in trawl catches at Bombay in 1978 and reached a peak of 374.7 t in 1982. During 1983-1987 period the catch remained stable around annual average of 260.9 t and contributed 0.34% of the total fish and 43.8% of the total lobster catch. After the second peak of 334.0 t in 1986, the catch declined rapidly to 2.2 t in 1994 and afterwards no catch was recorded. The entire fishery that lasted for 17 years, has been described in three phases, the developing, stabilized and declining phases. Biological investigations revealed that this slow growing species breeds only once a year during October-January and has low fecundity. The exploitation of spawning stock during the breeding period led to recruitment overfishing and consequent decline in the catches. In the absence of any stock management efforts, the removal of the spawning stock continued in the declining phase, which has led to total collapse of the fishery. In order to salvage this valuable resource, management option of banning further exploitation and returning the ovigerous female back to the sea have been suggested. Stock building process through sea-ranching of the species should be undertaken immediately.

Introduction

The scyllarid lobsters, commonly called sand lobsters, slipper lobsters or squat lobsters, constitute one of the important crustacean resources in the Indo-Pacific region. These lobsters grow to a moderate size and support fisheries of localised importance. In India, only one species of sand lobster, *Thenus orientalis* (Lund) occurring along both west and east coasts, forms a resource of commercial importance in Gujarat, Maharashtra and Tamil Nadu. In Maharashtra, *T. orientalis* fishery gained importance after the export of frozen rock lobster tails since early seventies. Initially, because of the taste and the attractive

colouration, rock lobster tails were exported and they gained popularity in foreign markets. The sand lobsters, however, on account of their muddy, unattractive colouration and small size were not appreciated. But slowly, owing to their fine delicate meat and the taste, the demand for sand lobsters went on increasing. Consequently the trawlers in Maharashtra exploited more and more sand lobsters to meet this unsatiable demand. The average annual landing of lobsters in the state during 1978-'88 period was 429 tonnes of which nearly 29% (124 t) was contributed by the sand lobsters (Kagwade *et al.*, 1991). But after 1986 there was a continuous decline in the catch, and finally after 1994,

excepting for few stray specimens, no catch of the species was recorded till date. This indicated almost complete overfishing of the stock from the coastal waters off Maharashtra. Therefore, an attempt is made in this investigation to find out the causes for the total destruction of this valuable resource, based on the available fishery data and biological and fishery information reported by Kabli (1989) and Kagwade and Kabli (1996 a, b).

Materials and methods

Catch and effort data were collected by the fishery survey assistants of C.M.F.R.I. from 1980-'98 at New Ferry wharf and Sassoon docks landing centres of Mumbai. These two are the largest fish landing centres of Maharashtra, which account for more than one third of the fish catch of the state. About 1500 trawlers operating in 30-80 m depth from Dahanu in the north to Ratnagiri in the south bring their catch at these landing centres. The biological information on size, growth, maturation, spawning, fecundity and sex-ratio reported by Kabli (1989), Kagwade and Kabli (1996 a, b) has been utilised in support of this investigation.

Results

Although sand lobster appeared in the trawl catches at New Ferry wharf and Sassoon docks even before 1978, the catch records were not maintained separately. Only when the exporters of frozen spiny lobsters found markets for the tail meat of sand lobsters in 1978, the trawlers commenced landing of the species at commercial scales in the subsequent years.

Table 1 gives catch, catch per boat trip and percentage of sand lobsters in total lobster and fish catch pooled for New Ferry wharf and Sassoon docks. It is seen that the fishery at Mumbai lasted for just 17-18 years since the commercial landing of the species commenced in 1979. During the

entire span of the fishery from 1978-1994, an estimated catch of 2401.1 t was landed at the catch rate of 2.47 kg/boat trip. It contributed to 0.13% of total fish catch and 37.1% of the total lobster catch comprising of panulirid spiny lobsters and scyllarid sand lobsters.

The sand lobster fishery began in 1978 with catch of only 1.5 t, which reached a maximum of 374.7 t in 1982 with highest C.P.U.E. of 8.247 kg/boat trip. Thereafter the catch fluctuated from year to year and again reached a second peak of 334.0 t in 1986. Subsequently, the fishery started its declining trend rapidly and reached a minimum of 2.2 t in 1994. Since 1994, although some stray specimens were observed, there was no noticeable landing, excepting for the year 1996, when about 2.0 t was recorded. On account of this rise and fall of the fishery, the fishery data have been segregated into three distinct phases (Table 2).

Phase I: This phase from 1978 to 1982 covering a span of five years can be regarded as a developing phase of the fishery. In this phase the initial catch was 1.5 t, which increased to the highest ever recorded level of 374.7 t in 1982. During this phase, the average annual catch was 159.5 t with C.P.U.E. of 4.181 kg/boat trip. The catch contributed 0.40% of the total fish landed and 46.3% of the total lobster catch. Monthwise percentage of the catch pooled for the developing phase of the fishery, (Table 2) shows that sand lobster was landed in all the months with two distinct peaks (June and December).

Phase II: The second phase of five years duration from 1983 - 1987 was a more or less stable phase, when catches with minor year to year fluctuations remained stable around annual average of 260.9 t and the catch rate was 5.659 kg/boat trip. This may be called a stable phase, during which a minimum of 204.5 t and a maximum of 334 t catch was recorded. The sand lobsters contributed to 0.34 % of the

TABLE 1. *Catch, C.P.U.E. and percentage of T. orientalis in total lobster and total fish catch in trawlers at Mumbai during 1978-1988*

Year	Catch(t)	C.P.U.E. in Kg/boat trip	% in fish	% in lobster
1978	1.5	0.51	0.006	0.76
1979	136.6	4.190	0.47	37.80
1980	140.4	3.381	0.41	42.58
1981	110.1	2.635	0.28	39.05
1982	374.7	8.247	0.54	68.06
1983	204.5	4.385	0.30	70.03
1984	291.3	6.508	0.41	52.79
1985	232.3	3.418	0.34	23.09
1986	334.0	7.048	0.36	32.04
1987	242.7	4.839	0.29	50.65
1988	183.3	3.642	0.19	49.54
1989	49.5	1.005	0.05	28.40
1990	59.4	1.262	0.06	24.13
1991	22.3	0.453	0.02	11.22
1992	7.5	0.138	0.005	5.12
1993	8.8	0.188	0.007	9.14
1994	2.2	0.043	0.002	1.79
1995	-	-	-	-
1996	2.0	0.046	0.001	1.96
1997	-	-	-	-
1998	-	-	-	-
TOTAL	2401.1	2.470	0.17	37.11

total fish and 43.8% of the total lobster catch of the stable phase. The monthwise catch also showed two peaks, the primary peak in June (15.6%) and the secondary peak in October (12.5%).

Phase III : The third phase was the declining phase from 1988-'94, which showed significantly continuous decreasing catches from 183.3 t in 1988 to the lowest of 2.2 t in 1994. During this phase C.P.U.E. declined from 3.642 kg/boat trip in 1988 to 0.043 kg/boat trip in 1994. Similarly, the percentage contribution of sand lobster to the total fish and total lobster catch also declined from 0.19 to 0.002% and 49.54 to 1.79% respectively. After this pe-

riod, although only a few stray specimens of sand lobster were observed at the landing centres, there was no noticeable catch in 1995 and the fishery collapsed totally. But once again a small quantity of about 2 t was noticed in 1996 during October - December period and there after despite a close watch, no catch was noticed in 1997 and 1998.

The monthwise catch (Table 2) during the declining third phase showed that the October peak was more prominent constituting 26.2% and a secondary peak in January with 14.2% of the total catch.

TABLE 2. *Monthwise pooled catch of T. orientalis and its percentage during three different phases at Mumbai*

Phases Months/Periods	Phase I 1978-'82		Phase II 1983-'87		Phase III 1988-'94	
	Catch		Catch		Catch	
	t	%	t	%	t	%
January	35.858	4.5	104.532	8.0	42.548	14.2
February	50.227	6.3	88.528	6.8	27.776	9.3
March	31.378	3.9	44.618	3.4	17.157	5.7
April	67.470	8.5	51.724	4.0	17.020	5.7
May	95.532	12.0	131.705	10.1	29.272	9.8
June	122.573	15.4	203.532	15.6	14.812	5.0
July	41.186	5.1	110.289	8.4	14.785	4.9
August	57.378	7.2	96.487	7.4	9.190	3.1
September	66.098	8.3	130.841	10.0	9.831	3.3
October	76.883	9.6	163.152	12.5	78.364	26.2
November	49.081	6.2	83.075	6.4	16.529	5.5
December	103.791	13.0	96.294	7.4	21.637	7.2
Total	797.455		1304.777		298.921	
Annual Mean	159.49		260.955		42.703	
C.P.U.E. in kg/ boat trip	4.181		5.659		0.860	
% in total fish	0.40		0.34		0.004	
% in total lobsters	46.3		43.8		22.1	

Spawning stock and fishery : The information on monthwise occurrence of mature and ovigerous females for the two years, 1985 and 1986 reported by Kagwade and Kabli (1996a) has been reanalysed by pooling the occurrence of ripe and ovigerous females to find out monthwise percentage of spawning females (Fig.1). Such well defined, single spawning period restricted to 3-4 months, is rarely exhibited by the tropical species.

Kagwade and Kabli (1996 b) estimated age and growth of the sand lobster and reported that it is a slow growing species; the commercial catches consisted of 3 years old males and 4.5 years old females. Females after attaining the sexual maturity grew even slower than males. From the sex-ratio of the species Kagwade and Kabli

(1996 a) inferred that sexes were not segregated from each other at any definite size or month. This clearly indicates that even during peak spawning period females remain in the fishing ground and do not undertake breeding migrations to either shallow or deep waters. They are therefore, equally vulnerable to the heavy fishing pressure of the postmonsoon fishing fleet.

The fecundity of sand lobster as reported by Kagwade and Kabli (1996 a) showed linear relation with size. It ranged from 20,050-53,280 for-240 mm sized females. This is far less as compared to 1,43,000-4,72,3000 for the spiny rock lobster *Panulirus polyphagus* which has protracted breeding period and produce eggs in at least four batches in a year (Kagwade

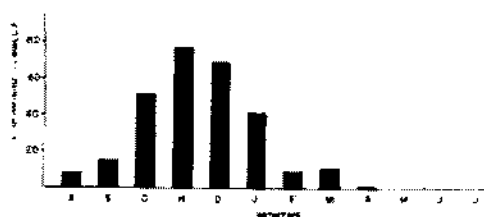


Fig. 1. Monthwise percentage of spawning females of *T. orientalis*

1988). Even for the scyllarid species, George and Griffin (1972) have reported fecundity of 750000 eggs. Thus sand lobster is a slow growing species with low fecundity. Spawning occurs in a short well defined period and the spawner is equally vulnerable to the fishing pressure. The exploitation of the spawning stock which constituted 33.3% to 34.3% of the total stock in the developing condition occurred in the catch from August - April with their percentage rising from 7.4% in August to a peak in November (77.0%) and declining again to 0.3% in April. For the rest of the months there were neither mature nor ovigerous females. During October, December, January and February their percentage was 53.5, 69.1, 41.5 and 10.9 respectively. Thus, sand lobster has a single, distinct spawning period with peak during October-January. Incidentally, the spawning females during October - January period formed 60.1% of the total females landed in the catch and the catch during spawning peak was 33.3% and 34.3% of the total during developing and stabilized phase of the fishery respectively. But during the declining phase, it constituted 53.1% of the total catch.

Discussion

Kagwade and Kabli (1996 a) reported that the spawning period of *T. orientalis* was from September-April covering a major peak in November and a minor in March. But their data clearly showed that the berried or ovigerous females mainly occurred during October to March, with two peaks in 1985 and a single peak in 1986. As the spawning population not only

consists of ovigerous females but mature or about to spawn females also, both the stages were clubbed together and the data pooled for the years 1985 and 1986 to avoid year to year variations. The re-analysis of the data clearly indicates that the species has a single spawning period with peak during October to January. Branford (1982) also reported that there is a single spawning period for *T. orientalis* occurring off Tokor delta in the Red Sea. Exploitation of the spawning females which formed 60.1% of the total catch might have been determined to the recruitment process of the species and resulted in rapid decline of the catch during subsequent years. This recruitment overfishing process continued unabated, and in the declining phase, when exploitation of the spawning stock increased to 53.2%, the fishery collapsed totally in 1995. In the absence of any management or conservation measures during in the subsequent years, whatever catch that appeared was landed only during spawning period, entailing further removal of the spawning stock, which led to almost total extermination of the stock.

Spiny lobster fisheries of the west coast of Africa, New Zealand and Western Australia have also declined over the years due to heavy exploitation (Bowen, 1980). But some of these countries have introduced management measures such as legal minimum size for capture, decrease in fishing effort by reducing the licensed fishing vessels, protection of ovigerous females by throwing them back into the sea and observing closed season. In the absence of any legal framework for the management of fisheries in the state, first two management options were not possible. The closed season during monsoon, from June 15th to August 15th, has been enacted in the state only recently. But this will not help in protection of spawning stock, as the breeding takes place during October-January. Therefore, conservation measure such as protec-

tion of ovigerous females by throwing them back into the sea could be adopted in future. This can be achieved only by educating and enlightening the fishermen. However, at present there is virtually no stock left in the sea, hence, catching of sand lobster in next five years should be banned totally and stock building attempts through sea ranching programmes should be taken up immediately.

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