THE OCEANIC TUNA FISHERY IN INDIA - AN UPDATE

V. S. Somvanshi and M. E. John

Fishery Survey of India
Botawala Chambers, Sir P. M. Road,
Bombay - 400 001
India

ABSTRACT

The present status of the oceanic tuna fishery in Indian waters is discussed. The fishery is exclusively by long lining, mainly foreign vessels operating under charter, with some Indian flag vessels. Under the charter scheme longliners started fishing in Indian waters in 1985. Maximum fleet size and effort (58 vessels, 19.8 million hooks) was in 1990. Consequent to the government policy of phasing out the charter scheme in favour of Indian ownership and joint-venture schemes, the number of vessels dropped to 17 and annual effort to about 3.9 million hooks in 1994. Under the Indian ownership and joint-venture schemes, 6 vessels of 42-55 m OAL are in operation.

Average annual production from the longline fishery in 1993-1994 was about 4114 t, 65% of which is contributed by the chartered vessels, 33.5% by Indian flag vessels and 1.5% by the survey vessels of the Government of India. Yellowfin tuna formed 46.5% of the catch, bigeye tuna 26.3%, billfishes 18.6% and other fishes (mainly sharks) 8.6%.

Research and development support for tuna fishing has been stepped up in recent years. Longline surveys yielded encouraging results indicating relatively high levels of abundance of yellowfin tuna in Indian waters. Biological research and environmental interaction studies of tuna distribution have been initiated, and preliminary results are available.

INTRODUCTION

The tuna fishery in Indian waters can distinctly be classified into a coastal fishery and an oceanic fishery. The pole-and-line and troll-line fisheries exploiting skipjack and young yellowfin tuna around Lakshadweep and the gillnet fishery around mainland India, in which different species of tunas occur, are the mainstay of the coastal tuna fishery, while the oceanic fishery is exclusively by longlining. While the smaller tunas and skipjack are the components in the coastal fishery, the large, deep-swimming yellowfin and bigeye tunas are the target species in the oceanic fishery. The status of the coastal tuna fishery has recently been discussed by James and Pillai (1994). The present paper addresses the status of the oceanic fishery, its recent trends, and the research support for optimum utilisation of the oceanic tunas and allied resources.

AVENUES FOR OCEANIC FISHING

Under the Maritime Zones of India (Regulation of Fishing by Foreign Vessels) Act, 1981, and the Rules (1982) made thereunder, the Government of India permitted the charter of foreign vessels for fishing in the Indian EEZ, and commercial tuna fishing in India started in 1985.

The three schemes introduced in 1991 are: (1) leasing of foreign fishing vessels by Indian entrepreneurs for operation in the Indian EEZ; (2) test fishing by engaging foreign fishing vessels; and (3) joint ventures between Indian and foreign companies in fishing, processing, and marketing.

As the charter scheme was originally envisaged as a prelude to joint-venture and Indian ownership enterprises, and having fulfilled to a large extent the objectives of chartering of enabling Indian entrepreneurs to acquire experience in deep sea / oceanic fishing, training Indian operative staff, enhancing our knowledge of resources, *etc*., the government decided in 1992 to gradually phase out the charter scheme in favor of joint ventures and Indian-owned vessels.

CHARTER FISHING

Introduced in 1985, fishing under the charter scheme witnessed phenomenal growth in subsequent years, taking India to the position of second largest producer of yellowfin tuna in the longline fishery in the Indian Ocean in 1990. Results of fishing under this scheme have been discussed by several authors (John *et al.*, 1988, 1991; Sudarsan *et al.*, 1990, 1991a; Sivaprakasam *et al.*, 1992, 1993, 1994; Sudarsan and John, 1994 a; Vijayakumaran *et al.*, 1995). An overview of the longline fishery for tunas under the charter scheme and its present status are discussed in this section.

EFFORT, CATCH AND CPUE

The chartered fishing fleet consists mostly of vessels of Taiwanese origin flying the flags of Panama or Honduras.

***Table 1**. Structure, by tonnage class, of the chartered tuna longline fleet operating in Indian waters, 1985-1994*

GRT	*200-400*	*400-600*	*600-800*	*800-1000*	*Total*
1985	1	-	-	-	1
1986	1	9	-	-	10
1987	1	3	1	-	5
1988	2	4	2	-	8
1989	2	13	15	-	30
1990	-	13	45	-	58
1991	1	2	19	-	22
1992	2	6	15	-	23
1993	3	7	18	-	28
1994	2	7	5	3	17

***Table 2**. Fishing effort of chartered tuna longline vessels operating in Indian waters, 1985-1994*

Year	*Number of vessels*	*Number of voyages*	*Voyage days*	*Sets made*	*Hooks operated (millions)*
1985	1	1	29	26	0.04
1986	10	15	1,062	768	1.54
1987	5	9	647	513	1.23
1988	8	13	840	655	1.57
1989	30	39	3,281	2,237	6.26
1990	58	81	9,187	6,608	19.82
1991	22	26	2,869	2,224	7.18
1992	23	29	3,282	2,474	7.92
1993	28	37	2,049	1,636	5.24
1994	17	17	1,394	1,213	3.88

The vessels are of 42 to 60 m OAL, with GRT ranging from 364 to 825. The structure of the fleet by tonage class in each year of the 1985-1994 period is shown in Table 1, and the fishing effort in Table 2. The maximum number of 58 vessels operated in 1990, when the effort reached 19.8 million hooks. Due to a shift in policy with regard to the issue of licences, the number of vessels fell to 17 in 1994.

The catch data are given in Table 3. The average annual catch in 1993-1994 was about 2674 t, consisting of yellowfin tuna (63.9%), bigeye tuna (4.2%), billfishes (24.8%), and other fishes (mainly sharks) (7.1%). The mean catch per fishing day during the period was 1.9 t, of which the yellowfin tuna component was 1.2 t.

FISHING AREAS AND SEASONS

The highest concentration of fishing effort (52%) was off the north-west coast, followed by Andaman & Nicobar waters (15%) and the south-east coast (13%). The vessels followed a clear operational strategy in the selection of fishing grounds with respect to different regions and months. Along the north-west coast, fishing activity starts by April and increases progressively to reach the peak by August-September. By the latter half of September the vessels start moving to the south-west coast, and in October maximum fishing effort is concentrated off that coast. From November the main fishing activity shifts to the Bay of Bengal, where it is more concentrated in Andaman & Nicobar waters during November-January and along the east coast during December-March. By April, vessels start moving back to the west coast, and from May fishing occurs exclusively off that coast. The quarterly distribution of effort by 5º square is shown in Figure 1.

FISHING BY INDIAN OWNERSHIP AND JOINT-VENTURE VESSELS

Making use of the liberal policy initiatives and institutional financing, the Indian fishing industry has already taken up tuna fishing, with all the catch going for export. One industrial longliner has been in operation since 1986, and five longliners of 42 to 55m OAL were added to the fleet in 1992-1993. A number of other protects for acquisition of tuna vessels are planned, as is the conversion of part of the shrimping fleet (vessels of 23-28 m OAL) to tuna fishing with monofilament longlines.

Catch statistics for the Indian vessels are given in Table 4. The average annual catch during 1993-1994 was 1379 t, consisting of yellowfin tuna (14.0%), bigeye tuna (70.4%), billfishes (7.0%), and sharks (8.6%). The high percentage of bigeye tuna caught by these vessels, in contrast to a meagre 4.21% for the chartered vessels, is significant.

CATCHES BY GOVERNMENT OF INDIA SURVEY AND TRAINING VESSELS

Catches made by survey and training vessels of the Government of India also formed an important component of the longline catch from Indian waters. The details for the 1983-1994 period are given in Table 5.

OVERALL PRODUCTION FROM OCEANIC FISHING

The total longline catches from Indian waters during 1983-1994 by chartered vessels and by Indian commercial and survey and training vessels are shown in Table 6. The highest annual catch was 12713 t, reported in 1990. In 1993-1994 the average annual catch was 4114 t, consisting of 1913 t of yellowfin tuna, 1084 t of bigeye tuna, 766 t of billfishes, and 351 t of other fishes (mainly sharks).

Table 3. *Catches by chartered tuna longline vessels operating in Indian waters, 1985 - 1994, in t.*

Year	*Yellowfin*	*Bigeye*	*Billfish*	*Other*	*Total*
1985	3	-	2	2	7
1986	839	86	169	809	1,953
1987	473	66	263	104	906
1988	627	11	216	93	947
1989	2,891	56	609	434	3,986
1990	10,352	2,56	1,478	485	12,571
1991	3,784	3,43	705	366	5,198
1992	4,349	139	655	528	5,671
1993	2,071	62	461	174	2,768
1994	1,344	164	866	205	2,579

Table 4. *Catch (t) statistics of Indian-owned/joint-venture tuna longline vessels operated in Indian waters, 1986-1994.*

Year	*Yellowfin*	*Bigeye*	*Billfish*	*Other*	*Total*
1986	229.3	-	31.9	231.4	492.6
1987	141.7	-	22.7	125.9	290.3
1988	98.7	-	10.7	116.8	226.2
1989	19.1	-	9	31.1	59.2
1990	4.1	-	6.6	62	72.7
1991	34.8	-	13.2	106.8	154.8
1992	10.8	-	14.4	84	109.2
1993	218.8	866.2	43.3	150.1	1,278.4
1994	168.7	1,076.3	149.9	85.2	1,480.1

RESEARCH SUPPORT

The exploratory tuna surveys conducted by the Fishery Survey of India had a tremendous impact on the growth of the longline fishery in India. Extensive surveys in different regions of the EEZ generated data on the availability and distribution of oceanic tunas and tuna-like fishes. Rich tuna grounds were charted, productive seasons identified, and estimates of the likely catch from the EEZ made. The survey results were disseminated from time to time to the fishing industry and other end-users (Varghese *et al.*, 1984; Sulochanan *et al.*, 1986; Sivaprakasam and Patil, 1986; Sivaprakasam and Sudarsan, 1988; Sudarsan *et al.*, 1988a, 1988b, 1988c, 1993; John and Sudarsan, 1993). The results of the chartered vessels' operations were also published at regular intervals. These reports provided the basic data support to the industry for the establishment of tuna fishing in the country. There is, however, a serious lack of data for investment decisions in the area of tuna purse-seining. This gap needs to be filled in the coming years.

In recent years, a beginning has been made in biological studies of yellowfin tuna occurring in oceanic waters, as reported by John and Reddy (1989), John and Sudarsan (1993) and Sudarsan and John (1994). The results of important biological investigations available are given in Table 6.

A Colloquium on Tuna Research organised by the Fishery

Figure 1*. Distribution of effort chartered tuna by longline fleet, 1992-1993.*

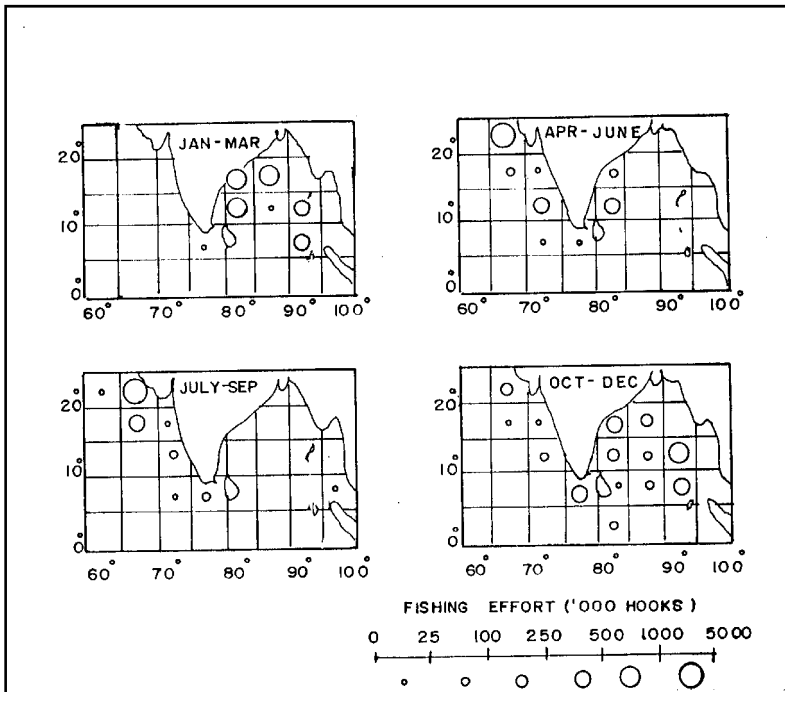

Table 5. *Catch (t) statistics of Government of India survey/training vessels operated in Indian waters, 1983-1994.*

Year	*Yellowfin*	*Bigeye*	*Billfish*	*Other*	*Total*
1983	14.0	1.5	10.8	33.8	60.1
1984	41.6	1.7	23.9	34.3	101.5
1985	114.9	0.9	18.9	47.2	181.9
1986	415.8	1.2	35.4	52.9	505.3
1987	97.7	0.7	23.3	59.3	181.0
1988	33.8	0.1	23.2	42.9	100.0
1989	11.7	0.1	12.5	20.7	45.0
1990	13.0	0.2	13.1	42.8	69.1
1991	14.2	-	5.3	9.2	28.7
1992	29.0	0.4	9.9	68.5	107.8
1993	8.5	0.2	5.7	56.4	70.8
1994	15.6	0.1	4.7	30	50.4

Table 6. *Results of biological investigations of tunas in the Indian Ocean.*

Parameter	*Study area*	*Results*	*Source*
L_∞	*Arabian Sea*	*175 cm*	*John and Reddy, 1989*
K (year -1)	*Arabian Sea*	*0.29*	*John and Reddy, 1989*
Natural mortality	*Arabian Sea*	*0.74*	*John and Reddy, 1989*
Sex ratio (F:M)	*EEZ*	*1 : 2.28*	*John and Sudarsan, 1993*
L/W relationship	*EEZ*	$W = 3.9258x10^{-5}\ L^{-2.8318}$	*John and Sudarsan, 1993*
Spawning season	*EEZ*	*Jan. - Apr.*	*Sudarsan and John, 1993*
Major food contents	*EEZ*	Loligo *sp.,* Charybdis *sp., teleost fishes*	*John and Sudarsan, 1993*

Survey of India took stock of the status of tuna research in India and set guidelines for future research (Sudarsan and John, 1993).

A study of the pattern of spatial and seasonal fluctuations in water temperature profiles and their influence on tuna distribution was recently made by scientists of the Fishery Survey of India and the National Institute of Oceanography (Nair and Muraleedharan, 1993).

In view of the potential applications of satellite remote sensing to tuna fishing, inter-institutional studies by the Fishery Survey of India in Bombay and the Space Application Centre in Ahmedabad are in progress. A recently commissioned study focuses on tuna exploration using satellite and sea truth data, with emphasis on internal waves, mixed layer depth, sea mounts, etc.

CONCLUSIONS

The tuna surveys and the operations of chartered vessels have indicated relatively high levels of availability of yellowfin tuna in Indian waters. John and Sudarsan (1994) recently made a comparison with the hook rates for yellowfin tuna for Japanese, Taiwanese and Korean commercial longliners in the Indian Ocean and also with the results of exploratory and experimental fishing in the seas around other Indian Ocean countries (Sri Lanka, Maldives, Myanmar, Thailand, Indonesia and Malaysia), and observed that hook rates in the Indian waters are significantly higher. The high level of CPUE, despite the increasing effort, is indicative of the healthy state of the stock. The chartered vessels' operations have confirmed the sustainable economic viability of tuna-fishing with longlines in Indian waters. The fishery is currently undergoing a transition from fishing under a charter scheme to fishing by Indian flag vessels.

REFERENCES

JAMES, P.S.B.R. AND P.P. PILLAI. 1994. Review of the national tuna fisheries - India. IPTP Coll. Vol. Work. Doc., 8: TWS/93/l/2: 2-5.

JOHN, M.E. AND K.S.N. REDDY. 1989. Some considerations on the population dynamics of yellowfin tuna, *Thunnus albacares* (Bonnaterre) in Indian seas. Studies on fish Stock Assessment in Indian waters. FSI Special Publication, 2: 33-54.

JOHN, M.E. AND D. SUDARSAN. 1993. Fishery and Biology of yellowfin tuna occurring in oceanic fishery in Indian Seas. In: Sudarsan, D. and M.E. John (eds.), Tuna Research in India : 39-61.

JOHN, M.E., S.M. PATIL AND V.S. SOMVANSHI. 1988. Tuna resources off the east coast of India as revealed by charter operations. Further studies on Tuna Resources in the Indian Exclusive Economic Zone. Bull. Fish. Surv. India, 17: 22-46.

JOHN, M.E., D. SUDARSAN AND A.K. BHARGAVA 1991. Trends in tuna longline fishery in Indian seas with particular reference to exploitation of yellowfin tuna. IPTP Coll. Vol. Work Doc. 6: TWS/91/70: 76-87.

JOHN, M.E. (MS). Studies on yellowfin tuna, *Thunnus albacares* (Bonnaterre, 1788) in Indian seas.

SIVAPRAKASAM, T.E. AND S.M. PATIL. 1986. Results of exploratory tuna longline survey conducted in the Arabian Sea off south-west coast of India during 1985-86. Occ. Pap. Fish. Surv. India, 3: 11 pp.

SIVAPRAKASAM, T.E. AND D. SUDARSAN. 1988. Tuna resources off the south-west of India as surveyed during 1986-87. Further studies on Tuna Resources in the Indian Exclusive Economic Zone., Bull. Fish. Surv. - India, 17: 1-24.

SIVAPRAKASAM, T.E., M.E. JOHN AND A.K. BHARGAVA. 1992. Chartered Fishing Vessels Operations in the Indian EEZ. 2, FSI: 20pp.

SIVAPRAKASAM, T.E., M.E. JOHN, A.K. BHARGAVA AND VAIJAYANTI RANE. 1993. Ibid., 3: 18pp.

SUDARSAN, D. AND M.E. JOHN (EDS.) . 1993. Tuna Research in India FSI, Bombay: 204pp.

SUDARSAN, D. AND M.E. JOHN. 1994a. Oceanic tuna fishery in India - recent trends. IPTP Coll. Vol. Work. Doc. 8: 5-9.

SUDARSAN D. AND M.E. JOHN. 1994b. Further studies on biological aspects of yellowfin tuna in the Indian EEZ. IPTP Coll. Vol. Work. Doc. 8: 135-140.

SUDARSAN, D., M.E. JOHN AND V.S. SOMVANSHI. 1988a. Observations on abundance, distribution and seasonality of yellowfin tuna in Indian seas as revealed by exploratory surveys during 1983-88. IPTP Coll. Vol. Work. Doc. 3. TWS/88/71: 251-261.

SUDARSAN, D., V.S. SOMVANSHI AND M.E. JOHN. 1988b. Atlas of tunas, billfishes and sharks in the Indian EEZ and adjacent oceanic regions. FSI/FC(FA)2/88: 57pp.

SUDARSAN, D., T.E. SIVAPRAKASAM, V.S. SOMVANSHI, M.E. JOHN, K.N.V. NAIR AND A. JOSEPH. 1988 c. An appraisal of the marine fishery resources of Indian Exclusive Economic Zone. Bull. Fish. Surv. India, 18: 85pp.

SUDARSAN, D., NI.E. JOHN, AL.IC. BHARGAVA AND S.TH PATIL. 1990. Tuna longline fishery in India. IPTP Coll. Vol. Work. Doc. 4, TWS/90/23: 234-243.

SUDARSAN, D., T.E. SIVAPRAKASAM, M.E. JOHN, A.K. BHARGAVA, S.M. PATIL AND V.V. NAIK. 1991a. Chartered fishing vessels operations in the Indian EEZ, 1. FSI: 29pp.

SUDARSAN, D., M.E. JOHN AND K.N.V. NAIR. 1991. Some biological considerations of the yellowfin tuna, *Thunnus albacares* (Bonnaterre) taken by longline gear in the Indian EEZ. IPTP Coll. Vol. Work Doc. 6: TWS/91/11: 18-26.

SUDARSAN, D., T.E. SIVAPRAKASAM, V.S. SOMVANSHI AND M.E. JOHN. 1993. Assessment of oceanic tuna and allied fish resources in the Indian EEZ based oh exploratory surveys. Proceedings of the National Conference on Tunas, April 1989, Cochin: 44-53.

SULOCHANAN, P., M.E. JOHN AND K.N.V. NAIR. 1986. Preliminary observations on tuna resources of the Arabian Sea with particular reference to distribution pattern of yellowfin tuna, *Thunnus albacares* (Bonnaterre). Bull. Fish. Surv. India, 14: 21-33.

VARGHESE, K.K., M.E. JOHN AND V. SIVAJI. 1984. Some observations on the tuna resources of the Indian Ocean. Bull. Fish. Surv. India, 13: 30-33.

VIJAYAKUMARAN, K., M.E. JOHN, A.K. BHARGAVA AND VAIJAYANTI RANE. 1995. Chartered fishing vessels operations in the Indian EEZ, FSI.