

FISHERIES SECTOR AND ECONOMIC GROWTH IN INDIA

K. Murugan* and K. Jothi Sivagnanam**

Fisheries sector plays a significant role in the Indian economy. The share of sector contributions in GDP was 1.07 percent during 2012-13, and its share in the GDP of the agriculture sector was 5.40. The fish production in India has reached 8.30 million tonnes per annum during 2013-14. The export earnings per annum have reached USD 2.9 billion mark and this is about 17 percent of nation's total export earnings. The sector has transformed from traditional activity into a significant commercial enterprise. Thus, it is obvious that increasing fish production will certainly help to promote growth and development but fish, particularly marine resources, are fast depleting due to overexploitation of our coastal areas. The basic objectives of the development programmes encouraged intensive capture fishing in the territorial waters, rather than enabling sustainable fishing practices. Government of India established fishing harbours, fish landing centres with facilities for handling of fish catches. These harbours and fish landing centres were established to take care of post-harvest operations to minimize fish losses. Moreover, the policy on infrastructure ensured adequate berthing and landing facilities for fishing vessels rather than being cleaner and 'state of art' fishing harbours/ fish landing centres. The post-harvest infrastructure requires adequate storage and handling facilities, both within the fishing harbours/fish landing centres and also at the market centres.

Keywords: Fish Production, Fishing Harbours

INTRODUCTION

Fisheries sector are contributing food security and nutrition and it is to ensure sustainable development in economic, social and environmental safeguards. Growth in the global supply of fish for human consumption has outpaced population growth in the past five decades, increasing at an average annual rate of 3.2 percent in the period 1961–2013; double that of population growth, resulting in increasing average per capita availability. World per capita apparent fish consumption increased from an average of 9.9 kg in the 1960s to 14.4 kg in the 1990s and 19.7 kg in 2013, with preliminary estimates for 2014 and 2015 pointing towards further growth beyond 20 kg (The State of Food and Agriculture, FAO, 2016).

The annual per capita consumption of fish has grown steadily in developing regions (from 5.2 kg in 1961 to 18.8 kg in 2013) and in low income food-deficit countries (LIFDCs) (from 3.5 to 7.6 kg), it is still considerably lower than that in more developed regions, even though the gap is narrowing. In 2013, per capita apparent fish consumption in industrialized countries was 26.8 kg. A sizeable and growing share of fish consumed in developed countries consists of imports, owing to steady demand and static or declining domestic fishery production (The State of Food and Agriculture, FAO, 2016).

Fisheries sector have contributes 15 percent of the animal protein in the human diet in the worldwide. Fisheries sector plays a significant role in the Indian economy in terms of its contribution to growth

* Assistant Professor, Department of Economics, Guru Nanak College (Autonomous), Velachery, Chennai, Tamil Nadu, E mail: murugan.kaliappani@gmail.com

** Professor and Head, Department of Economics, University of Madras, Chennai, Tamil Nadu E mail: kjothisiva24@gmail.com

and development. The share of sector contributions in GDP was 1.07 percent during 2012-13, and its share in the GDP of the agriculture sector was 5.40. The fish production in India has reached 8.30 million tonnes per annum during 2013-14. The export earnings per annum have reached USD 2.9 billion mark and this is about 17 percent of nation's total export earnings (A Fisheries Handbook Statistics, Government of India, 2015).

The fisheries as food and a rich source of cheap protein started receiving wider attention after the Second World War. The need to keep the population with supplemental diets and the nature's bounty in terms of rivers, canals, lakes, sea came handy in the minds of planners and the administrators who were looking for solutions to human starvation. The necessity also compelled the Governments worldwide to prepare contingency plans to exploit fishery resources.

The fish stocks are not exploited for its own sake; they are exploited because man needs food, employment and income. Therefore, there is an essential difference between management of stocks and fishery development, which is aimed at improving the social welfare. While the two do run parallel up to a certain extent, the scope of fishery development policy is considerably broader than that of management alone.

The demand for fish is determined by its traditional role in local diet, income level of the consumers and the price of potential substitutes like meat or chicken as compared to the price of fish. However, especially, in developing countries, distribution network may be very rudimentary and as such fish may be only regularly available in or near the fishing ports. Demand for fish is then only apparent in areas where fish is marketed, i.e., along the coast. In the interior, there may potential demand which remains unsatisfied. Similar reasoning applies to the distribution between rural and urban areas. Huge demand concentrated in the cities creates an incentive for private entrepreneurs to supply fish there, but distribution of fish among dispersed rural, even costal population may be considerably less rewarding. Landed fish can be destined for fresh consumption or further processing. The consumer has the choice of many species and kinds of fishery products.

Government Policies on Fisheries Sector

Many governments of the world, and India is no exception, have the stated policy goals to improve the national level of nutrition. The targeted populations are the lower economic fractions that normally have low animal protein levels in their diet. The highly priced species of white fish are outside the purchasing ability for this segment of the population. Often, these fish are small in size, of little economic value and presently handled in bulk in such a way that they can only be utilized for fish meal. This carries more emphasis in the present day context of any fishery development, as fish and fishery products contribute to the nutrition of economically deprived classes in developing countries. Their significant contributions as a foreign exchange earner lends more moral and legal support for special emphasis in any type of development plan of the nation.

In the marine fisheries sector, the Central Government has been implementing a Central Sector Scheme since 1964 to provide infrastructure facilities for landing and berthing of marine fisheries vehicles, traditional and motorized fishing craft and deep sea fishing vessels. So far, out of the 1376 fishery centre's situated in 3322 costal fishing villages along the Indian coast, only 256 fishing centre's have been developed, which form only 18.6 percent of the existing fishing centre's. The facilities created so far are adequate to accommodate only about 25-30 percent of the country's MFVs, resulting in over-crowding and a host of other accompanying problems. This proves that, there is an imperative need to develop more fishing harbours and landing centre's to meet the

requirements of the existing fishing fleet (Planning Commission, Government of India, 2011).

The development of the fisheries sector in India, dates back to the Second World War, wherein, the then Indian Government decided to go for intensive fish production programme as a part of 'Grow More Food Campaign' to supply food to the Indian army and the masses. However, the Government's Five Year Plans are the real kick-starters for organized fisheries Development, as part of agricultural development. Earlier, the emphasis was on fish production in water bodies like lakes, rivers, canals and reservoirs.

The Marine Fisheries Development Programme took a concrete shape since the middle of 1950 and came to a peak in late 1970s with Indo-Norwegian collaborative projects. The maritime states got the technology for fishing vessels and synthetic fishing nets. The collaborative project had completely changed the technical focus of the fishing economy completely by 1978. The emphasis was on fishing in inshore waters, using mainly the Trawl nets. The candidate species aimed at was shrimp, which was intended for export market. The assumptions were that sea had abundance of resources and therefore, it had to be exploited. Thus the marine subsector has experienced three recognized phases of development. Phase I was a pre-development stage (up to 1965), where fishing was still largely dominated by small indigenous craft and gear, and mechanization was in the very early stages. Phase II (1965 to 1986), reflected a major expansion in the use of synthetic gear, focus on exports, increases in the number of large mechanized vessels, government investments in the new fishing harbours, introduction of purse seine harvesting, and the start of motorizing smaller artisanal boats that could now extend their range further off shore. Phase III (1986-2000) witnessed substantial growth in motorization of the artisanal craft, increased use of ring seines, extension of fishing grounds off-shore, increase in the extended voyage fishing, and introduction of seasonal closure of fisheries. The fourth phase (post 2000 modernization) now undergoing with stagnation in in-shore catches, reduced investments and increasing conflict over new access to sea fishing. This is the result of "open access" nature of in-shore marine fisheries, as well as policies and management systems that failed to control the expansion of total fishing efforts to a level commensurate with the productivity of the resources.

Apart from quality, fish also constitutes quantitatively a good source of protein. The edible portions of fresh water and estuarine fishes investigated in India contain about 14-25 percent protein. In marine fishes also quantitatively, fish consumption might in a significant measure supplement the low-protein, high-cereal diet consumed in many countries of the world. Fish, including processed fish like fish flour, has been found to improve such diets. Cereal proteins are rather low in lysine and methionine, in both of which fish protein is relatively rich (Twelfth Five Year Plan, Government of India, 2012-17).

LITERATURE REVIEW

There are very few studies about the evaluation of fisheries sector in India. However, there are a few studies carried out in countries like Bangladesh. For instance, (Nowsad Alam, FAO, 2010) a conducted a study in Bangladesh and developed a new model to estimate the percent loss of fish at each stage of distribution channel and prescribed some appropriate loss reduction interventions considering the estimated losses of fish and fish products.

The International Fisheries Research Meeting in Paris in 1991 prioritized the need of estimating post-harvest fish losses with the conclusion that there has been no tried and tested methods by which fish loss could be estimated (Ward, FAO, 2000). Ward developed a field and desk based

tool to estimate post-harvest fish loss in West Africa and validated it in many African and Asian countries which dealt with assessment problems in detail touching almost all the aspects of post-harvest fishery losses. The physical loss assessment model was developed based on information on economic value of the fish lost at every step of distribution, collected by participatory rural appraisal that provided qualitative data and the questionnaire on loss assessment method provided quantitative data (Ward, FAO, 2000).

About 28 percent of landed fish lost 60-70 percent freshness and hence, the quality before it reached the consumer in local retail wet fish trader's shop. It has been assumed that the trend of post-harvest loss of wet fish is almost similar throughout the country, although the actual loss might be very high.

Studies revealed very high level of post-harvest loss during pre-processing, processing, storage and transportation of fishery products (Nowsad, 2006). Infestation of sun-dried fish by the blowfly and beetle larvae caused up to 30 percent loss of the products (Bala and Mondol, 2001, Nowsad, 2005). Dried fish contaminated by both insects and harmful insecticides comprises about 80 percent of the total dried products that is considered unfit for human consumption. Salted ilish, *Tenualosa ilisha* and smoked *Metapenaeus* shrimp had suffered from qualitative (nutritional loss) and quantitative losses (eaten out by insects, moisture loss and fragmentation) as the raw materials were not adequately handled and the products were preserved and marketed through open bamboo baskets (Nowsad, 2005). Typical fermented fish paste, *nga-pi*, and semi-fermented *shidhal* were found to be prepared under very unhygienic conditions: there were evidences of contamination and deterioration of raw materials and products

Coulter and Disney (1987) found the most serious marketing difficulties occurred in remote fishing communities in the Bay of Bengal and enclosed inland waters which lacked regular supplies of ice and transport, and where fishermen were in a particularly weak position in relation to intermediaries. In these locations much fish were processed into lower valued cured products and the process of curing involved considerable losses through spoilage and infestation.

The overall aim of the study is to examine the growth, composition and the contribution of the fisheries sector in India. The study is based on secondary sources. The secondary sources on growth, species composition, catch disposition, the market and processing infrastructure at state level were collected from the publication of Directorate of Fisheries, Government of India and Tamil Nadu.

The research study is divided into four sections. The first section is introductory in nature; it contains the background, objectives and data base. The second section describes the evolution of the fisheries in India. The third section analyses the state-wise fisheries sector in India. The last section provides the concluding remarks and policy suggestions.

Evolution of Fisheries Sector in India

From nutritional standpoint, fish is one of the most important animal protein foods available in many developing and under-developed countries. Approximately, 53 percent of the world's harvest is captured by developing nations and a large portion of fish catch is consumed domestically (FAO 1985). Fish can be regarded as an indispensable food item for large segments of the world's population, where protein needs are great (Pariser, 1973).

**Table 1: Percent Share of Major Fish Producing Countries in
World Fish Production: 2002-11**

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
China	30.0	31.0	30.5	31.2	32.8	32.8	32.2	34.1	35.2	34.8
India	4.6	4.7	4.6	4.9	5.1	5.0	5.6	5.4	5.7	5.7
Indonesia	4.1	4.4	4.2	4.3	4.4	4.6	4.7	4.7	5.2	5.3
United States of America	6.9	4.8	7.2	6.9	5.1	5.2	5.2	4.8	2.9	3.6
Vet Nam	4.3	4.3	4.2	4.0	3.9	3.8	3.4	3.2	3.3	3.4
Russian Federation	2.0	2.2	2.3	2.5	2.7	3.0	3.2	3.3	3.4	2.8
Japan	2.6	2.7	2.3	2.4	2.5	2.6	2.5	2.7	2.8	2.8
Myanmar	4.1	4.3	3.8	3.7	3.7	3.6	3.5	3.4	3.2	2.7
Chile	1.2	2.5	1.5	1.6	1.7	2.0	2.2	2.2	2.6	2.6
Norway	3.8	2.1	4.2	3.7	3.6	3.3	3.1	2.4	2.3	2.2
Philippines	2.6	1.6	2.4	2.2	2.2	2.3	2.3	2.9	2.5	2.0
Bangladesh	1.9	3.1	2.0	2.1	2.1	2.3	2.3	2.4	2.3	2.0
Thailand	1.5	1.6	1.6	1.6	1.7	1.7	1.8	2.3	2.1	1.8
Korea	3.0	1.1	3.0	3.0	3.0	2.6	2.2	2.0	2.1	1.4
Mexico	1.6	1.1	1.5	1.5		1.8	1.7	2.3	1.5	1.1
Malaysia	1.2	0.8	1.0	1.1	1.1	1.2	1.2	1.6	1.1	1.1
Brazil	1.1	0.7	1.1	1.0	1.1	1.1	1.2	1.2	0.9	0.9
Egypt	0.8	0.9	0.8	0.7	0.8	0.8	0.8	1.2	0.9	0.9
Spain	0.9	1.2	0.6	0.7	0.7	0.7	0.8	0.9	0.8	0.8
Taiwan	1.1	1.6	0.8	0.8	0.9	0.8	0.8	0.8	0.7	0.8
Ice Land	1.7	1.0	1.0	1.0	0.9	1.1	0.9	0.8	0.7	0.7
Canada	1.0	0.7	1.3	1.2	1.0	1.0	0.8	0.7	0.8	0.7
Morocco	0.8	0.7	1.0	0.9	0.6	0.8	0.7	0.8	0.7	0.6
Total of Above Countries	83.0	82.9	83.3	83.7	83.8	84.3	84.9	85.3	85.2	86.0
World Total	100	100	100	100	100	100	100	100	100	100

Source: Food and Agriculture Organization, 2013

The chemical composition of sea food comes quite close to that of land animals. The principal constituents are: water 66-84 percent; protein 15-24 percent; lipids, 0.1-22 percent; and mineral substances, 0.8-2 percent. Certain mollusks such as mussels have an appreciable content of glycogen (1-3 percent). Fish oils, in general, consist predominantly of triglycerly esters of fatty acids and minor proportions of free fatty acids, vitamins, colouring matters, hydrocarbons, sterols, phosphatides. However, fish oils differ remarkably from vegetable oils in containing a great variety of fatty acids (The State of Food and Agriculture, FAO, 1986).

Fish fats as a whole show a higher vitamin A level than those of most terrestrial animals. This particularly applies to the liver oils. Fish as food, more specifically as a protein donor, is bound to move towards focal position in view of the dwindling milk and meat resources.

Apart from quality, fish also constitutes quantitatively a good source of protein. The edible portions of fresh water and estuarine fishes investigated in India contain about 14-25 percent protein. In marine fishes also quantitatively, fish consumption might in a significant measure supplement the low-protein, high-cereal diet consumed in many countries of the world. Fish, including processed fish like fish flour, has been found to improve such diets. Cereal proteins are rather low in lysine and methionine, in both of which fish protein is relatively rich (Central Institute of Fisheries Technology, Government of India, 2008).

The success of the trawlers encouraged more fishers to venture into the sea, of course supported by the Government's policy of subsidy for new fishing boats and synthetic nets, especially, Trawl nets. This is evident from the fact that fish production increased from a level of 0.75 million tonnes in 1950-51 to 9.58 million tonnes in 2013-14, comprising 3.44 million tonnes from marine and 6.14 million tonnes from inland resources. The marine fishery resources in the Indian EEZ (Exclusive Economic Zone) have been estimated at about 3.934 million tonnes, constituting 51 percent demersal, 43 percent pelagic and 6 percent oceanic. The present production is estimated at about 2.834 million tonnes which is 72 percent of the harvestable potential (Twelfth Five Year Plan, Government of India, 2012-17).

GROWTH OF FISH PRODUCTION IN INDIA

India is a major producer of fish in the world. The fisher sector is changed from traditional activity to commercial use during the last six decades. We are exporters of fish products to the foreign countries such as USA, EU, China and Japan and other countries. The export of fish products are increased from 10, 048.53 crores in 2009-10 to 30, 613 crores in 2013-14. The volume of fish exports are increased from 6,78,436 tonnes to 9,83,756 tonnes in the same period (A Handbook of Fisheries Statistics, Government of India, 2014).

The production of fish in India is increased from 0.75 million metric tonnes (MMT) in 1950-51 to 10.07 MMT in 2014-15. There is tenfold increase in growth of fish production over the period of last six decades. The main reasons for these trends are potential growth of inland fisheries. The marine fish production has increased from 0.53 MMT in 1950-51 to 3.44 MMT in 2013-14. (A Handbook of Fisheries Statistics, Government of India, 2014). The annual growth rate of marine fish production has increased due to the effective implementation of various fisheries sector scheme in India.

Table 2: Fish Production in India: 1950-51 to 2014-15

Year	Fish Production ('000 tonnes)			Average Annual Growth Rate (Percent)		
	Marine	Inland	Total	Marine	Inland	Total
1950-51	534	218	752	-	-	-
1955-56	596	243	839	2.32	2.29	2.31
1960-61	880	280	1160	9.53	3.05	7.65
1965-66	824	507	1331	-1.27	16.21	2.95
1970-71	1086	670	1756	6.36	6.43	6.39
1973-74	1210	748	1958	3.81	3.88	3.83
1978-79	1490	816	2306	4.63	1.82	3.55
1979-80	1492	848	2340	0.13	3.92	1.47
1980-81	1555	887	2442	4.22	4.6	4.36
1981-82	1445	999	2444	-7.07	12.63	0.08
1982-83	1427	940	2367	-1.25	-5.91	-3.15
1983-84	1519	987	2506	6.45	5	5.87
1984-85	1698	1103	2801	11.78	11.75	11.77
1985-86	1716	1160	2876	1.06	5.17	2.68
1986-87	1713	1229	2942	-0.17	5.95	2.29
1987-88	1658	1301	2959	-3.21	5.86	0.58
1988-89	1817	1335	3152	9.59	2.61	6.52
1989-90	2275	1402	3677	25.21	5.02	16.66
1990-91	2300	1536	3836	1.1	9.56	4.32
1991-92	2447	1710	4157	6.39	11.33	8.37
1992-93	2576	1789	4365	5.27	4.62	5
1993-94	2649	1995	4644	2.83	11.51	6.39
1994-95	2692	2097	4789	1.62	5.11	3.12
1995-96	2707	2242	4949	0.56	6.91	3.34
1996-97	2967	2381	5348	9.6	6.2	8.06
1997-98	2950	2438	5388	-0.57	2.39	0.75
1998-99	2696	2602	5298	-8.61	6.73	-1.67
1999-00	2852	2823	5675	5.79	8.49	7.12
2000-01	2811	2845	5656	-1.44	0.78	-0.33
2001-02	2830	3126	5956	0.68	9.88	5.3
2002-03	2990	3210	6200	5.65	2.69	4.1
2003-04	2941	3458	6399	-1.64	7.73	3.21
2004-05	2779	3526	6305	-5.51	1.97	-1.47
2005-06	2816	3756	6572	1.33	6.52	4.23
2006-07	3024	3845	6869	7.39	2.37	4.52
2007-08	2920	4207	7127	-3.44	9.41	3.76
2008-09	2978	4638	7616	1.99	10.24	6.86
2009-10	3104	4894	7998	4.23	5.52	5.02
2010-11	3250	4981	8231	4.7	1.78	2.91
2011-12	3372	5294	8666	3.75	6.28	5.28
2012-13	3321	5719	9040	-1.51	8.03	4.32
2013-14	3443	6136	9579	3.67	7.29	5.96

Source: Hand Book of Fisheries Statistics, Government of India, 2014

Table 3: Year-wise Fish Export from India: 1994-95 to 2013-14

Year	Quantity (Tonnes)	Value (Rs. in Crores)	Unit (Rs./Tonnes)	Unit Value Index	Annual Growth	
					Quantity	Rate
1994-95	307337	3575.3	116331.6	4668.7	26.73	45.28
1995-96	296277	3450.1	116448.5	4673.39	-3.6	-3.5
1996-97	378198	4077.6	107816.5	4326.96	27.65	18.19
1997-98	385818	4649.7	120515.4	4836.6	2.01	14.03
1998-99	302934	4626.87	152735.3	6129.67	-21.48	-0.49
1999-00	343031	5116.67	149160.6	5986.21	13.24	10.59
2000-01	440473	6443.89	146294.8	5871.2	28.41	25.94
2001-02	424470	5957.05	140340.9	5632.25	-3.63	-7.56
2002-03	467297	6881.31	147257.7	5909.84	10.09	15.52
2003-04	412017	6091.95	147856.8	5933.88	-11.83	-11.5
2004-05	461329	6646.55	144074	5782.07	11.97	9.1
2005-06	512163	7245.73	141473.1	5677.69	11.02	9.01
2006-07	612643	8363.52	136515.4	5478.72	19.62	15.43
2007-08	541701	7620.93	140685.2	5646.07	-11.58	-8.88
2008-09	602834	8607.95	142791.4	5730.6	11.29	12.95
2009-10	678436	10048.53	148113.2	5944.17	12.54	16.74
2010-11	813091	12901.46	158671.8	6367.92	19.85	28.39
2011-12	862021	16597.23	192538.6	7727.08	6.02	28.65
2012-13	928215	18856.26	203145.4	8152.76	7.68	13.61
2013-14	983756	30213.26	307121.5	12325.6	5.98	60.23

Source: <http://www.mpeda.com>.

The growth rate has increased from 2.32 percent in 1955-56 to 9.53 percent in 1960-61 and 25.2 percent in 1989-90. During 2013-14, the growth rate has been decline to 3.7 percent. The growth rate was negative in 1965-66, 1981-82, 1982-83, 1986-87, 1997-98, 1998-99, 2000-01, 2003-04, 2004-05, 2007-08 and 2012-13 (Hand Book of Fisheries Statistics, 2014).

The production of inland fishing sector is increasing from 0.22 MMT during 1950-51 to 6.14 MMT in 2013-14. There is enamors growth of inland fishing sector in India. The average annual growth rate has increased from 2.3 percent in 1955-56 to 7.3 percent in 2013-14. The growth of inland fishing is 5 percent over the period of last six decades. Fishing efforts are largely confined to the inshore water through artisanal, traditional, mechanized sectors. About 90 percent of the present production from the marine sector is from within a depth range of up to 50 to 70 meters and remaining 10 percent from depths extending up to 200 meters. While 93 percent of the production is contributed by artisanal, mechanized and motorized sector, the remaining 7 percent is contributed by deep sea fishing fleets confining their operation mainly to the shrimp grounds in the upper East Coast (MPEDA, 2015).

Table 4: State-wise Fish Production in India (TE 2014-15)

States	State-wise Fish Production in India 2014- 15 ('000 tonnes)			Percent to Total 2014-15
	2012-13	2013-14	2014-15	
Andaman	36.62	36.95	37.18	0.37
Andhra Pradesh	1808.08	2018.42	1964.43	19.5
Arunachal Pradesh	3.71	3.63	4	0.04
Assam	254.27	266.7	282.7	2.81
Bihar	400.14	432.3	479.8	4.76
Chandigarh	0.05	0.11	0.12	0
Chhattisgarh	255.61	284.96	314.16	3.12
Dadra	0.05	0.05	0	0
Daman and Diu	19.01	19.86	28.77	0.29
Delhi	0.69	0.88	0.67	0.01
Goa	77.88	114.06	117.85	1.17
Gujarat	788.49	798.49	809.93	8.04
Haryana	111.48	105.58	111.2	1.1
Himachal Pradesh	8.56	9.83	10.74	0.11
Jammu & Kashmir	19.95	20	20.3	0.2
Jharkhand	96.6	104.82	106.43	1.06
Karnataka	525.57	555.31	613.24	6.09
Kerala	679.74	708.65	632.26	6.28
Lakshadweep	12.37	18.72	13.19	0.13
Madhya Pradesh	85.17	96.26	109.12	1.08
Maharashtra	586.37	602.68	548.75	5.45
Manipur	24.5	28.54	30.5	0.3
Meghalaya	5.42	5.75	5.89	0.06
Mizoram	5.43	5.94	6.39	0.06
Nagaland	7.13	7.47	7.84	0.08
Odisha	410.14	413.79	439.86	4.37
Puducherry	41.07	42.08	73.5	0.73
Punjab	99.13	104.02	114.77	1.14
Rajasthan	55.16	35.1	46.31	0.46
Sikkim	0.49	0.42	0.44	0
Tamil Nadu	620.4	624.3	697.61	6.93
Telangana			265.38	2.63
Tripura	57.46	61.95	63.56	0.63
Uttar Pradesh	449.75	464.48	494.26	4.91
Uttarakhand	3.85	3.89	3.94	0.04
West Bengal	1490.02	1580.65	1617.32	16.06
India	9040.36	9576.64	10072.4	100

Source: A Handbook of Fisheries Statistics, Government of India, 2014.

State-wise Fish Production in India

Fishing sector is one of the predominant sectors in India. The fishing sector is transformed into commercial sector due to quality of fish. Among the different states, Andhra Pradesh is predominately catching the fish. The highest share of the state in total fish production is 19.5 percent and followed by West Bengal (16 percent) and Gujarat (8 percent). The states like Tamil Nadu, Karnataka and Kerala accounted for around 6 percent each in total fish production during the same period. These six states put together accounted for more than 62 percent of total fish production of the country in TE 2014-15 (A Handbook of Fisheries Statistics, Government of India, 2014).

The share of inland and marine fish production in India is represented to 65 percent and 35 percent, respectively. Among the different states, Andhra Pradesh and West Bengal have highest share in the total production of fish. Both the states accounted for 26 percent and 23 percent of total inland fish production. Both states are having above half of inland production during 2013-14 (Marine Product Export Development Authority, Government of India, 2014).

In the case of marine fish production, Gujarat is having highest share and it accounted for 20 percent and followed by Kerala (15.2 percent), Maharashtra (13.58 percent), Andhra (12.73 percent) and Tamil Nadu (12.55 percent). The five major states accounted for 74 percent of total marine fish production in India. They are having three-fourth of share of marine fish production in India (AERC Research Report, Gujarat).

It showing marine fisheries resources, costal states and union territories of India is given in Table 6. The fishing is carried out through five manor fishing gears Viz., Trawl, Bagnets, gill nets, Seines and Hook and Line. More than 25 craft gear combinations are used in the process.

The marine fisheries are mainly exploited by traditional and small scale fishing vessels operating in the coastal waters upto 90-100 meters depth. The Deep sea resources largely remained under-exploited. Of the total marine fish production, about 31.5 percent comes from the east coast (Bay of Bengal) and 68.5 percent from the west coast. The fishery sector also accounts for 0.83 percent of total GDP and 4.75 percent of the Agriculture sector's GDP at current prices for the year 2012-13. A map depicting the Indian EEZ is appended. The scale of Marine fisheries in India is depicted in the following Table 7.

However, it forms an important component of the rural costal economy, generating income, employment, livelihoods and food security for an estimated 3.52 million people along the Indian Coast line, who depend on fishing for their livelihoods.

The sector is now a source of livelihood for over 14 million people and also contributed Rs.30, 213 crore through exports during 2013-14. India is the second largest producer of fish in the world with a share of 5.68 percent of the global total as per FAO Statistics. China is the largest producer of fish with a share of 34.82 percent of world fish production.

It has been estimated that more than one half of the world's population suffers from varying degrees of under-nutrition and malnutrition. While a more precise estimate is not yet possible owing to lack of sufficient data from many parts of the world, there is enough evidence already to justify such a conclusion. In view of the close and direct link between the nutritional status of a population and its health and efficiency, the serious implications of this unsatisfactory situation are obvious.

Table 5: State-wise Inland and Marine Fish Production in India (2013-14)

States	Production (In ' 000 Tonnes)			Share in Total production		
	Marine	Inland	Total	Marine	Inland	Total
Andaman	36.75	0.2	36.95	1.07	0	0.38
Andhra Pradesh	438.25	1580.17	2018.42	12.73	25.75	20.68
Arunachal Pradesh	0	0.55	0.55	0	0.01	0.01
Assam	0	266.7	266.7	0	4.35	2.73
Bihar	0	432.3	432.3	0	7.05	4.43
Chandigarh	0	0.11	0.11	0	0	0
Chhattisgarh	0	284.96	284.96	0	4.64	2.92
Dadra	0	0.05	0.05	0	0	0
Daman and Diu	18.78	0.23	19.01	0.55	0	0.19
Delhi	0	0.88	0.88	0	0.01	0.01
Goa	109.57	4.49	114.06	3.18	0.07	1.17
Gujarat	695.58	97.84	793.42	20.2	1.59	8.13
Haryana	0	116.9	116.9	0	1.91	1.2
Himachal Pradesh	0	9.83	9.83	0	0.16	0.1
Jammu & Kashmir	0	19.98	19.98	0	0.33	0.2
Jharkhand	0	104.82	104.82	0	1.71	1.07
Karnataka	357.36	197.95	555.31	10.38	3.23	5.69
Kerala	522.31	186.34	708.65	15.17	3.04	7.26
Lakshadweep	18.72	0	18.72	0.54	0	0.19
Madhya Pradesh	0	96.26	96.26	0	1.57	0.99
Maharashtra	467.46	135.22	602.68	13.58	2.2	6.18
Manipur	0	28.54	28.54	0	0.47	0.29
Meghalaya	0	5.75	5.75	0	0.09	0.06
Mizoram	0	5.94	5.94	0	0.1	0.06
Nagaland	0	7.47	7.47	0	0.12	0.08
Odisha	120.02	293.77	413.79	3.49	4.79	4.24
Puducherry	37.81	4.27	42.08	1.1	0.07	0.43
Punjab	0	104.02	104.02	0	1.7	1.07
Rajasthan	0	35.1	35.1	0	0.57	0.36
Sikkim	0	0.42	0.42	0	0.01	0
Tamil Nadu	432.27	192.03	624.3	12.55	3.13	6.4
Telangana	0	0	0	0	0	0
Tripura	0	61.95	61.95	0	1.01	0.63
Uttar Pradesh	0	464.48	464.48	0	7.57	4.76
Uttarakhand	0	3.89	3.89	0	0.06	0.04
West Bengal	188.24	1392.41	1580.65	5.47	22.69	16.2
India	3443.12	6135.79	9578.91	100	100	98.16

Source: www.indianstat.com

Table No. 6: Marine Fishery Resources: Costal States and Union Territories of India

States	Length of Coastal Line (Kms)	Continantal Shelf (000 Sq. Kms)	No. of Landing Centres	No. of Fishing Villages	No. of Fishermen Families	Fisherfolk Population
Andre Pradesh	974	33	353	555	163427	605428
Goa	104	10	33	39	2189	10545
Gujarat	1600	184	121	247	62231	336181
Karnataka	300	27	96	144	30713	167429
Kerala	590	40	187	222	118937	610165
Maharashtra	720	112	152	456	81492	386259
Odisha	480	26	73	813	114238	605514
Tamil Nadu	1076	41	407	573	192697	802912
West Bengal	158	17	59	188	76981	380138
A & N Islands	1912	35	16	134	4861	22188
Daman & Diu	27	0	5	11	7374	40016
Lakshadweep	132	4	10	10	5338	34811
Pondicherry	45	1	25	40	14271	54627
Total	8118	530	1537	3432	874749	4056213

Source: Hand Book of Fisheries Statistics, 2014, Government of India, Ministry of Agriculture, Department of Agriculture, Animal Husbandry, Dairying and Fisheries, New Delhi

It is unfortunate that, in spite of the great advances made in the knowledge of food and nutrition and in its application to raise the level of nutrition, the large majority of the human population is still living on a suboptimal nutritional level in the light of the dietary standards recommended by various bodies. This relates both to qualitative and quantitative deficiencies in the diet in large areas of the world.

For development, the sector contributes by providing food and nutritional security as well as employment opportunities to a considerable number of our population. Over the last six decades, the fishery sector has transformed itself from a purely traditional activity into a significant commercial enterprise. Thus, it is obvious that increasing fish production will certainly help to promote growth and development but fish, particularly marine resources, are fast depleting due to overexploitation of our coastal areas. Given such resource constraint, preventing the loss of fisheries, particularly during the various post-harvest stages, gains more significance.

Table 7: Scale of Marine Fisheries in India

Craft	Length (m)	Engine Power (hp)
Mechanised		
Trawlers	9-20	150-400
Gillnetters	7-14	80-100
Purseseiners	11-15	100-120
Dolnetters	10-15	80-100
Ringseiners	10-20	85-120
Pole and liners	10-12	100
Motorised (with > one outboard motors)		
Plank-built canoes	8-22	35-120
Plywood boats	10-17	40-65
Motorised (with one outboard motors)		
Catamaran	5-7	2-5
Dugout canoes	5-7	2-10
Plank-built canoes	5-12	2-25
Plank-built boats	7-9	8-15
Plank transom canoes	7-9	8-15
Plywood boats	9-12	8-15
Non-motorised		
Catamaran	5-7	-
Dugout canoes	5-7	-
Plank-built canoes	5-12	-

Source: CMFRI, Kochi.

The capture fisheries have increased through the past decades many fishery scientists believe that we will soon reach maximum sustainable yields in many of the commercial species. The emphasis in commercial fisheries has shifted from increased production to increased utilization. Implied in increased utilization is the need for reduction of losses due to poor handling and sanitation throughout the distribution chain. The use of non-commercial species, especially, fatty fish, for human food needs to be expanded as well. The right to harvest natural fishery resources carries with it the responsibility on the part of the government, fishers, processors and distributors to maximize its utilization.

The average annual growth rate of the fisheries sector in India was 5.96 percent in 2013-14. In the post-tsunami period, the sector received much attention from the administrators and planners of India. Investment in infrastructure was no more a constraint. It attracted almost all investors, both, quasi-government and NGOs towards reconstruction, rehabilitation of the affected people.

The Government of India through their schemes to develop marine fisheries in India, funded plan schemes for motorization of the traditional fishing crafts, safety of fishermen at sea; rebates on HSD

oil; introduction of intermediate crafts, fishing vessels monitoring system and promoting marine fisheries, incentives for the introduction of fuel efficient and environment- friendly fishing practices.

Table 8 gives the data of fishing crafts (both trawlers and gill nets) in India. It also acknowledges the phenomenal growth of fishing fleets in the country, which invites the attention of policy planners and resource managers of the sector. These eventually contribute to intensive exploitation of fishery resources in India. As such, the marine sector in India is faced with issues of sustainability with production reaching a plateau in recent years. Hence, a paradigm shift from increasing marine fish production to increasing profitability and sustaining the marine fishery resources through interventions is needed. Having an efficient marketing system is one of the approaches for increasing profitability in this sector.

Table No.8: Fishing Crafts: Costal States and Union Territories, 2010

States	Traditional Crafts (Non-Motorized)	Motorized Crafts	Mechanized Boats	Total
Andhra Pradesh	17837	10737	3167	31741
Goa	227	1297	1142	2666
Gujarat	1884	8238	18278	28400
Karnataka	2862	7518	3643	14023
Kerala	5884	11175	4722	21781
Maharashtra	2783	1593	13016	17392
Odisha	4656	3922	2248	10826
Tamil Nadu	10436	24942	10692	46070
West Bengal	3066	0	14282	17348
A & N Islands	1637	1491	61	3189
Daman & Diu	321	359	1000	1680
Lakshadweep	727	606	129	1462
Pondicherry	662	1562	369	2593
Total	52982	73410	72749	199141

Source: Marine Fisheries Census, 2010

CONCLUSION

For development, the sector contributes by providing food and nutritional security as well as employment opportunities to a considerable number of our population. Over the last six decades, the fishery sector has transformed itself from a purely traditional activity into a significant commercial enterprise. Thus, it is obvious that increasing fish production will certainly help to promote growth and development but fish, particularly marine resources, are fast depleting due to overexploitation of our coastal areas.

The capture fisheries have increased through the past decades many fishery scientists believe that we will soon reach maximum sustainable yields in many of the commercial species. The emphasis in commercial fisheries has shifted from increased production to increased utilization. Implied in increased utilization is the need for reduction of losses due to poor handling and sanitation

throughout the distribution chain. The use of non-commercial species, especially, fatty fish, for human food needs to be expanded as well. The right to harvest natural fishery resources carries with it the responsibility on the part of the government, fishers, processors and distributors to maximize its utilization.

In that endeavour, the Government of India established fishing harbours, fish landing centres with facilities for handling of fish catches. These harbours and fish landing centres were established to take care of post-harvest operations to minimize fish losses. The emphasis was on effective measures to minimize post-harvest fish losses, as of all food items we eat and see around us, fish spoils most quickly. The chemical composition of fish, qualities of inherent proteins and lipids and most of all, the nature of habitat where it lives, all contribute considerably to make it susceptible to spoilage soon after death.

The marine fisheries development programmes included the following major components.

- Motorization of Traditional fishing craft
- Safety of Fishermen at sea
- Rebate on HSD oil
- Introduction of intermediate craft of improved design including proto-type study of new intermediate vessel design.
- Establishment and operation of vessel monitoring system
- Promoting fuel efficient and environment friendly fishing practices
- Management of Marine Fisheries

The basic objectives of the development programmes supported/encouraged intensive capture fishing in the territorial waters, rather than enabling sustainable fishing practices. Moreover, the policy on infrastructure ensured adequate berthing and landing facilities for fishing vessels rather than being cleaner and 'state of art' fishing harbours/ fish landing centres. The post-harvest infrastructure requires adequate storage and handling facilities, both within the fishing harbours/fish landing centres and also at the market centres.

The development programmes also aim at the safety and welfare of fishers through development of Model Fishermen Villages. Accident Insurance Scheme for active fishermen, saving cum-relief scheme and training programmes for capacity building.

The institutional arrangements also take care of skill needs of fishers and the administrators of fisheries in the country. To speed up the process of Fisheries Development, on a par with National Dairy Development Board, a National Fisheries Development Board (NFBD) was set up in September, 2006 with headquarters in Hyderabad. The basic objectives are:

- To bring activities relating to fisheries and aquaculture for focused attention and professional management.
- To coordinate activities pertaining to fisheries undertaken by different Departments in the Central Government and also coordinate with the State/Union Territory Governments.
- To improve production, processing, storage, transport and marketing of the products of capture and culture fisheries.
- To achieve sustainable management and conservation of natural aquatic resources including the fish stocks.

- To apply modern tools of research and development including biotechnology for optimizing production and productivity from fisheries.
- To provide modern infrastructure mechanisms for fisheries and ensure their effective management and optimum utilization.
- To generate substantial employment.
- To train and empower women in the fisheries sector.
- To enhance contribution of fish towards food and nutritional security.

The NFDB, since then has been involved in the development of all major activities in the fisheries sector, including marine fisheries development.

The Government of India, in recent times has announced their policy towards Marine Fisheries Management as one of their goals. This is due to the realization of the fact that better than being a net drain on the economy, sustainable fisheries can create an economic surplus and be a driver of economic growth. This is obviously due to the fact that the success of fisheries exploitation depends upon employing an effective system of fisheries management, which include, measures such as reduction of fishing effort and alternative harvesting methods. Increased mesh sizes, licensing or quota regulations, restricted area and closure of fishery. This is, especially, so as over 90 percent of the total marine fish production comes from inshore waters. 61 percent of fish stocks are already over-exploited, 28 percent are fully exploited and 11 percent is under-exploited, leaving a very little scope for further expansion in the catch from inshore waters. However, these eventually make one point clear that the harvested quality of fish need be well handled, processed, transported and marketed so has to reach the consumer in utmost good condition (MPEDA, Govt. of India, 2014).

References

- A Handbook of Fisheries Statistics, Ministry of Agriculture (Department of Agriculture and Farmers Welfare, Animal Husbandry, Dairying and Fisheries) Government of India, (2013-14 and 2014-15)
- Anderson, James L. (1987), *Strategic Design and Marketing of Aqua cultured Products*, Paper presented at the 18th Annual Meeting of the World Aquatic Society, January 18-23.
- Bala, B. K. and Mondol, M.R.A (2001), *Experimental Investigation of Solar Drying of Fish using Tunnel Dryer*, Drying Technology, 19(2):1-10
- Borgstrom, G (1965), *Fish as Food*, Volume III Proceedings, New York
- Bostock, T.W (1987), *Report on a List to Gujarat, India to Assess Losses in Fish and Identity Means of Improving Utilization*, November-December 1986, Report of Tropical Development and Research Institute, London, United Kingdom
- Carpenter, K.J. (1979), *Fish in Human and Animal Nutrition, Advances in Fish Science and Technology*, Edited J.J. Connall, Fishermen survey, England, 124-130.
- Central Institute of Fisheries Technology (2008), Government of India, Cochin, Kerala
- Central Planning Commission (2011), Working Paper on Twelfth Five Year Plan, Government of India, New Delhi.
- Comprehensive Marine Fishing Policy(2004), Government of Indian Ministry of Agriculture, Department of Animal Husbandry, Fisheries and Dairying, New Delhi, November.
- Coulter, J.P. and Disney, J.G. (1987), *The Handling, Processing and Marketing of Fish in Bangladesh*, ODNRI Bulletin No. 1
- De Lucia and D. Assennato, (1994), *Agricultural Engineering in Development: Post-harvest Operations and Management of Foodgrains*, Technical Report, FAO

- Dublin, J.V. Mc Loughlin and B.M. Mc Kenna, Boole Pren, Dublin, *Economics and Sea Food Quality*, James Anderson, Department of Resource Economics, University of Rhode Island, Kingston & John Gray Anderson, Consumer Affairs Program, Department of Resource Economics, University of Rhode Island, Kingston, Rhode Island.
- FAO (1985) *World Catch and Trade of Fishery Products in 1984*, Infofish Marketing Digest No. 3:25.
- FAO (1986a.1984) *Year Book of Fishery Statistics*, Fishery Commodities, Vol.59, FAO, Rome
- FAO (1986b), *The State of Food and Agriculture 1985*, FAO, Rome
- Hodges, R.J., J.C. Buzby, and B. Bennett (2011) *Postharvest Losses and Waste in Developed and Less Developed Countries: Opportunities to Improve Resource Use*, Journal of Agricultural Science, Vol. 149
- India Marine Fisheries, Study Background Papers
- James D (1984), *The Future for Fish in Nutrition*, Infofish Marketing Digest No. 4:41.
- James, D. H. (1984), *Fish for the Future?*, *Proceedings 6th International Conference on Food Science Technology*, September 1983
- Marine Product Export Development Authority (1978), Government of India, New Delhi
- Monsoon Season Post-harvest Fish Losses in India, Desk Review of Secondary Source Data and Suggestions for Research Themes, February/March 1997, Project No. A0665, Natural Resources Institute, University Resources Institute
- National Research Council (1978), *Post-harvest Food Losses in Developing Countries*, U.S. National Academy of Sciences, Washington D.C
- Newsad, A. K. M. A. (2005), *Low Cost Processing of Fish in Coastal Bangladesh*, BGD/97/017 Field Doc: 05/2005, Food and Agriculture Organization of the United Nations, Dhaka.
- Newsad, A. K. M. A. (2006), *End of Assignment Report, Empowerment of Coastal Fishing Communities for Livelihood Security Project*, Food and Agriculture Organization of the United Nations, Dhaka
- Newsad, A. K. M. A. (2010), *Post-harvest Loss Reduction in Fisheries in Bangladesh: A Way Forward to Food Security*, Department of Fisheries Technology, Bangladesh Agricultural University, Mymensingh
- Pariser, E.R.(1973), *Proteins of Aquatic Origin as Food for Human Consumptions*, *Advances in Food* 20:189
- Policy Note of Government of Tamil Nadu (2015-16), Demand No. 7- Fisheries, Chennai
- Policy Notes (2015-16), *Animal Husbandry and Fisheries Department*, Government of Tamil Nadu, Chennai-05
- 'Post-harvest Fishery Losses', *Proceedings of an International Workshop held April, 12-16, 1987, at the University of Rhode Island*, Edited by Michael T. Morrissey. Co-sponsored by the U.S. Agency for International Development (USAID) and The International Centre for Marine Resource Development (ICMRD) at the University of Rhode Island, Published by ICMRD, 1988.
- Slavis, J. (1982), *Utilization of the shrimp by-Catch In: 65th By-Catch Bonus from the Sea*, Report of a Technical Consultation on –by Chatch Utilization held in Georgetown Centre, Ottawa, Canada
- State Planning Commission (1972) Government of Tamil Nadu, Chennai
- State Planning Commission (2012-17), *Twelfth Five Year Plan Document*, Chennai
- Ward, A. R. (2000), *Field and Desk based Tools for Assessing Fish Losses: Adaptation and Validation in West Africa*, Final Technical Report on Research Project R7008. Report 2564, Natural Resource Institute, Chatham, 45 pp.
- Ward, A. R. and Cheke, R. A. (1997), *Modelling Post-harvest Fish Losses*, *Aquaculture News* no. 24, December
- Ward, A. R. and Jeffries, D. J. (2000), *A Manual for Assessing Post-harvest Fisheries Losses*, Natural Resources Institute, Chatham, UK.
- Twelfth Five Year Plan Documents (2012-2017), Planning Commission, Government of India, New Delhi
- Indian Marine Fisheries, Issues, Opportunities and Transitions for Sustainable Development World Bank, August 2010, Report No.54259, Agriculture & Rural Development Sector South Asia Region.