Review Article

REVIEW ON PRESENT STATUS, ISSUES AND MANAGEMENT OF INDIAN MARINE FISHERIES

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ABSTRACT

Marine fisheries is recognized as a sunrise sector and the prospects of foreign exchange earnings and employability is attracting more and more people into active fishing and allied sectors.. Fisheries resources are nutritional security, besides livelihood support and gainful employment. All over the world, more than 30 million fishers and fish farmers and their families gain their livelihoods from fisheries. Globally, fish provide about 16 per cent of the animal protein consumed by humans, and are a valuable source of minerals and essential fatty acids. Marine fisheries are very important sectors of India. It provides employment to millions of people and contributes to food security of the country. With a coastline of 8,118 km, an Exclusive Economic Zone (EEZ) of 2.02 million sq km, and with extensive resources, fisheries play a vital role. This article represents initial reviews on the status, challenges, distribution, research and sustainable management of marine fisheries in India.

INTRODUCTION

Fisheries is a sunrise sector and its play a pivotal role for providing nutritional security, besides livelihood support and gainful employment (Sinha *et al*., 2017). Globally stock in 2015, maximally sustainably fished stocks as fully fished stocks accounted 59.9%, under-fished stocks for 7.0% and 33.1% stock is optimally exploited while in India, current rapid stock assessment estimates out of 52 commercially exploited groups 46% was abundant, followed by 17% less abundant, 33% declining, 2% depleted and 2% collapsed state (CMFRI, 2017). In a tropical country like India, where in the marine fisheries is supported by multispecies assemblages, severe collapses in fishery are unlikely and the marine fish production of the country has been increasing (Sathianandan, 2017). The annual fish production of the India depends on success or failure of groups like clupeoids, mackerel, Bombay duck, carangids and ribbon fish (Gurjar *et al.*, 2017). Sustainable harvest of the marine fishery resources are necessary as over exploitation of the resources is likely to harm the diversity and cause reduction in the availability of some of the resources. Management and regulations are necessary for sustainable harvest of marine fishery resources India is one among the top marine fish producing countries of the world and at present the country is at 6th position in global marine capture fish production after China, Indonesia, USA, Russia, Peru and India. The information necessary for such inference are generated through census (FAO, 2018). In India, presently total fish production during 2017-18 is estimated to be 12.60 million metric tonnes, of which nearly 65% is from inland sector and about 50% of the total production is from culture fisheries, and constitutes about 6.3% of the global fish production (NFDB, 2018). The fisheries and aquaculture production contributes around 1% to India GDP and over 5% to the agricultural GDP. This sector is a source of livelihood for over 14.49 million people in the country engaged fully, partially or in subsidiary activities pertaining to the sector (Anon, 2014). While in marine around 4.0 million people are employed. Fish consumption by India average 5-10 kg per capita since 2013-15 (FAO, 2018).Monitoring the diverse marine fishery resources of the country is being carried out regularly by CMFRI, Kochi. CMFRI collecting and estimating the fisheries data scientifically from all along the Indian coast leading to fish stock assessment for deriving management measures to keep the harvest of the resources at long term sustainable levels.

STATUS OF GLOBAL FISHERIES

Global, fish production is 170.9 million tonnes (mmt) out of which 90.9 mmt catch from capture fisheries and 80 mmt from aquaculture (Fig. 1). At present 88 percent of global fish catch was direct utilized for human consumption. Presently per capita fish consumption of 20.3 kg in 2016 (FAO, 2018).

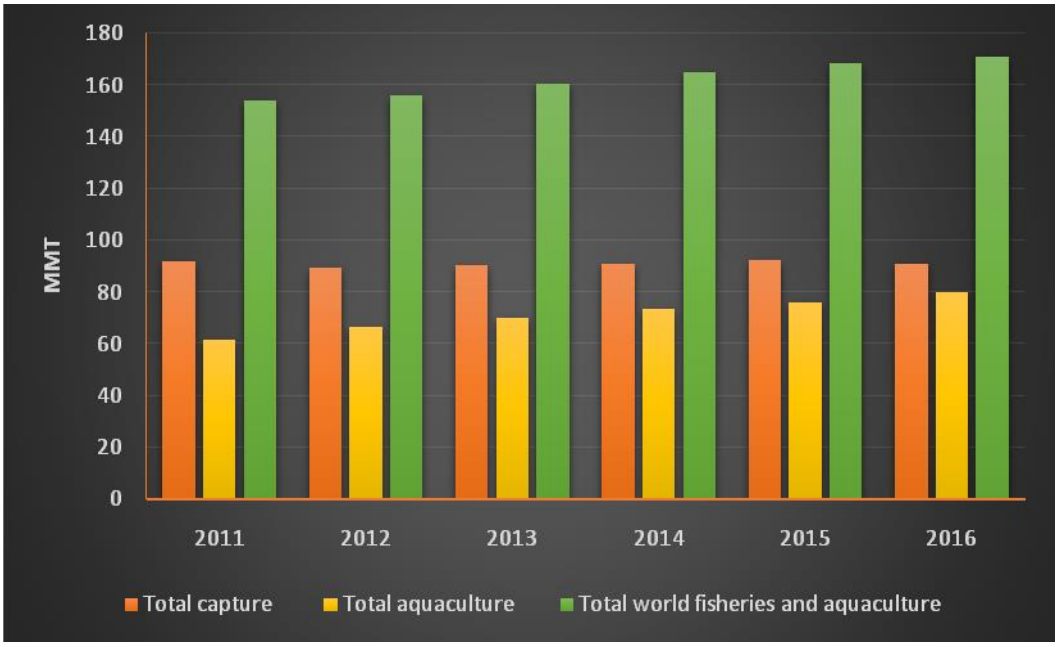

Fig. 1. World fisheries and aquaculture production

In capture fisheries as marine production 79.3 mmt & aquaculture 28.4 mmt (Fig. 2) and inland waters produced 11.6 million tonnes & aquaculture 51.4 mmt in 2016. World-wide China is the main fish producer and also largest exporter of fish and fish products. Top production of fish species during 2016 fish species name Alaska Pollock (*Theragra chalcogramma*). According to potential of fishing area Northwest Pacific is a most productive with catches in 2016 of 22.4 million tonnes. In 2016, all the most valuable species groups with significant production such as lobsters, gastropods, crabs and shrimps, with an estimated average value by group of USD 8 800 to USD 3800 per tonnes marked a new catch reported. An engaged in the fisheries and aquaculture sectors 85% in Asia, followed by Africa (10%) and Latin America and the Caribbean (4%). The total number of fishing vessels in the world in 2016 about 4.6 million while in Asia largest, fishing vessels is consisting such as 3.5 million (75%).

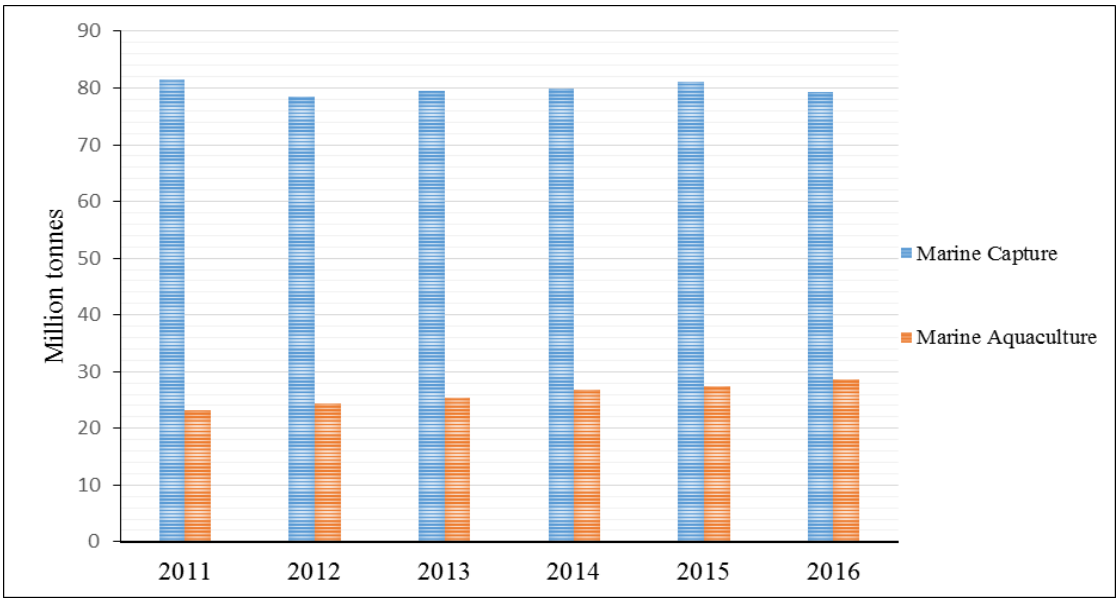

Fig. 2. World marine capture and culture production

STATUS OF INDIAN FISHERIES:

India has 2nd largest fish producing and also aquaculture or inland fish production (FAO, 2018). In 2016-17 provisional total fish production in the country as 11.41 mmt in which 7.77 mmt production from inland sector and 3.64 mmt from marine sector. Themarine resources of the country comprise an Exclusive Economic Zone (EEZ) of 2.02 millionsq. km, a continental shelf area of 5,30,000 sq.km and a coastline of 8,118 km. The marinefishery potential in the Indian waters havebeen estimated at 4.41 MMT constituting more than

47% demersal, 48% pelagic and 5% oceanic groups (DAHDF, 2018).The east coast covers four states and two Union Territories (West Bengal, Odisha, Andhra Pradesh, Tamil Nadu, Pondicherry and Andaman & Nicobar Islands) and the west coast covers five states and two Union Territories (Gujarat, Daman & Diu, Maharashtra, Goa, Karnataka, Kerala, and Lakshadweep). The maximum length of coast line (1912 km) is from Andaman & Nicobar Island followed by Gujarat (1600 km).Among them, Gujarat continued to be in the top most position in marine fish production with 7.86 lakh tonnes. Tamil Nadu stood behind Gujarat with 6.55 lakh tonnes (Table 1). Kerala has overtaken Karnataka to emerge as the third largest state in India. The region-wise breakup of the landings indicated that southwest and northwest contributed almost equally to the landings spectrum with 12.33 lakh tonnes and 12.32 lakh tonnes respectively whereas the southeast contributed 8.82 lakh tonnes and only 4.88 lakh tonnes by northeast. In the reporting year, 4 maritime states landed more than 5 lakh tonnes accounting for 67% of country's marine fish landings (CMFRI, 2018). Marine capture fisheries play a pivotal role for enhancing the India's economy. The present scenario of marine fish production from the exploited zone has to be sustained by closely monitoring the landings and the fishing effort and by strictly implementing the scientific management measures. In 2017, a total of 788 marine fish species were landed along the Indian coast with maximum numbers landed along the Tamil Nadu coast followed by Kerala and Maharashtra. Along the west coast 618 species were landed whereas the number of species landed along the east coast was 592. The average landings per species was high in Gujarat (3025 tonnes) followed by Karnataka (2513 tonnes) and West Bengal (2493 tonnes).

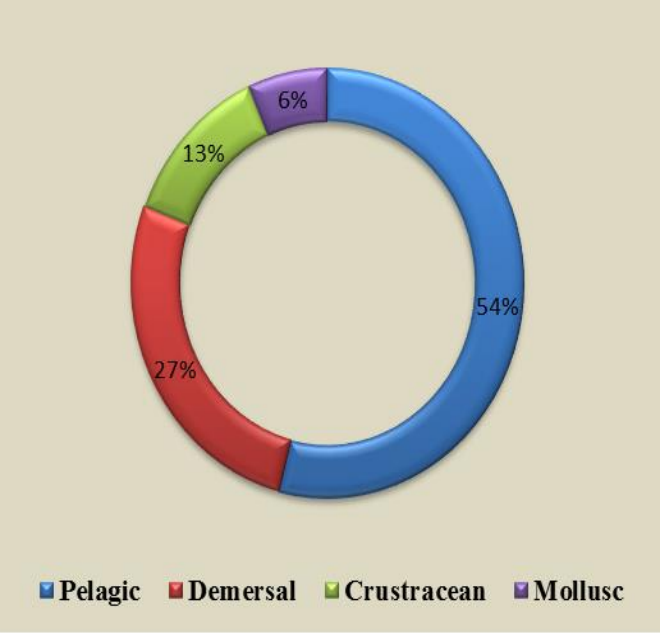

Fig. 3. Resources wise contribution of marine production of India

Pelagic finfishes dominated in the marine capture fish landing during 2017 contributing 54% of the total landings. Among pelagic, oil sardine, mackerel, ribbon fish, lesser sardines and Bombay duck contributed almost 60% of the pelagic fish landings. Most of these stocks are annual crops predominantly belonging to 0-year class. The abundance of these resources depends on the variations in the recruitment. The availability as well as the abundance of pelagic stocks in space and time is dependent on fishery independent factors such as meteorological and oceanographic variables, food availability etc. Demersal finfishes contributed 26.8% to total landings. The major demersal resources landed were threadfin breams, croakers, silver bellies, bulls eyes (*Priacanthus* spp.), and catfishes. Crustaceans comprised high value resources like shrimps, crabs and lobsters and the contribution from this group was 12.6%. Molluscs comprising squids, cuttlefish, clams and oysters accounted for the remaining 6.6% (Fig. 3).

Table 1. State wise marine fisheries production and resources

States/ UT's	Production (in lakh tonnes)	Coastline (kms)	Conti-nental Shelf ('000 sq.kms)	Landing Centres
Gujarat	7.86	1600	184	121
Tamil Nadu	6.55	1076	41	407
Kerala	5.85	590	40	187
Karnataka	5.48	300	27	96
Maharashtra	3.81	720	112	152
West Bengal	3.61	158	17	59
A.P	2.0	974	33	353
Odisha	1.27	480	26	73
Goa	1.0	104	10	33
Daman & Diu	0.64	27	-	5
Pondicherry	0.27	46	1	25
A & N	-	1912	35	16
Lakshadweep	-	132	4	10
Total	**38.3**	**8118**	**530**	**1537**

DEVELOPMENT IN INDIAN MARINE FISHERIES SECTOR:

As a result of modernisation, the Indian fisheries sector witnessed a steady growth from the first Five Year Plan (FYP) launched in 1951. The marine fish production in the country gradually increased from mere 5.8 lakh t in 1950 to 3.83 million t in 2017.The development of fisheries sector in India can be classified into three phases (Srinath, 2003). During the first phase (1950-66), landings was mainly by non-mechanized indigenous crafts and gears and remained below one million t. The second phase spanning from 1967-86 featured increased mechanization, improved gear

materials, introduction of motorized country crafts, expansion in export trade etc. The last phase during 1987-2010 witnessed intensification of mechanization as well as motorization of country crafts, modification of gears, multiday voyage fishing and expansion of fishing grounds. According to MPEDA, export earnings from marine sector increased from Rs 3.92 crores in 1961-62 to 45106.89 crores in 2017-18. The country exported 13,77,244 metric tonnes of seafood worth US$ 7.08 billion. USA and South East Asia continued to be the major import markets of Indian seafood. Frozen shrimp being the top item of export in terms of quantity and value, accounting for a share of 41.10 % in quantity and 68.46% of the total USD earnings. USA is the largest market (2, 25,946 MT) for frozen shrimp followed by South East Asia, European Union, Japan, Middle East countries, China, besides others (32,087 MT).

MAJOR SPECIES HARVESTED WITH PERCENTAGE PRODUCTION

Among the different marine fishery resources landed along the Indian coast the oil sardine (*Sardinella longiceps*) fetched back the first position in 2017 with a contribution of 3.37 lakh t at national level from 2.45 lakh t in 2016. The landings of other important resources are Indian mackerel 2.88 lakh t, ribbonfishes 2.39 lakh t, cephalopods 2.31 lakh t, lesser sardines 2.27 lakh t, penaeid shrimps 2.08 lakh t, non-penaeid shrimps 2.02 lakh t, threadfin breams 1.57 lakh t, croakers 1.50 lakh t and Bullseyes 1.43 lakh t (Table 2). In the assemblage wise classification of pelagic, demersal, crustacean and molluscs of the landed resources the pelagic resources landed 54%, demersal 26.8%, crustaceans 12.6% and molluscs 6.6%.

Table 2. Species wise marine fish production of India

Sl. No.	Fish resources	2017 (in tonnes)	2016 (in tonnes)	2015 (in tonnes)	2014 (in tonnes)
1	Oil sardine	337390	244992	265667	544684
2	Indian mackerel	287880	249241	237801	237056
3	Ribbon fishes	239355	217100	177259	209405
4	Other sardines	226970	195163	256016	206310
5	Threadfin breams	157773	170349	162764	136931
6	Croakers	150241	157793	155383	161864
7	Bombay duck	145115	144951	110417	112646
8	Other carangids	120019	83566	77707	58886
9	Scads	108010	105057	112131	86172
10	Silver bellies	89901	92764	23819	30191
11	Catfishes	88177	80559	83354	68675
12	Lizard fishes	57803	94817	77838	54202
13	Rock cods	53924	42781	43146	32144
14	Pomfrets	46877	44163	40804	50192

Source: CMFRI (2015; 2016; 2017; 2018)

SECTOR WISE CONTRIBUTION OF MARINE FISHERIES:

As per Marine census carried out in 2010 by Govt. of India; altogether 52,982 Traditional crafts, 73,410 Motorized crafts and 72,749 Mechanized crafts are in operation along the coast of India which contributes to the total Marine landing of the country (CMFRI, 2010). These three broad categories of vessel classification mask a number of underlying issues (Vivekanandan, 2007). First, they do not reflect perfectly homogeneous categories from a management perspective; as an example the mechanised category includes all boats that have an inboard diesel engine, whether they use small 15 hp motors or larger 150 hp engines. The mechanised sector remained as the highest contributing sector with 3.17 million t (82.6%), the motorised sector contributing 5.57 lakh t (14.5%) and the non-motorised sector contributing only 2.9% (Fig.4). The catch rates in terms of per boat catch was high (1568 kg/trip) for the mechanised sector whereas it was only 122 kg/trip for motorised sector and 55 kg/trip for non-motorised sector. In terms of hours of operation also the catch rates were high for mechanised sector (50 kg $^{-1}$) and low for other two sectors (20 kg^{-1} for motorised and 18 kg^{-1} for non-motorised).

ISSUES IN MARINE FISHERIES SECTOR:

OVER EXPLOITATION OF RESOURCES

Due to increasing the demand of fish and advancement in harvest technology have drastically enhanced the exploitation of ocean resources which led to serious pressures on marine resources. Reflecting the global importance of fisheries outlined above, the response of fish stocks to current patterns of exploitation are now among the most pressing of all of natural resource problems. The political, economic, consumer and conservation consequences are large. Data from the Food and Agriculture Organisation of the United Nations (FAO), collated at a global scale, suggest that 47% of fish stocks are already

exploited to their maximum sustainable limits, while 18% are reported as over-exploited and 10% are depleted (FAO, 2002). Exploitation effects from fishing cascade to other trophic levels with consequences for wider ecosystem quality and conservation (Pinnegar *et al*., 2000). A number of indicators point to a declining contribution of India's marine fisheries to sustainable development.There has been evidence of increased use of destructive fishing gear, such as ring seines, in some regions. Bottom trawling is another destructive approach for fishing in inshore waters, particularly in the western Indian Ocean. The harvest of juvenile fish/shrimp is also increasing. The large number of vessels docked and no longer fishing clearly points to overcapacity and poor economic returns. Smaller boats are making increasingly longer fishing trips to more distant areas, impacting on safety at sea. Conflicts between small-scale/artisanal boats and larger vessels operating within or just beyond the 22 km state/territorial fishing grounds are becoming more common (Milne, 2010).

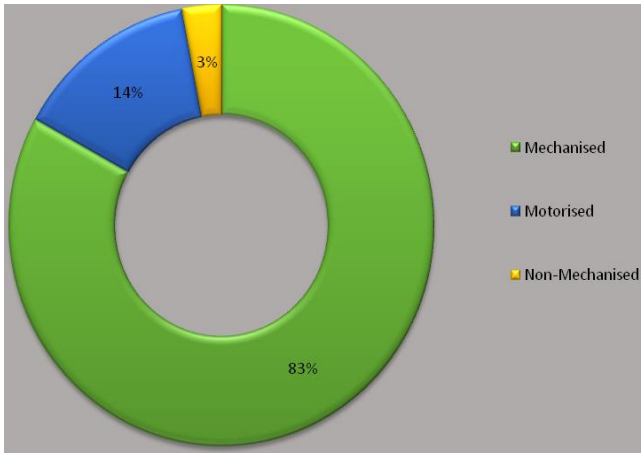

Fig. 4. Sector wise contribution of marine fish landings of India

COASTAL DEVELOPMENT

India's coastal zone supports nearly 30 percent of the country's population and a significant share of industry. Five major potential stressors on marine eco-systems, include coastal pollution, climate change, eco-system fragmentation and habitat loss, invasive species, and over fishing (Nellemann *et al.,* 2008). With the dramatic growth in India's economy over the past decade, concerns have been raised about impacts on coastal zones and indirectly on the marine fishery. To protect coastal areas from unregulated development for industry, tourism, and urban development, the Coastal Regulation Zone (CRZ) Notification 1991, was issued under the provisions of the Environment (Protection) Act 1986. A positive feature of the 1991 Notification is the recognition of traditional and customary rights of fishing communities.

HABITAT ALTERATION

Human activities are considered to be the prime cause of habitat alteration which led to depletion of marine resources. The sea has become an ultimate dumping ground for all kinds of pollutants including plastics, solid, liquid, organic and inorganic wastes; in which only few are biodegradable, others are not. The mangrove ecosystem is under various stress due to anthropogenic activities which affecting the zooplankton diversity. Thus, any change in the composition and functioning of the zooplankton community disturbs the state of the whole ecosystem (Takar *et al.,* 2018). CMFRI, 2016 reported the occurrence of macroplastics of 5 cm and 3 cm lengths in the gut of *Coryphaena hippurus* and *Euthynnus affnis,* respectively, collected from different regions of India Sea. Gurjar *et al.* (2019) observed microplastics in stomachs of fishes along Mumbai coast and ingested microplastics were found to be dominantly fibres, fragment and pellets. Particularly fish, is susceptible to ingesting microplastics due to their attractive coloration and buoyancy that resembles to their food items. So marine life is affected by pollutants directly or indirectly which change the whole ecosystems including genetic resources that may cause mass mortalities of fish and other organisms.

OIL POLLUTION

Oil spills are considered to be a major source of marine pollution. Due to leakage from oil tankers during transport of crude oil, a collision of tankers, rigs operation, leakage from pipeline and washing of tankers are major sources of oil spills. Oil spills destroy the fish habitats and alter the conditions of water which led to the mass mortality of fish and other biota. It is projected that 252-336 million gallons of oil spilt into the Persian Gulf during Gulf War (Norse, 1993).

CLIMATE CHANGE

Numerous factors that cause of climate change can be divided into two categories - these are related to natural processes and anthropogenic activity. Other than to natural causes of climate change, changes internal to the climate system, like variations in ocean currents or atmospheric circulation, can also influence the climate for short periods of time. As in many other environments, those occupied by fish are not stable, but characterised by natural and anthropogenic change. Natural environmental variations present their own challenges to fishery managers. Issues of environmental change cut across the whole field of fish exploitation, conservation, restoration and management, and are increasingly sources of policy concern (FAO, 2002). Climate is recognised already as one of the strongest influences on the growth, assemblage composition and abundance of juvenile fish during their residency in estuarine or coastal waters with consequences for recruitment, production and nutrient flux (Finney *et al*., 2000; Attrill and Power, 2002). While climate change reflects pollution through complex indirect pathways, changes in water quality have effects on fish that are more direct. Some species only can survive in specific habitats as the oceans warm up, the specific water temperature should require for their survival. So these species or fish stock will shifts and move to different areas.

BYCATCH

By-catch is one of the most significant issues which are affecting fisheries management today. Bycatch issue was observed first when captured public attention in 1960's and 1970's which is because of threat to the charismatic dolphins in the eastern tropical Pacific (Lewison *et al.,* 2004). Annually, average 7.3 million tons of marine life are caught incidentally, which one of the principal threats to marine biodiversity worldwide (FAO, 2004). Global bycatch approximately in amount to 40 percent of the world's catch, totalling 63 billion pounds per year (Keledjian *et al.,* 2014). India is a tropical country with multi-species and multi-gears are using for exploitation of fishery resources. Due to multi gear and multi species become more bycatch, which is one of the major ecological side-effects of fishing.

POST-HARVEST LOSSES IN MARINE FISHERIES

In India, fish is the major source of protein for over one-third of thepopulation especially for the rural poor in coastal areas. About 35 per centof Indian population is fish eaters and the per capita consumption is 9.8kg whereas the recommended intake is 13 kg (Srinath *et al.,* 2008; GOI, 2011). The marine fish production has also been stagnating over recentyears (CMFRI, 2004). As per FAO, the post-harvest loss in world fisheries is 10 percent. According to an analysis by Associated Chambers of Commerce and Industry of India, the post-harvest fish wastage leads to annual losses worth over Rs 15,000 crore in India's marine and inland fisheries sector. The post-harvest fish handlinginfrastructure poor in major maritime states in India which leads to wastage of about 25 percent of the total fisheries resources. Considering the nutritional significance coupled with stagnating catches in India, it is imperative that losses at all levels should be reduced. Fish is one of the most perishable food items, yet fish serve as an excellent animal protein source in developing countries. The reduction of fish losses can help alleviate shortages of other protein foods. Implied in the increased utilization is the need for reduction of losses due to poor landing and sanitation throughout the distribution chain. Post-harvest Food Loss (PHL) in general is defined as the measurable qualitative and quantitative loss along the supply chain, starting at the time of harvest till its consumption or other final uses (De Lucia and Assennato, 1994; Hodges, Buzby and Bennett, 2011). In the case of fisheries, PHLs can occur either due to waste or due to inadvertent losses along the way. Harvest and post-harvest losses has been defined as the quantity of marine fish which is not available or is not fit for human consumption due to physical damage, spoilage or some other reasons (Ames *et al.,* 1991). There are appreciable losses during both harvest and post-harvest stages in fisheries. Harvest losses are losses that occur at the time of harvesting and on board the fishing craft.

MANAGEMENT STRATEGIES

India's marine fisheries can generally be characterised as a free and open access system, underpinned by fairly conventional policy goals of maximising production based on increased fish landings through technology inputs and expanded fishing effort. This model is fairly consistent with many other countries, yet global experiences hows that this approach usually results in low levels of success in generating sustained economic benefits; insome cases it leads to stock collapse from over capacity and overfishing. Marine fishing under open-access conditions usually fails to support sustained livelihood development of fishers, particularly smaller-scale operators, as economic rents are dissipated and incomes decline. It is an appropriate time for India to step back and learn from a small but growing body of emerging national and international best practices in fisheries management that can help guide marine fisheries into becoming a better-managed and more sustainable sector for economic and social development. This is especially critical for inshore fishing, as opposed to deep sea fishing in more distant areas in the EEZ. While India's marine fishing sub-sector has many positive features to build on, a new approach is needed with an increased focus on maximising economic, social and environment benefits, improving productivity, and providing better equity. This needs to be supported by appropriate policy, legal, and institutional frameworks, and amore effective fisheries management system for both inshore and off shore stocks.

Improving the performance of marine fisheries, creating a more sustainable flow of social and economic benefits, and ensuring a healthy marine environment requires a number of reforms and actions to be implemented at both national and state levels. In brief, a comprehensive transitional reform process is needed to: Build awareness of the potential opportunities and policy options, and gain broad support for change(from civil society at the community level to senior policy makers);Develop a new policy framework (including objectives and roles and responsibilities); Establish the supporting institutional framework(legal framework, management systems and processes, accountabilities, organisational design); Strengthen the required human capacity to implement more effective fisheries management; Put the framework and capacity into practice through pilot programs in selected states; and Monitor progress and use an adaptive process to continually improve sub-sector performance (Milne, 2010). The marine fisheries management must be based on population subdivisions into smaller biological units or stocks. Stock-specific fisheries management includes the identification of discrete stocks, their growth, recruitment and mortality, etc. which is carried out on large scale to ensure the sustainability of a population, while maximizing its harvest. Information on morphological, physiological, and behavioural variability, parasite distributions, otolith elemental composition provide insights into a stock structure. Fish stocks are changing because of natural and anthropogenic activities. Therefore, conservation of fish stocks is, needless to say, of principal magnitude for appropriate management purpose through the implementation of different stocking strategies.

Marine stock enhancement (MSE) is an integral component of fisheries management involving the release of cultured

organisms to enhance or restore the depleting marine fish stock. A large number of countries are investigating the major potential for releasing cultured juveniles to boost up the marine fisheries.MSE is an integral component of fisheries management involving the release of cultured organisms to enhance or restore the depleting marine fish stock. A large number of countries are investigating the major potential for releasing cultured juveniles to boost up the marine fisheries (Bell *et al.,* 2008). The large-scale restocking is carried out to enhance the depleted stocks of commercially important species to improve catches which may deeply affect the genetic reliability of a population. Ryman *et al.* (1995) have elaborated two kinds of potential genetic concerns associated with this method, that is, introgression, whereby the genetic characteristics of natural populations are compromised by way of loss of adapted genes through interbreeding, displacement or eradication ofthe entire population due to the introduction of disease (s) and homogenization of a genetically differentiated population as a result of flooding with common exogenous gene pools.

The global efforts on marine stock enhancement have begun scientifically in the recent years (Bell *et al.,* 2008). In India, natural stock enhancement activities have been undertaking by Rajiv Gandhi Centre for Aquaculture (RGCA), which has already ranched the Asian sea bass, *Lates calcarifer* and the mud crab, *Scylla serrata* at Pazhayaar estuary in Tamil Nadu. CMFRI also already ranched the pink ear emperor and green tiger shrimp. The other program of MPEDA-RGCA for sea ranching of 1000 juveniles of the marine finfish, Cobia was the first of its kind in India. The ranching program with tagging of fish before its release was initiated to carry out the research studies to know the type of trophic dependence in the Indian estuarine marine food web (MPEDA, 2012). Our knowledge of tropho-dynamics of marine and estuarine fish is considered to be important and essential in order to sustain the marine stock enhancement. Stock enhancement of pen aeid prawns along the Kerala coast of India was considered to be not successful because of heavy mortality of hatchery-grown post larvae on their release to the sea. Moreover, they were neither acclimatized to the sea water nor acquired skills of predator avoidance. The efforts are intended to revive depleted marine snail species *such as Turbinella pyrum* (sacred chank), *Babylonia spirata* (whelk), *Volegalea cochlidium* (spindle shells), *Chicoreus ramosus* (murex) and *Chicoreus virgineus*a long the coast of Tamil Nadu in India. A total of 10,000 juveniles and 0.50 million larvae of the different species of snails were sea ranched in the Gulf of mannar in the year 2010. Natural stocks of all of the species of snails are exploited for their meat, shells and opercula.

CONCLUSION

The fisheries sector has been recognised as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of cheap and nutritious food, at the same time it isan instrument of livelihood for a large section of economically backward population of the country. Stock enhancement program must be integrated along with continue monitoring of resources and fishery management that involves habitat protection and stocking of juveniles with appropriate control of fishing effort. Therefore, marine fisheries need management and conservation measures necessary to sustain the marine resources in future.

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