Can We Really Increase Marine Fish Yield?*

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Recent years have been witnessing stagnation of marine fish yields, causing concern among a host of stakeholders including fishers, traders, consumers, exporters, planners and the public. The Indian marine fish yield has reached a plateau (2004-05), steadying around 2.7 million tonnes (see Fig.1).

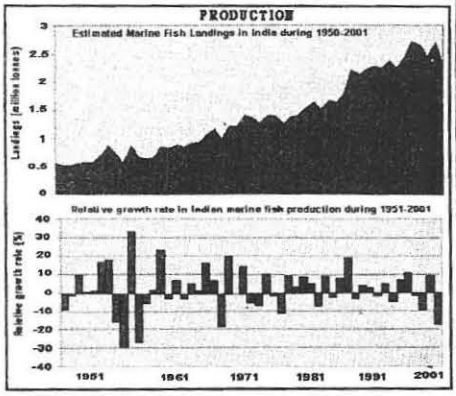

Fig. 1: Indian marine fish Yield (2004-05)

The expert committee appointed for revalidation of the stock (2000) has indicated that the potential yield from the Indian EEZ could be 39,34,417 tonnes, of which 20,17,072 tons are demersal fish, 16,73,545 tonnes pelagic and 2,43,800 tonnes oceanic resources. (See Tables 1-4).

Table 1: Estimates of potential yields in the Indian EEZ excluding the island territories (Source, Working Group Report, 2000)

Resource	Region-wise potential yields (t)				
	NE	SE	SW	NW	Total
Pelagic finfish	81,317	4,19,189	7,51,859	4,21,180	16,73,545
Demersal finfish	82,674	3,30,890	3,07,925	4,79,035	12,00524
Prawns, crabs, lobsters, Stomatopods	11,806	66,071	1,59,816	2,53,323	4,91,016
Squids	178	5,110	19,884	24,649	49,821
Cuttle fish	345	8,377	21,812	19,455	49,989
Octopus	0	97	1,352	0	1,449
Bivalves, gastropods	0	1,22,948	91,181	10,144	2,24,273
TOTAL	1,76,320	9,52,682	13,53,829	12,07,786	36,90,617

This estimate viewed against the present yield of 2.7 mt has raised hopes among many that there is scope for increasing the yield to the tune of about 1.2 million tonnes and this could be achieved just by increasing the fishing effort or by diversification of fishing or by exploring the deeper seas. Is this really possible or is this just wishful thinking?

Table 2: Potential yield estimates of pelagic fishery resources (t)

Species/group	Estimate (in tonnes)
Wolf herring	16,492
Oil sardine	2,94,869
Other sardines	1,01,490
Hilsa shad	26,029
Other shads	14,690
Bombay Duck	1,16,227
Anchovies	1,41,817
Other clupeids	78,932
Ribbon fish	1,93,670
Carangids	2,38,148
Mackerel	2,95,040
Seer fish	61,719
Coastal tuna	65,472
Barracuda	20,849
Mullets	8101
TOTAL	16,73,545

Understanding the mess we are in

Indian marine fisheries output has grown substantially in the past 50 years from an artisanal to an industrialized sector. The impact of mechanization, modernization, processing and value addition and development of trade have all resulted in creating an industry worth several billions of rupees at present. In the past, there was a situation where there was an increase in yield of fish with increase in fishing effort, which was characteristic of a healthy natural resource. The increase in fishing effort (in other words number and capacity of boats) went on with the assumption that the resources are abundant, endless and the more the number of boats and better the gear, the higher the quantities captured. This kind of capture frenzy continued till the fact slowly dawned upon all that the resources are not endless and yields from capture have stagnated, reduced or the profitability of capture was declining. The stakeholders started a game of blaming each other, the government, off shore fishing, aquaculture, trade, pollution, weather, etc., the list was endless. Now we have reached a situation where the yields have started reducing, valuable fishes have started disappearing or getting caught is smaller quantities and with individuals being much smaller than in the past, the fishing operations becoming non-remunerative, the industry being at the verge of a collapse. The fishers got marginalized, their income and employments got reduced and the emerging scenario of impending

Table 3: Potential yield estimates of oceanic fishery resources

Species/group	Estimates (in tonnes)
Yelllowfin tuna	1.14,800
Bigeye tun	12,500
Skipjack	85,200
Bill fishes	5,100
Pelagic sharks	26,200
Horse mackerel	n.a
Oceanic squids	n.a
Dolphin fish	n.a
TOTAL	2,43,800

Table 4: Estimates of additional harvestable yields (in tonnes) from Indian EEZ

Resource	Demersal	Pelagic	Oceanic	Total
Potential yield	20,17,071	16,73,545	2,43,800	39,34,416
Present yield (1993-98)	12,29,888	12,21,896	Neg.	24,51,784*
Additional harvestable	7,87,183	4,51,649	2,43,800	14,82,632

* Excluding cephalopods and other molluscs

*(The views expressed in this contribution are the personal ones of the author and may not reflect those of the organisation he represents.

doom started becoming more and more clear. Thus, before attempting to address the question of increasing yield from the seas, we need to understand what kind of a mess we are in. The following analysis is an attempt in that direction.

How Much do we Fish?: Differing information exists on the quantities of fish we catch from our seas. While it is understood that we do not have any mechanism to quantify the catch of fish in the high seas in the EEZ exploited by vessels of other countries as well as fish caught and traded in the high seas to foreign buyers, our own information on marine landings do not tally. The following Tables (Table 5 and 6) present the available information on the marine fish landing from the maritime States and islands.

A careful examination of the state-wise data presented shows that there are wide differences between the data on fish landings between the two sets. In some of the instances, the annual data show very wide gap. The CMFRI uses a scientifically developed, field tested and widely accepted stratified random sampling technique for the assessment. The methods for assessment used for the data obtained by the MoA from the various states are not known and therefore no comparison is possible. However, the fact remains that the scientific data sets present a stagnation and decline as against a uniform and positive growth rate indicated by the MoA data. Also, the MoA data contain landings of A & N and Lakshadweep islands. Field experiences however do not support the view that the marine landings are showing a positive trend with a slow growth rate.

What is the Current Growth Rate?: Based on the data the growth rates are being calculated every year. The growth rates in marine fisheries calculated by CMFRI and the MoA are given in Table 7 (next page).

The above data indicate erratic behaviour of the resource as no clear trend is discernible. However, to the scientific community, the negative growth rates indicated above are disturbing and could be treated as an alarm signal calling for immediate intervention. It must be noticed that a point of stagnation has already been reached.

How Much Excess Fishing Capacity we have?: The details of the fishing crafts (MoA data) are given in Table 8.

Analysis of the fishing capacity indicates excess capacity in the traditional, motorized and mechanized sectors. The traditional sector which contributes to only 13% of the total catch has an excess capacity of 81%. The motorized sector which contributes to 20% of the catch has an excess capacity of 60% while the mechanized sector which has the major share of 67% the marine yield has an excess capacity of 55%. Thus we have a fishery which has excess capacity in all types of gear. Of these, the excess capacity of the mechanized sector is the most alarming as it contributes to the bulk of the yield. Therefore, it is this sector where a reduction in fishing capacity can make a difference in the scenario. This is easier said than done. Since a lot of capital has been invested in this sector, it will be impossible to downsize the boats. The only alternative is to stagger the operational schedules of boats or introduce quota system or limited entry. These basic interventions can only gradually yield results as any reduction in fishing effort will first result in decrease of yield followed by an increase.

A close look at the status of the important marine fishery resources (see Table 9) clearly indicates that most of the resources are optimally exploited while a few others are either under stress or slightly over-exploited.

It is also obvious that most of the resources are exploited in the coastal waters within the 50 m depth zone. Thus, it is not only the fish resources which are overexploited, but the nearshore habitats are constantly traversed by the fishing gears in search of fish. In recent years several mechanized vessels have ventured in to deeper waters and commenced multiday fishing operations. This is certainly a welcome sign which will reduce the pressure on the coastal resources. Also the oceanic resources especially tuna, swordfishes, sailfishes, pelagic sharks are all underexploited. Special efforts are needed for capture of these resources and limited extent of foreign collaboration is possible for utilization of these resources.

Impact of Destructive Gears and Practices: With the emergence of powerful boats and very 'efficient' nets, the fishing power has increased drastically. The

Table 5: Marine Fish Production by States/Union Territories (2000-01 to 2003 -04) (In '000 tonnes)

Sl. No.	State/Union Territory	C.M.F.R.I. data				Ministry of Agriculture (MOA) data			
		2000-01	2001-02	2002-03	2003-04	2000-01	2001-02	2002-03	2003-04
1	Andhra Pradesh	189.529	152.757	164.911	192.007	182.50	204.94	248.50	263.93
2	Goa	61.867	36.938	64.986	95.890	67.33	66.55	72.29	83.76
3	Gujarat	684.328	467.124	468.254	444.105	620.47	650.83	743.64	609.14
4	Karnataka	182.914	193.680	207.288	184.075	205.90	128.42	180.16	187.00
5	Kerala	604.113	514.139	589.519	623.293	566.57	593.78	603.29	608.52
6	Maharashtra	368.222	395.966	449.599	415.094	402.84	414.27	386.86	420.01
7	Orissa	84.622	71.867	68.429	68.857	121.09	113.89	115.01	116.88
8	Tamil Nadu	393.332	350.709	398.666	355.163	367.86	371.00	371.50	373.00
9	West Bengal	71.283	97.510	158.534	193.643	181.00	184.30	181.50	181.60
10	A & N Islands	-	-	-	-	27.62	27.02	28.23	31.06
11	Daman & Diu	-	-	-	-	16.38	21.52	11.26	13.77
12	Lakshadweep	-	-	-	-	12.00	13.65	7.50	10.03
13	Pondicherry	12.718	12.013	19.459	14.968	38.95	39.60	40.11	42.80
	Total	**2652.928**	**2292.703**	**2589.645**	**2587.095**	**2810.50**	**2829.77**	**2989.85**	**2941.50**

Table 8: Details of fishing capacities

Sl.No.	State /UT	Traditional	Motorized	Mechanized	Total
1	Andhra Pradesh	53,853	4,164	8,642	66,659
2	Goa	1,094	1,100	1,092	3,286
3	Gujarat	9,222	5,391	11,372	25,985
4	Karnataka	19,292	3,452	2,866	25,610
5	Kerala	28,456	17,362	4,206	50,024
6	Maharashtra	10,256	286	8,899	19,441
7	Orissa	10,993	2,640	1,276	15,854
8	Tamil Nadu	33,945	8,592	9,896	52,433
9	West Bengal	4,850	270	3,362	8,482
10	A & N islands	1,180	160	230	1,570
11	Daman & Diu	252	350	805	1,407
12	Lakshadweep	594	306	478	1,378
13	Podicherry	7,297	505	560	8,362
	Total	**1,81,284**	**44,578**	**53,684**	**2,80,491**

Fig.2: Detail of excess capacities in the marine fisheries sector

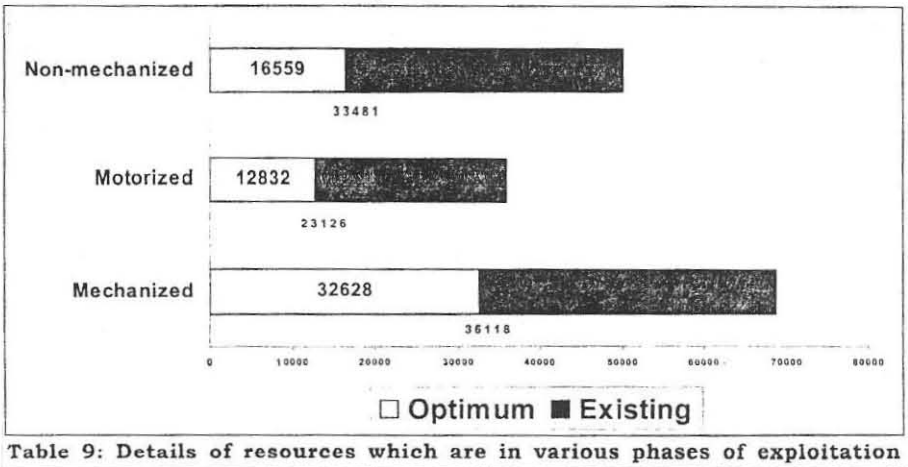

Table 9: Details of resources which are in various phases of exploitation

Species	Fully exploited	Over exploited	Under exploited
Sardinella longiceps	*All along*		
Hilsa ilisha	*NE coast*		
Rastrelliger kanagurta	*All along*		
Scomberomorus commerson		*SE & SW coasts*	
Euthunnus affinis	*All along*		
Katsuwonus pelamis			*All along*
Megalaspis cordyla			*SW coast*
Decapterus russelli			*All along*
Caranx carangus	*SE coast*		
Parastromateus argenteus		*West coast*	
Formio niger		*SW coast*	
Trichiurus lepturus		*East coast*	*West coast*
Harpodon nehereus	*NW coast*		
Nemipterus japonicus	*All along*		
Leiognathus bindus	*East coast*		
Secutor insidiator	*East coast*		
Tachysurus tenuuispinis		*West coast*	
T.thalassinus		*W & NE coast*	
Otolithus cuvieri	*NW coast*		
Johnius macrostomus	*NW coast*		
Penaeus monodon	*East coast*		
P. indicus		*East coast*	
P.semisulcatus		*SE coast*	
Metapenaeus monoceros	*All along*		
M. dobsoni	*All along*		
Panulirus polyphagus		*NW coast*	
Sepia aculeate	*East coast*		*West coast*
S.pharaonis	*East coast*		*West coast*

meal for the animal protein used in the formulated feed. Much of this comes from low value fish caught in the tropical region. Thus, it is deemed that development of aquaculture results in increasing the pressure on the resources for more and more fish meal, thus pushing up the capture of juveniles and low value fish. This also results in marginalization of small scale fish vendors and processors in the developing countries because of the lack of access for them to the low priced fish as the bulk is bought up by the feed industry. These negative impacts thus have a bearing on the resource as well as coastal livelihoods.

Impact of contrasting priorities: The shift in the priorities in the sector for various types of fish and fish products has also impacted the fishery resources. On one hand, the Government is encouraging conservation, sustainability, reduction in bycatch and juveniles while on the other it is also promoting development of byproducts from bycatch, encouraging animal feed industry and promoting aquaculture and fish meal plants. Also, India has adopted the FAO Code of Conduct for Responsible Fisheries aiming at conservation, sustainability and equitability by promoting resource friendly practices while at the same time advancing loans and providing subsidies for procurement of destructive gears like the ring seines and crafts like boats with high powered inboard engines. Such contrasting priorities by the government not only are adversely impacting the resource sustainability and resilience, but also sending wrong messages to all stakeholders. It is high time a clear knowledge driven view is taken by the Government on such diverging issues.

What are the Current Regulatory Instruments?: Presently the fisheries governance in the country is neither well informed or updated. No doubt, there are many MFRAs in the maritime States, most of which are archaic, defunct and unimplementable. There is need to revise, update and put in place knowledge based - MFRAs in all maritime States as well as MFRAs for the areas outside the territorial waters by the Government of India. Further, there are the closed season declared by the Govt. of India for the open seas and the directives to the States for enforcing the closed seasons in the territorial waters. Many States do not follow these instructions. Some States modify these to suit their interests. All these put the resources to high

pressures and consequent deterioration of its resilience. There are also intersectoral conflicts which have negative impact on the resources. The net result is the blaming game and resource depletion.

Status of Informed Fisheries Governance: There have been welcome changes in the attitude of policy makers in respect of following scientific advice and put in place knowledge driven policies and regulations for fisheries governance at the Centre and State levels. There are many State governments who have come out with fisheries policies. The Govt. of India also has been bringing out regulatory and advisory outputs for a well informed fisheries governance in the country. Though it is most gratifying to note that such an informed management regime is envisaged, since the coastal territorial waters where much of the marine fishing is concentrated is under the control of the State Governments, their implementation by the State Governments is far from satisfactory because of extraneous considerations. Thus, even today the marine fisheries governance in the country is far from satisfactory. There is need for the much required political will to implement the regulations in toto if anticipated results are to be obtained.

Increasing Yield or Increasing Net Returns and Profitability?: Quite often, marine fisheries are compared with agricultural crops where there are human inputs like seed, manure, labour, pest control etc, resulting in outputs and profits. It is possible to have control over input-output and have good management to ensure increased yield and profits. Marine fisheries demand a simple system of natural resource management and therefore, they cannot be compared to an input-output system. There is no human input here. Profitability and sustainability depend on the way a natural system is managed through appropriate management interventions. Therefore, rather than talking about 'increasing marine fish production', we need to look at how we can increase profitability from the capture fisheries. This is perhaps the most practical way of overcoming the present day problems of stagnation in yield and reduced incomes. We all know that the cheapest place for marine fish in the whole world is India. The focus of trade and export must shift from sale of unprocessed raw fish to semi-processed, processed or value added fish and products. This single intervention itself can make the difference in the scenario. Many foreign companies are eyeing India for setting up fish processing and value addition plants as the raw material is very cheap in India. This opportunity should be availed of by Indian entrepreneurs so that our people can get the benefits. Thus our outlook should be increasing profitability rather than increasing production.

Issues in Diversification, Value Addition, Momestic Market: Diversification in fishing is most essential for bringing more unfished areas under fishing operations. Our estimates of the potential yield shows that there are 3.9 mmt of potential yield of which around 2.7 mmt are currently caught. The balance of about 1.2 mmt are scattered in the EEZ spread across a very vast area. This includes not only fish but all varieties of pelagic resources such as oceanic squids, other cephalopods, shrimps etc. It must also be reckoned that there are many foreign vessels operating in the Indian EEZ which are already exploiting these resources, the quantities of which are not reported in India. So, all this 1.2 mmt are not available for exploitation and whatever is available for further exploitation lie scattered which would need dedicated and targeted efforts to exploit. So, even with diversification and increased fishing efforts in the deep sea and oceanic waters, the additional yield is likely to be limited.

Value addition has not attracted much attention in the export and domestic trade for marine fish. Even now, much of the fish is exported in just frozen form as whole fish or fillets. These are actually raw materials which are value added by importers in other countries. There are great opportunities in the Indian scenario for value addition of the marine fish caught .

Can Mariculture Really Contribute to Growth in Production?: Quite often statements are made by some stakeholders that mariculture will lead to substantial increase in the production and will push up the annual production figures to beyond 3.0 mmt. This is only wishful thinking. Mariculture may at best lead to 1,00,000 tonnes of the production in the next 5 to 6 years. Even this figure is hypothetical because there are many 'ifs'. So increase in quantity through mariculture is going to be negligible. However, it must be realized that growth of mariculture will result in better incomes and better values for the produce, thus pushing up the overall monitory benefits to the people who take up this activity. Also, mariculture of low food chain species will result in societal benefits to a large extent in the rural coastal poor.

What are our Commitments ?: India is a signatory to many international instruments and therefore has a commitment to keep its promises. The country is committed to rollback its resource position to that of 1985 by year 2015. India has also agreed to voluntarily implement the code of conduct for responsible fisheries. There are many other commitments for resources like tuna, whales, turtles, whale sharks, corals etc which all have to be implemented by the government. Unless a knowledge - based, enforceable, responsible and participatory management regime is in place, India will not be able to honour these and other commitments. Therefore, the need of the hour is to enforce a proper management regime which is implementable.

A Holistic Approach for Future

It must be recognized that any single approach or intervention will not yield either any anticipated impact or any visible change in the scenario. The fish resources are biological natural living resources which are part of a large ecosystem

obeying many laws of nature. They just cannot be managed in isolation. Many of the human interventions have negative impacts. Also many of the planned interventions are interlinked or have impacts on the ecosystem either directly or indirectly. Therefore, carefully planned holistic approaches over wide areas of the coastal seas beyond the narrow confines of the maritime States are needed if any positive outcomes and outputs are anticipated. The following main action points need be considered for making this change.

1. *Reduce losses*: Discards at sea constitute up to 30%. Other post harvest losses are up to 15% and on account of non-food uses up to 9.73%. In other words, up to 55% of the fish which is actually caught at sea could be better utilized for human food purpose through appropriate interventions to reduce losses.

2. *Harvesting Immature/ Undersized Fish*: Use of undersized fishing nets result in capture of undersized/immature fish. This results in great loss to the fishery resources. Strict adherence to the recommended cod end mesh size of 35 mm will allow the juveniles to escape and grow to commercial size, thus contributing to the total weight (quantity) of fish caught from the seas.

3. *Banning Destructive Fishing*: Fishers use several destructive methods of fishing such as blasting, poisoning, trawling in reefs, seagrass beds. Appropriate action should be taken by the Government to prevent such destruction. Ghost fishing must be reduced.

4. *Implementation of Closed Seasons*: The committee appointed by the Government of India has recommended a closed season for 47 days on the west coast from 15th June to 31st July and on the east coast also for 47 days from 15th April to 31st May. All maritime State Governments should be directed to strictly enforce the monsoonal ban as per the recommendations.

5. *Diversification of Fishing*: The pressure on the near shore fish stock should be reduced by opting for diversification of fishing to multi-day fishing, deep sea fishing. This will increase yields substantially.

6. *Optimizing Fishing Fleet Size*: The non-mechanized sector contributes to 13% of the yield. This sector has an overcapacity of 81%. The motorized sector contributes to 20% of the yield. This sector has an excess capacity of 60%. In contrast to these, the mechanized sector which contributes to 67% of the yield has an excess capacity of 55%. It is this sector where the excess capacity has to be gradually reduced to optimum levels. Even a reduction of 10% of trawlers can increase the fish yield by 50 lakh tons annually.

7. *Sea Ranching*: One of the methods to enhance coastal productivity is through sea ranching of juveniles of hatchery produced fish and shellfish. This has to be massive and continuous at various locations to achieve a noticeable impact. Government sponsored schemes are to be implemented for sea ranching of shrimps, high value species such as lobsters, crabs, sea cucumbers and demersal fishes on a long term basis for visible increase in production.

8. *Reducing Biological Overfishing of Stock*: The overall exploitation rate (E) is 0.59 for Southeast Asia while the optimum should be between 0.3 and 0.5. Therefore reduction in exploitation rate is an ideal way to increase the yield.

9. *Degradation of Critical Habitats*: Substantial loss of critical habitats such as mangroves, seagrass beds, estuaries, coral reefs, due to coastal pollution, fishing, industrialization, urbanization, global warming etc. Government action is needed to put in to place coordinated action plan to restore degraded critical habitats.

10. *Mariculture*: Production of fish from sea also could be enhanced through growing fish in sea by using pens, cages. Shellfishes like mussels, oysters, clams, scallops, seaweeds could be grown on rafts by using ropes, nets etc. The production of mussels through mariculture has reached the present level of 6,000 tonnes/y and oysters 1,000 tonnes/y. However it must be realized that production of fish and shellfishes through mariculture has its limitations and it would never compensate adequately the gap in capture fisheries, although value-wise the increase could be remarkable. Further, it would add to coastal livelihood, employment and nutritional security.

11. *Artificial Reefs and FADs*: These man-made structures will attract fish to these areas, thus allowing local fishers to undertake concerted fishing to capture fish easily. There is need to install FADs in certain sensitive and distressed areas to promote local livelihoods, but this should not be taken up as a massive activity across the coastal regions as it has also adverse impacts on the fish resources.

12. *Responsible Fisheries*: By following the Code of Conduct for Responsible Fisheries both in letter and spirit, it will be possible to increase marine fish yields systematically over the next few years. It must be reckoned that interventions in the capture process will result in an initial decrease which should be viewed without any panic. The situation will show improvement slowly as it takes time for the resources to respond. In a year or two the anticipated results will be achieved. Governmental initiative in this direction is urgently called for.

Resource resilience, sustainability, equitability, nutritional security, food security, employment generation, women empowerment etc are all very nice words to speak from platforms. But the fate of the poor fishers remain the same and that of the coastal fisheries continue to deteriorate. We are fast approaching a situation of no return if urgent and concerted action is not taken to prevent it. Informed and knowledge based marine fisheries management should be the first priority of the Central and State Governments to save the marine fisheries from total collapse.

(Footnotes).