

We, the members of the Committee to Study the Impact of the Closed Season on the Fisheries hereby submit our report.

- Director, Central Marine Fisheries Research Institute, Cochin - Chairman
- Commissioner of Fisheries, Govt. of Andhra Pradesh - Member
- Rep. of Fisheries Department, Govt. of Kerala - Member
- Rep. of Fisheries Department, Govt. of Tamil Nadu - Member
- Rep. of Fisheries Department, Govt. of West Bengal - Member
- Rep. of Fisheries Department, Govt. of Maharashtra - Member
- Rep. of Fisheries Department, Govt. of Karnataka - Member
- Rep. of Fisheries Department, Govt. of Gujarat - Member
- Director General, Fishery Survey of India - Member
- Deputy Commissioner, (Marine), DAOH - Convener

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ABBREVIATIONS

| | | |
|---------|---|---|
| CMFRI | - | Central Marine Fisheries Research Institute |
| DoF | - | Department of Fisheries |
| DK | - | Dakshina Kannada |
| DAHDF | - | Department of Animal Husbandry, Dairying, & Fisheries |
| EEZ | - | Exclusive Economic Zone |
| FDI | - | Factor Development Index |
| FSI | - | Fishery Survey of India |
| Gol | - | Government of India |
| HP / hp | - | Horse Power |
| IBM | - | Inboard Motorized |
| OBM | - | Outboard Motorized |
| MSY | - | Maximum Sustainable Yield |
| MEY | - | Maximum Economic Yield |
| nm | - | Nautical Miles |
| SDI | - | Social Development Index |
| UK | - | Uttara Kannda |
| UT | - | Union Territory |

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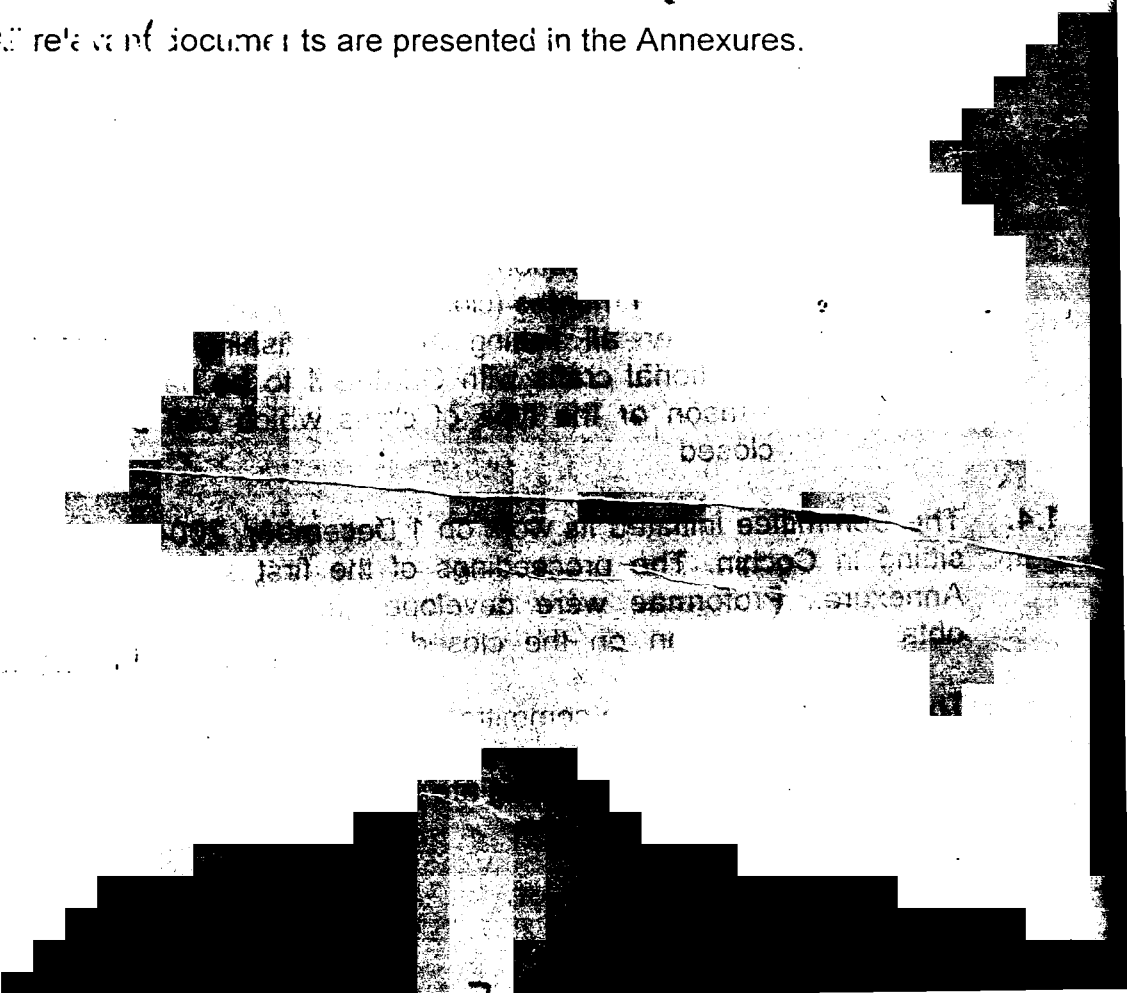
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CHAPTER 1

PREAMBLE

- 1.1. The Government of India constituted a Committee on 1st January, 2004 to study and report the impact of the closed fishing season on the marine fishery resources of the country vide No. 30035 / 15/97-FY(T-1), Government of India, Ministry of Agriculture, Department of Animal Husbandry & Dairying (Annexure 1).
- 1.2. The view of the Government was stated as follows: The Spawning periodicity of various marine fishes and shell fishes depends on a wide variety of oceanographic, climatological and ecological parameters which vary from place to place in the Indian ocean, Arabian Sea and Bay of Bengal. The maritime State Governments and the Government of India has been issuing ban orders for fishing operations in certain periods during the monsoon months every year. The monsoon ban was imposed to conserve and replenish the fishery resources of the Indian EEZ by protecting them during this period, which is said to be their main breeding season.
- 1.3. The terms of reference of the Committee is as follows:
 - (i) To carry out an evaluation study on the impact of closed season in increasing the fishery resources of the India EEZ
 - (ii) To study the population dynamics, recruitment, fecundity, natural death, catch etc. and the MSY and MEY in the Indian coasts
 - (iii) To study the diurnal oscillation, eutrophication and upwelling season, migration, productivity of waters during and after monsoon months (closed season)
 - (iv) Whether all fishing including fishing by non-mechanized traditional crafts with OBM/IBM to be banned during closed season or the type of crafts which can be allowed during closed season
- 1.4. The Committee initiated its work on 1 December, 2004 by holding its first sitting in Cochin. The proceedings of the first sitting are presented in Annexure. Proformae were developed and sent to all members for obtaining information on the closed seasons followed by the States.
- 1.5. The second sitting of the committee was held on 23.7.2005 at Bangalore during which detailed discussions and submissions were made. The proceedings of the second sitting are presented in Annexure

- 1.6. A draft report was prepared based on the outcome of the discussions and submissions received from the members. In the preparation of the draft, scientific opinion requested and received from mandated institutions were also considered for arriving at conclusions. The draft was circulated to members on 10.8.2005. Suggestions received were considered for improving the draft report.
- 1.7. The third sitting of the Committee 25 .8.2005 in Cochin where the draft report was finalized.
- 1.8. The Report has 6 Chapters and Annexures. Chapter 1, that is the present chapter has provided a brief preamble. Chapter 2 makes an evaluation of study of Impact of closed season in increasing fishery resources in the Indian EEZ. Chapter 3 deals with population dynamics, recruitment, fecundity, natural death, catch etc. and the MSY and MEY in the Indian coasts. Chapter 4 discusses diurnal oscillation, eutrophication and upwelling season, migration, productivity of waters during and after monsoon months (Closed season). Chapter 5 addresses the question whether all fishing including fishing by non-mechanized traditional crafts with OBM / IBM to be banned during closed season or the type of crafts which can be allowed during closed season. The last Chapter, Chapter 6 presents the summary and recommendations
- 1.9. All relevant documents are presented in the Annexures.



CHAPTER 2

Title : Evaluation of study of Impact of Closed Season in increasing Fishery Resources in the Indian EEZ

The first item in the terms of reference of the committee is to make an evaluation of the impact of closed season in increasing the fishery resources in the EEZ. The committee addressed this issue by generating an understanding of the nature of the closed season as practiced in the various maritime states.

CLOSED SEASON

The Govt. of India order No. 30035/15/97-FY (T-1)-Vol.II dated 22.03.2005 of the Deputy Commissioner (Fisheries) Ministry of Agriculture, Deptt. of Animal Husbandry, Dairying and Fisheries, Govt. of India had declared a uniform fishing ban in the west coast including the Lakshadweep islands and in the east coast including Andaman and Nicobar Islands for conservation and effective management of fishery resources and safety reasons. The order stated that " in view of the consensus arrived, the President is pleased to impose a uniform ban on fishing by all deep sea fishing vessels in the Indian Exclusive Economic Zone on the east and west coast as given below:

East Coast – From 15th April to 31 May, 2005 (both days inclusive)

West Coast – From 10th June to 15th August, 2005 (both days inclusive)

Similar ban may be imposed within the territorial waters of all the East Coast and West Coast States and UTs during this period to make the fishing ban total for all fishing vessels in their coastal waters.

The committee noted that the above order clearly stipulates that there is a uniform ban on all deep sea fishing vessels in the Indian EEZ and directed that a similar ban may be imposed within the territorial waters of all the East Coast and West Coast States and UTs during this period to make the fishing ban total for all fishing vessels in their coastal waters. In other words, the directive was to declare a **TOTAL BAN ON ALL FISHING IN THE TERRITORIAL WATERS** during the notified periods.

In the light of the letter and spirit of the above, the committee during its first meeting decided to examine the nature of the fishing ban as practiced by various State Governments. A proforma was designed (annexure...) and sent to the various maritime states and UTs to obtain the actual ground truth. A few states responded, but much of the information sought was not in the form of the proforma provided and hence could not be processed and compared. However, the gist of the information received from those responding states are given below.

1. Nature of the closed season in the maritime states

Scenario in the maritime states as per submissions by various states

Gujarat

As per the Government of India Order No. 30035/15/97-Fy(T-I) – Vol.II dated 22-03-2005 ban on fishing is imposed and closed season declared on Western coast from 10th June to 15th August. Government of Gujarat also issuing orders for the closed fishing season during this period. Gujarat fishermen are not going for fishing from 15th of May, therefore it is to say that they observed closed season starting from 15th of May.

There is representation from Akhil Gujarat Machhimar Association to declare closed season from 15th May to 31st July for trawlers only. There should be no closed season for small FRP fishing boats and FRP fishing boats operating with OBM for gill netting.

There is a suggestion for slight realignment of the ban period to co-inside with ban traditionally observed by fishermen based on their knowledge.

The revised period for ban is suggested above, if the days are counted it would be for 77 days i.e. 15th May to 31st July, whereas Government of India period i.e. 10th June to 15th August would be 67 days, so there will be increase of 10 days for ban period as per the suggestion of Akhil Gujarat Machhimar Association.

Maharashtra

The Maharashtra Marine Fishing Regulation Act 1981 which came into force in 1983 in the State. Under the provision of the act, the marine fishing ban was imposed from 1st June to Narali Pournima vide Govt. Order No. FDX 1481/22167/181/12-ADF dated 16th August, 1983. The fishing ban period was nearly 65 to 90 days depending upon the date of Narali Pournima. Since the fishing ban period was nearly 3 months, there was a demand from the coastal fishermen to reduce the ban period and accordingly the Govt. issued the revised order vide dated 14th August 1996 declaring the ban period from 10th June to Narali Pournima or 15th of August whichever is earlier.

The Govt. of India, Ministry of Agriculture, Department of Animal Husbandry and Dairying, New Delhi has issued a order vide dated 29th March 2004 declaring the ban period from 10th June to 15th August, 2004 (both day inclusive) in the Exclusive Economic Zone of West coast. This order is issued giving reference of the State Minister's Conference of Animal Husbandry & Dairying and not in the provision of any act.

The monsoon fishing ban period is observed in the State from last 20 years. It is observed very strictly during last 6-7 years. Necessary steps are being taken by the State Govt. Fisheries Department as well as the concerned agencies like Port Department, Mumbai Port Trust, Customs etc. to observe the ban period very strictly. The 100% sales tax free diesel quota is also stopped during this ban period. The mechanized fishing vessels are mostly grounded during this closed season.

The closed season is observed in the State from last 20 years but the results are not still satisfactory. The catch of most commercial important fishes are declined to a great extent. Hence the issue of observing closed season in the seas needs to be reviewed.

One of the important reasons for imposing the ban period for fishing during monsoon is the breeding period of most of the fishes. During May-June, when these fish are matured, the females with full of eggs are caught and when the fish are empty, the ban period is started. Again there are reports that most of the fish breed throughout year or the breeding season varies from fish to fish. Hence instead of observing the similar breeding period all over the coast, it is necessary to observe according to the habit of breeding season of the particular fish species at particular breeding ground.

The non mechanized fishing vessels are exempted for fishing during closed season. These vessels mostly fish in the shallow water in the creek, also affects the fish breeding, the juveniles and the fish coming for breeding in shallow water also caught by these non mechanized fishing vessels. Hence there should be complete ban for fishing by any fishing vessel including creek and high seas.

One of the important reason for fishing ban in monsoon is stormy weather and to avoid life losses or financial losses. But now a days a fishing vessel constructed are more seaworthy and equipped with modern equipments, wireless sets etc. Even there is a wide development in the weather forecast which can change the situation.

As per Govt. of India order dated 29th March the closed season for east coast is from 15th April to 31st May i.e. nearly 47 days where as for west coast it is from 10th June to 15th August, 2004, i.e. nearly 69 days bearing 22 days more than the east coast. The monsoon ban period observed on west coast is nearly 67 days is much more which creates the problem of employment of fishermen even there is a very much shortage for fresh fish along the coast where the people is more acquitted for fish. Hence the fishing ban period for east as well as west coast should be similar. The scientific views for such period may please be obtained from the Research Institute and a fishing ban period should be decided.

The State Government is thinking to have a ban period during February to March for dol net fishing from Vasai to Dahanu (Dist. Thane) and to catch juveniles of pomfrets to conserve the pomfret fisheries along the Maharashtra State. Similarly the order is to be issued to catch the pomfrets above 300 grams and lobster above 200 grams.

The issue of observing closed season in the seas needs to be reviewed, the scientific opinion on the impact of the ban on the resources should also be obtained. There is need to give more emphasis for conservation of fish fauna to a large extent as well the interest of fishermen should also be protected.

Goa

No view has been communicated by the state except a Table

Karnataka

Tradition of observing closed season during South West monsoon months by both traditional and mechanized fishermen was a practice even before K.M.F.R. Act was enacted. In general, fishing was not conducted from 1st June to 31st August every year during pre-act period. In the beginning, fishing using mechanized boats was prohibited along Karnataka coast from 1st June to 31st August and this period was reduced to 67 days during 2000 as per the decision taken in the meeting of officers of West Coast states held on 9-9-1998.

From the current year, further reduction in the ban period has been effected on par with the period being practiced in Kerala State and further during this period motorized traditional canoes (fitted with OBM or IBM Engines up to 25 HP for propulsion purpose) are permitted sea fishing. The copy of the notification dated 25.6.2005 is enclosed. As per the notification, along the coast of Dakshina Kannada and Udupi District ban period will be in force for a period of 57 days starting from 15th June to 10th August while it will be from 1st June to 29th July along Uttara Kannada District (45 days). This decision has been taken after having detailed discussions with the Fishermen associations of both mechanized and traditional sector, local elected representatives and fishermen leaders.

The views of the Government of Karnataka regarding observation of closed season are as under.

Though fishing ban is being observed since last two decades no significant effect has been felt with respect to marine landings. The landings are fluctuating over the years. Hence, it is difficult to conclude that observing closed season has beneficial effect.

Kerala

No view has been communicated by the state

Tamiil Nadu

Since different species of fishes have different spawning period, spawning period of all major variety of fishes is uniformly spread throughout the year. Hence, we may suggest that the ban period is not meant to facilitate breeding of the fishes but to conserve fishery resources in order to provide sustainable fishing activity in sea and hence livelihood support to the fishermen on sustained basis.

Pondichery

No view has been communicated by the state

Andhra Pradesh

The State has communicated that it is willing to implement a fishing ban, the time and duration of which may be decided after studying the impact of the present ban on marine fishing.

Orissa

No view has been communicated by the state

West Bengal

No view has been communicated by the state

In summary, the nature and extent of closed seasons as practiced presently by the maritime states could be summarized in a table below.

| State / UT | Closed Season | No of days | Types of fishing not allowed |
|-------------|--|------------|---------------------------------------|
| Gujarat | 10 th June to 15 th August | 67 | All crafts |
| Maharashtra | 10 th June to 15 th August | 67 | All crafts |
| Goa | 10 TH June to 15 th August | 67 | All crafts |
| Daman & Diu | 1 June to 15 August | 75 | Trawls, Gillnets, Doll nets |
| | 15 June to 10 Aug | | All except motorized |
| Karnataka | (DK & Udupi Dists) | 57 | traditional canoes with |
| | 1 June to 29 th July (UK Dist) | 45 | OBM or IBM engines up to 25 hp |
| Kerala | 15 June to 29 July | 45 | Mechanized Trawling |
| | 15 th April to 29 th May (east coast dists) | 45 | |
| Tamilnadu | 15 th June to 29 th July (West coast from Kanyakumari town to Neerodi) | 45 | Mechanized fishing boats / trawlers |
| Pondicherry | Not Available (NA) | NA | NA |
| Andhra | 15 th April to 31 May | | |
| Pardesh | | 45 | Traditional and Motorized Traditional |
| Orissa | Not available (NA) | NA | NA |

| | | | |
|-------------|--------------------|----|--|
| West Bengal | 15 April to 31 May | 45 | Trawling, Gill nets, Behundi net, Ber net |
|-------------|--------------------|----|--|

CONCLUSIONS

It is clear from the above that the duration and period of the ban are varied in the states. Further, the types of gear / fishing banned are also varied. In some states all fishing activities are banned while in some others only trawling or mechanized fishing are banned.

2. Type of fishing activities during the closed season in the maritime states

The following table summarizes the types of fishing activities which are currently permitted/ going on in various states / UTs during the ban period

| State/UT | Gear |
|----------------|--|
| Gujarat | Nil |
| Maharashtra | Nil |
| Goa | Nil |
| Karnataka | Motorized up to 25 hp |
| Kerala | All traditional and motorized gear including OBM/IBM with various capacities up to 110 hp IBM |
| Tamil Nadu | All non-motorized traditional gears and motorized with less than 25 hp (OBM) |
| Pondicherry | Not available |
| Andhra Pradesh | Gillnets, Shore seines, Traditional and Motorized OBM below 25 hp |
| Orissa | Not available |
| West Bengal | Nil |

CONCLUSIONS

It is clear from the above that in some states no fishing is allowed, in some others both non-motorized and motorized, the latter with very high fishing powers are permitted.

3. Impact of the closed season in the maritime states

The committee is of the opinion that IMPACT on the fishery resource must be fully understood before they are quantified or evaluated.

1. What are the indicators of IMPACT ?

It has been reckoned that fisheries management and regulatory interventions such as the closed season must result in certain positive impacts on the resources and its users (stakeholders). Thus, the committee is of the opinion that some of the positive impacts (benefits) should be identified as below:

- I. Increase in total yield after the ban period
- II. Increase in catch rate
- III. Stability of the species ratios
- IV. Increase in mean size (weight) of the fishes caught
- V. Sustainability of the fishery resources
- VI. Resilience of the fish stock
- VII. Secondary social and economic benefits

While it is obvious that IMPACT therefore should be measured in terms of each of the above, the general perception is that increase in catch alone is

the impact of a ban. This is not true. It is well known and understandable that if there is no fishing for some time or if the fishing efforts are reduced for some time, the catches will be more soon after the commencement of fresh fishing.. It is only natural and anticipated. Just an initial increase in fish yield alone is not an indicator of sustainability or resource resilience.

What is Sustainability of the resource? Ability to catch the same quantities of fish year after year is not sustainability. Sustainability has several dimensions. Consistent with the Brundtland definition, Sustainability is the condition in which we are reasonably confident that 'as we are meeting the needs (and wants) of the current generation, we are also passing along to future generations sufficient means for them to meet their needs (and wants)' . So , what are the measures of functions of sustainability ? The state of the environment system, the stress on those systems in the form of environment, exploitation, the human vulnerability to environmental changes in the form of loss of fishery resources, the social and institutional capacity to cope with the environmental changes, the ability to respond to demands of global pressures by collective efforts to conserve resources based on a knowledge based resource utilization. In fisheries, in order to ensure sustainability, the indicators must be identified. Some of these are: Steady and consistent total yield year after year, Consistent species composition and species ratios, steady rise in economic value and incomes, more or less steady fish population parameters, steady stock resilience (ability to reproduce, recruit and recover from setbacks including fishing), ability of the fishery resource to respond positively to changes in fishing efforts, sustainability in trade, markets, export earnings, livelihoods. Therefore, the indicators of sustainability should quantify, among others, the following: Indicators of stock size, exploitation rate and replenishment rate, potential yields of species/groups, indicators of species ratios, indicators of bycatches, discards, juveniles, economic

indices (e.g. FDI), social development indices (SDI), trade and market indices. There are a number of problem areas in marine fisheries for ensuring sustainability. These are mainly consequences of the following situations: Multi-species, multi-locale, multi-seasonal, multi-gear fisheries, over capitalization, excess capacity, unbalanced development, equity in distribution of income, gender equity issues, changing exploitation patterns, changing species ratios, changing predator-prey relationships, changing biota, destruction of bottom, juveniles, bycatch, discards at sea, natural calamities, policy lacunae, lack of monitoring and surveillance and lack of knowledge based management system. All these point towards developing a national agenda for sustainability through development of indicators, creating a mechanism for monitoring and implementation, ability for conflict management, willingness for stakeholder participation and at the policy formulation level a willingness for developing a knowledge based fisheries management and governance system

The committee was able to obtain the views of some states and mandated institutions on the impacts based on their understanding and perceptions of the 'impact'. These are summarized below.

Gujarat, Maharashtra, Goa, Kerala, Tamil Nadu, Andhra Pradesh and West Bengal have indicated positive impacts from the ban in terms of increased yields during the post ban period. However, no state had carried out a scientific analysis from the DoF to examine the impacts in detail. Thus the impacts were recognized only in terms of some increase in catch which was normal and anticipated. There have been some studies carried out by institutions the gist of which are given below. The CMFRI carried out a study on "Monsoon Fisheries of the West Coast of India" in 1992 (Bulletin No. 45, CMFRI, Cochin). It was clearly stated in the study (page.258) that "the rapid increase of ring seines and similar gears witnessed during the recent years would sooner or later assume the

status of another controversy as the ill effects of exploitation by these gears during the monsoon have greater deleterious effect on the resources than trawling. It is therefore recommended that urgent steps should be taken to regulate the number of ring seines and their further entry in to the fisheries. As this gear catches appreciable quantities of young fish, it is suggested to increase the mesh size to not less than 35 mm". In another study carried out by Cochin University (Kurup,2004: Impact of bottom trawling on the sea bottom and its living communities along the coastal waters of Kerala. Final Report submitted to the Ocean Science and Technology Cell, Department of Ocean Development, Govt. of India), it is stated that "the increase in abundance and biomass of polychaetes observed during July during when a ban on bottom trawling is in vogue in Kerala, indicated that the ban was useful in giving some respite for the generation and recouplement of polychaetes when there is no disturbance at the sea bottom". The study showed that during the ban of 45 days in the Kerala coast, significant regeneration of benthic communities has been observed, thus, fully justifying imposition of the ban as an efficient management measure for providing respite to the fish stock.

Views of mandated institutions

Views of Fishery Survey of India

No view has been received from the FSI

Views of Central Marine Fisheries Research Institute

The management of fisheries in India is governed by rules and regulations formulated under the Indian Fisheries Act 1897 and later under the Marine Fishing Regulation Act demarcating the fishing zones in 1978. The Government of India in 1977 enacted the Exclusive Economic Zone Act extending the rights to explore, exploit and utilize the living and non-living resources available in 200

n.m zone from the shore. As development of marine fisheries in the territorial waters extending upto 12 n.m from the shore is a State subject, different maritime States formulated their own rules and regulations for the management of the resources.

The regulatory measures formulated under the above Acts and Regulations, by and large, cover prohibition of destruction of resources by explosives and poisonous means and by destructive gears. The other regulatory measures include regulation of fishing in the nursery areas where juveniles are concentrated; indiscriminate fishing or catching of breeders in their migratory phase and leasing/licensing system of fishing rights, particularly in the inland waters. In the marine region, the regulatory measure that has been adopted as an administrative approach to the management of fisheries is the demarcation of fishing zones aimed at mainly safeguarding the interests of small-scale and medium-scale fisheries. The other management solutions discussed and advocated are: (1) regulation of fishing effort for exploiting the resources, particularly the shrimp resource which is a single critical resource and center of most of the controversies and conflicts in the country; (2) restriction of number of fishing gears which exploit the juvenile phase in the backwaters, estuaries and shallow inshore waters through licensing; (3) mesh size regulation; (4) minimum legal length for capture and (5) closed seasons and areas. Among these, although, the licensing of fishing gears engaged in the juvenile fishery is in force through regulation as in Kerala, its implementation has not been successful mainly due to socio-economic constraints, particularly lack of alternative employment opportunities for fishermen. Similarly, mesh size regulation could not be enforced due to multispecies, multigear nature of the fisheries and again, the socio-economic reasons.

The crucial problem of conflicts in the monsoon fisheries of Kerala was discussed by several committees and commissions appointed for the purpose. After considerable deliberations and detailed analyses of the pattern of the fisheries, information available on the resources and other related social and

economical implications, it was decided to ban trawling in the territorial waters of Kerala during June-August and this has been implemented since 1988 with relaxation in certain areas and with varied duration. One of the Commissions (Kalawar Commission) appointed to examine this issue recommended regulation of effort of 1145 trawlers during this period with the trawl codend mesh size not less than 35 mm taking into account the area, extent and intensity of fishing. However, the arguments for ban of trawling and extending into total ban of fishing are being continued.

The main objective of regulatory management of fishery resources is to ensure maximum sustainable yield or maximum sustainable economic yield. However, while considering the regulatory management tools, it is essential to consider the socio-economic conditions and employment opportunities of fishermen belonging to different economic and ethnic groups so that these measures could be implemented ensuring maximum benefit, safeguarding their interest even though the total objective of that regulatory measure or the fishery output may suffer. In such a situation, the classical management tools such as limiting the effort, regulation of entry by gear type and closed seasons or areas may not be totally acceptable unless alternative opportunities for their livelihood and basic needs are ensured or created. The failure of the total implementation of the present regulatory measure of ban of trawling to the satisfaction of different sectors appears to center around this crucial point, although the data available on the resource exploitation and cognate argument of adverse effects of trawling on spawning population and juvenile exploitation do not advocate total ban of trawling in the fishing grounds. Nevertheless in consideration of the conservation of the resource and unrestricted exploitation of juveniles, it has become imperative to stress viable management measures.

As the success of implementation of regulatory measures largely depends on the involvement of fishermen, it is necessary to take this aspect into consideration. It is observed that self-regulation practiced by fishermen

themselves as in the case of management of purse seine operation in Karnataka and sharing of day and night fishing between the artisanal and mechanised sectors in Tamil Nadu have been successful in the conflict management. Such a conflict management system with the total involvement of fishermen, administrators, politicians and others should work effectively as against the exclusively administrative approach as being followed now. It is therefore clear that the management of fisheries cannot be considered as a matter concerning administration or biology or resource assessment only, but as an integrated approach taking into account the sociological, economic and development objectives and priorities as well.

Impact of fishing ban in increasing and sustaining fishery resources

Status: Maritime states along the west and east coast of India now implement a marine fishing closed season of 45 days duration as a corollary to their Marine Fishing Regulation Acts. Earlier there was no uniformity of ban period, but after the intervention of the Ministry of Agriculture; this ban has been made uniform for all west coast (from June 15 to July 31) and east coast states (April 15 to May 29). However, different maritime states have enforced the ban from different years. For example, Kerala enforced the ban from 1988, while Andhra Pradesh and Tamil Nadu enforced it from 2000 and 2001 respectively. Karnataka, Maharashtra and Gujarat had self-imposed mechanized fishing ban during monsoon from the seventies.

Why this period of closure? It is generally contended that the spawning activity of most of the commercially exploited stocks takes place during monsoon (June-September) along the west coast and during April-May along the east coast. This was one of the considerations for closure of fishery during these periods. However, it is well known that in tropical marine finfishes and shellfishes spawning is generally protracted and fractional spawning is a common phenomenon. While most of the species spawn during monsoon months, they also spawn during other periods of the year with varied intensity. Ensuring better

catch rates and sustainable production for traditional fisherfolk who resume fishing after monsoon and whose activities were believed to be threatened by incessant trawling operations throughout the year was also another important consideration. Giving respite to the benthic-fauna from intense trawling pressure so as to enable the system for regeneration to ensure higher productivity is another reason for closure of fishery. Another dimension that was taken into account was the safety of fishermen and equipments during fishing in the rough seas in the monsoon months.

Impact on catch

To assess the impact of fishing ban, the landings along Kerala and Tamil Nadu & Pondicherry coasts were analysed.

Kerala: The average annual landings during the ban phase (1988-2002) were higher than in the pre-ban phase (1981-87). However, this increase is mainly due to large-scale introduction of motorized ring-seiners and the resultant increase in the catch of the pelagics. Although the demersal landings during the first ten years of fishing ban had shown an increasing trend, the demersal landings declined in the last five years.

A predictive analysis of the seasonal closure on demersal assemblage with respect to closure during May/ June/ July/September/June and July/ partial closure in June/ full closure in July was carried out. This study revealed that complete closure in June and July and closure as being practiced now are better options to sustain the demersal stocks off Kerala.

Notwithstanding the continuance of the ban on fishing by trawlers during the southwest monsoon, there has been no significant enhancement in the production either in the mechanized or motorized sectors during the last five years. The fishery appears to have stabilized at around 5.5 lakh tonnes annually.

Studies have also revealed that intensive trawling has an impact on species richness, diversity and the ecosystem.

The studies indicated that there was no significant change in the spawning behaviour or the spawning intensity between the pre-ban and post-ban periods.

The scaling up of the ring-seine operations both in the dimension of the net and also the magnitude of unit operations is causing concern. The landings from these nets were found to contain predominantly juveniles of some of the important pelagic resources. Increased catch of juveniles could adversely affect the resources. Since the ring-seine fishery has the capacity to exploit the resources even during the monsoon season, continued exploitation of the resources during the critical spawning season is expected to have deleterious effect on the health of the stock. Hence it is prudent to regulate the ring seine fishery through restriction on the size and number of unit operations and also the mesh size.

Tamil Nadu and Pondicherry

The Governments of Tamil Nadu and Pondicherry impose a fishing ban on mechanised vessels for 45 days from April 15 to May 29 every year. The ban came into effect in 2001 and is being followed for the last four years. To assess the impact of ban on fisheries, the landings, biological characteristics and stock of major fish groups along Tamil Nadu coast were analysed. The following are the salient findings of the study:

- The annual fishing effort of trawlers at Chennai decreased from 7.5 million hours in 1998 to 5.8 million hours in 2004, a decrease of about 30%.
- In the eight-year period between 1997 and 2004 the marine fish landings decreased from 472,500 tonnes in 1997 (pre-ban year) to 365,000 t in 2004 (ban-year), a decrease of more than 1 lakh tonnes (or >20%). The declining landings through the ban -years indicate that the ban has not

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helped recovery of the stocks.

Observations:

- Several studies have shown that intensive trawling has a detrimental impact on the species richness, diversity and the benthic ecosystem in general.
- To give respite to the disturbed ecosystem so as to regain its productivity and as conservation strategy it would be advisable to regulate trawling during certain periods of the year as is done presently.
- There is no report so far on the impact of fishing ban on primary and secondary production, eutrophication and migration of fish stocks.
- As marine fisheries in India is open-access without any control on the quantum of effort, there is every indication that fishing effort, especially for trawls, is way beyond the optimum, and this results in gross overcapitalization and reduced profit margins to fishers besides having adverse impact on the long term sustainability of the harvested stock. The ban has helped to reduce the annual fishing effort of mechanised vessels. Had there been no ban, the effort would have continued to increase to a critical level.
- Impact analysis carried out in Kerala indicates that to some extent that the 45-day trawl ban has helped in maintaining the catch rates at a rate which was prevailing before the ban and has also helped in increasing the average catches by a small measure
- Though there was good recruitment to the fishery immediately after the ban period, the increased recruitment did not last for more than 2 to 3 months.
- The ban, in the present form, has not helped long-term recovery of stocks.
- Another factor that makes the ban largely ineffective is the non-inclusion of motorised sector under the ban. The number and efficiency of motorized craft have increased in recent years. Inclusion of motorised craft under the ban will have positive impact.
- Temporal fishing ban alone is not enough for the recovery of fishable

stocks. Temporal ban will be effective under a larger, holistic management regime which should include spatial fishing restrictions, mesh size regulations, capping the capacity of fishing craft in major harbours, etc.

Suggestions and Recommendations

1. At present the fishing regulation is confined to mechanized fishing within the territorial waters. It is recommended that steps should be taken to stop further entry of ring seines into fisheries. As this gear catches appreciable quantities of young fish, it is suggested to increase the present mesh size of 10-20mm to 35mm.
2. There should be restriction on the dimension of the ring seine, as currently nets of more than 1 km length and depth of 100m are widely operated by boats 75-90 feet OAL, fitted with inboard engines of 110 hp.
3. During the ban period, units below 25 hp engines, alone should be allowed to operate.
4. The cod-end mesh size of the trawls should not be below 35 mm.
5. There should not be any addition to the existing fleet size of trawlers.
6. As comprehensive and stringent regulation of monsoon fishery is not possible due to a number of socio-economic and political reasons, total ban of all fishing may not be advocated.

The success of regulatory measures depends upon their effective implementation. To achieve this, the involvement of the fishermen, along with the political will is the prime requisite particularly in the background of socio-economic milieu prevailing in the fisheries sector. Considering this vital aspect, it is suggested that voluntary self-regulation by the fishermen and other interested groups as successfully practiced elsewhere may be adopted.

4. Impact of Closed Season on Breeding of Major Species

The committee examined the relationship between the breeding season and the ban period. In India, the mandated institution to assess, monitor and study the abundance, fluctuations and dynamics of exploited marine fishery resources is the Central Marine Fisheries Research Institute under the Indian Council of Agricultural Research. Information on the spawning season of major commercial species on both coasts of India were collected from 26 scientific publications (see appendix for details) of the scientists of the Institute and tabulated below along with the closed season on both coasts.

WEST COAST

Opening season of dominant finfish and shellfish along the Indian coast

| Species | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Source |
|---------------------------------|-----|-----|-----|-----|-----|------|------|-----|-----|-----|-----|-----|---------------------------------|
| NORTHWEST COAST | | | | | | | | | | | | | |
| <i>Micropogonias undulatus</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Chelodactylus djiddensis</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Merluccius dussumieri</i> | | | | | | | | | | | | | Khan, 2003 |
| <i>Merluccius lepturus</i> | | | | | | | | | | | | | Nair and Prakasan, 2003 |
| <i>Micropogonias nehereus</i> | | | | | | | | | | | | | Kurian, 2003 |
| <i>Merluccius japonicus</i> | | | | | | | | | | | | | Murty et al., 2003a |
| <i>Merluccius tumbil</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Merluccius niger</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Merluccius cuvieri</i> | | | | | | | | | | | | | Mohanraj et al., 2003 |
| <i>Merluccius diacanthus</i> | | | | | | | | | | | | | Mohanraj et al., 2003 |
| <i>Merluccius indicus</i> | | | | | | | | | | | | | Deshmukh, 2003 |
| <i>Merluccius semisulcatus</i> | | | | | | | | | | | | | Nandakumar and Maheswararaj |
| <i>Merluccius crassicornis</i> | | | | | | | | | | | | | Nandakumar and Maheswararaj |
| <i>Merluccius polyphagus</i> | | | | | | | | | | | | | Radhakrishnan and Mary Manjamma |
| <i>Merluccius duvaucelii</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |
| <i>Merluccius pharaonis</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |
| SOUTHWEST COAST | | | | | | | | | | | | | |
| <i>Merluccius sephen</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Merluccius longiceps</i> | | | | | | | | | | | | | Pillai et al., 2003 |
| <i>Merluccius fimbriata</i> | | | | | | | | | | | | | Pillai and Prathiba Rohit, 2003 |
| <i>Merluccius bataviensis</i> | | | | | | | | | | | | | Syda Rao, 1988 |
| <i>Merluccius tumbil</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Merluccius mesoprion</i> | | | | | | | | | | | | | Murty et al., 2003a |
| <i>Merluccius lepturus</i> | | | | | | | | | | | | | Nair and Prakasan, 2003 |
| <i>Merluccius russelli</i> | | | | | | | | | | | | | Kasim, 2003 |
| <i>Merluccius kanagurta</i> | | | | | | | | | | | | | Yohannan, 1977 |
| <i>Merluccius affinis</i> | | | | | | | | | | | | | Pillai and Gopakumar, 2003 |
| <i>Merluccius macrostomus</i> | | | | | | | | | | | | | Vivekanandan et al., 2003b |
| <i>Merluccius stylifera</i> | | | | | | | | | | | | | Nandakumar and Maheswararaj |
| <i>Merluccius homarus</i> | | | | | | | | | | | | | Radhakrishnan and Mary Manjamma |
| <i>Merluccius pharaonis</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |



SOUTHEAST COAST

| | J | F | M | A | M | J | J | A | S | O | N | D | |
|------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------------|
| <i>Rhizoprionodon acutus</i> | | | | | | | | | | | | | Raje and Jos |
| <i>Dasyatis imbricatus</i> | | | | | | | | | | | | | Raje and Jos |
| <i>Sardinella gibbosa</i> | | | | | | | | | | | | | Pillai and Pra 2003 |
| <i>Encrasicholina devisi</i> | | | | | | | | | | | | | Jayaprakash, |
| <i>Saurida undosquamis</i> | | | | | | | | | | | | | Sivakami et a |
| <i>Nemipterus japonicus</i> | | | | | | | | | | | | | Vivekanandar James, 1986 |
| <i>Upeneus sulphureus</i> | | | | | | | | | | | | | Vivekanandar |
| <i>Johnius caruta</i> | | | | | | | | | | | | | Mohanraj et a |
| <i>Leiognathus bindus</i> | | | | | | | | | | | | | Murty et al, 20 |
| <i>Penaeus semisulcatus</i> | | | | | | | | | | | | | Nandakumar Maheswaradu |
| <i>Panulirus homarus</i> | | | | | | | | | | | | | Radhakrishna Manisseri, 200 |
| <i>Loligo duvaucelii</i> | | | | | | | | | | | | | Meiyappan an Mohamed, 200 |
| <i>Sepia pharaonis</i> | | | | | | | | | | | | | Meiyappan an Mohamed, 200 |

NORTHEAST COAST

| | | | | | | | | | | | | | |
|---------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|-----------------|
| <i>Pristis microdon</i> | | | | | | | | | | | | | Raje and Josh |
| <i>Tachysurus tenuispinis</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Tachysurus thalassinus</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Osteogeneiosus militaris</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Nemipterus japonicus</i> | | | | | | | | | | | | | Murty, 1984 |
| <i>Nemipterus mesoprion</i> | | | | | | | | | | | | | Murty, 1981 |
| <i>Saurida tumbil</i> | | | | | | | | | | | | | Sivakami et al. |
| <i>Pampus argenteus</i> | | | | | | | | | | | | | Sivakami et al. |
| <i>Psettodes erumei</i> | | | | | | | | | | | | | Vivekanandan |
| <i>Mystus gulio</i> | | | | | | | | | | | | | Kaliyamurthy, |

 Spawning month

 Peak spawning month

PRE BAN

CLOSED
SEASON

POST BAN

The comprehensive picture on the ground truth that emerges from the above analysis clearly indicates the following.

- ✓ The spawning season of major species on both coasts are prolonged with one or more peaks
- ✓ Only a few species have their peak breeding season coinciding with the closed season (ban).
- ✓ The contention that closed season is during the peak breeding of most species is not true
- ✓ It is impossible to have a closed season coinciding with the peak breeding of all commercial species on either coasts of India
- ✓ Because of the above, closed season might not have impacted positively on the larval production in most species on both coasts

4. Summary and Recommendations

Based on the analysis of the present scenario, the committee is of the opinion that observance of the present closed season by various maritime states is not uniform both in letter and spirit. The Govt. of India directive was to have a ban on ALL FISHING during the ban period. While some states have implemented the closed season in toto as per the Govt. of India directive, a few states have made modifications both in the dates and duration of the ban. Further, some states banned all fishing activities, some others permitted non-motorized and low horse powered vessels for fishing, while yet some states banned trawling but permitted traditional vessels as well as high powered (even up to 110 hp) motorized vessels during the ban period. The committee is of the view that such loose implementation of the closed season negates the positive benefits which otherwise would have accrued if the spirit of the ban has been understood and implemented. The committee also observed that the present ban has not positively impacted on the fishery resources in ensuring sustainability, resource

resilience, but has helped to some extent in allowing a respite for the resources for partial recovery and the benthic biota to recover from the adverse impact of continuous trawling. Sustainability has to be understood in a wider context and indicators developed for monitoring so that end results could be achieved. The committee also noticed that the closed season has a positive impact on reducing the total fishing effort in the coasts as India already has an over capacity in fishing effort. The committee is of the opinion that positive impacts of a closed season can be obtained by effectively implementing a uniform closed season for the west coast and another uniform closed for the east coast for allowing a respite for the resources for recovery from continuous exploitation by flowing the principles of precautionary approach. Such a closed season should be implemented in such a way the positive impacts would help the resource to recover from set backs due to fishing pressure. Therefore, the fishing efforts during the closed season should be minimal in order to derive the benefits from the ban. The committee is also of the view that total fishing efforts in the closed season as well as the rest of the year should be suitably fixed and addition of more and more fishing vessels should not be permitted. In view of the above the committee makes the following recommendations.

The committee recommends that:

1. A mandatory closed season should be declared for the west coast of India from 15th June to 30th July every year, both days inclusive.
2. A closed season should be declared for the east coast of India from 15th April to 31st May every year, both days inclusive.
3. Only traditional non motorized and low horse powered motorized below 25 hp OBM / IBM vessels should be permitted during the ban
4. The States must ensure that is no further increase in traditional motorized OBM/IBM crafts for fishing during the ban period.

5. Licensing of all fishing vessels both traditional and motorized/mechanized should be mandatory and only such vessels permitted to operate in the territorial waters.
6. There should be a ban on all fishing activities beyond the 12 nautical miles in the EEZ during the ban period on both coasts and Govt. of India must ensure compliance and prevent poaching by vessels of other countries through surveillance by coast guards / marine patrol.
7. The total fishing capacity in terms of total horse power should be fixed for each maritime state and the State Governments must be directed to apportion this to the various craft-gear combinations and ensure strict compliance by enacting laws to implement punitive measures for offenders.
8. The States must also consider additional closed seasons for certain local fisheries to meet special conservational requirements emerging. Such closed seasons shall not replace the mandatory closed season proposed, but will be in addition to that.

CHAPTER 3

Population Dynamics, Recruitment, Fecundity, Natural Death, Catch etc. and the MSY and MEY in the Indian coasts

The various maritime states did not have any views on the population dynamics, natural death, catch, MSY and MEY as these could be obtained by carrying out long term scientific studies by scientists in mandated institutions. Therefore, the committee sought the views of the mandated institute CMFRI whose views are presented below.

1. Impact on population dynamics

Spawning and recruitment

Closure of fishing for 45 to 60 days would have influence on the dynamics of finfish and snellfish populations. For example, penaeid shrimps are continuous spawners, and, on an average, one spawning occurs during the ban period. Moreover, fishing ban gives an opportunity for the shrimps to grow. It is well known that the fecundity of larger shrimps is more than that of small ones. These two factors namely; the additional spawning and higher fecundity due to growth enhance the reproductive output of shrimps. The higher reproductive output is reflected as higher recruitment to the fishery after the ban period. This phenomenon is observed for small sized, short-lived finfishes also. For example, the post-ban months of June and July, there was good recruitment to the trawl fishery. For instance, an estimated 0.37 million juveniles of the threadfin bream *Nemipterus japonicus* were landed in June in the pre-ban years at Chennai Fisheries Harbour, whereas 3.62 million juveniles were landed in June in the ban-years. However, the magnitude of difference gradually reduced in the

subsequent months. Thus the influence is of short duration and does not have great impact on the fisheries of different kinds. Moreover, high recruitment due to fishing ban was not noticed for large sized, long living species such as the ray *Dasyatis jenkinsi*.

Mortality

During the ban period, fishing mortality reduces considerably. However, due to continuous spawning and release of youngones, the predation mortality is expected to increase. The extent to which the increased predation mortality affects the stocks is not known.

Annual Stock and MSY

The annual stock of seven major demersal finfishes viz, *Nemipterus japonicus*, *N. mesoprion*, *Leiognathus bindus*, *Secutor insidiator*, *Upeneus taeniopterus*,

U. sulphureus and *Saurida undosquamis* declined from 9,035 tonnes during 1997-2000 (pre-ban period) to 6,427 tonnes during 2001 - 2004 (post-ban period) off Chennai, i.e., a decline of nearly 30% of the stocks of major demersal finfishes through the ban period. Due to reduction in the total stock, the Maximum Sustainable Yield also reduced during 2001-2004. It could be concluded that seasonal ban has not helped either long-term recovery or increase in the MSY of the stocks.

2. Summary and Recommendations

The Committee reckons that the Indian marine fisheries is multispecies, multi locale and multigear in nature and it is impossible to have species based management interventions. The approaches are made more complicated because of the small size of the species, prolonged breeding periods, access to

many types of gears. Further, Indian marine fisheries is still an open access fishery which must be gradually changed to a regulated fishery. Managing an open access and unregulated fishery with tools like MSY, MEY, CPUE, Yield per recruit models etc is neither feasible nor advisable. The major concern challenging the marine fisheries of India is the issue of over capacity in fishing effort and all that is possible must be done to reduce the fishing efforts. In addition to this, stopping of juvenile fishing, reducing discards and bycatches and elimination of resource unfriendly gears and practices must receive immediate attention so as to address the question of long term sustainability of resource. The Committee is of the firm opinion that a change over from the present directive approach in fisheries management, to a participatory approach would yield the desired results through stakeholder participation in management.

The committee recommends that:

1. Adequate support should be provided by the DAHDF to the mandated institutions to develop the required information base which will help in developing management / policy advisories for an informed fisheries governance.

CHAPTER 4

Diurnal Oscillation, Eutrophication and Upwelling Season, migration, Productivity of Waters during and after Monsoon months (Closed season)

The Committee sought the views of the maritime states on the issues on diurnal oscillation, eutrophication, upwelling, migration, productivity during the ban. The maritime states which responded to the questionnaire did not have any views on these issues. The views presented here are those of the mandated institution, CMFRI.

Impact on environmental factors

Primary, Secondary and Tertiary production in relation to upwelling

The monsoons play a significant role in the ecological cycle and productivity of the sea. Solar radiation, which forms the primary source of energy and is essential for photosynthesis, is dependent on the intensity and the length of the daylight and atmospheric conditions. The biomass production in the sea is thus dependent on this energy and the nutrient supply generated through the complex physical, chemical and biological processes taking place in the dynamic marine environment and subsequently transmitted to aquatic organisms at different trophic levels. Similarly, the upwelling phenomenon, which occurs seasonally, is due to the strong monsoon winds. This process is important for re-fertilizing the impoverished surface layers and has a great bearing on fish production, its distribution and abundance pattern. Besides, the turbulence, edd

diffusion and thermal stratification caused by the interaction among the sea and atmospheric conditions and wind speed, play major role in the supply of nutrients which determined the productivity of the sea.

The influence of weather on fish populations and their behaviour in general and that of the southwest monsoon on the Indian marine fisheries in particular, have been recognized long back. Studies on this aspect were being carried out at the Central Marine Fisheries Research Institute almost from its inception. The important investigations in this direction have been to correlate the variation in the oil sardine catch of the west coast with the intensity of southwest monsoon; sea surface temperature with the mackerel fishery; upwelling occurring during the southwest monsoon on the distribution pattern and movement of fish and prawn stocks in the shelf waters; mud bank fisheries and the prawn fishery of the west coast in relation to hydrographical conditions in the shelf water during different seasons. Recently correlations were made on the abundance of oil sardine with the upwelling on the southwest coast of India and sea level as an indicator of intensity of the upwelling and consequently the oil sardine catch.

Eutrophication

Eutrophication is a phenomenon seen in coastal waters due to high nutrient enrichment, either natural or artificial, resulted in the blooming of phytoplankton organisms, which are harmful or harmless to the fishery. Usually, eutrophication occurs due to sewage discharge, industrial effluence and river runoff during monsoon. During post monsoon season, due to eutrophication, blooming of harmful phytoplankton organisms have been observed in the coastal waters of Calicut and Vizhinjam areas. At Calicut, blooming of the green flagellate, *Hornelia marina* was a regular phenomenon. At Vizhinjam and Kollam areas, regular blooming of the dinoflagellate, *Noctiluca*, *Cochlodinium* and *Goniolax* species were observed in recent years.

Seasonal migration

Whitebaits

The whitebaits (*Stolephorus* spp.) undertake seasonal migration along the southwest coast and the Gulf of Mannar in 4 distinct phases: (i) In October, when the northeast monsoon sets in, the shoals are discontinuously distributed in a narrow elongated band along the southwest coast from Mangalore to Cape Comorin. During November to February, the shoals form a continuous wide belt with a disruption between 11°N and 12°N (iii) During March-April, the shoals break up and begin their southward migration, which continues till July. (iv) In August, the southward migration culminates, with the bulk of the stock migrating towards north in the east coast and piling up between Cape Comorin and the central Gulf of Mannar in the east coast. The migration of the whitebaits follows the surface currents of the northeast and the southwest monsoons. During the southwest monsoon, the currents flow southwards along the west coast; and north and northeastwards in the Gulf of Mannar; during the northeast monsoon, the current flows in the reverse direction.

Oil sardine

The oil sardine *Sardinella longiceps* of 0-year class migrate *en masse* from the offshore to the inshore areas simultaneously all over the sardine centres along the southwest coast towards the end of the southwest monsoon. The new recruits, after reaching the inshore areas, continue to get reinforced uninterruptedly through the entry of fresh recruits, inspite of heavy fishing pressure. With the warming up of the surface waters and the deepening of the thermocline in summer (March to May), the shoals gradually move back to the offshore areas, vacating first from the north and then from the southern centres, every year. Large scale tagging of oil sardine was carried out by the CMFRI from several centres on the east and west coasts of India during 1967-68 and 1968-

69. The recoveries were limited. Hence, no definite conclusions could be drawn regarding the migration of this fish, but the limited recoveries revealed only local dispersal.

Shrimp Karikkadi, *Parapenaeopsis stylifera*

Experimental shrimp trawling conducted by the CMFR Institute at Cochin over a period of two years has shown that during the non-monsoon period (September/October to May) most of the shrimp stocks occupy the coastal waters within the 20m-depth contour. With the commencement of southwest monsoon and the consequent changes in the environmental conditions, the prawns leave the inshore areas in large numbers to the deeper zones. They remain mostly in the 20-40 m depth zone during June and in the 40-60 m depth zone during July and August/September. A small population of the species, however, exists very close to the shore within 5-6m depth, during the monsoon period, which is predominantly constituted by adults in spawning condition.

2. Summary and Recommendations

The Committee reckons that marine fisheries management must anchor on scientific principles and knowledge based analytical approaches. There are mandated institutions to carry out such in depth studies and develop policy advisories to the State and Central Governments to put in to place management measures. The DoF of various maritime states do not have the expertise or resources to make such studies. In the light of this, the committee makes the following recommendation.

The committee recommends that:

1. A national policy advisory group be formed at the Ministry for an informed marine fisheries governance.

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2. There should be a mechanism for monitoring and surveillance with the help of coast guard / marine patrol for effective implementation of regulations and to prevent poaching.

CHAPTER 5

Whether all fishing including fishing by non-mechanized traditional crafts with OBM / IBM to be banned during closed season or the type of crafts which can be allowed during closed season

From the available information on the ground truth on the actual situation prevailing during the ban presented in Chapter 2, it is obvious that various states had effected the ban in different ways. While in some states the ban was total and no fishing by any type of vessel was allowed, in some other states, only trawling was banned, all other types of fishing was permitted. While the committee fully acknowledges the social, economic and political reasons for such relaxations in some states, there exists an urgent need to review the situation in the light of a knowledge based fisheries management need following a precautionary approach for ensuring sustainability in the fishery resources of the country. The committee was very concerned about permitting fishing vessels with very high fishing powers (for e.g. inboard engines with up to 110 hp engines) in the guise of "traditional vessel". What is traditional in such vessels is only the shape of the vessel, not the engines or nets. The committee noted that the positive impacts which otherwise would have accrued from the closed season are negated by the indiscriminate and uncontrolled introduction and operation of such high powered vessels, most of the using resource unfriendly and destructive and even banned gears. The committee therefore, feels that there must be appropriate regulation of fishing efforts during the closed seasons and only licensed vessels with in the permitted horse powers with permitted gear only are allowed to operate. It was also felt necessary to restrict the mesh size of the gears as per recommendation s of kalavar Committee and recommendations of CMFRI. The views aired by some of the states are given below.

Views of Maharashtra

During ban period non-selective mechanized fishing methods like trawling (including mid water trawling) purse seining should not be allowed to operate all along the west coast to conserve migratory and commercially important shrimp and fishing species. However, non mechanized (but motorized with IBM or OBM engines) and non-motorised traditional crafts may be allowed for fishing operations during closed season with the condition that engines so fitted in canoes are used only for propulsion purpose. The limit on HP of the IBM or OBM engines may be allowed upto 25 HP.

1. It is opined that relief of allowing traditional crafts either fitted with motors for propulsion purpose or without motors for fishing during closed season may not drastically affect that recruitment process, on the other hand helps the traditional fishermen to make living during closed season.
2. It is opined that enhancement of relief under "Savings cum Relief scheme" from the current level of Rs. 300/- per month to fishermen at least to Rs. 1000/- per month will help in deterring fishermen from venturing into fishing during closed fishing season.
3. Government of India should ensure non operation of deep sea fishing vessels permitted by Government of India (both from Ministry of Agriculture and Ministry of Food Processing) during closed season in EEZ Zone and also in territorial waters of the respective state. In most of the time, local fishermen notice the operation of deep sea vessels in the territorial waters during closed season.

Views of Tamil Nadu

1. In respect of fishing crafts to be allowed, I wish to suggest that all Mechanized Fishing Boat and Crafts having more than 15 H.P. engine alone should be banned for fishing during the ban period. All other traditional crafts should be allowed to fish in the sea to support livelihood of poor fishermen as the present scheme of Savings-cum-Relief scheme provides too meager amount for sustenance of poor fishermen during the lean fishing period.
2. Committee may also think of restricting use of trawl nets throughout the year. Similarly, strict ban should be imposed on certain sizes of net meshes, and this ban rather than being imposed upon the fishermen, should be imposed on the producers of the banned mesh sizes and heavy penalty should be imposed upon the violators manufacturing banned mesh sizes.

Similarly, fishermen going for deep sea fishing should alone be allowed to fish with trawl nets. Here again, we may think of horse power as criteria to permit use of trawl nets by certain fishing crafts which means that fishing crafts only above certain horse power which alone can go for deep sea fishing, should be allowed to use trawl nets.

Similarly, use of trawl nets should be banned for use by open fishing crafts as these do not possess sufficient storage and preservation facilities and hence they cannot do deep sea fishing, even though they may use Engines of very High horse power like snake boat used in Kerala which have been fitted with 80 to 90 horse power Engines. But, since these boats do not have provision for sufficient storage and preservation facilities, despite having high horse power, they cannot indulge in deep sea fishing.

- stocks. Temporal ban will be effective under a larger, holistic management regime which should include spatial fishing restrictions, mesh size regulations, capping the capacity of fishing craft in major harbours, etc.
4. At present the fishing regulation is confined to mechanized fishing within the territorial waters. It is recommended that steps should be taken to stop further entry of ring seines into fisheries. As this gear catches appreciable quantities of young fish, it is suggested to increase the present mesh size of 10-20mm to 35mm.
 5. There should be restriction on the dimension of the ring seine, as currently nets of more than 1 km length and depth of 100m are widely operated by boats 75-90 feet OAL, fitted with inboard engines of 110 hp.
 6. During the ban period, units below 25 hp engines, alone should be allowed to operate.
 7. The cod end mesh size of the trawls should not be below 35 mm.
 8. There should not be any addition to the existing fleet size of trawlers.
 9. As comprehensive and stringent regulation of monsoon fishery is not possible due to a number of socio-economic and political reasons, total ban of all fishing may not be advocated.
 10. The success of regulatory measures depends upon their effective implementation. To achieve this, the involvement of the fishermen, along with the political will is the prime requisite particularly in the background of socio-economic milieu prevailing in the fisheries sector. Considering this vital aspect, it is suggested that voluntary self-regulation by the fishermen and other interested groups as successfully practiced elsewhere may be adopted.

Summary and Recommendations

The committee has taken in to consideration the status of fishing operations in the various maritime states and approached the issue of permitting some

3. Committee should also recommend limiting fleet size for every fishing harbour/berthing base after conducting detailed study to assess carrying capacity and catch per unit effort in all coastal areas.
4. Amount provided under Savings-cum-Relief Scheme during the lean month period to the fishermen has to be increased substantially as the amount is too meager to sustain the livelihood of the poor fishermen during the lean month period.

Views of Andhra Pradesh

The state is of the opinion that the decision on the type of vessels to be permitted / banned must be based on the impact of the present fishing ban on the sustainability of the resources.

Views of mandated Institutions

1. Views of Fishery Survey of India

Fishery Survey of India did not convey any views on this issue

2. Views of Central Marine Fisheries Research Institute

1. To give respite to the disturbed ecosystem so as to regain its productivity and as conservation strategy it would be advisable to regulate trawling during certain periods of the year as is done presently.
2. The reason for the present ban for being largely ineffective is the non-inclusion of motorised sector under the ban. The number and efficiency of motorised craft have increased in recent years. Inclusion of motorised craft under the ban will have positive impact.
3. Temporal fishing ban alone is not enough for the recovery of fishable

fishing activity by taking a holistic view in the light of the need for a precautionary approach for resource utilization as well as the social, cultural, economic, livelihood and nutritional security angles of small scale and traditional fishers who are wholly dependent on the seas for livelihood and food. The committee also noted with concern the fact that positive impacts of the closed season are negated by the unregulated and destructive fishing during the closed season in certain parts of the country. The Committee is also gravely concerned about the unregulated and destructive fishing activities and practices and the use of banned gears and very fine meshes during the closed season and the post ban period resulting in capture of undersized and juvenile fishes, thus adversely impacting the resource resilience and recruitment patterns. The committee is of the opinion that there is need for regulatory measures to restrict the mesh size uniformly and to notify the banned gears in all maritime states for strict compliance with punitive measures for offenders. Following the precautionary approach, the following recommendations are made.

The Committee recommends that:

1. No mechanized fishing should be allowed in the territorial waters up to 12 nm and in the entire EEZ during the closed season
2. Traditional fishing activities without motorization as well as with motorization with OBM /IBM up to 25 horsepower only shall be allowed in the territorial waters during the closed season, but the vessels should be licensed and their number regulated at the present (2005) level with no further additions.
3. No fishing net with mesh size below 35 mm should be permitted to be operated from motorized and/or mechanized fishing vessels.
4. The banned gears like Ring Seines, Surface Pelagic Trawls, destructive fishing practice such as dynamite-fishing must not

be allowed under any circumstance during the closed season as well as the rest of the fishing season.

CHAPTER 6

SUMMARY AND RECOMMENDATIONS

1. A mandatory closed season should be declared for the west coast of India from 15th June to 30th July every year, both days inclusive.
2. A mandatory closed season should be declared for the east coast of India from 15th April to 31st May every year, both days inclusive.
3. Only traditional non motorized and low horse powered motorized below 25^{hp} OBM / IBM vessels should be permitted during the ban.
4. The States must ensure that is no further increase in traditional motorized OBM / IBM crafts for fishing during the ban period.
5. Licensing of all fishing vessels both traditional and motorized / mechanized should be mandatory and only such vessels be permitted to operate in the territorial waters and in the EEZ.
6. There should be a ban on all fishing activities beyond the 12 nautical miles in the EEZ during the ban period on both coasts and Govt. of India must ensure compliance and prevent poaching by vessels of other countries through surveillance by coast guards / marine patrol.

7. The total fishing capacity in terms of total horse power should be fixed for each maritime state and the State Governments must be directed to apportion this to the various craft-gear combinations and ensure strict compliance by enacting laws to implement punitive measures for offenders.
8. The States must also consider additional closed seasons for certain local fisheries to meet special conservational requirements emerging. Such closed seasons shall not replace the mandatory closed season proposed, but will be in addition to that.
9. Adequate support should be provided by the DAHDF to the mandated institutions to develop the required information base which will help in developing management / policy advisories for an informed fisheries governance.
10. A national policy advisory group be formed at the Ministry for an informed marine fisheries governance.
11. There should be a mechanism for monitoring and surveillance with the help of coast guard / marine patrol for effective implementation of regulations and to prevent poaching.
12. No mechanized fishing should be allowed in the territorial waters up to 12 nautical miles and in the entire EEZ during the closed season.

13. Traditional fishing activities without motorization as well as with motorization with OBM /IBM up to 25 horsepower only shall be allowed in the territorial waters during the closed season, but the vessels should be licensed and their number regulated at the present (2005) level with no further additions.

14. No fishing net with mesh size below 35 mm should be permitted to be operated from motorized and/or mechanized fishing vessels during the closed season or the rest of the fishing season. The 35mm mesh size regulation is applicable to the cod-end of trawl nets also during the regular fishing season.

15. The banned gears like Ring Seines, Surface Pelagic Trawls, destructive fishing practice such as dynamite-fishing must not be allowed under any circumstance during the closed season as well as the rest of the fishing season.

ANNEXURES

TERMS OF REFERENCE

No. 30035 / 15/97-FY(T-1)
 Government of India
 Ministry of Agriculture
 Department of Animal Husbandry & Dairying

.....

Krishi Bhawan, New Delhi
 Dated the 1st January, 04

ORDER

Subject: Constitution of a Committee to study the impact of closed season on fisheries

The Spawning periodicity of various marine fishes and shell fishes depends on a wide variety of oceanographic, climatological and ecological parameters which vary from place to place in the Indian ocean, Arabian Sea and Bay of Bengal. The maritime State Governments and the Government of India has been issuing ban orders for fishing operations in certain periods during the monsoon months every year. The monsoon ban was imposed to conserve and replenish the fishery resources of the Indian EEZ by protecting them during this period, which is said to be their main breeding season.

3. In order to study the impact of closed season on fisheries, it had been decided with the approval of the Competent Authority to constitute a Committee to study the issue in detail.
4. The composition of the Committee is as follows:

| | | |
|----|---|----------|
| 1. | Director, Central Marine Fisheries Research Institute, Cochin | Chairman |
| 2. | Commissioner (Fisheries) Government of Andhra Pradesh | Member |
| 3. | Rep. of Fisheries Department, Govt. of Kerala | Member |
| 4. | Rep. of Fisheries Department, Govt. of Tamil Nadu | Member |
| 5. | Rep. of Fisheries Department, Govt. of West Bengal | Member |
| 6. | Rep. of Fisheries Department, Govt. of Maharashtra | Member |
| 7. | Rep. of Fisheries Department, Govt. of Karnataka | Member |
| 8. | Rep. of Fisheries Department, Govt. of Gujarat | Member |
| 9. | Director General, Fishery Survey of India | Member |

5. The terms of reference of the Committee is as follows:
- (i) To carry out an evaluation study on the impact of closed season in increasing the fishery resources of the India EEZ
 - (ii) To study the population dynamics, recruitment, fecundity, natural death, catch etc. and the MSY and MEY in the Indian coasts
 - (iii) To study the diurnal oscillation, eutrophication and upwelling season, migration, productivity of waters during and after monsoon months (closed season)
 - (iv) Whether all fishing including fishing by non-mechanized traditional crafts with OBM/IBM to be banned during closed season or the type of crafts which can be allowed during closed season
6. The Committee shall submit its report within 6 months
7. TA /DA of the members will be borne by their respective organizations

Sd/-

(K.K.Mehta)

Under Secretary to the Govt. of India

Distribution:-

To all members

Copy for information to:-

1. PS to JS (Fy)
2. PS to FDC

Annexure-2

Minutes of the first meeting of the committee held on 1 – 12 - 2004

Annexure-3

Minutes of the second meeting of the committee held on 23 – 7 - 2005

Minutes of the third meeting of the committee held on 25 – 8 - 2005

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Spawning season of dominant finfish and shellfish along the Indian coast

| Species | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Source |
|----------------------------------|-----|-----|-----|-----|-----|------|------|-----|-----|-----|-----|-----|----------------------------------|
| NORTHWEST COAST | | | | | | | | | | | | | |
| <i>Scoliodon laticaudus</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Rhynchobatus djiddensis</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Coilia dussumieri</i> | | | | | | | | | | | | | Khan, 2003 |
| <i>Trichiurus lepturus</i> | | | | | | | | | | | | | Nair and Prakasan, 2003 |
| <i>Harpodon nehereus</i> | | | | | | | | | | | | | Kurian, 2003 |
| <i>Nemipterus japonicus</i> | | | | | | | | | | | | | Murty et al., 2003a |
| <i>Saurida tumbil</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Parastomateus niger</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Otolithes cuvieri</i> | | | | | | | | | | | | | Mohanraj et al., 2003 |
| <i>Protonibea diacanthus</i> | | | | | | | | | | | | | Mohanraj et al., 2003 |
| <i>Acetes indicus</i> | | | | | | | | | | | | | Deshmukh, 2003 |
| <i>Penaeus semisulcatus</i> | | | | | | | | | | | | | Nandakumar and Maheswarad |
| <i>Solenocera crassicornis</i> | | | | | | | | | | | | | Nandakumar and Maheswarad |
| <i>Panulirus polyphagus</i> | | | | | | | | | | | | | Radhakrishnan and Mary Mani |
| <i>Loligo duvaucelii</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 200 |
| <i>Sepia pharaonis</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 200 |
| SOUTHWEST COAST | | | | | | | | | | | | | |
| <i>Dasyatis sephen</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Sardinella longiceps</i> | | | | | | | | | | | | | Pillai et al., 2003 |
| <i>Sardinella fimbriata</i> | | | | | | | | | | | | | Pillai and Prathiba Rohit, 2003 |
| <i>Stolephorus bataviensis</i> | | | | | | | | | | | | | Syda Rao, 1988 |
| <i>Saurida tumbil</i> | | | | | | | | | | | | | Sivakami et al., 2003 |
| <i>Nemipterus mesopriion</i> | | | | | | | | | | | | | Murty et al., 2003a |
| <i>Trichiurus lepturus</i> | | | | | | | | | | | | | Nair and Prakasan, 2003 |
| <i>Decapterus russelli</i> | | | | | | | | | | | | | Kasim, 2003 |
| <i>Rastrelliger kanagurta</i> | | | | | | | | | | | | | Yohannan, 1977 |
| <i>Euthynnus affinis</i> | | | | | | | | | | | | | Pillai and Gopakumar, 2003 |
| <i>Cynoglossus macrostomus</i> | | | | | | | | | | | | | Vivekanandan et al., 2003b |
| <i>Parapenaeopsis styliifera</i> | | | | | | | | | | | | | Nandakumar and Maheswaradu, |
| <i>Panulirus homarus</i> | | | | | | | | | | | | | Radhakrishnan and Mary Maniss |
| <i>Sepia pharaonis</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |
| SOUTHEAST COAST | | | | | | | | | | | | | |
| <i>Rhizoprionodon acutus</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Dasyatis imbricatus</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Sardinella gibbosa</i> | | | | | | | | | | | | | Pillai and Prathiba Rohit 2003 |
| <i>Encrasicholina devisi</i> | | | | | | | | | | | | | Jayaprakash, 2003 |
| <i>Saurida undosquamis</i> | | | | | | | | | | | | | Sivakami et al, 2003 |
| <i>Nemipterus japonicus</i> | | | | | | | | | | | | | Vivekanandan and James, 1986 |
| <i>Upeneus sulphureus</i> | | | | | | | | | | | | | Vivekanandan et al, 2003a |
| <i>Johnius caruta</i> | | | | | | | | | | | | | Mohanraj et al, 2003 |
| <i>Leiognathus bindus</i> | | | | | | | | | | | | | Murty et al, 2003b |
| <i>Penaeus semisulcatus</i> | | | | | | | | | | | | | Nandakumar and Maheswaradu, 20 |
| <i>Panulirus homarus</i> | | | | | | | | | | | | | Radhakrishnan and Mary Manisser, |
| <i>Loligo duvaucelii</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |
| <i>Sepia pharaonis</i> | | | | | | | | | | | | | Meiyappan and Mohamed, 2003 |
| NORTHEAST COAST | | | | | | | | | | | | | |
| <i>Pristis microdon</i> | | | | | | | | | | | | | Raje and Joshi, 2003 |
| <i>Tachysurus tenuispinis</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Tachysurus thalassinus</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Osteogeneiosus militaris</i> | | | | | | | | | | | | | Dan, 1984 |
| <i>Nemipterus japonicus</i> | | | | | | | | | | | | | Murty, 1984 |
| <i>Nemipterus mesopriion</i> | | | | | | | | | | | | | Murty, 1981 |
| <i>Saurida tumbil</i> | | | | | | | | | | | | | Sivakami et al, 2003 |
| <i>Pampus argenteus</i> | | | | | | | | | | | | | Sivakami et al. 2003 |
| <i>Psettodes erumei</i> | | | | | | | | | | | | | Vivekanandan et al 2003b |
| <i>Mystus gulio</i> | | | | | | | | | | | | | Kaliyamurthy, 1981 |

▧ Spawning month

▨ Peak spawning month

OFFICIAL VIEW OF CMFRI ON THE IMPACT OF FISHING BAN ON MARINE FISHERIES ALONG THE COAST OF INDIA

Prepared by Dr. M. Srinath, Dr. N.G.K. Pillai, Dr. E. Vivekanandan
and Dr. K.S.Mohamed

Introduction

The management of fisheries in India is governed by rules and regulations formulated under the Indian Fisheries Act 1897 and later under the Marine Fishing Regulation Act demarcating the fishing zones in 1978. The Government of India in 1977 enacted the Exclusive Economic Zone Act extending the rights to explore, exploit and utilize the living and non-living resources available in 200 n.m zone from the shore. As development of marine fisheries in the territorial waters extending upto 12 n.m from the shore is a State subject, different maritime States formulated their own rules and regulations for the management of the resources.

The regulatory measures formulated under the above Acts and Regulations, by and large, cover prohibition of destruction of resources by explosives and poisonous means and by destructive gears. The other regulatory measures include regulation of fishing in the nursery areas where juveniles are concentrated; indiscriminate fishing or catching of breeders in their migratory phase and leasing/licensing system of fishing rights, particularly in the inland waters. In the marine region, the regulatory measure that has been adopted as an administrative approach to the management of fisheries is the demarcation of fishing zones aimed at mainly safeguarding the interests of small-scale and medium-scale fisheries. The other management solutions discussed and advocated are: (1) regulation of fishing effort for exploiting the resources, particularly the shrimp

resource which is a single critical resource and center of most of the controversies and conflicts in the country; (2) restriction of number of fishing gears which exploit the juvenile phase in the backwaters, estuaries and shallow inshore waters through licensing; (3) mesh size regulation; (4) minimum legal length for capture and (5) closed seasons and areas. Among these, although, the licensing of fishing gears engaged in the juvenile fishery is in force through regulation as in Kerala, its implementation has not been successful mainly due to socio-economic constraints, particularly lack of alternative employment opportunities for fishermen. Similarly, mesh size regulation could not be enforced due to multispecies, multigear nature of the fisheries and again, the socio-economic reasons.

The crucial problem of conflicts in the monsoon fisheries of Kerala was discussed by several committees and commissions appointed for the purpose. After considerable deliberations and detailed analyses of the pattern of the fisheries, information available on the resources and other related social and economical implications, it was decided to ban trawling in the territorial waters of Kerala during June-August and this has been implemented since 1988 with relaxation in certain areas and with varied duration. One of the Commissions (Kalawar Commission) appointed to examine this issue recommended regulation of effort of 1145 trawlers during this period with the trawl codend mesh size not less than 35 mm taking into account the area, extent and intensity of fishing. However, the arguments for ban of trawling and extending into total ban of fishing are being continued.

The main objective of regulatory management of fishery resources is to ensure maximum sustainable yield or maximum sustainable economic yield. However, while considering the regulatory management tools, it is essential to consider the socio-economic conditions and employment opportunities of fishermen belonging to different economic and ethnic groups so that these measures could be implemented ensuring maximum benefit, safeguarding their interest even though the total objective of that regulatory measure or the fishery output may suffer. In such a situation, the classical management tools such as limiting the effort, regulation of entry by gear type and closed seasons or areas may not be totally acceptable unless alternative opportunities for their

livelihood and basic needs are ensured or created. The failure of the total implementation of the present regulatory measure of ban of trawling to the satisfaction of different sectors appears to center around this crucial point, although the data available on the resource exploitation and cognate argument of adverse effects of trawling on spawning population and juvenile exploitation do not advocate total ban of trawling in the fishing grounds. Nevertheless in consideration of the conservation of the resource and unrestricted exploitation of juveniles, it has become imperative to stress viable management measures.

As the success of implementation of regulatory measures largely depends on the involvement of fishermen, it is necessary to take this aspect into consideration. It is observed that self-regulation practised by fishermen themselves as in the case of management of purse seine operation in Karnataka and sharing of day and night fishing between the artisanal and mechanised sectors in Tamil Nadu have been successful in the conflict management. Such a conflict management system with the total involvement of fishermen, administrators, politicians and others should work effectively as against the exclusively administrative approach as being followed now. It is therefore clear that the management of fisheries cannot be considered as a matter concerning administration or biology or resource assessment only, but as an integrated approach taking into account the sociological, economic and development objectives and priorities as well.

Impact of fishing ban in increasing and sustaining fishery resources

Status: Maritime states along the west and east coast of India now implement a marine fishing closed season of 45 days duration as a corollary to their Marine Fishing Regulation Acts. Earlier there was no uniformity of ban period, but after the intervention of the Ministry of Agriculture; this ban has been made uniform for all west coast (from June 15 to July 31) and east coast states (April 15 to May 29). However, different maritime states have enforced the ban from different years. For example, Kerala

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enforced the ban from 1988, while Andhra Pradesh and Tamil Nadu enforced it from 2000 and 2001 respectively. Karnataka, Maharashtra and Gujarat had self-imposed mechanized fishing ban during monsoon from the seventies.

Why this period of closure? It is generally contended that the spawning activity of most of the commercially exploited stocks takes place during monsoon (June-September) along the west coast and during April-May along the east coast. This was one of the considerations for closure of fishery during these periods. However, it is well known that in tropical marine finfishes and shellfishes spawning is generally protracted and fractional spawning is a common phenomenon. While most of the species spawn during monsoon months, they also spawn during other periods of the year with varied intensity. Ensuring better catch rates and sustainable production for traditional fisherfolk who resume fishing after monsoon and whose activities were believed to be threatened by incessant trawling operations throughout the year was also another important consideration. Giving respite to the benthic-fauna from intense trawling pressure so as to enable the system for regeneration to ensure higher productivity is another reason for closure of fishery. Another dimension that was taken into account was the safety of fishermen and equipments during fishing in the rough seas in the monsoon months.

Impact on catch

To assess the impact of fishing ban, the landings along Kerala and Tamil Nadu & Pondicherry coasts were analysed.

Kerala: The average annual landings during the ban phase (1988-2002) were higher than in the pre-ban phase (1981-87). However, this increase is mainly due to large-scale introduction of motorized ring-seiners and the resultant increase in the catch of the pelagics. Although the demersal landings during the first ten years of fishing ban had shown an increasing trend, the demersal landings declined in the last five years.

A predictive analysis of the seasonal closure on demersal assemblage with respect to closure during May/ June/ July/September/June and July/ partial closure in June/ full closure in July was carried out. This study revealed that complete closure in June and July and closure as being practiced now are better options to sustain the demersal stocks off Kerala.

Notwithstanding the continuance of the ban on fishing by trawlers during the southwest monsoon, there has been no significant enhancement in the production either in the mechanized or motorized sectors during the last five years. The fishery appears to have stabilized at around 5.5 lakh tonnes annually.

Studies have also revealed that intensive trawling has an impact on species richness, diversity and the ecosystem.

The studies indicated that there was no significant change in the spawning behaviour or the spawning intensity between the pre-ban and post-ban periods.

The scaling up of the ring-seine operations both in the dimension of the net and also the magnitude of unit operations is causing concern. The landings from these nets were found to contain predominantly juveniles of some of the important pelagic resources. Increased catch of juveniles could adversely affect the resources. Since the ring-seine fishery has the capacity to exploit the resources even during the monsoon season, continued exploitation of the resources during the critical spawning season is expected to have deleterious effect on the health of the stock. Hence it is prudent to regulate the ring seine fishery through restriction on the size and number of unit operations and also the mesh size.

Tamil Nadu and Pondicherry

The Governments of Tamil Nadu and Pondicherry impose a fishing ban on mechanised vessels for 45 days from April 15 to May 29 every year. The ban came into effect in 2001 and is being followed for the last four years. To assess the impact of ban on fisheries, the landings, biological characteristics and stock of major fish groups along

Tamil Nadu coast were analysed. The following are the salient findings of the study:

- The annual fishing effort of trawlers at Chennai decreased from 7.5 million hours in 1998 to 5.8 million hours in 2004, a decrease of about 30%.
- In the eight-year period between 1997 and 2004 the marine fish landings decreased from 472,500 tonnes in 1997 (pre-ban year) to 365,000 t in 2004 (ban-year), a decrease of more than 1 lakh tonnes (or >20%). The declining landings through the ban -years indicate that the ban has not helped recovery of the stocks.

Impact on population dynamics

Spawning and recruitment

Closure of fishing for 45 to 60 days would have influence on the dynamics of finfish and shellfish populations. For example, penaeid shrimps are continuous spawners, and, on an average, one spawning occurs during the ban period. Moreover, fishing ban gives an opportunity for the shrimps to grow. It is well known that the fecundity of larger shrimps is more than that of small ones. These two factors namely; the additional spawning and higher fecundity due to growth enhance the reproductive output of shrimps. The higher reproductive output is reflected as higher recruitment to the fishery after the ban period. This phenomenon is observed for small sized, short-lived finfishes also. For example, the post-ban months of June and July, there was good recruitment to the trawl fishery. For instance, an estimated 0.37 million juveniles of the threadfin bream *Nemipterus japonicus* were landed in June in the pre-ban years at Chennai Fisheries Harbour, whereas 3.62 million juveniles were landed in June in the ban-years. However, the magnitude of difference gradually reduced in the subsequent months. Thus the influence is of short duration and does not have great impact on the fisheries of different kinds. Moreover, high recruitment due to fishing ban was not noticed for large sized, long living species such as the ray *Dasyatis jenkinsi*.

Mortality

During the ban period, fishing mortality reduces considerably. However, due to

continuous spawning and release of youngones, the predation mortality is expected to increase. The extent to which the increased predation mortality affects the stocks is not known.

Annual Stock and MSY

The annual stock of seven major demersal finfishes viz, *Nemipterus japonicus*, *N. mesoprion*, *Leiognathus bindus*, *Secutor insidiator*, *Upeneus taeniopterus*, *U. sulphureus* and *Saurida undosquamis* declined from 9,035 tonnes during 1997-2000 (pre-ban period) to 6,427 tonnes during 2001 - 2004 (post-ban period) off Chennai, i.e., a decline of nearly 30% of the stocks of major demersal finfishes through the ban period. Due to reduction in the total stock, the Maximum Sustainable Yield also reduced during 2001-2004. It could be concluded that seasonal ban has not helped either long-term recovery or increase in the MSY of the stocks.

Impact on environmental factors

Primary, Secondary and Tertiary production in relation to upwelling

The monsoons play a significant role in the ecological cycle and productivity of the sea. Solar radiation, which forms the primary source of energy and is essential for photosynthesis, is dependent on the intensity and the length of the daylight and atmospheric conditions. The biomass production in the sea is thus dependent on this energy and the nutrient supply generated through the complex physical, chemical and biological processes taking place in the dynamic marine environment and subsequently transmitted to aquatic organisms at different trophic levels. Similarly, the upwelling phenomenon, which occurs seasonally, is due to the strong monsoon winds. This process is important for refertilising the impoverished surface layers and has a great bearing on fish production, its distribution and abundance pattern. Besides, the turbulence, eddy diffusion and thermal stratification caused by the interaction among the sea and atmospheric conditions and wind speed, play major role in the supply of nutrients which determined the productivity of the sea.

The influence of weather on fish populations and their behaviour in general and that of the southwest monsoon on the Indian marine fisheries in particular, have been recognized long back. Studies on this aspect were being carried out at the Central Marine Fisheries Research Institute almost from its inception. The important investigations in this direction have been to correlate the variation in the oil sardine catch of the west coast with the intensity of southwest monsoon; sea surface temperature with the mackerel fishery; upwelling occurring during the southwest monsoon on the distribution pattern and movement of fish and prawn stocks in the shelf waters; mud bank fisheries and the prawn fishery of the west coast in relation to hydrographical conditions in the shelf water during different seasons. Recently correlations were made on the abundance of oil sardine with the upwelling on the southwest coast of India and sea level as an indicator of intensity of the upwelling and consequently the oil sardine catch.

Eutrophication

Eutrophication is a phenomenon seen in coastal waters due to high nutrient enrichment, either natural or artificial, resulted in the blooming of phytoplankton organisms, which are harmful or harmless to the fishery. Usually, eutrophication occurs due to sewage discharge, industrial effluence and river runoff during monsoon. During post monsoon season, due to eutrophication, blooming of harmful phytoplankton organisms have been observed in the coastal waters of Calicut and Vizhinjam areas. At Calicut, blooming of the green flagellate, *Hornelia marina* was a regular phenomenon. At Vizhinjam and Kollam areas, regular blooming of the dinoflagellate, *Noctiluca*, *Cochlodinium* and *Goniolax* species were observed in recent years.

Seasonal migration

Whitebaits

The whitebaits (*Stolephorus* spp.) undertake seasonal migration along the southwest coast and the Gulf of Mannar in 4 distinct phases: (i) In October, when the northeast monsoon sets in, the shoals are discontinuously distributed in a narrow elongated band along the southwest coast from Mangalore to Cape Comorin. During November to February, the shoals form a continuous wide belt with a disruption between 11°N and 12°N (iii) During March-April, the shoals break up and begin their southward migration, which continues till July. (iv) In August, the southward migration culminates, with the bulk of the stock migrating towards north in the east coast and piling up between Cape Comorin and the central Gulf of Mannar in the east coast. The migration of the whitebaits follows the surface currents of the northeast and the southwest monsoons. During the southwest monsoon, the currents flow southwards along the west coast; and north and northeastwards in the Gulf of Mannar; during the northeast monsoon, the current flows in the reverse direction.

Oil sardine

The oil sardine *Sardinella longiceps* of 0-year class migrate *en masse* from the offshore to the inshore areas simultaneously all over the sardine centres along the southwest coast towards the end of the southwest monsoon. The new recruits, after

reaching the inshore areas, continue to get reinforced uninterruptedly through the entry of fresh recruits, inspite of heavy fishing pressure. With the warming up of the surface waters and the deepening of the thermocline in summer (March to May), the shoals gradually move back to the offshore areas, vacating first from the north and then from the southern centres, every year. Large scale tagging of oil sardine was carried out by the CMFRI from several centres on the east and west coasts of India during 1967-68 and 1968-69. The recoveries were limited. Hence, no definite conclusions could be drawn regarding the migration of this fish, but the limited recoveries revealed only local dispersal.

Shrimp Karikkadi, Parapenaeopsis stylifera

Experimental shrimp trawling conducted by the CMFR Institute at Cochin over a period of two years has shown that during the non-monsoon period (September/October to May) most of the shrimp stocks occupy the coastal waters within the 20m depth contour. With the commencement of southwest monsoon and the consequent changes in the environmental conditions, the prawns leave the inshore areas in large numbers to the deeper zones. They remain mostly in the 20-40 m depth zone during June and in the 40-60 m depth zone during July and August/September. A small population of the species, however, exists very close to the shore within 5-6m depth, during the monsoon period, which is predominantly constituted by adults in spawning condition.

Observations:

- Several studies have shown that intensive trawling has a detrimental impact on the species richness, diversity and the benthic ecosystem in general.
- 4. To give respite to the disturbed ecosystem so as to regain its productivity and as conservation strategy it would be advisable to regulate trawling during certain periods of the year as is done presently.
- 5. There is no report so far on the impact of fishing ban on primary and secondary production, eutrophication and migration of fish stocks.

6. As marine fisheries in India is open-access without any control on the quantum of effort, there is every indication that fishing effort, especially for trawls, is way beyond the optimum, and this results in gross overcapitalization and reduced profit margins to fishers besides having adverse impact on the long term sustainability of the harvested stock. The ban has helped to reduce the annual fishing effort of mechanised vessels. Had there been no ban, the effort would have continued to increase to a critical level.
7. Impact analysis carried out in Kerala indicates that to some extent that the 45-day trawl ban has helped in maintaining the catch rates at a rate which was prevailing before the ban and has also helped in increasing the average catches by a small measure
8. Though there was good recruitment to the fishery immediately after the ban period, the increased recruitment did not last for more than 2 to 3 months.
9. The ban, in the present form, has not helped long-term recovery of stocks.
10. Another factor that makes the ban largely ineffective is the non-inclusion of motorised sector under the ban. The number and efficiency of motorised craft have increased in recent years. Inclusion of motorised craft under the ban will have positive impact.
11. Temporal fishing ban alone is not enough for the recovery of fishable stocks. Temporal ban will be effective under a larger, holistic management regime which should include spatial fishing restrictions, mesh size regulations, capping the capacity of fishing craft in major harbours, etc.

Suggestions and Recommendations 2 (MFR)

7. At present the fishing regulation is confined to mechanized fishing within the territorial waters. It is recommended that steps should be taken to stop further entry of ring seines into fisheries. As this gear catches appreciable quantities of young fish, it is suggested to increase the present mesh size of 10-20mm to 35mm.

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- 2 8. There should be restriction on the dimension of the ring seine, as currently nets of more than 1 km length and depth of 100m are widely operated by boats 75-90 feet OAL, fitted with inboard engines of 110 hp.
 - 3 9. During the ban period, units below 25 hp engines, alone should be allowed to operate.
 - 4 10. The cod end mesh size of the trawls should not be below 35 mm.
 - 5 11. There should not be any addition to the existing fleet size of trawlers.
 - 6 12. As comprehensive and stringent regulation of monsoon fishery is not possible due to a number of socio-economic and political reasons, total ban of all fishing may not be advocated.

The success of regulatory measures depends upon their effective implementation. To achieve this, the involvement of the fishermen, along with the political will is the prime requisite particularly in the background of socio-economic milieu prevailing in the fisheries sector. Considering this vital aspect, it is suggested that voluntary self-regulation by the fishermen and other interested groups as successfully practiced elsewhere may be adopted.

Submitted to the Director, CMFRI, Cochin on 06.08.2005

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