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REPORT OF THE WORKING GROUP FOR REVALIDATING THE POTENTIAL OF FISHERY RESOURCES IN THE INDIAN EEZ

October 2000

Submitted to the

Department of Animal Husbandry & Dairying
Ministry of Agriculture
NEW DELHI

सत्यमेव जयते

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भारत सरकार
Secretary
Government of India

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FOREWORD

Marine fish harvesting, especially in the coastal waters, has been putting enormous pressure on the exploitable resources globally. Unregulated fishing in certain parts have even culminated in serious depletion of commercially important fish and even at times in extinction of certain species. Apart from fishing pressure, fishable stock in our oceans are also seriously impacted by other human activities such as discharge of untreated industrial and municipal waste, agricultural run off etc. from the landward side besides ship borne pollution due to oil spill, oil and mineral extraction from sea bed etc. within the sea itself. Exponential growth of population and unsatisfactory food grain production in many parts of the world is leaving us with few options other than to focus more on fish production for achieving food security .Our earlier belief that the dynamic marine resources being renewable in nature may withstand the pressures at any level need to be changed, in the light of various scientific studies. In so far as these resources are vulnerable to uncontrolled tapping, the need for scientific management of the same in order to ensure sustainability of the fishing operation is underscored.

Management of living resources thus deserve priority consideration not only for ensuring the food and livelihood security of several lakhs of fishermen and their dependents but also to ensure availability of this gift of the nature for several generations to come.

It is in this context that the Govt. of India through a duly appointed Working Group undertakes the exercise of periodic updating of the fishable potential in our seas. It is hoped that the present volume containing the revalidated figures of our fisheries resources potential might serve as a useful tool for all those engaged in marine fisheries management.

I congratulate Dr. E.G. Silas and his team for the good work done and in finalizing this report in time.

(Binoo Sen)

New Delhi
1.10.2002

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1. PREFACE

The potential marine fishery resources of the Indian EEZ was estimated in 1991 as about 3.9 million tonnes by a Working Group of Experts constituted by the Government of India, Ministry of Agriculture, on the basis of data and information from exploratory fishery surveys, exploited fisheries resources and other data sources upto 1987. Since 1991, a considerable amount of data on fisheries resources through exploratory surveys, commercial fishing operations, surveys on the exploited fisheries based on fish landings, coastal subsistence fisheries and fishery oceanographic research have become available. Some information has also become available from fishing vessels under Charter, Joint venture, on Lease Agreements and from international data sources on highly migratory pelagic stocks.

The decade of nineties witnessed major changes in the pattern of fishing along some coastal areas, expansion of the fisheries in the traditional sector through enhanced operational and capture capabilities. These changes have no doubt increased the overall effort. Concurrent with these developments, there have been concerns about open access and the need for management and conservation of resources for the development to be sustainable.

Ministry of Agriculture (Department of Animal Husbandry and Dairying), Government of India under Order No.2100-1/98Fy(Ind) dated 24.5.1999 constituted a Working Group for the revalidation of potential fishery resources of the Indian EEZ under the Chairmanship of Dr. E.G. Silas, Former Vice-Chancellor, Kerala Agriculture University. The Working Group has been able to critically look at the marine fish catch statistics from 1990-1991 to 1999-2000; major species catch composition, boatwise and gearwise effort, and available information on environmental characteristics.

One of the uncontrolled but spectacular developments in the early nineties was the unprecedented rate at which the motorised sector expanded in a multi-dimensional fashion especially along the southwest coast. The increase in length of country boats to 18 m powered by two to three OBM generating an aggregate of 75 HP and above, and operating ringseines of dimensions reaching more than 900 m length x 90 m depth have completely changed the fishing scenario in Kerala. Can this be a sustainable development ?

The enhanced operational capabilities through motorisation and the overefficient gears in the traditional/artisanal sector such as ringseines have

further compounded the issue of the sharing of fish stocks. As a result, the nineties have witnessed increasing conflicts over fishing rights especially along Kerala coast. Sharing of stocks have also been a bone of contention among the traditional sector and the mechanised boats which again led to the imposition of a short term ban (30-45 days) on monsoon fishing for the latter.

Worldwide, many of the major fish stocks have declined and some reached critical levels. Global fish production has declined by 4% to 117 million tonnes in 1998 as against 122 million tonnes in 1997.

The data analysed has given indication of regional imbalances in some of the resources especially, the decline of catch of some commercial species/groups. It will not be long before the open access system without any regulation on catch and effort would lead to widespread "fish famine" in some regions along the coast. The revalidation exercise carried out by this Working Group also highlights that the time has come to regulate the open access system, the size of the fishing gears and mesh size. The apprehensions in some quarters of "overfishing" are not unfounded.

The 1992 Declaration of Cancun made at the Conference on Responsible Fisheries, developed the Code of Conduct for Responsible Fisheries with Guidelines and Criteria to help in the management of living aquatic resources. The past one decade has also seen a shift towards people's participation in developing management strategies especially in the traditional coastal fishing sector. Any future plan for coastal resources development should involve such a participatory approach.

The Rio Conference (1992) stressed the need for fostering biodiversity. Lack of foresight would lead to environmental imbalances, degradation of aquatic eco-systems such as coastal mangroves and coral reefs. Fisheries is a common property resource and we are still grappling with conflict management and not fisheries management. The open access multispecies fisheries, highly diverse craft and gear and over 3000 landing centres along the coast, pose problems in our fisheries management.

A contributing factor for the maladies seen in the Indian marine fisheries policy decisions in the nineties is the estimate of number of fishing vessels (2630) to be introduced for fishing the additional resources of 0.85 million tonnes, estimated by the revalidation of 1991. It is necessary to remember that the marine fishery resources are dynamic, non-static and are not distributed in the same abundance level along the vast continental shelf. It is also necessary to take

into consideration the capabilities of different fishing crafts in the existing sectors for harvesting additional resources. Marketability of the resources in terms of high value, medium value, low value and no value fish is also equally important. So also the harvesting of low value, high volume and high value, low volume resources. Any exercise without taking into consideration these and many other multifarious problems for determining the additional fleet size will only be futile.

The assessments made by this Working Group on the species/groupwise, regionwise and national resource status, and the recommendations made would enable policy decisions to be taken both at the Central and State levels for the management of fisheries.

I wish to place on record my sincere thanks for the excellent co-operation extended by all Members in the preparation of this report. I have also great pleasure on behalf of the Working Group to express thanks and appreciation for the help received from all experts and specialists of different organisations but for which it would not have been possible to carryout such in-depth analyses. My special thanks are due to Dr. V.S. Somvanshi, who functioned as very effective Member Secretary and organised the meetings of the Working Group and Sub-Groups. On behalf of the Members of the Working Group, I wish to place on record our sincere thanks to Ministry of Agriculture, Department of Animal Husbandry and Dairying for reposing on us the responsibility of studying, assessing and revalidating the marine fisheries resources potential of the Indian Exclusive Economic Zone.

sd/-

25 October, 2000
A-56, Girinagar North,
COCHIN-682 020.

E.G. SILAS
CHAIRMAN
WORKING GROUP

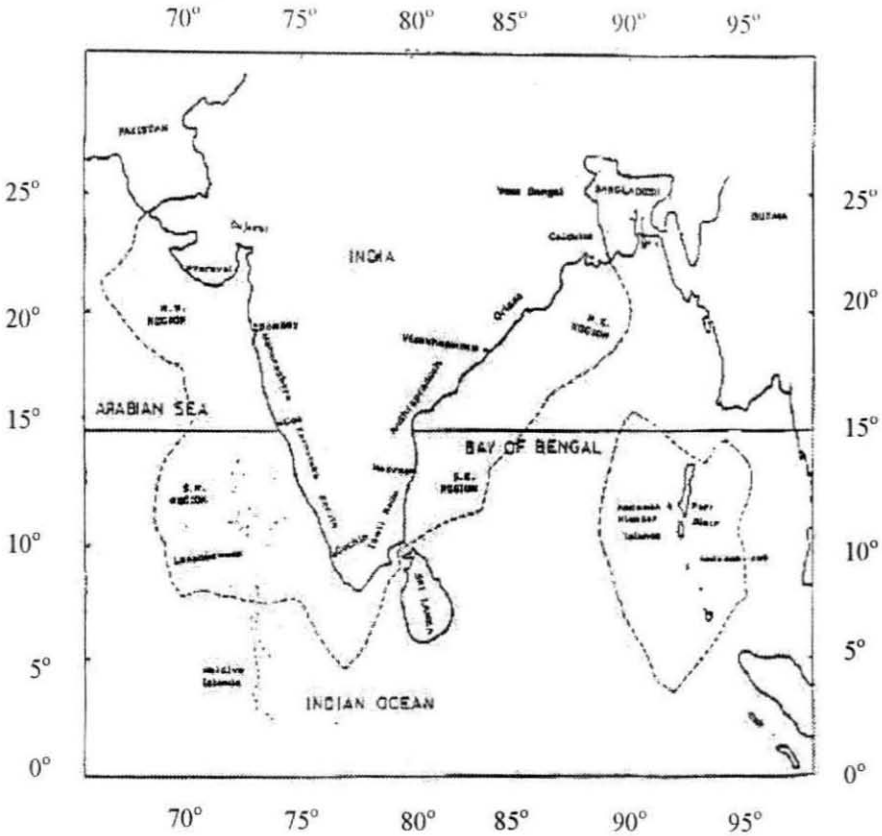
2. ACKNOWLEDGEMENT

In order to accomplish the task assigned to it, the Working Group had to consider large volume of scientific data and information on marine fisheries for which various institutions and agencies such as Fisheries Division of Ministry, CMFRI, CIFT, FSI, CIFNET, IFP, MPEDA, NIO, CUSAT and Fisheries Departments of various maritime states have been approached. The authorities and concerned officers of these organisations have promptly provided the needed information and all co-operation for the framing of this Report. A number of Scientists/Technical officers have also taken part actively in the deliberations of the Working Group and given valuable suggestions. The Working Group places on record its sincere thanks to all of them.

The Working Group wishes to express its sincere appreciation and thanks to all members of the Sub Groups constituted at CMFRI, Cochin and FSI, Mumbai for their active involvement without which it would not have been possible to accomplish the task assigned to the Group.

The Working Group express its sincere thanks and appreciation to the Director and staff of CMFRI, Cochin as well as to the Director General, and staff of FSI, Mumbai for providing all facilities for the Group for conducting the deliberations and finalising the Report. The secretarial assistance rendered by Smt. Helan Paul, Kum. Sunita Chetnani (FSI), Smt. N. Yesoda, S/Shri P.P.Pavitharan and G. Subbaraman (CMFRI) is gratefully acknowledged.

3. Map of EEZ of India



The outer margin of the EEZ is only provisional and without prejudice to agreements reached or to be reached with the concerned countries

E.E.Z Area	- 2.017 Million Km^2
West	- 859992 Km^2
East	- 561388 Km^2
A & N Island	- 596554 Km^2

4. THE CONSTITUTION AND TERMS OF REFERENCE OF THE WORKING GROUP

4.1 The Government of India, Ministry of Agriculture, Department of Animal Husbandry & Dairying have constituted the Working Group of Experts during May, 1999 (*vide* Order No. 21001-1/98-FY (Ind) dated 24th May 1999) with the following members and Terms of Reference.

Chairman:

Dr. E.G. Silas,
Retired Vice Chancellor,
Kerala Agriculture University
Cochin

Members

Dr. V.Narayana Pillai
Dirctor
Central Marine Fisheries Research Institute
Cochin

Dr. D. Sudarsan
(Retired Director General
Fishery Survey of India)
CBM Compound, Visakhapatnam
(Non official)

Dr. V. Sampath
Director
Department of Ocean Development
CGO Complex
New Delhi.

Dr. Y.S. Yadava
Fisheries Development
Commissioner
Department of Animal Husbandry
& Dairying
Krishi Bhavan, New Delhi.

Member-Secretary

Dr. V.S. Somvanshi
Director General
Fishery Survey of India, Mumbai.

4.2 The Terms of Reference of the Working Group

i) to revalidate the potential yield estimates of marine fishery resources made in 1991 on the basis of subsequent research survey and exploratory work on fishery resource of the Indian EEZ.

ii) to estimate the additional harvestable yield that could be obtained on a sustainable basis from different depth zones/regions of the Indian EEZ.

iii) to give suggestions on conservation of fishery stocks in the Indian EEZ in light of the existing legislation and various global conventions/initiatives.

The Working Group was asked to submit its report within six months from the date of its constitution.

4.3 Following members were Co-opted in the Working Group of Experts after the first meeting:

Dr. K.K. C. Nair
Senior Scientist
National Institute of Oceanography
Regional Centre
Cochin

Dr. V. N. Sajeevan
Senior Scientific Officer
Department of Ocean Development
Sagar Sampada Cell
Cochin

Dr. R. Damodaran
Professor
Department of Marine Sciences
Cochin University of Science and Technology
Cochin.

4.4 The term of the Working Group was extended upto 25.10.2000 (*Vide* Ministry's Order No. 21001-1/98-FY (Ind) dated 5.6.2000.

4.5 The Working Group met four times (20.8.99, 8.10.99, 4.10.2000 and 19.10.2000) and held intensive deliberations taking into consideration the data furnished by various organisations and other relevant aspects to prepare the draft report. Subsequent to the demitting the office by Dr. Y.S. Yadava and Dr. V.Narayana Pillai the meeting of the Group was attended by the present incumbents namely, Shri. M.K.R. Nair and Dr. Mohan Joseph Modayil respectively.

4.6 Sub-Groups

The Working Group during its first meeting held on 20.08.1999 constituted two Sub Groups, one each in FSI and CMFRI to analysis the data and work out the potential yield estimates on the basis of the data collected by both the organisations. The members of the Sub-Groups were as follows:

FSI	CMFRI
Shri K. Vijayakumaran	Dr. V.S.R. Murty
Dr. M.E. John	Dr. N.G.K. Pillai
Dr. A.K. Bhargava	Shri. K.N. Kurup
Shri D.K. Gulati	Dr. M. Srinath
Dr. (Smt) S. Varghese	Dr. G. Sudhakara Rao
Shri. P. Chalapati Rao	
Shri. B.M. Raut	

The Sub-Groups besides conducting their meetings and deliberations held two joint meetings one each at CMFRI, Cochin and FSI, Mumbai.

5. SUMMARY AND RECOMMENDATIONS

5.1. Summary

The total potential yield of the marine fishery resources of the Indian EEZ is revalidated as 39,34,417 tonnes consisting of 20,17,072 tonnes of demersal, 16,73,545 tonnes of pelagic and 2,43,800 tonnes of oceanic resources. For the first time the estimates of potential yield of as many as 68 species/groups are given.

The estimate of the potential yield (3.93 million tonnes) for marine fishery resources from the Indian EEZ obtained through the present revalidation in totality, is in agreement with the revalidation estimate of 3.9 million tonnes of 1991. The present exercise has also added additional resources viz. subsistence fisheries of bivalves and gastropods of 2.05 lakh tonnes and deepsea fishes of 1.01 lakh tonnes totalling 3.06 lakh tonnes. A disturbing trend seen is the substantial reduction of some of the important conventional resources namely, elasmobranchs, (- 97,000 t), catfishes (- 72,000 t), other clupeoids (- 1,31,000 t), ribbonfishes (- 1,17,000 t) and carangids (- 2,09,000 t). This calls for strict monitoring of the resources especially state/regionwise and specieswise with greater emphasis on assessment of stocks through intensified research programmes to enable rendering advice on management measures to be adopted. The time has come to stop open access and evolve regulatory mechanisms for judicious utilisation of the resources.

The decade of nineties has seen major changes in the pattern of fishing, in area expansion of traditional fishing especially through motorization, use of monofilament netting materials and gear modification. It has also seen the phasing out of charter and leasing of foreign fishing vessels and suspension of issue of new licenses to joint ventures. This period has also been one of high drama and conflicts among different sectors on the sharing of common resources. Some of these events have culminated in the government constituting the "Committee to Review the Deep Sea Fishing Policy" (1995). The recommendations (1996) delineate the inner limits of fishing by the large trawlers (> 20 m OAL) to 100 nautical miles from the shore or 150 m depth on the west coast and 50 nautical miles or 100 m depth on the east coast, whichever is farther. The Government has accepted this Committee's recommendations. The bulk of our fisheries as in the other parts of the world, is confined to the continental shelf (neretic zone) which is now fully left for utilization by the traditional (non-motorized and motorised) and mechanised (less than 20 m OAL) sectors. Some of the major conflicts witnessed during the nineties in the sharing of common shelf water resources have been between these two sectors only. The issues remain unresolved although short-term ban on fishing (monsoon trawling) has been imposed in certain parts. Sooner or later, many issues concerning sharing of stocks by different sectors will have to be addressed. The maritime states have a responsibility in formulating rules and regulations under the Marine Fishing Regulation Act (MFRA) to do away with open access and evolve judicious measures for sustainable coastal fisheries. The need for Monitoring, Control and Surveillance (MCS) and Vessel Monitoring System (VMS) are essential.

5.2. Recommendations

The Code of Conduct for Responsible Fisheries has given guidelines and criteria for the sustainable development of fisheries giving importance to participatory action by stakeholders in decision making. In developing the coastal management plans, such participatory action becomes a prerequisite. The Rio conference of 1992 also stressed the importance of conserving and equitable sharing of marine resources and the need to take suitable precautionary measures by every nation. For developing and sustaining our fisheries, we have to take recourse to these action programmes. Recognising these and related matters, the Working Group makes the following recommendations:

1. The revalidation of potential marine fishery resources on the basis of all available information is estimated as 3.93 million tonnes which takes into consideration a component of 2.05 lakh tonnes of bivalves and gastropods of the subsistence fisheries and 1.01 lakh tonnes of deepsea finfish and crustacean resources not indicated in 1991 revalidation of 3.9 million tonnes. It should be of concern that regionally some of the traditional commercially important species have shown substantial reduction from the validation figures of 1991. More important are elasmobranchs (- 97,000 t), catfishes (-72,000 t), other clupeoids (-1,31,000 t), ribbonfishes (-1,17,000 t) and carangids (- 2,09,000 t). Specifically some resources have reached asymptotic levels and some others are showing declining trends (Table 11). The Working Group recommends that research be directed specifically towards such species showing declining yields in order to develop strategies for reviving and managing the resources. Such work is also be intensified for monitoring the exploited resources to render advice on their rational utilisation.

2. The present revalidation is done after a long gap of 10 years. With the rapidly changing scenario of marine fisheries in the country, it would be prudent to have bi-annual appraisal of resources estimation including potential yield of resources in order to enable corrective measures to be taken in the management and developmental plans. This will also help in streamlining and updating the database from all sectors of fisheries at the Centre and State levels. The organisations mainly concerned with the data viz. CMFRI and FSI may together carry out such periodical appraisals for which supportive data from maritime states and other agencies may be obtained on a regular basis. Such appraisals may be made available to the administrative Ministry of GOI for dissemination to all concerned.

3. It should be made mandatory for all fishing vessels above 20 m OAL to report their operational details and specieswise catch to the FSI as per the prescribed format. Similarly the state machinery collecting catch data from the fishery harbours and other landing centres should also furnish such data to the FSI. The FSI in turn should furnish one set of all data to the NMLRDC at CMFRI.

4. Since collection of data on marine fish resources including population characteristics is a continuous process, the Working Group recommends that the present coverage of catch and effort statistics through the stratified multi-stage random sampling technique adopted by the CMFRI be strengthened to make it to a 5% coverage and the States adopt the same methodology for a 5% coverage to ensure more precise resource assessment.

5. Short term forecasts based on satellite imageries help in minimising the searching time for shoaling fishes which congregate along current boundaries, slicks, areas of upwelling and thermal fronts. Chlorophyll-*a* distribution pattern also indicates areas of concentration of herbivores such as the sardines. In Coastal Area Management we have not taken advantage of the benefits of Geographical Information System (GIS) for coastal resource studies, marine habitat management, coastal rural rapid appraisal and other related aspects. Since GIS and Remote Sensing are tools which enable rapid assessment of resource and environmental parameters, the Working Group recommends that institutional capabilities for use of such systems be provided/updated at CMFRI/FSI through the DOD.

6. The Working Group recommends that the steps taken for formulation of national and state level regulations and legislations in marine fisheries should conform to the objectives of the Code of Conduct for Responsible Fisheries and other relevant global Conventions and resolutions. This would also relate to regulations to be enacted for the operation of large trawlers (> 20 m OAL) making it mandatory for such units to report the catch and operational details to the monitoring agencies after each voyage to enable the Conservation and Management of Straddling Fish Stocks and Highly Migratory Species in the EEZ and contiguous high seas.

7. Observing that the fishing effort expended at present in the shelf waters up to 100m is near optimal in most areas, the Working Group recommends diversification to tap the following resources:

i) ground fish particularly perch resources of the rocky continental shelf edge (rock cod, pig-face bream, red snapper, *velameen* etc)

ii) fin fishes, crustaceans(deepsea lobsters and deepsea shrimps) and cephalopods from the upper continental slope

iii) squids in the shelf and oceanic region through squid jigging and other techniques.

Foreign expertise, if need be, may be availed for tapping the squid resources.

8. No directed effort has gone into squid fishing in the Indian EEZ. The Working Group recommends that some of the exploratory fishing vessels of the FSI may be equipped to specially carry out squid jigging operations in the shelf and oceanic waters of EEZ and make available the resource information for helping development of this fishery. Foreign expertise may be invited to train the crew in operational aspects of squid jigging.

9. The Working Group recommends to the Central Government to take active steps for developing a national capability for distant water fishing including purse-seining and long lining for tunas in the Indian EEZ and contiguous high seas. At present the bulk of the harvesting of tunas from the Indian Ocean is by the distant water fishing fleets operating from bases in some Indian Ocean countries. Our development strategy which has lagged, should take into account Article 62 of the Convention on the Law of the Sea. Any further delay of development in this area is bound to adversely affect the national interest. Hence there should be also a shift from the capital intensive large vessels to smaller fishing vessels (existing, upto 20 m OAL) for pelagic tuna fishing using monofilament long lining on priority.

10. In view of the national interest in Antarctic, capability for harvesting Antarctic fishery resources (Krill and finfishes) in the near future should be built up.

11. Any programme for the development of high sea fisheries for tunas should also take into account the availability of infrastructure facilities such as harbours, landing, handling and storage facilities, and even processing facilities if need be. The Working Group recommends that existing fishing harbour facilities be improved to take in larger vessels (over 20 m OAL). With the new Economic Policy launched by the Government construction of fishing harbour infrastructure under the "Build-own-operate-transfer" (BOOT) or "Build, own, operate and maintain" (BOOM) may be considered through existing larger Ports.

12. The Working Group observed that the frame survey of the fishermen population, fishing crafts and gear, health, education and socio-economic status conducted over two decades ago by the CMFRI has not been updated. Such surveys enable formulating strategies for development. It is essential that the Central Government accords priority attention to this and provides necessary funding support to the CMFRI to immediately implement the same jointly with the maritime states.

13. The quantity of by-catch, discards and destructive large scale fishing of shrimp and finfish juveniles adversely affect the stocks. At present there are no restrictions on the mesh size and gear size in the fishing gears operated in the traditional (Motorised and non-motorised) and commercial (mechanised) vessels, though some of the states have proposed regulations they are not being enforced. The Working Group strongly recommends the strict enforcement and compliance to mesh size regulations and gear regulations for all categories of fishing in vogue.

14. Deepsea fishing in the EEZ (ground fish, squids) and contiguous high seas for tunas and oceanic squids will necessitate a system of Monitoring, Control and Surveillance (MCS) and the Vessel Monitoring System (VMS). This should help to obtain real time operational data on catch composition, effort and fishing grounds. Introduction of the system would also need enforcement and compliance. The Working Group recommends that aspects relating to MCS be entrusted to Coast Guard and VMS to Fishery Survey of India at selected bases for which equipment and required trained manpower be provided. This recommendation will help the nation to implement the relevant provisions under the Code of Conduct for Responsible Fisheries.

15. Participatory fisheries also involves building up of greater awareness among the stake holders on laws and regulations on matters relating to fisheries in vogue in the area, on conservation aspects, habitats, endangered marine organisms and fishery resources management. The Working Group recommends that each maritime state should take up this responsibility through the activation of their extension machinery.

16. The share of artisanal sector (non-motorised) in marine fisheries is hardly 9%, the motorised sector accounting for 26% and mechanised 65% (CMFRI, 2000). There has been a steady decline in the non-mechanised crafts and their landings. These non-mechanised crafts use diversified fishing gears and operate near inshore waters, the catch yielding a good proportion of young fish. A

National Level Review Committee to Assess the Areawise Requirements of Different Categories of Fishing Vessels below 20m OAL (MOA/GOI/July 2000) recommended that "programme of motorisation of traditional craft should continue till at least 50,000 of the existing traditional craft are motorised". Presently there are about 31,726 motorised traditional crafts. The Working Group recommends that motorisation programme should be made total for this traditional sector (not limiting to 50,000) in order to alleviate drudgery and improve the socio-economic status and prevent inter-sectoral conflicts.

17. The following are the specific recommendations that the Working Group would like to make concerning conservation aspects:

(i) In view of the large scale destruction of live coral attributed to increased sea temperatures due to *El-Nino* phenomena, coral reef surveys should be initiated without delay to assess such damage to live coral and reef associated plant and animal communities, as they have an important bearing on fisheries.

(ii) The directed fishery for the whale shark along the Gujarat coast should be stopped as this largest of all fish species is protected in most parts of the world oceans.

(iii) The export of our fishery products has to be "Turtle-safe". The incorporation of the 'Turtle Excluder Device' (TED) in the trawl nets could involve investment of Rs.1500 - 2000 per unit. The financial assistance to offset the cost may be considered.

(iv) The Dugong is the most endangered marine mammal in the Indian Ocean and the populations in the Gulf of Mannar, Palk Bay and the Andaman & Nicobar waters which have protection under the Indian Wild Life Act are greatly threatened by fishing and poaching. This poses fisheries and environmental concerns for the protection of this mammal and calls for launching an international regional programme for the conservation and management of the dugong that migrates between India and Sri Lanka.

6. INTRODUCTION

6.1 Estimation of fishery resources potential is a pre-requisite for planning, exploitation and development. Based on scientific information, exploratory surveys, experimental fishing and other data available George *et al.* (1977) estimated the potential yield of fishery resources in the EEZ as 4.45 million tonnes.

6.2 The marine fish production in India increased from 1.658 million tonnes in 1987-88 to about 2.970 million tonnes in 1997-98, showing an average growth rate of about 5.5% per annum during this period. Simultaneous with the increase in production, there has been a marked increase in all categories of fishing vessels below 20m overall length (OAL) in the recent past. There are altogether 2.38 lakh fishing crafts of which, nearly 47,000 are mechanised boats, about 32,000 motorised traditional crafts and the rest traditional crafts. Apart from this, there are about 98 large fishing vessels of above 20 m OAL. The fishing activities of traditional and mechanised vessels are mainly concentrated in the area upto 70 m depth zone. Trawling by larger vessels is mostly confined to the northeast coast. Concentration of traditional crafts is more on the east coast (nearly 62%) and the motorised and mechanised vessels are more on the west coast.

6.3 Considering the necessity to revalidate the potential fishery resources of the EEZ, a Working Group was constituted in 1990, by Government of India which revalidated the fishery potential as 3.9 million tonnes.

6.4 A major change has also taken place in the mechanised fishing sector where single day fishing to multiday fishing has come into being in many areas. This has also brought into use the carrier boats for reaching the catch to the landing centres.

6.4.1 The nineties have seen a sea change in marine fisheries all along the coast. In the traditional sector, motorization has witnessed a major development reaching to the present level of about 32,000 crafts as against 15,292 countrywide (Source: MOA Revalidation Report in 1991). The length of the traditional canoes has also now increased to even 60 feet and presently most of them operate with three OBM having an aggregate power of 75 HP or more. There has been a rapid expansion of the operational range of these crafts as well as their fishing capabilities. Ring seines of the dimension of 900m X 90 m are now in use from such craft. The ring seine operations which take place from inshore waters to

about 100 m depth zone is a very major development contributing to between 30 to 40% of the total marine catch along the Kerala coast.

6.4.2 The motorisation of traditional boats increased rapidly and mini trawling commenced by traditional craft with the use of OBMs. The operational range of gill-netters has also increased to cover most of the continental shelf waters

6.4.3 In a major shift, the operations of *Sona* boats (13 m) and small mechanized boats have virtually replaced large trawlers (>20 m OAL) along the northeast coast which account for nearly 70 to 75% of the marine fish landings.

6.4.4 Another development that has taken place in the recent past is the extension of fishing activities by the mechanised sector (above 43 feet) to deeper areas along the southwest coast. Such operations have landed about 25 to 30 thousand tonnes of deepsea shrimp during the period October 1999 to March 2000. The main fishing area was Quilon Bank and the fishing was conducted in area upto 380 m depth.

6.5 Overall, except for Gujarat the landings from the mechanised sector have been fairly uniform throughout, while the contribution of the traditional sector with motorisation coming into effect has substantially increased.

6.6 The number of large trawlers (>20 m OAL) mainly based at Visakhapatnam which stood at around 180 in 1990 has presently come down to around 98 functional, of which seasonally about 20 are operated in Myanmar and Indonesia on lease agreement for fishing deep-sea lobsters and other resources. The remaining vessels may also operate seasonally accounting to hardly 1% of the total catch.

6.7 The 80's and early 90's saw the foreign fishing operations in the India EEZ under (a) Chartering (Deep-sea Fishing Policy 1981), (b) Leasing (c) Joint Ventures and (d) Test fishing schemes (New Deepsea Fishing Policy, 1991). Of these, vessels under Charter scheme have been phased out by 1996. Vessels under leasing have also been concluded by October 2000. Presently valid licenses for Joint Venture for 19 vessels are in vogue. No vessels are operating under Test fishing. The total catch under Charter saw a peak in 1990 when about 20000 tonnes were reported. With the phasing out, the landing from foreign fishing vessels under various schemes declined to 5500 tonnes in 1997. Out of 19 Joint Venture vessels under operation about 15 are tuna long liners working in oceanic waters.

6.8. The above changes in catch/effort have also seen a greater diversification of marine products being processed and exported. There has been a significant increase in the exports of quality-frozen fish and also I Q F products such as squids and cuttle fish. Still, shrimp accounts for the major component of this export trade in terms of value. The details of export of marine products during 1999-2000 are furnished below.

Major components	Quantity (tonnes)	%	Value (Rs. Crores)	%
Shrimps	110275	32.15	3645.22	71.25
Finfish	131304	38.28	537.34	10.50
Cuttle fish	32799	9.56	286.22	5 59
Squids	3491	10.18	296.80	5.80
Dried products	6576	1.92	42.77	0.84
Live fish	1678	0.49	37.99	0.74
Chilled products	3088	0.90	44.97	0.88
Others	22393	6.53	225.36	4.4
Total	343031		5116.67	

Source: MPEDA

6.9 With the acceptance of the "Report of the Committee to Review Deepsea Fishing Policy" under the Chairmanship of Shri P. Murari (1996) as of today, the country has no deep sea fishing policy. Govt. of India (Ministry of Agriculture, Dept. Of Animal Husbandry & Dairying) has appointed recently a Committee to formulate a Comprehensive Marine Fishing Policy and its report is awaited.

6.10 The Recommendations No. 5 and 6 of Murari Committee Report stipulate that fishing vessels above 20 m will have to operate beyond 100 n miles on the west coast, and 50 n. miles on the east coast and around Andaman and Nicobar islands. The relevant recommendations read as follows:

"Since the Indian mechanised boats below 20 m size have the capacity to fish in depths upto about 70-90m on the west coast, the distance from the shore represented by 150m depth line should be out of bounds for all vessels of more than 20m length OAL. Where the 150m depth zone is less than 100 nautical miles from the shore, the distance upto 100 nautical miles should be reserved for Indian vessels less than 20 m length. On the east coast, starting from Kanyakumari, Indian vessels below 20m size would have exclusive access upto 100m depth or 50 nautical miles from the shore whichever is farther. The depth

zone would also be defined by coordinates indicating distance from the shore. Distance will be determined by National Hydrographic Office/Coast Guard/Fishery Survey of India".

"In regard to Andaman & Nicobar and Lakshadweep groups of islands, a distance of 50 nautical miles from the shore would be reserved exclusively for Indian vessels below 20m length with proviso at Para 4. Further, if so required, the limit would be defined taking into account the need to keep waters between islands reserved exclusively for Indian vessels, even if some portions fall beyond the limit of 50 nautical miles".

6.11 Recommendation No. 7 of Murari Report reads as follows:

"In the area open to the vessels above 20m length, resource specific vessels for tuna and tuna like fishes, squids and cuttlefish, deepsea finfishes in midwater or pelagic regions and oceanic tuna may be allowed for exploitation by tuna longlining, tuna purse-seining, squid jigging and midwater trawling, provided these are defacto Indian owned registered vessels. The Indian owners should account for atleast 51% debt as well as equity".

6.12 By-catch and discards have been a major concern. FAO estimates (1996) indicate worldwide discards amounting to an average of 27 million tonnes per year (or about 32% of total reported annual production of marine capture fishery). In developing countries, especially in India, the proportion of discards will be much less as most of the by-catch is used as either food, feed or manure.

6.13 The global awareness on the decline of some of the major fisheries through overfishing, poor management and the socio-economic imbalances among coastal fisher communities and other sectors have brought about important International Conventions and Agreements to mitigate such situations. The Code of Conduct for Responsible Fisheries arising out of the Declaration at Cancun Conference in 1992 is one such. Responsible Fisheries also aims at participatory action involving the stake holders in decision making so that sustainable development in harmony with the environment could be achieved. The Rio Conference (1992) stressed on the conservation and management of marine biodiversity and emphasised an approach which takes full account of the need to exploit fisheries in a precautionary manner. The International Conservation and Management measures by fishing vessels on the High Sea (1994); the UN Agreement on Conservation and Management of straddling and highly migratory fish stock (1995), and the Kyoto Declaration and Plan of Action on Sustainable Contribution of Fisheries to Food Security (1995) have great

relevance to the Indian Fisheries. More recently ' Dolphin-safe', 'Turtle-safe', and 'Sea-bird safe' concerns have also come up in the import of sea food products to certain countries stressing the importance given to the protection of some of the endangered marine species.

6.14 The fishery resources of our coastal waters are under heavy pressure from exploitation and there is an urgent need to regulate the effort expended, conserve and manage the resources for sustainable production. Tapping of new resources and utilisation of non-conventional resources under by-catch are matters that need greater attention. Similarly value added product development both for domestic consumption and export would be an incentive for proper utilisation of the resources.

6.15 Responsible fisheries also aims at proper legislation, regulations, Monitoring, Control, Surveillance and effective enforcement for compliance and adequate research support. These need serious consideration both at Centre and State levels. Time has also come for considering licensing for specific fishery.

6.16 On Primary productivity, the NIO has estimated from 930 profiles of primary production collected from EEZ of India during 1980 to 1998. The total annual primary production (pp) has been calculated to be 262.59 million tonnes of carbon within EEZ euphotic zone (upto 150m) of India. The contribution to this from different sectors of EEZ are 93.57 (west coast), 79.84 (east coast), 10.02 (Lakshadweep Sea), 79.16 (Andaman Sea) million tonnes. Based on this, the fish production from Indian EEZ is estimated as 3.62 m.t. for the euphotic zone for a depth of 150 metres.

6.17 The first ever-comprehensive attempt of the country in assessing benthic productivity by studying macro and meio benthos of the shelf waters started in 1998. Data is now available(CUSAT) for the west coast shelf which indicates rough production of marine benthos to the tune of 3.6 million tonnes from an area of about 2,51,631.36 km^2 (the assumption made here is that most of the macro benthos have got a life span of one year and meiobenthos of about three months). The standing stock of benthos was found to be 28,916.7 $kg/km^2/yr$ in 30 m depth, 17.127 kg/km^2 /yr in 30 m depth, 17.127 $kg/km^2/yr$ in 50 m depth, 8, 260.8 $kg/km^2/yr$ in 100 m depth and 5,090.5 kg/km^2 /yr in 200 m depth. This indicates a rapid decline of benthic biomass as the depth increases.

7. REVIEW OF EARLIER ESTIMATES AND STATUS OF MARINE FISHERIES

7.1 The Indian Ocean comprising the area between Longitude 30° to 150 ° and from Asian landmass in north to 50° S has a total area of 51 million sq. km. The sea area under the EEZ of India is 2.02 million sq. km. comprising 0.86 million sq. km. on the west coast including Lakshadweep, 0.56 million sq. k.m on the east coast and 0.60 million sq. km around Andaman and Nicobar Islands (Table - 1).

7.2 Prior to 1977, attempts have been made to assess the fishery potential of Indian Ocean and the seas around India by Prasad et. al. (1970), Gulland (1971), Cushing (1973), Jones and Banerji (1973) and Mitra (1973). These were mainly based on primary production and fish production trends.

7.3 Based on the rate of primary production estimated through C^{14} technique and on the assumption that organic production of the Indian Ocean amounts to 1/5 of the world oceans Prasad (1970) suggested an exploitation of 11-12 million tonnes of fish from the Indian Ocean as against the catch of 2.1 million per annum.

7.4 George *et al.* (1977) reviewing the above estimates and utilising the exploratory survey data and fish landing trends assessed the potential yield of the Indian EEZ as 4.5 million tonnes.

7.5 Mathew *et al* (1990) estimated the potential yield in Indian EEZ based on values of secondary production (expressed in terms of Carbon ranging from 0.5 to 20 .92 gm C/Sq m/year) amounting to 3.74 million tonnes. They have also observed that the average secondary production in shelf area of west coast is twice that of east coast and the total production from the continental shelf area to be twice that of oceanic production.

7.6 Table 2 gives details of estimates of potential yield of marine fishery resources of the Indian EEZ by Nair and Gopinathan (1981), Alagaraja (1989), Joseph (1985, 1987) James *et al.* (1989), Desai *et al* (1989), Sudarsan *et al* (1990) and that of the present Working Group. The 1991 revalidation of 3.9 m.t, estimated 1.689 m.t of demersal, 1.916 million tonnes of pelagic stocks and 0.295 million tonnes of oceanic resources.

7.7 The CMFRI continued its efforts in estimating marine fish production and investigations on fishery and biology of major exploited stocks and their stock assessment.

7.8 The Fishery Survey of India continued the survey of demersal and oceanic resources along the continental shelf, slope area and in the oceanic regions. With acquisition of two Japanese tuna long liners in 1989, greater emphasis was given to survey the areas hitherto unsurveyed viz. Andaman and Nicobar Islands, northeast coast and northwest coast.

7.9 With the rapid motorisation, the fishing zone by the traditional and mechanised boats extended upto 100-m depth. The fishing vessels started using electronic gadgets and new avenues for fishery resources such as cephalopods and fin fishes were developed.

7.10 The Chartered Scheme started by the Government of India in 1983 continued upto 1995, thereafter, the scheme was phased out. The chartered tuna long lining operation reached its peak in 1990, when 59 vessels were under operation with production of 12571 tonnes. The chartered trawlers (demersal) catch ranged from a minimum 460 tonnes (1996) and maximum of 6670 tonnes (1991). The chartered vessel operation indicated commercial viability of operation to exploit fin fish resources in the Indian EEZ beyond the territorial waters.

8. METHODOLOGY AND APPROACH

The estimates of potential yields are made integrating the data on the coastal commercial fish landings collected by the CMFRI including the data on species composition and the population characteristics, fishery survey data through exploratory surveys conducted by the FSI and the data on the oceanic resource surveys.

8.1. Coastal Fishery Resources Data

8.1.1 Data base

One of the main mandates of the Central Marine Fisheries Research Institute, Cochin is monitoring the exploited marine fisheries resources of the country. The Institute discharges this function by collecting and analysing statistics on marine fish landings in the country by employing a national sample survey using

a multi-stage stratified sampling design along the coast line of the country. This data is used for estimating the resource-wise and gear-wise production for each region for assessment of the status of the exploited stocks. National Marine Living Resources Data Centre, CMFRI, is the storehouse of relevant processed information. The annual gearwise - statewise, resource-wise landings from 1985 to 1999 obtained from the NMLRDC of the CMFRI form the database for the present Working Group.

8.1.2 Methodology

Micro level study requires enormous data which are not readily_forth coming from any source. One of the main hurdles in applying a micro level analysis is the standardisation of fishing effort. Conventionally, the method used is to identify a standard gear in respect of the fish that is studied.

Thus for a given species of fish

Let C be the total catch, and let Cs be the catch by standard gear and Fs be the effort by standard gear.

Then, let Us = Cs/Fs, the Catch per unit effort by the standard gear. Effective effort for total catch is then found by

$$F = C/Us$$

This method does not differentiate the efficiencies of different gears in exploiting the same stock and often lead to overestimation of the effective effort. This is overcome to a certain extent as follows:

Let G, i = 1,2 ....., k be the catch of a given species by gears G1, G2, ... GK and fi, i = 1,2....., k be the corresponding efforts and

Ui = ci/fi, i = 1,2 ....., k, be the corresponding catch per unit effort (CPUE) by the ith gear. Then effective CPUE of the species is obtained as the weighted average, namely,

$Us = \sum Ei \times Ui$ where $Ei = Ci/C$ (Ei is the score of the efficiency of the i^{th} gear in exploiting the given species).

The standardised effort for the species is

Fs = C/Us.

Then the functional relationship between C./F and F is fitted as $C/F = a - b F$

Then, an estimate of MEY, the Maximum Expected Yield, following the usual method, is obtained as

MEY = a 2/ (4b)

The MEYs are estimated for different groups for all the maritime states. After ascertaining the consistencies the data are pooled on all India basis and the corresponding MEYs obtained.

8.2 Exploratory survey data on deepsea and oceanic resources

8.2.1 Database

The surveys for demersal resources were conducted using standardised gear and sampling was done following depth - area stratified random sampling technique. Eight survey vessels were deployed for demersal stocks surveys. Estimates of biomass of the demersal stocks were made using the swept area method based on the average CPUE of the respective resources obtained in the Demersal trawl surveys. These surveys were conducted upto 500 m depth along the Indian coast including the Andaman and Nicobar Islands. The potential yields (in terms of MSY) were estimated from the respective estimates of biomass of each stock as follows

a) For virgin stocks: MSY is calculated using Gulland (1971) formula
MSY = 0.5 M.Bv.

b) For exploited stocks modified Cadima (1977) formula is used
MSY = 0.5 (Y + MB)

Both the approaches have their limitations. In this situation it is assumed that they are expected to give a good first approximations as most of the exploited stocks in the Indian waters mainly belong to 0 or 1 age groups and can be considered as annual crops where the generation lag is almost negligible. In the present case the FSI have conducted regular round the year intensive survey in time and space and the estimates are based on large volume of data collected during the period 1988 - 1997 from the Indian EEZ.

8.2.2 Oceanic resources

The oceanic resources surveys were conducted using tuna long lining gear with 5 branch lines in each basket. In exploring the tuna and tuna like stocks by deploying five survey vessels, systematic sampling technique was employed to cover the EEZ.

i. Earlier estimates by Sudarsan *et. al* (1990) are based on MSY estimates, CPUE and area available in the EEZ of some of the Indian Ocean Countries. A factor was derived from these parameters, which was then applied to obtain MSY in the Indian EEZ where CPUE and area were known.

ii. The assessment of larger pelagics is based on foreign chartered vessel operations in the Indian EEZ. The chartered vessel operations reached peak in 1990 when 58 vessels were in operation with production of 12,571 tonnes. It is assumed that this production is only about 30% of the potential from sub-surface fishery that forms only 22% of the total tuna and tuna like fishery resources in the Indian Ocean (based on 1992-96, IOTC Landing Statistics).

iii. The most effective surface fishing method for tunas is purse seining which is well developed is western Indian Ocean. Data for the period 1992-96 reveals that percentage of yellowfin, skipjack and bigeye tunas is about 44.8%, 48.6% and 6.6% respectively. Assuming this percentage to be valid for Indian EEZ, the potential yield for skipjack, bigeye and yellowfin tuna from surface fishery is estimated.

iv. As the distribution of sharks extends from sub-surface to surface layers it is assumed that yield from surface fishery would be about the same from sub-surface fishery.

v. Production figures for sharks by chartered vessels are highly under reported as shark fins are only saved and therefore based on this raised to whole body weight. Natural mortality (M) are taken from published literature for the different species and used for calculation.

8.2.3 Survey data:

Data on demersal fishery resources and pelagics, such as tuna and allied species are based on data gathered by FSI survey vessels from April 1988 to March 1997 have been used to obtain mean CPUE. The data was extracted for different depth zones and for this Working Group data pertaining to areas between 100 to 300/500 m latitude-wise.

8.2.4 Landing statistics

Landing statistics provided by Ministry of Agriculture, New Delhi has been used for the purpose. For the groups perches, elasmobranchs, flat fishes,

where species split up landing figures are not available in the statistics of Ministry of Agriculture, percentage composition of CMFRI species statistics were used. Threadfin breams landings were used from CMFRI. Chartered vessels data available with FSI were added to the landing statistics.

9. REVALIDATION OF POTENTIAL YIELD ESTIMATES OF MARINE FISHERY RESOURCES

9.1 The potential yield estimates of demersal, pelagic and oceanic resources have been presented in Tables 5, 6 and 7 respectively and the Summary of potential yield estimates of marine fisheries resources in the Indian EEZ is given in Table 8. The total potential yield of the marine fisheries resource of the Indian EEZ is revalidated as 39,34,417 tonnes consisting of 20,17,072 tonnes of demersal, 16,73,545 tonnes of pelagic and 2,43,800 tonnes of oceanic resources.

9.2 The potential estimates of demersal resources species/group have for the first time included estimate of bivalves (oysters, clams and cockles, mussels, windowpane oyster) as 2,01,601 tonnes and chanks and other gastropods as 22,672 tonnes. The bulk of the total production is supported by shrimps (3,34,811 t), croakers (2,73,027 t), perches (2,26,793 t) and cephalopods (1,01,259 t). The estimate provides for the first time information for the potential yield of as many as 68 species/groups.

9.3 Among the pelagic resources the major components are mackerel (2,95,040 t), oil sardines (2,94,869 t), carangids (2,38,148 t), ribbonfishes (1,93,670 t), Bombayduck (1,16,227 t) and other sardines (1,01,490 t).

9.4 The potential yield estimates of oceanic tuna consist of major component yellowfin tuna (1,14,800 t), skipjack (85,200 t) and Big eye tuna (12,500 t). In addition, the pelagic sharks and billfishes are found to yield 26,200 t and 5,100 t respectively.

10. ESTIMATES OF ADDITIONAL HARVESTABLE YIELD FROM THE INDIAN EEZ

Considering the present yield of 24,51,784 tonnes (average of 1993-98) and the revalidated potential estimated as 39,34,417 tonnes, an additional harvestable yield from the Indian EEZ could be 14,82,633 tonnes (Table 8). However, there is a component of bivalves and gastropods in the revalidated

estimate to the extent of 2,05,358 tonnes, which is partially harvested as subsistence activity in the artisanal sector. The bulk of the additional harvestable yield is expected from the demersal resources on the shelf area such as large species of perches, deepsea and oceanic squids and the tuna and allied species from the EEZ. These additional resources could be effectively tapped employing the technologies such as trap fishing and hook and lines for perch resources abounding in the rocky and uneven stretches of the shelf and slope, jigging for variety of squids available on the shelf and oceanic regions. The new avenue available for development is in harvesting the oceanic tuna and allied resources in the EEZ and the contiguous high seas using tuna purse seining and tuna long lining techniques.

11. CONSERVATION AND MANAGEMENT OF FISH STOCKS IN THE INDIAN EEZ

On account of the increased fishing effort in various sectors of coastal fisheries the production of various resources has reached the near optimum level and some even show signs of depletion. This situation seems to have arisen not only due to excessive fishing effort but also due to unrestricted use of certain types of fishing gears with small mesh sizes. Consequently, there has been both growth over-fishing and recruitment over-fishing. Certain pelagic resources, besides the fishery dependent factors are affected by oceanographic and environmental parameters. It is therefore necessary to have the provisions available in the national and state fisheries legislation are strictly implemented towards regulation of the mesh size, type of fishing gear, fishing zones and seasons so as to protect the fish stocks and their habitats. Introduction and greater use of eco-friendly and selective fishing methods may help to obviate the above situation.

11.1 Exploitation of young finfishes

A matter of concern has been the sizeable quantity of early juveniles and sub adults of many commercially important resources landed all along the coast. The details given below are indicative of the magnitude of the problem.

11.1.1 Juvenile / Young Fish Landings

- About 1.5% (by weight) of annual trawl catch is composed of young fishes.

- They are represented by 9 species in Gujarat, 17 in Maharashtra, 32 in Karnataka, 50 in Kerala, 32 in Tamil Nadu and 48 in Andhra Pradesh.

Place	Quantity t / year	Year	Species
Calicut	430	1950-84	Flat fishes, threadfin breams
Bombay	600		Bombayduck, pomfrets, croakers
Kakinada	280		Croakers, threadfin breams
Veraval	530		Pomfret, ribbon fishes
Mandapam	610		Croakers, perches
Sakthikulangara	705		Sciaenids, threadfin breams, lizard fishes, Decapaterus, perches
Trivandrum coast	180		Anchovies, Decapterus, lizard fishes, Sillago, Scomberomorous, barracuda
Mangalore-Malpe (Bull trawlers)	185	1992	Carangids, Sardinella, Silverbellies, catfishes
Colachal	14-20		Carangids, threadfin bream, sciaenids
Rameswaram	27	1990	*T.tenuipinis, T.maculatus, T.thalassinus*
Madras	552	1999	Silverbellies
Bombay (Dol net)	290	1986-87	Bombayduck

Source: CMFRI

- An estimated annual average (1980-84) of 6200 t juvenile and young ones of fishes landed. If allowed to grow to attain marketable size this would have provided 1.5 lakh tonnes of fishes, which is roughly about 10% of the annual average catch valued about Rs.77.5 crores.

- It has been estimated that on an average, every year (1980-86) during September - October 8 million eggs (13.4 t) and embryos of *T.tenuispinis* are destroyed.

Significant are the large scale catches of young oilsardines and mackerels by ring seines during the monsoon, ribbonfishes and other young fish in the trawlnets and shrimps in crafts operating with mini-trawl along the Kerala coast, and Bombayduck and pomfrets in Dolnets. The decrease in mesh sizes of fishing gears contributes greatly towards this destructive trend. Mesh regulations and restricted seasons of operations are all matters that need serious consideration for conservation and enhancing production. Large quantities of young fish of marine species and young shrimp are also destroyed in the stake nets being operated in

the estuaries and coastal lagoons and lakes. Stake nets using extremely small mesh have increased several fold during the last two decades with no control.

11.2 Conservation of marine living resources and marine habitats

The international conferences and conventions held in various parts of the world during the last few years have drawn attention to the need for maintaining the marine bio-diversity and the protection of the marine habitats and endangered species. Often natural phenomena create worldwide changes as is now being witnessed in global warming and the effects of phenomena such as *El Nino* and *La Nina*. Besides these, anthropomorphic actions in the form of pollution, engineering works, reclamation and degradation of habitats and overexploitation of resources affect balance of nature. In the context of conservation and management of resources the following need greater attention.

11.2.1 Coral reefs and seagrass beds

Recent underwater studies clearly show that there has been death of corals in large areas worldwide due to the phenomenon of *'El-Nino'* and increase in seawater temperature. The damages are of such magnitude that they affect the dense thriving fish and coral communities of the reefs. This makes it imperative that the monitoring of coral reefs of Lakshadweep, A & N Islands, Gulf of Mannar and Gujarat coast be made to assess the extent of such damages and effect, if any, on the resources and species diversity. Unregulated tourism in coral islands and reef areas also make it necessary to have guidelines to be developed for the protection of such areas from any type of bio-deterioration.

11.2.2 Mangrove eco-system

Along the mainland coast and bay islands the mangrove eco-system is highly stressed. Mangroves form the spawning and nursery grounds for many marine and estuarine fishes, crustaceans and other organisms and any damage or destruction caused to the eco-system would also reflect on the living resources dependent on it. With new knowledge gained from tagging shrimp there is considerable evidence of the importance of mangroves as nursery grounds. Mangroves entrap silt, detritus and leaf litter and also protect the coastline from erosion. It is rich in bio-diversity.

11.2.3 Upland watershed and coastal productivity

Any changes such as construction of dams, weirs, diversion etc. of the river water which discharge nutrients into the sea and enrich the coastal productivity will profoundly affect the biodiversity. Consequently primary, secondary and tertiary productions will be affected leading to decline in living resources and loss of bio-diversity with socio-economic repercussions in coastal rural areas. The need for monitoring land-based operations including the discharge of pollutants into the sea is very important. The approach is highly multi disciplinary and needs an inter-organisational approach.

11.2.4 Endangered marine animals

a) Whale Shark is highly vulnerable (Silas, 1986) and recently a fishery for this shark has been developed along the Gujarat coast where the sharks apparently congregate for feeding. Conservation measures are needed to protect this largest of all living fishes.

b) Sea turtles: All sea turtles are endangered and protected under the Indian Wild Life (Protection) Act 1972. The world's largest congregation of nesting sea turtles (Arribada) takes place along the Orissa coast. Despite some regulatory and conservation measures in vogue, the incidental capture of turtles (olive ridley) still continue. Necessary training inputs for fabrication and operation of Turtle Excluder Device (TEDs) are needed. In this context necessary financial assistance to fishermen to offset the cost of incorporating TED in their nets may also be considered.

c) Marine mammals: Incidental catches of Dolphins, Porpoises and Dugongs are reported from coastal fisheries and landing centres. All marine mammals are protected under the Indian Wild Life (Protection) Act of 1972. Use of explosive for killing Dugong in the Gulf of Mannar and Palk Bay have been reported. Dugong is the most endangered marine mammal in the Indian seas and is restricted mainly to the areas where sea grass beds are available for browsing in coral reef areas. Dugong also migrate from Gulf of Mannar to Sri Lanka coast and back and as such international cooperation will be needed for the protection, and conservation of this highly endangered species.

d) Sea birds: Large colonies of sea birds roost on some of the coral reef areas (Suhili Parr) and on Piti Island in the Lakshadweep they congregate for roosting and breeding. It is important that they are undisturbed and protected from egg collectors. Sea birds are excellent indicators of surface shoals of

oceanic tuna as they can be easily spotted feeding in the same area. This makes scouting for tuna shoals easier and saves fuel and time for boats to approach the shoals.

11.2.5 Artificial reefs (AR) and fish aggregating devices (FAD)

For augmenting fish production setting up of artificial reefs and fish aggregating devices have been under taken by different countries. Along the Southwest coast trials have been carried out for setting up of ARs where quick colonisation of fish have been observed. While these methods may help in aggregating fish species to specific areas for easy harvest, unless properly controlled and regulated they could lead to depletion of resources or excessive catching of young fish. Good examples of growth over fishing (from payaos) have been reported from the Philippines and Indonesian waters and of late from FADs established in Western Indian Ocean. There may be situations leading to law and order problems in sharing the common resources generated through the ARs and FADs. Hence introduction of ARs and FADs should be done under strict regulation and monitoring

12. YIELD ESTIMATES OF THE INDIAN EEZ MADE IN 1991 AND 2000 - A COMPARISON

Critically examining the revalidation of 1991 in comparison to the present exercise (2000), the Working Group would like to draw attention to the following.

a). In spite of some major changes, the total estimate arrived at gives an impression that there has been no apparent change in the estimates of the potential. Examination of the components and region-wise data will bring to the light the following differences:

i. The present validation has also included bivalves and gastropods from the subsistence and traditional fisheries contributing 2,05,400 tonnes.

ii. An estimated 1,01,000 tonnes of deepsea finfishes has been included, which by itself may be an under estimate. This is a new resource and will need a considerable amount of care in handling, value addition and product development.

iii. The above mentioned two items of resources offset the substantial reduction seen in Elasmobranchs (-97,000 t), Catfish (-72,000 t), other clupeoids (-131000 t), Ribbonfish (-1,17,000 t) and Carangids (-2,09,000 t)

iv. The Working Group is unable to reconcile with the potential pelagic fishery resources beyond 50 m depth (actually between 50 and 200 m), given in the revalidation made in 1991 as 1,39,000 t for the Andaman group of islands and 63,000 t for the Lakshadweep group of islands (since the oceanic pelagic resources in the entire Indian EEZ are given separately as 2,95,000 t). In both these islands the 200 m depth limit may fall mostly within 0.5 to 2.0 nautical miles from high water mark and there has not been any estimate of this magnitude of resource reported from this depth zone for the bay islands. Incidentally, the average annual total landings of the demersal and pelagic resources together from the Andaman and Lakshadweep islands (during 1995-99) are estimated at 26120 t and 7684 t respectively. In the case of Lakshadweep, the major portion of the landing is contributed by oceanic pelagic fishes.

v. In view of the increased capabilities of the motorised and mechanised boats, the suggested number of 2630 medium and small sized fishing vessels (25-40 m: 1530; 12-20 m: 1100), by the Working Group of 1991 is not tenable.

13. STATEWISE LANDINGS AND SPECIES DIVERSITY

The landing data , the annual average for the periods 1985-89 and 1995-99 are shown in Table 10. The total national landings increased from 1.78 million tonnes to 2.49 million tonnes. This increase, however, is not consistent in different regions. While the increase is over 230% in West Bengal, it is only about 32% in Kerala. Karnataka and Goa registered considerable decline in the total landings.

In regard to different resources, the catfish registered an overall decline of 16,000 t. Substantial decline was observed in Kerala and Karnataka (from about 11,000 t to 500 t *T.thalassinus*) and Maharashtra, but Gujarat registered an increase of about 10,000 t. Bombay duck registered an increase of 6,000 t on all India basis but declined by about 22,000 t in Maharashtra and increased by 19,000 t in Gujarat and 7,000 t in West Bengal. Croakers registered an overall

increase of 66000 t but showed a decline of about 6,000 t in Orissa. The all India production of silverbellies remained more or less stable but substantial increase was obtained in West Bengal and decline in Karnataka and Goa. The penaeid prawns registered a growth of about 50000 t during 1995-99 but Goa registered decline in their landings. In the case of nonpenaeid prawns, there was an overall increase of about 80,000 t of which about 66,000 t of additional yield was obtained only in Gujarat.

The studies on different species showed that some species are overexploited in certain regions and either under or optimally exploited in certain other regions (Table 11). Therefore it becomes imperative to generate field data for at least the commercially important species. The vast coastline and species diversity even regionally makes in further necessary to collect data on exploited resources specieswise without depending upon groupwise data as has been done hitherto. In view of this, the information available on commercially important species of pelagic and demersal resources are given in Tables 12 to 16 indicating percentage composition in the maritime states and the bay islands. This information has greatly helped the Working Group in assessing and evaluating the data on catch and effort statistics collected by CMFRI and FSI. Such information will also be useful for the maritime states for formulating management strategies.

14. ANTARCTIC RESOURCES

Commercial exploitation of the fishery resources from the Atlantic Ocean sector (FAO Statistical Area 48) and Indian Ocean sector (FAO Statistical Area 58) of the Antarctic waters started from 1970. The Pacific Ocean sector (FAO Statistical Area 88) is the least exploited owing to its remoteness and the almost permanent ice cover on most of its Shelf areas. The countries engaged in the commercial exploitation of the Antarctic fishery resources during the period 1990-99 are Australia, Bulgaria, Chile, France, Japan, Republic of Korea, New Zealand, Poland, Russia, Spain, South Africa, Ukraine, U.K., U.S.A. and Uruguay. Total catch and species wise catch from Antarctic waters during the period 1990-99 are given in the Annexure-Ia. During the split year 1998-99, Area 48 accounted for 80.7% of the total catches followed by Area 58 (11.0%) and Area 88 (0.3%).

The Commission for Conservation of Antarctic Marine Living Resources (CCAMLR) is the agency involved in the management of the fishery and conservation of Antarctic marine ecosystem and krill. The CCAMLR came into

force on April 1982. At present, 23 countries including India are members of the Commission. The Commission during its annual meeting decides the catch quotas and Total Allowable Catches (TACs) for the ensuing split year, based on the requests made by member countries and following the recommendations of the CCAMLR - Scientific Committee. All member countries which are provided catch quotas in Antarctic waters have to strictly follow the regulatory and conservation measures adopted by the Commission.

Indian efforts so far, for exploitation of the Antarctic Marine Living Resources have been limited to the First Indian Antarctic Krill Expedition (FIKEX) conducted by the Department of Ocean Development in Area 58 (56° to 61° 17'S and 30° to 40° E) during the period 27 December 1996 to March 1996. This expedition did create interest among some Indian entrepreneurs to also look at possibilities of venturing to the Antarctic for resources such as finfishes on krill. Annexures-Ib and c gives information on map of the CCAMLR Statistical Areas, Sub areas and Division which should be informative for prospective entrepreneurs and major species currently exploited in the sectors adjacent to the Southern Indian Ocean (48, 58, 81.1 and 88.2); a summary of the current conservation measures, resolutions and regulations (Source CCAMLR).

15. ON THE REPORT OF THE COMMITTEE TO REVIEW THE DEEP SEA FISHING POLICY

The Murari Committee (1996) made 21 recommendations based on exhaustive discussions and deliberations with a wide spectrum of fisheries interests in the country. From the point of revalidation of the fishery resources and recommendations for the future, it becomes imperative to highlight the avenues open for future developments of marine fisheries in the light of this Report. Recommendations 5,6 and 7 are significant in that they delimit areas of operations of fishing vessels based on bathymetric depths (150 m on West coast and 100 m on East coast) and distances from shore in nautical miles (100 n.m on the West coast and 50 n.m on the East coast). The following is the situation:

1. On the west coast, except for a very narrow strip off Gujarat coast, no part of the continental shelf will be available for bottom trawling and deepsea fishing for the fishing vessels over 20 m OAL.

2. The areas open to fishing by vessels over 20 m OAL would be open ocean waters within the EEZ in the Arabian sea, off the Gulf of Mannar.

the Bay of Bengal, the Lakshadweep and Andaman Sea and contiguous high seas.

3. The commercially utilisable resources of these areas are mainly the tunas, pelagic sharks and squids. Heavy concentrations of organisms occur in the DSL between 300-500m, a resource that cannot be utilised at present economically; it also forms forage for oceanic tunas and squids.

4. Therefore the options open are:

   a) to go in a big way to utilise the oceanic tuna resources of the EEZ outside 100 n/m and the high seas of the Indian Ocean. The production of oceanic tunas from the Indian Ocean stands around 0.9 million tonnes and India's share in this is hardly 6,000 tonnes. The use of monofilament long lining for tuna from smaller fishing vessels < 20m OAL needs our immediate attention. Tuna long lining using smaller fishing vessels from oceanic waters are being successfully carried out in some of the tropical countries.

   b) Large resources of oceanic squids have been reported from the Arabian sea. However, we have so far made no attempt to utilise this resource. There is need for developing squid fisheries using the diverse types of methodologies adopted by the commercial operations in the other parts of the world.

   c) The third option would be the development of real deepsea trawling capability to tap the resources in depths of 1000m and beyond. Presently we do not have exploratory surveys for the deep demersal resources at such depths nor the type of vessels equipped for such operations.

It is very necessary that we develop the national capability to identify and utilise the resources from the EEZ and contiguous high seas on a priority. In the interim period it takes the country to develop purse seining for oceanic tunas, squid fisheries, and deep level bottom trawling it may be necessary to examine whether foreign expertise/joint programmes will be needed. This will have to be viewed in the light of UNCLOS Article 62 on Utilisation of Living Resources in our National interest.

16 GENERAL OBSERVATIONS

16.1 Operation of Indian owned large trawlers above 20m OAL:

The present status of this category of fishing vessels (23 -28 m OAL) mainly based at Visakhapatnam and Chennai is as follows

i) Vessels in operation	: 98
ii) Vessels based at Visakhapatnam	: 82
iii) Vessels based at Chennai	: 16

Seven of the Visakhapatnam based vessels are operating now in Myanmar waters and six in Indonesian waters. All these fishing vessels are outrigger and stern trawlers operating regularly or seasonally for shrimp and other resources such as cephalopods and finfishes.

16.2 Remote sensing and Geographical Information System (GIS) in marine fisheries

The advantages of using remote sensing and GIS technologies are now being recognised, but we are yet to tap the benefits of these tools in our coastal resource management. GIS enables extrapolation and interpolation of land based or sea truth data and help in marine habitat management, coastal resource studies, locating and developing the areas for coastal aquaculture and mariculture. Remote sensing also helps in detecting fish aggregating areas such as the thermal fronts, slicks, areas of convergence/divergence, current boundaries and sea mounts where forage for pelagic fishes are found in abundance and tuna shoals are present.

Short term and real time forecast would also be possible for herbivore fishes such as sardines, by using remote sensing based on chlorophyll-*a* distribution. Sea surface temperature (SST) obtained from remote sensing also indicate pivotal temperature spread which are critical for spawning activities of some of the commercial pelagic species. The SST derived from NOAA, AVHRR imageries can be utilised for the prediction of the Potential Fishing Zones (PFZ) in the sea. With the commissioning of Oceansat (IRS P-4) it has become possible to obtain real time satellite pictures of ocean colour which provide information on Chlorophyll- *a* distribution at surface level in the Arabian Sea and Bay of Bengal. Joint efforts are under way with CMFRI, NRSA, SAC, FSI and NIO for the utilisation of ocean colour monitor data along with the SST for identifying possible areas of concentration of pelagic fishes which show large scale changes

in occurrence and abundance in space and time. The Working Group expresses its satisfaction that the awareness of these tools in fishery resource appraisals is already there and desires that this should be given greater importance in coming years for developing short-term forecasts and resource estimates.

16.3 Commercial Exploitation of Seaweeds:

Seaweeds constitute a conventional resource, which has not received its due attention in the past. The importance of this resource is evident from the fact that nearly 40 units processing seaweeds have come up in different parts of this country for the production of Agar Agar (20 units) and Algin. The bulk of the collection of seaweeds (*Agarophytes, Alginophytes*) come from the Gulf of Mannar and Palk Bay.

The standing crop of all seaweeds in Indian waters is estimated to be more than 100,000 tonnes (wet weight) consisting of 6000 tonnes of agar yielding red seaweeds, 16,000 tonnes of algin yielding seaweeds and the remaining being edible and carrageenan yielding seaweeds. The above resource consists of about 60 commercially important species out of 700 species of marine algae recorded from the Indian seas.

The large scale collection of seaweeds from the coral reefs of Gulf of Mannar has been posing some conservation problems for the ecosystem. Hence, a shift from collection of seaweeds from the wild to mariculture of seaweeds is being advocated. This could lead to achieving high production targets. Pilot scale operations have shown the economic viability of seaweed mariculture in sea based structures and pond based systems.

16.4 Deep Scattering Layer (DSL) of Indian EEZ

Since the discovery of DSL in 1942, there has been consistent attempt world over to study their diurnal vertical migration, bio-composition and the trophic interaction within the layer and between ecosystems. However, this ecosystem in Indian waters remains the least investigated area, even though the theme is challenging and with great potential. The first attempt from Indian waters was by Silas (1982) and later studies were initiated by CMFRI on board FORV *Sagar Sampada* in 1985. The bio-composition include a wide variety of macrozooplankton and micronekton in the ratio 4:1.

The DSL forms forage for pelagic tuna/bill fishes, pelagic sharks, squids and probably some marine mammals. The diurnal migration of DSL, their bio-

composition and the extent to which they could be utilised as a resource needs more through investigation. In a survey of a part of North Western Arabian Sea the DSL resource was estimated to be over 100 million tonnes. Trials have been carried out for the extraction for Vitamin A and other product from Myctophids and other fishes of DSL. In assessing the DSL of the Indian EEZ it is necessary to bring to light the feasibility of economic utilisation of resources from this biomass.

16.5 Straddling Fish Stocks and Highly Migratory Fish Stocks

The importance of evaluating straddling stocks in resource management hardly needs emphasis. A good example is the *Hilsa* stock shared by India and Bangladesh. Regional International Cooperation is necessary to make assessment of such stocks. The catches of straddling stocks by species in 1991 given by FAO are furnished below.

(in tonnes)

Sl. No.	Species	Western Indian Ocean(Area 51)	Eastern Indian Ocean(Area 57)
1	Flying fishes	90	2039
2	Indo-Pacific King Mackerel	9483	24360
3	Lantern fishes	2210	-
4	Long tail tuna	29414	1080
5	Narrow-barred Spanish Mackerel	32447	13897
6	Seer fishes	12673	12181
7	Streaked Seer fish	372	850
8	Wahoo	1	-
	Total	86690	44407

Similarly for highly migratory species such as skipjack and yellowfin tuna, there is need for tagging experiments to be undertaken by the countries engaged in utilising these species. Such attempts are urgently called for as in the absence of information in its totality stock estimations will be difficult.

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18. ABBREVIATIONS USED IN THE REPORT:

AR	-	Artificial Reef
AVHRR	-	Advanced Very High Resolution Radiometer
CCAMLR	-	Commission for the Conservation of Antarctic Marine Living Resources
CIFNET	-	Central Institute of Fisheries, Nautical and Engineering Training
CIFT	-	Central Institute of Fisheries Technology
CMFRI	-	Central Marine Fisheries Research Institute
CPUE	-	Catch per unit effort
CUSAT	-	Cochin University of Science and Technology
DOD	-	Department of Ocean Development
EEZ	-	Exclusive Economic Zone
FAD	-	Fish Aggregating Devices
FAO	-	Food and Agriculture Organisation of the United Nations
FSI	-	Fishery Survey of India
GIS	-	Geographical Information System
IFP	-	Integrated Fisheries Project
IOTC	-	Indian Ocean Tuna Commission
IRS P-4	-	Indian Remote sensing Satellite P-4
MFRA	-	Marine Fishing Regulation Act
MCS	-	Monitoring, Control and Surveillance
MOA	-	Ministry of Agriculture
MPEDA	-	Marine Products Export Development Authority
MSY	-	Maximum Sustainable Yield
NIO	-	National Institute of Oceanography
NMLRDC	-	National Marine Living Resources Data Centre
NOAA	-	National Oceanic and Atmospheric Administration
NRSA	-	National Remote Sensing Agency
OAL	-	Over all length
PFZ	-	Potential Fishing Zone
SAC	-	Space Application Centre
SST	-	Sea Surface Temperature
TED	-	Turtle Excluder Device
UNCLOS	-	United Nations Convention on the Law of the Sea
VMS	-	Vessel Monitoring System

TABLE-1. THE DEPTH AND REGION-WISE AREA UNDER THE EEZ

(in '000 sq.km.)

Region/Latitude	Depth zone (m)					
	0-100	100-200	0-200	200-500	Total upto 500	Total for EEZ
North west coast (15°-23°N)	196.9	16.5	213.4	7.7	221.1	
South west coast (8°-15°N)	58.6	10.2	68.8	10.1	78.9	
Total for west coast	255.5	26.7	282.2	17.8	300.0	860.0*
Wadge Bank & Gulf of Mannar	16.8	5.8	22.6	3.3	25.9	
South east coast (10°-15°N)	33.8	4.8	38.6	1.8	40.4	
East coast (15°-21°N)	56.6	14.5	71.1	3.9	75.0	
Total for east	107.2	25.1	132.3	9.0	141.3	561.4
A&N Islands	24.8	10.1	34.9	9	43.9	596.5
Total	387.5	61.9	449.4	35.8	485.2	2017.9

* including Lakshadweep

Source : FSI

Table 2: ESTIMATES OF MARINE FISHERY RESOURCES POTENTIAL IN THE EEZ OF INDIA

(in '000 tonnes)

Authors / Source	Year	Depth Zone of EEZ	Region				Laksha-dweep	A & N Island	Oceanic Region	Total
			NW Coast	SW Coast	SE Coast	NE Coast				
George **et.al.**	1977	0-200 & Oceanic	883	1422	674	735	90	160	500	4464
Nair & Gopinathan	1981	Entire EEZ	-	-	-	-	-	-	-	5500
Joseph	1985	0-200 (demersal)	928	438	243	416	-	-	-	2025
Joseph	1987	0-500 & Oceanic	1620	853	425	531	90	160	500	4179
Alagaraja	1989	0-200	1050	900	750	300	-	-	-	3000
James **et.al.**	1989	Entire EEZ	-	-	-	-	-	-	-	4500
Sudarsan **et.al.**	1990b	Entire EEZ	-> 2357< -		- > 1090 <-		63	161	246	3921*
Mathew **et.al.**	1990	Entire EEZ	-> 2390** <-		-> 660 < -			690		3740
Desai **et.al.**	1989	Entire EEZ								3660
Revalidation Working Group	1991	Indian EEZ	1217	1311	554	321	63	139	295	3900
Bhaskran Pillai, N	1995	Indian EEZ								3450
NIO(Sarupriya)#	2000	Euphotic zone	-> 2400 <-							
Current revalidation	2000	Indian EEZ	See text							3934

* Includes 4000 t. of demersal resources from 300-500 m depth from areas other than 8oN-10oN Lat. along West coast.

** Includes Lakshadweep also

: upto 150 m. Personal communication from Dr.J.S.Sarupriya, NIO, Goa.

Source : Prepared by Working Group (2000)

Table 3: REGION-WISE MARINE FISH LANDINGS IN INDIA FROM 1989-1997(in tonnes)

Region	1989	1990	1991	1992	1993	1994	1995	1996	1997
North-west coast	915454	899864	9,90,747	10,40,236	9,96,634	11,33,56	10,70,284	12,20,871	12,40,583
South-west coast	687922	695619	7,47,532	7,46,818	7,38,683	7,41,784	7,49,283	7,95,074	7,64,683
Sub-total(West coast)	1603376	1595503	17,38,279	17,87,054	17,35,317	1875348	18,19,567	20,15,945	20,05,266
South-east coast	3,34,860	3,09,588	3,16,429	3,19,851	3,40,916	3,58,676	3,69,832	3,77,301	3,83,309
North-east coast	3,81,835	2,62,887	2,72,362	2,99,758	3,40,380	3,99,779	3,99,676	4,23,000	4,33,445
Sub-total(East coast)	7,16,695	5,72,475	5,88,791	6,19,609	681,296	7,58,655	7,69,508	4,19,601	8,16,754
GRAND TOTAL	**23,20,071**	**21,67,978**	**23,27,070**	**24,06,663**	**24,16,613**	**26,34,004**	**25,89,075**	**28,16,246**	**28,21,970**

Source: MOA

Table 4: AVERAGE ANNUAL STATE -WISE MARINE FISH LANDINGS IN INDIA DURING 1989-97(in tonnes)

Name of Fish	Andhra Pradesh	Orissa	Tamil Nadu	West Bengal	A & N Islands	Pondi-cherry	Gujarat	Karna-taka	Kerala	Mahara-shtra	Goa	Laksha-dweep	Daman & Diu	Total
Elasmobranchs	7900	6768	14913	317	693	951	29316	2232	5328	7843	2462	518	267	79508
Eel	990	1521	264	37	0	141	3541	4	118	2463	37	0	6	9120
Oil sardine	8669	3496	44758	203	0	2674	5202	17393	96316	1046	4079	0	58	183896
Anchovies	1225	1671	8428	0	1184	1832	8000	9558	27779	18982	1471	0	74	80205
Other clupeids	3061	10735	4397	26508	4515	594	8922	6513	31003	4106	873	0	434	101661
Cat fishes	4703	8692	2442	3027	478	729	18567	770	2264	7524	1268	0	213	50675
Bombay duck	770	722	0	2262	0	132	83543	0	0	56816	76	0	2031	146353
Lizard fishes	786	0	1268	0	0	363	0	752	9589	3149	0	0	0	15907
Perches	2052	2002	20456	59	1956	1662	6203	1442	30096	561	822	93	20	67424
Scianeids	2790	13407	10506	537	379	797	205761	6230	7538	12152	1385	0	258	261739
Ribbon fish	6894	4346	627	259	24	350	0	2488	1505	25026	5456	0	17	46993
Carangids	2067	1118	13601	0	1654	2309	25668	10496	48146	11615	199	58	214	117145
Silver bellies	2970	1820	39483	14	1242	1480	0	1397	5683	485	1466	0	316	56353
Pomfrets	3449	6608	2738	463	274	481	8205	1176	2006	10628	637	0	2022	38687
Mackerels	4611	2713	12112	202	1281	1776	4071	32458	75594	9877	9773	124	20	154612
Seer fishes	6781	4518	7592	82	618	1671	18366	3879	4139	7677	478	133	9	55943
Tunnies	1182	88	2520	0	654	766	19973	4205	12431	3104	0	6989	67	51979
Flat fishes	504	1433	3111	0	0	602	0	6612	7459	5599	538	0	65	25921
Penaeid shrimps	8722	3262	12439	1475	125	2192	24835	6715	51057	40433	1086	0	2813	155154
Non P. shrimps	7989	1654	5912	215	134	1503	12372	0	187	75192	0	0	108	105266
Cephalopods	3426	576	5681	169	16	500	20454	3926	27803	12415	1010	7	2	75985
OTHERS	48156	31993	104118	1699	7422	11349	90825	67711	105469	67804	38354	1292	4094	580286
TOTAL	129696	109143	317366	37529	22647	34853	593825	185956	551507	384498	71470	9214	13107	2460811

Source: MOA

TABLE 5:POTENTIAL YIELD ESTIMATES OF DEMERSAL RESOURCES (IN TONNES)

Sl. No.	Name of group /species	Total	Group Total
	Elasmobranchs	71407	71407
1	Shark	45064	
2	Skate	3686	
3	Rays	22658	
		0	
	Perches	226793	226793
4	Grouper	15748	
5	Pig face bream	9184	
6	Red snapper	10945	
7	Threadfin breams	128458	
8	Bull's eye	28416	
9	Other perches	34042	
10	Cat fishes	51255	51255
11	Eel	9081	9081
12	Croakers*	273027	273027
13	White fish	17474	17474
14	Threadfins	9342	9342
15	Silver bellies*	67247	67247
16	Indian drift fish	7947	7947
17	Goatfishes	19572	19572
18	Lizard fishes	27568	27568
19	Flat fishes	47304	47304
20	Moon fish	256	256
	Pomfrets*	46088	46088
21	Silver pomfret	29958	
22	Chinese pomfret	922	
23	Black pomfret	15209	
24	King fish	727	727
25	Trigger fish*	9073	9073
26	Black ruff*	27176	27176
27	Deep sea shark*	543	543
28	Green eye*.	4696	4696
29	Other deepsea fishes*'	65526	65526
30	Other fishes*	218422	218422
	Shrimps	334811	334811
31	Penaeid shrimps	194192	
32	Non-penaeid shrimps	138711	
33	Deepsea shrimps*	1908	
34	Crabs	31980	31980
35	Mantis shrimp*	120351	120351
36	Rock lobster	2727	2727
37	Deepsea lobsters	1147	1147
	Cephalopods	101259	101259
38	Squids*	49821	
39	Cuttlefishes	49989	
40	Octopus	1449	
	Bivalves	201601	201601
41	Oysters	37090	
42	Clams & cockles	126988	
43	Mussels	24114	
44	Window pane oyster	13409	
	Chanks & Other gastropods	22672	22672
45	Chanks	6225	
46	Other gastopods	16447	
	Total	**2017072**	**2017072**

* Under utilised resource

1 Silver bellies - includes 28315 tonnes from Andaman & Nicobar Islands

2 Pomfrets- To give an indicative picture the average composition of black, white and chinese pomfrets based on two years (1998-99) landing figures is as follows
1. Black pomfret - 33 %
2. Silver pomfrets - 65%
3. Chinese pomfrets 2%

3 Sciaenids- 80% of the yield from north-west coast.

4 Deep-sea shrimps- Underutilised resource, however up to 30,000 tonnes landings reported from Kerala coast (Quilon bank) in a six months period in 1999-2000. Potentially important resource.

5 Stomatopods- forms part of bycatch/ discards in shrimp trawl fishery.
Squids- Underutilised resource.

6 Other fishes- Comprises of young fish, small species and benthic biota such as Decapods, Echinoderms ,Molluscs, flying fishes,half beaks, sickle fish,unicorn cod, silverbiddies

7 Other deepsea fishes : includes under utilised Cubiceps, Myctophids, epinuli, emmelichthys

Table -6: Potential yied estimates of pelagic resources

(in tonnes)

Sl.No.	Name of Group/Species	Estimates
1	Wolf herring	16492
2	Oil sardine	294869
3	Other sardines	101490
4	Hilsa shad	26029
5	Other shads	14690
6	Bombay duck	116227
7	Anchovies	141817
8	Other clupeoids	78932
9	Ribbon fish	193670
10	Carangids(including Travelly, Leather jackets, scads,	238148
	Horse mackerel etc.)	
11	Mackerel	295040
12	Seer fish	61719
13	Coastal tunas (including E.affinis, T.tonggol, Auxis spp	65472
	Sarda orientalis) *	
14	Barracuda	20849
15	Mullets	8101
	TOTAL	1673545

* Coastal tunas - About 50% Little tuna

TABLE -7: POTENTIAL YIELD ESTIMATES FOR OCEANIC RESOURCES

(Potential yield in tonnes)

Sl.No.	Species/Group	Estimates
1	Yellowfin tuna	1,14,800
2	Bigeye tuna	12,500
3	Skipjack	85,200
4	Bill fishes	5,100
5	Pelagic sharks	26,200
6	Horse mackerel, Chorinemus	
7	Oceanic squids*	
8	Dolphin fish	
	Total	2,43,800

***Oceanic squids** - Silas (1986) has projected the potential harvest of oceanic squids from the Indian EEZ by 2000 AD to be in the order of 20-50 thousand tonnes

TABLE 8: REGIONWISE ESTIMATES OF POTENTIAL YIELD (IN TONNES) EXCLUDING THE ISLAND TERRITORIES

Resource	NE	SE	SW	NW	Total
Pelagic finfish	81317	419189	751859	421180	1673545
Demersal Finfish	82674	330890	307925	479035	1200524
Prawns, crabs, lobsters, stomatopods	11806	66071	159816	253323	491016
Squids	178	5110	19884	24649	49821
Cuttle Fish	345	8377	21812	19455	49989
Octopus	0	97	1352	0	1449
Bivalves, gastropods	0	122948	91181	10144	224273
TOTAL	176320	952682	1353829	1207786	3690617

Table 9: ESTIMATES OF ADDITIONAL HARVESTABLE YIELD FROM THE INDIAN EEZ

(in tonnes)

Resource	Demersal	Pelagic	Oceanic	TOTAL
Potential	2017071	1673545	243800	3934416
Present Yield (Average of 1993-98)	1229888	1221896	Negligible	2451784*
Additional Harvestable Yield	787183	451649	243800	1482632

* Excluding molluscs and other cephalopods

TABLE 10 a: ANNUAL AVERAGE MARINE FISH LANDINGS DURING 1985-89 AND 1995-99

(in tonnes)

Name of fish/group	1985-89	1995-99
Sharks	54027[a]	42936
Rays		2793
Skates		23132
Eels	6317	8317
Catfishes	50630	43762
Wolfherring		16067
Oil sardine	141831	167123
Other sardine	76541	116458
Hilsa shad		20255
Other shads		11818
Anchovies	68630	138080
Other clupeoids	132626	51868
Bombayduck	93185	99714
Lizard fishes	20557	25262
Threadfin breams		77541
Other perches	90083[b]	74936
Goat fishes		13477
Threadfins		9483
Croakers	102934	169643
Ribbon fishes	78384	122805
Carangids	111040	151601
Silverbellies	60766	60641
Whitefish		7025
Pomfrets	37356	41891
Mackerels	123832	212633
Seer fishes	35171	45059
Coastal tunas	34185	42786
Barracudas		15717
Mullets		6559
Flat fishes	29612	44975
Penaeid prawns	143073	192571
Non-penaeid prawns	48057	130789
Lobster		2409
Crabs		33289
Stomatopods		70758
Squids	39799[c]	53185
Cuttlefish		52698
Octopus		1556
Others	203386	95730
Total	**1598113**	**2497342**

a: All elasmobranchs, b: All perches including threadfinbreams,
c: All cephalopods
Source: CMFRI

TABLE 10 b : COMPOSITION OF POTENTIAL YIELD ESTIMATES

(in ' 000 tonnes)

Group	1991	2000	Diff
Elasmobranchs	168	71	**-97**
Eels	7	9	**2**
Catfish	123	51	**-72**
Oilsardine	191	295	**104**
Other sardines	96	101	**5**
Anchovies	53	142	**89**
Other clupeids	210	79	**-131**
Bombayduck	104	116	**12**
Lizardfish	48	28	**-20**
Perches	239	227	**-12**
Croakers	142	273	**131**
Ribbonfish	311	194	**-117**
Carangids	447	238	**-209**
Silverbellies	86	67	**-19**
Pomfrets	54	46	**-8**
Mackerel	224	295	**71**
Seerfish	42	62	**20**
Tunnies	279	65	**-214**
Flat fish	38	47	**9**
Penaeid shrimps	178	194	**16**
Non-penaeid shrimps	54	139	**85**
Cephalopods	71	101	**30**
Priacanthus	55	28	**-27**
Black ruff	9	27	
Indian drift fish	7	8	**1**
Deep sea shrimps	3	2	**-1**
Deep sea lobster	5	1	**-4**
Oceanic tunas	209	213	**4**
Bill fishes	4	5	**1**
Others	443	810	**367**
TOTAL	**3900**	**3934**	**34**

TABLE 11: PRESENT STATUS OF EXPLOITATION OF DIFFERENT SPECIES-STOCKS ALONG INDIAN COAST IN THE 0-50 M DEPTH ZONE

Sl. No.	Species	State of Exploitation		
		Full	Over	Under
1	*Sardinella longiceps*	All along	-	-
2	*S.gibbosa*	SE coast	-	West coast
3	*Hisla ilisha*	NE coast	-	-
4	*Encrassicolina devisi*	-	-	All along
5	*Stolephorus waitei*	-	-	-
6	*Rastrelliger kanagurta*	All along	-	-
7	*Scomberomorus*	-	SE&SW coast	-
8	*Euthynnus affinis*	All along	-	-
9	*Thunnus tonggol*	All along	-	-
10	*A. rochei*	-	-	All along
11	*Kaatsuwonus pelamis*	-	-	All along
12	*Kaaatsuwonus pelamis*	-	-	All along
13	*Megalaspis cordyla*	-	-	SW coast
14	*Decapterus russelli*	-	-	All along
15	*Selaroides lepiolepis*	SE coast	-	-
16	*Atropus atropus*	NW coast	-	-
17	*Alepes kalla*	SW coast	-	-
18	*Atule mate*	-	-	SW coast
19	*Caranx carangus*	SE coast	-	-
20	*Parastromateus argenteus*	-	West coast	-
21	*Formio niger*	-	SW coast	-
22	*Trichiurus lepturus*	-	East coast	West coast
23	*Harpodon nehereus*	NW coast	-	-
24	*Nemipterus japonicus*	All along	-	-
25	*Nemipterus mesoprion*	All along	-	-
26	*Leiognathus bindus*	East coast	-	-
27	*L.dussumieri*	Tamil Nadu	-	-
28	*L.jonesi*	Tamil Nadu	-	-
29	*Secutor insidiator*	East coast	-	-
30	*Tachysurus tenuispinis*	-	West coast	-
31	*T.thalassinus*	-	W&NE coast	-
32	*Otolithus cuvieri*	NW coast	-	-
33	*Johnius macrorhynus*	NW coast	-	-
34	*J.vogleri*	NW coast	-	-
35	*J.sina*	SW coast	-	-
36	*J.carutta*	SE coast	-	-
37	*Penaeus monodon*	East coast	-	-
38	*P.indicus*	-	East coast	-
39	*P.semisulcatus*	-	SE coast	-
40	*Metapenaeus monoceros*	All along	-	-
41	*M.dobsoni*	All along	-	-
42	*Acetes indicus*	NW coast	-	-
43	*Panilurus polyphagus*	-	NW coast	-
44	*Loligo duvauceli*	All along	-	-
45	*Sepia aculeata*	East coast	-	West coast
46	*S.pharaonis*	East coast	-	West coast

Source: Murty & Rao, 1996

TABLE 12: PERCENTAGE SPECIES COMPOSITION OF MAJOR PELAGIC FISH SPECIES IN DIFFERENT STATES

I: Other sardines				
	KAR	KER	TN	AP
Sardinella gibbosa	89.0		56.9	38.4
S.fimbriata	8.6	100.0		53.4
S.brachysoma	2.4			
S.albella			22.5	
S.dayii			0.9	
S.sirm			15.6	
S.clupeoides			4.1	

2. Anchovies

	KAR	KER	TN	AP	MAH
Stolephorus devisi	40	35	10	36	
S.bataviensis	30	26	25	40	
S.buccanneeri	10	12		8	
S.macrops	10	15		6	
S.heteroloba				5	
S.commerson	5	5	20		
S.indicus	5	5	45		
S.andhraensis		2		5	
Coilia dussumieri					100

3.Tunas and Billfishes							
	GUJ	MAH	KAR	KER	TN	AP	Minicoy
Euthynnus affinis	19.1	72.5	52.2	40.4	77.6	29.6	
Auxis thazard	4.1		7.0	8.8	5.8	2.5	
A. rochei			9.9	30.7	0.4	1.5	
Sarda orientalis			1.0	7.6	0.4		
Thunnus tonggol	71.5	4.7	13.4	2.1	1.0		
T.albacares	2.5		14.8	7.6	11.7	21.9	9.9
Katsuwonus pelamis				1.2	1.7	6.5	88.7
Istiophorus platypterus		22.8	1.2	1.0			
Makaria indica	2.8		0.5	0.3	1.4		
Xiphias gladius				0.3		38.0	
G.unicolor							1.4

4.Seerfishes

	KAR	GUJ	KER	AP	TN
Scomberomorus commerson	89.7	42.8	96.6	57.3	90.9
S.guttatus	10.2	57.2	3.1	40.9	5.6
S.lineolatus			0.1	1.8	3.4
Acanthocybium	0.1		0.2		0.1

5. Carangids

	GUJ	KER	KAR	AP	TN
Megalaspis cordyla	78.9	8.5	16.7	16.0	
Decapterus russelli	1.5	33.6	15.0	27.4	
D.macrosoma		11.6	7.7	2.8	
Selar crumenopthalmus		5.4		5.6	
Alepes djedaba		21.8		0.2	
A.para				1.3	12.0
C.kalla		2.0	35.5		
C.leptolepis					8.0
Atropus atropus	0.8			0.6	5.0
Caranx spp.		5.6	8.2	17.0	15.0
Carangoides spp		4.2	7.3	11.0	9.0
Scomberoides spp.	10.2	2.8	3.4	9.5	37.0

6 Ribbonfishes						
	GUJ	KER	KAR	AP	TN	MAH
T.lepturus	100	100	100	85.7	100	100
T.russelli				5.3		
T.gangeticus				2.4		
L.savala				1.5		
E.muticus				4.2		

Source: CMFRI

ble 13: PERCENTAGE COMPOSITION OF MAJOR DEMERSAL FINFISH SPECIES IN THE YIELD FROM DIFFERENT STAT

Species	GUJ	MAH	GOA	KAR	KER	TN
SHARKS						
1. *Scoliodon laticaudus*		72			5	25
2. *Rhizoprionodon acutus*					37	3
3. *R. oligolinx*					5	27
4. *Carcharhinus bleekeri*					3	30
5. *C. melanopterus*		2			43	1
RAYS						
1. *Dasyatis bleekeri*		13				21
2. *D. imbricata*		15				2
3. *D. sephen*		6				36
4. *D. uarank*		7			65	17
5. *D. zugei*		49				
6. *Aetobatus narinari*		3			35	10
SKATES						
1. *Rhynchobatus djeddensis*		97			95	98
CATFISHES						
1. *Tachysurus thalassinus*					86	
2. *T. serratus*					14	
3. *T. dussumieri*		35				
4. *T. tenuispinis*						
5. *Osteogeneiosus militaris*		32				
6. *T. sona*		3				
7. *T. caelatus*		15				
LIZARD FISHES						
1. *Saurida tumbil*	90	72			73	
2. *S. undosquamis*	10	28			27	100
THREADFIN BREAMS						
1. *Nemipterus mesoprion*	25	60		52	70	26
2. *N. japonicus*	73	34		48	19	39
3. *N. delagoae*	2	6			8	23
PERCHES-GROUPERS						
1. *Epinephelus tauvina*					2	51
2. *E. diacanthus*					63	
3. *E. merra*						16
4. *E. sonnerati*					4	
5. *E. chlorostigma*					8	
6. *E. bleekeri*					6	
7. *E. albomarginatus*					6	7
8. *E. undolosus*						
PERCHES-SNAPPERS						
1. *Lutjanus rivulatus*						26
2. *L. lutjanus*					63	
3. *L. gibbus*					12	3
4. *L. fulviflamma*						61
PERCHES-PIGFACE BREAMS						
1. *Lethrinus nebulosus*					5	55
2. *L. lentjan*					18	19
3. *Pristipomoides typus*					56	

Species	GUJ	MAH	GOA	KAR	KER	TN
CROAKERS						
1. *Atrobucca nibe*	15					8
2. *Johnius carutta*					2	
3. *J. coitor*	6			37		
4. *J. belangerii*	7				52	
5. *J. glaucus*	10					1
6. *Johnieops vogleri*	5	27				
7. *J. macrorhynus*		23				5
8. *J. dussumieri*	6	4				13
9. *J. sina*	7	10			19	1
10. *Otolithoides biaritus*	12					
11. *Otolithes cuvier*	7	22		60	1	15
12. *O. ruber*	8			3	20	
13. *Protonibea diacanthus*	7	14				8
SILVER BELLIES						
1. *Leiognathus bindus*				24	4	9
2. *L. splendens*				14	60	13
3. *L. brevirostris*					8	32
4. *L. dussumieri*						21
5. *Secutor insidiator*				62	9	12
6. *Gazza minuta*					11	6
GOAT FISHES						
1. *Upeneus sundaicus*						41
2. *U. oligospilus*						12
3. *U. vittatus*						12
4. *U. sulphureus*						17
5. *U. tragula*						15
POMFRETS						
1. *Pampus argenteus*		45	66			
2. *Formio niger*		55	34			
FLATFISH						
1. *Cynoglossus macrostomus*				98	85	19
2. *C. dubius*						73
3. *C. macrolepidotus*					8	
THREADFINS						
1. *Polynemus indicus*	40	56				
2. *P. sextarius*	25					
3. *P. tetradactylus*	9	28				

Source: CMFRI

TABLE 14: PERCENTAGE COMPOSITION OF MAJOR SPECIES CONTRIBUTING TO THE NON-PENAEID PRAWN FISHERY IN DIFFERENT MARITIME STATES

Species	L_{max} (mm)	Gujrat	Maharashtra
Acetes spp	40	87	10
Nematopalaemon tenuipes	80	10	90
Exhippolysmatra ensirostris			

TABLE 15 : PERCENTAGE COMPOSITION OF MAJOR OF PENAEID PRAWN SPECIES CONTRIBUTING TO THE FISHERY IN DIFFERENT MARITIME STATES

Species	Lmax (mm)	Gujarat	Maharashtra	Karnataka	Kerala	Tamilnadu	Andhra Pradesh	Orissa
Panaeus indicus	230					12.71		
P. semisulcatus	250					20.69		
Metapenaeus dobsoni	125			15.18	33.22	15.80	29.85	16.76
M. affinis	186	4.55	11.63			2.22		9.75
M. monoceros	210		9.50	28.84	5.91	10.34	32.92	7.59
M. brevicornis	125		4.83					
M. lysianassa	90							10.17
Parapenaeopsis stylifera	140	52.55	43.00	22.62	46.54			12.12
P.hardwickii	135	5.03						30.05
P. maxillipedo	125					6.66		
Trachypenaeus curvirostris	95			17.41	5.64			
Solenocera crassicornis	140	29.00	19.27				7.77	7.21
S. choprai	110			12.94				
Metapenaeopsis stridulans	105					11.66		

TABLE 16: PERCENTAGE COMPOSITION OF MAJOR SPECIES OF LOBSTERS AND CRABS CONTRIBUTING TO THE FISHERY IN DIFFERENT MARITIME STATES

Species	Lmax (mm)	Gujarat	Maharashtra	Karnataka	Kerala	Tamilnadu	Andhra Pradesh
LOBSTERS							
P. polyphagus	400	50.17	100				
T. orientalis	250	49.83				46.43	
P. homarus	320				94.28	20.94	
P. ornatus	500					28.93	
CRABS							3144
C. cruciata	160		64.13	30.62	36.10	8.02	9.36
P. sanguinolentus	165		6.53	30.64	13.23	49.46	63.13
P. pelagicus	160			38.74	41.64	36.19	12.16
Other crabs		95.91	25.57		9.03	633	15.35

ANNEXURE-Ia

1. ANTARTIC RESOURCES

Catch (tonnes) of major species from CCAMLR Convention Area

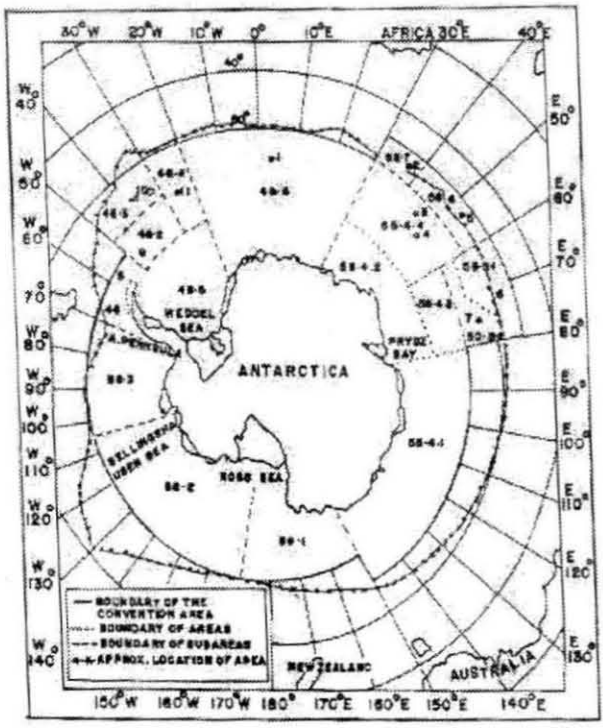
Species names	1986-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
Antartic krill (Euphausia superba)	379144	357538	302961	88776	83962	118715	101708	82508	809881	101817
Mackeral ice fish (Champsocephalus	41624	13389	65	-	28	3946	5	216	74	339
Petagonian tooth fish (Dissostichus	5761	5613	12497	5788	5648	8911	8740	10226	11168	17262
Miscellaneous	38687	79910	51942	316	141	177	629	487	233	480
Total	465216	456450	367465	94880	89779	131749	111082	93437	92456	119898

1.1 Catch (tonnes) by species reported for the split year 1998-99 (July '98 to June '99)

	Area											
	48	48.1	48.2	48.3	58.4.1	58.4.3	58.5.1	58.5.2	58.6	58.7	88.1	All area
Euphausia superba	76341	8150	12585	4741	-	-	-	-	-	-	-	101817
Champsocephalus	-	-	1	265	-	-	-	73	-	-	-	339
Dissostichus eleginoides	-	-	-	4291	-	-	5402	5451	1912	205	1	17262
Miscellaneous	-	-	16	36	-	-	8	24	30	25	341	480
	76341	8150	12602	9333	-	-	5410	5548	1942	230	342	119898

ANNEXURE-Ib

CCAMLR STATISTICAL AREAS, SUBAREAS AND DIVISIONS



Area 48: Atlantic Ocean Sector
Area 58: Indian Ocean Sector
Area 88: Pacific Ocean Sector

1. Bouvet Islands
2. Prince Edward and Marion Islands
3. O.b.Bank
4. Lana Bank
5. Gozet Islands (France)
6. Kerguelen Islands (France)
7. Mc. Donald and Heard Island (Australia)
8. South Shetland Islands
9. South Okney Islands
10. South Georgia
11. South Sandwich Islands

II SUMMARY OF CURRENT CONSERVATION MEASURES AND RESOLUTIONS

II.1 General

Conservation Measure No	Title	Area/ Subareae/	Species/ Fishery	Period in Force And/or Fishing Season
118/XVII	Scheme to promote compliance by non-Contracting Party vessels with CCAMLR CONSERVATION MEASURES	All Areas	All fisheries	Indefinite
119/XVII[1,2,3]	Licensing and inspection obligations of Contracting Parties with regard to their flag vessels operating in the Convention Area	All Areas	All fisheries	Indefinite
146/XVII[1,2]	Marking of Fishing Vessels and fishing gears	All Areas	All fisheries	Indefinite
147/XVIII[1,2]	Provisions to ensure compliance with CCAMLR conservation measures by vessels, including between contracting parties	All Areas	All fisheries	Indefinite
148/XVII	Automated satellite-linked vessel monitoring system (VMS)	All Areas	All fisheries	Indefinite
170/XVIII	Catch Documentation scheme for *Dissostichus spp*.	All Areas	All fisheries	Indefinite
160/XVII[3]	Prohibition of directed fishing for *Dissostichus eleginoides* in Statistical Sub area 58.7	58.7	Dissostichus eleginoides	From 7th Nov.1998 until reopend by the Commission on the advice of the Scientific Committee
172/XVIII[1]	Prohibition of directed fishing for *Dissostichus spp*. Except in accordance with specific conservation measures in the 1999/2000 season	48.5, 88.3, 58.4.1 (east of 90°E), 58.5.1, longline fishing areas in 58.5.2	Dissostichus spp	From 1st December 1999 to 30th Nov.2000

(Except for waters 1 to 1 Kergulen Island, 2 the Crozet Island; 3 the Prince Edward Island).

SUMMARY OF CURRENT CONSERVATION MEASURES AND RESOLUTIONS

II.2 Trawl Fisheries

Conservation Measure		Area/Subarea/ Division	Species/ Fishery	Period in Force And/or Fishing Season
No	Title			
4/V	Regulation on mesh size measurement	All Areas	Supplements conservation measure 2/111	Indefinite
32/x	Precautionary catch limitations on *Euphausia superba* in Statistical area 48	48	*Euphausia superba*	Indefinete until the total catch in any season exceeds 620000 tonnes
174/xviii	Percautionary catch limit for *Electrona carlsbergi* in Statistical Sub area 48.3 for the 1999/2000 season	48.3	*Electrona carlsbergi*	From 1st Dec. 1999 to 30th Nov. 2000 or until the catch limit or the by-catch limit of any species listed in conservation measure 95/XIV is reached whichever is sooner. Special provision for Shag Rocks applies.
175/XVIII	Limitations of total catch of *Champsocephalus gunnari* in Statistical Sub area 48.3 in the 1999/2000 season	48.3	*Champsocephalus gunnari*	From 1st Dec. 1999 to 30th Nov. 2000 or until the catch limit or the by-catch limit of any species listed in conservation measure 95/XIV is reached, whichever is sooner. Closed from 1st March to 31st May 2000
106/XV	Precautionary catch limitation *on Euphausia superba* in statistical division 58.4.1	58.4.1		Indefinite until the total catch in any season exceeds 775000 tonnes.
44/XIV	Precautionary catch limitation on *Euphausia superba* in statistical division 58.4.1	58.4.2		Indefinite until the total catch in any season exceeds 450000 tonnes.
176/XVIII	Fishery for *Dissostichus eleginoides* in Statistical division 58.5.2 for the 1999/2000 season	58.5.2	*Dissostichus eleginoides*	From 1st Dec. 1999 to 30th Nov. 2000 or until the catch limit or the by-catch of any of the species listed in conservation measure 178/XVIII is reached, whichever is sooner
177/XVIII	Fishery for *Chamspsocephalus gunnari* in Statistical division 58.5.2 in the 1999/2000 fishing season	58.5.2	*Chamspsocephalus gunnari*	From 1st Dec. 1999 to 30th Nov. 2000 or until the catch limit or the by-catch of any of the species listed in conservation measure 178/XVIII is reached, whichever is sooner.

II.3 Longline Fisheries

Conservation Measure		Area/Subarea/ Division	Species/ Fishery	Period in Force And/or Fishing Season
No	Title			
29/XVI[1,2,3]	Minimisation of the incidental mortality of sea birds in the course of longline fishing research in the Convention area	All area	All longline fisheries	Indefinite
179/XVIII	Limits on the fishery for *Dissostichus eleginoides* in Statistical Sub area 48.3 for the 1999/2000 season	48.3	*Dissostichus eleginoides*	From 1st May to 31st August 2000 or until the catch limit is reached, whichever is sooner.
180/XVIII	Catch limit on *Dissostichus eleginoides* and *D. mawsoni* in Statistical Sub area 48.4	48.4	*Dissostichus eleginoides* and *D. mawsoni*	Season as for *Dissostichus eleginoides* in Sub area 48.3, until the catch limit for *Dissostichus eleginoides* in Sub area 48.4 is reached, or until the catch limit for *Dissostichus eleginoides* in Sub area 48.3, as specified in any conservation measure is reached, whichever is sooner.

II.4 New Exploratory Fisheries

Conservation Measure		Area/Subarea/ Division	Species/ Fishery	Period in Force And/or Fishing Season
No	Title			
31/X[1,2,3]	Notification that Members are considering initiating a new fishery	All areas	All new fisheries	Indefinite
65/XII[1,2,3]	Exploratory fisheries	All areas	All exploratory fisheries	Indefinite
184/xviii	Exploratory longline fishery for *Dissostichus spp.* In Statistical Sub area 48.6 in the Exploratory longline fishery for *Dissostichus eleginoides* in Statistical divisions 58.4. in the 1999/2000 seasons.	48.6	*Dissostichus spp.* Exploratory longline fishery	North of 60° S from March to 31st August 2000 or until the catch limit is reached. South of 60° S from 15th Feb. Until 15th October 2000 or until the catch limit is reached.
185/XVIII	Exploratory trawl fishery for *Dissostichus spp.* In Statistical divisions 58.4.3 (BANZARE and Elan Banks) in the 1999/ Exploratory longline fishery for *Dissostichus eleginoides*. In Statistical divisions 58.4. in the 1999/2000 seasons 2000 season.	58.4.1, 58.4.3	*Dissostichus spp.* Exploratory trawl fishery	From 1st December 1999 to 30th No. 2000 or until the catch limit or the by-catch limit of any another species is reached, whichever is sooner.
187/XVIII	Exploratory longline fishery for *Dissostichus spp.* In Statistical divisions 58.4.3 outside areas under national jurisdictions in the 1999/2000 seasons	58.4.3	*Dissostichus spp.* Exploratory longline fishery	From 1st May to 31st Aug. 2000 or until the catch limit is reached, whichever is sooner.
188/XVIII[3]	Exploratory longline fishery for *Dissostichus eleginoides*. In Statistical divisions 58.4. in the 1999/2000 seasons	58.4.4	*Dissostichus eleginoides* Exploratory longline fishery	From 1st May to 31st Aug. 2000 or until the catch limit is reached, whichever is sooner.
189/XVIII[2,3]	Exploratory longline fishery for *Dissostichus eleginoides*. In Statistical subarea 58.6. in the 1999/2000 seasons	58.6	*Dissostichus eleginoides* Exploratory longline fishery	From 1st May to 31st Aug. 2000 or until the catch limit is reached, whichever is sooner.
190/XVIII	Exploratory longline fishery for *Dissostichus spp.* In Statistical Sub area 88.1. in the 1999/2000 seasons	88.1	*Dissostichus spp.* Exploratory longline fishery	From 1st December 1999 to 31st August 2000 or until the catch limit, whichever is sooner.
191/XVIII	Exploratory longline fishery for *Dissostichus spp.* In Statistical Sub area 88.2. in the 1999/2000 seasons	88.2	*Dissostichus spp.* Exploratory longline fishery	From 15th December 1999 to 31st August 2000 or until the catch limit, whichever is sooner.

II.5 CCAMLR Reporting system

Conservation Measure		Area/ Subarea/ Division	Species/ Fishery	Period in Force And/or Fishing Season
No	Title			
40/X	Monthly catch and effort reporting system	All areas	All fisheries	Indefinite
51/XII	Five-day catch and effort reporting system	All areas	All fisheries	Indefinite
61/XVII	Ten-day catch and effort reporting system	All areas	All fisheries	Indefinite
121/XV[1,2,3]	Monthly fine-scale biological data reporting system for trawl and longline fisheries	All areas	All trawl and longline fisheries	Indefinite
122/XVI[1,2,3]	Monthly fine-scale biological data reporting system for trawl and longline fisheries	All areas	All trawl and longline fisheries	Indefinite