7. SUMMARY AND CONCLUSIONS
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Based on the study and analysis of data the conclusions drawn are summarised below:

1. India along its coastline of 7517 kms has an Exclusive Economic Zone measuring about 2.01 million square kilometer.

2. No direct estimates based exclusively on EEZ data for the fishery potential for the EEZ of India have been made while the potentials for the Indian Ocean have been given varying from 7.8 to 16 million tonnes.

3. The entire EEZ has been divided into four regions viz. along west coast, east coast around Lakshadweep and Andaman Islands, the area of which are 0.698, 0.576, 0.23 and 0.566 million square kilometers respectively.

4. The study is based on the data collected during 220 cruises spread over more than 20 years in different seasons. The data were collected onboard ships like Darshak, Gaveshani, and Sagar Kanya and those participated in IIOE, from 1364 stations in the EEZ.

5. Study has been made and maps prepared to show the coverage of study and existing gaps. The area is divided into 249 one degree squares, out of which a total of fifteen squares have not been covered in any season: eleven in Andaman Sea, one along east coast and 3 on west coast. These should be covered and observations made.

6. The euphotic zone or the light penetrating depth varies from 14m in nearshore waters to 90m in clear waters of Lakshadweep. In offshore waters it generally varies between 40 and 60m.

7. Temperature along west coast varies between 21.7 and 39.2°C with minimum variation in monsoon and maximum temperature during April to May. In Lakshadweep waters the average temperature is slightly higher. Mixed layer depth was found between 50 and 60 m. Temperature increases away from the coast. Along east coast, the temperature varies between 20 to 30°C and it
decreases away from the coast. In Andaman Sea the maximum temperature further rises to 31°C and the mixed layer depth lies at 75-80 m on western side. The isolines show temperatures to increase from north to south along west coast at surface.

8. The salinity at three depths are given. Generally, the salinity in all the seasons is higher along west coast than that on east coast. An unexpected low salinity of 21.7 x 10^{-3} was noticed in pre-monsoon along west coast. The average salinity values increases slightly with depth.

9. The O₂ concentration decreases with the depth at all the places. The lowest values were noticed during pre-monsoon. The maximum reached upto 8.5 ml l⁻¹ along west coast during monsoon months. The isolines show the O₂ concentration ranging between 4 and 5 ml l⁻¹ with few pockets of values higher than 5 ml l⁻¹. There is a sharp decline at 100 m along west and east coasts.

10. The phosphate concentration shows an increasing trend with depth. High concentration exists off Bombay and Goa on west coast and off Calcutta and between Madras and Visakhapatnam along east coast. There is high concentration at 100 m depth in entire area of study. Andaman waters are poor in phosphate.

11. The nitrate values also increase from 0 to 100 m depth in almost all areas but they decrease away from coast. The highest value of 4.74 ug-atl⁻¹ reached during pre-monsoon along west coast. The concentration at 100 m depth was unusually high particularly along west coast and in Andaman waters.

12. The chlorophyll a at surface in the entire EEZ ranged between 0.017 and 7.16 mgm⁻³. The west coast showed higher values and averages than the east coast during all the seasons. Minimum values were found to be in Andaman and Lakshadweep Seas except few unusually high values in pre-monsoon in the later which increased the average to 0.438 mgm⁻³.

13. The average chlorophyll a concentration in entire EEZ was 11.81 mgm⁻². It was high during pre-monsoon in west coast where the average was 18.075 mgm⁻² with a range of 0.16 to 92.85 mgm⁻². The annual average was highest
(13.37 mgm$^{-2}$) along west coast followed by east coast (13.01 mgm$^{-2}$). The waters of two islands do not differ much in column chlorophyll.

14. The annual pattern indicates higher concentration of chlorophyll a off Gujarat, Bombay and Trivandrum on west coast and off Visakhapatnam and whole Orissa along east coast. There was a small patch of high concentration of about 15 mgm$^{-2}$ near Lakshadweep Sea.

15. The surface primary production in the entire EEZ was highest (43.07 mgCm$^{-3}$d$^{-1}$) during monsoon followed by pre-monsoon and post monsoon (12.78 and 9.51 mgCm$^{-3}$d$^{-1}$) respectively. Area-wise, it was highest along the east coast followed by west coast, Andaman Sea and Lakshadweep Sea.

16. The values of column primary production were also highest along the east coast (682.16 mgCm$^{-2}$d$^{-1}$) in monsoon followed by post-monsoon and pre-monsoon (291.56 and 72.32 mgCm$^{-3}$d$^{-1}$) respectively. The high production in monsoon results in higher fish catches in post-monsoon. If we look region wise, again the east coast tops with 1081.06 mgCm$^{-2}$d$^{-1}$ followed by west coast (490.94), Andaman Sea (470.74) and Lakshadweep Sea (236.29 mgCm$^{-2}$d$^{-1}$).

17. The rate of primary production is higher along the east coast than that of west coast except during post-monsoon months. But the area of EEZ is much less on east coast hence the potential estimates are less.

18. Seasonwise pre-monsoon was the best along the west coast and post-monsoon was the best along east coast. Overall picture shows biomass decreases towards outer boundary of EEZ along west coast.

19. The annual zooplankton biomass was found to be the highest (0.59 mlm$^{-3}$) along the west coast followed by the east coast (0.31 mlm$^{-3}$), Lakshadweep and Andaman Seas with an almost identical value (0.12 mlm$^{-3}$).

20. A correlation matrix among various parameters show that primary production has positive correlation only with chlorophyll $a$, zooplankton and nitrate concentration. Using multiregression analysis two equations are derived to
compute the primary production from seven other parameters. The computed values were found to be close to the average value of primary production.

21. The benthic studies show that shelf region up to 200 m depth supports highest standing crop ranging from 14.1 to 1.8 g mm\(^{-2}\). The maximum density (10-20 g mm\(^{-2}\)) is seen north of Cochin and southern tip of mainland. This corroborates high fishery production (prawns) off Cochin. At other places it varies between 1 and 10 g mm\(^{-2}\). The biomass also decreases towards offshore. The annual demersal yield is known to be 1.2 million tonnes. Out of this 0.75 m tonnes is estimated to be from the west coast and 0.33 m tonnes from the eastern EEZ.

22. The fishery potential from primary and secondary production has been estimated for each season in every region of the EEZ. The highest pelagic potential is calculated to be 0.52 \times 10^6 tonnes during monsoon on the west coast while on the east coast it is during pre-monsoon months so also in Andaman and Nicobar Seas.

23. The total annual pelagic potential has been estimated as 1.29 \times 10^6 and 1.16 \times 10^6 tonnes along the west coast and the east coast respectively. Around Andaman Island the waters can sustain 0.92 \times 10^6 tonnes while that of Lakshadweep Sea the least (0.15 \times 10^6 tonnes).

24. The total annual estimated yield, taking into consideration the pelagic and the demersal resources, therefore, comes to 2.04; 0.15; 1.49 and 0.92 million tonnes along the west coast, Lakshadweep, east coast and Andaman Sea plus a combined total of 0.12 mt of demersal resources for areas of Lakshadweep and Andaman Seas not included in respective areas since separate figures are not available. This brings the estimate to a total of 4.72 million tonnes.

25. The present annual catch on an average is 1.6 million tonnes while the potential as estimated is 4.72 million tonnes per year. Therefore the marine catch from Indian EEZ could be stepped up to three times. The areawise figures are:
<table>
<thead>
<tr>
<th>Area</th>
<th>Present catch (million tonnes)</th>
<th>Estimated potential (million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Coast</td>
<td>1.13</td>
<td>2.04</td>
</tr>
<tr>
<td>Lakshadweep Sea</td>
<td>0.009</td>
<td>0.15</td>
</tr>
<tr>
<td>East Coast</td>
<td>0.524</td>
<td>1.49</td>
</tr>
<tr>
<td>Andaman Sea</td>
<td>0.006</td>
<td>0.92</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.12 *</td>
</tr>
</tbody>
</table>

* This is a combined total of demersal resources for areas of Lakshadweep and Andaman Seas.

It is observed that there is maximum scope for increasing the fish catch in the waters around Andaman and Lakshadweep Islands. Along the east coast it can be increased by almost three times while along the west coast it can be at least doubled. This requires integrated approach efforts and infrastructure facilities.

26. The Indian catch particularly along west coast is seasonal and mostly restricted between October and March but other months too have shown a good potential therefore fishing efforts should be increased all the year round to augment the production.

27. More efforts are needed particularly along east coast and around Andaman Islands to increase the fish catch of these areas.

28. These are conservative estimates since the production through nanno-and pico-plankton is not included, and the actual production may therefore vary.

29. It is suggested that the relationship between surface chlorophyll a and column primary production should be further authenticated so as to estimate the column production from surface chlorophyll values to avoid long and tedious process of estimating column production by conventional methods.

30. It is also suggested that more direct estimates based on acoustic and experimental fishing surveys are also made for better prediction.