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## Fishermen livelihoods and marine fishery resources: An impact study in Gulf of Mannar coast, Tamil Nadu

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### Abstract

Marine fishery resources provide nutritional security and livelihoods to people. Also it's plays pivotal role in Indian economy. Even though it has issues like marine fishery resources depletion due to the overexploitation of marine fishery resource, pollution and lack of sustainable marine fishery resource management and these problems are also found in the Gulf of Mannar coast, Tamil Nadu. The objective of the present study was find impact of livelihoods of fishermen communities on the marine fishery resources depletion. This study was carried out in Gulf of Mannar coast, Tamil Nadu during April 2017 to August 2017. Collected data were analysed by correlation coefficient and simple regression. Calculated correlation coefficient value was 0.91 which indicates that the significance levels of positive relationship are established between the fish production and population. 'R' square value was 0.99\* which indicates that 99% of fish productions are influenced by the fisher population. Results revealed high correlation between the marine fishery resources (production) and livelihoods of fishermen community (fisher population). It explains that high level of dependency of marine fishery resources affect the marine fishery resources at negative way which is also one of the reasons for resource depletion. It leads to poor economic status of fishermen households.

**Keywords:** livelihood dependency, marine resources depletion

### Introduction

Tamil Nadu State with the second longest coastline in the country covers an area of 1,076 km comprising 13 coastal Districts with an Exclusive Economic Zone (EEZ) of 1.9 lakh sq. km and continental shelf area of 41,412 sq. km [9]. The marine fisherfolk population in Tamil Nadu is 9.64 lakh, living in 608 fishing villages. Moreover marine fishery resources provide an important source of income, food, and employment opportunities, directly as well as indirectly. Also it contributes significantly to foreign exchange earnings. More than a million fishers in the State depend on fisheries for their livelihood in Tamil Nadu [8]. Major issue in marine fisheries was depletion of natural resources due to the habitat destruction, overfishing, and destructive fishing practices, pollution, and high quantities of by-catch etc., (Hauge, K.H. *et al.*, 2009) and the same issues were reported in Tamil Nadu. Hence, depletion of marine fishery resources threatened the livelihood of people, especially the poor rural people due to high level dependency on these freely available natural resources for their livelihood and survival strategies. Therefore, understanding how the degradation of fishery resources increases the vulnerability of the livelihood of coastal households, and the coping mechanism employed by them, is critical for planning sustainable livelihoods. In this regards objective of the study was drafted to analyses relationship between the livelihoods of fishermen and marine fishery resources.

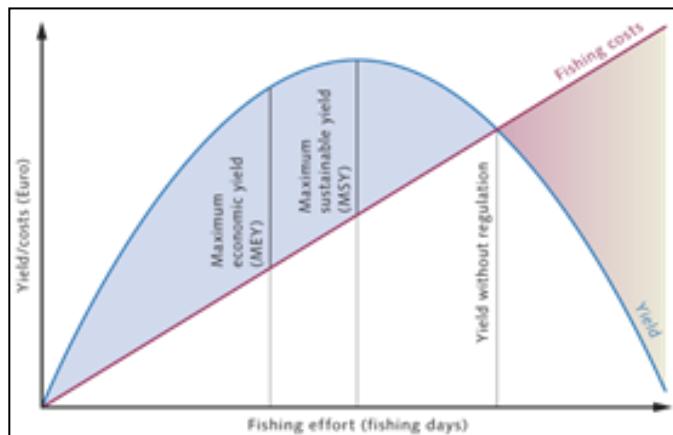
### Materials and Methods

The present study was conducted in Gulf of Mannar coast (GoM), Tamil Nadu. Gulf of Mannar coast includes three districts such as Ramanathapuram, Thoothukudi and Tirunelveli in Tamil Nadu. Therefore secondary data of fish production, fishing effort and fisher population were collected from the various sources of published data by government organizations such as Fisheries Policy note and Marine fisheries census. Also, case study was carried out in the Tharuvaikulam fishing village at Thoothukudi district, Tamil Nadu during the period of April 2017 to August 2017.

Case study was conducted for making comparison with previous available data. Tharuvaikulam fishing village was selected for case study due to availability of both mechanized and non-mechanized fisher population in Thoothukudi district. Selected sample size for this study was 50 respondents by simple random technique. Simple correlation and regression were used to find out the cause and effect of fish production, fishing effort and fisher population. Growth rates were also calculated for fish production, fishing effort and fisher population.

## Concepts

Concepts need to be understood while discussing the result of the study such as given below.



**Fig 1:** Bio-economic concepts in marine fisheries

**Maximum Sustainable Yield (MSY):** A sustainable harvest level that maximizes revenue from fishing, or generates the largest value of sustainable catch in numbers or kilograms. Total fish production showing that the increases at decreasing rate from the point of MEY to MSY<sup>[16]</sup>.

**Maximum Economic Yield (MEY):** A sustainable catch or effort level that creates the largest difference between (discounted) total revenues and the total costs of fishing. For profits to be maximized it must also be the case that the fishery applies a level of capital and other resources in combinations that minimize the costs of harvesting at the MEY catch level. Up to the point of MEY the fish production is showing that increases at increasing rate<sup>[11]</sup>.

**Overfishing:** Catching too much fish for the system to support leads to an overall degradation to the system. Overfishing is a non-sustainable use of the oceans<sup>[16]</sup>.

We all know that fish and other aquatic species are a finite resource in our oceans. However, fishermen have started capturing more and more fish at a rate that is much faster than they can reproduce and replenish the water bodies with more fish. Many marine scientists have gone to the extent of saying that the threat faced by our marine ecosystem is much larger than any other environmental threat like increasing pollution. They have also predicted commercial extinction (not fit for fishing) of marine life if this trend continues.

## Results and Discussion

### (i) Depletion of Marine fishery resources

As mentioned, marine fishery resources are declining over years which was the major issue in marine fisheries but fish production showed increasing trends. The present study also indicated that marine fish production and fishing effort showing increasing trend due to overexploitation of marine fishery resources and increasing population respectively. In this regard, regression was done for fishing effort and fish production. Calculated 'R' square value was 0.42\* which indicates that 42% of fish production influenced by fishing effort. Also calculated 'R' square value for growth rate of fish production and fishing effort was 0.24\*\* which explains that 24% of production only influenced by the fishing effort. As per Maximum Sustainable Yield (MSY) and Maximum Economic Yield (MEY) concepts, fishing effort increasing the fish production also increasing at decreasing rate was the real development but the present study revealed that fishing effort increases the fish production was increased at decreasing rate which is indicated by low 'R' square value for fish production and fishing effort and their growth rate. However, increasing fishing efforts over the last 50 years as well as unsustainable fishing practices are pushing many fish stocks to the point of collapse reported by world wildlife focusing on sustainable practices that conserve ecosystems, but also sustain livelihoods and ensure food security<sup>[14]</sup>. Tamil Nadu marine fish production has platitude and fishermen should be encouraged to adopt sustainable fishing practices<sup>[1]</sup>. Reducing fishing effort was help for maintain sustainable marine resource management reported by Mohamed<sup>[13]</sup>.

**Table 1:** Marine fish production and fishing efforts in Tamil Nadu during 2009-10 to 2016-17

Year	Fish production (lakhs tones)	fishing effort	Growth rate	
			Fish production	Fishing effort
2009-10	3.97	45,763	0	0
2010-11	4.04	60,863	0.02	0.33
2011-12	4.25	63,520	0.05	0.04
2012-13	4.82	33,026	0.13	-0.48
2013-14	4.21	35,689	-0.13	0.08
2014-15	4.57	38,788	0.09	0.09
2015-16	4.66	40,009	0.02	0.03
2016-17	4.72	35,666	0.01	-0.11

*Source: Fisheries policy note, Tamil Nadu*

Regression Statistics for fish production and fishing effort  $R^2 = 0.42^*$

Regression Statistics for growth rate of fish production and fishing effort  $R^2 = 0.24^{**}$

### (ii) Fisherfolk livelihoods on marine fishery resources in Gulf of Mannar coast, Tamil Nadu

The marine fishery resources were overexploited due to high dependence on marine resources for their livelihood, increasing fishing effort, etc., which are explained here. Mini

and Srinath (2003) has been found that the reason for the fluctuations of increase and decreased trend of fish production due to the over exploitation<sup>[12]</sup>.

**Table 2:** Population and occupation details of fisherfolk in Gulf of Mannar coast, Tamil Nadu (2010)

Districts	Fisherfolk population	Children in population	Occupied in population
Ramanathapuram	193413 (24.09)	60254 (31.15)	67302 (34.80)
Thoothukudi	82560 (10.28)	26549 (32.15)	27367 (33.15)
Tirunelveli	24639 (3.06)	8313 (33.73)	7513 (30.49)
Total	300612 (37.44)	95116 (31.64)	102182 (33.99)

**Note:** Figures in parentheses indicate percentage

**Source:** Marine fishery census 2010 Tamil Nadu, Central Marine Fisheries Research Institute (CMFRI)

**Table 3:** Fishermen occupation details in Gulf of Mannar coast, Tamil Nadu

Districts	Fulltime fishing	part time fishing	fish allied activities	Other than fishing	Total fish and allied occupation
Ramanathapuram	44815(66.59)	3983(5.92)	16886(25.08)	1618(2.40)	65684(97.59)
Tuticorin	20759(75.85)	1005(3.67)	4836(17.67)	767(2.80)	26600(97.20)
Tirunelveli	5334(70.99)	613(8.15)	808(10.75)	758(10.08)	6755(89.91)
Total	70908(69.39)	5601(5.48)	22530(22.04)	3143(3.07)	99039(96.92)

**Note:** Figures in parentheses indicate percentage

**Source:** Marine fishery census 2010 Tamil Nadu, CMFRI

Total fisherfolk Population in Tamil Nadu was 8,02,912 of which 3,00,612 (37.44%) is in Gulf of Mannar coast of which 1,02,182 (33.99) are only occupied in the study area, which indicates that presence of low level earners in fishing communities. Total occupation includes fulltime fishing, part time fishing, fisheries allied activities and other than fishing. About 97 % of people were occupied in fishing and fish related activities but only 3,143 (3.0 %) of people were occupied in other than fishing activities which explains that huge of population are dependent on marine fishery resources in the study area.

### (iii) Case study

The number of respondents selected for this study was 50 in Tharuvaiulam fishing village. Result explained out of 291 samples in the households, only 79 people are earners with 74.91% dependency on marine fishery resources. Moreover, among the earners, 92.40 % of households depend upon marine fisheries of which 88.23 % of people entirely depend upon marine fishing. The study proved that fishing communities are highly depending on marine fishery resources for their livelihoods and this also reported in Table 4.

**Table 4:** socio economic details of fisherfolk in Tharuvaiulam fishing village

Factor	Numbers
Total household	50
total population of the study	291
Total dependers	218 (74.91)
Total earner	79 (27.15)
Fish related earner	73 (92.40)
other earner	6 (7.59)
100% fishing income	45 (88.23)
less than 100% for income	6 (11.76)

**Note:** Figures in parentheses indicate percentage

### (iv) Relationship between the fish production and fisherfolk population in Tamil Nadu

In Tamil Nadu, marine fish production and population was showed increasing trend for the past seven years. To know the relationship and dependency between marine fish production and fisherfolk population regression was calculated.

**Table 5:** Marine fish production and fisherfolk population of Tamil Nadu for the year 2010-11 to 2016-17

Year	Fish production	Fisher population
2010-11	8.92	4.04
2011-12	9.15	4.25
2012-13	8.11	4.82
2013-14	9.24	4.21
2014-15	9.43	4.57
2015-16	9.64	4.66
2016-17 (p)	9.85	4.72

**Source:** Fisheries policy note, Tamil Nadu

Fish production and fisher population  $R^2 = 0.99^*$

Calculated correlation coefficient was 0.91 which indicates that the significance levels of positive relationship are established between the fish production and population. 'R' square value was 0.99\* which indicates that 99% of fish

productions are influenced by the fisher population. It explained that the increasing marine fish production is due to over exploitation and increasing fisher population. In this line Krysten Jetson (2014) also reported that overfishing was over the last few decades have pushed our oceans to the limit and they may now be on the verge of a collapse, thereby affecting the everyday way of life and source of income of those who depend on them [15].

### Conclusion

Increasing fisher population and fishing effort and high level dependency on marine fishery resources are the major causes for overexploitation. Moreover, overexploitation is one of the major reasons for marine fishery resource depletion. Hence resource depletion leads to the poor economic status of fishing communities because of high level dependency on marine fishery resources for their livelihoods. This study recommends that providing alternative livelihood to fishing communities will help to prevent the overexploitation and maintain sustainable level of marine fishery resources.

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