



Exploitation of Marine Fisheries in Kerala – An Analysis

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Fisheries is a commercially important occupation, impacting the livelihood of 39.9 lakh fishermen in India and 2.3 lakh fishermen in Kerala. Extraction of fisheries in a sustainable manner from sea and oceans ensures their presence for future generations. India stands at seventh position in world marine fish production in the year 2014. Catch of marine fish after the imposition of ban on trawling since 1988 in Kerala has grown at a rate which is three times faster than that before the ban. The usual period of ban on trawling coincides favourably with the spawning period of Mackerel whose catch is the largest in Kerala in 2016.

Key words: Marine fisheries, Western Indian coast, Maximum sustainable yield.

Fisheries have been commercially and industrially important for many years. Sustainability in fishing indicates the presence of fish populations in oceans and freshwater wildlife for the future generations. Sea food is accepted and loved in many parts of the world for its taste, fat and protein content. For lakhs of families it has become a source of livelihood. Sea wildlife is also harvested for economic reasons such as oysters that produce pearls used in valuable jewelry.

Increase in the demand for sea food has led to the advancement in technology for harvesting them. This has led to the depletion of population in fish ecosystems around the world. Seventy seven billion kg of fish is harvested each year. Fishing at this rate will lead to the collapse of world fisheries (National Geographic, 2012). All West African fisheries are now over-exploited, coastal fisheries have declined to 50% in the past 30 years. Catches in the tropics are expected to decline a further 40% by 2050, and yet some 400 million people in Africa and Southeast Asia rely on fish catch to provide their protein and minerals (British Broadcasting Corporation, 2012). With threat of climate change on agricultural production looming large, people depend more than ever on fish for their nutritional needs. In this regard to continue relying on the ocean as an important source of food, economists and conservationists caution sustainable fishing practices.

In the fishery literature, it is common to distinguish between biological overfishing and economic over fishing. Biological over fishing is any level of effort, which prevents the population stock from generating the maximum sustainable yield, while economic over fishing takes place when the additional cost of effort over and above the minimum required for harvesting

of a certain amount of fish, dissipate the potential rents from the exploitation of resources (Rajasenan and Paul, 2012).

Materials and Methods

Compound Annual Growth Rate (CAGR) was used to measure the past performance of economic variables. It was used to find out the trend in the fish landings. The data pertains to a period of 10 years from 2004 to 2013. The growth in fish landings were analyzed by using the exponential growth function (Mohamed *et al.*, 2014) of the form,

where, Y= dependent variable for which growth rate was estimated

a= Intercept

b= Regression co-efficient

t= Time variable

e= Error term

Results and Discussion

From Table 1, it is understood that during 2014, world fish production was at 81.5 million tonnes. The group of fish consisting of Herrings, Sardines and Anchovies contribute the largest to the extent of 17.4 million tonnes, which is 19%. Individually, Anchoveta species contribute the largest, to the extent of 5.6 million tones, which is 6%. India stands at 7th position in the world with production of 3.4 million tonnes which is 4%. Compound annual rates of growth in fish production among the top 20 countries were calculated for the period from 2005 to 2014. Declining growth was observed in majority of the countries excluding in India (1.28% per annum).

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Table 1. Production of marine fish in the top 20 fish producing countries for the period from 2005 to 2014 (in tonnes).

Country or Area	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	CAGR
China	14588940	14631018	14659036	14791163	14919596	15414830	15768630	16167443	16274926	14811390	0.97
Indonesia	4683866	4794418	5034624	4995477	5099708	5374621	5701440	5813800	6101725	6016525	3.15
Peru	9388488	7017491	7210544	7394538	6927778	4301607	8249157	4849211	5854233	3548689	-7.10
USA	4892967	4852284	4767596	4349853	4222052	4425961	5153452	5128381	5230874	4954467	0.95
India	3691362 (3.91%)	3844837 (4.17%)	3859293 (4.25%)	4099227 (4.54%)	4066756 (4.51%)	4689316 (5.25%)	4311132 (4.59%)	4872129 (5.33%)	4645182 (5.01%)	3418820 (4.19%)	1.28
Russian Fed	3197738	3284306	3475883	3383724	3826129	409879	4254877	4331398	4345868	4000702	2.16
Myanmar	1732250	2006790	2235580	2493750	2766940	3063210	3332979	3579250	3786840	2702240	7.40
Japan	4334346	4337677	4297897	4311188	4104877	4065850	3775585	3650950	3656854	3630364	-2.40
Viet Nam	1987900	2026600	2074500	2136400	2280500	2414400	2514300	2705400	2803800	2711100	4.29
Philippines	2269738	2319120	2499695	2561337	2602589	2611768	2363228	2322974	2331721	2137350	-0.67
Norway	2392594	2256448	2380425	2431371	2532754	2680186	2282608	2150555	2074363	2301288	-0.95
Thailand	2814295	2698803	2304951	1873432	1870702	1810620	1835126	1719628	1843747	1559746	-5.62
Chile	4328315	4160741	3819303	3554816	3453786	2679742	3063467	2572876	1770945	2175486	-8.60
Mexico	1319249	1363429	1469848	1581750	1613809	1526504	1566063	1575409	1626869	1396205	1.22
Korea Rep	1646539	1758685	1870105	1956569	1858576	1734025	1748508	1670122	1597874	1718626	-0.76
Bangladesh	1333866	1436496	1494199	1557754	1821579	1726586	1600918	1535715	1550446	1532459	1.19
Malaysia	1214183	1286478	1385703	1398375	1397683	1433377	1378799	1477281	1488705	1458126	1.82
Iceland	1664657	1327079	1399190	1284034	1141869	1060641	1138462	1358596	1366675	1076558	-2.57
Morocco	1026395	876877	879469	997127	1165062	1136240	958907	1161511	1253299	1350147	3.84
Spain	854428	961164	819821	921605	930367	973290	1007464	931583	1034173	1103537	2.31
World	94201610	91994321	90779826	90130042	90157126	89153694	93750042	91305829	92572586	81549353	-0.68

Marine fish production of Kerala during 2007 to 2016 is compared with that of India in Table 2.

Table 2. Production of marine fish in India and in Kerala for the period from 2007 to 2016 (in tonnes).

Year	India	Kerala
2007	3024160	442053 (14.62)
2008	2919490	581601 (19.92)
2009	2978000	570854 (19.17)
2010	3104000	560822 (18.07)
2011	3250000	553600 (17.03)
2012	3372000	544740 (16.15)
2013	3321000	530638 (15.98)
2014	3443110	522308 (15.17)
2015	3493760	524468 (15.01)
2016	3463350	516745 (14.92)
CAGR	2.11	0.03

It shows that during 2014, Kerala had the highest fish production of 0.5 million tonnes, which is 20% of India's production. Whereas, in the year 2007, Kerala

had the least fish production of 0.44 million tonnes, which is 15% of India's production. The compound annual growth rate of marine fish production in Kerala (0.03%) is lower than that of India's (2.11 %) average during 2007 to 2016.

Data on species wise production of marine fish in Kerala from 2007 to 2016 are presented in Table 3 and the CAGR has been computed. The analysis revealed that production of Non Penaid Prawn species is growing faster with CAGR of 27.82%, followed by Cat fish with 21.43%.

As per the IUCN (International Union for Conservation of Nature) Red list of threatened species, there are seven categories of threat levels viz, the least concern (LC), near threatened (NT), vulnerable (VU), endangered (EN), critically endangered (CR), extinct in the wild (EW) and extinct (EX). As per the IUCN threat status, shown in Table 4, vulnerable status exists only for Mackerel, while the least concern status exists for Oil Sardines, Perches, Carnax and a few other fish. From this, it can be concluded that none of the fish species in table 4, relevant to Kerala face an endangered or a higher threat. Schooling behaviour, if exists in fish, makes them more vulnerable to be preyed upon by natural predators and also to be caught more easily by fishermen. Unfortunately, the fish captured in large

quantities in Kerala such as Oil Sardines, Lesser Sardines, Anchovilla, Perches and Crabs display schooling hence, making them more vulnerable. In Kerala, ban on trawling is a practice, which is aimed at reducing overfishing. It started in the year 1988,

except in Neendakara and later covering entire Kerala since 1989. Marine fishing is banned for a period of 47 days (usually from June 15 to August 1) every year. This is the crucial breeding time for fishes and will give an opportunity for the fishes to

Table 3. Species wise marine fish production in Kerala for the period from 2007-2016.

Sl. No.	Name of Fish	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	CAGR
1	Elasmobranch	3213	3208	3123	3003	2909	2886	2884	2873	4888	4464	3.30
2	Eels	169	170	169	168	167	166	166	161	630	679	13.85
3	Cat Fish	172	171	169	167	181	179	179	168	1472	1112	21.43
4	Chirocentrus	264	264	264	244	247	246	246	241	976	733	11.46
5(a)	Oil Sardines	15612	156514	154247	151971	152071	149649	143585	140383	155684	72257	8.26
5(b)	Lesser Sardines	70115	70654	68633	67072	63555	62106	59230	57981	41260	30873	-7.23
5(c)	Anchovilla	33048	33143	32506	31972	32034	32333	31511	30857	25768	37063	-0.62
5(d)	Trisocles	3180	3150	3094	3074	3055	3035	3034	2972	2206	8037	3.45
5(e)	Other Clupeids	16089	16099	15546	15314	14976	14490	14481	14276	4046	2165	-15.78
6	Saurida & Saurus	5923	5919	5732	5596	5486	5362	5361	5337	3654	3560	-5.00
7	Hemirhamphus & Belone	706	711	707	701	697	693	692	683	379	146	-10.77
8	Perches	32224	32214	31107	30483	29960	29374	29358	29444	15857	30780	-3.44
9	Red Mullet	1599	1637	1636	1626	1620	1614	1610	1478	1060	572	-7.48
10	Sciaenids	9700	9643	9522	8811	8721	8620	8613	8445	3508	8015	-5.58
11	Ribbon Fish	16092	16118	15911	15210	15189	15023	14776	14585	8465	16256	-2.96
12(a)	Caranx	27637	27575	27429	27185	26914	26614	26595	26030	10346	9691	-9.59
12(b)	Chorinemus	984	985	978	968	961	952	951	908	39	55	-25.69
12(c)	Other Carangids	22227	22204	21410	20765	20379	19852	19757	19616	13758	19021	-3.20
13	Leiognathus	5427	5408	5336	5266	5208	5144	5141	5016	3956	2662	-5.30
14	Lactrius	3584	3585	3544	3447	3416	3380	3373	3259	647	706	-15.15
15	Pomfrets	1534	1523	1513	1544	1534	1523	1522	1498	3069	6948	11.80
16	Mackerel	45601	45459	45335	45017	44510	44237	42696	43916	74395	77891	4.93
17	Seer Fish	2556	2560	2517	2539	2510	2477	2469	2411	6575	10395	12.15
18	Tunnis	12254	12263	12183	12072	11920	11950	10458	10562	17280	30767	5.95
19	Sphyræna	2177	2156	2118	2085	2056	2025	2025	2027	725	791	-9.82
20	Mugil	3274	3223	862	858	856	852	852	849	9	6	-44.78
21	Soles	14495	14363	14192	13918	13792	13646	13480	13405	10941	10613	-3.04
22(a)	Penaid Prawn	49022	49353	48456	47678	47007	45099	44597	42126	50947	51971	-0.12
22(b)	Non Penaid Prawn	1686	173	1714	1693	1679	1664	1659	1516	6443	9829	27.82
22(c)	Lobsters	431	427	412	402	394	385	385	387	251	0	-4.30
22(d)	Crabs	4538	4493	4628	4528	4514	4466	4465	4457	8314	12789	8.45
22(e)	Stomatopodes	9559	9406	9470	9448	9411	9382	9381	9210	0	0	-0.36
23	Cephalopodes	14909	14879	14538	14269	14054	13814	13607	13825	34057	43794	9.57
24	Miscellaneous	11981	11881	11784	11660	11550	11436	11433	11340	12437	10880	-0.49
TOTAL		441982	581531	570785	560754	553533	544674	530572	522242	524042	515521	0.02

enhance their population. Among the various fish species commonly found in the marine fish landings of Kerala, the details of spawning months

are available for five species. The usual trawling ban period coincides favourably with the spawning months of *Rastrelliger kanagurta* (Indian Mackerel)

They are often thrown back into the ocean, dying or dead. Dolphins, marine turtles, seabirds, sharks, juvenile fish, fish with no commercial value, corals are caught, the list goes on. Billions of unwanted animals trapped by fishing nets are then discarded. By catch

is devastating our oceans. It is largely unnoticed, under reported, unmanaged and ignored; depleting valuable natural resources and pushing marine life towards extinction.

Table 5. State of exploitation of selected fish species and International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP) group fished in the Western Indian Ocean (Stock assessments based on 2004 data, catch volumes based on 2002 data) and IUCN status.

Fish	Scientific Name	FAO Status	Main Fishing Countries	IUCN Status
Narrow-barred Spanish Mackerel	<i>Scomberomorus commerson</i>	Fully exploited to over exploited	India, Madagascar, Iran, Pakistan	Not in catalogue
Various Nantian Decapods	<i>Nantantia</i>	Fully exploited to over exploited	India, Madagascar	Not in catalogue
Bombay Duck	<i>Harpadon nehereus</i>	Fully exploited	India	Not in catalogue
Croakers, drums nei	<i>Sciaenidae</i>	Fully exploited to over exploited	India, Pakistan	Vulnerable
Percoids nei	<i>Percoidei</i>	Fully exploited to over exploited	India	Not in catalogue
Pony fishes (=Slipmouths) nei	<i>Leiognathidae</i>	Fully exploited	India, Indonesia	Least concern
Sea Catfishes	<i>Ariidae</i>	Fully exploited	India, Pakistan	Least concern
Hair tails, scabbard fishes nei	<i>Trichiuridae</i>	Medium to fully exploited	India, Oman	Least concern
Anchovies, etc. nei	<i>Engraulidae</i>	Fully exploited	India, Pakistan	Least concern
Clupeoids nei	<i>Clupeoidei</i>	Fully exploited	India, Pakistan, Iran	Not in catalogue
Indian oil sardine	<i>Sardinella longiceps</i>	Medium exploited	India, Oman, Pakistan	Least concern
Wolf-herrings nei	<i>Chirocentrus spp</i>	Fully exploited	India	Not in catalogue
Kawakawa	<i>Euthynus affinis</i>	Medium to fully exploited	Iran, Maldives, Oman, India	Not in catalogue
Tuna like fishes nei	<i>Scrombroidei</i>	Medium to fully exploited	India, Pakistan, Mozambique, Saudi Arabia	Not in catalogue
Barracudas nei	<i>Sphyræna spp</i>	Fully exploited	Pakistan, Oman, Yemen, India	Not in catalogue
Butterfishes, pomfrets nei	<i>Stromateidae</i>	Fully exploited to over exploited	India, Pakistan	Least concern
Carangids nei	<i>Carangidae</i>	Fully exploited to over exploited	India, Pakistan, Oman, Saudi Arabia	Least concern
Indian Mackerel	<i>Rastrelliger kanagurta</i>	Fully exploited to over exploited	India, Tanzania, Oman, Egypt	Data deficient
Jacks, crevalles nei	<i>Caranx spp</i>	Medium to fully exploited	India, Pakistan, UAE, Mauritius, Saudi Arabia	Not in catalogue
Pompanos nei	<i>Trachinotus</i>	Fully exploited	India	Least concern
Giant tiger prawn	<i>Penaeus monodon</i>	Fully exploited to over exploited	India, Indonesia	Not in catalogue
Cephalopods nei	<i>Cephalopoda</i>	Medium to fully exploited	India	Least concern

It is estimated in Gujarat that around 30% of the mechanized landings constitute low value fishes, which have a huge untapped economic value. In Kerala, out of the total fish catch, 54% by weight is targeted fish, while there is 8% discards, 19% by catch, 11% trash, 6% juveniles and 2% damaged (Salim *et al.*, 2014).

The different categories of fisheries subsidies in the state of Kerala included the central government grant for marine fisheries development, fishing harbour development, reimbursement of sales tax on HSD oil for fishing boats and kerosene subsidy for the motorized boats. Harmful subsidies create overcapacity in the fishing industry and have resulted

Table 6. Pelagic fish production in Kerala from 2004 to 2013 (in MT) compared to MSY.

Name of Pelagic Fish	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Oil Sardines	255	264	268	264	264	264	244	247	246	246
Lesser Sardines	171847	149375	162376	15612	156514	154247	151971	152071	149649	143585
Mackerel	42840	44092	46885	45601	45459	45335	45017	44510	44237	42696
Anchovilla	35177	30084	33658	33048	33143	32506	31972	32034	32333	31511
Ribbon Fish	18550	15611	16534	16092	16118	15911	15210	15189	15023	14776
Tunnis	11141	11881	12702	12254	12263	12183	12072	11920	11950	10458
Sphyræna	1582	2094	2232	2177	2156	2118	2085	2056	2025	2025
Pomfrets	1389	1499	1549	1534	1523	1513	1544	1534	1523	1522
Chirocentrus	255	264	268	264	264	264	244	247	246	246
Total		255164	276472	126846	267704	264341	260359	259808	257232	247065
Difference between MSY up to 80m and total pelagic fish production		369971	348663	498289	357431	360794	364776	365327	367903	378070
Difference between MSY up to 200m and total pelagic fish production		452792	431484	581110	440252	443615	447597	448148	450724	460891

in marine capture fisheries underperforming as a global asset. These subsidies, such as support for vessel construction and fuel tax waivers, reduce the real costs of fishing and enable unprofitable fishing

to continue (United Nations Organization, 2014). The annual kerosene subsidy to the marine fisher folk in Kerala is to the tune of Rs.60 crores. The state of Kerala received a grant of Rs. 1,717 lakhs for

Table 7. Demersal fish production in Kerala from 2004 to 2013 (in MT) compared to MSY.

Name of Demersal Fish	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Elasmobranch	3024	3149	3287	3213	3208	3123	3003	2909	2886	2884
Non Penaid Prawn	2923	1716	1799	1686	173	1714	1693	1679	1664	1659
Lobsters	0	398	448	431	427	412	402	394	385	385
Cat Fish	152	167	176	172	171	169	167	181	179	179
Eels	145	167	173	169	170	169	168	167	166	166
Total	6244	5597	5883	5671	4149	5587	5433	5330	5280	5273
Difference between MSY up to 80m and total demersal fish production	87199	87177	87171	87175	87174	87175	87176	87177	87178	87178
Difference between MSY up to 200m and total demersal fish production	6099	5430	5710	5502	3979	5418	5265	5163	5114	5107

development of marine fisheries, infrastructure and post-harvest operations and Rs.700 lakhs for fishing harbor development in 2009-10 under the centrally sponsored schemes. Government of Kerala spent an amount of Rs.20 crores for integrated coastal development activities and Rs.18 crore for fishing harbor development including the central share. The total subsidies in the marine fisheries sector of the state constitute 4 per cent of the gross earnings from fisheries (Aswathy and Salim, 2012).

Conclusion

The catch of marine fish in Kerala is growing at faster rate in the recent years. The ban on trawling imposed for a period of 47 days every year has less impact in controlling overfishing and hence measures

such as minimizing net size, minimizing area of fishing per fisherman, limiting the average potential catch of a vessel in the fleet, limiting the number of poles or lines per fisherman, restricting the number of simultaneous fishing vessels and limiting a vessel's average operational intensity per unit time at sea. Subsidies, which are harmful to the sustainable marine fisheries in Kerala may be eliminated or reduced. The fishing of juveniles to be avoided and the fishing gear needs modification, so that fewer non target species are caught as they can escape, even if trapped. The ban on trawling needs to be more scientific and effective. Suitable conservation measures may be formulated and effectively implemented to reduce the pressure on fully exploited to over exploited species of fish in Western Indian Ocean.

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