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The Future of Small Pelagics Fish Resources for Food Security

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Abstract

The paper briefly reviews the proportion of small pelagics and their current status which are not quite pleasing. On the other side, the demand for fish and fishery products has continued to rise as consumption has more than doubled since 1960s. Food fish consumption grew from 9.0 kg in 1961 to 20.3 kg by 2016 in per capita terms, at an average rate of about 1.5 % per year. Small pelagic fishes have undergone considerable variations in both, their distributions and abundance over time influenced by seasonal, interannual and decadal climate variations. Therefore, sustained production of marine pelagic fishes is crucial for maintaining and enhancing total marine fish production.

Mini Review

Oceans are the living treasures in the planet earth, which can be viewed through a multitude of dimensions of utility and services by virtue of its very existence; As a vibrant and diverse ecosystem, as the most important carbon sink, a medium for trade and travel, a vast space for uncertainties and danger, regulator of the earth's climatic patterns and more over a provider of food and lively hood.

Marine fisheries are particularly important for the livelihood and food security of the poor for majority of the maritime nations due to relatively easy accessibility of fish resources, and impressive nutritional properties of small cheap fish. According to the estimates worldwide about 120 million people are engaged in fishing, while more than 3 billion people obtain 20% or more of their animal protein intake from fish. The drivers and dependency on fisheries sector vary between boundaries: while vast area of coast and high degree of rural unemployment are the drivers for fisheries dependency in countries like India, high levels of malnutrition urges the populations of many African and Pacific countries to rely heavily on fish for their vital nutrients.

The marine fisheries can be broadly grouped under two major categories, demersal fisheries and pelagic fisheries. Demersal fisheries are confined to the continental shelf and continental slope, targeting fishery resources that associated with the sea bottom, and chiefly exploited by using dragging gears like trawls [1]. The fisheries of organisms living freely in the water masses is termed pelagic fisheries, but this again can be considered under two divisions, small pelagics and large pelagics, based on the mean size of individual fish as well as the commercial value. Sardines, other clupeids', mackerel, etc. mainly forms the small pelagic fishery whereas the larger species like tuna, bill fishes, sharkes etc. forms the large pelagics, which in turn obviously fetches more commercial attention than the former.

Why Small Pelagics

Even though the whole marine fisheries of the world come under the same domine and expected to contribute to food security, practically small-scale fisheries are much more significant than large scale fisheries. This is due to the fact that, Small-scale pelagic fisheries not only provide the bulk of employment, but the fish landed by this sector is almost exclusively used for local consumption, and hardly destined for export or reduction to fish meal for aquaculture. On the other hand, small fish, such as sardines, are more important than big fish. This is not only because small fish tend to be cheaper, but also they tend to be eaten whole (with heads and bones), making them nutritionally superior with high levels of dietary protein and is rich concentrations of essential nutrients such as vitamin A, calcium, iron and zinc. Although small pelagic fish aggregate in large shoals and usually exhibit important spatial structure, their dynamics in time and space remain unpredictable and challenging. Sardine and anchovy biomasses have declined over the past 5 years causing an important fishery crisis while sprat abundance.

According to FAO, fish accounted for about 17 percent of animal protein consumed by the global population in 2015. Moreover, fish provided about 3.2 billion people with around 20 % of their average per capita intake of animal protein. The world percapita fish consumption for industrialized, developing and LIFDC's (Low Income Food Deficient Countries) are in the tune of 26.8 kg, 18.8 kg and 7.6kg (per person per year) respectively [2]. But the interesting fact is that, it is mostly poor countries in Asia and Africa with relatively low per capita fish consumption that are most dependent on fish as a source of nutrition. Almost 75% of the countries where fish is an important source of animal protein are income-poor and food deficient. This is because the importance of fish for the poor is not so much a matter of how many kilograms of fish one consumes, but rather about the relative position of fish in one's overall diet. Hence, one 'humble sardine' a week in a monotonous diet is a much more significant contribution to global food security than the same sardine in a rich man's diet.

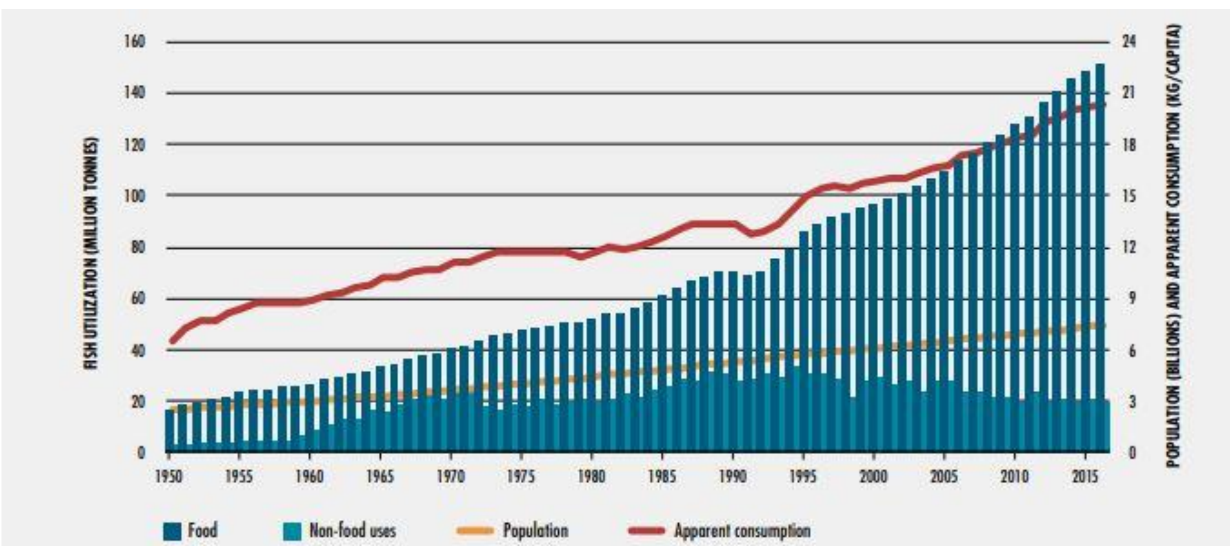

Figure1: Trends in world fish utilization and apparent consumption (Source: FAO- SOFIA).

The spatial distribution of small pelagic fishes within and among regions of the globe has been of interest to fisheries scientist and fisherman. These species are the target of the most productive fisheries in the world [3,4]. Small pelagic fishes have undergone considerable variations in both, their distributions and abundance over time; influenced by seasonal, interannual and decadal climate variations [5-9]. Historically, these variations have been analyzed based on time series analysis [10,11]. However, fisheries depend also on the spatial features [10], and that information is scarce or is not included in the traditional analysis. Samb and Pauly [12] argue that there is an antagonism between the emphasis on the temporal and spatial analysis of fisheries. Thus, management of this fishery demands new approaches to improve understanding of the mechanism of such variations, additional to basic time series analysis.

Recent studies on the distribution and abundance of pelagic fishes include the use of spatial information and mapping tools such as Geographic Information Systems (GIS) [7,10,13-15]. Particularly, Watson and Pauly [10] suggested the use of spatial information in form of maps as an important part to manage fisheries on ecosystem basis. Consequently, this implies the existence of standardized areas delimited by boundaries or regions, which defines a system, diverging from the others on species composition and particular physical and biological features. According to Pauly and Zeller, regionalization will serve as baselines for assessing the health of ecosystems, and to evaluate the effects of fishing and management scenarios [14].

The definition of the major fishing regions of the world is mainly based on physical structures (presence of shelves, coastal currents, fronts, etc.) and biological features. The first classification type is well represented by the broadly Large Marine Ecosystems (LME), defined by Sherman [16], which is capable of identify entities with boundaries and internally homogenous [17]. Similar approach was performed by Longhurst [18], who provided a framework for comparative studies of ocean processes in the form of 57 Biogeochemical Provinces (BGCP), with boundaries defined by oceanographic structures. The second classification is based on species composition and variability obtained from landings statistics. One example of this one, it is the global fisheries statistics assembled and maintained by the Food and Agriculture Organization of the United Nations (FAO), which consist of 18 large, arbitrary fishing areas for statistical purposes, and which are not verified against spatial variations of the local data sets [14]. Such observations led Pauly, et al. and Watson, et al. [17,15], to re-sample the statistical data into a half degree latitude and longitude grid of cells to study the fishing down marine food webs in a global scale, for all reported taxa and countries from 1950 to 2001. A further approach, has been implemented by Watson and Pauly [10], whose utilized GIS tools to re-allocate this statistical data into a buffer representing the Economic Exclusive Zone (EEZ), because most of the catches (around 75 % of the total landings), in a global scale, fall in this fringe (Anonymous 2002), while maintaining the same spatial grid size.

Trends in Global Pelagic Fish Production

The global fish production peaked about 170.9 million tonnes in 2016 with a slight increase from the previous year's catch of 168.7 million tones [19]. Whereas the world marine capture production has fell down from 81.2 million tonnes in 2015 to 79.3 million tonnes in 2016. The substantial decline in catches of the most important single species small pelagics like anchoveta by Peru and Chile because of El Nino alone accounted for 1.1 million tonnes of this decrease. Production of pelagic species peaked at 40 million tonnes in the early 1990s that has been followed by a decreasing trend till now. Small pelagic species constitute almost 50 percent of the landings, followed by "miscellaneous coastal fishes. The clear indication of the declining trends in the pelagic resources and subsequent increase in demersals are evident from the fate of the Peruvian Anchovy, *Engraulis ringens;* which was the largest single species fisheries resource in the world marine capture fisheries since long, fallen in to second position since 2014. Presentlyit was reported a production of 3.19million tonnes after the demesal fish Alaska Pollock, *Theragra chalcogramma (*3.47 million tonnes).

According to the recent estimates by FAO, the overall state of marine fishery resources has continued to decline. The proportion of marinefish stocks fished within biologically sustainable levels has showed a decreasing trend, from 90.0% in 1974 to 66.9 % in 2015. On the other hand, the percentage of stocks fished at biologically unsustainable levels increased from10 % in 1974 to 33.1 % in 2015, with the largest increases in the tail end of 1970s and 1980s.The maximally sustainably fished stocks in 2015(previously termed fully fished stocks) accounted for 59.9 % and under fished stocks for 7.0% of the total assessed stocks. Most of the pelagic stocks are in either fully fished or overfished status. Alarming situations are persisting in the in the Mediterranean and Black Sea, where catches have dropped by one-third since 2007, which is mainly attributable to reduced landings of small pelagics such as sardine and anchovy but with most other species groups also affected (Table.1).

Scientific name	Common name	Production *(tonnes)*			% Variation		Variation, 2015 to 2016
		Average 2005–2014	2015	2016	2005–2014 (average) to 2016	2015 to 2016	*(tonnes)*
Engraulis ringens	Anchoveta (=Peruvian anchovy)	6 522 544	4 310 015	3 192 476	–51.1	–25.9%	–1 117 539
***Sardinella* spp.**	Sardinellas nei	2 281 285	2 238 903	2 289 830	0.4	2.30%	50 927
***Trachurus* spp.**	Jack and horse mackerels nei	2 463 428	1 738 352	1 743 917	–29.2	0.30%	5 565
Clupea harengus–	Atlantic herring	2 111 101	1 512 174	1 639 760	22.3	8.40%	127 586
Scomber japonicus	Pacific chub mackerel	1 454 794	1 484 780	1 598 950	9.9	7.70%	114 170
Engraulis japonicas	Japanese anchovy	1 323 022	1 336 218	1 304 484	1.4	––2.4%	–31 734
***Decapterus* spp**	Scads nei	1 394 772	1 186 555	1 298 914	–6.9	9.50%	112 359
Sardina pilchardus	European pilchard (=sardine)	1 098 400	1 174 611	1 281 391	16.7	9.10%	106 780
Scomber scombrus	Atlantic mackerel	822 081	1247 666 1	138 053	38.4	–8.8%	–109 613
Sardinops melanostictus	Japanese pilchard	257 346	489 294	531 466	106.5	8.60%	42 172

Table 1: Short term changes in world production of top ten small pelagic species [19].

Future Constraints

While fish production from marine capture fisheries has been fairly stable in recent years (around 80 million tonnes since 2006), the proportion of small pelagics and their current stock status are not quite pleasing. On the other side, the demand for fish and fishery products has continued to rise as consumption has more than doubled since 1960s. Food fish consumption grew from 9.0 kg in 1961 to 20.2 kg by 2015 in per capita terms, at an average rate of about 1.5 % per year. FAO is pointing a further growth, with an estimate of about 20.5 kg within the upcoming two years. They envisages that the expansion in consumption has been driven by increased production along with other factors, including reduced wastage.

The targets for future food safety measures hence require more emphasis on production, consumer access, distribution and utilization of low-cost nutrient-rich fish (e.g. small pelagic species), and better utilization of often-wasted nutrient dense parts of fish could boost availability and consumption of fish nutrients. This would require policy changes, infrastructure investment and more research (including on how to cut post-harvest losses in fisheries), as well as consumer education.

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