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An economic analysis of the fisheries sector of Pakistan (1950-2017): Challenges, opportunities and development strategies

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Abstract

The research article presents an overview of the production of Pakistan fisheries sector for the period 1950-2017 and the trade of fishery products from 1980-2011. The results obtained based on economic analysis, reveals that the fish production and export gradually increased year by year. Although, the progress of growth rate of fish production noticed in last two decades was very low as compared to other developing countries. The study also depicts that inland aquaculture production is increasing rapidly beyond marine aquaculture in Pakistan. On the contrary, there is no existence and support of marine aquaculture practices yet to increase fish production. The study describes and proposes the recommendations for security of fisheries sector and the future development opportunities for coastal and non-coastal communities. In Pakistan, fish production through aquaculture has emerged as the utmost potential way to meet fish demand, food security, livelihood, employment and national GDP. In addition, it is an urgency to emphasize on marine aquaculture to rehabilitate marine fishery resources, which can create livelihood opportunities in the coastal regions. In conclusion, the fundamental concept of this article is to propose developmental strategies for authorities to develop and expand aquaculture sector, which could render various opportunities to support livelihood in Pakistan.

Keywords: fisheries, production, export, economic analysis, strategies, Pakistan

Introduction

It is a well-known fact that the fisheries productions from capture and aquaculture are the major resources to contribute food, secure livelihood, generate employment and support national economy [1-3]. Fish is rich in nutrition and can alleviate nutritional deficiencies by supplying calcium, vitamin A, iron and zinc and help to cure various diseases [4-5]. In 2012, the total fish production was 185 million tons, from which 91 million tons was capture (including 11.6 and 79.7 million tons from inland and marine captures), and other from aquaculture, respectively [6]. Fish production through aquaculture uninterruptedly plays an important role in increasing the fisheries production globally. In 2012, share of aquaculture was 90.4 million tons i.e. 144.4 billion USD [7]. Livelihood of 58.27 million people in world are directly depend upon capture fisheries, while 18.86 million people are engaged in fish/shellfish farming. Noteworthy, nearly 7.2 billion of the world's population consumes 136.2 million tons of fish food with 19.2 kg/capita/year, rest 21.7 million tons of fish are utilized as reduction/raw materials for fish feed and livestock [6]. China is the world's largest producer, processor, consumer and exporter of seafood. In addition, 35% of the seafood production exclusively comes from China. With overall seafood export of 4.16 million metric tons (mmt), China prospers at the top among other exporting countries. It has been reported that about 13 million people are engaged in fisheries industry in China [8]. Fisheries sector is remarkably booming around the globe via various opportunities and self-employment with passage of time. In Asia, fishermen and fish farmers are totaled as 21 million and 18.9 million, respectively [9]. However, compared to other Asian nations, contribution in fisheries sector via various factors is gradually changing in Pakistan. Pakistan, having 1,120 km of coastline and inland water reserves are 3,102,408 ha, respectively [10]. The major fish harbors of Pakistan are Karachi Fisheries Harbor, Korangi Fish Harbor, Pasni Fish Harbor and Gwadar Fish, Karachi Fisheries

Harbor it handles about 90% of fish and seafood catch with 95% of its fish products exports from Pakistan ^[11]. In addition, the (figure 1) shows the coastal belt and some minor regular functioning fish harbors at Baluchistan and Sindh coasts are blessed with plenty of fishery resources.

Pakistan's commercially important marine fish fauna consists of about 250 demersal fish, 15 species of shrimp, 50 small, 15 medium and 20 large pelagic fish, about 12 squid/octopus/cuttlefish and 5 lobsters species ^[12]. In addition, the freshwater fauna comprises of more than 200 fish species including (20 commercial species) and 35 shellfish ^[12]. Pakistan is the first country in north Indian Ocean region, whose case for extension of continental shelf has been recently approved by UN ^[13]. The fisheries sector of Pakistan, plays substantive role in order to alleviate poverty, accomplishing food security and contribute in economy to a lesser extent. Nonetheless, fisheries sector alternatively supporting respective sub-branches of livelihood to relevant folks along the coast and inland areas in Pakistan. The national Gross Domestic Product (GDP) in 2016-17 attained 5.3%, with difference of 0.8% as compared to previous year 2015-16 (4.5%) ^[14-15]. In 2017, the share of agriculture sector with the support of its four major sub-sectors viz. crops, livestock, fisheries and forestry was about 19.53% in GDP. In addition, the share of fisheries sector in agriculture was 2.12% and its share in GDP accounts as 0.41% respectively ^[16]. Moreover, the employment ratio in Fisheries sector was around 4 lacs directly and 6 lacs indirectly, making almost 1% of national labor force ^[17-18]. In 2017, Pakistani fisheries sector contributed 6,58,486 MT (Metric Tons) including 1,54,757 MT from aquaculture and 5,03,728 MT from capture fishery. Although, export and import were 1,04,686 MT and 1,855 MT, respectively. In addition, the value of export earnings was 2,77,842 (000) (thousands) USD and import expenditure 6,885 (000) USD in 2013. Furthermore, the export of seafood from Pakistan was enhanced as 16,991 tons and value was 49.82 million USD in 2014 ^[19]. The exports of fish and its products in the first half of Fiscal Year (FY) Dec 2016-July 2017 had earn 183.5 million USD, which depicts a high increase of more than 10% as compared to the 166 million UDS last FY year 2015-2016 ^[20]. In addition, almost 30-35% of Pakistani seafood is imported by over 50 countries of Europe ^[21]. Despite, the fisheries sector in Pakistan growing slowly and there is an adequate need for improvement is highly considered. On the other hand, overexploitation has caused extreme burden on marine fishery resources. Pakistan fisheries sector lacks in proper planning and management practices, which is a prerequisite to overcome various issues especially for aquaculture development ^[12]. Aquaculture in Pakistan has immense potential for development of fisheries sector and in fact it is gradually increasing. What is more, the government is considering a bit more attention towards the fisheries sector by investing substantial amount ^[22]. Nevertheless, there is enough work to be done for the development of aquaculture sector. Previously, many researchers have described Pakistani fisheries sector thoroughly in various ways ^[23-28]. However, available literatures focused mainly on biology, biodiversity, toxicology etc. and is devoid of study on economic importance of this sector in Pakistan. In this study an attempt has been made to bridge the gaps and making useful suggestions for improving, advancing and expanding fisheries sector with economic prospective in Pakistan.

Materials and Methods

Data acquisition for Pakistani Fisheries sector

Data acquired in this research was collected from different sources such as previously published reports, project reports, scientific review and short communication articles. Project was drafted by gathering information related to total fisheries production, aquaculture production and capture fisheries production data in the period 1950-2017. Export and import of fishery products in the period 1980-2011 in Pakistan, was obtained from Food and Agriculture Organization (FAO) global fisheries reports, by online data processing. Data procurement was also done by using FishStatJ – FAO Global Fishery and Aquaculture Statistics Software, USA.

Data preparation and construction

Total fisheries, aquaculture and capture production data for Pakistan (1950 to 2017) was divided into major groups corresponding with calculation of time and production quantity as computed for the analyses of average growth rate and production quantity. The results obtained were constituted graphically by using Microsoft Excel 2007 and Graphpad Prism 6.01 commercial scientific software (GraphPad Software, San Diego, CA). In addition, similar software were also utilized to calculate percentages and annual growth rates. Annual growth rates were calculated as:

$$GR = \frac{(Pre\ V - Pas\ V)}{Pas\ V} \times 100$$

Where, GR represents = growth rate, Pre V = present year value and Pas V = past year value.

Results

Total Fisheries Production (Pakistan)

The total fisheries production in Pakistan reported during the period 1950-2017 was totaled as 2,43,37,449 MT, with an average rate of production 3,57,903 MT year⁻¹ (per-year), 2,19,81,192 MT from capture and other remained 23,56,257 MT from Aquaculture see (Figure 2). The highest fish production, 6, 77,606 MT was obtained in the year 1999. On the contrary, the lowest production was observed of the period 1950-1963, where, the total fisheries production recorded in the consecutive fourteenth years was 8,99,319 MT, with an average production rate of 64,237 MT year⁻¹. Initially, the Production step-up in the period 1964-1975, the total production for consecutive (1964-1975) 12th years was 20, 47,122 MT, with an average of 17, 05,935 MT year⁻¹, growth rate average gained in each year was calculated as 187 MT year⁻¹. Remarkably, the contribution of fisheries production began to increase in the successive 20 years was observed in the period 1984-2003, where total calculated production was 1,06,18,323 MT with an average of 5,30,916 MT year⁻¹. However, if we compare with initial 10th years from 1950-1959, the total production observed as 5,73,994 MT. Noteworthy, the production growth increased in the last decade (2008-2017), in which the total production was 61,72,756 MT, with an average rate of 6,17,275 MT year⁻¹, 86,359 MT year⁻¹ higher as compared to the decade of 1984-2003 was 5,30,916 MT year⁻¹. Furthermore, the total fisheries production growth rate percentage from 1950-2017 calculated as 5.95% year⁻¹, and the highest and the lowest growth rates recorded in the year 1953 and 1974 was 109 % -19.6 %, respectively see (figure 3). Briefly, the highest production growth rate as 3,590 MT was observed in the year 1953, whereas, the lowest growth production rate as -46361 MT was in the year 1974.

Capture fishery production

The Pakistan Fish production mostly comes from capture fishery, in the initial period of our study representing from 1950 and it seems as from 1950-2017 capture fishery has an important role in terms of contribution such as more than aquaculture. The initial numbers of fish production are showing very low rate in 1950 the capture fishery has produced After 1950, a miserable production as 24,451 MT was recorded in next year 1951, and in contrast with that in the first decade of study from 1950-1959 the total fish captured as 5,65,994 MT, and the year⁻¹ estimation calculated as 56,599 MT. However, in the year of 1997 fish capture had produce as 5, 89,795 MT about 23,801 extra than 1st decade. The highest capture production as 6, 54,530 MT were recorded in the year 1999, considered as the peak capture fisheries production in the history of Pakistan see (figure 4). During the period 1990-2000, there was a twice rise and fall of the production quantity. During this decade (1990-2000), the two peak points of production growth are clearly shown in the graph, with average production rate of 5, 61,496 MT year⁻¹. In the first part of the graph from 1950 to 1982 can be noticed it showing very low average rate of 1, 47,634 MT year⁻¹. While, in the second part of the graph the average rate calculated was 4, 88,289 MT year⁻¹ in the period 1983-2017. Year⁻¹ average production during 1950-2017 was computed as 3, 20,504 MT year⁻¹. The (figure 5) representing the percentage of capture production percentage contributed in the total fisheries production. From 1950-1999 percentage of capture fisheries in total fish production estimated as 98% year⁻¹. After then from 2000-2017 capture fishery contribution was estimated as 80% year⁻¹. The capture fishery contribution percentage in total production was 98% in 1950 and in 2017 was 76.5%. It does not mean that the participation of capture fisheries is being reduced, due to the rapid growth of aquaculture the contribution percentage of capture fishery seems as descended.

Aquaculture production

Aquaculture practices are not very new trend in Pakistan, the (figure 6) presenting the aquaculture production in Pakistan from the period 1950-2017. Insignificantly the aquaculture production contributed very low in the initial period. The highest contribution of aquaculture production recorded as 1, 53,230 MT about 23.5% in total fisheries production in last year 2017. Where, the total aquaculture production in the consecutive 41 years (1950-1990) collapsed and contributed only 1, 44,208 MT. At the same time, Aquaculture production average was estimated as 3,517 MT about 0.64% year⁻¹ for further understanding see figure 5 and after then from 1991 aquaculture has commenced standing up in term of fish production. Furthermore, from 1991-2017 significant estimated growth rate were observed as 5,460 MT year⁻¹ and as per decade 1991-2000, 2001-2010 and 2011-2017 were estimated as 4,483, 8,430 and 2,050 MT year⁻¹ respectively.

Export fisheries production

(Figure 7) presenting the fisheries export products and its value in Pakistan, the fisheries export is a major earning source of Pakistan, the figure disclosing the year wise trend of fish export quantity from 1980-2013 and export earnings of same time. The lowest and highest export of fisheries production 4,709 MT 7,619 (000) USD and 1, 13,235 MT which has earn 1, 45,843 (000) USD was recorded in the year 1982 and 2006, respectively. The year⁻¹ estimated average

export of fish products calculated as 25,874 MT in the period of 1980-1995. Whereas, from the period 1996-2011 the estimated average of fish export computed as 80,435 MT year⁻¹. Whereas, the average estimation of fish products export from the period 1980-2013 were calculated 53,154 MT, 78,771 (000) USD year⁻¹. The (Figure 8) representing the export percentage from the total fisheries production. The highest and the lowest fisheries production export reported during 2009 and 1982 as 19.07% and 1.39%, respectively. The year⁻¹ consecutive average percentage of fish export of 16 years from 1980-1995 and 1996-2011 calculated as 5.36% and 13.70%, respectively. In addition, year⁻¹ average export in the period of 1980-2013 were estimated as 9.99%.

Import fisheries

The import fisheries is not much as compare to export in Pakistan the (figure 9) presenting the import and its value expenditure of fish and fishery products in Pakistan from 1980-2013. Initially import of fish and fishery products in Pakistan was very low. The year-1 import trade estimated in Pakistan from 1980-2002 was 24.2 MT the expenditure were spend was 54.6 (000) USD and from 2003-2013 were estimate as 1,468 MT 2,622 (000) USD year⁻¹. The total import of fish and its products in Pakistan from 1980-2013 was 16,707 MT and at the same time expenditure value were use as 30,104 (000) USD. The lowest import recorded was in 1984 as 1 MT value were 5 (000) USD, Remarkably in the year 2007, the highest recorded import was 2,206 MT the expenditure value was 2,141 (000) USD.

Discussion

Fish confer health benefits for humans, as it contains various essential nutrients ^[29]. In correspond to these health advantages, the demand of fish is rapidly increasing all over the globe. It is a clear scenario that, capture fisheries does not fulfill the fish demand exclusively, rather aquaculture plays a vital role in providing food in particularly developing countries. It has been reported that as a result of efforts in the aquaculture sector, fish yield has been increased ^[30]. In contrast to capture fisheries, aquaculture sector is vigorously growing, about 6.5 percent year⁻¹, with the passage of time. It is very interesting to mention that growth rate in aquaculture sector is outstanding and out of figure compared to growth rates of all the other food sectors ^[2, 29, 31-32]. Fisheries directly or indirectly supports around half a billion people globally and among them 95% belong to the developing countries. Aquaculture has become the back bone of fisheries sector and offers quantitative and qualitative strong development evidence through market-driven growth and boosts the circulation of cash in rural areas. Aquaculture and related processing industries offers new economic opportunities especially for women's employment. Some major fish producing countries share about 10 percent of GDP from fisheries (fishery and Aquaculture) sector. Fish trade is worth around USD 100 billion a year, higher-cost fish species to developed countries from developing countries and import lower-cost fish by developing countries makes a positive trade balance ^[33].

World's fish production is continuously increasing due to aquaculture ^[7]. For example, in 2012, China produced, 16,167,443 and 41,108,304 T (tons) by capture and aquaculture, revealing that aquaculture has produced 24,940,861 T more than the capture fishery. Whereas, aquaculture production from Vietnam (463,300), Indonesia

445,460 and Bangladesh (190,291) T was more than capture fishery. Other top fish producing developing countries like India, Norway, Thailand, Chile, Myanmar, Philippines etc. have been engaged in regular efforts to bring additional development in their aquaculture sector. The growth rate of aquaculture in Pakistan is increasing but as compared to other leading countries in aquaculture this production growth rate is very low was recorded. Pakistan fisheries sector has been lower in the race of fish production specifically in aquaculture fish production as compared to other fish producing countries. On the other hand, in Pakistan according to some studies the high commercial marine fish species had been exploited due to capture fishery [25, 34-38]. However, in Pakistan there is no any proper evidence of marine aquaculture. In addition, the inland aquaculture is existing in Pakistan on the extensive, semi intensive and at some farmers practicing through intensive farming. In Pakistan the cultivation of some commercially important Asian carp fish species are very famous such as *Labeo rohita*, *Cirrhinus cirrhosus*, *Catla*

catla, *Hypophthalmichthys molitrix*, *Cyprinus carpio*, *Ctenopharyngodon idella*, *Hypophthalmichthys nobilis* and on very small scale, some species such as *Tilapia*, some kinds of Cat fishes, snake head and other ornamental fishes are in regular practices. For the aquaculture development, government and non-government organizations are applying various efforts to initiate intensive aquaculture with many farming methods as cage, pen and cemented nurseries only to demonstrate and train local fish farmers for the promotion and development of inland and costal aquaculture on the grass root level. The marine environmental conditions may not suite to various aquatic species but there are also many famous aqua-verities, common commercial species as, *cobia*, *sea bass*, *milkfish*, *finfish*, *pearl spot* and *grey mullets* which can be cultured in Pakistani water bodies. Moreover, commercially important species of Crustacean, Mollusks and Seaweeds can be cultured along with the above mentioned fish species to enhance the scope and opportunities in aquaculture.

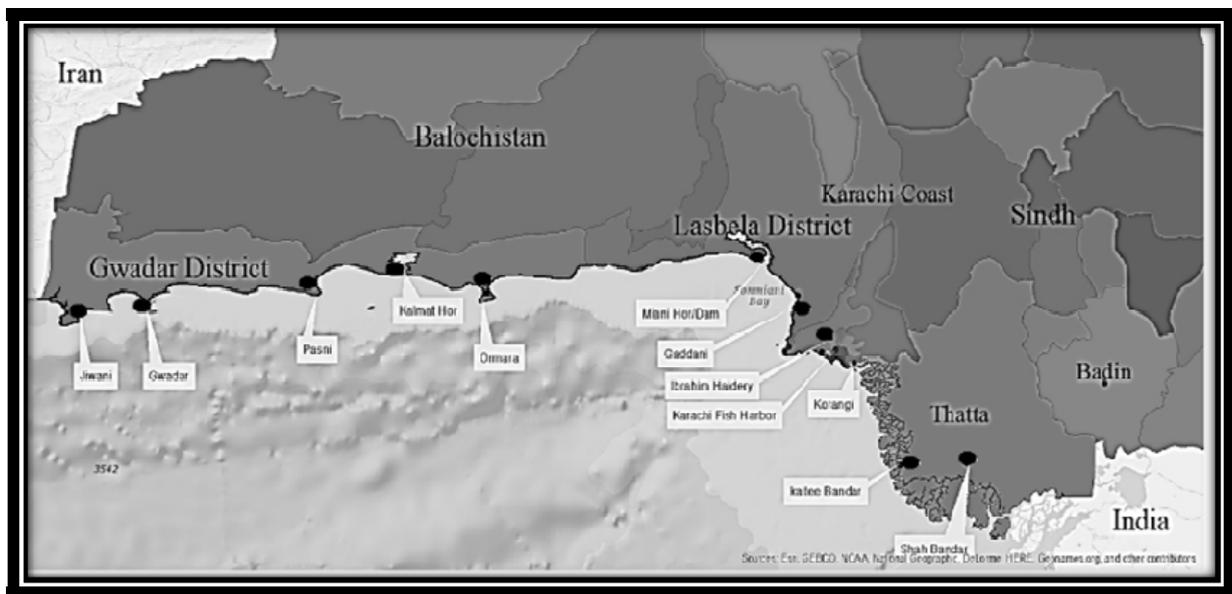


Fig. 1: Showing Costal Belt of Pakistan

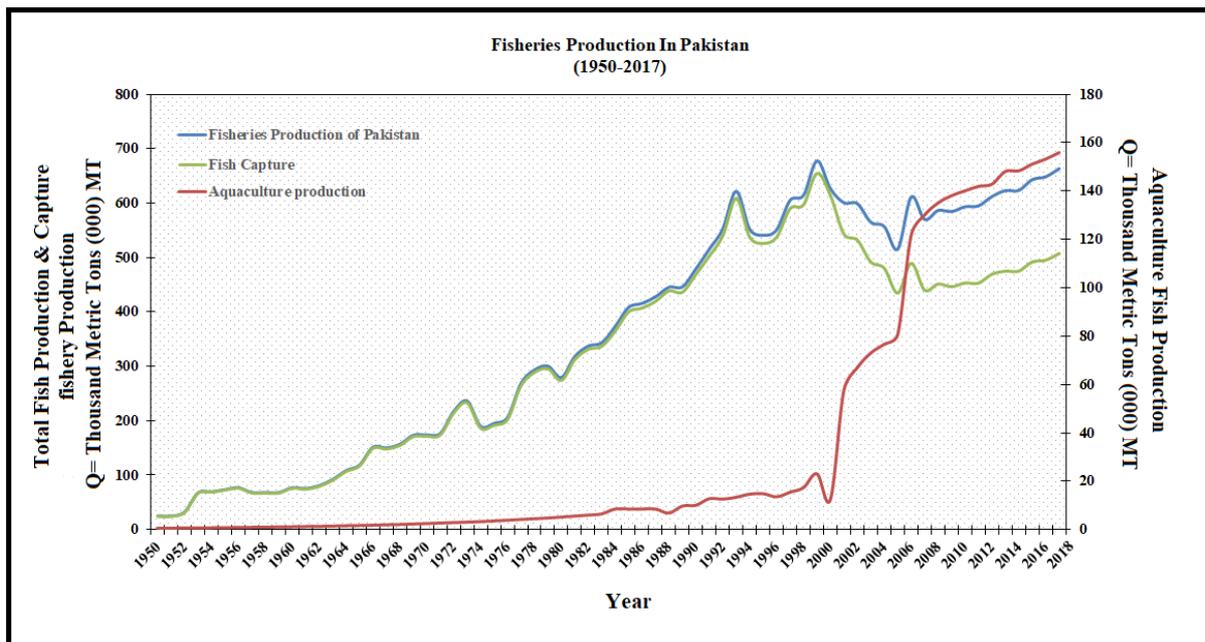


Fig 2: Representing the time scale series data of total fisheries production from 1950-2017 in Pakistan

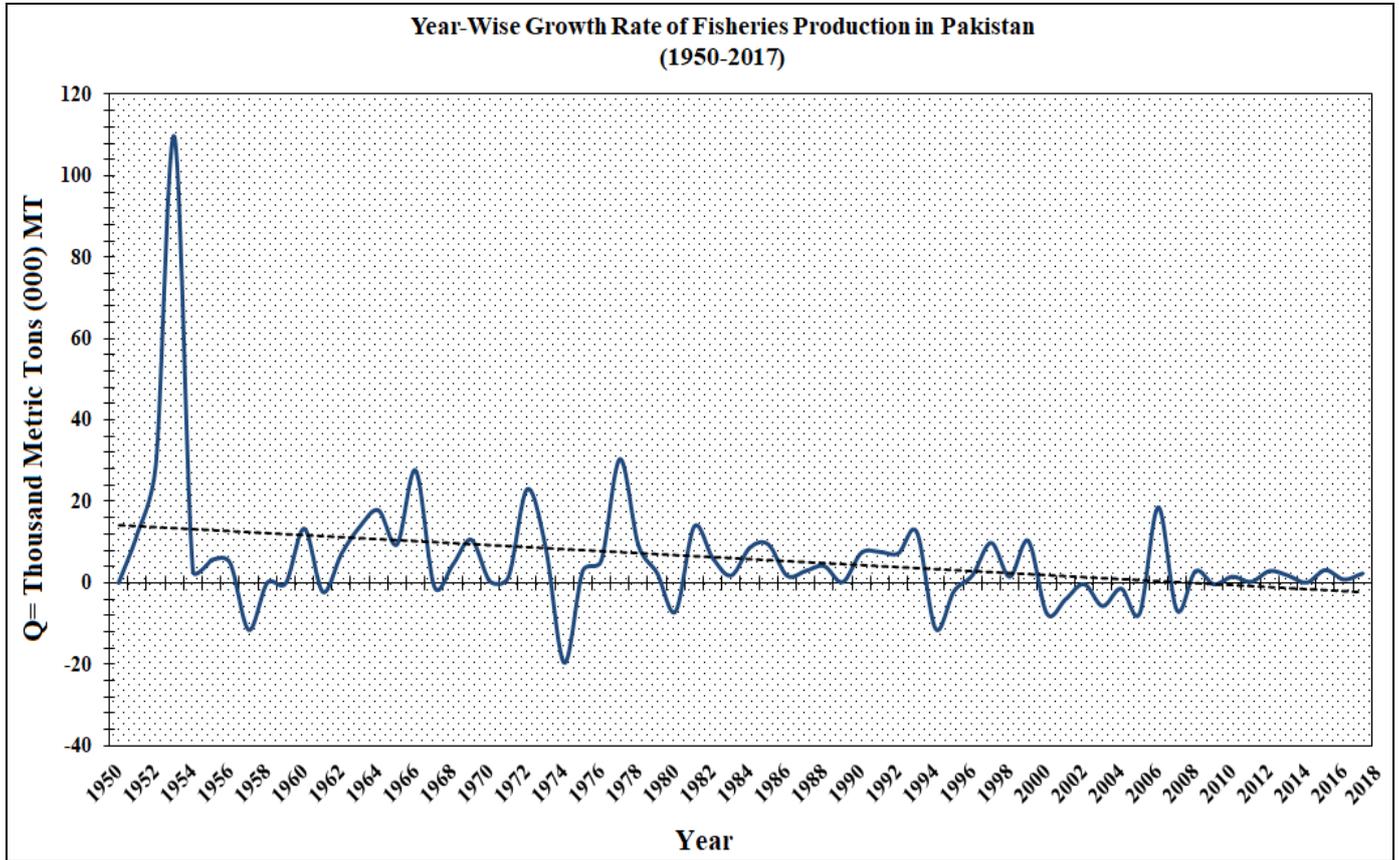


Fig 3: Representing the per-year growth rate of fisheries production from 1950-2017

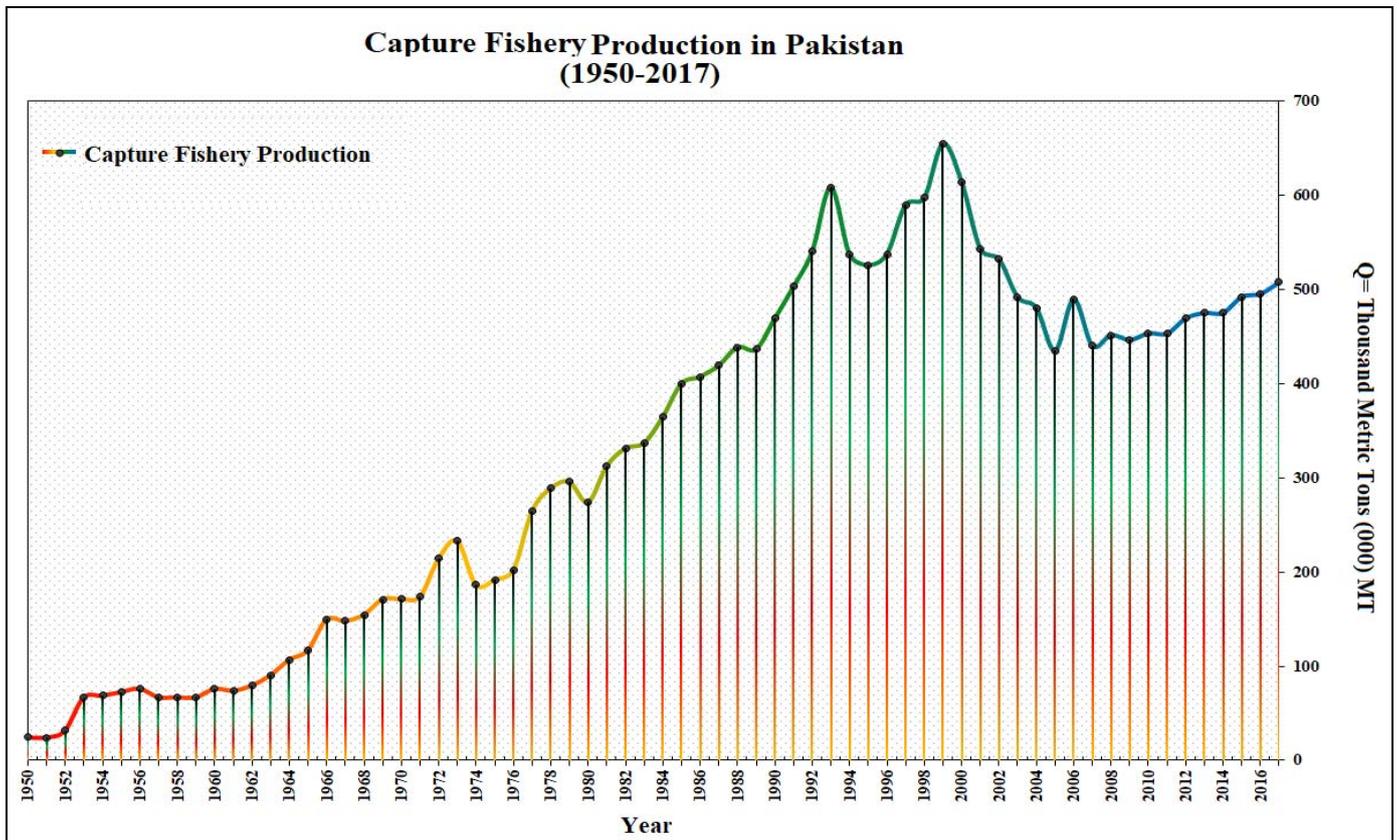


Fig 4: Representing the capture fishery production in Pakistan from 1950-2017

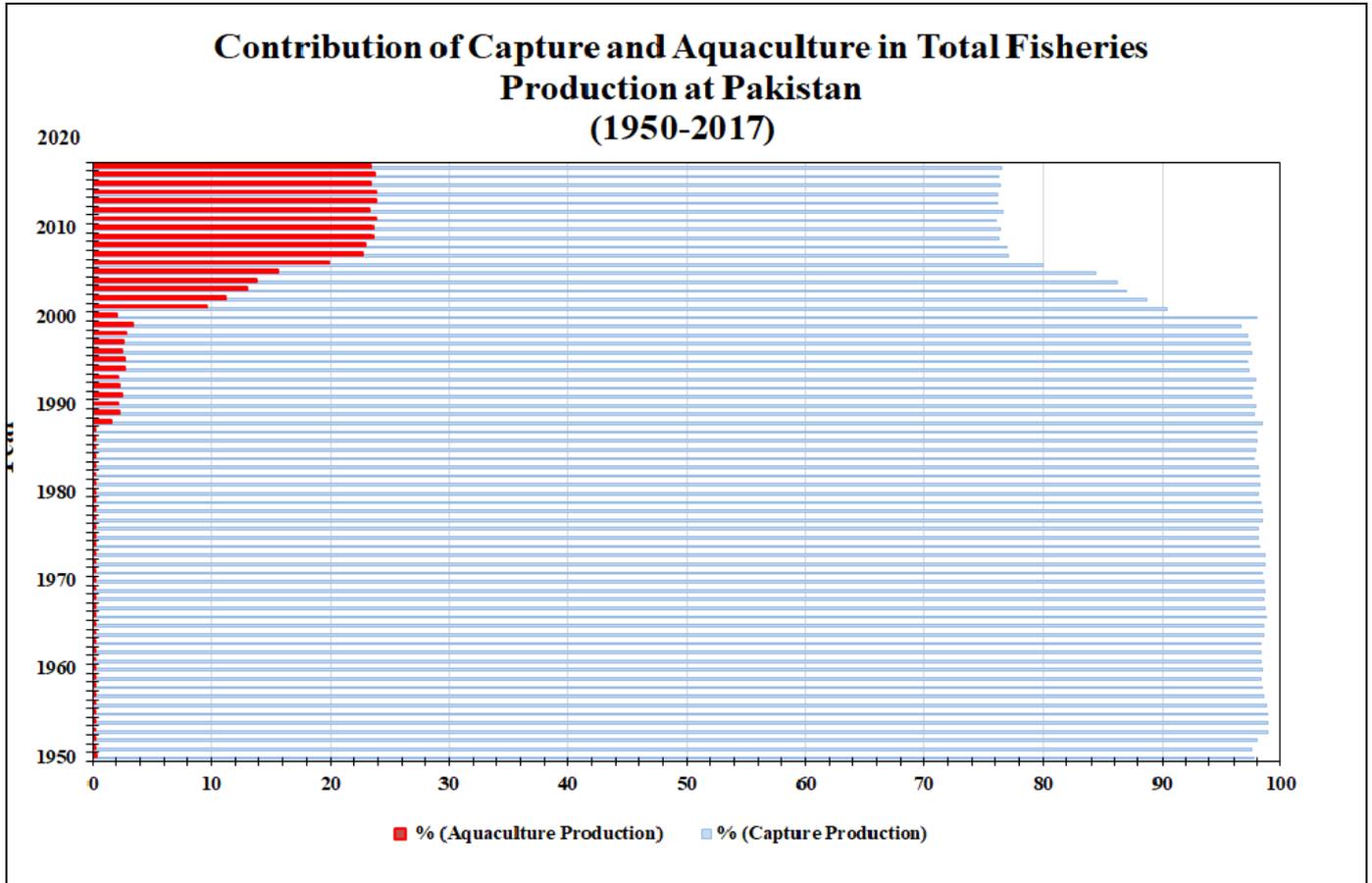


Fig 5: Showing The Percentage Of Capture And Aquaculture Fisheries In Total Production At Pakistan From 1950-2017

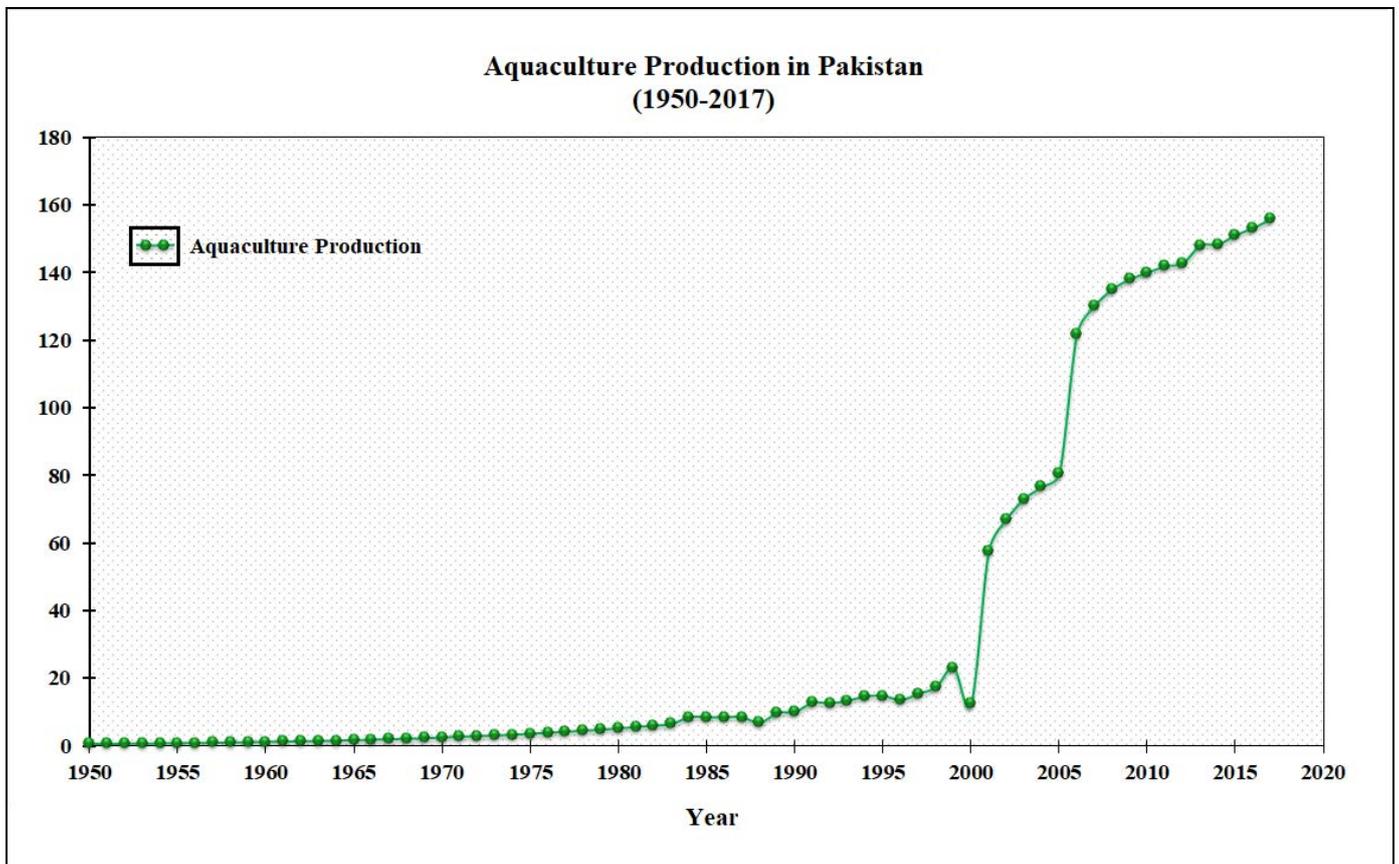


Fig 6: Representing the Aquaculture Production in Pakistan from 1950-2017

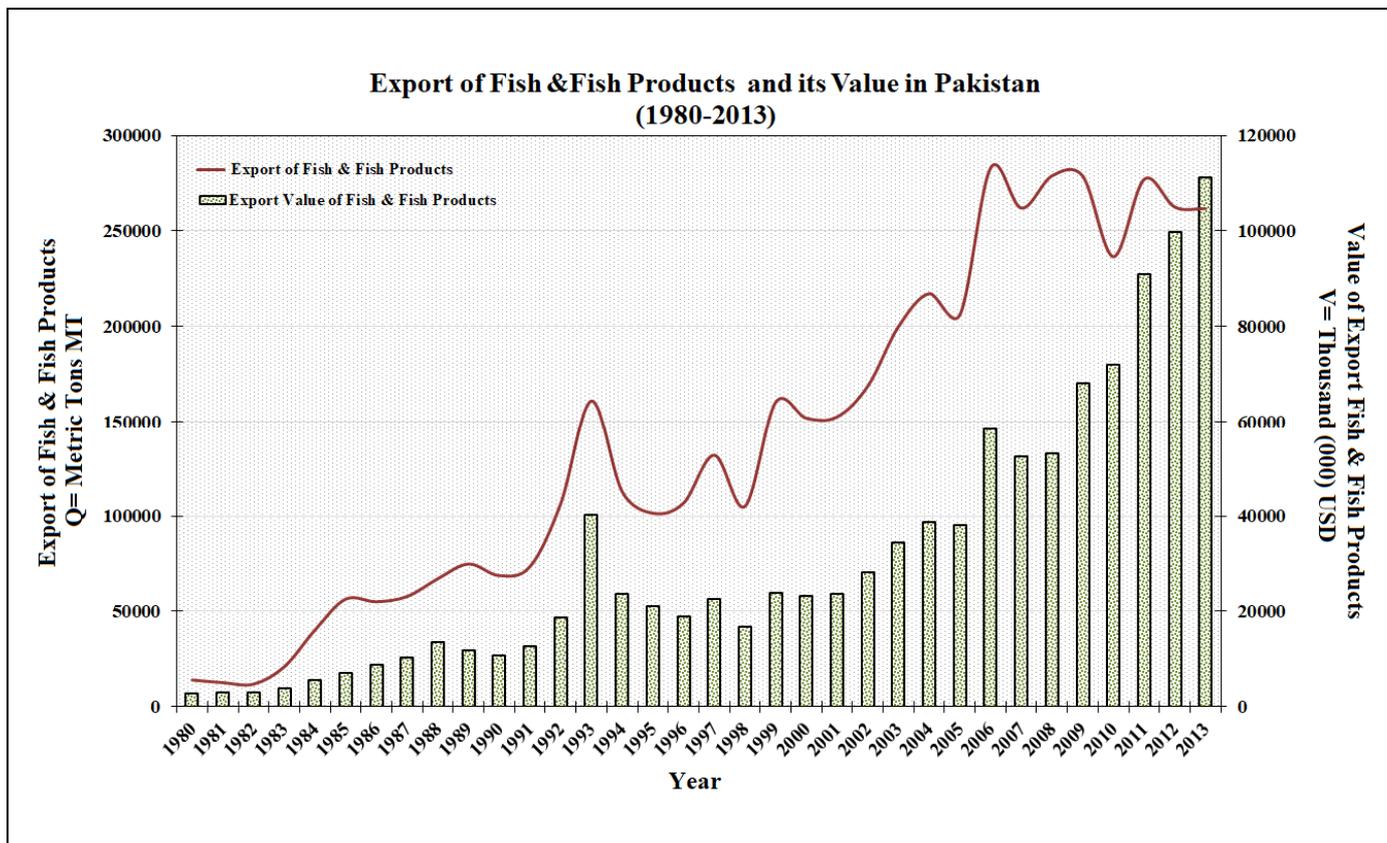


Fig 7: Representing the Export and its Value of Fish and Fish Products in Pakistan from 1980-2013

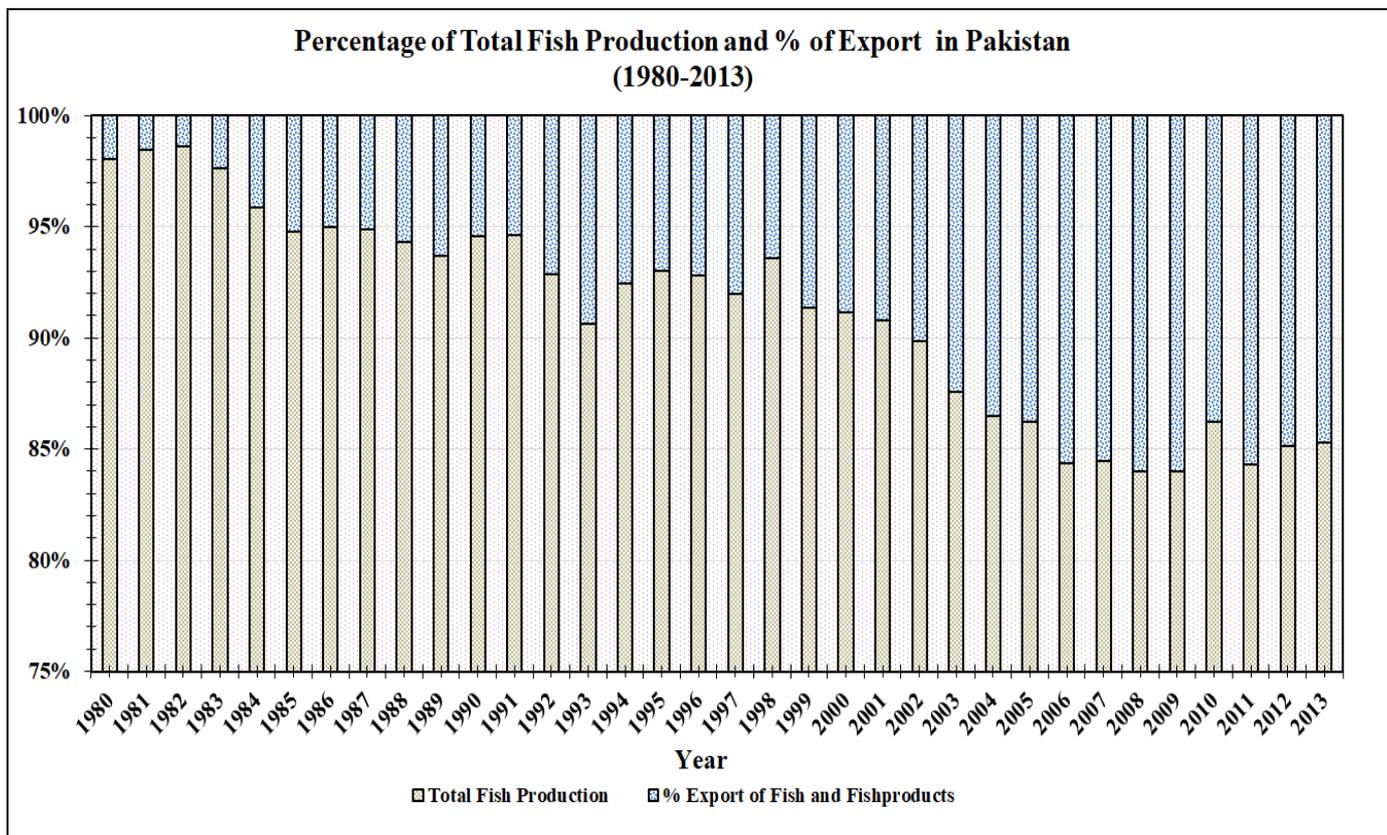


Fig 8: Presenting the Percentage Ratio of Export Fish and Fish Products in Total Fisheries Production at Pakistan from 1980-2013

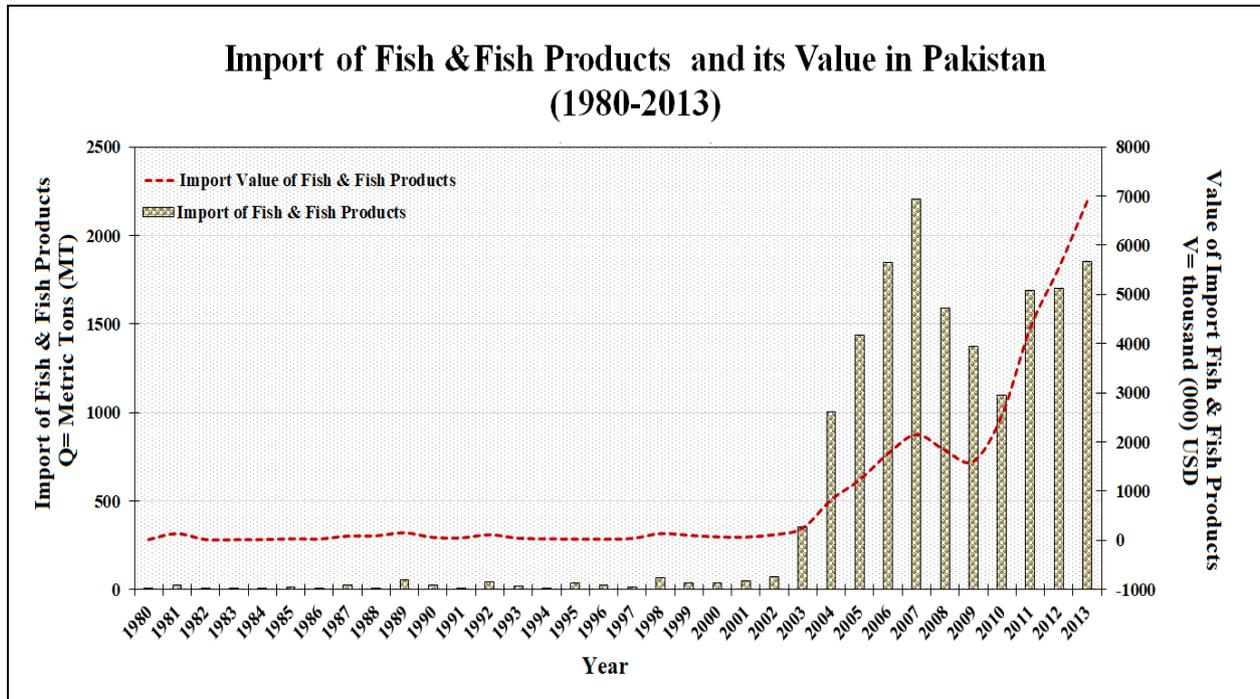


Fig 9: Representing the import and value expenditure of fish and fish products in Pakistan from 1980-2013

Conclusion

In conclusion, this study has revealed that after 1999 aquaculture sector in Pakistan is growing with an average 7,230 MT year⁻¹. The growth rate of aquaculture in Pakistan is increasing but as compare to other leading countries in aquaculture this production growth rate is very low, the improvement of fish yield in Pakistan, need to strengthen its institutions and some presume rapid actions are necessary to meet the demand of fish. Thus, in this way aquaculture can be used as economic booster, through Mariculture and marine aquaculture promotion, sector will not only can ensure the fish production but also can stable to enhance livelihood, food security and employment options.

Recommendations

Strategies for furthering Aquaculture and Fisheries Development in Pakistan

The result and discussion clearly indicate some evidence that Pakistan capture fishery is going decrease and in the inland aquaculture production is tardily on an on to overcome fish demand. Moreover, Pakistan fisheries production and its export position can be develop from coastal region trough cultivate some marine commercial fish, shellfish and bivalve. Previously, many steps have been taken by the government for the utilization of this opportunity, but all steps had not enough proper results to establish marine aquaculture. So, if Pakistan fisheries could not succeed to spread aquaculture in the past, that is not mean that it cannot run in the race of aquaculture, fisheries have to enforce some major developmental strategies with application of modern productive methods to establish marine aquaculture. Shortly thereafter, the cost savings will eventually let down in farming expenses and fish industry will stand up...year, after year..., the enhancing strength will turn to reasonable profit for next it will be more competitive. The main aims: the enhancement of aquaculture, law enforcement, governmental collaborations and establishment of new platforms can be come into sound to generate employment, produce quantitative and qualitative seafood, fish export and

alternatively it can reduce the pressure upon natural resources. Here, fish farming might become an important commodity that would be appropriate to commencing strategies to apply on fisheries sector at Pakistan, further action should be taken to:

1. Economic Corridor, project between Pakistan and China is the best opportunity that can be used for the development of Sindh and Baluchistan coast in Pakistan. A, The Ministry of Science and Technology of Pakistan (MST) and the State Oceanic Administration (SOA) of China should establish a joint platform for marine administration management and cooperation for marine affairs and its development. B, MST & SOA should establish a joint research center for the scientific research to control and protect natural resources. C, MST & SOA should develop a Project with collaboration of fisheries department to establish marine aquaculture farming in coastal areas to fulfill the demand of seafood and extend the trade between each other.
2. Aquaculture Department: Pakistan fisheries department should be make an institution under the provincial administration that particularly focuses on aquaculture. Aquaculture department should be jointly engaged in all other departments of fisheries. The department should be responsible to develop fish and shellfish hatcheries, Public farms, Training centers and transformation and implementations of latest farming technologies at specific areas. Moreover, the department could pay attention towards adopt pen, cage, tidal-ponds and raft culture to generate fish, Prawn, shrimp, oyster and seaweed. It will be accommodative to increase fish production, fish farmers, public awareness, national and international trade and it will create vast job opportunities in field for literate and illiterate youth.
3. Implementation: There is a necessarily need to support shrimp farming in coastal region. Fisheries department jointly should work along its all Directorates like Marine, Research & Development, Hatcheries & Trainings and Inland fisheries with collaboration of planning and

development department, international organization and local non-governmental organizations (NGOs), to promote shrimp farming. The motive should be built some small shrimp hatcheries to facilitate local shrimp farmers and provide technical knowledge to public. Through this facility shrimp seed will be easily available at local areas and it would be a vital source of export income too.

4. Fisheries Microfinance Program: the provincial government should take this authoritative step to develop Microfinance Banks (MFBs) under the law of Microfinance Institutions (MFIs) Ordinance and Prudential Regulations for Microfinance banks to facilitate small fish farmers. Government should establish a plan along with fisheries department, NGOs, Microfinance banks and MFIs with sufficient funds to be provided with minimal and bearable formalities, for the sustainability of Small-scale aquaculture at coastal region by the intensions of poverty alleviation along with aquaculture promotion.

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