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Research Paper

Employment generation and opportunities in India aquaculture value

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Abstract
Aquaculture, still the fastest-growing food-producing sector in the world, has achieved a reputation as a significant contributor to poverty alleviation, food security, and income generation. In India, fisheries and aquaculture are major sources of food, nutrition, employment, and revenue. At the primary level, the sector employs around 16 million fishermen and fish growers, with about double that number employed further down the value chain. In the last three decades, employment in the primary fisheries and aquaculture sectors has grown faster than employment in traditional agriculture. In 2006, the estimated number of fish farmers was almost 9 million, with 94 percent operating in Asia (FAO, 2009). For each person employed in the primary sector, it is estimated that there could be four employed in the support services, including fish processing, marketing, and service industries – for example, accountants, divers, and researchers. In aquaculture, this indicates an employment level of about 36 million. Including household dependents, there would be more than 100 million people dependent on the aquaculture sector for a living.

Keywords: *Employment opportunities, Increase Jobs in the Market, government schemes for aquaculture,*

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I. Introduction

Fisheries have been recognized as a powerful income and employment generator as it stimulates growth of a number of subsidiary industries and is a source of animal protein. It is an instrument of livelihood for a large section of economically backward population of the country. Fisheries sector is the only sector that offers cheap and good animal protein to the people, particularly to the economically weaker sections of the society and thereby it serves as a means to ensuring national f'ood security. It is also a major contributor of foreign exchange earnings for several countries including India through export. The potential of forward and backward linkages through boat building, construction of fishing harbours, fish processing etc., contribute further to diversification and strengthening the regional and national economy.

Aquaculture is the cultivation of aquatic organisms under controlled conditions. Though there are some types of aquaculture, like algal culture, which is the cultivation of kelp, seaweed, and other algae, and the growing of cultured pearls, the primary form of aquaculture is fish farming or pisciculture. Fish farming or aquaculture of this kind is end-directed, that is, fish are grown or cultivated for human consumption or for industrial and medicinal purposes. Aquaculture also saves fishermen time, as they do not have to spend their days at sea fishing. It allows them free time to pursue other economic activities, like engaging in alternative businesses. This boosts entrepreneurship and provides more hiring possibilities and more jobs. The increase in jobs is mostly realized in third-world countries as aquaculture provides both a food source and an extra source of income to supplement those who live in these regions. Aquaculture increases the number of possible jobs in the market. It provides both new products for a market and creates job opportunities as labor is required to maintain the pools and harvest the organisms grown.

Aquaculture is the process of rearing, breeding, and harvesting of aquatic species, both animals and plants, in controlled aquatic environments like oceans, lakes, rivers, ponds, and streams. It serves different purposes, including food production, restoration of threatened and endangered species populations, wild stock population enhancement, the building of aquariums, and fish cultures, and habitat restoration.

- Mariculture (Eriksson, H et.al.,2012)

- Fish Farming (Chakroff, M. 1976)
- Algaculture
- Integrated Multi-Trophic Aquaculture(IMTA)
- Inland Pond Culture
- Recirculating Systems
- Open-net pen and Cage Systems
- Flow-through / Raceway

Job options in aquaculture

There are many types of careers and occupations in the aquaculture sector, ranging from on-farm jobs to careers in academic institutions and government and other national agencies. Many of the occupations are highly skilled and require both formal training and on-the-job upgrading. A practical list of occupations in the aquaculture sector includes naming some (Bostock,J.et al.,2010)

- Aquaculture engineers
- Aquatic veterinarians
- Aquaculture development specialists
- Aquaculture divers Biologists
- Environmental assessment technicians
- Environmental and regulatory affairs managers
- Farm managers
- Feed production technicians
- Fish farm technicians
- Fish health technicians
- Hatchery technicians
- Hatchery managers
- Policy advisors
- Processing supervisors
- Processing line operators
- Production managers
- Research and development coordinators
- Research scientists Research technicians
- Waste management technologists

Why Aquaculture?

As wild fisheries production continues to decline, the availability of domestic farm-raised fish and shellfish is growing exponentially.

The market continues to be very promising with more health-conscious consumers becoming aware of the benefits of eating fish and shellfish products.

Aquaculture is now the fastest-growing animal-production industry, and it represents nearly a $100 billion industry worldwide.(Asche, F,et al.,2010)

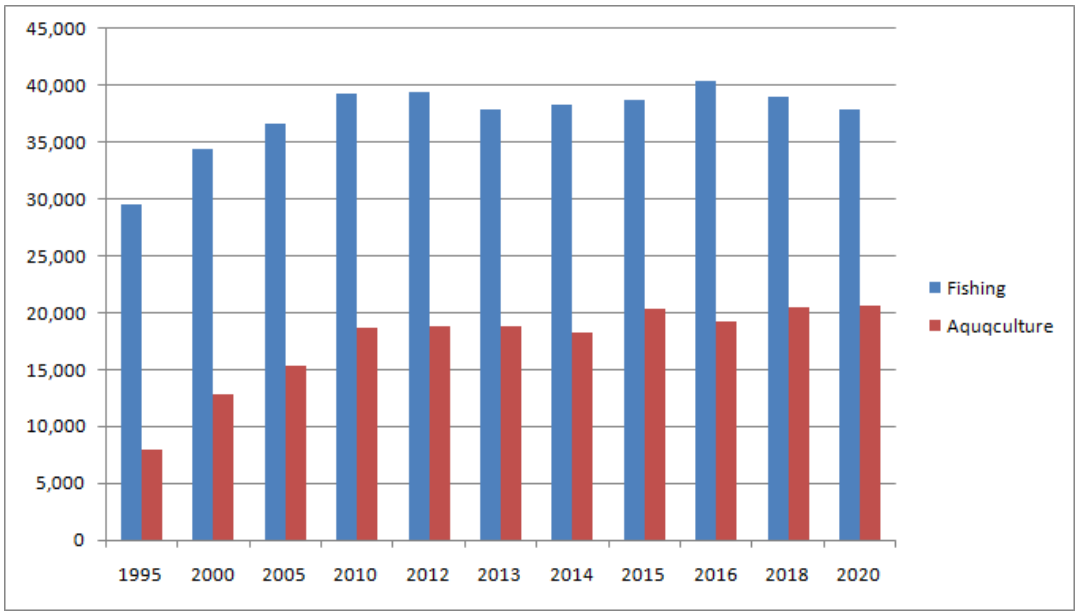
- Sources of Food
- Sources of Fuel
- Job Opportunities
- Reduce Trade Deficit
- Pollution Control
- Reducing Wild Stock Pressure
- Using Sea Resources Sustainably
- Biodiversity Conservation
- Efficiency Increasing
- Reduce Environmental Disturbance

Employment Avenues:

Even though there were a massive quantity of fisheries installation in India and avenues for expansion this has now not been propagated because of a lack of schooling centers and attention most of the knowledgeable kids. The creation of a schooling center with centers for ornamental fish breeding can preserve the production and export of ornamental fish and also increase the inner demand. This may in the long run create possibilities for unemployed teens. But, there are constraints on the availability of professional manpower for the enterprise as a demand, revolutionary methods in breeding and cultivation thru cage culture, pen way of life, and hatchery operation including integrated farming and diversification also are critical to reinforce

manufacturing and export. Studies and improvement have created with generation of expertise to help the sector in addressing the productive issues level and the provision of essential inputs for tradition just like the fish seed, enormously efficient breed, and remedy by using related to aquaculturists, farm managers, and exporters, traders, breeders, and cutting-edge fishermen. Interventions on the policy degree helped to expand and execute fisheries development within the USA Being a pretty remunerative quarter it is taken into consideration a prime source of employment era and there are profession avenues in numerous branches of fisheries and aquatic sciences.(Hussmanns, R et al.,1990)

Number of people engaged in fishing and aquaculture worldwide from 1995 to 2020



Source: FAO

Figure: 1 this statistic depicts the number of people engaged in fishing and aquaculture worldwide

This statistic depicts the number of people engaged in fishing and aquaculture worldwide from 1995 to 2020. In 2020, the number of people working in fishing amounted to around 37.88 million. Some 20.67 million were engaged in aquaculture.

Number of people engaged in fishing and aquaculture in India

State-wise details of total number of people engaged in fisheries, aquaculture and its allied activities

S.No	Name of the States	Number of people engaged in fisheries, aquaculture and its allied activities
1.	Andhra Pradesh	1,496,688
2.	Arunachal Pradesh	24,015
3.	Assam	2,524,106
4.	Bihar	6,027,375
5.	Chhattisgarh	220,355
6.	Goa	10,545
7.	Gujarat	558,691
8.	Haryana	118,455
9.	Himachal Pradesh	11,806
10.	Jharkhand	140,897
11.	Karnataka	974,277
12.	Kerala	1,044,361
13.	Madhya Pradesh	2,232,822
14.	Maharashtra	1,518,228
15.	Manipur	47,711
16.	Meghalaya	16,567
17.	Mizoram	6,289
18.	Nagaland	7,958
19.	Odisha	1,517,574
20.	Punjab	7,591

21.	Rajasthan	57,260
22.	Sikkim	581
23.	Tamil Nadu	1,283,751
24.	Telangana	862,221
25.	Tripura	7,761
26.	Uttarakhand	8,352
27.	Uttar Pradesh	3,900,005
28.	West Bengal	3,236,261
29.	A and N Islands	25,941
30.	Chandigarh	524
31.	Daman & Diu and Dadra Nagar Haveli	40,016
32.	Delhi	3,346
33.	Jammu & Kashmir	17,396
34.	Ladakh	22
35.	Lakshadweep	6,518
36.	Puducherry	107,272
37.		

Table: 1 total number of people engaged in fisheries, aquaculture
This information was given by Union Minister for Fisheries, Animal Husbandry & Dairying

Objectives of this study

- ✓ **The main objective is to emphasize that there is a good career opportunity in aquaculture**
- ✓ **Saying that aquaculture is very important to meet the global demand for fish**
- ✓ **Notification of Central Government State Government Grants and Financial Assistance**
- ✓ **To know the profitability of fish farming**
- ✓ **To the educated youth are made aware of job opportunities**

II. Characteristics of aquaculture employees

2.1. Age profile

In all the international locations surveyed, the general public of aquaculture workers are within the age range of 20–39 years. As discern 1 illustrates, in Africa about eighty three percentage of humans employed in all four farms are between 20 and 39 years vintage; within the Americas simply over half, and the common for the five surveyed farms in Asia become about fifty five percentage. In Europe, more than 3-quarters of employees in the three nations surveyed were aged less than forty. Age shape is an crucial inference of the socio-economic shape of any community. The a while of the fishermen of India were referred to in one-of-a-kind studies papers via distinct authors. Bhoumik and Pandit studied the age of fishermen at a few bells of West Bengal and mentioned that the age of the fishermen changed into among 18-62 years Right here eight.Seventy five% were among 12-18 years, 50.Eighty three% have been between 19-forty years, 26,25% have been between forty one-60 years and 14.Sixty five% were above 60 years of age. The study on the adoption conduct of the conventional fishermen reported that 38.33% of the fisher people belong to the middle age group, forty eight.33% belong to the vintage age organization and among the trawler proprietors most of them belonged to the middle (forty three.33%) and vintage age (35%) companies respectively. Immanuel in her study on linkages among research, extension, and clients systems in marine fishers in Kerala said that fifty two.Sixty seven% of the fishermen come below the middle age organization and 27.33% are comes underneath the antique age group and 20% comes under younger age institution. Santosh ram et al. Studied the socio-economic of the fishermen's community across the Junglighat fish touchdown middle, South Andaman reported that the age organization of 21-40 years changed into determined to be maximum observed by way of age groups of 41-60, and eleven-20. >60 and zero-10 in a descending order indicating values of forty four.44%, 25.93%, 12.97%, nine.26%, and 7.Four% within the case of 0-10

Carp Fish Farming

Catla (Catla Catla), rohu (Labeo Rohita), and mrigal (Cirrhinus mrigala) contribute the bulk of production to the extent of 70 to 75 percent of the total freshwater fish production. Next, the most produced carp fishes are silver carp, grass carp, common carp, and catfish. (Jhingran V. G.1982)

Generally, carp fish holds a second important group contributing the balance of 25 to 30%. These are the most produced carp fish in India. You can start carp fish farming on a small and large scale also. Additionally, you can grow these fishes in ponds and tanks equally.

Catfish Farming

Commercial catfish farming is one of the most profitable businesses in India. Additionally, you can grow catfish in ponds, cement tanks, and even plastic tanks. (Busch, C. D et al.,1978) Catfish have a great demand and price in the market. There are several hybrid varieties are available in the market. Hybrid catfishes have better growth, higher survival rates, and better meat yield than purebred channel catfish. (Boyd, Claude E et al.,1978)

Crab Farming

Andhra Pradesh, Tamil Nadu, and Kerala are the states where crab farming has gained exponential popularity. A package of technology for field culturing of crabs in coastal ponds as well as for the production of seed in the hatchery is available and envisages the scope for the large-scale development of crab farming in the country. (Ruscoe, I.M et al.,2004)

Mud crab has a potential export market worldwide. Commercial crab farming business is developing the lifestyle of the people of coastal areas. With proper care and management, you can earn more from the crab farming business than any other aquaculture business.(Samarasinghe, R.P et al.,1992)

Fish Hatchery

You can categorize the hatchery activities for fish breeding and seed production as (i) induced breeding of Indian major carps (Catla Catla, Labeorohita, and Cirrhinus Mrigala), (Mohapatra, B.C et al.,2003) minor carps (C. Reba L. bata, and Puntius sarana) and Chinese carps and strain development of Indian major, minor, and Chinese carps; (ii) intensive rearing of the seed of these carps; (iii) breeding and seed production of air-breathing catfishes (Clarias batrachus and Heteropeustes fossils); (iv) breeding and seed production of giant freshwater prawns (Macrobrachium rosenbergii); and, (v) breeding and seed production of ornamental fish (Colisa sp.).

Fresh Water Prawn Farming

Freshwater prawn farming has received increased attention only in the last two decades due to its high consumer demand. The giant river prawn, Macrobrachium rosenbergii is the largest and fastest-growing prawn species. Additionally, you can culture either under monoculture or polyculture with major carps. (Wood, J.F et al.,1992)

Freshwater prawns are reared in a variety of freshwater enclosures, including tanks, irrigation ditches, cages, pens, reservoirs, and natural waters; the commonest form being earthen ponds. Normal rearing methods comprise various combinations of the formerly used "continuous" (ponds operated indefinitely, with regular cull-harvesting and restocking) and "batch" (single stocking, single harvesting) systems; these are known as "combined systems".

Ornamental Fish Farming

Keeping colorful and fancy fishes known as ornamental fishes or aquarium fishes. Aquarium fishes are mainly grouped into two categories, viz., Oviparous (egg–layers) and Viviparous (live-bearers). (Huntingford FA et al., 2006) Further, you can categorize the freshwater ornamental fish varieties broadly into Tropical and Coldwater species also. Management of these two categories is different in nature. In India, you can get financial assistance from NABARD for ornamental fish farming.(Morton A et al., 2004)

Pearl Farming

Pearl culture is gaining rapid popularity in India. The pearl has a good domestic demand in the country. China and Japan are the two major countries who export pearls in India. Pearl farming is an attractive business venture because of the high value of the final product.Although black pearls vary greatly in value depending on the size and quality, large, round pearls of high quality can sell for very high prices. One of the principal advantages of pearl production is that the final product is lightweight and nonperishable.(Southgate PC et al.,2008)

Seaweeds Production

Seaweed has many unique properties with innumerable applications in a large number of industries. It is considered the medicinal food of the 21st century. The bioactive compounds found in seaweeds await a major breakthrough for a variety of applications in the medical field. Agar, carrageenan, and alginate are popular examples of seaweeds—these have been used as food for human beings, feed for animals, fertilizers for plants, and as sources of various chemicals.(Dumelod BD, et al.,1999)

Shrimp Farming

Freshwater shrimp farming and brackish water shrimp farming both are profitable aquaculture business in India. In addition, you can start this as a small scale also. Commercial shrimp farming demands adequate knowledge of farming technology.(Santos, C. et al.,1978) (Shigueno, K. 1975)

Tilapia Fish Farming

Tilapia is one of the most popular fish of the common people in India. The business is no doubt very lucrative. The most interesting thing is, you can grow tilapia at home on a small farm. And also, you can grow commercially in a large farming area. Though tilapia is the second most farmed fish in the world, India does not farm Tilapia to that extent commercially. Interested entrepreneurs in this type of aquaculture business, apply for financial assistance for various items like Pond Development, construction of New Ponds, the first year inputs, etc. under a centrally sponsored subsidy scheme (Alceste, C. & Jory, D. 2002).

4. Increase Jobs in the Market

Aquaculture increases the number of possible jobs in the market. It provides both new products for a market and creates job opportunities as labor is required to maintain the pools and harvest the organisms grown. (Nash, C.E., 2004)

The increase in jobs is mostly realized in third-world countries as aquaculture provides both a food source and an extra source of income to supplement those who live in these regions.

Aquaculture also saves fishermen time as they do not have to spend their days at sea fishing. It allows them free time to pursue other economic activities like engaging in alternative businesses. This boosts entrepreneurship and provides more hiring possibilities and more jobs.

5. Government motivating the formers

The government is making continuous efforts to make the farmers self-reliant in India. The potential for income through fish farming is very high. Therefore, various schemes are being run by the government to promote fish farming. Tamilnadu Government is providing free training to the people to encourage fish farming in the state. (Tata, C et al., 2017)

List of Tamilnadu State Training institutions

- Erode Bhavanisagar Centre for Sustainable Aquaculture - Bhavanisagar, Tamil Nadu
- Fisheries College and Research Institute -Thoothukudi, Tamil Nadu
- Parakkai Fisheries Training-Parakkai, Tamil Nadu
- Paraprofessional Institute of Aquaculture Technology-Muttukadu Chennai Tamilnadu
- Dr. MGR Fisheries College and Research institute - Ponneri Chennai Tamilnadu
- Tamil Nadu J. Jayalalithaa Fisheries University (TNJFU),-Nagapattinam, Tamilnadu
- Kanyakumari Ganapathipuram Centre for Sustainable Aquaculture- Kanyakumari, Tamilnadu

List of Out State Training Institutions

- Central Institute of Fisheries Education, Kakinada
- Central Institute of Fisheries Education, Saltek, Kolkata
- Central Inland Fisheries Research Institute Barrackpore, Kolkata
- Kendriya Matsyaki Shiksha Sansthan, Powerkheda
- College of Fisheries Pantnagar
- Central Freshwater Living Research Institute, Kaushalyaganga, (Bhubaneswar)

State and Central government schemes for aquaculture

1. Centrally Sponsored Scheme on Development of Inland Fisheries and Aquaculture

Development of Freshwater Aquaculture.
Development of Brackishwater Aquaculture.
Coldwater Fisheries and Aquaculture.
Development of Waterlogged Areas.
Productive Utilization of Inland Saline/Alkaline Soils for Aquaculture.
Integrated Development of Inland Capture Resources (reservoirs/rivers etc.)

2. PRADHAN MANTRI MATSYA SAMPADA YOJANA

The Pradhan Mantri Matsya Sampada, with a total projected investment of Rs. 20,050 crores, would be executed during a five-year period from FY 2020-21 to FY 2024- 25. The plan aims to close significant gaps in fish production and productivity, quality, technology, post-harvest infrastructure an management, value chain

modernisation and strengthening, traceability, the establishment of a strong fisheries management framework, and the welfare of fishermen.

3. Centrally Sponsored Scheme on Blue Revolution

Blue Revolution: Integrated Development and Management of Fisheries' Foreseeing high potential, the Hon'ble Prime Minister has called for ‒a revolution‖ in the fisheries sector and has named it as ‒Blue Revolution‖. The Blue Revolution, with its multi-dimensional activities, focuses mainly on increasing fisheries production and productivity from aquaculture and fisheries resources, both inland and marine.

4. Development of Freshwater Aquaculture (FFDA's)

This includes the following subsidies under the FFDA's scheme.

For the construction of the new ponds the subsidy available is 20% along with ceiling for Rs 2 lakh and a ceiling of Rs 40,000/ha for all the farmers except SC's and ST's for whom it will be R$ 50,000/ha le, 25% of the subsidy. For hilly region the subsidy is 25% and the available amount is Rs.60.000/ha for all farmers except SC's and ST's where it is Rs. 75,000/ha. For reclamation/renovation of ponds/tanks the subsidy available is 20% with a ceiling of 12,000/ha for all farmers except SC's and ST's where it is Rs. 15,000/ha. Cost of inputs for finfish culture the subsidy available is 20% ie, Rs 30,000/ha for all farmers except SC's and ST's where it is Rs 35,000/ha For integrated fish farming the subsidy provided is 20% which is of Rs 16,000 where for all farmers except SC's and ST's where it is Rs. 20,000/ha ie, 25% For freshwater fish seed hatchery where the subsidy is 10% for Rs 8 lakh for the plain and hilly areas.

5. National fisheries development board scheme

The National Fisheries Development Board (NFDB) was established in 2006 as an autonomous organization under the administrative control of the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Government of India to enhance fish production and productivity in the country and to coordinate fishery development in an integrated and holistic manner. A wide range of fishery development activities viz., intensive aquaculture in ponds and tanks, culture based capture fisheries in reservoirs, Coastal Aquaculture, Mariculture, Sea Weed cultivation, establishment of infrastructure, fishing harbours and fish landing centres, fishing dressing centres and solar drying of fish, domestic marketing, deep sea fishing and tuna processing, ornamental fisheries, trout culture, artificial reefs technology upgradation and capacity building of fishermen and fish farmers are being supported through the State Governments/Implementing agencies. The activities of NFDB are overseen by a Governing Body under the Chairmanship of the Hon'ble Minister for Fisheries, Animal Husbandry & Dairying. The Governing Body and the Executive Committee consider and decide the activities of the Board and provide periodic guidance. The Executive committee, with the Secretary in charge of Department of Fisheries as its Chairman, provides the general superintendence, direction and the control of the affairs and functions of the Board. The NFDB is headed by a Chief Executive.

- Providing focused attention to fisheries and aquaculture (Production. Processing, Storage, Transport and Marketing)
- Achieving sustainable management and conservation of natural aquatic resources
- Applying modern tools of research and development for optimizing production and productivity from fisheries.
- Providing modern infrastructure mechanisms for effective fisheries management and optimum utilization
- Training and empower women in the fisheries sector and also generate substantial employment
- Enhancing the contribution of the fish toward food and nutritional security

6. NABARD Scheme for Aquaculture

National Bank for Agriculture and Rural Development (NABARD) is a financial institution that was set up by the Indian government to promote sustainable agriculture and rural development in India. The functions of NABARD include the propagation of technological innovations, financial solutions, and non-financial solutions, and institutional development

Key achievements of NABARD schemes for fish farming

Some of the activities undertaken by NABARD for rural development contain;

• Provision of refinancing support

• Improving rural infrastructure

• Preparation of credit plans at a district level and encouraging banks to achieve targets Supervision of RRBs (Regional Rural Banks) and Cooperative Banks

• Development of sound banking practices within the economically backward sections In India

• Training artisans to develop handicraft activities and also offering them help in

marketing their produce
The SHC Bank Linkage Project that was developed by NABARD has become one of the most noteworthy microfinance projects at a global level
• NABARD has designed the Kisan Credit Card that has benefitted crores of farmers in the country It takes credit for having financed one-fifth of the rural infrastructure of India
The institution pioneered watershed improvement for climate-proofing

III. Results

The cultivation sector provides a vital supply of employment, financial gain and livelihoods, particularly in rural communities, each coastal and inland , for developing countries. ladies represent a big proportion of the cultivation manpower, particularly in process. world knowledge specific to the cultivation provide chain is tough to ascertain. the explanation for this is often simple: downstream from production, in core activities such as process and wholesale trade, cultivation is commonly combined with capture fisheries, though the 2 sectors could also be entirely totally different in terms of market value exposures, environmental impacts and governance mechanisms.

The cultivation sector recorded a mean annual increase in direct employment of four.29 per cent from 1995 to 2018. Globally, cultivation these days provides direct work for a calculable twenty.5 million individuals, accounting for roughly one third of all employees engaged in fisheries and cultivation. whereas the quantity of these engaged in these 2 industries has accumulated from thirty six.2 million in 1995 to fifty nine.7 in 2018, there has been a shift towards cultivation production off from capture fisheries, that originally depicted eighty per cent of total employment

IV. Conclusion

The conclusions of this report suggest that aquaculture has benefited the overall socio-economic conditions of the areas in which it operates. The industry has provided jobs, particularly non-seasonal jobs. These have enabled young people to stay in their communities, enhancing the economic viability of isolated areas. Total remuneration levels in all of the enterprises surveyed were at, or above, the minimum wage, and usually above wages in alternative sectors. Farms also provided indirect benefits, such as medical and pension coverage, and in some cases, bonuses.

Aquaculture increases the number of possible jobs in the market. It provides both new products for a market and creates job opportunities as labor is required to maintain the pools and harvest the organisms grown. Aquaculture increases the number of possible jobs in the market. It provides both new products for a market and creates job opportunities as labor is required to maintain the pools and harvest the organisms grown. In this article I have designed an article that not only discusses fish farming and fish farming methods but also mainly calculates the profits in fish farming. In today's era, educated youths are lamenting that they don't have a job, that is not right, rather than lamenting that they don't have a job, this fish farming is an industry that gives employment to many people. Apart from that, in this article I have also compiled grants and bank loans from Central and State Governments. The schemes of the government are reaching many people and people know it with interest and can start self-employment and provide employment to many people by using the welfare schemes of the government. It is 100 percent possible that the development of aquaculture technology will lead to the rise of human society. Due to the growing population, the demand for fish is increasing. It is good to know not only fish but also other freshwater farming techniques.

A number of suggestions are made that would improve the governance of labour in aquaculture. Because of the relatively long time that elapsed between the compilation of the information reported in this document and its publication, the situation may have improved here or there. Therefore, these suggestions may not be needed there. However, they remain relevant where such is not the case or for countries thriving to develop aquaculture in a sustainable manner. Note should be taken that this study does not intend to pinpoint any specific country or aquaculture system; its goal is to use them as case studies for the purpose of generating lessons, positive or negative, to learn from.

Reference

[1]. Eeckhaut, Igor, et al. "Madagascar Holothurie SA: The first trade company based on sea cucumber aquaculture in Madagascar." (2008).
[2]. Eriksson, Hampus, et al. "Sea cucumber aquaculture in the Western Indian Ocean: challenges for sustainable livelihood and stock improvement." Ambio 41.2 (2012): 109-121.
[3]. FAO, UFAO. "World review of fisheries and aquaculture." State of World Fisheries and Aquaculture: opportunities and challenges. Rome. Food and Agriculture of the United Nations. Part 1 (2014): 3-93.
[4]. Pauly, Daniel, and Dirk Zeller. "Comments on FAOs state of world fisheries and aquaculture (SOFIA 2016)." Marine Policy 77 (2017): 176-181.
[5]. Gräslund, Sara. Chemical use in shrimp farming and environmental implications of antibiotic pollution. Diss. Institutionen för systemekologi, 2004.

[6]. Mmochi, Aviti. "Mariculture." Western Indian Ocean 20.10 (2016): 289.
[7]. Lae, Raymond. "Evolution of populations (fish and crustaceans) in a tropical lagoon, Lake Togo, subject to an alternating regime of closure and opening of the lagoon rim." Aquatic Living Resources 7.3 (1994): 165-179.
[8]. Chakroff, M. "Fresh water fish pond culture and management [A joint peace crops and volunteers in technical assistance publication; MD]." Volunteers in Technical Assistance, Mt. Rainier (1976).
[9]. Costa-Pierce, Barry A., A. Safari, and G. W. Atmadja. "Growing fish in pen systems." The WorldFish Center Working Papers (1989).
[10]. Bostock, John, et al. "Aquaculture: global status and trends." Philosophical Transactions of the Royal Society B: Biological Sciences 365.1554 (2010): 2897-2912.
[11]. Al Khawli, Fadila, et al. "Innovative green technologies of intensification for valorization of seafood and their by-products." Marine Drugs 17.12 (2019): 689.
[12]. Alday-Sanz, Victoria, et al. "Facts, truths and myths about SPF shrimp in Aquaculture." Reviews in Aquaculture 12.1 (2020): 76-84.
[13]. Asche, Frank, et al. "Fair enough? Food security and the international trade of seafood." World Development 67 (2015): 151-160.
[14]. Auchterlonie, Neil. "The continuing importance of fishmeal and fish oil in aquafeeds." Aquafarm Conference, Pordenone, Italy. 2018.
[15]. Roberts, M., S. Painter, and E. Popova. "An introduction to East African Coastal Current ecosystems: At the frontier of climate change and food security." (2021).
[16]. Barange, M., et al. "Impacts of climate change on marine ecosystem production in societies dependent on fisheries." Nature Climate Change 4.3 (2014): 211-216.
[17]. Jhingran, Vishwa Gopal. "Fish and fisheries of India." (1975).
[18]. Hussmanns, Ralf, Farhad Mehran, and Vijaya Varmā. Surveys of economically active population, employment, unemployment, and underemployment: an ILO manual on concepts and methods. International Labour Organization, 1990.
[19]. Boyd, Claude E., Robert P. Romaire, and Ellen Johnston. "Predicting early morning dissolved oxygen concentrations in channel catfish ponds." Transactions of the American Fisheries Society 107.3 (1978): 484-492.
[20]. Busch, C. D., C. A. Flood, and R. Allison. "Multiple paddlewheels' influence on fish pond temperature and aeration." Transactions of the ASAE 21.6 (1978): 1222-1224.
[21]. Ruscoe, Ian M., Colin C. Shelley, and Graham R. Williams. "The combined effects of temperature and salinity on growth and survival of juvenile mud crabs (Scylla serrata Forskål)." Aquaculture 238.1-4 (2004): 239-247.
[22]. Samarasinghe, R. P., D. Y. Fernando, and O. S. S. C. de Siha. "Pond culture of mud crab in Sri Lanka." Mud Crab 1 (1991): 30.
[23]. De Silva, Sena S. "Reducing feed costs in aquaculture: Is the use of mixed feeding schedules the answer for semi-intensive practices?." Aquaculture Asia 11.4 (2006): 7.
[24]. Islam, Md Shahidul. "Perspectives of the coastal and marine fisheries of the Bay of Bengal, Bangladesh." Ocean & Coastal Management 46.8 (2003): 763-796.
[25]. Tata, Cyrus, and Fiona Jamieson. "Just Emotions? The need for emotionally-intelligent justice policy." Scottish Justice Matters 5.1 (2017): 32-33.
[26]. Nash, C. E. "Achieving policy objectives to increase the value of the seafood industry in the United States: the technical feasibility and associated constraints." Food Policy 29.6 (2004): 621-641.
[27]. Huntingford, Felicity A., et al. "Current issues in fish welfare." Journal of fish biology 68.2 (2006): 332-372.
[28]. Morton, Alexandra, et al. "Sea lice (Lepeophtheirus salmonis) infection rates on juvenile pink (Oncorhynchus gorbuscha) and chum (Oncorhynchus keta) salmon in the nearshore marine environment of British Columbia, Canada." Canadian Journal of Fisheries and Aquatic Sciences 61.2 (2004): 147-157.
[29]. D. Dumelod, Rachel Patricia B. Ramirez, Cecile Leah P. Tiangson, Erniel B. Barrios, Leonora N. Panlasigui, Benelyn. "Carbohydrate availability of rice broth with lambda-carrageenan." International Journal of Food Sciences and Nutrition 50.4 (1999): 283-289.
[30]. Southgate, Paul C., Andrew C. Beer, and Poasi Ngaluafe. "Hatchery culture of the winged pearl oyster, Pteria penguin, without living micro-algae." Aquaculture 451 (2016): 121-124.
[31]. de los Santos, Ceferino. Modern Aquaculture for the Philippines . Yuhum La Defense Press, 1978.
[32]. Shigueno, Kunihiko. "Shrimp culture in Japan." (1975).
[33]. Alceste, C. C., and D. E. Jory. "World tilapia farming." Aquaculture Magazine, Buyer's Guide 2002 (2002): 40-52.
[34]. Lauenstein, P.C. 1978. Intensive culture of tilapia with geothermally heated water. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Culture of exotic fishes, Symp. Proc. Fish Culture Selection, American Fisheries Soc., Auburn, Alabama: 82-85.
[35]. Liao, I.C. and I.C. Chang. 1983. Studies of the feasibility of red tilapia culture in saline water. p. 524-543. In: L. Fishelson and Z. Yaron (Edirors), Proc. Int. Symp. on Tilapia in Aquaculture, 8-13
[36]. Lauenstein, P.C. 1978. Intensive culture of tilapia with geothermally heated water. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Culture of exotic fishes, Symp. Proc. Fish Culture Selection, American Fisheries Soc., Auburn, Alabama: 82-85.
[37]. Liao, I.C. and I.C. Chang. 1983. Studies of the feasibility of red tilapia culture in saline water. p. 524-543. In: L. Fishelson and Z. Yaron (Edirors), Proc. Int. Symp. on Tilapia in Aquaculture, 8-13
[38]. Lauenstein, P.C. 1978. Intensive culture of tilapia with geothermally heated water. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Culture of exotic fishes, Symp. Proc. Fish Culture Selection, American Fisheries Soc., Auburn, Alabama: 82-85.
[39]. Liao, I.C. and I.C. Chang. 1983. Studies of the feasibility of red tilapia culture in saline water. p. 524-543. In: L. Fishelson and Z. Yaron (Edirors), Proc. Int. Symp. on Tilapia in Aquaculture, 8-13
[40]. Lauenstein, P.C. 1978. Intensive culture of tilapia with geothermally heated water. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Culture of exotic fishes, Symp. Proc. Fish Culture Selection, American Fisheries Soc., Auburn, Alabama: 82-85.
[41]. Liao, I.C. and I.C. Chang. 1983. Studies of the feasibility of red tilapia culture in saline water. p. 524-543. In: L. Fishelson and Z. Yaron (Edirors), Proc. Int. Symp. on Tilapia in Aquaculture, 8-13
[42]. helton, W.L., K.D. Hopkins, and G.L. Jensen. 1978. Use of hormones to produce monosex tilapia for aquaculture. p. 10-33. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Proc. Symp.
[43]. Culture of Exotic Fishes. Fish Culture Section. American Fisheries Society, Auburn, Alabama, USA.
[44]. .Shelton, W.L. 1987. Genetic manipulations-sex control of exotic fish for stocking. p. 175-197. In: K. Tiews (Editor), Proceedings of World Symposium on Selection, Hybridization and Genetic Engineering in Aquaculture, Bordeaux, 27-30 June, 1986, Vol.II. Heeneman, Berlin.
[45]. helton, W.L., K.D. Hopkins, and G.L. Jensen. 1978. Use of hormones to produce monosex tilapia for aquaculture. p. 10-33. In: R.O.

[46]. Smitherman, W.L. Shelton and J.H. Grover (Editors), Proc. Symp.
[47]. Culture of Exotic Fishes. Fish Culture Section. American Fisheries Society, Auburn, Alabama, USA.
[48]. .Shelton, W.L. 1987. Genetic manipulations-sex control of exotic fish for stocking. p. 175-197. In: K. Tiews (Editor), Proceedings of World Symposium on Selection, Hybridization and Genetic Engineering in Aquaculture, Bordeaux, 27-30 June, 1986, Vol.II. Heeneman, Berlin.
[49]. helton, W.L., K.D. Hopkins, and G.L. Jensen. 1978. Use of hormones to produce monosex tilapia for aquaculture. p. 10-33. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Proc. Symp.
[50]. Culture of Exotic Fishes. Fish Culture Section. American Fisheries Society, Auburn, Alabama, USA.
[51]. .Shelton, W.L. 1987. Genetic manipulations-sex control of exotic fish for stocking. p. 175-197. In: K. Tiews (Editor), Proceedings of World Symposium on Selection, Hybridization and Genetic Engineering in Aquaculture, Bordeaux, 27-30 June, 1986, Vol.II. Heeneman, Berlin.
[52]. helton, W.L., K.D. Hopkins, and G.L. Jensen. 1978. Use of hormones to produce monosex tilapia for aquaculture. p. 10-33. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Proc. Symp.
[53]. Culture of Exotic Fishes. Fish Culture Section. American Fisheries Society, Auburn, Alabama, USA.
[54]. .Shelton, W.L. 1987. Genetic manipulations-sex control of exotic fish for stocking. p. 175-197. In: K. Tiews (Editor), Proceedings of World Symposium on Selection, Hybridization and Genetic Engineering in Aquaculture, Bordeaux, 27-30 June, 1986, Vol.II. Heeneman, Berlin.
[55]. helton, W.L., K.D. Hopkins, and G.L. Jensen. 1978. Use of hormones to produce monosex tilapia for aquaculture. p. 10-33. In: R.O. Smitherman, W.L. Shelton and J.H. Grover (Editors), Proc. Symp.
[56]. Culture of Exotic Fishes. Fish Culture Section. American Fisheries Society, Auburn, Alabama, USA.
[57]. .Shelton, W.L. 1987. Genetic manipulations-sex control of exotic fish for stocking. p. 175-197. In: K. Tiews (Editor), Proceedings of World Symposium on Selection, Hybridization and Genetic Engineering in Aquaculture, Bordeaux, 27-30 June, 1986, Vol.II. Heeneman, Berlin.
[58]. Vannuccini, S.1998. Western world – the focus of new tilapia market. INFOFISH International, 4:20-24.
[59]. Varadaraj, K. and T.J. Pandian. 1990. Production of all-female triploid Oreochromis mossambicus. Aquaculture, 84:117-123