Library Progress International *Print version ISSN 0970 1052*
Vol.44 No. 3, Jul-Dec 2024: P. 17448-17462 *Online version ISSN 2320 317X*

Original Article *Available online at www.bpasjournals.com*

A Study On Aquaculture And Its Impact In Environmental

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How to cite this article: Raveena R Nair,Balaji B, S Viswakalyan, Vijayanand T S, Rashik Hameed Mukilan M, (2024) The Knitwear Capital Of India: An In-Depth Analysis Of Tirupur Textile Industry. *Library Progress International,* 44(3) 17448-17462.

Abstract

Aquaculture, also known as fish farming, is the practice of cultivating aquatic organisms such as fish, shellfish, and plants in controlled environments. While aquaculture has the potential to contribute to global food security and provide economic benefits, it also has several environmental impacts that need to be considered. The main aim of this research is to know the impact and effect of aquaculture in the environment, to analyse the reasons for aquaculture in the environment, to create awareness on aquaculture and its impacts in environment, to find the importance of aquaculture business in economy. The present paper was analysed through the doctrinal research methodology and empirical method of research was used. The present analysis was made through a convenient sampling method where the survey was taken from the common public, students, professionals, etc. The sample size in the present analysis is 203 samples responded. The research tools used in the present paper such as graphical representation were also used to analyse the study. The environmental impacts of aquaculture can vary depending on various factors, including farming methods, species cultivated, location, and management practices. Sustainable aquaculture approaches, such as integrated multi-trophic aquaculture, land-based recirculating systems, and proper site selection, can help minimize these environmental impacts and promote responsible and sustainable practices in the industry. These include the adoption of responsible farming techniques, proper waste management, the use of alternative feeds, improved disease management, and the implementation of regulations and guidelines. By adopting these practices, it is possible to minimize the negative environmental effects of aquaculture and promote the industry's sustainability for the future.

KEYWORDS: Aquaculture, Environmental growth, Nutrition and Health benefits of marine, Marine habitation, water pollution.

INTRODUCTION

Aquaculture, also known as fish farming, is the practice of cultivating aquatic organisms such as fish, shellfish, and plants in controlled environments. While aquaculture has the potential to contribute to global food security and provide economic benefits, it also has several environmental impacts that need to be considered. Habitat Destruction: The establishment of aquaculture facilities can lead to the destruction or alteration of natural habitats such as wetlands, mangroves, and coastal areas. Water Pollution: Aquaculture operations generate large amounts of waste, including uneaten feed, faeces, and chemicals. High nutrient levels from fish farms can cause eutrophication, depleting oxygen levels and leading to the growth of harmful algal blooms. Escapes and Genetic Interactions: Farmed fish can escape from aquaculture facilities and potentially interbreed with wild populations. Chemical Use: Aquaculture operations often rely on the use of chemicals such as antibiotics, pesticides, and antifouling agents to control diseases and parasites, and maintain water quality. Feed Production: Many aquaculture species are fed with fishmeal and fish oil, which are often derived from wild-caught fish. The large-scale fishing of these forage fish can lead to overfishing and disrupt marine food chains. Energy Use and Greenhouse Gas Emissions: Aquaculture facilities require energy for various operations, including heating, lighting, water circulation, and processing. It's worth noting that the environmental impacts of aquaculture can vary depending on the specific farming methods used, the location of the farms, and the species being cultivated. Governments around the world have recognized the importance of aquaculture in meeting the growing demand for seafood and have implemented various initiatives to support and regulate the industry. It's important to note that government initiatives on aquaculture can vary significantly across countries and regions, depending on local priorities, resources, and environmental conditions. The specific initiatives implemented also evolve over time as the understanding of aquaculture's impacts and best practices continues to develop. Shrimp Farming: India is one of the largest producers of farmed shrimp, primarily located in coastal regions. Shrimp farming has led to concerns over mangrove destruction and loss of important coastal habitats. The conversion of mangroves into shrimp ponds can result in habitat loss for various species and impact coastal ecosystems. Norway: Norway is a major producer of farmed salmon. Aquaculture has had impacts on wild salmon populations due to the potential spread of diseases and parasites from farmed to wild fish. Escapes from salmon farms have also raised concerns regarding genetic interactions and competition with wild populations. China: China is the world's largest producer of farmed fish and has faced challenges related to water pollution and habitat degradation. The rapid growth of aquaculture has resulted in significant environmental pressures, including eutrophication, habitat loss, and pollution from intensive farming practices. It's important to note that the environmental impacts of aquaculture can be influenced by various factors, including the scale and intensity of operations, farming techniques used, regulatory frameworks, and environmental conditions specific to each country or region. Efforts are being made globally to promote sustainable aquaculture practices, improve monitoring and regulation, and reduce the industry's environmental footprint.

OBJECTIVE

1. To know the impact and effect of aquaculture in the environment
2. To analyse the reasons of aquaculture in the environment
3. To create awareness on aquaculture and its impacts in the environment
4. To find the importance of aquaculture business in economy

LITERATURE REVIEW:

(Diana, James S., 2019) This overview examines the status and trends of seafood production, and the positive and negative impacts of aquaculture on biodiversity conservation. Capture fisheries have been stabilized at about 90 million metric tons since the late 1980s, whereas aquaculture increased from 12 million metric tons in 1985 to 45 million metric tons by 2004. Aquaculture includes species at any trophic level that are grown for domestic consumption or export. Aquaculture has some positive impacts on biodiversity; for example, cultured seafood can reduce pressure on overexploited wild stocks, stocked organisms may enhance depleted stocks, aquaculture often boosts natural production and species diversity, and employment in aquaculture may replace more destructive resource uses. On the negative side, species that escape from aquaculture can become invasive in areas where they are nonnative, effluents from aquaculture can cause eutrophication, ecologically sensitive land may be converted for aquaculture use, aquaculture species may consume increasingly scarce fish meal, and aquaculture species may transmit diseases to wild fish. Most likely, aquaculture will continue to grow at significant rates through 2025, and will remain the most rapidly increasing food production system. **(Shang, Yung C., 1985)** The economics of aquaculture is reviewed on two levels: micro and macro. Microeconomics in aquaculture deals mainly with the management measures and elements affecting the efficiency of operation at the farm level, while macro-economics addresses the assessment of social benefits and costs of an aquaculture project. If aquaculture is socially beneficial but unattractive to private investors, public support on credit, marketing, extension, training, and research may be appropriate, especially during the early stages of development. The importance of economic analysis is emphasized since it provides a basis not only in the decision making of the individual farmer, but also in the formulation of aquaculture policies. Thus, greater attention should be focused on the improvement of economic data for analysis. **(Sanchez-Jerez, P., I. Karakassis, F. Massa, D. Fezzardi, J. Aguilar-Manjarrez, D. Soto, R. Chapela, et al., 2015)** Aquaculture is an increasingly important food-producing sector, providing protein for human consumption. However, marine aquaculture often struggles for space due to the crowded nature of human activities in many marine coastal areas, and because of limited attention from spatial planning managers. Here, we assess the need for coastal spatial planning, emphasising the establishment of suitable areas for the development of marine aquaculture, termed Allocated Zones for Aquaculture (AZAs), in which aquaculture has secured use and priority over other activities, and where potential adverse environmental impacts and negative interactions with other users are minimised or avoided. We review existing examples of marine aquaculture spatial development worldwide and discuss the proper use of site selection in relation to different legal and regulatory requirements. National or regional authorities in charge of coastal zone management should carry out spatial planning defining optimal sites for aquaculture to promote development of sustainable marine aquaculture and avoid conflict with other users, following a participatory approach and adhering to the principles of ecosystem-based management. **(Goldburg, Rebecca, and Rosamond Naylor, 2005)** The depletion of many marine fisheries has created a new impetus to expand seafood production through fish farming, or aquaculture. Marine aquaculture, especially of salmon and shrimp, has grown considerably in the past two decades, and aquaculturists are also beginning to farm other marine species. Production data for salmon and shrimp indicate that farming supplements, rather than substitutes for fishing. Since most farmed marine fish are carnivores, farming them relies on the capture of finite supplies of wild fish for use in fish feeds. As aquaculture is not substituting for wild fisheries, heavy dependence on wild fish inputs is a concern as marine aquaculture grows. Other likely impacts include escapes of farmed fish and large-scale waste discharges from fish farms. A viable future for marine ecosystems will require incorporation of ecological perspectives into polices that integrate fishing, aquaculture, and conservation. **(Wiber, Melanie Gay, Sheena Young, and Lisette Wilson, 2012)** The Bay of Fundy along the southwest coast of New Brunswick, Canada is one of the most densely stocked finfish aquaculture areas in the world. An inshore multispecies fishery that dates back to the earliest European settlement shares these waters, and has been the economic mainstay of coastal communities. These inshore fishermen are increasingly displaced by the expanding aquaculture industry. A recent study conducted among fishermen in Southwest New Brunswick recorded their observations about the environmental impact of finfish aquaculture and the consequences for their commercial fishery. Fishermen all reported significant environmental degradation around aquaculture sites. Within 2 years of an operation being established, fishermen reported that gravid female lobsters as well as herring avoid the area, scallop and sea urchin shells become brittle, scallop meat and sea urchin roe becomes discolored. The use of chemicals to control sea lice on farmed salmon has also caused lobster, crab and shrimp kills. These and other concerns suggest that more comprehensive and detailed studies are required to establish the environmental and economic interactions of aquaculture and the inshore fishery, as well as on the stocks on which that fishery rely. The study also points to the need for more effective use of fishermen's knowledge in designing such studies.

(James S. Diana, Hillary S. Egna, Thierry Chopin, Mark S. Peterson, Ling Cao, Robert Pomeroy, Marc Verdegem, William T. Slack, Melba G. Bondad-Reantaso, and Felipe Cabello, 2013) As aquaculture production expands, we must avoid mistakes made during increasing intensification of agriculture. Understanding environmental impacts and measures to mitigate them is important for designing responsible aquaculture production systems. There are four realistic goals that can make future aquaculture operations more sustainable and productive: (1) improvement of management practices to create more efficient and diverse systems at every production level; (2) emphasis on local decisionmaking, human capacity development, and collective action to generate productive aquaculture systems that fit into societal constraints and demands; (3) development of risk management efforts for all systems that reduce disease problems, eliminate antibiotic and drug abuse, and prevent exotic organism introduction into local waters; and (4) creation of systems to better identify more sustainably grown aquaculture products in the market and promote them to individual consumers. By 2050, seafood will be predominantly sourced through aquaculture, including not only finfish and invertebrates but also seaweeds. **(Price, Carol, Kenneth D. Black, Barry T. Hargrave, and James A. Morris, 2015)** Increasing human population and reliance on aquaculture for seafood will lead to expansion of the industry in the open ocean. To guide environmentally sustainable expansion, coastal stakeholders require tools to evaluate the risks that marine aquaculture poses and to craft science-based policies and practices which safeguard marine ecosystems. We summarized current knowledge regarding dissolved nutrient loading from marine fish farms around the world, direct impacts on water quality and secondary impacts on primary production, including formation of harmful algal blooms. We found that modern operating conditions have minimized impacts of individual fish farms on marine water quality. Effects on dissolved oxygen and turbidity are largely eliminated through better management.

Nutrient enrichment of the near-field water column is not detectable beyond 100 m of a farm when formulated feeds are used, and feed waste is minimized. We highlight the role of siting fish farms in deep waters with sufficient current to disperse nutrients and prevent water quality impacts. We extensively discuss the potential for advances in integrated multi-trophic aquaculture (IMTA) to assimilate waste nutrients. Although modern farm management practices have decreased environmental effects of marine fish farms, we conclude that questions remain about the additive impacts of discharge from multiple farms potentially leading to increased primary production and eutrophication. Research results on secondary effects upon primary production are highly variable. In some locations, nutrient loading has little or no trophic impact, while at others there is evidence that nutrients are assimilated by primary producers. Research on far-field and regional processes, especially in intensively farmed areas and over longer time scales, will refine understanding of the full ecological role of fish farms in marine environments. **(Troell, Max, Rosamond L. Naylor, Marc Metian, Malcolm Beveridge, Peter H. Tyedmers, Carl Folke, Kenneth J. Arrow, et al., 2014)** Aquaculture is the fastest growing food sector and continues to expand alongside terrestrial crop and livestock production. Using portfolio theory as a conceptual framework, we explore how current interconnections between the aquaculture, crop, livestock, and fisheries sectors act as an impediment to, or an opportunity for, enhanced resilience in the global food system given increased resource scarcity and climate change. Aquaculture can potentially enhance resilience through improved resource use efficiencies and increased diversification of farmed species, locales of production, and feeding strategies. However, aquaculture's reliance on terrestrial crops and wild fish for feeds, its dependence on freshwater and land for culture sites, and its broad array of environmental impacts diminishes its ability to add resilience. Feeds for livestock and farmed fish that are fed rely largely on the same crops, although the fraction destined for aquaculture is presently small (~ 4%). As demand for high-value fed aquaculture products grows, competition for these crops will also rise, as will the demand for wild fish as feed inputs. Many of these crops and forage fish are also consumed directly by humans and provide essential nutrition for low-income households. Their rising use in aquafeeds has the potential to increase price levels and volatility, worsening food insecurity among the most vulnerable populations. Although the diversification of global food production systems that includes aquaculture offers promise for enhanced resilience, such promise will not be realized if government policies fail to provide adequate incentives for resource efficiency, equity, and environmental protection. **(Reid, Gregor K., Helen J. Gurney-Smith, David J. Marcogliese, Duncan Knowler, Tillmann Benfey, Amber F. Garber, Ian Forster, et al., 2019)** The heavy reliance of most global aquaculture on the ambient environment suggests inherent vulnerability to climate change effects. This review explores the potential effects of climate change stressors on aquaculture biology and resources needed to support decision-making for vulnerability assessment, planned adaptation, and strategic research development. Climate change-mediated physiochemical outcomes important to aquaculture include extreme weather, precipitation and surge-based flooding, water stress, ocean acidification, sea-level rise, saltwater intrusion, and changes to temperature, salinity, and dissolved oxygen. Culture practices, environment, and region affect stressor exposure, and biological response between species or populations are not universal. Response to a climate change stressor will be a function of where changes occur relative to optimal ranges and tolerance limits of an organism's life stage and physiological processes; the average magnitude of the stressor over the production cycle; stressor rate of change; variation, frequency, duration, and magnitude of extremes; epigenetic expression, genetic strain, and variation within and between populations; health and nutrition; and simultaneous stressor occurrence. Information from the largest aquaculture producers such as China and the top 3 global culture species is still sparse in the literature. This potentially limits thorough understanding of climate change effects on some regional aquaculture sectors. **(Reid, Gregor K., Helen J. Gurney-Smith, Mark Flaherty, Amber F. Garber, Ian Forster, Kathy Brewer-Dalton, Duncan Knowler, et al., 2019)** Increases in global population and seafood demand are occurring simultaneously with fisheries decline in an era of rapid climate change. Aquaculture is well positioned to help meet the world's future seafood needs, but heavy reliance of most global aquaculture on the ambient environment and ecosystem services suggests inherent vulnerability to climate change effects. There are, however, opportunities for adaptation. Engineering and management solutions can reduce exposure to stressors or mitigate stressors through environmental control. Epigenetic adaptation may have the potential to improve stressor tolerance through parental or early life stage exposure. Stressor-resistant traits can be genetically selected for, and maintaining adequate population variability can improve resilience and overall fitness. Information at appropriate time scales is crucial for adaptive response, such as real-time data on stressor levels and/or species' responses, early warning of deleterious events, or prediction of longer-term change. Diet quality and quantity have the potential to meet increasing energetic and nutritional demands associated with mitigating the effects of abiotic and biotic climate change stressors. Research advancements in understanding how climate change affects aquaculture will benefit most from a combination of empirical studies, modelling approaches, and observations at the farm level. Research to support aquaculture adaptation requires an increasing amount of environmental data to guide biological response studies for regional applications. Increased experimental complexity, resources, and duration will be necessary to better understand the effects of multiple stressors. Ultimately, in order for aquaculture sectors to move beyond short-term coping responses, governance initiatives incorporating the changing needs of stakeholders, users, and culture ecosystems as a whole are required to facilitate planned climate change adaptation and mitigation.

(Peel, D., and M. G. Lloyd., 2008) This paper provides a new discussion of the emerging governance regime for marine and coastal environments. It examines the evolution from a non-statutory to a statutory planning regulatory regime for marine aquaculture in Scotland. Specifically, the definition of development, which underpins the statutory operation of the terrestrial planning system, has been extended to include aquaculture developments within 12 nautical miles of the coast. This effectively expands the geographical territory over which land use planning controls operate in Scotland, and coincides with an emerging interest in the governance, planning and management of the marine environment. Taking into account the various controls put in place over time, the paper identifies the changing state-market-civil relations involved in this shift. Notably, over time, the state has progressively intervened in different ways to correct the perceived market failures associated with aquaculture and its environment. The analysis presented here illustrates the deliberate transition to a statutory planning context through a review of the steps taken by the stakeholders involved to devise a regulatory regime that better serves a contemporary social construction of the public interest. It provides evidence of an explicit attempt within the wider modernisation project to design an appropriate form of governance that is open, participative, accountable, coherent and effective. The paper suggests that the elaboration of such contemporary forms of active mediation remain iterative, partial and dysfunctional and points to an important research agenda to inform the emerging marine environmental planning and governance debates. **(Hopkins, J. Stephen, Paul A. Sandifer, M. Richard DeVoe, A. Frederick Holland, Craig L. Browdy, and Alvin D. Stokes., 1995)** Shrimp culture technology has resulted in development of a major shrimp farming industry worldwide. Without the shrimp farming industry, increasing demands for shrimp by consumers could not be met, resulting in increased pressure on wild shrimp resources. Unfortunately, there are realized and potential adverse environmental effects on estuarine ecosystems as a result of shrimp farming. The effects can be categorized as wetland destruction for construction of shrimp farms, hypernutrification of estuarine ecosystems by shrimp pond effluent, "biological pollution" of native shrimp stocks through escapement of aquaculture stocks, water use and entrainment of estuarine biota, and impacts of shrimp farm chemicals on estuarine systems. While the shrimp farming industry in the United States is small, the United States is effectively addressing all the realized and potential environmental impacts through regulation and research at the federal and state levels. Areas of regulation and research include stringent prohibitions on wetland destruction, regulation of effluents and support of research to eliminate and/or reduce effluents, escapement prevention technology and development of high-health stocks, minimizing entrainment of estuarine biota through water conservation and screening technology, and regulation of chemical use in the shrimp farming industry and support of research on shrimp pathology and environmentally safe disease control. Work is still in progress and not all problems have been resolved to the complete satisfaction of shrimp farmers and estuarine conservationists. However, the situation in the United States should serve as a model of how to encourage sustainable economic development through commercial shrimp farming while abating adverse environmental impacts on estuarine systems. To further improve the situation, the development and adoption of "best management practices" for shrimp aquaculture are recommended. **(MIKKELSEN, EIRIK, 2007)** In this paper, I investigate aquaculture externalities on fisheries, affecting either habitat, wild fish stock genetics, or fishing efficiency under open-access and rent-maximising fisheries. This is done with a Verhulst-Schaefer model of fish population-dynamics and production, coupled with a simple aquaculture production model. Externalities are modelled by letting carrying capacity, the stock's intrinsic growth rate, or catchability coefficient in the fishery depend on aquaculture production. The different externalities can give totally opposite results on steady-state fishing effort, yield, and stock, even for only negative externalities. With a catchability externality, increased unit cost of fishing effort implies reduced aquaculture production to maximise benefits to society under reasonable assumptions. Resource allocation between the industries is analysed under three different coastal management regimes: 1) aquaculture has a primary right of use; 2) joint management of aquaculture and fishery; 3) fishers have a primary right of use, including the right to sell marine farming rights. **(Chu, Jingjie, James L. Anderson, Frank Asche, and Lacey Tudur., 2010)** Aquaculture is a controversial issue in the U.S.A., and to what extent U.S. aquaculture stakeholders support its expansion determines the future of this industry. This paper compares the perceptional differences of aquaculture stakeholders in the U.S.A. and Norway, and investigates how their perceptions influence their decisions to support aquaculture development. Original data were collected from an online survey of key aquaculture stakeholders and experts in both countries. Based on multinomial logit models, all of the perception variables contribute significantly to the likelihood that an aquaculture stakeholder is willing to support aquaculture expansion. These findings provide useful information for U.S. and Norwegian aquaculture policymakers, regulators, and stakeholders regarding how perceptions influence decisions; the key perception differences between the U.S.A. and Norway; and how policies, practices, and education could change perceptions of aquaculture stakeholders and thereby the future of U.S. and Norwegian aquaculture. **(Rosenthal, Harald., 1985)** Aquaculture can be considered as a rapidly growing industry in many parts of the world. The impressive overall upward trend in production is likely to continue for the rest of the century. However, aquaculture will still be a minor contributor to the world's protein supply, even though the projected annual output of about 30 million tons can be realized by the year 2000. Nevertheless, aquaculture can play an important role in many developing countries not only within the context of rural development, but also as a commercial activity that focuses on export markets. Progress in aquaculture will always be accompanied by a number of constraints that occur with or through expansion of this industry. Some of the most important problem areas are briefly addressed, including those related to environmental degradation, disease control, human health and competition for resources. Finally, gaps in science and technology as well as research priorities are identified.

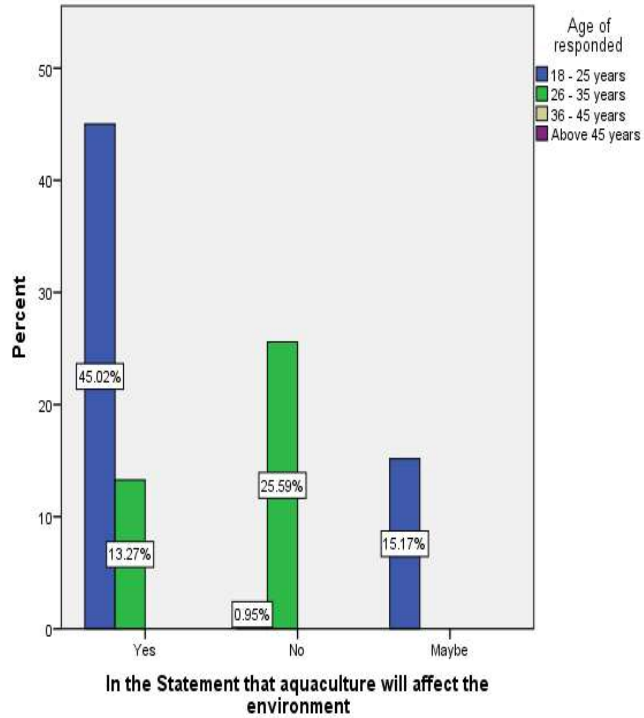
(Cranford, Peter J., Pauline Kamermans, Gesche Krause, Joseph Mazurié, Bela H. Buck, Per Dolmer, David Fraser, et al., 2012) An ecosystem-based approach to bivalve aquaculture management is a strategy for the integration of aquaculture within the wider ecosystem, including human aspects, in such a way that it promotes sustainable development, equity, and resilience of ecosystems. Given the linkage between social and ecological systems, marine regulators require an ecosystem-based decision framework that structures and integrates the relationships between these systems and facilitates communication of aquaculture–environment interactions and policy-related developments and decisions. The Drivers-Pressures-State Change-Impact-Response (DPSIR) management framework incorporates the connectivity between human and ecological issues and would permit available performance indicators to be identified and organized in a manner that facilitates different regulatory needs. Suitable performance indicators and modeling approaches, which are used to assess DPSIR framework components, are reviewed with a focus on the key environmental issues associated with bivalve farming. Indicator selection criteria are provided to facilitate constraining the number of indicators within the management framework. It is recommended that an ecosystem-based approach for bivalve aquaculture be based on a tiered indicator monitoring system that is structured on the principle that increased environmental risk requires increased monitoring effort. More than 1 threshold for each indicator would permit implementation of predetermined impact prevention and mitigation measures prior to reaching an unacceptable ecological state. We provide an example of a tiered monitoring program that would communicate knowledge to decision-makers on ecosystem State Change and Impact components of the DPSIR framework. **(Han, Hongyun, and Ye Jiang., 2018)** China's fishery has undergone the structural changes of shifting from fishing-dominated to aquaculture-dominated sectors. Structural changes of mariculture sector are undergoing as a result of internal and external factors, rising demand, government promotion policies, technological advancement, resource and environmental constraints should be responsible for the evolution of geographical distribution, varieties, waters and modes, which in turn have exerted environmental impacts. It is shown that mariculture is transferring from traditional waters to deep-sea and onshore waters. Accompanying the development of new varieties, intensive modes are developed fast while traditional extensive modes are still dominant. The rapid development of intensive mariculture and modern mariculture modes has exerted internal source pollution to marine environment. To facilitate sustainable development of mariculture, it is necessary to expand the mariculture space, optimize the cultivated modes and varieties. It is believed that irrational human economic activities should be responsible for coastal water pollution and ecological degradation. Scientific guidance on mariculture industry layout, modern ecological farming pattern and reasonable matching cultured population, the development of mariculture technologies and pollution treatment facilities, and supervision and guidance of laws and regulations are urgently required to facilitate balanced sustainable development of mariculture. **(Kutty, M. N, 1999)** While Asia's share in 1996 global aquaculture production of fish and shelfish (26.38 million mt as estimated by FAO) was maximal (91%), those of Europe (4.7%) and North America (1.8%) were low. Intriguingly, the relative increases (%) in production over the decade in both the developed continents have decreased. Among the top ten producer countries, China accounted for 67% of total world production, followed by India (7%), Japan (3%), Indonesia (2.5%), Thailand (1.9%), USA and Bangladesh (1.5%), Korea (RoK) (1.4%), Philippines (1.3%) and Norway (1.2%). While India has increased its farmed freshwater fish production and shrimps very impressively, utilization of marine aquatic resources (except for shrimps), spread over an expansive EEZ of two million km2, is poor. India has little production of farmed marine fishes, molluscs and seaweeds, in which even smaller Asian countries excel. An index of Biodiversty Utilization for Aquaculture (BUA), calculated for India is quite low (0.13), when compared to the highest (0.51) for Taiwan and RoK. India can gain much by diversification of aquaculture, recruiting more species from her rich aquatic fauna and flora and also by developing ecofriendly and sustainable aquaculture systems by sharing of experience and technology with our Asian neighbours through cooperative efforts. **(ANDERSON, JAMES L., 2019)** This paper explores the relationship between traditional fisheries, fisheries enhancement (ranching), and aquaculture. It evaluates why they are different and why fisheries economists have largely neglected aquaculture issues, despite the fact that most of the growth in fish supply over the past two decades has been the result of aquaculture development. It is argued that the core difference between aquaculture and traditional fisheries is the degree of control; control of the environment, production, and marketing systems. It is further argued that the degree of control is closely related to the strength of property rights. Three examples are presented to provide empirical support for the propositions. They focus on the salmon, lobster, and shrimp industries. **(Ike, Nwachukwu, and Onuegbu Roseline, 2007)** This paper evaluated the level of adoption of aquaculture technology extended to farmers in Imo State, Nigeria. To improve aquaculture practice in Nigeria, a technology package was developed and disseminated to farmers in the state. This package included ten practices that the farmers were supposed to adopt. Eightytwo respondents were randomly selected from the three zones of the state. Data were collected through structured interview schedule. The results showed that the level of adoption of the technology was low. Less than half of the respondents adopted the technology. After the construction of the ponds, which were usually not to specification, the farmers found it difficult to adopt the other recommendations, (e.g., pond maintenance, feeding, harvesting, and fish preservation). It was discovered that the farmers did not have adequate funds to maintain their small ponds and to purchase the necessary feed and other necessities for aquaculture. To increase the level of adoption of aquaculture technologies in Nigeria, it is necessary to change its perception from subsistence to commercial and sustainable farming practice; to assist the farmers with credit facilities and to provide closer monitoring of the process by extension agents.

METHODOLOGY

The present paper was analysed through the doctrinal research methodology and empirical method of research was used. The present analysis was made through a convenient sampling method where the survey was taken from the common public, students, professionals, etc. The sample size in the present analysis is 203 samples responded, the independent variables in this analysis are gender and age of response, occupations, educational qualification. The dependent variables are in the statement that aquaculture will affect the environment, that aquaculture impact on the sustainable development of the environment, what are causes that affects the environment by doing aquaculture, why the aquaculture plays an important role growing business; the aquaculture will impact in the overfishing on the wild stock. The research tools used in the present paper such as graphical representation were also used to analyse the study.

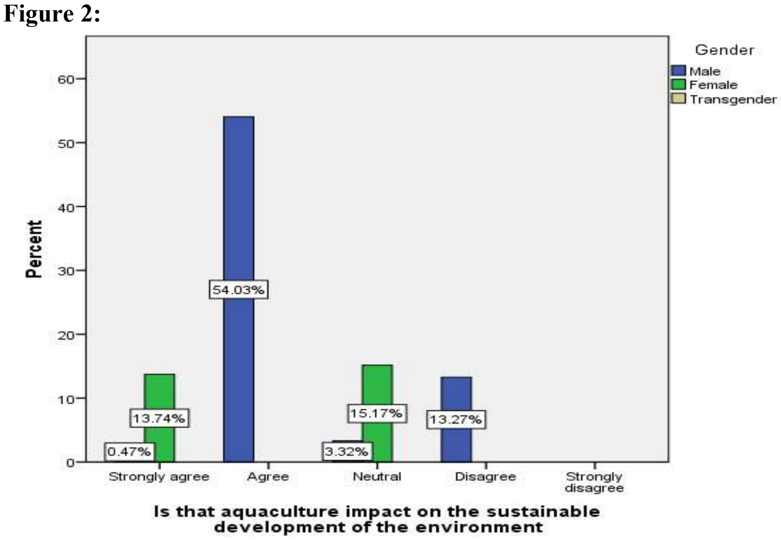
ANALYSIS:

Figure 1:

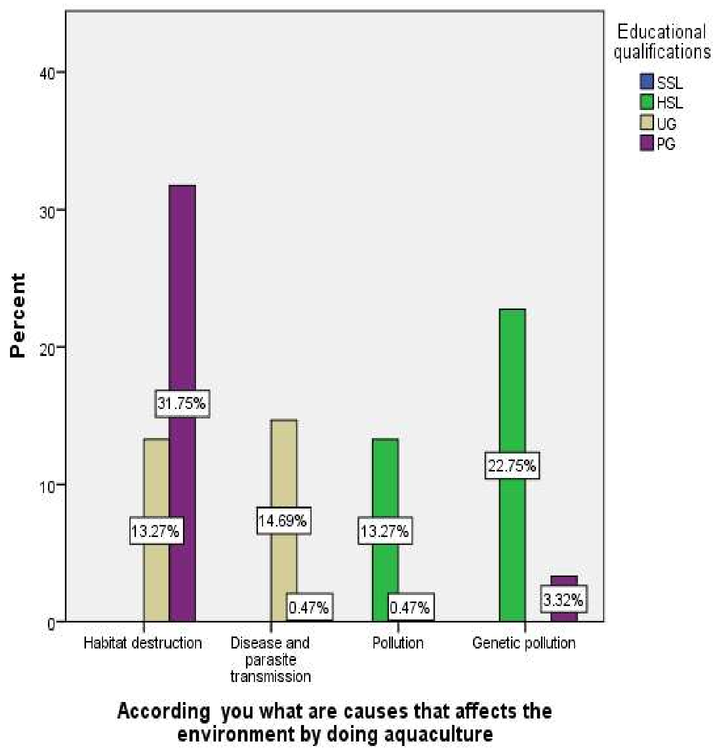


Legend:
This table tells the age of respondents and aquaculture affects the environment.

Figure 2:



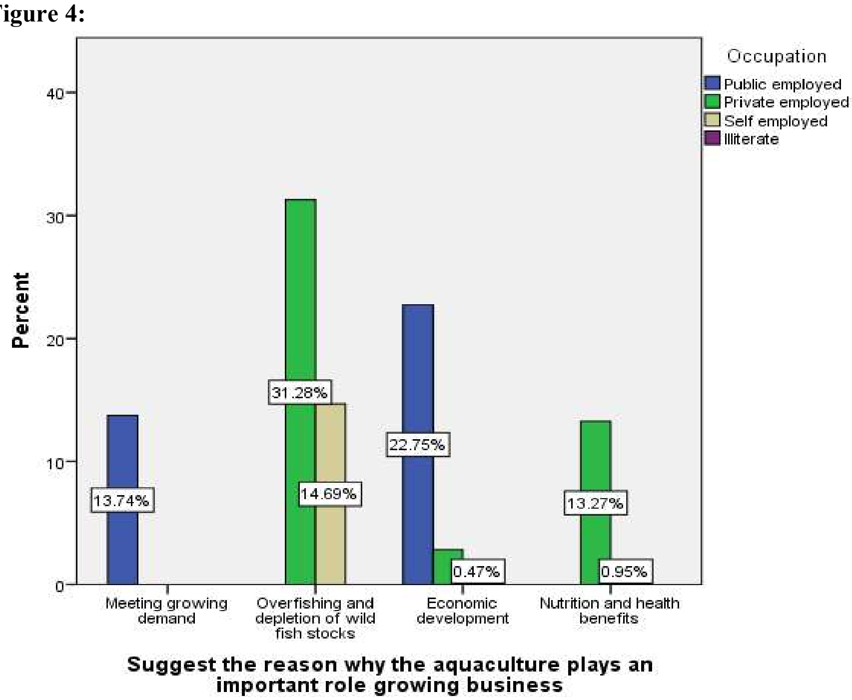
Legend:
This Table tells that gender and the aquaculture impact on the sustainable development of the environment.
Figure 3:



Legend:

This bar tells the educational qualifications and the causes that affect the environment by doing aquaculture.

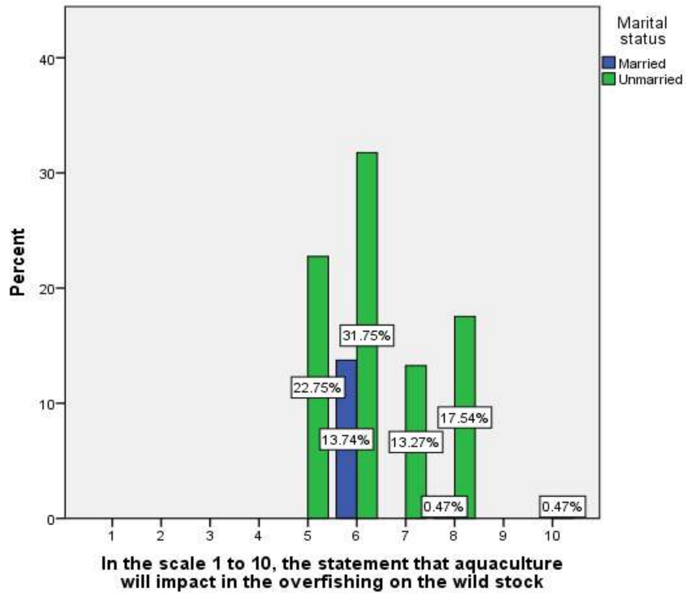
Figure 4:



Legend:

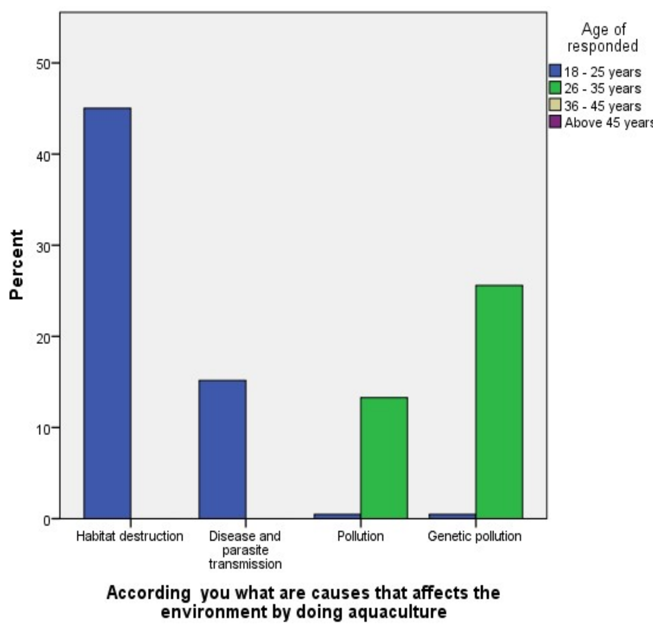
This bar tells the occupation and the aquaculture plays an important role growing business.

Figure 5:

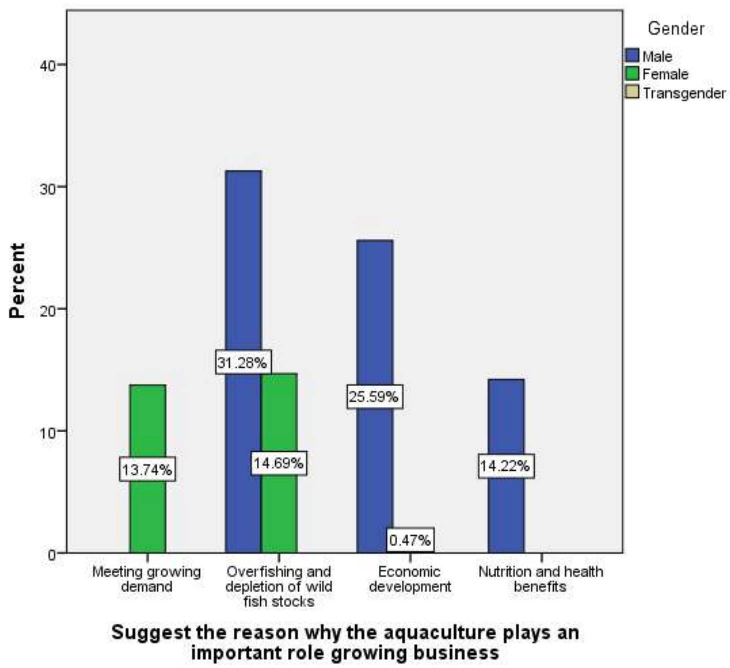


Legend:
This bar tells the Marital status and the impact of overfishing on the wild stock.

Figure 6:

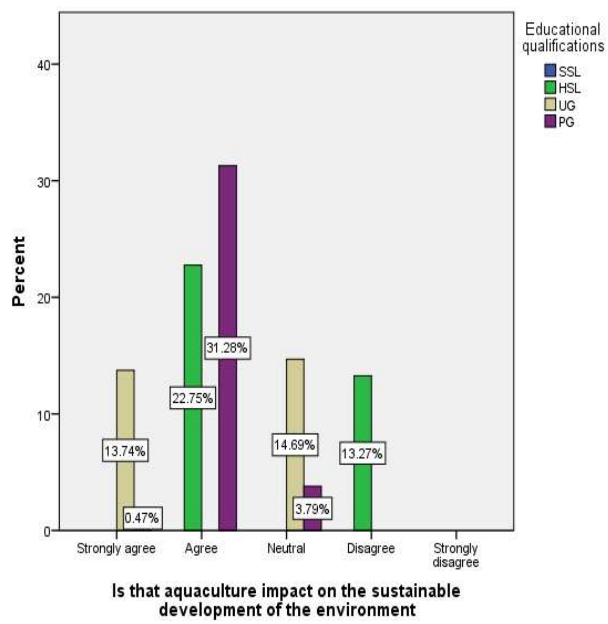


Legend:
This bar tells the age of respondents and the causes that affect the environment by doing aquaculture.
Figure 7:

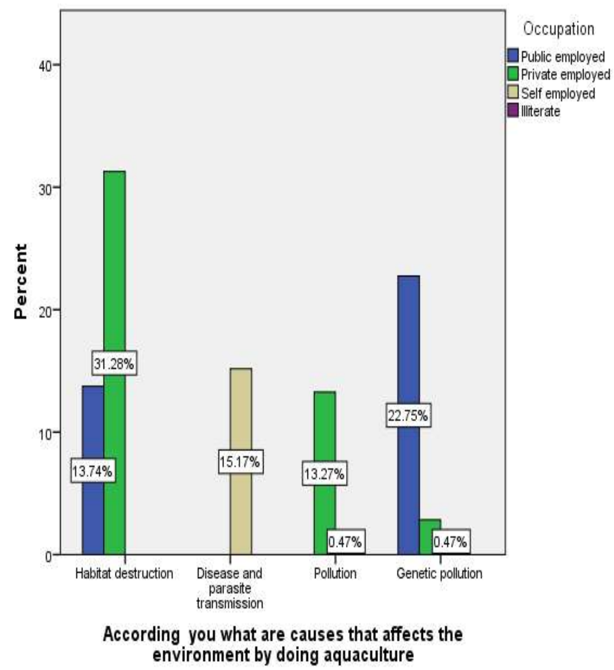


Legend:
This bar tells the gender and the aquaculture plays an important role in growing business.

Figure 8:

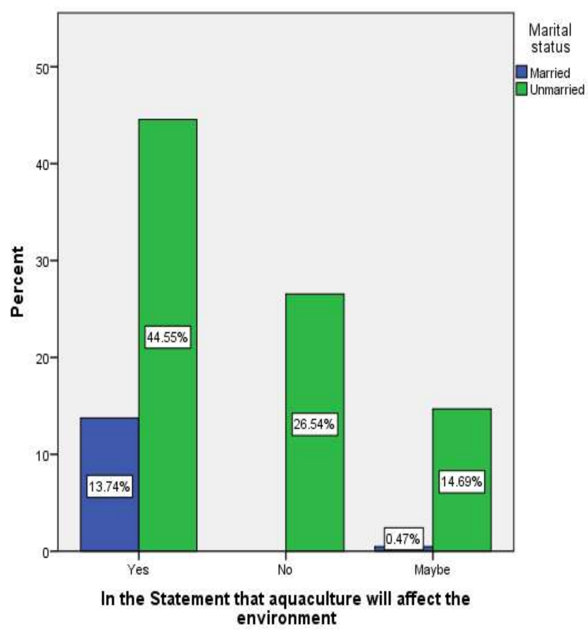


Legend:
This bar tells the educational qualification and the impact on the sustainable development of the environment.
Figure 9:

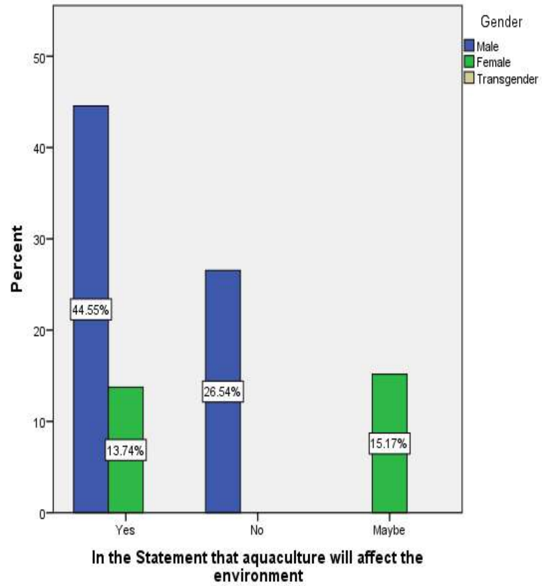


Legend:
This bar tells the occupation and the causes that affect the environment by doing aquaculture.

Figure 10:



Legend:
This bar tells the marital status and the aquaculture affects the environment.
Figure 11:



Legend:
This bar tells the Gender and the aquaculture that affect the environment.

RESULTS:

From (Figure 1) it revealed that 45.02% of 18-25 year old respondents stated Yes for aquaculture that affects the environment and 25.59% of 26-35 year old respondents stated No and 15.17% of 18-25 year old respondents stated Maybe.**From (Figure 2)** it revealed that 54.03% of Male respondents stated Agree for aquaculture impact on the sustainable development of the environment and 15.17% of Female respondents stated Neutral and 13.74% of Female respondents stated Strongly agree.**From (Figure 3)** it revealed that 31.75% of PG graduates stated Habitat destruction as the cause which affects the environment by doing aquaculture and 22.75% of HSL qualifications respondents stated Genetic Pollution as the cause and 13.27% of UG graduates stated Habitat destruction as the cause.**From (Figure 4)** it revealed that 31.28% of Private employed respondents stated overfishing and depletion of wild fish stocks as the reason that aquaculture plays an important role in growing business and 22.75% of Public employed respondents stated Economic development as the reason and 13.75% of Private employed respondents stated Nutrition and Health benefits as the reason.**From (Figure 5)** it revealed that 31.75% of Unmarried respondents stated a scale of 6 for the aquaculture that will impact in the overfishing on the wild stock and 22.75% of Unmarried respondents stated a scale of 5 and 17.54% of Unmarried respondents stated a scale of 8.**From (Figure 6)** it revealed that 18-25 year old respondents stated Habitat destruction as the major cause which is 45% that affects the environment by doing aquaculture and 26-35 year old respondents stated Genetic pollution as the cause which is 25% .**From (Figure 7)** it revealed that 31.28% of Male respondents stated that Overfishing and depletion of wild fish stocks as the reason that aquaculture plays an important role in growing business and 25.59% of Male respondents stated Economic development as the reason and 14.22% of the same category stated Nutrition and health benefits as the reason.**From (Figure 8)** it revealed that 31.28% of PG respondents stated Agree for the aquaculture that will impact on the sustainable development of the environment and 22.75% of HSL qualification respondents stated Agree and 14.69% of UG respondents stated Neutral.**From (Figure 9)** it revealed that 31.28% of Private employed respondents stated that Habitat destruction as the cause that affect the environment by doing aquaculture and 22.75% of Public employed respondents stated Genetic pollution as the cause and 15.17% of self employed respondents stated Disease and Parasite transmission as the cause.**From (Figure 10)** it revealed that 44.55% of Unmarried respondents stated Yes for aquaculture that will affect the environment and 26.54% of Unmarried respondents stated No and 14.69% of the same category stated Maybe.**From (Figure 11)** it revealed that 44.55% of Male respondents stated Yes for aquaculture that will affect the environment and 26.54% of the same category stated No and 15.17% of Female respondents stated Maybe.

DISCUSSION:

From (Figure 1) it revealed that the majority of 18-25 year old respondents stated Yes for aquaculture that affects the environment.**From (Figure 2)** it revealed that majority of Male respondents stated Agree for aquaculture impact on the sustainable development of the environment.**From (Figure 3)** it revealed that PG graduates stated Habitat destruction as the cause which affects the environment by doing aquaculture.**From (Figure 4)** it revealed that Private employed respondents stated overfishing and depletion of wild fish stocks as the reason that aquaculture plays an important role in growing business.**From (Figure 5)** it revealed that Unmarried respondents stated a scale of 6 for the aquaculture that will impact in the overfishing on the wild stock.**From (Figure 6)** it revealed that 18-25 year old respondents stated Habitat destruction as the major cause.**From (Figure 7)** it revealed that of Male respondents stated that Overfishing and depletion of wild fish stocks as the reason that aquaculture plays an important role in growing business.**From (Figure 8)** it revealed that PG respondents stated Agree for the aquaculture that will impact on the sustainable development of the environment.**From (Figure 9)** it revealed that Private employed respondents stated that Habitat destruction as the cause that affect the environment by doing aquaculture.**From (Figure 10)** it revealed that Unmarried respondents stated Yes for aquaculture that will affect the environment. **From (Figure 11)** it revealed that Male respondents stated Yes for aquaculture that will affect the environment.

LIMITATIONS:

In the limitation which is veritably small in the exploration (203) as we know that advanced sample groups will try to exclude the sample error because lower sample size might fail to explain the characteristics of the whole population of the state country, which might lead to sample error (inaccurate results). The sample frame is grounded on the online check not on the arbitrary slice due to the epidemic situation. The main limitation on this exploration, the study of aquaculture and its impacts on the environment.

CONCLUSION & SUGGESTION:

In conclusion, aquaculture, while having the potential to contribute to food security and economic development, also has significant environmental impacts that need to be carefully managed. Habitat Loss: The establishment of aquaculture facilities can result in the conversion or destruction of natural habitats, such as mangroves and wetlands, leading to the loss of important ecosystems and biodiversity. Water Pollution: Aquaculture operations generate waste, including excess nutrients, chemicals, and organic matter, which can be released into surrounding water bodies. Disease and Genetic Interactions: Intensive aquaculture practices can lead to the transmission and spread of diseases and parasites among farmed and wild populations. Chemical Use: The use of chemicals, such as antibiotics and pesticides, in aquaculture can have implications for water quality, non-target organisms, and the development of antibiotic resistance. Feed Production: The reliance on fishmeal and fish oil from wild-caught fish for aquaculture feed can contribute to overfishing and disrupt marine food chains. Energy Consumption and Greenhouse Gas Emissions: Aquaculture facilities require energy, and depending on the energy sources used, can contribute to greenhouse gas emissions and climate change. To mitigate these environmental impacts, sustainable aquaculture practices are being developed and promoted. These include the adoption of responsible farming techniques, proper waste management, the use of alternative feeds, improved disease management, and the implementation of regulations and guidelines. By adopting these practices, it is possible to minimize the negative environmental effects of aquaculture and promote the industry's sustainability for the future.

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