

A Positive Impact on Coastal and Marine Environment By Implementation of Biofloc System

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Abstract

Aquaculture industry is increased extremely from recent years due to requirement and demand. Similarly, the requirement of feed ingredients like fish meal and fish oil demand also increased extremely. Mostly these industries depending on unconsumed or commercially less demand, minor pelagic fin fish which are containing high percentage of bones and fat. The capturing of massive fishery resources changes the marine habitat and biodiversity. In Biofloc system, the nutrients are recycled and the discharge waste contains minimal nutrient levels. Worldwide, among the countries, few are using the Biofloc system which is beneficial to the one who cultivates, as well as to the ecosystem.

Keywords: Aquaculture; Massive capture; Biofloc; Marine habitat and biodiversity

Introduction

From last decade the aquaculture sector is increased vastly with advanced technologies, good culture management and bio security measures etc. The expansion of aquaculture industry will also restrict in future course due to land cost or land availability [1,2]. More over the feed industries must depends on fish meal or fish oil for the synthesis of different types of feeds for aquatic organisms [3]. For these ingredients in turn depends on various types of fishery resources. The demand of fish meal and fish oil increasing due to requirement for the production of aquatic feeds. The annual production of fish meal is 6.3 million tonnes and 1 million tonne of fish oil produced from the 400 production plants by utilizing 33 million tonnes of fish and trimmings [4]. From the 12kg of raw fish grade extract 2.4kg of fish meal and 1kg of fish oil [5]. Generally the feed industries preferred fish meal and its oil by the reason of containing high value of proteins, essential amino acids, minerals and omega-3 fatty acids [6]. The advanced technology is developing during recent days in aquaculture industry for more profits. Among them, the Biofloc system (BFT) is one of the method and in this is technique, the nitrogen wastes were recycled and produced organic protein in situ through microbes and it minimize the food conversion ratio (FCR) levels. BFT system is considering as efficient alternative system due to nutrients will be continuously recycled and reused. The discharges are causes direct impact to marine, estuarine or creek environment without BFT system and lead to eutrophication or shows impact on wild stock by toxic chemicals or diseases. The indirect impact could be shows on environmental which cause the habitat loss and niche space [7,8]. The capturing of various types of fishery resources from shows effect on habitat change and also biodiversity because of the marine ecosystem is

size-structured based food web which means change in the size of population and abundance will leads to change in the quantity and type of prey consumed [9].

Exploitation of Fishery Resources for the Production of Feed

The aquaculture feed produced companies required fish meal and fish oil which is majorly from capture fishery resources. During 2004, 95 million tonnes of fish and shell fishery were captured globally. Among them 34.8 million tonnes were utilized for non-food uses i.e. for the production of fish meal and fish oil for animal feed synthesis [10]. The major capturing species were herring, sardines, mackerel, pilchards, anchovies, sand eels and other non-commercial species. The capturing of Krill was 80,000 tonnes/year for feeding farmed fish and crustaceans [11]. In 2006, 3724 tonnes of fish meal and 835 thousand tonnes of fish oil were consumed by aquaculture industries [12]. The global fisheries production was reached 167.2 million tonnes (Mt) in 2014, with 73.8Mt from aquaculture and 93.4Mt from capture fishery. In capture fishery 81.5Mt from marine waters and remaining from inland waters. The non-food products were reached to 21Mt for the various purposes like pharmaceutical industries, aquatic feed raw materials and for live stock feeds. Of this 21Mt, 15.8Mt utilized as fishmeal and rest for fish oil. In 2015, fish meal and fish oil were produced 4.76Mt and 0.856Mt respectively by utilizing the 13.9Mt of whole fish, 3.75Mt of wild capture by-products and 1.94Mt of aquaculture by-products [13].

Biofloc Technology (BFT) and Its Positive Impact

First BFT system was developed at Ifremer-COP (French

Research Institute for Exploitation of the Sea, Oceanic Center of Pacific) on different penaeid shrimps like *Litopenaeus vannamei*, *L. stylirostris*, *Penaeus monodon* and *Fenneropenaeus merguensis* [14-16]. The BFT system is nothing but the activated suspension technique which means reutilization of nutrients in the pond bottom. During the culture system, animals excreting more nitrogenous waste due to usage of high level of proteins in feed. By using different biofilters can remove these wastes but it involved high cost. In case of BFT system, the inorganic immobilised nitrogen wastes can be utilized by the heterotrophic bacteria and converted into useful organic protein contents in situ by the addition of carbon source [17]. For the growth of heterotrophic bacteria maintain high quality C:N (20:1) ration levels for easily uptake of inorganic nutrients [18-20]. The various carbon sources have to use to increase the carbon levels in pond and is varies on the cultured species like *Macrobrachium rosenbergii* (Acetates, Tapioca, Glucose, Glycerol and Glycerol with Bacillus), *Penaeus monodon* (Cassava meal), Tilapia (Wheat flour, Cellulose), *Litopenaeus vannamei* (Dextrose

and Tapioca) [21]. In Biofloc system, maximise the utilization of wastes and recycled the nutrients levels [22]. The growth of aquatic organisms mainly based on the percentage of protein in the feed in pellets and is containing 24-28%. By using the Biofloc system the can increase protein levels up to 38% and also can provide free amino acids such as alanine, glutamine, arginine and glycine which are acts as attractants also [23-25] and also containing essential fatty acids, minerals and vitamin 'C' which enhances the not only growth and also the immune system [22,26,27]. During the culture of cat fish also observed specific growth rate and low FCR levels with Biofloc technology [28]. The BFT system implemented ponds shown low FCR and also with good survival rates [29,30]. The dried Biofloc contains quality protein and replaces the soya bean meal or fish meal in aqua feeds. The development of BFT will also helpful to prevent diseases from incoming waters due to zero water exchange [31]. Finally, the BFT system will decrease the production cost, beneficial to cultured species to enhance the growth, survival rate and prevention of diseases and also eco friendly.

Aquaculture Impact on Marine Environment

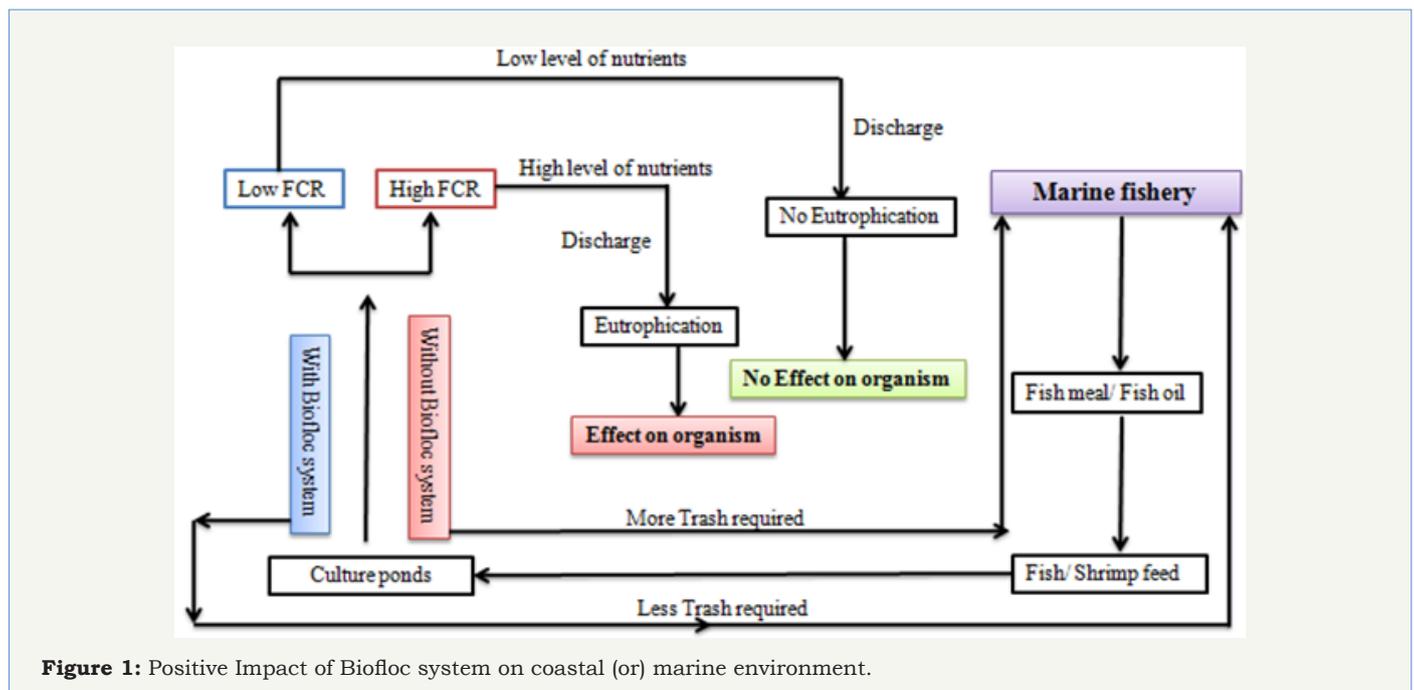


Figure 1: Positive Impact of Biofloc system on coastal (or) marine environment.

From last two decades, the production of post larvae and high protein pellet feeds increased and majorly contributed by Asian countries [32]. The discharges from aquaculture ponds have show negative impact on the creeks and coastal waters. The levels of nitrogen, phosphorus, biological and chemical oxygen demands which leads to effect on biota of the respective areas [33]. The change in the pH levels have also shows impact on organisms due to change in the physiological changes like enzymes, membrane processes etc [34,35]. Worldwide 50% of the mangroves were removed due to development of aquaculture. Moreover, these discharges were changes the water quality and change the productivity levels [36,37]. The countries like Vietnam 90% fish meal is imported and in feature required 2-3 times greater than the present level of usage

[38]. The implementation of BFT system in aquaculture sectors will be directly benefited as economically and indirectly support to eco-friendly (Figure 1). Feed production industries developing remarkably and they required more by products for the synthesis of pellet feeds. No doubt, for feature required more trawlers for catch and it leads to over exploitation as a result of change in the ecosystem and biodiversity as a direct impact and indirectly show impact on bio-geo-chemical cycles [39]. If the replacement of fish meal by using animal and plant proteins will be protect the marine ecosystems. From animals, among invertebrate sources like earthworms, zooplankton and silk worm pupae etc and from vertebrates, blood meal, meat and poultry products etc. From single cell proteins (bacteria and fungi), oil seeds (sunflower, soya been



and cotton seed), legumes and corn meal also acts as potential replacers of fish meal [40]. Ray et al also suggested, synthesis feed from plant based proteins which contain high level of proteins and also less production of nitrogen and phosphorus wastes. Moreover, it is eco-friendly and also reduced over exploitation of marine fishery [41].

Conclusion

The aquaculture feed industries either directly (or) indirectly depends on marine fishery resources for the production of feed and other ingredients. By using Biofloc system, can produce same yield with minimal feed usage (or) less wastage. As a result, most of the marine niches can sustain as like same due to decrease of fishery resources utilization.

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