

# **INTRODUCTION**

## 1.0 INTRODUCTION

Aquaculture, the farming and husbandry of fresh water and marine organisms furnishes about 12 percent of the food, man obtains from the waters of the globe. It is a rapidly growing industry of international significance. Aquaculture is developing, expanding and intensifying in almost all regions of the world. The phenomenal increase in population and the raising demand for animal protein have increased the demand for fisheries development globally. Fish and fishery products contribute around 15% of the animal protein supporting the nutritional security. The world fish production in the order of 130 million metric tons of which 50% is contributed by aquaculture. Fisheries and aquaculture products are globally important sources of much needed, high quality, aquatic animal proteins and invaluable providers of employment, cash income and foreign exchange.

India is the second largest producer of fish through aquaculture next to China. India accounted for 4.7% of world fish production and 2.5% of global market. The annual export earnings from fish and shellfish are more than Rs.8000 crores. India has rich potential for aquaculture and the production definitely can be multiplied by utilizing the available reservoirs, lakes, ponds etc. The global average per capita consumption of fish is around 16 Kg. The present average per capita consumption in India is around 9 Kg. Even to reach the global average of 16 Kg, taking into consideration of 50% of Indian population will be fish consumers; by 2020 the domestic requirement itself will be in the order of 9 million tons. The average fish production in India is around 7 million tons equally contributed by fresh water and marine (Thirunavukkarasu, 2008).

Semi-intensive and intensive fish farming is gaining importance in India. Artificial feed plays an important role in semi-intensive fish culture, where it is required to maintain a high density of fish than the natural fertility of the water can support. The role of supplementary feed in intensive fish farming cannot be ignored as the whole nutritional requirements of fish depend upon the feed (Ayyappan and Jena, 2008). For fish supplementary diet, the continuous dependence on conventional feed stuffs such as fish meal and fish oil has led to an increase in the prices of these components. Although fishmeal represents an ideal nutritional source of dietary protein and lipid for fish, there is an urgent need to reduce the current total of the feed industry upon this expensive and finite commodity of uncertain supply and cost. Financial limitations are depressing the development of aquaculture because of the impact of the increasing prices of fish meal and other traditional protein feed stuffs. Hence research is needed to intensify and utilize less expensive and more sustainable ingredients in fish feeds, while maintaining nutritional quality equal to or better than those based mainly on fish meal.

Plant and animal wastes are receiving considerable attention as possible feed ingredients for fish diets, particularly in developing countries. Animal protein supplements are the principal by-products of animal slaughter houses such as meat and bone meal, poultry by-product meal and fish wastes, which generally contain 45-65 percent crude protein and are good sources of indispensable amino acids. One distinguishing characteristic of feedstuffs of animal origin is their high protein quality. Animal proteins are also rich in trace elements, vitamins, unidentified growth factors (UGF) and essential amino acids (EAA's), especially lysine and methionine. Rendered animal by-products are interesting alternatives to fish meal, because

of their low cost and wide availability. The use of terrestrial animal proteins at the expenses of fish meal in aqua feeds could immediately result in significant savings for feed manufactures.

In intensive systems, fishes have the advantage that they can be fed a prepared feed that includes a high percentage of plant proteins. Protein and lipid from plant sources offer a great promise to extensively replace the fish meal in diets for fishes. The principal raw materials of plant proteins are cereals and their products, roots, tubers, leguminous seeds, vegetable oil extraction residues, kitchen scraps, green vegetable wastes, oilseeds etc. Due to its moderately high protein content relatively low phosphorus content and low cost compared to fish meal, there is an increasing global interest in using plant protein sources in aquaculture diets. Plant proteins can be cost effective and they are free of potential contaminants like dioxin, PCB and mercury. The more economic way to reduce the amount of contaminants in farmed fish is to use plant-based materials as a significant source of some of the proteins and oils in their diet (Krishnankutty, 2005).

In India, with the emergence of large scale commercial carp culture, diseases of varied aetiology are being increasingly recognized as major hurdle to successful and sustainable farming. Disease outbreaks are constraint to aquaculture production thereby affects both economic development of the country and socio-economic status of the local people. Disease control in aquaculture industry has been achieved by following different methods using traditional ways, synthetic chemicals and antibiotics. However, the use of such expensive chemotherapeutants for controlling diseases has been widely criticized for their negative impacts like accumulation of residues in tissues, environmental

pollution, development of drug resistance in pathogens, immunosuppression and reduced consumer preference for aqua products. Traditional methods are also ineffective against controlling new diseases in large aquaculture systems. Therefore, alternative methods need to be developed to maintain a healthy environment in the aquaculture systems thereby to maintain the health of the cultured organisms (Sahu *et al.*, 2008). Use of probiotics, medicinal herbs and veterinary growth promoters is gaining importance in controlling potential pathogens and for the improvement of fish health and aquatic environment.

Probiotics are quite common in health promoting “functional foods” now a day for humans, as well as therapeutic, prophylactic and growth supplements in animal production and human health (Senok *et al.*, 2005). Probiotic is a live microbial adjunct, which has a beneficial effect on the host by modifying the host associated or ambient microbial community, by ensuring improved use of the feed or enhancing its nutritional value, by enhancing the host response towards disease or by improving quality of its ambient environment. The beneficial effects of probiotics include higher growth and feed efficiency, immuno-stimulatory functions, prevention of intestinal disorders and pre-digestion of anti nutritional factors present in the ingredients (Watson, 2008).

Medicinal herbs have been used as popular medicines to secure health and longevity in land mammals and humans in Asia, especially China, India, Japan and Korea. There is a developing interest in using medicinal herbs, as a kind of dietary supplement in aquaculture, and in showing the positive effects on growth and immune response. Medicinal herbs can improve digestibility, quantity of microflora in the intestine by increasing some good microbes and

inhibiting some microbial pathogens and they have growth promoting, anti-stress and antimicrobial characteristics (Ji *et al.*, 2007).

To maximize the growth of fish in normal condition, it must either be genetically manipulated or given a drug, which will act on physiology to improve the metabolic and digestive efficiency. Growth promoters are non-nutritive materials, which at very low levels of incorporation in the feed increase the efficiency of feed utilization. Studies have been conducted on a variety of growth promoters in fishes as feed additives both hormonal and non-hormonal, as a sequence to their effectiveness in livestock. Non hormonal growth promoters include substances like vitamins and minerals, which are added to feed. It is claimed that non-hormonal growth promoters improve animal health and prevent infection apart from enhancing growth rate.

In fresh water aquaculture, Indian major carps have been reared in tanks or artificial ponds on land. Carps have been usually given a moist or dry pellet diet, prepared by mixing an artificial compound diet and fish meal. The fish meal causes water to deteriorate and it settles on the bottom, resulting in self-pollution and outbreaks of infectious diseases. Therefore, an artificial diet that completely satisfies the nutritional and immunological requirements has to be developed for establishing sound technology for the carp culture industry. Recently, strict demands of hygiene and safety of aquacultured fish without concomitant pollutants and antibiotics have increased in India. Aquaculture industries need to improve and progress fish rearing strategies for eradicating and overcoming this problems.

Hence the present study was undertaken in order to evaluate the possibility of using cheaper source of supplementary fish feeds and efficacy of graded levels of plant wastes, animal wastes, probiotics, medicinal herbs and veterinary growth promoters as a feed additive on growth, nutritional indices and feed utilization efficiencies of Indian major carp, *Catla catla*. The objectives of the present study include:

- To identify and utilize less expensive and more sustainable ingredients in fish feed formulation for the culture of edible fresh water fish, *Catla catla* (Hamilton, 1822).
- Formulation of different types of fish feeds using plant wastes (vegetable and fruit wastes), animal wastes (broiler and fish wastes), probiotics (Sporlac<sup>®</sup>, Provisacc<sup>®</sup>, Bioboost<sup>®</sup> and Eubioz<sup>®</sup>), medicinal herbs (*Cynodon dactylon* and *Phyllanthus emblica*) and veterinary growth promoters (Vimeral<sup>®</sup> and Supplevite<sup>®</sup>).
- Nutritional assessment such as protein, carbohydrate and fat contents in the control and prepared feeds.
- Impact of selected feeds on growth parameters (weight gain, length gain and specific growth rate) in *C.catla* during 15, 30, 45 and 60 days of the experiment.
- Estimation of nutritional indices such as water content, protein, carbohydrate, fat, ash and calorific content in the muscle tissues of *C.catla* fed with selected diets before and after treatment.
- To assess the efficiency of prepared feeds on the feed utilization efficiencies such as feed conversion ratio (FCR), protein efficiency ratio (PER), protein productive value (PPV) and feed efficiency (FE) of *C.catla* after the experiment.