

# Research For Sustainable Aquarial Development In Thua Thien Hue Hydro Power Region, Vietnam

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## Abstract

Thua Thien Hue province has a fairly large area of irrigation, hydroelectricity and natural reservoirs (98 lakes in 7 districts and towns and a total capacity of more than 1,189 million m<sup>3</sup>, approximately 5,300 ha). Aquaculture is considered a strength of the province, it actively contributes to the cause of industrialization - modernization of the economy and protection of the ecological environment. Restructuring the agricultural and rural economy helps to diversify economic activities and create conditions for rational and more efficient use of natural resources and resources. The current situation of fishing in Vietnam shows that fishery resources are declining. The strong aquaculture development over the past time has met the increasing demand for food for the society and offset the limitation of fishing output. At the same time, it contributes to the implementation of the strategy "Restructuring the fishery industry towards enhancing added value and sustainable development". Besides, aquaculture also contributes significantly to providing a source of animal protein in the diet of Vietnamese people, especially ethnic minorities and mountainous people. Seafood products provide nearly 40% of the total animal protein for Vietnamese people. However, aquaculture development still faces many challenges such as scattered investment, weak infrastructure, low science and technology content. Aquaculture development is still small, spontaneous and unplanned (often exceeded or disrupted), which leads to the environment in some places showing signs of deterioration, disease outbreaks and imbalance between supply and demand.

**Keywords:** Fisheries, hydropower, sustainable development

## Introduce:

The aquaculture industry in the districts along the hydropower reservoir in recent years has been fragmented and small, which is not commensurate with the potential and available advantages. The main aquaculture species at present are traditional fish species. The main farming methods are extensive and improved (accounting for over 80% of the total area of aquaculture in the region). Therefore, the productivity is still low, the output and value brought are not high, the infrastructure conditions are still limited and the production technical level of the people has not met the requirements. During the production process, when the disease appeared, the farming environment showed signs of pollution, leading to low and unstable aquaculture production efficiency. In addition, some policies have not responded in time to practical conditions, the link between farmers and farmers and between farmers and businesses inside and outside the region is still limited,

fragmentary and unsustainable. The aquaculture area in the developed farming areas has not yet complied with the planning, the farmers have difficulties in loan procedures and the loan amount is small. The application of farming technology is not synchronized, the possibility of high risks, leading to aquaculture development lacks stability and sustainability.

## 1. Aquaculture Development

When considering the development of an economic sector or of a field of economic activity, one tends to focus only on the increase in the size of the contribution of the industry, the increase in the production potential of the industry, the rationality of the production structure of the industry and the efficiency in the operation of the industry, etc. Along with the overview of the development concept presented above, the author draws the following conclusion that the concept of aquaculture development is understood as

"Aquaculture development is the process of growing and progressing in all aspects of aquaculture activities in a locality or country in certain periods. It is the process of increasing the output as well as the value of farmed products, improving farmers' income and increasing production efficiency. On the basis of increasing resources for farming and changing the quality of products as well as the quality of resources to ensure aquaculture activities". It means that aquaculture development is considered in terms of both breadth and depth. Developing aquaculture in breadth is a development direction on the basis of expanding aquaculture area and scale. Specifically, the development aims to increase aquaculture production by expanding the farming area and enhancing the technical facilities for aquaculture [2]. Developing aquaculture in depth is creating growth by focusing on changing the structure and quality of aquaculture activities in order to increase production efficiency. Specifically, development in this direction is to increase the output or value of aquaculture products on the basis of intensive farming, invest more capital, apply new techniques and technologies, and build aquaculture infrastructure. produce. This development is suitable for each type of farming in order to increase farming productivity and increase product quality thereby increasing value. In addition, the change in the structure of aquaculture forms, the structure of aquaculture products in a more reasonable and effective direction. From there, increasing product value, reducing production costs and increasing profits is also a way to promote development. Thus, in-depth development is a way to increase aquaculture efficiency per unit area or unit of production resources.

## **2. Sustainable development of aquaculture in hydropower reservoirs**

Sustainable development in aquaculture follows three pillars of harmonious development in all three aspects: economy, society and environment. It is based on ensuring the needs of the present generation without

compromising the ability of future generations to meet their needs.

The content of the three aspects are:

**Economic problem:** it is profit, efficiency in aquaculture. Sustainable development of the aquaculture industry is about achieving high economic efficiency, ensuring long-term benefits and a responsible fisheries committed to the community. It is to avoid future recession and stagnation and to avoid leaving the burden of debt on future generations.

**Environmental factors:** no negative impacts on the environment and wastewater for surrounding areas, preserving the environment, natural resources and biodiversity. Based on a rich, diverse and stable ecosystem for a long time. Besides, sustainable aquaculture is striving in the direction of using plant-based feed instead of fishmeal and applying sustainable farming methods. Towards raising high-value indigenous specialty species and local seed production will help create strengths for the region, proactively source seed, ensure adequate supply of seed and contribute to cost reduction. manufacture.

**On social issues:** Sustainable aquaculture refers to farming activities that bring economic welfare to people. It has a good social impact and is efficient in the use of natural resources. Sustainable aquaculture does not threaten human health, but contributes to poverty reduction for farmers and fishermen and long-term support for the economy and social welfare of local communities. It must ensure the interests of the community to benefit from aquatic resources, balance the enjoyment of the resources of generations.

Characteristics of the sustainable development of aquaculture in hydroelectric reservoirs in Vietnam: (1) Sustainable development of aquaculture associated with water conditions; (2) Sustainable development of aquaculture is associated with the laws of natural development of organisms and high seasonality; (3) Sustainable development of aquaculture towards large-scale production but less rich variety; (4) Sustainable development of aquaculture is closely

linked with scientific, technical and technological progress; (5) Sustainable development of aquaculture is associated with satisfying the increasing needs of the people.

### **3. Aquaculture in hydroelectric reservoirs in Thua Thien Hue province, Vietnam**

#### **3.1. Current status of aquaculture on reservoirs**

Currently, a number of reservoirs in the province have raised wild fish in the form of ecology and raised fish in cages such as Khe Ngang lake (Huong Ho commune), Tho Son lake - Huong Xuan commune (Huong Tra), Khe Loi lake - Thuy Phu commune (Huong Thuy), Nam Lang lake - Phu Bai town (Huong Thuy), Hoa My lake - Phong Hoa commune (Phong Dien), etc.. The species for ecological stocking are mainly traditional fish such as carp and sesame. The main types of cage culture are grass carp, persimmon, monogamous tilapia, and lentils. Initially, farming households and investment establishments have obtained certain economic benefits. In general, fish farming on reservoirs is still small and there is no simultaneous investment. The issue of water use and exploitation has not been planned and clearly defined and appropriate to the actual situation of the locality. Therefore, most of the reservoirs are still not used to promote the advantages of effective aquaculture development and bring sustainable income for people.

#### **3.2. Breeding species**

The movement of freshwater farming in the province is quite rich in subjects. In addition to the traditional species such as carp, drift, carp, tilapia, pink bream, hybrid catfish, square-headed perch, etc., new cultured species have economic value and are favored by the market today such as salmon, eels, beaded slices, ... are being raised in popularity. The biological characteristics of these cultured species can be applied well in reservoirs in the province. In addition, the natural species in the reservoirs are quite abundant. Through

monitoring of fishing activities, it is possible to list many main and high economic value species such as snakehead, scad, eel, carp, loach, etc. Depending on the biological characteristics The ecology and natural conditions of each lake can annually release these species to regenerate natural aquatic resources in large reservoirs.

#### **3.3. Breeding form**

**Cage culture:** mainly carp, tilapia and persimmon. Tried new farming of species that are currently of high economic value and meet market demand such as eel and trout.

**Ecological farming** without feeding, combined with pruning, stocking and regeneration of aquatic resources.

Based on the eating habits of the species, annual ecological stocking of large water surface, combined with pruning, compensation and regeneration of resources in the lake. Ecologically stocked species are quite abundant in addition to the traditional fish species, which can be stocked with sardines, bream, square-headed perch, etc.

**Shrimp farming:** It is possible to invest in non-feeding ecological farming in a small scale to facilitate care, management and harvesting by culturing in a suitable area.

#### **Policies**

Some hydropower reservoirs are due to the nature of hydroelectricity, so some localities have very good conditions but it is difficult to be allowed to serve fish farming. In addition to a few reservoirs that are tendered by local authorities for wild-breeding, the remaining reservoirs have not yet received any investment for local people. Some localities are proposing to invest in freshwater fish farming, but there is no specific plan.

With abundant reservoir works in the province, the current level of investment is not commensurate and popular to take advantage of the reservoir's full potential. Therefore, it is necessary to create conditions on mechanisms, policies, plans and roadmaps for aquaculture development on dams and reservoirs..

### Seed production problems

About breeders: The Aquaculture Breeding Center is a unit that receives, researches and transfers technologies for breeding aquatic breeds. Other freshwater aquatic seed suppliers mainly provide seed services. Besides, there are also a number of companies and small-scale fish rearing households that import seed from other provinces to supply individual needs and some households in the locality such as communes of Phu Loc district, Phu Vang and Huong Thuy town.

Although the source of artificial breeding breeds in the province does not meet the needs of farmers, for common cultured species, business establishments can serve to meet 100% of the demand for breeders.

### Diseases and environmental problems

Freshwater aquaculture in the developing province is still scattered, small-scale and household farming. With natural, abundant rivers and streams and clean water sources, diseases rarely occur in freshwater fish farming. However, in some localities where cage fish are raised, there are often dead carp scattered throughout the seasons. People do not have a plan to prevent diseases, leading to fish farming susceptible to intestinal bleeding.

### Mining problem

Due to the characteristics of large reservoirs, the management team in the reservoir areas has not been paid enough attention and there has not been a coordination between functions and tasks of the management units. The problem of natural exploitation on reservoirs has not been paid attention to and managed closely, so illegal mining activities often occur during the day. The issue of investment in

fish farming in reservoirs contributes to the management of natural resources and proper exploitation according to regulations.

### Production organization and management

The development of freshwater fish farming in the reservoir has been directed by the Provincial People's Committee in the task of implementing a number of work and work plans in 2012. The Department of Agriculture and Rural Development has directed the Sub-Department of Agriculture and Rural Development. Fisheries on the research and development of fish farming in reservoirs. However, the implementation of production organization is still difficult and has not really been put into practice. The cause of this problem is that there is no basis for appropriate development mechanisms and policies. The issue between exploitation and farming as well as the management coordination between relevant authorities and localities still has many shortcomings and has not been paid due attention

### 3.4. The potential of reservoir fish farming

#### *Water potential*

According to the Department of Statistics, the total area of freshwater water bodies is nearly 5,300 hectares, including: natural lakes, irrigation, hydroelectricity, freshwater reservoirs, sandy areas, and low-lying fields flooded in the rainy season. By type of water surface: natural reservoirs have 908.6 hectares, accounting for 17.7%, irrigation reservoirs have 996.0 hectares, accounting for 19.4%, small ponds and lakes have 811.0 hectares, accounting for 15.8% and lowland fields is 2,425.9 ha, accounting for 47.2%.

Table 1: Hydroelectricity reservoirs in Thua Thien Hue province

Number	District/ town	Total number of lakes	Including		
			Irrigation	Hydroelectricity	Natural Lake
1	A Luoi	15	14	1	
2	Nam Dong	3	1		2

3	Phu Loc	3	3		
4	Huong Tra	12	10	2	
5	Huong Thuy	13	11	1	1
6	Phong Dien	48	16		32
7	Quang Dien	4			4
	<b>Total</b>	<b>98</b>	<b>55</b>	<b>4</b>	<b>39</b>

Hydropower reservoirs include A Luoi Hydropower - A Luoi district, Binh Dien, Huong Dien - Huong Tra district, Ta Trach lake - Huong Thuy town. The capacity of hydropower reservoirs is estimated at 1,051 million cubic meters of water, of which Ta Trach reservoir is being completed and is expected to be put into operation in 2016. The hydroelectric reservoirs have a large basin area and high depth, so they are suitable for investment and development of cage fish farming, especially special species of high economic value such as sturgeon, eel, grass carp, Lang Nha fish.

**Irrigation Reservoir:** 55 lakes with a capacity of 128 million cubic meters of water, about 40% of irrigation reservoirs have a depth of > 10m. The catchment area is quite large, which is convenient for cage farming of grass carp, tilapia, persimmon and the natural ecology of traditional fish species

**Natural reservoirs:** 39 lakes with a capacity of about 10.5 million cubic meters of water, mainly concentrated in Phong Dien, Nam Dong and Huong Thuy districts. There are about 30% of natural lakes with a depth of > 5m and a fairly large lake area suitable for tilapia cage farming and ecologically stocking of traditional fish species.

With a capacity of about 1,189 million cubic meters of water stored in reservoirs, every year in addition to the purposes of domestic use, agriculture and irrigation, it is used for freshwater aquaculture with appropriate orientation at the reservoirs. This is a turning point in economic development in accordance with local climate and weather conditions without affecting the ecological environment and increasing income for the community living around the area.

#### ***Natural environment and labors***

Weather in Thua Thien Hue is divided into two distinct seasons. The rainy season starts from August to November with an average rainfall of 2,500–2,700 mm. The average annual temperature in the cold rainy season is about 12<sup>0</sup>C, the highest in the hot season is 38<sup>0</sup>C.

With the characteristics of annual rainfall, there is an adequate volume of water for reservoirs. Through the process of analyzing and surveying water quality conditions, factors such as temperature, depth, pH, water color, dissolved oxygen, NH<sub>3</sub>, alkalinity and H<sub>2</sub>S content of the reservoirs are suitable for the growth of the species that are widely farmed.

The labor force in rural areas in the province is mainly unskilled labor, in which most of them are farming, growing crops, aquaculture and retailing. It can be said that this labor source is quite abundant and idle, so they can invest in fish farming at suitable locations without much impact on other jobs. With natural conditions and abundant local labor force, it can initially be determined that the potential for raising common freshwater fish species on Irrigation reservoirs, hydropower plants, and natural reservoirs is very large in the local area. Taking advantage of the large water surface area to regenerate aquatic resources, improve the value of effective use and management of reservoirs and dams, which contributes to economic development for the region's people.

#### **4. Some solutions for sustainable aquaculture development in hydropower reservoirs in Thua Thien Hue province, Vietnam**

##### ***4. 1. Solutions for planning and organizing implementation according to the plan***

State agencies have approved the master plan for aquaculture development up to 2025, detailed regional planning associated with key aquaculture species in order to use effectively at reservoirs for irrigation, hydroelectricity and natural reservoir.

#### ***4.2. About science and technology and extension work***

It is necessary to focus on raising the species raised to create large commodity production with traditional cultured species such as red flamingo, monogamous tilapia, basa fish, grass carp, etc.

It is necessary to research, develop and apply advanced technology on farming techniques of economically valuable species such as eels and langurs. Regularly treat the environment, diseases, feed production technology, biological products and products for environmental treatment and improvement used in farming. Summarizing and replicating advanced models such as eel, langur, red conifer, tilapia, basa, cage/raft, and valuable species.

It is necessary to strengthen vocational training and technical training to equip people with basic knowledge on cage design techniques, cage/raft culture techniques and ecological culture in reservoirs.

The government socialize the production of aquatic breeds and encourage all economic sectors to research, develop and apply new technologies. It is necessary to comply with regulations on traceability, apply national standards and regulations to production.

#### ***4.3. Solutions for production organization and management***

It is necessary to apply and implement the institutions and policies of the central and local governments that are currently in effect. That is in order to manage aquaculture in reservoirs and hydropower reservoirs with economic efficiency and environmental sustainability, and to ensure the State's regulations such as policies on supporting farmers affected by diseases, natural disasters, etc.

It is necessary to create favorable conditions for units operating in the field of services of supplying freshwater aquatic breeds, providing food and consuming products such as tax support, licensing, consulting and timely inspection.. It is necessary to strengthen the local force of fishery extension workers and officials in charge of aquaculture to meet professional qualifications. As well as, it is necessary to have a reasonable policy to create linkages with specialized agencies in the implementation of the Scheme.

Through mass communication channels, training courses and conferences to propagate and mobilize people to strictly comply with the State's legal policies in the field of fisheries. Promote people's awareness in taking advantage of the existing water surface area for aquaculture, increasing income sources and creating jobs.

It is necessary to provide information, addresses and phone numbers of establishments providing feed, breeding and product consumption services in the field of aquaculture.

Building a statistical and forecasting system on production and consumption markets from central to local levels and businesses. This is to meet the requirements of state management, which is gradually modernizing and integrating into the international economy.

#### ***4.4. Solutions on support policy***

- Supported people: People who participate in aquaculture in reservoirs, hydropower reservoirs and irrigation projects under the scheme.

- Conditions for households to be supported: They participate in aquaculture community organizations or directly cultivate aquaculture in the area of reservoirs, hydropower reservoirs and irrigation systems. There are enough employees and commitment to comply with the requirements of the Project. It is necessary to have a positive attitude in cooperation, honesty in reporting and dedication to promoting the development of local aquaculture activities.

- Forms of support: the government can provide direct support to the people, including: Aquaculture technical training, seed support, cages, feed processing machines, fish feed, chemicals, etc.

#### **4.5. Technical solutions.**

The project must be implemented with appropriate technical solutions and meet the given objectives:

- Using modern technical equipment in monitoring the hydrological and hydrological conditions at the locations where the Project is implemented. Investigate and survey livelihood conditions and management status in reservoirs and hydropower reservoirs.

- Training and deploying large-water fish farming techniques under the management of the community.

- Training and deploying fish farming techniques in cages.

- Training and deploying fish farming techniques in reservoirs.

- Using statistical methods and making reports to evaluate the success of the Project. Provide technical solutions to replicate the Project in the coming time.

#### **4.6. Market solutions**

- Strong focus on domestic market and export orientation;

- Linking between purchasing and processing enterprises and producers. Produce according to order and have a consumption contract signed between the buyer and the seller;

- Calling and encouraging seafood processing enterprises in the province and neighboring areas to process and export products from freshwater aquaculture;

- Enhance product promotion and access to export markets;

- Branding, building clean farming areas and promoting to supermarkets, restaurants inside and outside the province;

- Strengthening the linkage between buyers, processors, producers and traders of input materials for aquaculture.

#### **4.7. Solutions for environment and reservoir safety in the rainy season**

- Farmers have a consensus in the production organization. It is necessary to

apply scientific measures to manage the farming environment, implement clean and safe farming technologies in terms of environment and disease. That contributes to limiting environmental pollution, creating clean products of high value and contributing to minimizing damage caused by diseases occurring on farmed aquatic animals.

- Arrange the appropriate density of cages and rafts and choose the rearing species that take advantage of each other's food, which contributes to a clean water environment.

- Placement of cages/rafts are suitable places. It is necessary to comply with regulations on dyke protection so it will not affect the dam reservoir. In the rainy season, the owners have a plan to protect the cages when rearing in hydroelectric and irrigation reservoirs.

- The development of aquaculture on reservoirs is associated with suitable farming forms and develops in the allowable natural conditions. Wastewater from fish farming can be used for irrigation of agricultural and forestry crops. Therefore, the problem of affecting the environment will be minimized, which contributes to changing people's awareness. That helps them to proactively create food sources to meet their consumption needs instead of exhausting aquatic resources in the wild with destructive and unsustainable forms of fishing such as minesweeping and electric pulses. That contributes to the protection of natural aquatic resources.

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