

SUSTAINABLE AQUACULTURE IN NAM DINH PROVINCE: PROBLEMS AND SOLUTIONS

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Abstract

In recent years, aquaculture in Nam Dinh province has been proven as an advantageous field of production with high socio-economic efficiency, contributing to job creation and increasing income for the people. The output of aquaculture increases every year, contributing to the development of the whole province's economy. However, at present, aquaculture in Nam Dinh province is facing a number of challenges and difficulties, such as management and planning of land for agriculture and aquaculture; the insufficient source of aquatic breeds (shrimp breeds) that has not been of quality control, environmental pollution problems in aquaculture and so on. These shortcomings affect productivity, quality, efficiency and the sustainable development of the industry. In the coming time, to have a sustainably developing aquaculture, Nam Dinh province needs radical solutions for the aforementioned problems.

Keywords: *Aquaculture, problems, solutions, Nam Dinh.*

1. Introduction

Aquaculture is a production activity based on the integration of available natural resources (sea surface, river water, ponds, low-lying fields, billabongs, lagoons, climate, etc) with the system of aquatic organisms (mainly fish, shrimp and other aquatic products) with direct human involvement. This activity in Vietnam includes the farming and cultivation of freshwater, brackish and saltwater aquatic products with the main forms namely intensive, semi-intensive, extensive and improved extensive farming; farming in cages on sea, river, lagoon or coastal water surface; mollusc farming; farming in ponds, lakes, lagoons; farming in low-lying fields and rice fields.

Nam Dinh is a coastal plain province in the south of the Red River delta, with three major estuaries: Ba Lat, Ninh Co and Day. Every year, a large amount of alluvium, organic matter and mineral salts come from rivers and deposit in the coastal area. With a coastline of 72km long, over 90,000 ha of fertile alluvial land and over 17,000 ha of land with water surface, Nam Dinh has a huge advantage for the development of exploitation and aquaculture. Over the past years, Nam Dinh has strongly developed aquaculture in both freshwater and brackish areas with a sharp increase in aquaculture production each year, contributing to job creation, income growth, and attraction the investment from many

economic sectors in Vietnam and from other countries, contributing to the economic development of the locality. However, at present, aquaculture in Nam Dinh province is facing many challenges, such as: the conversion of the areas with inefficient rice or salt production into aquaculture areas; sources of aquatic breeds, environmental issues in aquaculture, product consumption, especially in the context that the Covid-19 pandemic has a significant impact on productivity, quality and efficiency and the sustainable development of aquaculture. Therefore, the sustainable development of aquaculture requires long-term strategic solutions based on scientific research results with an overview and sustainable approach.

2. Method

2.1. Research data

The paper uses databases from relevant agencies of Nam Dinh province, published plans and reports, and Nam Dinh's statistical documents related to aquaculture.

2.2. Research method

- Methods of collecting, processing and analyzing documents: The data collected from reports related to aquaculture of the Department of Agriculture and Rural Development of Nam Dinh province, main website of Nam Dinh newspaper, Nam Dinh province allow the researcher to have accurate assessment for the current situation in the area of the study.

- In-depth interview method: Subjects of in-depth interview are officers from the Department of Agriculture and Rural Development in Hai Hau district and Nghia Hung district, Nam Dinh province and some aquaculture farmers in Nam Dinh province.

3. Results

3.1. Current status of aquaculture in Nam Dinh province

Total aquaculture production in 2020

According to the report on the results of aquatic production in 2020 and the implementation of production tasks in 2021 of the Department of Agriculture and Rural Development of Nam Dinh province, the total aquaculture production in 2020 of the whole province is estimated at 170,490 tons, equal to 102.4% of the year plan and increasing 6.32% (+10,142 tons) in comparison with the previous year, of which aquaculture output reached 114,182 tons, equal to 102.41% of the year plan and increased 8.14% (+8,594 tons) compared to the previous year; exploitation output reached 56,308 tons, equal to 102.38% of the year plan and increased 2.8% over the previous year. The total production value of aquatic products in 2020 is estimated at 9,900 billion VND (current prices) and 4,900 billion VND (constant prices 2010), in which exploitation reaches 1,626 billion VND, farming reaches 3,274 billion VND. Overall, it accounts for about 33% of the structure of

agriculture, forestry and fisheries [1].

Aquaculture area in 2020

* *Freshwater aquaculture*: the farming area is 9,800 ha, no increase compared to 2019; production reached 56,672 tons with an increase of 12.4% compared to 2019. In which:

- *Traditional fish farming (carp, mud carp and grass carp)*: The farming area reached 9,400 ha; output is 38,600 tons, increased 11.8% compared to 2019.

- *Red snapper farming*: The farming area is 240 ha; the output reached 1,680 tons with an increase of 11.04% compared to 2019. In some places, the polyculture of red snapper and whiteleg shrimp achieved good results.

- *Giant snakehead farming*: With fast growth rate, stable consumption market, it continues to be chosen by many farmers. The farming area is 60 ha; production reached 1,290 tons with an increase of 9.2% compared to 2019.

Some special aquatic species with high economic value such as shortshell turtle, frog, eel, loach, large edible snail, hybrid catfish, etc which are commonly farmed by local people bring high income for farmers.

* *Brackish and saltwater aquaculture*: The farming area is 6,500 ha, increasing 85 ha compared to 2019. The output reached 57,210 tons with an increase of 4.2% compared to 2019. In which:

- *Brackish water shrimp farming*: The farming area reached 3,400 ha; brackish water shrimp production reached 7,280 tons, increasing 21.5% compared to 2019, reaching 98% of the plan. In which, tiger shrimp farming area is 2,400 ha, tiger shrimp production is 2,450 tons, increasing 3.64% in comparison with 2019. Whiteleg shrimp farming is still invested by localities with increasing level of intensive farming. In 2020, the farming area of whiteleg shrimp was 1000 ha with an increase of 60 ha compared to 2019; production reached 4,200 tons with an increase of 31.1% compared to 2019.

- *Clam farming*: the commercial clam farming areas has expanded stably with the farming area of 2,165 ha, the output of clam reached 39,500 tons with an increase of 4.05% compared to 2019.

- *Sea fish farming*: This is a species with high economic value and is increasingly being focused in brackish areas. In 2020, the area of sea fish farming was 615 ha; the output reached 5,210 tons, equal to 92.5% compared to 2019, due to the low price of fish at the beginning of the year, farmers released later than the previous year.

It can be seen that Nam Dinh's aquaculture has developed dramatically both in freshwater and brackish water farming areas. The cultured species are increasingly

diversified, in which shrimp, four-eyed sleeper and bivalve molluscs (clams) are the main species which are focused on promoting development by Nam Dinh aquaculture, aiming to reorientation of restructuring of the aquaculture sector. To be specific, clam is identified as one of the main cultured species under the Provincial Agricultural Sector Restructuring Scheme towards increasing added value and sustainable development. To accomplish that goal, in recent years, the commercial clam farming areas of the province have been strictly controlled to European standards; to satisfy domestic consumption demand and raw materials demand of factories to process and export clam products to the European market. Clam farming, therefore, has created jobs, raised incomes and enriched many coastal households.

Production and supply of aquatic breeds

Nam Dinh province has a wide tidal flat, favorable for clam culture development and hatchery production. The seed supply source for clam farmers in the province mainly comes from natural collection and local production. With good quality and high survival rate, clam breeds produced and collected in the province do not only serve the needs of farmers in the area but also are consumed in provinces and cities namely Thai Binh, Hai Phong, Quang Ninh and so on. Clam farming and breed production has brought high income for many households in the coastal districts. Currently, the province has more than 100 hatcheries (producing saltwater and freshwater breeds). The people have mastered the breed production technology of many cultured species such as mollusks, four-eye sleeper. The quality of breed produced locally is increasingly guaranteed and trusted by the people.

According to a report by the Department of Agriculture and Rural Development of Nam Dinh province, production and nursing establishments in the province have focused on building infrastructure to meet production conditions. Up to now, 49 establishments have been inspected and granted certificates of eligibility for production and nursing (30 establishments will be granted in 2020). Condition maintenance checks have been conducted in accordance with regulations.

As a result, in 2020, the output of aquatic breeds of all types is estimated to reach 13,585 million with an increase of 10.23% compared to 2019. In which, freshwater seed production will reach 970 million, mainly traditional fish. The citizens have Access some cultured species such as eel, loach, Thai frog, large edible snail produced at the Special Aquatic Breeding Center and a number of facilities in Nghia Hung district. The brackish breed production continued to thrive, concentrating in coastal communes of Giao Thuy and Nghia Hung districts with main species namely clam, mussels, tiger shrimp, sea crab, four-eye sleeper etc. Brackish water breed production in 2020 will reach 12,615 million, equaling 111.11% compared to 2019.

3.2. Some current problems raised in aquaculture in Nam Dinh province

3.2.1. The problem of management and planning of aquaculture area

From 2017 to 2020, Nam Dinh province has converted more than 2,871 ha of paddy land at the foot of low-lying fields or fields contaminated with salt and alum to concentrated aquaculture or switched to rice cultivation combined with aquaculture to have high economy efficiency. Specifically, the area switched to rice cultivation combined with freshwater fish farming is nearly 2,709 ha, of which in 2017, nearly 266 ha were converted; in 2018 nearly 566 ha; in 2019, over 1,095 ha; by 2020 more than 781 ha⁹⁰ will be converted..

According to statistics of relevant agency, the whole Nam Dinh province has about 16,150 ha of water surface which has been converted to effective aquaculture. For areas where previously ineffective rice, sedge, and salt production areas, the people who converted to aquaculture received support from the province in building technical infrastructure for production. The whole province has 44 transformed projects, of which 32 projects have achieved economic efficiency many times higher than pre-transformation. The farming method in the project areas has been shifted towards the establishment of intensive and semi-intensive farming areas. However, realizing that the profits gained from whiteleg shrimp farming, many households have spontaneously converted their unplanned areas to culturing whiteleg shrimp. Due to spontaneous and unplanned development, many farms do not meet the conditions of technical infrastructure, such as: storage ponds, settling ponds, water supply and drainage systems and so on. Shrimp ponds are interspersed with salt fields and vegetable fields; therefore, it is difficult to apply technical measures, especially in dealing with problems arising from water quality and disease. On the other hand, the electricity system serving the farming areas is incomplete. Shrimp farming must share the irrigation system with salt and vegetable cultivation, so there is no separate irrigation and drainage system. Many farmers lack knowledge of science, technology and experience, so diseases on white leg shrimp arise complicatedly, causing significant impacts on the economy and the farming environment.

3.2.2. The problem of breed sources and quality of aquatic breeds

For clam breeds production: The current challenge for the local clam breed production is that most of the hatcheries are small and produce by experience, therefore, the output is unstable and the quality is non-uniform. Aquatic breeds production infrastructure is self-invested by households and has not received the proper attention and support from the State, thus, has not yet ensured standardization; is vulnerable to weather and natural disasters related damages.

⁹⁰ <http://baonamdinh.com.vn/channel/5085/202010/tich-cuc-chuyen-doi-co-cau-cay-trong-tren-dat-trong-lua-kem-hieu-qua-2540435/>

In addition, some aquatic breeds that cannot be domestically produced and have to be imported from China, have been interrupted and cannot be imported over the past time due to the impact of the Covid-19 pandemic, such as: garrupa, sea bass, red snapper... slowing down the farming season; Mollusk breed production in the first few months of the year faced many difficulties in importing and selecting quality original broodstock, leading to unqualified produced breeds.

For the main cultured species with high economic value, the second biggest demand is whiteleg shrimp, Nam Dinh province has not actively produced seed on the spot... The current source of shrimp seed is mainly from the Southern provinces, seed quality is hard to control, cost and loss rate during the transportation is high. In order to overcome difficulties and limitations in the aquatic breeds production, the Department of Agriculture and Rural Development of Nam Dinh province and related sectors are proceeding to implement supporting programs for hatcheries to upgrade technical infrastructure, employ new production technologies to meet the demand for farming, especially major breeds farming.

3.2.3. The problem of waste discharge in aquaculture and the risk of environmental pollution

Currently, industrial shrimp farming, intensive and semi-intensive shrimp farming areas in Nam Dinh province are thriving, associated with increased productivity, significant economic value. However, it will always carry potential risks of causing environmental pollution if businesses and farms do not follow the waste management process. Many for-profit shrimp farms in the province tend to make the most of their farming area and do not reserve enough area for settling ponds to treat shrimp farming water before discharging it.

In 2020, the province brackish water shrimp farming area reached 3,400 ha; the production reached 7,280 tons, increasing 21.5% compared to 2019, reaching 98% of the plan. In which, tiger shrimp farming area is 2,400 ha, tiger shrimp production is 2,450 tons, increasing 3.64% in comparison with 2019. Whiteleg shrimp farming is still invested by localities with increasing levels of intensive farming. In 2020, the farming area of whiteleg shrimp was 1000 ha with an increase of 60 ha compared to 2019; production reached 4,200 tons with an increase of 31.1% compared to 2019. [1].

Reality shows that although industrial shrimp farming is well-developed in Nam Dinh, present concentrated shrimp farming areas have not had a separate water supply and drainage system, this is also one of the factors that put pressure on the environment. According to research by Le Thi Thanh Thuy, Nguyen Hong Son, Do Phuong Chi, Tran Quoc Viet, Bui Thi Lan Huong, Do Thi Thu Ha (2017) *The current status of shrimp farming water quality in coastal areas of Nam Dinh and Quang Ninh*, the current status of shrimp farming water quality in coastal areas of Nam Dinh and Quang Ninh provinces is mainly polluted with organic matter, such as: P, K, DO, NH₃, TSS and Coliform. Especially in the

post-culture wastewater, the contents of the above indicators are all high. According to research results, most of the shrimp farming areas do not have their own water supply and drainage systems planning, the water supplied to the aquaculture areas is shared with the irrigation system for agricultural production. On the other hand, the wastewater after farming is not treated and discharged into the canal system of the region, polluting the water quality in shrimp farming area, mainly organic pollution. In addition, the link between farming households in the region is not yet close, especially, the sense of responsibility in disease treatment is limited, leading to the spread of disease to the farmed shrimps [2].

Nevertheless, intensive shrimp farming brings profits, contributing to jobs creation in coastal localities. However, in reality, the lack of planning and people who do not comply with the regulations on seasons, farming density, disease prevention, wastewater treatment, or for-profit purposes tend to make the most of the farming area without reserving an area for settling pond to treat wastewater before discharging into the environment, increase the production without caring about waste disposal ... has seriously polluted the aquaculture environment. Chemical abuse for water cleaning purposes and antibiotics abuse to treat shrimp diseases not only have a negative impact on the production environment but also affects the surrounding environment. In addition, the farming households and aquaculture establishments are not aware of improving ponds, wastewater treatment, industrial shrimp sludge. In fact, the sludge in aquaculture (industrial shrimp farming, intensive shrimp farming, industrial pangasius farming...) contains food sources of residual, decomposing rotting, chemicals and antibiotics, minerals such as Diatomite, Dolomite, Sulfur, and toxic substances in alum soils. These substances could not only spread diseases to other households that use the polluted water sources for farming but also cause direct contamination of groundwater, surface water and indirectly affecting the living environment of the surrounding residents.

3.2.4. The problem of aquaculture output

The current reality shows that the logistics and service system of Nam Dinh is still small and have not yet met the purchasing, preserving, and processing demand, thus reducing the value of seafood products; processing and exporting seafood remains limited, mainly for domestic consumption, there has not a product chain with export value.

Due to the impact of the Covid -19 pandemic, the prices of fresh seafood of all kinds in the domestic market plummeted, bringing many hardships upon the people. For seafood export, according to the Department of Agriculture and Rural Development of Nam Dinh province statistics, in 2019, seafood exporting businesses exported through small quotas to China about 3,000 tons of goby, 40 thousand tons of exploited aquatic products, 200 tons of fresh shrimp; about 6,000 tons of clams exported to Europe, Japan, and Korea. However, from the beginning of 2020 up to now, most seafood products of exporting businesses were

stored. In the domestic market, social distancing causing many difficulties regarding raw materials to seafood processing businesses, leading to higher production prices and reduced output of goods consumed due to reduced domestic consumption demand. In addition, China's border trade policy of not importing seafood products through unofficial channels, but via official ones, along with EC's issuing of a "yellow card", costing seafood exporters to Europe more money and time due to goods detained for inspection.

3.3. Some policies recommendations to develop aquaculture in Nam Dinh towards sustainability

Based on the results of analysis on the current status of aquaculture in Nam Dinh province, the article proposes a number of recommendations to develop sustainable aquaculture ensuring harmony between socioeconomic and environmental development, including:

Firstly, perfecting the legal policy on state management for aquaculture, step by step bringing aquaculture establishments to comply with the law on production conditions, quality assurance, and food safety and hygiene, in accordance with the standards of the international market. Building and perfecting the quality control system for aquaculture materials (seeds, feed ...); at the same time, speeding up the socialization of quality control and testing materials used in aquaculture.

Secondly, strengthening the State management on environmental protection by authorities at all levels; agencies involved in the enforcement of the Law on Environmental Protection for aquaculture and seafood processing establishments. In particular, improving the appraisal capacity, reports on environmental impact assessment of investment projects, as well as strictly comply with the process of preparing and evaluating environmental impact assessments in accordance with the law. Strengthening the State management of product and goods quality, food safety and hygiene, building and protecting copyrights, and protecting trademarks.

Thirdly, the planning for aquaculture development should be based on ecological zoning, development of technical infrastructure for water supply, drainage, and waste treatment for industrial, and intensive aquaculture... in order to meet the requirements of resources, infrastructure, contributing to environmental sanitation, disease prevention, and specified environmental standards. At the same time, investors in aquaculture farming and processing have to focus on investing and operating centralized collection systems, properly classifying industrial and domestic solid waste; managing, storing and transferring hazardous solid waste in accordance with regulations, as well as developing a centralized wastewater treatment system, waste gas treatment system ensuring environmental standards.

Fourthly, investing in infrastructure, scientific and technical innovation for aquaculture. Increasing investment in science and technology, research and development and

production of quality mollusks, step by step proactively meeting local demand for breeds, creating an active position in production.

Fifthly, fostering trade promotion for local seafood products to reach major markets. Supporting and connecting associations and businesses to be the direct subjects carrying out joint activities on trade promotion, developing seafood consumption markets for major seafood products. Building distribution networks, directly sign contracts with food supply organizations, distribution centers, supermarkets of large markets. Promoting the formation of distribution channels for domestic aquatic products from producers and firms to markets and supermarkets through a system of wholesale markets and large fishing centers.

4. Discussion and Conclusion

Over the past years, aquaculture in Nam Dinh province has gained several achievements and certain development in many fields. The district's aquaculture has achieved many good results with a sharp increase in aquaculture production compared to 2019.

The current situation of aquaculture in Nam Dinh province remains spontaneous and unsustainable with rapid increase in the value of aquaculture production, yet ineffective area planning, aquaculture seed production has not kept up with the development requirements, the waste discharge in aquaculture is likely to cause environmental pollution, and the problem of product consumption is also facing difficulties in the context of the Covid-19 pandemic.

In the coming time, in order to develop aquaculture in Nam Dinh province toward sustainability, it is necessary to synchronously implement solutions to facilitate the district's aquaculture to become a strong economic sector of the province, contributing to improve income, protect workers' health in aquaculture and processing businesses and protect people's health.

Notes: The article is part of the research results of a ministry-level topic: *The attitude of Northern coastal area residents towards the current exploitation of coastal natural resources*; Office of Vietnam Academy of Social Sciences presides over and PhD. Bui Thi Van Anh is in charge.

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