Focus on hatcheries
Global aquaculture makes new strides
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Recent development on lobster farming in Norway - prospects and possibilities

Due to a high market demand, low wild catches and a continuing increase in prices, the European lobster has become a promising candidate for closed-cycle and controlled aquaculture. In 2000, the company Norwegian Lobster Farm AS initiated an extensive R&D project on the European lobster, in cooperation with the Institute of Marine Research, Stavanger University College and Rogaland Research. The research facilities are located on Kvitsøy, an island on the south-western coast of Norway. The project includes R&D work on biology, technology, feed, market, monitoring of water quality, health management and comparative studies on single cages vs. communal rearing systems. The aims of the project are to explore the possibilities and potentials of producing the European lobster in land-based facilities using re-circulation of seawater.

The only operating lobster hatchery in Norway today, is the one located on the Kvitsøy island. Moreover, Norwegian Lobster Farm AS is the first and only company in Norway focusing on land-based production of plate-sized lobsters. In this article, focus will therefore be given to this company and the results obtained from this project.

Recent developments

Several projects have been conducted in Norway on the European lobster, although most of them have focused on stock enhancement and sea ranching purposes. The most extensive projects was a lobster hatchery with production capacity of 130,000 juveniles for sea ranching per year established by the Tiedemann company (1981-1994) and the sea ranching programme PUSH conducted by Institute of Marine Research (1990-2001). In the PUSH programme 125,000 juveniles were tagged and released around Kvitsøy and gave recaptures of 7% market sized lobsters. All these projects have provided scientists with knowledge on juvenile production, general population biology, growth, fecundity, mortality and migration. Furthermore, the ongoing project has provided and still provides us with updated knowledge on more commercial aspects on land-based farming practices.

New law ensures exclusive harvesting rates in licensed areas

A new law ensuring property rights to released sedentary invertebrates was approved by the Norwegian Parliament in 2000. This law will be put into full effect from 1 January 2003, and ensures exclusive harvesting rights in specific areas for decapods, molluscs and sea urchins to persons holding a proper license. This new law has promoted an increasing commercial interest in lobster sea ranching of lobster in Norway, and a tenfold companies have been established during the past two years. These companies are located along the entire Norwegian coastline, and most of them are now ready to apply for licenses and start commercial sea ranching.

To establish sea ranching of lobster as a commercial and viable industry, an important prerequisite is access to a large amount of cheap and high quality lobster juveniles from commercial hatcheries. Hence, the company Norsk Hummer AS is planning to build a new large-scale factory for production of lobster juveniles for sea ranching purposes. Heating of water will be based on waste water heat from a methanol factory which reduces the energy demand. The production in this factory will be highly automated and have a production capacity up to 2.4 million lobster juveniles annually. This factory will thus be able to produce a high quantity of lobster juveniles with good quality at low and acceptable price levels. Moreover, some small-scale hatcheries are also being planned. The main advantage of small hatcheries are smaller building and operational costs, smoother logistics arrangements (e.g. transportation) when using local brood-stock and may therefore become compatible to large-scale factories.

Land-based farming

In the past, the development of land-based farming has been severely hampered by lack of suitable technology and production methods, where the major constraints have been the need for single rearing cages to avoid cannibalism, need of heated water, lack of high quality dry food, high labour costs, inadequate technological solutions and high investment costs. Thus, the focus on the ongoing project has been to develop adequate solutions that can remove these constraints, while still ensuring good water quality, nutrition and welfare for the lobsters.

Results from the ongoing project at Kvitsøy

The preliminary results indicate that it is possible to farm larvae from hatching to market size (plate size: 250-300 grams) in 24-30 months. The growth rates of large juveniles fed commercial dry cod feed (Danafeed) have so far been close to the results obtained in similar feeding experiments with European lobster using natural feed (see Figure 1). The good growth rate on a clearly sub-optimal feed gives reasons to believe that only smaller changes in the receipts are necessary to obtain a good lobster feed.
Communal rearing

Communal juvenile rearing does not seem to be an alternative for intensive farming, but can be a method for small scale extensive production of lobster juveniles for sea ranching and/or stock enhancement. By rearing juveniles in communal systems, the lobsters being released may be more prepared to avoid predation and therefore contribute to increase the survival rate after release in the wild.

Technology

Norwegian Lobster Farm AS has developed suitable technology for farming lobster juveniles (up to TL 9 cm) and technology for raising plate-sized lobster in highly intensive systems (1200 to 2000 pieces/m²). The latter concept is being patented and will be tested during 2003, while the former concept has been tested with good results (survival over 80%) and is commercially available. Both systems can be fully automated while in operation, and they are possible to combine with bio-secure production systems enabling tracking of single individuals. Moreover, a software programme is being developed for image processing of single individuals to identify growth, mortality and moult frequency. The two concepts have only modest investment costs, and it is possible to operate fully automatic reducing the need for employees. Profit on investments can be gained after only years.

Market

All market research show that portion sized lobster has a substantial potential. Market research estimates the national demand in Norway to be over 150 tons annually at the current price level of 30-35 Euro/kg. Moreover, there is a positive attitude to both the product’s size and weight (total length 20 cm - 300 gram) especially in the high-end segment. Further, there exists a considerably higher global demand (approximately 40,000 tons/year), with Scandinavia, Europe and Asia being the potentially best markets.

Feed and product quality

The first artificially grown plate-sized lobster has now been commercially sold, and the product was well received. In addition has the product been tested at the Culinary Institute of Norway. Although the general results were indeed positive, they indicate that in order to produce a superior product it is a necessity to do more research in feed development and meet the nutritional needs of the lobster. Although the general were indeed positive, (sjeik settinga) they are not. However, to produce a superior product it is a necessity to do more research in feed development and meet the nutritional needs of the lobster. For instance, the lobster grown on cod feed had pale blue pigmentation due to the lack of pigments (i.e. astaxanthin) in this feed. Thus, a new lobster feed with three different levels of astaxanthin have been produced in two different pellet sizes, and feeding experiments have been initiated to find the minimum astaxanthin contents necessary in the feed to ensure natural pigmentation of the lobsters. Preliminary results from the trial show that the coloration of the lobster shell is turning to dark blue and black. A new test of the product will be done at the Culinary Institute of Norway after completion of the ongoing feed trial in May 2003.

Waste production and oxygen requirements

In order to build a state-of-the-art land-based lobster farm, the lobsters basic metabolic waste products (i.e. TAN) and their respiration rate needs to be quantified during different stages in development. Such values will provide us with information needed to work out the basic criteria for dimensioning of the farm technology (i.e. size of biofilter). The current feeding experiment will therefore also try to quantify these parameters?? values?? for lobsters of different ages and sizes. Consequently, sampling of dissolved oxygen, ammonia and suspended solids is carried out at several points in the recirculation system. The capacity and efficiency of the biofilter vs. the total ammonia production of the lobster stock is considered a vital dimensioning criterion. This experiment is carried out in cooperation with Rogaland Research, and the results will be available at the end of summer 2003.

The Norwegian Lobster Farmers’ Association

In August 2001, the Norwegian Lobster Farmers Association was established. The association has its main office in Stavanger in south-western part of Norway, and most of the lobster farming companies in Norway are members. In addition of dealing with political issues, the Norwegian Lobster’s Farmers Association is developing the future industrial framework for the new industry. Moreover, a national network is now being initiated, and will represent all interested companies and private persons involved in lobster farming in Norway. The main goal is to gain control and regulate the future expansions in a sustainable manner and to enhance possible positive synergy effects among Governmental (GO) and non-Governmental (NGO) institutions.

Future prospects

Today, the prospects for establishing a commercial and viable lobster farming industry (sea ranching and land-based farming) are at its all time best. The European lobster is one of the world’s most valued sea products. Moreover, having in mind the recent innovations on all aspects of controlled land-based farming, most of the historical challenges are about to be solved. Thus, the industry now holds sufficient biological knowledge and have developed several useful technological concepts. It is therefore obvious that controlled aquaculture of this species has a huge global market potential.

However, it is very important not to underestimate the need for R&D to support and stimulate a commercial development of this new industry. Thus, more public and private funds should be available to accompany the private investment capital. In addition, whether it is sea ranching or land-based farming, major expansions should only be done based on new knowledge on sustainable farming procedures. Moreover, building an industry based on a close link between research institutions and commercial companies will prevent building up barriers between research and practical use of new knowledge. So far, no successful attempts on commercialising to commercialize lobster production has been made in Norway. However, we expect that several companies will succeed in establishing of new lobster hatcheries, land-based farms or sea ranches on a commercial basis in the coming years.

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