Emerging Fisheries Development

Project Summary: FDP 250 2002

Cod Growout
2000-2003
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Introduction

The concept of cod growout based on the wild fishery has been around since the mid 1980s. In recent years, the idea of holding cod obtained from cod traps, increasing their weight over the summer months, and harvesting them in the fall (when market prices are traditionally higher) saw rejuvenated interest in this province. With the reopening of the cod fishery in 1997, eight growers became involved in cod growout, harvesting a total weight in the fall of 93,447 lbs, round weight. This number dropped somewhat in 1998 but increased substantially in 1999 when seven growers harvested 238,680 lbs. head-on gutted based on the interest expressed and the applications submitted to the Department of Fisheries and Aquaculture for the 2000 year, production was expected to increase dramatically over the next few years. To ensure that this increase in production could be realized, a strategic plan was devised, and the needs identified. This original proposal to the Fisheries Diversification Program outlined these needs and nine projects were proposed to address these needs.

Growout Production

In 2000, 38 sites were licensed for cod growout around Newfoundland, and 18 of these sites procured starting stock (140 MT), while in 2001 and 2002, there were 41 licensed (16 used) and 48 licensed (14 used), respectively, with starting stocks of 195 MT and 186 MT.

Objectives

The overall common objective of the projects was to increase the amount of farmed cod produced over the following three years and to increase the quality of the product being entered into the consumer market. The specific project objectives were:

1) To provide technical support and assistance to new growers in an effort to help them get the optimal output from their operations.
2) To investigate ways to reduce the cost of feed to the growers, and investigate trials of live holding of baitfish species.
3) To investigate size grading of the stock at various stages and its effect on the growth performance of the fish.
4) To investigate the nutritional content of the baitfish species used as feed and the nutritional content of a manufactured artificial diet.
5) To assess through biochemical analysis the problem of soft texture in farmed cod fillets and attempt to mitigate the problem in future years.
6) To develop a marketing plan and strategy for farmed cod and identify potential niche markets for the product.
7) To aid growers in the implementation of proper husbandry practices and provide basic business management training for the fisherman/farmers.
8) To identify potential fish health issues and to develop and implement a fish health management plan.
9) To assess the potential of holding cod in cages over the winter months to be able to introduce farmed cod into the market in the earlier spring months.

These nine objectives provided the basis for nine respective projects planned for two years (2000 and 2001). During 2001 a tenth project, investigating a moist feed, was organized using remaining money from several projects. At the end of 2001, there was significant money remaining to warrant continuation for a third year, in which four projects were conducted: continuation of the fish health, marketing, and technical support projects, as well as an addition to the soft texture project, whose aim was to produce a processing and handling video.

**Technical Support**

The Fish, Food and Allied Workers Union (FFAW) hired an experienced technician, Roland Hederson, to coordinate a technology assistance program to new growers. Assistance was provided in 2000 and 2001 to new entrants through provision of growout nets and/or a bait cutter (dependant on location and quantity of fish involved), while in 2002, existing nets and bait cutters purchased in the previous two years were provided as available. Assistance was conditional on growers agreeing that in the event that their fishery was unsuccessful (no starting stock), the materials/equipment would be returned to the Program for redistribution to other applicants. The FFAW coordinator assisted with coordination, harvest, collection, transportation, logistics and technical support in the harvest, collection, and transport of wild cod. Detailed farm production logs were issued to growers and monitored on a regular basis to collect data for technical and economic analysis. A final report from this project is available.

**Feed Cost Reduction/Live Feed**

DFO conducted experiments with herring in 1995-96, successfully holding up to 60,000 lbs. in a trap in Fortune Bay for more than 30 days. If cod growers could take advantage of this technology, there would be good opportunity to reduce the cost of feed. The potential to hold similar quantities of capelin was not known, but was worth investigating. The FFAW facilitated an arrangement between
cod growers and commercial herring fishers in Fortune Bay to conduct live feed (herring) holding operations in 1999. This approach was to be tested again in 2000, including the hiring of a technician to monitor status of bait-fish held in cages, however this was not possible due to limited access, and high cost of available bait.

Size Sorting and Impact on Performance

This project would refine and test a live cod sorting system (grates) and identify any impact of size sorting on performance. The ability to grade the fish upon transfer from the trap and separate them into different cages of different sizes would enhance the growth in each of the respective cages, as compared to cages containing various sizes of fish. In addition, a grate could facilitate the release of undersized fish (<18") prior to transfer to growout cages.

In 2000, field-testing of 40-mm, 45-mm, and 55-mm (spacing) grates placed between transfer cages took place in Rushoon and Petite Forte. The system seemed to function well, and it was possible to successfully size sort fish using different sized grates. It was then planned to test whether these grates could be used in growout operations to both actively release undersized cod before weigh-in, and grade fish for division between several growout cages.

In 2001, DFO conducted an ACERA-funded project to implement two new studies - size sorting (grading) and release of undersized cod, in conjunction with FFAW. Sites in Gooseberry Cove and Plate Cove West participated in the size sorting experiment and two sites in Petty Harbour participated in the undersized release experiment. The results of these studies are available through the ACERA program.

Cod Nutrition/Manufactured Feed

The objective of this project was to reduce feed costs in future years by testing formulated cod diet as an alternative to baitfish. The use and acceptance by the fish of a pelletized feed would lead to improvements in the availability of feed, reduction in feed costs, and improvements in the overall operational performance and economics of cod growout.

A coordinator was hired to coordinate and monitor the manufactured feed trials between the research facility (Marine Institute) and two cage sites (New Harbour and Rushoon). Field trials were carried out in 2000 using a dry pelleted feed from Taplow Feeds in British Columbia with poor results. The feed was rejected by the fish and, as a result, gained little weight in Rushoon and actually lost weight in New Harbour. A final report for this project is available.

As a result, remaining money in this project was reallocated in 2001 into a new contract for a moist feed study conducted by the Marine Institute. This project is described on page 10.
Soft Texture in Farmed Cod

Prior to this project, there was concern that the quality of farmed cod was susceptible to high incidences of melanin and a breakdown of fish texture after filleting. These issues surrounded growout for years and had a negative impact in some markets. In the past few years, shipments of farmed cod had been reported as being very soft in texture and not adequate for placement in the market as a high quality fillet. This obviously had an impact on the establishment of markets in future years, and the problem would have to be addressed from a scientific standpoint.

DFO, working with local consultants and the Marine Institute, conducted several experiments to identify mitigative measures and practices during handling and storage. The deterioration of flesh texture and the resultant reduced quality of fish can be attributed to three main causes: (1) the condition of fish before slaughter, (2) chemical and microbiological changes occurring after slaughter, and (3) damage/defects caused by handling and processing.

In 2001, the Marine Institute conducted a Flesh Quality Study using tank-reared and wild cod. Many comparisons between the two were made and an attempt to decipher the best harvesting method from these studies was done. Overall, the wild fish scored lower for texture than farmed cod. The best harvest practice was where fish did not need to be stunned, filleted 0 - 2 days post-mortem, and kept at low temperatures to increase rigor time length and thus decrease damage. However, it was determined that filleting before rigor produced best results. It was interesting to note that the cod would not eat the manufactured DANA feed those used in trials. A final report for this study is available.

In 2001, some farmed cod sent to US buyers had received bad texture reviews, and as a result, the US had hesitated to buy more fish. There was concern that NF processors, while very experienced and efficient at processing wild cod, were not adapting their processing line for growout cod, whose flesh has different characteristics (i.e., different rigour time) than wild cod. It was therefore decided that remaining funds be used in 2002 to address how quality is affected by handling and processing. Specifically, a video would be produced to outline current handling and processing techniques for growout cod and its unique flesh characteristics. In addition, the Marine Institute developed a research plan to study some possible contributors during handling/harvesting to soft texture.

NAIA subcontracted the production of a video to capture all stages of the cod growout process from the cod trap, to feeding, harvesting and finally the processing and packaging for export. It can be used to demonstrate the process of on-growing trap cod, demonstrating the importance of appropriate handling practices along the entire chain of production. The video can serve as both an educational and promotional tool. It can be used locally in promoting cod growout as a viable industry for rural economies, building on NAIA’s communications strategy. As a promotional tool, the video can be used in fish markets, stores and trade shows where Newfoundland products are featured or promoted. As a marketing tool the video highlights the pristine, icy cold waters from which Newfoundland cod are harvested, fed and grown into what becomes a high quality cod fillet. A copy of this video is available.

The Marine Institute was contracted to assess the impact of pre-harvest resting and slaughter method on the post-harvest flesh quality of growout cod. From the study, several conclusions and recommendations were put forward. First, growout cod, when chilled, can be in full rigour by 24 hours post-harvest, and can remain as such up until 120 hours post-harvest. As a result, one must fillet the
cod prior to this rigour period, though this will result in higher drip loss than if fillets are produced while in rigour or beyond. Appropriate crowding of cod for up to 8 hours pre-harvest does not improve nor detract from post-harvest flesh quality. As well, slaughtering the cod with a percussive blow coupled with gill severing does not improve the post-harvest flesh quality as compared to gill severing alone, though the use of a percussive blow is warranted in order to lessen struggling at harvest. A final report of this study is available.

**Marketing of Farmed Cod**

The cod growout initiative over the past three years experienced relatively good market prices for both whole cod and fillets. To-date, the sale of farmed cod and the prices received came from the spot market for fresh cod, primarily in late fall in eastern US markets. It was determined that these prices are not predictable, and growers in future years should explore other avenues to achieve top value for their product. It was expected that cod growout production would increase significantly over the following five years, and the establishment of secure markets in the early marketing phase should ensure the highest possible return to the growers in the years to come.

The marketing initiative for farmed cod included, several sub-components, all related to the overall objective of the project, specifically a market development strategy, market intelligence, promotional literature, and market promotion. This effort was shared between the Processing and Marketing Services Division of DFA and NAIA.

In 2000, little work was done under this project. An unsuccessful attempt to transfer live cod (3587 lbs.) to Toronto for the live fish market in December failed and 90% of the fish died on day two of the trip. Problems continued and fish were sold in Canso, Nova Scotia the following day.

Preliminary work in 2001 investigated the possibility of cod growers forming a consortium, to provide a more stable market supply by combining the relatively small stocks from around the island, as well as providing a larger time window to satisfy market demand. This could also guarantee a price upfront, rather than growers competing with each other come harvest time. However, a series of meetings with processors in 2002 were not successful in identifying a processor who could meet the specific requirements of a collective group of growers. This resulted in a change in approach to address marketing issues at hand, and in September, NAIA hired a consultant to work with a group of five growers (all in Placentia Bay) in establishing a coordinated program for sales and marketing. Woodman Sea Products declared a potential longer-term interest in working with cod growers, and agreed to purchase all product by the dates established by the growers at a set price, which the growers agreed to, creating a safety net on which the group could build its 2002 US marketing effort.
Woodman’s agreed to process product for the marketplace to enable a marketing footprint to be established in 2002 for expanded efforts in 2003.

Based on the limited harvest periods identified by the growers and to generate the highest returns, marketing effort was away from the chains and directed at the restaurant trade.

The market strategy resulted in several recommendations for future growth of this industry:

- Target market should be high-end, white tablecloth restaurants located in large urban cities, whose celebrity chefs have a predisposition to menu fare featuring cod fillets.

- Positioning strategy should be to establish cod growout as a premium, environmentally and ecologically friendly, all natural, high quality, semi wild cod fish yielding consistently large, thick white fillets ideally suited for high end white tablecloth restaurant menus.

- Product strategy should be the processing of fresh, whole head on, gut removed cod, 8 to 12 lbs. each, well iced, and packaged in 50 lb styro cartons.

- Pricing strategy should be to demand a premium price in recognition of the intrinsic value proposition, its limited seasonality of supply, and the cod growout story.

- Production strategy should be to negotiate a partnership with a select processor(s) to maximize production efficiencies, maintain a consistent high quality end product and coordinate a reliable source of feed.

- Harvest strategy should be to develop a protracted and orderly harvest schedule, designed to maintain a strong market presence over a minimum of three months.

- Distribution strategy should be to centralize local processing among one or two fish processors and to centralize distribution according to a geographic market segmentation and target market orientation.

A copy of this detailed market strategy is available.

**Stock Husbandry and Business Management**

As with any other sector of the aquaculture industry, proper husbandry of the fish would ensure the highest possible gains in growth over the season with minimal mortalities. Cod growout must be viewed as a business, where profits are realized after payments of all capital and operation costs. The success in future years in this sector is dependant upon the implementation of sound business practices, and not viewing the operation as a side project to other aspects of the fishery.

Several growout sites in 2000 experienced problems with disease brought on by the stress of high water temperatures (18-20°C) ultimately caused by shallow sites and low flushing. Stocking densities may have also been a factor. In 2001, two of the growers on the West Coast who experienced these problems applied for alternate sites.

In 2000, stocking densities of 20,000 lbs in cages (40’ x 40’ x 20’) were recorded, though this did not seem detrimental. In 2001, stocking density did propose a problem on a site in Plate Cove West, where more than 16,000 lbs were added to one cage and later experienced high mortality. This may also have been affected by high temperatures.

It is recommended that stocking densities do not exceed a final density of 25 kg/m³, and in times of high temperatures (>16°C), the fish need not be disturbed or fed, as this would give them prolonged exposure to warmer sur-
face waters rather than cooler deeper waters. For future site selection, deeper water (approx. 50’) and/or high exchange rates are essential.

**Cod Health**

In the years prior to this project, there had been no major disease outbreaks or parasitic infections causing significant mortalities. This does not mean that a disease outbreak would not occur in the future, and the growers and DFA must be prepared. To reduce the risk of a disease event, proper husbandry protocols have to be followed as discussed in the previous project, and the necessary preventative measures must be taken.

Initially, this work was lead by NL DFA staff, with regular involvement from Dr. Daryl Whelan as a consultant. After September 2001, Dr. Whelan joined the NL DFA staff and became the lead manager of this project. The main focus of the project was to carry out a semi-regular sampling protocol on sites from as many areas of the province as possible. Diagnostic sampling was triggered when criteria dictated, such as a behavioral change in the fish, increased water temperatures, mortalities exceeding the allowable mortality threshold, post-transport/grading and producer requests. Sampling was completed on any moribund or lethargic fish found within a cage, based on a SCUBA inspection of the cage and the fish. The samples gathered were analyzed at one of the NL DFA Fish Health Laboratories (St. John’s or St. Alban’s). A complete post-mortem was conducted onsite for gross abnormalities. Laboratory work consisted of using detection disciplines in Bacteriology, Mycology, Parasitology, and Haematology. Samples were forwarded to referral laboratories as warranted (i.e., Atlantic Veterinary College, Microtek, University of Bergen). The sampling protocols developed were based on the number of sites that actually secure a starting stock of cod and the location of the sites.

DFO, DFA, and FFAW representatives carried out mortality (mort) removal in 2000 through scuba diving and smaller amounts were removed by the grower. The major concern was the amount of time these morts remained in the water before they could be removed and in some cases no one was available and morts were left up to several days. This resulted in the development of a mortality drawstring (bridle) system designed for the grower, to remove any morts on a regular schedule. Most growers had this system installed in their cages and thus required very little scuba diving in 2001.
In 2001, atypical furunculosis was detected in the Bonavista Bay area. In 2002, vibriosis was detected on active sites. A fish health workshop was held in 2001. Emphasis was placed on minimizing mortalities during such disease events by using proper site husbandry.

Thermographs and related equipment were purchased to monitor, long term, temperature patterns at cod growout sites around the island. The lack of historical temperature data has allowed many cod growout sites to be licensed on the basis of anecdotal temperature profiles and patterns. In addition, bacterial and parasitic diseases that can cause problems in this industry are exacerbated with temperature stresses.

**Overwintering**

Two growers (Gooseberry Cove and Rushoon) agreed to participate in this project. During the winter months, once the temperature in the water started to decrease, the fish were monitored for feed intake, growth rate, and behavior. Feeding was reduced as required, and parameters such as temperature, oxygen, salinity, and pH were measured on a regular basis. Upon harvest, flesh quality, time to rigor, and bleeding characteristics were all recorded.

In both sites, fish lost weight during the winter months, showing little hope for this practice in the future. The problems that occurred during the experiment were of an expected nature (i.e., fish eat less during the winter months, and weather and ice are a problem for visitation and damage. Both growers were compensated for weight loss.

At the end of the overwintering project, one grower was left with a sizeable number of scrod (3,111 lbs.). Another project would determine to what extent these fish could grow. These were left in the water over the spring and summer, fed herring, capelin, and squid (15,655 lbs. in total), and then inspected for growth. Sampling showed an average weight of approximately 4 lbs. but many were still scrod. At the end of the experiment (August 6, 2001), the total weight was 3,900 lbs., thus these fish showed little growth over the specified time period. Final reports of both of these projects are available.

**Moist Feed**

The objective of this project was to investigate the possibility of a moist feed diet to supplement, if not replace, the baitfish diet currently being used in cod growout. This study consisted of manufacturing a suitable feed for cod growout by Quality Bait Services, formulated by nutrition experts from the National Research Council (NRC) in Nova Scotia.
The various feeds were manufactured using fishery byproducts and were to be tested in 2001 on 15,000 lbs. of cod on a growout site in Open Hall. However, due to the extended high water temperatures to the end of September, the project was postponed until 2002, though leftover feed was used in a palatability test, and showed the fish took the feed very well. Although expensive and limited in economic potential, it was considered a valuable exercise to provide a medium for delivery of medications or an emergency food supply in the event of a scarcity or periodic unavailability of baitfish. Due to prioritization for remaining funds, the project was not continued in 2002. A report of the work done in 2001 is available.

**Partners/Contributors**

- Department of Fisheries and Aquaculture
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- Department of Fisheries and Aquaculture
  Processing and Marketing Division
- Fish, Food and Allied Workers Union
- Newfoundland Aquaculture Industry Association
- Newfoundland and Labrador Cod Growers’ Association
- Program Planning & Coordination Division
  Fisheries and Oceans Canada
- Centre for Aquaculture and Seafood Development
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