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Assessment of Handling Practices for Snow Crab by Harvesters Landing Product to Makkovik Processing Facility

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Makkovik Processing Facility

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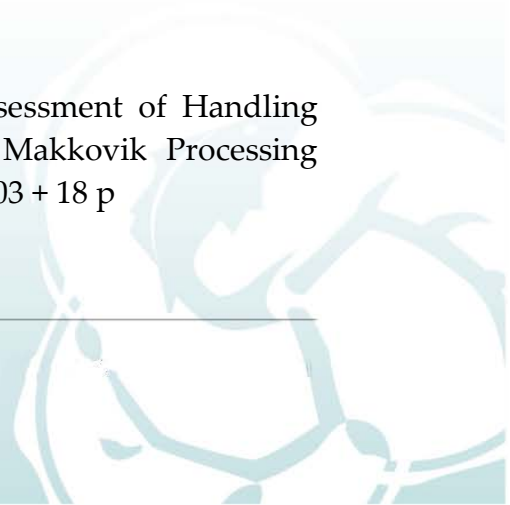


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Introduction

The Snow Crab Handling Procedure Project was developed in response to a small group discussion in the Snow Crab Fishery Workshop held in Makkovik, February 2-3, 2011. The workshop was attended by fishers, processors, and Nunatsiavut, Federal and Provincial government representatives. The discussion on “Handling Procedures”, facilitated by John Mercer (chair of the TJFB), has achieved consensus on two topics: (1) the resource is to be *harvested sustainably*; and (2) in a manner that *optimizes revenue*. A manner in which to achieve these two goals suggested by participants include: (1) Avoiding unnecessary mortality by improving the handling of soft shell crab to return to the water with the least harm possible; and (2) exploring icing and handling methods of commercially sized crab to ensure the best quality product.

The handling project was conducted by the Centre for Aquaculture and Seafood Development (CASD) to examine current handling practices in Nunatsiavut during the fishery in July, 2011 by conducting interviews with fishers, and taking samples of snow crab to be graded according to condition. The project objectives established were to:

1. Assess current practices that reduce unnecessary mortality of soft shell crab and commercially sized crab;
2. Assess handling procedures of crab to improve quality for market

Makkovik Shellfish Processing Overview

Torngat Fish Producers Cooperative operates two processing facilities located in Nain and Makkovik. The company is focused on developing long term sustainable processing operations. Operating in a northern environment the company faces many challenges with respect to raw material procurement, logistics and human resources. Seafood processing operations in other parts of Newfoundland also face these issues, but not to the same degree.

The Makkovik operation mainly processes snow crab and turbot and operates from June to November, depending upon availability of raw material (See Figure 1). The processing of snow crab is a relatively new addition to the operation which started in the past 6 years. The crab processing operation at Makkovik is small in comparison to operations in eastern Newfoundland having an estimated annual production of one million pounds of raw material.



Figure 1: The processing facility in Makkovik.

As with all shellfish processing operations, it is important to ensure the quality of the product being delivered to the facility is the best quality achievable by the harvester. With respect to snow crab processing, the liveliness of the crab landed by the harvester is an indication of how the product was handled. The quality of the crab landed is a concern for the Makkovik operation.

Methodology

Development of Data Collection Form

In assessing the handling and holding techniques applied by harvesters landing at the Makkovik processing facility data was collected on the following key areas:

- Vessel design and layout
 - Deck layout
 - Fish hold layout
- Handling practices at sea
 - Sorting techniques for undersize and soft shell crab
 - Stowage methods
 - Icing ratio
- Handling practices on shore
 - Off loading methods
 - Handling at dock-side
- Historical review of past catches
 - Review IDG grading data for 2011
 - Review grading reports for 2010

C-A project leader developed a data collection form (See Appendix A) to be used as a guide while interviewing the harvesters. In addition to the discussions, photos were taken of each vessel showing the deck area available and the fish hold.

Assessing Landing of Snow Crab

In assessing the harvesters handling of snow crab, data was collected in the following areas:

- Total Pan Weight
 - Weight of crab
 - Weight of ice
 - Number of lively crab
 - Number of weak crab
- Number of Critically weak crab
- Number of soft shell crab
- Number of dead crab
 - Dead crab determined by visual inspection only

Inspection of the product was conducted inside the processing holding room. The number of pans inspected was based on 2% of the total number of pans of product landed. The total number of pans was calculated based on dividing the hailed weight of the catch by 45 lbs.

The C-ASD technologist travelled to Makkovik to conduct interviews and collect observational data with the remaining harvesters delivering product to the operation.

Observations

Observational information was also collected on the following areas:

- Fishery participants
- Off loading procedures
 - Handling of product in the fish hold
 - Handling of product at dockside
- Current inspection procedures

Information on these areas was collected from general observations and through discussions with the plant supervisor, quality control staff and line supervisors.

Results and Discussion

Development of Data Collection Forms

Prior to travelling to the processing facility, the CASD project leader developed a questionnaire guide to aid in assessing the vessel and at sea handling procedures of the crew (See Appendix A). The form incorporated key information with respect to deck layout, handling of the product and stowage procedures.

In addition to the interview form, a product inspection form was also developed. This form was based on the landed product inspection form currently being used by Independent Dockside Graders Inc. in the grading of snow crab throughout Newfoundland and southern Labrador (See Appendix B).

Harvester Interviews

The snow crab fishery in Makkovik usually starts in late June due to the presence of pack ice in the fishing areas. This year, the fishery started about 4 weeks earlier than normal. The vessels involved in the fishery are leased by the individual awarded resource permits by the Nunatsiavut government. A total of 9 permits are awarded for harvesting snow crab. Most of the harvesters involved in the 2011 snow crab fishery have been involved in past harvests.

The C-ASD technologist met with the vessel skippers, who were still completing their quota allocations and the general manager for the Makkovik operation, to discuss handling and stowage procedures for snow crab landed at that facility. From the discussions, the majority of vessels involved in the fishery were contracted by the permit holders. All vessels ranged in size from 34' 11" to 65' with average a total crew of 5 persons (the smaller vessels in the fishery (under 35 ft) normally carried a 4 man crew). The average landing for these vessels was between 18,000 to 24,000 lbs of product.

One of the key focuses of retaining product quality is the handling of the product during harvesting activities. Based on discussions with the crew, the normal trip duration is 6 days dock to dock. Weather may result in an additional day at sea, however 4 fishing days is normal. Since the product is landed to the processing facility, an additional day at sea fishing should not be a significant issue. The normal harvesting period for vessels that stow crab on ice in other areas of Newfoundland is 5 days dock to dock. This crab, however, may be trucked 12 to 14 hours to processing facilities.

In reviewing the harvesting process, the average time required to recover a string of gear was between 2- 2 ½ hours. During harvesting, each crew member has a set of tasks to carry out. Normally, two crew members are assigned to cull the catch of crab, removing undersize, female and soft shell product. The reject crabs are discarded immediately by tossing them over the rail of the vessel.

The harvestable crabs are transferred from the picking table to the fish hold using a chute (See Figure 2). When the string of gear is recovered, one crew member is responsible to stow and ice the catch in the fish pound. The crew man spreads a 6" layer of ice on the bottom of the fish pound. Then using a tote pan, the harvested crabs are collected from the holding pound and transferred to the fish pound where they are stowed. The crew member ensures that all the crabs are oriented carapace side up. After 4 pans of crab are placed in the fish pound, the

crew man spreads approximately 1 pan of ice over the product. This procedure is repeated until the maximum stowage height of 90 cm is reached. It is estimated that 2 pans of ice is then distributed over the product. The shelving is then put in place and the process is repeated.

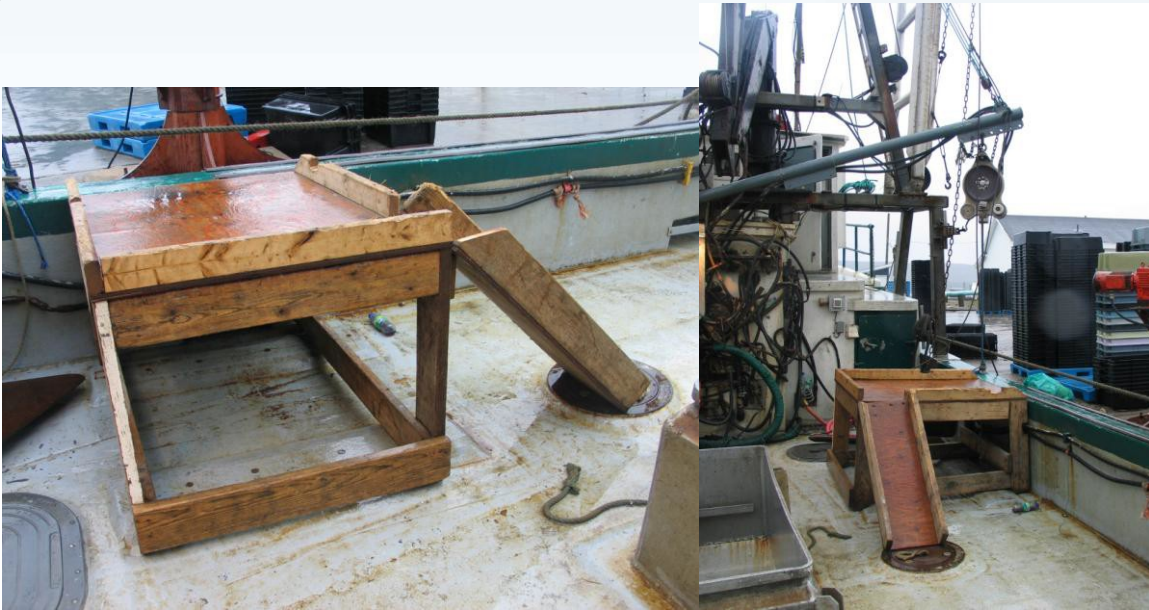


Figure 2: The crab picking table, showing the transfer chute to the fish hold.

The stowage procedure for the vessel is very important with respect to ensuring access to each day's harvest. When the product is placed into the fish hold, each day's harvest is segregated so that there is no mixing of older crab with fresh product. This is normally done by placing only one day's harvest in a fish pound. Upon landing, the crew member that stowed the product into the fish hold conveys where each day's harvest is located (loading plan) to the off loading crew.

Ensuring the highest quality product is being landed for processing starts with the handling of the crab during the harvesting period. All the vessels that were viewed by CASD technologist were open deck design and the catch was bulk stowed in the fish hold. The process described by the crew, with respect to handling the product, indicated that there was a focus on limiting the crabs' exposure to the elements by transferring it to the fish hold. However, the process of transferring crab to the fish hold was identified as a potentially critical issue with respect to maintaining product quality.

Previous research conducted on snow crab survivability has shown that impacts from handling have a significant negative impact on the survivability of the animal¹. As shown in Figure 2, when the crab is landed onboard the vessel, the product is dumped onto a picking table. The snow crab destined for processing are directed down a chute into the fish hold. This process of moving the crab from the picking table to the fish hold has subjected the animal to 3 impacts:

- Impact when the pot is dumped onto the table
- Impact when the animal hits the edge of the man hole in the deck
 - The drop from the table to the deck is approximately 30"
- Impact from the deck to the fish pound
 - The vessels measured had a dropping distance of 36" to 42"

The most significant impact is the dropping distance from the deck to the fish pound (See Figure 3). However, all of these impacts can potentially attribute to the survivability of the animal.



Figure 3: Fish pound where the snow crab dropped for temporary storage.

One harvester interviewed placed the crab in pans and stored the product on the deck during harvesting. When either the fleet of gear was retrieved or all the pans were filled, the product was then lowered into the fish hold. It was then iced as per the procedure described above. This method eliminates the handling impacts of moving the crab into the fish hold. However,

¹ Survivability of Snow Crabs Discarded from the Pot Fishery: Protocol for Conducting Experiments at Sea: http://www.fishaq.gov.nl.ca/research_development/fdp/fdp_307.pdf

prolonged exposure to the elements also has a negative impact on the survivability of the animal².

Initial discussions with the client indicated that a key point of concern was the procedure followed by harvesters in returning crab that don't meet minimum acceptable specifications (under 3.75" and/or soft shell). How these animals are returned to the ocean would have an impact on their survivability. Discussions with the harvesters interviewed indicated that the discarded crab are tossed over the rail of the vessel as the gear is being hauled back. The average vertical distance from the top of the rail to the water surface was approximately 6 ft. However, when the harvester is "tossing" the animals over the rail, the height from which the animal falls is much higher than 6'.

Recommendation

The handling of the crab after it is landed onboard the vessel is one of the key factors identified in maintaining a quality product landed to the wharf. It is recommended that a snow crab handling system be manufactured and installed onboard one vessel for the 2012 harvesting season, to evaluate the effect on crab quality.

Vessel Design

The vessels used in the harvest of snow crab for the Makkovik operation are leased by the permit holders to harvest product. These vessels were involved in harvesting snow crab, shrimp and other species. The key issues initially identified to be evaluated with respect to vessel design included:

- Available deck area to handle the product and gear during harvesting operations
- Adequate area available in the fish hold to carry sufficient ice for the volume of crab the vessel could carry.
- Adequate areas available in the fish hold to stow the catch and allow the harvester to separate each day's fishing effort.
- Identify upgrades to vessels which would increase product quality and the survivability of by-catch.

² Mortality of Snow Crab Discarded in Newfoundland and Labrador's Trap Fishery: At Sea Experiment on the Effect of Drop Height and Air Exposure, Scott Grant: <http://www.dfo-mpo.gc.ca/Library/277158.pdf>

When the CASD technologist arrived in Makkovik, the majority of the vessels involved in the fishery had completed their harvesting operations. Of the vessels that remained, 4 vessels were above 50' in overall length and 1 vessel was below 40' in length. All the vessels had open deck design and bulk stowed the catch in the fish hold. One of the larger vessels had a refrigerated sea water system for holding the product.

The larger vessels had sufficient deck area to allow for harvesting operations and culling of the catch. The main issues identified with respect to harvesting procedures are:

- Amount of ice the harvesters took

The interviews with the harvesters indicated that the average amount of ice taken by each vessel was 8 xactics tubs. Assuming each vat held 1000 lbs of ice, the amount of ice taken would allow for a maximum landing of 16,000 lbs of crab. However, this assumes that the ice does not melt and no allowance for the heavier icing required for the initial layer of ice along the bottom of each pound.

Sufficient icing is important to maintain product quality from harvest to processing. In practice, icing snow crab at a ratio of 2 lbs of crab to 1 lb of ice is sufficient to maintain the quality of the product. The vessels inspected did not have insulated fish holds nor did they have refrigeration systems. Therefore it is critical that the harvester takes sufficient ice. The harvester should allow an additional 2 or 3 xactics boxes of ice in addition to the minimum amount of ice required based on the 2:1 ratio of crab to ice.

- Returning undersize and soft shell crab

CASD, in previous projects, have assisted in designing and evaluating handling systems for vessel decks to allow more efficient processing of crab by the harvester. These systems incorporated a chute mechanism to allow for a gentler transfer from deck to fish hold. Also, the table had a chute system for discarded crab so instead of tossing the reject crab over the rail of the vessel; they were directed toward the chute and slid back into the ocean.

- Method of transferring product from the deck to the fish hold

As identified earlier, most of the vessels viewed transferred the crab into the fish hold via a man-hole. The crab that was being kept is transferred to the fish hold using a chute. Although this method minimizes the exposure of the crab to the elements, the key concern is in relation to the impact trauma that is inflicted to the crab. Increasing the size of the man-hole and installing a chute system to reduce the falling distance from the deck to the fish pound will minimize the impact trauma to the crab and potentially extending its shelf life.

Assessment of Snow Crab Landings

In determining the quality of product landed, the CASD technologist assessed the quality of snow crab landings during the site visit period. The landings from 4 vessels were assessed based on the criteria indicated in the form included in appendix B. The sampling level for each catch was based on 2% of the landed weight. This sampling rate would provide a strong indication of current handling practices by the harvester. Detailed inspections of 3 vessels that bulk stowed snow crab were conducted. However, the landings of the RSW vessel were only inspected to determine the number of undersize crab in the catch.

The majority of the product landed at the Makkovik operation was landed by vessels that bulk stowed the catch. The assessment results of the 3 vessels that landed product during the time period the CASD technologist was on site is summarized in Table 1 below.

Table 1: Summary of snow crab landing at Makkovik.

Criteria	%/# of	%/ wt of crab
Lively	19.98	21.76
Weak	43.83	44.50
Critically Weak	34.00	26.28
Dead	0.10	0.08
Soft Shell	0	0
Under Size (3.75")	2.09	1.51

As can be seen in the table, the majority (>75%) of the product sampled was assessed to be either weak and /or critically weak categories. Although the crab was landed at the processing site, if it had to be held on ice prior to processing (i.e. overnight) a complete cull of the catch would have to be done.

Crab was landed by a vessel that used refrigerated sea water as the holding medium. The harvest for this vessel was not assessed for liveliness of the product since all the crab landed was lively. However, random samples were taken to evaluate the percentage of undersize crab. The samples assessed indicate that there was less than 2% of the catch in this category.

Overall, from the product assessed most of the harvesters are not handling the product to maintain a high quality product. The handling practices could be related to a combination of two issues:

1. No independent grading and no deterrent for poor handling
2. The vessels are harvesting product on contract. As such, the goal is to land the volume of crab in as few trips as possible.

Current Assessment Procedures

The landings of crab are currently assessed by the quality control staff for the processing operation (See Figure 4). The procedure followed allows for assessing two tote pans of crab per 10,000 lbs of product. The total number of animals' sampled per vessel landing is approximately 200. The criteria the company is monitoring is:

- Liveliness (weak or live)
- Size (Graded to 4" standard)

The quality of the product landed is not assessed using current standards. Also, based on the average landings, the current assessment procedure only allows for sampling of less than 2% of the catch. However, due to other required duties, this is all that the current staff can sample.



Figure 4: Quality control staff assessing a landing of snow crab.

In addition to the lower sampling rates, if there is an issue identified with a particular landing, the staff has no recourse action. The information is provided to the general manager who is responsible to relay that information to the harvester.

At other landing sites where snow crab landings are assessed by an independent third party, landings that had greater than 20% critically weak and/or 4% or greater dead crab in a catch, are reported to inspectors at the Department of Fisheries and Aquaculture. If possible, DFA inspectors travel to the processing operations to ensure a full cull of the landing is conducted prior to processing the product.

Landings which the sampling indicates have a high percentage of critically weak or dead

crab are not culled prior to processing at the Makkovik operation. The company relies on the butchers to remove the dead animals based on the quality of the sections. In landings where there is a high percentage of weak or dead crab, on-line culling does not remove 100% of the poor quality product.

Recommendations

Assessment of landing and providing feedback to the harvester and processor is critical to maintain and improve the quality of product landed. It is recommended that Torngat Fisheries discuss having an independent grading company (i.e. Independent Dockside Grading Limited) inspect all landing for the 2012 snow crab fishery. Grading companies, such as IDG, have trained personnel that they can utilize to provide immediate feedback to the harvester, processor and the Department of Fisheries and Aquaculture.

If the company chooses to conduct the inspection of landings, it is recommended to significantly increase the amount of samples examined to at least 6% of the catch based on hauled weight. The grading systems in use at other landing sites in Newfoundland inspect the catch at the 20% level. At the suggested 6% level, the company is still significantly lower than other areas, but the data would provide a much stronger indication of the quality of the product. The level suggested would require the inspection of 13 pans of crab for every 10000 lbs of product landed.

Increasing the inspection level would require a more dedicated effort; possibly one person would have to be dedicated to this task. In addition, automation of the process through utilizing a computerized scale system to capture the data collected would allow the inspection process to be carried out by a single individual. Such systems are available through local companies.

Through the company inspection additional categories of “critically weak”, “dead” and “under legal size” should be captured. Also, the company should establish a standard for these categories where additional action would be taken. For example, where 10% of the samples are critically weak and/or 3% of the samples are dead then the Department of Fisheries and Aquaculture are notified. Likewise, if 5 % of the samples are under the allowable size then the Department of Fisheries and Oceans would be notified.

Finally, to ensure improvements in the quality of landed product, feedback to the harvester is necessary. Thus, reports on each landings sampling should be provided to the harvester. To encourage improving handling practices, marginal or poor grading reports would result in increased inspection levels. This information should be given to the harvester within one hour after offloading is complete.

Observations

During the 10 day on-site visit to the Makkovik operation the CASD technologist assessed the landings and observed the flow of product from the vessels to the processing operation. From the general observations, the offloading and handling of the product to the processing facility was efficient. Once product was removed from the fish hold of the vessel it was immediately transferred to the weigh station and onto the processing operation (See Figure 5). The rate the workers offloaded a vessel was on par to the production rate of the processing operation. Thus, within an hour after offloading, the product was processed and packaged.



Figure 5: Offloading a vessel and transporting it to the processing operation.

Although the off loading procedure was efficient, there are issues with current practices. The first issue is the handling of crab in the fish hold by the off loaders (See Figure 6). When removing crab from the top layer of the fish pound, to maintain a fast pace, the product is often dropped into the pans. The shock the crab receives from the impact can potentially result in killing the animal since it is already in a weakened state. Also, the impact can result in the animal dropping its limbs, which downgrades the quality of the section.



Figure 6: Offloading crew removing crab from fish pounds.

The focus of the crew is to quickly and efficiently remove the product from the fish hold. However, the offloading supervisor should be vigilant of excessive handling of the product. Also, the crew should be reminded to stack pans so that the pan they are filling is close to the height of the product in the fish pound. This would minimize the shock of dropping the product into the pans.

The final issue with respect to off loading is mixing of the product on a pallet. As identified earlier, it is important that the first harvested product be removed from the vessel first. Discussions with the harvesters and offloading crew indicated that the loading plan is verbally passed on to the crew as to which pound contains each day's harvest.



Figure 7: Offloading the catch from the F/V Atlantic Provider.

Normal offloading operations have a minimum of 3 persons offloading the vessel. Each individual removes product from a pound (See Figure 7) into tote pans. Once there is a stack of 5 tote pans of product it is moved towards to the main hatch. When there are 2 stacks

of pans (i.e. a total of 10 pans), it is removed from the hold. Each lift can contain product from two of three pounds. Depending upon the catch rates, this can result in mixing of fishing days. This issue becomes significant when product cannot be processed immediately and has to be held on ice. In such a situation, the focus for the processor is to process the oldest product first.

Fishery Participants

The current Makkovik operation was originally opened in 1991 and at that time was primarily a ground fish processing operation. Because of the moratorium in 1992, the company had to invest in its operations to expand its processing capacity to other species to maintain viability. As such, the Makkovik operation was expanded to allow the production of snow crab. This expansion has allowed the company to maintain a viable operation in Makkovik.

The continued investment in the operation is a strong indication of the company's long term commitment to the operation. Discussions with the harvesters and the general manager highlighted the point that the fish harvesters landing raw material to the operation have little investment in the fishery. The majority of vessels that supply snow crab to the processing facility are contracted by local harvesters who have a permit to deliver product to the Makkovik operation. As such, once the quota is caught, the vessels return to their port of origin. Discussions with a harvester who has invested in the fishery through purchasing his own vessel and gear, indicated that he is interested in providing top quality product to the operation. The interest to provide a top quality product was evident in the assessment of his catch with approximately 81% of his landings in the lively to weak categories as compared to the average of 65% for all the vessels that bulk stowed their catch.

It was also evident through the discussions with the harvesters that encouraging investment in the fishery will also benefit the landed quality of product. In addition to improving product quality, harvesters can be called upon to work with the company and the government to develop other fisheries. This would ensure a strong and viable operation.

Recommendations

Based upon observations and discussions with harvesters and the processor the following recommendations are put forward for consideration:

- The Nunatsiavut government encourage harvesters/permit holders to invest in their fishing operations. A time line should be initiated to phase out contracting out harvesting services (3 years) and purchase individual enterprises.

- The Nunatsiavut government should place conditions in the issuance of the 2012 permits requiring harvesters to acquire the services of vessels that have a capacity to carry a minimum of 15000 lbs of product (snow crab). The minimum catch capacity will ensure at least a 3 hour work period for the operation.

- Current harvesters who have invested in their own enterprise should be permitted to harvest sufficient product (snow crab) to allow their enterprise to remain viable. As such, the Nunatsiavut government would increase the volume of product available to harvesters/permit holders who own their own enterprises and proportionately reduce the quotas to harvesters who continue to contract harvesting services.

- The development of additional fisheries is critical to maintaining a viable operation in Makkovik.
The Nunatsiavut government should implement a program to conduct harvesting surveys on fisheries suitable for the operation in Makkovik and Nain. The government should investigate the potential to harvest and process resources such as whelk, scallop, etc. To encourage investment in the fishery, only permit holders who own their enterprises would be eligible to conduct the surveys and expand their operations to other species.

Conclusions

The work conducted on this project was commenced near the conclusion of the snow crab processing season. During the time period that the CASD technologist was on-site, the remaining vessels had approximately 75% of the allotted quota remaining to harvest. From the information gathered, overall, the quality of the snow crab landed at the Makkovik operation can be significantly improved through the implementation of improved handling systems onboard the vessels and through improved icing techniques.

The vessels involved in the fishery are mainly contracted by the local permit holders to harvest their quota of product. Only one harvester interviewed owned his fishing enterprise. The contracted vessels harvested crab in other areas and are well aware of the concerns of handling snow crab to ensure a quality product is landed. However interviews with the crew indicated that there was little concern on improving quality. The focus seemed to be on landing the product in as few trips as possible.

Working in a remote northern community poses significant challenges for the company. Limited human resources is a significant issue. Although the CASD technologist was not specifically investigating production issues, discussion with management highlighted the

need for additional investment in automation of the snow crab processing operation. In addition to work shortages, a more in depth understanding of each worker's defined roles and responsibilities will potentially aid the company in creating a more flexible work force.

Recommendations

The recommendations put forward to the Nunatsiavut Snow Crab Fishery to consider are summarized below.

Onboard Handling Practices and Market Quality

Inspection of Snow Crab Landings

- Work with the Department of Fisheries and Aquaculture and the Nunatsiavut government to contract an independent third party grader to assess landings.
- Currently, the company inspects a maximum of 200 crab per vessel. This sampling procedure only provides a weak indication of the quality of the product being landed. It is recommended that the sampling protocols be increased to a level to provide a more reliable assessment of the quality of a catch. It's suggested that the company set a minimum level of inspecting 6% of the catch.
- Conduct sampling on a continuous basis so as to assess the quality of each days fishing effort.
- Purchase a scale system dedicated for assessing snow crab landings. Computerized scale systems can be linked to the local network to provide size distribution data.
- Provide assessment reports to the plant management and the harvester.
- Implement additional grading categories to identify the percent of snow crab "critically weak", "dead" and "under 3.75".
- Work with the Department of Fisheries and Aquaculture to implement a system where by harvesters not landing quality product would be inspected by DFA inspectors.

Offloading and Dockside Handling

- The harvester should provide the off loading supervisor with a written copy of the

loading plan for the vessel. The loading plan will clearly show where each days fishing effort is located in the fish hold.

- The crew working in the fish hold are set up so as not to mix harvest days. This is increasingly important when product has to be held for extended periods on ice prior to processing. The use of a tagging system or only removing pans from each off loader will minimize this issue.
- The off loading crew should receive refresher training on the proper handling of snow crab. Emphasis should be placed on the importance to not allow the product to be dropped into their pans.

Additional Observations

Nunatsiavut Government

- The Nunatsiavut government encourage harvesters/permit holders to invest in their fishing operations. A time line should be initiated to phase out contracting out harvesting services (3 years) and purchase individual enterprises.
- The Nunatsiavut government should place conditions on the issuance of the 2012 permits requiring harvesters to acquire the services of vessels that have a capacity to carry a minimum of 15000 lbs of product (snow crab). The minimum catch capacity will ensure at least a 3 hour work period for the operation.
- Current harvesters who have invested in their own enterprise should be permitted to harvest sufficient product (snow crab) to allow their enterprise to remain viable. As such, the Nunatsiavut government would increase the volume of product available to harvesters/permit holders who own their own enterprises and proportionately reduce the quotas to harvesters who continue to contract harvesting services.
- The development of additional fisheries is critical to maintaining a viable operation in Makkovik. The Nunatsiavut government should implement a program to conduct harvesting surveys on fisheries suitable for the operation in Makkovik and Nain. The government should investigate the potential to harvest and process resources such as whelk, scallop, etc. To encourage investment in the fishery, only permit holders who own their enterprises would be eligible to conduct the surveys and expand their operations to other species.

Production Employees

- Provide a 5 day quality control and supervisor training session for the management team of both the Makkovik and Nain processing operations. Marine Institute has

developed several programs in this area and can work with the company to refine programs to specifically fit the needs of this company. It is suggested that the training session be conducted in Goose Bay and that 2 representatives from the secretariat also attend.

- Provide training for the workers at the processing facility specific to their area of operation. It is suggested that snow crab production workers have sanitation/hygiene training and snow crab processing training.

Additional Investment in the Operations

- Worker shortages are a significant issue for the processing operation. It is recommended that the company investigate automating components of the snow crab processing operation. For example, installing an automated crab butchering and cleaning system can potentially provide additional workers for other areas of the operation.
- The company is similar to other snow crab processors in that there is inefficiency due to small volumes of crab being landed to the operation. This is apparent mainly at the start of the season and near the finish of the season. The cost of running the operation for a small volume of snow crab is very significant. It is suggested that the company investigate producing a raw crab product for markets. This would allow for minimal equipment operation thus reducing operational costs such as clean-up.
- The company should work with the Nunatsiavut government to investigate the potential of developing other fisheries for the facilities operated by Torngat. The potential of producing whelk and scallops, as an example, may extend the production period for the company and diversify the products the company can offer its customer.

