NorthEast Consortium Final Report

Evaluating the practicality and economic viability of a pilot Acadian Redfish (*Sebastes fasciatus*) jig fishery.

Award # 11-027

Period of Performance: July 1, 2010 – June 30, 2011
Final Report Submitted : July 1, 2011

By

Adam Baukus, Steve Eayrs and Kristin Garabedian

Gulf of Maine Research Institute

Contact: Adam Baukus
Gulf of Maine Research Institute
350 Commercial St. Portland, ME
Phone: (207) 228-1691
Email: abaukus@gmri.org

Introduction

The goal of this project was to explore the potential revival and development of a redfish fishery in downeast Maine using automatic jigging machines. The main reason to target redfish is that they are currently an abundant and under-utilized species. According to NMFS, redfish are not overfished, and overfishing is not occurring (NEFSC 2008), one of only three managed stocks in the New England region to be in this category (figure 1). The redfish allocation for 2010 was the third largest at 6,848 tons, only 1,587 tons of which were harvested as of April (NMFS 2011). Redfish could offer fishermen an alternative target when quota of other species is running low, or is at a low market price. This could result in more consistent and efficient fishing operations for fishermen, and a reduction of fishing pressure for other fish species.

Redfish biology and fishery

Redfish have unique biological characteristics that require careful consideration when attempting to revive a fishery. Acadian redfish (*Sebastes faciatus*) is one of three species of redfish found in the Northwest Atlantic, and the only species found in the Gulf of Maine (Sevigny *et al.* 2003). This species is most commonly found in deeper in-shore waters. Typical habitat for aggregations of Acadian redfish is the steep rocky edges of sharp drop-offs and in habitats with muddy or hard bottom type. They are noted for extreme longevity, reportedly living to 75 yrs old, and low fecundity with viviparous reproduction (Campana et al 1990). Variation in recruitment is very high, with a pattern of large recruitment pulses occurring at an interval of 5-12 years (Magnusson and Johannesson 1997). These factors collectively result in higher vulnerability and less resiliency to overfishing compared to species like herring with shorter life spans and, higher reproduction rates.

Fisheries for redfish are found in the US, Canada, Greenland, Iceland, and in international waters prosecuted by a number of other countries (Sigurdsson et.al. 2006, Sevigny et.al. 2003). Historically redfish were caught in large quantities as by-catch species in cod and shrimp trawl fisheries, before targeted fisheries began (Ratz 1999). Like many other countries, the targeted US redfish fishery began in the 1930s. In 1952 peak landings for this species measured 130,000 metric tons. By the 1950s the stock of redfish was heavily exploited (Mayo 2006). In the Gulf of Maine, landings continued to decrease until a slight increase in the late 1970s followed by another decline in the 1980s and 1990s (Figure 2). As of 2005 redfish catch rates were at their lowest level since the 1930s. Due to recent high recruitment rates it is believed that age structures of this species are being restored (Mayo 2007). Although they are separate stocks from the Gulf of Maine population, Iceland and other areas have seen recent improvement in catch rates suggesting a positive stock condition (Real 2009). Gulf of Maine fishermen report no lack of redfish for those who wish to target them (Michael Walsh, pers comm).

Over the last few decades increases in minimum mesh size for bottom trawls in the Gulf of Maine have effectively eliminated the trawl fishery for redfish. The current minimum codend mesh size is 6.5 inches, and the legal redfish size is 9 inches, which results in a majority of the catch slipping through the net unless it is already very full of other species. Combined with a low market price, this fishery is no longer lucrative or feasible using trawl gear and this codend. With the recent move towards sector management in the Gulf of Maine, redfish have again become a species of interest due to their high abundance and allocated quota. This has caused interest among fishermen to explore alternate gear types in hopes of creating a profitable commercial fishery in the Gulf of Maine.

Jigging machines

Automatic jigging machines offer unique capabilities to target redfish. The DNG company, based in Iceland, developed one of the first models of jigging machine and is still considered to be the standard in the industry (Bates 2011). These machines are portable and easily fitted on any size vessel. The jigging fishing method has almost no physical habitat impact, and allows for fishing in any habitat type, unlike other gears with more bottom contact that might get snagged or torn in rock or ledge areas. It also would be expected to use considerably less fuel than bottom trawling, since the tow process and drag from gear and bottom contact are eliminated. There is potential for high selectivity and low bycatch through use of various hook types, sizes, lures or baits in addition to the time, place and depth the jigs are used at (Bates 2011, Nowara and Walker 1998). Jigging machines also have the benefit of landing fish in excellent condition, opening potential opportunities for higher market prices or new markets. These types of machines have been used successfully to capture pelagic and demersal species around the world (MacDonald et al 2007, Bower and Ichii 2005), and local interest has been recently indicated by smaller boat owners looking to diversify their fishing endeavors; to catch low volumes of redfish efficiently, cheaply, and with a minimum of environmental impact

While these machines have proven successful in many different ocean basins, downeast Maine is a prime study location for several reasons. Similar to many regions, fishermen downeast have been hit hard by increased costs and reduced allocations of groundfish. However, unlike waters to the south, this region lacks the diversity and abundance of groundfish. Species including cod, haddock, and pollock are historically scarce in the area as seen by the ME-NH inshore survey. The survey does show recent increases in the number of redfish in the area, specifically with larger numbers observed in the fall near the downeast area (Sherman et al 2009). This presence of redfish is also noted by local fishermen from Port Clyde, one of the northern most groups of ground fishermen in the state (Travis Thorbjornson pers comm). The additional landings and revenue from targeting redfish could be crucial for small boat operators in the region, as downeast ground fishermen have low catches and low revenues compared to the rest of Maine and New England. In 2009 downeast fishermen on average landed only 743 lbs of groundfish, bringing in an average revenue from groundfish of $2,737 per permit, compared to averages of 56,210 lbs and $44,842 per permit for the state of Maine as a whole (NEFMC 2011). The question remains as to the price and market availability for

redfish, but there is some potential, as Port Clyde fishermen have seen success with sales of redfish through their community supported fishery marketing model. This method of sales has seen recent increase in popularity, with similar options forming throughout many areas of New England.

Goals and Objectives

The goal of this project was to determine if a profitable commercial fishery for redfish could be established using electronic jigging machines. The project was broken down into two areas, a field research component, and a market research component.

The objectives of the field research component were to:

- Demonstrate potential daily catch rates of redfish
- Determine optimal hook size and shape for catching legal size redfish
- Assess levels of bycatch using jigging machines

The objectives of the market research component were to:

- Investigate the level of interest and obstacles in serving redfish in local restaurants
- Identify factors that are most important in determining the popularity and the price for redfish

Methods

Field Research

Field work was carried out from July 31, 2010 to August 18, 2010 from a commercial lobster boat, the 38 foot F/V Andanamara, based out of Swan's Island, Maine (Figure 4). Ten sampling days covered the widest area feasible for single day trips (Figure 3). The vessel was outfitted with three DNG C-6000i electronic jigging machines (Figure 5). Each machine was equipped with approximately 1000 feet of Dacron line terminating in a 4 meter long leader, made from 130 pound test, 1.225 mm diameter disappearing pink fluorocarbon. Four hooks of the same size and shape were spaced 1 meter apart on the leader with a 5 pound weight attached to the bottom. Initially three different hooks types were used: Mustad Circle 6/O with a red tube lure, Mustad Circle 6/O with a gummy shrimp lure, and an O'Shaughnessy J-hook 8/O with a neon tube lure. Later the Mustad Circle 6/O with a gummy shrimp lure and O'Shaughnessy J-hook 8/O with a neon tube lure were replaced with Gamakatsu 2/O hooks with a hand-made fly (Figure 6). Leaders were randomly assigned to a machine each day. The following data were collected for all deployments of the jigging machines: GPS location, date, time gear set, time gear haul, hook type, and average depth. The following biological data was collected for each specimen brought on board: species, weight (kg), length (cm), machine number, hook number, and hook location.

When catch rates on the machines were low, hand lines with were also used with a variety of hook sizes and baits to determine if fish were present and jigging machines were ineffective. Bottom longlining for groundfish was also performed by the captain on

several of the sampling trips. This was done in separate but adjacent areas to the jigging machines, and was not part of this project, but allowed for insight into fish abundance in the area fished and opportunities for integrating jigging machines into other fishing protocols. Catch rates of the jigging machines (kg/hook hr) were calculated by totaling the catch weight for all machines on a given sampling day, dividing by the number of hooks (4 hooks/machine, 3 machines = 12 hooks), then dividing by the number of hours the hooks were in the water on that day. Catch rates of the longlining gear were calculated for comparison, using the same equation (kg of catch/#hooks/#hrs).

Market Research

Market research was done through the use of an online survey. The survey was created using the Survey Monkey online application (www.surveymonkey.com) and was designed to take about 10 minutes. The survey comprised 11 questions designated into three parts. In the first part questions were used to determine the type of seafood establishment taking the survey. In the second part, questions focused on general preferences for seafood, and in the final partquestions related to knowledge and preferences for redfish before and after being given information about the species. Questions were formatted as a variety of open answer, ranking, and multiple choice questions (Appendix A). In total 45 seafood restaurants and distributors were contacted via e-mail with a request to complete the survey and a link to the survey. Two follow up e-mails were sent to participants to remind them of the survey's closing date. The survey was active from June 26, 2010 until September 13, 2010.

Results

Field Research

Ten days of sampling were completed with daily round trip search distances ranging from 28.8 km to 197.6 km. Total fishing time for the jigging machines varied between 2.5 to 4.7 hours per day; these times represent the times hooks were in the water, and do not include time spent searching for fish aggregations. Bottom depth varied between sites, ranging from 35 to 530 feet. The jigging machines were primarily set on default DNG settings to jig near the bottom, although occasionally adjustments were made to the settings to fish higher in the water column. Catch rates were very low, ranging from 0.003 kg/hook hr., to 0.247 kg/hook hr. (Table 1). Catch rates for the concurrent bottom longlining gear were even lower, ranging from 0.0006 kg/hook hr. to 0.052 kg/hook hr. Species caught on the jigging machines included atlantic cod, atlantic mackerel, Acadian redfish, pollock, and longfin squid.

Market Research

Eight seafood establishments completed the online survey, while five began taking it but did not complete it. Nine establishments were from the restaurant community, three were seafood distributors, and one was anonymous. The restaurants ranged in both seating capacity and average price of a meal (under $15 to over $36).

When asked about the level of knowledge the establishments had with redfish there were replies of having no knowledge (3), little to some knowledge (3), and substantial knowledge (2). The survey responses all showed that there was an interest in learning more about redfish and working with them. The survey asked for ranking order of six factors based on their importance when purchasing seafood, the quality of product was the most important factor followed by whether the population of the species is in good health. Establishments responded they would pay a higher premium for redfish based on six different factors; most would be willing to pay a range of 5% to 20% (Figure 8).

There were no strong preferences towards processing as whole fish or fillets, and the option of offering the product seasonally did not indicate a loss of interest. Characteristics used to determine freshness were smell, clear eyes, color of gills, and firmness of the flesh. Traceability of the harvest method and location was mentioned as important. Responses as to why redfish is not a common food fish specified the lack of availability from seafood distributors and lack of interest from the public as primary reasons. There was a response indicating the belief that redfish are a threatened species, and several responders asked for more information on sustainability and impact of harvesting methods and taste of fish. The requested volume of fish necessary for each establishment to operate with varied among those surveyed from ten pounds to ten thousand pounds, and most requested weekly delivery.

Discussion

Catches

Catch rates of any species of fish was extremely low for this study, and there is reason to believe the main reason for this was a lack of fish, not a lack of effectiveness of the machines. Despite vast searches over many miles, very few aggregations of fish were encountered in the study area. We searched as far as possible for single day trips, traveling as far as 197 km in one trip. Alternate methods were used to verify that the fault was not with the machines. Sampling by rod and reel with various hook sizes and baits turned up very few fish and no species that were not captured by the machines. Bottom longlining in adjacent areas yielded similarly low returns, and commonly a majority of the 2,000 hooks on the longline were retrieved with bait intact after a 4-5 hr soak. Conversations with several local fishermen led to alternate sampling spots being identified but they yielded limited catching success.

Our results highlight a lack of current information about redfish distribution both spatially and temporally. Multiple reports from fishermen and survey reports suggest they can be found in the sampling area, but our limited success suggests their distribution may be spatially variable or seasonal. Further testing is therefore necessary before we can answer questions about selectivity and bycatch of fish jigging. It also remains unknown what quantity of fish can be landed in a day trip if large aggregations of fish were located. Redfish are known to aggregate into large schools so quantity landed may not be an issue, but potentially another important consideration is what the current ex-vessel price is. The market variation may affect how many fish you want to land or how much time and effort you are willing to put into it.

Jigging machines

We were able to get a sense for the capabilities of the machines in this study. Electronic jigging machines are not a common fishing gear in the US so there is little experience using them. The machines that were used in this study have a wide range of features and settings that can be specifically tailored for more targeted fishing effort. The basic settings consist of: options for fish sensitivity, or the amount of weight needed to be caught for the machine to haul in automatically, speed of the jigging action, length of the jig stroke and the length of time between jig strokes, speed in which the machines haul in the line, distance of hooks from the bottom, how frequently the machine checks to determine the bottom depth. More complex settings can be set for specific bottom types, specific fish species, and fishing with baited hooks. There are also a number of search settings that can be used to search for fish in the entire water column or just certain portions of the water column. Finally there are a number of settings to customize the type of jig stroke from pre-set factory jig strokes or creating your own custom jig stroke. This high level of customization and adaptability lends itself to targeting almost any desired species and any habitat.

Jigging machines are becoming popular, especially in Iceland, Norway and pacific northwest fisheries, where coastal fisheries are reviving or regulations limit other gear types. New features are being developed for the machines including being able to program machines through a PC in the wheelhouse, or have one reel that acts as a master to control others to the same settings. The DNG factory cannot currently keep the machines in stock, and all machines are hand crafted and sent on demand, demonstrating their increased popularity (Bates 2011). The machines proved very easy to install and use. Their small space requirements make them ideal for small boats. Their quick deployment made it very feasible to use in addition to other gear and rapidly sample a large number of sites. In this study the machines were used in conjunction with long line gear, but they could easily be utilized before/after using a variety of gears including gillnets, lobster traps, and trawling.

We were also able to document the challenging aspects of using the jigging machines. The primary unknown being the total amount of fish we could land in a day. With a variety of jig strokes and lure/bait options the operator can target a wide variety of species, but there are some types of fish the machines would not be effective for, such as flatfish and monkfish. The tight association to the bottom for these species makes it difficult to target with jigs. Another potential negative is the technical complexity of using the machines. While the machines are simple in design, the fundamental skills fishermen normally attribute to troubleshooting their gear may not apply to these machines. The reliance on computers to operate the equipment is not desirable to some, and most likely service on the machines cannot be done locally, opening the door for costly delays. There are thoughts among some industry members that jigging machines are unnecessary for redfish as there is little difficulty in catching them with trawl nets, and once the right size fish are located there is little bycatch. In certain regions this may be true, but it is important to consider the scale of bycatch is still greatly reduced using jigging machines versus trawl nets, and the escapement of fish during haul back can be

significant and affected by sea state and other factors (Madsen et al 2008). The fish that escape the net are likely to have low survival as barotrauma caused by bringing fish up from depth can cause mortality with rates of up to 18-30% of the catch recorded, (Lisovsky et al 1995) and higher rates probable.

Study location

Arguably the location of our study site was not ideal for this project, as more reliable landings of redfish are common out of ports to the south, like Gloucester, MA. However there are several reasons that made it worth the effort. Firstly the concept of the project was brought to us by downeast fishermen, from an area where many small boats were looking to add value to daily trips. Although, after last minute changes from industry partners we ended up working further to the northeast, perhaps further away from reliable redfish aggregations. Secondly, although redfish are more commonly caught to the south, there was possibility for increased marketing potential in the downeast region. Success in selling redfish through the community supported fisheries model at local co-ops in this region was a viable option, with a need for more information and trials.

Survey

Unfortunately the lack of landings made testing the success of redfish sales in the community supported co-ops impossible, but we were able to begin the process of market research with an online survey. The limited number of responses to the survey (8) leaves it difficult to make definitive statements about marketing perspectives, but does suggest interest in the product and warrant further investigation. Responses showed a willingness to pay a higher price if the product met certain criteria (Figure 8), with the most popular choices being the high quality of the product, if it was caught locally, and if bycatch was reduced during harvesting. Redfish is a great fit to all these categories. Interviewing restaurants and processors in person may have yielded better results but was beyond the scope and budget for this project. We were able to involve our intern, Kristin Garabedian, from the University of New Hampshire (Figure 7), who helped develop and distribute the online survey to local establishments. An online survey has the advantage of reaching a larger sample size than personal interviews. Increased popularity and knowledge of redfish in the marketplace could increase the return rate of surveys in the future.

Offering a high quality product is vital to any market, especially when trying to create a new market, or change the perspective of an old market as with redfish. As redfish are known to spoil slightly faster than other species of fish this becomes even more paramount (Rehbein et.al. 1994). There are methods such as Ike Jime (Fletcher and Hodgson 1988), using plate freezers and slurry ice machines (Crowley 2011), and treating fillets with sodium lactate to preserve the bright red color (Erkan 2003) that help keep product quality at a maximum and could be expanded upon for processing redfish. These methods are often perceived as excessive and unnecessary to harvesters, however, the United States just passed a comprehensive new food safety law that could affect both importing and exporting of seafood (Slavin 2011) which could lead to these methods becoming more widespread.

Conclusion

There are still many uncertainties involving the redfish fishery and its recovery. Current knowledge of redfish distribution is limited, with historical ranges potentially contracted, or highly seasonal. Knowledge of size and age class structure is often biased by sampling method and gear type. The resiliency of redfish stocks to fishing pressure is also unclear. NAFO reports show that regulating mesh size isn't always the answer, as smaller mesh leads to increased catch, but not necessarily of smaller size classes (Lisovsky et al 1995). This suggests significant amounts of legal sized fish are escaping, and likely lost to barotrauma mortality. Underwater tagging techniques for mark and recapture studies (Sigurdsson et al 2006) may be a good tool to help us learn about distributions and migrations, age structures etc., without killing fish. It is agreed that redfish are currently an abundant resource, but without increased ex-vessel prices and expanded market potential a successful fishery is questionable. Further research is needed to help estimate what fishing practices are sustainable, and how to make progress on the marketing front.

Figures

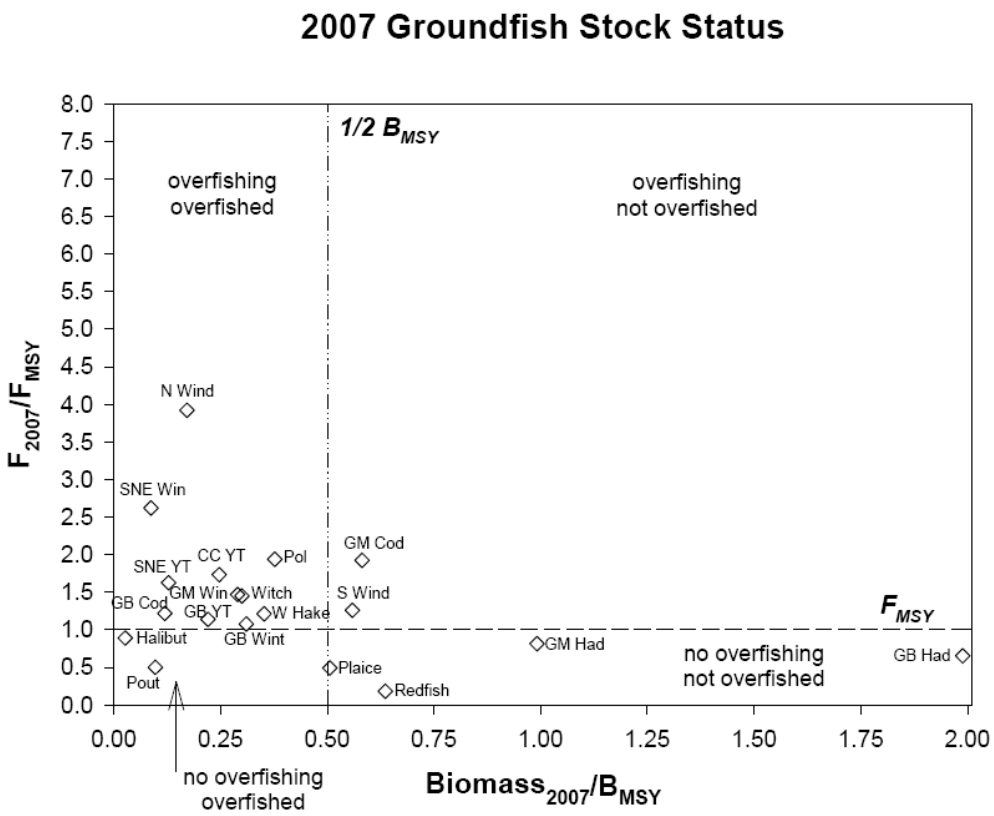

Figure 1. Status on 19 groundfish stocks in 2007 with respect to Fmsy and Bmsy or their proxies based on the GARM III review.

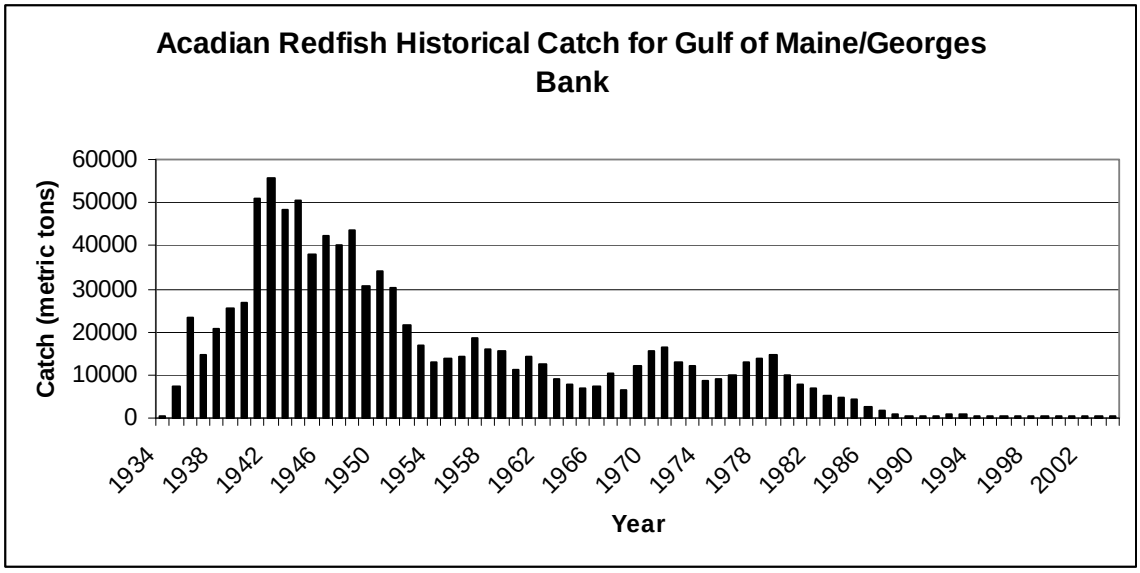

Figure 2. Acadian Redfish Historical Catch for Gulf of Maine/Georges Bank.

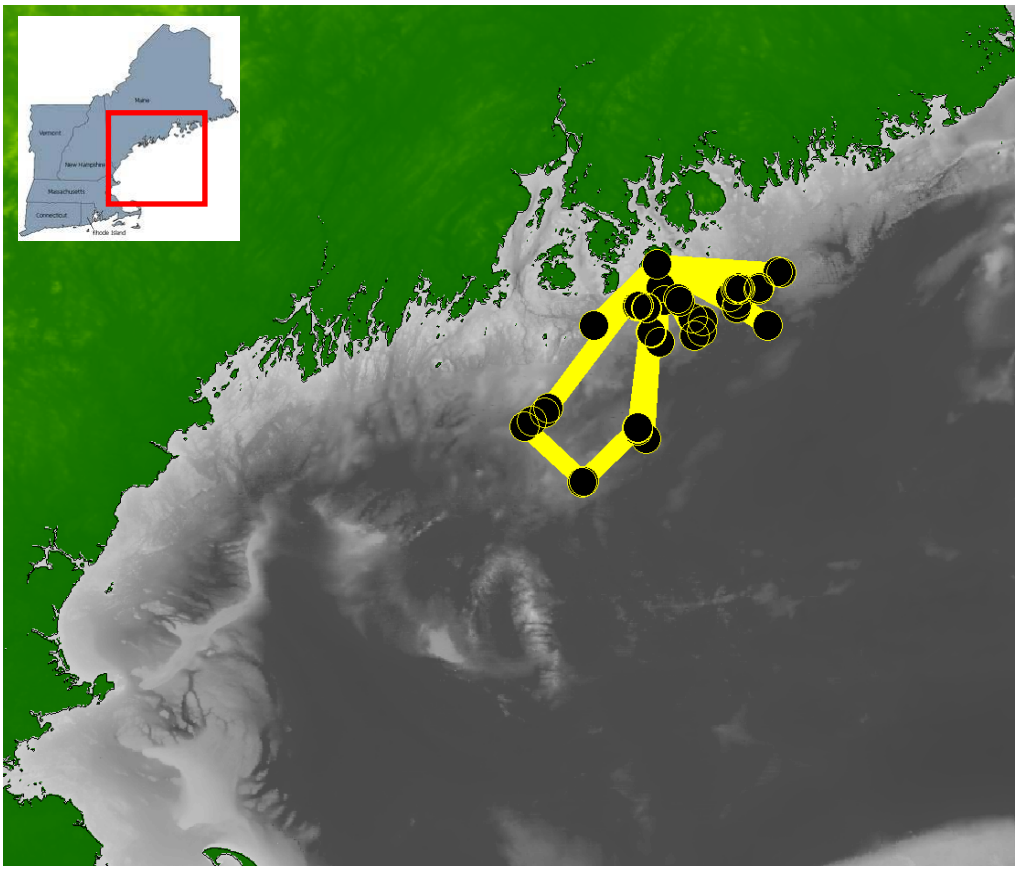

Figure 3. Sampling sites and search area, based from Swan's island, ME.

Figure 4. The sampling vessel, F/V Andanamra.

Figure 5. Jigging machines installed on F/V Andanamara. Three machines were deployed off the port rail and stern quarter.

a) **b)** **c)** **d)**

Figure 6. Hook and lure types used on jigging machines: a) Mustad Circle 6/O hook with red tubing lure b) Mustad Circle 6/O hook with gummy shrimp lure c) Mustad O'Shaughnessy J-hook 8/O with a neon tube lure d) Gamakatsu 2/O hooks with a hand-made fly

Figure 7. Intern Kristin Garabedian with redfish caught on jigging machine.

Table 1. Catch data for sampling trips. No data were recorded for day one jigging times, therefore no kg/hook hr. was calculated.

Sampling Day	Jigging Time (hrs)	Catch Weight (kg)	Kg/Hook hr	Species Caught
1	--	1	--	Pollock
2	3.1	4.5	0.121	Cod, mackerel, pollock
3	2.4	0.1	0.003	Pollock
4	4.6	3.4	0.062	Pollock
5	3.5	1	0.024	Pollock
6	2.8	0.5	0.015	Redfish
7	3.7	2.5	0.056	Mackerel, pollock, redfish
8	3.2	9.5	0.247	Cod, redfish
9	3.7	4	0.090	Pollock, squid
10	4.75	1.1	0.019	Pollock

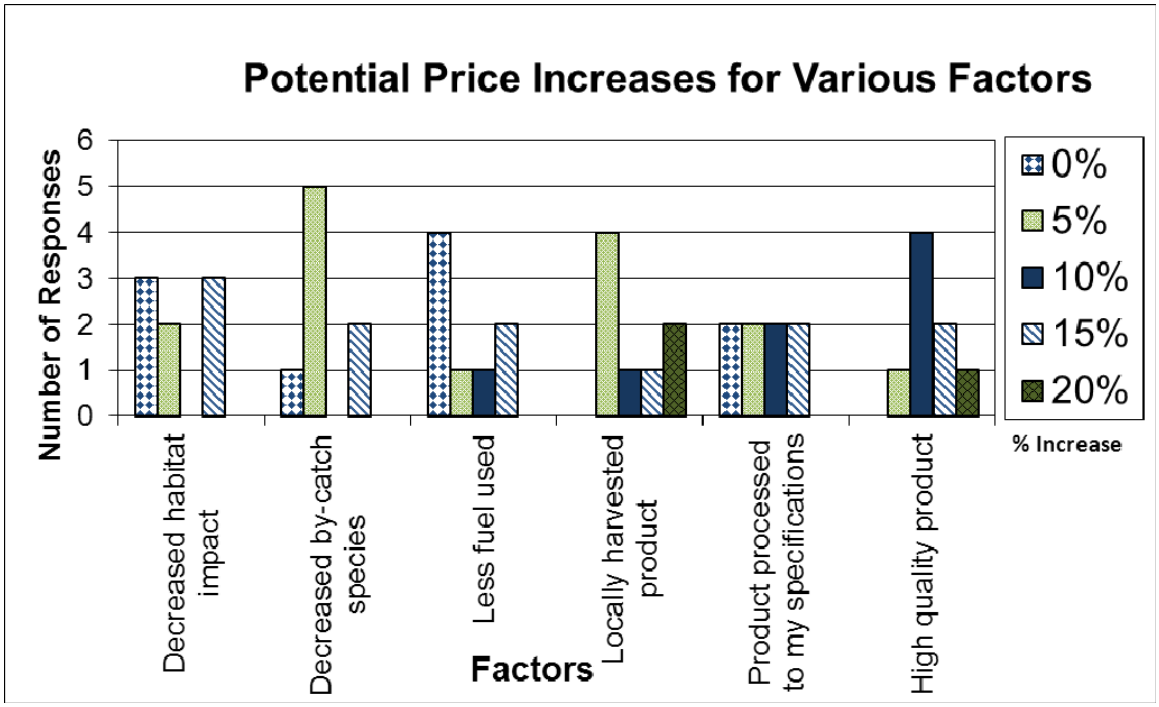

Figure 8. Potential Price Increases for Various Factors. Responses indicate the participant was willing to pay an increased price for the given factor.

Sources

Bates, Quentin. 2011. Jigging is low footprint fishing. Fishing News International. April 2011, Issue 4, Vol 50, pp 35.

Bower, John R., Ichii, Taro. 2005. The red flying squid (*Ommastrephes bartramii*): A review of recent research and the fishery in Japan. Fisheries Research. Volume 76, Issue 1, pp 39-55.

Campana, S. E., K. C. T. Zwanenburg, J. N. Smith. 1990. $^{210}Pb/^{226}Ra$ determination of longevity in redfish. Can. J. Fish. Aquat. Sci. 47: 163-165.

Crowley, Michael. 2011. Quality Packs: Plate freezers and slurry ice can give you an edge in the market. National Fishermen. Vol. 91 No. 11 pg 30-35.

Erkan, N. 2003. Treatment of fish fillets (*Scomber colias* and *Mugil cephalus*) with sodium lactate and propylgallate: Influence on shelf life quality. Archiv fur Lebensmittelhygiene, 54 (3): 60-64 May-Jun 2003.

Fletcher, G.C., Hodgson, J.A. 1988. Shelf-life of Sterile Snapper (*Chrysophrys auratus*).

Journal of Food Science. Vol 53, Iss 5 pp 1327-1332.

Lisovsky, S.F., Tretyak V.L., Kiselava V.M., and S.M.Kotlyarov. 1995. On minimum mesh-size during deepwater redfish fishery with midwater trawl in NAFO Divisions 3NO. *NAFO SCR Doc*. 95/25. Serial No 2533, 9 pp.

MacDonald, Paul, Laurenson, Chevonne, Marrs, Sue. 2007. Jig Fishing Pilot Study in Shetland Coastal Waters: Final Report to NAFC Marine Centre. 156 pages.

Madsen N, Skeide R., Breen M., Krag LA., Huse I., Soldal AV. 2008. Selectivity in a trawl codend during haul-back operation – An overlooked phenomenon. Fisheries Research,Vol 91, Iss 2-3, pp 168-174.

Magnusson, J.V., Johannesson, G. 1997. Distribution and abundance of 0-group redfish in the Irminger Sea and off East Greenland: relationships with adult abundance índices. ICES Journal of Marine Science, 54: 830-845.

Mayo R, Col L, Traver M. 2006. Status of Fishery Resources off the Northeastern US: Acadian Redfish. NOAA Northeast Fisheries Science Center.

Mayo R, Brodziak KT, Burnet JM, Traver ML, Col LA. 2007. The 2005 Assessment of Acadian Redfish *Sebastes fasciatus* Storer, in the Gulf of Maine/Georges Bank Region. NOAA Northeast Fisheries Science Center Reference Document 07-06.

National Marine Fisheries Service, Northeast Regional Office. 2011. Table 1. Combined Sector and Common Pool Vessel Landings and Revenue, 2009 and 2010. Available at: http ://www.nero.noaa.gov/ro/fso/reports/Sector_monitoring/ Table_1.pdf

New England Fishery Management Council (NEFMC). 2011. Framework Adjustment 45 to the Northeast Multispecies Fishery Management Plan. 408 pp available at: http://www.nefmc.org/nemulti/frame/fw45/110120_Final_FW_45_Resubmit.pdf

North East Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007. 2008 Groundfish Assessment Review Meeting (2008 GARM), Northeast Fisheries Science Center, Woods Hole, Massachusetts, 4-8 August 2008. Northeast Fisheries Science Center Reference Document 08-15.

Nowara, Gabrielle B., Walker, Terence I. 1998. Effects of time of solar day, jigging method and jigging depth on catch rates and size of Gould's squid, *Nototadarus gouldi* (McCoy), in southeastern Australian waters. Fisheries Research, Vol 34, Iss 3, pp 279-288.

Ratz HJ. 1999. Assessment of Redfish in NAFO Subarea 1. NAFO Scientific Council Research Document 99/41.

Real, N. 2009. Fishing Giant Reports Positive Redfish Season. 29 Sept. http://fis.com/fis/worldnews/worldnews.asp?l=e&ndb=1&id=33994.

Rebein, Hartmut, Martinsdottir, Emilia, Blomsterberg, Frederik, Valdimarsson, Grimur, Oehlenschlaeger, Joerg. 1994. Shelf life of ice-stored redfish, *Sebastes marinus* and *S. mentella*. International Journal of Food Science and Technology. Volume 29, Issue 3, pp 303-313.

Sevigny, J-M, Roques S, Bernatchez L, Valentin A, Parent É, Black MN, Chanut J-P, Marcogliesel D, Arthur R, Albert E, Desrosiers B, Atkinson B. 2003. 2. Species identification and stock structure. In: Gason D, ed. Redfish multidisciplinary research zonal program (1995-1998): final report. Can Tech Rep Fish Aquat Sci. 2462:xiii + 139 p.

Sherman, S.A., Stepanek, K.L., Gowen, A.M., Sowles, J. 2009. Annual Report on the Maine-New Hampshire Inshore Trawl Survey (January 1, 2009 – December 31 2009) Maine Department of Marine Resources, Research Reference Document 07/2010.

Sigurdsson, T., Thorsteinsson, V., Gustafsson, L. 2006. In situ tagging of deep-sea redfish: application of an underwater fish-tagging system. ICES Journal of Marine Science, 63(3): 523-531.

Sigurosson, Th., Kristinsson, K., Ratz, H-J., Nedreaas, K.H., Melnikov, S.P., Reinert, J. 2006. The fishery for pelagic redfish (*Sebastes mentella*) in the Irminger Sea and adjacent waters. ICES Journal of Marine Science, 63: pp 725-736.

Slavin, Joe. 2011. US enacts landmark food safety act. InfoFish International, Number 1, January/February 2011, pp 37-39.

Appendix A: Seafood Survey

Page 1

The Gulf of Maine Research Institute appreciates your time taking this brief survey, which should take less than 10minutes. Your responses will help us in our work with the region's seafood industry.
Thank you for your time!

Page 2

*What is your affiliation?

Restaurant
Seafood Distribution/Sales
Other
If "Other" please specify

Page 3

Please provide the following information about your restaurant. If this does not pertain to you please skip ahead.

What is the average price of a dinner at your restaurant?

under $15
$16-20
$21-25
$26-35
$36 over
Average Price

What is the seating capacity of your restaurant?

Under 50
51-100
101-150
151-200
Over 201
Seating Capacity

How often do you print your menus?

At least once per week
At least once per month
Every few months
Less than once per year

Page 4

Please rank order the following in terms of importance to you when purchasing seafood. Most important (1), second most important (2), etc. to least important (6). You may only rank one factor for each level of importance.

*

1Most Important 2 3 4 5 6 Least Important

The fishing gear used decreases the impact on ocean bottom habitat.

The fishing gear used decreases bycatch of nontarget species.

The method used to catch seafood uses less fuel.

The seafood product is harvested locally.

The seafood product is of a high quality.

The population of the species is in good health.

Page 5

What do you look for in a fish to determine if it is a high quality product?

What type of processing do you usually require for fish (fresh, frozen, whole, fillets)?

*

*

Page 6

This is a photo of an Acadian Redfish.

What is your current level of knowledge of Acadian Redfish (Sebastes fasciatus)?

None

I have heard of this species before.

I know some information about this species.

I know a lot of information about this species.

Please describe your experience with and interest in Acadian Redfish.

I have never worked with Acadian Redfish and am not interested in working with this species.

I have never worked with Acadian Redfish and am interested in working with this species.

I have worked with Acadian Redfish in the past and am not interested in working with it again.

I have worked with Acadian Redfish in the past and am interested in working with it again.

I am currently working with Acadian Redfish.

Page 7

What has prevented you from working with Acadian Redfish?

*

Page 8

Please explain why you are not interested in working with Acadian Redfish.

*

Page 9

Please explain what currently prevents you from working with Acadian Redfish?

*

Page 10

Acadian Redfish (Sebastes fasciatus) is a native species to the Gulf of Maine. This species is longlived and has a population that is in good health due to little fishing pressure in this region since the early 1990s. Its flesh is a light pink color with a mild flavor. Redfish are suitable for a wide range of dishes and preparation techniques since they absorb flavors well.

After learning this information about Acadian Redfish do you believe that it is a product you would be interested in working with?

Yes

No

Perhaps with more information

Page 11

Please explain what other information you would like about Acadian Redfish.

*

Page 12

For the following questions please base your answers for Acadian Redfish. Assume the market price is $6/pound.

If the following conditions were true for an Acadian Redfish product, would you be willing to pay a premium? If so, how much of a premium?

	No	5%	10%	15%	20%	More than 20%
The fish is processed to my specifications.	○	○	○	○	○	○
The fishing gear used decreases bycatch of nontarget species.	○	○	○	○	○	○
The fishing gear used decreases the impact on ocean bottom habitat.	○	○	○	○	○	○
The method used to catch the fish uses less fuel.	○	○	○	○	○	○
The product has a high quality.	○	○	○	○	○	○
The product is harvested locally.	○	○	○	○	○	○

Page 13

In order for your business to be interested in Acadian Redfish what quantity per shipment and frequency of shipments would you require?

*

If Acadian Redfish were only seasonally available, would you be interested in working with it?

Yes ○
No ○
Maybe ○

If maybe, please give further explaination.

Page 14

Acadian Redfish have an appealing bright red color. They have a prominent large eye and large spines around their fins.

Given this information which processing method would best suit your needs if you were to work with this species?

Whole Fish
Fillets
Either

Page 15

Acadian Redfish can be caught using gear that reduces bycatch and eliminates impacts to ocean bottom habitat. In addition, fishermen may take shorter trips which decreases their fuel consumption and carbon footprint.

If you knew these strategies were employed to catch Acadian Redfish, how would your interest in Acadian Redfish be affected?

*

I would be more interested in Acadian Redfish.
My interest in Acadian Redfish would not change.
My interest might increase with more information

Page 16

Would you be interested in participating in an event which allowed you to learn more about Acadian Redfish, including an opportunity to try it prepared different ways?

*

Yes
No

What would you like to see included in any upcoming events pertaining to redfish?

Page 17

Please provide us with your contact information if you would like to be included in future communications and events related to seafood. Please note that your contact information will be kept private and will not be linked to your responses to this survey.

Name:

Company:

Address:

Address 2:

City/Town:

State:

ZIP:

Country:

Email Address:

Phone Number:

Thank you for providing us with important information that will help us determine the feasibility of developing a thriving Acadian Redfish market. We appreciate your time!

This survey is part of a larger research effort of the Gulf of Maine Research Institute and commercial fishermen to understand the effectiveness of an Acadian Redfish jig fishery. The project will test the jig's effectiveness in reducing bycatch of unwanted species, as well as improved quality handling. Simultaneously understanding the potential market ramifications will help inform fishermen's decision to invest in new jig fishing gear. If you would like more information please contact Steve Eayrs, Fish Behavior & Gear Technology Research Scientist at steve@gmri.org.

About the Gulf of Maine Research Institute

The Gulf of Maine Research Institute (GMRI) catalyzes solutions to the complex challenges of ocean stewardship and economic growth in the Gulf of Maine bioregion. Our dynamic fusion of science, education, and community gives us range to effect change from multiple directions, while our objectivity and commitment to collaboration make us the go to organization for marine communities grappling with contentious issues, management transitions, and new business systems.