

Avoiding bycatch in U.S. Sea Scallop closed areas fisheries.

Cate O'Keefe, Department of Fishery Oceanography, SMAST, UMass Dartmouth ckeefe@umassd.edu
Greg DeCelles, DFO, SMAST UMass Dartmouth, GDeCelles@umassd.edu
Steven X. Cadrin, DFO, SMAST UMass Dartmouth SCadrin@umassd.edu
Dan Georgianna, DFO, SMAST UMass Dartmouth DGeorgianna@umassd.edu

Abstract

Since 1999, the scallop fisheries have been granted access to closed areas on Georges Bank, and the access programs have been managed through individual vessel quotas for scallops, and a common-pool total allowable catch (TAC) for yellowtail flounder bycatch. The scallop resource is neither overfished and nor is overfishing occurring, but the yellowtail flounder resource is both overfished and experiencing overfishing according to criteria of U.S. fishery regulations. The yellowtail flounder bycatch TAC has forced early closure of these fisheries in more than half of these access fisheries.

We present two programs designed in cooperation with fishermen and permit holders to avoid yellowtail flounder bycatch in these access fisheries, one in Closed Area II (CAII) in 2009 and the other in the Nantucket Lightship Area (NLA) in 2010. For both programs, we mapped the areas of scallop and yellowtail flounder densities and sent the density maps to permit owners and captains. In the second program, we implemented a daily system of captains transmitting daily yellowtail flounder catch and number of tows by area, analyzing the data, and sending messages to captains indicating low, medium, and high scallop densities per pound of yellowtail flounder by area. The 2009 CAII fishery closed three weeks after opening yielding only 61% of the scallop TAC. About 1/3 of vessels participated in the 2010 NLA voluntary reporting program. Observer data indicates that the scallop TAC will be caught for the first time in any closed area access fishery for the first time in the 2010 NLA fishery.

Introduction

Most fishery economic models are based on the assumption of competition driven by a motive for profit that allows only market interactions between fishermen. This assumption leads to models that rule out non-market voluntary cooperation for the common good and conclude that free riders provide the sufficient condition for sub-optimal yield in common pool fisheries.¹ In public good models based on individual profit motivation, the optimal strategy for all participants is to withhold contribution to the public good.²

Fishery management strategies have used command and control regulations, legally enforceable rights, or a combination of the two in attempts to overcome perverse incentives and achieve optimal yield. Individual Transferable Quotas and other management actions have prevented fishery collapse by reducing catch rates below the fishing mortality rates associated with competitive equilibrium fishing effort in several countries.³

Informal groups or clubs with voluntary memberships may also create institutions and regulations that mitigate perverse incentives to achieve common goals.⁴ Wilson presents theories for club formation based on search for fish and defense against harmful actions by competitors.⁵ Wilson concludes that cooperative behavior in pursuing group goals rather than individual goals depends upon distribution of species, behavioral characteristics of target species such as movement, catch technology, and human

social characteristics. Ostrom argues that social norms based on reciprocity, trust, and fairness can mitigate loss of social goals through individual incentives.⁶ Ostrom also presents design principles for successful programs for cooperation to achieve group goals.

Voluntary bycatch avoidance programs in fisheries limited by common pool TACs for bycatch offer opportunities for cooperative behavior to avoid closures that limit catch of target fisheries. Fleet communications programs that share information on location of bycatch among vessels may increase the total yield of target species that is caught by the fleet⁷. Results, however, have been mixed. Abbott and Wilen compare the failure of a bycatch avoidance using fleet communications program in a Bering Sea fishery with the success of a similar program “*for the same fleet over the same period*” (ital. in original) in the Bering Sea.⁸ The authors speculate that the failure of cooperative measures was caused by resource conditions that were not suited to fleet communications programs: large area fished, long fishery season, random and unpredictable location of bycatch species, and low benefits from cooperation.

This paper presents a description of two successive programs for voluntary avoidance of bycatch in the U.S. Atlantic Sea scallop fishery based on Wilson’s theories and Ostrom’s prescriptions for successful cooperative behavior. We also present some preliminary results from these programs. The paper is composed of sections describing the sea scallop fishery, the rotational fishery management system, and voluntary bycatch avoidance programs for the 2009 Closed Area II and the 2010 Nantucket Lightship Area access scallop fisheries. The paper concludes with some observations on the success of the process used in designing and operating the program for voluntary bycatch avoidance.

U.S. Atlantic Sea Scallop Fishery and Management

The Atlantic Sea Scallop (*Placopecten magellanicus*) fishery, extending from Maine to North Carolina, is one of the most valuable fisheries in the U.S., averaging almost US\$400 million per year in dockside value from 2004 through 2008. The scallop fishery developed rapidly in the late 1940s and early 1950s in New England, especially New Bedford, MA and then declined in the 1960s and early 1970s (Figure 1) at least partially due to Canadian-registered vessels that had moved closer to New England reducing the catch per unit effort in those areas and capturing some of the U.S. market by reducing exvessel prices to U.S.-registered scallop vessels⁹.

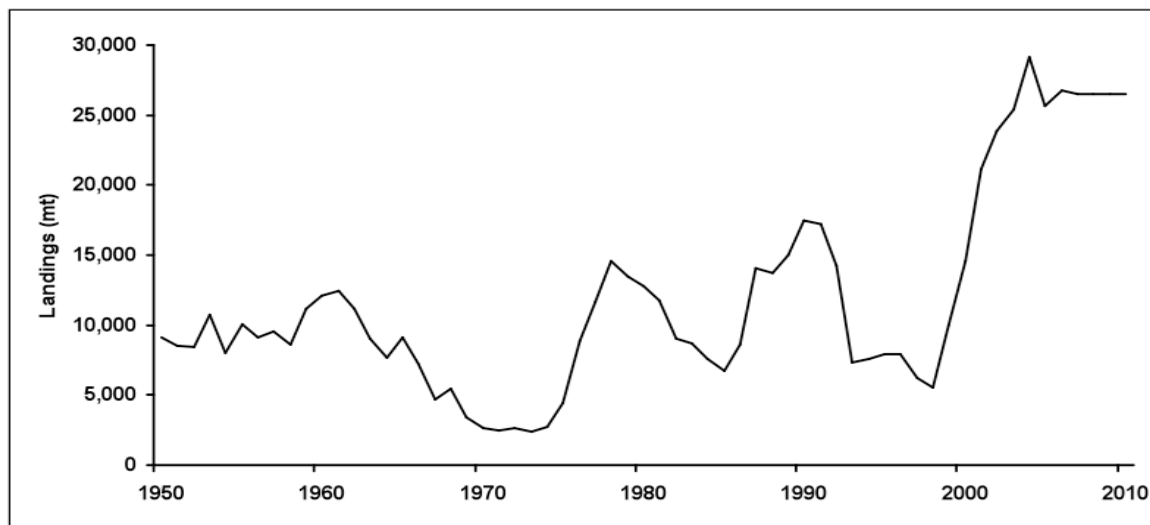


Figure 1. U.S. Landings of Atlantic Sea Scallops by Year. Source: NMFS.

The Fishery Management and Conservation Act in 1976, now known as the Magnuson Stevens Act (Act), reserved an Exclusive Economic Zone for U.S. vessels, forcing Canadian-registered vessels off the now-U.S. portion of Georges Bank. U.S.-registered scallop vessels filled the niche left by the departed Canadian registered vessels. The Act also encouraged growth of the U.S. scallop fishery by subsidizing the construction of new vessels.

In 1982, the Scallop Fishery Management Plan required by the Act set a maximum average scallop meats per pound per trip. The meat count regulations failed to fulfill conservation goals even with after the maximum meat count was reduced to reduce the catch of young scallops. Vessel owners and captains also strongly disapproved of the regulation due to disputes over dockside enforcement methods of sampling and estimating meat counts. In 1994, meat count regulations were replaced by limited access permits for offshore scallop vessels and regulations limiting crew size and days fished per year. Full-time limited access permitted vessels were limited to 120 days at sea per year (DAS).

Later in 1994, The U.S. Secretary of Commerce took Emergency Action to close large areas of Georges Bank and areas to the south to rebuild depleted stocks of cod, haddock, and flounders. (Figure 2) These areas were approximately the same areas that had been closed during spawning season for various groundfish species since 1970. The Emergency Action, made permanent shortly thereafter, closed these areas year round to all mobile gear, including scallop dredges. Three more areas further south were closed year round to scallop dredges in order to protect young scallops. Together these six areas contained 85% of the harvestable biomass¹⁰.

Scallops, which move little after reaching maturity, grew quickly in the closed areas of Georges Bank and by 1999 scallop density was 10 times greater in the closed areas than in open areas. These abundant stocks tempted fishermen, who were tightly constrained by low biomass in the open areas, to enter the closed areas, which increased encounters with enforcement agencies in the U.S. and Canada.

The period of low scallop landings in the mid-to-late 1990s, due to low biomass in the open areas, and sharp reductions in DAS to meet the new stock reference points in the Sustainable Fisheries Act forced most vessels below the break-even point¹¹. Proposals to allow transfer of DAS between vessels in order to reduce costs split the permit holders into two organizations, one lobbying for transfer of DAS and the other opposed to transfer and consolidation of DAS quotas. The inaccessible high biomass in the closed areas offered support for a wider strategy of opening the closed areas to scalloping, leading to a merger of the opposing organizations into the Fishermen's Survival Fund, which lobbied successfully for an official assessment of scallop stocks in the closed areas and eventual opening of scallop fishery in Closed Area II in 1999 controlled by fixed number of trips per vessel with trip catch limits for scallops and yellowtail flounder bycatch caught by scallop dredges in this area.

Scallop dredges retain incidental bycatch of some finfish. Yellowtail flounder is a frequent bycatch in the scallop fishery, because they occupy similar habitats as scallops. Unlike the scallop resource, yellowtail flounder stocks on Georges Bank and in southern New England are overfished and overfishing is occurring. Total catch of yellowtail flounder is limited to allow rebuilding. The scallop fleet is allocated 10% of the allowable catch of yellowtail flounder each year, based loosely on the catch history of the scallop fleet, which traditionally retained and marketed its yellowtail flounder bycatch.

The high catch per unit effort (CPUE) in the closed area access fisheries and stock assessment data showing increased biomass in the open areas led to a rotational area management system in 2004.¹² Planned access rotated among closed areas, which were limited by scallop catch per vessel, and fishing in the open areas limited by DAS. Vessel owners were allowed to convert closed area trips to open area trips at a fixed exchange rate of DAS for closed area trips. Rotational area management successfully moved the scallop catch closer to optimal yield. U.S. scallop landings averaged 24,000 metric tons (mt)

per year from 2000-2007 under area management compared to 9,000 mt per year from 1950-1999 under other forms of management. In the most recent stock assessment scallops were classified as neither overfished nor was overfishing occurring according to criteria in the Act with an estimated stock size of 1.5 times B_{msy} .¹³

Inefficiencies remained in the scallop fishery, however. Bycatch limits for yellowtail flounder, which were almost entirely discarded during closed area trips, often closed the fishery before the maximum scallop catch was reached (Figure 2). Scallop catches also fell below the closed area TAC when vessel owners chose open area trips over closed area trips because the DAS in the open areas yielded more net income than the trip limit for scallops in the closed area.

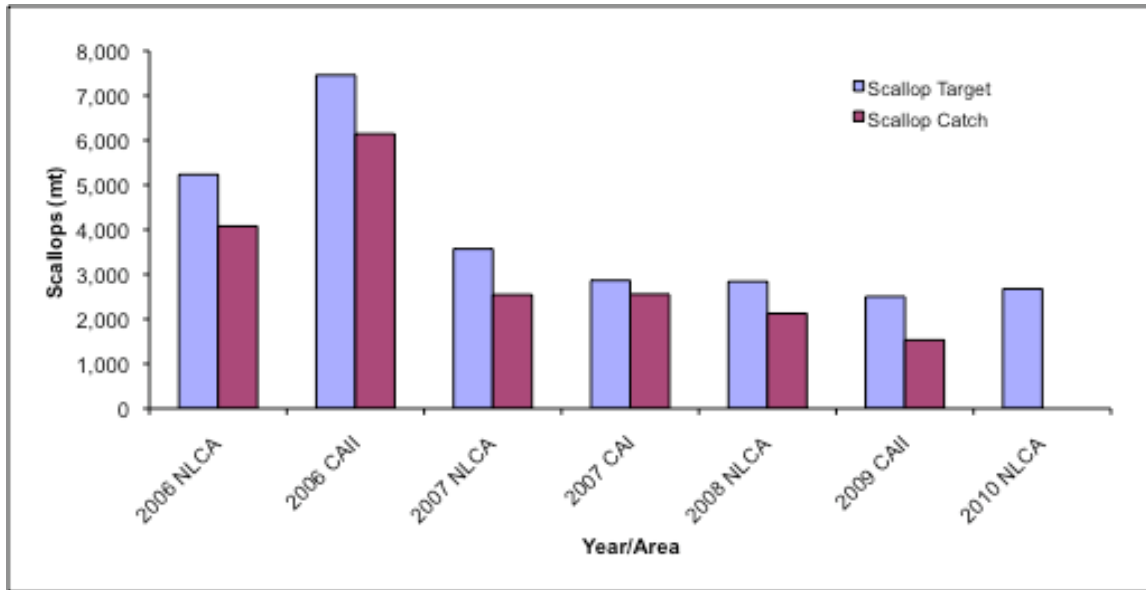


Figure 2. Scallop Catch Limit and Scallop Landings in Closed Area fisheries from 2006 through 2010. Source: NMFS

Economic efficiency requires equal exploitation rates (catch/Biomass) between open areas and closed areas, given equal trip costs in the open and closed area fisheries, CPUE. As shown in Figure 3, exploitation rates were consistently lower on Georges Bank, where most of the exploitable biomass and catch is from the closed areas, than in the mid-Atlantic fisheries, where most of the biomass and catch is in the open area fisheries. In terms of the reference point for overfishing in the scallop FMP (instantaneous fishing mortality (F)=0.29) that was in effect in 2008¹⁴, overfishing occurred in the mid-Atlantic and under fishing (catch less than optimal yield) occurred on Georges Bank.

Scallops left on the seafloor due to early closures suffer high natural mortality rates from high density and large size. Using video surveys, Stokesbury et al showed that scallops in the Nantucket Lightship area increased significantly after closure in 1994, reached a maximum around 2002, and then decreased significantly starting in 2004 almost entirely due to natural mortality (senescence, predation, and disease). They estimated the loss due to increases in natural mortality at US\$ 100 million¹⁵.

Early closures of closed area access fisheries probably also cause more habitat damage. Shifts of fishing effort from the closed to the open areas where the exploitation rate for scallops is lower, results in increased time in contact between the dredge and the benthic environment.

There is some evidence that vessel owners and captains attempted informally to avoid bycatch of yellowtail flounder in scallop closed area fisheries. Rago et al reported that yellowtail flounder bycatch as a percentage of scallop catch were low for the first few months after the CAII access fishery opened in 1999, and “On-board observers reported that fishermen were using radio communication to identify and avoid areas of high yellowtail flounder bycatch.”¹⁶ In the 2006 CAII scallop fishery, the pattern of cumulative scallop catch was lower at the start of the fishery than at the end of the fishery, indicating the possibility of early avoidance with a break-down of cooperation as the fishery progressed towards closure. (Figure 4). In an analysis of the CAII fishery in 2006, Bachman found a significant positive relationship between yellowtail flounder bycatch and the proportion of trips taken.¹⁷

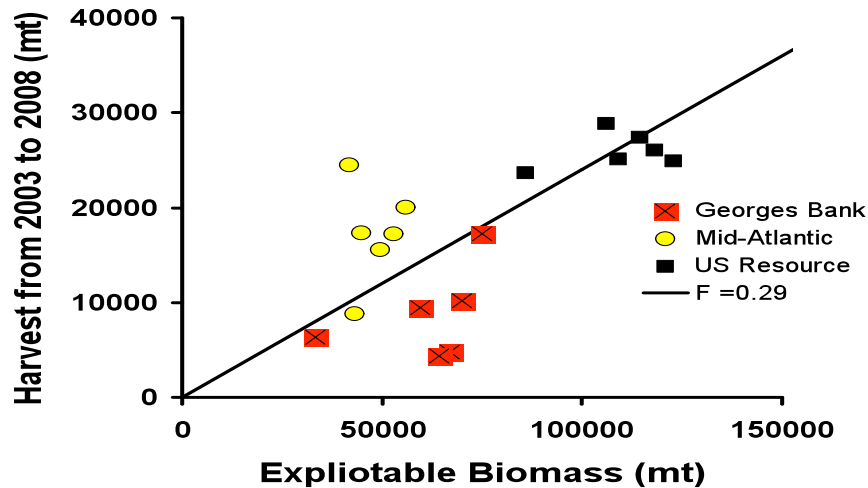


Figure 3. Exploitation Rate for Sea Scallops from 2003 to 2008. Source: NMFS & SMAST

Based on these indications of bycatch avoidance in the closed area scallop fisheries, we designed and implemented formal programs for bycatch avoidance using fleet communication in 2009 and 2010. For the CAII access fishery in 2009, we sent scallop permit holders maps showing density of scallop and yellowtail flounder by area within the fishing area in CAII. In 2010, we constructed maps of scallop and yellowtail flounder densities for the Nantucket Lightship Area Access fishery and devised a real time reporting system to receive messages from captains on yellowtail flounder densities in the area they were fishing, analyze these data, and send messages to the scallop fleet fishing in this area identifying areas of high yellowtail flounder densities.

2009 CAII fishery

The 2009 CAII scallop access fishery allowed one trip per vessel limited to 18,000 pounds of scallop meats for each of the 348 limited access scallop vessels. As with other CAII trips, the scallop catch was estimated as landings because the average discard rate for scallops for all CAII fisheries was less than 1%¹⁸. The yellowtail flounder catch was estimated from catch rates of scallop meats per pound of yellowtail flounder from observed trips and scaled to the scallop catch for the fleet. About 10% of the trips had observers aboard.

The bycatch rate limit (pound of yellowtail flounder allowed per pound of scallops) was set higher than the previous CAII fishery in 2006, but the exploitable yellowtail flounder biomass in CAII had increased sharply. The Groundfish Assessment Review Meeting in 2008 (GARM III) reported that the exploitable

Biomass for Georges Bank yellowtail flounder had increased since 2006 due to the strong 2005 year-class.¹⁹

There was some evidence that GARM III had underestimated the increase in yellowtail flounder biomass in CAII. In summer 2008, SMAST in cooperation with 11 scallop vessels tagged almost 75,000 yellowtail flounder in the portion of CAII that was scheduled to open in 2009.²⁰ The tag and recapture Peterson study estimated yellowtail flounder biomass at age 2+ yellowtail flounder in the CAII access area at 7,600 mt, which suggests that 1300 mt could be caught in the access area and still meet rebuilding objectives compared to 158 mt allowed in the 2008 CAII fishery estimated from the NMFS trawl survey.

Before the fishery opened, we overlaid the flounder spatial distribution from the Peterson study with scallop distribution estimated from our annual video survey to produce a map showing densities of each species. Two weeks before the fishery opened, we sent the map and a letter to a list of vessel owners asking them to avoid areas of high YT density in order to reach the scallop TAC in the CAII fishery.

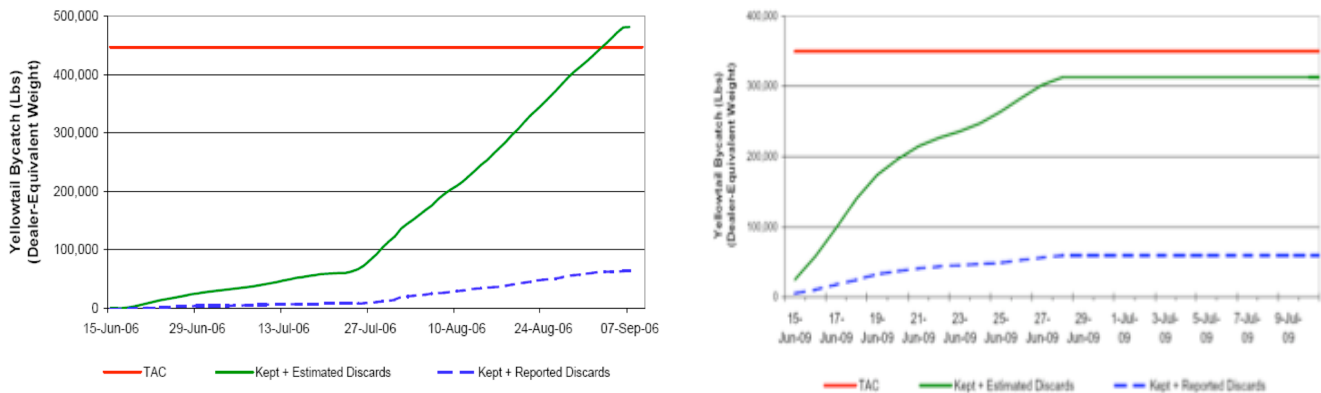


Figure 4. Yellowtail bycatch Cumulative Totals in 2006 (left) and 2009 CAII Scallop Fisheries. Source NMFS.

As can be seen from Figure 5, the scallop video survey and yellowtail flounder tagging study showed scallops as spatially distinct from yellowtail flounder in the access area in CAII, a relatively small fishing area, satisfying two of Abbott and Wilen’s criteria for success of voluntary bycatch avoidance: spatial separation between target and bycatch species within a small area that allows bycatch avoidance with low search costs and close proximity of fishing vessels that creates peer pressure for cooperation. The fishery was also set for fixed length of time and cooperation had a high return due to the high value of the target, two other conditions cited by Abbott & Wilen (2010). Allocation of only a single trip in CAII weakened incentives for individual gain for skippers and owners of single vessels.

Initial assessment of the performance of the 2009 bycatch avoidance program is not promising. The pattern of cumulative catch of yellowtail flounder in 2009 did not show the same pattern of avoidance in the early stages of the fishery that cumulative yellowtail flounder catch showed in 2006. (Figure 4) The 2009 scallop fishery in CAII shut down three weeks after opening due to surpassing the YT TAC, leaving 40% of the scallop TAC on the ocean floor.

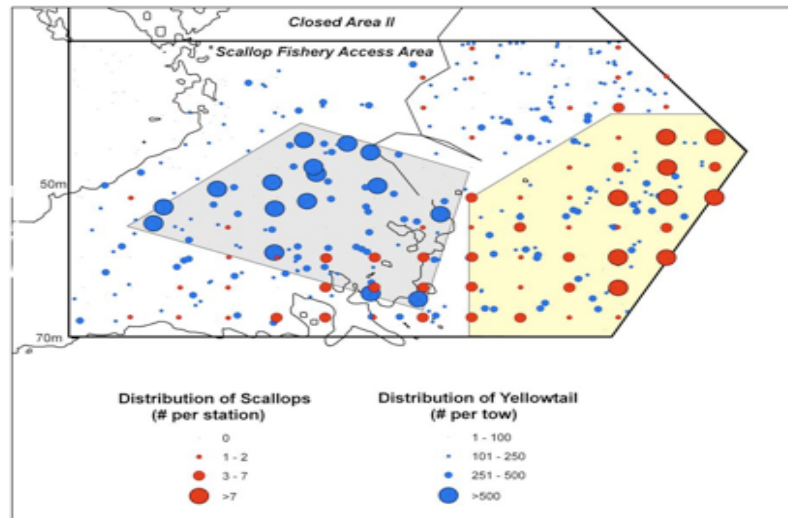


Figure 5. Densities of Scallops and Yellowtail in CAII in 2009. Source: SMAST.

2010 Nantucket Lightship Area Access (NLA) Fishery

Despite the early closure due to the derby fishery in CAII in 2009, the 2010 NLA fishery showed promise for cooperative bycatch avoidance. As with the CAII fishery in 2009, the bycatch rate limit for yellowtail flounder for the 2010 NLA was almost double the rate for the NLA fishery in 2008, but unlike the large increase in yellowtail flounder biomass in CAII, there was little evidence of a large increase in yellowtail flounder in the NLA. A cooperative dredge survey conducted by the Virginia Institute of Marine Science with industry partners showed scallop and yellowtail flounder densities by area within the NLA that showed most areas below an average rate of yellowtail flounder bycatch below the average ratio for the maximum allocation for the fishery.

Rumors in the port, which were later verified by the observer data, blamed the early closure of the 2009 CAII fishery on a few large tows of yellowtail flounder in areas where we had advised. The indication developed from these rumors that changes in those tows would have kept the fishery open longer, which led to the prevailing opinion that small improvements in avoidance could lead to large gains in scallop catch. Showing increasing interest in bycatch avoidance, about 100 scallop vessels ($\frac{1}{4}$ of the limited access scallop fleet) were represented at our first meeting (April 26, 2010) of the Fishermen's Steering Committee to discuss a plan for voluntary bycatch avoidance for the NLA fishery, scheduled to open on June 15. We presented the results from the CAII fishery from 2009 and planned improvements (yellowtail densities from a recent cooperative trawl survey and real-time reporting) for the coming NLA fishery, including Boatracs authorization sheets for email messages and protocols for sending and receiving messages. The attendees responded with suggestions and discussion.

More owners and captains attended our next meeting (June 3), where we presented a plan modified by suggestions from the previous meeting and other contacts we had made with fishermen and boat owners. Once again, we discussed modifications and tuned the program's components and protocols for the opening of the fishery, which was delayed until June 28. On June 10, we sent a map showing scallop densities per pound of yellowtail flounder from the VIMS dredge survey (Figure 6) a letter explaining the program, instructions for sending and receiving bycatch information, and forms for recording bycatch by day for tows and bycatch in each area fished.

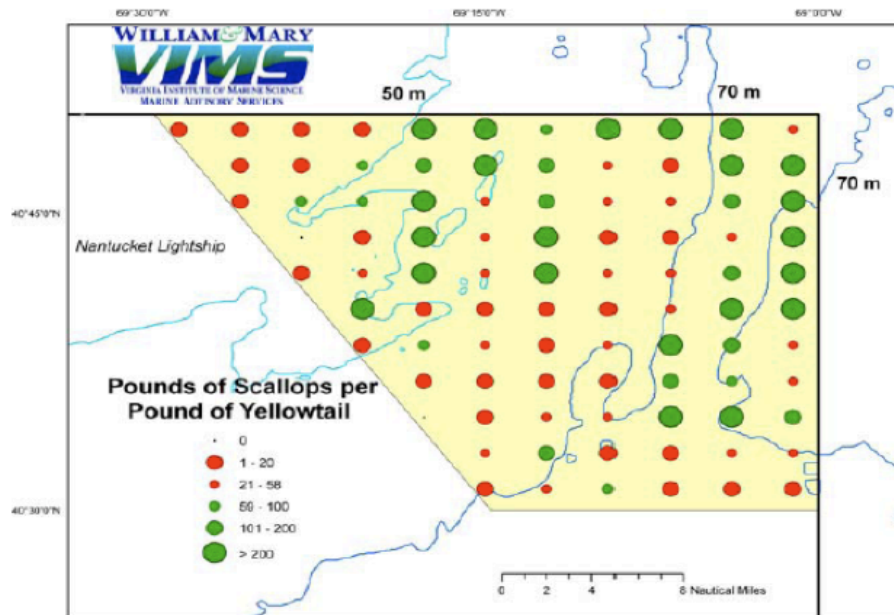


Figure 6. Scallop/Yellowtail Densities by Area in NLA in 2010. Sources: VIMS and SMAST.

Throughout this period, we publicized the program through formal and informal means. Commercial Fishery News, which is widely read in the Northeast, printed an article on the front page of their June edition on the program and an op-ed piece that we had written on the benefits of cooperation.²¹ Saving Seafood, a website widely followed in the Northeast, carried news of the program. We also used organizing communication tactics: telephone, email, web site, and walking the docks to push the program.

When the NLA fishery opened on June 28, 2010, owners of 90 vessels representing 120 of the 348 trips allowed in the access fishery had signed consent sheets. Thirty vessels sent us weights of yellowtail flounder caught in areas they fished by tow during the first day of fishing. We calculated the mean of yellowtail catch per tow for those areas and sent the following message to those who had signed the consent form and posted it on the Saving Seafood web site,

“Hello Fleet. Yellowtail Update for Tues. 6-29: 30 vessels reported 410 tows from 12:01am Mon 6/28 thru 8:00am Tues 6/29.

Yellowtail catches were:

HIGH: Q

LOW: D,E,F,G,H,J,K,L,M,N,O,R,S,T,U,V,W,X,Y,Z,AA,BB,DD,EE

NO DATA: A,B,C,I,P,CC,FF,GG,HH

Cell Q had high reports from multiple boats and is a current yellowtail hotspot.

Please continue to report data daily in the format: cell, # tows, YT lbs.

Next report Wed 6/30.

Thank you!!”

We repeated this process every day that the fishery was open and boats were reporting their yellowtail flounder catch to us.

Conclusions: economic incentives, natural conditions, and design principles

The closed area scallop/yellowtail flounder fisheries on and near Georges Bank satisfy most of the conditions suggested by Abbott and Wilen (2010) and Wilson (1990 and 2007) for cooperative solutions to reduce bycatch: high rewards for cooperation, fisheries limited in time and space, spatially distinct target and bycatch species, and sessile target species, whose fine-scale densities are estimated annually by video survey. These conditions may not be sufficient for attaining optimal yield of each species, however; high rewards can as easily work against as for cooperative behavior.

Social institutions also supported voluntary bycatch avoidance. Almost all of the limited access scallop vessel owners belong to the Fishery Survival Fund, a powerful trade organization that has represented scallopers' interest for over 15 years. The Fishery Survival Fund endorsed and supported the bycatch avoidance program in 2010. Fishermen determined the design of the program, one of Ostrom's design principles.²² There were clear boundary rules; participants knew with whom to cooperate, the first of Ostrom's design principles. The area fished was small enough so that fishermen could see who was fishing in areas of high yellowtail flounder density, a form of self-monitoring facilitated by peer-pressure, another of Ostrom's design principles.

It is far too early to estimate the performance of the voluntary bycatch avoidance programs: a process that involves selecting objectives and metrics to represent those objectives, collecting data, and analyzing those data based on the chosen metrics. Preliminary reports seem promising. About 1/3 of the fleet joined the process with over 60 vessels reporting yellowtail catch and number of tows by area per day. Their yellowtail bycatch was below the average of scallops per yellowtail that would close the fishery. There is some evidence that scallopers moved off the areas that we analyzed as low scallop per yellowtail densities and fished in areas with high scallop per yellowtail densities. If these trends continue, the scallop allocation will be caught for the first time in a closed area fishery.

In the immediate future, we plan to report results to the Fishermen's Steering Committee and to the Fishermen's Survival Fund. Management plans haven't been completed for 2012, but scallop access to closed areas on George's Bank seems likely. We have begun to plan for another voluntary bycatch avoidance program in 2011 adjusting for errors (many technology problems) and knowledge gained in the 2010 NLA fishery (mainly communication failures). We plan to include voluntary gear modifications to exclude yellowtail flounder in the future. Several modifications have shown promise. Several vessel owners and captains told us that they were trying some modifications to reduce bycatch this year.

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²² Ostrom, op. cit. p. 150-151.