INTERNATIONAL COUNCIL FOR THE EXPLORATION OF THE SEA

ICES CM 2010/P:04
Reversing the burden of proof: Results based management of fisheries

Confronting the bycatch issue: An incentive-led approach to maximizing yield in the US sea scallop fishery

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Abstract:

In response to rising costs and increased regulatory intervention, industry-based programs for bycatch reduction, resource surveys and fisheries monitoring have been promoted by fishermen, scientists and fisheries managers. Bycatch of yellowtail flounder in the US sea scallop fishery is a constraint to achieving optimum yield of scallops. Since 1999, the rotational area scallop fisheries on Georges Bank have been subject to total allowable catches for yellowtail flounder bycatch. Bycatch of yellowtail flounder has often forced early closures of these scallop fisheries, resulting in economic losses of over US $100 million. To address this constraint, we collaborated with the scallop fishing industry to implement a bycatch avoidance program. We designed a system to collect information on incidental catch that expands the use of existing Vessel Monitoring System technology and relies upon the active fishing fleet to provide data. Vessels supplied real-time communications about incidental bycatch rates during fishing activities. In turn, we compiled the information for the fleet and sent it back to active fishing vessels. While providing spatially- and temporally-specific data on catch rates of non-target species, the fishing fleet gained valuable information about distribution of yellowtail flounder in order to avoid bycatch "hotspots". The system was designed as an inexpensive method to employ traditional fisheries dependent data and create individual based incentive for bycatch avoidance to benefit the entire fishery. The system provided accurate advice to the fishing fleet for bycatch avoidance and was an economic and conservation success. The scallop fleet harvested the target scallop allocation worth US $ 40 million while only catching 29% of the yellowtail bycatch allocation. This case study demonstrates an example of results based management through a small scale incentive-based approach to achieve maximum yield of scallops by confronting bycatch restrictions.

Keywords: results based management, sea scallops

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INTRODUCTION

Current fisheries management in the US is mandated to allocate Annual Catch Limits with Accountability Measures (US DOC, 2007). These limits are determined by the Regional Fishery Management Councils and enforced by the National Marine Fisheries Service. Although management councils include industry stakeholders, there is currently little input from the fishing industry on the level of precaution, or risk that is employed when setting the limits. The fishing industry also has little control over how the limits are monitored, enforced or allocated. This type of top-down control restricts industry from developing incentive-based solutions to fishery problems, such as bycatch.

“Reversing the burden of proof” in fisheries management is a concept that shifts the decisions for operational fishing targets and impacts of fishing activities from government officials to the fishing stakeholders (Lassen et al., 2008). Under such a system, the fishing industry bears the responsibility to prove that proposed fishing activities will occur within acceptable limits. Setting limits remains a government responsibility, which must account for the values and objectives of all interested stakeholders (in the US, the resources of the ocean are in the public trust and exploitation of any resource must meet the standards of the public). However, fishing operations conducted within those limits would be determined by the fishing industry. This would require that the industry can reliably demonstrate that fishing activities will not exceed species allocation limits, destroy important marine habitat, threaten species of particular concern, increase bycatch, etc. (Lassen et al., 2008).

Such a reversal of responsibility from government to the fishing industry requires an investment from industry to obtain accurate scientific information and work cooperatively to define objectives. Although the inherent objective of fishing is to maximize yield for economic benefits, there are examples within the US sea scallop fishery that attest to the willingness of the industry to bear the burden of proof for sustainable fishing (O’Keefe and Stokesbury, 2009). This report describes an industry-led and incentive-based bycatch avoidance system in the US sea scallop fishery in which scallop yield could be maximized by confronting yellowtail flounder bycatch issues. The system was conducted outside of government and management regulation and proved to be a conservation and economic success.

GEORGES BANK SEA SCALLOP FISHERY MANAGEMENT

The sea scallop is one of the most economically valuable commercial species in the northeast US and supports the most valuable wild scallop fishery in the world (Hart and Rago, 2006). Georges Bank, which is divided between the U.S. and Canada, constitutes the world’s largest single natural scallop resource (Caddy, 1989). The US sea scallop stock is managed as a single unit in order to achieve the yield and fishing mortality objectives of the Atlantic Sea Scallop Fishery Management Plan (NEFMC, 1982).

In 2004, Amendment 10 to the scallop management plan introduced formal rotational management of scallops. The scallop management plan incorporated three large regions of Georges Bank that were designated for fishing closures by the National Marine Fisheries Service in 1994 in an area rotation scheme. Scallopers were allowed access to portions of the areas for specified amounts of time managed through an allocation of “trips” with possession limits (Fig. 1; NEFMC, 2004).

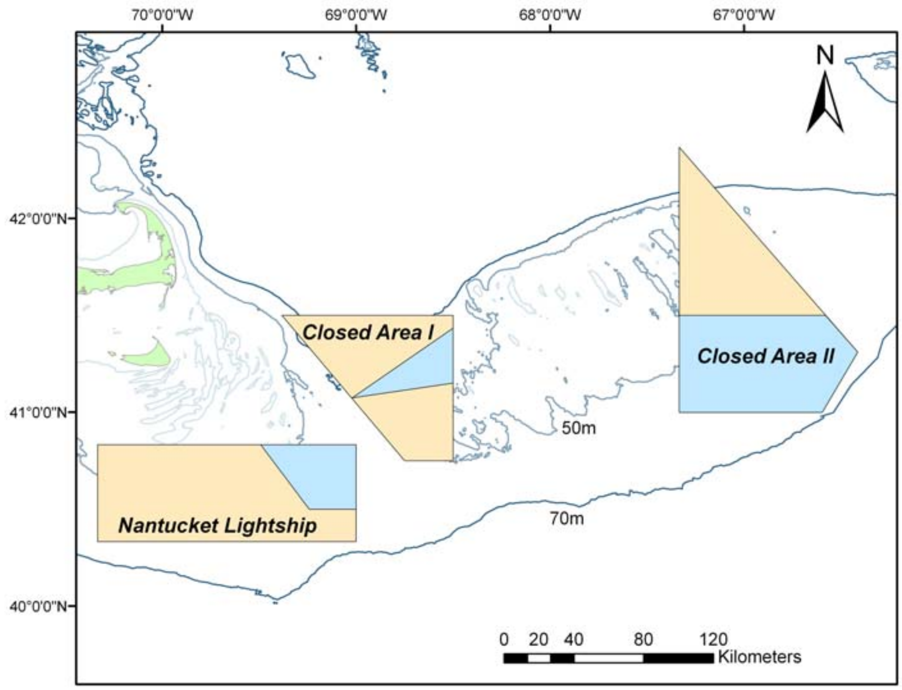

Figure 1. Georges Bank groundfish closures established in 1994 with scallop access areas overlaid in blue.

Although scallops are abundant in the closed areas, groundfish stocks are still depleted. The management actions that were enacted to allow scallop harvest in the three closed areas of Georges Bank included measures to account for impacts on groundfish stocks. The scallop access areas were spatially limited to protect important juvenile groundfish habitat and temporally restricted to avoid spawning times for groundfish (NEFMC, 1999). Also, a specific measure to limit the bycatch of yellowtail flounder in the scallop fishery was incorporated in the management plan.

Yellowtail flounder are managed as three separate stocks, with mixing of these stocks across portions of Georges Bank (Cadrin, 2003). The Georges Bank and Southern New England/Mid-Atlantic stocks are currently overfished with overfishing occurring. Landings have declined to historic low levels (Fig. 2) and both stocks are currently in rebuilding plans as mandated by the Magnuson-Stevens Fishery Conservation and Management Act. The yellowtail allocation to the scallop fleet is limited to 10% of the total allowable catch (TAC) of yellowtail flounder to promote the rebuilding plans (NEFMC, 2000).

Rotational management has been successful for the scallop resource, and scallop biomass and landings from Georges Bank are currently greater than previously observed (Fig. 2). However, the access fisheries in the closed areas of Georges Bank have been constrained by bycatch of the overfished yellowtail flounder stocks. This restriction has caused the access area scallop fishery to be shut down before reaching the full scallop TAC several times, most recently in 2009 (Table 1). Foregone scallop yield from these early closures has caused economic losses and concern about scallop health and natural mortality in the areas (Stokesbury et al., 2007).

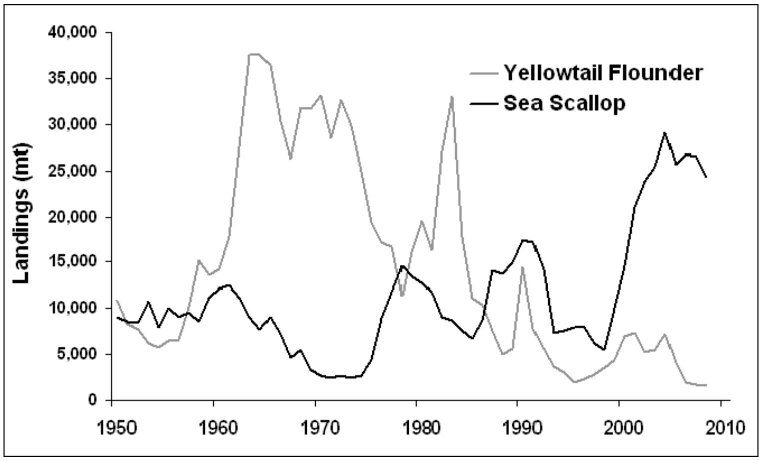

Figure 2. Landings of yellowtail flounder and sea scallops (mt) from 1950 through 2009.

Under the current management system, the access portions of the Georges Bank closed areas open on 15 June for scallop harvest, as constrained by the yellowtail TAC. Yellowtail flounder is treated as an open access resource without individual allocation, and bycatch is monitored through the industry-funded observer program at a minimum level of 10% coverage (i.e., at least 10% of fishing trips in the access area fishery are sampled at sea). Reporting of observer data is required within 24 hours of the vessels' return, and yellowtail bycatch rate is monitored on a thirty-five day moving average.

This management system has resulted in a loss of scallop yield from the access fishing areas. Due to the depleted status of the Georges Bank and Southern New England/Mid-Atlantic yellowtail flounder stocks, the TAC allocated to the scallop fishery has decreased over time. When yellowtail bycatch reaches approximately 70% of the TAC, the area is scheduled for closure. Any scallop trips that have not taken place when the access area fishery is closed are excluded from the area, and vessels are compensated with open area Days-At-Sea.

Fishing in the access areas may occur in regions where yellowtail flounder are more densely concentrated. There is no method for identifying areas with high yellowtail density, because methods of analyzing observer data are not spatially specific and observed bycatch rates are averaged over the entire trip.

A time lag exists between data collected by observers and reporting of data by the National Marine Fisheries Service for the access area fisheries. This time lag can create derby-style fishing as fishermen race to the fishing grounds to avoid losing their trip due to early closure from yellowtail flounder bycatch. This derby fishing is exacerbated due to many vessels conducting multiple trips in the area. The race to fish is introduced by managing the yellowtail TAC as an overall fleet allocation, whereas the scallop TAC is allocated on an individual basis.

Two of the access areas on Georges Bank have recently closed early because of yellowtail flounder bycatch, with an economic loss of over US $65 million (Table 1). The economic loss combined with a lack of response from fisheries management to develop a solution has provided ample incentive to the scallop fishing fleet to devise a system for active avoidance of yellowtail flounder bycatch in an attempt to maximize scallop yield from the rotational management areas.

Table 1. Summary of yellowtail allocation, scallop harvest and loss of economic yield from the Nantucket Lightship Closed Area (NLCA) and Closed Area II (CAII) fisheries in 2006-2009.

Year	2006	2006	2008	2009
Area	NLCA	CAII	NLCA	CAII
Opening	06/15/06	06/15/06	06/15/08	06/15/09
Scheduled Closing	01/31/07	01/31/07	01/31/09	01/31/10
Actual Closing	07/20/06	09/06/06	08/04/08	06/29/10
Yellowtail TAC (lbs)	31,544	449,743	68,784	384,330
Yellowtail Catch (lbs)	55,458	462,971	67,461	313,056
Scallop target (lbs)	11,540,000	16,444,280	6,263,994	5,518,170
Scallop landings (lbs)	8,990,170	13,545,201	4,684,823	3,375,277
Forgeone yield ($)	$17,850,000	$21,000,000	$11,100,000	$16,000,000

YELLOWTAIL FLOUNDER BYCATCH AVOIDANCE SYSTEM

In response to the problem of lost yield in the scallop access area fishery resulting from bycatch of yellowtail flounder, we collaborated with scallop fishermen to develop a bycatch avoidance system focused on real-time communication of fine-scale spatial distribution of yellowtail flounder. The goal of the system was to provide fishermen with up to date information on the location of yellowtail flounder aggregations in an effort to avoid bycatch “hotspots” while harvesting the full allocation of scallops.

Closed Area II 2009

In 2009, we provided the fishing fleet with a map of scallop and yellowtail flounder distributions in the access portion of Closed Area II (Fig. 3). The yellowtail distribution information was collected during a large-scale Peterson tagging experiment conducted in June 2008 (Melgey, 2010). The scallop distribution information was collected during an annual scallop video survey (O’Keefe and Stokesbury, 2009) conducted in May 2009. We overlaid the data sets and identified areas where the distribution of the two species did not overlap. We provided the map and a letter to the fleet prior to the opening of the access fishery, and suggested that fishing effort should concentrate in areas where yellowtail flounder were not present.

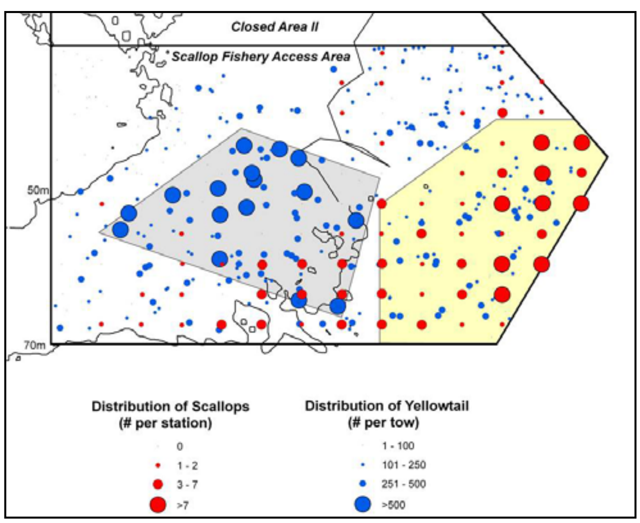

Figure 3. Map of scallop and yellowtail flounder distribution in the access portion of Closed Area II provided to the scallop fishing fleet on 8 June 2009, prior to the opening of the area.

The information proved to be accurate based on fishery observer information, but the advice was not followed by the entire fleet. One third of the observed vessels had very large tows in areas we identified with high yellowtail density and low scallop density. Due to the non-spatially specific analysis of observer data, these high tows were averaged across the entire region. As a result of time-lagged data reporting, the active fishing vessels could not avoid high bycatch areas. The area closed to scallop harvest within two weeks due to exceeding the yellowtail flounder TAC. The resulting economic loss was US $16 million, and the biological consequences included potential natural mortality of unharvested scallops, high fishing mortality on the overfished yellowtail flounder stock and a shift in fishing effort from an area with high catch per unit of effort to areas with lower catch per unit of effort, which can increase habitat impacts.

Nantucket Lightship 2010

In response to the Closed Area II 2009 fishery, we solicited ideas for improving bycatch avoidance in the Nantucket Lightship Closed Area 2010 fishery. Feedback from fleet members suggested that active participation in the form of daily communication may provide the incentive that is needed to avoid areas with high bycatch rates.

We designed a two-phase system, which incorporated fishermen input and collaboration with existing survey collected information. Phase one was similar to the efforts we used in 2009 for Closed Area II. The Virginia Institute of Marine Science conducted an industry-based dredge survey in the Nantucket Lightship access region in 2009, which collected catch information for yellowtail flounder and scallops. Based on the allocated TAC for yellowtail (147 mt) and the target for scallop harvest (2672 mt), we combined the yellowtail to scallop catch rate in a stop-light analogy map. We determined areas where the catch ratio would allow full harvest of the scallop target without exceeding the yellowtail TAC (58 lbs of scallops to 1 lb of yellowtail; Fig. 4). Additionally, we conducted a scallop video survey in the region in May 2010. This updated scallop distribution data confirmed the VIMS data from 2009. The combined information was sent to the fleet prior to the area opening.

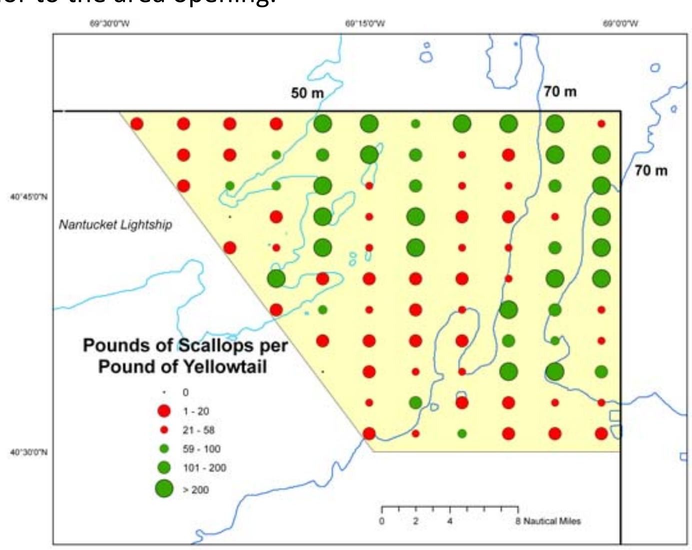

Figure 4. Stop-light map of the scallop to yellowtail catch rates provided to the scallop fishing fleet on 10 June 10 prior to the opening of the area (adapted from DuPaul and Rudders, 2010).

Phase two incorporated daily email exchange with the vessels to identify yellowtail flounder bycatch "hotspots". Fishermen suggested using the 13000 and 43000 Loran C lines overlaid on the access area to form a grid of 34 individual lettered cells (Fig. 5). We asked the industry to provide yellowtail catch information for each grid cell that they fished. The information was sent to us once every 24 hours. The data was compiled and analyzed, and then advice on the status of each cell was transmitted back to the fleet.

In designing this system, we identified specific objectives for success. We needed a high level of fleet participation, effective classifications of time, scale and bycatch avoidance advice, and measures to determine the effectiveness of the effort. We wanted the system to be simple and user-friendly and therefore, relied on existing email technology to support the real-time communications. We worked with Boatracs® and SkyMate, the two Vessel Monitoring System providers used by the scallop fleet, to set up an authorized email address to exchange information with the vessels. We determined that the size of the grid cells was large enough to collect viable information and mask individual fishing locations, but small enough to address the fine-scale spatial aggregations of yellowtail flounder. We collected information about yellowtail catch only, because fishermen were reluctant to participate if they had to divulge information on where they were catching scallops. We also decided that the individual vessel information would remain confidential.

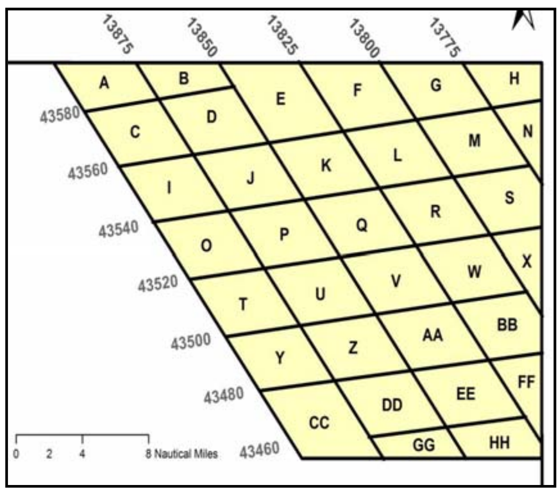

Figure 5. Nantucket Lightship Closed Area scallop fishing access region overlaid with Loran C lines to make a grid of lettered cells for reporting of yellowtail catch.

The fishery opened on 28 June and real-time reporting lasted through 15 July. A total of 122 vessels signed-up for the program, with 62 vessels actively reporting through the duration of the fishery. Two independent researchers compiled the daily emails and separately analyzed the data. We classified cells as low, medium or high based on the weighted mean catch of yellowtail per tow (lbs). The cell classifications and justification for classification was distributed among five researchers for consensus prior to sending the information to the fleet. These protocols acted as a measure of quality assurance for the system.

We identified a yellowtail hotspot within 32 hours of the fishery opening and three additional high bycatch areas over the next 72 hours (Fig. 6). After the first three days of reporting, we identified a flaw in the email system: the vessels were not receiving the daily advisories. We solved the problem, and the first effective fleet advisory on yellowtail bycatch hotspots was received by the vessels on 1 July. Following this advisory, the overall yellowtail catch per tow substantially declined (Fig. 7). The fishing effort in cells that had been identified as hotspots also declined; all reported fishing effort from the hotspots had ceased within three days of the first effective advisory (Fig. 8).

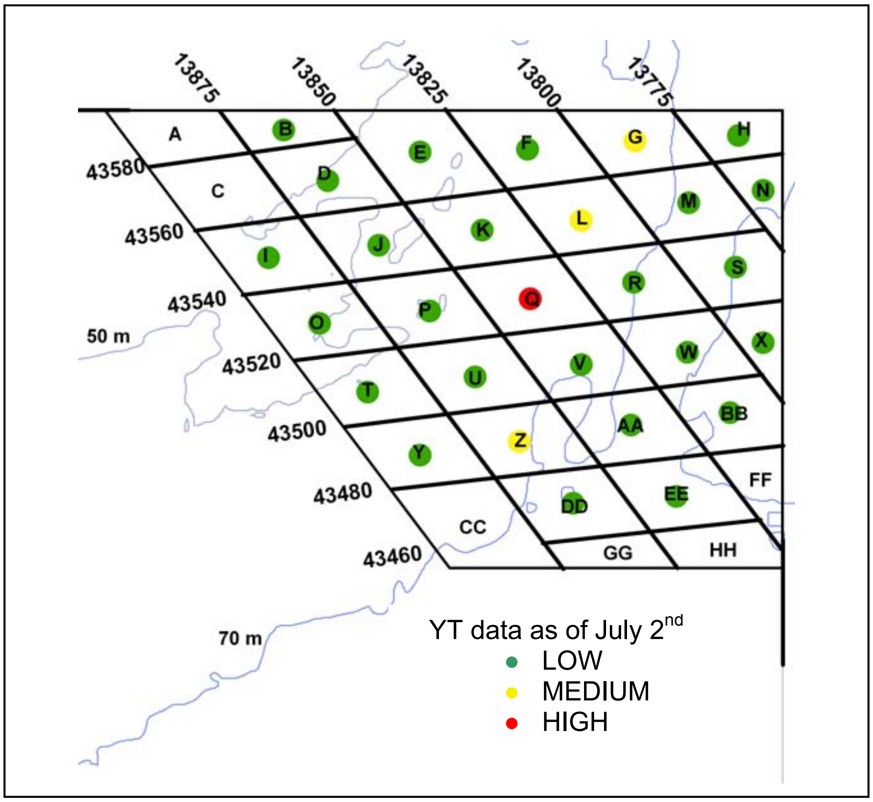

Figure 6. Yellowtail (YT) catch per tow for each grid cell from 28 June through 2 July.

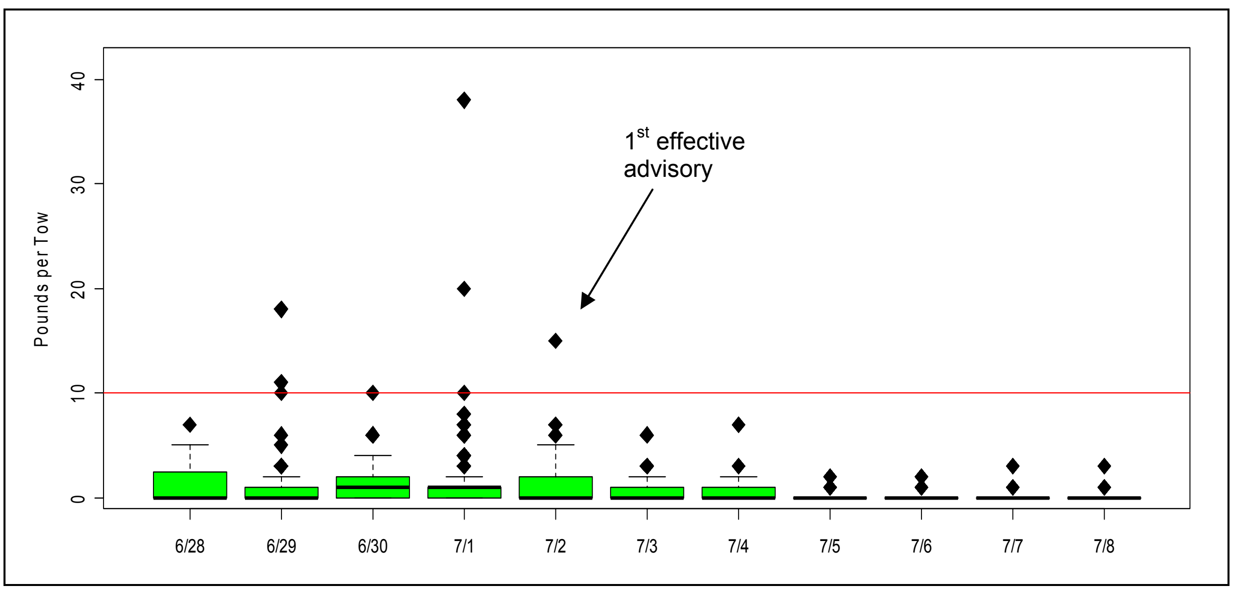

Figure 7. Pounds per tow of yellowtail flounder caught in all cells combined during the reporting period and after the first effective advisory was received by the fleet.

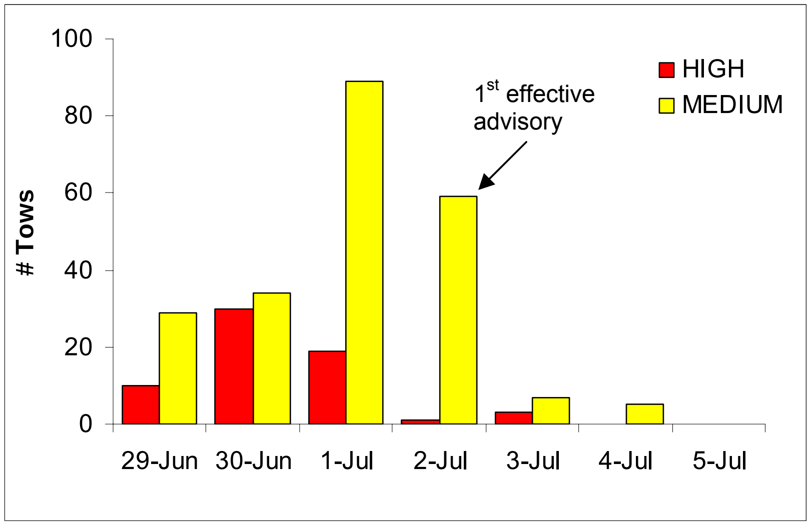

Figure 8. Number of tows for each cell that was identified as HIGH or MEDIUM during the initial reporting period and after the first effective advisory was received by the fleet.

To measure the effectiveness of the program, we compared results with observed fishing trips to determine if the distribution of yellowtail flounder reported was similar to that sampled by fishery observers (Fig. 9). The distributions of yellowtail and scallops matched closely with the vessel reports and the survey information that was disseminated prior to the area opening. We also investigated the total amount of yellowtail flounder TAC that was harvested from the area (Fig. 10). By the end of the reporting period (15 July), only 26% of the yellowtail TAC had been harvested. The full target of scallop harvest (2624mt) was caught in the area by early August, and over 70% of the allocated TAC for the overfished Southern New England/Mid-Atlantic yellowtail flounder stock remained unharvested.

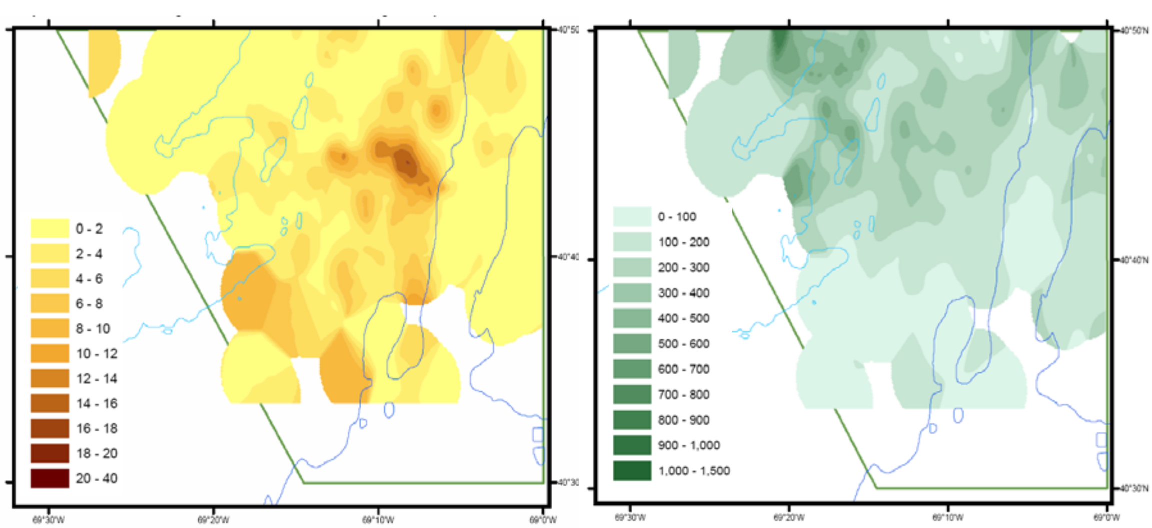

Figure 9. Yellowtail flounder lbs per tow (left panel) and scallop lbs per tow (right panel) from observed trips (adapted from NMFS Northeast Fisheries Observer Program; http://www.nefc.gov/fsb).

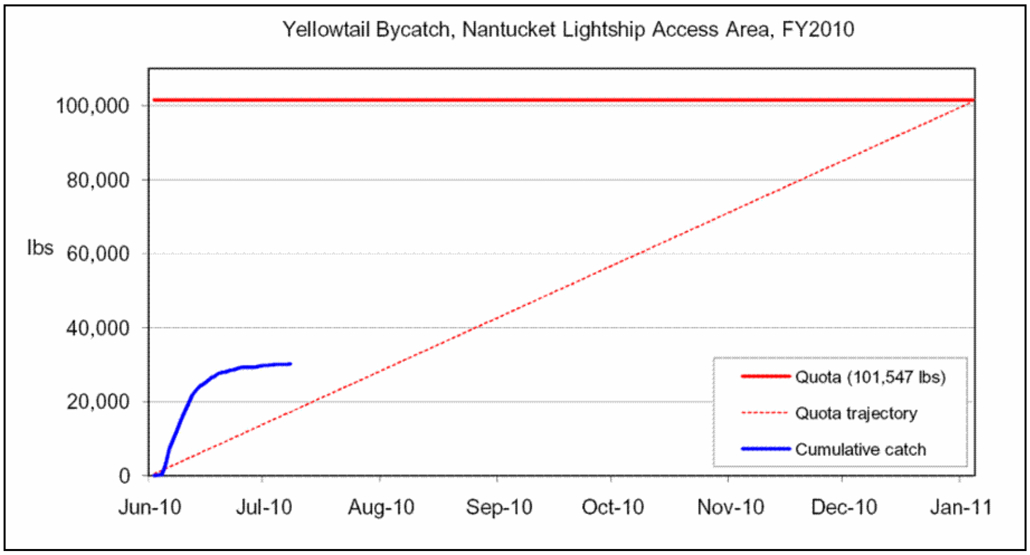

Figure 10. Cumulative yellowtail bycatch from the Nantucket Lightship access area fishery (blue line) compared to the overall TAC (solid red line) and projected catch (dotted red line; adapted from NMFS Northeast Regional Office; http://www.nero.noaa.gov/nero).

An important aspect for the success of this program was the level of outreach to the fleet and incorporation of feedback from the fishing industry. We held multiple meetings with industry members, sent two mailings to the entire scallop fleet and attended fisheries management meetings and workshops prior to the opening of the closed area fishery to promote the system. Also, we updated our bycatch advisory daily during the critical first few weeks of the fishery when fishermen were making decisions about trip timing. The first information from the National Marine Fisheries Service was publicly available ten days after the area opened and many trips were already completed (Fig. 11); thus the bycatch avoidance system data was the only information available to the active fishing vessels.

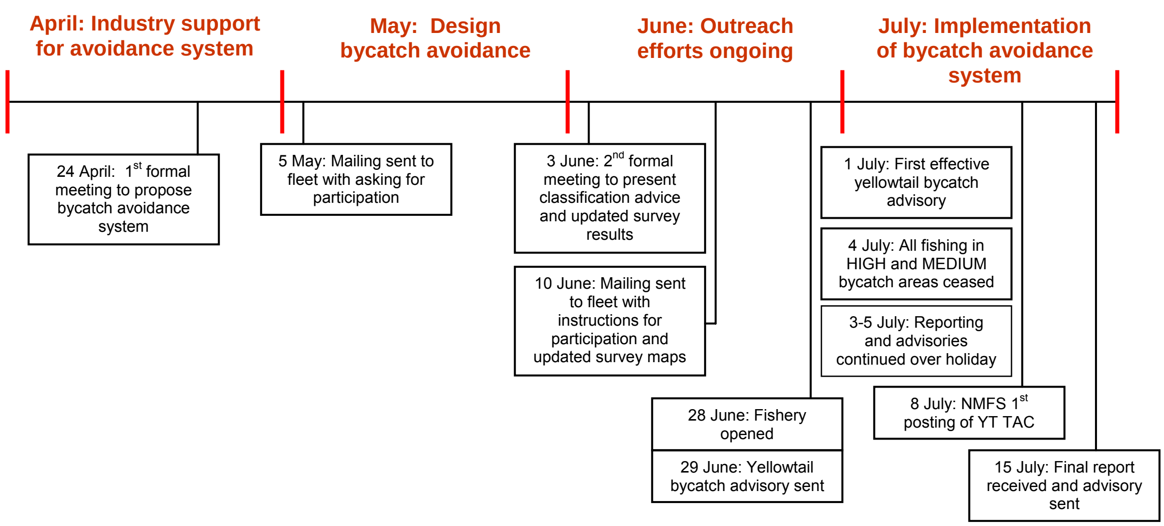

Figure 11. Timeline of events for development and implementation of the bycatch avoidance system for the Nantucket Lightship Closed Area 2010 fishery.

CONCLUSIONS

The bycatch avoidance system in the 2010 Nantucket Lightship scallop access fishery was an economic and conservation success. The full scallop allocation was harvested, while less than 30% of the yellowtail flounder bycatch TAC was removed. The revenues from this access fishery alone exceeded US $40 million in landed value. The conservation of over 70% of the overfished Southern New England/Mid-Atlantic stock is expected to promote stock rebuilding in future years.

The US sea scallop fishing fleet received the benefits of an industry-led program to confront bycatch of yellowtail flounder and worked collaboratively to build a successful program. The fleet was willing to bear the additional costs of recording bycatch information on a tow-by-tow basis as well as sending and receiving daily emails in order to maximize the scallop yield from the area. They identified that the lack of real-time, spatially-specific information resulted in a loss of potential scallop harvest and an increase in bycatch of an overfished species.

Feedback on the system to date has focused on continuing such efforts outside of formal management and regulation. The scallop fishery is still managed with traditional top-down government control, however, this example of fleet organization and participation to actively avoid bycatch of an overfished species suggests that “reversing the burden of proof” may be successful. The fleet has expressed strong interest in continuing this system in future access fisheries for yellowtail flounder and other bycatch species. An additional objective for the system is to reduce the derby-style fishing behavior by continuing to build trust with the industry. Furthermore, the system could be expanded to include other fisheries and larger areas. Overall, this example demonstrates results based management through an industry-led incentive-based program for maximizing yield while confronting the bycatch issue.

ACKNOWLEDGEMENTS

The SMAST Bycatch Avoidance System was feasible through cooperation with the US sea scallop fleet and the SMAST Fishermen’s Steering Committee. Nikki Jacobson was especially helpful with data analyses, and Commercial Fisheries News was helpful with outreach efforts. William DuPaul and David Rudders from the Virginia Institute of Marine Science provided data to enhance the project. Specific contributions to this project included Boatracs, SkyMate, the Massachusetts Marine Fisheries Institute and Virginia Institute of Marine Science.

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