

## 10 Northeast Scallop Survey

### 10.1 Introduction

The evaluation of scallop surveys off New England using industry vessels is one part of a set of case studies performed by the National Fisheries Conservation Center and intended to assist NMFS and industry in designing more effective cooperative data gathering efforts. As with the other case studies, we relied primarily on interviews and a review of the available written record (see Tables 10.1 and 10.2 and the Methods chapter (chapter 3) for more detail). This review summarizes the development of the program and how it might be replicated in the long term. Similar to other cooperative programs, the challenge is to find a way to build incentives into the collection of information to create positive feedback for the industry, and at the same time maintain scientific credibility of the survey methodology and data analysis.

Table 10.1. Sources interviewed, in alphabetical order. NMFS refers to the National Marine Fisheries Service

Name	Title & Organization	Fisher	NMFS	Private Institution
Bob Bruno	Fisheries Survival Fund	X		
Teri Frady	NMFS/NERO		X	
David Frulla	Fisheries Survival Fund	(Atty rep)		
Steve Murawski	NMFS/NEFSC		X	
Marjorie Ohrman	Exec Dir Fisheries Survival Fund	X		
Paul Rego	NMFS/NEFSC		X	
Brian Rothschild	Univ. Mass/Dartmouth C-MAST			X
Mike Sissenwine	NMFS/NEFSC		X	
Kevin Stokesbury	Univ. Mass/Dartmouth C-MAST			X

Table 10.2. Additional sources. NMFS refers to the National Marine Fisheries Service, Council to the New England Fishery Management Council, GAO to the General Accounting Office, and Register to the Federal Register.

Source	Description
NMFS	NMFS. 1999. Our Living Oceans. NOAA Technical Memorandum NMFS-F/SPO-41. June 1999. U.S. Department of Commerce, Washington, D.C.
NMFS	NMFS/NERO. Additional Georges Bank Sea Scallop Exemption Program Trips Authorized. Notice to vessel owners. Oct. 5, 1999. <a href="http://www.nero.nmfs.gov/ro/doc/nr9933">http://www.nero.nmfs.gov/ro/doc/nr9933</a> .
NMFS	NMFS/NERO. 2000. Sea Scallop and Restricted Gear Closed Area Regulations, Seasonal sea scallop closure areas. NMFS Northeast Region Information Sheet No. 5 (May 1, 2000) 7 pp.
NMFS	Sea Scallops Return to Eastern Georges Bank. News Release NOAA99-R132, June 9, 1999.
NMFS	Sea Scallop Opening on Georges Bank Yields 6 Million Pounds of Meats. News Release NMFS NE Region NR99-20, Nov. 8, 1999.
Council	Lai, H. And P. Rago. Sea Scallops. Status of Fishery Resources of the Northeast United States. NEFSC website.
Council	Sea Scallop Fishery Management Plan Summary. 1999. 2pp. <a href="http://www.nefmc.org/documents/scallop.htm">http://www.nefmc.org/documents/scallop.htm</a> .
GAO	General Accounting Office. 2000. Fishery Management: Problems Remain with National Marine Fisheries Service's Implementation of the Magnuson-Stevens Act. GAO/RCED-00-69 April 6, 2000.
Register	50 C.F.R. 648.50. Subpart D. Management Measures for the Atlantic Sea Scallop Fishery.
Publication	DuPaul, W. And J. Kirkley. 1998. Virginia Sea Grant Marine Resource Advisory No. 71 VSG-98-10. December 1998. Online. 4 pp.

Source	Description
Publication	Glass, C. 1999. "Fishermen, scientists working to solve problems." Page 9B Commercial Fisheries News April 1999.
Publication	Plante, J.M. 1999. "Scientists find scallops rebuilding 'ahead of schedule'" Page 16A Commercial Fisheries News, October 1999.
Publication	Rising, D. "Fisheries panel proposes scallop plan." Boston Globe. Online. May 5, 2000. <a href="http://www.boston.com/news/daily/05/fish_plan.htm">http://www.boston.com/news/daily/05/fish_plan.htm</a> .
Publication	Sissenwine, M. 1998. "Joint science/industry research benefits all." Page 5B Commercial Fisheries News, October 1998.

## 10.2 The setting

Atlantic sea scallops, once one of the highest value species landed in northeast fisheries, have been overfished since the early 1990s. Intense regulation of the fishery since 1994, combined with large closed areas to protect groundfish, had reduced both the amount of time and the areas that were available to scalloping. As open areas became depleted, further limiting fishing opportunities, pressure heightened to find out what was happening with scallops in the closed areas. Attempts by industry to get permits for experimental fishing and by scientists to conduct resource surveys coincided with government's interest in expanding its own survey capability in the region. The desire for more and better information brought the parties to the table to design a cooperative survey of closed areas. Results not only showed an abundance of scallops of large size, but contributed to openings of previously closed areas and consideration of new management measures to allow rotational closures for scallop conservation.

## 10.3 The story

The Atlantic sea scallop (*Placopecten magellanicus*) occurs from North Carolina to Newfoundland. Sea scallops are taken year round with dredges and increasingly with otter trawls in the Mid-Atlantic. The major commercial fisheries are conducted in the Gulf of Maine, on Georges Bank, and offshore from Virginia Beach to Long Island. The fishery is regulated by the New England Fishery Management Council. Over the years the scallop fishery has been one of the most economically valuable in the Northeast, ranking fifth in dollar value among all species landed.

Scallops reach maturity at about 3 years, and are of a catchable size at ages three to four. They achieve the most growth – 50 to 80 percent – between three and five years of age, and slow down after age seven. They can reach an age of 16 years. The scallop populations in the Mid-Atlantic Bight and Georges Bank are not related, and the fisheries in both areas depend on the growth of "seed" or small scallops to exploitable size.

Measures to regulate the fishery from 1982 through 1993 relied on meat counts, a way to restrict the size – and therefore the age – of a scallop before it could be taken in the fishery. When this proved ineffective in reducing fishing mortality and restoring abundance, the New England Fishery Management Council in 1994 changed its approach by limiting entry, restricting effort through days at sea per vessel, reducing crew size and increasing the gear mesh size. The days at sea provision was tied to a schedule aimed at reducing fishing mortality rates to meet the council's overfishing definition, then based on a level of spawning stock age. Also in 1994, four areas on Georges Bank were closed to protect depleted groundfish stocks, eliminating all fishing, including dredging for scallops.

Despite the restrictions on effort, landings continued to decline. By 1996 a stock assessment on Georges Bank and in the Atlantic Bight indicated sea scallops were overfished in both areas and at a low population level. The Sustainable Fisheries Act, enacted that same year, required a more stringent overfishing definition based on a stock age that would maximize yield and rebuild the population within 10 years. Further restrictions were imposed on days at sea, cutting the allowable days to 142 in 1998, and 120 in 1999. As scallopers were moved out of areas on Georges Bank, pressure built on the remaining open areas and on Mid-Atlantic populations. Additional areas in the mid-Atlantic were closed to scallop fishing. Scientists and managers predicted that in order to meet the requirements of the Sustainable Fisheries Act, days at sea would have to be cut even further to 35 to 70 per vessel—well below what skippers said would cover the costs of a trip.

Meanwhile, in the groundfish closure areas on Georges Bank, the untouched scallops prospered. In the first 20 months of the groundfish closures, sea scallop biomass within those areas tripled. These closed areas became the object of curiosity and scrutiny as scallopers had an increasingly more difficult time finding productive beds. As other areas in the mid-Atlantic became depleted and days-at-sea were cut shorter, fishermen wanted information on the condition and abundance of scallops in the closed areas.

There were several attempts to acquire experimental fishing permits that would allow entry into the closed areas, but the applications had varying degrees of detail and scientific methodology. “They were not well thought out and there was no expectation that the design was sufficient to answer the questions,” according to Paul Rago of NEFSC. “Some of them just looked like fishing expeditions,” he said. None was approved.

The recollection of industry applicants is that they had tried for several years to get permits to conduct research in the closed areas. According to a recent GAO investigation of events, the first formal proposal and application for permit was in 1998. Their review found some confusion in the recollections of the parties:

Fishermen said that they had requested permission to have major universities conduct research in all three closed areas as early as 1996...NMFS officials remembered conducting discussions in 1996 and informing industry officials that a formal proposal would be needed because the research would be done in a closed area. They stated that they had helped industry officials prepare the proposal but that it was not submitted until 1998.

That application, a formal proposal by the Center for Marine Science and Technology (CMAST) of the University of Massachusetts at Dartmouth to conduct dredge surveys of scallops in Closed Area II, was approved.

### **10.3.1 1998 Scallop Dredge Survey/ Closed Area II**

The adage that “success has many fathers and failure is a bastard child” captures the collective perception (in hindsight) of how the cooperative dredge survey of Closed Area II evolved. There are differing recollections of what actually kicked off the cooperative survey and differing perceptions of what its objectives were. None disagree, though, on at least one result: the confirmation of a huge biomass of scallops in Closed Area II contributed to additional scallop openings in 1999 worth \$36 million to the industry.

According to the Fisheries Survival Fund, an industry association formed initially to represent the

interests of scallopers in New Bedford and Fairhaven, an accurate picture of the number and condition of scallops in the closed areas was crucial to economic survival. “We were going to be looking at 51 days fishing time in 2000,” said Bob Bruno, owner of a fishing vessel operating out of New Bedford. “That was not enough to survive. We had to do something. We came together to show that there were adequate scallops out there.”

Marjorie Ohrman is a bookkeeper who serves as the executive director for the Fisheries Survival Fund and was one of the original organizers of the group. She recalls that they formed the group because the scallopers knew they needed good science to make their case at the council. “Initially the fishermen in New Bedford were petitioning to do research in the closed area,” she said. “They didn’t get far with the council or the [NMFS] regional office.” Ohrman sees the involvement of Brian Rothschild of CMAST and retention of Washington attorney David Frulla by the association as the key events that got the research permit ball rolling.

Bruno agrees. “As fishermen, we’ve been going to meetings for years. Just because we don’t have a piece of paper that says ‘you’re a scientist’ we weren’t taken seriously until we got linked up with CMAST to propose this work and provide information.” He said the scallopers had been saying all along that there were plenty of scallops in the closed areas and their fishing days didn’t need to be curtailed further.

By spring of 1998, when Frulla joined the effort, the Fisheries Survival Fund, CMAST and NMFS had been discussing a dredge survey in the closed area. His strategy was to support CMAST’s request for the experimental fishing permit, and secondly to file a petition for rulemaking to open the closed areas to fishing.

“I don’t know why it was so difficult to get the experimental permit,” Rothschild says. He observed that the obstacles arose from technical issues, and that the Northeast Science Center was trying to make the survey comprehensive. “It got complicated and difficult,” he said. “So we said, let’s do Area II as a feasibility study, then see what happens.” Everyone pitched in, Rothschild said, and they came up with a very high estimate of scallop abundance.

In Rothschild’s view, one of the obstacles was an apparent need for the National Marine Fisheries Service to control research and information collection. “This is not a useful approach,” he says. He said there is a need for more trust, and a more simplified process.

“There were millions of dollars of scallops sitting on the bottom. The more scallops there are, the less bottom time is required for the dredges. It should be a win-win situation. Our proposed survey method is inexpensive. They ought to be using the NMFS boat on things they can do better. There are much more important scientific problems for the Service than estimating scallop abundance.”

At the Northeast Fisheries Science Center in Woods Hole, Steve Murawski would agree that organized pressure from industry helped get the joint survey going. But he doesn’t go along with the perception that NMFS scientists were unaware of the condition of scallops in the closed areas. “The perception that we didn’t know about the large biomass in the closed areas was wrong. The 1996 surveys showed it was there; the data was there. It’s a misnomer to claim it was an ‘undiscovered’ resource.” He points out that the agency was aware the industry knew about the scallops, too, because there were so many violations prosecuted for fishing in the closed areas.

The industry’s objective for the survey was straightforward: are there sufficient scallops of a large enough size to warrant opening up the groundfish closed areas to scalloping? The research

objectives for the NEFSC were more complex. While they, too, wanted an estimate of abundance, doing so using commercial vessels to tow the dredges required somehow accounting for the highly varied ‘footprint’ of the bottom gear. Because every vessel and every tow is different, they had to figure out a way to interrelate the data from one vessel to another to provide consistent, reliable results. Furthermore, in order to extrapolate absolute abundance from estimates of relative abundance, they needed to have an idea of the efficiency of the dredge tows. NMFS also had to get some idea of how much bycatch of flounders and other groundfish occurred during scalloping, since the purpose of the closures was to protect those species.

The CMAST application for an experimental fishing permit was approved to allow “fishing” in the closed area by the research dredges. CMAST provided researchers, the industry provided vessels and dredges, and the NEFSC provided electronic equipment and the survey design. From the science center’s point of view, the purpose of the project was to calibrate the guidance and action of the NMFS dredge and commercial dredges as a first step to testing the feasibility of using commercial vessels to do surveys.

Financial support for the industry was in the form of a 10,000 pound catch of scallops they were allowed to sell, and fishermen also did not have to count the days working on the project against their days-at-sea allocation. NEFSC supported the salary of a post-doc at CMAST, and a portion of the proceeds of the sale of the scallops also went to UMassD. A portion of pooled proceeds was used to cover expenses of the participating vessels, and the cost of observers.

The NEFSC worked with CMAST and the scallopers on the design of the survey, and all participants agree that at this stage collaboration was successful in designing the project and solving problems. For example, not all the vessels that wanted to participate were needed for the survey and a lottery was devised as a fair way to get enough vessels to do the job. The effort to shape a design that would calibrate the industry vessels with each other and in turn with the NOAA research vessel *Albatross* required application of substantial technology as well as the operational knowledge of the fishermen. Technology was one of the areas of common interest, according to Murawski, “The skippers and mates were very interested in the technology we were using to map the survey, and to report position and time. In many cases we were able to coordinate with their bridge electronics. Some had very sophisticated computers that could just download data.”

In another potential conflict, scallopers, lobstermen, NMFS and CMAST scientists put their heads together to address the concern that deploying the mobile gear for the survey in the closed areas would damage fixed gear used in the area for lobster. “The offshore lobstermen were able to work out an accommodation so that there were minimal gear conflicts,” Murawski said. “Having scientists involved in the negotiation between gear groups was enlightening for all of us. We crowded around the nautical charts and figured it out.”

The survey went forward in August and September 1998 using six vessels, each sampling 100 stations in a two week period – one every three square nautical miles. In a series of layered experiments, each vessel performed about 300 tows of 10 minutes each. The first major experiment was to estimate the relative density of scallops in the closed areas, and by calculating the average “footprint” of a tow, to extrapolate to the total area. The second major effort was to study the relative efficiency of the dredge by going back and forth over the same plot multiple times, keeping track of the take of scallops each time and of each pass in relation to the total.

“Efficiency is an important consideration in quota setting,” explained Paul Rago of NEFSC. “Different vessels have different catch rates. In order to be accurate in estimating total abundance, we need to expand the relative numbers.”

The project also looked at three other issues such as scale and patchiness of scallop beds, the rate at which dragging filled the dredge, and tows designed to determine when the scallop dredge actually stopped fishing during haulback. But of all the experiments, the “depletion tows” or efficiency experiments were to become the most hotly debated aspect of the 1998 research.

During the field work, everyone pitched in and the research went smoothly. Agreed upon roles were for captain and crew to operate the vessel, and the researchers to weigh, sort and categorize the catch. “People crossed roles fairly quickly,” Murawski observed. We had a lot of assistance from the fishermen and their crews in sorting the catch. They were interested in how we conducted that task and seeing the science through a different set of eyes.”

Rago agrees. “When you’re out on the water you share a common destiny. You have to pull together to get the mission accomplished.” Rago observed, however, that the rhythm and pace of scientific surveys is far different than the pattern of activity during normal fishing. “When you’re fishing, time is money. You avoid delays. At first it was frustrating for the crews to take the time sort and count everything. But once they saw the captain was supportive, then the crew followed along. We had excellent crews and captains who had a strong belief in the utility of what we were doing.”

The rough spots in the project cropped up when data analysis began. Murawski acknowledges that there was no agreement at the outset on the timing of peer reviews and release of the data. “Different players perceived their roles differently and had different motivations for how they wanted to release the data. It became problematic. Different estimates of scallop biomass were coming out that may have created false expectations.”

Kevin Stokesbury is a research associate at UmassD who joined the project in September 1998 on temporary assignment to the NEFSC to do data entry and analysis. His position was half funded by NMFS and half by the Fisheries Survival Fund and UmassD. “The squabbling started over when people got copies of the data.”

Ohrman recalls that the project worked fine until “Brian stepped over the government and announced how much product was offshore. Then it fell apart. The project was done and Brian announced the results before the government could finish processing the data.”

But timing was not the only issue. Stokesbury characterizes some of the events as scientific debate over two points that related directly to the estimate of the density of scallops: how long the dredge was on the bottom, and the rate of efficiency of the tows. “Based on different values of when the dredge starts and stops fishing, it made a difference of 20 percent in the total estimate of biomass. The debate was over the amount of fishing that occurred during haulback.”

Rago explained that the dredges are so heavy that they actually stay on the bottom until nearly directly under the stern of the vessel, therefore making haulback time an important period of contact with the bottom.

The difference of opinion about the efficiency experiments had to do with the model used to adjust the repeated tows over the same area. “It’s hard to do the same spot repeatedly. When you look at the paths recorded on the GPS they look like spaghetti,” Rago said. NEFSC scientists had

a model designed to accommodate the differences in wind, sea state, currents and the different “action” created among tows by different vessels as they attempted to set the dredge down on the same spot each time. But CMAST scientists thought that even with the GPS and other electronics, the dredges were actually sampling in a new area each time. “It biases the data and gives a lower efficiency than what’s actually going on.”

The difference was an estimate of 40 percent efficiency from NEFSC and 16 percent from CMAST. Translated into the abundance estimate the gap was between 30 million and 60 million scallops.

The scientific and statistical committee of the council and the stock assessment review committee for scallops reviewed the information and went with the 40 percent efficiency estimate.

Both Stokesbury and Murawski said the important issue for the future is to establish early in the project who is responsible for what elements of data analysis, when data will be available and to whom. “When we do these kinds of projects, we have to release through the same peer review process as stock assessment goes through,” Murawski said. “If we don’t, we set ourselves up for embarrassing conclusions about fishermen-collected data. We need to be careful that “new” science gets the same level of scrutiny as “old” science and uses the best methods and interpretation.”

The fallout of the controversy over the release of data and the estimates of scallop biomass created the perception expressed by Frulla, Ohrman and Stokesbury that cooperation on the subsequent surveys in 1999 was not as forthcoming. “Some felt that Rothschild stepped on their prerogatives,” Frulla said. “It wasn’t as cordial the next year; we had very little collaboration.”

But even with that, all three give the project high marks. “The net result was positive,” Frulla said. “People worked hard on the government side and on the council side.” Stokesbury observes that there are not many positive stories in fishing these days, yet this is one of them. “It got the industry involved in collecting data, and in the long run got them into the fishery for six more weeks.”

On June 15, 1999, scallopers were allowed to return to parts of Georges Bank that had been closed for five years. Parts of Closed Area II were opened to scalloping under rules designed to avoid overfishing on the scallops and avoid bycatch of recovery groundfish.

### **10.3.2 1999 Scallop Dredge Survey/ Closed Area I and Nantucket Lightship**

Once the pilot was completed successfully and confirmed that the commercial dredge and the NOAA research survey dredge could be calibrated to show consistent results, the NEFSC moved into the second phase of the project. The objectives were to assess the numbers and size of scallops in the remaining two areas that had been closed since 1994 – Closed Area I and Nantucket Lightship. The other major objective of the second cooperative survey was to evaluate the amount of bycatch in the scallop dredges.

Looking at the potential for bycatch of other protected species expanded the scope of the project and created an opportunity for involving other fishermen, said Murawski, “A lot of the controversy over the closed areas revolved around the impacts of scalloping on the recovery of other species. It was a major controlling factor. We were able to generate good information on bycatch and allow the definition of the area that would later be opened to fishing in 1999.”

The joint survey was conducted between August 6 and September 1 in Closed Area I, a triangular-shaped span of water approximately 40 miles south east of Cape Cod; and in the Nantucket Lightship area, a rectangle approximately 30 miles south of Nantucket. The fishing vessel *Santa Maria* and the fishing vessel *Kathy Marie*, both New Bedford scallopers, were chosen by lottery to participate in the biomass estimate portion of the survey. In addition, fishing vessels *Westport* and *Tradition* were chosen by lottery to participate in the bycatch portion of the experiment. The industry also provided crews for the project, described by several participants as “all-star crews” of hands drawn from many different operations, not just the vessels chosen in the lottery.

For their time, the scallopers used their allocated days-at-sea and retained for sale 14,000 pounds of sea scallop meats from their 10-day trips. “At the time that amount of scallops was high,” Murawski said, and worth about \$80,000. An additional incentive was that the vessels only had to count days-at-sea actually used in the survey tows. In comparison, a regular fishing trip also counts days to and from the grounds against the days-at-sea allocation.

Ohrman said the Fisheries Survival Fund was disappointed that they were not initially included in the 1999 survey, but eventually several skippers from the organization did take part. CMAST did not participate, but instead conducted its own project in the closed areas using video (see below).

As with the 1998 project, NEFSC was responsible for the survey design, the industry provided platforms and crews, and VIMS provided researchers and other scientific assistance. Murawski said the team used committees, meetings, hands-on problem solving, a website, and facilitated meetings to develop the project and communicate during its operation. “You don’t put this kind of assemblage together without coming back with a great amount of respect, and a deeper appreciation for the sets of problems and motivations that people bring to the project,” he said. “The level of cooperation was unusually high.”

What made the 1999 survey so valuable was the intensity and scale of information it was able to generate about scallops, their habitat, and the other species associated with them in the closed areas. As Murawski explained:

In our regular survey, we sample throughout the sea scallop’s range, looking at relative abundance and stock condition, collecting data at hundreds of stations from the Mid-Atlantic through Georges Bank. A few dozen of those stations are in these closed areas. The survey with commercial vessels in August was more intensive, occupying some 500 sites in and around just these two areas, and intended to collect data important for managers as well as scientists — abundance, location, bycatch, and other biological data. What resulted from this collection of intensive spatial data was a graphic description of critical habitat and an array of policy options set out in much more detail with what fishermen perceived as more reliable information.

In October 1999 the survey results were reported to the New England Fishery Management Council’s (NEFMC) Scallop Plan Development Team. “Based on the red flags raised in the experiment the council was able to devise measures that avoided bycatch,” Murawski explained. They limited the area opened, required use of very large (10-inch) mesh, placed observers on vessels and set a hard bycatch cap of 850,000 pounds of yellowtail flounder to force closure of the fishery once it was reached.

The information led to additional openings that resulted in landings of 6 million pounds of scallop meats worth approximately \$36 million. The bycatch cap for yellowtail was hit in mid-November.

This was the first time a bycatch cap was used in New England. Murawski said that information exchange about bycatch rates that developed among the fishermen meant they avoided hot spots, and actually cut their bycatch rates to well below what was predicted in the experimental tows. In the research project, they caught a pound of yellowtail flounder for every pound of scallops. In the actual fishery, scallopers took only 12 pounds of yellow tail per 100 pounds of scallops.

NEFSC created a website where they posted daily catch rates and bycatch rates for the fishery. “Fishermen tapped in,” Murawski said. Each vessel sent an email message detailing what they’d caught in the previous 24-hour period. If they had an observer aboard, they also reported their bycatch rate. “It allowed the fleet to share real-time information, monitor where fishermen were going, and avoid areas where the bycatch was high.”

### **10.3.3 1999 Scallop Video Survey**

Although not a joint NMFS/industry cooperative data collection project, the survey of scallops in closed areas in 1999 through the use of video has become entwined with the dredge surveys, is frequently mentioned in conjunction with the NMFS surveys, and—to some degree—came about because of the 1998 dredge survey.

After the debate over the procedure and data for determining efficiency, Stokesbury says he didn’t think doing more “depletion tows” was going to contribute further knowledge. He went to Rothschild with the idea of doing video surveys of the scallop beds. “I had surveyed scallops in shallower water by SCUBA,” he said, “and I thought it could be done in deeper water with video. Brian said ‘prove it.’”

The video survey idea not only side-stepped the controversy over the efficiency research, it also avoided entirely the question of obtaining a permit for experimental fishing. Taking visual images only, with no actual sampling of the bottom, did not constitute “fishing,” so as long as the vessels informed enforcement authorities they were going into the closed areas, but without any fishing gear on board.

With some preliminary drawings Stokesbury got together with several scallopers and they built a pyramid of PVC pipe as a model for a device to hold lights and a camera. After some testing in shallow water with CMAST’s small research vessel, they took the design to some gear welders. “Kevin had the ideas, fishermen know how to modify gear,” said Bruno. “We do a lot of jury rigging out on the water when we have to do make-shift repairs. We used all the years of doing this type of thing to help out on the project.”

The result was a 700-pound steel pyramid rigged with lights and cameras at different levels and intervals, and cable feeds back to computer, VCR and television on board. Stokesbury said they worked to design and build a piece of equipment that was adaptable enough to fit on any of the New Bedford vessels. The rig hangs off the stern winch and is lowered into the water.

Video surveys of Closed Area I, II and Nantucket Lightship were conducted by CMAST in cooperation with vessels and crews from members of the Fisheries Survival Fund. The project was supported with both in-kind and direct contributions from many sectors of the New Bedford

fishing community. The shorebased suppliers contributed fuel, food, supplies, welding and other technical support; vessels and crews worked as volunteers.

The survey design used a standard sampling technique, focusing on areas where scallopers had dragged historically. Stations at .85 nautical miles were sampled, taking four images of the bottom at each station. They sampled 50 to 60 stations a day, more than 650 in all. Stokesbury said the standard error for the video sampling was 2.3 percent, in comparison to a standard error for a trawl survey of 25 percent.

The surveys provided a library of both video and digitized images that are then used to count the number of scallops and measure the size of each scallop. The CMAST team assumed an average meat count of 18 scallops per pound and an average shell height of 4.5 inches, coming up with preliminary biomass estimates of 14.6 million pounds in Nantucket Lightship and 28.3 million pounds in Closed Area I. This squared with the average count and size of scallops from the Closed Area II survey. NEFSC's Sissenwine called the dredge survey and video survey results "very consistent."

"The length frequencies came out better than we'd hoped," Stokesbury said. "NMFS was sampling in the same places, and we have close agreement on size estimates."

Stokesbury said the key advantage of the technique is that they were "able to provide a preliminary estimate of absolute abundance when we stepped off the vessel." They completed the surveys in August, and were able to provide estimates to the scallop plan development team in September. The New England council used the video information, as well as that from the cooperative dredge surveys, in devising management measures that allowed the additional scallop openings in 1999.

By May 2000, the council was considering a proposal for rotational openings, allowing scallop dragging in previously closed areas, while closing others to allow rebuilding. The rotational strategy would cover the fishery from Maine to North Carolina. The proposal will be under discussion for several months, and is not likely to take effect until next year.

The council's scientific and statistical committee has cautioned that even in considering rotational openings, managers "carefully record the consequences of keeping some fraction of the currently closed areas closed for an extended period of time," in order to study growth, mortality, recruitment and biomass changes as well as condition of the bottom.

#### **10.4 Conclusions and lessons learned**

Several conclusions are readily apparent from the story described above. We describe these and assess the degree to which these might be applicable in other situations.

##### **10.4.1 The timing was right**

The cooperative survey of closed areas of Georges Banks included several scientific institutions and working fishermen. To some degree, the project that came about because various interests merged at a point in time when pressure from the scallop industry to get into the closed areas had built to a desperation level. "We knew the scallops were there, even though we were closed out," according to Ohrman. "The scallops were at a point where they were going to die." CMAST had been working with fishermen, who Stokesbury says "perceived that they had to do it to survive,"

to come up with an experimental permit application. At the same time, NMFS's openness to cooperative data collection with the industry was well publicized. "The idea of involving the fishing industry in fisheries science is very much in vogue these days," wrote Mike Sissenwine in October 1998 in *Commercial Fisheries News*. "From the perspective of a scientist, the prospect of new collaborations is welcome." Whether intentional or the serendipity of events, "we found each other at a good time," said Frulla.

#### **10.4.2 Familiarity breeds success**

The players in the project were familiar with each other. Their substantial history and a few dominant personalities did have an influence on the project. There is a perception on the industry side that changes in leadership in the NMFS Northeast Region opened the door to collaborative research. Rago agrees. "The atmosphere has changed radically," he said. Certainly leadership among captains of scalloping vessels contributed substantially to widespread support of the project. The role played by the Fisheries Survival Fund in providing a representative voice for the industry was cited as very positive. "Previously self interest, and positioning for anticipated regulatory changes created an atmosphere of everyone for himself," Rago said. The scientific community, as well, was not without its personalities and agendas. "The science community is not monolithic, either," said Murawski. "Different parts of the community have different motivations and are trying to garner resources through different avenues." The differences in motivation and interests of the parties played out in the difficulties over timing and release of the data from the project. Clearly the fishing industry wanted a good news story about the abundance of scallops. CMAST, as their original partner, wanted to deliver the good news. NMFS was following its peer review process and got overtaken by events.

#### **10.4.3 Respect increased over time**

But the levels of trust and respect between the parties increased substantially over the duration of the projects in 1998 and 1999. "Respect built as the team built and went along," said Ohrman. "Working side by side had positive benefits," Rago said. "We could see how each other approached problems and figured out solutions." There was more respect between parties over the duration of the project, Bruno said. "I've fished for 38 years, and even though I'm on shore more now, I can see the attitude is changing. During the dredge surveys they've come to see that fishermen had something to offer."

This kind of cooperative work is educational for fishermen too, Stokesbury observed:

Scientists and fishermen have different views of what is under the water. They would say to me, 'there are so many scallops they are on top of each other.' As a scallop scientist, I know that seeing one scallop every meter is high density. With acoustics and video as recent additions to the technology, they can see for themselves that scallops aren't on top of each other. In the past, we were using a gear that is highly selective to estimate density. It gives a different impression.

#### **10.4.4 Collaborative technical design**

The technical design of the project appears to have been collegial and developed with considerable consultation both with the fishing industry and both CMAST and VIMS. The fishermen's experience with gear, the action of the dredges, the application of GPS and other electronics on their vessels all contributed to operational success. Use of communications

strategies from traditional meetings to a new website kept the links open and had real-world application in the fishery when it was reopened to scalloping. Debate over the details of the efficiency experiments and haulback effects aside, the scientific design of the survey has been validated by independent peer review, and the data was able to be used in a timely and effective way by managers. The participation of the industry in its collection appears to have given it additional validation in the council process. With 20-20 hindsight, the participants are all claiming credit for the success of the project. "Many people, to their credit, are saying it was a good idea and we should have done it a long time ago," said Murawski.

#### **10.4.5 Objectives could have been clearer**

The weak points in the overall design appear to be the failure to articulate and harmonize the various objectives of the participants at the outset, and to come to agreement from the beginning how and when the data would be used. A clearer understanding by the fishermen that NMFS had research objectives beyond just estimating the abundance of scallops might have alleviated some of the perceptions about being shut out of the 1999 surveys after the debate over the 1998 data analysis. Clearly future projects must spell out the peer review and timing process for data analysis, data sharing, and release of results. All the parties agree that much of the controversy could have been avoided had this been done at the outset.

#### **10.4.6 Financial incentives added extra motivation**

The financial incentives available for this project in the form of scallop sales and use of days-at-sea contributed greatly to its success. As Sissenwine wrote in 1998:

There is another obvious but often unspoken factor: Some industry-based science projects provide fishermen new opportunities to catch fish during a time of considerable financial hardship. As long as the project is gathering useful scientific information, there is nothing negative about this economic motivation and no reason to avoid talking about it openly.

What needs to be considered in the future, Murawski says, are more creative ways to devise incentives tailored to the situation. If the catches in the survey, he points out as an example, wouldn't be higher than in the regular fishery, what else could you do? Frulla agrees.

We need to be creative about how to pay for industry time and vessels and create incentives. In the cooperative research, the scallop catch provided money, but what about video research? Or seed surveys, where you don't have a product to pay the way? We need to find a way to break through the structure to find alternative funding sources. How do you translate a TAC set-aside into a pool of money that can be used if you don't fish? The industry has a core of altruistic people who go as far as they can, but they have to pay the crew, fuel, and so on.

#### **10.4.7 No long-term strategy**

Another element that was missing from the project design, according to Murawski, is consideration of how to put something in place for the long term:

We should use it to design something that is routine. In this fishery, rotational areas are a good idea. We should encourage the segue from research vessel surveys to industry based surveys. For example, using a research dredge one side, commercial dredge on other. During the experiment, we towed both at once, and discovered the calibration was successful. We can

calibrate the catch rates of the two different dredges with technology and get results that are consistent between the two dredges. Industry could pick up the survey from NMFS, and with oversight and guidance they could do it; NMFS could get out of the business. We could save agency research vessels for surveys where they really are required. Scallops and surf clams should be industry conducted and funded. They can do more in terms of intensive stations, layers of data.

### **10.5 Summary**

To summarize:

“It is exactly the kind of scientific work that can be done very efficiently aboard commercial vessels,” Sissenwine said. “The commercial fleet can cover a lot of survey stations and produce extremely useful information very quickly, and it can be done at a low cost while generating income for fishermen through the sale of scallops caught in the survey.”