National Evaluation of Cooperative Data Gathering Efforts in Fisheries

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by

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1 Executive Summary

This study looked closely at seven case studies of cooperative fisheries-related data gathering and/or research efforts around the country, ranging from the Bering Sea in the North Pacific to the North Atlantic off New England. Our goal was to identify key insights that could be used to improve the design and implementation of such efforts in the future. Such insights are vitally important, given the need to make the best use of available knowledge and resources to improve stock assessments, develop improved bycatch reduction methods, and increase our basic understanding of the marine ecosystems on which fisheries depend.

More specifically, the National Marine Fisheries Service (NMFS) hopes to utilize the resulting analysis to better target the agency's resources toward scientific projects that can establish successful partnerships with the fishing industry for sustained use and stewardship of marine resources. Thus, the case studies fall into four categories that are typical of government / industry partnerships:

- gear development;
- biological surveys;
- observer programs; and
- ecological studies.

We found that each case study represented a significant success, either in terms of new information produced, long-standing problems solved, or the cooperative relationships formed. Because of their uniqueness, success was achieved by different means in each case. In each, however, some combination of strong positive and negative motivations was an important element in leading participants to risk changing the status quo. The particular ways in which these motivations played out depended in most cases on the culture of the individual fishery and the personal relationships that existed among participants. None of the cases occurred in a vacuum. Instead, they were influenced by the political, legal, economic, or ecological contexts of which they were a part. While some efforts took place in part outside the existing fisheries management infrastructure, each had eventually to deal with the network of rules, procedures, and regulations that govern fisheries. At this point, participants who were knowledgeable about the workings of the management system were invaluable.

A consistent finding was that NMFS' science and management roles often conflict. The actions needed to foster good science and the working relationships on which it depends can be at odds with the actions needed to establish and then enforce regulations. As a result, NMFS' efforts at cooperative data gathering are often viewed with suspicion and new regulatory initiatives can undermine existing cooperative relationships. We suggest that one solution to this problem would be to link NMFS' science and management roles more tightly in some instances, rather than attempt to separate them as in the past. If data gathering efforts are tied to specific management issues, and the data analysis methods needed to address them, it may give participants more "ownership" of the data gathering effort and more of a stake in its ultimate success.

The following table summarizes the key recommendations. Further discussion and substantiation is contained in the body of the report.

Table 1.1. Summary of recommendations.

Design Element	Recommendation
Motivation & Goals	Tie the data gathering design to specific management issues and the data analysis methods needed to address them. Link clear "rules of evidence" to explicit decision criteria. Only initiate a project when all key groups have adequate motivation. Identify opportunities related to regulatory procedures, economic pressures, or pending closures and legal decisions that can provide such motivation. Make sure that studies build on questions of direct interest to industry. Identify these by soliciting industry ideas on how to prioritize information gaps, capitalizing on fishers' inherent interest in natural history and ecology of fisheries. Design the project with an awareness of learning curves of all kinds, and use this to develop realistic expectations about the nature and timing of outcomes.
Building Relationships	Identify the requirements for credibility from industry's perspective and work to meet these. Such requirements might include working at sea together, taking time to discuss scientific questions with fishers on an individual level, and other kinds of outreach at the personal level. Create opportunities for new kinds of interaction between industry and NMFS that will provide fishers more insight into the science process and NMFS staff more awareness of fishers' individual perspectives. This may require specific policies to support and reward NMFS staff who develop effective relationships with industry. Depend on informal structures and processes for relationship building where possible. However, consider the use of more formal structures and neutral parties when there are large numbers of participants or NMFS alone cannot effectively deliver difficult messages, facilitate communication, or manage negotiations. In a project's early stages, allow enough time for venting of resentments and anxieties about past history and the present situation.
Participation	Encourage participation by credible leaders of all involved groups and make industry an equal partner from the start. Choose key participants who have stamina, stubbornness, and an interest in and an ability to see other points of view. Include someone with skill at dealing with the fisheries bureaucracy. Strive for continuity of these participants and ensure they have adequate motivations and rewards. Allow leadership to rotate as different issues arise. Develop methods of identifying and training NMFS staff and fishers with leadership potential. Encourage them to become involved in relationship building and data gathering efforts and reward them for doing so.

Table 1.1. (continued)

Design Element	Recommendation
Strategy	Cast a broad net for potential solutions and look for ways that the ecology, economics, and sociology of the fishery can support or promote the project's goals.
	Where institutional barriers may exist, develop technical solutions first, and use these solutions as leverage for breaking through institutional barriers. Also, utilize industry's ability to work outside the bureaucracy through other avenues of influence.
	Consider keeping the project outside the bureaucracy for as long as possible.
	Break extremely large efforts into more manageable pieces.
	Give some thought at the outset to possible long-term applications of the cooperative effort.
	Learn about and account for past history, down to the personal level.
Program Management	Secure dedicated funding for cooperative data gathering so these efforts do not cannibalize resources needed for stock assessment and other activities.
	Select projects with the greatest chances of success by prioritizing potential projects based on clear criteria.
	Have a clear agreement on how information will be used and on how and when it will be released and by whom.
	Improve the ability to learn from experience by establishing a mechanism to enable NMFS staff and industry representatives, nationwide, to share knowledge about the causes of success and failure of cooperative data gathering efforts.

2 Introduction

This report presents the results of an in-depth evaluation of seven case studies of cooperative research and data gathering efforts involving the National Marine Fisheries Service (NMFS) and the sport and commercial fishing industries. The evaluation was motivated by NMFS' desire to improve the design and implementation of such efforts in order to improve the information base for stock assessments and management decisions. In particular, we desired to:

- better understand why cooperative data gathering efforts succeed or fail;
- develop recommendations to increase future chances of success; and
- improve expectations about what cooperative data gathering can and cannot accomplish.

Starting with a list of seven representative case studies provided by NMFS, we gathered and evaluated written material such as reports, correspondence, legal and regulatory filings, emails, and scientific publications. We also carried out extensive interviews with from six to 20 contacts per case. Using the methods detailed in the following section, we assessed the relative degree of success of each cooperative effort, analyzed the role of several critical factors in determining the degree of success, and considered how the lessons learned from each case study might be more broadly applied to other cooperative efforts in the future.

This report summarizes the evaluation's objectives and the methods we used to address these. It reviews the history of each case study, presents our conclusions and the evidence that documents them, and makes recommendations for the future.

3 Methods

This section describes analytical methods used to obtain and organize background information on each case study, assess the relative degree of success of each, and analyze the influence of key determinants of success or failure.

3.1 Core questions

Within the overall context of NMFS' desire to improve the design and implementation of cooperative research and data gathering programs, our evaluation of the seven case studies focused on three distinct questions intended to help achieve this goal:

- What was the degree of success achieved in each case study?
- What were the factors that determined the degree of success?
- How applicable to other circumstances are the lessons learned from each case study?

We defined "success" as the degree to which the effort met its original objectives, both explicit and implicit, and the presence of unintended consequences, both positive and negative. We did not use the level of conflict as a measure of success (i.e., less conflict equals more success) because conflict is often an inherent part of attempts to collaborate and because the absence of conflict may merely mean that crucial issues were avoided.

We included among the "factors" the larger management context, particularly changes in quotas and other regulatory constraints; lawsuits and/or the threat of lawsuits against one or more of the parties; the history of relationships, professional and personal, among the participants; the level of supervisory support, both within NMFS and industry organizations; leadership on a personal level; and the problem-solving method(s) used by the participants.

By "applicability to other circumstances" we mean the extent to which the approaches taken and the lessons learned from each case study are potentially useful to participants in other, similar efforts. In the narrowest terms, lessons learned from a particular case would only be applicable to situations where the key factors were identical. At the other extreme, some lessons may be applicable across a broad range of key factors.

3.2 Methods used to gather information

NMFS initially identified seven case studies, briefly described the main issues in each, and provided a preliminary list of contacts as sources of information (see Appendix 1).

We gathered raw material through interviews and review of documents, including reports, scientific and technical articles, newspaper articles, administrative records (e.g., memos, faxes, emails), and regulatory notices. The amount and nature of such material varied from case to case, depending on the nature of the case. For example, cases involving complex regulatory proceedings (pingers, BRDs) had more associated written material than the more purely research oriented cases (e.g., tagging). We made a significant, but not exhaustive, effort to obtain as much of the written record as possible.

An initial list of contacts was provided by NMFS and we expanded this with referrals from individuals on the original list and with our individual contacts in a variety of organizations. As the list of interviewees in each chapter shows, we attempted to interview the majority of direct participants in each case study as well as knowledgeable observers who could provide an outside perspective. We continued interviewing new contacts until we had thoroughly cross-checked the important elements of each case and had begun to hear the same material repeated. This required as few as nine contacts with the less complex cases and as many as eighteen with more complicated ones.

The interviews for each case study progressed through three stages: first, outlining the story and the main issues; second, deeper investigation of the factors influencing each case; and, third, fact checking and review by key contacts. Interviews were loosely structured around the core questions listed above. In our experience, giving interviewees the opportunity to set the tone and direction of the conversation, rather than using a highly structured survey instrument, provides more useful data. Once conversations were underway, we branched out from the original direction of the interview by asking additional questions based on the specific evaluation criteria.

In some cases, we challenged one contact with information obtained from another to probe their depth of understanding, their relative objectivity, or to develop a different perspective. We also carried out follow-up interviews with some contacts to pursue material from an earlier interview or to address questions raised by other contacts. We also utilized a few knowledgeable individuals, with whom we had long-standing prior relationships, as fact checkers and to provide us greater insight into the history and underlying motivations of particular groups. All interviewees were given the option of placing all or part of their interview off the record; however, this option was rarely exercised. We made detailed, and in most cases verbatim, notes of all interviews.

3.3 Methods used for addressing the core questions

We used somewhat different methods for addressing each of the three core questions listed above.

For assessing the degree of success, we searched for objective measures to document the outcome(s) of each case. These included the implementation of new policies or procedures, acquisition and use of new data, and improvements in management methods or decisions. Where possible, we compared such measures to each effort's original objectives. We also searched for subjective measures such as participants' assessment of success; whether potential gains were left unrealized; whether the case involved unnecessary effort, time, or conflict; and our own subjective judgment of effectiveness by comparison to analogous efforts. We also searched for evidence of unintended consequences, both positive and negative. These included evidence of altered working relationships, lawsuits avoided or filed, and attempts to apply a particular case's methods in other analogous situations.

We identified the potential key factors listed above at the beginning of the project based on our past experience, relevant literature, and the suggestions of the project advisors and added other factors during the process of building the story for each case study. We then reviewed each story and systematically cross referenced the list of key factors to ensure we had considered the possible influence of each. We then asked ourselves whether and how each story might have turned out differently if each factor, in turn, had been excluded, and also examined evidence that suggested how factors interacted in each case. Where this process raised new questions, we returned to the raw material or carried out additional interviews.

Assessing the applicability to other circumstances of lessons learned in each case was an entirely subjective process, based on the extent to which key prerequisites of success were present across a range of cases.

3.4 Methods used to validate findings and avoid bias

We used a range of techniques to help us avoid bias in the data gathering and analysis and to verify our conclusions. These techniques are described in more detail in Chapter VII of Qualitative Data Analysis by Miles and Huberman (Sage Publications, Beverly Hills, 1984).

We guarded against interviewing non-representative contacts, generalizing from non-representative events, and relying to too great an extent on accessible and/or elite contacts by:

- systematically interviewing a broad range of contacts with a variety of relationships to each case study
- following up on suggestions from all sources for additional interview candidates
- searching for objective information on the outcomes of each case study
- using the different case studies as contrasts to test the plausibility of our emerging conclusions.

We guarded against influencing interviewees by asking open-ended questions, making it clear how interview results would be used, and allowing contacts to speak off the record. Where interviewees' positions were known through their previous speeches, writings, or other activities, we used this knowledge as a rough check on the internal consistency of their statements. We used the advisory panel as a check on the possibility of subtle influences on our own perceptions. The panel reviewed an earlier draft of the report from a more objective and skeptical perspective. The three panel members have distinctive backgrounds and were not directly involved in performing the evaluation.

Given the inherently non-quantitative nature of much of the information we gathered, we attempted to corroborate findings and conclusions by comparing several different sources and kinds of evidence. For example, we cross checked exceptionally passionate interviews with more objective sources and compared claims to the written record where possible. Where we found that interviewees were distorting the record, we tried to understand their motivations and to use this as a basis for further investigation. Our goal was to ensure that our findings were based on several different lines of evidence that were mutually supportive, a process called "triangulation."

While we used as wide a range of information sources as possible, we did not necessarily always take these at face value, but weighted them in terms of their relative validity. For example, we gave more credence to sources who had been directly involved in events, who had a long-standing base of experience in the topic being discussed, whose statements could be validated through cross checks with other sources, who provided a thoughtful description and analysis of events, and who responded directly and knowledgeably to challenging or probing questions. We also gave more weight to interviewees we knew from previous interactions were more likely to be objective and balanced.

Finally, we used the seven case studies as contrasts and replicates wherever possible to test the plausibility of our conclusions. First, we identified what we believed to be essential features of any successful cooperative data gathering effort and assumed that such features should appear consistently in all the case studies. Second, where we concluded that the role of certain key factors was influenced by the circumstances of an individual case, we specified “if – then” hypotheses and tested these, with follow-up data gathering if needed.

4 Summary Findings and Lessons Learned

This section summarizes the main findings of the case studies and describes approaches to help ensure the success of cooperative data gathering efforts. The individual chapters provide additional, specific detail and we recommend that these be read to provide background and context for the brief summary here.

4.1 Success is possible

The set of case studies clearly shows that cooperative data gathering efforts can achieve their goals. To differing degrees, each case presents a story of success and provides lessons for other similar efforts. In some cases (combined logbook, pingers), clearly defined goals, once achieved, can be embodied in revised regulations and procedures and maintained with little further effort. In other cases (BRDs, tagging) more fluid situations require that the data gathering effort be periodically adjusted. In the tagging programs, for example, shifting management approaches and more restrictive quotas have eroded the historical reservoir of goodwill among participants, highlighting the need for renewed commitment to an updated set of goals.

Despite the generally optimistic picture presented by the cases we examined, there is no guarantee of success. The case studies underline pitfalls that can hamper an already difficult process and there are many examples from all coasts of cooperative efforts that have failed, for a variety of reasons, at all stages of development.

4.2 Each case is unique

Each cooperative data gathering effort is a unique response to a specific problem and a distinctive set of circumstances. For example, the implementation of an ITQ system in the Alaska sablefish fishery significantly raised each fisherman's stake in the accuracy of the stock assessment and the quota based on it. With fixed ITQ shares, fishermen's catch and income now rise and fall with the quota. This increased economic incentive led to a sustained effort to improve the information going into the stock assessment, by improving the mechanics of the survey, incorporating biological data into the logbook, and lobbying for funding for additional biological studies. In contrast, the development and adoption of pingers in the New England gillnet fishery was directly motivated by the fear that continued porpoise mortality would lead to severe cutbacks on fishing activity. In yet another instance, the two tagging programs were largely the result of a broad agreement that improved data would be beneficial in the long term, rather than an immediate response to a crisis or changed economic circumstances. These programs are encountering difficulty because this goal is no longer as relevant. In the case of bycatch reduction devices (BRDs) in the Gulf of Mexico and the South Atlantic, participation in cooperative research was industry's way of trying to ensure that an inevitable regulatory requirement would be as palatable as possible. The history of the bitter controversy over turtle excluder devic es (TEDs) was still fresh in everyone's minds and no one wanted to repeat that history.

We believe this fact – that each cooperative data gathering effort has unique characteristics – means that a single design or design approach to such efforts is not feasible. This is not surprising, given the diversity of fisheries, fleets and ownership structures, gear types, histories, and ecological conditions. Each effort, to a large extent, must be custom designed and, as the following paragraphs strongly suggest, allowed to develop organically from the motivations, knowledge, and experience of the participants.

4.3 Strong motivation is necessary

At present, cooperative data gathering efforts represent a change from the status quo, in which NMFS has the principal responsibility for data collection, analysis, and interpretation. They require that industry, NMFS, and sometimes academia or conservation organizations work together in unfamiliar ways, often in the face of mistrust and resentment over past history and present circumstances. These efforts are risky, and face significant practical and psychological impediments. Overcoming these impediments, and changing the risk / reward balance, usually requires strong motivation (either positive or negative) to energize action. Participants in successful cooperative efforts must have more to lose by sticking with the status quo than by trying to change it. Effective motivations can be threats (such as pending lawsuits, e.g., pingers), fear of loss (such as a potential closure or quota reduction, e.g., Oregon trawls), or an opportunity for a useful gain that cannot be achieved any other way (e.g., scallops). The ideal motivation is some combination of both negative (fear of loss) and positive (opportunity for gain) elements. Motivations will necessarily vary among participants because of their differing circumstances and perspectives, but all should have some clear stake in a successful outcome.

Motivations for participants in the case studies differed from case to case, as the previous subsection and Table 4.1 show. Whatever it is, however, our research strongly suggests that powerful motivations to change the status quo are an essential ingredient in successful cooperative data gathering efforts. The BRD case study shows that these motivations may not extend to the changes in fishing practices or management regimes that arise from the data gathering effort itself. In that case, widespread cooperation broke down as resistance developed to the actual implementation of BRDs in the Gulf of Mexico.

Table 4.1. Negative and positive incentives that motivated participants in each of the case studies.

Case study	Fear	Potential reward
Sablefish survey	unnecessary quota reductions loss of income	improved stock assessment increased quota and income
Sablefish logbook	unnecessary quota reductions inefficient record keeping	reduced record keeping costs improved stock assessment increased quota and income
Oregon trawl	loss of livelihood	more sustainable livelihood improved stock assessment increased quota and income
BRDs	ineffective and overly costly BRDs costly litigation and conflict	involvement in decision making better BRDs limit on shrimp loss to BRDs reduced economic pressure
Tagging		improved knowledge expanded fishery fun
Scallops	loss of income expanded closures	reduce threat of closures increased quota and income

Case study	Fear	Potential reward
Pingers	closures loss of income ESA listing and increased uncertainty	remove ESA problem from table remove threat of closures increased predictability

4.4 Culture and personal relationships dominate

By definition, cooperative data gathering efforts involve participants from groups (NMFS, other management agencies, industry, academia, conservation organizations) with different priorities, histories, and traditions and standards of behavior. In many instances, these cultural differences have contributed to miscommunication and misunderstanding, mistrust, conflict, delay, and the ultimate failure of cooperative efforts. The case studies clearly show that cultural differences must be recognized, understood, and dealt with for cooperative efforts to succeed. This is not unique to fisheries, but is widely recognized among management and organization specialists. For example, a majority of business mergers fail to achieve their original goals, not for economic reasons but because of unresolved cultural differences between the two organizations. Evidence from the case studies, and from other research into cooperative behavior, shows that the best way to address cultural issues is to develop effective and trustworthy working relationships among individual participants working face to face.

Cooperative data gathering efforts are much more than simple agreements to share the logistical burden of data gathering. They are instead cooperative problem solving efforts and the data gathering happens successfully only if and when problems are successfully solved. The story of each case study illustrates the key role played by personal relationships in this process. Personal relationships provide confidence that others can be counted on to fulfill their commitments, confidence that cannot readily be created in any other way.

For example, Arne Fuglvog, a commercial sablefish longliner, invested time in talking directly with scientists at NMFS's Auke Bay Laboratory about shortcomings in the sablefish stock assessment. His resulting appreciation of the lab's funding constraints and of the biologist's need for improved information was instrumental in generating essential industry support for administrative changes and increased research funding. Conversely, Mike Sigler, the longline survey Project Leader, has made himself readily available for discussion with fishermen and has spent significant time at sea because, "The way you establish credibility with fishermen in Alaska is to spend time at sea."

In the early stages of both tagging programs, far-sighted scientists spent significant amounts of time meeting with fishermen on the docks to advocate the benefits of long-term tagging programs. These early relationships were a primary reason for the successful expansion of these programs and had surprising staying power, even after these scientists retired. However, these relationships have not been sufficiently renewed over time and, as new challenges arise, there are insufficient avenues of communication to maintain industry commitment and participation. In the scallop survey, pre-existing relationships were enhanced by the process of designing and implementing the field program. The substantial economic payoff that resulted has also strengthened these connections.

In the pinger case, preexisting relationships among core members of the Harbor Porpoise Working Group (Dave Wiley of the International Wildlife Coalition, Bob MacKinnon of the Massachusetts Gillnetters' Association, Sharon Young of the Humane Society, and Karen Steuer of the Center for Coastal Studies) were sufficient to get the Working Group started and attract a larger group of participants. By all accounts, however, it required a year's worth of confrontive meetings to develop enough trust among this larger group for them to move forward with problem solving. This level of overt mistrust and conflict contrasts with the majority of the other cases and it was only the threat of severe restrictions on fishing activity and a desire to avoid litigation that kept participants involved.

The BRD development effort in the Gulf of Mexico and the South Atlantic was unique among the case studies we examined in its combination of wide geographic scale, large numbers of participants, high potential for conflict, and far-reaching regulatory implications. These factors made it impractical to depend completely on the development of personal relationships in an informal or ad hoc setting. Creating confidence among participants that alternative BRD designs would be evaluated consistently and fairly required creating a more formal structure with detailed written procedures. This structure also brought participants together in an organized system of committees and workgroups, promoting the development of working relationships. At the state level in the South Atlantic, long-term relationships among shrimpers, Sea Grant or marine extension staff, and state agency personnel helped create a less contentious environment for BRD development and implementation.

4.5 Larger contexts influence results

None of the cooperative data gathering efforts we examined occurred in isolation. They were not simply data gathering or research efforts. They were conscious attempts to influence management decisions and the processes by which these are made, and were therefore strongly influenced by their larger management, ecological, and sociological contexts. The tagging programs at one time were exceptions to this generalization but they are rapidly losing their ability to remain separate from larger issues. In fact, the most concrete suggestion we heard for revitalizing the tagging programs involved linking them even more closely to management issues.

The motivation for cooperative efforts often stems from outside events – the creation of an ITQ fishery for sablefish, cuts in west coast groundfish quotas, or the threat of an ESA lawsuit over harbor porpoises in New England. In addition to such direct influences, there are factors that are indirectly related to cooperative efforts but are nevertheless important. For example, the history of TEDs in the Gulf of Mexico and the South Atlantic dominated the attitude toward BRDs of nearly everyone we interviewed in this case study. As another example, the pinger solution in New England was developed against the backdrop of impending large-scale groundfish closures that significantly raised the stakes for finding a solution to this bycatch problem. The effort to improve the quality of data collected on the Oregon trawl fishery must be seen in the context of severe cutbacks in groundfish quotas and rising concerns about the status of groundfish stocks.

Industry structure in a particular case can also influence the outcome of cooperative efforts. In New England, the ability of Maine gillnetters to readily move into a healthy lobster fishery made it less attractive for them to implement the pinger solution than for gillnetters in other areas. Differences in shrimp distribution mean that shrimp fisheries in the Gulf of Mexico are predominantly federal fisheries and those in the South Atlantic are state fisheries. As the BRD case study describes, this had an important influence on the somewhat divergent history of BRD development and implementation in these two regions.

Because of their influence, these and other elements of the larger context should be explicitly considered in the design of cooperative efforts. They provide opportunities for developing useful goals, sharpening motivations (both positive and negative), recruiting participants, and creating leverage that magnifies the motivations described in Table 4.1.

4.6 Bureaucracy must be dealt with

Fisheries management is an unavoidably bureaucratic system and all the cooperative data gathering efforts we examined became enmeshed in bureaucracy at some point in their history. (By "bureaucracy" we mean formally defined procedures for decision making. We intend this as a neutral description without inherent negative connotations.) For example, adjustments to the sablefish logbook, which in and of themselves were relatively straightforward, ran afoul of cost issues related to the Paperwork Reduction Act and legal concerns about confidentiality of collected information. In the pinger case, the Harbor Porpoise Working Group was an ad hoc effort that operated outside of the formal fisheries management structure, a position that gave it important flexibility. However, actually implementing the pinger solution required action through the formal processes of the New England Fisheries Management Council and the Mammal Protection Act's Take Reduction Team. Because of its broad geographic scale and its large numbers of participants, the BRD development effort in the Gulf of Mexico and the South Atlantic was unable to depend on informal structures and was necessarily bureaucratic from its inception.

The two tagging programs, in their earlier phases, were relatively unaffected by bureaucratic issues. More recently, however, they have been impacted by management decisions to reduce quotas, despite their best efforts to keep their scientific activities distinct from management issues. The Cooperative Tagging Center has recently experienced budget cutbacks that have limited its ability to supply tags to participants and process data.

These examples show that remaining outside the bureaucratic management process for as long as possible can increase the efficiency and flexibility of cooperative data gathering efforts. Ways of accomplishing this include organizing ad hoc working groups, obtaining funding from non-governmental sources, and focusing on aspects of the system that are not yet covered by regulation. However, at the point that the results of such efforts must enter the formal management process, patience, staying power, and the ability to navigate the bureaucracy can be key parts of successful cooperative efforts.

4.7 Link NMFS's science and management roles

Participants in several case studies argued forcefully that NMFS's regulatory and enforcement responsibilities invariably infiltrate and undermine cooperative data gathering efforts in several ways. Where industry mistrust of NMFS runs deep, proposals to cooperate may immediately and suspiciously be viewed as maneuvers to promote a predetermined policy. Attempts to circumvent this problem by creating a clear distinction between the gathering and preliminary analysis of research data and the eventual use of that data in management decisions run the risk of leaving industry participants resentful and feeling "out of the loop" when these decisions restrict fishing effort. NMFS's need to rigorously substantiate the effectiveness of new methods before revising regulations can frustrate fishers who are more accustomed to ad hoc experimentation and empirical decision making. In other situations, the constraints and requirements of the regulatory system as a whole can complicate, delay, and defeat cooperative efforts. Despite the fact that industry is directly involved in the design and implementation of many cooperative efforts, a consistent thread running through our interviews was the concern that the data from such efforts would be used "against" them because industry has little if any voice in data interpretation.

Whatever the relevance or justification for such concerns, they are an unavoidable part of cooperative efforts. The case studies strongly suggest that NMFS cannot escape its dual nature – that its regulatory and enforcement role infiltrates even pure research efforts like tagging. For example, enforcement issues became a sticking point in the development of revisions to the sablefish logbook; the shrimp industry in the Gulf of Mexico eventually responded to regulatory decisions about BRDs with a lawsuit; and resentment about quota reductions affected participation in the tagging programs.

There are strategies that attempt to postpone or circumvent this issue. Working through contractors, Sea Grant staff, or advocacy organizations can temporarily insulate data gathering efforts. Strictly dividing responsibilities between scientific and management staff within NMFS can also work temporarily. However, if data are worth gathering, they will invariably be used to make management decisions and, at that point, such temporary barriers will crumble and conflict is likely to ensue.

We believe it is fruitless to attempt to keep science and management separate in cooperative data gathering efforts. Key decisions facing a wide range of fisheries demand improved information about bycatch reduction, habitat protection, stock assessment, catch levels, ecological interactions, and socioeconomic impacts. Well-accepted study design principles assert that this information will be collected more efficiently and will be of higher quality if data gathering programs, beginning with their initial design, are targeted specifically at management information needs. In other words, data should be collected keeping in mind how they will eventually be used. This may well require extending the partnership with industry beyond the design and implementation of fieldwork to the design of data analysis and interpretation approaches and to specifying how data will be used in decision making. Nelson Beideman, Executive Director of Blue Water Fishermen's Association, talking about how to revive interest in the tagging programs, suggested:

> There needs to be a plan that everybody is a part of so they can see what's necessary [in terms of knowledge and additional data] for each of the highly migratory species and lay out a plan for how to get there.

This is, of course, likely to lead to conflict. However, we believe that conflicts over specific management decisions, and over the interpretation of data used in these decisions, could be healthy if structured carefully. Such conflicts could provide a starting point for determining what information is needed to resolve disagreements and what specific data gathering activities are needed to fill these information gaps. Soliciting fishers' involvement in defining knowledge gaps and identifying how these relate to management decisions that directly affect them could more deeply engage them in data gathering efforts and increase acceptance of even painful management decisions. For example, there is good evidence that people are more willing to accept negative outcomes if they have been directly involved in the decision-making process (refs). Fishers' past involvement in data gathering has already given them some sense of ownership about the data and this has actually been fostered by many cooperative programs. The down side of this sense of ownership is the feeling of betrayal that "our data is being used against us." However, the potential up side is that this sense of ownership can also provide the leverage needed to encourage greater participation in the decision-making process, and more willing acceptance of its results.

4.8 Essential requirements for success

The themes described above, and discussed in more detail in the individual case studies, suggest a set of requirements for successful cooperative data gathering efforts:

- Ensure that strong motivations (both positive and negative) exist that give all participants a substantial stake in the success of the effort; avoid projects that lack such motivations.
- Clearly specify how the data produced will be used in management decisions.
- Involve fishers in discussions about the overall study design process (i.e., the basic links between management decisions, the information needed to make those decisions, the analyses required to develop that information, and the data gathering design needed to support those analyses).
- Encourage the development of personal relationships among the participants by structuring the process appropriately and allowing time for them to develop.
- Keep the effort outside bureaucracy as long as possible.
- Include participants with expertise at navigating the bureaucracy when the outcome is likely to result in new regulations.
- Let the project's design emerge from the priorities and experience of the participants.
- Provide training for NMFS staff and interested fishers in communication, relationship building, and conflict resolution.

5 Sablefish Longline Survey and Combined Logbook Program

5.1 Introduction

The evaluation of the sablefish longline survey (Survey) and combined logbook program (Logbook) 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 5.1 and 5.2 and the Methods chapter (chapter 3) for more detail). This review examines both the Survey and the Logbook because both focused on improving data input to the stock assessment and annual quota setting. In addition, recent efforts to improve the Survey and develop the Logbook were motivated in large part by the implementation of the IFQ fishery and consequent concerns about the accuracy and completeness of the Survey data.

Table 5.1. Interviewees.

Name	Title & Organization	NMFS	Fisher	IPHC
Dr. Phil Rigby	Alaska Science Center	X		
Dr. Mike Sigler	Survey Project Leader, Auke Bay Lab	X		
Dr. Jeff Fujioka	Former Survey Project Leader, Auke Bay Lab	X		
Patsy Bearden	NMFS Operations	X		
Lori Gravel	Records Management Officer, Sustainable Fisheries Div.	X		
Jonathan Pollard	Attorney, Office of NOAA General Counsel	X		
John Winther	Owner of survey vessel Ocean Prowler		X	
Arne Fuglvog	Executive Director, Petersburg Vessel Owners' Association		X	
John Gauvin	Executive Director, Groundfish Forum		X	
Dr. Bruce Leaman	Director, International Pacific Halibut Commission			X
Heather Gilroy	International Pacific Halibut Commission			X
Janet Smoker	Consultant, Fisheries Information Services, Inc.			

Table 5.2. Additional sources. IPHC refers to the International Pacific Halibut Commission and NMFS to the National Marine Fisheries Service.

Source	Description
Arne Fuglvog	Personal file on Survey and Logbook, including letters, notes, faxes
IPHC	Staff regulatory proposals and annual meeting summaries
NMFS	Survey cruise reports, available from www.afsc.noaa.gov/abl/sablecruise.html
NMFS	Special notice of the IFQ program, February 1999 re Logbook
NMFS	Administrative record on Logbook, including emails, letters, faxes
Publication	Low, L. L., G. K. Tanonaka, and H. H. Shippen. 1976. Sablefish of the Northeastern Pacific Ocean and Bering Sea. Northwest Fisheries Science Center Processed Report. 115 p.

5.2 The setting

The sablefish longline fishery is active in the Bering Sea and the Gulf of Alaska, and was primarily a Japanese fishery until the passage of the Magnuson Fisheries Conservation and Management Act (MFCMA) in 1976. Sablefish quotas began by bilateral agreement with Japan in 1975 (Low et al. 1976) and the longline survey was conducted by the Japanese as part of the "fish and chips" provisions of the MFCMA, which traded fishery research in U.S. waters for access to U.S. fishery resources. The Japan-U.S. cooperative survey was conducted annually from 1978 to 1994, with the first year (1978) as an experimental survey to establish methods.

NMFS began longline experimentation at the Auke Bay Lab in 1985 as groundwork for a domestic longline survey, assuming the Japanese would discontinue their participation once they no longer had access to sablefish (the last year of access was 1987). At about this time, John Winther, an Alaskan fisherman, began to push for more American participation in the Survey and, according to Winther, Congressional intervention was required to open the Survey to bidding by domestic fishermen. The domestic survey has been conducted annually since 1987, with standard methods adopted in 1988; thus, the two (Japanese and domestic) overlapped for several years. (See Table 5.2 for location of Survey reports).

The sablefish fishery became an IFQ fishery in 1995, which tied individual fishermen's income directly to the size of the TAC and highlighted concerns about accuracy and completeness of survey data. Since some sablefish fishers fish for halibut and other groundfish, they were aware of the International Pacific Halibut Commission's stock assessment procedures and used this as a model of how more a greater range of data types and sources (survey, logbooks, port sampling) could support stock assessment. Thus, efforts by industry and NMFS scientists to improve the database for stock assessment focused on two targets – the longline survey and the vessel logbooks.

5.3 The story

This story has two intertwined parts. The first is the effort to adapt the Survey to American fishing techniques (in 1987 and 1988) and reduce the interactions with groundfish fleets that might bias the Survey's results (1995). The second is the more recent success in developing a more efficient and biologically useful logbook reporting system. Both efforts focused on improving the database for stock assessment and quota setting and involved many of the same people within NMFS and industry.

5.3.1 Longline survey

History of the Survey. The Survey began in 1978 as a cooperative U.S. / Japanese effort. It samples the Gulf of Alaska, Bering Sea, and Aleutians. Sampling currently occurs annually in the Gulf of Alaska and alternate years in the Bering Sea and Aleutians. The survey data have been the primary information used to track changes in sablefish abundance. Primary objectives for the most recent survey were to:

- determine the relative abundance and size composition of the commercially important species: sablefish, shortspine thornyhead (*Sebastolobus alascanus*), and rougheye and shortraker rockfishes (*Sebastes aleutianus* and *S. borealis*) and Greenland turbot (halibut) (*Reinhardtius hippoglossoides*); and
- determine the relative abundance and size composition of other groundfish species caught during the survey: Pacific cod (*Gadus macrocephalus*), arrowtooth flounder (*Atheresthes stomias*), grenadiers (*Macrouridae*), and the relative abundance of Pacific halibut (*Hippoglossus stenolepis*).

Two significant subsequent events altered the history of the survey.

First, the passage of the Magnuson Act in 1976 stimulated greater participation of American fishers in the fishery and, by 1986, interest in bidding on the Survey contract. John Winther, a sablefish fisherman in Petersburg, AK, submitted the first American bid to NMFS in 1986. It was rejected, but, after obtaining the support of the AK Congressional delegation, Winther was subsequently awarded a contract to perform the domestic Survey in 1987 and has performed it every year but three since then. The Japan-U.S. cooperative survey, conducted with a Japanese fishing vessel, ran in parallel through 1994.

Winther, and the others who occasionally have participated in the Survey, do so as a money-making proposition, with their profit coming from the right to keep and market fish caught during the survey. According to Winther, gross income from the Survey has ranged from $1 million to $2.4 million over the years. However, costs can also be high. Beginning in 1999, the federal government retains 30% of any income over $1.2 million. According to Winther, the Survey vessel is also responsible for $60,000 to $70,000 for gear and a similar amount for two contract biologists to collect data on board. The responsibility for some costs, such as those for biologists, has recently been transferred directly to the Survey contractor. Again according to Winther, total costs in 1998 amounted to more than $900,000, with the bulk of that going to cover operational costs to keep the vessel, with its crew of 18, at sea for over 100 days. In 1992, the Department of Commerce's procurement agency began requiring a cash payment from the winning bidder, but this payment formula was modified in 1999 (30% payment of income over $1.2 million referred to above) partly to reduce the risk to the bidder of unforeseen changes in market prices and fish abundance.

Participation in the Survey involved a learning curve during 1987 and 1988. In addition to basic familiarization with the sampling stations and scientific methods, the Survey shifted from Tara hooks used by the Japanese to circle hooks used by American fishers. This required a comparative survey with side by side fishing with each kind of hook to obtain a conversion factor that would maintain the integrity of the Survey's time series. As Mike Sigler remembers, "Nobody had all the answers. The vessel captain and the scientists needed to work together over a period of years to improve the survey, finding ways to improve efficiency, and integrate the scientists and the crew to reduce labor on the boat." (This involved mostly Dr. Mike Sigler of the Auke Bay Lab, Harold "Skip" Zenger (Alaska Fisheries Science Center, Seattle) and Jerry Kennedy Sr., captain of the Ocean Prowler.)

Thus, the Survey from 1987 to 1995 was essentially a continuation of past practices, with some minor adjustments to the Survey's station locations, the shift to American fishing technology, and improvements in efficiency. The conversion of the sablefish fishery to an IFQ system in 1995, however, had more far-reaching effects. The first of these was logistical and stemmed from interactions between the Survey and fishing fleet, whose activity during the lengthened season (March 15 to November 15) overlapped the Survey period and could bias the Survey results. The second was more structural. It reflected industry's increased awareness that, under the IFQ system, NMFS' stock assessments directly impact individuals' catch quotas and earnings. This led to an effort to improve the data going into the stock assessment by expanding the data collected in the logbook.

Concerns about interactions and bias. The IFQ fishery is open for much of the year, rather than being restricted to a season of as little as 10 days in any one area. Whereas in the past the Survey vessel was alone on the fishing grounds, there is now the potential for direct interaction between longline fishing vessels and the Survey. There was also interaction with trawl fishing vessels beginning in 1995 due to a short rockfish fishery opening about July 1. Thus fishing activity in the Survey area just prior to the Survey could locally diminish sablefish abundance and bias the

Survey results downward, resulting in a somewhat lower TAC. Fishermen refer to the pattern of fishery catches since the IFQ system was put into place (increasing abundance for every species on the blackcod grounds except sablefish, declining sablefish TAC but steady catch rates) as evidence that the Survey is underestimating actual abundance. As a result, according to both NMFS staff and industry, "people are starting to not trust the Survey."

This problem was identified as the IFQ regulations were being developed but a solution was not included in the regulations at that time. Since then, NMFS staff at the Auke Bay Laboratory and the leaders of industry associations have worked hard to document and then reduce interactions. These efforts include letters each year to all permitted fishermen, distributing the Survey schedule on the internet and in NMFS notices, radio messages from the Survey vessel, articles in association newsletters, and face-to-face meetings with individual fishermen in a variety of situations. Fishing vessels are requested to stay at least five nautical miles away from each Survey stations for seven days before and three days after the planned sampling date (to allow for survey delays). However, these efforts have not been entirely successful and interactions between the sablefish fleet and the Survey continue to occur. The fleet is large (several hundred vessels) and widely dispersed, with many isolated operations. It is therefore difficult to directly contact every member of the fleet. In addition, in any large group, there are a few individuals who, as one fisherman characterized it, "will fish in a survey spot… some guys are just greedy and short sighted."

The persistence of this problem led in 1996 to a North Pacific Fishery Management Council request to evaluate alternative measures to solve the problem, including a system of rolling closures that would bracket the Survey as it progressed through the Gulf and the Aleutians. This regulatory solution would have closed large areas of the Gulf ahead of the Survey vessel to ensure that there was no fishing in the survey area for eight days prior to the survey. This would have affected both the sablefish fleet and the groundfish trawl fleet that targets primarily rockfish. These broader impacts caused the Groundfish Forum, an association of groundfish factory trawlers, to approach NMFS staff at Auke Bay to negotiate a non-regulatory solution that would have much less impact on the groundfish trawl fleet. They were primarily concerned that the need to avoid the Survey stations would have disrupted a short, but carefully timed, opening, leading to economic impacts on the fleet. Representatives of Groundfish Forum met with NMFS staff in February 1997, "got out the maps," and examined the specific sites and areas needing to be closed. They developed a solution based on revising the Survey schedule beginning in 1998 to minimize interactions with the trawler fleet, as well as impacts on the trawler fleet. To date, there has been 100% compliance from the relatively small (less than 20 vessels) trawler fleet. While this solution removed interactions with the trawlers, it did not resolve the problem of interactions with sablefish longliners.

Some interactions with the longline fleet remain, along with the potential of some downward bias in the Survey's abundance estimates. However, the size of any such bias cannot currently be verified. In addition, any such bias would not contribute to overfishing, since it would tend to reduce the allowable catch. Thus, NMFS science staff found they had no basis to recommend regulatory rolling closures and that attempts be made to identify and work with individuals who disregard the voluntary Survey closures.

The search for additional sources of data. The second result of the shift to an IFQ fishery was that many in industry became much more directly concerned about the accuracy of the stock assessments underlying the yearly TAC. This was because their individual quotas, and therefore their incomes, are directly related to the overall TAC. There is no longer the opportunity to make up for a smaller overall TAC by fishing faster than others in the fleet. An important missing piece of information was reliable catch rate data. However, as Mike Sigler put it, “We were skeptical about catch rate data. Because fishermen concentrate on schools of fish, the catch rate can remain the same even as schools get smaller.”

Despite this concern, NMFS staff at the Auke Bay Laboratory felt obligated to try to verify the information they were hearing from fishermen and to respond directly to their concerns about the Survey. Together with a few key fishermen, they began to think about gathering other kinds of information to feed into the stock assessment.

Key among these were analysis of longline catch rate data collected by observers since 1990, the collection and reading of otoliths from the observer program, and the establishment of a port sampling program. Although industry pushed for programs to collect these additional data types, a major constraint on the development of such new data gathering programs is the limited budget for sablefish assessment work. In an attempt to redress this, industry leaders contacted Senator Ted Stevens requesting a decision that the 3% IFQ assessment fee be made available to support stock assessment research. Senator Stevens replied positively, however, no funds from this source have yet been made available. In addition, the Auke Bay Laboratory submitted a sablefish research proposal for funding from the national $2.25 million MSA funding initiative and were successful in 1998 in obtaining $179,000 to fund sablefish research and assessment.

Their first step was to analyze past observer data on catch rate. Data collection began in 1990 but the data were not examined in detail until fishermen requested that additional sources of data be used in the stock assessment. While potentially useful, observers are present on only a portion of the boats in the fleet. The next step was an attempt to modify the logbooks fishermen are required to fill out to include more biologically useful information. As Mike Sigler describes it, “I was trying to listen to fishermen and this seemed like a way to listen to them on paper…There is a huge amount of information out there, though it can be hard to interpret.” While the actual changes to the logbook format turned out to be relatively simple, the effort to overcome institutional barriers and get these changes incorporated in the regulations would take almost five years.

5.3.2 Combined logbook program

The old logbook system. The logbook reporting system in place prior to the beginning of 1999 was somewhat complex and also subject to occasional adjustments. The following description outlines its main features.

Logbook data were used for enforcement of fishing regulations and for management of catch totals. They were not used in any way in stock assessment. When the U.S. fishery started in 1989, originally all catcher and catcher/processor vessels filled out a groundfish logbook. However, this was changed in 1996/97 so that only catcher vessels over 60 feet in length and all catcher/processors were required to do so. Presently, catchers, catcher/processors, motherships, buying stations, and shoreside processors all have separate logbooks.

All the groundfish (not IFQ, but more on this later) logbooks have a similar procedure. A yellow sheet is sent in quarterly to NMFS Enforcement to check compliance with fishing regulations and document proper observer coverage. These data are not used for quota management. The vessel maintains a daily logbook (white sheet), which accounts for each day of the year. This white sheet remains in the logbook, either on the vessel or at the shoreside buying/processing facility for the entire fishing year. Catcher vessels have a blue sheet, termed a discard copy, which is submitted to the processor with the fish and reports what discards occurred at sea.

Superimposed on this system were the IFQ reporting requirements. Because sablefish is both a groundfish and an IFQ species, vessels were required to conform to both sets of reporting requirements. While there was no sablefish IFQ logbook prior to the combined logbook, there was a card swipe system that deducted the catch immediately from that fisherman's quota and provided an electronic record of measured catch weight. Finally, if a vessel had a federal permit and fished in state waters, it was also required to fill out a state logbook for sablefish, in addition to the NMFS logbook. In the view of industry representatives and the biologists at the Auke Bay Laboratory, this system did not provide information useful for stock assessment because catch data were not broken out by species or catch area for earlier logbook versions and because detailed effort information necessary for standardizing effort was not available. Catches were only broken down to species in the processor logbooks, but by then it was impossible to match catch totals to specific catch areas.

While halibut is not considered a groundfish species, vessels 60 feet and over fishing for halibut were still required to maintain a NMFS groundfish logbook and report halibut catch numbers in the discard section. In addition, IPHC regulations for many years have required all vessels 25 feet and over fishing for halibut to complete a logbook, separate from other records on the vessel (some enforcement officers allowed the NMFS logbook /others did not). As an IFQ species, halibut catches are also managed for the IFQ program by the same card swipe system used for sablefish. In 1998, IPHC required skippers (for vessels 25 ft or over) to complete an official logbook, either the NMFS logbook, the IPHC logbook, or the PVO/ALPFA logbook. IPHC allowed the NMFS logbook to be used as they did not want to burden the fleet with duplication of effort. IPHC port samplers gathered additional information needed for stock assessment directly from vessel captains if the NMFS logbook was used as it was missing the gear information. The lack of a combined NMFS/IPHC logbook left IPHC with the options of moving forward with its own logbook (resulting in duplicate reporting requirements) or using the NMFS logbook and asking its port samplers to gather the additional data needed for halibut management (resulting in increased costs and poorer data).

The impetus for change. The NMFS logbook reporting system in place prior to 1999 produced data that, while sufficient for compliance and some management purposes, was not useful for stock assessment. The desire for improved data on the part of the sablefish industry and NMFS's Auke Bay biologists combined with the IPHC's desire for improved reporting to create the incentive for a combined logbook that would serve the needs of the major regulatory agencies and also provide improved scientific data for stock assessment. This desire for a streamlined reporting system that also captured biological information quickly ran into two key obstacles.

The first was the fact that the NMFS groundfish logbooks were first and foremost a management tool for tracking compliance. Because additional reporting requirements must pass a review by the Office of Management and Budget under guidelines of the Paperwork Reduction Act (PRA), there is a natural pressure within the system to avoid asking for any information (e.g., scientific data) that is outside the boundaries of the agency's prime mission. Given the perception that industry was already burdened with reporting requirements, requests for adding scientific data to the logbook were declined because of the lack of space on existing log sheets, the cost of gathering such data, and the fact such data were not needed for quota management. NMFS scientists then contacted IPHC and asked for information available through IPHC's port sampling program. Though this provided some useful data, it was hit or miss process because the port samplers did not always collect sablefish data

The second obstacle appeared almost immediately (see timeline below). Language in the MFCMA prohibits NMFS from providing to other agencies any information collected under its regulatory regime. The only exceptions are agencies specifically named in the Act. Since IPHC was not so named, the Act thus prevented NMFS from sharing logbook data with IPHC, effectively dooming the original idea of simply having a joint logbook for both agencies.

An uphill battle. The basic concept underlying the desire for a combined logbook was to incorporate into one reporting mechanism the interests of IPHC, NMFS quota management and regulatory enforcement, and the science needed for sablefish stock assessment. As the timeline in Table 5.3 shows, this effort extended from December 1994 to February 1999. Resolving the technical details of the new logbook required only two meetings (in March of 1996 and June of 1998) and phone conversations, faxes, and emails among the participants. The administrative record for this effort documents that the actual level of effort involved was not extreme and that there were no major differences among the parties' respective suggestions on how to modify the logbook.

The record also documents that the lengthy period of time required to actually define and implement these changes was due primarily to legal and institutional concerns, rather than more straightforward technical issues. The overall process fell into three phases. The first, from December 1994 through March 1996 included the original development of interest in the project and the first technical working meeting. During the second period, from April 1996 through the end of 1997, legal and institutional issues became dominant, resulting in the termination of the effort in May 1996. Following this decision, industry attempted to implement a voluntary sablefish logbook program and IPHC, NMFS, and industry exchanged a series of letters laying out their respective positions. Despite concerted effort by industry association leaders to implement the voluntary logbook, there was very poor participation by the fleet (17 boats in 1997, 22 in 1998, and perhaps 25 in 1999, out of a total of approximately 200 eligible boats). In late 1997 and early 1998, direct requests from industry leaders to the NMFS Regional Director at a council meeting apparently restarted the process, as indicated by the February 1998 letter from the Regional Director to IPHC. The third period, extending from February 1998 through February 1999, saw the effort conclude. A single workgroup meeting, in June 1998, finalized the new logbook format, clearing the way for the necessary regulatory review prior to implementation.

The shape of a solution. While the documents officially ending the effort in May 1996 cite several shortcomings of a combined logbook, it appears from the record of the third phase that the legal issue of confidentiality was paramount.

The new, combined logbook for both catcher and catcher/processor vessels includes additional data fields of interest to both IPHC and the NMFS scientists responsible for stock assessment. It also includes a new green sheet, in addition to the existing white, yellow, and blue sheets. This green sheet is to be provided voluntarily to IPHC port samplers who then forward the logbook sheets from longliners fishing for sablefish to NMFS scientists responsible for stock assessment. The new NMFS regulations concerning the combined logbook, as well as the documentation required for the PRA review, emphasize that these additional questions are optional and not required by federal law. Because the data are not formally required under federal regulations, and because captains voluntarily submit the green sheets to IPHC, the Magnuson Act's constraints on transferring data are not triggered. However, IPHC regulations required the vessels to complete the information, so it is the skipper's choice to use the NMFS logbook or complete the halibut information in a separate book for IPHC (i.e., completing two books for one trip). Both NMFS and IPHC have encouraged the relevant vessels to voluntarily submit the green sheets to IPHC, whose port samplers interview the skippers and pick up the sheets. The skippers sign the logsheet agreeing the IPHC could mail a copy to NMFS' Auke Bay Lab. This new system does not affect either the card swipe system for IFQ species or the weekly production report from the processors that summarize the logbook catch data and that are used for quota management.

Table 5.3. Timeline for development of the combined IPHC/NMFS groundfish logbook.

Date	Event
Initiation	
12/94	Council's enforcement committee expresses interest in combining IPHC and NMFS logbooks; first contact between IPHC and NMFS.
7/95	NMFS Enforcement identifies confidentiality issue as potential problem.
12/95	NMFS and IPHC set goal of implementing joint logbook by 1/97.
3/96	1st workgroup meeting, with representatives of IPHC, ADF&G, USCG, NMFS (Observer Program, Economics, Enforcement, Auke Bay Lab, IFQ Program, Operations).
Complications	
4/96	Internal NMFS issues arise re confidentiality of data and the location and control of logbooks and data entry. Office of NOAA General Counsel becomes involved.
5/96	IPHC staff state their position in favor of joint logbooks and offer to collect and process all data and distribute them to other interested agencies.
5/96	NMFS Regional Director formally ends effort, citing the complications that have arisen. Subsequent memo from NMFS Operations cites lack of benefit to NMFS, increased printing and Paperwork Reduction Act costs, and confidentiality issues.
6/96 – 3/97	Industry begins voluntary sablefish logbook effort, which ends in disappointment.
8/97 – 11/97	Exchange of letters among NMFS Regional Director, IPHC, and industry reiterating their respective positions; little evidence of flexibility.
Implementation	
2/98	NMFS Regional Director asks IPHC to resume joint effort on logbook due to industry request.
6/98	Meeting to finalize logbook format.
6/98	NMFS Regional Director formally announces new combined logbook format in letter to Council.

Date	Event
2/99	NMFS Operations announces logbooks have been mailed.
2/99	Formal NOAA bulletin announces combined logbook format.

5.4 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.

5.4.1 Performing field work together builds relationships

Adapting the Survey to American vessels, a process that occurred in 1987 and 1988, was fairly straightforward. The presence of NMFS scientists aboard the survey vessel facilitated communication and problem solving about needed modifications to sampling gear and methods. Based on our personal experience and that of many contacts in academia, government agencies, industry, and conservation organizations, we consider working at sea together an effective way to break down communication barriers between representatives of these groups. This was facilitated by the Auke Bay scientists' awareness that a primary means of establishing credibility among commercial fishermen in Alaska is to spend time at sea. Their willingness to do so was matched by Winther's and Kennedy's (owner and captain, respectively, of the survey vessel Ocean Prowler) understanding that performing the survey necessarily involved a learning curve about scientific sampling procedures. It may be worthwhile consciously searching for, or creating, opportunities to perform field work together in the early stages of cooperative programs.

5.4.2 Institutional issues can be more difficult than technical problems

Similarly, the development of the specific revisions to the Logbook format proceeded smoothly. The identification of and agreement on these revisions required only two working meetings and a relatively small number of emails, faxes, and phone conversations among the key participants. The bulk of the four-plus years from inception to final implementation (see Table 5.3) was taken up with administrative and/or institutional issues. As with the Survey, effective communication among the core group of participants (Sigler, Fuglvog, Bearden, Gilroy (see Table 5.1 for affiliations)) smoothed the way for agreement on these technical details. However, it was insufficient, by itself, to overcome institutional hurdles. This is not a unique or unusual finding; it is almost a truism among managers and others involved in organizational change that institutional, rather than technical, issues are typically the "deal breakers." According to both Mike Sigler and Arne Fuglvog, the fact that the technical solution was essentially complete was important in persuading NMFS managers to restart the effort. While this was a lucky accident in this situation, a deliberate strategy of developing technical solutions prior to resolving institutional problems may provide useful leverage in other situations.

5.4.3 Continuity of participation helps overcome delays

We asked participants in the Logbook effort whether, in hindsight, they thought the effort could have proceeded more quickly. Their judgment was that, given the legal and regulatory constraints, and the complexity of NMFS' management structure, the process probably could not have been accomplished faster. As a result of the length of time required to complete this effort, the continuity of the key participants (Sigler, Fuglvog, Bearden, Gilroy) was extremely important. Removing any one of them would have very likely derailed the effort because each represented an essential interest group and provided that group's perspective. As a result of this continuity, they were able to immediately resume the effort in early 1998 and quickly conclude it, without the necessity of bringing new participants up a learning curve. Maintaining continuity of participation over this period of time requires people with unusual stamina and a certain degree of stubbornness, elements not usually considered when choosing people to take part in cooperative efforts. Sigler, Bearden, Fuglvog, and Gilroy all agreed that the obvious benefits of a combined logbook were key in maintaining their interest. In cases such as this, where there is no regulatory driver for change, the identification of and agreement on clear benefits are essential to sustaining involvement.

5.4.4 Industry participants can play unique roles unavailable to others

Industry representatives played key roles, in both the Survey and Logbook efforts, in identifying problems and solutions to these. In both instances, they provided realistic and first-hand information about what approaches were likely to be most successful. As the IFQ fishery was being implemented, Arne Fuglvog and the Petersburg Vessel Owners' Association helped clarify and draw attention to the potential for increased interactions between the Survey vessel and the fishing fleet. Industry associations have since made a concerted effort to reach their members through newsletters, radio messages, and personal contacts to stress the importance of having an unbiased estimate of sablefish abundance. In another example, members of the sablefish longline fleet realized that the absence of better biological information (e.g., from analyzing observer data, collecting otoliths, etc.) was largely due to lack of funding for NMFS scientists. They were then able to go directly to higher-level NMFS managers and to members of Congress to help obtain additional funding. Similarly, in early 1998, industry was able to approach the NMFS regional director directly with a request to revive the Logbook effort and to present evidence that the revised Logbook format was essentially complete.

In both instances, industry was able to use avenues of influence not open to the NMFS scientists and managers directly involved in the two efforts. In these other decision-making arenas, industry's voice carries more weight than does that of NMFS staff. This case thus illustrates how a strategic partnership between NMFS staff and industry can together have more impact on the system, especially in terms of breaking administrative logjams, than either might have alone.

5.4.5 An absence of "us" vs. "them" behavior

Conversations with all participants in both the Survey and Logbook efforts were marked by a complete absence of the "us vs. them" attitude prevalent in other situations. In contrast, one contact in another case study commented, "I hate to tell you this, but it really is 'us' and 'them.'" Instead, we found substantial evidence of deliberate attempts to bridge gaps and overcome stereotypes. These include:

- Auke Bay scientists' willingness to spend time at sea to help establish their credibility with industry;
- the ability of the sablefish longline fleet's leaders to develop empathy for NMFS scientists, to understand that their failure to incorporate additional data types in the sablefish stock assessment was due to lack of funding (not incompetence), and to realize they were doing the best they could with limited resources;
- industry's readiness and ability to work through alternate channels to achieve their goals;
- NMFS scientists cooperative support of such industry efforts; and

- Groundfish Forum's initiative in approaching NMFS staff to develop a non-regulatory solution to the problem of trawler interactions with the Survey.

5.4.6 Four sources for cooperation

All is certainly not "sweetness and light." For example, some members of the large and geographically dispersed longline fleet disregard requests to stay clear of the Survey area, illustrating the difficulty of achieving full voluntary compliance from a large, dispersed, and diverse fleet. Nevertheless, participants in this case exhibited a notable level of cooperation and mutual understanding. Participants and knowledgeable observers have proposed four possible explanations.

First, the U.S. sablefish fishery is relatively new, having developed only after passage of the MFCMA in 1976. As a result, there has been little time for negative history and deep-seated resentments to develop. Second, the fishery has been relatively healthy, and NMFS stock assessment staff have not become the target of anger over declining quotas. Third, establishment of the IFQ fishery in 1995 provided a compelling motivation for individual fishers to become more interested and involved in the science underlying the stock assessment. Finally, quiet leadership through persistence, communication, and example contributed to effective working relationships. The question of how to first identify and then enlist and sustain the participation of such leaders cuts across all the case studies and is discussed in the Summary chapter.

5.4.7 Summary

To summarize, the absence of negative past history, combined with the existence of clear benefits from revised procedures, the IFQ system's incentives for improving the stock assessment, cooperative working relationships, and effective leadership provided the ingredients for the successful Survey and Logbook efforts.

6 Oregon Trawl Enhanced Data Collection Project

6.1 Introduction

The evaluation of the Oregon Trawl enhanced data collection project (EDCP) is one 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 6.1 and 6.2 and the Methods chapter (chapter 3) for more detail). This review examines both the experimental enhanced logbook and the observer program, which combined to gather previously unrecorded information on fishing strategies, discard, and fish biology.

Table 6.1. Interviewees. ODF&W refers to the Oregon Department of Fish and Wildlife and NMFS to the National Marine Fisheries Service.

Name	Title & Organization	ODF&W	Fisher	Other
Greg Davis	Observer, Skipper FV *Aja*		X	
Joe Easley	Administrator, Oregon Trawl Commission			X
Tim James	Owner FV *Endevour*; Former Commissioner OTC		X	X
Keith Matteson	ODF&W, EDCP team	X		
Richard Methot	NMFS, NWFSC, Seattle			X
Robert Rees	Observer; fishing guide			X
Mike Retherford	Owner/Skipper FV *Excaliber I*		X	
Mark Saelens	ODF&W, EDCP coordinator	X		
Cyries Schmitt	NMFS-NWC, Newport			X
John Wallace	NMFS, NWFSC, Seattle			X

Table 6.2. Additional sources. ODF&W refers to the Oregon Department of Fish and Wildlife, PFMC to the Pacific Fisheries Management Council, and NMFS to the National Marine Fisheries Service.

Source	Description
ODF&W	Research proposed to OTC from ODFW, March 1995: Enhanced Data Collection Project
PFMC	Report of the Observer/Data Collection Steering Group, Supp. Report E6 June 1995
NMFS	Preliminary Results from the Enhanced Data Collection Project: Trip Limit Induced Discardings Supplemental NMFS Report B. 12, April 2000
ODF&W	Sample pages, Coastwide Uniform Logbook and Travel Logbook
ODF&W	Sample Pages, EDCP Observer report forms

6.2 The setting

The Pacific Fisheries Management Council sets annual harvest guidelines for the dover sole, thornyhead, sablefish (DTS) trawl complex fishery. Decisions about catch levels are based on assessment models that rely for their validity on good estimates of landed as well as discarded catch (and resulting mortality). By 1994 it was clear that more scientific information was needed to prudently manage this fishery, as many of the species involved were thought to be at or near MSY (maximum sustainable yield). The Oregon Trawl Commission (OTC) suggested that a program be developed to collect more and broader-based information on both the total removals and the biology of species involved in this complex. This would be accomplished through a voluntary enhanced data collection project (EDCP), with fishers recording additional information in an expanded logbook and with a subset of vessels also having observers placed on board to collect data. The Oregon Department of Fish and Wildlife developed the program for and with the OTC. It was in operation for three full years, 1996-1998, with a startup phase beginning in 1995 and some activities carried over to 1999.

6.3 The story

Sablefish and thornyhead are highly prized West Coast groundfish species, and subject to heavy fishing pressure by the trawl fleet. In recent years, dover sole, thornyhead, and sablefish have accounted for almost half of Oregon's groundfish catch and over half of the ex-vessel value. The best scientific information possible is required to conservatively manage these stocks and ensure their continued viability. Essential to this effort is knowledge about non-landed fish, or discarded catch. Prior to this project, much of the discard information used in stock assessments came from research performed by Pikitch in 1985-1987 while she was in residence at OSU. This left the Council's Groundfish Management Team to use wildly disparate figures for discard of various target and protected (salmon, halibut) species, with little accurate data on the survivability of discarded fish. Furthermore, little biological (age composition, year class strength, etc.) information existed for species prior to their entry into the fishery because sampling of landed catches at shoreside missed the opportunity to account for smaller or less desirable fish discarded at sea. The project described here was jointly agreed upon to try to remedy some of these gaps.

A voluntary, enhanced data recovery program for Oregon-based vessels was established to be administered by ODF&W, coordinated by Mark Saelens of the Marine Finfish Technical Services sector and funded in part by the OTC. After startup, additional funding was secured from NMFS and the project became a coastwide program including vessels from Washington and California. Owners and shippers of vessels would agree to record information on an expanded logbook and some would also carry observers who would record additional catch and discard data. A vessel was to commit to participation in the program for a four-month period. Enhanced logbooks would collect further information such as fishing strategy, gear deployment and problems, fishing depth, and estimated retainable and discarded catch. Observers would record all catch as target, weighback, or discard. All species of groundfish catch as well as prohibited species would be enumerated. Finally, biological sampling of catch usually discarded would be carried out, and an attempt made to determine survivability for species such as sablefish.

ODF&W developed and field tested both EDCP logbooks and observer forms on several commercial vessels in 1995. They also held public meetings in several locations in Oregon prior to the implementation of the program in 1996. These were poorly attended by fishermen, although some boat owners and OTC members did come out.

Old logbooks were initially used to ease the transition to recording more information than usual. The printed information was lined out by the operator and retained catch was written at the top of the form and discarded catch at the bottom. This became unmanageable in practice and the enhanced logbooks were quickly distributed.

From its outset, the program intended to gather segregatable data and provide it to the larger community of interested and statistically sophisticated users for further analysis. ODF&W did provide summary information on how the program was progressing, most notably at the quarterly OTC meetings, at the various council meetings, and in a series of forums offered in Washington, Oregon and California in March 1997. In these meetings, available summary data that was provided showed that this fishery could be discarding fully forty percent of its catch. A final report of the project is currently being prepared, while, concurrently, NMFS is using some of the data to ascertain how a full-scale program with enhanced logbooks and some type of consistent observer coverage might be designed.

6.4 Outcomes

From a scientific point of view, the results of the enhanced data collection project are still unknown. One of the most interesting and important aspects of the effort was to be a comparison of data from vessels that used the enhanced logbook and had an observer on board with data from vessels that used only the enhanced logbook. The OTC is currently releasing a request for proposals for this work. The program's interim results, however, have substantiated that the fishery does have a high discard rate. These results have also shown that the regulatory mechanism used to keep the fishery going year round – monthly trip limits – forces a dramatic increase in the discard of target species when each trip limit is reached.

The program utilized a number of volunteer vessels and shippers and over three years developed data that will continue to help improve management of the fishery. Interviews with captains suggested a problem with unrealistic expectations. Since fishers were told that the program would help them, they might have expected this to mean an increase in quotas or an easing of other restrictions. One said, "Just for once, when the government says it is for my own good, I'd like to benefit. I don't see any benefit at this point." Of course, he was willing to admit that in the longer term, a well managed fishery is one that is most likely to be available year after year after year, and that this requires the best available data for decision making. Another captain complained about an observer who he felt was dishonest in his reports and then, after being discharged from the vessel, made damaging public statements of questionable validity. This skipper suggested that there be a formal process for challenging observer data if participants felt justified in doing so. Some program participants felt that cooperation among comparable agencies in different states could be improved, and that this would benefit the fishery, and fishers, through use of more coordinated data gathering and analysis.

6.5 Conclusions and lessons learned

While the verdict is still out on the overall success of the Oregon Trawl Enhanced Data Collection Project, 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.

6.5.1 Participation was less than hoped for

The level of participation – ten percent of the fleet – was less than hoped for, but does represent more than four thousand trawls for which there is much more extensive data than normal. Financial and logistical constraints contributed to the lower than expected coverage (original plans had been to put observers on ten to fifteen percent of the fleet and enhanced logbooks on up to forty percent). The program could not afford a crew of twenty to thirty observers on staff (the number needed to meet the goal of ten to fifteen percent coverage) when a portion of those might be drawing pay without a vessel slot. At the same time, if a smaller number were hired because of budget constraints, then there would be times when a space was available to the program but there was no observer to fill the berth. Future such efforts should evaluate goals under real-world conditions to ensure they can be met with the available financing and personnel.

6.5.2 Participants were enthusiastic about the program

Many of the participants who were rewarded for their involvement by fleece coats, jackets, or caps were enthusiastic about aiding in the development of better science. Observers, in general, did not have problems with crew members and did not think their presence changed the way the vessel and crew went about their fishing. While the old logbook is back in use at this point and discarded catch is not being recorded, the Pacific Fishery Management Council and NMFS are considering implementing portions of the program on a more permanent basis, largely as a result of the successful operation of the program. All participants agree it has been a successful cooperative venture. An important element in this success has been NMFS' awareness of the logistic and economic pressures industry must operate under. As a NMFS official, involved in the EDPC, said, "fishermen are operating a business out there on the water and government needs to keep that in mind when designing a voluntary enterprise such as this."

6.5.3 Summary

To summarize, conditions in the fishery made the need for improved information clear and the approach taken to designing the program fostered a cooperative attitude among participants. The program did not meet its goals for level of observer coverage but did produce data with significant management implications. The true tests of the program's success will be the degree to which enhanced data collection becomes a permanent feature of the fishery and the usefulness of the program's data in decision making.

7 Cooperative Research Program Addressing Finfish Bycatch

7.1 Introduction

The evaluation of the Cooperative Research Program Addressing Finfish Bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries (Program) 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 7.1 and 7.2 and the Methods chapter (chapter 3) for more detail). This review examines the development and implementation of the Program in both the Gulf of Mexico and the South Atlantic. It examines the influence of participants' recent experience with TEDs (turtle excluder devices) as well as regional differences in how the Program developed. This case study is unique in its combination of an extremely large number of participants and great geographic extent. The story below is therefore painted in relatively broad strokes (Table 7.3) that capture the main themes and provide a basis for the evaluation's findings and recommendations.

Table 7.1. Interviewees. NMFS refers to the National Marine Fisheries Service, State to a member of a state agency, Fisher to a member of industry or an industry organization, and Conser. to a member of a conservation organization.

Name	Title & Organization	NMFS	State	Fisher	Conser.
Wilma Anderson	Executive Director, Texas Shrimp Association			X	
Kenny Atwood	Ex-President, Georgia Shrimp Association			X	
Charles Brunell	Shrimp fisherman, involved in BRD testing			X	
Felix Cox	Snapper fisherman, ex-shrimper			X	
Kim Davis	Regional Fisheries Project Manager, Center for Marine Conservation				X
Larry DeLancey	Program Supervisor, Crustacean Management, South Carolina Dept. Natural Resources		X		
Fred Dennis	Gulf and S. Atlantic shrimper			X	
Greg Faulkner	Louisiana net designer				
Gary Graham	Fisheries specialist, Texas Sea Grant Program		X		
Judy Jamison	Executive Director, Gulf and South Atlantic Fisheries Foundation				
Mike Justen	Sustainable Fisheries Division	X			
Dr. Andy Kemmerer	Past regional administrator, southeast region	X			
Jim Murray	Formerly SeaGrant, North Carolina		X		
Scott Nichols	Director, Mississippi Lab	X			
Jerry Schill	Executive Director, North Carolina Fisherman's Association			X	
Susan Shipman	Georgia Department of Natural Resources		X		
Richard Vendetti	Fisheries economist, formerly fisheries coordinator, Univ. of Georgia Marine Extension		X		
Michael Weber	Independent consultant				

Table 7.2. Additional sources. NMFS refers to the National Marine Fisheries Service, Foundation to the Gulf and South Atlantic Fisheries Development Foundation, Inc., and Register to the Federal Register.

Source	Description
NMFS	Cooperative Research Program Addressing Finfish Bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries: A Report to Congress. Southeast Regional Office, April 1995.
NMFS	J. Watson, A. Shah, S. Nichols, D. Foster. 1997. Bycatch reduction estimates for selected species in the Gulf of Mexico for bycatch reduction devices evaluated under the regional bycatch program. Southeast Fisheries Science Center.
NMFS	Red Snapper / Shrimp Research Program Summer 1998 Project. Final Report. April 1999.
NMFS	Gulf of Mexico bycatch reduction device testing protocol manual. April 4, 1999 draft. Mississippi Laboratories, Pascagoula, MS.
NMFS	NMFS Response to the 1997 Peer Review of Red Snapper (*Lutjanus campechanus*) Research and Management in the Gulf of Mexico. Prepared by MRAG Americas, Inc. for NMFS Southeast Regional Office. May 1999.
NOAA	News bulletins: nr97-01, 06, 17, 18, 26, 29; nr97R191; nr98-022, 024, 029, 030, 034, 038, 039, 044, 045, 057, 058, 065, 067; nrg98-61; nr99-022, 024.
Foundation	P. Hoar, J. Hoey, J. Nance, and C. Nelson, eds. 1992. A research plan addressing finfish bycatch in the Gulf of Mexico and South Atlantic shrimp fisheries. Tampa, FL.
Foundation	An industry workshop addressing bycatch issues in southeastern U.S. fisheries: A report to the National Marine Fisheries Service. November 1995. Tampa, FL.
Foundation	Final report: Continued observer coverage of the Gulf of Mexico and South Atlantic shrimp fisheries to characterize the catch and evaluate the efficiency of bycatch reduction devices. November 1995. Tampa, FL.
Foundation	S. Branstetter. 1995. Bycatch and its reduction in the Gulf of Mexico and South Atlantic shrimp fisheries. Tampa, FL.
Foundation	Final report: Continued efforts to reduce bycatch in the Gulf of Mexico and South Atlantic shrimp fisheries and disseminate such information to the fishing industry. August 1998. Tampa, FL.
Other	Civil Action No. 96V-217. Georgia Fishermen's Association, Inc. and Jack D'Antignac, Plaintiffs, vs. Georgia Department of Natural Resources, Defendant. August 8, 1996. Superior Court of McIntosh County, State of Georgia.
Press	Numerous news articles from newspapers in Gulf and South Atlantic states.
Register	50CFR Part 622, Vol 62, No. 82, April 29, 1997
Register	50CFR Part 622, Vol 62, No. 127, July 2, 1997
Register	50CFR Part 622, Vol 63, No. 71, April 14, 1998
Register	15 CFR Part 902, 50CFR Part 622, Vol 63, No. 96, May 19, 1998
Register	50CFR Part 622, Vol 63, No. 166, August 27, 1998
Register	50CFR Part 622, Vol 64. No. 82, April 29, 1999

7.2 The setting

The shrimp industry in the Gulf of Mexico and the South Atlantic is geographically widespread and made up of a large and diverse fleet. The absence of formal and standardized permitting or registration requirements makes it difficult to determine the size of the fleet, but there may be as many as 7,000 vessels (longer than 15 feet) and 20,000 boats operating in the area from North Carolina to Texas. The relative lack of industry organization, with a few exceptions, complicates the dissemination of information and the clarification and resolution of problems.

Within this broad context, there are important differences between the Gulf and South Atlantic regions, and among states within these regions. In general, the shrimp fishery in the Gulf takes place predominantly in offshore, or federal, waters, where most of the concern about the bycatch of juvenile red snapper is focused. In contrast, the shrimp fishery in the South Atlantic is primarily an inshore fishery concentrated in state waters. In this region, regulatory agencies' bycatch concerns focused on weakfish and spanish mackerel. As a result of this onshore – offshore difference, regulatory responsibility in the Gulf falls mainly to NMFS and the regional fishery management councils, while state agencies and the Atlantic States Marine Fisheries Commission (ASMFC) play a much more dominant role in the South Atlantic.

Other differences in the nature of the bycatch problem in these two broad regions affected regulatory approaches to BRD (bycatch reduction device) development, as well as industry responses to these. Juvenile red snapper are relatively rare in any one shrimp trawl in the Gulf and the bycatch impact on the stock stems from the extremely high number of shrimp hauls in the region. In contrast, weakfish and spanish mackerel are a more visible component of finfish bycatch in the South Atlantic and their bycatch was thus more easily related to interest in reducing finfish bycatch in general, for both economic and conservation reasons.

The Program was created and carried out against the backdrop of complex and ongoing regulatory, political, and legal processes that operated within the regional fishery management councils, state and federal agencies, state and federal governments, and the courts. The broad outlines of this history are presented in the timeline in Table 7.3, however, we will not deal with it in detail except where it directly affected the Program.

Finally, every person we spoke to said that, in one way or another, the TED experience dominated participants' perception and behavior during the development and implementation of BRDs. Effective TED designs, full compliance by industry, and industry involvement in the protection and restoration of nesting beaches was achieved only after a long and bitter conflict. This left a residue of suspicion and resentment toward NMFS in some quarters of the shrimp industry. However, it also fostered a strong desire among all parties never to have to go through that experience again. So, when concerns about finfish bycatch began to arise, there was a conscious decision to try a different approach. All the managers we spoke to, as well as the majority of the fishers, wanted to avoid the mistakes they believed were made by all parties to the disputes over TEDs. As one state manager put it:

> I was the manager and my real fear was getting into another TED controversy. That was the reverse Midas touch; everyone got tarnished in one way or another.

The large degree of industry involvement in the Program, and in similar but smaller efforts in some of the South Atlantic states, was described by early participants in these efforts as a deliberate attempt to learn from the TED experience. Many fishers described themselves as more fatalistic as a result of their experience with TED regulations; they had little hope of permanently forestalling regulations mandating BRDs and were intent instead on helping to improve them and reduce their economic impact. Largely as a result of these factors, the overall level of "heat" with the BRD issue was much less. As one key participant in both issues related,

> With TEDs we had public demonstrations, public hearings with 4000 to 5000 people. We had some tough hearings with the BRDs but there was no comparison, with usually 50 to 60 people at meetings or sometimes 100. We were always treated with respect and the shrimpers in general were courteous. With the TED stuff though, there was always a question about whether we were going to walk out alive [said facetiously]. These were the same people too, but there was a profound difference.

On a more pragmatic level, the presence of TEDs in shrimp nets has led to interest in developing one device to solve both turtle and finfish bycatch problems and to pressure from industry to include reductions in finfish bycatch due to TEDs when assessing progress toward bycatch reduction targets.

7.3 The story

While the Program covered both the Gulf of Mexico and the South Atlantic, the story in these two regions follows two parallel and somewhat different plots (Table 7.3). Concerns in the Gulf focused primarily on red snapper bycatch, which occurred mostly in federal waters. Attention in the South Atlantic centered on weakfish and then spanish mackerel and the bycatch of both occurred largely in state waters. Despite these and other important differences, some consistent themes play out in both regions.

7.3.1 Genesis of the Program

Concerns about the red snapper stock in the Gulf of Mexico led to a 1989 stock assessment that concluded that both direct and incidental harvest would have to be greatly restricted to permit stock rebuilding. It also showed that over 90 percent of the fishing mortality on age 0 and age 1 red snapper was due to shrimp trawling. The only way to rebuild snapper stocks without halting all directed commercial and recreational take of red snapper was to significantly reduce mortality due to shrimp trawling. The Gulf of Mexico Fishery Management Council considered large-scale closures of the shrimp fishery to protect red snapper juveniles. However, analyses suggested these closures would be of little benefit and the Council began searching for alternative management approaches. At that time, many parties questioned the adequacy of current shrimp bycatch estimates and expressed concern about the potential economic impacts on the shrimp fishery of proposed management measures.

This issue was addressed by Congress during the 1990 reauthorization of the Magnuson Act. It prohibited until January 1, 1994 any implementation of shrimp fishery closures or bycatch reduction devices (BRDs) in federal waters and set up a three-year research program to:

- identify fish stocks subject to significant incidental harvest by shrimp trawling;
- collect and evaluate data on the extent of such incidental mortality on such stocks;
- assess the status and condition of such stocks;
- collect and evaluate data on sources of fishing mortality on such stocks from sources other than shrimp trawling; and
- evaluate the effectiveness of bycatch reduction devices.

At about the same time, attention began to turn to the potential impacts of finfish bycatch in shrimp trawls in the South Atlantic. As Jim Murray, formerly of North Carolina Sea Grant, remembers:

> In the course of dealing with TEDs in the mid to late 1980s, it became clear to us that the next major issue was going to be bycatch…As TEDs were being dumped on deck [during a field test of TED designs] there was a lot of bycatch and the environmental community was very concerned…once the TED issue was addressed properly there was still going to be another issue and that would be bycatch.

And Jerry Schill, Executive Director of the North Carolina Fisherman's Association, said that, "I knew in the late 1980s that the buzzword for the 1990s was going to be bycatch." As a result, North Carolina Sea Grant was awarded a Saltonstall-Kennedy grant in 1989 to investigate gear modifications to reduce finfish bycatch. Shortly thereafter, in 1991, the ASMFC adopted

Amendment 1 to the Weakfish Fishery Management Plan (FMP), which recommended that South Atlantic states implement measures, by January 1, 1994, to reduce bycatch mortality of weakfish in their shrimp trawl fisheries by 50%.

Only North Carolina implemented measures to reduce weakfish bycatch, but gave fishers wide latitude in the choice of bycatch reduction devices. As a result, the ASMFC adopted Amendment 2 to the weakfish FMP, which required that the South Atlantic states implement, by the 1996 shrimping season, measures to achieve a 50% reduction in weakfish bycatch in shrimp trawls.

Thus, despite different initial motivations, the shrimp industry, as well as state and federal regulatory agencies, in both the Gulf of Mexico and the South Atlantic were deeply involved in the issue of finfish bycatch and the development of methods to reduce this bycatch. The Program launched by the 1990 reauthorization of the Magnuson Act would provide impetus, direction, and needed coordination to efforts in both regions.

7.3.2 Results

All BRD designs basically entail cutting a hole in the shrimp net to allow fish to escape before the net is hauled on board. This is a traditional practice of long standing in the shrimp industry, especially in inshore areas where high densities of finfish and/or jellyfish can clog nets, reduce tow times, and increase sorting time. The regulations that were pending in both the Gulf of Mexico and the South Atlantic raised significant concerns within industry for two primary reasons. First, BRDs would have to meet explicit, quantitative targets for the removal of particular species of bycatch and, second, they would have to be used at all times and in all areas, removing the element of choice for individual shrimpers.

In developing the details of Program, NMFS attempted to address these concerns, and learn from past experience with TEDs, in two ways. It determined to ensure both scientific credibility throughout the design and implementation of all studies and the substantive participation of all affected parties. As Andy Kemmerer, formerly the regional administrator of the southeast region put it:

> We looked back at TEDs and didn't want to do the same thing. We wanted industry to be an active participant, to be more involved in collecting and evaluating data, both organizationally and individually.

Initial attempts to directly fund industry organizations showed that most of them did not have the administrative capacity to manage government grants. The bulk of Program funding therefore flowed through the Gulf and South Atlantic Fisheries Development Foundation (Foundation), which had industry members on its board of directors and had better relationships with industry than did NMFS. The Foundation set up a 34-member Finfish Bycatch Steering Committee with representatives from:

- commercial and recreational fisheries;
- conservation groups;
- Sea Grant;
- NMFS;
- both the Gulf of Mexico and South Atlantic fishery management councils;
- both the Atlantic and Gulf States Marine Fisheries Commissions; and
- resources agencies of North Carolina, South Carolina, Louisiana, and Texas.

The Foundation also set up a 15-member Technical Review Panel and an 8-member Gear Review Panel to advise the Steering Committee on specific issues related to biological research, gear technology, and sociology and economics. These three groups developed a formal research plan which was published in August 1992 and which guided the next few years worth of research and testing. These groups held frequent meetings during the early 1990s to review results and reassess the Program's priorities. An early priority was to develop explicit protocols for selecting and then field testing candidate BRD designs, as well as quantitative criteria for eventual certification. These efforts resulted in the certification of the fisheye, Gulf fisheye, and Jones-Davis BRDs for use in the Gulf of Mexico.

By all accounts, the Program achieved significant accomplishments, from better characterization of bycatch patterns to improved understanding of net dynamics and the behavior of fish swimming inside shrimp trawls. In addition, our sources were unanimous in praising the high level of cooperation and the open exchange of information the Program fostered. The Program accomplished its primary goal of identifying BRD designs that met the formal certification requirements.

Despite the passage of Amendment 9 in the Gulf of Mexico and the ASMFC regulation in the South Atlantic (see below), and the fading away of the Program's formal structure, there are several pieces of unfinished business still under active consideration. First, there is continuing disagreement over the actual effectiveness of BRDs, in terms both of the reduction in mortality of target bycatch species and of shrimp loss rates. The wide range of fishing styles and oceanographic and ecological conditions makes it extremely difficult to resolve this issue. Second, studies in the Program's later stages documented a lower than expected rate of mortality reduction. While efforts are underway to improve performance through design adjustments and better training in installation and use, this aspect of the Program remains incomplete. Third, the Program's estimates of the economic impact of the BRD regulations are open to question because of ongoing controversy about shrimp loss rates and the difficulty of accurately characterizing the shrimp fleet and its fishing effort. Finally, an effort is underway in the South Atlantic to modify the statistical criteria for BRD certification in order to somewhat reduce the burden of proof required for certification.

7.3.3 Fallout and current prospects

After years of stock assessment studies, research into a wide range of BRD designs, and political activity at both the state and federal level, events in the Gulf came full circle in 1998 with the passage of Amendment 9 to the shrimp FMP by the Gulf of Mexico Fishery Management Council. Amendment 9 mandated the use of approved BRDs in shrimp nets throughout most of the Gulf. It followed the establishment of similar requirements by the ASMFC in 1996 for state waters in the South Atlantic and by the South Atlantic Fishery Management Council in 1997 for federal waters in this region.

The passage of Amendment 9 and related regulations had two immediate consequences. The first was separate lawsuits filed by the Texas Shrimp Association (TSA) and conservation organizations against the Department of Commerce. The TSA suit challenged the validity of the Program's data used by NMFS in developing and justifying the regulations and the other suit argued that BRD use should also be required in the eastern Gulf of Mexico in order to reduce finfish bycatch in general (bycatch of juvenile red snapper is less of a problem in that region). The second consequence was a striking decrease in the level of industry cooperation in some aspects of the Program's ongoing research efforts. As one key participant remarked:

> Overall, there was very good cooperation in the research and development program but this started to fall apart when the regulations came out in 1998. Nobody signed up [for the randomized observer program; see below]. There were also problems with the vessel monitoring systems on boats to compare with port sampling data… Up until that point [regulation], we had great cooperation… We didn't get around that problem.

For example, NMFS attempted, through an interim rule, to implement a randomly designed study in the summer of 1998 to obtain the first statistically valid, fleetwide estimates of BRD effectiveness. Only 51 of 350 targeted vessels supplied logbook information and NMFS received only one response to its first 100 attempts to place observers on randomly selected vessels, despite a regulatory requirement to comply with the observer study. Different sources pointed to different reasons for the failure of this study. Industry sources pointed to the sudden shift from a cooperative approach during the Program's earlier years to mandating a study under a regulatory requirement. Industry sources also argued that simply sending letters to randomly selected shrimpers was insulting and culturally insensitive. As one shrimper put it, "You send me a letter like that I'll go out of business first before I comply." Industry sources also raised concerns about the difficulty of obtaining insurance coverage for observers and the expense of purchasing extra safety equipment to comply with Coast Guard regulations. In contrast, other sources noted the Program's past history of relatively trouble-free observer studies and suggested that anger at Amendment 9's BRD requirements and the regulatory mandate behind the 1998 study underlay the failure of the 1998 study.

Whatever the reason, the failure of the 1998 study represented the end of the Program's history of widespread cooperative research efforts, open communication, and data sharing. Faced with a possible lengthy fight to enforce compliance vs. the immediate need for some information to make decisions about the snapper quota, NMFS abandoned its randomized effort, and relied on voluntary, paid participants to carry observers. The data from this effort are acceptable as an example of BRD capabilities and identified some important, until then undiscovered, characteristics that affect performance. However, the ability to estimate effectiveness for the fleet as a whole was lost and with it the opportunity to improve admittedly poor estimates of overall BRD effectiveness.

The fallout from the 1996 ASFMC regulations in the South Atlantic was much different and varied somewhat from state to state. In North Carolina, which had implemented its own BRD requirement in 1992, an estimated 70% of shrimpers were using one kind of BRD or another by 1996. Because of the economic benefits of reducing finfish bycatch (longer tow times, reduced sorting time, improved shrimp quality), "they wouldn't have taken them out if you had told them to," according to Jerry Schill, Executive Director of the North Carolina Fisherman's Association.

There was also little or any reaction to the regulations in South Carolina, where state managers with good credibility with industry had for years been warning about the pending need to deal with weakfish bycatch. In addition, field trials involving shrimpers showed that shrimp loss was low enough to be acceptable. Despite some complaints, BRDs have apparently been accepted as part of normal routine.

There was greater resistance in Georgia, where the Georgia Fisherman's Association filed suit against the state and where anecdotal evidence suggests a much greater degree of noncompliance with BRD requirements. Many shrimpers in this state assert that shrimp loss rates are higher than claimed by the state's Department of Natural Resources and that they simply cannot survive economically with the high loss rates caused by BRDs. The state's estimates of shrimp loss are based largely on replicated studies carried out by the University of Georgia's Marine Extension office. Because the tow times in these studies were much shorter than those used in commercial hauls (1 hour vs. 2 – 4 hours) there may well have been less net clogging and thus less shrimp loss.

At present, the Program's formal, centralized structure is no longer active and the Program's research did not definitively resolve uncertainties about rates of either finfish exclusion or shrimp loss. However, many of the Program's participants sit on local and regional advisory panels and working groups that continue to address these issues and to identify ways to improve BRD effectiveness. In important ways, the Program succeeded in institutionalizing its original commitments to scientific rigor and to the substantive involvement of all affected parties.

Table 7.3. Timeline of key events in the history of BRD development in the Gulf of Mexico and the South Atlantic.

Date	Event
1989	Voluntary bycatch reduction efforts begin in North Carolina, with wide latitude on choice of devices by industry
1990	Magnuson reauthorization prohibits BRDs in Gulf until 1994 and sets up 3-year research program
1991	Organized bycatch reduction efforts begin in South Carolina, targeted on weakfish
1991	South Carolina awarded an S-K grant to investigate BRDs
1991	ASMFC passes Amendment 1 to weakfish FMP, which recommended that South Atlantic states implement, by 1994, measures to reduce bycatch mortality of weakfish by 50%
1991	Program structure of Steering Committee, Technical Review Panel, and Gear Review Panel in place
1991	South Carolina awarded an S-K grant to investigate BRDs
1992	Program research plan published by Gulf and South Atlantic Fisheries Development Foundation
1992	North Carolina enacts regulations requiring BRDs but giving industry wide latitude in choice of device
1994	ASMFC passes Amendment 2 to weakfish FMP, which required that South Atlantic states implement, by 1996, measures to reduce weakfish bycatch by 50%
1995	South Atlantic states submit bycatch reduction plans to ASMFC
1996	Regulations requiring BRDs in state waters implemented in South Atlantic states
1996	Gulf Council passes regulation mandating BRDs in offshore shrimp trawls

Date	Event
1996	Georgia Fisherman's Association files suit contesting BRD requirements
1996	Congress imposes one-year delay on BRD regulations in Gulf of Mexico to allow for additional red snapper assessment
1997	Georgia Fisherman's Association loses suit on technicality
1997	Regulations requiring BRDs in federal waters implemented in the South Atlantic
1997	Gulf of Mexico Fishery Management Council approves Amendment 9, which requires BRDs in federal waters of the Gulf of Mexico
1998	Regulations requiring BRDs in federal waters implemented in the Gulf of Mexico
1998	Texas Shrimp Association files suit against BRD requirements in Amendment 9
1998	Randomized study of fleetwide BRD effectiveness in Gulf of Mexico fails due to lack of response from industry

7.4 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.

7.4.1 Past history played a dominant role

More so than in any other case study, past history influenced the perceptions and behavior of participants in government agencies, fisheries, and conservation organizations. The memory of bitter conflicts over TEDs is fresh enough that virtually all of our contacts said that one of their primary motivations was to avoid repeating that history with BRDs. As a result, commercial fishers in general were resigned to the fact that some sort of BRD would be required. They were intent on focusing less of their energy on outright resistance and more on ensuring that BRDs that were implemented were as effective as possible. Industry's experience with TEDs also demonstrated that their suggestions would be heard and would result in improved designs. As a result, there was broad support for the cooperative research program throughout the Gulf and South Atlantic. However, the TED experience also increased fishers' cynicism about the regulatory system. We heard many comments to the effect that their experience with TEDs had increased their skepticism about how data from the research program would be used and whether their concerns would be heard and addressed.

7.4.2 A formal structure was necessary

As in all the case studies, the development of working relationships and some degree of trust among participants was a key part of the story. However, the Program's number of participants and the large geographic area involved made it impossible to depend on informal, ad hoc approaches and the development of close personal relationships. The research program instead effectively used a series of committees and working groups and established clear, written procedures for how BRD candidates would be selected and how studies would be carried out. These detailed procedures were essential for creating the necessary confidence that there was a "level playing field." In contrast, personal relationships among shrimpers, Sea Grant or university extension staff, and state agency personnel played a large role at the state level in the South Atlantic.

7.4.3 Regional differences affected outcomes

We found that regional differences in the regulatory environment and the nature of the shrimp fishery strongly affected both approaches and outcomes in different regions. In general, BRD implementation proceeded with less industry resistance in the South Atlantic states. There are two factors that seem to explain this difference. First, the state agencies with responsibility for managing the mostly inshore fishery in the South Atlantic had closer and more personal relationships with fishers than did NMFS in the Gulf of Mexico and were able to utilize non-regulatory Sea Grant and marine extension personnel to a larger extent in proselytizing about BRDs. Thus, fishers in general had a more positive assessment of state agencies' motives and performance, although, as one put it, "Fishermen are not much more kind to state regulators than to the feds. But still, they would like to deal with the ones they know [state] rather than the ones they don't [feds]. We don't separate bureaucrats, it's 'us' and 'them.'"

Second, representatives of state government were generally more supportive of bycatch reduction measures in the South Atlantic. In addition to the efforts of state resource agencies described elsewhere in this chapter, two public statements by elected officials illustrate this regional contrast. In a meeting with shrimpers in the early spring of 1987, Congressman Lindsey Thomas told shrimpers that he would help with issues related to implementing TEDs but that they had to bring an end to this bycatch. One month later, in a meeting with thousands of shrimpers in Louisiana, Governor Edwin Edwards made a statement to the effect that, if it comes to shrimp vs. turtles, then it's "bye bye turtles."

7.4.4 State agencies took advantage of greater flexibility

In addition, greater flexibility at the state level allowed some state agencies to begin promoting BRDs as a voluntary measure long before the federal regulations were enacted. The second factor involves the nature of the shrimp fishery itself. Overall bycatch of fish is higher in the inshore, state-managed, fisheries of the South Atlantic than in the offshore, federally-managed, fisheries of the Gulf. As a result, inshore fishers were much more receptive to the economic argument that BRDs would improve economic yield by reducing fish bycatch and catch processing time. In contrast, Gulf fishers' were predominantly concerned about the negative economic impact of BRD-caused shrimp loss.

7.4.5 NMFS' science and regulatory roles conflict

This case highlighted the inescapable tension between NMFS' scientific and regulatory roles. Despite the Program's clearly defined procedures, fishers retained an inherent mistrust and cynicism about NMFS' underlying motivations. We heard numerous comments about the role that regulatory politics unavoidably plays in federal management decisions. Whatever the relative merits of these comments, the important issue is that this widespread perception tends to undermine confidence in NMFS-sponsored science, especially where the stakes are perceived to be high, as in the Gulf shrimp fishery. As one Sea Grant scientist working at the state level put it, "Our biggest advantage is that we're *not* NMFS." NMFS' dual role complicates the task of building trust with industry. One participant from at the state level in the South Atlantic said, "I get so mad at them for shooting themselves in the foot" when they assign enforcement responsibility to gear specialists, and continued by arguing, "That's the problem with NMFS; there's no way they can be a regulator in the morning and an educator in the afternoon."

7.4.6 Amendment 9 decreased cooperation

The evidence seems is clear that the overall level of cooperation dropped dramatically in 1998 after the regulations mandating BRDs were released. This timing was unfortunate because it prevented development of valid estimates of fleetwide BRD performance. Because regulations often, but not always, reduce cooperation, at least in the short term, it would have been ideal to ensure that key pieces of information are in hand before regulations are implemented. The timing of regulations cannot always be so finely tuned, but their possible impact on the availability of crucial information should be considered in the planning process.

7.4.7 Better industry organization could promote problem solving

Many sources, from industry, government, and other groups, noted that the shrimp industry is poorly organized. One observer noted that, "One of the biggest problems in working with the shrimp industry is that it was closer to dealing with 15,000 to– 20,000 small businesses." One shrimper complained about the difficulty of building an active organization and acknowledged industry's role in the lack of effective problem solving, "Fishermen are poorly organized and this makes it hard to reach agreement; there's nobody to deal with." For example, there were only a total of 15 attendees at two public hearings in late 1995 to consider Georgia's proposed BRD rule and a total of three written comments received over a period of two months. There was equally low turnout at similar meetings in South Carolina. Many industry associations have shrunk in size over the years and shrimpers are often reluctant to pay dues or otherwise fund organizations. One knowledgeable long-term participant from the South Atlantic claimed that a better organized industry would "absolutely" promote the development and implementation of improved solutions. It may be useful for NMFS to consider ways of fostering the development of active industry organizations, perhaps working through local Sea Grant or marine extensions programs.

7.4.8 Single-species bycatch reduction can be problematic

One long-term participant in the South Atlantic argued that focusing bycatch reduction efforts on one or two species can be counterproductive and create unnecessary resistance:

> It would have been less contentious if we had just said, "Come on, let's reduce fish bycatch, we're catching a lot of fish." But managers may not have been able to turn that into a law; the good of the overall ecosystem is not a good enough argument. The regulatory and legal system doesn't really support ecosystem management yet.

As a result of the focus on weakfish, some fishermen contest the need for BRDs by maintaining they don't catch weakfish. In addition, the removal of bycatch reduction requirements for spanish mackerel undermined the credibility of the stock assessment and decision-making process that had, just a short time before, asserted that spanish mackerel stocks were in serious trouble. It may be worth investigating the usefulness of alternative, ecosystem-level arguments for reducing bycatch in some situations.

7.4.9 Large-scale gear development has inherent contradictions

The Program provided the information needed to certify a small number of BRDs for use over wide geographic areas. According to some participants in the South Atlantic, smaller-scale differences in bottom habitat, tidal dynamics, boat sizes, net types, and target and bycatch species made it problematic to certify one or a very few BRDs that worked effectively in all conditions. However, it can be prohibitively expensive to duplicate gear research for a wide range of local conditions and this can also lead to a complex administrative system in which different regulations are promulgated and enforced in different areas. While uncomfortable with the "one size fits all" approach generally used in the BRD research program, individual shrimpers would be equally uncomfortable with the increased costs stemming from a patchwork of BRD regulations that required different BRDs in different areas.

7.5 Summary

To summarize, the cooperative BRD research program was an ambitious, large-scale undertaking that broke significant ground by setting up formal structures for collaborative decision making about research and BRD certification. The program achieved its goals of certifying BRDs that met minimum requirements. It also highlighted the importance of past history in influencing attitudes as well as how differences in states' roles affected the course of events.

8 Cooperative Tagging Center and Cooperative Shark Tagging Program

8.1 Introduction

The evaluation of these two tagging programs for highly migratory species 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 8.1 and 8.2 and the Methods chapter (chapter 3) for more detail). This review summarizes the programs' history and focuses on how they have been affected by the recent shift to more restrictive fishery management plans for highly migratory stocks. The overall challenge facing these programs is finding a way to maintain a needed cooperative atmosphere when industry perceives that the data they help to gather are being used "against them" to restrict quotas and areas of operation. The Cooperative Tagging Center (CTC) and the Cooperative Shark Tagging Program (CSTP) (part of the Apex Predators Program) have many similarities and are therefore dealt with together in this chapter, although they are conducted and managed separately.

Table 8.1. Sources interviewed.

Name	Title & Organization	NMFS	Fisher
Cooperative Tagging Center			
Al Anderson	Captain, recreational charter boat		X
Nelson Beideman	Executive Director, Blue Water Fishermen's Association		X
Dr. John Graves	Virginia Institute of Marine Science; chair, ICCAT Advisory Committee		
Rebecca Lent	Chief, Highly Migratory Species Division	X	
Ellen Peel	Executive Director, The Billfish Foundation		X
Dr. Eric Prince	Chief, Migratory Fishery Biology Branch SEFSC; Director, Cooperative Tagging Center	X	
Dr. Jerry Scott	Chief, Sustainable Fisheries Resources Division, Southeast Fisheries Science Center	X	
Other fishers			X
Coop. Shark Tagging Program			
Nelson Beideman	Executive Director, Blue Water Fishermen's Association		
Teri Frady	Chief of Research Communications, Northeast Region	X	
Glen Hopkins	Commercial fisherman		X
Dr. Nancy Koehler	Director, Cooperative Shark Tagging Program	X	
Other fishers			X

Table 8.2. Additional sources.

Source	Description
CTC	
NMFS	Cooperative Tagging Center web page: www.sefsc.noaa.gov/public/tag.html.
NMFS	C. D. Jones, M. T. Judge, M. A. Ortiz, D. S. Rosenthal, and E. D. Prince. 1995. Cooperative Tagging Center Annual Newsletter: 1995. NOAA Technical Memorandum NMFS-SEFSC-364.
NMFS	C. D. Jones, D. S. Rosenthal, T. L. Jackson, M. T. Judge, and E. D. Prince. 1996. Cooperative Tagging Center Annual Newsletter: 1996. NOAA Technical Memorandum NMFS-SEFSC-391.
NMFS	M. Ortiz, D. S. Rosenthal, A. Venizelos, M. I. Farber, and E. D. Prince. 1998. Cooperative Tagging Center Annual Newsletter: 1998. NOAA Technical Memorandum NMFS-SEFSC-423.

Source	Description
NMFS	E. L. Scott, R. E. Bayley, J. Tashiro, and C. Watada. 1991. Cooperative Game Fish Tagging Program Annual Newsletter 1990. NOAA Technical Memorandum NMFS-SEFSC-295.
Publication	G. A. McFarlane, R. S. Wydoski, and E. D. Prince. 1990. External tags and marks: Historical review of the development of external tags and marks. American Fisheries Society Symposium. 7: 9-29.
Publication	E. L. Scott, E. D. Prince, and C. D. Goodyear. 1990. History of the Cooperative Game Fish Tagging Program in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, 1954 – 1987. American Fisheries Society Symposium. 7: 841-853.
CSTP	
NMFS	Apex Predators Program web page: www.nefscsharks.nmfs.gov/.
NMFS	The Shark Tagger: Newsletter of the Cooperative Shark Tagging Program.
Publication	J. G. Casey and N.E. Kohler. 1990. Long Distance Movements of Atlantic Sharks from the NMFS Cooperative Shark Tagging Program. In: S.H. Gruber, ed. Discovering Sharks. 1990. American Littoral Society, Highlands, N.J. pp.87-90.
Publication	Casey, J.G. 1985. Transatlantic Migrations of the blue shark; a case history of cooperative shark tagging. pp. 253-268. In: R.H. Stroud, ed. World Angling Resources and Challenges. Proceedings of the First World Angling Conference, Cap d'Agde, France, September 12 to 18, 1984. Int. Game Fish Assoc., Ft. Lauderdale, FL.

8.2 The setting

Large, highly migratory species in the Atlantic Ocean, such as sharks, tunas, swordfish, and billfish, are targeted by both sport and commercial fishers. Their wide geographic range has made it difficult to gather basic information about distribution, movement patterns, and life histories, information that is essential to management. The Cooperative Tagging Center (CTC) is managed out of NMFS' Southeast Fisheries Science Center in Miami and focuses on highly migratory species such as tunas and billfishes. The Cooperative Shark Tagging Program (CSTP) focuses primarily on sharks and is managed from the Narragansett Lab of NMFS' Northeast Science Center. Both programs originated as research efforts to improve basic understanding of movement patterns and biology. Over time, the data they produced became more closely linked to the management and regulatory process. Both programs have a long history of cooperating with each other. For example, numerous shark recoveries are often reported to the CTC and then turned over to the CSTP. Alternatively, numerous swordfish and tuna are tagged and recaptured out the CSTP and are then report to the CTC.

8.3 The story

The history of both programs follows a similar pattern. An earlier, extended phase of program expansion and cooperation among participants is followed more recently by a period of building resentment and waning interest as management decisions impact industry.

8.3.1 Cooperative Tagging Center

Phase I: Growth and expansion. The Cooperative Tagging Center (CTC), formerly titled the Cooperative Game Fish Tagging Program, is a joint research effort by scientists at NMFS' Southeast Fisheries Science Center in Miami, FL and recreational and commercial fishermen. The program was created in 1954 by Frank Mather of the Woods Hole Oceanographic Institution to focus on bluefin tuna, but quickly expanded to include billfishes and other tunas. The program became a joint effort of NMFS and Woods Hole in 1973 and the sole responsibility of the NMFS Southeast Fisheries Science Center upon Mather's retirement in 1980. At present, target species include sailfish, blue marlin, white marlin, swordfish, bluefin and yellowfin tuna, and other tunas such as albacore, bigeye, blackfin, and skipjack. The program became immensely popular with both recreational and commercial fishers and over 34,000 are listed as current participants. Ellen Peel, Executive Director of the Billfish Foundation, an association of sport fishers, pinpointed a key reason for sport fisher's support for the program, "From an angler's perspective, they saw first-hand that catch numbers were going down and that they weren't catching as many fish as before." The opportunity to become directly involved in improving the scientific data base for management decisions was thus attractive to both sport and commercial fishers.

Ellen Peel describes the importance of the tagging effort to the sport fishery at greater length:

> The tagging program has been very important to us. What we have found here is that it has been the single most important tool or conduit for educating the public in a hands-on experience of scientific data gathering and contributing to data. It provides us an opportunity to explain why data are important, how to place tags, and manage the data. We send out brochures with every tag kit we sell or give away and we have a video we're in the process of updating to provide free to clubs. When we go to fishing events or clubs in person, then we do demos and share information.

During this first phase, which extended from 1954 to about the mid-1990's, the program exhibited many traditional indicators of growth. The species list expanded, as did the numbers and types of participants. Program staff conducted outreach activities to publicize the program and the value of tagging information. Scientists visited numerous fishing tournaments beginning in the early 1970s and this, according to long-time participants, provided the sport fishing public an opportunity to get to know scientists first-hand. Long-term participants described anglers' excitement at participating in improving the scientific knowledge base. Similar outreach activities increased support and interest among commercial fishers.

In general, sport fishers do the majority of the tagging and retrieval for the billfishes, while the bulk of the tag retrieval and reporting for swordfish and bluefin tuna are from the commercial fishers. This reflects the fact that, historically, recreational fishers have released a greater percentage of their catch for the recreational species. However, some commercial fishers have tagged significant numbers of fish. Given the wide distribution of the target stocks, tag retrieval and reporting is necessarily an international activity. As described below, fostering and increasing the participation of foreign fishers and scientists has been one of the program's main challenges.

Over time, however, the program's popularity began to exceed its abilities to provide tags and manage the return data. Again, Ellen Peel comments that, "The Billfish Foundation realized that NMFS couldn't keep up with the demand [for tags]," and longtime commercial fishers made similar observations (see next section). Participants had also historically tagged a wide range of non-target (mostly nearshore) species of interest to them (such as king mackerel and red drum) and, by the late 1980s, almost 50% of available tags were being placed in non-target fishes. The program's growth led to the development of cooperative alliances (formalized in an official memorandum of understanding) between the CTC and the Billfish Foundation in 1990 and the BOAT/U.S. Clean Water Trust in 1996. The Billfish Foundation, which represents recreational fishers of large game fish, helps fund the purchase and distribution of tags for the program's target species. The BOAT/U.S. Clean Water Trust has taken over the provision of tags for nearshore, non-target species that are of great interest to many participants but not part of the central mission of the CTC. Also in 1996, the Federation of Japan Tuna Fisheries (FJTF) began volunteer billfish tagging from their high seas longline operations, as part of an international tagging program initiated under ICCAT.

The CTC also worked cooperatively with the Billfish Foundation to develop improved tags with better retention characteristics. For example, a lengthy cooperative double tagging study rigorously compared the effectiveness, in terms of infection rates, retention, and effects on growth of new, more biologically compatible, tag designs. In addition, the program has continuously worked to develop, systematize, and publicize methods for capture, tagging, release, and data management (see McFarlane et al. 1990, Jones et al. 1995, 1996, and Ortiz et al. 1998). While not part of the CTC, a large-scale volunteer industry effort, beginning in 1990, to gather samples of gonads and other tissues to aid stock assessment built on the relationships established through previous tagging efforts. An important aspect of the CTC's efforts has been its participation in reward programs to recognize fishers who tag or release fish. For example, the Axelson Fishing Tackle Company (AFTCO), in cooperation with the CTC, awards trophies to those tagging the most of each of the seven designated species. CTC participants are also eligible for $500 annual lottery awards from ICCAT. The CTC lists its most active taggers in the annual newsletter and awards a special embroidered program cap to each person reporting a recapture.

The only problems identified in a formal review of the program's efforts through 1987 (Scott et al. 1990) were an inability to generate adequate international participation and the inaccuracy of volunteer taggers' size estimates of tagged and released fish. For example, Dr. Prince, the Center's current director, tells about a Venezuelan captain who refused to return tags because he thought they were FAO (United Nations Food and Agricultural Organization) tags and FAO had never benefited him. In response to this information, the cooperative international efforts through the ICCAT Enhanced Research Program for Billfish rented a small office on the dock in Cumana, Venezuela, with posters (in Spanish) advertising cash payments for tag returns. This approach increased tag returns in the southeastern Caribbean by 30% compared to the same area during the previous 15 years. Most recently, in 1996, the Federation of Japan Tuna Fisheries (FJTF) started its volunteer tagging activities for billfish from their high seas longline operations in 1996 as part of an international tagging program initiated under the auspices of ICCAT.

Despite the expanding participation during this first phase, and the active support from many industry segments, there remained visible signs of resistance, particularly among foreign fishers, to providing regulatory agencies with information. For example, Dr. Prince reports that, according to the ICCAT landings data base, high-seas longline vessels (from numerous nations) land about 70-90% of all Atlantic billfish in any given year. However, the offshore longline fleet provides less than 20% of returned tags to the CTC. In addition, the overall tag return rate for billfish is much lower than for bluefin tuna, swordfish, and yellowfin tuna where commercial fisheries exist. The presence of such disproportionate returns suggests intentional underreporting of tag recaptures, even after making allowances for fish mortality and tag shedding. In fact, Center personnel and others have heard both first- and second-hand accounts of captains with jars of NMFS tags on board that they will not return, partly because they do not want to provide tangible evidence they are "handling fish they claim they never handle" and partly because of deep-seated suspicion toward any regulatory agency. There is some evidence, in higher return rates from the eastern Atlantic, that pressure from ICCAT in recent years has improved reporting in foreign fleets. This additional source of information has proved extremely valuable in improving the understanding of larger-scale stock structure in the Atlantic.

This lengthy growth phase was marked by relationship building, expanding interest and participation, the improvement and standardization of tags and tagging methods, and the development of useful new knowledge. Trends in some of these indicators began to reverse in the mid-1990s as both recreational and commercial fishers took issue with NMFS' management decisions and as budget constraints limited the program's ability to provide tags and process data.

Phase II: Resentment and resistance. The program's second phase has occurred against the backdrop of more restrictive management decisions. These decisions have resulted from increased pressure from conservation groups, information that indicated key stocks have declined, and new policies on overfishing in the 1996 Magnuson-Stevens Fisheries Conservation and Management Act. It is not unusual for members of both the commercial and recreational segments to be suspicious of the data underlying management decisions that restrict their activities. In this instance, however, the fact that U.S. fishers had actively cooperated in gathering some of the data on which these decisions were based helped create a sense of betrayal. As one captain who has been an active tagger for many years put it:

> I can tell you this, recent decisions with regard to the management of pelagic species have put a sour taste in the mouths of those who have been long-time supporters of NMFS. Many in the … community have decided not to support NMFS any further… Some ask me why I tag fish for people who limit our access to the resource. I'm being asked some very difficult questions.

It is impossible to quantify how much such anger about management decisions has reduced participation in the tagging program. However, it is not difficult to find U.S. captains, both recreational and commercial, who will admit, off the record, that they have reduced or discontinued their tagging and/or reporting efforts for this reason.

We found that resentment about management decisions took two forms. The first was a more general anger, among both commercial and recreational fishers, that quotas and other restrictions were increasing, often based on data provided cooperatively through the tagging program. The second took the form of more specific complaints about the analysis and interpretation of tag return data. Fishers voiced explicit disagreements with the way conclusions were drawn about stock boundaries, distribution patterns, and other parameters that entered into management decisions. They pointed to particular results and/or perceived discrepancies in analyses to argue that management decisions were, in some cases, more influenced by politics than science.

In addition to these resentments, funding constraints hampered the CTC's ability to produce enough tags to fill all requests from participants. While support from the Billfish Foundation has helped ease this shortage, it has not completely resolved it. Both CTC staff and participants in the commercial industry, in particular, cited restrictions on the availability of conventional (as opposed to the newer archival) tags. Commercial captains are no longer routinely given 50 or 100 tags at a time and this has contributed to reduced interest in the program.

We found, however, that another factor may have also contributed to a decline in fishers' interest. Nelson Beideman, Executive Director of Blue Water Fishermen's Association, observed that:

> The reason the program got started was that scientists said they needed the information. Everybody now just figures that they got what they needed. If there was a push [from scientists] then industry would get more involved again. There's been no recent push… There needs to be a plan that everybody is a part of so they can see what's necessary [in terms of knowledge and additional data] for each of the highly migratory species and lay out a plan for how to get there.

There may be a perception among some of the CTC's participants that the program's original purpose has been fulfilled and that further effort will not pay useful dividends. This perception may also exist among some scientists and NMFS managers. The program's emphasis has traditionally been on documenting basic patterns of distribution, movement, and growth and it has achieved significant progress in these areas. Because additional improvements in these areas does not necessarily require continued large-scale, long-term tagging efforts, the base of scientific support for the program may be shrinking. While recent improvements in data analysis methods have permitted the use of tagging data in stock assessments, this new application for the program's data is relatively new and has not been widely publicized.

At this point, despite its past accomplishments, a combination of factors is contributing to an erosion of interest and participation in and support for the Cooperative Tagging Center.

8.3.2 Cooperative Shark Tagging Program

In most respects the structure, history, and purpose of the Cooperative Shark Tagging Program (CSTP) parallel that of the CTC. The CSTP is a joint research effort by scientists at the Narragansett (RI) Laboratory of NMFS's Northeast Fisheries Science Center and recreational and commercial fishermen. The program was created in 1962 by Jack Casey of the U.S. Fish and Wildlife Service's Sandy Hook (NJ) Laboratory and moved to its current home at NMFS's Narragansett Laboratory in 1966. The program targets large Atlantic sharks and, beginning from a base of fewer than 100 volunteer taggers, has expanded to include over 6,500 volunteers from the Atlantic and Gulf coasts of North America and Europe. Volunteers in the program's early years were primarily recreational fishers because there was little commercial fishing on sharks at that time. Participants were motivated primarily by an interest in helping to improve basic knowledge on stock identity, movement, rates and routes of migration, abundance, age and growth, mortality, and behavior, as well as by the excitement of tagging itself. As the commercial fishery developed and the program grew, participants became increasingly interested in providing information to improve management decisions.

As with the CTC, recreational fishers account for most of the tagging and both commercial and recreational fishers for the recaptures. Between 1962 and 1995, more than 128,000 sharks of 40 species have been tagged and more than 6,000 sharks of 32 species have been recaptured. The program has had difficulty meeting the demand for tags from participants and, on occasion, has had to ration them and target distribution to specific regions.

By all accounts, Jack Casey's personality was a key to the program's development. Nancy Koehler describes Jack Casey's early efforts to begin the shark tagging program:

> Success has been largely because of Jack's personality… there are some people who are just so interested in what they are doing that they suck you in. He was very charismatic, involved, and willing to listen. He would go to the docks, talk to the guys, keep in contact throughout the year, and help out whenever he could. His approach has always been very sincere.

Just as with the CTC, the program's expansion phase was followed, beginning in the mid-1990's, by a period of more restrictive management decisions and increasing resentment, particularly among commercial participants. Just as with the CTC, we found fishers who acknowledged they have reduced or discontinued their tagging and/or reporting efforts.

The program has attempted to respond to this by maintaining a clear distinction between their role as scientists and management decisions made elsewhere in NMFS. As Nancy Koehler describes it:

> … this is an area where those problems [conflicts over management] are ignored. In many cases we have been able to be outside or above those problems. That [science] is our role and

> we are very careful; we aren't enforcement. This is part of the reason for our success. They are willing to be more open with us because we focus on the science, go to tournaments, they show us their fish. In the past, this has worked to give us better communication. [But] there is no question that regulations do hurt us in terms of their participation or good will. They don't feel they can participate because of regulatory restrictions.

The CSTP thus faces the same central challenge the CTC does, maintaining involvement in the face of increasing concern and contention over management decisions.

8.4 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.

8.4.1 Fishers were deeply interested in marine ecosystems

Both programs tapped into a deep reservoir of interest among commercial and recreational fishers in improving the basic knowledge base about fish stocks. For example, Nancy Koehler says, "There is no question that high-seas fishermen want to know more. They are unbelievable observers." This formed the raw material the programs built upon. While a necessary ingredient, this interest alone was not enough to ensure success. It had to be matched with an equivalent input from scientists that provided the specific rationale for how tagging results would be useful in management. Conversations with fishers in the other cases and more broadly in other fisheries indicate that this level of interest is typical. Many, although certainly not all, fishers are both curious about marine ecosystems and willing to contribute in some way to improved understanding.

8.4.2 Consistent, personal outreach fostered involvement

This reservoir of interest was tapped primarily through consistent outreach at the personal level. Nancy Koehler's description of Jack Casey's early efforts is paralleled by Ellen Peel's account of a scientist from the Panama City (FL) Laboratory who in the early 1970s attended every angling tournament he could to explain the importance of tagging. As a result, the involvement of early participants was asked for, encouraged, and fostered, often on an individual basis. While, as Nancy Koehler puts it, "There is only one Jack," several of the other cases show that consistent relationship-building can have a lasting beneficial impact on cooperative programs. In fact, one key finding of this case is that such benefits can last as long as ten or 20 years, especially if consciously reinforced by program managers.

8.4.3 Industry was an equal partner

Both tagging programs also demonstrated that fishers are willing and able to learn and apply new techniques, perform high-quality data gathering, participate in field tests of new methods, and understand the uses and implications of data, e.g., how differential return rates in different areas impact on assumptions about stock structure. This was consistently true across the other cases as well, indicating that industry members can be equal partners in many aspects of the design and implementation of cooperative data gathering efforts.

8.4.4 Two key weaknesses of voluntary programs

However, the CTC and, to a lesser extent, the Cooperative Shark Tagging Program also highlighted two key weaknesses of such cooperative, voluntary programs. First, fishers from other countries are often not as responsive to incentives as the U.S. fishers active in these two programs. Such incentives include an interest in improving basic knowledge, which often reflects a longer-term perspective, the excitement of being involved in science, competition for awards with other participants, and monetary rewards. Second, neither program has solved the riddle of how to maintain interest when management decisions restrict catch quotas and fishing activity. Thus, NMFS has had a difficult time maintaining a distinction between its management and science activities. The agency's regulatory role inevitably spills over into science activities. For example, shark fishers' respect and liking for Nancy Koehler on a personal level has not overcome their anger at management decisions nor prevent a reduction in their level of cooperation. This is a structural problem for NMFS that we identified in other case studies as well. It may be impossible to successfully maintain this distinction, especially as the stakes for both recreational and commercial fishers rise and science becomes ever more critical in decision making. As the next paragraph suggests, the tagging programs may benefit from removing this distinction and linking their data gathering efforts more explicitly to the information needs of management decisions.

8.4.5 It may be time to redefine goals

The CTC is now over 40 years old and it may be time to redefine its basic purpose and communicate this through renewed outreach activities. This could provide a means of recapturing attention and maintaining involvement among recreational and commercial fishers, even in the face of restrictive management decisions. In fact, conflicts over specific management decisions, and over the interpretation of data used in stock assessments, could provide a starting point for discussions about what information is needed to resolve disagreements. These in turn could help define agreements about specific data gathering activities needed to fill these information gaps. Soliciting fishers' involvement in defining knowledge gaps and identifying how these relate to management decisions that directly affect them could re-engage them in data gathering efforts. Fishers' past involvement in data gathering has given them some sense of ownership about the programs and this has actually been fostered by programs. The down side of this sense of ownership is the feeling of betrayal that "our data is being used against us." However, this sense of ownership can also provide the leverage needed to revive interest and participation. In any case, periodically reexamining its underlying scientific purpose (i.e., what are we trying to learn, how can we learn it, how can we tell when we've arrived?) is a healthy exercise for any long-term program.

8.4.6 Summary

To summarize, the shared interest in improving basic biological understand, fostered by the personal outreach of key fisheries scientists, laid the foundation for the long-term success of these tagging programs. More recently, industry reactions to regulatory restrictions and improvements in scientific understanding make the time ripe for a careful reconsideration of the programs' goals.

9 The Pinger Solution

9.1 Introduction

The evaluation of the collaborative development and implementation of porpoise avoidance devices by New England sink gillnetters, conservationists, scientists, and managers 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 9.1 and 9.2 and the Methods chapter (chapter 3) for more detail). This review focuses primarily on the activities of the Harbor Porpoise Working Group (Group), an ad hoc effort to assess the ability of pingers to deter harbor porpoises from sink gillnets in New England. It does not examine the subsequent activities of the Harbor Porpoise Take Reduction Team, which operated under the more formal prescriptions of the Marine Mammal Protection Act (MMPA).

Table 9.1. List of interviewees

Name	Title & Organization	NMFS	Fisher	Academic	Other
Laurie Allen	Northeast regional office	X			
Ted Ames	Past Executive Director, Maine Gillnetters' Association		X		
Eric Anderson	New Hampshire gillnetter		X		
Dr. Rollie Barnaby	New Hampshire Sea Grant			X	
Kevin Chu	Northeast regional office	X			
Michael Crowley	Correspondent, National Fisherman				X
Pat Fiorelli	Fishery Analyst and Public Affairs Officer, New England Fisheries Management Council				
Teri Frady	Head of research communications, NMFS, Woods Hole	X			
Scott Kraus	New England Aquarium			X	
Dr. Jon Lien	St. Johns University, Newfoundland			X	
Debra Palka	Research Fisheries Scientist, NMFS Northeast Regional Office	X			
Dr. Andy Read	Duke University; past chair TRT Scientific Review Group			X	
Sharon Young	Humane Society of the US				X
Dr. David Wiley	Senior scientist, International Wildlife Coalition				X

Table 9.2. List of additional sources. NMFS refers to the National Marine Fisheries Service.

Source	Description
NMFS	Summary of multispecies (groundfish) management plan, www.nefmc.org.
NFMS	Petition to list harbor porpoise under the Endangered Species Act.
NMFS	NMFS. 1993. Proposed listing of Gulf of Maine population of harbor porpoises as threatened under the Endangered Species Act. Federal Register 58: 3108-3120, January 07, 1993.
NFMS	NMFS. 1998. Feds and northeast gill netters to reduce harbor porpoise entanglement in gear. Press release, December 1, 1998. www.noaa.gov/public-affairs/pr98/dec98/noaa98-r169.html.
NMFS	G. T. Waring, D. L. Palka, K. Mullin, J. W. Hain, L. J. Hansen, and K. D. Bisack. 1997. Marine mammal stock assessments – 1996. Northeast Fisheries Science Center.
NMFS	G. T. Waring, D. L. Palka, P. J. Clapham, S. Swartz, M. C. Rossman, T. V. N. Cole, K. D. Bisack, and L. J. Hansen. 1999. U.S. Atlantic marine mammal stock assessments – 1998. Northeast Fisheries Science Center.

Source	Description
Publication	Anonymous. 1999. Harbor porpoise factsheet. www.imma.org/porpoise.html.
Publication	R. Barnaby. 1995. Harbor Porpoise Working Group: A solution to bycatch in the Gulf of Maine sink gill net fishery. Nor'easter, spring/summer 1995. Seagrant/gso.uri.edu/region/noreaster/noreasterSS95/bycatchrefs_barnaby.html.
Publication	R. Barnaby. 1997. Using collaborative problem solving: Process in fisheries management decisions. Presented at the annual meeting of the American Fisheries Society, Monterey, CA, August 1997.
Publication	T. Corey and E. Williams. 1995. Pinger Power. Nor'easter, spring/summer 1995. Seagrant.gso.uri.eduk/region/noreaster/noreasterSS95/Bycatch_SS95.html.
Publication	COSEWIC home page: www.cosewic.gc.ca.
Publication	M. Crowley. 1993. Do net pingers shoo away marine mammals? National Fisherman. May 1993, 42-43.
Publication	A. J. Read. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. Rep. International Whaling Commission Special Issue 15: 133-147.
Publication	J. Fullilove. 1994. How to make a gillnet 'pinger.' National Fisherman. May 1994, 29.
Publication	S. D. Kraus, A. Read, E. Anderson, K. Baldwin, A. Solow, T. Sprawling, and J. Williamson. 1995. A filed test of the use of acoustic alarms to reduce incidental mortality of harbor porpoise in gillnets.
Publication	S. D. Kraus, A. Read, E. Anderson, K. Baldwin, A. Solow, T. Sprawling, and J. Williamson. 1997. Acoustic alarms reduce porpoise mortality. Nature 388: 535.
Publication	S. Pollack. 1994. A promising collaboration. pp. 57-59, in Win-Win Bycatch Solutions, ed. by B. Warren, National Fisheries Conservation Center and Journal Publications, Seattle.
Publication	D. Schneider. 1996. Can New England fishermen and harbor porpoises co-exist? Scientific American, online edition, September 1996. www.voyagepub.com/stories/0996mar7.htm.
Publication	B. Warren. 1994. Counting porpoises: high stakes guesswork in the Gulf of Maine. National Fisherman June 1994.

9.2 Background

In 1991, members of the New England commercial fishing, conservation, scientific, and fisheries management communities formed an ad hoc working group to discuss the entanglement and death of harbor porpoises in gill nets. This Harbor Porpoise Working Group continued meeting for about four years, disbanding once its studies were successfully completed and as the New England Fisheries Management Council began implementing time-area closures to protect harbor porpoise.

The factions involved in the Group were motivated by the threat of fisheries closures under the MMPA and fears about the implications of a potential listing under the Endangered Species Act (ESA). While it was not obvious what these implications might be, it was clear that, under the provisions of the ESA, "everything would have to be considered differently because it ups the ante." Thus, public opinion, the threat of potential pressure from the judiciary, and a collective desire to end the threat to the porpoise population prompted the activities of the Group. Its early meetings were characterized by confrontation, accusation, and heated argument, but the members eventually resolved themselves into a meaningful collaboration. Though not without continuing disagreement on some points, the Group met regularly and accomplished some notable achievements. Among these was the creation of a program to develop, test, and implement the use of an alarm device, colloquially called a pinger, that can be attached to gillnets to warn porpoises away. In 1998, pingers became an integral element of the federal fishery management plan for the gillnet fisheries from Cape Cod Bay to the Eastern Gulf of Maine. This development of pingers is widely regarded as among the most successful collaborations of its kind.

9.3 The setting

In the 1980s, scientists and conservationists grew increasingly concerned that the entanglement of porpoises in commercial sink gillnets from Cape Cod Bay to the Eastern Gulf of Maine might pose a serious threat to the continued survival of the species. The harbor porpoise *(Phocoena phocoena)* is among the world's smallest cetaceans, growing to an average length of 1.55 meters and weighing 55 kg., and generally inhabiting coastal waters in depths of less than 150 meters. They are migratory, moving from the Bay of Fundy to Cape Hatteras, and very susceptible to incidental harm and mortality from commercial fishing operations world wide. Because harbor porpoises are migratory, reliable populations assessments have proved elusive. However, improved survey and analysis methods used in 1991, 1992, and 1995 surveys produced an average estimated population size of 54,300 for the Gulf of Maine / Bay of Fundy population (Waring et al. 1997).

Most of the information that raised concerns about fishery impacts on the species, however, came not from population studies but from federal and state observation of entanglements in fishing gear. For the period 1990 – 1995, mortality and serious injury from such entanglements were estimated by NMFS to be about 1,833 per year (Waring et al. 1997), and, for the period 1992 – 1996, 1,460 (Waring et al. 1999). This level of bycatch mortality was above the estimated reproductive rate of the population. The 350 or so boats of the sink gillnet fleet, ranging in size from 35 - 50 feet, posed the greatest threat to the harbor porpoises in New England waters. The mammals pursue cod, haddock and pollock into the nearly-invisible nets, which can be up to 3,000 feet or more in length, and become entangled, suffocate, and die. Fishermen try to avoid them not only for conservation reasons, but because the porpoises often seriously damage their gear.

9.4 The story

The story begins as an ad hoc and collaborative effort in the early 1990s to devise a solution to porpoise entanglements through the Harbor Porpoise Working Group and ends years later in the more formal Take Reduction Team process set up by the Marine Mammal Protection Act. Although the circumstances in the two time periods differed, this case does allow for some comparisons between the two kinds of problem solving efforts.

9.4.1 Motivation for collaboration

In 1986, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) confirmed the harbor porpoise as threatened and designated it as endangered in 1990. By 1990, the United States was faced with considering similar designation under the Endangered Species Act (ESA). In February of 1991, the Sierra Club Legal Defense Fund filed a petition, on behalf of the International Wildlife Coalition in Falmouth, MA and several other groups, to list the harbor porpoise as threatened or endangered under the ESA, an action that triggered a formal status review by NMFS. In parallel, however, some conservationists involved in the listing petition also realized that so dramatic a threat to fishing fleets could potentially be unpopular and possibly politically disastrous in some quarters. More importantly, as Sharon Young describes it:

> I know that litigation can push things in unproductive directions … [and] … that people are more apt to do something if they understand why there is a problem and are more invested in the solution.

Therefore, Dave Wiley of the International Wildlife Coalition (one of the parties to the listing petition), Bob MacKinnon (President of the Massachusetts Gillnetters' Association), Sharon Young of the Humane Society, and Karen Steuer of the Center for Coastal Studies met at Dave Wiley's home in 1991 to discuss the possibilities of a collaborative solution to the porpoise bycatch problem. A major outcome of this meeting was their decision to convene a larger group to explore this option further (see next section for more detail).

By 1992, with the listing petition filed and national and New England environmental advocates threatening to pursue this aggressively, fishermen realized the issue would not disappear on its own. Conservationists had recently won significant victories involving dolphin mortality in offshore tuna seines and turtle mortality in Gulf of Mexico shrimp nets. The New England gillnetters therefore realized they possibly faced drastic closures of certain prime grounds when fishing was best but when porpoise were also most numerous. And NMFS, given its statutory responsibility for developing regulatory measures to respond to any ESA listing, began to consider its options for such measures. In 1993, Bill Fox, NMFS's current director, wrote the New England Fishery Management Council, asking them to consider porpoise bycatch as part of the multispecies (groundfish) fishery management plan. The council was at the time developing Amendment 5 to the fishery management plan, which would further regulate a range of gear types, including gillnetting. Fox believed it would be more sensible to develop any regulations needed to reduce porpoise bycatch in the context of the fishery management plan, rather than as a separate ESA activity. Thus, while there was still plenty of room for disagreement and debate about the population statistics and mortality rates, the harbor porpoise issue was clearly on the front burner for all factions.

9.4.2 The Harbor Porpoise Working Group

In 1991, members of the fishing fleet and their advocacy organizations first responded to these developing pressures by raising money and girding for battle. Later in 1991, however, gillnetter Bob MacKinnon and Dave Wiley of the International Wildlife Coalition, following on their earlier meeting at Wiley's home, organized a larger meeting at the New England Aquarium to explore solutions to the porpoise problem. They invited key people already involved in the harbor porpoise conflict. Many of these people had known and worked with each other, not always on the best of terms, in the past during other collisions between fishermen and conservationists over the increasingly stressed marine resources off New England. In addition, there were personal relationships, "Some of my best friends are current or former fishermen," (Sharon Young) and this strengthened the desire to try for a collaborative solution. This personal knowledge of each other is widely cited by participants as a primary ingredient in the eventual success of the pinger collaboration, as was the blend of representation across the spectrum of the various factions. This meeting at the New England Aquarium of what was to become the Harbor Porpoise Working Group included:

- Eric Anderson, a gillnetter and future member of the New England Fishery Management Council;
- Ted Ames, Executive Director of the Maine Gillnetters' Association;
- Dr. Rollie Barnaby, University of New Hampshire Sea Grant, a key motivator and facilitator in this process;
- Doug Beach, National Marine Fisheries Service, Protected Resources Division;
- Ellie Dorsey, Conservation Law Foundation;
- Pat Fiorelli, a staff member at the New England Fishery Management Council, who played a key role as a liaison between the ad hoc group and the council;

- Scott Kraus, New England Aquarium, former fisherman and later chief scientist on the NMFS/NFWF study of pinger effectiveness;
- Bob MacKinnon, fisherman, president of the Massachusetts Gillnetters Association and early promoter of the working group;
- Dr. Andy Read, Duke University scientist familiar with the Canadian porpoise listing
- Ronald Smolowitz, gear developer and fishing industry consultant;
- Karen Steuer, Center for Coastal Studies, Provincetown, MA, an independent research organization; and
- Dave Wiley, International Wildlife Coalition.

The evolution of the working group is best captured in the following comments by key participants.

Rollie Barnaby stated:

> We spent a year doing nothing but calling each other names and yelling. The only reason you go to meetings like this in the beginning is to call each other assholes. Why we kept going back I don't know, but we had all day meetings and we always went to lunch together. At the end of the year, we said, "What are we doing? Let's try to write a goal and figure out why we're meeting together." The goal was so simple: To reduce the take of porpoise with the least possible impact on fishermen.
>
> The next thing we learned was that there were some things we were never going to agree on. We were never going to agree on the population of those animals… So we said, "Let's stop arguing about that one." We got to the point where we could also say, "We're going to have to modify our fishing gear or we're talking about massive closures." That's why fishermen worked so hard in this process. During the entire existence of the working group, we never took a single vote. All our action was by consensus.

Pat Fiorelli remembers that:

> The work group grew from people having heated, polarized discussions to inviting scientists to speak and actually doing some real information gathering since nobody could even agree on the facts of the situation. Conservationists came (to meetings), fishermen came, council staff came. We only took action or wrote a letter to somebody when we had consensus. We eventually all agreed on pingers being a potential solution and wrote to (then NMFS director) Bill Fox.
>
> Part of the group's success probably came from informal social gatherings after hours. We went out together and got to know each other, and we dropped the guises people usually bring to formal meetings. We liked each other. Later, when this got into the formal council process, the coalitions broke down when people gave testimony, but the main work was done.

Scott Kraus added:

> Fishermen don't trust statistics, and there really were serious statistical problems with earlier population and mortality studies. Statistics have been the downfall of fishermen forever, and when they came to the group at first they just wanted to argue that they weren't killing as many porpoises as the environmentalists and NMFS said. I had to convince them that that wasn't good enough and they finally got it because the petition to list porpoises was looming.

> At the beginning of an effort like this, it is necessary to contribute your own time, gratis. I was compelled as a conservationist and former fisherman. The option of just shutting down the fisheries wasn't acceptable.

After agreeing to disagree on the statistics of porpoise population and entanglement, the working group turned its attention to finding ways to reduce porpoise entanglement and death regardless of the statistics. The group perceived pingers as a win-win solution because of the potential to reduce porpoise mortality without extreme restrictions on fishing effort. However, there was resistance to the concept of acoustical deterrence (pingers) within both NMFS and the environmental community for a variety of reasons, including the difficulties of enforcing deployment and ensuring that pingers were actually working once deployed. Members of the Working Group were aware of the animal behaviorist Dr. Jon Lien's (Memorial University, St. Johns, Newfoundland) successful work deterring large cetaceans from highly vulnerable cod traps. Rollie Barnaby contacted him for advice and, as Bamaby describes it, "Jon loaded his pickup truck with pingers and drove for two days, gratis."

9.4.3 Gear development: The pinger experiments

Between 1992 and 1995, three studies took place under the auspices of the Harbor Porpoise Working Group in attempts to determine pingers' effectiveness in deterring porpoise entanglement. The first was conducted by Jon Lien and four fishermen, with virtually no budget. The second was conducted by Lien and the third, which finally led to acceptance of pingers by NMFS and the conservation community, was financed by NMFS and the National Fish and Wildlife Foundation and conducted by Scott Kraus of the New England Aquarium and Andy Read of Duke University. Each study attempted to correct the perceived deficiencies of the previous study.

Study #1, Fall 1992, Jeffrey's Ledge, Gulf of Maine. This was essentially a preliminary experiment, conducted on a shoestring budget, and using Jon Lien's pingers, which were large and designed for whale avoidance on cod traps. Four fishermen volunteered their vessels for the study, which only a small number of sample sets. Many pingers were lost due to a flawed method for attaching them to the nets. There was much variation in where pingers were placed on the nets and the experiment was also criticized for the way in which the locations of experimental and control sets were chosen. Though subsequent studies validated pingers' effectiveness, critics at this early stage suggested that nets with pingers might simply have been set where there were no porpoises. Despite the lack of a rigorous study design, the results of this first study were encouraging to the Working Group, even if they were not completely scientifically defensible. Nine porpoise became entangled in unpingered nets; none in pingered nets.

Study #2. Fall, 1993, Jeffery's Ledge. In the second study, carried out a year later, four boats fished for an entire season with NMFS observers aboard. (NMFS paid the observer costs, a total of about $8,000.) For this study, fishermen built their own, smaller, pingers with Lien's help. They placed pingers on half their gear, sometimes using two pingers per string (one at each end) and sometimes just one. Of the nets with pingers on each end, 32 porpoises became entangled in unpingered nets and only one in pingered nets.

A disagreement arose at this point between NMFS and fishermen on the interpretation of the study's results. This centered around differing approaches to classifying nets as either pingered or control, based on the number and placement of pingers. While valid from a statistical point of view, this disagreement nevertheless frustrated fishermen, who argued they had entangled 41 porpoise in unpingered nets over two years, and only one in a pingered net, and still nobody seemed to believe them.

This rift irked fishermen, threatening the continued viability of the collaboration and the Harbor Porpoise Working Group. Key participants recall that the entire collaboration could have come apart at this point, but that Barnaby's leadership and the group's reservoir of good will saved the project. The group overcame this challenge with its decision to send a delegation of fishermen and conservationists together to Washington, D.C. to lobby for funds for a more scientifically valid study the next year. This presentation of a united front, fostered by the ad hoc relationships in the working group, produced results. Within months, NMFS had agreed to finance up to $250,000 in observer coverage for the next (1994) season, and the National Fish and Wildlife Foundation offered $250,000 for other study costs.

Study #3. Fall, 1994. The Working Group's goal was to mount a study that would resolve the design flaws of previous studies and produce data that would be scientifically and statistically defensible. Scott Kraus from the New England Aquarium agreed to be the principal investigator, and New Hampshire fishermen again agreed to participate. This time, Kraus used 15 boats instead of four, in a double-blind design, so fishermen would not know whether they were fishing pingered or unpingered gear, though they would attach a device to all nets. Pingers were water-activated, so the fishermen didn't know which were live or dummy when they set, though they could tell when they hauled back because the pingers were beeping. (They sound like the alarm of a school bus backing up.) This methodology assured immunity from the criticism of the earlier two experiments, that fishermen could skew the sample by simply setting pingered gear where they were sure there were no porpoises in the area.

Some fishermen resented the need for the double-blind methodology, expressing anger that NMFS just didn't trust them. Fishermen also objected to the NMFS recommendations for the size and placement of the nets. NMFS wanted the nets laid out in a grid, but fishermen objected because this was contrary to common practice, and they prevailed on this point. They did agree to use NMFS recommended groupings of 12 300-foot-long strings of gear. Fishermen agreed to these and other NMFS suggestions, Kraus said, because of the magnitude of the threat to their ability to continue fishing. Time and area closures sufficient to protect the dolphins would have devastated them. "It always helps to have the big sword hanging on the wall," Kraus said.

The results of this third study validated those of the shoe-string studies of the past two seasons: Unpingered nets caught 25 porpoises, pingered nets caught two.

Further studies. 1995 and 1996. Following the 1994 controlled study, four experimental fisheries were conducted to further investigate pingers' effectiveness. In these studies, all nets in a designated area used pingers, but only a portion of these were observed. In 1995, at Jeffreys Ledge, no porpoises were observed taken in 225 pingered nets. In 1996, at Jeffreys Ledge, nine porpoises were taken in 88 observed hauls. In Massachusetts Bay, two porpoises were taken in 171 observed hauls, and, just south of Cape Cod, no porpoises were taken in 53 observed hauls.

9.5 Outcomes

9.5.1 Regulatory time and area closures

During the period described above (1991 – 1994), the New England Fishery Management Council implemented a number of modifications to the Northeast Multispecies (groundfish)

Fishery Management Plan (FMP) that imposed restrictions on gillnetting to reduce the incidental take of harbor porpoise. These closures were executed against the backdrop of increasing pressure for large-scale reductions in fishing mortality to help rebuild depressed groundfish stocks in the region. Amendment 5 to the FMP was intended to reduce fishery mortality by about 50% through a similar reduction in fishing effort, accomplished by capping allowable days at sea, limiting access through a permit moratorium, and other measures. Despite growing concerns about groundfish stocks, however, large area closures were not widely considered at this time.

As a matter of policy, the Council tried, wherever possible, to overlap closure areas intended to reduce porpoise take with those intended to rebuild groundfish stocks. Despite consistent effort, however, the council was not successful at designing closures that simultaneously served both purposes, partly because there were very few closures during the early 1990's intended to reduce groundfish mortality. The closures specifically intended to reduce porpoise bycatch were enacted through the following measures:

- Framework 4, implemented May 25, 1994, which established the initial area closures to reduce the bycatch of harbor porpoise in the sink gillnet fishery.
- Framework 12, implemented October 30, 1995, which expanded the area and extended the time period of the Mid-Coast Closure Area to reduce the bycatch of harbor porpoise in the Gulf of Maine gillnet fishery.
- Framework 14, implemented March 5, 1996, which specified additional area closures.
- Framework 15, implemented September 11, 1996, which detailed additional area closures.
- Framework 16, implemented March 3, 1997, which severely restricted the use of small mesh pelagic gillnets, used as bait nets by lobstermen and tuna fishermen, in the harbor porpoise closure areas. Such nets could only be deployed when tied off to the boat and checked frequently.

During the period these closures were being implemented, pingers were still in a testing phase. The Council supported the use of pingers in certain closed areas under experimental fishing permits in order to assess their effectiveness (see preceding discussion of the three pinger studies). The Working Group' motivation remained the same – to develop methods that would reduce porpoise bycatch and thus stave off widespread time and area closures. However, NMFS's status review of the ESA listing petition was stalled and pressure from this quarter was of immediate significance.

9.5.2 MMPA reauthorization and the end of the Working Group

The reauthorization of the MMPA in 1994 included the establishment of Take Reduction Teams (TRTs) for several species, including harbor porpoises. By this time, the closures described above had had only limited success at reducing porpoise bycatch. This was because these initial closures had closed only relatively small areas. When fishing effort moved to areas just outside the closures, the resultant concentration of boats actually increased bycatch in some cases. Although the council had at first defined the minimum closures possible, every year saw the closures expanded and bycatch reduced. Thus, conservation advocates continued to push for further measures to reduce porpoise bycatch, a position that was strengthened by the MMPA's requirement that bycatch be reduced to a defined level (potential biological removal, or PBR). While the MMPA, under section 118, specifically recognized past efforts to reduce porpoise bycatch (i.e., closures and pinger development), Congress nevertheless set a deadline of April 1, 1997 for reducing mortality to the PBR level. This deadline represented an extension of almost one year beyond the original language in the MMPA, in recognition of the magnitude of the problem in New England.

With the completion of the third pinger study in late 1994, and the pending development of the TRT mandated by the reauthorized MMPA, the Working Group disbanded. Its primary goal of developing a workable porpoise deterrent had been met and many of its participants were soon to take their places on the more formally structured TRT for harbor porpoise. This group was larger, subject to bureaucratic constraints that did not apply to the Working Group, and under constant pressure to develop a Take Reduction Plan (TRP) that would meet the MMPA's statutory deadline of April 1997. As a result, according to several participants in both groups, the TRT was a much more contentious vehicle for collaboration than was the ad hoc working group. Although some participants (mostly fishermen) took issue with NMFS's population and bycatch estimates, the MMPA gave the TRT no authority for altering these.

With the arguments about population and bycatch estimates again off the table, the TRT continued the Working Group's pursuit of a solution that would protect both harbor porpoise and industry's ability to fish. It developed in 1996 a TRP based primarily on closures and the use of pingers. By using pingers, sink gillnetters can fish inside closed areas, unless the area also becomes part of a groundfish closure. In this case, all fishing activity on groundfish must cease. This TRP was a consensus plan, that is, all members of the TRT agreed to its provisions; not all TRTs resulted in consensus plans. Following a suit brought by the Humane Society, the International Wildlife Coalition, and the Center for Marine Conservation in 1998 against NMFS to implement the TRP, it was implemented on December 8, 1998. Shortly afterward, the New England Fishery Management Council approved Framework 28 of the Northeast Multispecies Fishery Management Plan to bring the Management Plan into agreement with the TRP. (Note that the regulations implementing the council's fishery management plan are in force only in federal waters. The MMPA's Take Reduction Plan, in contrast, extends to the shoreline, including state waters.) The Harbor Porpoise Working group thus ultimately met their goal of reducing porpoise entanglement with as little damage to the fishing fleet as possible. The suit mentioned earlier in this paragraph also asked NMFS to make a decision on the 1991 listing petition and NMFS decided in January 1999 not to list the harbor porpoise as threatened or endangered.

Of the approximately 350 boats active in the fishery in 1992, however, about 100 no longer gillnet, primarily those that fished the Eastern Gulf of Maine where closures in response to the collapse of groundfish stocks, along with an unwillingness to use pingers, led this portion of the fleet to abandon the fishery. In addition, the presence of a productive coastal lobster fishery provided a ready alternative for many Gulf of Maine gillnetters. Gillnetters in New Hampshire established a pinger co-op to purchase and maintain the devices. When a skipper heads for the grounds, he orders up the pingers he needs for the trip and picks them up on the dock. The Humane Society and the Center for Marine Conservation used their award of legal fees in the 1998 suit against NMFS to purchase pingers for gillnetters in New Hampshire, Maine, Massachusetts, and Rhode Island who requested them in response to a notice in National Fisherman Magazine.

Fishermen now say that the first generation of pingers could be vastly improved upon, but that they and NMFS are involved in much more critical resource issues and their priorities for activism and action lie elsewhere. Chief among these possible improvements is a change in the alarm frequency to one that would not attract pinnipeds, which treat the pingers as dinner bells. Unlike harbor porpoises, which avoid the pinger alarm, seals are attracted to pingered nets, where they eat fish caught in the nets, resulting in lost or damaged catches.

About 80,000 small cetaceans are caught in fishing nets every year and the success with harbor porpoises has helped to stimulate pinger experiments are going in many places throughout the world. The results of the collaboration of the Harbor Porpoise Working Group, the Lien and Kraus and Read studies, and subsequent work by gear manufacturers to develop effective, inexpensive pingers are of immense value beyond the New England grounds.

Table 9.3. Timeline for the development of the pinger solution.

Date	Event
1986	COSEWIC confirms harbor porpoise threatened
1990	COSEWIC lists harbor porpoise as endangered
1991	Petition to list harbor porpoise under Endangered Species Act filed
1991	Start of Harbor Porpoise Working Group
1992	1st experiment
1993	Fox request to council to include solution in FMP
1993	2nd experiment
1994	3rd experiment
1994	Framework 4 closes areas to gillnetting to reduce the bycatch of harbor porpoise
1994	Amendment 5 closes areas to gillnetting
1995	Framework 12 expands time and area of Mid-Coast Closure to reduce the bycatch of harbor porpoise in the Gulf of Maine gillnet fishery
1996	Framework 14 establishes additional area closures to reduce bycatch of harbor porpoise in the Gulf of Maine gillnet fishery
1996	Framework 15
1997	Framework 16 prohibits the use of small mesh pelagic gillnets (bait nets) in the harbor porpoise closure areas
1995	Take Reduction Team established
1998	Take Reduction Plan implemented

9.6 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.

9.6.1 Technical solutions can work

This case study provides clear evidence of the viability, in some instances, of technological solutions to bycatch problems. The pinger solution was based on related experience in a similar situation in Canada and some understanding of porpoise behavior. Although the original pinger design had to be modified to fit the different fishing gear in New England, the history of past success in deterring whales and the promising results from the initial trial in New England were enough to encourage continued development and testing. It proved important to make using pingers as easy and convenient as possible. Reducing their size, improving their reliability, and using a pinger coop to relieve individual fishers of responsibility for maintaining the equipment were all useful development. More fundamentally, it was fortunate that some members of the Group were familiar with Dr. Lien's work in Canada; without this the technology would never have been transferred to New England. A readily accessible clearinghouse of information on solutions to bycatch and related problems could be equally useful in other similar situations.

9.6.2 Pending regulation can motivate action

This case also provided a clear example of the power of pending closures or other restrictions and potential increases in administrative requirements in motivating industry to seriously consider solutions to the porpoise bycatch problem. No one was sure what the results of an ESA listing would be; for example, other marine mammals such as the humpback whale had been listed without major impacts on fishing practices. However, industry members were certain that, at a minimum, the level of administrative aggravation would increase dramatically, as would uncertainty about the future of the fishery. Our contacts were unanimous in their judgment that the combination of apprehension about closures and anxiety about increased uncertainty were the key factors in persuading industry to seek an alternative solution to the bycatch problem.

9.6.3 The threat of legal action can motivate cooperation

Shortly following the filing of the petition to list the harbor porpoise under the ESA, key members of both industry and conservation groups realized the benefit of developing a parallel, less formal process to search for solutions to the bycatch problem. They recognized the downsides to the legalistic listing process, including a possibly lengthier route to a solution, more time and energy spent in administrative and legal procedures, ongoing damage to porpoise stocks, continued and increased uncertainty for industry, and delays in focusing on actual problem solving. The parallel, ad hoc process avoided these shortcomings without closing out participants' options to return to the more legalistic process if the Group's efforts failed.

9.6.4 Effective leadership was essential

Establishing the Group depended primarily on two things – the motivations mentioned above (fear and uncertainty), along with credible leaders who could commit at least a significant portion of their constituency to the ad hoc process. Leadership continued to be important throughout the Group's lifetime. Different leaders were important at different stages, depending on the primary issues facing the Group. Initially, Dave Wiley, Bob MacKinnon, and Karen Steuer were instrumental in selling the idea of a less formal process to a wider audience. As the Group began its work, John Lien provided the technical leadership needed to begin testing and adapting the pingers in the New England environment. At a later stage of development, Scott Kraus and Andy Read developed the more detailed study design needed to substantiate pinger performance and Tim Smith, of the Northeast Fisheries Science Center, helped make the Group's case to NMFS and the National Fish and Wildlife Foundation for funding to carry out the third and final study. The informal structure of the Group, and the trust developed throughout the first year of venting and relationship building, made it easier to shift the leadership role as needed. The question of how to first identify and then enlist and sustain the participation of such leaders cuts across all the case studies and is discussed in the Summary chapter.

9.6.5 Opportunities for venting can be useful

Interviews with key participants suggest that the early opportunity for Group members to vent their frustrations was an important part of the Group's ultimate success. Although it can appear counterproductive at the time, such venting is often necessary in contentious situations where tensions are high and people are feeling threatened and/or misunderstood. It is a chance to get everyone's issues out in the open, discover misperceptions and stereotypes, and identify elements that must be part of any workable solution. By all accounts, while at times uncomfortable, this process was managed well enough that it did not drive participants further apart. In analogous situations, ad hoc working groups should include members who are familiar with and can help manage this early stage of group development.

9.6.6 Find ways to motivate volunteer efforts

Volunteer efforts were essential to the success achieved in this case. The contributions of Lien and the industry members who carried out the early studies laid the groundwork needed to attract the funding for the final, more rigorous, study. These volunteer efforts were motivated by a desire to find a nonregulatory solution to the bycatch problem and the shared belief that pingers would be effective. Where sufficient funding is not immediately available, similar future efforts should ensure that their members include those who can volunteer needed time, skills, knowledge, and materials and/or recruit those who can.

9.6.7 Fishers and scientists view evidence differently

There was a clear tension between scientists' and fishers' different approaches to evaluating and interpreting evidence on pingers' effectiveness. This is a common theme in cooperative studies of this type. Scientists' desire for more rigorous studies, designed to produce statistically significant results, and their different rules of evidence, look like overkill to fishers. Conversely, fishers' willingness to depend on their personal observations and experience, and to base conclusions on smaller amounts of data, can look like wishful thinking to scientists. These differences can be an important source of frustration, especially when time is perceived to be short, because gathering additional data can defer resolution of the problem, delay implementation, and raise costs. In this case, despite their frustration, fishers finally accepted that a more rigorous study was simply a necessity for getting the decision-making system to accept their evidence as valid. Scott Kraus apparently played a key role in this process, both because he represented a more neutral institution (New England Aquarium) and was able to communicate readily with fishers. In other instances, some have suggested that a solution to the tension between fishers' and scientists' approach to evidence is to provide fishers' some sort of basic training in study design. Participants in the pinger case considered this unrealistic; they believe that such information must be directly connected to a pressing problem to be retained and applied. Otherwise, it is simply too far outside the limits of normal, day-to-day activities to be retained.

9.6.8 Strategic outside funding made the difference

Despite the Group's early progress, the outside funding from NMFS and NFWF was the element that finalized the Group's success by providing the resources to carry out the more formal, scientifically valid study (Study #3). It was important that both industry and conservation parties supported this request together. It was also helpful that members of the Group and people they were associated with were familiar with the funding system and helped develop the funding request. In some cases, industry groups are large and well funded enough to pay for such research on their own. For other smaller ones, such as the sink gillnet fishery, outside support can be essential to success. Such efforts should therefore ensure they have access to needed expertise in obtaining additional funding at the appropriate stage in the problem solving effort.

9.6.9 Summary

To summarize, the threat of impending regulatory closures and a common desire to avoid a lengthy and contentious legal process motivated industry and conservation representatives to create an informal, alternative problem-solving process. This process benefited from having a possible technological solution to focus on and from the presence of participants who were able to provide different kinds of leadership throughout the Group's various stages of development. While volunteer efforts were instrumental in gathering evidence for the viability of the pinger solution, it was not until substantial outside funding was obtained that the Group was able to finally design and carry out the rigorous study that convinced scientists and managers of pingers' effectiveness. As a result, pingers have been recognized in regulations as a practical solution to the harbor porpoise bycatch problem.

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. Http://www.nero.nmfs.gov/ro/doc/nr9933.
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 Scallopers 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. http://www.nefmc.org/documents/scallop.htm.
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.

Source	Description
Publication	DuPaul, W. And J. Kirkley. 1998. Virginia Sea Grant Marine Resource Advisory No. 71 VSG-98-10. December 1998. Online. 4 pp.
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. http://www.boston.com/news/daily/05/fish_plan.htm.
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."