Proceedings of the New England Bycatch Workshops

November 23, 2002 - Narragansett, RI
December 3, 2002 - Portland, ME
December 4, 2002 - Portsmouth, NH
February 1, 2003 - Groton, CT

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Cover photo: Fishermen hauling a 3-inch control mesh codend net used in gear selectivity experiments. *Photo courtesy of Rhode Island Sea Grant Sustainable Fisheries Extension Program.*

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"As we move forward we need to recognize that the general goal of the various interest groups is the same—a healthy ocean with sustainable fisheries. We need to find ways to work together on what we agree on and find ways to address the things we disagree on."

—Workshop participant

General Introduction

Margaret Petruny-Parker, Rhode Island Sea Grant Program

Bycatch is a complex term with different meanings depending on who you are, where you are, and what time period is being considered. In the United States, current law defines bycatch as “discards” with the underlying concern being the fate of discards or discard mortality. While the unintentional take of marine mammals, sea turtles, and birds remains an important concern, the primary bycatch or discard concern currently in the New England region pertains to discards associated with the harvesting of finfish, particularly in the region’s quota-managed groundfish fisheries.

From November 2002 through February 2003, Sea Grant Fisheries Extension programs in Rhode Island, Maine, New Hampshire, and Connecticut hosted a series of fisheries educational workshops on the bycatch situation as it relates to New England fisheries. As part of a larger series of educational workshops on key fisheries management issues, the bycatch workshops were aimed at providing a foundation of information for future fisheries management and policy discussions. They provided an opportunity for commercial and recreational fishermen, managers, scientists, environmentalists, and others to share up-to-date information and observations and to begin a dialogue about possible next steps.

Each of the four workshops followed a similar structure centered on what the term bycatch means, what is currently known about bycatch in New England through the National Marine Fisheries Service (NMFS) Observer Program, observations from fishermen, state regulatory agency assessments, and what information is available on options to reduce the problem through the use of emerging gear technologies and management strategies. Representatives from the partner Sea Grant programs, NMFS, the fishing community, state management agencies, the Manomet Center for Conservation Services (Manomet), and the New England Fisheries Management Council (NEFMC) presented information on each of the major topics identified above. Each presentation generated follow-up comments, questions, and answers. Each workshop also included discussion among workshop participants on how the bycatch situation in New England fisheries can be improved and the appropriate actions needed to make continued improvements.

This document is a composite summary of the four workshops and includes an overview of each of the presentations as well as comments, questions, and answers generated by the presentations. Also included is a summary of the discussions that took place near the end of each workshop either through a panel format or general audience discussion. Finally, at the end is a summary of the overlapping themes that emerged at all four workshops in the major areas of data collection, research, management, education, and process.

Workshop Overview

This workshop was the first in a series of three workshops covering the topics of bycatch in New England fisheries, marine protected areas (MPAs) as they relate to fisheries management, and property rights in fisheries management. The workshops were conducted in four states as a joint effort by the Rhode Island, Connecticut, Maine, and New Hampshire Sea Grant programs and the NMFS Northeast Fisheries Science Center (NEFSC). The Lake Champlain Sea Grant Program was also a partner in the Rhode Island workshop.

Opening Remarks

Rhode Island Bycatch Workshop
Saturday, November 23, 2002
Coastal Institute Building, University of Rhode Island Bay Campus
Narragansett, Rhode Island

Kathleen Castro, Rhode Island Sea Grant Program

Bycatch is an important issue that affects the sustainability of fisheries. It reduces yield, gives a general perception of waste, and may harm stocks. Bycatch is a combination of several issues that need to be discussed collectively to find effective and creative solutions. This workshop is structured around three main questions:

- What is bycatch?
- What do we know or not know about the bycatch situation in New England fisheries and how it affects us?
- What are the possible solutions?

The speaker presentations will be followed by a panel discussion. Panelists will be asked to present their ideas about how we can work together to find and implement solutions.

Maine Bycatch Workshop
Tuesday, December 3, 2002
Holiday Inn by the Bay
Portland, Maine

Sherman Hoyt, Maine Sea Grant Program

Bycatch is an issue in which there appears to be a lot of good news. But Maine fishermen are very discouraged about the state of the industry. And the overall picture is bleak. In a vision statement from website fishresearch.org [Gulf of Maine Aquarium]:

"From the late 1800s through the 1970s, fishermen and scientists interested in the Gulf of Maine fishery ecosystem interacted and cooperated on a regular basis. During the 1980s and early 1990s, this relationship was strained during the bitter debates over proposed fishing restrictions on Georges Bank and in the Gulf of Maine.

To the immense credit of both fishermen and scientists, these two communities have recognized that they need each other, that the sum of their understanding of the fishery ecosystem is greater than their individual knowledge, and that they need to reestablish trust and working relationships. The hunger of all parties to acquire better information on the fishery ecosystem, the resurgence of fish stocks on Georges Bank, the desire to develop greater consensus about management strategies for the Gulf of Maine, as well as extensive cooperative efforts among science, industry, and management and substantial new federal funding, have set the stage for an exciting period of collaborative fishery research."

The challenge is to find a way to collaborate to work to solve problems facing the fishing industry.

New Hampshire Bycatch Workshop
Wednesday, December 4, 2002
Urban Forestry Center
Portsmouth, New Hampshire

Rollie Barnaby, New Hampshire Sea Grant Program

The purpose of workshop is to highlight what bycatch is and what is being done about it.

Connecticut Bycatch Workshop
Saturday, February 1, 2003
University of Connecticut, Avery Point
Groton, Connecticut

Nancy Balcom, Connecticut Sea Grant Program

This series is meant to be a forum for fishermen (commercial and recreational), the public, and resource managers (both federal and state) to share information and begin to discuss these topics/issues.

The focus of these workshops is on education. Since there are no regulations at stake, the intent is to have a candid, informal discussion about the issue of bycatch. Our thoughts, together with those generated at the other workshops, will be combined into a composite summary that can be used to further address the problem of bycatch.

Part I

What Is Bycatch?

General Overview: Bycatch—Definition, Causes, and Types

Presented by Laura Skrobe, Rhode Island Sea Grant, at the Rhode Island, Maine, and New Hampshire Workshops

Presented by Tessa Simlick Getchis, Connecticut Sea Grant, at the Connecticut Workshop

Defining Bycatch

Bycatch is not a new issue or problem. It has existed since fishing first began. Virtually all fisheries in the world have some bycatch associated with them. Definitions of bycatch specifically cover:

- Incidental catch (Marasco and Terry, 1982) or unintended fisheries catch (NOAA, 1997)
- Any catch of species (fishes, sharks, marine mammals, turtles, seabirds, etc.) other than the target species (Bailey et al., 1996)
- Unwanted species or individuals caught during fishing operations (Hall, 1996)
- The unwanted portion of the catch taken while fishing for specific target species (Isaksen and Valdermarsen, 1994)
- The harvest of fish or shellfish other than the species for which the fishing gear was set (Wallace and Fletcher, 2000)
- Portion of the catch returned to the sea as a result of economic, legal, or personal considerations, plus the retained catch of non-targeted species (McCaughran, 1992)
- The portion of a fishing catch that is discarded as unwanted or commercially unusable (American Heritage Dictionary)

The Magnuson-Stevens Act (MSA) (1996) defines bycatch as “fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. [Bycatch] does not include fish released alive under a recreational catch and release fishery management program.” In the Act, fish are defined as “…finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds.”

Causes of Bycatch

Bycatch exists because of the imperfect nature of fish capture, the limited selectivity of certain fishing gear, the behavior and distribution of fish, and the structure of management programs. The following examples illustrate how these factors cause bycatch:

- Limited selectivity of certain fishing gear (Alverson, 1998; NOAA, 1998)
  –Examples of nonselective gear uses are trawling for flatfish and longlining for swordfish, in which bycatch often includes sharks, marlins, tunas, and turtles.
  –An example of a selective fishing method is harpooning for swordfish. Some consider gillnetting for salmon, mid-water trawling for Atlantic herring, and purse seining for menhaden “clean” fishing because the species are targeted by sight and the gear is set right on them so that a low percentage of the total catch is bycatch. Some consider pot fishing to be clean as well.
- Fish behavior and distribution that result in a mixture of species occupying the ocean space subject to a fishery or fisheries (Alverson, 1998)
  –The co-occurrence of many groundfish species results in trawl catches that typically contain several species of different sizes and sexes. Each of these species may be subject to a specific regulatory regime (e.g., minimum size, net mesh–size restriction, trip limits, and area closures). The resulting array of regulations leads to discarding.
  –Lobster pots that can capture not only lobster but black sea bass, tautog, and crabs also produce bycatch.
- Management programs, such as a quota system, may result in high-grading (discarding of small specimens of the target species to make room for more valuable specimens of the same species) when the total allowable catch is limited (Clucas, 1996)

Types of Bycatch

Bycatch can be categorized as either regulatory discards or economic discards. *Regulatory discards* are harvested fish that fishermen are required by regulation to discard whenever caught or are required by regulation to retain but not sell (MSA, 1996). This includes fish that may be below legal size or which are caught in excess of established bycatch or catch quotas. *Economic discards* are fish that are the target of a fishery but cannot be retained because they are of an undesirable size, sex, or quality, or for other economic reasons (MSA, 1996). Specific examples include:

- Fish of the wrong species (non-target species), including nonmarketable species caught in floating fish traps, groundfish caught during scallop dredging, and even a sea robin, for example, caught recreationally instead of fluke
- Fish of the wrong size; specifically, regulated species below legal minimum landing size, but also individuals that command too low a price on the market to be worth landing. This type of bycatch occurs in just about every fishery, even though there is no size restriction in the regulations
- Fish of the wrong sex, such as berried female lobster, which are subject to processing and marketing considerations
- Fish damaged by gear through mishandling or by predation while in the nets, such as fish in a gillnet eaten by sea lice
- Fish captured beyond quota, including small specimens of the target species discarded to make room for more valuable specimens of the same species (Clucas, 1996). This high-grading practice may also involve species of low market value or damaged or poor quality fish that are discarded to allow retention of more marketable specimens. High-grading may occur in any commercial fisheries regulated by a quota system and in recreational fisheries with imposed fish limits. Fluke is a good example of a fishery likely to practice high-grading.
- Fish or other organisms designated prohibited species that, by law, must be returned to the sea. Marine mammals, turtles, and birds, as well as certain fish are prohibited species and become bycatch in situations such as whales entangled in lobster pot lines, sea turtles entrapped in trawl nets, and sturgeon caught in floating fish traps

Comments and Questions

- In the olden days, we used bycatch for bait. With the scarcity of fish and increased regulations, we now have a different way of doing business.
- Is bycatch a term for non-target species that are kept? Maybe it can be broken down into bycatch and discards.
- In the United States we are constrained by the MSA. Some of the definitions come from other countries with other types of regulations. We are really talking about discards and the fate of discards or discard mortality.
- Discards are treated as negative in the MSA, although the Act recognizes that they cannot be totally avoided. We need to use fishing practices that minimize it—get the discards over the side quickly, shorten tows, or allow fishermen to keep discards.
- We need to define what we are trying to achieve: What is the baseline where we can say that the bycatch problem is being solved? The MSA recognizes that bycatch can't be totally avoided—it must be minimized to the extent practicable. The difficulty comes in defining the phrase, "extent practicable." Fishermen, managers, and environmentalists may all have different perspectives on this.
- We need to recognize that the law is the law. We need to look at the law and recognize that it defines bycatch as discards. The MSA also recognizes that bycatch cannot be avoided, but discard mortality needs to be minimized.
- The term bycatch is so tainted by the legal environment and the media.
- We need to find ways to reward the people who reduce discards.
- Discards are wasteful, particularly juveniles of fish species we are trying to rebuild.
- Fishermen and others want to avoid the waste.
- A lot of fishermen use their 100-pound trip limits as a kind of bycatch fishery. If they know they're limited to 100 pounds of scup, and they know they will definitely catch more than the limit, they use that day to target another species and use the 100-pound allocation as a bycatch fishery. They target what they can catch the most of, knowing they will fill the smaller amounts allocated in "bycatch quota" as well.

- A fisherman in Rhode Island used to fish with his father and they would catch everything and process it for fishmeal. So whenever they would catch something nice, like a fluke, they would put that in a basket on the side and say, “Be careful with that, that’s bycatch.” That’s what they were actually targeting because that’s what was of value.
- When a lot of fishermen think about the bycatch issue, they say, “It’s not bycatch, it’s incidental catch.” There are major fisheries with multiple target fish. Some are minor in terms of volume and can be considered incidental, but it’s a component of the value landed. So fishermen don’t like to hear bycatch described as unwanted, because often it can be important to them.
- In the past, fish that were regarded as discards are now targeted. So what used to be a discard is now either bycatch or targeted, and the things that are discarded now—that are not regulatory discards—will be future targets. Soon we’ll be fishing for sea robins! It’s important to be careful when discussing discards and bycatch to make that distinction.
- At a recent meeting, I asked shellfishermen attendees to talk about the topic of bycatch. They actually have a good amount of bycatch, but the bycatch for them—be it fish or shellfish—may be more valuable. Bycatch can enable shellfishermen to get into another fishery, especially if one fishery is slowing down. Usually you see the opposite of that, like lobstermen moving into the hard clam industry. But oystermen are getting into hard clams as well; shellfishermen are starting to look at the word “bycatch” differently.
- Bycatch should be thought of in terms of the fate of the discards—the overall discard mortality. Some species, such as scallops, may survive when discarded while other species do not. Discard mortality is the real issue. There is little information on fish survivability.
- Certain fishing practices or certain species will have mortality percentages assigned, such as 8 percent or 10 percent. These are the numbers that should be used to calculate mortality; but for the estimates, all discards are considered to be mortalities (100 percent mortality).
- There has been some short-term work done in Connecticut with winter flounder—mortality was well under 50 percent.
- In Rhode Island some work has been done with scup mortality, and we were surprised by how hardy they were. They were caught, trawled, and monitored, and they held up well after being caught twice.
- Using tautog as an example: All fish caught in recent trawl study survived. Tautog is a very hardy fish.
- We need to do more research on actual versus estimated discard mortality.
- There is no incentive for fishermen to try out new gear concepts to reduce bycatch. It takes an initial investment, then an application for an experimental gear permit that requires numerous trials. This is a failure by management to encourage new technology.
- The experimental gear permitting process has also frustrated the fisheries councils; the problem in part is attorneys. Some requests for experimental fishing permits had to go through an Environmental Impact Statement/Environmental Assessment (EIS/EA) process. If an EIS is needed, it requires a lot of work and research to be put into something that may not pay off. This is the result of a legally driven process.
- A lot of applications for experimental fisheries have no chance of success. They have to demonstrate a reasonably valid experimental approach, and few actually do that.
- Research set-asides are seen to basically favor one or two fishermen by giving them access to 1,000 pounds per day and leaving other fishermen without that quota. This creates discrepancy and affects the price at the dock. It is a potentially bad situation. There needs to be more sensitivity in research set-asides regarding how these dealings affect fish prices at the dock. Research set-asides are a good concept in theory; in practice, it still needs a lot of work to get the maximum benefit.
- Manomet has looked at a number of research set-asides and decided that they weren’t worth our while to pursue because whatever money comes from the sale of the fish pays only for the vessel. There’s nothing left to pay for the science.

Virtually all fisheries in the world have some bycatch associated with them.

Part II

Bycatch in the New England Fisheries

Quantifying Bycatch: A Report on the Observer Program

Presented by Michael Fogarty, NMFS, at the Rhode Island Workshop
Presented by David Potter, NMFS, at the Maine, New Hampshire, and Connecticut Workshops

Putting scientists at sea on commercial boats has a long history. In this region it can be tracked back to 1915 when observers stood on board steam trawlers. Since then, observers have been an integral part of the research program. As an onboard observer, one gains a critical understanding of the issues facing today's fishermen and the actual operation of the fishery. In recent years, the observer program has been expanded in response to management needs.

On the East Coast, the NMFS Observer Program began in 1977 when the extended jurisdiction act was passed and foreign vessels started obtaining permits to fish our waters. It was important to monitor their catch, so we put observers on every foreign vessel. In 1988, we started a small domestic observer program. The domestic observer program began with an emphasis on monitoring bycatch of protected species. In 1990, the observer program was driven primarily by protected species concerns; and through the 1990s, the emphasis remained on marine mammals. At that time, only 5 percent of observed trips were directed at fish. Now the emphasis is on discards of groundfish. Additionally, observers now monitor new gear testing in experimental fisheries and obtain economic information. They do not monitor for compliance. NMFS currently has court-ordered mandates to meet a certain level of observer coverage. In 2002, the agency was ordered to have 5 percent observer coverage in the multispecies groundfish fishery. NMFS is meeting the requirement. This figure will increase to 10 percent in coming years unless adequate justification is provided for lower levels of coverage. Prior to the court-ordered mandate, NMFS was attaining 1 to 2 percent observer coverage overall.

The organization of the NMFS Northeast Fisheries Observer Program is outlined in Table 1. Note that NMFS observers are hired by contract; they are not NMFS employees.

Table 1. NMFS Northeast Fisheries Observer Program organization

• Branch Chief	• Administrative Assistants (2)
• Branch Secretary	• Supervising Editor (1)
• Biologists (6)	• Editors (3)
• Statistician (1)	• Data Entry (3)
• Computer Assistants (1)	• Area Coordinators (3)
• Program Director (Contractor)	• Observers (43)

The objectives of the NMFS Northeast Fishery Observer Program are to:

- Work with industry to improve the fishery information base—information obtained only by working with commercial fishermen
- Monitor biological characteristics of catch; for example, size and age composition of catch
- Estimate the take of protected species, such as sea turtles and marine mammals, as stipulated by regulation
- Monitor discards, an important factor used in stock assessments
- Monitor experimental fisheries, such as the small mesh fishery for silver hake in the Gulf of Maine, to determine whether it is meeting "clean fishery" requirements
- Design and monitor conservation gear

- Obtain economic information, including costs associated with fishing, to determine economic impacts of certain regulatory measures
- Monitor foreign fisheries

The total annual budget for the Northeast observer program is $7 to $9 million. Funding comes from NMFS, the Atlantic Coast Cooperative Statistics Program, the NMFS Office of Protected Species, and industry-funded fisheries. Each observer program day-at-sea costs $1,150. In 2001, Northeast observers spent 2,300 days at sea, making 1,495 trips and 7,784 hauls, primarily using gillnets and otter trawls (Fig. 1). The large effort placed on gillnets is due, in large part, to the marine mammal entanglement issue. Information collected by observers is synthesized through NMFS for use by nongovernmental organizations and the states (Fig. 2).

Figure 1. 2001 observer coverage by gear type. The large effort placed on gillnets is due primarily to the marine mammal entanglement issue.

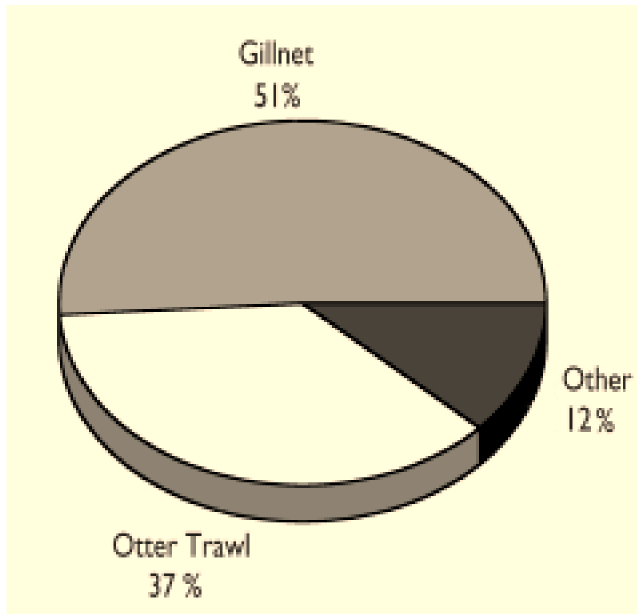
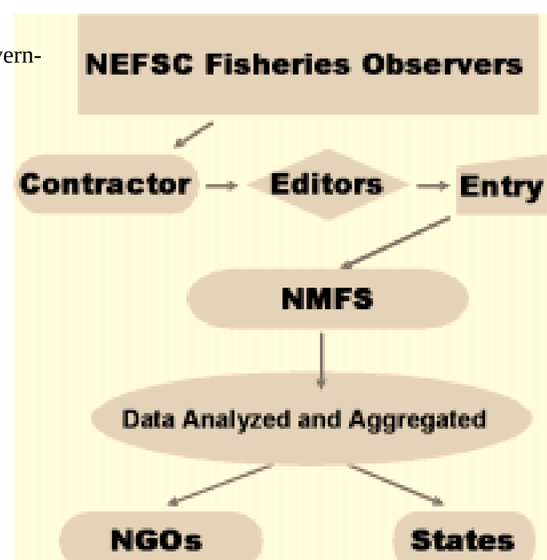


Figure 2. Flow of information gathered by NMFS observers and ultimately made available to nongovernmental organizations (NGOs) and the states.



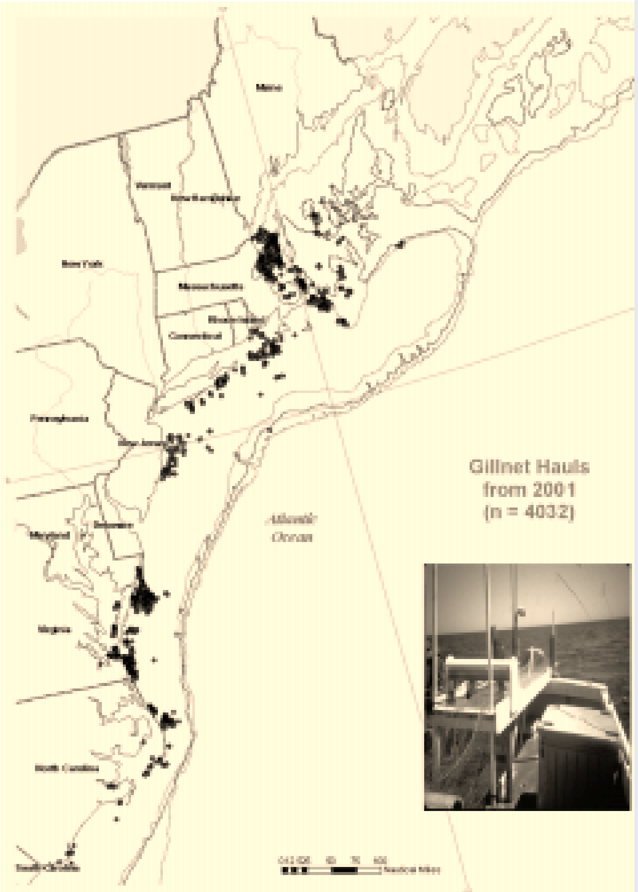


Figure 3. Observer coverage on gillnet trips covers coastal waters from the Gulf of Maine through North Carolina.

Observer Sampling

There are a number of issues in observer sampling: Is sampling representative of the fleet as a whole? What are the biases? Representative sampling is difficult to achieve because NMFS needs to rely on fishermen who are willing to have observers on board. These fishermen may not be representative of all fishermen in the fishery. Does fishing behavior change when observers are on board? What could prevent this? Fishing behavior may change when an observer is on board. For example, a fisherman may not take a trip into an area in which he or she feels a marine mammal take could occur. And finally, what data sources should be used? Of the four data sources used for stock assessment—port sampling and interviews, vessel trip reports, observer data, and research vessel surveys—more emphasis is now placed on vessel trip reports than on port sampling and interviews for obtaining information from fishermen. Observer data is critical for quantifying discards of protected species. And research vessel surveys serve as an independent check of the other information. The heart of stock assessments is based on information coming from the fishermen not the research vessel surveys.

Observer Coverage—Gillnet Trips

Observer coverage on gillnet trips encompasses coastal waters from the Gulf of Maine through North Carolina (Fig. 3). Coverage is concentrated in the western Gulf of Maine and the mouth of Chesapeake Bay. A big component of this coverage is monitoring incidental takes of marine mammals.

Of the targeted species—those species identified by boat skippers as the targeted catch—monkfish and cod are most targeted and are also the primary species caught (28 percent and 18 percent, respectively) (Figs. 3a and 3b).

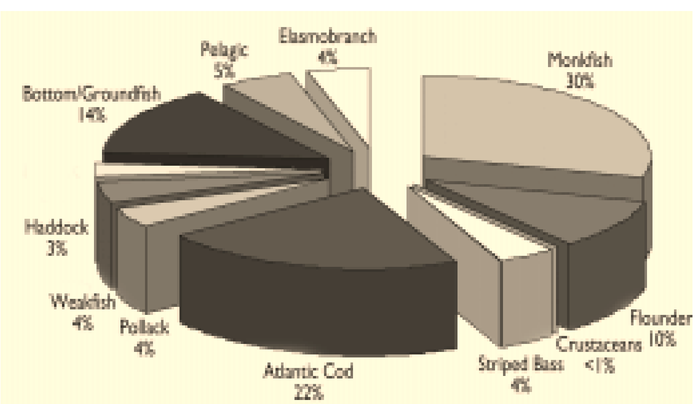


Figure 3a. Monkfish and cod are the species most targeted on observer-covered gillnet trips.

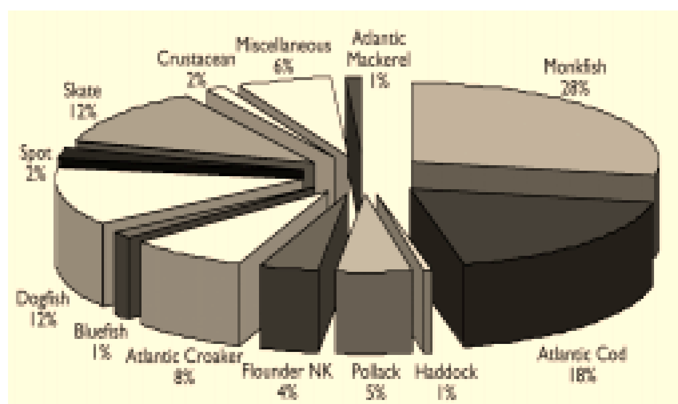


Figure 3b. Monkfish and cod are the primary species caught on observer-covered gillnet trips.

Observer Coverage—Otter Trawl Trips

Otter trawl coverage extends from the Gulf of Maine south to the eastern shore of Maryland and out to the continental shelf (Fig. 4). The major component being monitored is the flounder and groundfish fisheries.

Flounders and groundfish comprise more than half the targeted species (57 percent) but constitute little more than 10 percent of the primary species caught. Mackerel is a dominant part of otter trawl trips but is seldom identified as a target species (Figs. 4a and 4b).

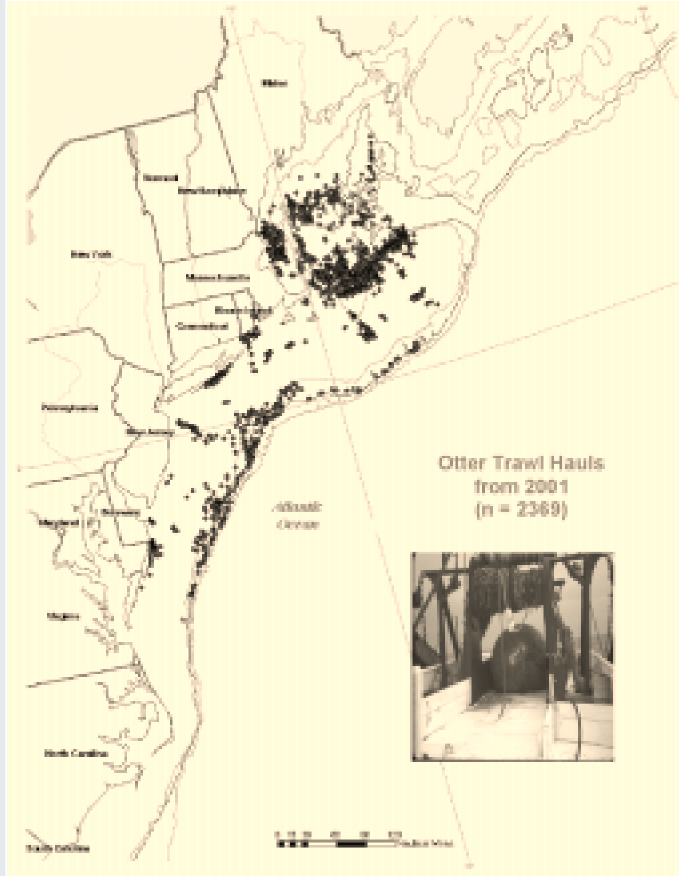


Figure 4. Observer coverage on otter trawl trips extends from the Gulf of Maine to the mid-Atlantic region and out to the continental shelf.

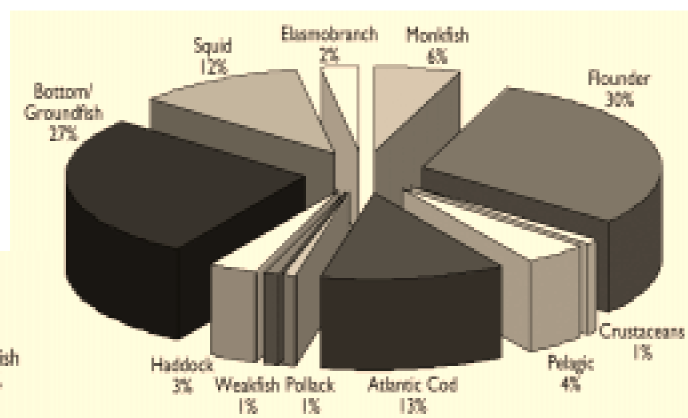


Figure 4a. Flounders and other bottom/groundfish are the target species on observer-covered otter trawl trips.

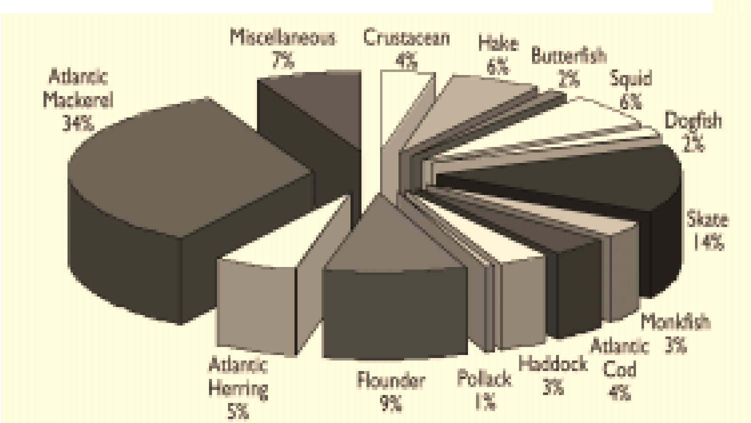


Figure 4b. Atlantic mackerel is the primary species caught on observer-covered otter trawl trips.

Figure 5. In 2001, observers reported incidental takes on trips from the Gulf of Maine to Cape Hatteras, N.C., and out to the continental shelf.

Figure 5a. Observed incidental takes by fishing gear type in 2001.

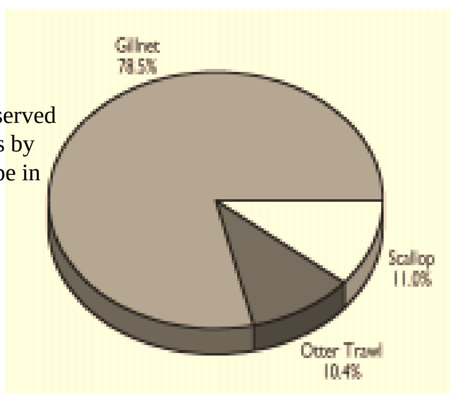
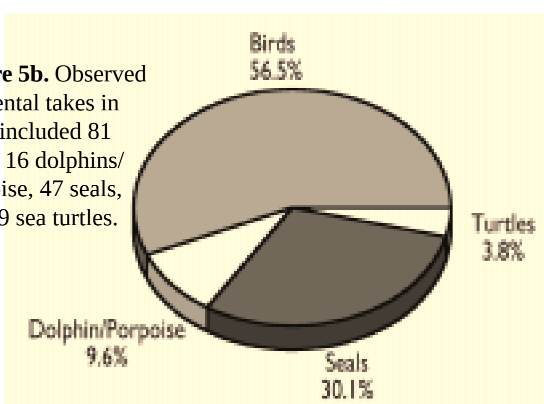


Figure 5b. Observed incidental takes in 2001 included 81 birds, 16 dolphins/ porpoise, 47 seals, and 19 sea turtles.



Observer Coverage—Incidental Takes

In 2001, Northeast Fisheries Observer Program observers documented 82 incidental takes of marine mammals and sea turtles. These takes were documented during trips ranging from the Gulf of Maine to Cape Hatteras, N.C., and out to the continental shelf (Fig. 5). Over 75 percent of the incidental takes occurred in gillnets, with otter trawls and scallop dredges making up the remainder of the takes (Fig. 5a). Birds comprised more than half the incidental takes recorded, with marine mammals making up an additional 40 percent (Fig. 5b). Because of conservation issues, there are particular concerns regarding the takes of leatherback sea turtle and harbor porpoise. The data reported here do not include longline trips.

Conclusion

The NMFS Observer Program will continue to grow because it is being driven by litigation and management needs. In order for the program to succeed, however, NMFS must improve interactions with the fishing industry. It will be important for the agency to develop an outreach program to help industry members understand why observers are on the docks, why they are collecting data, how that data will be used, and how the data are compiled and released. NMFS is working to insure better access to observer data, and one mechanism includes development of a new website to house program information, reports, and observer data. NMFS is using observer data to try to characterize fishery precision—species targeted to species actually caught. The ultimate goal is to estimate the ratio of what is caught and landed to what is caught and discarded.

Comments and Questions

- How do you select vessels to carry observers if you do not have 100 percent coverage and ensure random sampling? Fishermen may be fishing in the general area and it is assumed that the vessel being observed is representative of all the vessels in that area and that may not be the case.
- You cannot have refusals because that gives a bias to the estimates.
- It is important for observers not to represent enforcement so fishermen do not change their style of fishing.
- **Q:** For observer coverage, 100 percent may be overkill, but doesn't an increase in coverage (statistically from 5 to 10 percent) also increase the effectiveness of this program and decrease biases in the data?
  A: I don't think there would be a substantial difference in the statistical results of the observer data unless you increased coverage from 5 percent to a much higher percentage of about 30 to 40 percent. But cost is prohibitive and financially this doesn't make sense.
- A full sampling of a fishery, such as that occurring in the Pacific Northwest, is no longer a sample, so there's very low error. But this also carries an enormous cost.
- In response to the groundfish lawsuit, we are trying to get discards of 17 groundfish species below 30 percent. The observer coverage level initially started at 2 percent, and at 2 percent, we had 12 of 17 below that discard level. At 5 percent we had all 17 species below 30 percent. We feel very confident that, at 5 percent, this program provides statistically significant data of discard rate and variability.

- It is difficult to determine a percentage of observer coverage because the commercial fishing industry is changing. We need to focus on getting an adequate sample size to get a small coefficient of variation in estimates.
- If you want to look at percentages of coverage in a small fishery, you need a larger percentage for an accurate sample size. In a larger fishery, the percentage is smaller because of the size of your sample population. It's important to keep in mind the sample population when you're talking about percent observer coverage.
- **Q:** What should the fishing industry do to change the rules so we can do our job?
  A: By regulation, if you have been assigned an observer and refuse to take an observer, you cannot fish. We do not have enough enforcement to enforce this regulation. NMFS has few enforcement agents and is having difficulty getting enforcement to do the job. Some fishermen do not know the rules. This is an outreach need.
- **Q:** Does industry recognize that the observer program is separate from enforcement?
  A: Sometimes, due to the complexity of laws, many fishermen are not sure they are in compliance. These fishermen may be reluctant to take observers on board. There must be a stronger effort to help fishermen understand that observer data are important.
- **Q:** Many fishermen want observers on board. We should get together on developing this observer program.
  A: We have had quite a bit of cooperation. Fishermen want to have observers on board to prove what they know is truly happening at sea through an unbiased data collection system.
- **Q:** There is a trust factor that has to come between fishermen and new observers.
  A: Yes, observers need training.
- There is a significant interest coming from industry. As a gear conservationist, it benefits me to have a strong observer program so I have a baseline of information to work from. It shows me where there may be problems that need to be solved.
- **Q:** There is a difference in the quality of observers. Some are good to work with and some are not.
  A: Fishermen need to report this. The contractor is now utilizing a more selective process in choosing observers.
- **Q:** Are observers well paid?
  A: All observers have a bachelor's degree or the equivalent of education and experience. This is equivalent to a GS 5 level. Salary converts to about $160 for a 12-hour day at sea.
- The Northwest Training Center in Alaska runs 365 days a year, has 10 times more observers, and covered about 37,000 days at sea last year.
- In Alaska, the fishing industry pays for its own observer coverage. There is a reluctance to fund a national program because of this.
- **Q:** What is their economic fishing base? How can they financially support so many observers?
  A: Several contract vendors supply observers. Factory boats pay for observers to make sure everyone is getting their share of the quota.
- **Q:** Fishermen are concerned about underfunding for the observer program. How do we get adequate funding? Industry resources as they stand today are extremely limited. If we had a good observer program that was able to determine areas where there are a lot of juvenile fish, we could close an area for a time period.
  A: We could use observer data as a trigger mechanism for management measures.
- **Q:** If an observer sees fishermen continually using the wrong gear, does this ever get noted?
  A: The aggregate data will show that someone is fishing with the wrong size net, but will not show the individual using the wrong gear.
- **Q:** Who has access to the database?
  A: NMFS law enforcement has access to the database if they want it. They may go back to the database after an infraction occurs, but they do not use the database to catch offenders.
- Fishermen need to know the data are confidential for their comfort level.
- **Q:** Have observers ever worked on party boats and private boats?
  A: We've never been on a private boat—charter boats have asked. They would like to have coverage to dispute claims that they have high release mortality. My feeling is that we will have some coverage on party boats relatively soon.
- **Q:** Is this program only monitoring federal permit holders for now? Sea bird interactions have historically been a problem with charter boats.
  A: For the most part we're collecting the seabird data for the U.S. Fish & Wildlife Service—the agency primarily responsible for those data. Ecologically we're interested in these data, especially after the driftnet loss of seabirds a few years back.

"In New Bedford, if you brought in a fish weighing less than three-quarters of a pound, you were laughed out of town. The standard was higher and meant 133 fish in a box. Any excuse and the buyers would cut the price."

—Joe Rendeiro

- Currently, all protected species interactions, such as sea turtles incidentally hooked, are considered mortalities. But no data exist on that type of survivability.
- Environmental groups have heard from fishermen that they do not accurately report discards because they feel the information will be used against them.
- **Q:** What percent does the total observed catch represent compared to the actual catch?
  A: It is quite similar to the percent trip coverage—5 percent or less.
- **Q:** If you have an abnormally high level of discards, is it treated as an anomaly? Is this an index of abundance?
  A: We do not throw these data out. We look carefully at what is going on. We get a more precise estimate by collapsing information over seasons.
- **Q:** How significant are levels of retention in driving levels of abundance in models?
  A: We use the information to get to age composition. Gear type gets figured in by determining a selectivity curve reflective of sizes caught using a particular gear type.
- Observer data will be used to improve stock assessments. In recent cod assessments it resulted in the identification of a whole age class of fish a prior assessment did not show.
- **Q:** Has NMFS considered making vessel trip reports voluntary rather than mandatory? We consider the voluntary reporting more valuable. Some in industry may not be reporting discards to our detriment.
  A: The decision was made to go to complete coverage to avoid bias. There is no easy answer, but we need to pay attention to the quality of the data. NMFS is reluctant to use discard data from fishermen's vessel reports.
- **Q:** Will electronic data entry supplement an observer on a boat or replace logbooks?
  A: It will be used by observers while on the vessel to streamline data transmittal.
- We may need to move in the direction of developing a study fleet equipped with electronic data collection systems. Fishermen would receive stipends to input data. This would be more cost effective.
- **Q:** Has there ever been an analysis of the money spent to manage a fishery vs. the worth of that fishery?
  A: Yes. Several studies have been conducted. The harbor porpoise research used a couple million dollars over four years in research costs. It would have been easy to say we should pay people not to fish as part of this study. But the trickle down effect from people not fishing means that gear workers and fish processors are out of work. So it's impossible to pay someone not to fish, because there are other people affected by that decision. Impacts of regulations on fishing communities have been conducted. But we have never done this with the observer program.

Observations by Fishermen

Presented by Christopher Brown, Rhode Island Commercial Fishermen's Association, at the Rhode Island Workshop

The definition of bycatch that makes the most sense to me is from a Sea Grant publication. It states, "Bycatch is the harvest of fish or shellfish other than the species for what the fishing gear was set. Bycatch is sometimes called incidental catch and some bycatch is kept for sale." There are other bycatch considerations such as whale, dolphin, and turtle entanglements or discards caused by adherence to wasteful regulations. From my experience—28,000 tows for 4,800 days at sea—I have had zero whales, three turtles, and a couple of dolphins end up in the trawl. We do not interact with marine mammals and turtles frequently, but bycatch is an emotional issue when they are involved. Bycatch tends to get blamed on the fishermen, not the regulators. Bycatch is a normal function of trawling, but the discards are a function of regulation. Environmental groups tend to attack the conduct of fishermen rather than work to change the regulations. Green groups litigate for profit.

In New England, all fisheries have bycatch and all gear types have the potential for bycatch. Some species that are caught have no financial value (e.g., dogfish, ocean pout, sea robin, and spider crab), but they have ecosystem value. The current management strategy does not recognize ecosystem dynamics—it is geared toward protecting "tasty" fish. This suggests a bit of arrogance in terms of understanding ecosystem relationships. For example, juvenile fish are not caught as frequently because of larger mesh size requirements, and fishermen embrace this approach. The 3-inch mesh now used in the whiting fishery allows juveniles to escape. We also tow a 6.5-inch codend to catch 12-inch flounders. It bothers fishermen to catch the young of any fish.

The most troubling aspect of bycatch is regulatory discards. It is difficult for fishermen to have to throw back fish when quotas have been reached. It is against fishermen's nature to be wasteful, so they don't like to report discards, and they fear [that the data will be used against them]. High-grading does occur. For example, in fishing for squid, fluke is a bycatch. When 100 pounds of fluke is reached, some fishermen will throw out the smaller fluke to make room for the big fluke because the bigger fish are worth more. NMFS assumes every fish that is thrown back is dead although fishermen try and save fish as much as possible. Fishermen want desperately to save fish; we are frontline conservationists. We want to get to healthy fish stocks.

Fishermen use an understanding of fish behavior to limit bycatch. Over the course of a year, I may catch 35 to 40 different kinds of fish. There could be a tremendous potential for mishaps, but mishaps are unlikely because fish are selective about who they hang out with—similar species stay together. Another factor that causes bycatch is similar migration patterns. For example, flounder are spawning in spring at the same time scup may be entering the same waters. There is a potential for a lot of carnage to occur. There are legal reasons for why bycatch occurs and that has to do with adherence to regulations.

Fishermen need to shoulder responsibility for bycatch. There is the need to raise the consciousness of some fishermen and we try to do this using peer pressure, but it is impossible to regulate morality. Fishermen should never put capitalism ahead of sustainable fishing practices. Cures for the problem rest with input from gear technicians and regulatory reform. Scientists need good information on discards. They often underestimate discards and this affects abundance estimates. Managers should require all boats to fish with larger mesh. There is a huge difference when fishing with a larger mesh size, but it is currently financially impossible to make a living with large mesh because of the limited amount of days in the groundfish fishery. The bycatch issue needs to stand alone and is best addressed by responsible harvesters and conservation engineers, in conjunction with a reformed regulatory process, that draw upon a full slate of management tools.

Comments and Questions

- Environmentalists have a simplistic view of bycatch. They want a bycatch quota that, when reached, would require fishermen to stop fishing. Fishermen want to eliminate discards because of the waste. But the practices in place now are working to minimize bycatch while recognizing that some is going to occur. The current situation is a balance of different things that allow fishermen to continue to go to sea as stocks are being rebuilt.
- Rather than focusing on preserving individual species, more emphasis should be placed on fishermen going to sea with larger mesh. Overall conduct would be better and there would be less waste.

Presented by Proctor Wells, Maine Commercial Fisherman, at the Maine Workshop

Originally when asked to speak on the topic of bycatch, I was hesitant. The industry is very defensive because of the actions being launched against us by environmental groups. It is a difficult time for the industry.

Bycatch is not a big issue in my mobile fishery. But for me, bycatch is broken down into two categories—regulatory discards and actual bycatch. Twenty years ago there were no regulatory discards: If I was able to put it on the deck, I was able to sell it. If it was not a legal size for market, it was sold as bait. As managers and industry members we need to do a better job to stop fish from going over the side. I am an advocate of trying to improve our fishing practices to be cleaner fishers. I have been involved in working with researchers to test gear to improve methods.

Sometimes markets develop for species, such as the market that developed for monkfish. We began using a hexagonal mesh net to avoid catching small juvenile monkfish. In addition, I have been working with Dan Schick, at the Maine Department of Marine Resources, on the sweepless trawl. We lost the whiting fishery because of the bycatch problem, but the sweepless trawl is showing promise. It works to reduce the catch of small flounder, white hake, and other fish. These are a couple of examples of better equipping ourselves to be better fishermen. Through fish behavior studies and gear technology we may be able to develop a species-specific trawl. The Nordmore grate really helped the shrimp fishery. We need to get this information to fisheries managers.

But we have a long way to go in streamlining the permitting process to get this kind of work done. Industry has tried to speed the process but it has been difficult trying to change the system. There are good projects being conducted in collaborative research but the science needs to go through peer review. There is the impression that if the research was not done on the *Albatross* in the normal fashion, the data are excessively scrutinized. This is very frustrating for industry. If one could be 98 percent efficient using a certain type of trawl and the fisherman was allowed to keep whatever was brought on board the boat, sell it, and report it, this would be a much better system.

Comments and Questions

- **Q:** If 6.5-inch diamond mesh is the right size, and we bring in everything we catch, wouldn't we have a better idea of the true biomass?
  A: Yes, let's bring it in and even donate it to food banks or charities to avoid the waste.
- **Q:** Some work has shown significant impacts on reducing the catch of small cod and flounders. It is very frustrating because we do good work but it does not get put into practice. How do we support gear technology work and get it into the management process? We need to come up with a reward system for people to use the appropriate gear, and then place an observer on board to document the benefit.
  A: If fishermen can prove this net saves *X* pounds of fish, then fishermen should be rewarded with extra days at sea. But we do not have the data to back up this approach. It is also a different way of thinking than the way the current management process works. Litigation is driving things now and prevents people from being innovative and thinking outside the box.
- Fishermen are businessmen. We need to create economic rewards for helping to promote a bigger biomass.
- An otter trawl with a composite codend [6.5-inch square mesh over a 6.5-inch diamond mesh] produces a 60 to 70 percent reduction in undersized cod. Round fish escape out the square mesh and the flatfish escape out the diamond mesh.
- It has been difficult to get management to look at this because of the small number of tows. Through the observer program we should be able to compare this fishing method with others.
- **Q:** Are some people not following the regulations?
  A: The majority of fishermen are conscientious. About 90 percent follow the rules. Would an incentive system change the behavior of those who do not comply?
  A: An observer program would push them aside.
- Most fishermen are afraid to get caught not following the rules. We have too much to lose. And the majority of fishermen will not tolerate it.
- We need to work harder to streamline the experimental fishery permitting process to test gear and put observer coverage on board to document results.
- The permitting process needs to be improved and vessels involved in collaborative research need to be protected so they do not lose their days at sea.
- Right now it takes 18 months to get a permit to take part in collaborative research. Nonprofit organizations cannot afford not to spend money during this waiting period. It also affects the research. For example, fish may migrate into deeper water while waiting to get a permit to do the research.
- The Canadians do it more simply; they issue the permits and assign an observer.
- The region has a lot of collaborative research money. We need to demonstrate that we are using this information or the funding will dry up. Government research projects are exempt from the laws. NMFS needs to approve this kind of research as government research so the rules can be waived for participating fishermen, but these participants should not be allowed to sell their catch.

Presented by Bud Fernandes, New Hampshire Commercial Fisherman and NEFMC Member, at the New Hampshire Workshop

The biggest successes in bycatch reduction have been in the smaller mesh fisheries, such as the shrimp and whiting fisheries. This has included use of the Nordmore grate and the raised footrope trawl. The pinger program aimed at reducing the catch of harbor porpoises has also been successful.

The biggest discard problem now pertains to what we catch that does not live and that we cannot sell—regulatory discards. Regulatory discards result from individual species management practices involving quotas and trip limits. For example, there is a low quota for dogfish. Female dogfish are being used as a proxy for rebuilding the stock. Scientists are concerned that the female adult stock of dogfish is in jeopardy even though there is a high biomass because of males in the population. Trip limits are designed to reduce mortality, but in practice, trip limits translate into regulatory discards. Management has responded by increasing mesh size to 6.5 inches and by closing areas. Rolling closures are currently in use in the Gulf of Maine.

The ways to approach discards include the season or time one fishes, the area fished in, and the gear used. The biggest issue is how to access one species of fish that is abundant without jeopardizing rebuilding programs for other species not in abundance at this time. For the cod fishery, new gear is being advanced. Fishermen on Cape Cod are developing a topless net, and Canadian fishermen are working on a separator trawl. In the whiting fishery, there has been some success experimenting with a grate. Efforts are under way to rejuvenate this fishery. Special access programs (SAPs) for use in closed areas are another way to regulate bycatch. These allow access for fishermen who are able to use the right gear to reach an appropriate bycatch level. These types of experimental programs allow fishermen to test ideas on reducing bycatch.

Comments and Questions

- There have been reductions in bycatch due to management measures. For example, limiting days at sea has reduced bycatch. We need to determine what will be acceptable.
- We need more cooperative research programs to look at discard mortality by species. There may be a high rate of discards for dogfish, but they may also have a high rate of survivability.
- It is difficult to properly study discard mortality. For management purposes, all discards are presumed dead.
- **Q:** Regarding dogfish, are there any behavioral differences between males and females that can be used to avoid capturing females?
  A: It may be a matter of timing; females are usually first in migration movements.

Presented by Joseph Rendeiro, Southern New England Fishermen's and Lobstermen's Association, at the Connecticut Workshop

I have been fishing for 52 years. Responsible people knew, back when yellowtails [yellowtail flounder] were good, that we could not go on killing fish like this—killing the little ones and taking all the big ones. In the late 1950s, a group of fishermen decided to talk to someone at the NEFSC in Woods Hole about yellowtails. At that time we asked for trip limits and mesh restrictions; we didn't know to ask for area closures. We just thought something should be done. A marine biologist told us we would never see the day when there were no yellowtails: "They spawn faster than you can ever catch them." A few years later we were on a 7,500-pound limit, with a mesh restriction of 5 1/8 inches in 1980 (which wasn't enough). Other limits were 12,500 pounds of cod, 12,500 pounds of haddock, and all the flounder you could catch. If you could catch them all in one trip, you had a good trip but that was pretty hard.

Regulations then started to make fishermen object. Area 1 and Area 2 were closed March, April, and May. When these closed areas opened up, it was like the gold rush. This management approach did not make sense. In New Bedford, if you brought in a fish weighing less than three-quarters of a pound, you were laughed out of town. The standard was higher and meant 133 fish in a box. Any excuse and the buyers would cut the price. Then they legalized an 11-inch yellowtail. That's barely the size of your hand. So now everyone fished closer to home and caught more fish because smaller fish had value. This smaller legal size, tied with the indiscriminate use of small mesh, is the cause of bycatch.

Bycatch is the hardest thing to regulate in New England because it is a small-mesh fishery. When you're fishing for hake, whiting, or squid, you're going to catch flounder, you're going to catch fluke, you're going to catch everything. But no one can make a living without the small mesh. One thing I think they [the regulators] did do right, that made a difference in the past few years, was the demarcation between large and small mesh. This had a big impact because there was a tremendous amount of cheating before this. The demarcation line in southern New England stated that if you got caught with small mesh on your boat, you were in big trouble. Fines became serious and your permit was confiscated. That's when Georges Bank got better.

I talked to several local fishermen about their experiences with bycatch. Here's what they had to say:

"If you fish with a 6.5-inch mesh, you don't get any bycatch. Everything we catch we keep: squid, whiting…except skate, because lobstermen don't need them anymore."

"You throw over 1,000 pounds because you can only keep 500. I gave my bycatch to soup kitchens, but got arrested for it. Someone in Alaska did the same thing and was considered a hero."

"Scup is back, but we're not allowed to catch it. So we catch them and we have to throw them back. This system is wrong."

"We catch fish that we have to throw away needlessly and uselessly. Other than gear technology, the best way to minimize bycatch is through mesh restriction—6.5-inch mesh is the way to go, but that should be where it stops. The only exception would be monkfish which need a larger mesh."

With any management measure that is taken, if the fishermen don't agree with it, it's not going to work. You can't control fishermen from land. You have to come up with a program that fishermen believe in. Flounder will not come back. People will tell you that fishermen caught them all. But what about pollution? What about all the plants along the harbor? This is all a part of the problem. When we figure out a solution, we have to remember that fishermen were not the only culprit; the government, pollution, they all had their part. The problem with NMFS is that, since their inception, they have never listened to fishermen. When the government is involved, there is no fixing the problem.

Comments and Questions

- **Q:** When one flounder is not doing well, it seems like another is. How can fishermen be blamed for the demise of one type of flounder, yet in the same area, another species of flounder is doing fine? If it were the fishermen, all the flounders would be doing poorly at the same time.
  A: It is because of the food chain. Flounders don't eat the same type of food so their stock sizes vary. The surveys are not well conducted, with uneven trawl doors, etc. You need a fisherman to catch fish, not a scientist.
- **Q:** Recently in Rhode Island, there were some quotas on winter flounder that weren't filled, which means that perhaps they weren't there.
  A: Winter flounder in Rhode Island were caught by the barrel as bait in the lobster fishery. That's where that population went. We killed all the little ones. The same thing happened with whiting. In Spain, 7-inch whiting is a delicacy. All the small ones were taken. You cannot sustain a fishery by fishing like this.

Observations by Party Boat Operators

Presented by Rocky Gauron, Gauron Fisheries, at the New Hampshire Workshop

I operate three large party boats and am president of the Gulf of Maine Recreational Fishermen's Association. My family has been in this business for 60 years. For party boats, the size limits on the fish we're allowed to keep is the major bycatch issue. There is a 23-inch limit for cod and a 23-inch limit for haddock. We end up throwing back nine out of 10 fish because they do not meet the size limit. In addition, the fishing season runs from April to October. This also limits what we can target. We have no technology to really limit the size of the fish we catch. We use 12-inch circle hooks to help increase survivability, but the number of fish that make it back to the ocean floor, which can be 300 feet down, is unknown. We build fishing trips on success but patrons become frustrated because they have to throw good fish back. If the legal size limit for haddock was reduced to 21 inches we could target more. There is enough haddock out there that we would leave cod alone.

The 10 fish bag limit in effect is not as much of a problem as the size limits. Our recommendation to reduce bycatch would be to keep the 10 fish bag limit and drop the legal size limit for haddock to 21 inches, or drop the bag limit and allow fishermen to keep three haddock at a larger size. In terms of monitoring the catch, we have no problem with observers on our boats. It would help us keep track of what is going on when there are 50 to 60 people on the boat. Finally, there must be a way to open up windows to let dogfish be pruned out. Dogfish are now showing up in rivers.

Comments and Questions

- Management goals call for rebuilding dogfish to 900,000 metric tons. By comparison, the target for groundfish is about 500,000 metric tons.
- The NEFMC is not overly concerned about haddock, but the 23-inch regulation is a result of a judge's decision made in response to a lawsuit. It will be in effect for another eight months but may be revisited when Amendment 13 is submitted.

Using Discard Estimates in Stock Assessments—Effects on Quotas

Presented by David Simpson, Connecticut Department of Environmental Protection, at the Connecticut Workshop

Discards can be defined as fish thrown overboard dead, eaten by birds, or eaten by other fish. Biologists assume that 80 percent of commercial fishery discards are dead. In the recreational fisheries, biologists assume that 10 percent are dead; the majority are released alive. Discards are calculated by age; they are higher for smaller fish since size prevents landing. Discards are of paramount interest for making accurate stock assessments.

In order to estimate stock size and set quotas, one must "know" the volume of the catch—catch being defined as landings plus discards (Fig. 6). We use "virtual population analysis" (VPA) to estimate stock size. VPA is a method of working backward through a year class of fish to estimate historical stock size and fishing mortality by year and age (Fig. 7). For example, we would start at age 4 in 2001 to estimate how many fish must have been available at age 3 in 2000 and so on. Estimates improve as we go back in time—we know more about the past than the present.

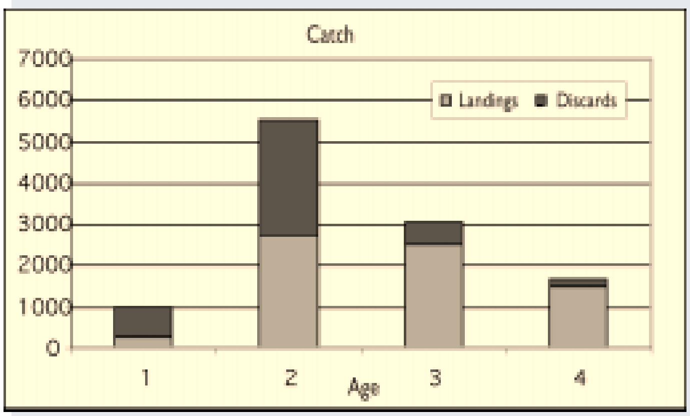


Figure 6. Sample catch data. Catch is defined as landings plus discards for each year class (age).

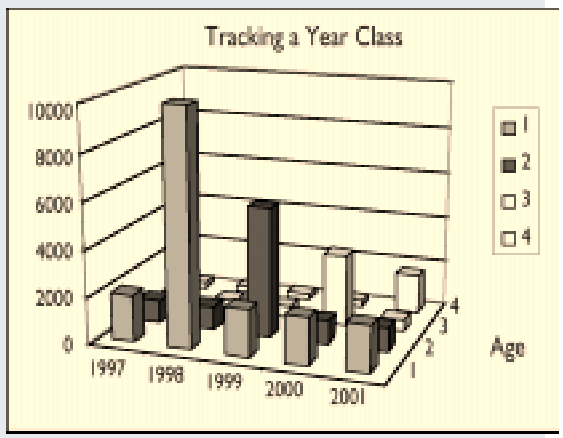


Figure 7. Sample estimate of stock size and age structure using the VPA method. VPA back-calculates through a year class to estimate historical stock size and fishing mortality by year and age.

VPA is calculated using the following information (all by year and age): catch, catch weight—the average weight of fish caught (by age)—natural mortality, percent of mature fish, and abundance (tuning) indices, which aid most in estimating recent stock size and fishing mortality.

The VPA results in estimates of stock size (numbers and weight) and fishing mortality (by year and age). Stock size is then calculated as follows:

Stock Size = Catch*(Z/(F*U)); where
Z = Total mortality rate
F = Fishing mortality rate
U = Percent of fish dying that year

Sample Calculation—Stock Size (for age 2 in 1999)

- If Catch (C) = 10,000 fish and
- Z = 0.6, F = 0.4, and U = 0.45,
- Then the stock must be:
- (0.6/(0.4*0.45) = 3.3 times larger than the catch.
- So: 10,000*3.3 = 33,000 fish in 1999 stock at age 2

Table 2

Age	1997	1998	1999	2000	2001
1	2000	10000	2000	2000	2000
2	1000	1000	5500	1000	1000
3	500	500	500	3025	500
4	250	250	250	250	1664
	1997	**1998**	**1999**	**2000**	**2001**
1	3000	15000	3000	3000	3000
2	1500	1500	8250	1500	1500
3	750	750	750	4538	750
4	375	375	375	375	2496

Table 3

Age	1997	1998	1999	2000	2001
1	2000	10000	2000	2000	2000
2	1000	1000	5500	1000	1000
3	500	500	500	3025	500
4	250	250	250	250	1664
	1997	**1998**	**1999**	**2000**	**2001**
1	3000	15000	3000	3000	3000
2	1000	1000	5550	1000	1000
3	500	500	500	3025	500
4	250	250	250	250	1664

Table 4

Age	1997	1998	1999	2000	2001
1	2000	10000	2000	2000	2000
2	1000	1000	5500	1000	1000
3	500	500	500	3025	500
4	250	250	250	250	1664
	1997	**1998**	**1999**	**2000**	**2001**
1	2000	10000	2000	3000	3000
2	1000	1000	5500	1500	1500
3	500	500	500	4538	750
4	250	250	250	375	2496

Tables 2–4. Three scenarios, based on varying catch size estimates. Top half of each table is catch size for each year and age; bottom half is resulting stock size estimate at each year and age. Grey numbers indicate scenario impacts on stock size.

Sample Calculation—Fishing Mortality (F) (for age 2 in 1999)

- F = (Z – M) or
- F = (0.6 – 0.2) = 0.4; where
  Total mortality: $Z = 1n[N/(N*e^{(-M)} – C*e^{(-M/2)})]$
  Natural mortality: M = 0.2
  Catch (C) = 10,000 fish
  Population estimate (N) = 33,000

The key to accurately estimating stock size is the catch. What happens if catch estimate is wrong? The following scenarios are possible:

Scenario 1 (Table 2)

- Catch in all cells is increased by 50 percent (across five years (1997–2001) and four ages (1–4)
- Result:
  -F: unchanged in all ages and years
  -Stock size increases 50 percent in all ages and years.

Scenario 2 (Table 3)

- Age 1 catch is increased by 50 percent
- Result:
  -F: at age 1 is higher, and all other cells unchanged
  -Stock size is higher in age 1 (all 5 years), in age 2 (in 2000 and 2001), and age 3 (in 2001)

Scenario 3 (Table 4)

- Catch in last two years (2000 and 2001) is increased 50 percent
- Result:
  -F for those two years increases, F for 1997 and 1998 declines, 1999 is mixed.
  -Stock size increases in 1996 as well as in subsequent year classes.

Using Discards to Set Quotas

First, we project stock size for the coming year, making the assumption that the same proportion of fish will be removed at each age (Fig. 8). Then we take the total allowable catch (TAC) minus the discards to give the quota (Fig. 9). Again, catch is key because unaccounted for catch will generally result in lower estimates of stock size and quotas.

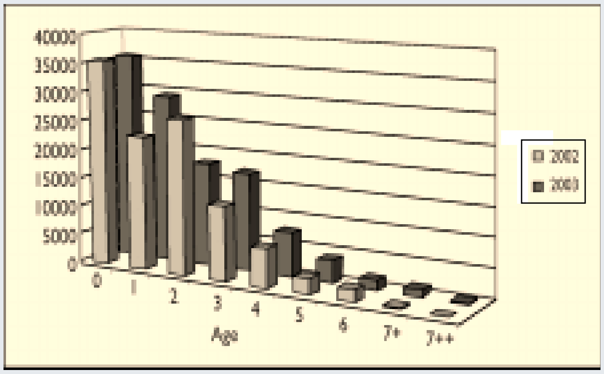


Figure 8. Projecting stock size for 2003, based on 2002 numbers, making the assumption that the same proportion of fish will be removed at each age.

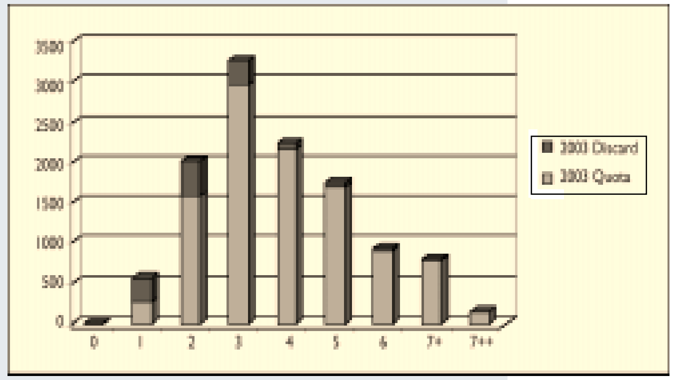


Figure 9. Quota is calculated by subtracting the discards from the TAC. In this example, quota is the 2003 TAC by age.

Improving Catch Data

There are several ways to improve the quality of catch data, including more complete reporting of landings, increased sea sampling, more fishing vessel trip reports reporting discard data, and more information on the size of discards in recreational fisheries.

Comments and Questions

- Catch is definitely important, but the other key element is discard rates.
- Knowing discard rates is key to stock assessment. The summer flounder data are probably not too bad. But scup presents an obvious problem because there are trips where 200 to 500 pounds are discarded, and other trips with 40,000 pounds discarded in a single tow. Do you use these numbers in the equation and expand it out to the entire fishery? That will give you a real big number. So scup assessment is more difficult at the moment. From a fishing standpoint, scup is strictly a regulatory discard.
- The reasons for discards vary—economic, regulatory, etc. But increasingly discards are purely regulatory.
- There are two types of regulatory discards: those based on size and those based on trip limit. Scup is both of these.
- For managing a fishery, one would definitely want to separate the types of regulatory discards in the fishery; but for the purposes of this presentation, numbers of discards are lumped together.
- **Q:** It is hard to understand why we do not use a variable rate in natural mortality. Smaller size limits are actually getting more allocation than they should and vice versa.
  A: The size limit doesn't affect the natural mortality rate, only the fishing mortality rate. We are using 0.2, but we know it can't be an absolute constant. However, currently there is no alternative.
- In the striped bass fishery, natural mortality rate has played a big role in allocation, especially size limits.
- In recreational allocation, the portions of natural mortality and fishing mortality are important and play a role in allocation.

Using Discard Estimates in Stock Assessments—Effects on Quotas

Presented by Mark Gibson, RIDEM Division of Fish and Wildlife, at the Rhode Island and New Hampshire Workshops

Elements of a Stock Assessment

There are three types of information used in stock assessments: fishery independent abundance index, fishery landings and discards, and biological samples, tagging, and/or life history studies. The fishery independent abundance index is composed of trawl surveys performed outside the fishery. Landings and discards represent a body count—the number of fish removed due to fishing practices. Biological samples, tagging, and life history studies provide auxiliary information about factors such as migration patterns, exploitation rates, and growth rates.

Fishermen may not be aware of how important accurate discard information is in stock assessments. We estimate discards in both the recreational and the commercial fisheries. In the recreational fishery, discards are estimated by the Marine Recreational Fisheries Statistics Survey (MRFSS) as the B2 or released-fish component. Survey data are obtained by interviews in the field and by phone. The estimates are based on angler recall. Fishermen tell the interviewer which fish were released or kept. The interviewer does not actually observe this. The estimate of fish lost is then computed as:

Trips * Catch Rate * Percent Loss

Discards in the commercial fishery are estimated from sea sampling data, vessel trip reports, or by fisheries observers by estimating the ratio of discards to landed catch in observer samples or from vessel trip reports. This can be sorted by gear type or by region. The discards are then computed as:

Ratio * Total Landings

An accurate final computation of stock assessments is dependent on fishermen filling out accurate vessel trip reports and operating their boats in the same manner regardless of whether observers are on board or not.

Stock Assessment Basics

In order to perform an assessment of a stock, one must first know the stock biomass. Biomass calculations are based on a principle of conservation of biomass (determine where biomass came from and where it went) and the notion of virtual populations (there must be at least as many fish alive in the beginning as one can account for dead later).

Stock Biomass = Relative Index/Catchability

This year’s biomass equals last year’s biomass minus last year’s catch plus the increased weight of the survivors due to growth plus any new recruits that may have come into the population.

Biomass (t) = Biomass (t-1) – Catch (t-1) + Growth + Recruits

The rate that the fishery is removing fish of the stock (exploitation rate) is equal to the landings divided by the biomass.

Exploitation Rate = Landings/Biomass

These are the simple equations involved in stock assessments. They are all data driven. Biomass will be underestimated if we do not have the full body count.

Winter Flounder Stock Assessment—An Example

We can work through a stock assessment using Rhode Island winter flounder as an example. The sources of information employed are multiple seine and trawl surveys conducted by the University of Rhode Island (URI), RIDEM, NMFS, and power plants; commercial and recreational fishery surveys; and tagging studies.

Trawl survey data show a high abundance of winter flounder in the late 1970s and early 1980s and declines through the next couple of decades (Fig. 10). Commercial and recreational landings data show high abundance in the 1960s and 1980s with lows (less than 500 metric tons) in between (Fig. 11). Landings have remained low since 1993, due to closure of the fishery. Both commercial and recreational fishermen are prosecuted for landing winter flounder.

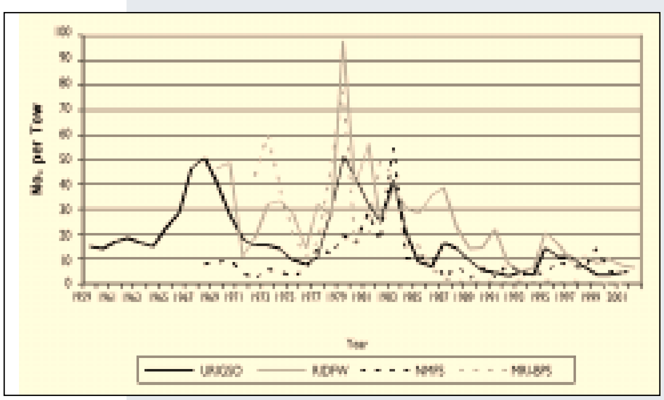


Figure 10. Winter flounder abundance in trawl surveys in Rhode Island waters from 1959 onward. These are independent surveys performed outside the fishery.

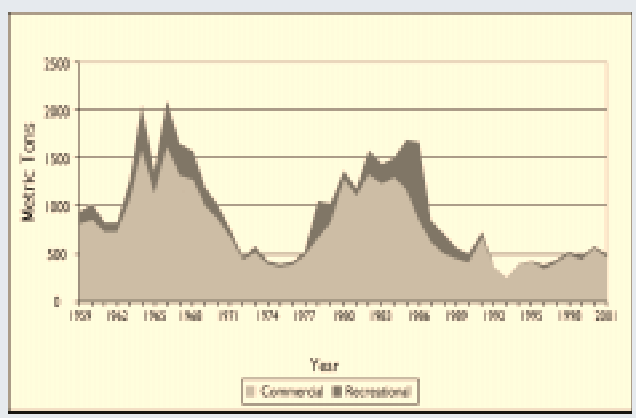


Figure 11. Winter flounder commercial and recreational landings in Rhode Island waters from 1959 onward. Note that recreational fishery landing estimates came from tagging studies prior to 1979.

Estimates of discards for winter flounder come from observer data, vessel trip reports, and marine recreational fishing surveys (Fig. 12). The number of discards is not high compared to the landed catch. Discards tend to mirror commercial and recreational fisheries landings data. There may be some question about reliability of these estimates due to the variability in the data for winter flounder.

Scientists can use data from tagging studies to estimate historical fishing mortality rates and compare where and when fish were tagged with where and when they were caught (Table 5).

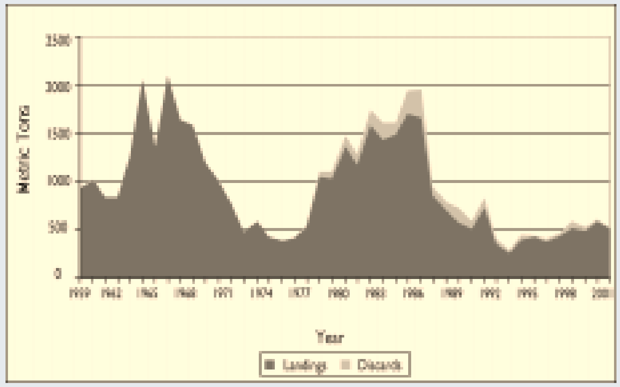


Figure 12. Winter flounder commercial and recreational landings and discards in Rhode Island waters from 1959 onward.

Table 5. Rhode Island winter flounder tagging studies are used to estimate exploitation rates and the contribution of recreational fisheries.

Tagging	LocationYears	No. Tagged
Narragansett Bay	1937–1942	558
Pt. Judith Pond	1937–1942	279
Watch Hill, Block Island Sound	1940–1942	307
Rhode Island Sound	1940–1942	675
Narragansett Bay	1958–1960	980
Narragansett Bay	1980–1982	997
Narragansett Bay	1986–1992	6,766
Narragansett Bay	1996–1999	840
Pt. Judith Pond	1999–2002	1,067

Once all information sources are gathered, the assessment is performed using the following steps:

- Assemble and evaluate available data, including evaluations of data quality
- Select appropriate model
- Run model and review diagnostics
- Adjust configuration or inputs and re-run
- Compute measures of uncertainty
- Perform projections and sensitivity analyses
- Formulate management advice

Using the winter flounder example and assembling the available data, one can compare the current state of the stock relative to the goal for a rebuilt stock (Fig. 13). Scientists may then make projections about the length of time necessary to rebuild a stock based on the fishing mortality rate. For example Figure 14 demonstrates that if the fishing mortality rate were cut in half, the stock would be rebuilt to the desired biomass (B_{msy}) in 10 years. Quotas would grow over time with growth of the stock.

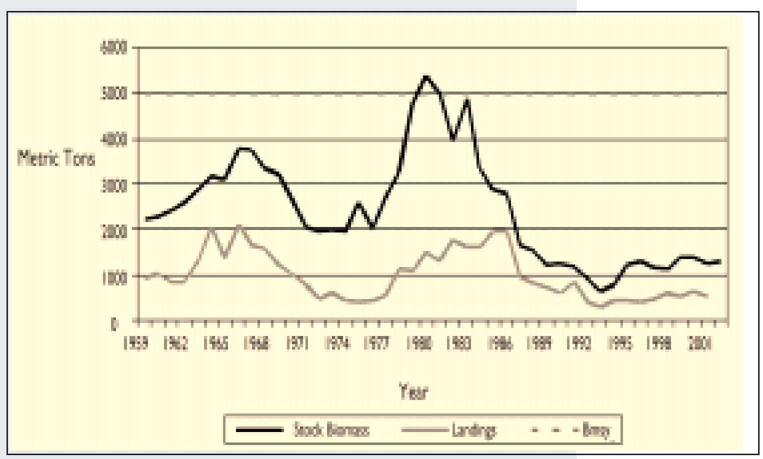


Figure 13. Rhode Island winter flounder stock biomass in metric tons (black line) and total landings from commercial and recreational sectors (grey line) shown relative to goal rebuilt stock biomass (B_{msy}) (dashed line). Data from 1959 to 2002.

"You throw over 1,000 pounds because you can only keep 500. I gave my bycatch to soup kitchens, but got arrested for it. Someone in Alaska did the same thing and was considered a hero."

—New England fisherman

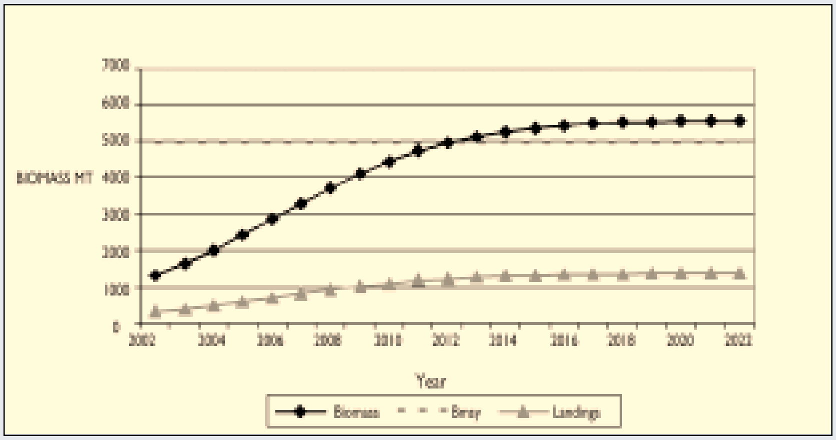


Figure 14. Projecting future stock biomass and the time necessary to rebuild a fish stock. If fishing mortality were cut in half, the stock would be rebuilt to the desired level in 10 years.

Stock assessments allow for comparisons to be made based on various discard assumptions as shown in Table 6. If discards are not figured into the assessment, the estimated stock size would be lower, resulting in a lower allowable catch for fishermen. If discards are underestimated, fishermen would be allocated a lower allowable catch than necessary to rebuild the stock to a desired level in the desired time frame and scientists would understate the allowable catch removed from the population in the future.

Table 6. Rhode Island winter flounder stock assessment results allow comparisons under various discard assumptions.

	Stock Productivity	Carrying Capacity	Bmsy	F 2001	B 2001	F Rebuild	Landings
No Discards	0.557	10615	5307	0.611	1190	0.300	7067
With Discards	0.563	9937	4968	0.563	1324	0.320	7169
2X Discards	0.561	9926	4963	0.518	1474	0.320	8265
3X Discards	0.554	10221	5110	0.480	1638	0.320	8685

Accurate tabulation of fishery landings and discards is essential to an accurate stock assessment. The discard estimates are produced from both scientific surveys and information provided by fishermen. It is important to recognize that missing or inaccurate discard estimates may have counterintuitive impacts on assessments and management advice. Fishermen may think that if they report discards, something bad is going to happen. However, inaccurate reporting of discards may lead to underestimates of stock size, which has consequences in a quota-based management system.

Comments and Questions

- **Q:** With fishermen using 6.5-inch mesh nets, such as in the flounder fishery, we do not see juveniles.
  A: Biologists do not rely on commercial fishing information to determine the juvenile portion of the population. This comes from independent surveys by state and federal agencies. Fishermen provide information on what is being killed.
- **Q:** There has been a lot of estimates on stocks through the years and not a lot of good information.
  A: Biologists need good information from fishermen on landings and discards for accurate stock projections. This is not always clear to fishermen.
- It is not always easy to get good estimates of discards.
- Accurate discard data result in less to rebuild. There is no down side to accurate discard reporting.
- **Q:** If we eliminated discards, how would that affect the stock assessment?
  A: Allowable landings would get bigger.

Finally Fishing for Just Whiting

Presented by Daniel Schick, Maine Department of Marine Resources, at the Maine Bycatch Workshop

Today, I'd like to discuss the use of bycatch in stock assessments and give results of the progressive, cooperative gear research efforts made to date in creating a low bycatch whiting fishery in the Gulf of Maine. I have been involved in shrimp gear research since the late 1980s and in whiting research since the 1990s. Mike Brown has also been involved in shrimp and whiting gear research in the '90s, and Les White has worked in this area for the last two years. Fishermen get very frustrated [with the research process] because the scientific method is more complicated than simply fiddling with gear and finding what works. It involves establishing controls and doing many trials. It is also a slow process to secure funding and permits to get the research done. We need more people in the region like Chris Glass of Manomet so there will be more scientists to partner with the fishermen to do the work effectively. We need to see results get into management practice. If the work is done well, people will buy into it and feel comfortable with the results. We need to determine standards, in advance, to be used to evaluate the results.

Stock assessments involve looking at the existing stock and factoring in natural and fishing mortalities. Assessments are used in forming recommendations to management. An assessment is only as good as the information going into it. We need good data from the fishery [landings and discard data] to accurately determine what is being caught. Sea sampling is an important component of understanding actual mortality in fisheries. For example, the Gulf of Maine cod fishery did not use bycatch estimates in fishing mortality for many years. In 1999, the stocks were low and the catch per day was down to 40 pounds. At that point, the fishery was not a directed fishery. It was designed to be a discard allotment. Tons of fish went overboard causing regulatory discards. That forced assessment methods to include discard estimates. But the stock had declined so drastically that adding the discard data did not increase allocations in management measures.

In the whiting fishery, landings were high in the 1950s through the early 1970s (Fig. 15). Then landings dropped to almost nothing. Landings jumped up in the mid-1980s, spiked in the mid-1990s with the Spanish market, and have now dropped to almost nothing over last few years as a result of the regulatory process. But there was a large amount of discards because of the small mesh size used to target shrimp.

The development and use of the Nordmore grate—a hard, sloping panel of parallel bars mounted in the extension of the net that sort by fish size—has been very successful in minimizing bycatch in the shrimp fishery. It changed the rate of fish release from shrimp nets from 20 to 40 percent release to over 95 percent release of fish and over 95 percent retention of shrimp with grate use. The grate served as a barrier to water flow into the codend. The selectivity of the codend was a function of the size of the mesh and the water forcing function. The Nordmore grate resulted in shrimp and only small fish caught in the codend. This technology was exported to the whiting fishery.

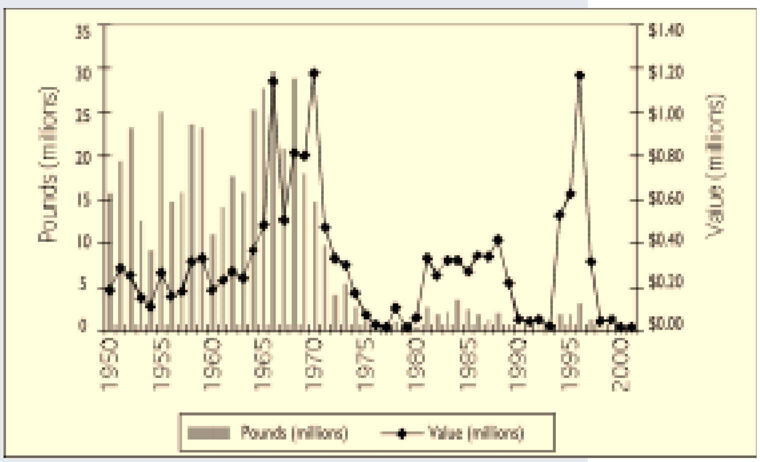


Figure 15. Maine whiting landings (1950–2002) in pounds and value.

Gear Selectivity Research

Initially, gear modifications were made to obtain a larger shrimp catch with less bycatch. The Nordmore grate was a primary example. Recently, tests have been conducted to adjust size selectivity by varying the spacing of bar pairs in the grate and varying codend mesh size. A raised footrope, with or without a roller frame, was added to reduce bycatch of flatfish.

The Nordmore grate has been tested with 40 millimeter (mm), 50 mm, 63 mm, and 70 mm bar spacing. Tests were conducted by comparing the grate to control nets with small mesh and no grate, or with 40 mm grate. The idea was that the larger the bar spacing, the more that regulated species can pass through. Results show that the best bar spacing so far is 50 mm, but 45 mm may prove better.

Codend meshes of 1.75 inches, 2.25 inches, 2.5-inch diamond, and 2.2-inch square have been tested. The 1.75-inch mesh coupled with a 40 mm grate produced low percent bycatch. The 2.5-inch coupled with a 50 mm grate also produced good results. The 1.75-inch and 40 mm-grate net targeted whiting that were too small. The whiting selectivity profile for 2.5-inch and 50 mm-grate net is more consistent with the whiting fisheries management plan.

Lastly, tests have been done to document the effect of using a raised footrope. Footropes with 30-inch and 42-inch droppers with a roller frame, and 30-inch droppers without a frame were tested. The 42-inch droppers with a frame produced the best results until a net without a frame was tested. The raised footrope trawl with no roller frame fished well, produced low bycatch, and was nicknamed the “bottom friendly” net for low bottom contact and captured only 2.5 percent of the regulated species.

Findings To Date

The bottom friendly net with 50 mm bar spacing and 2.5-inch diamond mesh codend meets the dual criteria of size selectivity for whiting and low bycatch of regulated species. Creating a fishery utilizing this gear will require a framework adjustment to the small mesh multispecies fishery management plan. In 2002, we continued testing the bottom friendly net over more area in the Gulf of Maine. The 3-inch diamond codend was tested with a grate in paired tows because the 3-inch mesh is the default mesh size in the fishery management plan. Of the 62 tows completed, bycatch averaged only 3.6 percent.

Next Steps

In order to bring back the whiting fishery, gear modifications must continue and a market for the product must be created. Low volume, unreliable product, and low product recognition must be overcome. The northern stock of whiting is in great shape. A productive whiting fishery will relieve economic hardship in the fleet.

Comments and Questions

- **Q:** A request is being made in Rhode Island to increase landing limits for whiting. If we encourage the whiting fishery in Maine to redevelop, will we be contributing to flooding the market?
  A: The marketing problem is connected to the number of fish that hit the docks in one day. It depends on the timing of the landings. The amount of whiting we would be landing in Maine would probably not affect the market price.
- With whiting, a consistent market brings a consistent price. We need to avoid price fluctuations.
- With the Spanish market [8- to10-inch fish], the local market was expanded to include a world market. Landings may have reached as high as 4 million pounds in one year with 20 boats participating. As this was being established, the management measures became more restrictive.
- We need to decide what size fish we want to sell. It is important to consider the fish’s spawning size.
- Ten inches is whiting spawning size.
- In the past, we did not land whiting less than 12 inches because there was no market for the smaller size.
- **Q:** Can we use New Hampshire-Maine trawl survey data to demonstrate that we have a juvenile whiting population nearshore year round?
  A: This is a big nursery area. Restrictions apply in these inshore waters from April to June.
- We need to obtain better data on discard mortality rates including how much is thrown off the deck as well as how much is affected by the net [e.g., fish scales lost in struggle through the net; fish may escape capture but not survive].
- **Q:** Did managers assume 100 percent mortality for cod in the Gulf of Maine?
  A: Yes they did. We probably need more work on this, but they did not have any better number to use.
- Gulf of Maine cod are coming back but are not there yet.
- Today, aggregations of whiting may not be available because inshore areas are [closed to fishing at certain times of the year] and the offshore areas contain a large amount of fixed gear.

Part III

Finding Solutions to Bycatch in New England

Gear Technology—Commercial Fishing

Presented by Christopher Glass, Manomet, at the Rhode Island, Maine, New Hampshire, and Connecticut Workshops

The intent of this presentation is to give an overview of ongoing gear technology work in the New England region and to offer a bit of a global perspective on it. The real bycatch problem is discard mortality. Some work has been done on survivability of various species, but we do not have enough information to draw conclusions. As fish stocks increase, the levels of discards will increase. What works today may not work tomorrow. There is seasonal and regional variability in bycatch.

If one observes a fishing net while it is deployed underwater, one will note different species of fish reacting in different ways. This species-specific behavior allows scientists to make modifications to the net in ways that will allow fishermen to catch or release fish under the water so they are not brought up in the net and then discarded. One such example is a separator trawl that has two separate codends. Gear modifications also give fisheries managers more options in managing fish stocks.

Methods of Bycatch Reduction

Mechanical separation devices and nets sort fish by size or shape. Here are several examples:

- *Composite codend*—Combines a 6.5-inch diamond mesh on bottom, which is useful in releasing flatfish, with 6.5-inch square mesh on top, which is useful in releasing round fish, to provide a better selection for flatfish and round fish, as well as releasing non-target, smaller individuals.
- *Nordmøre grid*—Developed in Norway for the northern shrimp trawl fishery, this device now has been tested or introduced in Australia and Canada. It is not behavior oriented; it makes use of the size differences between shrimp and finfish.
- *Selection grid*—This is another size selection device that can be used in groundfish fisheries. The device can be used upside down or sideways depending on the target fish.
- *Sorting/separation grid*—This device uses a guiding panel and a sorting grid to separate small and large fish. The management opportunities with this technology are plentiful.
- *Ex-it small cod excluder*—There is a popular misconception that these bycatch reduction devices only work with small vessels. Yet many extremely large vessels use this device. Its 16 mm bar spacing reduces undersize cod bycatch by 60 to 66 percent.
- *Sort-X small fish excluder* —Good in theory, but this device is a danger to crew on deck, not practical, and too expensive.

Another set of devices and nets reduce bycatch by separating fish according to their behavior. Below are some examples:

- *Square mesh escape panels*—Nets with escape panels along the top of the trawl. There are two modifications on the panels: The Danish panel is sited on the side, and the Swedish panel, also sited on the net's side, has square mesh to allow cod to escape.
- *Footrope arrangements*—These are composed of chains attached at the fishing line every 30 centimeters (cm). Two modifications on the device include a footrope arrangement for muddy ground and one for high-speed towing. The arrangement for muddy ground consists of chains only attached at certain parts of fishing line to avoid capture of debris. The high-speed towing arrangement uses chain and is attached by short dropper chains of 20 to 25 cm. These are referred to as the raised footrope trawl and the sweepless raised footrope trawl.
- *Topless trawl*—This trawl net is designed to be flatfish specific.
- *Square mesh window*—Developed in Norway and Scotland, this net uses mesh selectivity to draw on the difference in swimming abilities between fish and shrimp.
- *Radial escape section (RES)*—Developed in Norway, this modification also captures the difference in swimming abilities between fish and shrimp.
- *"Murphy Shooter" RES*—This is a third device that utilizes the difference in swimming abilities.

"Twenty years ago there were no regulatory discards: If I was able to put it on the deck, I was able to sell it. If it was not a legal size for market, it was sold as bait."

—Proctor Wells

Through the development of new fishing gear modifications, we're trying to ensure that we end up with sustainable fisheries. But the gear modifications must be simple and cheap in order for them to make their way into fishing practice.

Comments and Questions

- The goal of this kind of research is to provide a toolbox to industry so that they can target the fish they want to catch.
- **Q:** Are any of these gear types being commonly used?
  A: Some of them are. Square mesh windows is an example.
- In the New England region, only two bycatch reduction methods have been implemented: the Nordmore grate and the raised footrope trawl.
- The Nordmore grate was great, but we need to continue to develop new gear modifications.
- The sweepless net is best for reducing bottom impacts.
- **Q:** Mesh color may trigger behavior in fish. Has this been looked at?
  A: There are efforts in progress to look at this. A square mesh panel was not efficient, but its efficiency can be improved by giving fish a strong visual stimulus behind them. The natural behavior pattern causes fish to end up in the codend and not charge the side mesh. Changes in colors in sections of the net force a charging behavior and results in an increase in size selectivity.
- Sorting has actually made the nets quite a bit lighter—at least in the squid fisheries at the Hague Line. Because of this, the bycatch itself is much lower.
- Historically, we have always had species-specific trawls. We then moved to all-purpose trawls and we are gradually getting back to the single-species targeting.
- Simple modifications have been made. For example, fishermen do not go to places where they know they will catch dogfish.
- The video shows what discards would have been. Fishing gears in use are not that efficient.
- Sometimes a bycatch reduction of 60 percent may not be considered good enough. But why shouldn't it be used?
- It is difficult to measure how many fish are impacted by gear and do not survive. There is an unaccounted mortality factor in stock assessments.
- The fishing industry has done many things themselves to reduce the problem of bycatch.
- We may need regulations such as bycatch allocations to encourage the use of this gear.
- Individual fishermen can decide to use a more efficient net because they see the benefit. This information can be shared. It does not always have to be approached through regulations.
- The problem is we do not have the days at sea to try these new methods.
- **Q:** Is there adequate funding for this research?
  A: There is more funding available now than there was five years ago but not enough to take the results to the implementation level. This would require fleet-wide trials and extensive observer coverage. Many things are being developed but the funding is not there to have these methods adopted.
- **Q:** There seems to be technology that has been developed elsewhere. Can it be tried here?
  A: Some of it is being worked on here as well. But although this type of work has been going on in this region, it is not being implemented. We are currently three years into the latest funding cycle and we have to start making use of the research results. There is a disconnect between the scientific product and implementation. Funding will dry up.
- **Q:** How do we make sure the technology makes its way to the next level?
  A: Lobbying may be needed, but it may simply be a matter of pushing the buttons to get these things implemented. Industry needs to see the results of this type of work.
- There have been initiatives in the past couple of years to do this. Manomet held a series of meetings in the region. The output of those meetings is on the Manomet website. We still need to find a way to get to the next level.
- This information does not get to the public and it should.
- There is a huge need for research, but the hang up is that fishermen have to go to NMFS for permits to do this type of research and NMFS has its own agendas to do their own research. It is hard to get fishermen and scientist programs in place.
- We need to streamline experimental fisheries process and have observer coverage to document what is working and what is not.

Gear Technology—Recreational Fishing: Hooking Mortality—What Are the Issues and How Do We Best Manage Them?

Presented by Nancy Balcom, Connecticut Sea Grant Program, for Mark Malchoff, Lake Champlain Sea Grant Program, at the Rhode Island Workshop

Today's presentation will characterize marine catch and release mortality in New England, identify the sources of mortality, describe current research being conducted in the mid-Atlantic region, and offer suggestions for reducing hooking mortality.

The majority of economically important marine fish species in the Northeast are fully exploited or overexploited. The recreational fishing effort is not insignificant, especially in waters adjacent to metropolitan areas. Species targeted include bluefish, striped bass, black sea bass, and porgy. Many of these species are released alive. Management regulations and changing angler values help to ensure this. Information from the MRFSS suggests that the number of fish released alive is increasing, which is likely a function of stringent catch limits and stock rebuilding (Fig. 16).

In 2001, New England anglers released alive over three million bluefish, 2.7 million scup, one million summer flounder, and 0.25 million black sea bass. This represents 69 percent of the bluefish, 48 percent of the scup, 64 percent of the summer flounder, and 61 percent of the black sea bass caught by marine recreational anglers in the five-state region. Not shown in Figure 16 are the striped bass data, which (not surprisingly) dwarfs the plots shown here. In 2001, New England anglers caught an estimated 8.4 million bass—about 94 percent of which were released alive.

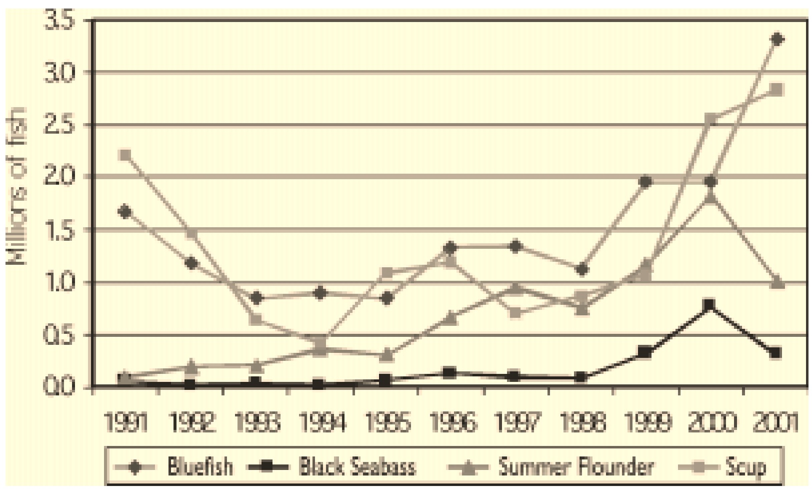


Figure 16. Data represent the released-fish (B2) component of the MRFSS for the period, 1991–2001. *Source: NMFS Fisheries Statistics and Economics Division, Silver Spring, Md.*

Thousands of Fish Released, How Many Live?

Research is starting to confirm what anglers have long suspected: Most fish, especially marine fish, live following release. Table 7 shows data collected by Malchoff and Heins at Captree Boat Basin on Long Island in 1995. The authors caught and caged 90 weakfish. After 72 hours, the mortality was 2.6 percent. Other workers have also reported low mortality in marine fisheries. Bugley and Shepherd (1991) recorded very low mortality (2 to10 percent) in a study of black sea bass caught on natural baits. Other studies on other species have revealed higher mortalities, but short-term mortality in marine inshore species is commonly no worse than 10 to 20 percent.

Table 7. Weakfish mortality following capture by single-barb hooks. *Source: Malchoff, M. and S. Heins. 1997. Short-term hooking mortality of weakfish caught on single-barb hooks.* North American Journal of Fisheries Management *17:477–481.*

	Temp (˚C)	**Salinity (ppt)**	**Number of Fish**	**Percent Mortality**
Trial 1	27	29	26	0.0
Trial 2	23	23	31	6.5
Trial 3	23	25	26	3.8
Trial 4	22	32	7	0.0
Total			90	
Mean mortality				2.6
95% Confidence Interval				0.6-7.0

Causes of Mortality

Why do some fish die following their release? There are three primary causes: hook wounding, stress, and depressurization (barotrauma). Hook wounding is an important mortality factor that is also species specific. It is influenced by many variables including the wound's location, hook style and size, presence or absence of barbs, and lure type (artificial vs. live bait). Previous scientific studies identified the factors that influence hooking mortality. The first is hook location. The greatest risk occurs in the areas of the gill and stomach; intermediate risk occurs in the areas of the lower jaw, isthmus, and eye; lowest risk occurs in the snout, maxillary, corner of mouth, and cheek (Fig. 17).

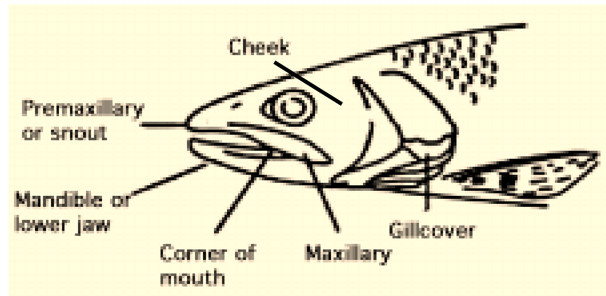


Figure 17. Diagram of a fish's head showing potential hooking locations.

The other factor that influences hooking mortality is the type of bait/lures used. Baited hooks result in greater injury than artificial lures. Fish tend to swallow live bait into the gullet near the gills, although it is possible to reduce this type of risk by using different angling techniques.

Angling stress causes mortality because of a cascade of physiological events:

- Muscular exertion
- Production of lactic acid in muscle tissues
- Increase in blood lactate
- Decrease in blood pH (blood becomes more acidic—"blood acidosis")
- Problems regulating ion exchange between body tissues and the water

If the fish is not exercised to exhaustion or encounters only minor oxygen debt, it usually regains its ability to regulate ion exchange and control important metabolic processes and will live. If the fish is exercised to exhaustion and encounters significant oxygen debt, lactic acid production continues (anaerobic glycolysis), ion regulation ability and metabolic processes remain out of control, and the fish will die.

Barotrauma is a third cause of mortality. It results from bringing a fish up from depth too fast. The fish's swim bladder overinflates/ruptures, the stomach/intestines are displaced, and the eyes bulge. The volume of air in a fish's swim bladder is proportional to the pressure at the depth at which a fish is swimming. If a black sea bass is suddenly retrieved from 33 feet, the pressure decreases by 1 atmosphere (atm) and the volume in the swim bladder increases by 50 percent. This phenomenon—well known to divers and high school chemistry students—is known as Boyle's Law. The relationship is not linear, however—pressure at 100 feet is only 3 atm, but swim bladder volume will increase by 75 percent. Some researchers advocate puncture of the swim bladder by inserting a hollow needle behind the pectoral fin. But if not done correctly, this can kill a fish. The best advice is to minimize capture of sub-legal fish in waters deeper than 50 feet and return live fish to the water immediately. Malchoff has witnessed black sea bass swimming back to depth if *released within 30 seconds of capture*. Anglers determined to puncture the swim bladder should learn to do it correctly. Contact your local Sea Grant office or contact Florida Sea Grant to request this information. More information can be found at http://edis.ifas.ufl.edu/SG047.

Can Hooking Mortality Be Reduced?

Recent research has explored the use of artificial lures vs. bait, hook style and size, the role of water temperature, and other variables. Malchoff and others have used standard methods in performing hooking mortality studies. The studies are composed of a series of angling trials with 10 to 25 fish per trial. At the end of the angling trial, fish are caged as close as possible to their capture site. Cage designs are usually a compromise of portability and cost yet enclosing enough space to prevent fish crowding (Fig. 18). Hook style and size, hook removal status (left or removed), wound location, presence of bleeding, salinity, and water temperature are recorded. Following capture, fish are kept aboard in some type of life-well, with oxygen maintained by water exchange or aeration. In these studies, all fish recovered after 72 hours. Mortality is expressed as a percentage of the total number of fish in each trial. Statistical bootstrapping is used to determine mean mortality with a 95 percent confidence interval. Mortality is modeled using a logistic regression.

Anglers often can’t control many of the variables influencing catch and release mortality. However, terminal tackle is one that they can control. Interest in trying to reduce hook wounding has led several researchers to investigate the role of three hook types in the summer flounder fishery (Fig. 19). The results of this study are shown in Figure 20. As predicted, circle hooks did reduce the incidence of gut hooking. However, the differences were not significant, as is shown in the data generated from a logistic regression model. The significance of each component in the model, after adjustment of the other components, is listed in Table 8.

This study was carried out in two locations—Virginia/North Carolina and New York. Leader status had two levels: 1) leaders cut and hooks left in (Virginia/North Carolina fish with hook wound posterior to pharynx) and 2) all leaders and hooks removed (Virginia/North Carolina fish with hook wound anterior to pharynx, and all New York fish, regardless of hook wound location). In either study area, the level of mortality in the fishery was found to be quite low, ranging from about 6 to 15 percent (Table 9).

Figure 18. Example of a cage design used in angling trials.

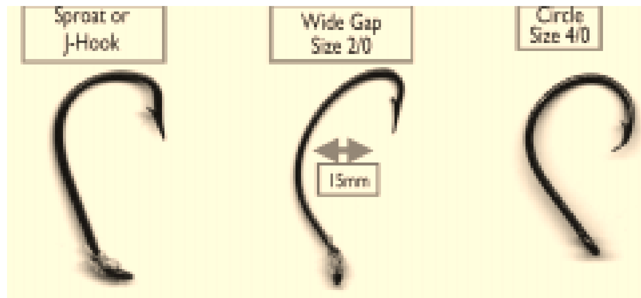


Figure 19. Three different hook types used to study hook wounding in summer flounder.

Table 8. Results generated by a logistic regression model run on data generated by the summer flounder hooking study. *Source: Malchoff et al., 2002.*

Parameter	**Probability**
Leader status	<0.0001
Hook type	>0.05
Wound location	<0.0001
Bleeding	<0.0001
Temperature (˚C)	<0.05
Length (mm)	>0.82
Bleeding*Hook Type (interaction)	<0.0001
Bleeding*Length (interaction)	<0.01

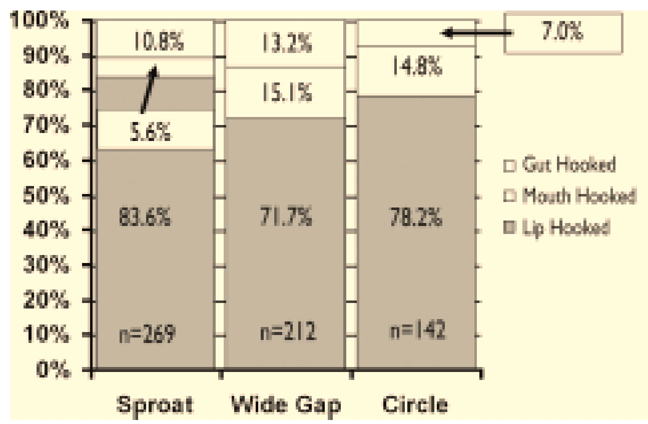


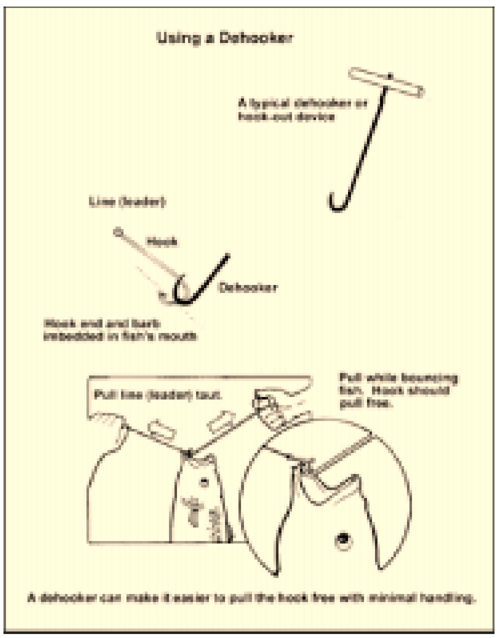
Figure 20. Results of hook type vs. wound location in a summer flounder hooking study.

Table 9. Overall summer flounder mortality across both study locations. *Source: Malchoff et al., 2002.*

	NY	**VA-NC Combined**	**Overall (total)**
Mortality	14.6	6.1	9.5
95% CI	7.9–21.2	3.2–9.5	7.4–11.9
Sample	247	376	623

Other hooking studies have yielded interesting results. Below are some highlights:

- Circle hooks are a significant predictor of wound location in tuna. Bluefin catch and release mortality is estimated at 4 percent with circle hooks, and 28 percent on straight hooks (Skomal, Chase, and Prince, 2002).
- Circle hooks resulted in lower mortality in 16 species in the pelagic longline fishery (Falterman and Graves, 2002).
- "Careful release" (rolling hook out, cutting gangion) reduced discard mortality to 11 percent in the pacific halibut fishery (Trumble, Kaimmer, and Williams, 2002).
- Fewer striped bass were deeply hooked (10.6 percent vs. 45.6 percent) with circle hooks compared to standard hooks in Chesapeake Bay (Lukacovic and Uphoff, 2002).
- There was little difference between treble hooks and single hooks on mortality in spotted seatrout (Duffy, 2002).
- Mortality in tauter was significantly higher in deep water (11 to 17 meters) vs. shallow water (less than 10 meters) (Lucy and Arendt, 2002).



In order to maximize survivability of released fish, Malchoff recommends the following:

- Minimize stress
- Try circle hooks or barbless hooks to minimize wounding
- Set hook quickly if fishing with live bait
- Use dehooker or other techniques to minimize handling
- Contact Sea Grant for additional advice

For More Information:

- New York Sea Grant Website: http://www.seagrant.sunysb.edu/Fishery/AnglerResource/Techniques/ReleasingFish.htm
- Florida Sea Grant Website: http://edis.ifas.ufl.edu/SG047
- Contact Mark Malchoff, Lake Champlain Sea Grant: mark.malchoff@plattsburgh.edu

Figure 21. The proper use of a dehooking tool.

Gear Technology—Commercial and Recreational Rod and Reel/Handline Sector

Presented by Gil Pope, Rhode Island Representative to the Atlantic States Marine Fisheries Commission (ASMFC), at the Connecticut Workshop

There is a lot of bycatch or hook-and-release mortality in recreational fisheries (handline or hook-and-line fisheries). In the case of striped bass, I believe this mortality is almost double the number of fish allowed to be harvested by the commercial sector, or about 8 percent of the catch. This varies according to many factors, such as water temperature and season.

Temperature and season are especially important when saltwater fishing. The higher the temperature, the higher the mortality rate. In the upper Chesapeake Bay of Maryland, when water temperature rose too high, areas were closed to all types of fishing because the mortality rate was over 78 percent. Depth is another important factor. Fish such as cod have a difficult time tolerating rapid pressure differences. In fresh water, habitat is an issue. People often fish on spawning beds. If a fish is removed from the bed for even a few seconds, another fish will eat the unguarded eggs. Stringent management control of spawning beds would alleviate the situation. While difficult to enforce, making people aware of the reasons for the restriction might alleviate bad feelings about not being able to fish in certain areas at certain times. For fish such as cod that are not able to tolerate being brought up from depth too quickly, lowering the recreational and commercial size limits on bottom fish known to have huge discard mortality rates would be helpful. This would benefit the charter boat industry as well, where a trip may catch 15 codfish and the customer can keep only one. This is not good for business and doesn't help the resource because fish are discarded that could be kept. This is a personal observation that must be weighed against the total fishery mortality rate. An alternative to lowering size limits would be to encourage the use of larger size hooks when cod fishing. Using a larger hook would result in catching only larger fish since the large hooks are hard for small fish to swallow. This is applicable to all recreational fisheries.

In the rod-and-reel/handline fisheries, not much has been much done in the way of gear technology other than the switch from linen lines to spectra-lines with zero-stretch (brought over by people who used them for kite fishing). These fisheries use a variety of hooks, lures, and plugs. The plugs are probably the most technologically advanced of all the available gear technology. Hook use is quite variable. The worst type of hook is the treble hook. Many bluefish have been caught using a front CastMaster with a treble hook. Once the bluefish closes its mouth, the angler can't open the mouth to free the hook and he/she must cut the mouth open to free the fish. The CastMaster with a single hook is a better alternative. To make the hook really safe, the angler can bend the barb back with a pair of pliers, making hook removal much easier. This arrangement is also a bit safer than the plug. Plugs, spoons, and trolling with umbrella rigs, which have a long hook, catch the fish somewhere in the mouth without inflicting much damage. Single tube lures—some of which are made with surgical tubing—are easy to remove from the fish. Stainless steel hooks provide yet another alternative and will not rot (rust) in the fish. People are wary to use these, though, because the fish won't be able to get rid of it. However, I've seen bluefish just about ready to pass a stainless hook. There are two schools of thought: If a bronze hook is used and it does get stuck somewhere, it might dissolve slowly causing infection, whereas a stainless steel hook might not be removable, but it won't corrode.

> "The biggest question facing the [handline] fishery is, 'How will we turn our discards into landings?' It becomes a matter of trusting the fishermen. Fishermen hate to throw back a dead fish, especially one that's 1 inch under the legal size."
>
> *—Gil Pope*

Fishing with live bait is another controversial issue. Live bait fishing uses treble hooks, single hooks, J-hooks (easily swallowed), and circle hooks. Circle hooks are safe and effective. They were first used in halibut and cod fishing on trout lines and longlines. Circle hooks (mentioned in new Amendment 6) actually curve inward and will hook in the side of the mouth almost every time, but they are hard to sell to the public because they look unreliable. Another issue with live bait is predation on the hooked fish. I've fished using live bait in the Florida Keys; I caught 10 fish and got none to the surface because hammerhead sharks immediately ate them. How can a recreational fishery be sustained with these experiences? Every fish will either get eaten on the way up or the way down. That's 100 percent hook mortality in one way or another. The predator factor must be taken into account.

Catch and Release Recommendations

Anglers not planning to keep their catch can minimize fish damage and mortality by following several guidelines. Try removing the hooks from a popping plug (a plug that stays on the surface). The fish will come to the surface, swallow, and let go. The fish can still be played, get two or three strikes, and the fishing experience is still enjoyable. And it doesn't hurt the fish. Try not to play a fish too long, however, especially bigger fish. The longer a fish is played, the more stressful to the fish. Fish do not cope with exhaustion. The size of the fish makes a difference in the amount of gill area they have. Fish gills do not grow in relation to body size, so bigger fish actually don't fare as well as smaller ones because of a low gill-to-oxygen demand ratio.

True sportsmen experiment without hooks or they crimp back the hook; with any resistance, they can pull the hook out with no real damage to the fish. Anglers should use a hook removal tool. They're a must in all fisheries. Buy the biggest, best quality tool because the smaller removal tools seem to do more damage than good. Use a lipping tool (closes on the bottom lip of the fish). This allows the angler to control the fish long enough to reel it to the boat and remove the hook without touching the fish. Fish handling leaves bruises and marks, as well as removes the slime on the fish. Always use gloves and handle the fish as little as possible. The type of rod also plays a role in the time it takes to get the fish into the boat.

Fish tagging is an issue that arises in the handline fishery. Should anyone be able to tag and release fish? The data are anecdotal. There is no hard information on who tagged fish and when, so the data do not provide good mortality rate information and cannot always be used by management. In addition, if tagging is improperly done, the swim bladder can be punctured, killing the fish.

Size Regulations and Daily Limits

The perfect size at which to harvest fish is also a difficult question for the handline sector. Studies done in New Hampshire and Maryland illustrate opposite ends of the spectrum. In the New Hampshire study, with a 32-inch limit, 5,900 fish were harvested, but 19,464 that were released died. In the Maryland study, with an 18-inch limit, more smaller fish were utilized. The hook-and-release mortality was much lower. Also, when is egg production more important in the larger size than hook-and-release mortality and at what size is optimum production attained? Which fishery do we want—the one in which fish can be taken and used or the one in which three times the harvested amount is thrown back dead? Smaller fish are dying; in some cases, a smaller size limit may be the solution. It is a question of philosophy. This also becomes a high-grading issue. For example, in Rhode Island, handline fishermen are allowed four striped bass per day that are over 32 inches. So there will be guys who keep fishing, using the tougher hooks and throwing back dead fish, until they get their best four fish. With a set poundage amount and a size limit at 28 inches, fishermen would be encouraged to keep the 28-inch fish, and high-grading would occur less.

Fish Species vs. Release Survivability

The following are fish species for which release survivability information exists. Note, however, that each species must be handled differently because of the difference in hook-and-release mortality between them:

- Striped bass: 8 percent mortality (some studies are as high as 25 percent or as low as 3 percent, but 8 percent is generally accepted)
- Cod/pollock/haddock: Likely high mortality because of the depth issue
- Bluefish: Unknown. But many people find this fish undesirable and throw it back. Mortality probably high
- Fluke: 10 percent mortality
- Winter flounder: Don’t know; these fish haven’t been well studied
- Scup: Low mortality because they don’t swim very deep and a bigger hook can be used to avoid catching smaller ones
- Sea bass: Low to medium mortality depending on hook size. Depth is not an issue
- Tautog: Very low mortality
- Weakfish: Very soft; sometimes fall right off the hook. Fairly good survivability unless overly handled

Bycatch Regulations and Management

Making mandatory bycatch regulations in the recreational fishery is difficult; for example, Amendment 6 of the striped bass plan called for the mandatory use of circle hooks, which was subsequently rejected by the public. The biggest question facing the fishery is, ‘How will we turn our discards into landings?’ It becomes a matter of trusting the fishermen. Fishermen hate to throw back a dead fish, especially one that’s 1 inch under the legal size. How is this remedied? Managers must trust the recreational/commercial angler to do the right thing. We seem to have gotten away from doing that and want to pin the blame on the fishermen. I, for one, would like to see better real time data on abundance and mortality. Let’s look at a prime example: Scup and fluke have scheduled reductions in fishing mortality in a current FMP during periods of underestimated and increasing stock abundance. Fluke appears to be on the way up, as does scup, but fishermen are scheduled for another 33 percent reduction. I do not think it will happen, but there is a lag in the data, which throws off discard estimates. We need to encourage NMFS and the ASMFC to increase their gathering of MRFSS data since they are currently inaccurate and untimely. This is hurting a lot of anglers. MRFSS data are used extensively in all management plans yet they are inadequate. The data were never intended to be used in this fashion. Can or will NMFS and the ASMFC adapt to new management ideas on the allowable utilization of unavoidable and regulatory discards? Are they willing to change management styles? The recreational or commercial angler should not be punished for something they cannot avoid.

Comments and Questions

- Sizes differ between treble and circle hooks—an 11-inch hook is not the same for both—the circle hook would be smaller.
- A lot of barbs can be bent back to make the hook almost barbless, which is a great idea to prevent mortality.
- Each hook company has a different way of sizing their hooks. So with mandatory hook sizes, the angler must pick a manufacturer because they are different. If the manufacturers cannot get together, it is almost impossible to make a law regarding hook size.

- **Q:** Does a recreational code of fishing exist?
  A: There was one; it passed through the legislature and nobody knew until it was done. Anglers felt put off and didn't buy into the process.
- **Q:** Do you think the commercial fishery for striped bass has had a tremendous impact on the numbers of striped bass in Rhode Island waters?
  A: No. I think the success of the charter industry switching from codfish to striped bass has had an effect. Overall, the commercial fishery (three per day) in Rhode Island does not have much of an impact. In Massachusetts, they keep 40 fish per day. High-grading is an issue. When the limit was at 40 inches, people kept, on average, one in 30. Again, does a smaller size limit lessen this mortality? I think in some cases we have made the size limit too big for the good of the stock.
- **Q:** Do you have any information on striped bass bycatch in other fisheries?
  A: Studies have been done in the dogfish fishery. This bycatch is underestimated by about 20 percent in the commercial fisheries, but there is no information to prove that. The information has been anecdotal and fish caught in the Exclusive Economic Zone is not included.

Management Strategies

Presented by Paul Howard, NEFMC, at the Rhode Island, Maine, and New Hampshire Workshops

Presented by Eric Smith, Connecticut Department of Environmental Protection, at the Connecticut Workshop

Being a fisheries manager is a difficult profession. There are numerous legal requirements, including the Marine Mammal Protection Act, Endangered Species Act, and Regulatory Flexibility Act. There are competing national standards—of the 10 national standards in the MSA, many compete with each other; for example, end overfishing but minimize the economic and social impacts on fishermen and their communities. There are differing public perspectives: The recreational fishermen want to maximize access to fish and feel they did not cause any of the overfishing problems. The commercial fishermen want a sustainable fishery and want to maximize revenues. The environmentalists take the simplistic view of wanting fish in the ocean. Fisheries management is also made difficult by lawsuits launched because everyone takes an overly simplistic approach to the problems in the fishery. Finally, the quality and amount of scientific information on which managers make decisions often breed a lack of trust. However, despite confusion and uncertainty, significant gains have been made.

The MSA requires that, "to the extent practicable, bycatch should be minimized and the mortality of bycatch that cannot be avoided should be minimized." The fisheries councils are required to consider about 20 factors and conduct assessments to determine what is "to the extent practicable." Prior to 1996, bycatch was incidental catch. After 1996, the Sustainable Fisheries Act (SFA) substituted "discards" for "bycatch." The Act also requires standardized reporting methodology to assess the amount and type of bycatch occurring in a fishery. The councils must have bycatch reports in all of their fishery management plans.

Bycatch is also reported in the fisheries. Each permitted vessel must report catch and landings in vessel trip reports submitted on a periodic basis. The sea sampling/observer program places personnel on boats to observe and estimate discards on a haul-by-haul basis. The MRFSS is composed of interviews and random phone calls of recreational anglers. Each method has some drawbacks. The vessel trip reports are not very reliable. Observer program reporting is reliable but expensive. And the recreational sampling program is not very reliable.

In addition to obtaining bycatch data to comply with legal requirements, bycatch data are used in stock assessments. The amount of bycatch is estimated annually in assessments. Generally, bycatch estimates fall into three categories: stocks for which no estimates are possible, stocks for which estimates are possible, but not included in a catch-at-age matrix, and stocks for which estimates are available and used. For most stocks, estimates of discard mortality are not known. Generally, assessments assume all discards are dead. We have made great progress in New England to reduce bycatch. Fisheries managers have taken extensive measures to reduce bycatch as part of FMPs:

- Effort reductions have decreased fishermen's days at sea
- Minimum mesh size has gone from unregulated to larger mesh size requirements

- Exempted fisheries must demonstrate minimal bycatch occurring to keep fishing
- Year-round and seasonal closures were put in place, such as the seasonal closure to protect cod aggregates during spawning season
- Increased possession limits, such as the limit for haddock, were increased as stocks improved
- Selective fishing gear was developed including the footrope trawl and Nordmore grate
- Running clock meant that if fishermen catch their abundance in one trip, they call into dock three days later
- Mandatory observer coverage
- Bycatch limits
- Small mesh multispecies plan

The fishery management councils' goals are to:

- Collect accurate data to define the problem before taking action. This includes accurate data on the percentage of bycatch and on mortality
- Define "to the extent practicable." The goal is to work with NMFS to develop a national policy on what is practicable
- Support cooperative research to improve fishing gear. The Northeast region has many opportunities for cooperative research; we need to demonstrate that we are applying the research to management problems
- Develop process to apply gear research results to management
- Be adaptive (short term vs. long term)
- Develop incentives for fishermen to avoid bycatch, such as more days at sea if they use 2-inch larger mesh than required, or allow to them to fish in closed areas if they use new untested gear being developed
- Maintain stocks at or close to B_{msy}.

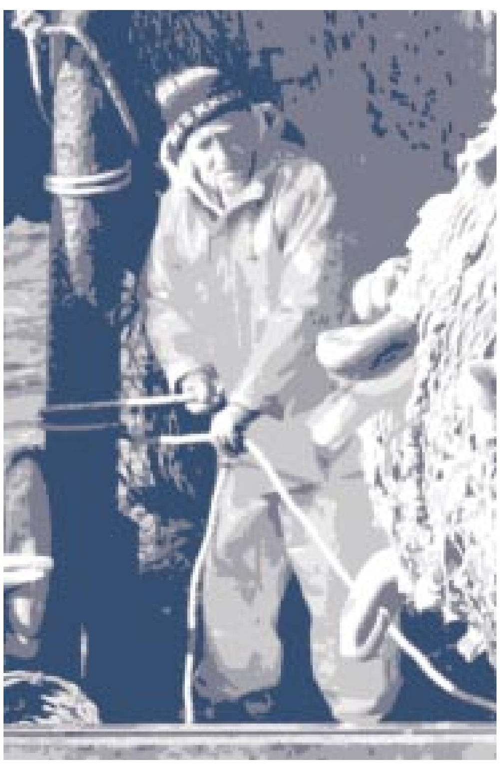
If all stocks are maintained at high abundance, we will have less problem with bycatch. Low abundance of one stock could prohibit the catching of the other stocks. For example, an abundance of haddock exists but can't be harvested because skate stocks are low; scallops are productive, but we have to worry about the bycatch of southern New England yellowtail flounder.

Collecting timely and reliable data is essential to meet National Standard 9 requirements and to improve accuracy of stock assessments. The NEFMC has implemented an extensive list of measures over the years to reduce bycatch but very little credit has been given. Observer coverage, study fleets, and more selective gear research are the keys to solving bycatch problems.

Comments and Questions

- What is missing here is the fact that in the SFA there is a 10-year rebuilding stage. In my mind, that has damaged many fisheries (while, granted, doing good in some fisheries). Fisheries need to rebuild over different time periods. Management must address the unique rebuilding periods.
- Before the SFA, there was no standard and therefore no goal to achieve. Ten years is an arbitrary number for the biology of the species addressed. Now some people ask if 10 years is useful or not; that point is debatable. It would be helpful to see something more scientific and less arbitrary.
- **Q:** Are effort reductions reducing bycatch?
  A: Overall fishing effort is increasing. Days for individual fishermen have been reduced, but the capacity in the fleet has increased.
- **Q:** The means of measuring effort may not give the true picture of what is happening. Catch rates have not gone up. Industry is being made less efficient by management measures aimed at managing individual species of stocks. Steaming time is a big part of days at sea. We may need to look at aggregate trip limits or TACs and allow fishermen to go out and keep everything they catch.
  A: The problem is that we are not at a point where all stocks have been rebuilt. Fishermen will target species with highest market value.
- Stocks are at different abundance levels. If fishermen are allowed to keep everything, they will target the ones that will bring a higher price. Managers are trying to have fishermen target fish at higher abundance levels.
- Great gains have been and will continue to be made in rebuilding stocks. Examples include herring, scallops, whiting, and monkfish.

- Fishermen need to understand the importance of accurate bycatch data. It affects stock assessments. Fishermen tend to think the more information they give, the more it will be used against them.
- **Q:** If hard TAC numbers are used in relation to bycatch, there is an assumption made that scientists know the population of a stock. But stock assessments can be wrong.
  A: Industry should demand more accurate and timely science to support a hard TAC system.
- The majority of fishermen are saying the science is wrong. Fishermen need to work with the scientists to have some buy-in of the science.
- Fisheries management has to find the right medium to manage for both fishing mortality reductions and bycatch reductions.
- Most discards thrown overboard are sub-legal size fish. How do we avoid this?
- The real problem from the fisherman's point of view is that regulatory discards are a massive waste. Management understands that. If we can find a way through gear technology to avoid nontarget species, then we can avoid trip limits.
- Regardless of the mesh size, some flounder get caught most times. Yellowtail is a good example of this because they get hung up on the net. There is no foolproof method.
- Scup are rebuilt, so the running clock approach works very well for them. Cod and yellowtail flounder are slower at rebuilding. Most people are put off by the running clock approach because of the mortality issue. You cannot make a productive trip in that short amount of time. Under the old running clock you could decide not to go cod fishing and instead go out and fish in another fishery while maybe discarding cod in that trip. Catch fish, come home, and stay home—that's the "new" running clock.
- On the West Coast, the observer program is funded by the fishing industry. On the East Coast, in our scallop fishery, there is some funding set aside by industry for research and observers. This is a lucrative fishery. There is reluctance for the government to pay for a national observer program.
- We currently have funding for over 300 days of observer time to put on cooperative research platforms.
- Recently there has been a major reorganization in NMFS. The science and research director no longer will report to the regional administrator. He/she will report to a science director at headquarters. It will be interesting to see how this effects communication—the expectations are that it will improve. Better communication will cut down the bureaucracy of going up the chain of command.
- **Q:** Is there a specific process (e.g. number of tows) that experimental work needs to go through to be accepted by NMFS?
  A: Peer review is needed but it would be useful for this information to go to management development teams so they can consider it as they develop management strategies.



"Fishermen need to shoulder responsibility for bycatch. There is the need to raise the consciousness of some fishermen and we try to do this using peer pressure, but it is impossible to regulate morality. Fishermen should never put capitalism ahead of sustainable fishing practices."

—Chris Brown

Handouts from Paul Howard:

[Code of Federal Regulations]
[Title 50, Volume 4]
[Revised as of October 1, 2002]
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[Page 44-45]

TITLE 50—WILDLIFE AND FISHERIES

DEPARTMENT OF COMMERCE

PART 600—MAGNUSON-STEVENS ACT PROVISIONS—Table of Contents

Subpart D—National Standards

Sec. 600.**350** National Standard 9—Bycatch.

(a) Standard 9. Conservation and management measures shall, to the extent practicable:

(1) Minimize bycatch; and

(2) To the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

(b) General. This national standard requires Councils to consider the bycatch effects of existing and planned conservation and management measures. Bycatch can, in two ways, impede efforts to protect marine ecosystems and achieve sustainable fisheries and the full benefits they can provide to the Nation. First, bycatch can increase substantially the uncertainty concerning total fishing-related mortality, which makes it more difficult to assess the status of stocks, to set the appropriate OY and define overfishing levels, and to ensure that OYs are attained and overfishing levels are not exceeded. Second, bycatch may also preclude other more productive uses of fishery resources.

(c) Definition—Bycatch. The term “bycatch” means fish that are harvested in a fishery, but that are not sold or kept for personal use. Bycatch includes the discard of whole fish at sea or elsewhere, including economic discards and regulatory discards, and fishing mortality due to an encounter with fishing gear that does not result in capture of fish (i.e., unobserved fishing mortality). Bycatch does not include any fish that legally are retained in a fishery and kept for personal, tribal, or cultural use, or that enter commerce through sale, barter, or trade. Bycatch does not include fish released alive under a recreational catch-and-release fishery management program. A catch-and-release fishery management program is one in which the retention of a particular species is prohibited. In such a program, those fish released alive would not be considered bycatch. Bycatch also does not include Atlantic highly migratory species harvested in a commercial fishery that are not regulatory discards and that are tagged and released alive under a scientific tag-and-release program established by the Secretary.

(d) Minimizing bycatch and bycatch mortality. The priority under this standard is first to avoid catching bycatch species where practicable. Fish that are bycatch and cannot be avoided must, to the extent practicable, be returned to the sea alive. Any proposed conservation and management measure that does not give priority to avoiding the capture of bycatch species must be supported by appropriate analyses. In their evaluation, the Councils must consider the net benefits to the Nation, which include, but are not limited to: Negative impacts on affected stocks; incomes accruing to participants in directed fisheries in both the short and long term; incomes accruing to participants in fisheries that target the bycatch species; environmental consequences; non-market values of bycatch species, which include non-consumptive uses of bycatch species and existence values, as well as recreational values; and impacts on other marine organisms. To evaluate conservation and management measures relative to this and other national standards, as well as to evaluate total fishing mortality, Councils must—

(1) Promote development of a database on bycatch and bycatch mortality in the fishery to the extent practicable. A review and, where necessary, improvement of data collection methods, data sources, and applications of data must be initiated for each fishery to determine the amount, type, disposition, and other characteristics of bycatch and bycatch mortality in each fishery for purposes of this standard and of section 303(a)(11) and (12) of the Magnuson-Stevens Act. Bycatch should be categorized to focus on management responses necessary to minimize bycatch and bycatch mortality to the extent practicable. When appropriate, management measures, such as at-sea monitoring programs, should be developed to meet these information needs.

(2) For each management measure, assess the effects on the amount and type of bycatch and bycatch mortality in the fishery. Most conservation and management measures can affect the amounts of bycatch or bycatch mortality in a fishery, as well as the extent to which further reductions in bycatch are practicable. In analyzing measures, including the status quo, Councils should assess the impacts of minimizing bycatch and bycatch mortality, as well as consistency of the selected measure with other national standards and applicable laws. The benefits of minimizing bycatch to the extent practicable should be identified and an assessment of the impact of the selected measure on bycatch and bycatch mortality provided. Due to limitations on the information available, fishery managers may not be able to generate precise estimates of bycatch and bycatch mortality or other effects for each alternative. In the absence of quantitative estimates of the impacts of each alternative, Councils may use qualitative measures. Information on the amount and type of bycatch should be summarized in the SAFE reports.

(3) Select measures that, to the extent practicable, will minimize bycatch and bycatch mortality. (i) A determination of whether a conservation and management measure minimizes bycatch or bycatch mortality to the extent practicable, consistent with other national standards and maximization of net benefits to the Nation, should consider the following factors:

(A) Population effects for the bycatch species.

(B) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).

(C) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects.

(D) Effects on marine mammals and birds.

(E) Changes in fishing, processing, disposal, and marketing costs.

(F) Changes in fishing practices and behavior of fishermen.

(G) Changes in research, administration, and enforcement costs and management effectiveness.

(H) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources.

(I) Changes in the distribution of benefits and costs.

(J) Social effects.

(ii) The Councils should adhere to the precautionary approach found in the Food and Agriculture Organization of the United Nations (FAO) Code of Conduct for Responsible Fisheries (Article 6.5), which is available from the Director, Publications Division, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy, when faced with uncertainty concerning any of the factors listed in this paragraph (d)(3).

(4) Monitor selected management measures. Effects of implemented measures should be evaluated routinely. Monitoring systems should be established prior to fishing under the selected management measures.

Where applicable, plans should be developed and coordinated with industry and other concerned organizations to identify opportunities for cooperative data collection, coordination of data management for cost efficiency, and avoidance of duplicative effort.

(e) Other considerations. Other applicable laws, such as the MMPA, the ESA, and the Migratory Bird Treaty Act, require that Councils consider the impact of conservation and management measures on living marine resources other than fish; i.e., marine mammals and birds.

[63 FR 24235, May 1, 1998]

Date	Action	Measure	Probable Impact
1996	Amendment 7	1. GOM/GB/SNE minimum mesh size 2. Effort reduction 3. Minimum fish sizes 4. Certified bycatch fisheries program (exempted fisheries program) 5. Limit on groundfish landings by scallop vessels 6. Year round closed areas 7. Increased haddock possession limit to 1,000 pounds	1. Reduce discards of undersized fish 2. Overall reduction in effort reduces discards of non-target species 3. Minimum fish sizes encourage compliance with mesh regulations, reduce incentive to catch small mesh 4. Establish standard for small mesh fisheries, encouraging development of techniques to reduce bycatch 5. Discouraged targeting of groundfish by scallop dredges, may have increased discards of some flounders. 6. Closed areas may have reduced discards by reducing fishing on spawning aggregations 7. Increase in haddock possession limit reduced haddock discards as stock began to increase
May 1, 1997	Framework 20	1. GOM cod trip limit, included “running clock” 2. Gillnet restrictions including limits on number of nets, additional required days out of fishery	1. Running clock mitigated impact of GOM cod trip limit on discards by allowing landings of overages 2. Additional gillnet restrictions may have reduced discards by limiting effort, but amount of impact uncertain
May 1, 1998	Framework 25	1. Seasonal closures in GOM and established WGOM closed area 2. Increase to haddock trip limit, including seasonal adjustment 3. Raised footrope trawl required in small mesh areas 1 and 2	1. By reducing fishing effort during times fish were aggregated, likely reduced discards 2. Haddock trip limit adjustment reduced discards as stock increased 3. Raised footrope trawl reduced discards in whiting fishery in a small area in the GOM
Jan. 19, 1999	Framework 26	1. Additional closures in inshore GOM during cod spawning	1. Extended protection to fish (primarily cod) aggregated during spawning
May 1, 1999	Framework 27	1. Expanded seasonal closed areas in GOM 2. Reduced GOM cod trip limit, including trigger which allowed further reductions in-season 3. Increased haddock trip limit 4. Increased minimum mesh size for square mesh	1. Extended protection to fish (primarily cod) aggregated during spawning 2. Reduction in trip limit increased cod discards 3. Haddock trip limit increase reduced discards as stock increased
June 10, 1999	Framework 29	1. Scallop access program to CAII, including bycatch limits, gear requirements	1. Several measures reduced discards of yellowtail flounder in CAII access program
June 10, 1999	Scallop Framework 11	1. Adopted requirement for 8-inch twine top on scallop dredges in all areas	1. Large mesh twine top demonstrated reductions in groundfish bycatch in scallop dredges
July 29, 1999	Framework 30	1. Established BG cod trip limit	1. May have increased regulatory discards by imposition of trip limit, unless vessels able to avoid cod catches
Jan. 5, 2000	Framework 31	1. Increased GOM cod trip limit to 400 lbs./4000 lbs. 2. Extended modified running clock 3. Additional GOM inshore closures	1. Reduced discards as a result of low FW 27 cod trip limit 2. Change to running clock may have increased discards 3. Extended protection to fish (primarily cod) aggregated during spawning
	Amendment 12	1. Established regulations for small mesh multispecies	1. Measures designed to reduce mortality on small-mesh multispecies likely reduced discards of groundfish in this fishery
June 1, 2000	Framework 33	1. Additional seasonal closures in GOM, including triggered closures 2. Seasonal May closure on GB	1. Extended protection to fish (primarily cod) aggregated 2. Extended protection to fish (primarily cod) aggregated while spawning
June 15, 2000	Framework 34	1. Access to groundfish closed areas for scallop dredge vessels, with gear restrictions and bycatch limits	1. Restriction reduced yellowtail flounder bycatch in access program
Sept. 1, 2000	Framework 35	1. Seasonal whiting raised footrope trawl fishery in upper Cape Cod Bay	1. Provided opportunity for whiting fishery while virtually eliminating groundfish bycatch
Aug. 1, 2002	FW 33 Court Order	1. Additional gear restrictions, including increased mesh sizes in all areas and limits on number of gillnets 2. Reduced available effort 3. Additional year round closed area in GOM 4. Yellowtail flounder trip/possession limits in SNE/MA area 5. Mandatory level of observer coverage	1. Gear restrictions should minimize groundfish discards 2. Fishing effort declines should reduce absolute number of discards 3. Year round closed area may reduce discards 4. Trip/possession limits may result in increased discards unless fishermen avoid catch 5. Increased observer coverage should improve discard estimates

Part IV

Panel-Audience Discussion

Rhode Island Workshop

Moderator: David Beutel, Rhode Island Sea Grant Program

Focus Question: "As stocks increase and the bycatch problem likely becomes worse, what should my organization or agency be doing to make a positive impact on the reduction of bycatch?"

Panelists

- Doug MacPherson, Rhode Island Saltwater Anglers Association (RISAA)
- Gib Brogan, Oceana
- Ralph Boragine, Rhode Island Seafood Council (RISC)
- Michael Fogarty, NMFS

Recreational Fishing Sector – Doug MacPherson

RISAA has a number of initiatives aimed at reducing fishing mortality. We educate our membership in the proper handling of fish, the use of dehooking devices, which we sell to our members, and we encourage the use of circle hooks. RISAA also supports high-grading regulations. These are difficult to enforce, but we do want to maintain the regulations.

Environmental Organization – Gib Brogan

The role of Oceana is to lend support to the process by advocating for policies and processes that will make actions smoother in the future, such as supporting forums like this one that promotes collaboration. We support measures that are in the best interest of the oceans—healthy oceans. These measures must be generalized because oceans are a public resource. Oceana supports measures that minimize the impact of fishing activities on nontarget species and the environment and measures that use the best available technology and methods to count bycatch and assess its impact. These may include an expanded observer program and modern, up-to-date reporting methods, such as vessel monitoring systems that employ satellite technology. Finally, we support a management planning process that takes into account all of the fish killed.

Commercial Fishing Industry – Ralph Boragine

The role of the RISC is to provide a continuing forum for education and discussion on problems such as bycatch. The RISC is working to establish an industry-based research trust from the $1.5 million groundfish fund.

NMFS – Michael Fogarty

The perspective of the NEFSC is that bycatch may not increase as stocks increase. NMFS is working to rebuild all stocks so bycatch becomes less of an issue. We are working to improve observer coverage to obtain better information and developing gear technology that will minimize the impact. And scientists at NMFS are moving toward ecosystem-based management.

Summary of Responses

- There is a general mistrust among recreational fishermen about the MRFSS data collection process. We need to address this issue.
- It is basically a money issue—we need to increase the field intercept part of the program and telephone survey component.

- In response to the recent trawl survey controversy, NMFS is working to involve fishermen in assessing the problem. We need to communicate better and have industry also see the data.
- Recreational fishermen sense that environmental groups do not regard recreational access to the resource as being important.
- Commercial fishermen have a general mistrust of recreational fishermen and they may view recreational fishermen as a nuisance. The perception is that recreational fishermen take all the fish.
- As we move forward we need to recognize that the general goal of the various interest groups is the same—a healthy ocean with sustainable fisheries. We need to find ways to work together on what we agree on and find ways to address the things we disagree on.
- Commercial fishermen want to keep access open for everyone.
- There is a perception that NMFS limits people's activities but it is the NEFMC that defines the regulations. NMFS advises the council.
- NMFS needs to do a better job with trawl surveys to improve data collection.
- All fisheries need to be brought to a higher stock level to avoid the problem of bycatch.
- A better understanding of ecosystem dynamics needs to be developed and more money put into science.
- The impacts of fishing activities on benthic communities need to be looked at carefully.
- We need to do a better job of incorporating fishermen's knowledge.
- Litigation does not help bring people together to communicate and solve problems.
- Environmental groups resort to litigation because they do not feel part of the management process; their point of view is not being heard.
- Some recreational fishermen support a regulation that would prevent high-grading. Once one or two fish were caught, fishermen would not be able to catch and release the rest of the day. Others would not support this type of measure because the limits would be so low.

Closing Remarks — Kathleen Castro, Rhode Island Sea Grant Program

Sea Grant's role is to help parties move past differences by encouraging communication. There is a need to develop trust and working relationships, and to remember common goals. And there is a need to foster cooperative research and help take research into the policy arena.

Maine Workshop

Moderator: Sherman Hoyt, Maine Sea Grant Program

Focus Question: "What should my organization, business or agency be doing to continue making progress on reducing bycatch?"

Summary of Responses

- Use experimental fisheries as a bridge between research and management
- Use information we have already gathered
- Expand cooperative research projects
- Implement sale of the catch as a way to fund experimental fisheries
- Make personal contact with Congressional representatives to acquire additional funding
- Adjust management measures to protect vessels involved in collaborative research from losing access
- Continue efforts to have regulatory agencies and fishermen work together to develop species-specific research agendas to find solutions
- Get information out about positive work done on bycatch
- Approach all sectors to hire fisheries promotional person
- Maine Department of Marine Resources is willing to promote whiting and other clean fisheries
- Ask Congress for more money for observer program—environmental groups are willing to do this
- Invite fishermen to talk to environmental organizations to explain conservation measures needed and gain their support
- Fishermen need to start to tie some of these issues together by collecting their own data
- Write letters to state and federal agencies requesting that the permitting process for experimental work be expedited
- Define needs (e.g., permits granted in six days not six months)
- Make experimental research part of NMFS federal funding. Incorporate collaborative research, such as

Saltonstall-Kennedy and Northeast Consortium grants, into the NEFSC experimental research process
- Develop solid scientific peer review process for collaborative research results
- Develop a more cost-effective way to improve data coming from fishermen, such as development of a study fleet
- Develop more trust regarding data collection process. Help fishermen recognize the importance of providing accurate data on bycatch
- Encourage fishermen to collectively identify bycatch situations and work together to have the fleet avoid them without having to implement more rules. Move towards adaptive management
- Involve environmental organizations by making them observers
- Develop volunteer observer program

> "Under the old running clock [management approach] you could not go cod fishing but you could go out and fish in another fishery while maybe discarding cod in that trip. Catch fish, come home, and stay home—that's the 'new' running clock."
>
> *—New England fisherman*

New Hampshire Workshop

Focus Question: "As stocks increase and the bycatch problem likely becomes worse, what should my organization or agency be doing to make a positive impact on the reduction of bycatch?"

Ocean Conservancy – Geoffrey Smith

Minimizing bycatch is an important aspect of fisheries management plans because it is harmful biologically and wasteful economically. There is a need to improve observer coverage to get better data. The Ocean Conservancy is willing to go to Congress to secure more funding. We support collaborative research on gear technology, including accelerating the permitting process. Proceeds from the sale of the catch should be used to fund additional research. The Ocean Conservancy is willing to work on fishery management plans aimed at reducing discards and targeting healthy stocks.

Summary of Responses

- Fishermen need to report discards accurately for stock assessment purposes but, if they do report them, there is concern that lawsuits will be launched and they will be shut down.
- Environmental groups are aware that discards are being underreported and they want accurate reporting. Environmental groups hope that through the use of more selective gear, discard rates will come down.
- Gear needs to be very specific to be effective and is developed in response to fish behavior. However, the healthiness of individual species may vary from one area to another. In some areas, certain species can be targeted while in other areas the same species cannot. For example, Cape Cod yellowtail flounder are in poor shape, but Georges Bank yellowtail flounder are in good shape.
- We may be developing gear to address short-term problems.
- The theory that, as stocks increase, bycatch increases does not go hand in hand. Bycatch could be reduced in healthier stocks as fishermen are able to become more selective.
- There are two management approaches that can affect bycatch as stocks increase: 1) cut fishing mortality drastically and keep it low for a 10-year period. If constant fishing mortality is maintained, fishermen will be catching more fish as the stocks grow; or 2) maintain a constant catch strategy. This requires putting in another catch figure as fish stocks increase and puts the burden on management to determine this figure. Discards are the concern with this scenario.
- Before fishermen leave the docks, they know the amount of money they must make to make the trip economically viable. Discards would be lower if the money per trip was adequate because fishermen will stop fishing and go home.
- Developing new gear technologies is a way of providing a toolbox for managing species. Adaptive management must go along with this toolbox.
- There are too many hoops to jump through to get gear research started.
- Funds for gear research are limited and tend to focus on the most political species. The special access program in Amendment 13 tries to get at some of these obstacles to experimental fishing.
- Trying to avoid fish is a disheartening way for fishermen to fish. Now it is a race to beat the clock.
- The Northeast Consortium invested $2.5 million in 18 projects in 2001 and $2.9 million in 18 projects in 2000.

> "Trying to avoid fish is a disheartening way for fishermen to fish. Now it is a race to beat the clock."
>
> *—Workshop participant*

- The hard quota for bycatch forces new gear design to avoid bycatch and allows fishermen to keep fishing.
- Bycatch hard caps also force fishermen to target healthier species.
- Bycatch quotas are not a good thing in all cases, especially in multispecies fisheries. We have to look at social and economic impacts.
- We need to update discard mortality estimates for particular types of gear.
- We need a library of information on fish reaction to different types of gear under different environmental conditions.
- We need to manage the people who fish and modify human behavior using realistic regulations.
- There is a need to get away from the adversarial relationships that exist. Everyone needs to come to the table to reach consensus.
- Fish stocks may rebuild, but we may still be generating fishing rates at overfishing levels because of fishing capacity.
- There is a need to match capacity with sustainable harvest levels. Deciding who is going to fish and who is not is a very difficult issue.
- The Special Area Access Program in Amendment 13 needs further development and needs to be brought to the next step.
- The NEFSC has funding for collaborative research to test new gear.
- Bycatch might be given to institutions that serve food.

Connecticut Workshop

Focus Question: *"As stocks increase and the bycatch problem likely becomes worse, what should my organization or agency be doing to make a positive impact on the reduction of bycatch?"*

Panelists

- Gib Brogan, Oceana
- David Potter, NMFS
- Eric Smith, Connecticut Department of Environmental Protection

Environmental Organization – Gib Brogan

Oceana is a new ocean conservation organization based in Washington, D.C. We are working to conserve the oceans for the long term. One of the misconceptions about us is that we are anti-commercial fishing and that is untrue. What can we do to make a positive impact on the reduction of bycatch? Get people involved at the grassroots level; get them involved in the process. By doing this we can get the problem recognized by public officials who can focus their efforts on the problem. We are working on local, regional, and federal levels, focusing on legislation that will help solve the problem of bycatch. This includes assessing what is being taken, requiring accurate and timely reporting of all catch, such as the use of vessel monitoring systems (VMS), putting meaningful limits on both targeted species and bycatch, and incorporating all discards and bycatch information into the development of management plans. Oceana also fully supports communication between user groups, especially in settings like this that share ideas and opinions.

NMFS – David Potter

We should be allowing experimental fisheries to test equipment in a meaningful way. Commercial fishermen know how (and how not) to catch fish. If given efficient equipment and proper incentive, fishermen will have the most efficient gear. Then, as stocks get rebuilt, fishermen can target them accordingly.

Connecticut Department of Environmental Protection – Eric Smith

What we should do is capture the technological innovation and then implement it into effective management plans. The U.S. government is not going to fund this type of research; it is not in their priority. Yet bycatch reduction is a national interest—it's in our national laws like the MSA. Thousands of people write in to NMFS regarding this problem, so my idea is that funding should come from a broad-based society or we ought to go to the nongovernmental organizations and use their fundraising resources to fund this effort. A lot of people would respond—by donating $5 or $10, people will actually feel like they are making a difference. It would not only bring them a feeling of accomplishment but would also help the problem.

Summary of Responses

- That's a great idea. By using human capital, we might be able to start funding these initiatives. Environmental organizations are very good at pointing out problems, but few can offer solutions.
- VMS have improved dramatically. We should have government funding for these systems. In New England, profits are too marginal to be able to pay for VMS.
- Imperfect information results in imperfect decisions; VMS are a way to get better information.
- VMS should not come out of the resource. The focus is always on the commercial sector, but if some claims are correct, some recreational fisheries have a bigger effect. So is it fair to make the commercial sector pay for these systems on their own?
- We appear to be in a dilemma in fisheries management. The fishing community does not trust in management anymore. Environmental groups are taking the lawsuit route but are really trying to say that they want to be a part of the management system. Managers are trying to do the best they can with the best available data, which are often not good data. They are trying to make the best decisions and do not always get credit for the progress they have made. We need to address ways to get past this.
- Management styles started out with a distrust of fishermen.
- Someone had said in a previous workshop to imagine the following scenario: A fisherman out in the Gulf of Maine pulls up a lot of juvenile cod. This tells him the fish are migrating and it is a detriment to the stock to continue fishing in that area. The fisherman calls the observer program for help in documenting this and the observers respond by coming out on boats in that area. The observers radio this information directly to managers and communication begins through a previously established network that ultimately tells fishermen not to fish in that area. Fishermen observations lead to a management measure they were directly involved in creating. In turn, environmental groups monitoring this process develop faith that the fishermen will behave responsibly and protect the ecosystem in the long run. The question is how do we get there?
- Around 1989 we were close to that process. A huge year class of yellowtail had half of its mortality due to discards and half due to landings. Fishermen were screaming for area closures to protect them. We developed the flexible area action system (FAAS). We tried to use the system—some semblance of the process described above—about nine times, but it got bogged down at the NMFS office where they could not verify the information. Afraid that one angry fisherman was trying to box out competitors, the office held the information for months and the system failed.
- Today the system might actually work because of faster technology and the observer program. We are getting closer to it being a reality.
- The observer program now has the capability to respond to that type of situation.
- We do this already. If there are too many dogfish, you have to get out of there. So you warn other fishermen. This reduces bycatch.
- **Q**: What is Sea Grant going to do?
  A: We can offer a forum such as this available to all interested groups. This may help to establish a working relationship and hopefully a sense of trust among all of these groups.
- Rhode Island Sea Grant just received a grant to take this to the next step. We will work with commercial fishermen and gear technologists to hold two more meetings within the next year to compile current information and to bring in people to talk about the work being done.
- Private funding is like gold to Sea Grant programs because it's match. States do not have the money to invest in universities anymore. Private money is a huge contribution to efforts like today.

Part V

Summary

General Summary

While acknowledging that progress has been made to reduce bycatch through the implementation of gear technology and management measures, participants in the bycatch workshop discussions generally concluded that significant work remains to be done to address the problem. Fishermen expressed concerns about the waste associated with throwing fish back overboard, gear technologists pointed to the promise of innovative fishing techniques but voiced frustration at the disconnect between research results and the implementation of management measures, managers pointed to the need to more accurately quantify discards to improve stock assessments, and environmentalists called for a more extensive observer program to monitor the situation.

In addressing the question of how to continue to make progress in reducing bycatch, participants' suggestions fell into one of the following major categories: data collection, research needs, management practices, educational needs, and the communication process.

Data Collection

Throughout the discussions, there was a general recognition that more accurate and detailed information on discards is needed. Some suggested that the most efficient way to accomplish this would be through the development of a "study fleet"—a subset of the entire fishing fleet—that would be compensated for taking the time to collect detailed information on discards using state-of-the-art data recording technology. Proponents of this approach stated that this would be more efficient and provide more accurate information than logbook reporting by all fishermen. Increased observer coverage would also ensure more accurate reporting of bycatch, with all interested parties—fishermen, environmental groups, managers, and scientists—receiving timely access to the data.

Participants felt that accurate reporting of bycatch information will lead to development of a more extensive database capable of supporting an ecosystem approach to management. This would include developing a more detailed understanding of the life history of various species and interactions among species, as well as continued monitoring of environmental parameters. This type of information appears crucial to making the best decisions possible about where and when fishermen should be fishing to minimize bycatch. A collaborative research approach that ties standard scientific methods with field observations from fishermen is needed.

Research Needs

Collaborative research aimed at identifying effective gear modifications to reduce bycatch must be continued and expanded. Participants pointed to the need to take research results to the next level where extensive fleet trials can be conducted. Without this step, it would be difficult to generate the type of data needed to make gear modifications a viable management option.

Research on survival rates of discards must be done to more accurately assess the species most impacted, and studies of fish behavior are needed to determine the best means of avoiding take of or impact to untargeted species or undersized fish.

Input is needed from all stakeholder groups to prioritize research needs and identify critical research questions, and this would best be accomplished through the development of a collaborative research planning process.

Management Practices

In all of the workshop discussions participants pointed to the need to streamline the permitting process for collaborative, experimental fishing research. Fishermen and scientists called attention to the long delays in obtaining permits simply to begin the research. Additionally, more effective means of integrating research results on gear technology into the management system must be developed.

Fishermen called for management measures that provide incentives to fish efficiently, such as more days at sea, for those demonstrating bycatch reductions. In turn, managers called for more guidance in determining how much bycatch is acceptable and more clearly defining what is "practicable" under the law.

Underlying the discussions on management measures and bycatch was the general desire to move towards a more adaptive management approach that is responsive to changing stock conditions. All agreed that this will depend on the development of a timely, extensive, and accurate fisheries database that all stakeholders have access to and trust in.

Educational Needs

Commercial and recreational fishermen need to be more aware of the importance of accurate discard and landings data, and the role these data play in stock assessments and subsequent quota determinations. An active educational outreach program is vital to dispelling fears associated with reporting too much information to managers and environmentalists and to recognizing that accurate reporting is in their best interest.

Observers must be well trained, thereby easing their acceptance by fishermen. And enforcement officers must be aware of the importance of enforcing observer regulations to prevent bias in the data collection process.

Communication Process

A common theme echoed throughout the workshops was that communication among stakeholder groups, managers, and scientists to address the problem of bycatch is paramount. Continued communication will go a long way toward moving past a contentious situation and developing a sense of trust that will enable interested parties to work together in achieving common goals.

"Being a fisheries manager is a difficult profession."

—Paul Howard

Appendix

List of Participants

Rhode Island Bycatch Workshop Participants— November 23, 2002

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