

PUTTING FISHERMEN'S KNOWLEDGE TO WORK: THE PROMISE AND PITFALLS

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ABSTRACT

Indigenous fishermen's knowledge often gets dismissed for being subjective, anecdotal, and of little value to today's fisheries and centralized management strategies. Yet, fishermen have spent much of their lives accumulating intimate, fine scale ecological information that is not otherwise available. Pitfalls encountered during efforts to access fishermen-based information during the mapping of historical Gulf of Maine spawning grounds of cod and haddock are reviewed and the strategies developed to overcome them are included. Current and future roles for fishermen's knowledge in managing coastal fisheries are examined. Various ways to integrate the local place-based information of fishermen into current management strategies and potential for introducing a new local management paradigm are explored.

INTRODUCTION

In New England, fishermen's knowledge has often been dismissed as subjective, anecdotal, and dealing only with local situations. It is usually further discredited by the argument that fishermen's reports are not only subjective, but they usually describe commercial stocks that were fished out decades ago and at best, are only historical footnotes describing a marine ecosystem that may no longer exist.

I tend to disagree. I have used fishermen's knowledge often in my life, not only in the traditional way of catching fish, but also as an important source of ecological information about a fishery. From this perspective, the accuracy and breadth of knowledge shared by fishermen is very impressive. Fishermen and their subjective, anecdotal descriptions have a pivotal role to play in the development and function of sustainable fisheries.

However, the question of whether fishermen's knowledge gets integrated into mainstream science to influence management ultimately depends on the ways it is used. Fishermen and their vessels for example, are currently being used to develop "real time" catch data for faster, ongoing stock assessments. Though useful in

bolstering the status quo, this approach tends to employ fishing vessels rather than fishermen's knowledge, which deals with local populations and their seasonal habitats.

Fisheries science, involved as it is with the analysis of large population units, has not focused on local level phenomena, such as the changes in behavior and distribution of local populations associated with the collapse of a stock that are so often described by fishermen. The preoccupation of fisheries science with system-wide characteristics has left it without historical parameters that allow interpretation of fine-scale changes in stock distribution, behavior, or migration patterns over time. Consequently, management has lacked the ability to detect or interpret fine scale changes in abundance.

A New Role for Fishers' Knowledge

This lack of an historical perspective may have aggravated attempts to manage New England's commercial fisheries. We have all been so preoccupied by the depressed state of our fisheries that we may have missed some of the root causes of their depletion.

If we are to develop sustainable fisheries, we must, at the very least, understand how and why the stocks collapsed in the first place. While fishermen and scientists acknowledge that many stocks have declined because of high catch rates, the problem is far more complex than the simplistic rationale of "too many fishermen chasing too few fish". (National Academy of Science 1997) Declines in abundance have consistently been accompanied by local changes in distribution, migration patterns and species assemblages. Clues abound about the disruption of local interrelationships and changes associated with them. But fine-scale changes cannot be detected by today's system-wide fisheries assessments.

It is here that fishermen's knowledge can play an important and perhaps critical role. Fishermen are, in fact, the only available source of local, historical, place-based fisheries information. Just to survive, let alone succeed, each fisherman has become proficient at figuring out how local changes in a fish stock affect distribution and abundance. This creates a pool of people with unique experiences with local marine ecology.

Not only do they have special knowledge about what is presently there, but each generation of fishermen has developed its own particular fishing patterns that are attuned to the stock

migrations and behavior present during that period. With a little effort, information can be retrieved about such factors as distribution, behavior, species assemblages and abundance that are unique to the period.

Information collected from several generations of fishermen creates a series of historical windows into a fishery's local ecology that can be used to identify long-term processes in the fishery (Hutchings and Meyers 1995). Compiling an historical database forms a timeline that allows those processes to be studied. If a relatively short time span is used to capture changes occurring before, during, and after the depletion of a fishery, the sequential effects of its depletion on the marine ecosystem can be analyzed. Linking the intimate, place-based knowledge of fishermen with scientists would help in the study of how highly productive coastal ecosystems functioned when they were more robust. This would also provide historical perspective into the fine-scale details so lacking in fisheries today.

The value of fishermen's historical insights into fisheries ecology goes beyond its benefit to research. Fishermen's knowledge is most powerful when it is applied to fisheries management. Fisheries management, based on an understanding of local, long-term details of a fishery's ecology offers a whole new paradigm. Alternatives such as community-based strategies using local knowledge and local participation to maximize productivity within sustainable fisheries could maintain local populations and forage stocks while at the same time protecting spawning areas and nursery grounds.

THE GULF OF MAINE COD SPAWNING GROUNDS PROJECT

A good example of the use of traditional fishermen's information surfaced during efforts in New England to revitalize the collapsed inshore cod fishery. Two fishing associations, Maine Gillnetters Association and Maine Fisherman's Co-op successfully petitioned the Maine State Legislature to form a Groundfish Hatchery Commission to study the feasibility of establishing one or more groundfish hatcheries. Raising the groundfish license fee to commercial fishermen funded the hatcheries. The commission found large areas of groundfish habitat along the coast that used to be highly productive, but were now abandoned. They concluded that, if hatchery production could be used to increase the number of active spawning sites along the coast by reintroducing groundfish into these areas, the resulting spawning success

would drastically reduce the time depleted stocks would need to recover. The commission recommended that young cod and haddock be released near once-productive spawning grounds and nursery areas in an attempt to jump-start the process. Releasing juveniles in the right habitats would be a critical step.

Unfortunately, most of the inshore grounds that were suitable for such a project had been fished out decades before and had long been abandoned and forgotten by fishermen. With collapsed cod and haddock stocks, scientists were unable to locate spawning areas by conventional methods.

In spite of the fact that the Gulf of Maine had maintained a directed cod fishery for more than three centuries, few spawning grounds were known. Most of the spawning areas suitable for such a project had been "fished out" decades earlier and had been abandoned and forgotten. Few current fishermen were even aware of their existence.

A study was funded to locate and interview the few remaining fishermen who had fished those areas to identify coastal spawning and nursery areas of cod and haddock. It became my privilege and great pleasure to interview these older fishermen and to draw the spawning ground maps based on their knowledge.

Prior to the fishermen-based spawning ground study, very few coastal spawning locations for cod and haddock were known, causing researchers to raise important questions about whether either species had actually been year-round coastal residents. Fishermen, however, indicated quite the opposite was true. As the interviews proceeded, the number of confirmed spawning sites mounted.

It soon became clear that both cod and haddock once had spawning areas along the whole length of the Gulf of Maine's coast. By the time the study was over, nearly 700,000 acres of spawning grounds for cod and haddock were identified (see Figure 1), and numerous questions had been raised about what actually caused coastal fisheries to collapse. Their contributions have provided new insights into the causes of the collapse of Atlantic cod in the study area. (Ames *et al.* 2000)

An accompanying study, using side-scan sonar, (Barnhardt *et al.* 1998) found the spawning locations given by fishermen, including their descriptions of substrates and depths were

exceptionally accurate. This reinforced general acceptance of the locations identified by fishermen as coastal New England's historical spawning grounds for Atlantic cod.

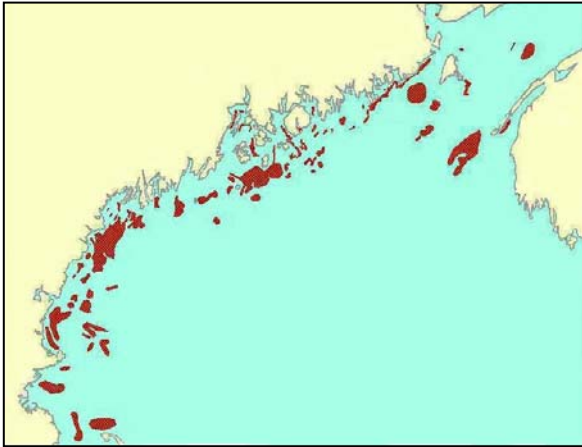


Figure 1. Map showing cod and haddock spawning grounds along the Gulf of Maine coast, identified in the study.

PITFALLS TO AVOID WHEN INTERVIEWING FISHERS

Collecting fisheries information about commercial stocks does not come without its own set of hurdles. Simply interviewing some fishermen and then cleaning up the data to make it presentable to the scientific community is only a small part of what has to be done to interview fishermen effectively. The process of figuring out who can best provide the information you seek can be formidable. The knowledge of a random fisherman may not be enough.

In addition, the majority of interviewers confirm that fishermen can be difficult to interview, their information is difficult to verify, and once verified, is very difficult to integrate into conventional fisheries information. A well-defined strategy for surmounting these hurdles is essential for good results.

Also be aware that different gear types may give quite different types of information. What is observed by one fishing technique alone can be very misleading. For example, an overview of coastal New England shows that hook fishermen caught cod in their feeding areas. Since fish do not feed when they are spawning, hook fishing may not provide good information about spawning locations. Otter trawlers and gillnetters caught fish whether or not they were feeding and so became a prime source for spawning ground information. Similar issues exist with each gear type.

A brief description of the problems that emerged during the spawning ground project, and the strategies used to resolve them, follows. Hopefully they will be of use to others:

1. When we started, we did not know the names or addresses of the fishermen who were part of the collapsed coastal fishery for cod and haddock. Most of them were retired and had not fished for decades.

We asked Maine's two coastal groundfish organizations to help us identify older fishermen to interview. Their members prepared a list of older fishermen for us who were well known locally and respected for their skill at catching cod and haddock in coastal waters.

2. Fishermen generally mistrust fisheries researchers and managers. To counter this, a local fisherman accompanied the interviewer, introduced him, and participated in the session. This proved to be an effective way to put everyone at ease.

3. In general, fishermen are not inclined to hand over hard-won knowledge that could threaten the livelihood of friends, family, and self by inviting competition or closures.

The project did not encounter this concern often because the fishermen being interviewed were older and were no longer groundfishing. They had little motivation to safeguard or falsify information about spawning areas.

In addition, the interviews focused on coastal spawning areas that had been fished out years ago, rendering their location relatively worthless.

4. Fishermen are often reluctant to answer questions if they perceive the interviewer to be collecting information simply for the sake of collecting it, or worse yet, collecting it for management purposes.

The survey addressed this concern by explaining that its purpose was to rebuild the fishery for the benefit of fishermen. The few remaining fishermen who had taken part in the fishery were the only ones who knew where the spawning grounds were located.

They were told that, if we could find them, funding would be available to support an effort to rebuild the stocks. In the end, fishermen themselves were to be the beneficiaries.

All recognized that restoration efforts were a long shot at best, but felt that it was worth talking with us anyway. And, if all went well, fishermen in their area would regain a fishery.

5. Fishermen feel especially threatened when asked to share information that may become public and often refuse to talk.

Interviewers should recognize the economic consequences fishermen face when their fishing secrets are revealed. Once made public, it becomes available to anyone, including competitors, fisheries managers, and anti-fishing interests. Facts so glibly asked for in an interview often form a key part of a fisherman's economic existence and they need to be reassured that they won't be misused.

The challenge to interviewers starts with thoughtful decisions about what to ask and how to handle the resultant information to minimize the detrimental consequences to those sharing it. Only then does it involve strategies for persuading fishermen to share their knowledge. These are not trivial issues.

PITFALLS TO AVOID WHEN PROCESSING FISHERS' INFORMATION

Traditionally, many fisheries scientists have brushed fishermen's information aside because it is so difficult to integrate into research's high-tech, statistics-based world. Even when fishermen's subjective observations can be confirmed, they will lack the reproducibility and precision of a carefully controlled experiment.

Given these concerns, controlling data quality becomes critical. Researchers who find ways to accommodate these limitations by developing ways to validate fishermen's knowledge, however, may find a treasure trove of site-specific information about fisheries ecology.

Three different strategies for validating data were developed during the cod spawning ground project. The first came from recognizing that each spawning ground and its location had to be independently verified in some credible way before the results could be considered for peer review.

A protocol was developed to ensure that;

- (a) each spawning site was identified independently by two or more fishermen,
- (b) the presence of cod and haddock was established on-site during known spawning seasons, and
- (c) the depth and substrate present at the site

agreed with known species behavior.

This was adequate to validate the 30-60 year-old observations being described.

A second problem arose from our efforts to figure out exactly where fishermen said a given site was located. Some fishermen identified spawning grounds directly on nautical charts, but most preferred to simply name a fishing ground in an area, or gave marks and bearings leading to the bottom they had once fished.

With marked nautical charts, two independent reports confirmed the site, but the other cases required additional work. In addition to the criteria listed above, the location of grounds lacking bearings, but which had been named by two or more fishermen, had to be verified by additional fishermen or references.

Spawning areas identified by sets of landmarks required the marks to be found and then plotted by dead reckoning. Once the site was established, it then had to be correlated with the bottom types reported on a nautical chart. Finally, other fishermen had to be questioned to establish independent confirmation of the ground.

Of all parameters encountered in the study, timelines were perhaps the most difficult to establish. Fishing information collected during the spawning ground study was, by necessity, decades old. Even though fishermen were quite sure of the season or month they had caught ripe fish, they often could not recall the exact year when it happened. In these cases, supporting information occurring during the same period had to be identified and then used to determine the approximate year when the fish were caught.

NEW APPLICATIONS FOR FISHERS'

KNOWLEDGE

The mapping project of cod and haddock spawning grounds displays only a fraction of the potential value found in fishermen's knowledge.

Two years ago it gave rise to my current work, a new project building a prototype database for Atlantic cod from fishermen's knowledge. The results of the spawning ground interviews became key components of the database. Combined with a 1920s data set of historical fishing information and basic habitat information, the database allowed closer examination of distribution and movements that was invaluable in untangling the historical stock structure of Gulf of Maine groundfish.

Fine-scale details of the distribution and behavior of Atlantic cod in the Gulf of Maine became obvious after placing the 1920s data set on GIS (Geographic Information System). Movement patterns to and from the historical cod spawning grounds linked them to historical fishing grounds identified from the reports and logs of fishermen from the same period.

Seasonal distribution patterns, migration corridors, and the fine-scale details of Atlantic cod stock structure were identified for the 1920s. Movement patterns associated with the spawning grounds identified several local populations of cod. Enough historical information was available on Atlantic cod in the Gulf of Maine to allow local, long-term behavior patterns to be compared with those found today.

A comparison that matched spawning grounds and winter fishing grounds of the 1920s (Ames, 1997) with recent distribution patterns of gadoid eggs (Berrien and Sibunka 1999), indicated that local populations of cod were still using the same spawning grounds. Another comparison relating recent tagging studies (Perkins *et al.* 1997) to historical movement patterns showed that the local population of cod inhabiting the area still followed the same routes.

Today's Gulf of Maine managers and fishermen alike are trapped by a system totally dependent on annual stock assessments, that cannot even detect local indicators of depletion, and must watch helplessly as one fishery after another is depleted to a fraction of its historical productivity.

Fishermen's knowledge can play a new and positive role in the restoration of commercial stocks. Their local, fine scale information offers a new paradigm based not solely on annual stock assessments, but on strategies that protect and enhance local spawning grounds, local nursery areas, and maintain local forage stocks and critical habitats. This provides an unparalleled opportunity to create an overarching historical framework that will allow assessment data to be linked to stock structures, abundance, migrations, distribution patterns, and a host of related ecological parameters.

Used in conjunction with historical references, fishermen's knowledge can provide valuable insights that may be pivotal to developing sustainable fisheries based on ecological principles.

Local, place-based historical information linking

local populations, abundance, and critical habitats to stock assessment data can supplement, and perhaps even replace, management strategies based on today's stock assessments. Historical profiles of stocks and their seasonal habitats could even be used to guide the placement and character of Marine Protected Areas.

The linking of fishermen's knowledge to historical reports offers a new paradigm to fishermen, managers, and environmentalists in support of local and regional efforts to restore coastal fisheries. Similar studies should be initiated for other coastal stocks found today.

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QUESTIONS

Omer Chouinard: What kind of gear was used?

Ted Ames: Trawling, handline, gillnet, and otter trawl. One of the things that is really neat is that in one of the studies I was doing, by isolating the hook fishery from other fisheries, I was able to get the feeding habitat.

Jennifer Graham: How do you set boundaries for your plotting areas?

Ted Ames: Massachusetts Bay fishermen have known for a long time that fish move in a different way there. Their migration didn't appear to go back into the Gulf of Maine proper. Their behavior is different in Cape Ann. They come up the shore and back. We arbitrarily decided the area was big enough. It was arbitrary with a little bit of practical fishermen knowledge.