

Emergence of multi-stakeholder-driven cooperative research in the Northwest Atlantic: The case of the Northeast Consortium

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Abstract

The past 50 years in the Gulf of Maine and Georges Bank is marked by a growing divide between fishermen, scientists, and managers. This paper tracks the scientific, regulatory, social and political evolution of fisheries management in the Northwest Atlantic, culminating in a distrustful and adversarial climate, a convergence of diverse policy needs, and the emergence of a multi-stakeholder cooperative research program—the Northeast Consortium. The institutional structure and activities of the Northeast Consortium are presented and we conclude with a discussion of the role of cooperative research in building mutual understanding and respect, trust and scientific legitimacy.

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1. Introduction

Pioneering marine scientists in the Northwest Atlantic from the early 1900s needed commercial fishermen to gain access to the oceans and the knowledge fishermen had from years of observations on the water. However, with the rapidly expanding research capacity at the National Marine Fisheries Service (NMFS) since the 1970s, there were fewer opportunities for direct collaboration and communication. Coupled with the increasingly sophisticated but less transparent stock assessment methods and models, ever-tightening regulatory constraints on fishing, and progressively severe socioeconomic costs felt throughout the northeast coastal and fishing communities, the divide between fishermen, scientists and managers grew larger and larger. While many fishermen did not believe the underlying science and distrusted the fisheries management process, scientists were reporting dramatic stock declines through the 1980s and 1990s. Management responded with further regulatory measures to reduce fish mortality, although many conservation organizations felt the rules

were insufficient while many in the fishing industry believed the rules were too severe. Conservationists turned to the courts and litigation. Industry turned to the legislative branch and direct appeals to their Congressmen. The litigation and Congressional initiatives of the 1980s and 1990s sharpened an adversarial edge to fisheries management in the northeast. By the late 1990s, the convergence of the adversarial strategies and the social, cultural and economic impacts made the time right for a resurgence of cooperative research, and there was an expansion of programs and models in the northeast. Today, the fisheries of the northeast have come full circle, returning to cooperative research.

This paper discusses the evolution of the political and regulatory context in the northeast fisheries, and the origins, institutional structure and objectives of the Northeast Consortium, a multi-stakeholder-driven model of cooperative research. We suggest the resurgence of cooperative research and the expansion of programs and models in the northeast occurred *because* of a convergence of these fisheries policy dynamics—status of fish stocks, socioeconomic hardship, and adversarial climate—and not as a solution to the specific policy and management problems. The example described here is the Northeast

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Consortium, a multi-stakeholder-driven model of cooperative research aimed, in part, to integrate fishermen's knowledge with the scientific framework, giving fishermen a greater voice in science.

2. Early days of cooperative research

Cooperative fisheries research among fishermen and scientists was relatively common in the United States from 1900–1950s, with early fisheries scientists at the Bureau of Commercial Fisheries and its predecessor, the Commission on Commercial Fisheries, utilizing fishermen's knowledge in the research endeavor [1–4]. In the Gulf of Maine from the late 1800s through the 1970s, fishermen and scientists also worked together and interacted regularly [4]. Their working relationship began with promise, with “the two sides dedicated if not to each other then to a shared devotion to the sea and its health: the government scientists to the monitoring and care of the fishery, the fishermen to a respect for a science that aided them” [2, p. 6]. In Henry Bigelow and William Schroeder's landmark text, *Fishes of the Gulf of Maine*, the natural history of many fish species are detailed based on the authors' observations in conjunction with those made by commercial fishermen. In fact, Bigelow likely held fishermen's knowledge in high esteem, viewing fishermen's observations as valid and relevant, including them side by side with the scientists' findings [2]. Other examples include the use of fishing vessels to help with the first haddock stock assessments in the 1920s and 1930s, and some vessels of Boston's haddock fleet making up one of the first “study fleets” available to scientists [4].

However, the collaborative, equal status of fishermen and scientist changed over the last 50 years, as the NMFS expanded their research capacity. With the addition of research vessels and staff, there was less need to utilize fishing vessels to access the fish and marine environment. The creation of the National Oceanic and Atmospheric Administration in 1970 further consolidated and expanded the federal fisheries scientific and regulatory capacity and the passage of the Magnuson Fishery Conservation and Management Act in 1976 clearly established the central role of the “best scientific information available” standard in setting conservation and management measures. In addition, the science-based standards of Magnuson enhanced the role of highly controlled, standardized sampling protocols and advanced statistical analysis and mathematical modeling to determine single-species stock status, while decreasing NMFS's wider biological science, gear research, and extension activities [2]. Fishermen were provided fewer opportunities to contribute the knowledge they possessed, which NMFS and other scientists tended to consider not relevant and reject as anecdotal [2,5]. As one NMFS scientist noted, “you want to piss off a room full of fishermen? Just say the word anecdotal” [2, p. 93].

3. Stock assessment science and regulatory restrictions

In the last 50 years, the scientific methods and analytical models of determining stock status became increasingly sophisticated, but less transparent and understandable to non-scientists in the northeast. The quantitative, computerized stock assessment models supply fisheries managers with the current status and future trends in harvested fish species' abundance and productivity. The assessments are the technical basis that managers use for establishing the annual fishery quotas, effort limits or other management measure that will achieve optimum yield, while avoiding overfishing or damage to the ecosystem. The NMFS informational web-site illustrates the elements of the stock assessment in the following manner (Chart 1).

Each element of this model can involve complicated mathematical formulas and assumptions. For example, the “fishery CPUE” element of the abundance factor in stock assessment is a catch-per-unit-effort measure that divides the yearly landings by the fishing effort [7]. A 1998 National Research Council review of the stock assessment procedures in the Northeast groundfish fishery suggested a more elaborate calculation of CPUE, accounting for changes in fishing technology (e.g., gear, engines), fishing competence between skippers and crew, and management restrictions (e.g., closed areas, discard and bycatch rules, effort limitations) [8].

These stock assessment methods were showing significant declining stocks and changes in the stock mixture of the Gulf of Maine and Georges Bank ecosystems in the 1980s and 1990s (Chart 2).

However, many fishermen did not believe the science underlying the stock assessments, particularly since it was not always consistent with their own experience [2]. The increased catch efficiency of fishermen, which as in part a ramification of the Magnuson-driven fleet modernization in the late 1970s and early 1980s [10,11], enabled fishermen to continue to catch fish when the stock assessment models

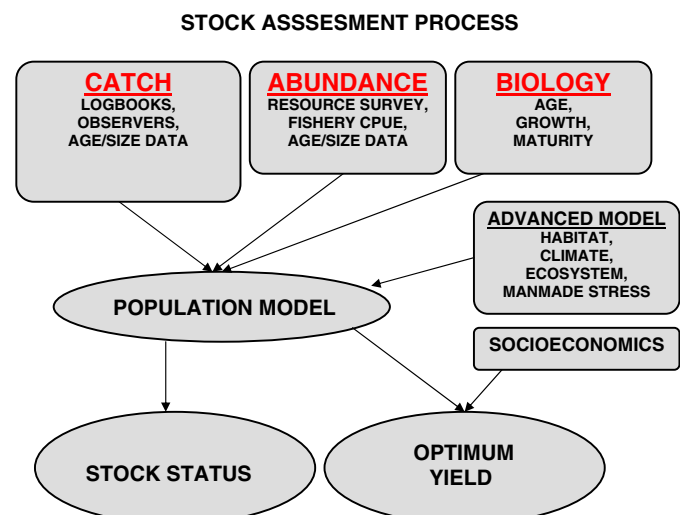


Chart 1. NMFS illustration of stock assessment components [6].

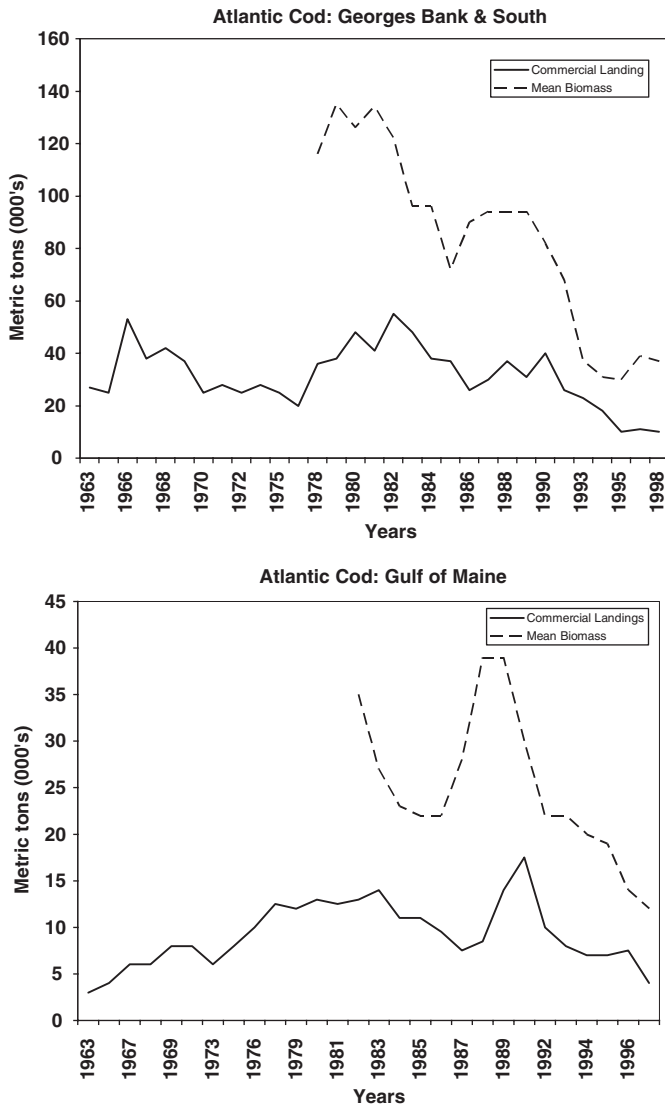


Chart 2. Cod biomass estimates and commercial landings data (1960–2000) [9].

were showing a declining biomass. In other words, there was a 1–2-year lag time before the stock declines were evident in the commercial landings data, as demonstrated by Gulf of Maine and Georges Bank cod data above. Fishermen’s on-the-water experience was not immediately confirming the scientists’ predictions and thus contributed to the industries suspicions and disbelief. Fishermen did not trust the science, while at the same time, scientists were suspicious of fishermen. As the National Research Council noted in 1998,

Catch per unit effort (CPUE) has not been used in assessments of the New England groundfish stocks since 1994. With the current quality of logbook data and the various restrictions that recently have been imposed on fisheries, the skepticism about the usefulness of current aggregated catch-and-effort data in constructing CPUE series as expressed by NMFS and the SARC [Stock

Assessment Review Committee] is appropriate. *However, harvesters have a greater trust in the data that they themselves provide, and therefore an effort should be made to validate and use CPUE data.* [emphasis added] [8, p. 62].

With these stock levels, the regulatory restrictions aimed at reducing fish mortality (e.g., daily catch limits, net mesh size increases, reduction in number of days fishing, closure of certain essential fish habitat and spawning grounds, etc.) had gotten increasingly tight throughout the 1990s. For example, fishermen who were fishing over 250 days in the mid-1980s, were fishing 88 days by the mid-1990s and 50 or less in early 2000s [2]. Table 1 below summarizes the evolution of regulatory approaches in the northeast multi-species groundfisheries. It demonstrates a pattern of minor restrictions at the same time as permitted expansions in others fisheries activities through the 1980s and early 1990s, followed by significant and rapidly incurring restrictions in the mid to late 1990s/early 2000s.

4. Cumulative socioeconomic impact and growth of adversarial management climate

The progressively restrictive regulations have had deep, long-term socioeconomic impacts on New England fishing communities, including significant restructuring of the fleet and shore-side support industries [15–17]. In fact the prolific use of framework adjustments to implement management measures, while individually showing no significant socioeconomic impact, may have additive or synergistic impacts [18]. These changes have contributed to impeding the economic and social resilience and flexibility of the fleet and fishing communities, increased tensions between industry sectors and gear types, and amplified a sense of hopelessness [15]. These impacts have furthered the misunderstanding and suspicion between fishermen and managers, i.e., the growth of mistrust. The National Research Council acknowledged this chasm in their 1998 review of the stock assessment procedures, recommending actions to “improve relationships and collaborations between NMFS and harvesters by providing, for example, an opportunity to involve harvesters in the stock assessment process and using harvesters to collect and assess disaggregated catch per unit effort data” [8, p. 5].

Many in the fishing industry fought to resist the reduction in fishing capacity, the resulting socioeconomic hardship, and the science underlying the restrictions. A common strategy involved direct appeal to elected officials in Washington, DC [5]. As one New England Fisheries Management Council participant said, “The science is out of whack; I’ll just call my Congressman” [5, p. 136]. Industry has also used the courts, as one fishermen leader noted, “litigation becomes unfortunately a tool for change” [19, p. 177]. Environmental and conservation organizations would also use litigation to advance stricter conservation measures [14].

Table 1
Multi-Species Groundfish Management Chronology, including key lawsuits and scientific controversies [12–14]

Year	Management event	Major regulatory action
1977	New England Fisheries Management Council Plan	<ul style="list-style-type: none"> • Quotas, cod, haddock, yellowtail flounder • Trip and size limits • Minimum codend mesh size, 5 1/8 in. (130 mm)
1982	Interim Plan for Atlantic Groundfish	<ul style="list-style-type: none"> • Seasonal Georges Bank closed areas • Trip limits eliminated • Minimum codend mesh size increased, 5.5 in. (140 mm)
1986	Northeast Multi-species Fisheries Management Plan	<ul style="list-style-type: none"> • Expanded species—Pollock, redfish, winter flounder, American plaice, witch flounder, windowpane flounder, white hake • Expanding seasonal Georges Bank closures • Seasonal Southern New England closure
1987–1991	FMP Amendment 1–4	<ul style="list-style-type: none"> • Expanded Southern New England/Mid-Atlantic closure, March–May • Expanded George Bank regulated mesh area • Southern New England mesh size restrictions, 5.5 in. (140 mm) • Exclude scallop dredge vessels from Southern New England closure area • Gear restrictions, northern shrimp • Increased minimum size, cod, haddock, Pollock, yellowtail flounder, American plaice • Expanded species—silver hake, red hake, ocean pout • Bycatch limits
1991	<i>Conservation Law Foundation Lawsuit Settlement</i>	<ul style="list-style-type: none"> • <i>New deadlines for new FMP to eliminate overfishing in 5 years</i>
1992	Magnuson Amendment—Northwest Atlantic Ocean Fisheries Reinvestment Program	<ul style="list-style-type: none"> • Reinvestment program to promote development of commercial fisheries and underutilized fisheries in northwest Atlantic
1994	Emergency Action and FMP Amendment 5	<ul style="list-style-type: none"> • Moratorium on new vessel permits • Established days-at-sea (DAS) effort reduction program (50% over 5–7 years) • Increased mesh size to 6 in. diamond or square (152 mm), Gulf of Maine and Georges Bank • Set Southern New England and Mid-Atlantic mesh size, 5.5 in. • Mandatory landing and DAS reporting system • Prohibited pair-trawling for multi-species • Finfish excluder devices, Northern shrimp • Porpoise bycatch reduction, gillnets • Expanded Area II closure area, from 4 to 6 months • Haddock possession limit, 500 lbs
	Second Emergency Action (implemented in Framework Adjustment 9 in 1995)	<ul style="list-style-type: none"> • Year-round Georges Bank closure areas I and II, Nantucket Lightship closure area • Prohibited small mesh and retaining regulated species with small mesh • Increased Southern New England mesh size to 6 in. (152 mm) • Prohibited scallop dredge vessels in closed areas
1996	Buy-back Program	<ul style="list-style-type: none"> • Initiated \$2 M buy-back program
	FMP Amendment 7	<ul style="list-style-type: none"> • Accelerated DAS reduction (50% over 2 yrs) • Expanded seasonal Gulf of Maine closure areas • Established target total allowable catch (TAC), cod, haddock, yellowtail flounder • Increased haddock trip limit, 1000 lbs
1997	FMP Framework Adjustment 20	<ul style="list-style-type: none"> • Gulf of Maine cod trip limit, 1000 lbs/day • Gillnet net limits
1998	FMP Framework Adjustment 25	<ul style="list-style-type: none"> • Established 1-month rolling closures inshore Gulf of Maine from Mass Bay to Penobscot Bay

Table 1 (continued)

Year	Management event	Major regulatory action
		<ul style="list-style-type: none"> ● Temporary year-round closures on portions of Western Gulf of Maine (Jeffreys Ledge and Stellwagen Bank) ● Additional seasonal Gulf of Maine closures (Cashes Ledge) ● Gulf of Maine cod trip limit, 700 pounds/day then monitoring trigger reduced to 400 pounds/day 8 weeks later.
1999	FMP Framework Adjustment 26	<ul style="list-style-type: none"> ● Expanded inshore Gulf of Maine rolling closures, April ● Additional seasonal Georges Bank area closures
	FMP Framework Adjustment 27	<ul style="list-style-type: none"> ● Expanded duration of inshore rolling closure to 2 months ● Reconfigured and expanded duration of Cashes Ledge closure, from 1 to 4 months ● Prohibited scallop dredge vessels from rolling closures and Cashes Ledge ● Gear restrictions, roller and rockhopper maximum diameter, 12 in. in Gulf of Maine inshore area ● Gulf of Maine cod trip limit, 200 lbs/day, then monitoring trigger reduced to 30 lbs/day 4 weeks later ● Increased minimum mesh size, 6.5 in. (165 mm), Gulf of Maine, Georges Bank, Southern New England
	Interim Rule	<ul style="list-style-type: none"> ● Gulf of Maine cod trip limit, 100 lbs/day; 500 lbs maximum.
	FMP Amendment 9	<ul style="list-style-type: none"> ● Prohibition on brush–sweep trawl gear ● Expanded species—halibut
2000	FMP Framework Adjustment 31	<ul style="list-style-type: none"> ● Gulf of Maine cod trip limit, 400 lbs/day; 4000 lbs max/trip ● Expanded rolling closure areas, February
	FMP Framework Adjustment 33	<ul style="list-style-type: none"> ● Additional Georges Bank seasonal closures ● Additional 1-month conditional Gulf of Maine closure areas ● Increased haddock trip limit, 3000 lbs/day
	<i>Conservation Law Foundation Lawsuit and Judicial Decision</i>	<ul style="list-style-type: none"> ● <i>Catch levels remain too high, NMFS not adequately rebuilding stocks or prohibiting overfishing</i>
2001	FMP Framework monitoring trigger	<ul style="list-style-type: none"> ● Expanded rolling closures, January
2002	(2) Interim Actions—Lawsuit Settlement	<ul style="list-style-type: none"> ● DAS restrictions for vessels using >25% of DAS during May–July; adjustment in calculating DAS start and end times/clock. ● 20% reduction in DAS used baseline ● Year-round closure on Cashes Ledge ● Expanded rolling closure areas III and IV ● Increased Gulf of Maine trawl and gillnet mesh size, 6.5 in. (165 mm) ● Day gillnet limits ● Increased Southern New England trawl mesh size, 7.0 in. square or 6.5 in. diamond. ● Increased Georges Bank and Southern New England gillnet mesh size, 6.5 in. ● Longline gear restrictions, hook size, number and shape ● Increased minimum size of cod, 22 in. ● Increase Gulf of Maine cod trip limit, 500 lbs/day; 4000 max ● Possession limits, yellowtail flounder
	<i>“Trawlgate” Breaks</i>	<ul style="list-style-type: none"> ● <i>Industry participants in NFMS fisheries trawl survey raise concerns about discrepancy in length of cables on trawl</i>
2003	FMP Amendment 13	<ul style="list-style-type: none"> ● Proposed
2004	FMP Amendment 13	<ul style="list-style-type: none"> ● New categories of DAS based upon permit history, 1995–2001 ● 40% reduction in DAS ● DAS leasing and transfer program

Table 1 (continued)

Year	Management event	Major regulatory action
		<ul style="list-style-type: none"> ● Special access programs, yellowtail flounder, winter flounder ● Established a sector allocation program ● Increased Gulf of Maine cod landing limit, while decreasing Georges Bank cod landing limit ● Gear requirements, gillnets ● Expanded closure areas for habitat protection
	Framework Adjustment 40A	<ul style="list-style-type: none"> ● Established incidental catch total allowable catch (TAC) for B-DAS and a B-DAS pilot program ● Established a Closure Area I hook gear haddock special access program
	<i>Conservation Law Foundation, Natural Resource Defense Council file complaint in federal district court</i>	<ul style="list-style-type: none"> ● <i>Complaint alleges that Amendment 13 does not comply with the overfishing, rebuilding or bycatch requirements of the Magnuson–Stevens Act</i>

The impacts of litigation were lamented by many participants at the first national *Managing Our Nation's Fisheries: Past, present and future* conference in November 2003:

“Shortcomings in EFH [essential fish habitat] conservation primarily have revolved around polarized positions: litigation or threats of litigation, perceived hidden agendas, and general distrust among important stakeholders” [20, p. 172–173].

“Litigation and judicial management of our Nation's fisheries is unappealing to all” [21, p. 177].

“Lawsuits impeded effective public participation, tax valuable resources (time, people and money), and often slow progress” [22, p. 210].

The proliferation of lawsuits and the resulting NMFS staff workload in response has been so great that NMFS created a tailored fisheries litigation database to track thousands of cases filed by citizens, industry and environmental groups and the 100 active cases [23]. Congress characterized the legal challenges to NMFS regulatory actions as “a crisis” in appropriation language from 2001 [24]. Margaret Spring, Senior Counsel (minority) for the US Senate Commerce, Science and Transportation Committee, added “litigation issues have really strained the budgetary and analytical capacity of the agency [NOAA]” [25, p. 211].

5. Policy convergence and cooperative research

The fisheries management context in the northeast in the late 1990s/early 2000s was ripe for the emergence of cooperative research. There was an abyss between scientists and fishermen about stock assessment science and a distrust and disbelief among fishermen whose fishing practices and behavior regulations sought to control. The fishing industry and fishing communities were experiencing substantial socioeconomic change and a policy need existed

to respond to the pain of capacity reduction—a capacity that government had promoted 20 years ago [10,11]. The stakeholders' relationships were adversarial and the industry had experience with and success from direct Congressional appeals [5]. Many in the scientific community saw the need to engage fishermen more fully in science, as the National Research Council acknowledged in 1998 when it recommended greater collaboration—it noted in its report, “complex interactions among the fish populations, the environment and fishery management could be explored. The exploration of these interactions is especially valuable because harvesters who spend time on the water believe that these factors are important” [8, p. 65].

These socioeconomic impact, political capability, and scientific credibility factors converged to facilitate the emergence of cooperative research, and particularly the Northeast Consortium, as a Congressional policy response in the northeast fisheries. Northeast Consortium-funded cooperative research was a means to provide economic assistance to fishermen, give fishermen a voice in science, and address the underlying uncertainties in the science by promoting the integration of fishermen's knowledge with the scientific framework.

Linking economic assistance and cooperative research was not without precedent. To mitigate the impact of social and economic transitions in the industry, the federal government had instituted fishing vessel buyback programs as early as 1995 [16], funded vocational centers to retrain fishermen and their families to enter other industries, and paid fishermen for participation in research [26]. In late 1998, Congress designated \$5 million in emergency funds to provide “emergency disaster assistance to persons or entities in the Northeast multi-species fishery that incurred losses from a commercial fishery failure due to declining stocks of groundfish” [26]. In return for the compensation, participants had to either make their vessel available for cooperative research projects or take part in a survey on sociocultural and economic information gathered for

fisheries analyst and fisheries managers. In 1998, Congress also kicked off the planning and design of the Northeast Consortium, the multi-stakeholder-driven cooperative research funding and capacity-building program in New England described below.

6. Northeast Consortium

The Northeast Consortium case study was assembled from multiple methods and data sources. Interviews were conducted with the program Director, a Consortium Representative, and a subset of participating fishermen and scientists [27]. Program tracking data were assembled and analyzed (e.g., numbers of proposals, types of projects in the funding portfolio).

6.1. *Origins and objectives*

The Northeast Consortium was designed and planned through a \$300,000 Congressional appropriation to the New Hampshire Sea Grant program. The original program objectives, structure, and process was developed with considerable input from multiple stakeholders, including a Sea Grant Knauss Fellow in US Senator Judd Gregg's office, Senator Gregg and his staff, Sea Grant leadership in New England, and an Advisory Committee with up to thirty representatives from the commercial fishing industry, academic scientists and researchers, fisheries managers, and officials from non-governmental organizations [28]. It sought to simultaneously address the adversarial history between fishermen, scientists and managers, economic hardship of groundfishermen in the Gulf of Maine and on Georges Bank, and the informational needs for effective fisheries management. According to its founding Principal Investigator and Director, Ann Bucklin, "It builds trust and encourages communication when you bring factions together to solve problems. It's helped the fishing community with employment options, helping reduce overcapacity without fishermen having to accept a government bailout or sit on the beach" [29, p. 3].

The Northeast Consortium was formally established in 1999 to encourage and fund cooperative research and monitoring projects in the Gulf of Maine and Georges Bank that create genuine partnerships among fishermen, scientists, educators, and marine resource managers. It was created and funded through a Congressional initiative that sought to improve fisheries management by building partnerships and advancing knowledge of how the oceans work. The Northeast Consortium was also seen as a constructive means to provide economic assistance in a form other than a direct bailout. With the input of a multi-stakeholder Advisory Committee it set out four objectives.

6.1.1. *First objective—partnerships*

The Northeast Consortium sought to develop partnerships between commercial fishermen and researchers, educators and coastal managers. Through partnerships, it

was believed that communication, mutual understanding and potentially trust would improve among fishermen, scientists and managers. As Director Bucklin noted,

Our highest priority is partnership ... The Northeast Consortium was created because of a feeling that the stakeholders are not all on the same page ... How can you possibly create policies and management strategies that fishermen are going to pay any attention to [when] they are based on data the fishermen do not believe? ... It's impossible to create good management in an arena where nobody trusts anybody, nobody even understands anyone and nobody's listening... It is more the point that the data we produce [through cooperative research] is building the relationship between fishermen, managers, and scientists that is founded on trust and common knowledge ... it's got to help when it comes time to making management decisions [28].

6.1.2. *Second objective—enable participation*

The Northeast Consortium aims to enable commercial fishermen and commercial fishing vessels to participate in cooperative research and development of selective gear technologies. This goal contributes to building capacity in the industry and among individual fishermen to engage in cooperative research activities. In turn, payment for participating in research diversifies the fishermen's business plan and improves their economic viability. Bucklin commented, "the idea is to offer the ancillary source of income for fishermen ... to basically keep them alive during bad times ... we want to create the new fishermen who are smarter, better, more selective, more market wise ... to get them educated about how you are going to have to fish in order to make it sustainable" [28].

6.1.3. *Third objective—integrate fishermen knowledge and science*

The Northeast Consortium aims to help bring fishermen's information, experience and expertise into the scientific framework needed for fisheries management. It seeks to integrate fishermen knowledge into the science and management process by translating that knowledge into the language of the scientific framework (i.e., hypotheses, research designs) and using the tools of science to investigate what was previously called the anecdotal information of fishermen. Again, Director Bucklin elaborates,

the goal is to make sure that fisheries management reflects what fishermen know and that maybe in due course, how fishermen explain what they know ... [Fishermen] need to be able to talk the talk if they are going to get their knowledge into fisheries management. Part of the Northeast Consortium's mission is to teach them to talk ... to scientists in [the scientists'] language so that scientists will say, 'Oh yeah, that's really something we need to pay attention to' [28].

6.1.4. Fourth objective—equip fleet for research

The final objective seeks to promote the development of infrastructure capacity in the fleet by equipping and utilizing commercial fishing vessels as research and monitoring platforms. “The idea is that the fishing vessel becomes equipped so that the [fishermen] ... can maybe become eligible for participation in another research project or funding through the [New England Fisheries Management] Council or funding from SK [Saltonstall–Kennedy] because they have this special equipment on the boat” [28].

6.2. Structure and operating procedures

The Northeast Consortium consists of four research institutions: University of New Hampshire (UNH); University of Maine; Massachusetts Institute of Technology (MIT); and Woods Hole Oceanographic Institution (WHOI). Each institution has designated an individual who serves as a representative to the Northeast Consortium. The representatives are the UNH, Maine, and MIT Sea Grant Directors and a Senior Scientist at WHOI. The Northeast Consortium has a 5-member administrative staff and a Director/Principal Investigator.

An Advisory Committee of up to 30 members provides programmatic advice and guidance, and makes recommendations regarding funding decisions at all stages of the competitive grant-making process: review and approval of the Request for Proposals (RFP), review of Planning Letters, and review and selection of Full Proposals. The Advisory Committee includes representatives of all stakeholder groups, including industry, research, management and regulation, and environmental groups, and serves as a link to constituent groups and partner agencies and programs within the cooperative research mission areas.

The Northeast Consortium provides funding through two competitive RFPs per year. One RFP funds comprehensive cooperative research projects, while the second provides seed funding to test the feasibility of an idea, try out new gear, or otherwise lay the groundwork for a new cooperative research project. The intent is to provide funding for projects that address fisheries and ocean management issues in the Gulf of Maine and Georges Bank.

Funding recommendations and decisions are made by the representatives, based upon recommendations of a review panel comprised of Advisory Committee members and additional reviewers who supply needed disciplinary breadth, including commercial fishermen, scientists, and representatives of governmental, quasi-governmental, and non-governmental agencies and organizations. Northeast Consortium proposals are evaluated according to the following criteria, in priority order:

- Importance of the proposed idea for oceanographic and fisheries research.

- Technical merit of the proposal and the project as proposed.
- Prospects for partnership between commercial fishermen and researchers.
- Prospects for impact of the proposed work on an end-user community.
- Experience of the project proposers; available resources for the project.
- Results from prior Northeast Consortium support.

Project development proposals are evaluated based upon the potential or demonstrated impact on future fishermen–scientist research partnerships, feasibility of project implementation, and potential impact of the idea on fisheries and ocean science or management in the Gulf of Maine and Georges Bank.

To promote a fair decision-making process, the Northeast Consortium conducts evaluations of its review procedures and overall program. For example, 63 panelists over four panel review processes were asked whether the proposal review processes were fair on a 5-point scale. Over 95% of panelists felt the review process was fair. The findings are summarized in Table 2.

6.3. Funding portfolio

The Northeast Consortium has underwritten 120 projects from 2000 to 2004. Topic areas are identified each year as high priority for funding by the Advisory Committee as part of the evaluation of the draft RFP, with subsequent assessment of planning letters and project proposals based upon the evaluation criteria. In general, the Northeast Consortium funds projects on selective gear research and development, fisheries biology and stock structure, evaluation of ecosystems, closed areas and fish habitats, oceanographic and meteorological monitoring, socioeconomic impacts, and education activities (see Chart 3). Since priorities are set by the Advisory Committee with representatives from fishing industry, scientific community, fisheries management, and non-governmental organizations, the research portfolio is not directed purely by the short-term, immediate management needs. Rather, projects reflect longer-term benefits or address innovative and important future topics, such as ecosystem health, environmental monitoring, and novel gear designs.

Within the 43 gear projects, the largest majority relate to selectivity and bycatch reduction in trawl gear design. The table below summarizes the total number gear projects categorized by gear type (Table 3).

As one conservation gear scientist said about the diversity of funded projects,

This is a strength of the Northeast Consortium. It can fund a very promising but completely novel idea that other funders would not.... I believe these approaches to bycatch reduction [in my two projects] will have

Table 2
How fair was the review process? ($N = 63$)

Mean	Very fair (1)	Somewhat fair (2)	Neither (3)	Somewhat unfair (4)	Very unfair (5)
1.3	74.6% (47)	22.2% (14)	1.6% (1)	1.6% (1)	—

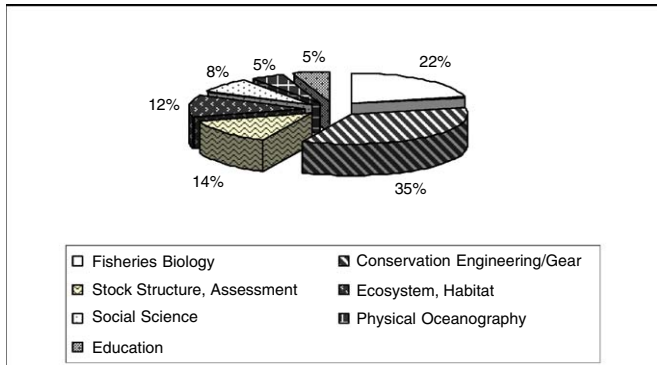


Chart 3. Northeast Consortium research portfolio 2000–2004 ($n = 120$).

Table 3
Conservation engineering/gear cooperative research, 2000–2004 ($n = 43$)

Gear type	Percentage (%)
Groundfish trawl	44
Gillnets	14
Shrimp (e.g., grate, beam trawl)	12
Longline, hook	9
Miscellaneous (e.g., alternative baits)	9
Lobster trap	7
Scallop dredge	5

astonishing implications for fisheries management in the near to medium term...I have to say that both are really exciting and are probably the most innovative and intriguing projects I have worked on for more than 10 years [30]!

A leading oceanographer in the region concurred,

The Northeast Consortium allowed us to go out and collect data that other more traditional scientific funding sources would not fund. This has been extremely helpful. In traditional scientific funding it is difficult to conduct much exploratory work, e.g., looking for larval concentrations in coves vs. coastal current systems, looking at seasonal cycles of production in Eastern versus Western Gulf of Maine. The Consortium has allowed us to collect background information driven by intuition, curiosity, and the fishermen's knowledge... The data have been used as background to obtain other funding; it has been a fundamental piece of proposals to successfully get that subsequent funding [31].

6.4. Outreach to fishing and scientific communities

Significant outreach activities are undertaken to ensure that opportunities for cooperative research are available to as many commercial fishermen as possible. This approach was based on a recommendation of the Advisory Committee that significant outreach effort—beyond that possible by representatives, Advisory Committee members, and staff—was needed to attract more commercial fishermen to cooperative research, to assist them in preparing competitive proposals, and to match-make between fishermen and researchers with similar interests. To meet these goals, five community-based organizations in Maine, New Hampshire, and Massachusetts are funded annually to conduct outreach, in addition to internal Northeast Consortium outreach activities.

The outreach strategy over the Northeast Consortium's first three years focused on increasing general awareness of the funding source, facilitate fishermen–scientist partnerships, and expand the reach of cooperative research into the broad and diverse fishing industry of the Gulf of Maine and Georges Bank. Outreach activities included workshops, newsletters, trade-show booths and presentations, web-sites, and extensive one-on-one assistance in meshing fishermen ideas with the scientific method, matching scientists and fishermen, and consulting on proposal development.

Overall, the outreach effort was very successful, increasing the number of proposals submitted and the interest in Northeast Consortium funding (Chart 4).

Beginning in 2003/2004 and after achieving high levels of general awareness among fishermen of the funding opportunity [32], the Northeast Consortium adjusted its outreach strategy to achieve targeted, specific communication and extension needs (e.g., promoting regional coordination among investigators, accessing hard-to-reach audiences, expanding number of available scientific partners). For example, it sponsored and facilitated a regional coordinating meeting among scientists, managers and fishermen investigators looking at ecosystem and habitat, gear and conservation engineering, and socioeconomic issues (see further details below). In 2004, the Northeast Consortium funded or oversaw further refinement and targeting of outreach workshops and activities to reach future leaders in the fishing industry (e.g., 30–45-year olds) and facilitate communication and coordination to minimize conflicts and tensions between fishing communities (e.g., neighboring ports).

In order to expand research capacity for cooperative research in the region, the Northeast Consortium supports

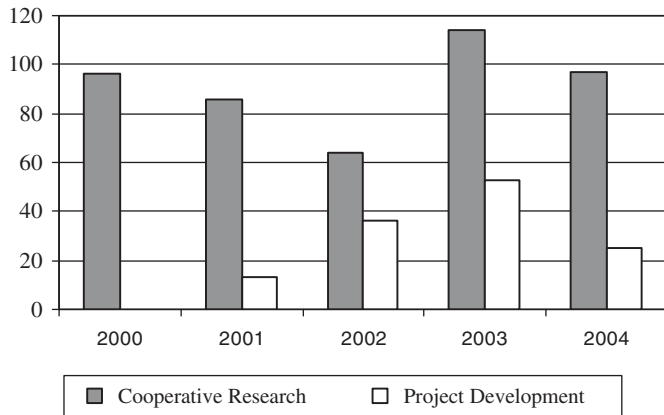


Chart 4. Cooperative research and project development proposals submitted.

graduate student fellowships designed to build capacity in designing and conducting cooperative research projects, conducts informational seminars at regional universities, colleges, and research institutions to expand awareness, and began working with the Regional Association for Research in the Gulf of Maine (RARGOM) on a regional scientist directory and web publication. In general, the match-making efforts suffered from a lack of available scientists to partner with the huge number of interested fishermen.

Finally, the Northeast Consortium expanded its involvement in cooperative research discussions at the national and international with sponsorship and active roles in organizing symposia and conferences, e.g., Symposium on Cooperative Research and Management at the 2005 American Fisheries Society (AFS) annual meeting, 2006 Conference of the Working Group on Fishing Technology and Fish Behavior, International Council for the Exploration of the Sea (ICES)/UN Food and Agriculture Organization (FAO). Northeast Consortium staff serve on AFS steering committees and its representatives serve as the US delegate to ICES and on several ICES working groups and committees.

6.5. Regional coordination

The Northeast Consortium has funded and facilitated special initiatives to promote greater regional coordination and communication among scientist and fishermen investigators throughout the Gulf of Maine and Georges Bank region. In 2003, it cosponsored meetings on ecosystem and habitat recovery to identify critical research themes and initiatives to better understand the biology, ecology and oceanography of closed areas. Specifically, fishermen and scientist investigators met to share information about research activities on Jeffreys Ledge and the Western Gulf of Maine Closure Area and to explore opportunities for collaboration and other coordinated activities among investigators.

The Northeast Consortium also funded preliminary coordinating meetings among the conservation engineering/gear research community to plan for greater collaboration in the future and to begin on specific topics of mutual interest, e.g., analytical methods, bycatch reduction strategies and findings. In 2004, it committed to sponsoring further regional coordination workshops among conservation engineering/gear on research priorities, data sharing, standardization of analytical methods, and coordination of future research.

The Northeast Consortium, in partnership with regional Sea Grant programs, and the National Marine Fisheries Science Center in Woods Hole and the NMFS Regional Office in Gloucester, has committed to sponsor a regional social science research planning effort. The initiative will identify and prioritize the collection and analysis of fishery management-relevant social science data in the New England and Mid-Atlantic regions and develop specific action strategies for moving forward on those social science priorities.

Annually, the Northeast Consortium hosts a Project Participants meeting to present research findings, discuss partnership challenges and strategies, and consider overall program implementation goals and challenges. The annual meeting is attended by over 100 fishermen, scientists and managers.

6.6. Application of findings in fisheries management

The Northeast Consortium-funded socioeconomic impact assessment surveys have shown that over 80% of sampled commercial fishermen cite “generating sound scientific data” and “assurance that the data generated would be used in making management decisions” as very important motives for their participation [32]. Identified as a critical challenge for cooperative research, the Northeast Consortium has made an organizational commitment (i.e., staff and support funding) to facilitating the transfer of results from projects to fisheries managers, fishermen and other end-users. The Consortium staff work in consultation with the New England Fisheries Management Council to develop strategies to fully utilize cooperative research findings, products and other deliverables. Additional strategies are being examined with the Advisory Committee and the Northeast Consortium is working in coordination with the NH Sea Grant fisheries extension specialist, to promote technology transfer of cooperative research products.

Furthermore, the Northeast Consortium developed and is implementing a technical peer review process on all final reports. The technical review considers all appropriate aspects of funded cooperative research projects once they are complete, including methods, data, data analysis and management, results and conclusions, deliverables, application for ocean and fisheries management, socioeconomic impacts, and other impacts on end-users. In guidance the Northeast Consortium states, “The Consortium is

committed to facilitating the successful transfer of project results and products to appropriate end-users (e.g. fishermen; local, state, regional or federal government; academic community; and others who might benefit from the research findings) and considers the technical review of a project as an important step in encouraging the use of its findings or products” [33]. The Northeast Consortium peer review procedures were developed in parallel with review procedures under development by the NEFMC’s Research Steering Committee. The two procedures ensure full acceptance of the Northeast Consortium final peer review results by the NEFMC end-users.

Finally, the Northeast Consortium staff coordinates with New Hampshire Sea Grant fisheries extension staff and the New England Regional Sea Grant programs to facilitate transfer of results to end-users. While fisheries management end-users in the New England Fisheries Management Council and NMFS are important users of cooperative research findings, fishermen and the broader fishing industry and coastal communities also benefit from the products, services and findings from research. For example, one socioeconomic impact assessment project that Northeast Consortium funded produced a final report, *Commercial Fishing Industry Needs on Gloucester Harbor, Now and in the Future*, with recommendations that were adopted into the Gloucester’s Harbor Plan and Designated Port Area Master plan [34].

6.7. Socioeconomic impact assessment

The Northeast Consortium is continuing its comprehensive program evaluation and socioeconomic impact assessment initiated in 2002. The assessment is examining the lessons learned from cooperative research projects, impacts and achievements in a broad array of management, scientific and social settings, and the role of cooperative research projects and outreach activities in building mutual understanding, trust, and genuine partnerships between fishermen and scientists throughout the scientific process. The assessment initiative is employing multiple analytical tools, including surveys, interviews, content analysis, economic modeling, observations and dramaturgical analysis. Findings from studies in 2002–2004 are being submitted for publication and will not be reported here.

The Northeast Consortium was a sponsor of the fourth Sea Grant sponsored AFS 2005 symposium, *Partnerships for a Common Purpose: Cooperative Fisheries Research and Management*. Through extensive preparatory case studies and steering committee analysis, the symposium reviewed and built upon the current understanding of cooperative fisheries research and management programs by discussing lessons, characteristics of successful programs, and future opportunities. Panel discussions aimed to move forward our understanding of the critical issues facing cooperative fisheries research and management today.

In sum, the Northeast Consortium is a stakeholder-driven program that has the credibility of a neutral

university-based initiative, and permits multiple stakeholders to set the research priorities and promotes research coordination. It conducts considerable outreach communication activities designed to build capacity among the scientific and fishing communities who have not worked often together in the recent past, and facilitates the transfer of results to appropriate end-users. Finally, it is committed to program evaluation and understanding the socioeconomic impacts of cooperative research and examining the underlying factors that make cooperative research projects function.

7. Discussion

Cooperative research through the Northeast Consortium emerged from a convergence of political, socioeconomic and scientific factors and conditions in the late 1990s/early 2000s. The political environment was characterized by stakeholders using litigation and Congressional appeals to advance their interests and an adversarial decision-making climate with little trust among scientists, fishermen and fisheries managers. The social and economic conditions in fishing communities were dire, with rapid socioeconomic transitions underway from rapidly increasing regulatory restrictions. The science was reporting dramatically overfished and crashing stocks, while the fishermen did not believe or trust the underlying science or the complicated analytical formulas and computer models that resulted in the stock assessments. Fishermen were demanding a voice in the science.

The Northeast Consortium was structured as a multi-stakeholder-driven process, open to all fishermen, encouraging and facilitating partnerships, promoting the transfer of findings to managers and other end-users, and monitoring progress to ensure that it would remain fair, inclusive, and credible. The Northeast Consortium has multiple objectives, including economic, industry capacity building, and scientific research goals. It has funded a wide range of projects and undertaken several programmatic initiatives. While there remain many questions about its impacts and success, we needed to understand the overall policy context for the origins and objectives of the Northeast Consortium as a necessary first step to address these subsequent questions.

On a programmatic level there are several important issues, e.g., are fishermen and scientists working throughout the Gulf of Maine and Georges Bank aware of the opportunity, utilizing the assistance available to access the funding, and interested in participating in cooperative research? Do they believe in the objectives of the Northeast Consortium and do they achieve benefits from participating on projects? What obstacles to participation do they face?

Beyond these programmatic questions, the literature on collaboration and partnerships, particularly between disparate stakeholder groups, suggests that there are more transformative benefits that may arise from working

together. For example, cooperative research could be viewed as an extension of the joint fact-finding principles from the dispute resolution field. Joint fact-finding is diverse stakeholders seeking out experts or information that both will accept as credible and relevant. It legitimizes the expert and the information and their use in a decision-making process because all parties in a dispute have reached agreement upon its appropriateness and application [35]. Therefore, are the results from the Northeast Consortium-funded cooperative research projects considered legitimate in the eyes of all the stakeholders? Is the science perceived as more credible because the Northeast Consortium is a multi-stakeholder-driven funding program located at a university, as opposed to other institutional models? Are the perceptions of legitimacy different between fishermen, scientists and managers who participate in cooperative research projects versus those who do not?

Furthermore, collaborative processes have been applied in other context fraught with distrust and ineffective communication. In environmental pollution control regulations and clean-up decision-making, scientists, managers and participating community members have been shown to possess such distinct worldviews that their language is fundamentally different [36]. Since collaborative processes often actively promote and facilitate two-way communication, some argue that it builds mutual understanding, respect, and a less adversarial climate [37–39]. Consequently, through respectful, honest and fair process, it may build trust in government institutions [40] and interpersonal trust [41]. Thus, has the Northeast Consortium multi-stakeholder-driven process itself generated more two-way communication, mutual understanding and respect among stakeholders? Has it built trust? For individual projects, have research partners, particularly those where partners feel everyone is treated fairly, built trust in each other? Is there a difference in levels of trust between fishermen, scientists and managers who participate in cooperative research and those who do not?

These are but a few of the remaining research questions that must be studied before cooperative research and the Northeast Consortium can be fully assessed and their impacts and effectiveness determined.

8. Conclusion

On the national level several recent studies and government reports have called cooperative research an essential component of future fisheries management [42–44]. There may have been a convergence of New England fisheries policy issues—the public responsibility to mitigate harsh socioeconomic impacts on the fishing industry and communities, the fishermen’s direct appeal to Congress, and distrust, disbelief and uncertainty in the science—that contributed to the development of the Northeast Consortium. Furthermore, an explosion of cooperative research in the northeast (e.g., NMFS Cooperative Research Partnership Program, scallop research set-aside funds,

lobster industry funding, low interest loans tied to participation in research, and other industry initiatives) has produced a testing ground for several cooperative research models [45].

The Northeast Consortium is a model that has demonstrated some early success in New England. At the same time it may present the opportunity to improve communication, mutual understanding, and trust among fishermen and scientists. As one fishermen survey respondent from Massachusetts noted in 2003,

I truly believe that cooperative research is essential for sound management. We need to break through the stereotypes, provide a forum or avenue for education. Scientists educating fishermen and fishermen educating scientists, and working together if we are going to preserve stocks, the environment, fishing communities, and a way of life [32].

However, while the last five years of multi-stakeholder-driven cooperative research in the northwest Atlantic have been very promising, important questions remain for future research to fully assess the impact and success of this new model of cooperative research.

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