Northeast Cooperative Research

Program Overview, Recent Activities and Future Opportunities

NEFMC Research Steering Committee
Taunton Ma – July 19, 2017

Presented by
John J. Hoey, Ph.D.
Deputy Chief, Cooperative Research Branch
NMFS - Northeast Fisheries Science Center
Woods Hole, Mass. & Narragansett, RI
Outline

1. Coop Res Goals and Objectives
2. 2010-2014 Strategic Plan Research Priorities
3. 2016 Review, response and the Center’s new strategic plan
4. What Coop Res is currently working on - fishery dependent data and inputs to assessments (surveys, bio sampling, FDD).
5. Upcoming activities
6. Next steps in implementing action items from Program Review
Cooperative Research Goals

- Improve the data upon which fishery management decisions are made,
- Foster coordination, cooperation, communication, and mutual respect among scientists, managers, and industry.

“Working together/ solving fishery challenges”

Scientific Objectives:

- Improve precision of analytical stock assessments and address concerns about bias in sampling.
- Fill Data Gaps.
- Improve the temporal and spatial resolution of multi-species catch (haul based), gear performance, and life history data to support more timely analysis of a greater diversity of management options.
2010-2014 Priority Research Themes

1- Support development and implementation of innovative monitoring tools and pilot programs to address critical data gaps as the industry moves to new management regimes – electronic logbooks and study fleets (fishery dependent).

2 - Surveys and data Gaps – support industry based survey programs - pilot surveys to address critical data gaps – species specific biological samples (fishery independent & fishery dependent).

3 - Conservation Engineering Networks - Develop a comprehensive conservation engineering program within NEFSC/NCRP to achieve regional coordination and technology transfer with industry.


Vast majority of additional funding was invested in external multi-year projects Conservation engineering networks and avoidance programs were emphasized.
Recommendations were offered in five themes:

1) Increase the usage of NCRP data products & services
2) Consider separating out the Research Set Aside Program from the Northeast Cooperative Research Branch
3) Improve communication about the roles and functions
4) Develop organizational structure within the NCRP
5) Explore synergies between the newly formed Cooperative Research Branch and the Fisheries Sampling Branch within the newly created Fishery Monitoring and Research Division (FMRD)
FY2015-2016 – Transition Years

From – Northeast Cooperative Research Strategic Plan 2010-2014
To – NEFSC Strategic Science Plan 2016 – 2021

Coincident with structural adjustments to Center Division and Branch structure - still underway

**Strategic Goals (Coop Res Perspective)**

- Greater integration of coop res across center science activities
- Improved accuracy and efficiency in data collection and expanded integration of ecosystem data into assessments.
- Greater direct engagement w/ constituents focused on improving trust in stock assessments
Industry Contributions to Assessments

Industry Based Fishery Independent Surveys
Relative Indices of abundance
Biological sampling opportunities

Survey Gear Catchability Research  Depletion and calibration studies
Sweep catchability differences (q)

Fishery Dependent Data - Total Catch (landings and discards)  Stock
specific removals (location)  Biological (size-age-maturity-fecundity)

• FDD Complementary haul data -- Temporal – Spatial – Gear discard
characteristics in the context of  ecosystem approach to fisheries
(local ecological knowledge).

• Environmental Observations coincidental to catch and effort data.
Early Surveys & Survey Gear Research

- GOM Cod & SNE YTF (pre 2008) closed area studies w/ multiple vessels MaDMF and RI DEP
- Trawl Survey Sweep Comparison – Bigelow sweep study twin trawl and paired trawls 2009-2010
- SMAST WTF and SNE YTF (CFRF)

Recent and periodic Surveys

- ME-NH Inshore Survey (NCRP supplementary funding replaced in FY14).
- NEAMAP – Mid Atl RSA funding replaced in FY14
- Black Sea Bass - Scup ventless trap – Mid Atl RSA program eliminated in FY14.
- Scallop rotational area surveys supported by RSA programs
- Penobscot East bottom longline w/ shallow inshore jig stations (2010-2016).
- NEFSC Central GOM hard bottom longline survey for species of concern.
- High density stratified sampling for GEB YTF (Aug 2013)
- Bigelow side-by-side and Habcam w/ GEB YTF net (Oct 2014)
- Survey gear study GEB bridle length and herding (Sept & Oct 2014)
- Survey gear catchability study – sweep comparison focused on witch flounder in GOM – Aug 2016
Trawl Survey Sweep Efficiency Study Motivation:

There is great interest among both NEFSC assessment scientists and stakeholders to better understand the catch efficiency of the standard Bottom Trawl Survey (BTS) fishing gear as this knowledge can serve to improve stock assessments.

Study Goal:

To estimate relative catch efficiency for standard BTS rockhopper sweep for several flatfish species.

Twin trawl and paired trawl projects were designed and implemented in 2009, 2010, 2013, 2014, and 2016. Additional surveys were implemented by external partners to evaluate sampling density and trawl efficiency. Another Rockhopper - chain sweep survey is scheduled for Aug 2017.
Cooperative Research Bottom Longline Survey

• Random-stratified survey design based on the existing bottom trawl survey design

• Sub-stratified by bottom type (rough/smooth)
  – Complex rocky habitat

• Tub-trawl bottom longlines
  – Deployed from 2 commercial vessels

• Fishermen gave input into gear and operational protocols

For full survey design see poster
LLS abundance index would improve assessments; 
Primary index for cusk; supplementary for skate (selectivity)
Cooperative Research Bottom Longline Survey

Summary

Longline Survey will provide indices for ~ 9 species of interest:
-- improve the Cusk and Thorny Skate assessments; inform the status review
-- provide supplementary indices for important commercial species:
  Cod, Haddock, Spiny Dogfish, Red Hake, White Hake

Longline survey currently not synoptic: indices must be used in conjunction with other indices/data for species that have larger stock area and distribution

‘Area fished’ estimates using current velocities is a novel approach; potentially provide minimum biomass estimates for data poor species and corroborate BTS estimates for other species
Enhanced Biological Sampling

Fish maturity and egg production (fecundity) can differ among fish stocks and over time, and each species has unique characteristics to its reproductive biology. We analyze different sample types to address particular research questions for each species. Collaboration with industry partners facilitates the collection of samples to address these data gaps.
Support development and implementation of innovative monitoring tools and pilot programs to address critical data gaps as the industry moves to new management regimes.

1. Transfer technology of new fishery-dependent monitoring and reporting tools (eVTR - Study Fleet).
2. Gear and Operational characteristics.
3. Increasing the detail and number of observations used to characterize catch, harvesting patterns of fleet components to support the estimation of discarded catch.
Expanding Fine Scale & Electronic Data Collection

- Ongoing NCRP Study Fleet electronic reporting R&D
- eVTR expansion 2013 PSMFC collaboration Mid-Atl fleet focus
- eVTR expansion - sectors use FLDRS for sub-trip reporting (DMS)
- eCLAMS special application for ITQ fishery – ongoing system R&D
- Expanded temp/depth loggers & R&D on new probes
- Real-Time Telemetry of bottom temp and location
- R&D on automating WIFI transmission of GPS polling and TD data
- Collaboration w/ NWS – automated at-sea weather data
- FLDRS system modifications to support EFP projects

Number of each trip type in FLDRS by year

<table>
<thead>
<tr>
<th>Year</th>
<th>Haul by Haul</th>
<th>Sub-Trip</th>
<th>Non-Commercial</th>
<th>EVTR</th>
<th>EM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>179</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>972</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>1689</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>2632</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>3781</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>4324</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>5238</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>5749</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>6631</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>6398</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>6842</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>2982</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Study Fleet Data Uses and ancillary (leveraged) research opportunities

Data analyses in support of stock assessments – direct comparisons of self reported and NEFOP estimates of kept and discarded catch – goal of collaborating with analysts to improve discard estimates.

As participation and coverage increases across fisheries, areas and seasons; a rigorous quality control program could allow further use of self-reported data in assessments and management.

Bottom Temperature Forecasts & Fisheries Contributions
Stock Availability to Surveys

Realtime Bottom Temperatures from Fishing Vessels

Butterfish
Scup
Bluefish
Witch Flounder
Yellowtail
Atl Mackerel

Debiased Bottom Temperature Hindcast

Spatial Extent:
45°N to 35°N
78°W to 65°W
depth = 10-350 M
Spatial resolution = 5 km
Temporal resolution = day

Semi-prognostic adjustment
“Debiased” ROMS = Daily ROMS BT hindcast - BT difference

Approach: Regional Habitat Models

NOAA US Fishery Data
Spatial grain = 11km

Ocean Observations (SF Temperature data) + Physical Models
Regional Habitat Projection
What about applying old methods using new tools

Continuous, real time, & practical collaborative science to inform strategic & tactical fisheries management

Goal: Sustainably harvest seafood while minimizing collateral damage to a rapidly changing ecosystem we don’t control

William F Thompson

Johan Hjort
Select any species in your history

Filter Data by depth, temperature, size, season...

Automatically maps data.

Automatically graphs data. Ex. Catch or by-catch and temperature, depth etc.

Automatically creates a table of your selected data.

Graphs By-catch of each effort
Upcoming activities – emphasis on increased usage of NCRP data products and services in an inclusive and collaborative process

The NEFSC will convene workshops to communicate the value of cooperative research and improve awareness and integration of NCRP products and services.

NEFSC Goal for FY18 to institute: 1) cross-cutting cooperative research study teams and 2) mechanisms to engage industry in this process.

The NEFSC will continue to support and emphasize Fisheries Dependent Data Visioning Project (FDDV); continue to develop and support electronic data transfer from fishing vessels.
Review Implementation Actions

The NEFSC Strategic Plan aspires to have more fisheries science done in cooperation with the fishing industry.

We will be seeking input and participation in upcoming workshops & mechanisms to engage industry in design/execution of research.

Work on action items has started and will be ongoing.

Requires much more than just CRB – Center-wide.

Building partnerships to improve the scientific information available to manage fisheries.

Cultivating trust and respect.
Resources required?

Mutual Trust
### Total Number of Trawl Trips Over Time

<table>
<thead>
<tr>
<th>Year</th>
<th>Study Fleet</th>
<th>NEFOP/ASM/IFS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vessels</td>
<td>Trips</td>
</tr>
<tr>
<td>2007</td>
<td>11</td>
<td>407</td>
</tr>
<tr>
<td>2008</td>
<td>22</td>
<td>606</td>
</tr>
<tr>
<td>2009</td>
<td>23</td>
<td>1261</td>
</tr>
<tr>
<td>2010</td>
<td>28</td>
<td>1419</td>
</tr>
<tr>
<td>2011</td>
<td>27</td>
<td>1638</td>
</tr>
<tr>
<td>2012</td>
<td>33</td>
<td>1634</td>
</tr>
<tr>
<td>2013</td>
<td>29</td>
<td>2063</td>
</tr>
<tr>
<td>2014</td>
<td>39</td>
<td>1927</td>
</tr>
<tr>
<td>2015</td>
<td>39</td>
<td>1918</td>
</tr>
<tr>
<td>2016</td>
<td>43</td>
<td>1993</td>
</tr>
<tr>
<td>2017</td>
<td>40</td>
<td>1133</td>
</tr>
</tbody>
</table>

### Total Number of Trawl Efforts Over Time

<table>
<thead>
<tr>
<th>Year</th>
<th>Study Fleet</th>
<th>NEFOP</th>
<th>ASM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vessels</td>
<td>Trips</td>
<td>Efforts</td>
</tr>
<tr>
<td>2007</td>
<td>10</td>
<td>404</td>
<td>2341</td>
</tr>
<tr>
<td>2008</td>
<td>14</td>
<td>479</td>
<td>3415</td>
</tr>
<tr>
<td>2009</td>
<td>15</td>
<td>1105</td>
<td>6011</td>
</tr>
<tr>
<td>2010</td>
<td>21</td>
<td>1315</td>
<td>7388</td>
</tr>
<tr>
<td>2011</td>
<td>24</td>
<td>1573</td>
<td>10209</td>
</tr>
<tr>
<td>2012</td>
<td>29</td>
<td>1488</td>
<td>8994</td>
</tr>
<tr>
<td>2013</td>
<td>24</td>
<td>1770</td>
<td>11130</td>
</tr>
<tr>
<td>2014</td>
<td>34</td>
<td>1628</td>
<td>10153</td>
</tr>
<tr>
<td>2015</td>
<td>32</td>
<td>1544</td>
<td>10193</td>
</tr>
<tr>
<td>2016</td>
<td>33</td>
<td>1581</td>
<td>9850</td>
</tr>
<tr>
<td>2017</td>
<td>30</td>
<td>881</td>
<td>5563</td>
</tr>
</tbody>
</table>

### Trawl HbyH

<table>
<thead>
<tr>
<th>Year</th>
<th>Study Fleet Trips</th>
<th>PSMFC Trips</th>
<th>NEFOP Trips</th>
<th>ASM Trips</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vessels</td>
<td>Trips</td>
<td>Efforts</td>
<td>Vessels</td>
</tr>
<tr>
<td>2013</td>
<td>24</td>
<td>1770</td>
<td>11310</td>
<td>15</td>
</tr>
<tr>
<td>2014</td>
<td>34</td>
<td>1628</td>
<td>10153</td>
<td>16</td>
</tr>
<tr>
<td>2015</td>
<td>32</td>
<td>1544</td>
<td>10193</td>
<td>7</td>
</tr>
<tr>
<td>2016</td>
<td>33</td>
<td>1581</td>
<td>9850</td>
<td>5</td>
</tr>
</tbody>
</table>

As of 7/18/2017
Northeast Cooperative Research Program

Expanding Fine Scale & Electronic Fisheries Data Collection

Fisheries Logbook and Data Recording Software (FLDRS) and other specialized equipment is used by industry partners to record high resolution fishing and environmental data.

NCRP Study Fleet
- Thirty-seven vessels from Wanchese, NC to Seabrook, NH
- Collect haul-by-haul data on kept and discarded species
- Associated GPS and temperature/depth data
- 2808 trips in 2014
- 1662 trips in 2015
- Help test and troubleshoot NEFSC electronic data tools

Global Positioning System (GPS) Data
Transmission via satellite, cell phone, or e-mail
On-board computer with Electronic Logbook software
NEFSC database for analysis

Expand Electronic Reporting
- Collaboration with Pacific States Marine Fisheries Commission and external partners
- Fifty-eight vessels reporting haul-by-haul and sub-trip data in the Mid-Atlantic region
- Gears include trawl, scallop-dredge, gillnet, and longline

Collecting Habitat Data
- Temperature/Depth loggers deployed on fishing gear
- Poll bottom temperature every ninety seconds
- Over three million records collected
- Shared with regional oceanographers

eCLAMS
- Collaboration with PSMFC, NEFSC Data Management Systems and the Mid-Atlantic surf clam/ocean quahog industry
- Development of new software to allow the entire fleet of ~fifty vessels to report their catch electronically (eVTR)
- Installations and deployments are currently ongoing

Real-Time Telemetry Project
- Partnership with NEFSC oceanographers
- Provides low cost method to transmit real time bottom temperatures
- Data used to validate and improve oceanographic models
- Goals include improving predictive modeling for more selective fishing strategies
Using Commercial Fishing Gear to Collect Bottom Temperatures for Model Verification, Understanding Species Distributions & Bycatch Avoidance

Dominique St.Amand*, James Manning1, John Manderson1 & Mark Phillips2

*Integrated Statistics, Woods Hole, MA; 1 Northeast Fisheries Science Center; 2 F/V Illusion, Greenport, NY

Introduction

The Northeast Fisheries Science Center (NEFSC) Cooperative Research Program has been working with commercial fishers for 10 years in a Study Fleet (SF) program to collect tow-by-tow catch composition information using an electronic logbook. The Study Fleet (SF) provides a platform for a multitude of projects, including collecting ocean bottom temperatures. Sensors are installed on the fishing gear of participating vessels to collect bottom temperature and depth (TD) data during fishing activities. This data collection effort extends from Cape Hatteras, NC to Hampton, NH, with over 3.7 million bottom temperatures collected by fishery participants and made available online. Since the inception of the TD project, technology improvements include automated haul by haul transmissions of TD data statistics via satellite, automated Wi-Fi telemetry to onshore servers, and web-based products where contributors can view both their data alongside ocean model predictions.

Objectives

To collect TD data during normal fishing operations.
To determine if there are correlations between bottom temperatures and species distributions.

To provide bottom temperatures to oceanographers, scientists, and vessel participants in near real-time, aiding in fishing efficiency, model verification and catch and bycatch analysis.

Methods

Utilizing commercial fishers and their gear as a means to collect ocean temperature/depth (TD) data.

Aquatec provides the user with an interface to view data for a near real-time experience. Technicians maintain these instruments through routine data extractions along with annual calibration.

NEFSC Cooperative Research is collaborating with the NEFSC Oceanography Branch to operationalize software and hardware to facilitate near real-time transmission of haul by haul of depth and temperature data while a vessel is offshore. With a Wi-Fi routine for raw data extraction, the Oceanographic Branch at the NEFSC developed a website for our participants to view current and historical data, making the data easily accessible.

Results

Test products are being developed to catalog TD data while providing visual tools to a broad group of users. This test webpage provides historical data by site, as well as model comparisons and forecasts.

Models are compared with historical TD data; most model outputs are within a few degrees of measured observations. This provides access and more utility of the data for a broad range of users.

At a fisheries level, TD data acquired from SF held a role in assessments for Bluefish, Butterfish, and Squid.

Many fish species are temperature-sensitive, therefore, providing the models with measured TD data allows for a more accurate thermal habitat niche to be projected.

Conclusions

Commercial fishing vessels can be used to collect scientific data such as temperature and depth in areas and during times of the year not currently included in standard surveys.

Utilizing fishing vessels as a platform can be a low-cost method to increase data collection.

Using bottom temperatures to define habitat niches has provided information to now support a directed Butterfly fishery with a quota of 31,000 MT worth approximately $45 million (based on 2013 pricing) versus a bycatch only fishery in 2012.

Additional Work/Projects

Development of a single ‘closed logger system’ that includes all routines for the wireless transmission of data from the gear to satellites, and reduces instrument cost to about half.

Installing weather stations on fishing vessels to collect more environmental information. To be used for model verification and real-time weather information where data buoys do not currently provide coverage.

Acknowledgements

Mark Phillips, Fisherman - ‘I use the temperature data to understand why fish are or are not in a particular area. Temperature is a major driver of fish distributions. I see this in the yellowtail flounder and squid fisheries. Cold water on the bottom drives squid up to the water column. Yellowtails hate warm water, anything above 42 or 43 degrees.’

On-the-Water Observations

Mark Phillips, Fisherman - ‘I use the temperature data to understand why fish are or are not in a particular area. Temperature is a major driver of fish distributions. I see this in the yellowtail flounder and squid fisheries. Cold water on the bottom drives squid up to the water column. Yellowtails hate warm water, anything above 42 or 43 degrees.’