Western Gulf of Maine Inshore Fisheries – Ecosystems Project
Meeting #1 (of 3)
Co-hosted by COOA & NAMA
Meadowbrook Inn, Portsmouth, NH
December 7, 2004
9:30-2:00

Attendance:

Heather Deese, NAMA, marine research
David Goethel, fishermen – groundfish, NH
Ellen Goethel, marine educator
Troy Hartley, UNH (observing for social science study)
Amy Holt-Cline, COOA, marine research
Lew Incze, fisheries oceanography and Census of Marine Life
Les Kaufman, BU fish ecology
George Littlefield, fisherman – groundfish, NH
Craig Pendleton, NAMA, former fisherman
Jeffrey Runge, COOA plankton ecology

Absent/Declined:
Randy Gauron, fisherman – groundfish, NH
Peter Kendall, fisherman – groundfish, NH
Frank Mirarchi, fisherman – groundfish, MA
Bobby Nudd, fisherman – lobster, NH
Tim Towers, fisherman – party / charter, ME

Introduction, Welcome, Plan for Meetings & Project:

Jeffrey Runge, Craig Pendleton, Heather Deese:

This set of meetings provides an opportunity to step back and have a constructive discussion outside the pressure of management decisions or research funding cycles. We hope this will be a chance to work towards points of agreement, a positive discussion. NAMA's involvement follows on our history of bringing people together for discussions, nurturing collaborative research, expanding education and community initiatives. COOA's involvement stems from their role as a regional ocean observing and modeling group, and their focus on making their research useful for fisheries.

We have planned on focusing on two topics: 1) feeding relationships between key species and 2) inshore environments. The focus area is inshore Western Gulf of Maine (from the coast through the WGOM closed area – from Portland south to Provincetown).

We have been motivated by:

- Ecosystem-Based Management – What will it mean for us specifically, concretely, in this region?
- What are the real research questions we need answered? – How do we diagnose the problems in the 'system'?

We will have three meetings. Meeting 1, today, for brainstorming on the topics and deciding the general form and purpose for the products. Meeting 2 ,in February, we'll review draft strawmen of illustrations, flesh out the details, and then possibly seek further comments from other researchers and fishermen. Meeting 3, in the spring, we'll review and incorporate feedback.

We hope to present results at Maine Fishermen's Forum, or other appropriate forums related to research and management (e.g., NEFMC), depending on what we all decide as a group.

Group Introductions:

Heather Deese, NAMA science director Background in physical oceanography, and also working for the national government in Australia with different types of scientists, interface scientists and policy people. Learned importance of communication between government policy folks, different types of scientists, politicians, developed sets of graphic ecosystem illustrations working with various scientific disciplines to help communication. Will play role of facilitator for this meeting.

Les Kaufman, fish biologist at BU Trying to "invent" EBM in his lab – what are the diagnostics – the things you can actually measure. History of habitat work. Now working on food webs, changes in food webs related to protected areas on Jeffreys and Stellwagen using stable isotopes, which show how high in the food web the animal was when it died.

Amy Cline, COOA Background teaching marine science and fisheries in Nova Scotia. Using GIS, had fishermen and scientists teach in her classroom. Inspired seeing changes in students and parents departments. Enthusiastic about translating science to educators that can use it, how you teach people about the ocean, expand education, get people excited and seeing results of their actions. Mentioned a course - Andy Rosenberg in teaching at UNH on EBM.

Lew Incze. biological oceanographer at USM / Census Marine Life Focus on larval ecology - how physics influence production in marine communities, larvae of crustaceans and fish. Involved in GLOBEC work on Georges Bank studying lobster life stages. Census of Marine Life - focusing on biodiversity, ocean and biological processes, and EBM – how do you link these together? Definitions of EBM reviewed and discussed by David Packer (on coml. Website).

George Littlefield commercial fisherman Family history: Fishes from Hampton. Started gillnetting, now dragging. Working with Jeffrey Runge, enjoys the research. In terms of this project, would be good to have something concrete to give the Council or others to help them understand and help them make decisions.

Jeffrey Runge biological oceanography Studied zooplankton (*Calanus* species) on west coast, in Canada and now in Gulf of Maine. Very interested in zooplankton in general, especially relationships to climate cycles, relationships to fish. Enjoys working with physicists and biologists together, including coupling of understanding of life histories of copepods and fish larvae to circulation and climate models for Gulf of Maine. For this project, particularly interested in determining what the important issues and research projects are.

Ellen Goethel marine educator, invertebrate biologist Did research for a year. Conservation commission and wetlands policy for coastal areas in NH, saltwaters and community impacts on nearshore areas. Around commercial fishing many years. Perspective on the state and federal government fisheries issues.

David Goethel fisherman, biologist Now on New England Fishery Management Council. Educating people at council level, you have to get past the politics. He has a lot of ideas for what he thinks this project could offer. Knows what would be useful. In order to brief people effectively, maximum 1.5 pages, hopefully mostly pictures. Long history and dedication to collaborative research, better products.

Craig Pendleton fishermen, now boat owner Discouragement with fisheries management in the 90s and opportunity to meet Dee Hock, visa credit card, inspired him to get involved with building a new organization with fishermen and environmentalists together focused on decisions made at most local level possible. Had to stop fishing and come ashore. Now his Captain, Mike, also involved with collaborative research as well. NAMA staff now includes Craig, Heather, Mike Crocker who writes newsletter 'Collaborations' on fishermen-scientist research in New England. Now working on 'fleet vision' project. Brining on another staff person for directing operations.

Troy Hartley here as social scientist To observe the discussion looking at how to describe and measure success of discussion between fishermen and scientists.

Discussion of our intentions as a group and the types of products we want to develop:

We want some 'ecosystem illustrations,' figures, diagrams to:

- Illustrate basic life history, species associations and interactions.
- Start from single species (fished species) – but illustrating how to manage more than one species at a time.
- Pelagic and benthic predator prey diagrams.
- Spatial – geographic focus.
- 3-d?
- Nested set of more and more detailed illustrations.
- Somehow show first order and second order effects.
- How non-commercial species play in, including environment, habitat, waters.
- Simple pictures – but capture essence of the variability (e.g., food webs change by month, or habitat).
- Analogy of the food web as a complex circuit board – not all channels carrying energy at all times, but all important at some times in some places. Make sure no parts of the circuit go dead.
- A flow chart would be very helpful for managers and legislators to follow and visually show them different species and how they are connected to other small species.
- Diagrams are more powerful than statements. People will look at pictures before they will read the text if they have to study something quickly.
- NMFS is the center of data for management decisions – so what do they need?
- Predator Prey relationship information is NEEDED.
- If would also be excellent to know more information about density dependent effects on feeding.

Issues:

- Amount of detail depends on your audience. Who is our audience, Council? Council eventually will need extremely detailed numbers on why and how much of a particular species needs to be allowed at each level.
- NMFS set up for 100 years to count fish. Is there an evolutionary shift going on within the organization?
- Council gearing up to leave certain amount of feed fish (herring) in the ocean (not fish).
- Herring 220,000 tons allowable biological catch, but council allowed only 200,000 tons TAC.

AUDIENCE	PRODUCT
Policy makers	Diagrams, short, clear, to the point
Research community	Detailed diagrams and documentation. Possibly write up some clear statement on what we know and what we need to know; more detail and scientific references
Fishermen	A clear product which they agree with so they can say, "Yes, when I set out from the dock in the morning, those are the things I have in my head that steer where and how I go try to catch fish".

Reminder of Goal:

- Working together to develop models/images useful for decision makers.
- Keep in mind that, the level of detail needed for each audience is very different.

Discussion of possible approaches:

- Start with an issue – and show how the decision would have been made differently under an 'ecosystem-based approach' (e.g., herring would have included numbers needed by other predators besides humans).
- Say something with more certainty – the uncertainty of 50% is pretty hard to hear – the list of knowns versus unknowns.
- Develop scenarios based on best knowledge of the system – start with pictures and mind models, maybe eventually develop some simple computer models.
- Alternative systems and food web shifts – what has happened in alternating herring / sand lance years? Seabirds and whale shift based on whether it is sand lance or herring
- Seek comments and feedback on our products from research and fishing communities.

Future meeting:
Invite a marine mammal feeding expert. Mason Weinrich or Peter Stebeck (follow up with Lew).

Goals for the project and today's meeting:

- Share knowledge, fishermen – scientists
- Ecosystem relationships for fisheries
- "EBM" practical, specific examples, definitions for our area --- could encompass and direct towards: research priorities, management of fisheries and other marine activities, gear, water quality
- Concrete products
- Illustrations
- Text with references appropriate to broad scientific audience
- Publish material in appropriate place
- Posters and handouts for participants and other to use as see fit
- Present at Fishermen's Forum (early March?)
- Present at Council and appropriate related groups

Butcher board notes:

These notes were collected from discussion throughout the day. Heather, Amy, Jeff will go away and try to create illustrations, diagrams, appropriate text to capture this information. We will all review these draft materials and flesh them out at the next meeting. (There are some topics which are 'missing' information because of the way the conversation flowed.)

1. Food web interactions

Story: Herring and Whiting alternate abundance in different years.

Type of info	Herring	Whiting	Sand Lance (Sand eel)
Feeding habits	Grazing, cruising	Ambush, Omnivore Note feed on larger prey as they grow	
Prey	Smaller stuff *Calanus finmarchicus* and other copepod species Euphausids (?) Shrimp or shrimp eggs, larvae, juveniles? See below	Anthropods Euphausids Fish – maybe herring Maybe sand lance? Could be that whiting are moving up into water column to feed on sand lance and therefore fishermen do not see abundances of sand lance / whiting?	
Predators (or species found abundant at same places & times)	Tuna (and higher quality flesh, fatter than when feeding on sand lance or whiting) Cod (will take whiting) Monkfish (find dense groups feeding on herring on the bottom during diurnal migration, otherwise dispersed, difficult to catch)		
Abundance notes			Hampton / Seabrook river has had more in past few years than 10-15 years ago.
Behavior notes	Herring are sometimes found in nearshore during shrimping season (March) are they feeding on shrimp / eggs / larvae?		

We need maps of western Gulf of Maine area to show distribution of these species
Focus on Stellwagen – changes in whales, seabird distribution and abundance patterns in various years associated with abundance of sand lances and herring. Sand lance found mostly (or at highest densities?) in sandy southern part of Stellwagen. Herring more on the ledges and fingers northern Stellwagen

Why variability in abundance of these different species?
Fronts, upwellings?
Interannual temperature changes (NAO?)

Currents?

Lots of Longhorn Sculpin are found nearshore year round, but some seasonal movement in and out are seen by fishermen during shrimp season because that is when fishermen are nearshore.

Red Hake – possible indicator species
- An interesting species from a feeding perspective – possibly as an indicator species for what type of prey are available / abundant at any particular time
- Omnivore
- Guts are always full
- Prey type depends on size
- Interesting relationship with scallops (small juveniles live inside scallops, larger juveniles hide under scallops)
- Typical hake: 8 pounds, 30 inches length
- Found in featureless mud bottom, 30-50 fathoms

Dogfish – important species in food web.
Found now throughout water column through day and night.
Used to migrate diurnally (surface night, bottom day).
Omnivore feeding habits – (Is this point of contention scientific realm?)
Has there been a change in what they are eating? Is this related to any interactions with fishery? (Bycatch thrown overboard?)

2. The inshore environment of the western Gulf of Maine – historical changes

Discussion of many changes to species found within the inshore environments in these areas over the past 25-30 years.

Definitions and notes:
"Inshore" = into very shallow, "up to beach" estuaries and salt marshes, up rivers
"Offshore" = deeper waters, still within 10-15 miles of shore
- Get copies of chart # 13278 – note references below

<u>Changes to the environment:</u>
The loss of wetlands has created drastic effects due to development. The areas are now a raging river where there used to be large clam flats and sediment for habitat. Species move because of the changes in habitat.

Description inshore habitat change Ipswich Bay, Merrimack, Seabrook, Hampton (similar elsewhere along coast?):
- Loss of marsh grass (spartina) and peat
- Loss of mud flats
- Loss of clams and worms
- Depleting forage based for fish which used to come inshore to feed in salt marsh, on mud flats, at high tide (on clams and worms?)
- In total, loss of wetland buffer (does this lead to different storm effects or other changes in physical environment? Nitrogen sources, storage? Nutrient movements?)
- Deeper, faster water flows in river and estuaries (less shallows)
- More surface water erosion on land

- In general, estuaries are environment with high 'P/B ratio' which is ratio of production to biomass, in other words, a lot of primary productivity, as well as high growth rates for the invertebrates, but also high turnover (short life spans, fast growing species)

Changes to the fish species found inshore:
Many species used to come in very shallow near shore to spawn:
Cod: B&S "Fishes of the Gulf of Maine" showed the old cod spawning sites show near mouth of Merrimack. They would go inside the dirty mouth and spawn.

Haddock, cod, yellowtail flounder, "Dabs"- (American Plaice). These fish have changed from inshore species to off shore 1970s the fish began to disappear to the mid 1990s.

Species gone or moved offshore (started in 1970s – mid 80s complete).
Mackerel, blue back (marine river herring). These are not seen in shore but off shore. Striped bass, bluefish (found inshore, occasionally).

Blackbacks (NH and Maine?). Mystery. Spawn saltmarshes in April and May. Found up to brackish water. Juveniles way up into fresh water in rivers. As grow, every year migrate further offshore. Possible not found inshore since rivers have been cleaned? Powerplant impacts with heat? They lived in a polluted river environment; now that the river is cleaner they have disappeared. How does the water quality affect the population of the species? The chlorination of the sewer aligns with the disappearance of the horseshoe crabs. What happened there?

- Horseshoe Crabs – disappeared from Hampton/Seabrook area in early 1970,s (corresponds to when started using chlorine in waste water).
- Mouth of Merrimack River generally less diverse fish community in recent years.
- Cod used to spawn right up in mouth of Merrimack (depth? See Bigelow & Schr) – no spawning in different areas, deeper (30-35 fathoms) in Ipswich Bay.
- Mackerel – (David used to catch when? Size? Depth? Habitat? Season?)
- Haddock – example from Merrimack River where Haddock spawned same inshore location for 5 years and then never came back.
- Yellowtail Flounder
- Pollock – juveniles especially used to be inshore in very high numbers. Juvenile Pollock like rock bottom but in many areas the rocky bottoms inshore have been changed due to the effects of coastal development. Fishermen used to have to work hard to avoid them and treated them as nuisance bycatch. The large Pollock used to come west to spawn at thanksgiving. Now these large ones just stay offshore. Seasonal patterns are 'mirror image' to cod (offshore spring, onshore spawn in fall). Juveniles like ledge, rock, boulder environs in less than 60 fathoms, also river mouths. See chart 13278, relatively inshore high spots (edge of 'light blue on chart) for the areas you used to find juveniles between June 1 and November 30 each year. See offshore spots (prong, northern edge) for where you find juveniles now (same season?). Spawning also occurs offshore now and not inshore. (Did it always occur offshore?)
- Dabs (American plaice) – now not found within 40 fathoms.
- Herring
- Alewives
- Blueback river herring
- Ocean pout (Congo eel) – preferred habitat is sand bottom

Species still found inshore in high numbers:

- Crab
- Lobsters
- Sculpin

- Bluefish seasonally (every year or less predictable?)
- Striped Bass (seasonally?)
- Blackbacks (lower numbers) because they have to spawn inshore.
- Longhorn Sculpin

Longhorn Sculpin - Possible indicator species:
- Numerous
- Medical studies
- Nearshore
- Suspect fairly stationary
- During winter smaller fish caught, during summer, larger fish
- Shorthorn sculpin found further east and north (in Maine)

<u>What are the possible environmental or other influences and factors in why the species community has changed?</u>
- Feeding conditions for adults have changed
- Feeding, habitat or other conditions have changed for juveniles unfavorable
- Survival of eggs and larvae (including food availability for larvae feeding on zooplankton – fish larvae prey on phytoplankton, zooplankton, including larvae of benthic invertebrates "meroplankton")
- Reduced population size overall
- Temperature and salinity changes
- Benthic habitat change: intro of exotic algae
- Benthic habitat changes: intro of various invertebrates (green crab, Japanese crab, tunicates, sponges)
- Note most of these species migrate onshore-offshore seasonally
- Could physical oceanographic factors be influencing choice of spawning locations (retention might be better inshore)? Could local alongshore / across shore currents have changed during this period and be influencing spawning behavior?
- Factors in general affecting spawning location (local evolution, physical retention of eggs and larvae, prey for larvae, physical conditions for larvae survival – temperature, salinity)

<u>Possible follow-up projects and historical datasets:</u>
- We could compare shifts of species presence from "known" stories from fishermen to data from powerplants, looking at the mass inshore fishery data which has history.
- Need water quality testing over long period of time compared with fish guts and other data. Use fish species (specific species) as indicators of effects of change.

- Possible hypothesis that there were changes to water quality in late 70s and early 80s (introduction of toxics, pharmaceuticals or other chemical issues that altered adult migrations or inhibited spawning and recruitment success).

Possible data sources for inshore water quality / Inshore benthic and pelagic surveys:
- Power plant records
- Seabrook
- Pilgrim
- Newington
- Millstone
- Braedon Bay
- Mass Inshore survey data

- Maine / NH occasional surveys
- Bigelow long term data
- Meghan Tyrell, Well Estuarine Research Reserve – Lew Inzce contact
- Larry Harris (UNH?)
- Jim Carlton, Williams College
- John Teal (ask Les) shoreline change

3. Interannual variability

General:

- Cold water - What are the affects of change in temperature on fish? Fish pool in deep parts trapping to stay warm.
- Where fish hang out is changing according to temperature and food source?
- How do fronts set up from year to year?
- Climatological influences need to be factored out when considering how fish respond…??
- A good year for larvae- how does it compare with the temperature, currents, salinity, plankton blooms, circulation, etc.?

Goal – show the environmental conditions that interact with the species

2003, 2004 as examples

Dec 2003 strong ecological shift:

- Herring came back "inside" Jeffreys Ledge on cold years. - Herring in high numbers ~ whiting in low numbers (Herring depths? Seasons?).
- Salinities on the bottom of Ipswich Bay were 24ppm - Storm caused mixing that caused record low salinities within Ipswich Bay resulted right after large storms, mixing of cold fresh surface waters down to 50 fathoms, extremely unusual.
- Cod have not come inside Jeffreys for the first time in years – they moved to east of Jeffreys into deeper areas last winter (late 2003 – early 2004) (due to cold?) and never really returned this summer.
- Dogfish 'normally' stay at surface until approx. 6°C, at which point the fish go down to warmer water (depths? Seasons?).
- More monk fish in colder water – have moved south with the colder water, finding more in this area inshore of Jeffreys this year and less to the north off Portland. (Are they also still in offshore basins?)
- White-sided dolphins – high numbers.
- Fin whales – medium numbers, more than last year.
- Humpback – fishermen not seeing any.
- Minke – very few.

Possible story: Fish recruitment success: spawning, larval transport and food needs, settlement, juvenile nurseries – interannual variability?

Influences: timing of spring phytoplankton bloom- early bloom related to high recruitment of haddock on the Scotian Shelf

Food needs for larval stage - Plankton, especially copepods
Climate – temperature, currents, upwelling

Note importance in how we frame this --- may not be feasible to predict recruitment, because of the many factors involved in determining year class strength, but could be possible to understand whether environmental conditions. Climate, bloom timing, copepod production, winds and currents affecting distribution of fish larvae were (or will be) very good, average or very bad for recruitment.

Satellite data – sea surface temperature, sea surface color indicates phytoplankton (and possibly zooplankton?). Satellite data can also show position and timing of fronts, which may promote aggregations of copepod prey and forage species.

Species of interest:
Gulf of Maine Cod – spawn in Ipswich Bay May 15 – June 15, and also in December. – where do the eggs and larvae go – south and east from Ipswich Bay around Cape Ann – moving through lower salinity water at mouth of Merrimack, either entrained in Cape Cod Bay or not depending on variability. See David's hand drawn map of local current patterns. Harvard groups, U Maine groups, or U Mass Dartmouth may be able to do particle tracking models. David notes that he sampled for UNH fecundity study in past and they found that the fish spawning at the end of the spawn – late June, higher fecundity.

GoM Cod: Where do the larvae go after they spawn? When do they spawn? At what depth do they spawn? Spawn May 15- June 15 in Ipswich Bay (species?, shrimp? cod?).

Georges Bank Cod
Georges Bank Haddock – 2003, 1999 good year classes

4. Another Possible subject: fish movements seasonally related to bottom temperature?

Coldest bottom temperature is in March
Shrimp – female movement inshore during winter, lay eggs, then move back into deeper waters in early spring / throughout spring and mix back up with smaller males. Shrimp aggregate tighter during colder years. Shrimp settle in different depths to lay eggs depending on water temperature. Shrimp let go of their eggs in the water column During February-April, the shrimp release their eggs. Are herring eating the shrimp eggs?

5. Another possible subject: how to set biological catch targets from ecosystem basis Basing on ecosystem states, not simply population models; (incorporating food needs of other species besides humans); environmental variability. Etc. Topic for further set of meetings?