Appendix D. Agenda and Presentations from the 2009 Consortium Meeting, Boston, MA

# Agenda

*Finding Solutions to Threatened Species Bycatch in the NW Atlantic – Progress and Priorities*

| | |
|---|---|
| Venue: | New England Aquarium, Boston, MA |
| Host: | Consortium for Wildlife Bycatch Reduction |
| Dates: | March 19-20, 2008 |
| Hotel: | Hilton, Financial District, Boston (617-556-0006) |
| Contacts: | *Tim Werner*, Consortium Director (twerner@neaq.org; 617-226-2137 [o]; 978-257-7903 [c])<br>*Amanda Thompson*, Lab Manager and Administrative Assistant, Research Department, NEAq (athompson@neaq.org; 617-973-0249 [o]; 978-406-1950 [c]) |

Overview

Bycatch persists as a major threat to endangered marine species worldwide. Among the most promising solutions are changes made to fishing gear and methods that can keep the fishing sector economically viable while reducing bycatch of marine mammals, turtles, birds, and other species.

Central to the philosophy of the Consortium for Wildlife Bycatch Reduction is that sustainable futures for threatened species and fishermen alike will be secured through science-industry partnerships mobilized towards finding practical solutions. The Consortium's goal is to support collaborative research between scientists and the fishing industry that leads to the development of practical fishing techniques for avoiding the depletion of species endangered by excessive bycatch. Towards this end, the Consortium has supported several projects in the Northwest Atlantic, which include evaluation of novel ropes for reducing severe entanglements of baleen whales, characterization of longline-pilot whale interactions, and studies of shark bycatch deterrents.

The purpose of this meeting is to review the Consortium's contributions, and to outline five-year research plans for two specific bycatch challenges that have been targeted by the Consortium: (1) Rope entanglements (from trap and gillnet fishing) of baleen whales and sea turtles, and (2) Conflicts between longlines and cetaceans, sharks, and sea turtles. These plans will guide decisions on funding priorities, ensure that individual projects are contributing to the achievement of longer term strategic outcomes, and provide a platform for aligning Consortium programs with those of other organizations that have similar goals and objectives.

Although not a major focus of this meeting, bycatch of cetaceans and other endangered non-target species in gillnets is a critical global challenge and an area of interest to the Consortium. Tim Werner will briefly describe a project he is undertaking with Andy Read, Norm Holy, Scott Kraus, and others to evaluate barium sulfate nets as a potential bycatch reduction technology for small cetaceans and sea turtles.

Structure of the Meeting

The meeting will involve presentations by Consortium members and invited guests. Each presenter will have between 20-30 minutes, followed by questions. At the end of each thematic block of presentations, we will have a general discussion related to that theme. In addition, group discussions will be directed at assisting the Consortium draft its 5-year research plans for the two identified fisheries bycatch priorities.

Proposed Meeting Outputs

- As in previous years, all presentations will be made available on the Consortium's website after the meeting.
- The draft report by Dr. Erika Zollett will be submitted for publication.
- Two Five-year Strategic Plans to be drafted and revised with input from the group.

Agenda

**March 19**

9:00 – Welcome (Dr. S. Kraus, T. Werner)

*Regional Context*

9:15 - Dr. Erika Zollett: Bycatch of protected species and other species of concern in U.S. East Coast commercial fisheries

9:45 - Amanda Johnson: Mitigating marine mammal and sea turtle bycatch in Northeast commercial fishing operations

10:15 - Tim Werner: Evaluation of novel gillnets for conserving endangered marine species

*Whale/Turtle Entanglements*

10:45 - Dr. Moira Brown: Assessment of large whale entanglements in the Canadian Maritimes

11:15 - Patrice McCarron: Maine Lobster Fishery -- Update on Field Testing of Experimental Vertical and Groundlines

11:45 - Dr. Ken Baldwin: Vertical lines and whales, a perspective from physical experiments

12:15 - Kara Dodge: Sea turtle entanglements in vertical lines

12:45 - Lunch

1:30 - Dr. Carl Wilson: Trap reductions and efficient lobster fishing

2:00 - Defining a 5-year research plan for rope-conflicts with whales and sea turtles
(The text and strategic components are listed below to facilitate group discussion)

**A. Defining the goal**.

Draft versions for consideration/discussion:

Goal: *Within five years, eliminate all entanglement-related mortality in* threatened *baleen whales (and sea turtles?) in the NW Atlantic from S. and E. Florida to the Gulf of St. Lawrence.*

Outcome: Commercial fisheries *bycatch is no longer a threat to the survival of endangered whales (and sea turtles?) nor to the prosperity of fishermen in the NW Atlantic whose methods are otherwise considered environmentally sustainable.*

**B. Identifying strategic elements**

- Modification to fishing gear/methods
  - Weak rope, stiff rope, glow rope, pop-up buoys, etc.
- Spatial approaches
  - i.e., areas in the water column of highest entanglement risk
- Effort reduction
  - reducing # of lines in the water column

**C. Draft research questions/priorities**

- To what extent is entanglement risk a function of gear density? If we were to reduce vertical lines in the water column by, say, 60%, would entanglement risk be reduced by 60%?
- Are there other gear modifications that should be explored? Should we do some field trials of pop-up buoys in high-risk areas?
- Where and when are the "hotspots" (two-and three-dimensional), defined as the areas of greatest overlap between gear and whales? How predicable are these locations from year-to-year? How do they change according to season? How useful is an area-based approach to reducing baleen whale entanglement severity?
- Should an "index of mortality" be developed to classify and monitor entanglement types and their associated gear?
- What can be learned from previous entanglements? How can we do a reverse engineering analysis?
- What should be studied with respect to groundlines?

5:00 - Wrap-up
5:30 - Adjourn

6:30 - Dinner

**March 20**

*Longline Bycatch*

8:30 - Rich Ruais: Review of collaborative research to reduce longline bycatch, and current needs

9:00 - Dr. Andy Read: Interactions between pilot whales and the pelagic longline fishery off Cape Hatteras: Lessons Learned and Future Plans

9:30 - Dr. John Mandelman: Shark bycatch and depredation in longline fisheries: Progress and research gaps in reducing shark interactions

10:00 - Defining a five-year research plan for cetacean, shark, and sea turtle bycatch in longlines

**A. Defining the goal.**

Goal: What is our five-year goal? Which taxa do we focus on? What are the priority fisheries?

Outcome: What do want to change as a result of the research supported by the Consortium?

**B. Identifying the strategic elements?**

- Modification to fishing gear/methods
  - pingers, circle hooks, "weak" hooks, deep sets, bait, earth metals, etc.
- Spatial approaches
  - deeper sets, hotspots, etc.

**C. Draft research questions/priorities.**

- For which of the corresponding bycatch reduction needs for threatened species and industry needs is the Consortium is ideally placed to contribute?

12:30 – Adjourn

Participants:

Ken Baldwin, UNH
Moira Brown, NEAq and Canadian Whale Institute
Jerry Conway, Consultant
John Higgins, NMFS-NER
Nick Jenkins, Consultant
John Kenney, NMFS-NER
Scott Kraus, NEAq
Patrice McCarron, MLA
Sara McNulty, NMFS-NER
Rich Ruais, Blue Water Fishermen's Association
John Watson, Consultant
Carl Wilson, DMR
Diane Borggaard, NMFS-NER
Erin Burke, DMF
Kara Dodge, UNH
Norm Holy, Better Gear, LLC
Amanda Johnson, NMFS-NER
Amy Knowlton, NEAq
John Mandelman, NEAq
Hank McKenna, Consultant
Andy Read, Duke University
Erin Summers, DMR
Tim Werner, Consortium and NEAq
Erika Zollett, Adjunct Research Associate, NEAq

# Bycatch of protected species and other species of concern in U.S. East Coast commercial fisheries

Dr. Erika A. Zollett
Adjunct Research Associate
NEAQ, Consortium for Wildlife Bycatch Reduction

# Road Map

Brief Introduction: Goals & Challenges

↓

Methods: Criteria & Data

↓

Results: Tables & Summary

↓

Wrap-up: Conclusions & Recommendations

# Goals

- Conduct a literature review
- Consolidate available information on bycatch
  - Protected species and other species of concern in U.S. East Coast commercial fisheries

# Goals

- Provide a resource for scientists, managers, and conservation practitioners
- Identify priorities for research and management

# Challenges

- Information is dispersed – multiple regulators and management entities
  - NOAA Fisheries
    - By gear type
  - Regional Fishery Management Councils
    - By target species
  - US Fish and Wildlife Service, States, ASMFC

# Challenges

- Most research and management efforts focuses on:
  - Single species
  - Taxa
  - Fishery

Center for Coastal Studies

# Challenges

- Differing scales and availabilities of data
- Sparse, inconsistent data/estimates
- Unknown survival rates
- Limits on understanding:
  - If bycatch is occurring at biologically sustainable levels
  - Where we should focus our efforts

# Methods

- Literature review
  - Published and unpublished
  - Most up-to-date information
- Fishery observations and estimates
  - Few estimates available
    - Most for marine mammals
      - Protections under MMPA
      - Stock assessment reports

Greenpeace / Gavin Newman

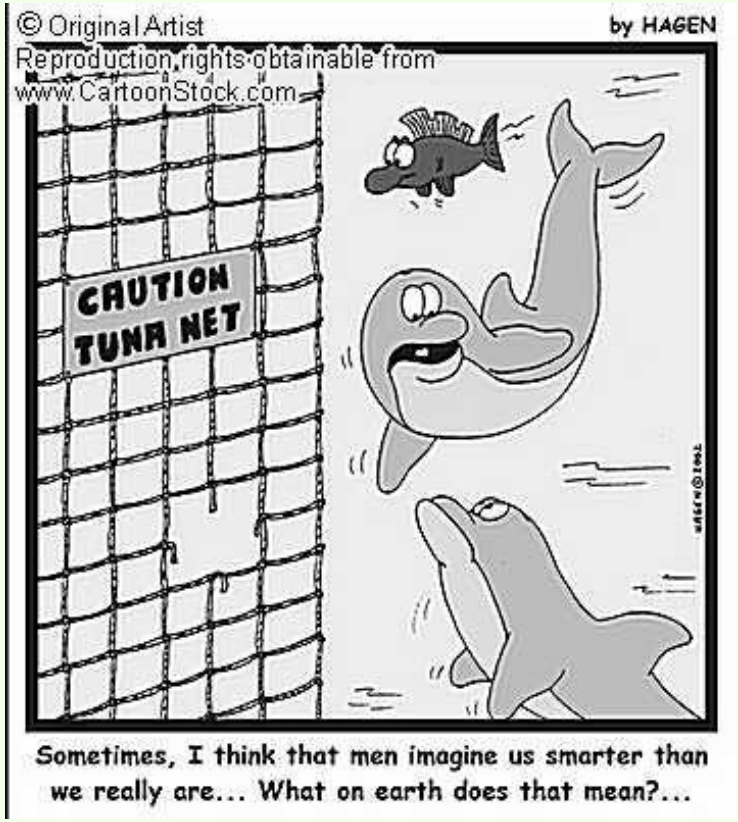
# Methods

- U.S. East Coast commercial fisheries – List of fisheries 2009
  - Prepared by NOAA
  - Required by the MMPA

- All fisheries
  - Maine to Florida
  - Dive and aquaculture fisheries were excluded
  - Fisheries that occurred in this area <u>and</u> in the Caribbean or the Gulf of Mexico were included but not those that occurred solely in these regions.

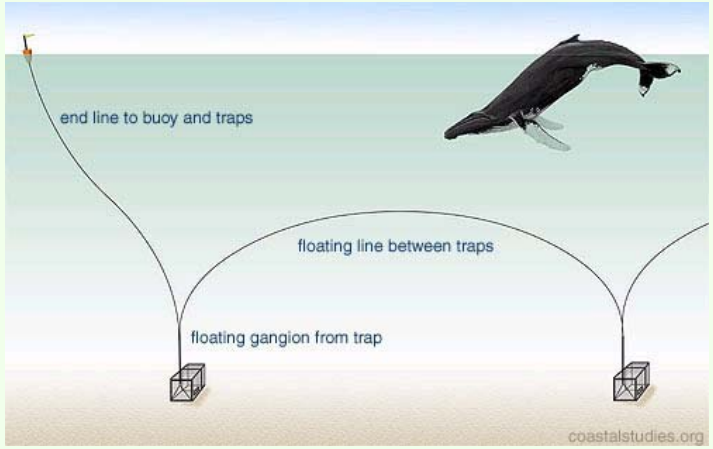
# Methods

- Gear type
- Target catch
- Documented bycatch
- Potential bycatch
- Current regulations
- Geographic area



# Methods

- Potential bycatch
  - Where bycatch may occur but has not been documented
  - Extrapolate based on existing knowledge
    - Of species included in this study
    - i.e. right whales + vertical lines of lobster pot gear
    - Can extrapolate to other pot fisheries within range of distribution



# Methods

- Protected and threatened species
- Criteria differed between taxa due to variable data and management
  - Marine mammals
  - Sea turtles
  - Sea birds
  - Fish
  - Invertebrates

Elliot Norse

# Marine Mammals

- ESA: Six species listed on East Coast
  - Blue, humpback*, fin*, sei, sperm, and North Atlantic right whales*

  *most likely to interact with commercial fishing gear
- MMPA:
  - Protects all marine mammals in U.S. waters
  - Investigated all interactions through Stock Assessment Reports
  - Twenty-four stocks (22 species) interacted with East Coast commercial fisheries
  - Fifteen did not

# Marine Mammals

- From the most recent NOAA Stock Assessment Reports
- For U.S. East Coast commercial fisheries

| DOCUMENTED BYCATCH: | NO DOCUMENTED BYCATCH: |
|---|---|
| Small cetaceans: Bottlenose (coastal and offshore stocks), common, Atlantic white-sided, Risso's, Atlantic spotted, Atlantic pantropical spotted, and striped dolphins; harbor porpoise | Small cetaceans: Frasier's, spinner, clymene, and white-beaked dolphins* |
| Large whales: Humpback, minke, fin, North Atlantic right, and sperm whales | Large whales: Blue* and sei whales* |
| Small whales: Long- and short-finned pilot, Cuvier's beaked, mesoplodon beaked, and pygmy sperm whales | Small whales: Northern bottlenose, pygmy killer, True's beaked, Sowerby's beaked, Blainville's beaked, Gervais' beaked, dwarf sperm, killer, and melon-headed whales |
| Pinniped: Harbor, harp, gray, and hooded seals | |
| Sirenian: West Indian manatee | |

* Interactions suspected but not present in SARs

# Sea Turtles

- ESA: All six species found in U.S. waters
- Five – on the U.S. East Coast
  - Green
  - Hawksbill
  - Leatherback
  - Loggerhead
  - Kemp's ridley

# Sea birds

- ESA: Two species on East Coast
  - Bermuda petrel and roseate tern
  - No documented bycatch of either of these species
  - Interactions with fisheries have not been identified to be a conservation threat to either species

Bermuda petrel

Roseate tern

# Sea birds

- Mid-Atlantic/New England/Maritime Regional Working Group (MANEM)
  - Fishery interactions – threat to populations:
    - Red-throated loon*, common loon, red-necked grebe*, northern fulmar, greater shearwater*, sooty shearwater, manx shearwater, northern gannet*, herring gull, sabine's gull, black-legged kittiwake, pomarine jaeger, common murre, thick-billed murre*, razorbill*, black guillemot*, and Atlantic puffin*

    **Also threatened at the species level by fisheries bycatch*

- U.S. Southeast Waterbird Conservation Plan
  - Fishery interactions – threat to populations:
    - Red-throated loon, common loon, northern gannet, horned grebe, black-capped petrel, Bermuda petrel, and Audubon's shearwater

# Fish

- ESA: Three species on East Coast
  - Smalltooth sawfish
  - Atlantic salmon
    - Bycatch is not listed as factor for decline
  - Shortnose sturgeon
    - Occurs only in rivers and estuaries
    - More likely to be threatened by construction of dams and pollution than by commercial fishery

# Fish

- Species of concern: Twelve on East Coast
  - Identified as being potentially at risk by NOAA OPR
  - Not listed under the ESA
    - Information is insufficient
    - Status and threats are too uncertain
  - River herring (Alewife and blueback herring), Atlantic sturgeon, Atlantic wolffish, barndoor skate, cusk, dusky shark, night shark, sand tiger shark, speckled hind, thorny skate, and warsaw grouper
    - Bycatch: only one of the threats to these species
    - Some of these are targeted by fishing efforts
    - Some are landed if captured (even if not targeted)

# Invertebrates

- ESA: Two species on East Coast
  - Elkhorn and staghorn coral
  - Bycatch not likely to be a primary conservation concern for either species
  - No other species of concern due to bycatch

Elkhorn coral

Patrick Lynch

Staghorn coral

NOAA

# Results

- East Coast commercial fisheries

| | 50 reviewed | 40 with bycatch |
|---|---|---|
| Gillnets | 12 | 10 |
| Longlines/hooks & lines | 8 | 6 |
| Trawls | 7 | 7 |
| Traps and pots | 7 | 5 |
| Purse seines | 4 | 4 |
| Dredges | 4 | 2 |
| Pound and stop nets, seines, weirs | 8 | 6 |

# Results

- Tables were produced that include for each fishery:
  - Target species
  - Geographic area
  - Documented bycatch
  - Potential bycatch
  - Sources of information
  - Bycatch management measures

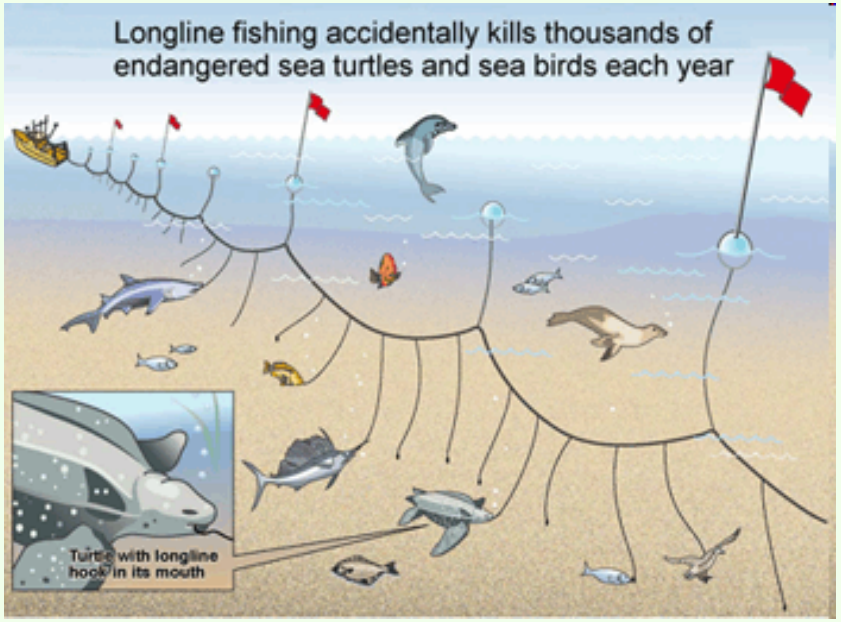
# Results

| | Marine mammals | | Sea turtles | Sea birds | | Fish | | Total |
|---|---|---|---|---|---|---|---|---|
| | ESA | MMPA only | ESA | ESA | Other plans | ESA | Species of concern | |
| **Gillnets** | 3 | 12 | 4 | 0 | 13 | 2 | 5 | **39** |
| **Longlines** | 1 | 13 | 2 | 0 | 3 | 1 | 6 | **26** |
| **Trawls** | 0 | 9 | 4 | 0 | 3 | 2 | 4 | **22** |
| **Traps/pots** | 3 | 4 | 1 | 0 | 0 | 0 | 2 | **10** |
| **Purse seines** | 0 | 5 | 0 | 0 | 0 | 0 | 1 | **6** |
| **Dredges** | 0 | 0 | 1 | 0 | 3 | 0 | 2 | **6** |
| **Pound nets, stop nets, seines, weirs** | 0 | 6 | 3 | 0 | 0 | 1 | 1 | **11** |

The number in each box corresponds to the number of species that were documented as bycatch in the corresponding fishing gear type.

# Results

- Found highest number of documented bycatch species in:
  - Mid-Atlantic gillnet
  - Northeast sink gillnet
  - Atlantic, Caribbean, Gulf of Mexico large pelagics longline



# Conclusions

- Consolidated available information
  - Reviewed 50 fisheries
  - First comprehensive assessment
  - Looked across taxa
  - Produced tables that cover all bycatch associated with fishing

# Conclusions

- Highlights the challenges of prioritizing areas for bycatch management and research
  - ESA-listed species and species with slow life histories should be priorities
    - Particularly where species are extremely endangered, global populations are low, and high bycatch exists
  - Fisheries with more or less documented bycatch?
    - May be an artifact of level of coverage or awareness
    - Focus of existing management measures
    - Does not need to interact with many species to be a concern
    - High bycatch of a single species/stock may be occurring

# Conclusions

- Highlights the challenges in identifying biological status
  - All documented interactions included
  - Few estimates are available
  - Most cases, data insufficient
    - To estimate incidental takes
    - To understand biological sustainability
  - Little information about rate of animals being released alive or related survival rates

# Recommendations

- Identified research and management needs to better understand bycatch

1. Consistent data across taxa <u>and</u> information about population structure
   - To determine if biologically sustainable
   - To identify priorities

# Recommendations

2. Increase and supplement observer data
   - Will always be sparse
   - EC fisheries too small to pay for FT coverage
   - Need new avenues to collect data
     - Video coverage of all hauls
     - Creative incentives to encourage reporting

# Recommendations

3. Future efforts to consider impacts on multiple species
   - Gear modifications - fishery/species specific
   - But single species mitigation can be:
     - Confusing to fishermen
     - Involve multiple regulatory agencies
     - Lead to displaced and unintended effects

# Recommendations

4. Restructure/streamline management
   - Difficult to integrate data from agencies
   - Need consistency
5. Consider bycatch within context of ecosystem
   - To know full impact of bycatch
   - Ecosystem Based Management

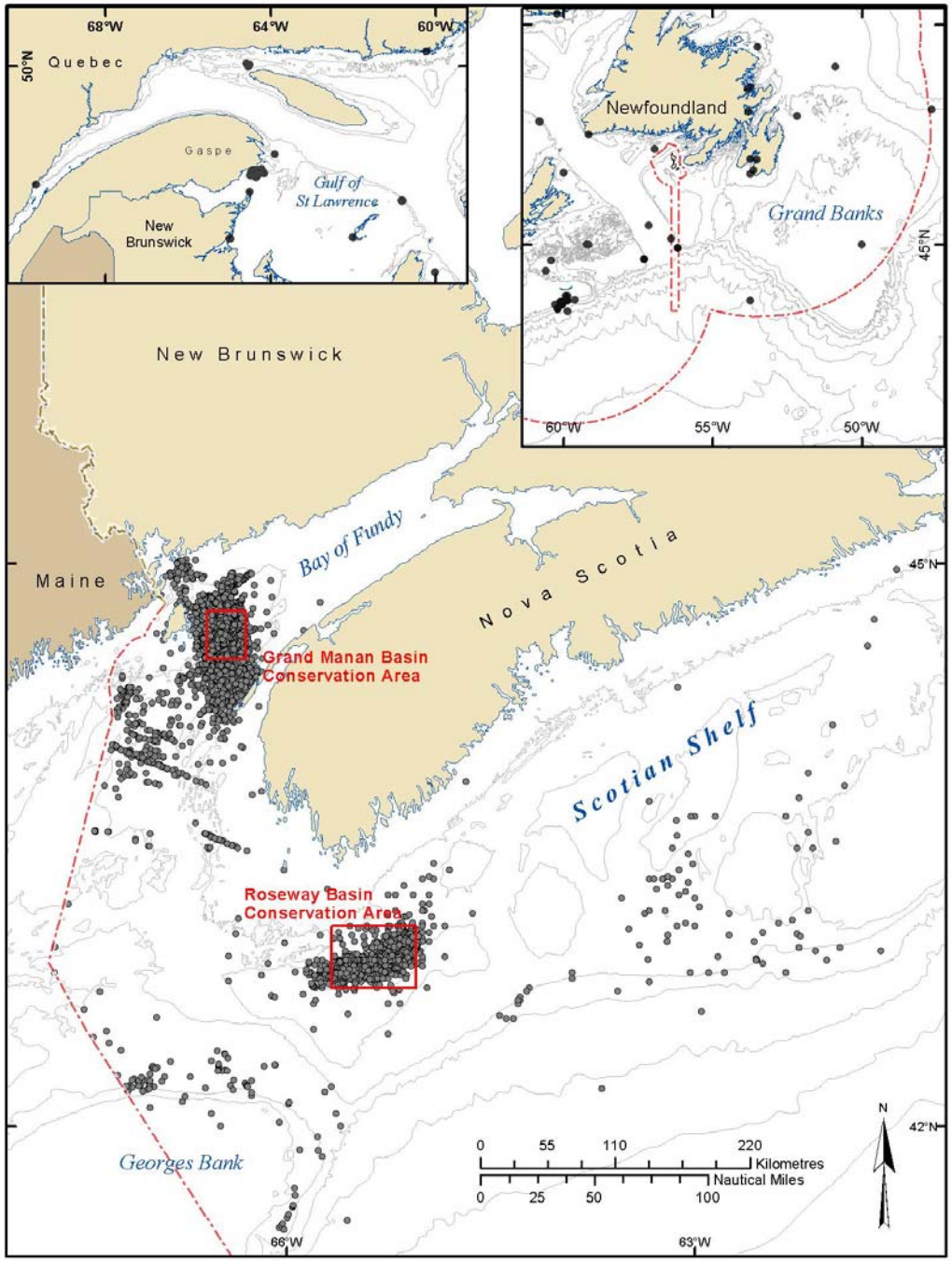
# Acknowledgements


- New England Aquarium + Consortium for Wildlife Bycatch Reduction – Tim Werner, Scott Kraus
- Stacey Horstman (NOAA), Amanda Johnson (NOAA), John Mandelman (NEAQ)
- NOAA: David Stevenson, Melissa Andersen, Henry Milliken, Allison Rosner, Diane Borggaard, Pat Scida, Ellen Keane, Kim Damon-Randall, Sarah Laporte, Dana Hartley, Meredith Cavanagh, Mark Minton, John Kenney, John Higgins, Anne Ney, Shelley Norton, Melissa Warden, Kim Murray, Lynn Lankshear, Mike Asaro
- UNH: Andy Rosenberg, Rachel Feeney, Travis Ford, Ken LaValley, Jamie Cournane, Emily Klein, Karen Alexander, Bill Leavenworth
- Shannon Lyons Green (MD Sea Grant), Jennie Harrington (MRAG Americas), Nancy Young (Univ. of St. Andrews), Craig Watson (FWS)

# Assessment of Large (mostly Right) Whale Entanglements in the Canadian Maritimes

Preliminary work in progress

Moira Brown
New England Aquarium
Canadian Whale Institute
March 2009




Right Whales in Canadian Waters – 1951- 2005

- > 80% of known pop.
- June through December
- (~ May and now January)
- Primary habitats
  - Grand Manan Basin
  - Roseway Basin and waters between and
  - Eastern Scotian Shelf
  - Gulf of St. Lawrence
    - Gaspe

- -Data poor outside of two conservation areas

# Current situation with entanglement mitigation

By Fishermen and NGOs

- Disentanglement response (1999)
  - Volunteer fishermen
  - Basic training to DFO officers
- Voluntary gill net removal
  - ~1999/2000
- Voluntary code of conduct
- Fishermen/Right whale working group
- WWF Canada Share the Oceans campaign

By DFO and Fishermen

- Some support for disentanglement effort (acquisition of equipment only)
- Strategy for LFA 36, 37 & 38 (western side lower Bay of Fundy)
  - Aerial surveys and GMFA hotline
  - Voluntarily not set trawls within 2 km of right whales
  - Voluntarily move gear away from approaching right whales

# Mandate in Canada for Right Whale Recovery under Species at Risk Act – DFO (Recovery Strategy for the North Atlantic Right Whale in Atlantic Canadian Waters [Proposed: 2009]

**Objective 2**: *Reduce mortality and injury as a result of fishing gear interactions (entanglement and entrapment)*

*Rationale*: A serious threat to right whales is injury and mortality from fishing gear interactions in Canadian waters: this may affect the survival of the species. **To increase the chances for survival, the number and severity of entanglements or entrapments must be reduced.**

*Strategies*:

a) Evaluate, promote, and/or implement where necessary, strategies (*e.g.* gear modifications, effort restrictions) that will reduce the potential for harmful interactions between fishing gear and right whales. Collaboration between researchers, fishers and resource managers on the development and field-testing of modified fishing practices will assist in the identification and application of mitigation measures.

b) Evaluate and minimize the effects of all new and expanding fisheries on right whales.

c) Collaborate with fishers about ways in which they can, through measurable voluntary action, reduce the number/frequency of interactions between right whales and fishing operations.

d) Support emergency response and disentanglement programs in eastern Canada that are able to rapidly respond to reports of entangled or entrapped right whales.

Next step: unspecified Action Plans within two years, critical habitat for Roseway Basin

# Known right whale interactions
## n=20

Databases examined

- NEAq – photo id
- PCCS - ALWDN
- DFO – SABS
  - No gear archived
- GMWSRS
- Published accounts
  - Lien et al 1989
  - Knowlton & Kraus 2001
  - Johnson *et al* 2005
  - Canadian Recovery Plan 2000

Results for right whales only

- 3 entrapments in herring weirs, all animals released without serious injury
- 4 (+ 1 poss) entanglements in gill nets, 3 observed (2 freed themselves, 3 partially disentangled) (< 2000)
- 6 entanglement in lobster trawl gear (1 fatal)
- 3 in crap pot gear + 1 in unspec. pot gear
- 1 entangled in a cod trap (Nfld)
- 1 entangled in a Danish Seine (fatal) (now id'd as crab pot gear)
- 1 in aquaculture gear later id'd as lobster trawl gear
- 1 unknown gear

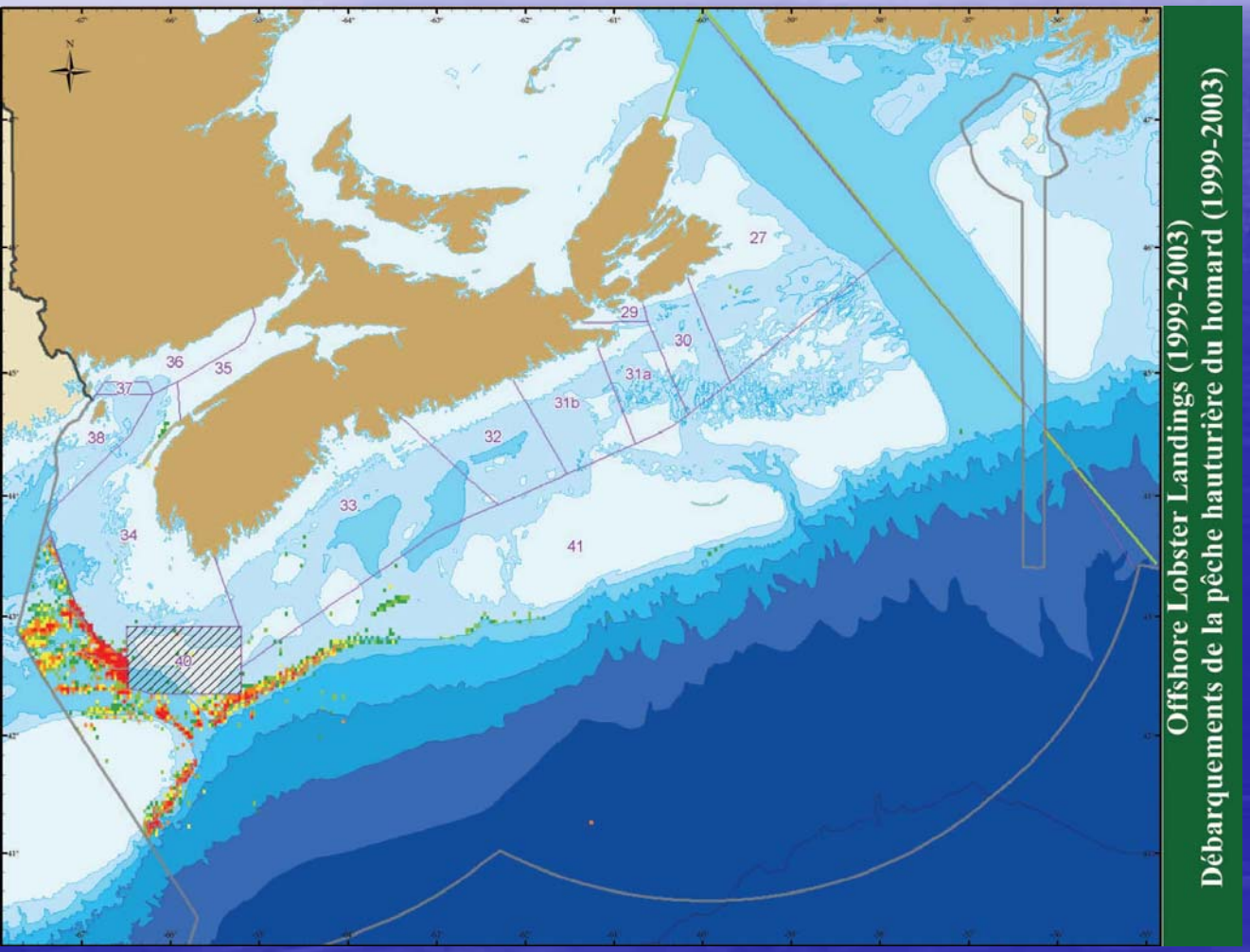
Gear investigations – by NMFS

Fundy fishing practices

# Gear Research in Eastern Canada

- ECE/NMFS/NS fisherman – load cells on gill net hauling lines
- CWI/GMFA – test of sinking (EsterPro) and neutrally buoyant (HydroPro) ground line
- Dalhousie/DFO Tech Report – probability of entanglement by fishery based on summer and fall right whale distribution and distribution of gillnet, hook and line and crab pot fisheries
- DFO/GMFA fishermen
  - rope durability testing
- DFO
  - Profile ground line on experimental lobster trawl in shallow near shore waters
- DFO/WWF
  - logger study profiling sinking ground line in Bay of Fundy – distribution of elevation above the bottom, bunching of pots, effect of current on position of groundline (SG = 1.1, 14-20 pots)

# Eastern Canada Offshore Lobster Fishery – in assessment for MSC certification




- LFA 41
- 8 licenses
- 3-4 boats all owned by Clearwater
- No trap limit
- TAC 720 tonnes
- ~ 30 sets 100 pot trawls
- Year round, but mostly in spring and fall
- Already using sinking groundline (EsterPro)

# Maine Lobster Industry Field Testing of Experimental Vertical and Groundlines

Consortium for Wildlife Bycatch Reduction
March 19, 2009

Patrice McCarron
Maine Lobstermen's Association

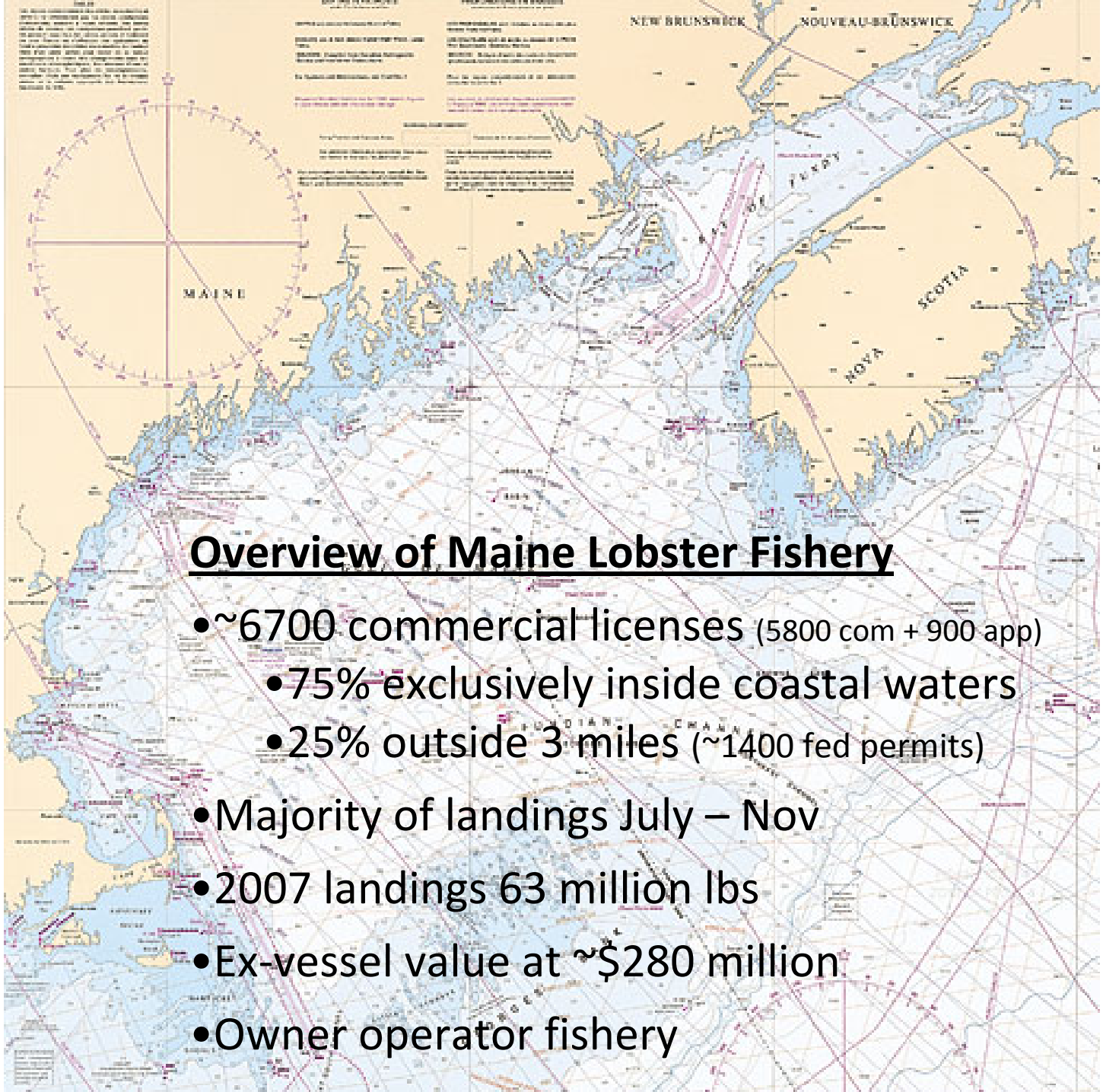
MAINE Lobstermen's Association

# About the MLA

- State-wide industry organization founded in 1954
- Advocate for lobstermen & the lobster industry
- Seek to be fair & proactive – focus on big picture
- ~1200 members from Kittery to Eastport – lobstermen and businesses
- Governed by a Board of Directors comprised of lobstermen along the Maine coast

# Some Challenges….

- Maine lobster fishery is large and owner operated
- Proud of conservation, fishermen don’t believe they are harming whales
- Not a lot of obvious overlap between right whale feeding/transiting areas and the bulk of our fishery in time or space
- Unique geological and oceanographic conditions
- Very limited data on how whales become entangled and therefore how to make gear safer




## Overview of Maine Lobster Fishery

- ~6700 commercial licenses (5800 com + 900 app)
  - 75% exclusively inside coastal waters
  - 25% outside 3 miles (~1400 fed permits)
- Majority of landings July – Nov
- 2007 landings 63 million lbs
- Ex-vessel value at ~$280 million
- Owner operator fishery

# The Lobster Industry is Known for Conservation

V-notch Protection

Zero Tolerance

3 ¼” min carapace

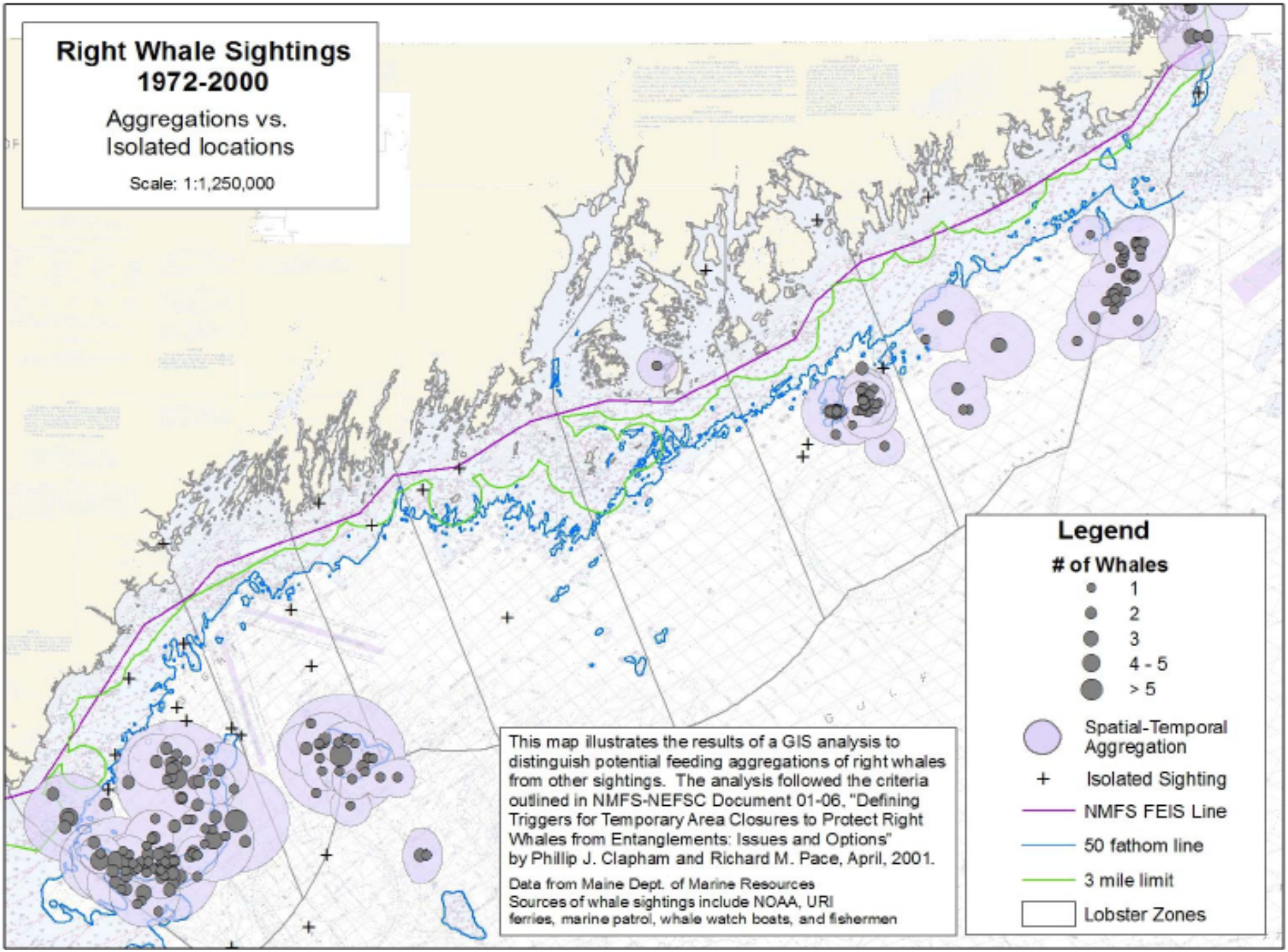
Escape Vents

Oversize Protection >5”

Berried Females

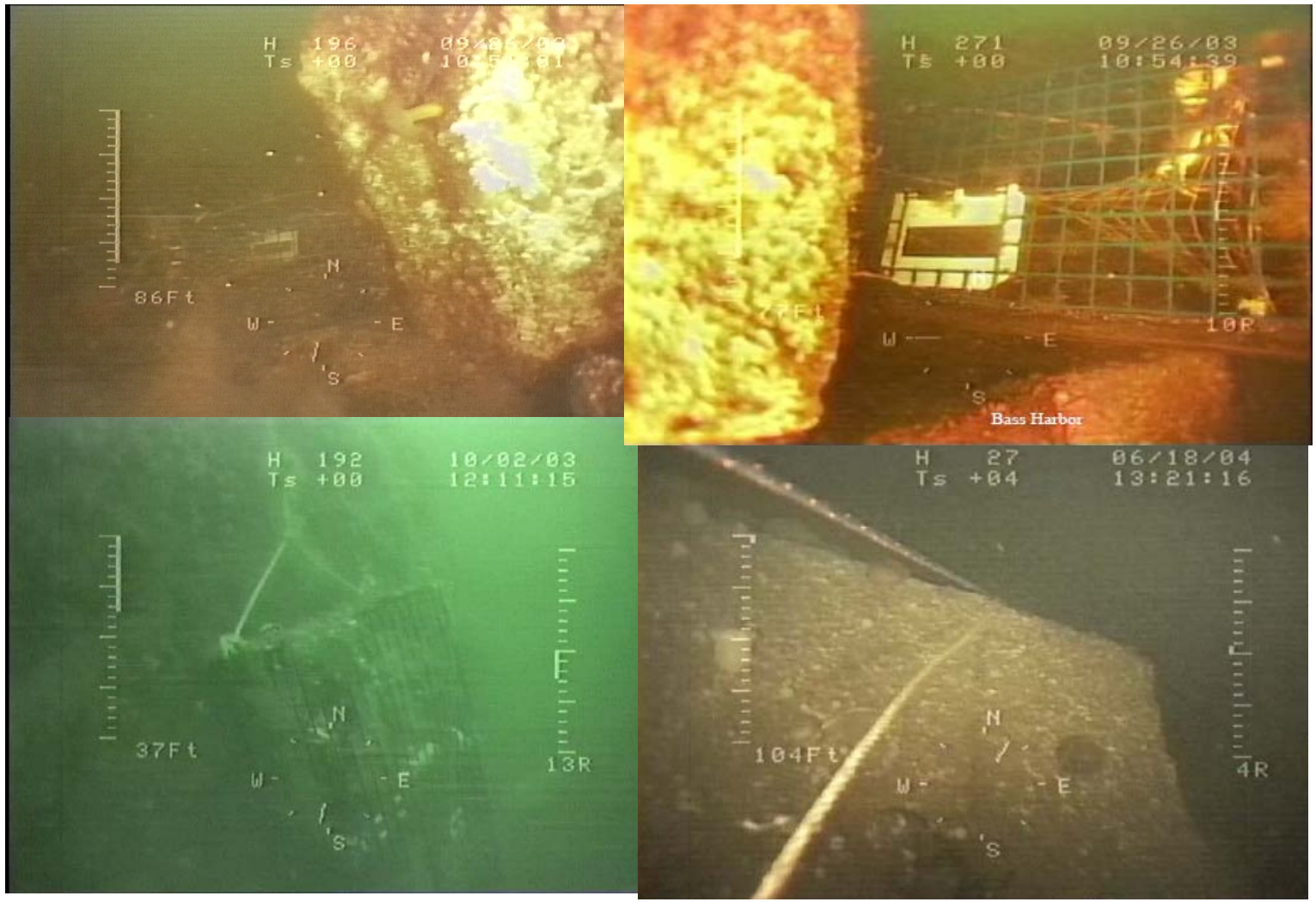
Trap Limits (800 max)

No dragging lobster


Right Whale Sightings
1972-2000
Aggregations vs.
Isolated locations
Scale: 1:1,250,000
This map illustrates the results of a GIS analysis to distinguish potential feeding aggregations of right whales from other sightings. The analysis followed the criteria outlined in NMFS-NEFSC Document 01-06, "Defining Triggers for Temporary Area Closures to Protect Right Whales from Entanglements: Issues and Options" by Phillip J. Clapham and Richard M. Pace, April, 2001.
Data from Maine Dept. of Marine Resources
Sources of whale sightings include NOAA, URI ferries, marine patrol, whale watch boats, and fishermen
Legend
# of Whales
1
2
3
4 - 5
> 5
Spatial-Temporal Aggregation
Isolated Sighting
NMFS FEIS Line
50 fathom line
3 mile limit
Lobster Zones

# Unique geology and oceanography

extreme hard, rocky bottom, strong tides & bottom currents



# Summary of Gear Removed from Whales

**Summary of NMFS Gear Entanglement Data for Years 1997 to 2005**

| | | # entanglements | gear recovered | % gear recovered | Origin of Gear Determined (there can be multiple pieces of gear removed from a single whale) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Canada | DE | MA | ME | NC/VA | NY | offshore | RI | Unknown or blank* | Totals Confirmed Origin Gear** |
| Managed under ALWTRP | Right | 48 | 23 | 48% | 3<br>aquaculture (1)<br>lobster (1)<br>unknown pot (1) | 0 | 1<br>lobster (1) | 3<br>lobster (3) | 0 | 0 | 3<br>lobster (3) | 0 | 15 | 25 |
| | Hump | 122 | 36 | 30% | 8<br>gillnet (4)<br>lobster (2)<br>crab pot (1)<br>whelk pot (1) | 1<br>Conch pot (1) | 5<br>gillnet (1)<br>lobster (3)<br>slime eel pot (1) | 2<br>lobster (2) | 4<br>gillnet (4) | 0 | 0 | 3<br>lobster (3) | 23 | 46 |
| | Fin | 17 | 4 | 24% | 2<br>gillnet (1)<br>crab pot (1) | 0 | 2<br>gillnet (1)<br>slime eel pot (1) | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| Not Managed Under ALWTRP | Minke | 45 | 9 | 20% | 0 | 0 | 0 | 4<br>lobster (4) | 0 | 1<br>gillnet (1) | 0 | 0 | 9 | 14 |
| | Sperm | 1 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Brydes | 1 | 1 | 100% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| | Blue | 1 | 0 | 0% | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Unknown | 21 | 1 | 5% | 0 | 0 | 0 | 1<br>lobster (1) | 0 | 0 | 0 | 0 | 0 | 1 |
| | TOTALS** | 256 | 74 | 29% | 13 | 1 | 8 | 10 | 4 | 1 | 3 | 3 | 49 | 92 |

*Gear types determined when Origin of gear (where set) is unknown:

**right whales** gear types: gillnet (2), lobster (2), crab pot (1), unknown (10);
**humpback whales** gear types: Anchor system (2), Danish seine (1), entrapment (1), gillnet (9), lobster (3), unknown pot (2), tuna (1), unknown (5);
**fin whales** gear types: Gillnet (1);
**minke whales** gear types: Lobster (5), otter trawl (3), unknown (1)
**byrdes** whales gear types: unknown pot (1)

**Totals for "Confirmed Origin of Gear" can be higher than totals for "gear recovered" because multiple pieces of gear can be recovered from a single whale

# Disentanglements in Maine Gear

- 1999 Humpback in midcoast Maine
  - Successfully disentangled,
  - not sighted since
- 2002 Right Whale in midcoast Maine
  - Sighted gear free in 2006
- 2003 Humpback whale in southern Maine
  - Whale likely already sick, emaciated carcass found a few days later
- 2003 Right Whale in midcoast Maine
  - Primary entanglement in monofilament line; lobster gear entangled secondary; likely still entangled
- 2004 Right Whale in southern Maine
  - Kingfisher is carrying lots of fishing gear, sighted in 2008 with gear, but still healthy

# Project Overview

- Field testing through the Consortium for Wildlife Bycatch Reduction
  - managed by New England Aquarium
  - ropes developed by Better Gear
  - field tested by MLA
- Gear technologies did not come from the industry
- MLA tested operational feasibility of the gear, not risk reduction to whales

# Field Testing

- Vertical Lines
  - glow rope (2005)
  - stiff rope (2006)
  - weak rope (2005-2007, 2009)
  - TTLC (2007-2008)
- Sinking Groundlines
  - barium sulfate rope (2005-2008)
  - metallocene ropes (2006-2007, 2008-2009)

# Data Collection

**Experimental Rope Gear Handling Assessment**

*If you fished more than one type of experimental rope, please fill out a separate sheet for each rope type*

## How was the rope fished?

**Name:** _____

**Experimental Rope Type:** _____
*NEAq sink (light grey), Hyliner lopro (silver/grey with red tracer), Other (please name*

**How was gear fished? (pairs, triples, trawls, etc):** _____

**How many sets of gear was the rope fished on?** _____

**Amount of rope fished** *(total length for all sets in Fathoms)* **?** _____

**General Location/Area Fished:** _____

**Depth Range Fished** *(in Fathom)* **:** _____

**Typical Bottom Type Fished:** _____
*average % of time on bottom types: ledge, rocky, cobble, gravel, mud, sand, mixed (please defin*

**During Which Months was the Rope Fished:** _____

**Estimated Number of Times Rope was Hauled:** _____

**Number of Hauls**
Place a tick mark each time the rope is hauled.
If you have rope deployed on multiple sets of gear, place a tick mark each time you haul through the gear.

## How did you like the rope?

*Please rate the rope on the following characteristics on a scale of 1 to 5 by circling the number that best describes the performance of the rope.*

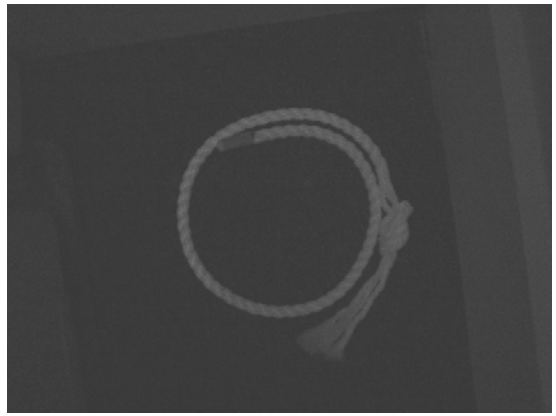
**1 (terrible)** = hard to imagine a worse rope; **2 (poor)** = worse than most ropes I have used in the past; **3 (average)** = as good as most ropes I have used in the past; **4 (good)** = fishes better than most ropes I have used in the past; **5 (excellent)** = hard to imagine a better rope for what I used it for.

| Scale: 1 = terrible 2 = poor 3 = average 4 = good 5 = excellent | | | | | | Comments |
|---|---|---|---|---|---|---|
| Fouling | 1 | 2 | 3 | 4 | 5 | _____ |
| Chafing | 1 | 2 | 3 | 4 | 5 | _____ |
| Hangups | 1 | 2 | 3 | 4 | 5 | _____ |
| Noise | 1 | 2 | 3 | 4 | 5 | _____ |
| Kinking | 1 | 2 | 3 | 4 | 5 | _____ |
| General Durability | 1 | 2 | 3 | 4 | 5 | _____ |
| General Handling | 1 | 2 | 3 | 4 | 5 | _____ |

**Any Other Comments** *(please note anything signficant while rope was being fished):* _____

_____

# Glow Rope



- 3/8” Luminescent Polypropylene (float) line
  - recharges via UV exposure
- One batch produced
- Fished 1 field season at 4 sites in 2005
  - southern Maine (York and Yarmouth)
  - Midcoast Maine (Cushing)
  - Downeast Maine (Cutler)

# Glow Rope Issues

- Overall it fished well, but
  - must be fished in combination with sinking rope at the top of the buoy line
  - never observed glowing through water
  - fouling at surface interfered with luminescence
  - chaffing on hard bottom
  - some minor handling and noise issues
- Loses luminescence, likely due to crushing of glow particles in the hauler
  - possible solution to encapsulate glow particles in glass, but very expensive
- No research on whale behavior and glow rope

# Stiff Rope

- Rubber Sections Over Inner Core of Rope
  - Rope A:
    - 6” sections of 3/8” outer diameter rubber* sleeve
    - strung over a 3/16” inner core of braided polyethylene (4800 lb br strength)
  - Rope B:
    - 6” sections of 7/16” outer diameter rubber* sleeve
    - strung over a 3/8” inner core of twisted polypropylene (2300 lbr strength)
  - Rope C:
    - 6” sections of 1/2” outer diameter rubber* sections
    - strung over a 5/16” inner core of braided polyethylene (8000 lb br strength)
- Fished at 3 sites in 2006
  - Rope B fished in York (southern Maine)
  - Ropes A and C fished in Yarmouth (midcoast Maine)

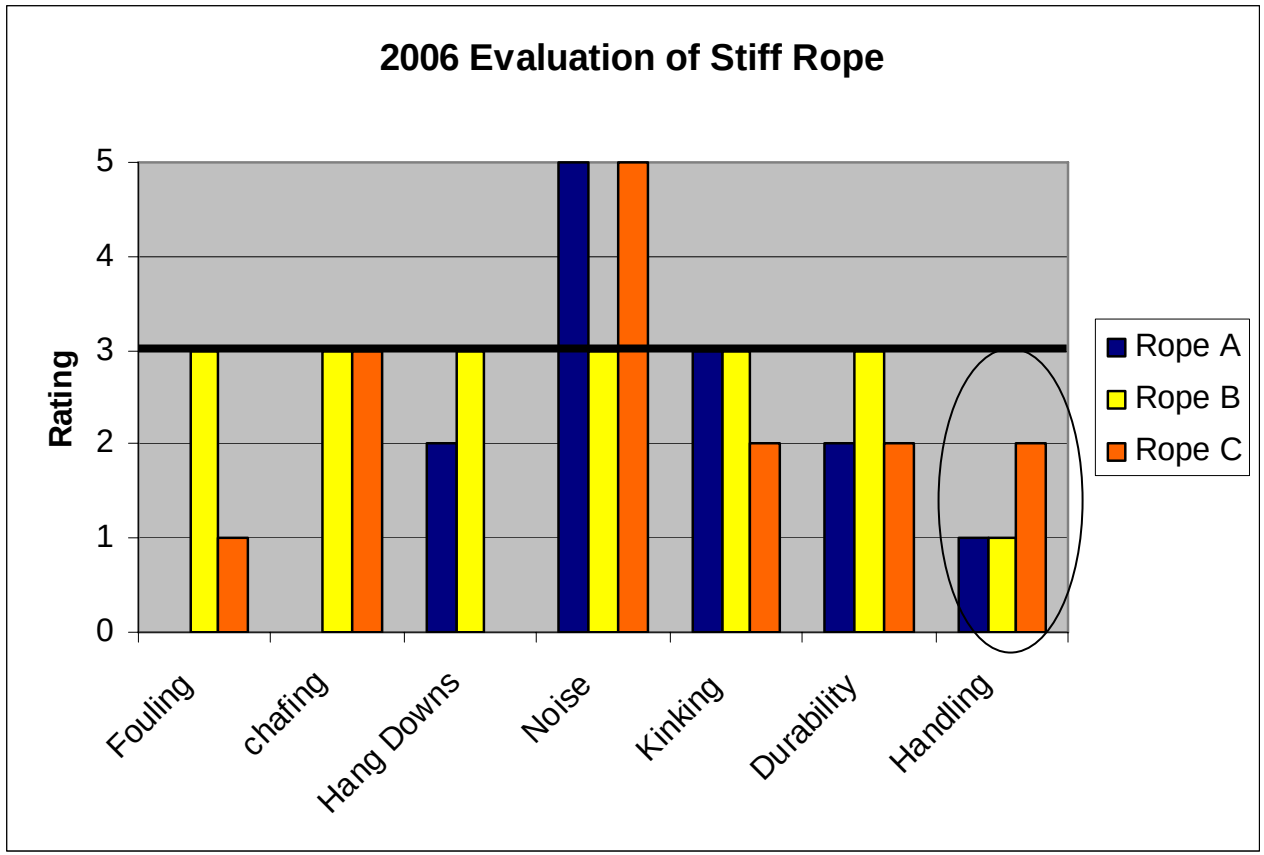
* EPDM rubber hardness of 60

# Stiff Rope in Hauler

# Stiff Rope

excellent

terrible




3/8”

7/16”

½”

# Stiff Rope Issues

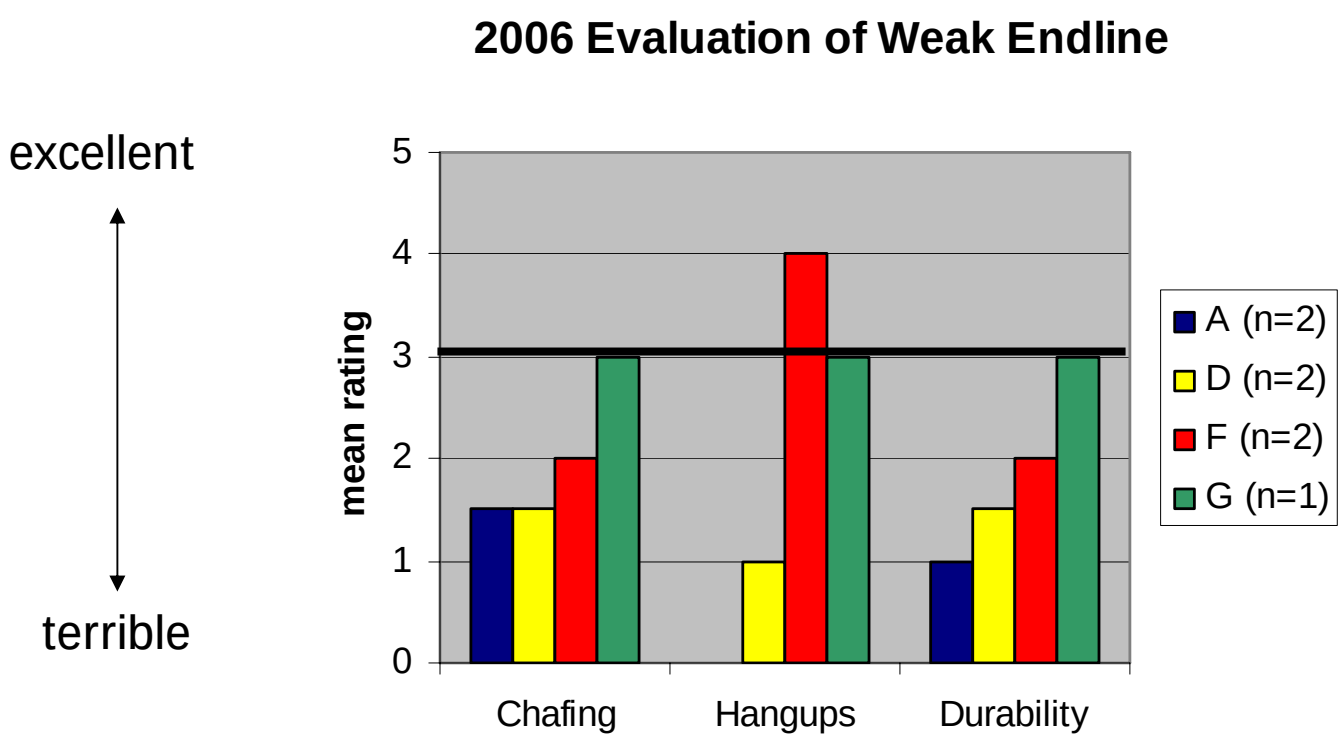
- Rope performance
  - rubber casings split from inside out due to friction from inside rope
  - inside rope slipped and stretched causing gaps between rubber sections
  - difficult handling
    - doesn’t coil on deck
    - can’t be easily shortened or lengthened
    - cumbersome to fish especially when moving gear
- Rubber sections may pose a risk to whales in baleen

# Weak Rope

- Weak sink line -- polypropylene infused with barium sulfate
- Fished with float rope spliced into bottom 1/3 to prevent hang downs

| 2005 Rope | 2006 Rope | 2008 rope |
|---|---|---|
| 5/16” BaSO4 sink line | 3/8” BaSO4 sink line | 5/16” BaSO4 sink line |
| ~600 lbs estimated breaking strength | 1,000 lb estimated breaking strength (target was 800 lb) | 1,200 lb estimated breaking strength |
| Tested at 4 sites<br>York, Yarmouth, Cushing, Cutler | Tested at 10 sites<br>York, Yarmouth, Harpswell, Cushing (x2), Tenants Harbor, So Thomaston (x2), Cutler (x2) | Tested at 1 sites<br>Yarmouth |

# Weak Endlines



# Weak Line Issues

- Worked best in southern Maine
  - Need further research to determine potential in trawl fishery in southern Maine
  - Gear cannot be predictably hauled from one end of the gear in Maine
- Not feasible in midcoast or downeast Maine
  - severe chaffing, durability and hangdown issues
  - parted off before rope was hauled downeast
  - parted off after one haul midcoast
- A lot of anxiety with this idea amongst lobstermen due to potential gear loss
- Benefit to whales?

# Time Tension Line Cutter

- Developed by Blue Water Concepts
- Lab tested at UNH
- Fished at 7 sites in 2007-2008
  - 3 in Downeast (Cutler, SW Harbor)
  - 4 in Midcoast (Matinicus, So Thomaston, Boothbay)

# TTLC Logsheet

## Time Tension Line Cutter (TTLC) Logsheet

**Name:** _____

**TTLC Serial #:** _____ **Date Logsheet Completed:** _____

*Embossed on the side, may also be written in blacl*

### HOW WAS THE TTLC FISHED?

How was your gear rigged *(singles, triples, trawls/specify #)*? _____

Length of vertical line *(in Fathom)*?_____

General Location/Area Fished: _____

Depth Range Fished *(in Fathom)*:_____

Typical Bottom Type Fished: _____

*avg % of time on bottom types: ledge, rocky, cobble, gravel, mud, sand, mixed (please define)*

During Which Months was the TTLC Fished: _____

Estimated Number of Times TTLC was Hauled: _____

### HOW WAS THE TTLC RIGGED?

How far from the trap was the TTLC spliced in ( *in Fathom*)? _____

Did you use a knot to warn you that it was coming? *(please describe)*

_____

Did you use a jump rope? How long was the jump rope *(in Fathom)*?

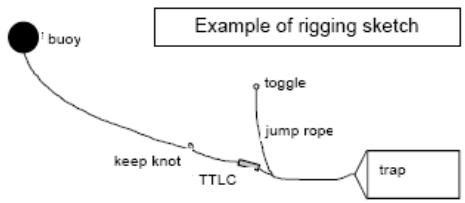
_____

Did you use a toggle or floatation on the jump rope? _____

Did you tie jump rope off to a cleat or other device? *(please describe)*

_____

Please sketch how your TTLC was rigged into your vertical line and describe how it was rigged




### IS THE TTLC OPERATIONALLY FEASIBLE?

How much EXTRA time (on average) did it take you to haul your gear when you first rigged the TTLC? *(in minutes)* _____

How much EXTRA time (on average) did it take you to haul your gear once you figured out how to fish the TTLC? *(in minutes)* _____

How <u>many hauls</u> did it take you to get comfortable hauling the TTLC? _____

Did you ever observe a gap on the TTLC between the two plastic sections? *(specify how often and size of gap)* _____

Do you think you could successfully fish the TTLC on your gear? *(why or why not)* _____

PLEASE FEEL FREE TO PROVIDE ADDITIONAL COMMENTS ON THE BACK

# TTLC Rigging

## How to Rig a Time Tension Line Cutter (TTLC)

**To Tie the TTLC into your Buoy Line**: You will be cutting your buoy line and threading one end into the TTLC from the top, and the other from the bottom. The gray end of the TTLC, which has the big hole on top (Figures 1 and 2), should face up towards the buoy. From the top, thread the rope through the large hole and out the side (Figure 3). Then threat the rope through the side hole (just below where the rope comes out) through the device to the other side (Figure 4). Then wrap the rope around the device, tuck under loop (Figure 5) and pull tight (Figure 6). You can fish the TTLC with this rigging. If you are not comfortable with this rigging, you can just add a knot (Figure 7), or you can double wrap it (Figure 8) or double wrap it with a knot (Figure 9). Repeat the same with your vertical line from the bottom of the TTLC.

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

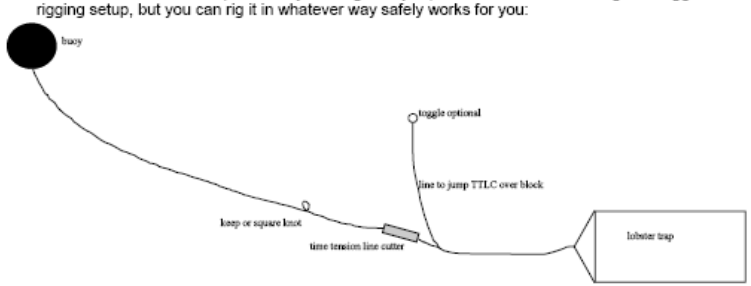
Figure 6

Figure 7

Figure 8

Figure 9

**How to Fish the TTLC:** When placing the TTLC on your buoy line, it should be placed about 1 to 1.5 Fathom from the trap to allow you to rig it to "jump the block". The following is a suggested rigging setup, but you can rig it in whatever way safely works for you:




The square knot or keep know will warn you that the TTLC is headed for the block. It is recommended that you either cleat off the keep knot, use a cam cleat or rig a self clearing cleat that works for your boat. The person who designed the TTLC says it should only add 20 seconds to your hauling to get the TTLC over the block and the trap on board.

*Prepared by the Maine Lobstermen's Association (October 2007)*

# TTLC Issues

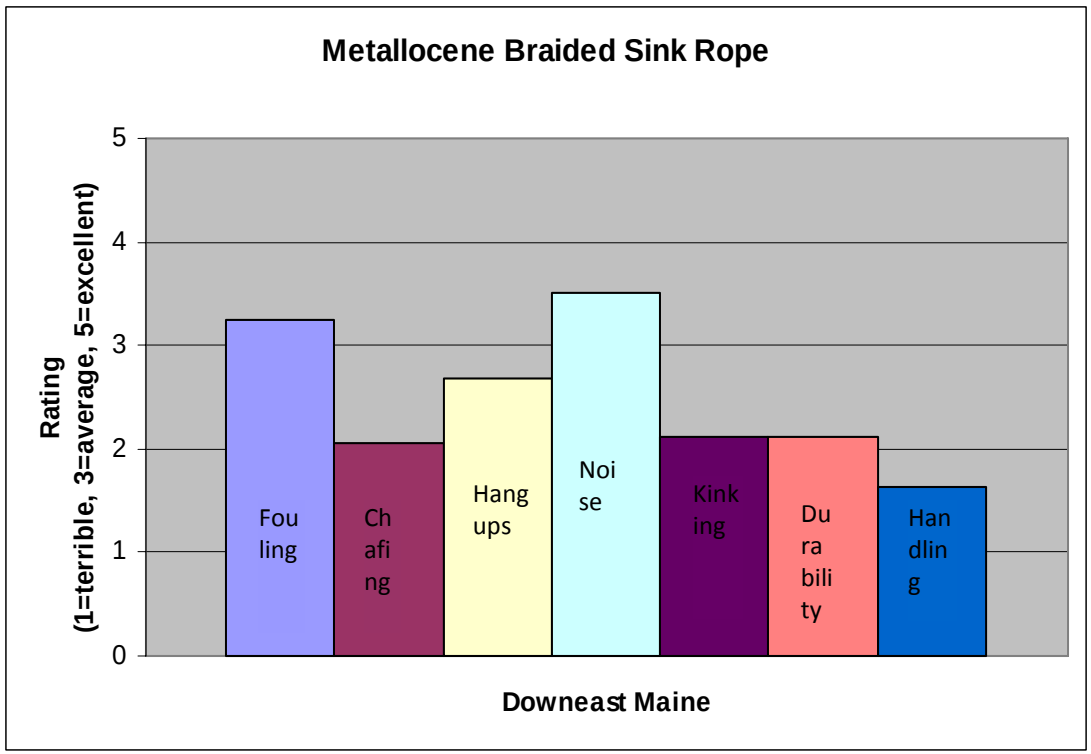
- One unit failed; didn’t close after tension released
- Setting gear back presents safety issues
  - Interaction of TTLC and jump rope with other gear on deck
- Operational concerns to scale up for all gear
  - Safety issues when gear is tangled in congested areas
- Increased time to haul gear
  - 30 seconds to 2 minutes
- Hauling TTLC is cumbersome but doable on a small scale
  - Most potential in large trawl fishery; not likely to work in a single, pair, small trawl fishery

# Metallocene Braided Sinking Groundlines

- 2006 Batch A
  - 3/8” green braided metallocene polyethelene outer sheath tightly wrapped over braided polyester inner core.
- 2006 Batch B
  - 7/16” green braided metallocene polyethelene outer sheath loosely wrapped over braided polyester inner core.
- 2007 Batch
  - 3/8” cream colored braided exterior with a twisted center with a marine coating

# Summary Braided Sink Ropes

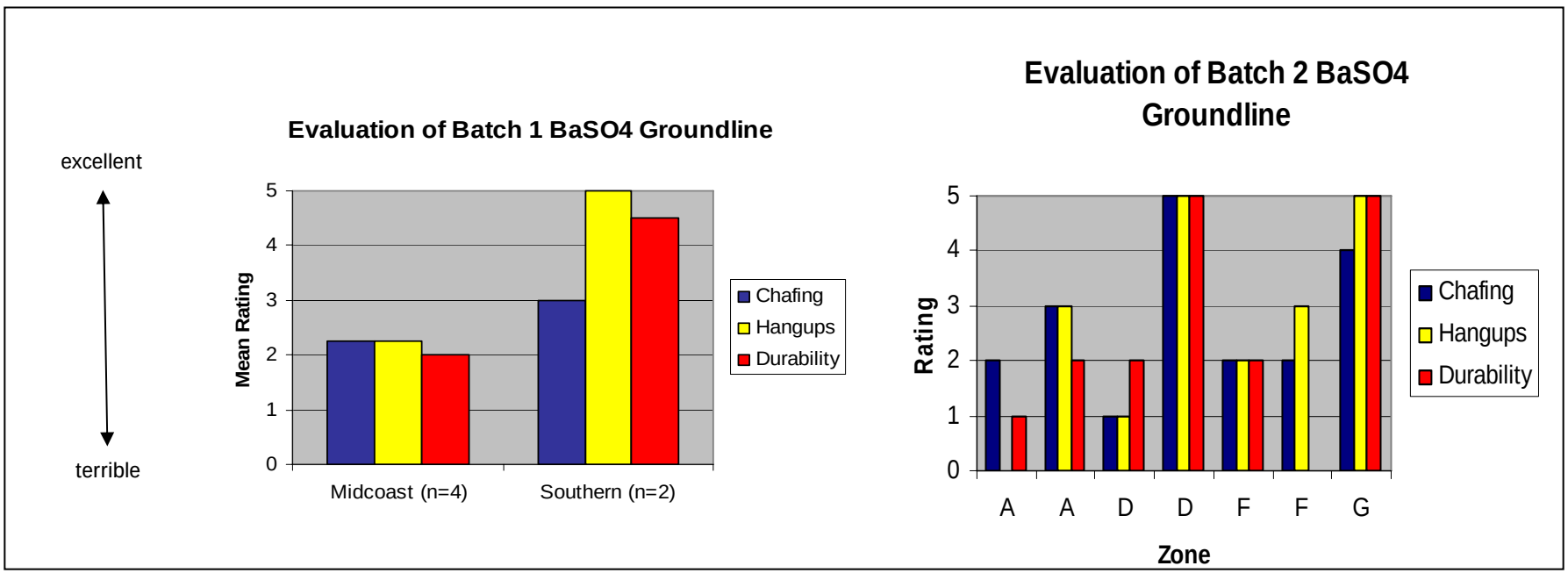
| Overview of Lobstermen Evaluation of Braided Metallocene Sink Rope 2006 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Zone** | **Depth** | **Bottom Fished** | **Fouling** | **Chafing** | **Hangups** | **Noise** | **Kinking** | **Durability** | **Handling** |
| F (Batch B) | 5 | ledge and rocky | | 3 | 2 | 5 | 2 | | 2 |
| G (Batch A) | 6-15 | Across all bottoms | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 1=terrible; 3=average; 5=excellent | | | | | | | | | |



# Barium Sulfate Sinking Groundlines

3/8” gray polypropylene line infused with BaSO4

- 2005 Batch (3 seasons)
- 2006 Batch 1
- 2006 Batch 2 (2 seasons)



# Experimental Line Field Test Summary

All tests very small scale as “proof of concept”

- Glow rope: concept failed due to crushing of glow particles in hauler and fouling issues
- Stiff Rope: concept failed due to handling issues and concern over interaction in baleen
- Weak Rope: concept failed on hard bottom/strong tide and current areas, difficulty in manufacturing the rope to spec
- TTLC: operational safety and unit reliability concerns
- Braided sink rope: 2cnd run was different than original; durability issues on hard bottom
- BaSO4 sink rope: worked well in southern Maine

# Looking Ahead

Ways to Improve

- Improve quality control of gear production
  - ensure gear meets standards before field tested
- Prepare a spec sheet for industry participants explaining gear and technology
- Develop clear logsheets and experimental protocols
- Need data that gear is whale safe(r)

Further Research

- Need to better understand entanglements
  - how, when and what part of gear system to inform gear modifications
- Understand Risk
  - Level of risk reduction associated with conservation measures
- Potential Areas to Investigate
  - understand impact of geology, oceanography, etc in Maine on whale behavior
  - shortening floating groundines, develop bmp's for fishing/setting gear
  - stiff endlines, i.e. danforth anchors downeast
  - glow rope or avoidance technique
  - Gear marking technology

# Engineering By-catch solutions for large whales – what have we learned?

*OR→*

Ken Baldwin
Center for Ocean Engineering
University of New Hampshire

Consortium for Wildlife By-Catch Reduction, New England Aquarium,
March 19-20, 2009

# Vertical lines and whales, a perspective from physical experiments

Consortium for Wildlife By-Catch Reduction, New England Aquarium,

March 19-20, 2009

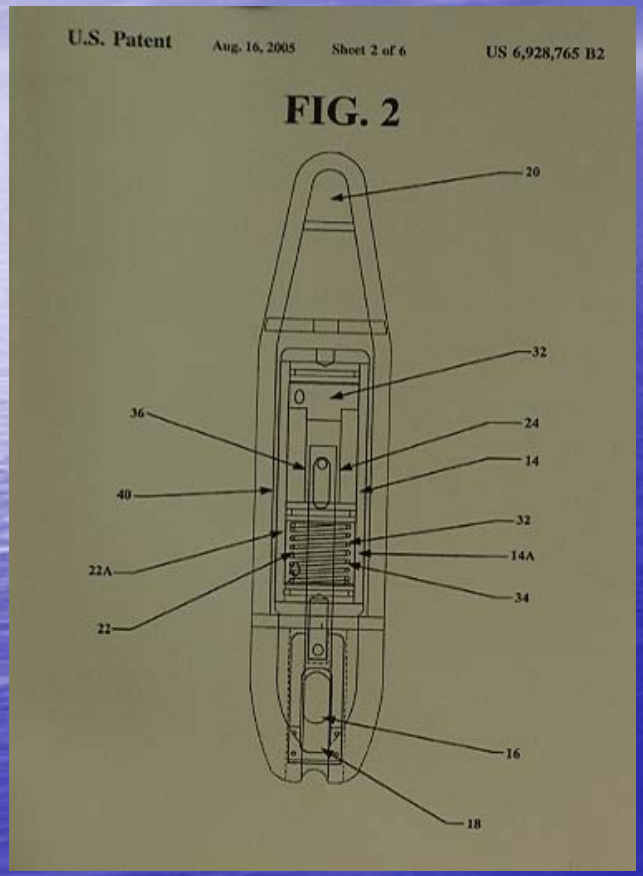
# Overview of Presentation

- Three projects
- TTLC evaluation: 2006
- Flipper – line interaction : 2007
- S-K TTLC study: 2008/2009

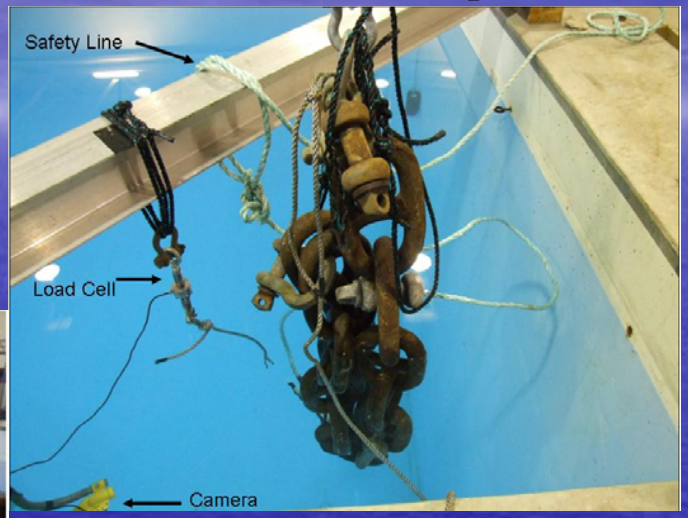
# Time Tension Line Cutters

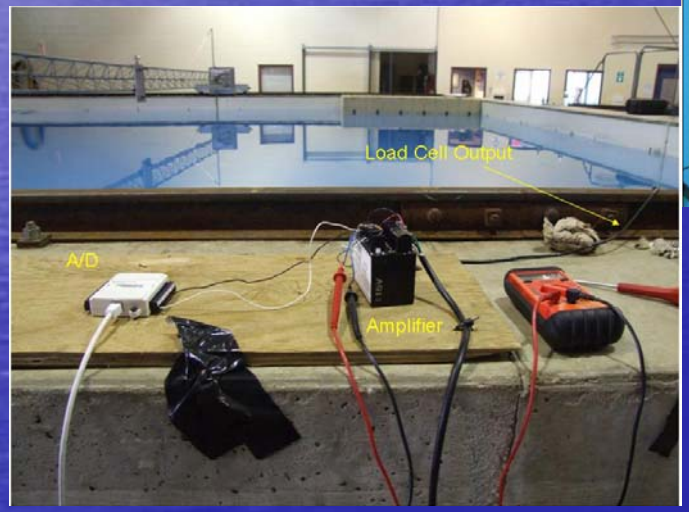
- TTLC workings
- Measurement and load setup
- Testing
  - Static tests
  - Dynamic tests
  - Cold tests

# TTLC workings



# Measurement and load setup



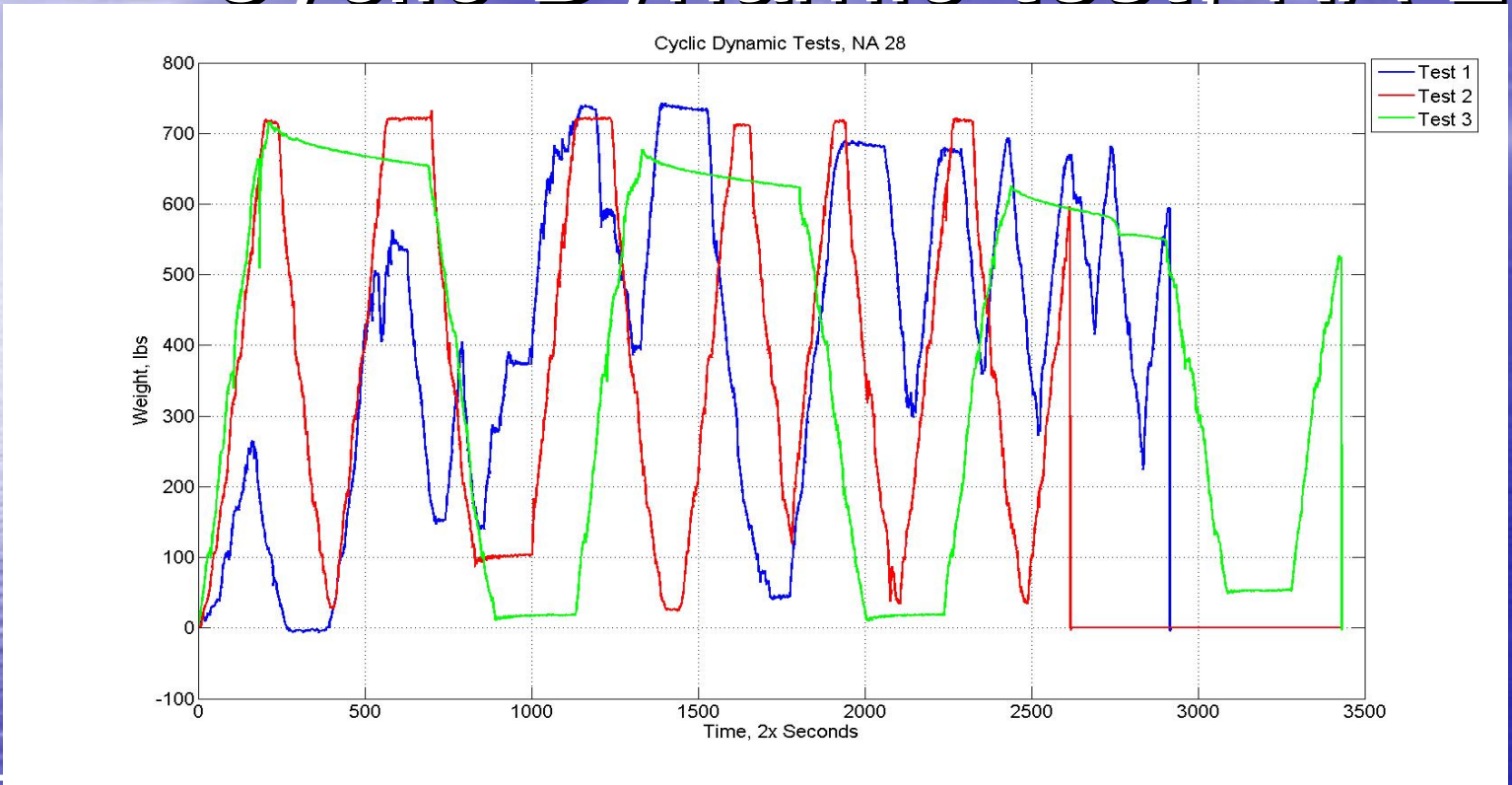
# Static load repeatability tests

Six units tested for repeatability at static load

All six units showed consistent times

| S/N | NA 7 | NA 10 | NA 15 | NA 20 | NA 24 | NA 28 |
|---|---|---|---|---|---|---|
| Time, Test 1 | 3.41 | 1.8 | 11.71 | 11.16 | 1.425 | 19.55 |
| Time, Test 2 | 3.78 | 1.85 | 12.15 | 12.54 | 1.81 | 19.23 |
| Time, Test 3 | 3.68 | 1.88 | 14.3 | 11.71 | 1.28 | 20.32 |

# Cyclic Dynamic test, NA 28




| NA 28 | Total time | Break time |
|---|---|---|
| Test 1 | 24.3 | 19.96 |
| Test 2 | 21.8 | 16.7 |
| Test 3 | 28.6 | 20.52 |

# Cold tests: Ice Water & Refrigerator

| S/N | NA NONAME | NA 20 |
|---|---|---|
| Time, Static | 0.96 | 8.75 |
| Time, Cold | 3.58 | 18.8 |
| Time, warmed up | 1.375 | |

| S/N | NA 20 | NA 28 |
|---|---|---|
| Time, Static | Avg 12 min | Avg 20 min |
| Time, Cold | 23.78 | 41.68 |

# Summary: TTLC

*TTLC behaved as expected*, cut the line

Time to cut is extended when the TTLC are ‘cold’

Blade needs a bit of attention

# Flipper – line interaction : 2007

*You built a what.....*

# Flipper – line interaction

- *Motivation*: Study line appendage interaction at ‘Full Scale’

# Flipper – line interaction

*Motivation*: Study line appendage interaction at ‘Full Scale’

*Motivation*: The interaction of the gear with the bottom affects the tension in the lines

# Flipper – line interaction

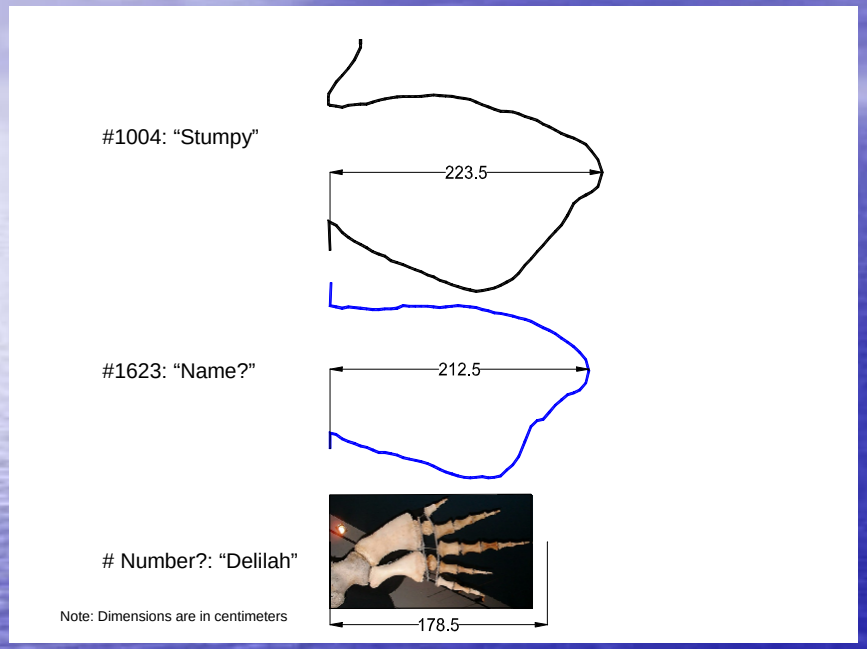
*Motivation*: Study line appendage interaction at 'Full Scale'

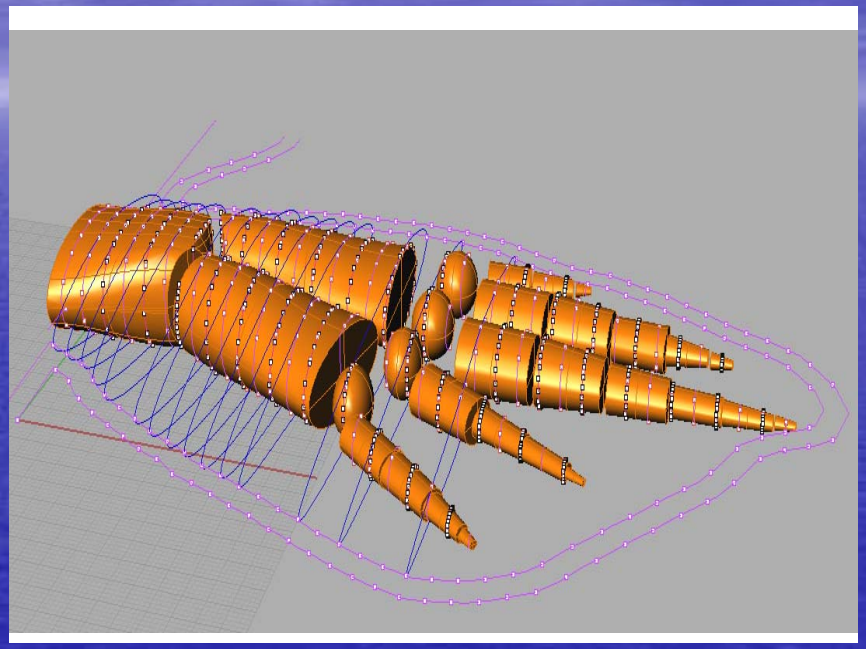
*Motivation*: The interaction of the gear with the bottom affects the tension in the lines

*Motivation*: Geometrically similar and kinematically similar experiments

# Flipper – line interaction

# Flipper – line interaction



# Flipper – line interaction

# Flipper – line interaction

# Flipper – line interaction

* **What happens to the line when it hits the flipper……..**
* **Depending on forward / aft position…**
* **Depending where along the flipper the line hit……**

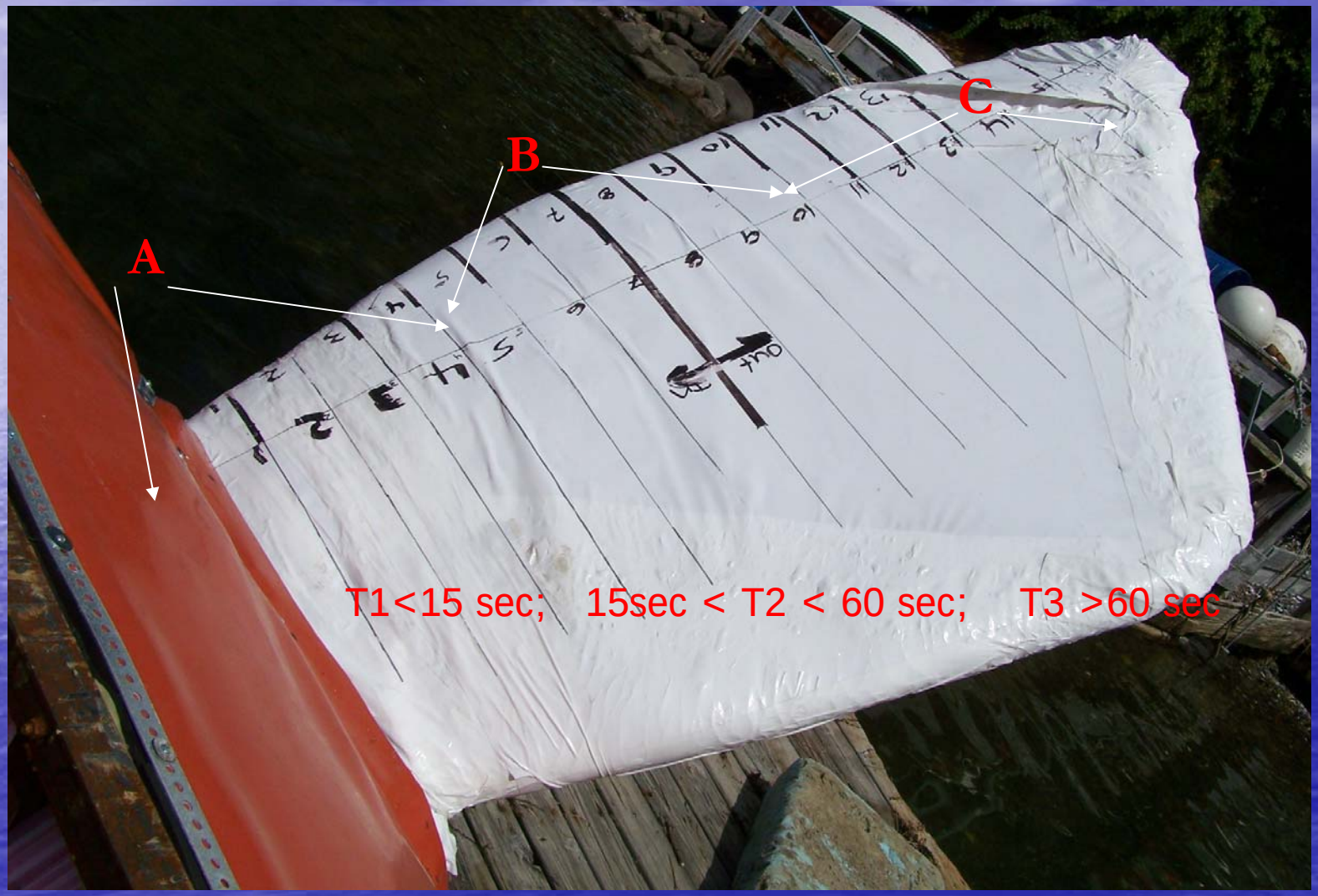
**Trial Summary**

**Zones:** A-B-C **Angles:** A: Acute (forward); N: Normal; O: Oblique (rear)

**Ropes:** Poly Steel PS, Whale safe Rope WSR

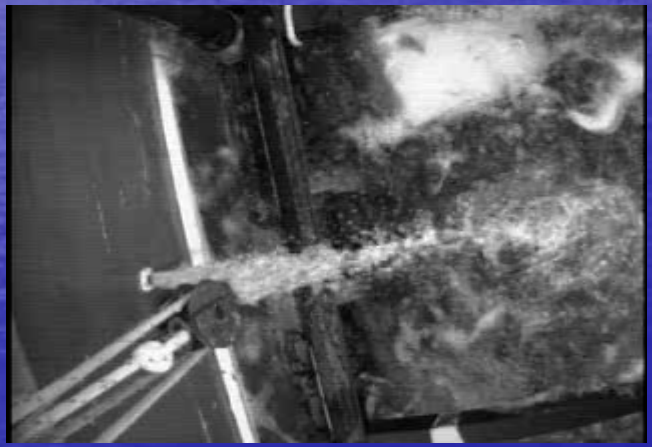
**Five traps**: F **Three traps**: T

# Flipper – line interaction

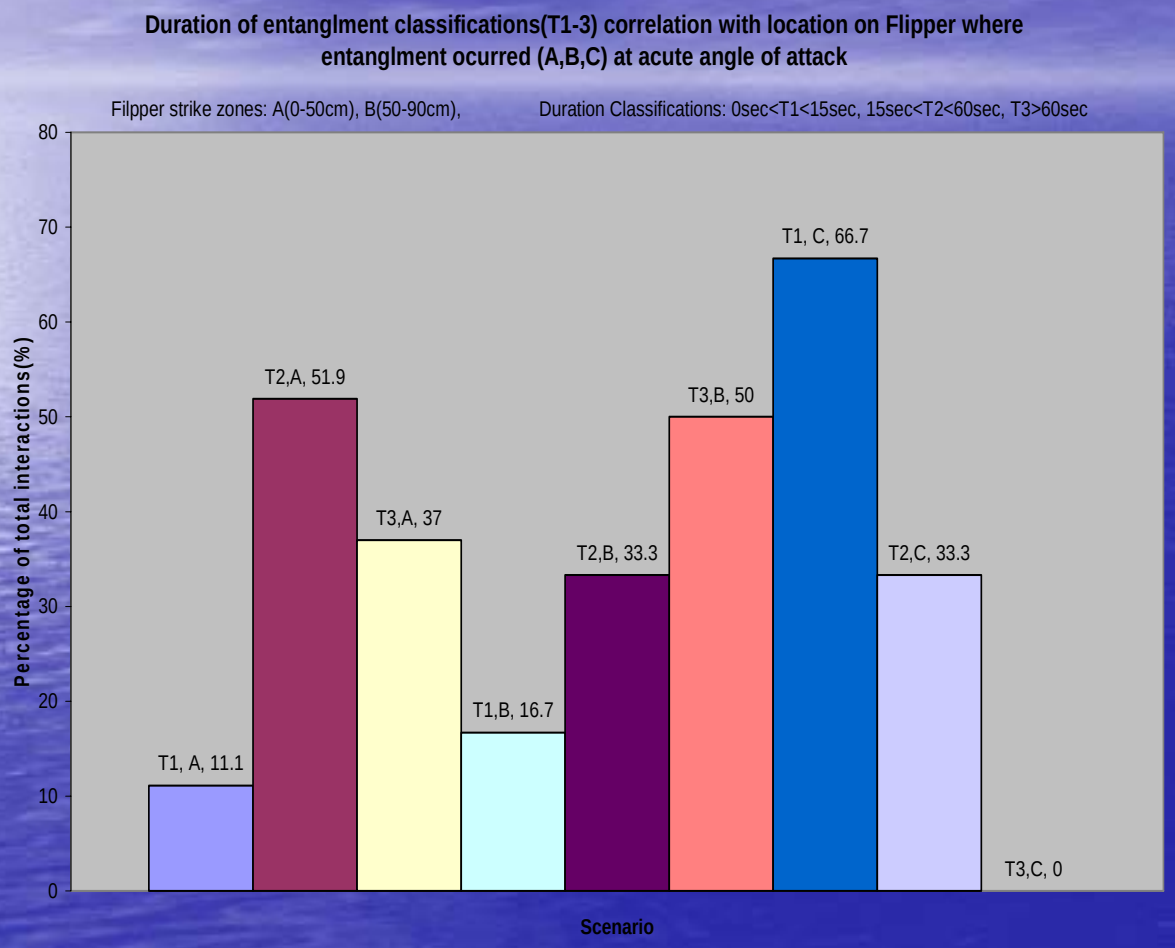


# Flipper – line interaction

# Flipper – line interaction

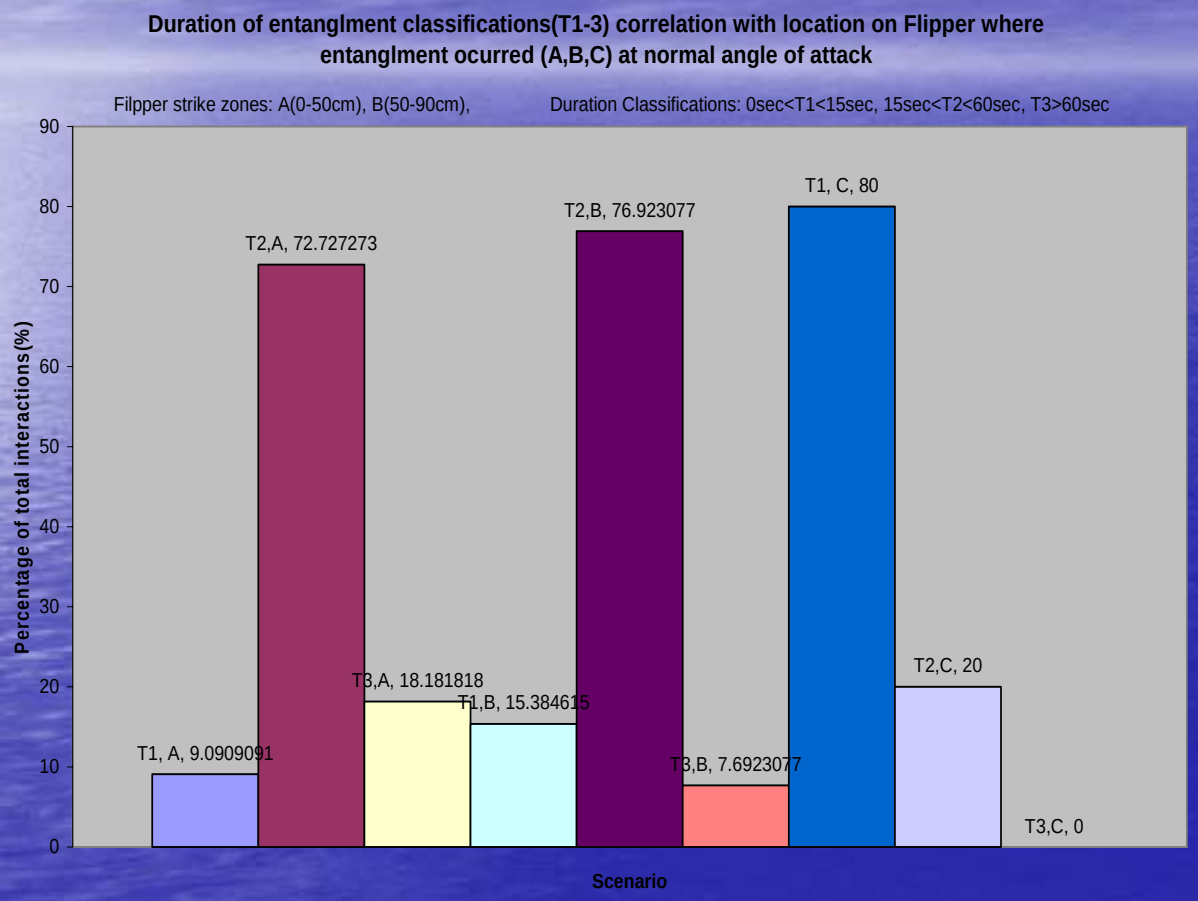


# Flipper – line interaction




ACUTE Angle of Attack

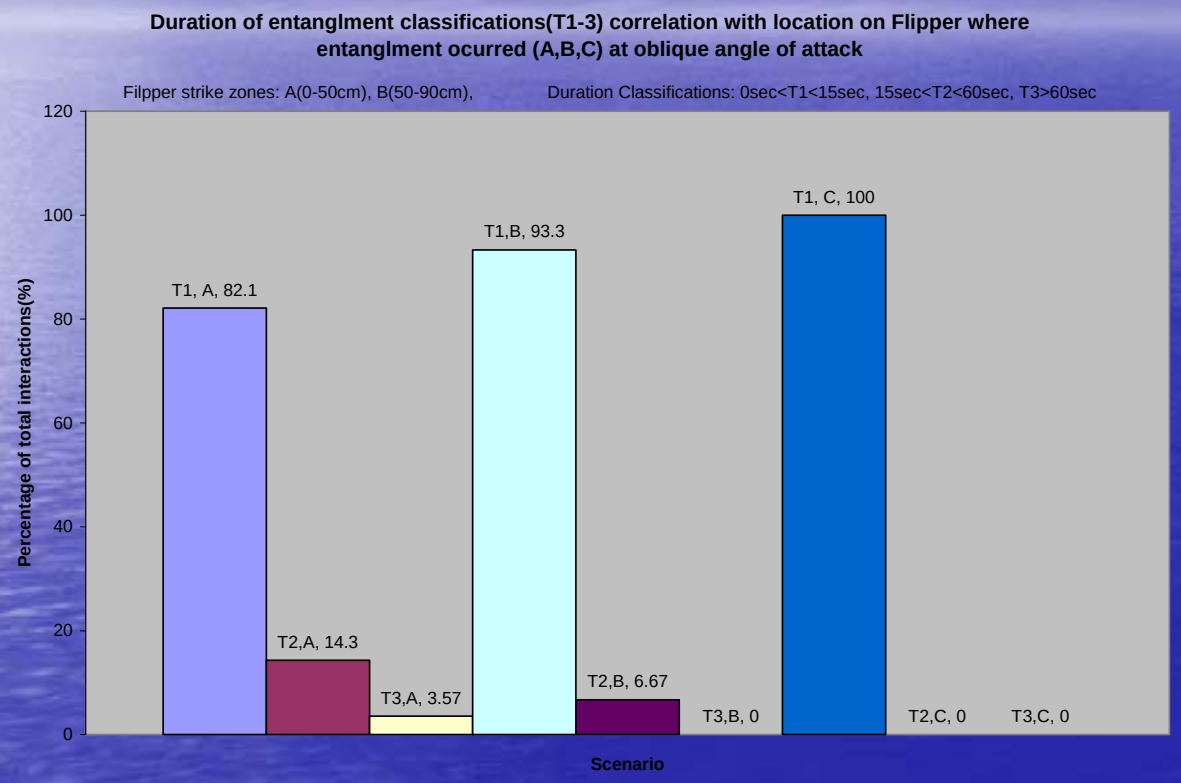
# Flipper – line interaction




NORMAL Angle of Attack

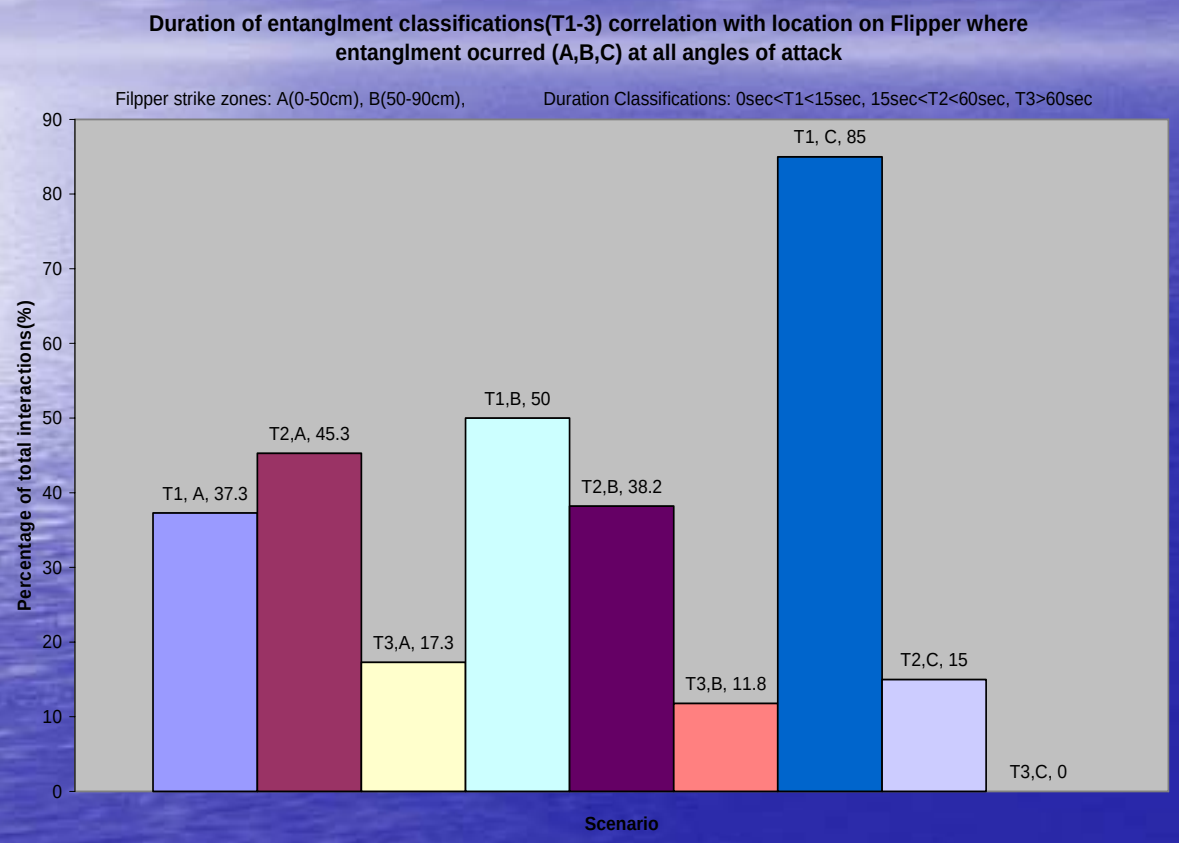
Consortium for Wildlife By-Catch Reduction, New England Aquarium, March 19-20, 2009

# Flipper – line interaction



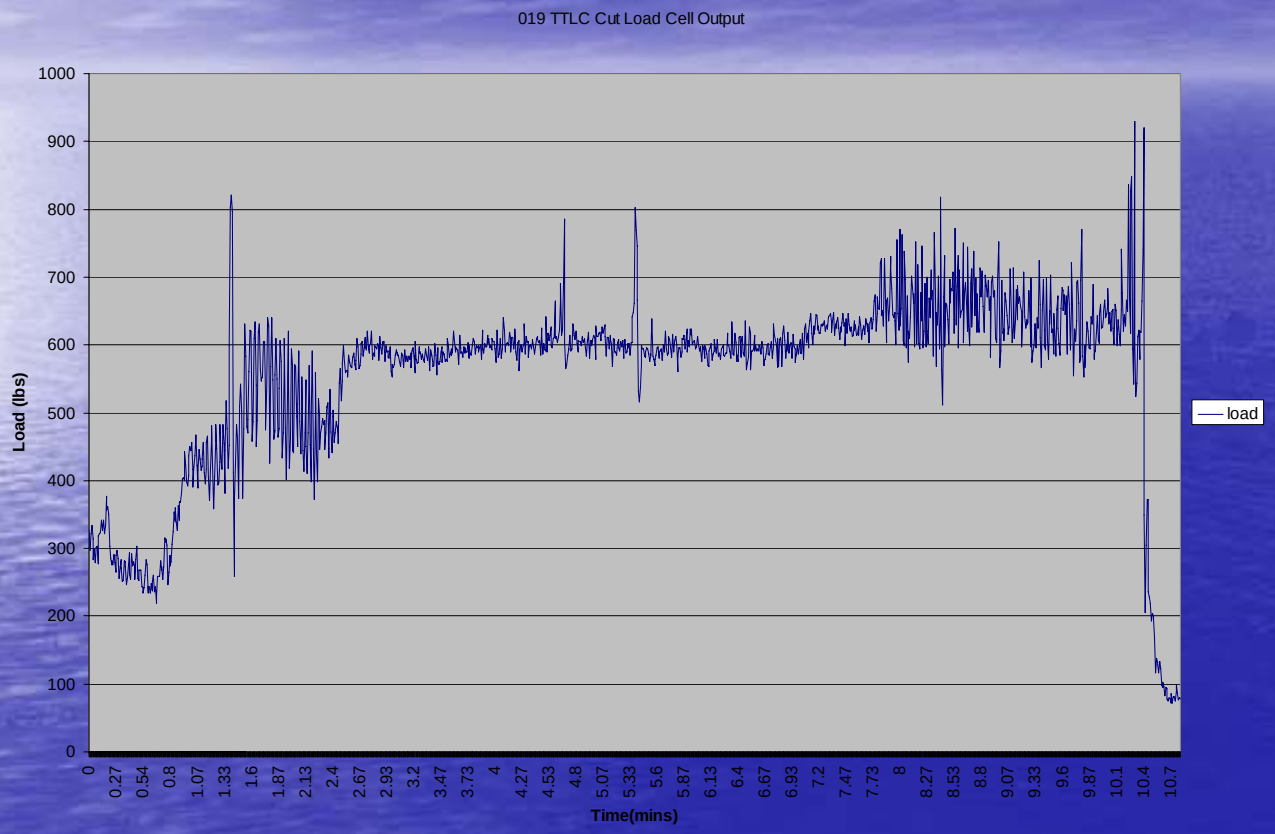

OBLIQUE Angle of Attack

# Flipper – line interaction




Summary of ALL angles

# Flipper – line interaction




TTLC with WSR load vs. time

# Flipper – line interaction

# Flipper – line interaction

## Interesting observations

→Line/flipper interactions were as anticipated: for angles A & N the line would snag and stay on the flipper, especially if it hit inside 80 cm

→For hits beyond 80 cm the buoy would remain above the water until all the slack expired, then the buoy would release under the flipper

→For angle O the line mostly slid off the end of the flipper as the slack expired and the line gained tension

→The process was line type independent

# S-K TTLC study: 2008/2009

S-K program priority on Right Whale Gear Entanglement Mitigation Research.

Project goal is to define the operational parameters of the Time Tension Line Cutter (TTLC) for use in the vertical lines of fixed fishing gear

The project has two main components: One is a pilot study with the fishing community and the second is more experimental

The *pilot program component* of this project will be designed to obtain data on the use of the TTLC from the fishing community and from periodic inspection and evaluation of the TTLC being used

The *controlled testing component* will address the issue of gear which could become entangled on a whale and how effective the TTLC will be on releasing the gear

# S-K TTLC study: 2008/2009

## TTLC Pilot Study Log

Vessel name: _____ Vessel operator: _____

Gear type: _____

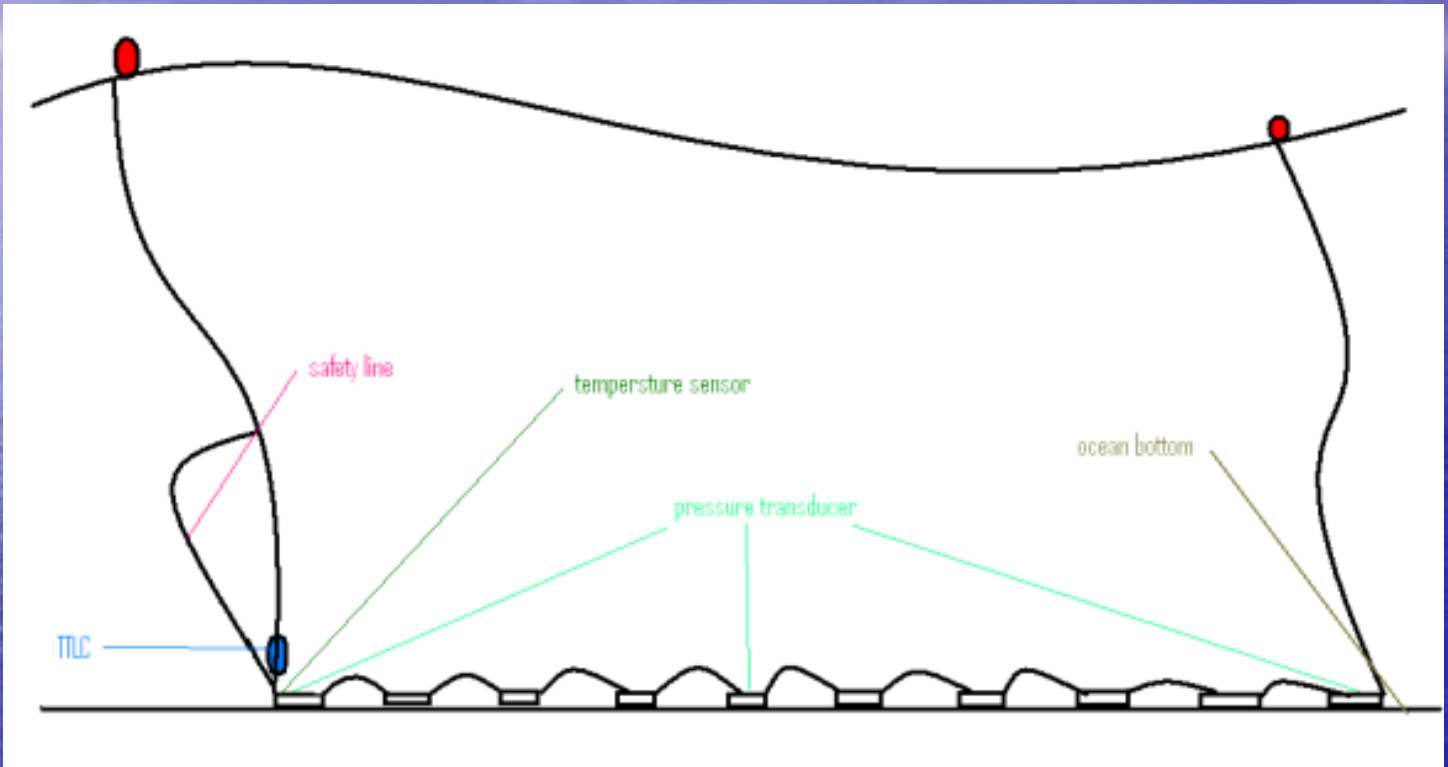
| TTLC/Trawl # | # traps | Date/ Haul # | Depth (fm) | Bottom type | TTLC Band | Comments |
|---|---|---|---|---|---|---|
| 1 | | | | M Sa Gr Rky | Gr Y R | |

This is a work in progress……

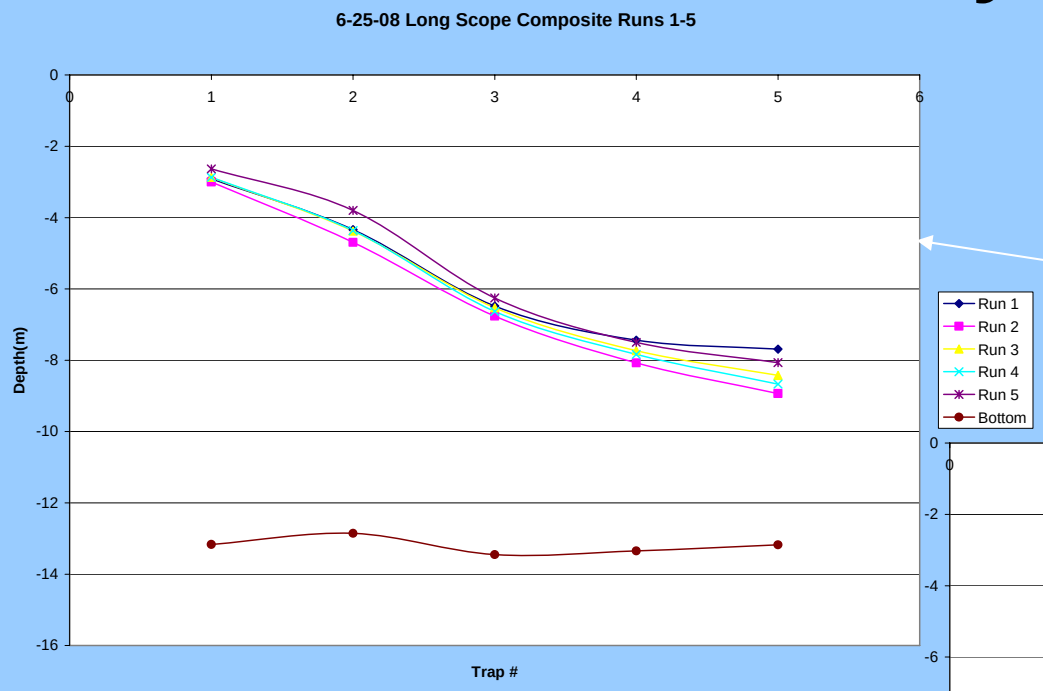
# S-K TTLC study: 2008/2009

- Experimental scheme
- 5-10-20 trap trawls
- Two different end-line lengths for each test scenario
- Different depths of water
- Different bottom types
- All trials were at 2 knots

# S-K TTLC study: 2008/2009



# S-K TTLC study: 2008/2009



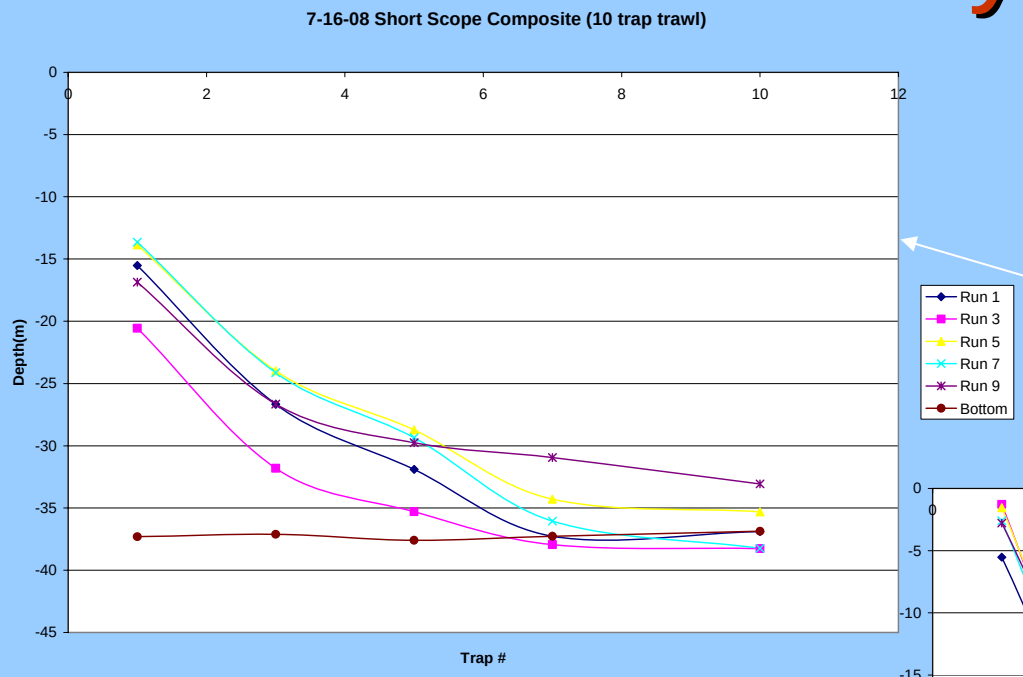

5 traps

Hard bottom, depth 45’ (13.7m)

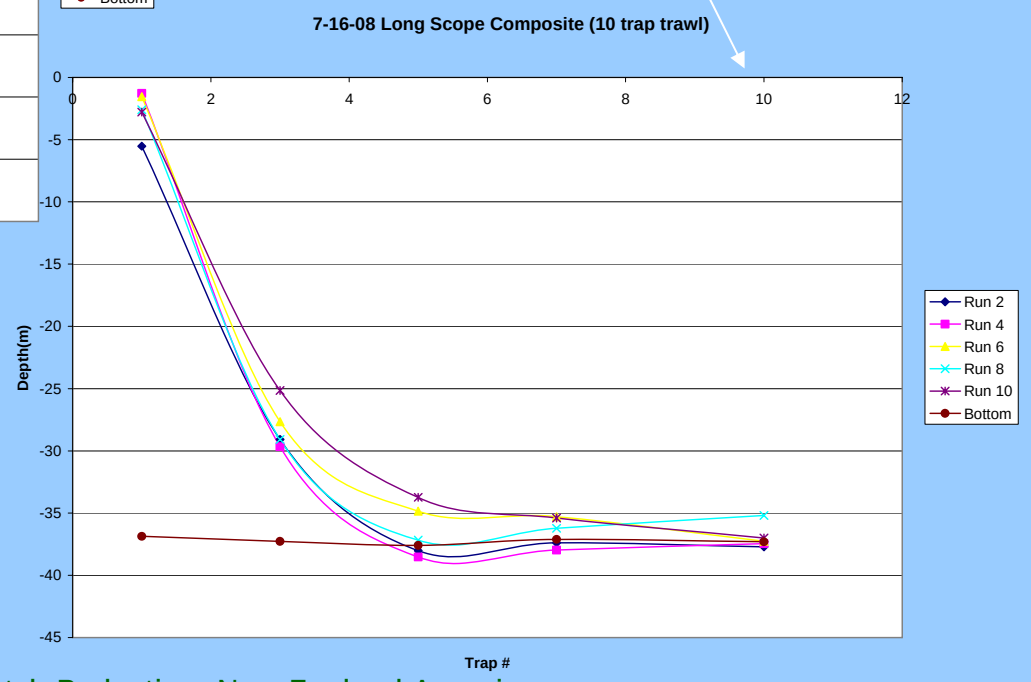
Long: 108’, Short: 60’

Consortium for Wildlife By-Catch Reduction, New England Aquarium,
March 19-20, 2009

# S-K TTLC study: 2008/2009

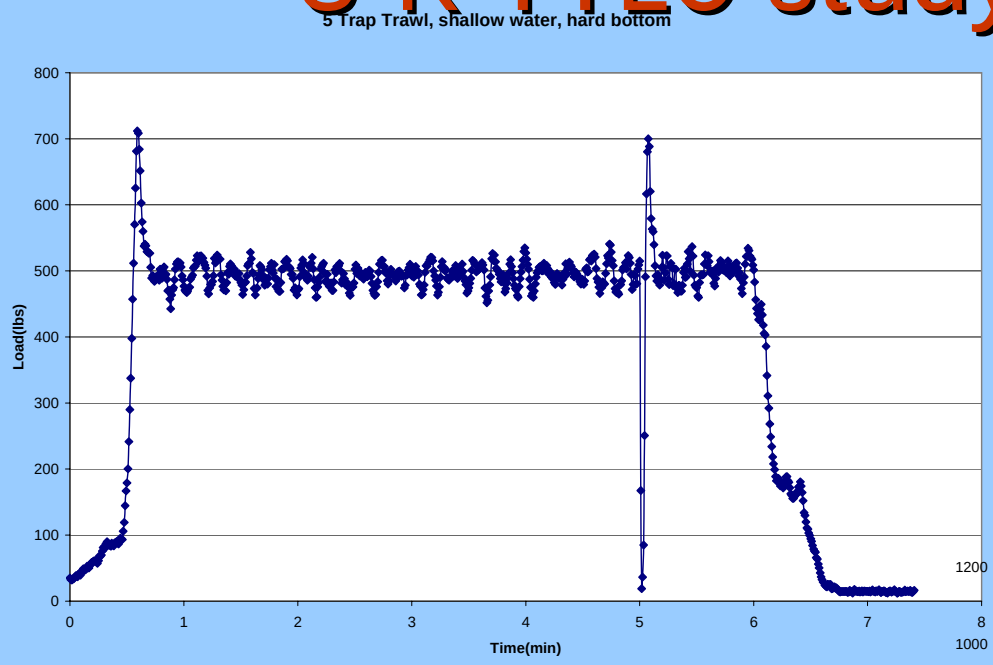



10 traps
Mud bottom, depth 240' (73m)
Short: 330' , Long: 600'

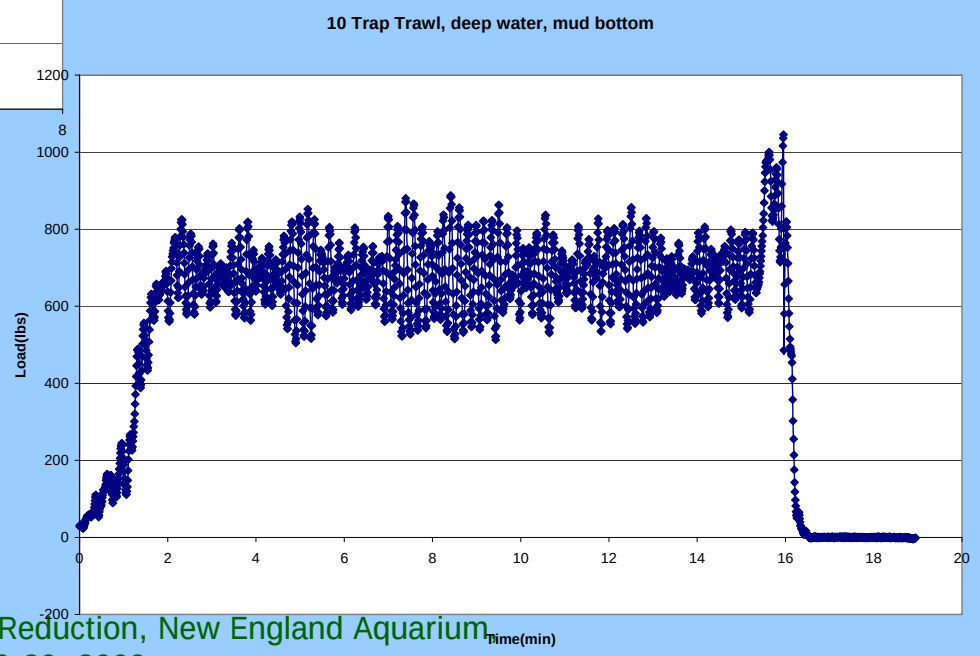



Consortium for Wildlife By-Catch Reduction, New England Aquarium, March 19-20, 2009

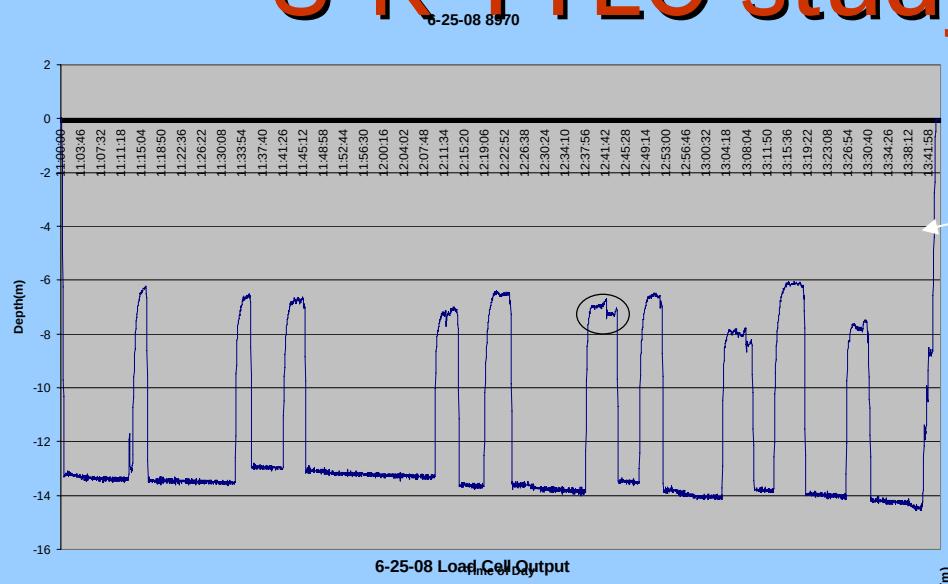
# S-K TTLC study: 2008/2009




Representative plots of load vs. time for two bottom types and trawls



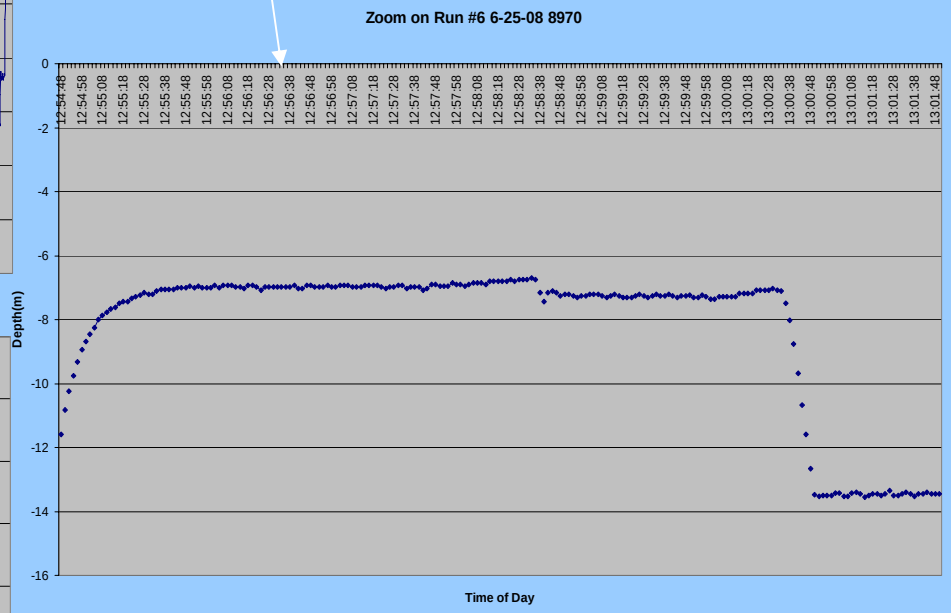
# S-K TTLC study: 2008/2009

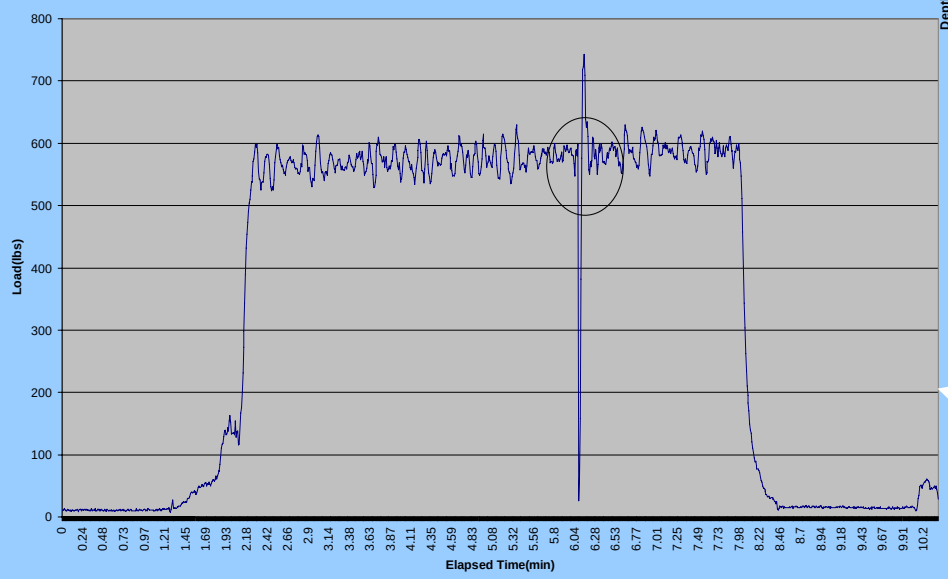



Depth (Pressure) vs. time for

a series of events and

a single event




Load vs. time

# SUMMARY

- TTLC shows promise as a device which can mitigate the possibility of entanglement……it cuts the lie with no knots in relatively short time in cold environments
- The flipper – line experiments were line type independent
- The tension, load, in the vertical line when trawls are being towed is less then 1100 pounds
- The pilot study when it is finished should provide a perspective on the TTLC from a user perspective

THANKS FOR LISTENING,

QUESTIONS

# Sea Turtle Entanglements in Buoy Lines

**Kara Dodge**
**Large Pelagics Research Center**
**University of New Hampshire**
**Durham, NH 03824**
**USA**

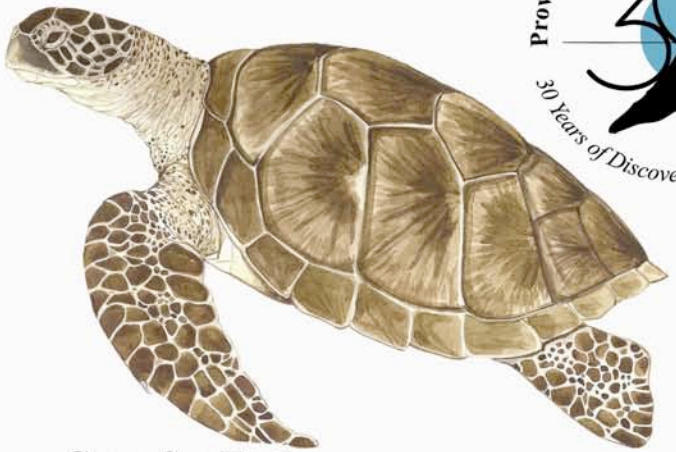
Photo: Andy Myers

# SEA TURTLES

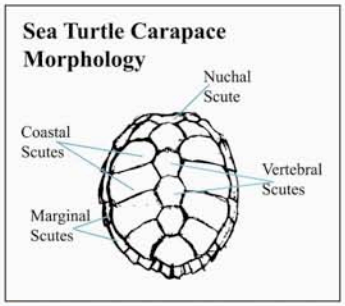
Provincetown Center For Coastal Studies

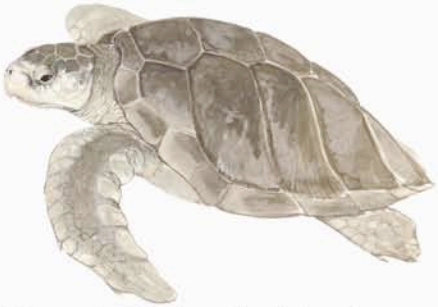
30 Years of Discovery and Commitment

**Leatherback Sea Turtle**
*Dermochelys coriacea*



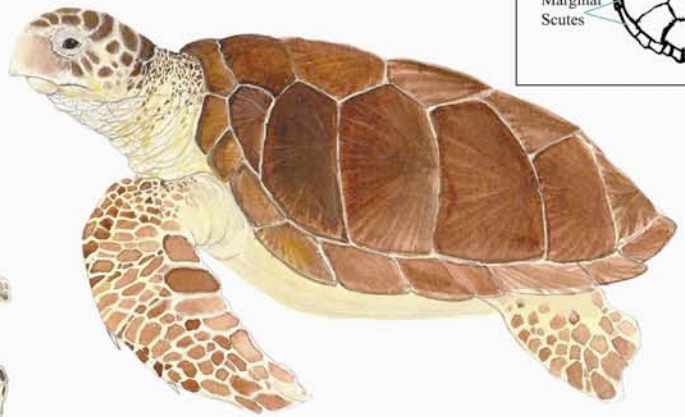
**Green Sea Turtle**
*Chelonia mydas*



**Kemp's Ridley Sea Turtle**
*Lepidochelys kempii*

**Hawksbill Sea Turtle**
*Eretmochelys imbricata*



**Loggerhead Sea Turtle**
*Caretta caretta*

Illustrations by Karen C Kramer

# Leatherback *Dermochelys coriacea*

- Specialized gelatinous diet
- Primarily water column feeders
- Heat conserving adaptations
- Mammalian-like bone growth
- Deep diving capability (>1000m)
- NE US: late spring, summer & fall

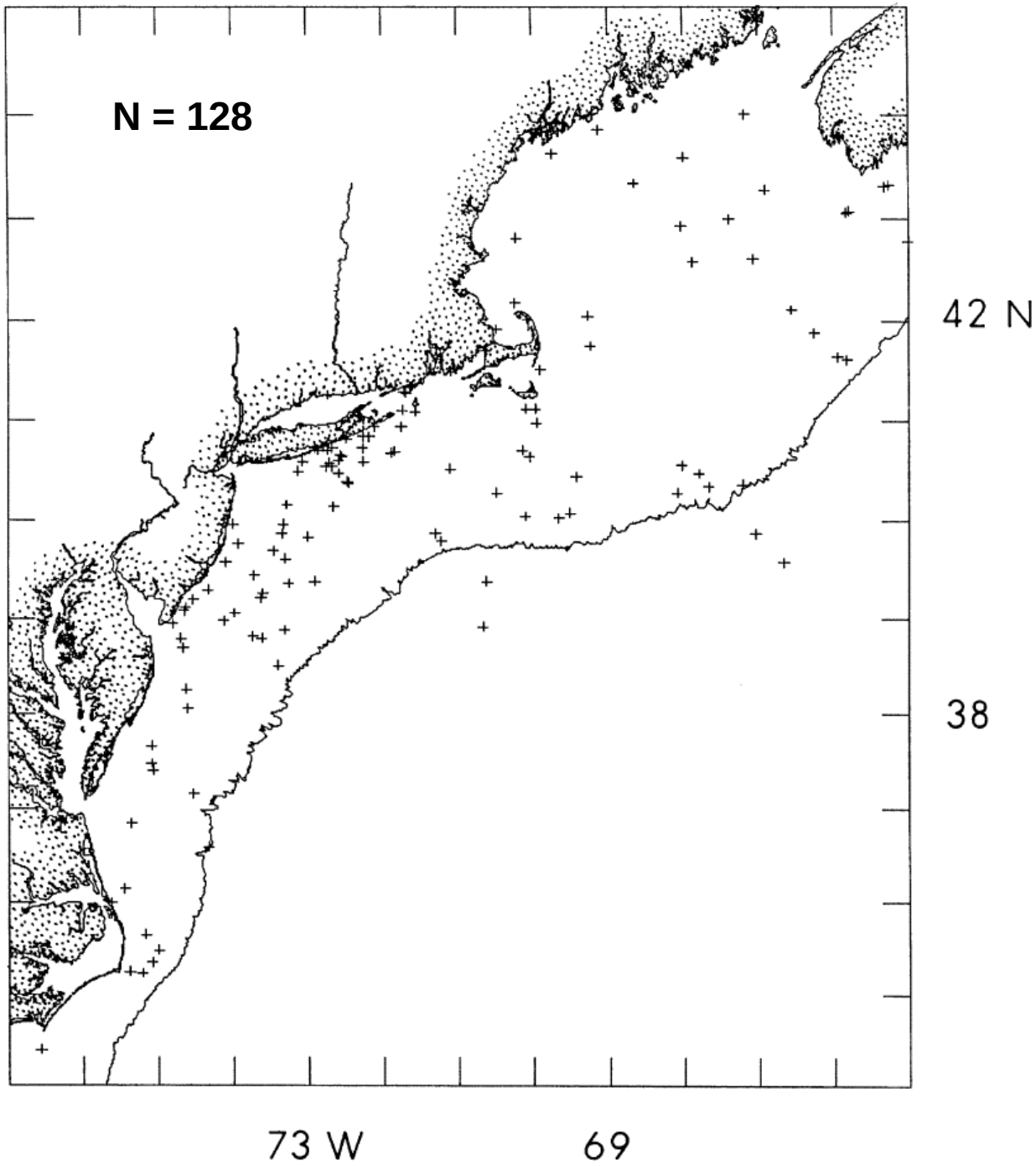
Photo: MA Audubon

Photo: Connie Merigo

# Leatherback Distribution

# Systematic Survey Data: CeTAP 1978-1982

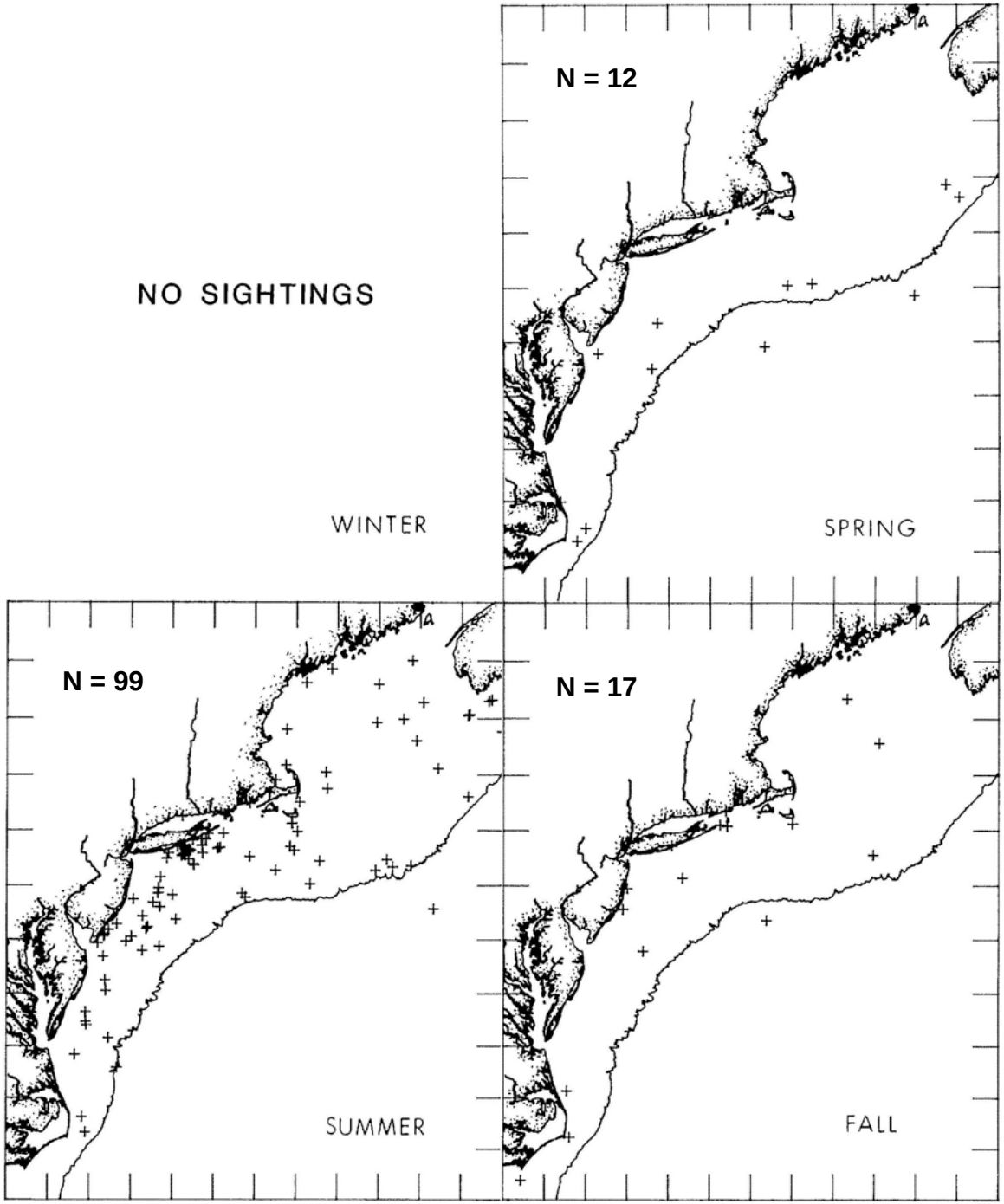
Shoop and Kenney (1992)
Herpetological Monographs 6, 43-67



# Leatherback Seasonality

# Systematic Survey Data: CeTAP 1978-1982

Shoop and Kenney (1992)
Herpetological Monographs 6, 43-67



# Opportunistic Data Sets

- **Strandings**
- **Sightings**
- **Entanglements**

Photo: Kara Dodge

Photo: New England Aquarium

Photo: Wayne Davis

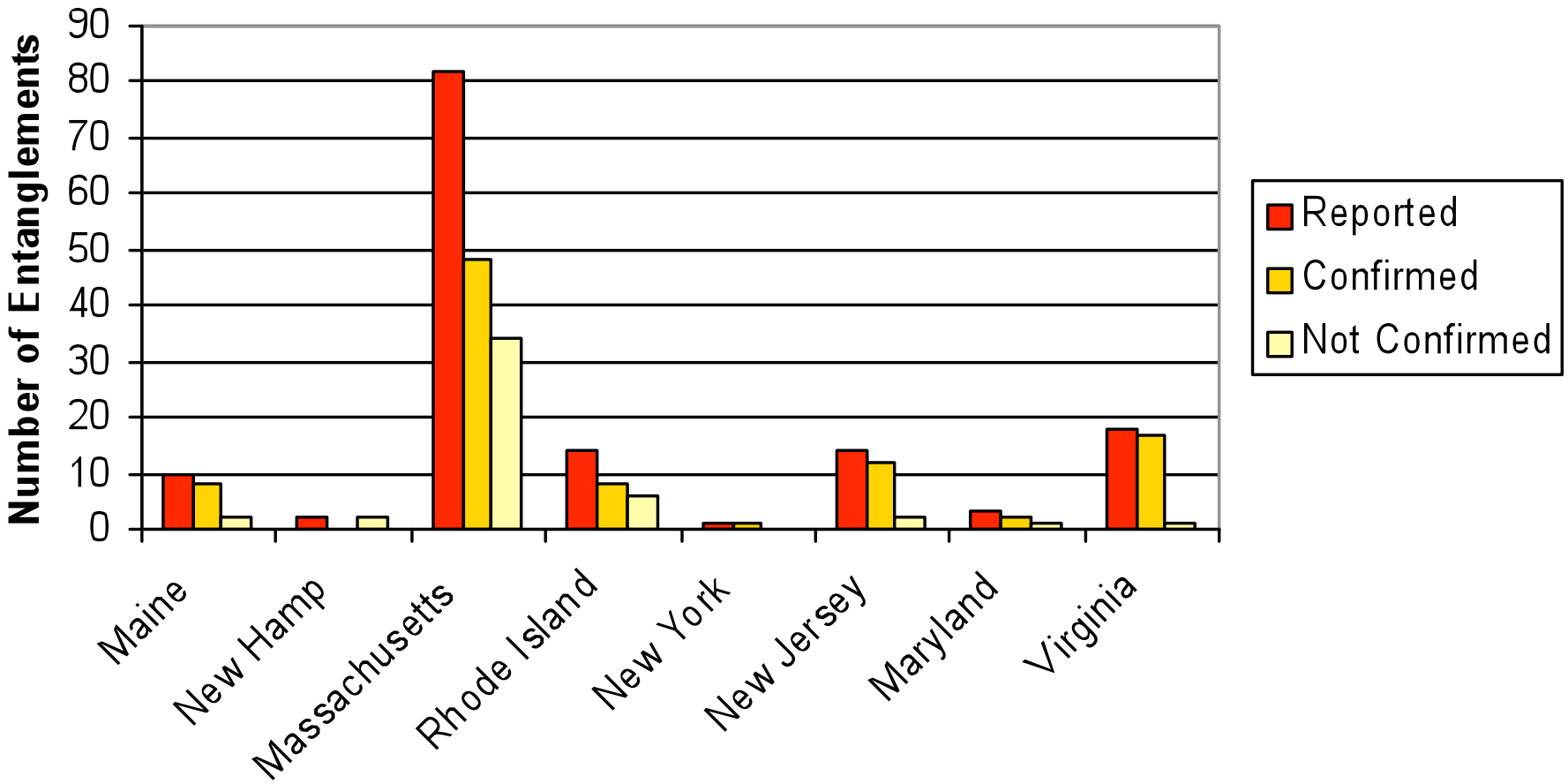
# ENTANGLEMENT DATA

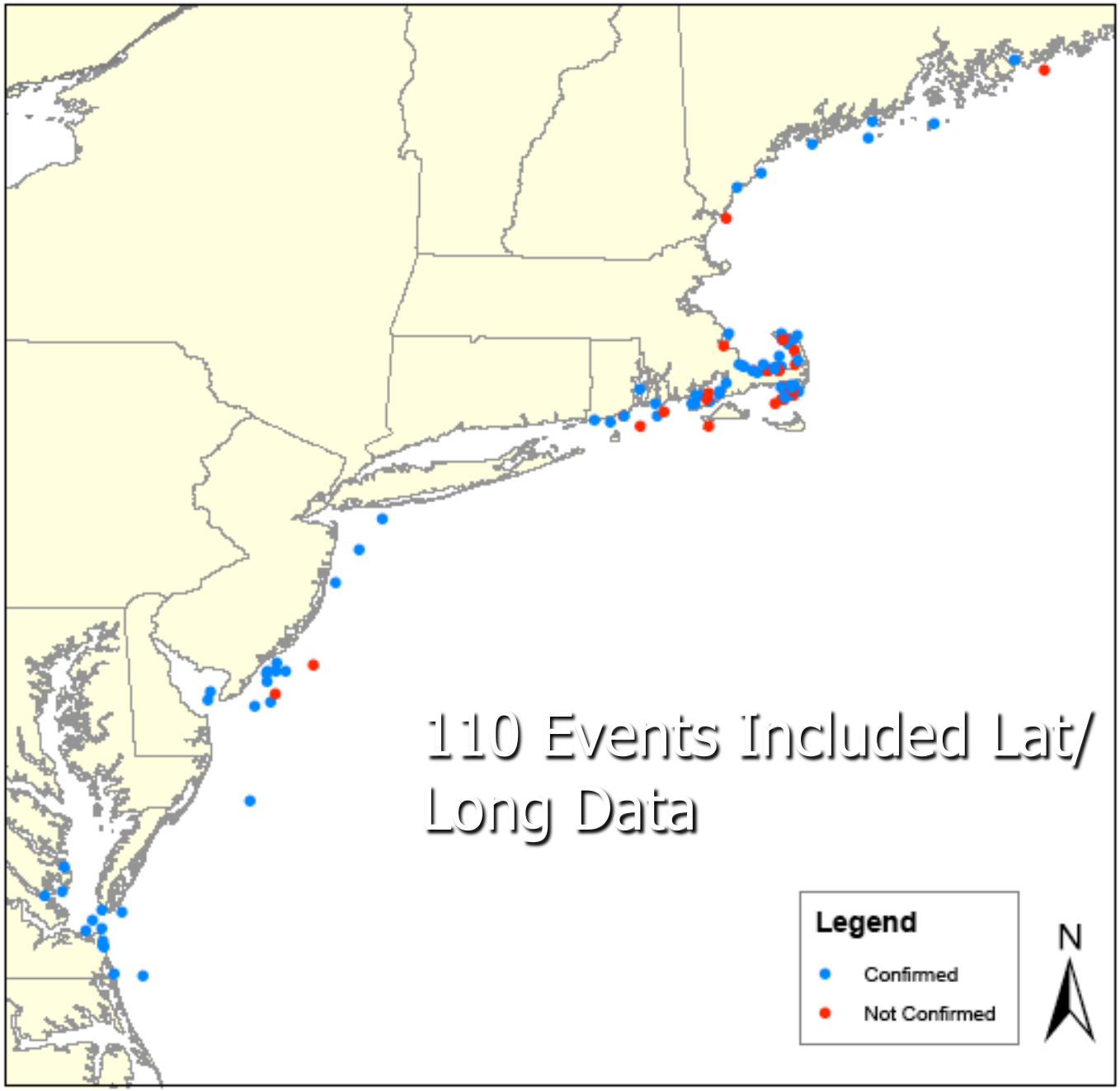
**All Data Presented is from 2002 – 2007**

The following entanglement data has been collected by STSSN and STDN organizations and submitted to NMFS.

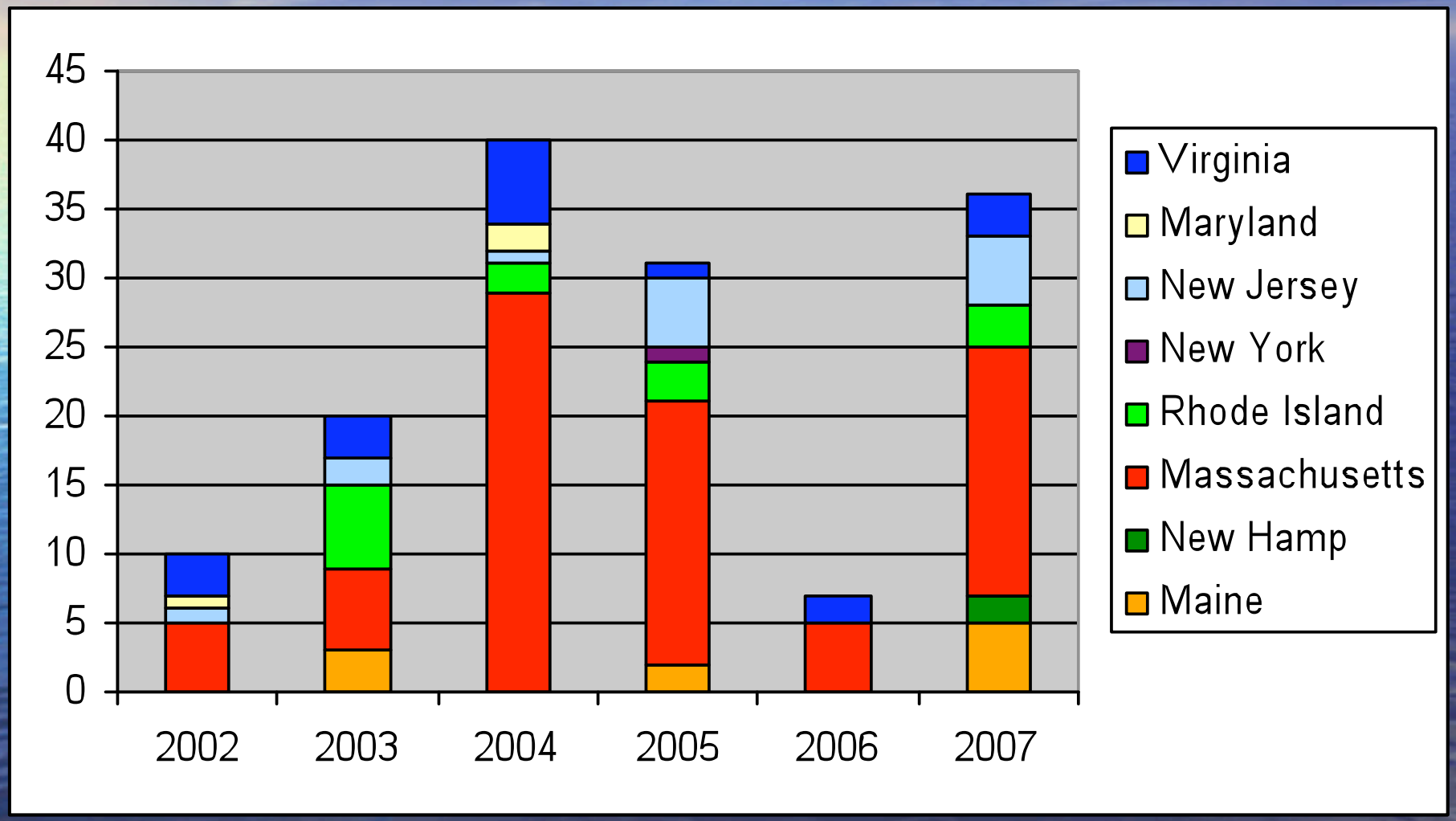
*Please do not reproduce any of this data without permission.*

# 144 Reported Line Entanglements
# 96 Events Confirmed
## (Data from 2002-2007)

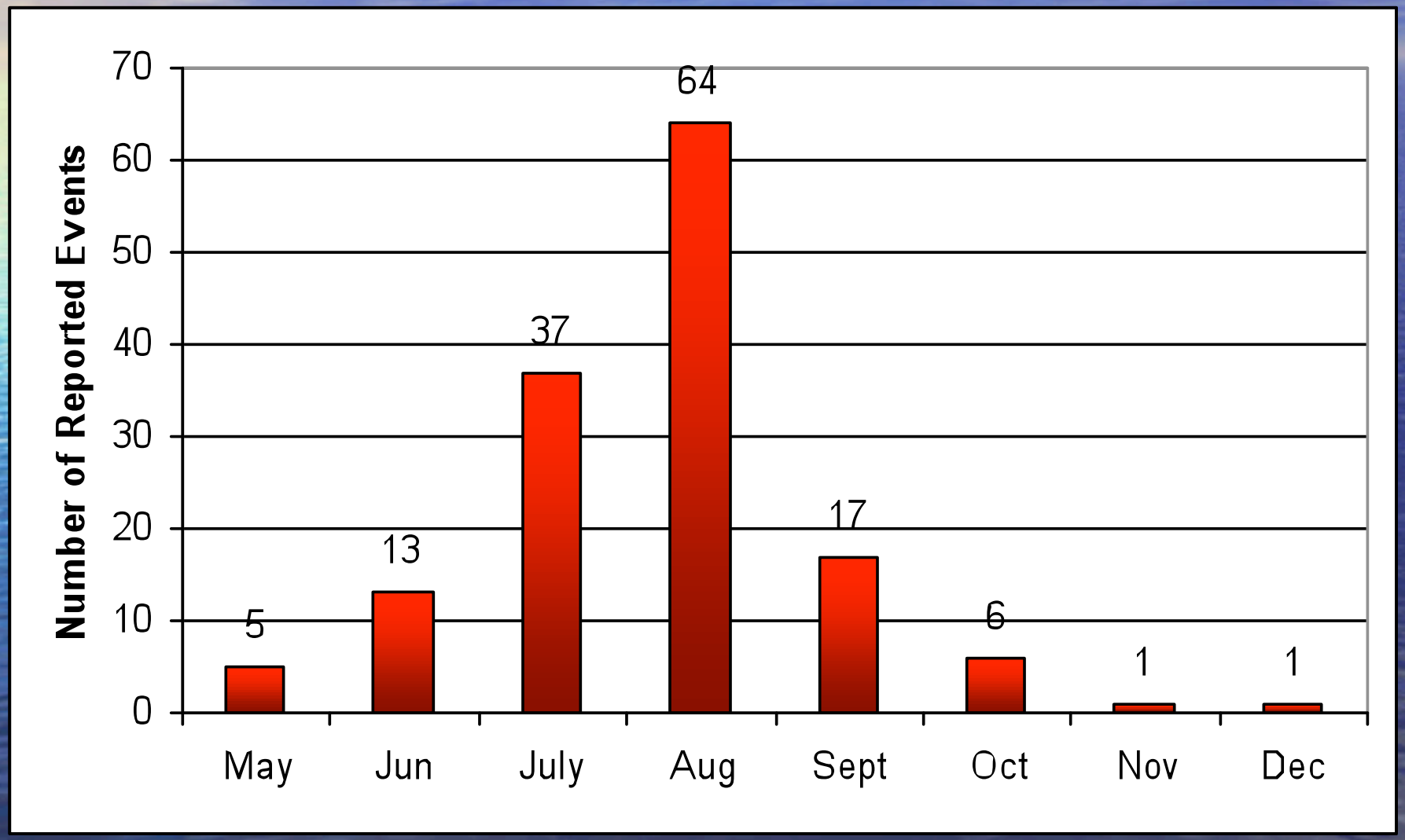



110 Events Included Lat/ Long Data
Legend
Confirmed
Not Confirmed
N

# Total Reports by Year for All States



# Total Reports by Month for All States and All Years



# 96 Confirmed Events

| | |
|---|---|
| Condition: | 75 Alive |
| | 21 Dead |
| Species: | 87 Leatherback |
| | 8 Loggerhead |
| | 1 Green |

# Disposition of Animals

**75 Live Sea Turtles**

Partially or Fully Disentangled: **72**

Collected for Rehabilitation: **2**

Turtle Shed Gear: **1**

**21 Dead Sea Turtles**

Floating and/or Anchored: **12**

Stranded on Shore with Gear: **9**

# Gear Identified by NMFS & Partners
## (Of the 96 Confirmed Events)

21 Lobster pot gear

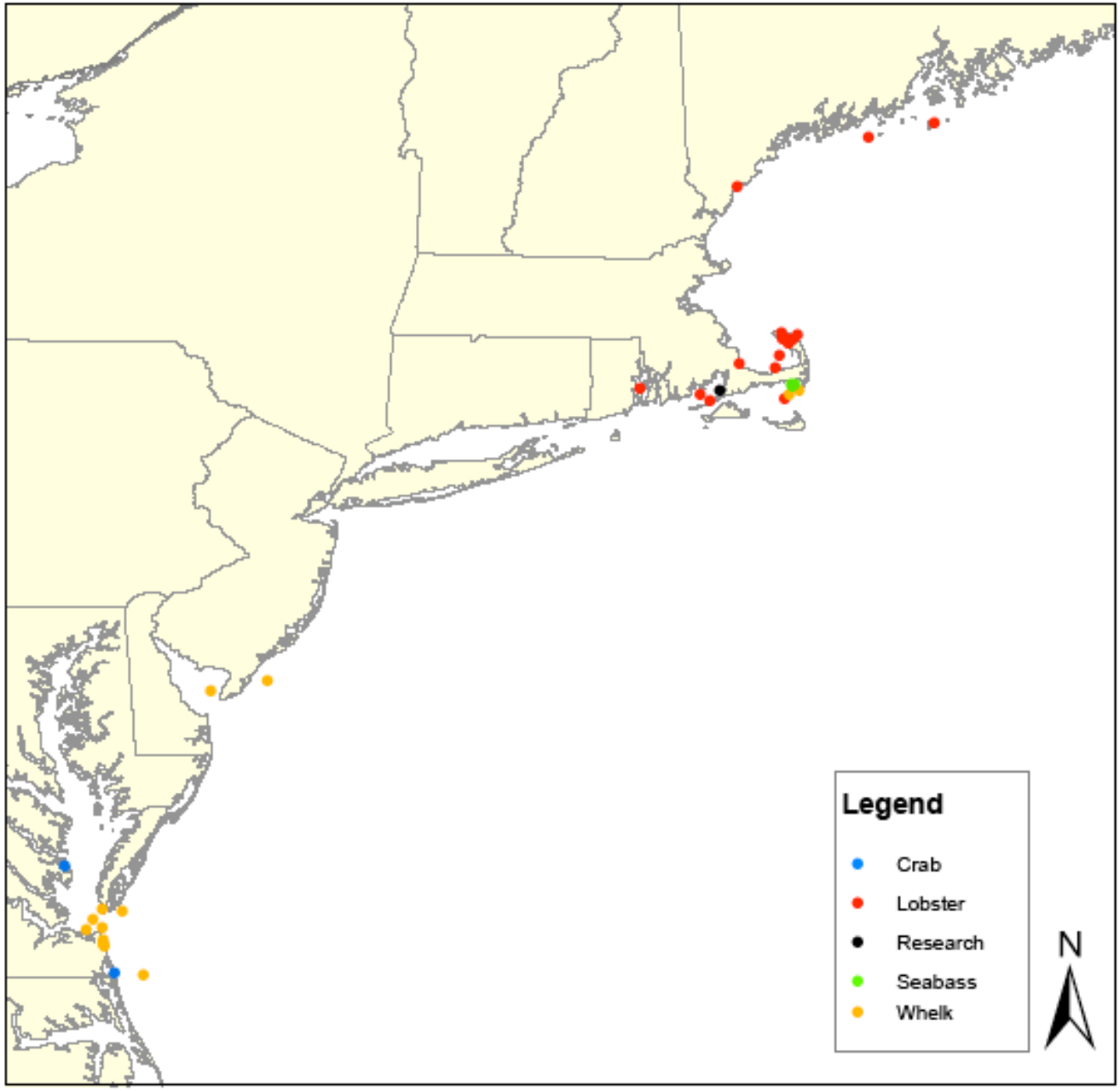
13 Whelk pot gear

2 Crab pot gear

5 Sea Bass pot gear

1 Research pot

**Total = 42 events**


Legend
Crab
Lobster
Research
Seabass
Whelk
N

# *Preliminary* 2008 Data

22 Reports Total (14 Dc & 8 unknown sp.)

- ME – 3 confirmed, 1 unconfirmed
- MA – 7 confirmed, 2 unconfirmed
- RI = 1 confirmed, 2 unconfirmed
- NY = 3 confirmed
- VA = 3 unconfirmed

# Parts of Gear = Entanglement Risk

## GEAR COLLECTION & DOCUMENTATION

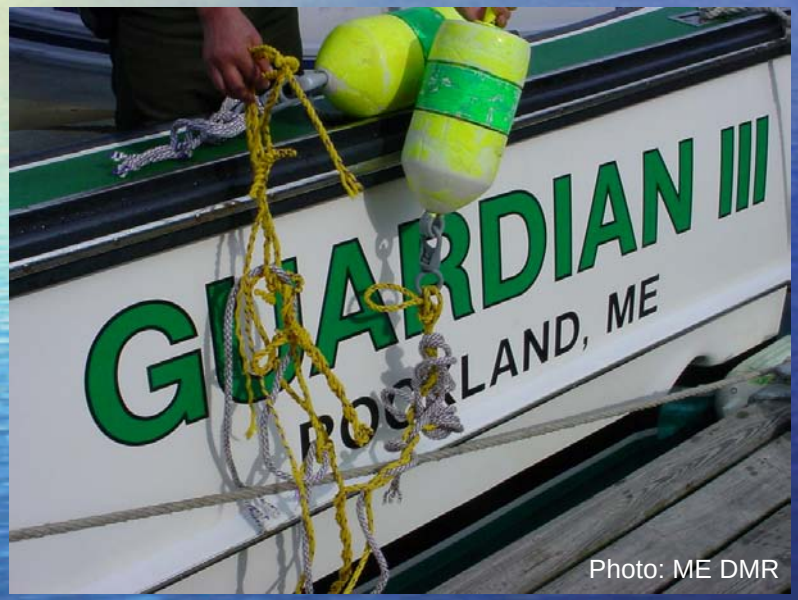


Photo: ME DMR

Photo: PCCS

Buoy Line, Surface System Float Line, Bridle*

# Parts of Turtle = Entanglement Risk

Front flippers

Neck

Pygal

Photo: Provincetown Center for Coastal Studies

Photo: Andy Myers

# Types of Entanglement

Single wrap – one or more body parts
Multiple wraps – one or more body parts
Single traps, trawls, gear impingement

Photo: Don Lewis

# Disentanglement

- Less risky* than whales
- Good chance of removing all gear
- Entanglement data
- Gear shedding unlikely

Photo: MA Audubon

Photo: MA Audubon

# Disentanglement

- Stop-gap measure
- Entangle again
- Pressure necrosis injuries – “minor” entanglements may be misleading

# Entanglement Risk Reduction

## Gear Modifications

- Weak links etc. (tension/force)
- Sinking ground line
- Glow rope*
- Stiff rope
- Bottom release devices
- Biodegradable materials
- Elimination of surface system line

Photo: ME DMR

# Entanglement Risk Reduction

## Management Measures

- Seasonal closures in key areas?
- Gear-type restrictions?
  - effort reduction (e.g. ban on singles in high use areas)

# Entanglement Risk Reduction

## Outreach to Fishing Community

- Cooperative at-sea research on sea turtles
- Gear modification R & D

Photo: Kara Dodge

# Entanglement Risk Reduction

## Outstanding Questions

- Mechanism for entanglement unknown
- Turtle behavior when encountering gear
- Gear densities in shelf waters
- Rate of sea turtle entanglement (unreported/undetected)
- Population-level impact of line entanglements

# Entanglement Risk Reduction

## Current & Future Research

- Updated seasonal sea turtle distribution & abundance for northeast shelf!
- Sea turtle behavior studies (satellite and archival tagging) = high use areas, environmental correlations, dive behavior
- Prey dynamics
- Predictive habitat models

# Collaborative Research

- Baseline health assessment (NEAq)
- Sea turtle entanglements (PCCS)
- 3D movements during inter-nesting interval, St. Croix, USVI (Univ. of Wales Swansea and WIMARCS)
- Gelatinous zooplankton surveys (WHOI)
- South Atlantic Bight tagging (Georgia DNR)
- Thermal and energetics modeling (UNC Wilmington)
- Future: 3D movements and oceanographic sampling in New England forage grounds, MA (MA DMF, Univ. of Wales Swansea, and WHOI)

# Support and Funding

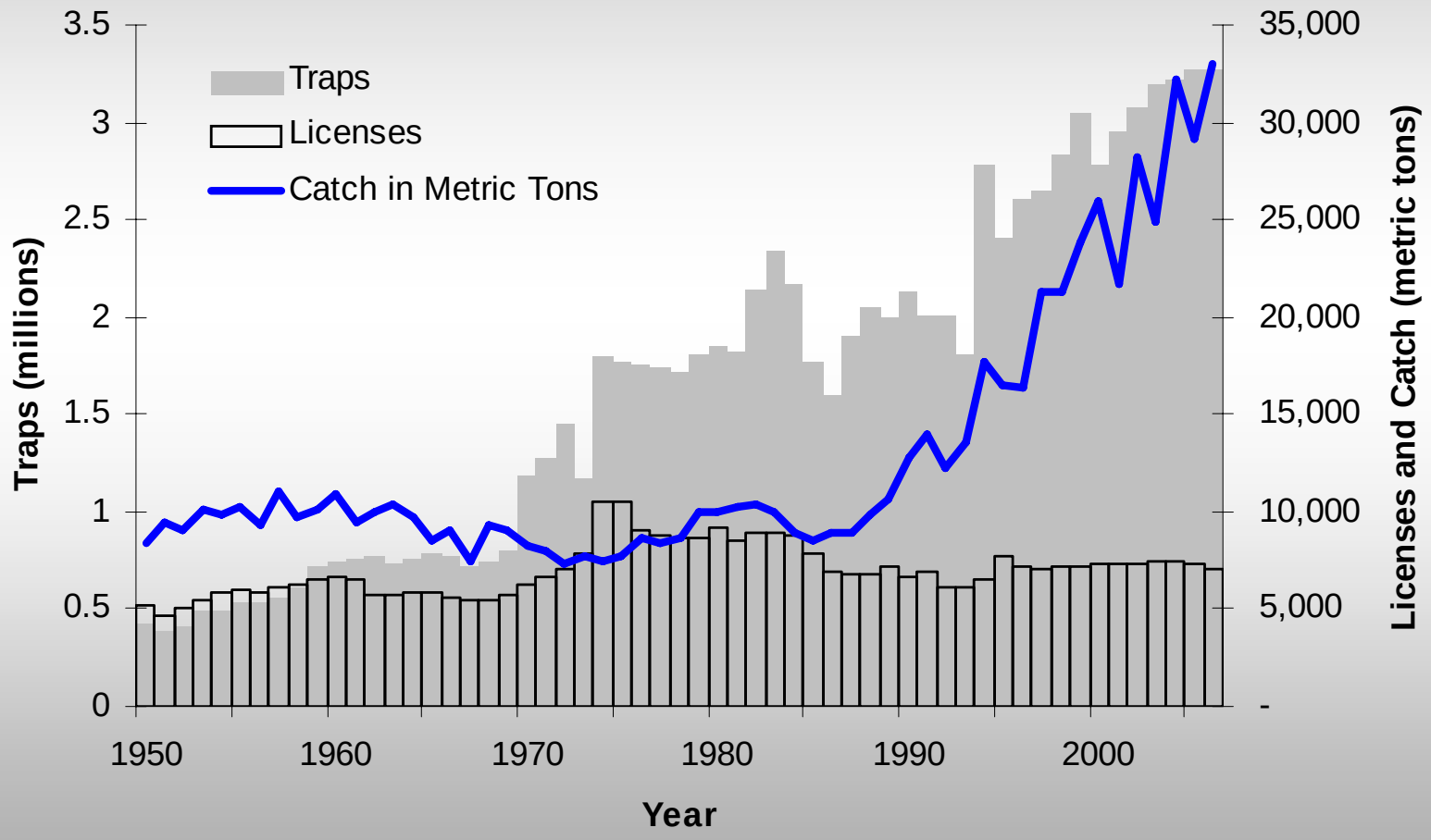

- UNH Marine Program Fellowship (KLD)
- Large Pelagics Research Center
- NOAA Fisheries NERO & NEFSC
- National Fish & Wildlife Foundation
- Provincetown Center for Coastal Studies
- New England Aquarium
- Cape Cod Commercial Hook Fishermens Association
- Woods Hole Oceanographic Institution
- MA Audubon Wellfleet Bay Wildlife Sanctuary
- MA Division of Marine Fisheries & Marine Environmental Police
- Pura Vida, Inc.
- F/V Sea Holly
- F/V Rolling Stone
- F/V Sea Bag
- M.F. Dodge Carpentry
- 1-888-SEATURT (Karen Dourdeville)

# Trapped on Monhegan? An experimental approach to Maine's largest fishery

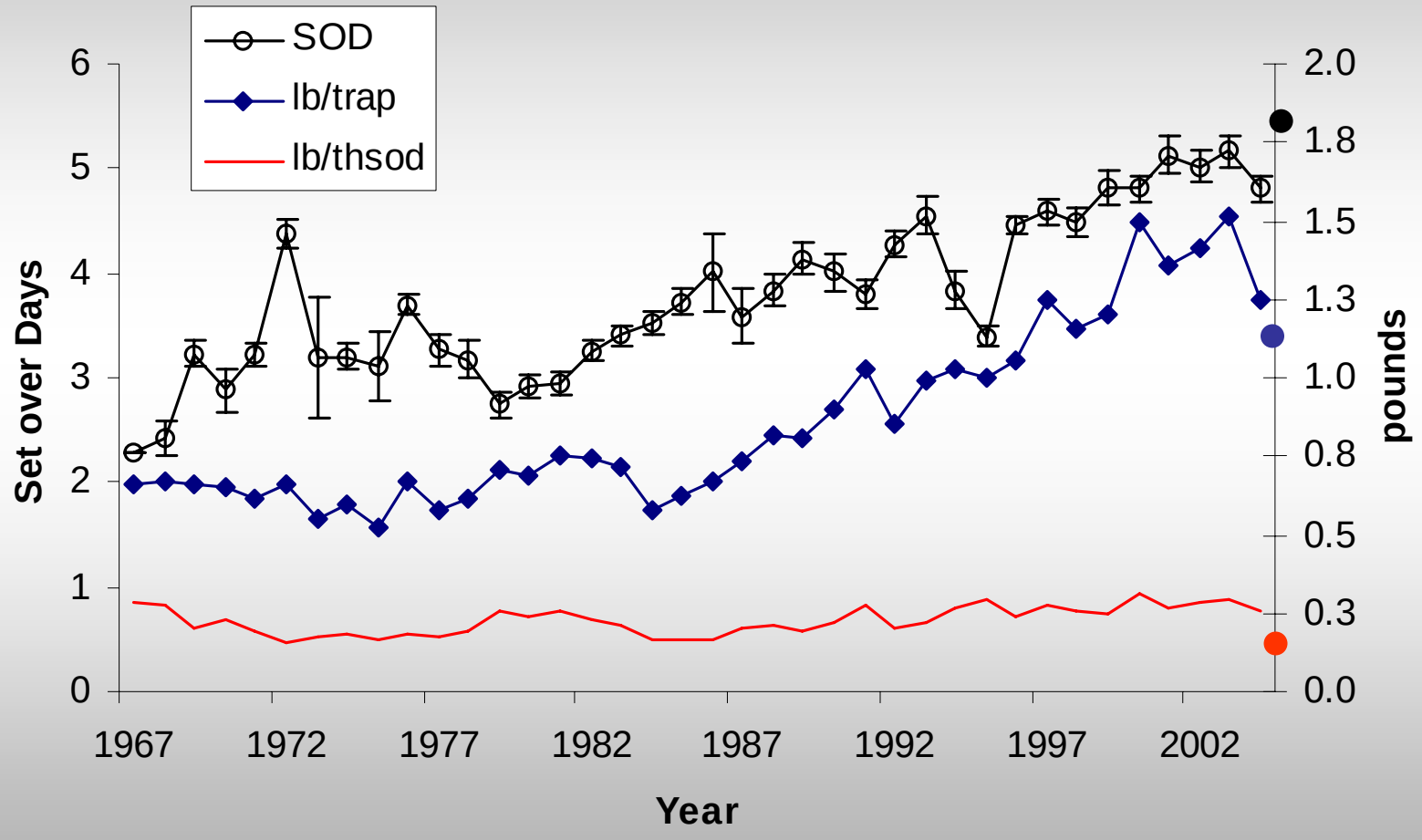
NOAA

GULF OF MAINE LOBSTER FOUNDATION

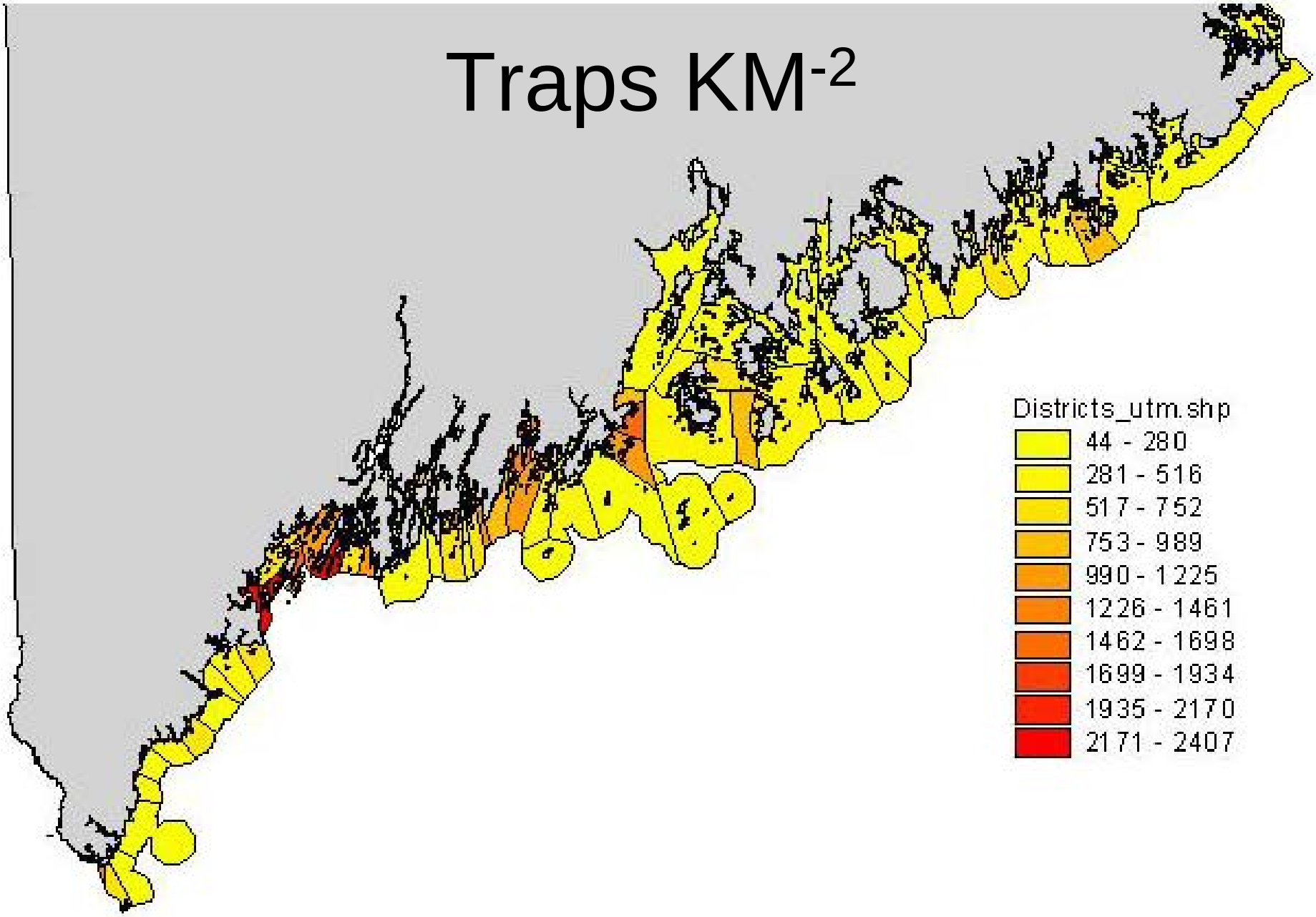
# The big bang


Traps
Licenses
Catch in Metric Tons
Traps (millions)
Licenses and Catch (metric tons)
Year
3.5
3
2.5
2
1.5
1
0.5
0
35,000
30,000
25,000
20,000
15,000
10,000
5,000
-
1950
1960
1970
1980
1990
2000

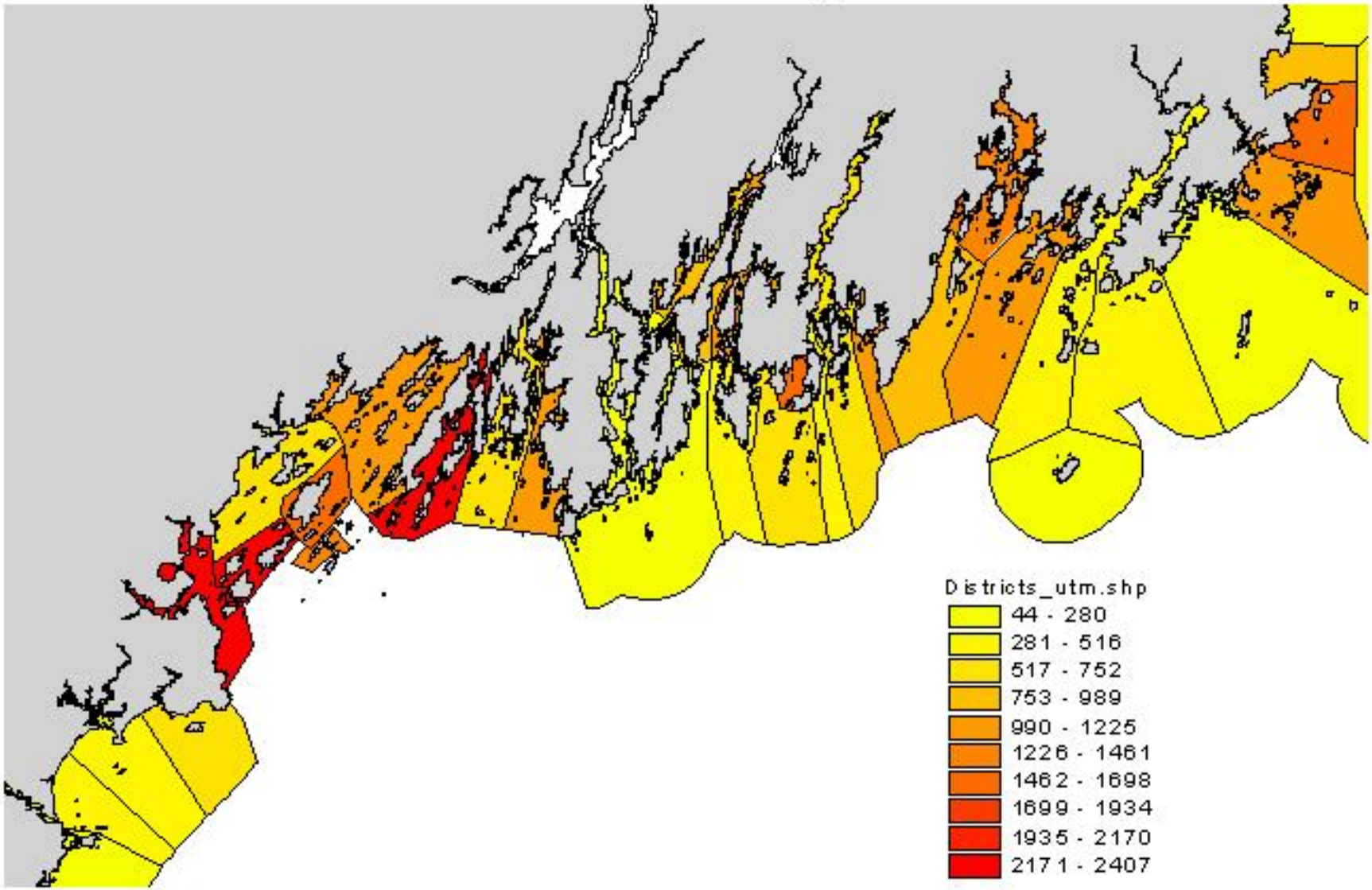
# Efficiency of the Maine Fishery



# Traps $KM^{-2}$

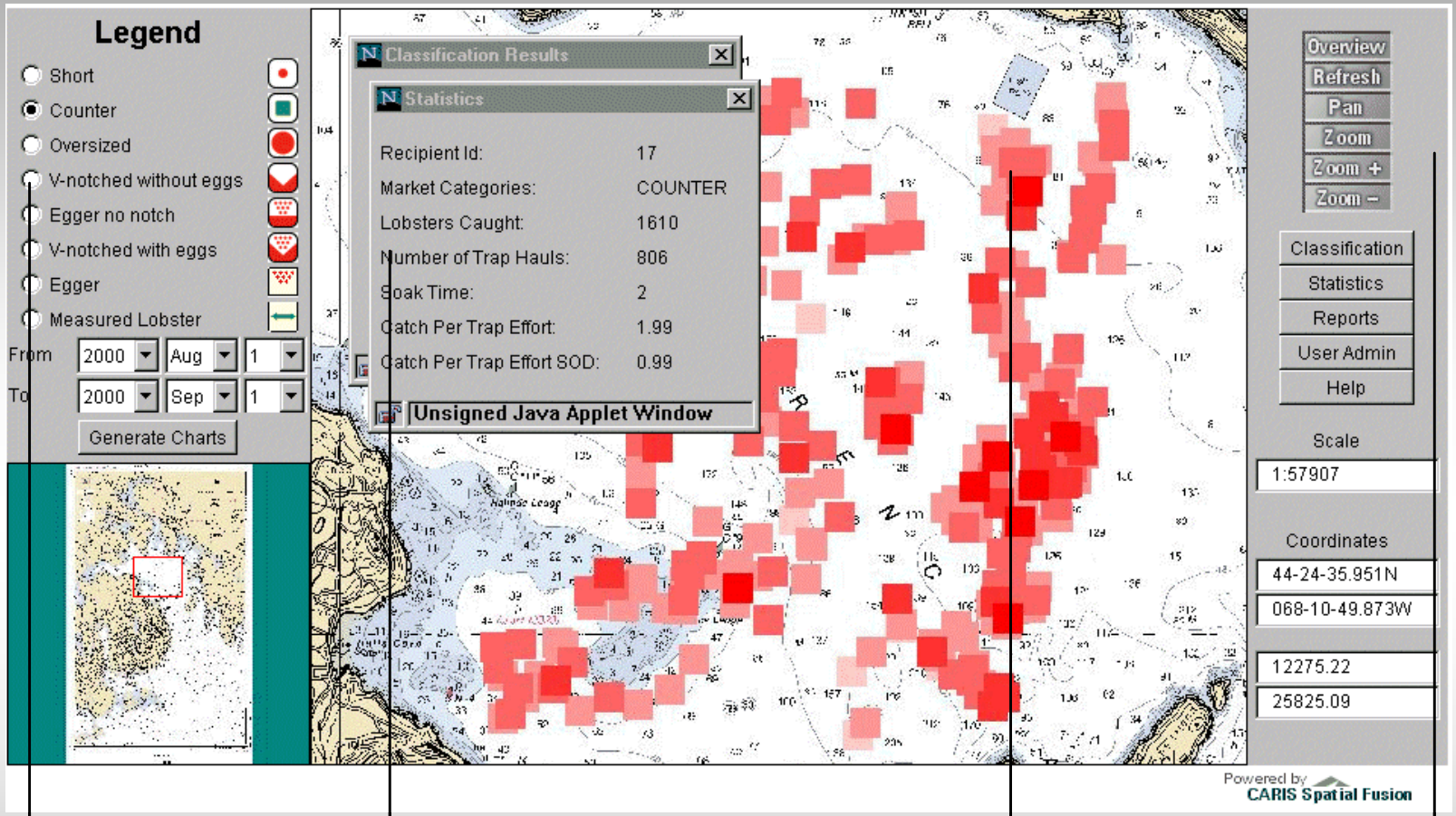

Districts_utm.shp
44 - 280
281 - 516
517 - 752
753 - 989
990 - 1225
1226 - 1461
1462 - 1698
1699 - 1934
1935 - 2170
2171 - 2407

# Mid Coast Traps $KM^{-2}$



# Electronic Logbooks

1 2 3 4 5
6 7 8 9 0
THISTLE MARINE

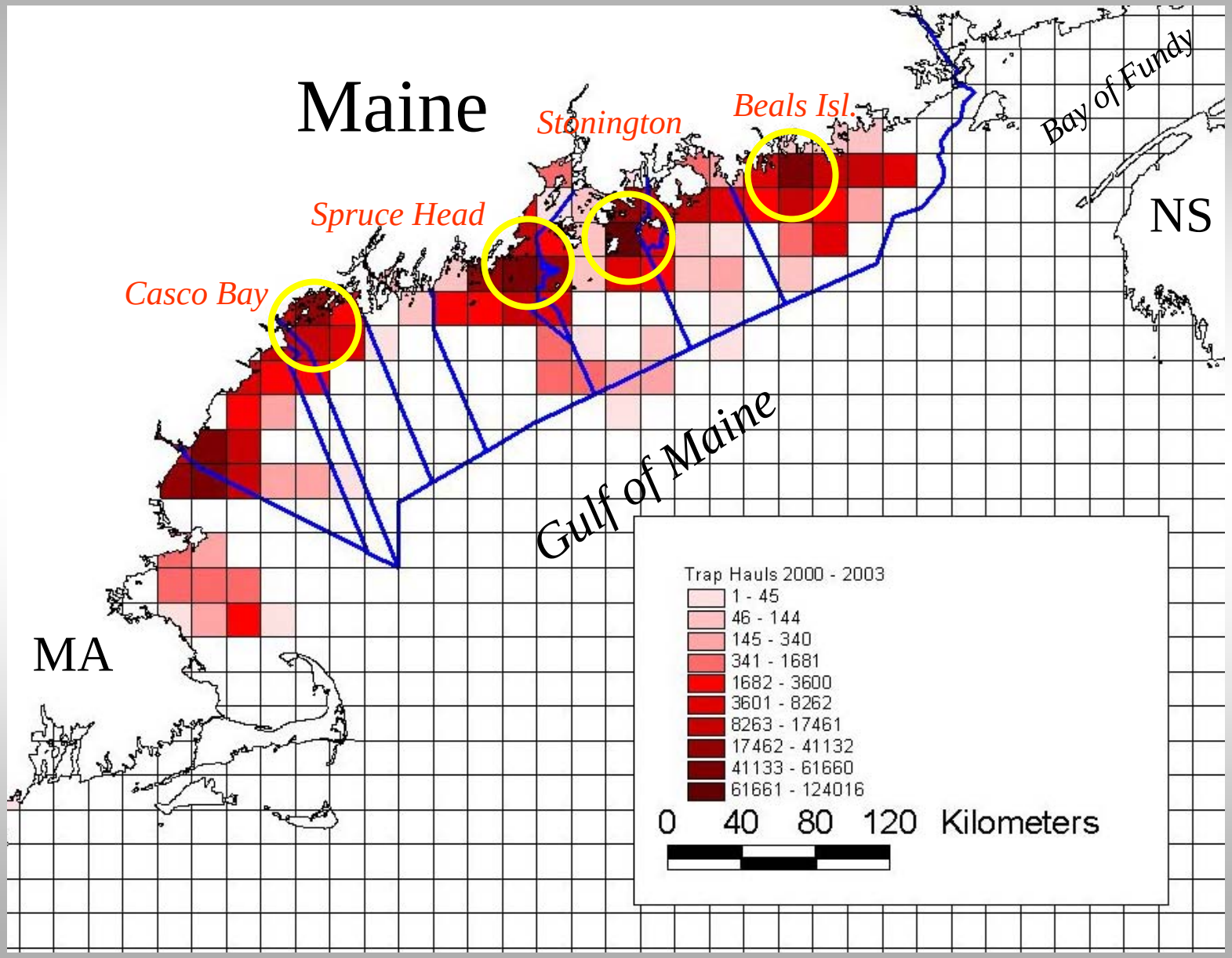


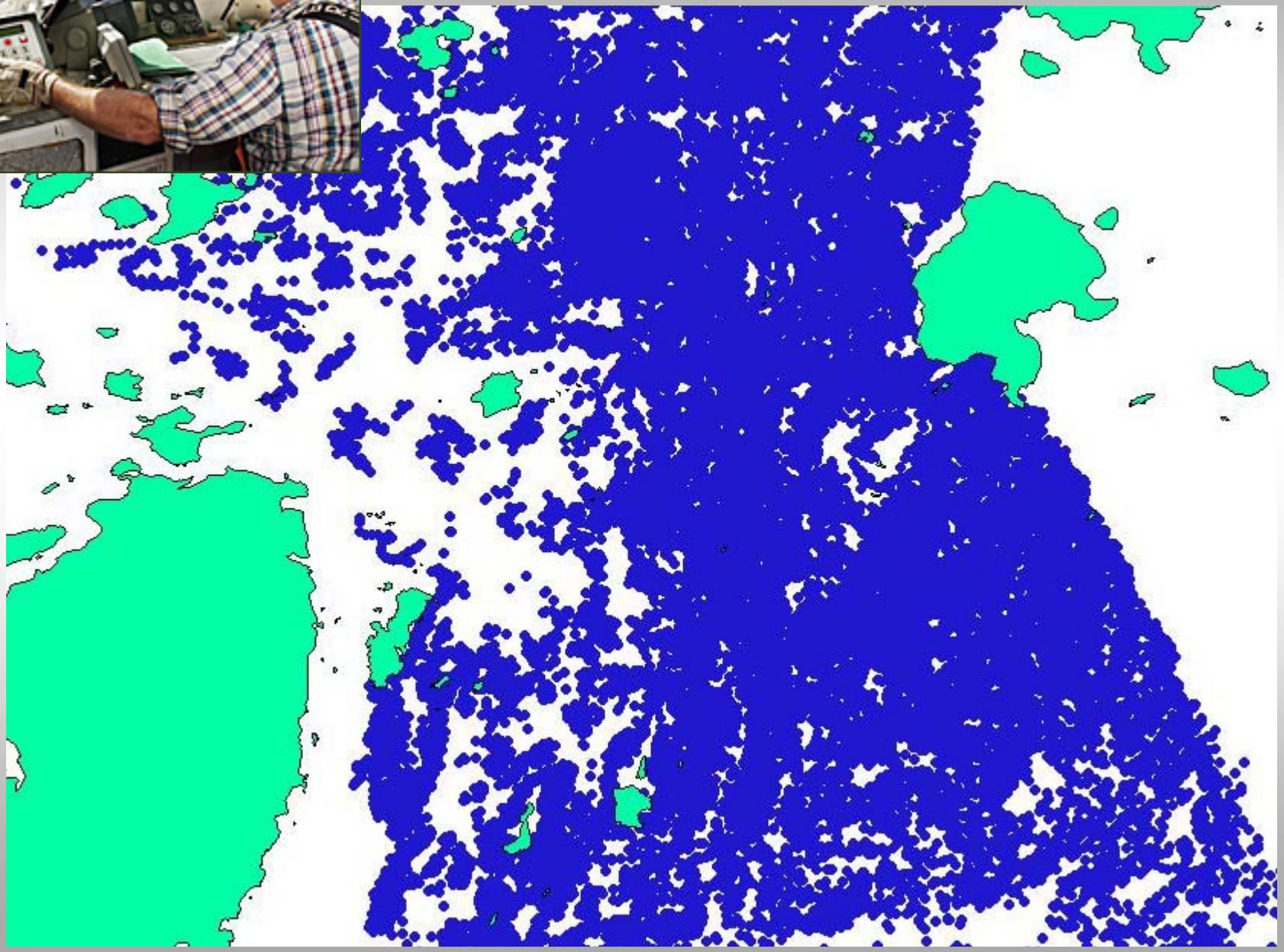

User defines lobster category and date range to query.

Catch statistics are generated for each query submitted.

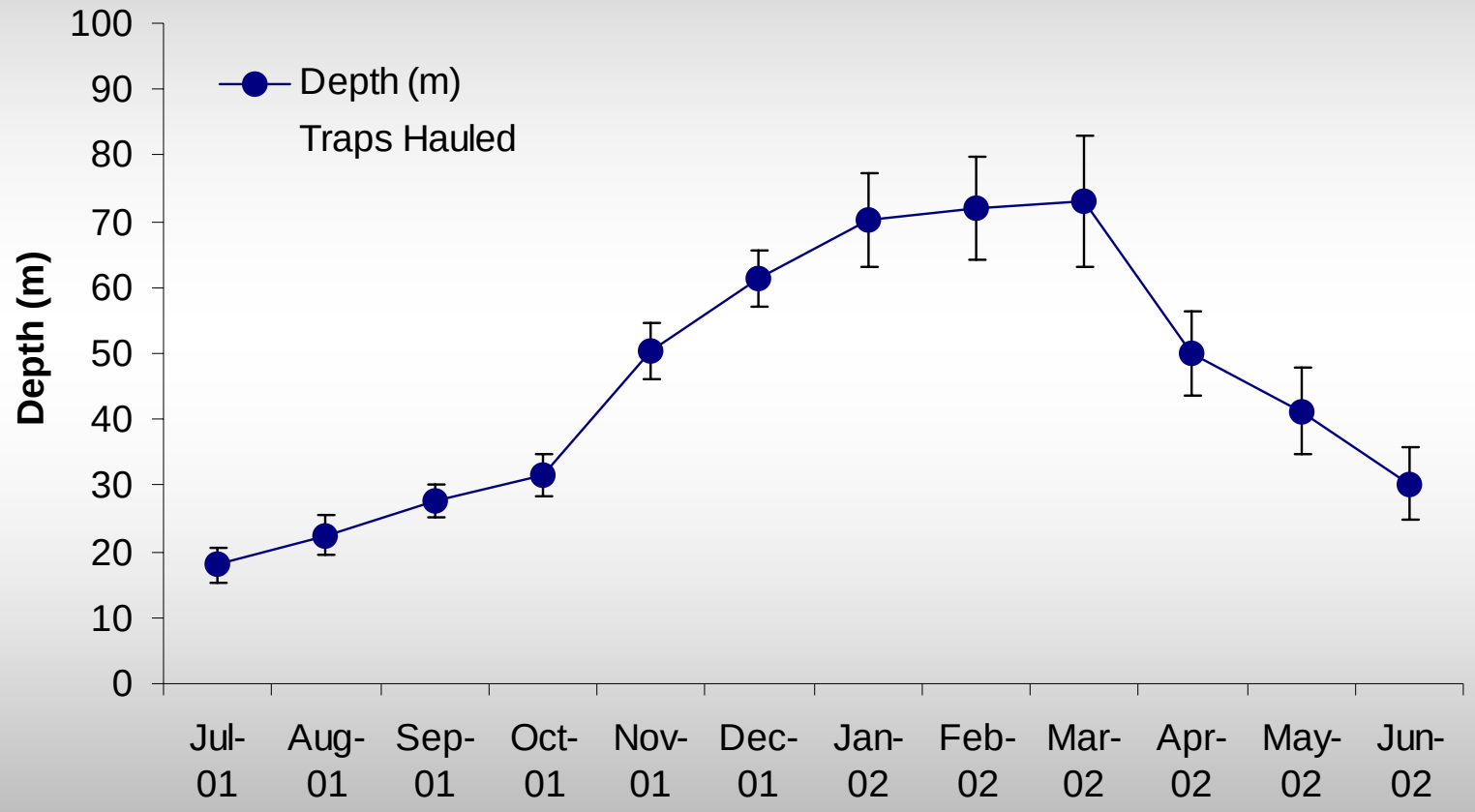
Results indicate the relative intensity of lobsters recorded.

Users can select the area of interest to further refine query results.

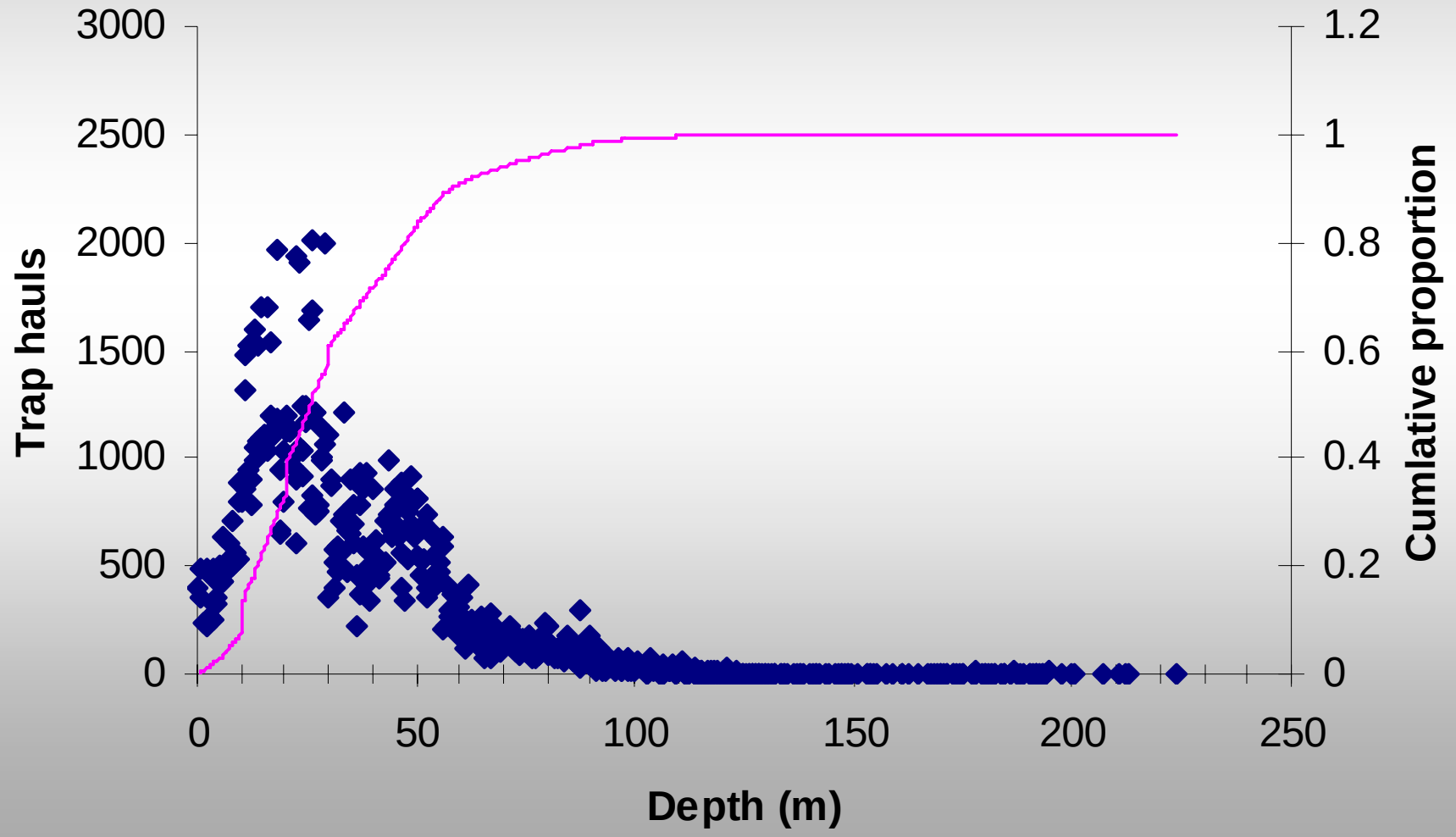

Maine
Stonington
Beals Isl.
Bay of Fundy
Spruce Head
NS
Casco Bay
Gulf of Maine
MA
Trap Hauls 2000 - 2003
1 - 45
46 - 144
145 - 340
341 - 1681
1682 - 3600
3601 - 8262
8263 - 17461
17462 - 41132
41133 - 61660
61661 - 124016
0 40 80 120 Kilometers



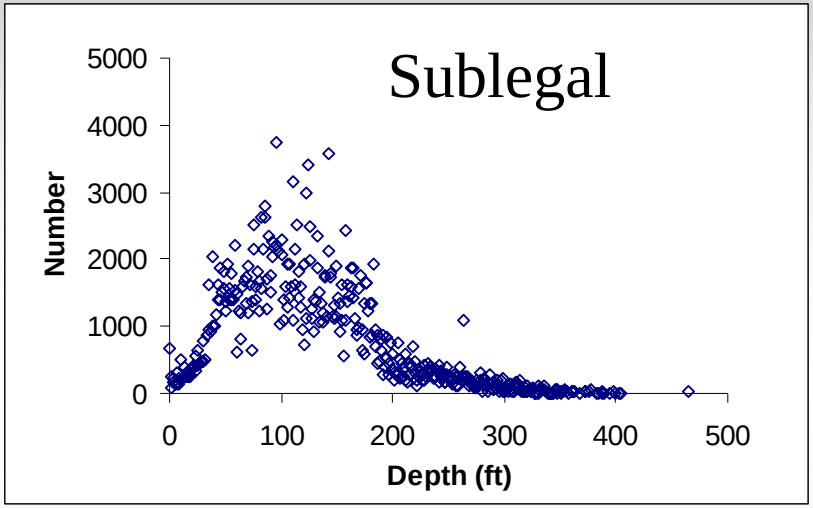
# Depth of trap hauls by month

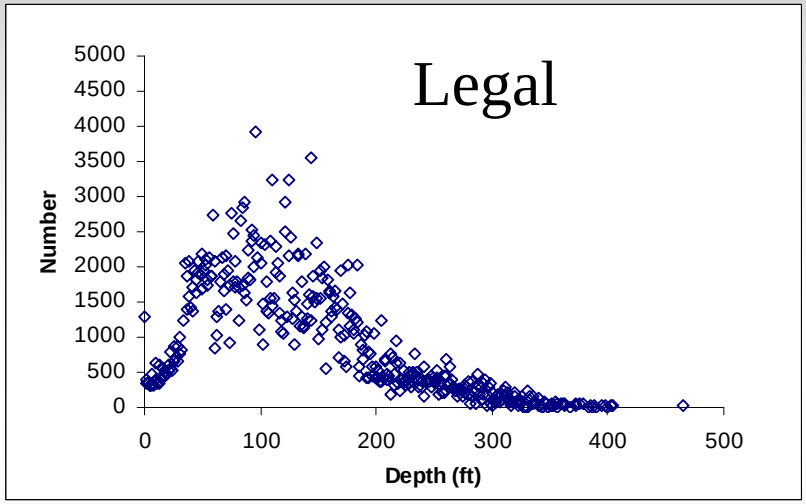


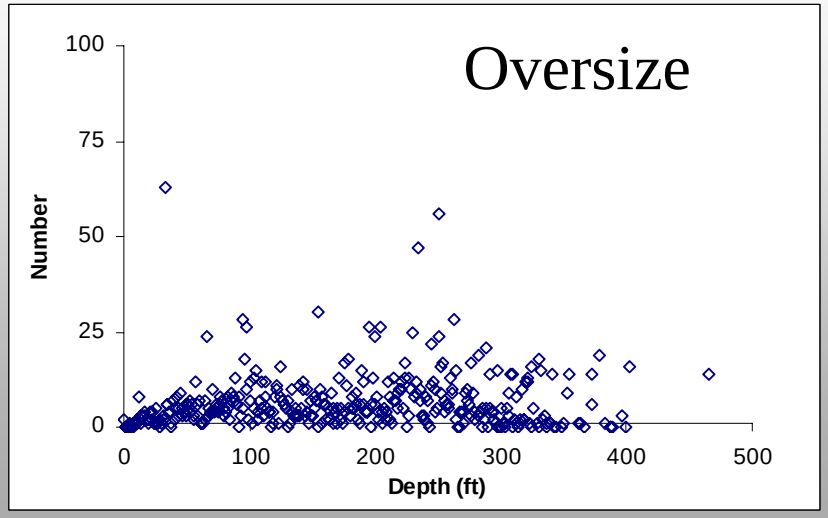
# Trap Hauls by Depth

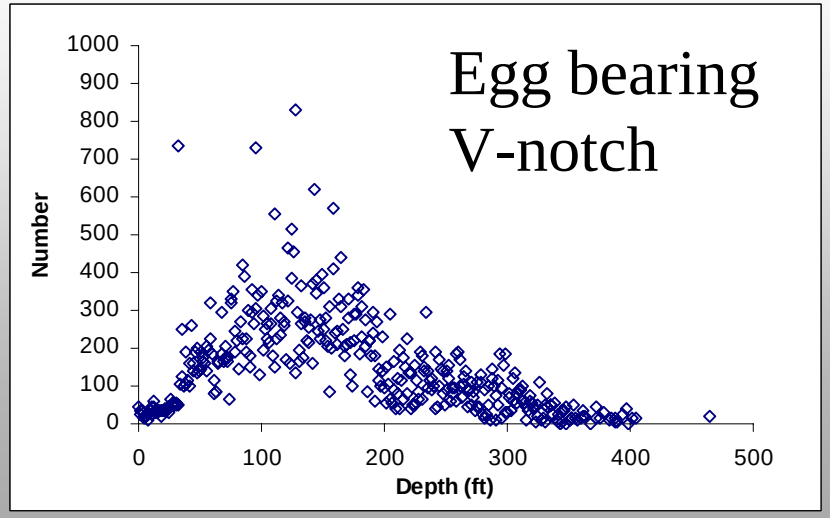


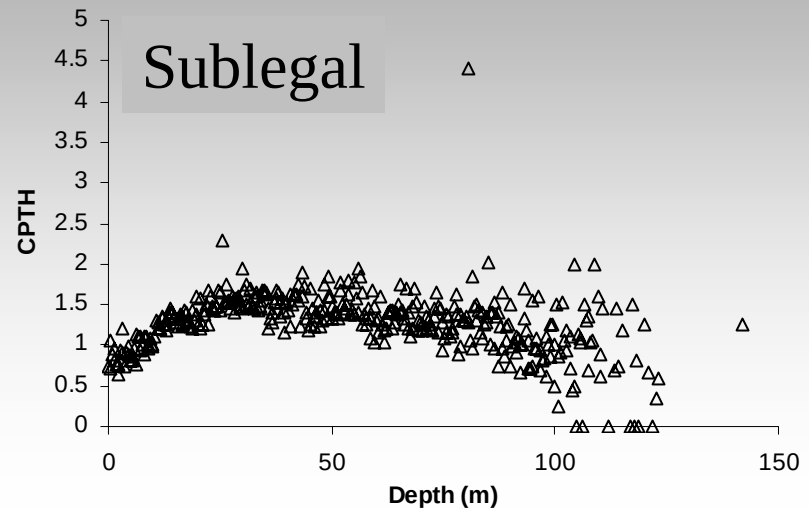
# Catch at depth

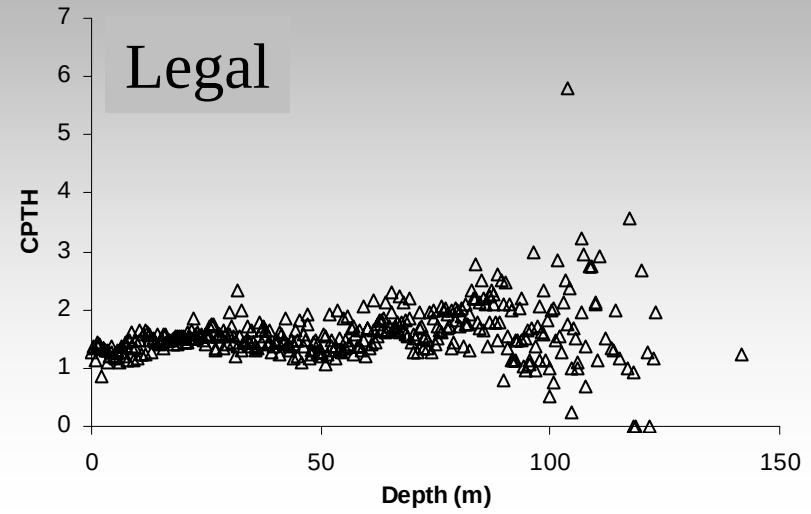


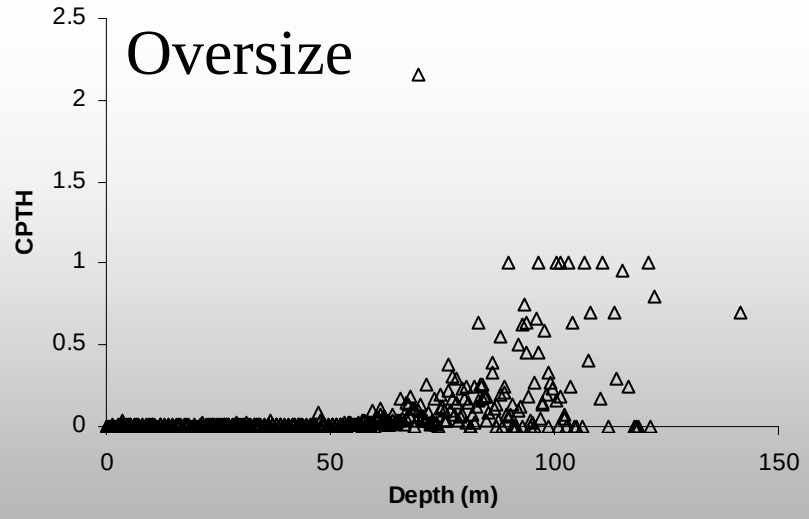



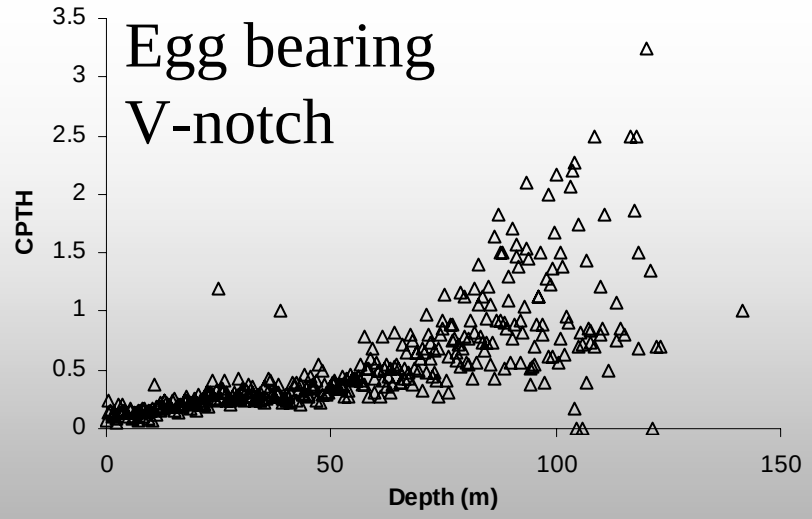



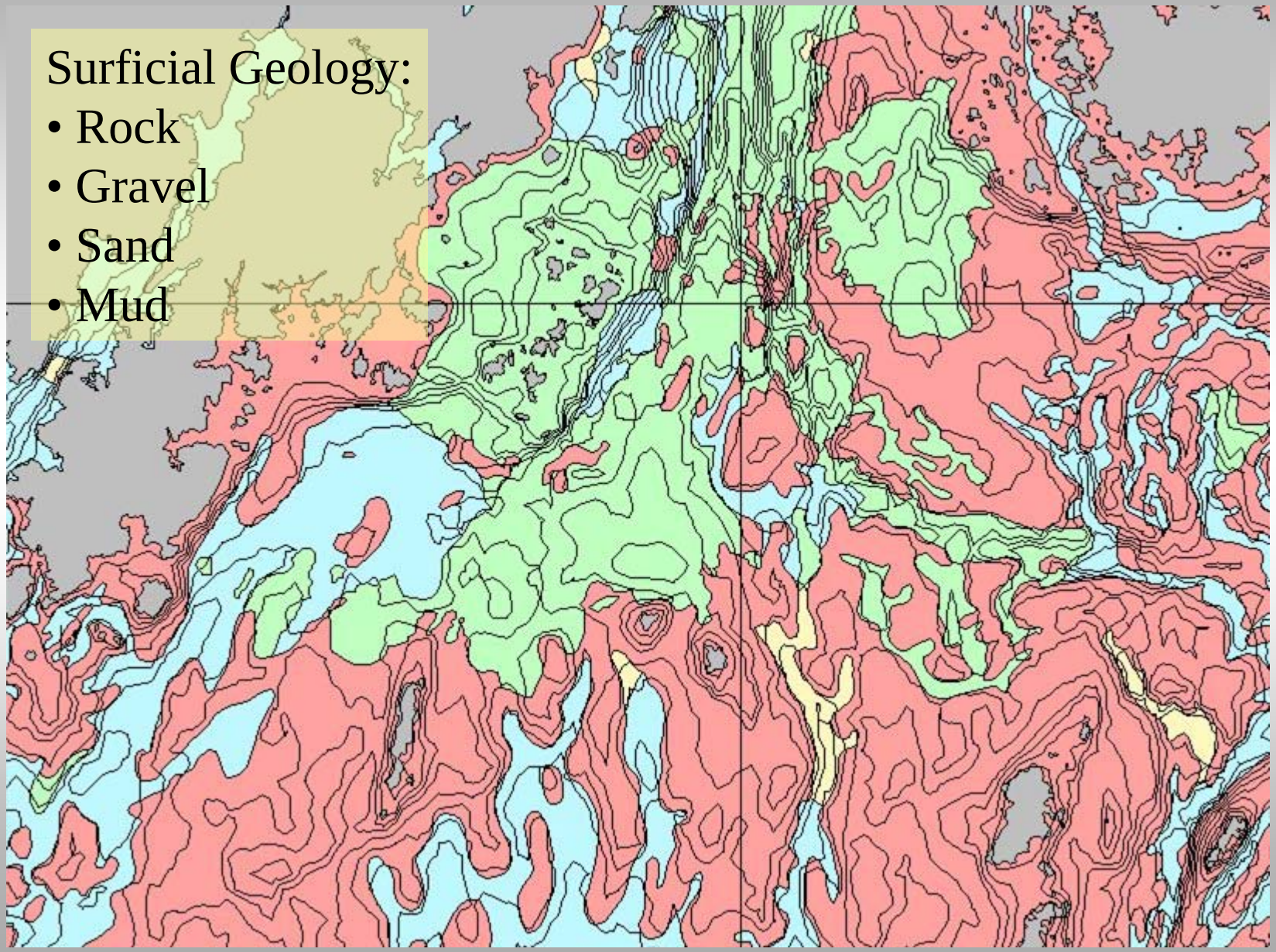



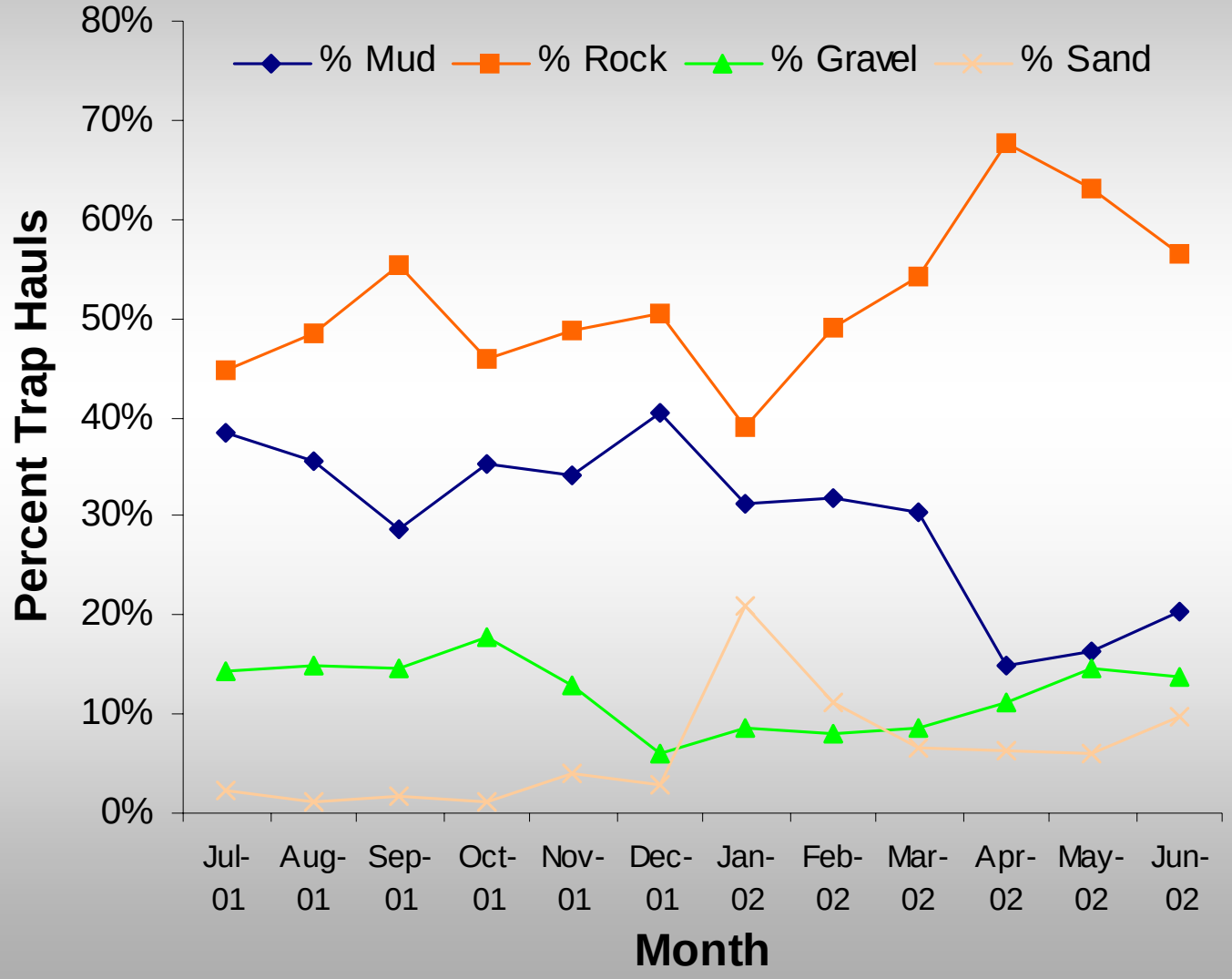

Sublegal
CPTH
Depth (m)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
50
100
150


Legal
CPTH
Depth (m)
0
1
2
3
4
5
6
7
0
50
100
150

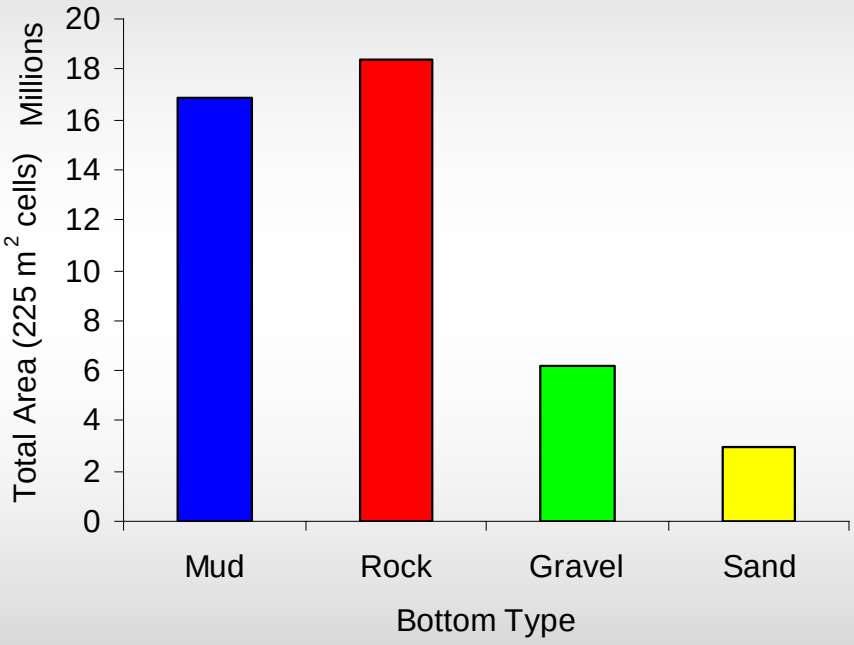

Oversize
CPTH
Depth (m)
0
0.5
1
1.5
2
2.5
0
50
100
150


Egg bearing
V-notch
CPTH
Depth (m)
0
0.5
1
1.5
2
2.5
3
3.5
0
50
100
150

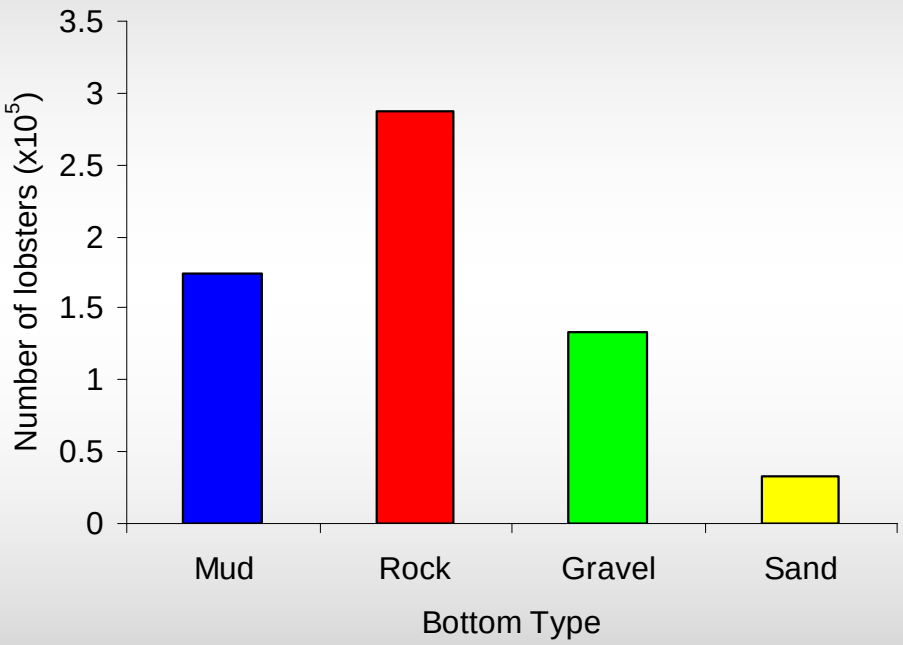

Surficial Geology:
• Rock
• Gravel
• Sand
• Mud


% Mud
% Rock
% Gravel
% Sand
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percent Trap Hauls
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Dec-01
Jan-02
Feb-02
Mar-02
Apr-02
May-02
Jun-02
Month

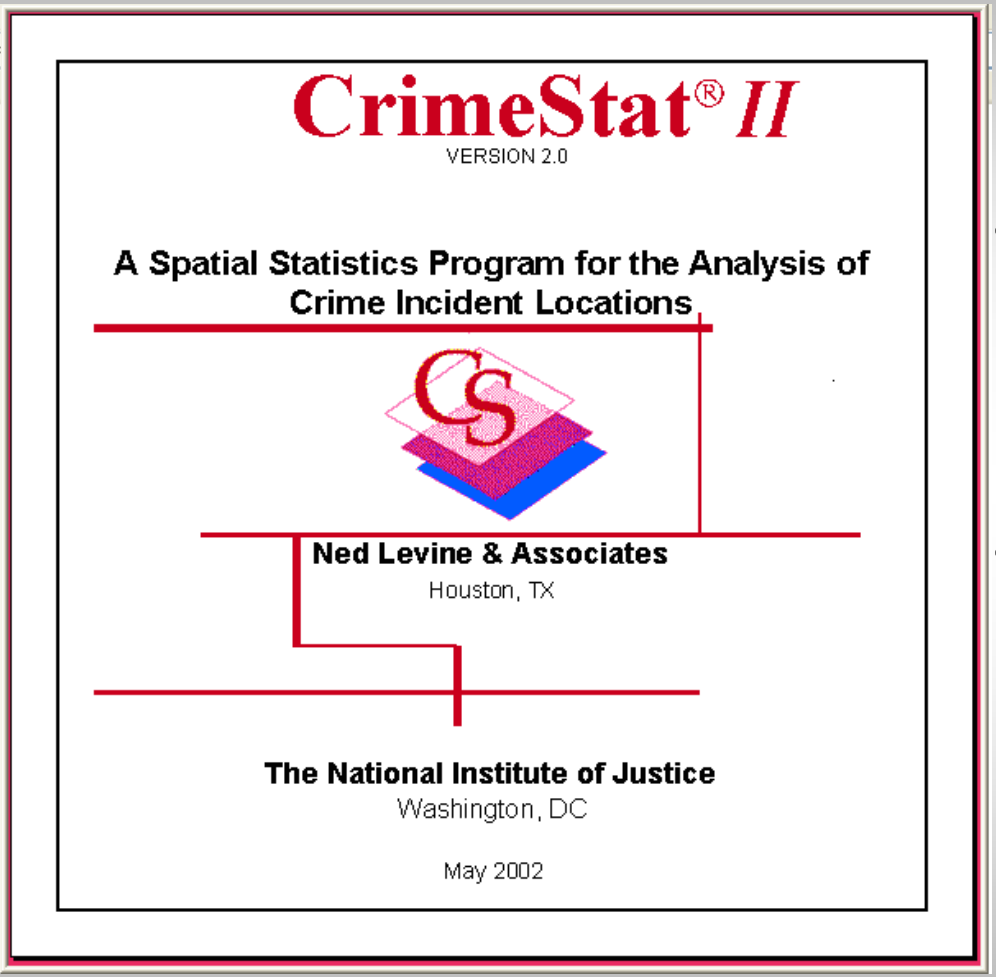
# Available area




# Lobsters caught



# Nearest neighbor analysis

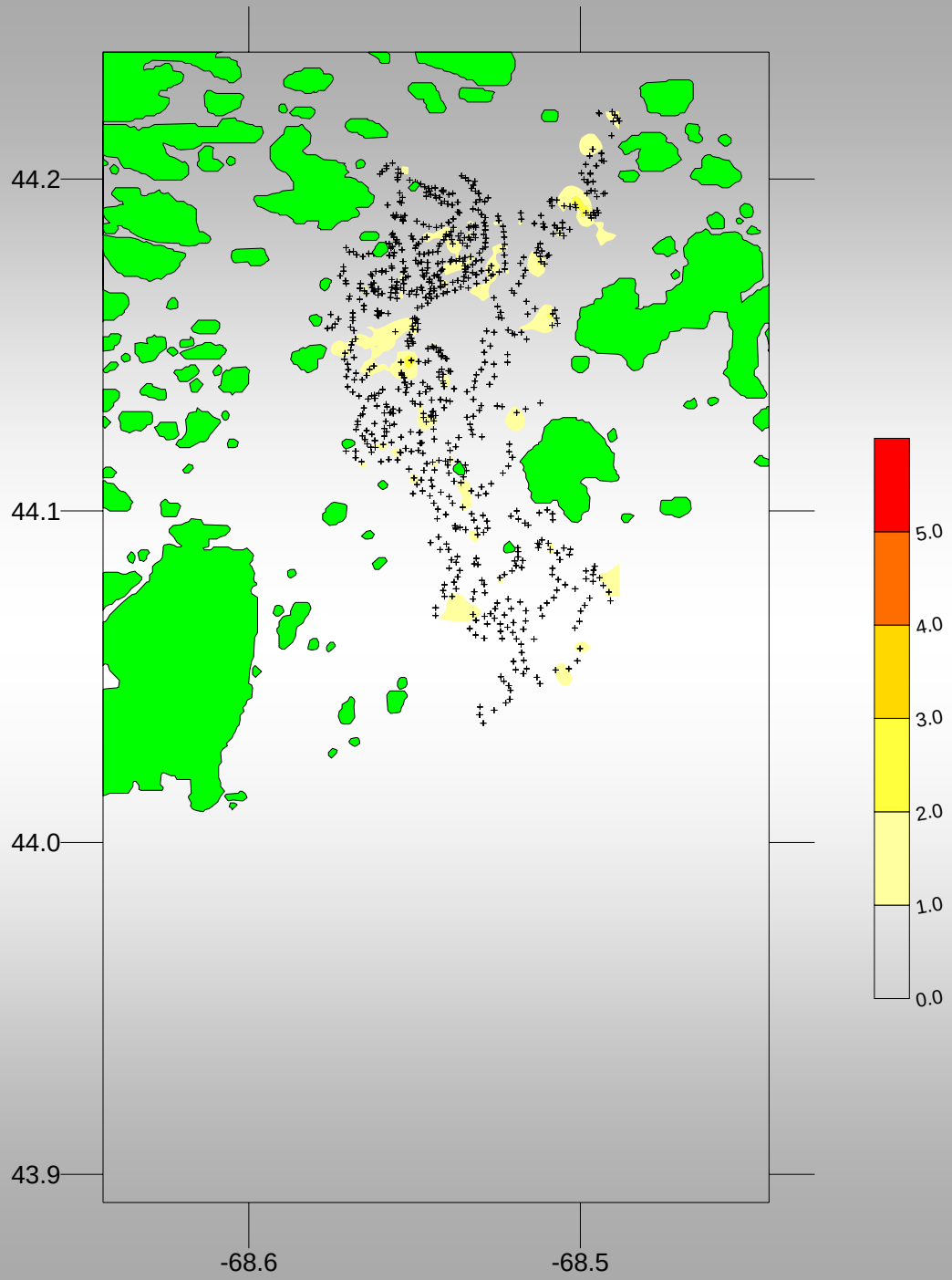


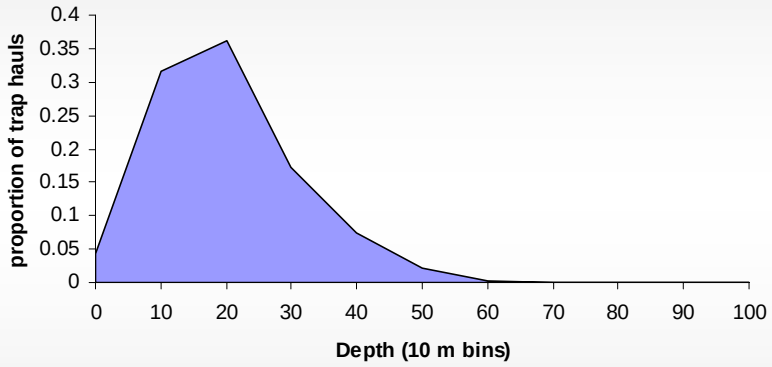

- First-order properties (global)
  - Seasonal patterns CPTH
  - Changes in depth
  - Habitat selection
- Second-order properties (neighborhood)
  - Within the overall distribution
  - Minimum distance between points
  - Index of spatial clustering

# Stonington 2001

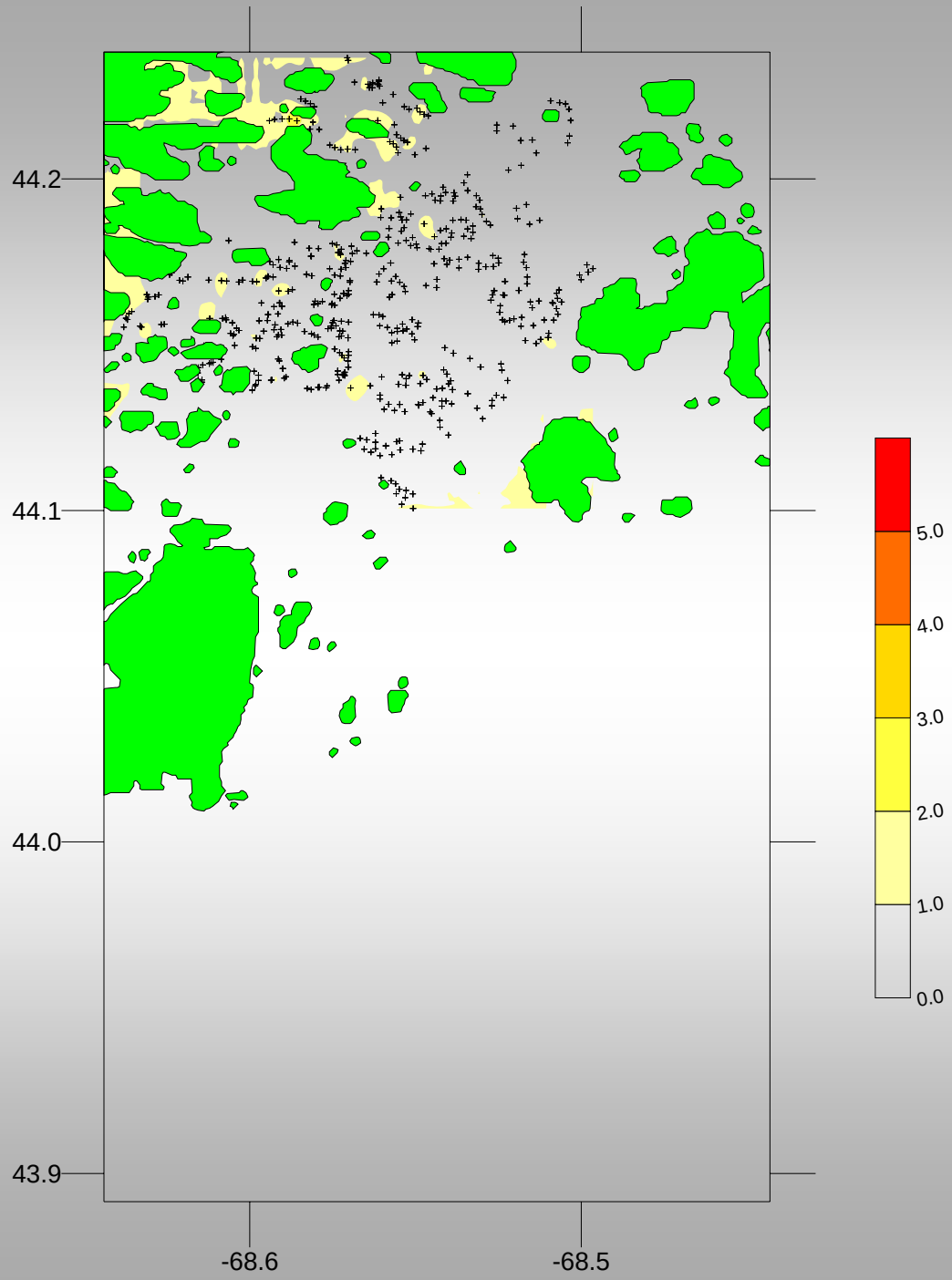
- Area represents ~100 fishermen fishing ~80,000 traps
- Choose first week of each month (June-December)
- Minimum of three logbooks reporting each month
- Maximum of three days fishing each week per boat
- Statistics summarized for the participant fleet.

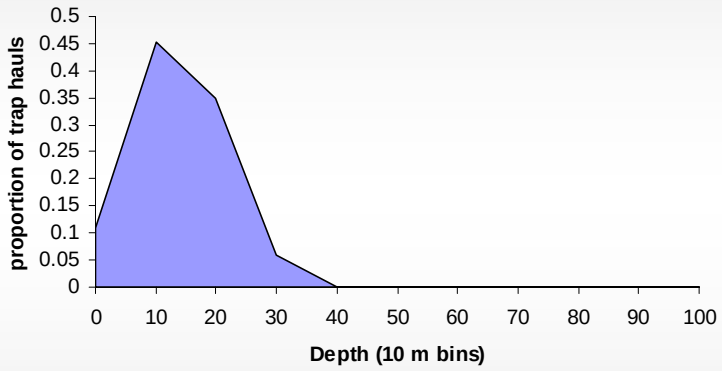
# June


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

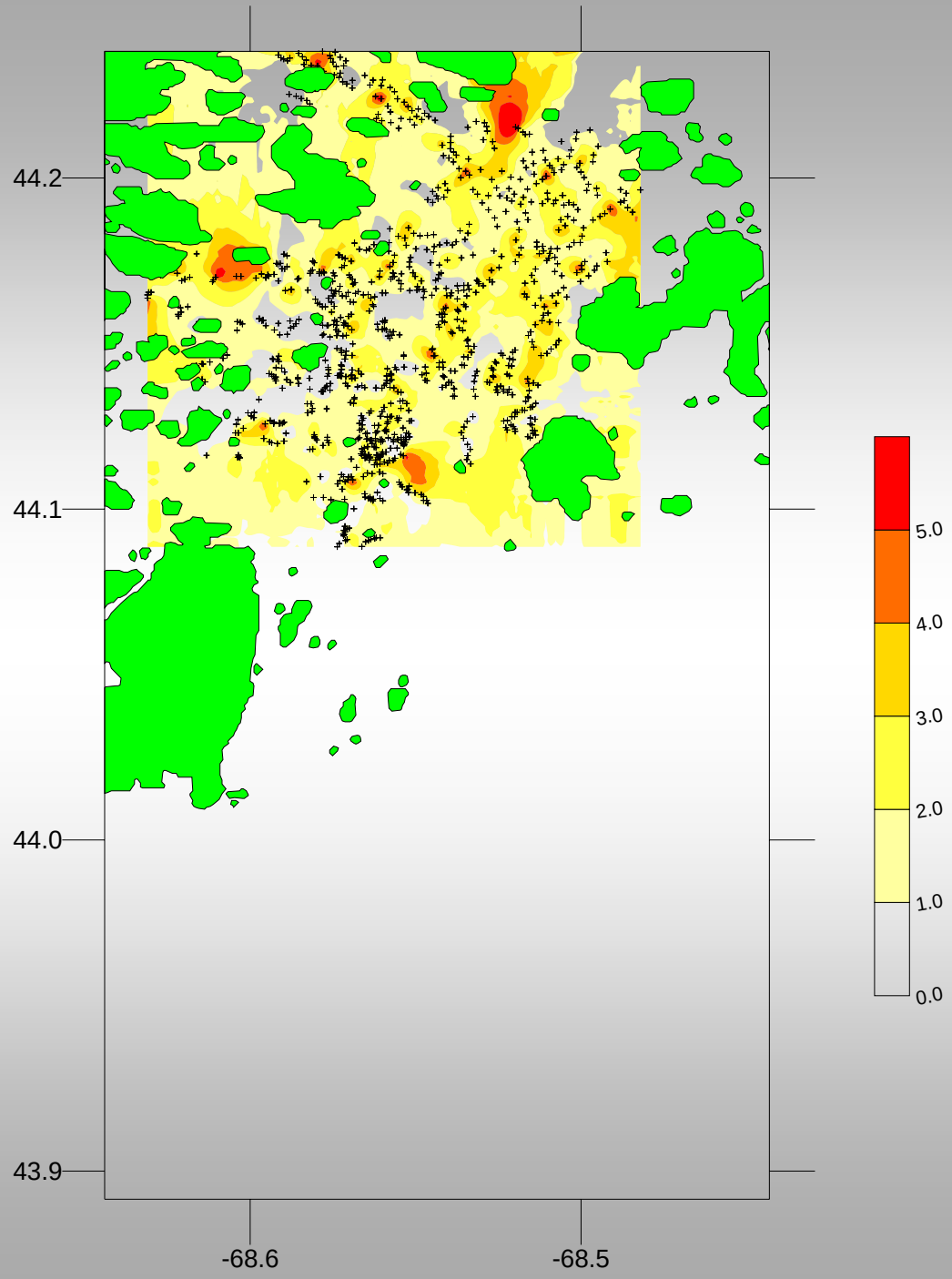

proportion of trap hauls
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

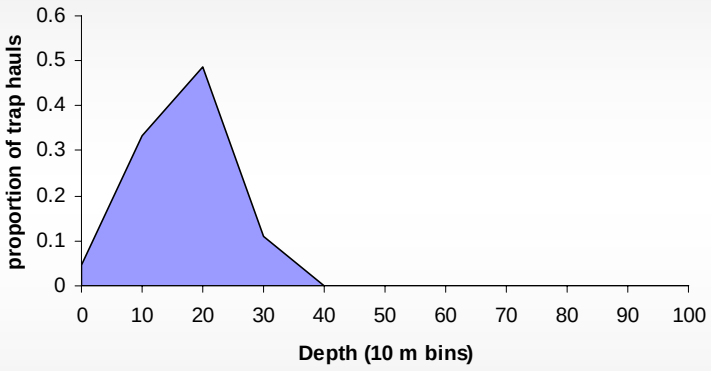
# July


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

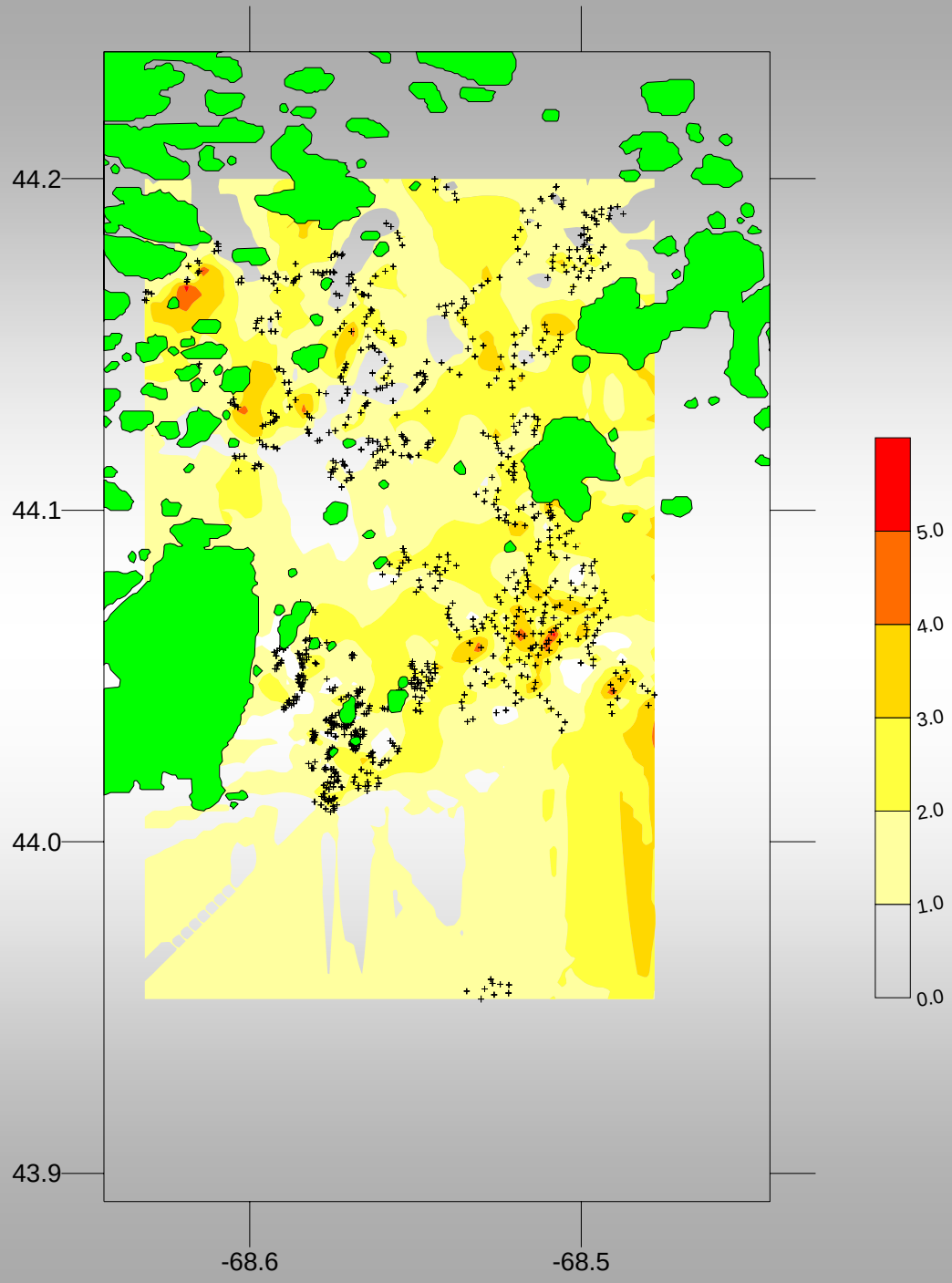

proportion of trap hauls
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

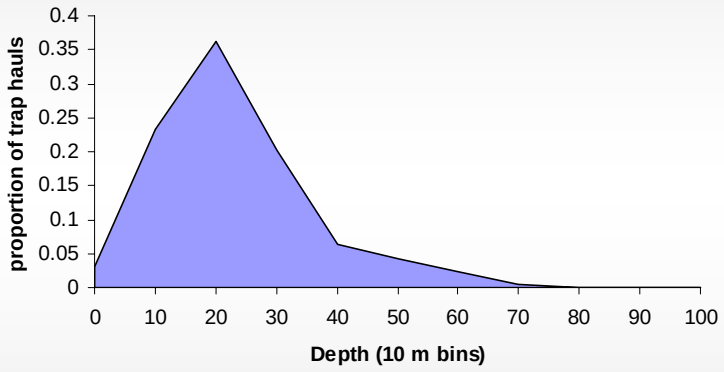
# August


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

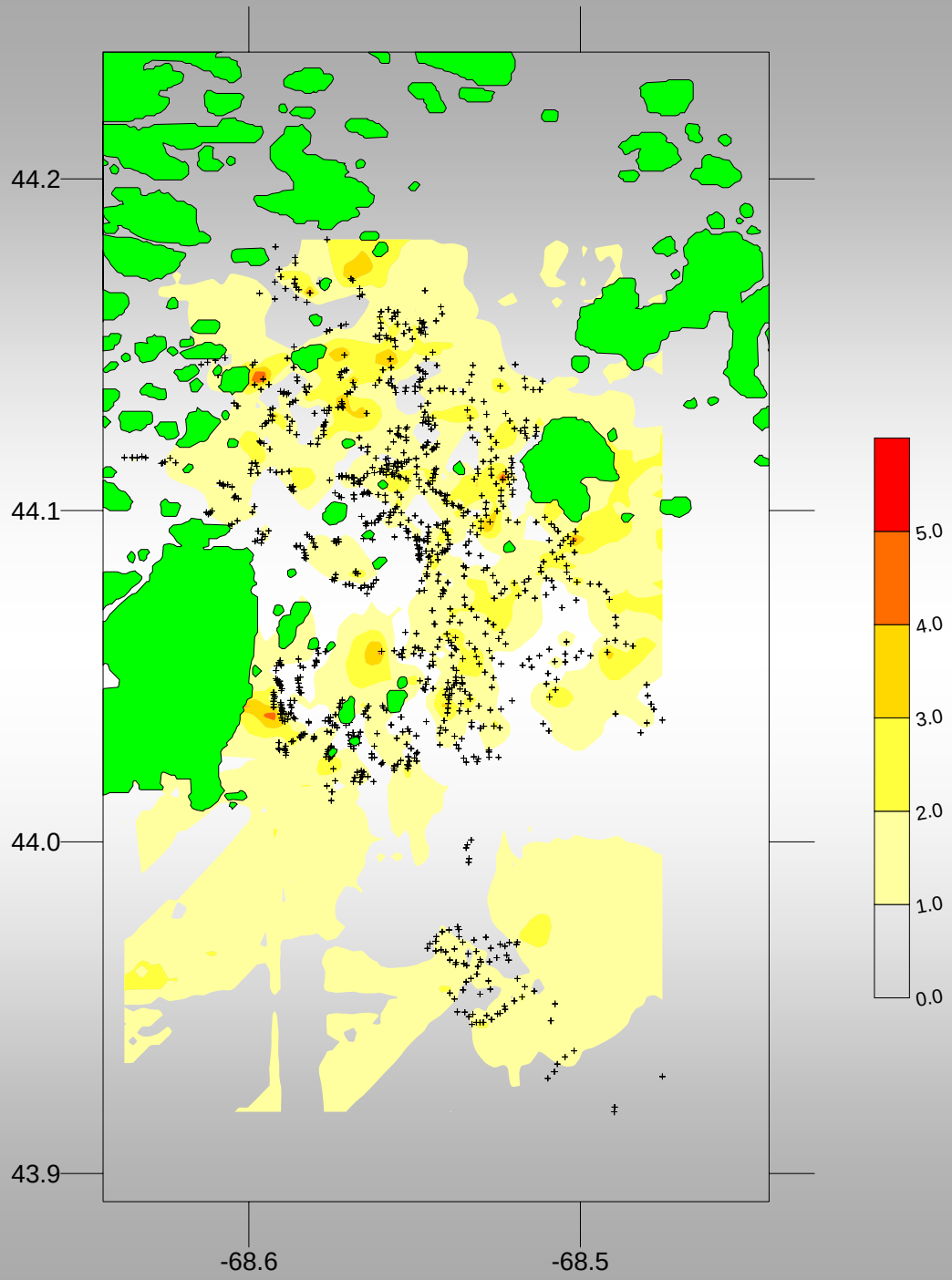

proportion of trap hauls
0.6
0.5
0.4
0.3
0.2
0.1
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

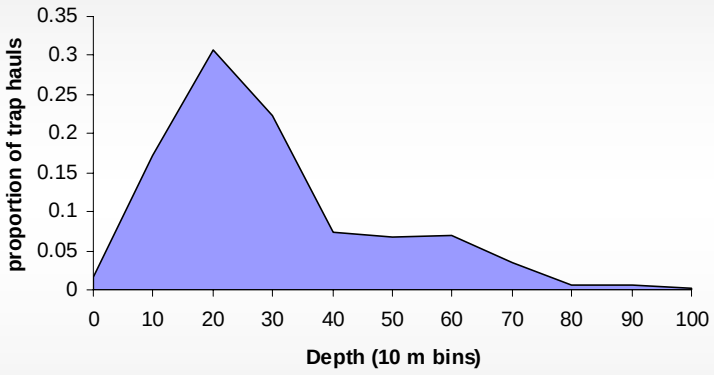
# September


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

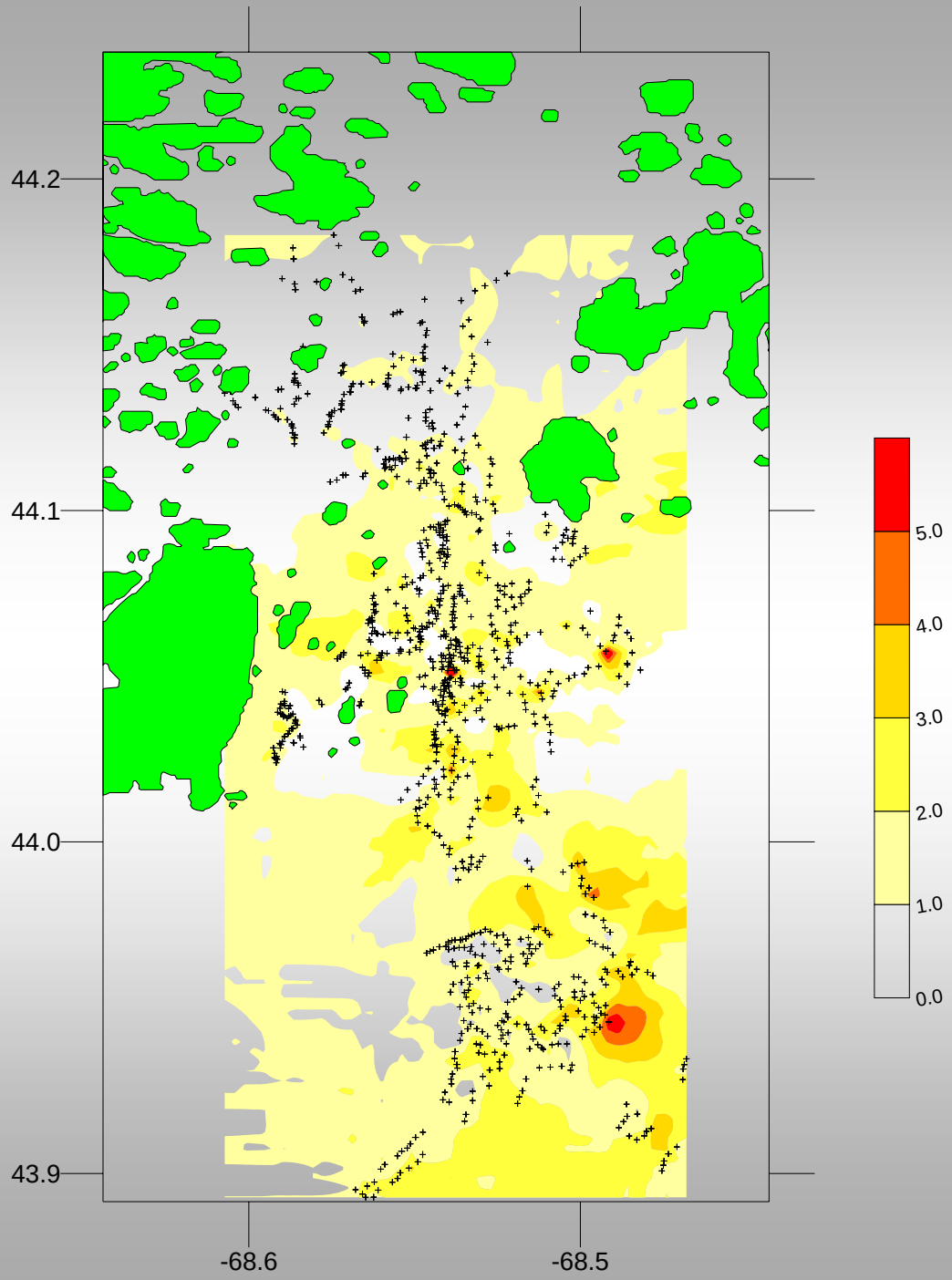

proportion of trap hauls
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

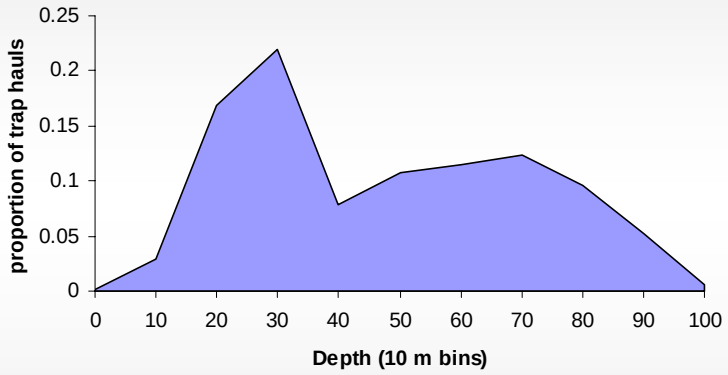
# October


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

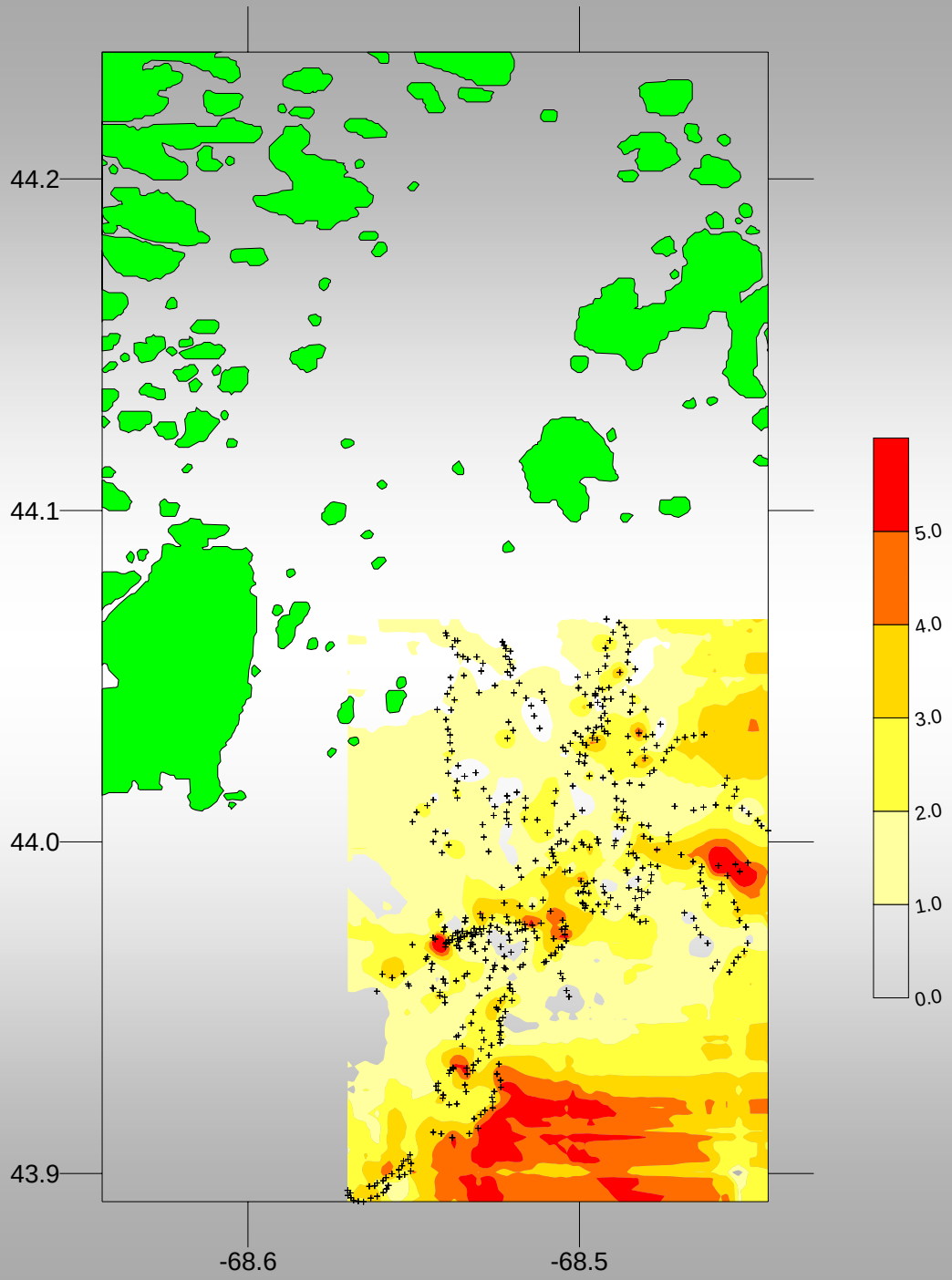

proportion of trap hauls
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

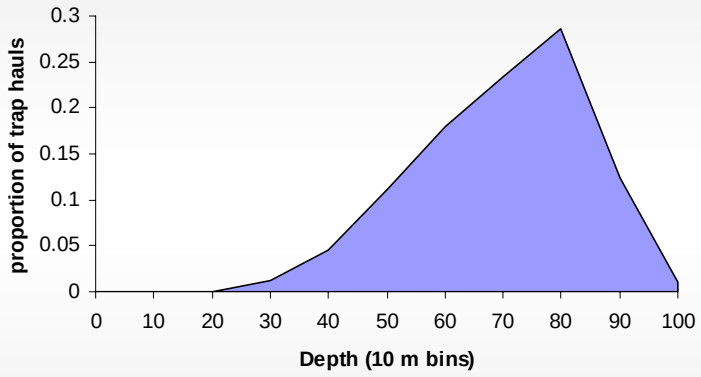
# November


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

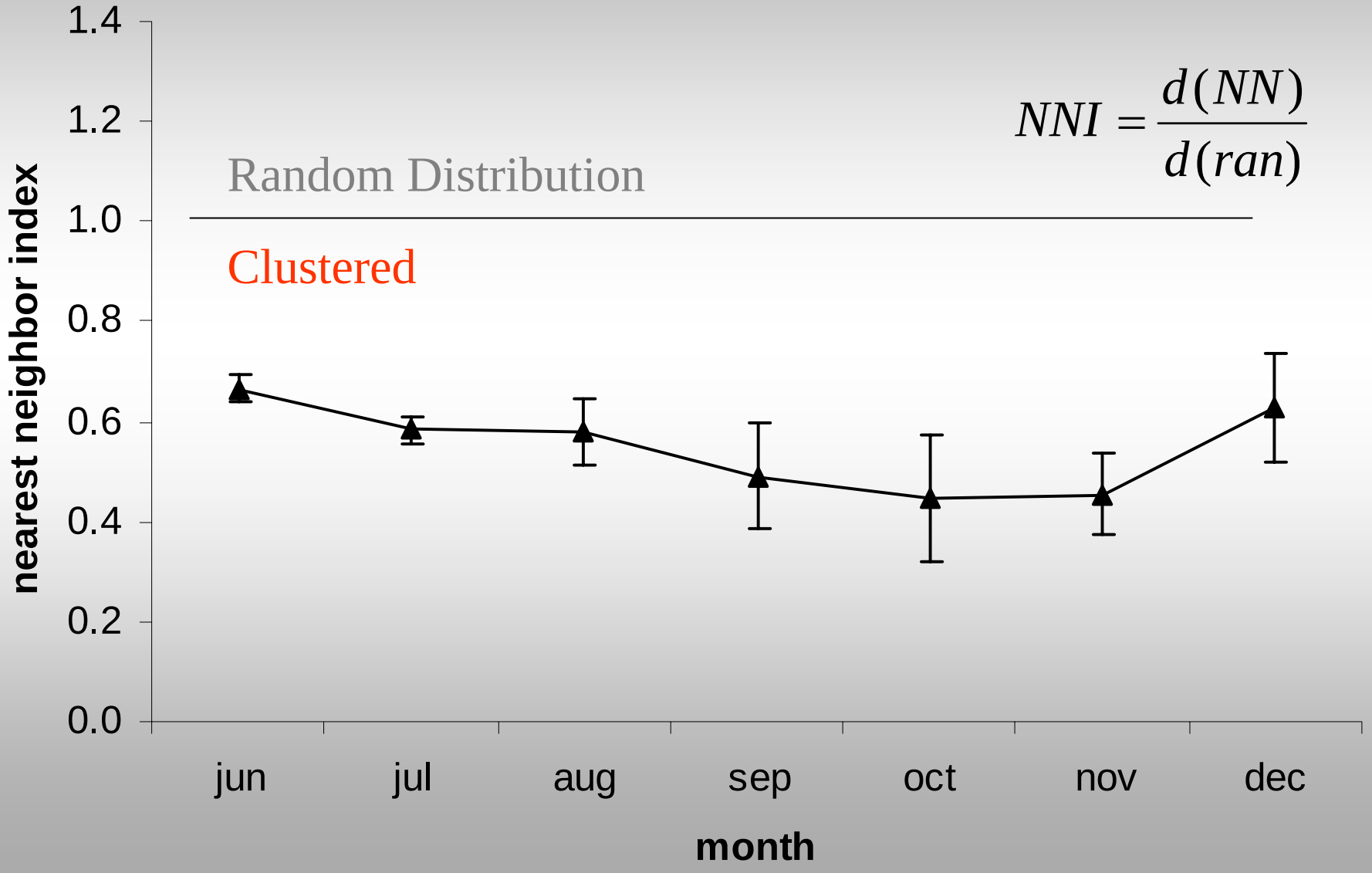

proportion of trap hauls
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

# December


44.2
44.1
44.0
43.9
-68.6
-68.5
5.0
4.0
3.0
2.0
1.0
0.0

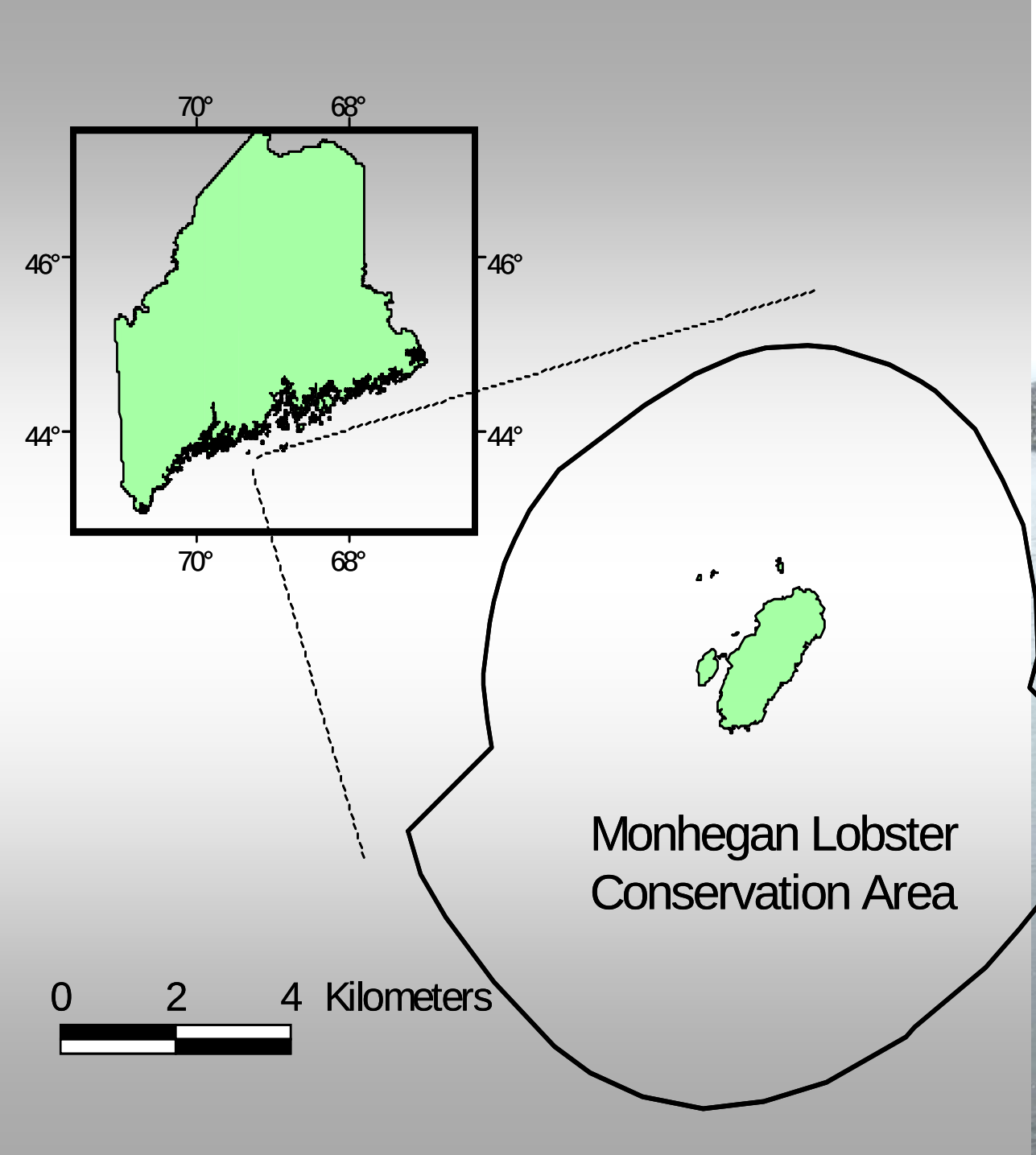

proportion of trap hauls
0.3
0.25
0.2
0.15
0.1
0.05
0
0
10
20
30
40
50
60
70
80
90
100
Depth (10 m bins)

# Nearest Neighbor Index



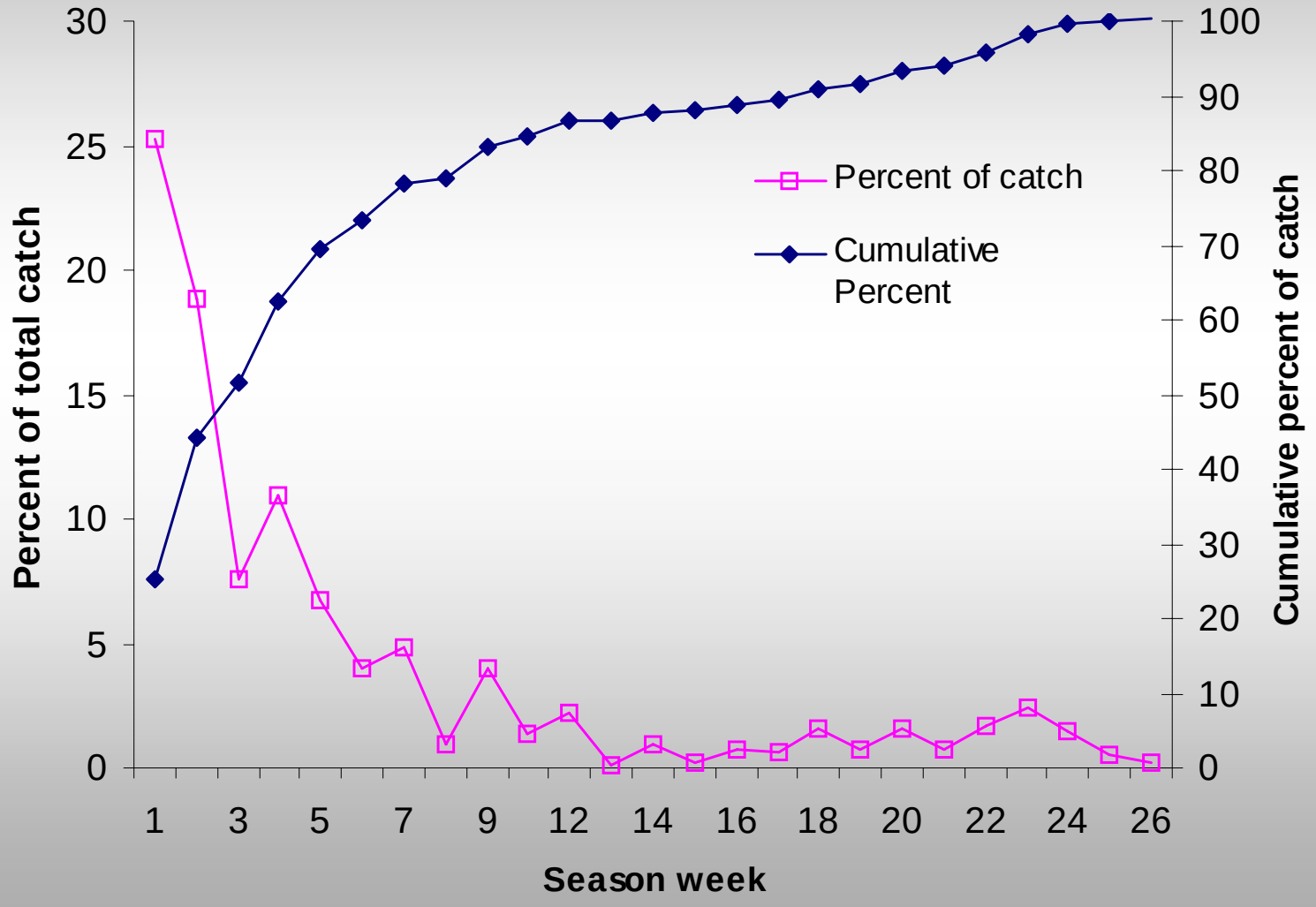

$$NNI = \frac{d(NN)}{d(ran)}$$

# STEVE MEYERS'S VIEW


70°
68°
46°
44°
Monhegan Lobster
Conservation Area
0
2
4
Kilometers

KATHLEEN
MONHEGAN

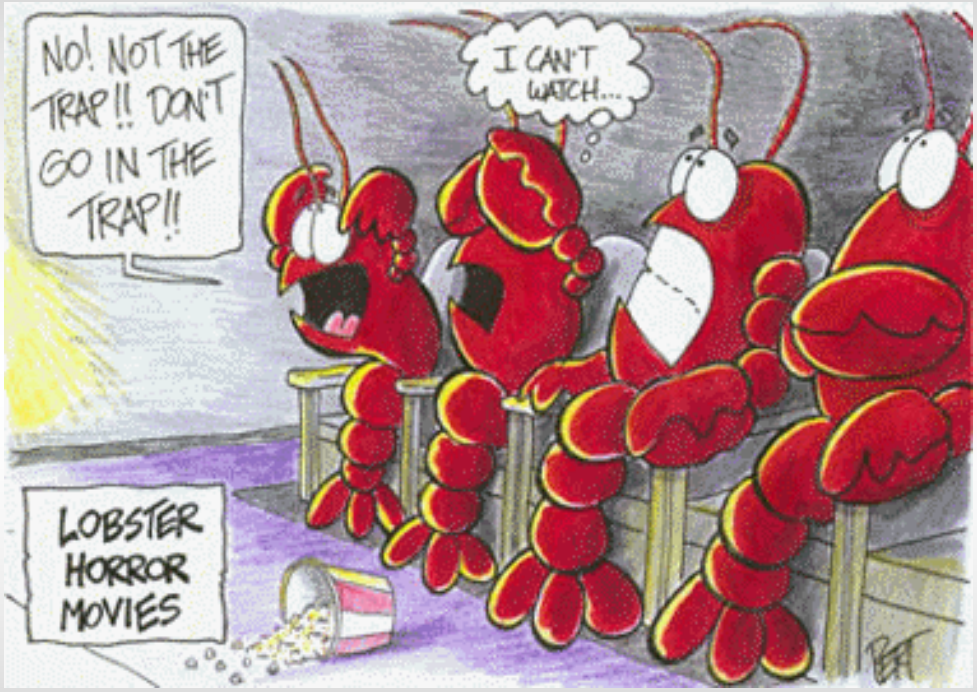
# Monhegan Cumulative Catch

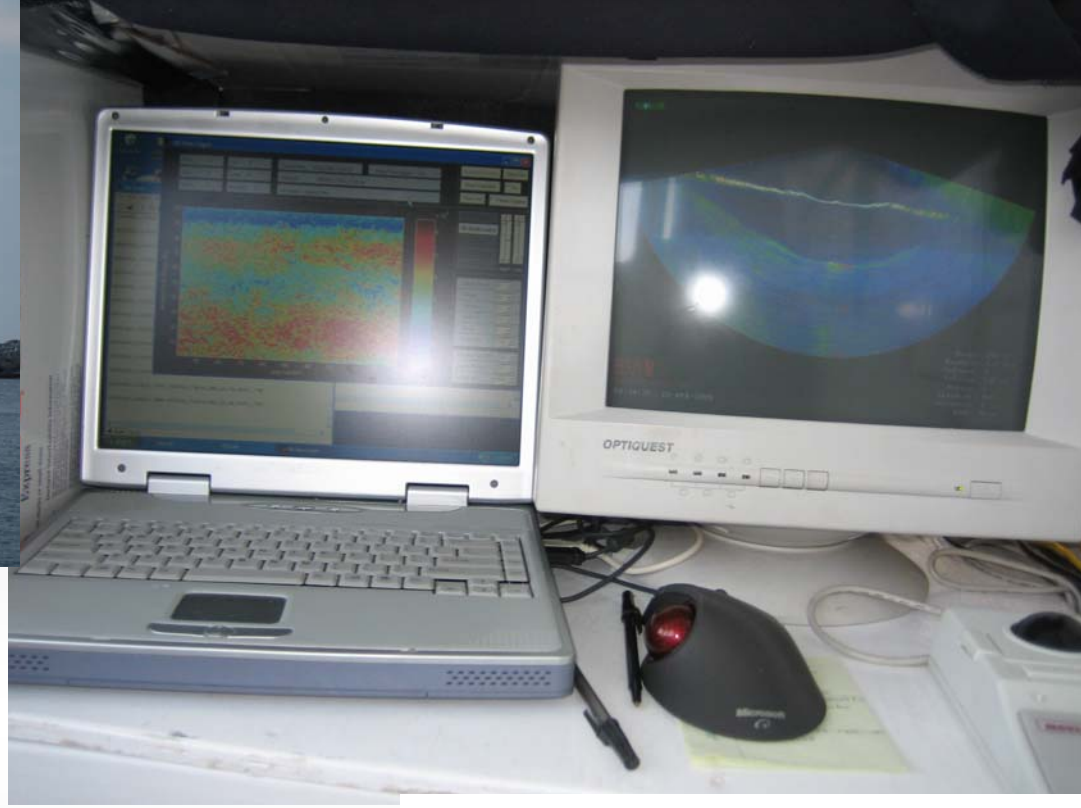


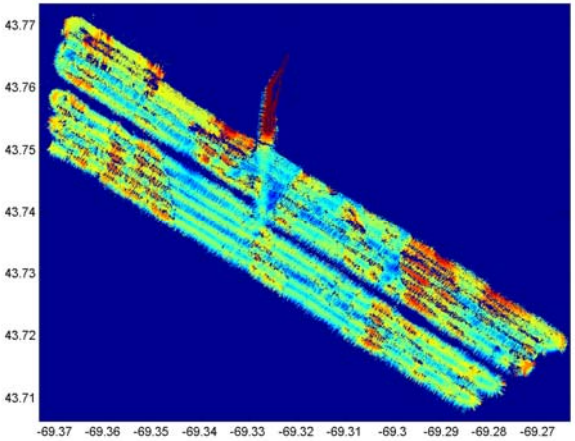
# To test the impacts of trap density

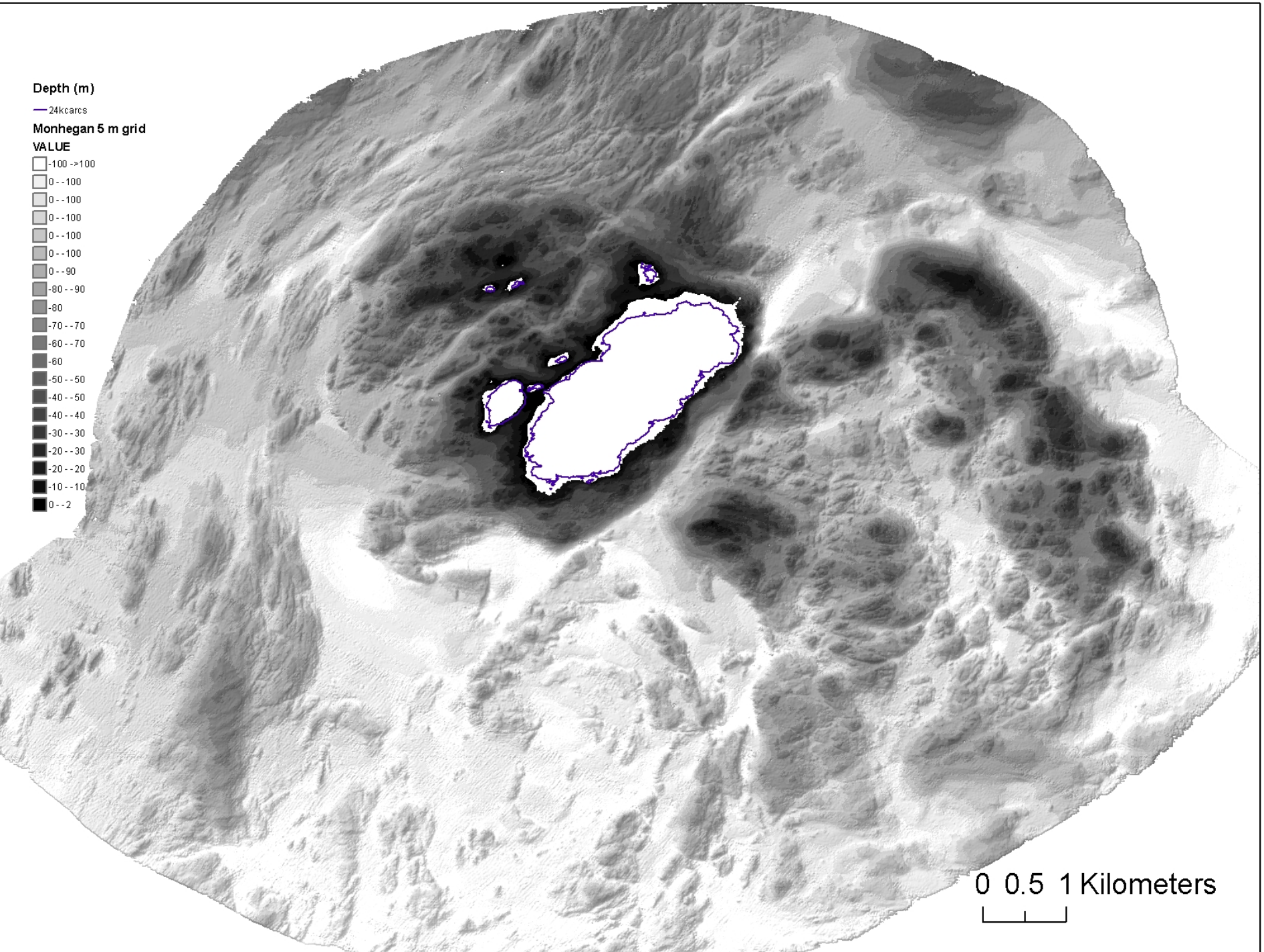
Cooperative experiments

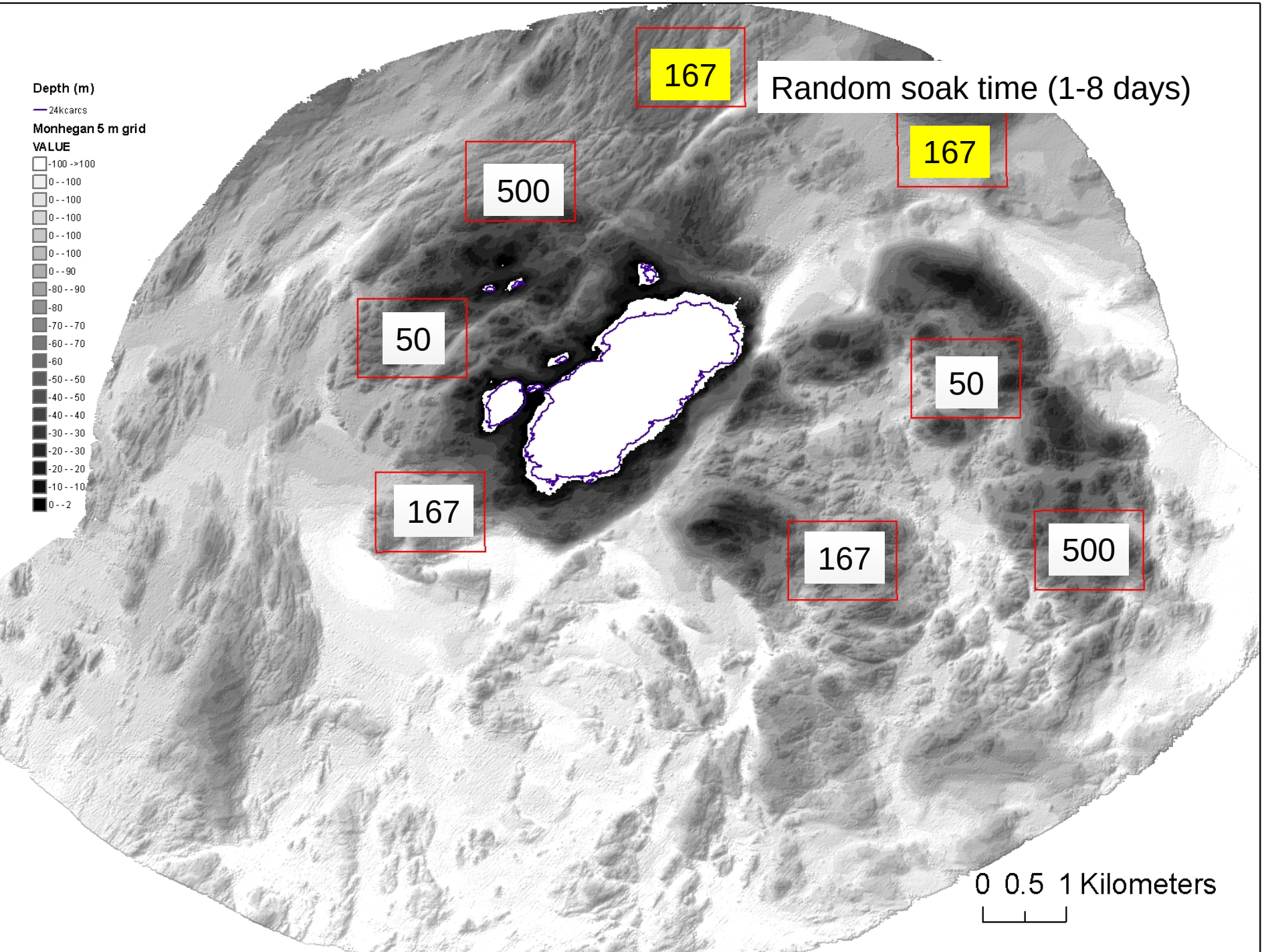
- September through October 2005
- Each lobster was batch tagged
- Legal lobster removed from area
- Recaptured lobster recorded tagged
- 2007 Experiment to further investigate soak times on catch

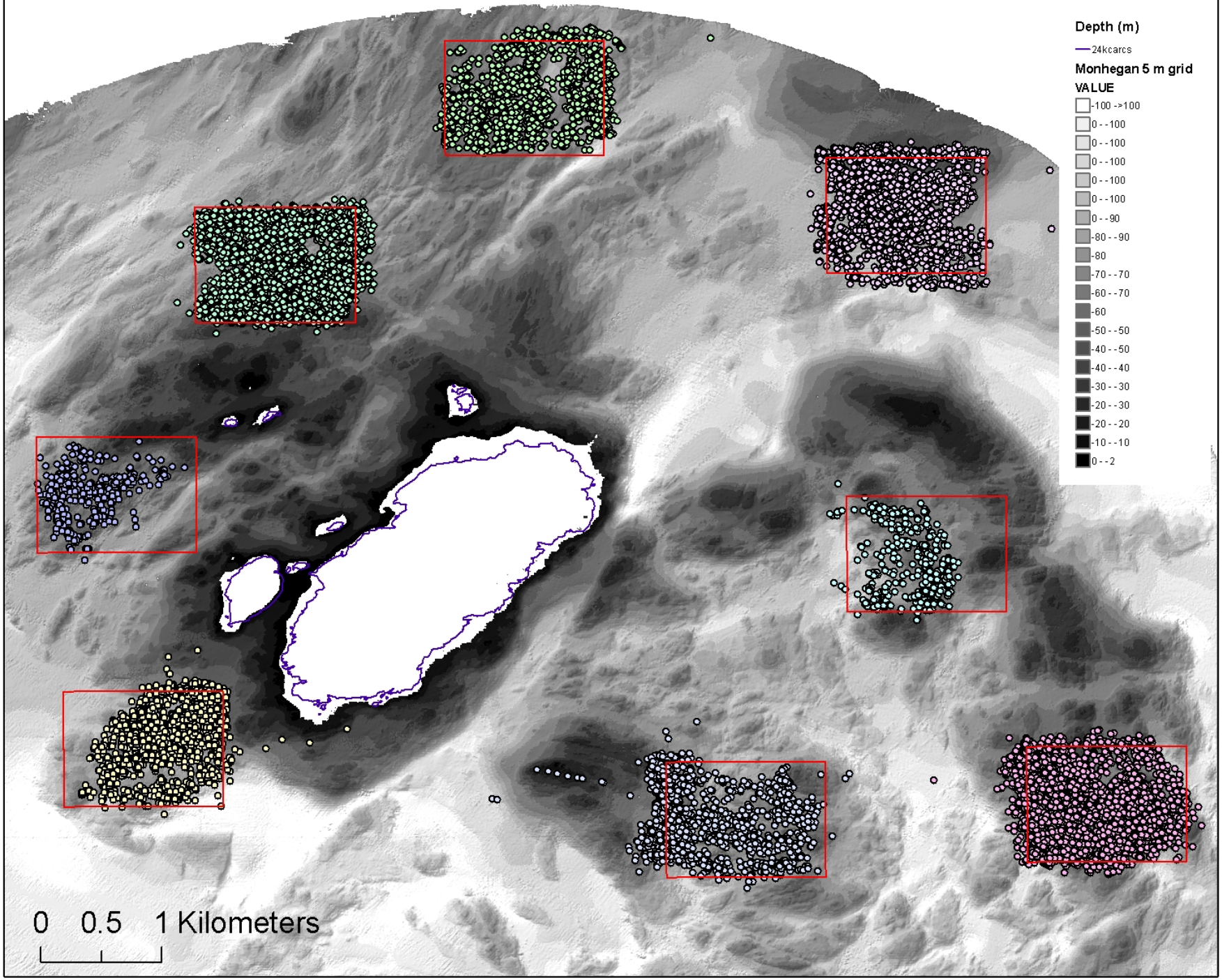


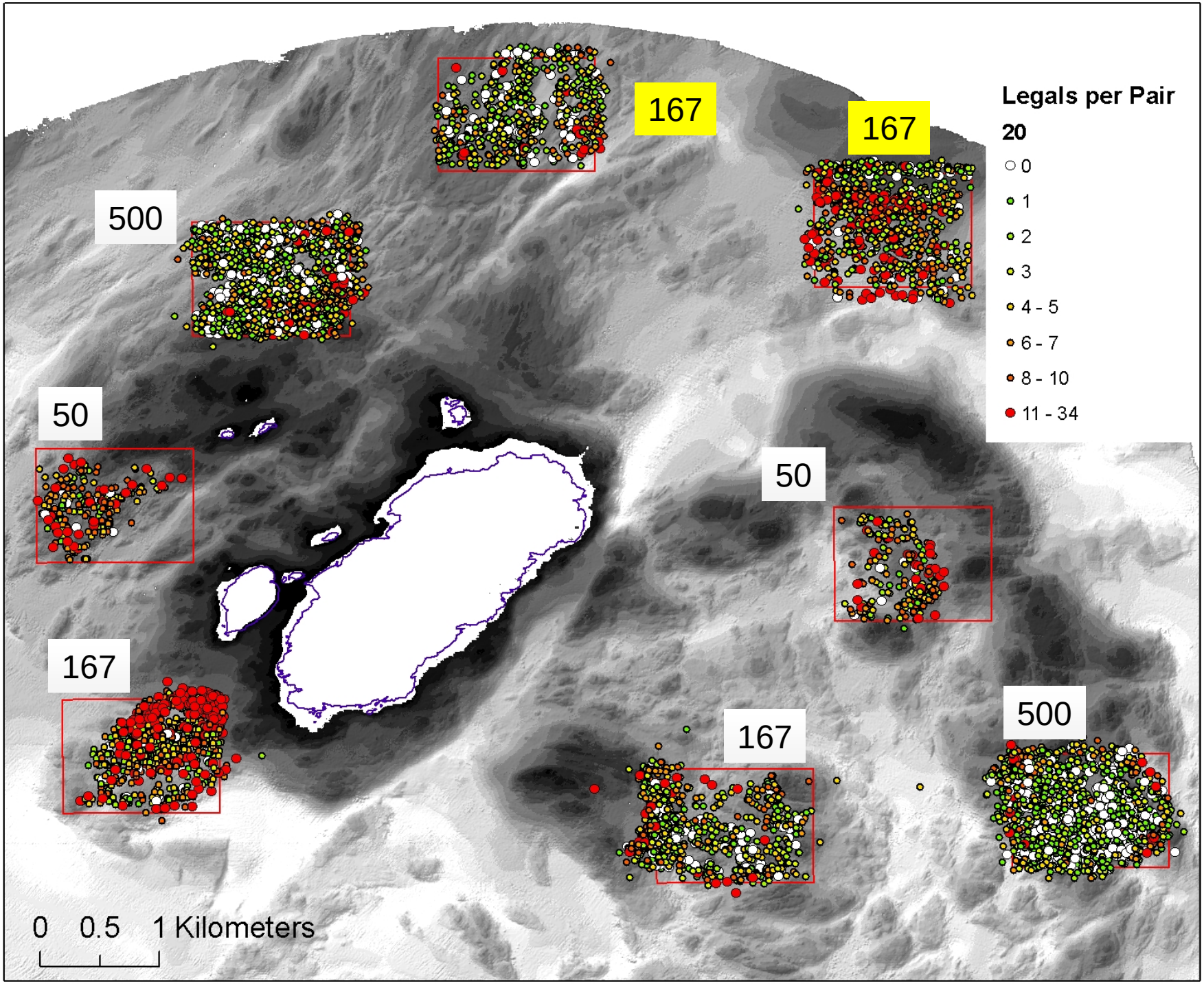

OPTIQUEST

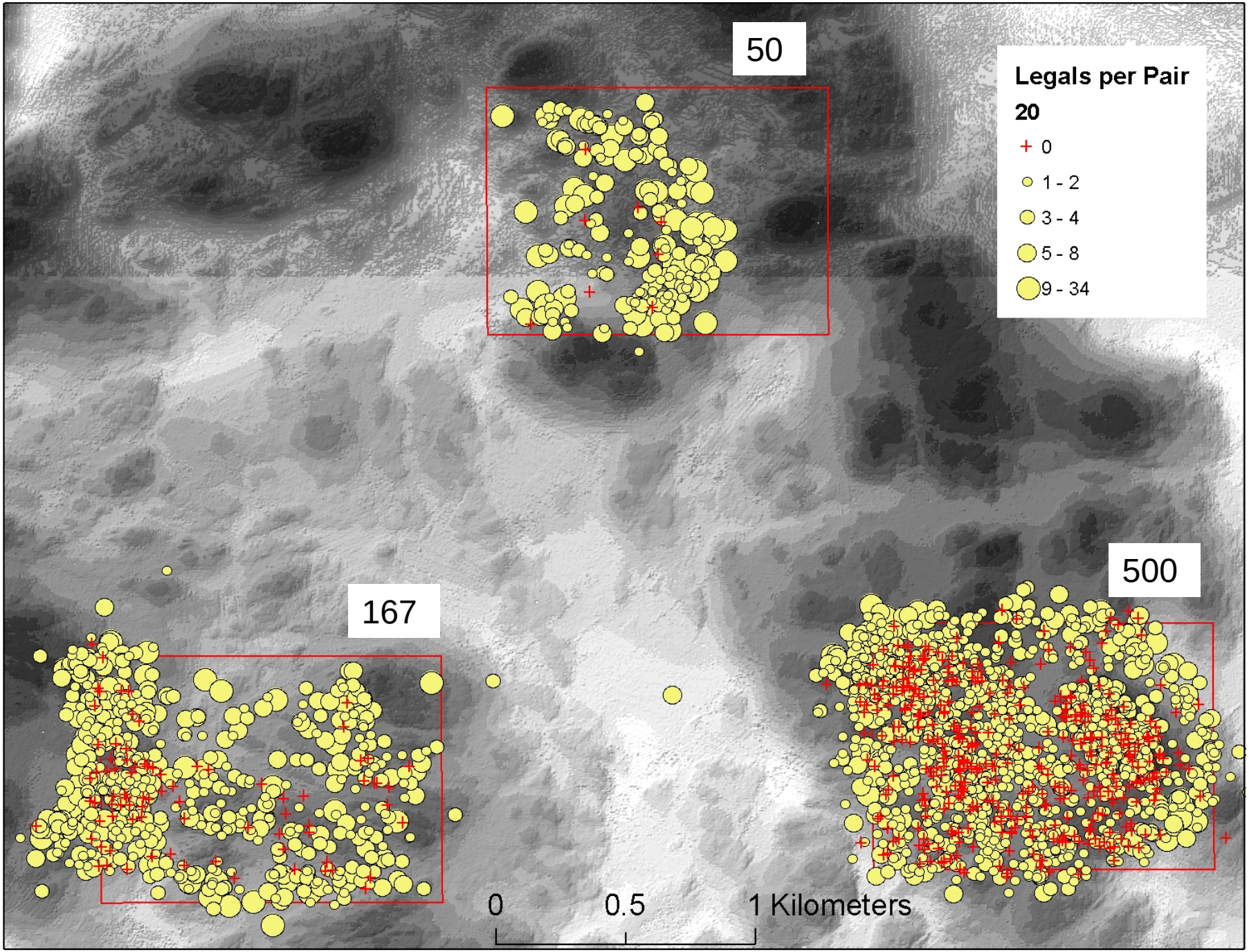

43.77
43.76
43.75
43.74
43.73
43.72
43.71
-69.37
-69.36
-69.35
-69.34
-69.33
-69.32
-69.31
-69.3
-69.29
-69.28
-69.27


Depth (m)
24kcarcs
Monhegan 5 m grid
VALUE
-100 ->100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -90
-80 - -90
-80
-70 - -70
-60 - -70
-60
-50 - -50
-40 - -50
-40 - -40
-30 - -30
-20 - -30
-20 - -20
-10 - -10
0 - -2
0 0.5 1 Kilometers

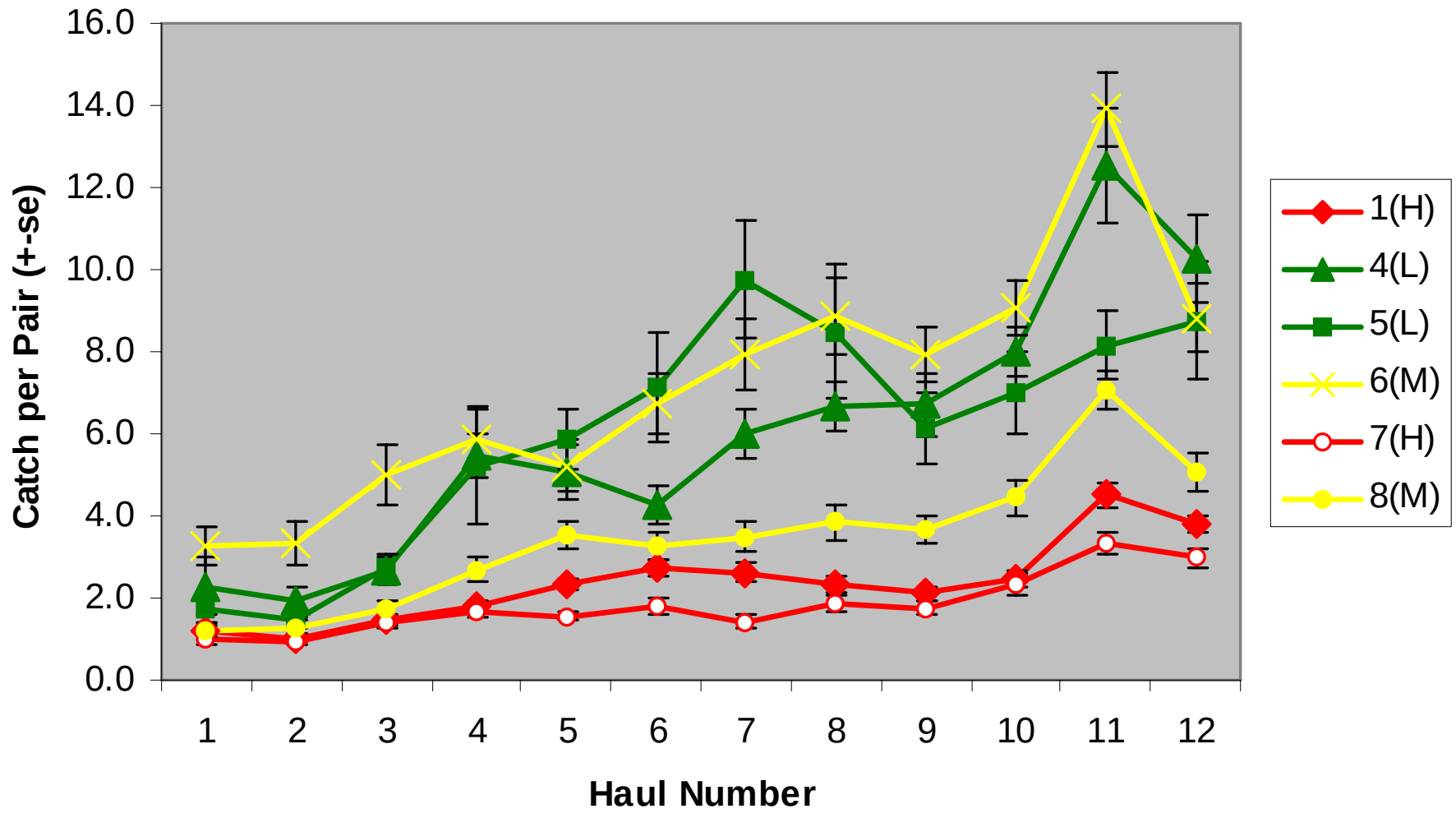

Random soak time (1-8 days)
167
167
500
50
50
167
167
500
Depth (m)
24kcarcs
Monhegan 5 m grid
VALUE
-100 ->100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -90
-80 - -90
-80
-70 - -70
-60 - -70
-60
-50 - -50
-40 - -50
-40 - -40
-30 - -30
-20 - -30
-20 - -20
-10 - -10
0 - -2
0 0.5 1 Kilometers


Depth (m)
24kcarcs
Monhegan 5 m grid
VALUE
-100 ->100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -100
0 - -90
-80 - -90
-80
-70 - -70
-60 - -70
-60
-50 - -50
-40 - -50
-40 - -40
-30 - -30
-20 - -30
-20 - -20
-10 - -10
0 - -2
0 0.5 1 Kilometers

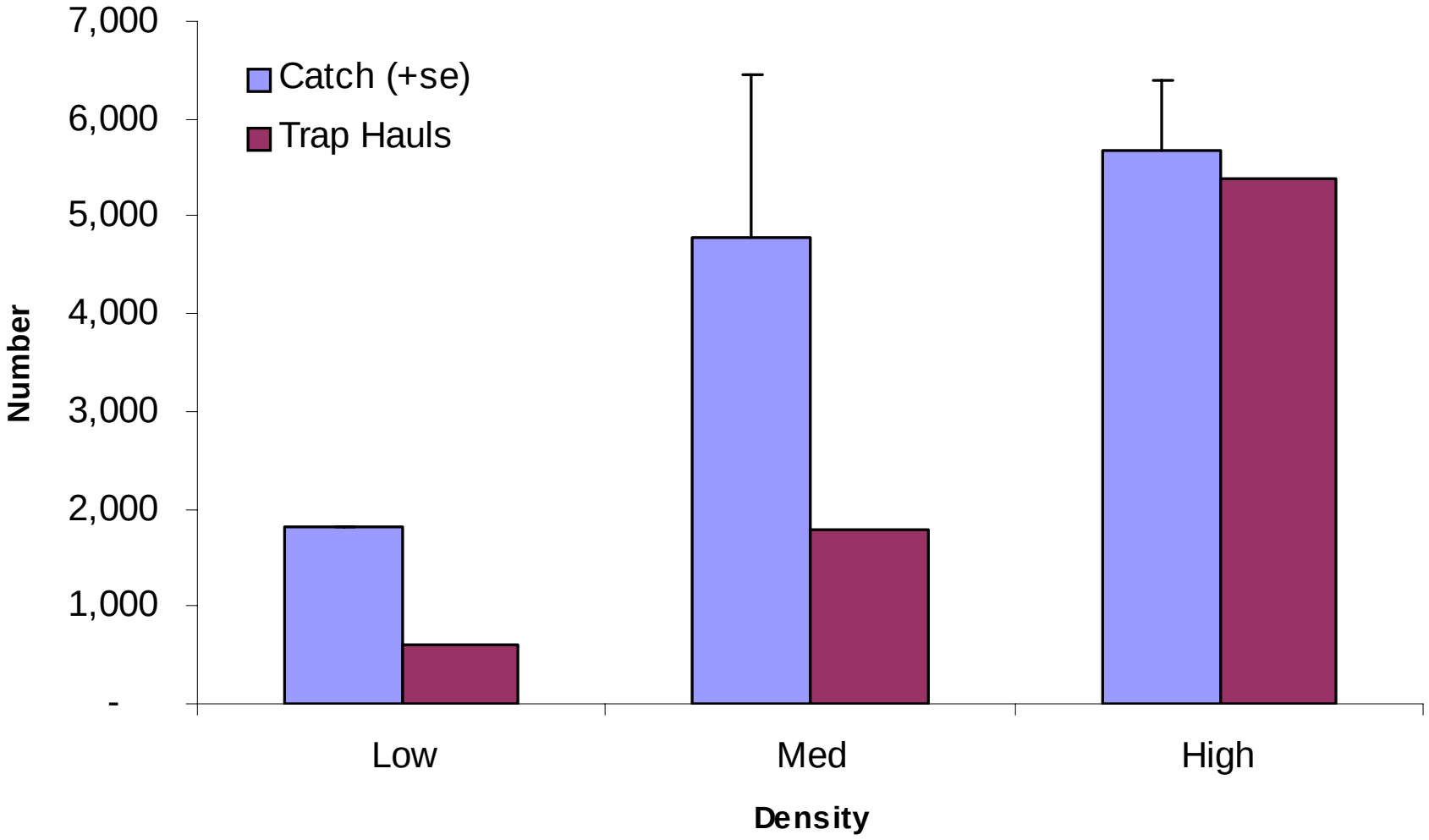

Legals per Pair
20
0
1
2
3
4 - 5
6 - 7
8 - 10
11 - 34
167
167
500
50
50
167
167
500
0 0.5 1 Kilometers


50
167
500
Legals per Pair
20
0
1 - 2
3 - 4
5 - 8
9 - 34
0
0.5
1 Kilometers

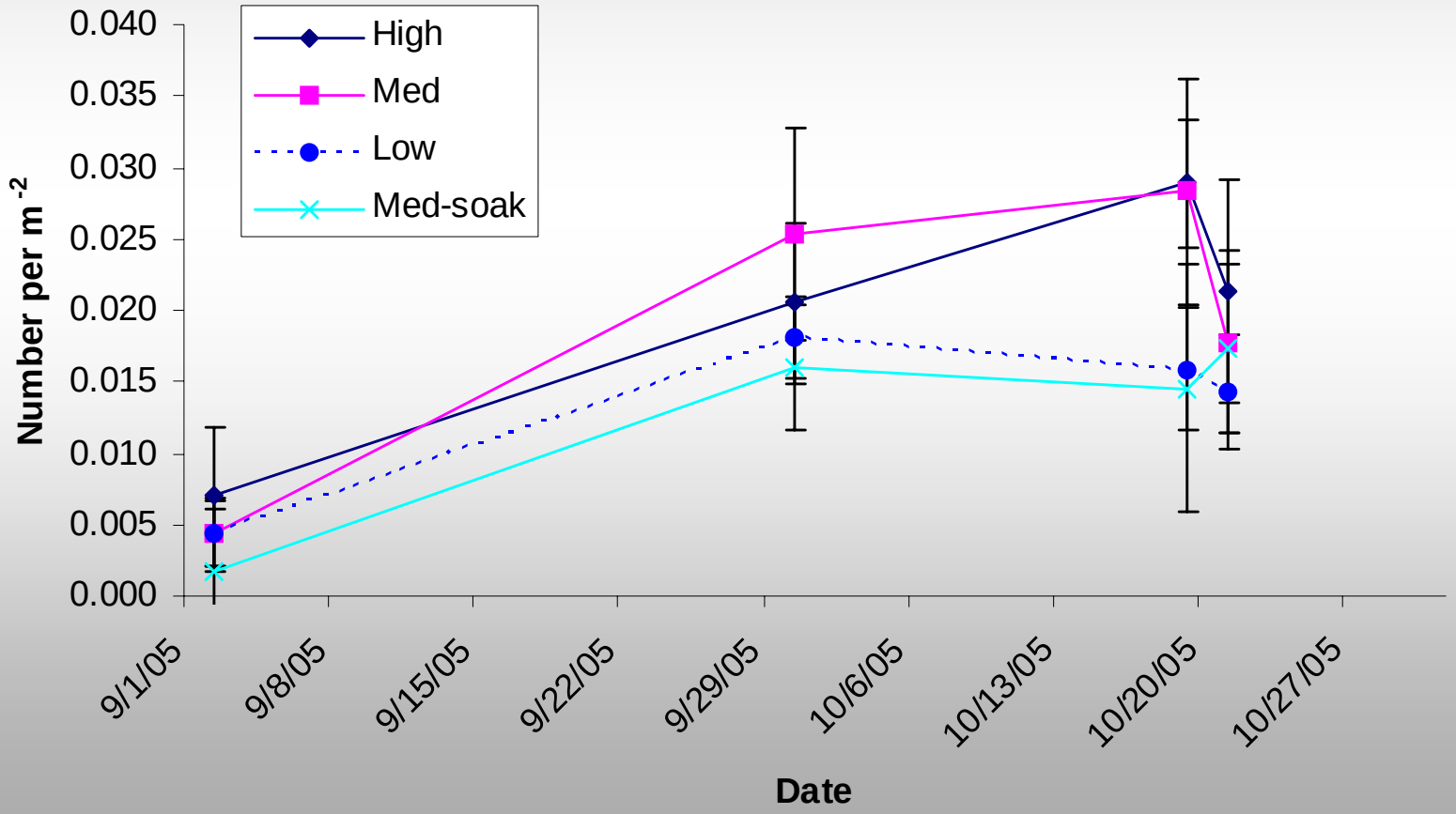
# Catch per Pair by Area



# Cumulative Effects



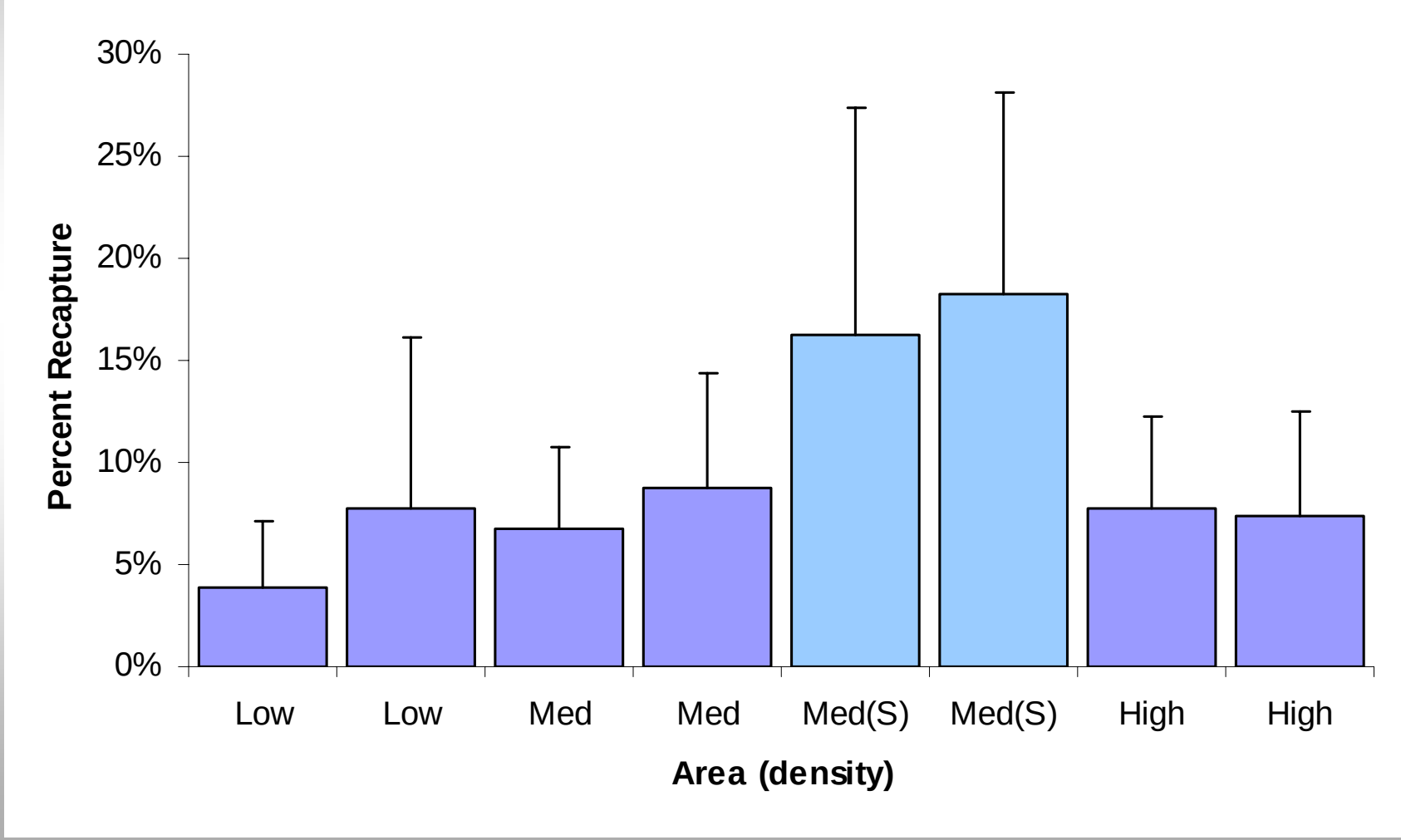
# Abundance Estimates



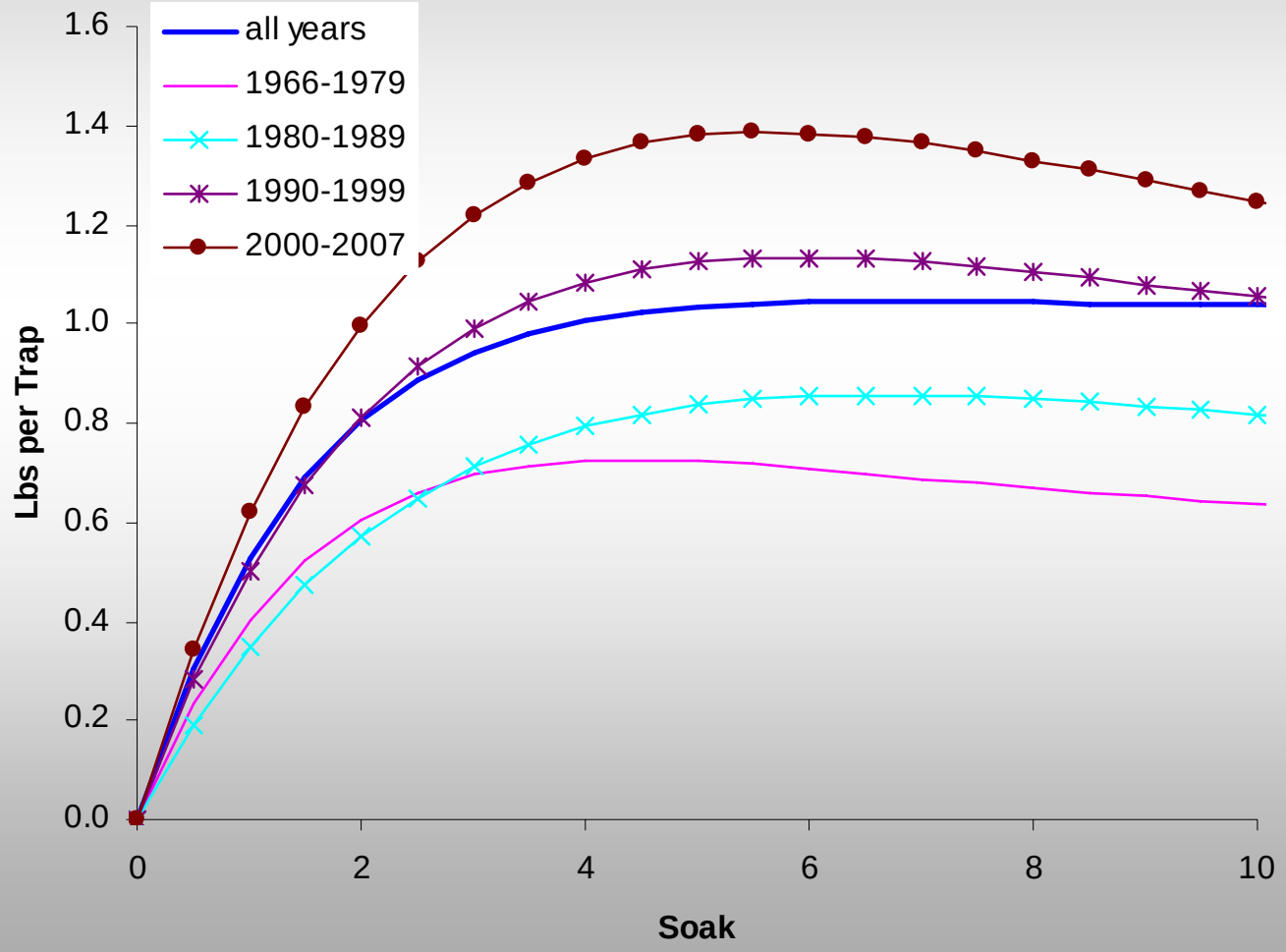
PORT CLYDE, MAINE

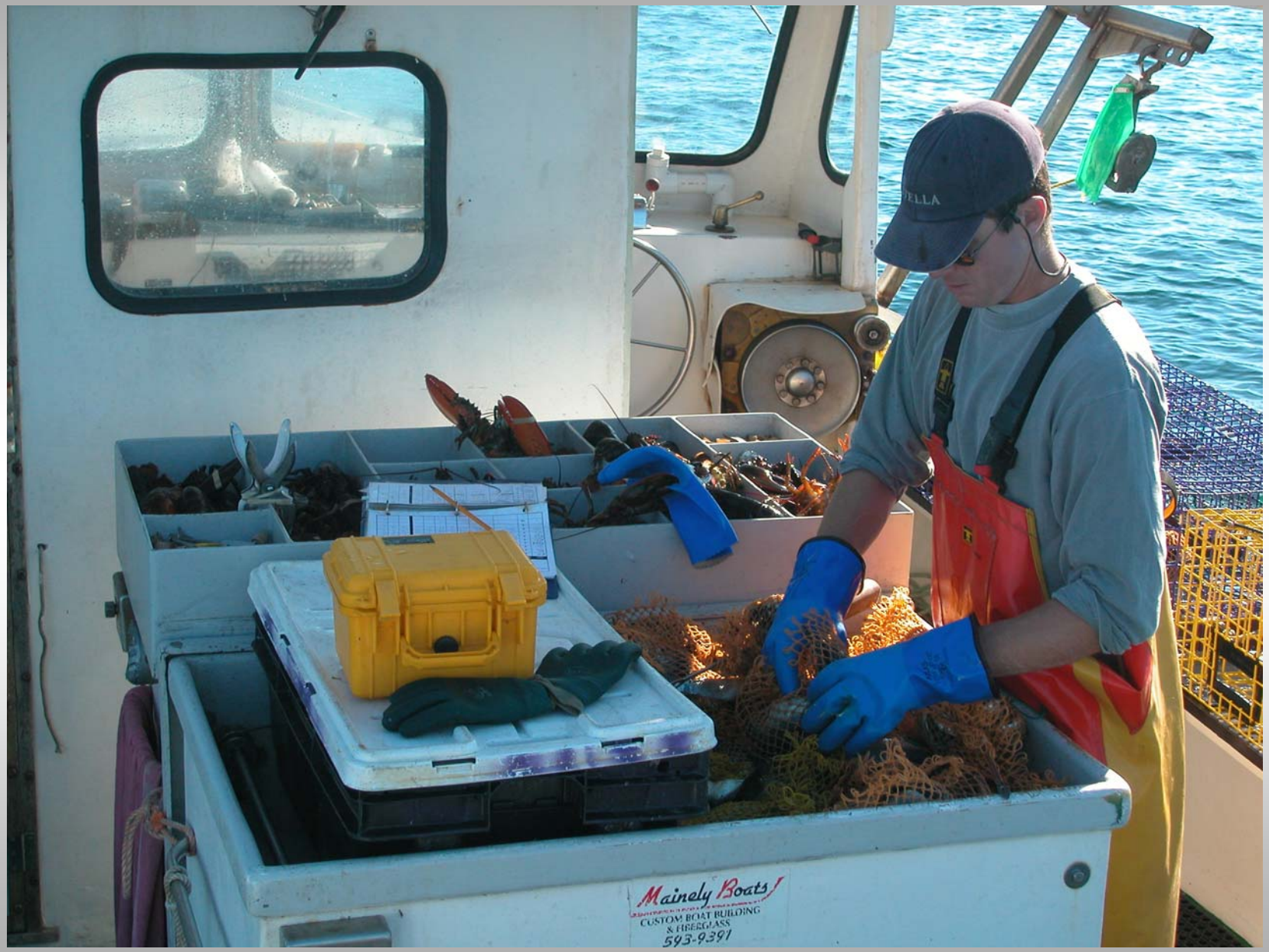
WESMAR

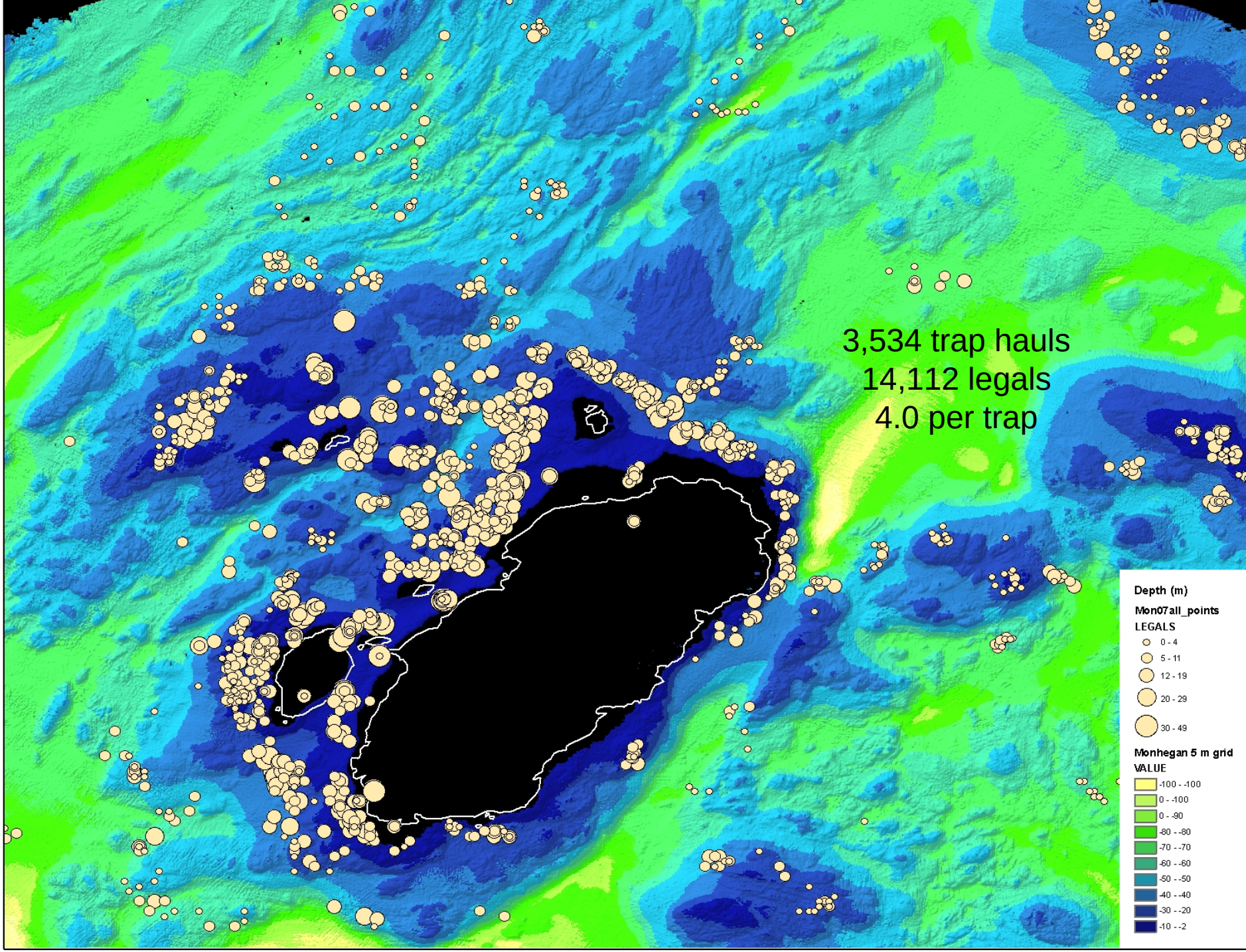
# First Day After Tagging Recaptures

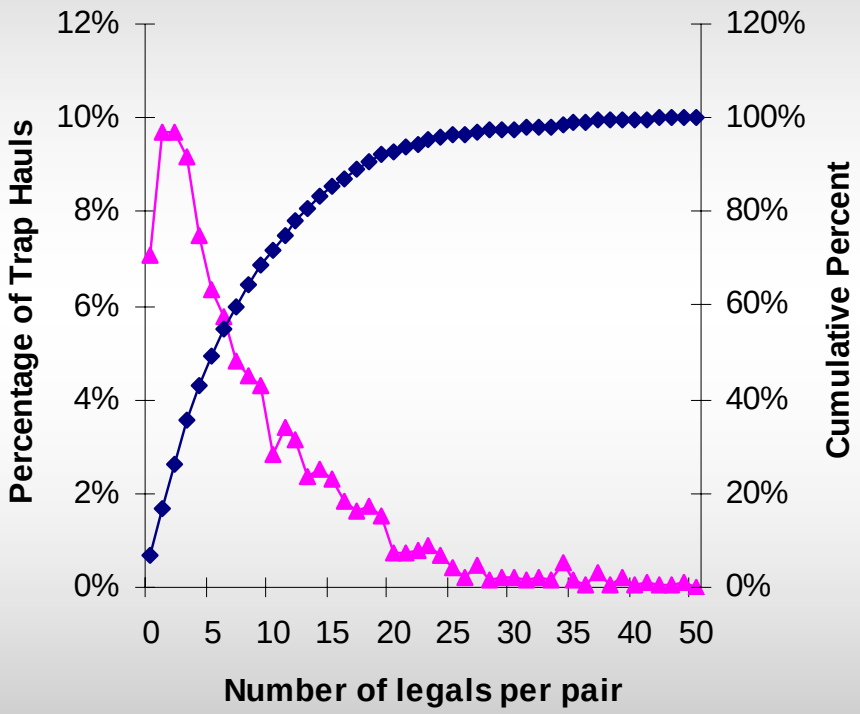


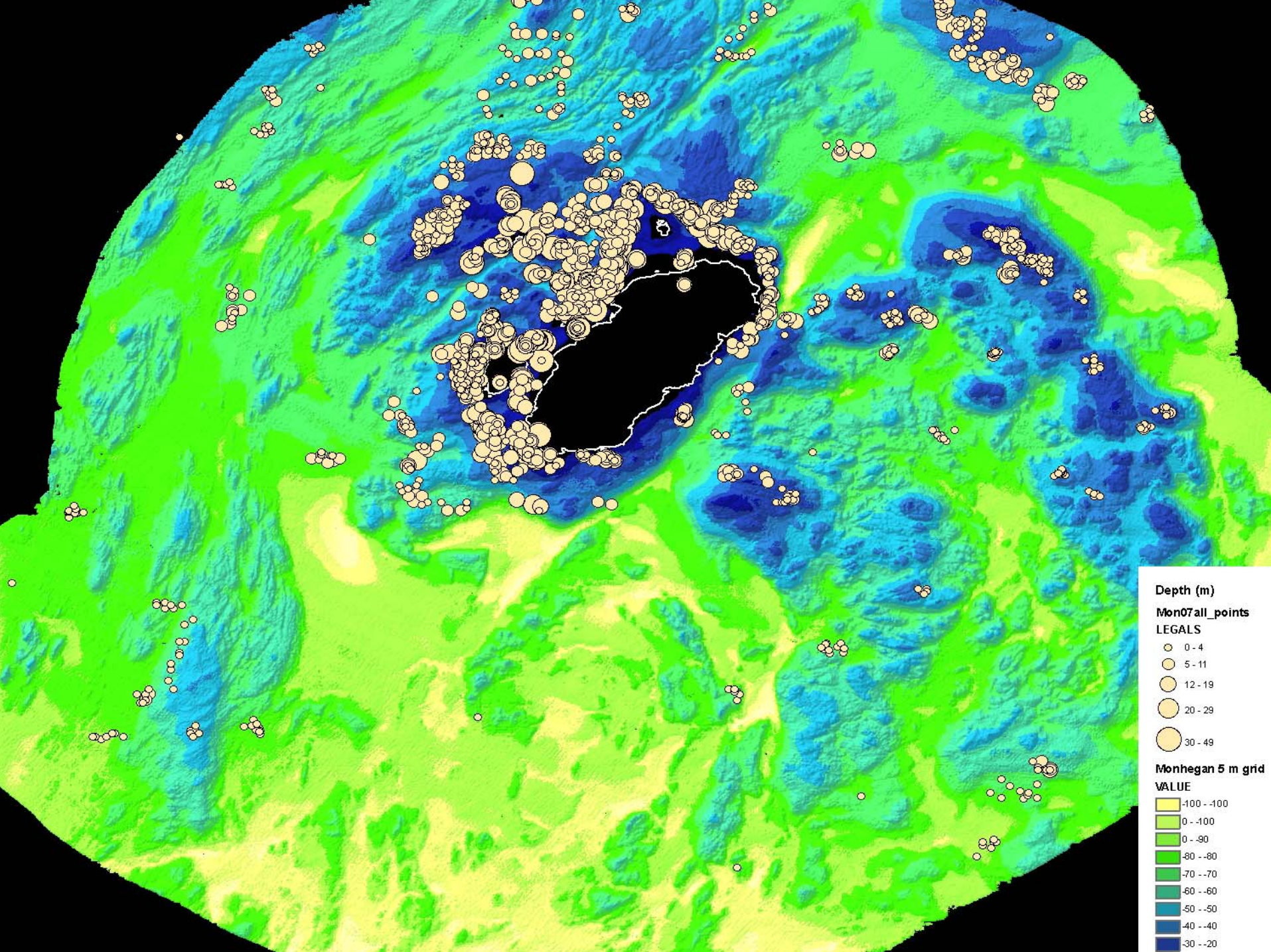
# Lobster Fishery: Catch and Soak Time



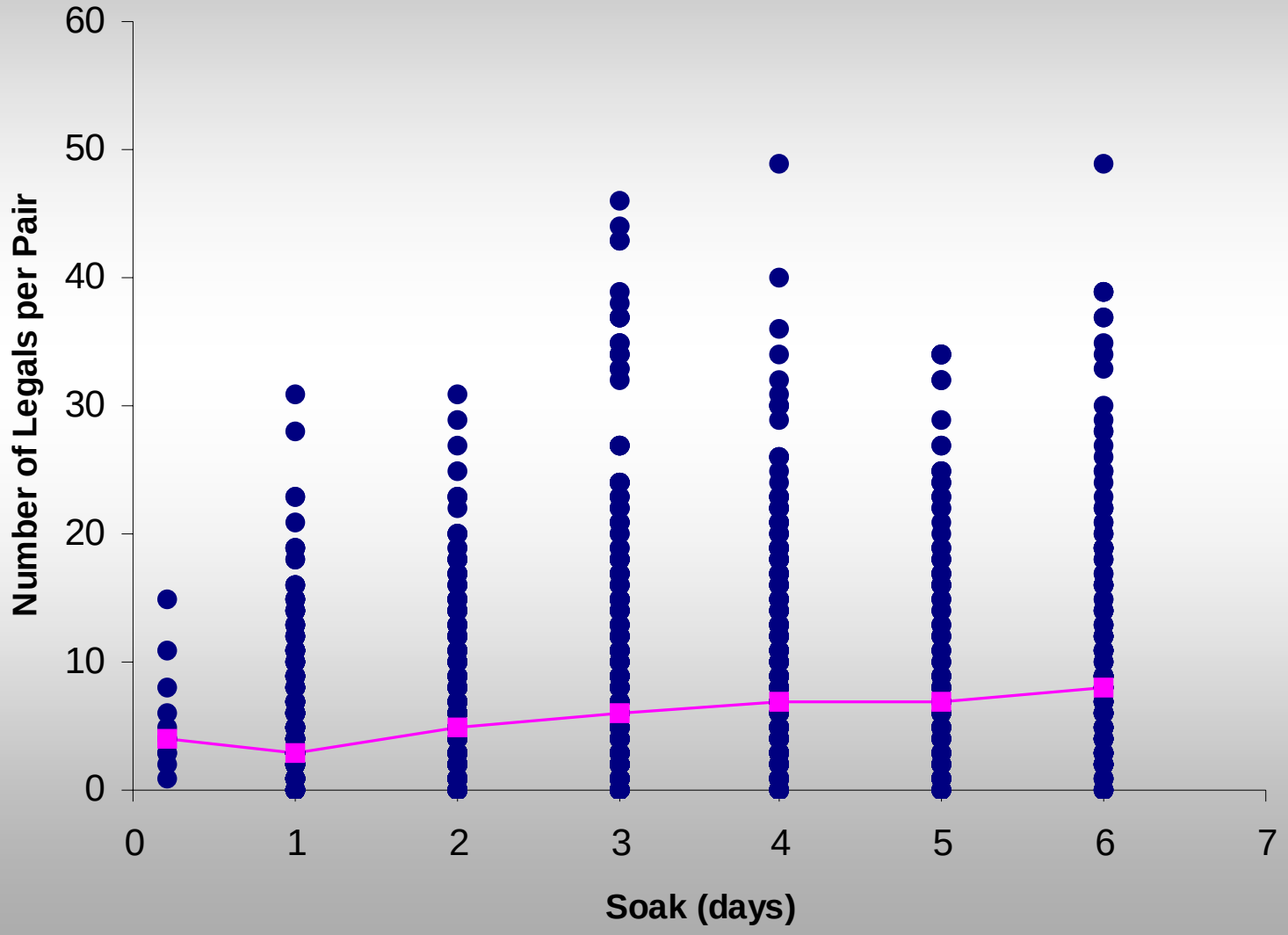

Mainely Boats
CUSTOM BOAT BUILDING
& FIBERGLASS
593-9391


3,534 trap hauls
14,112 legals
4.0 per trap
Depth (m)
Mon07all_points
LEGALS
0 - 4
5 - 11
12 - 19
20 - 29
30 - 49
Monhegan 5 m grid
VALUE
-100 - -100
0 - -100
0 - -90
-80 - -80
-70 - -70
-60 - -60
-50 - -50
-40 - -40
-30 - -20
-10 - -2

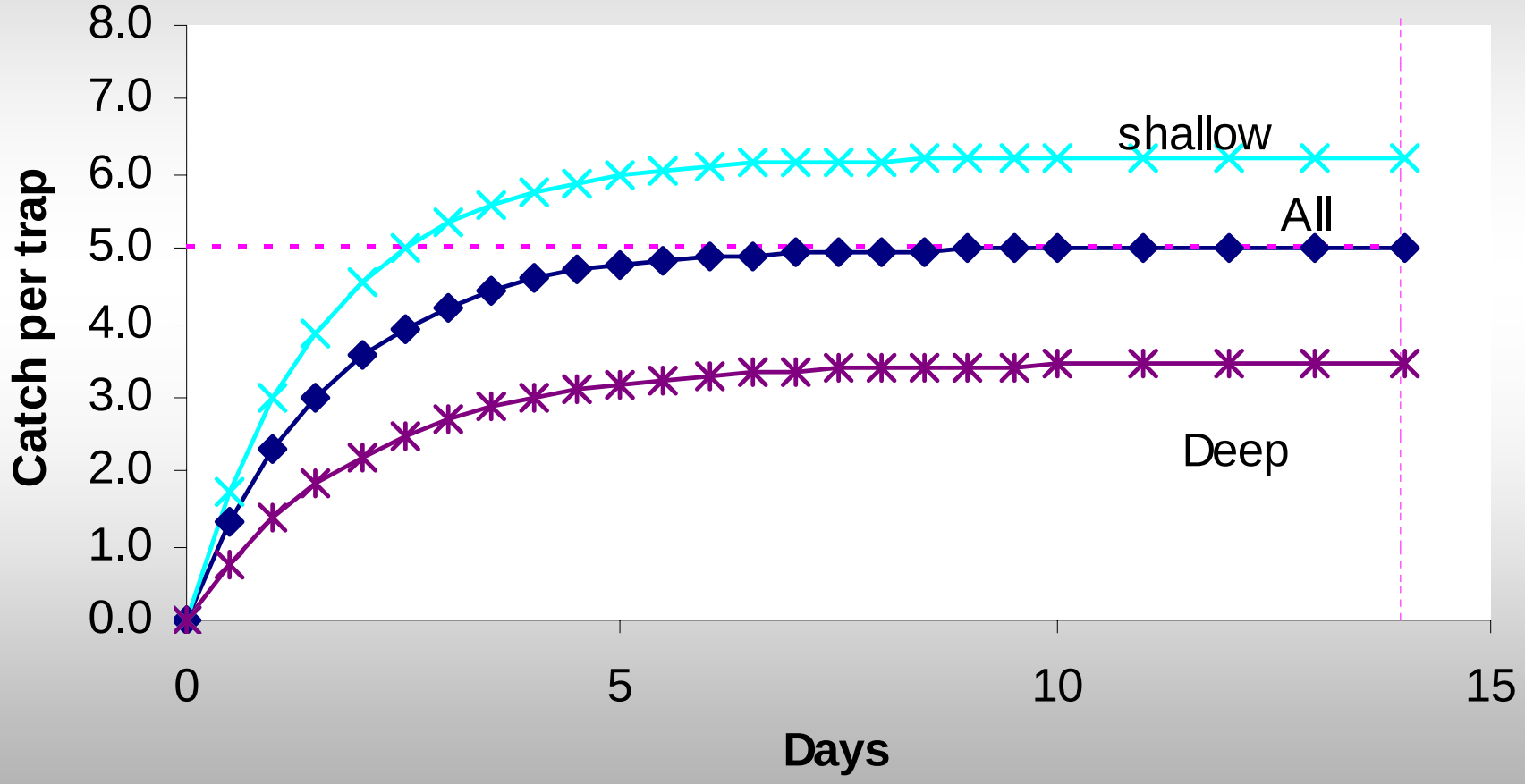

12%
10%
8%
6%
4%
2%
0%
120%
100%
80%
60%
40%
20%
0%
0
5
10
15
20
25
30
35
40
50
Percentage of Trap Hauls
Cumulative Percent
Number of legals per pair


Depth (m)
Mon07all_points
LEGALS
0 - 4
5 - 11
12 - 19
20 - 29
30 - 49
Monhegan 5 m grid
VALUE
-100 - -100
0 - -100
0 - -90
-80 - -80
-70 - -70
-60 - -60
-50 - -50
-40 - -40
-30 - -20

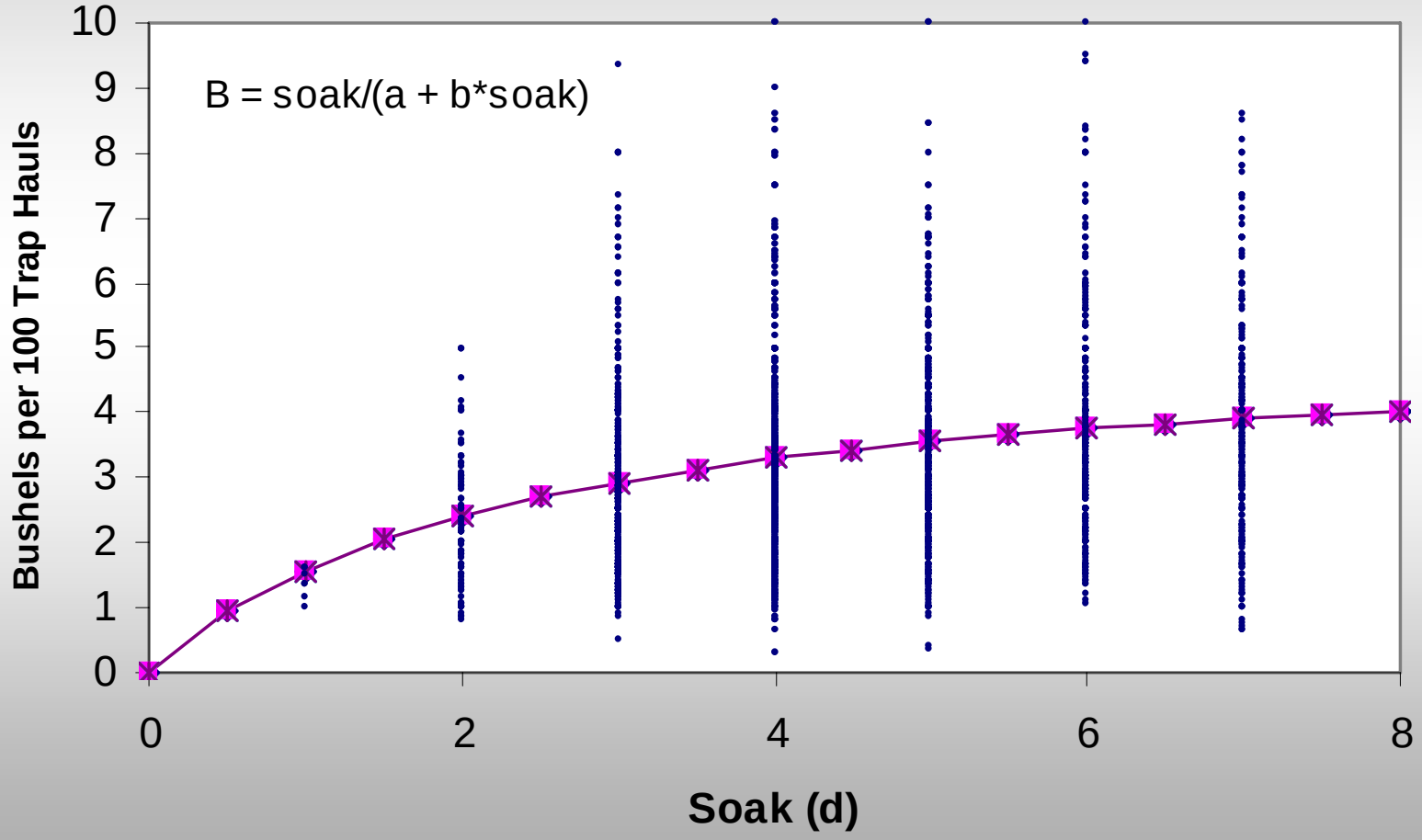
# Average Catch with Soak



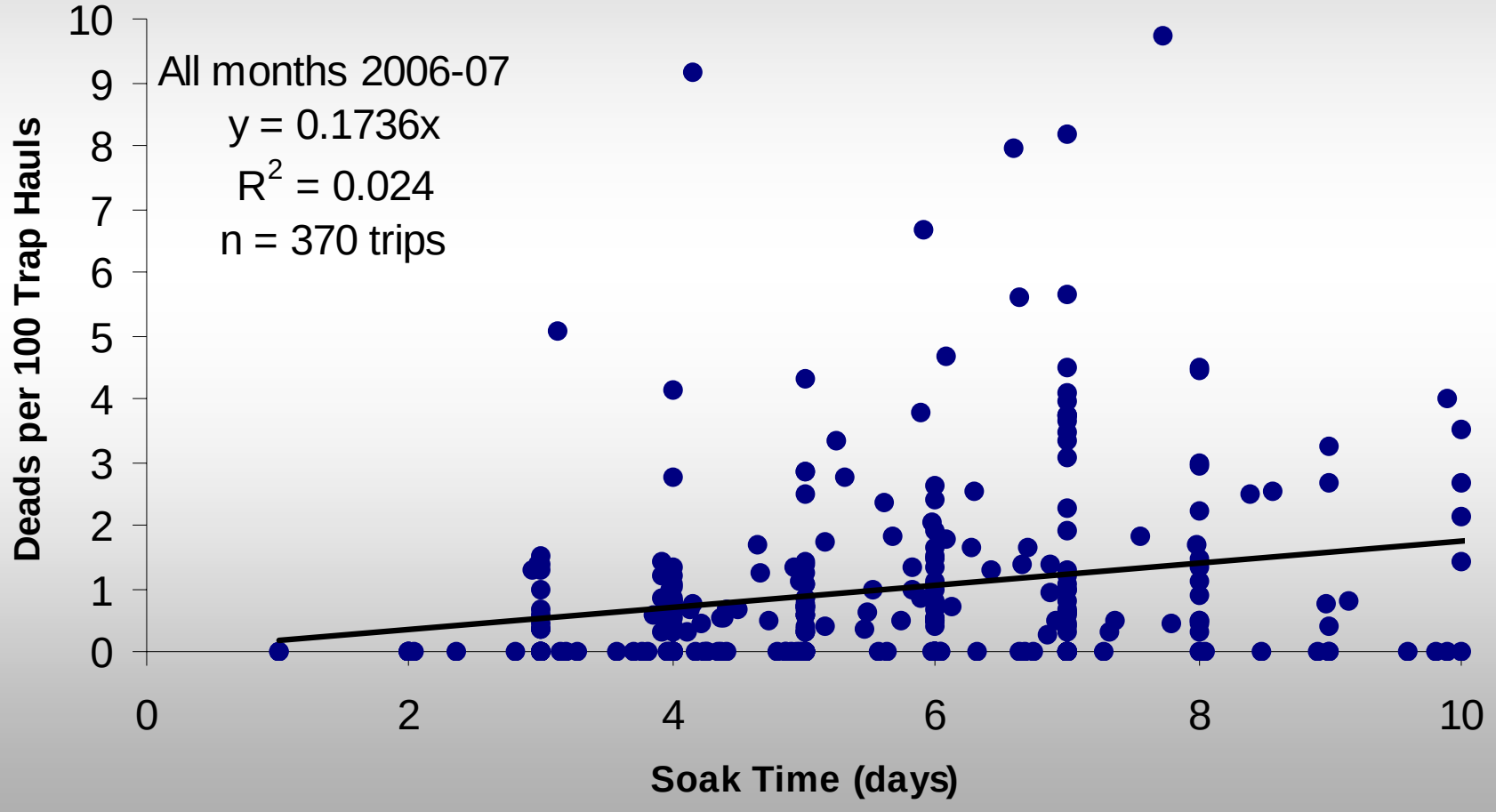
# Experimental Catch and Soak



# Baits used and Soak Time



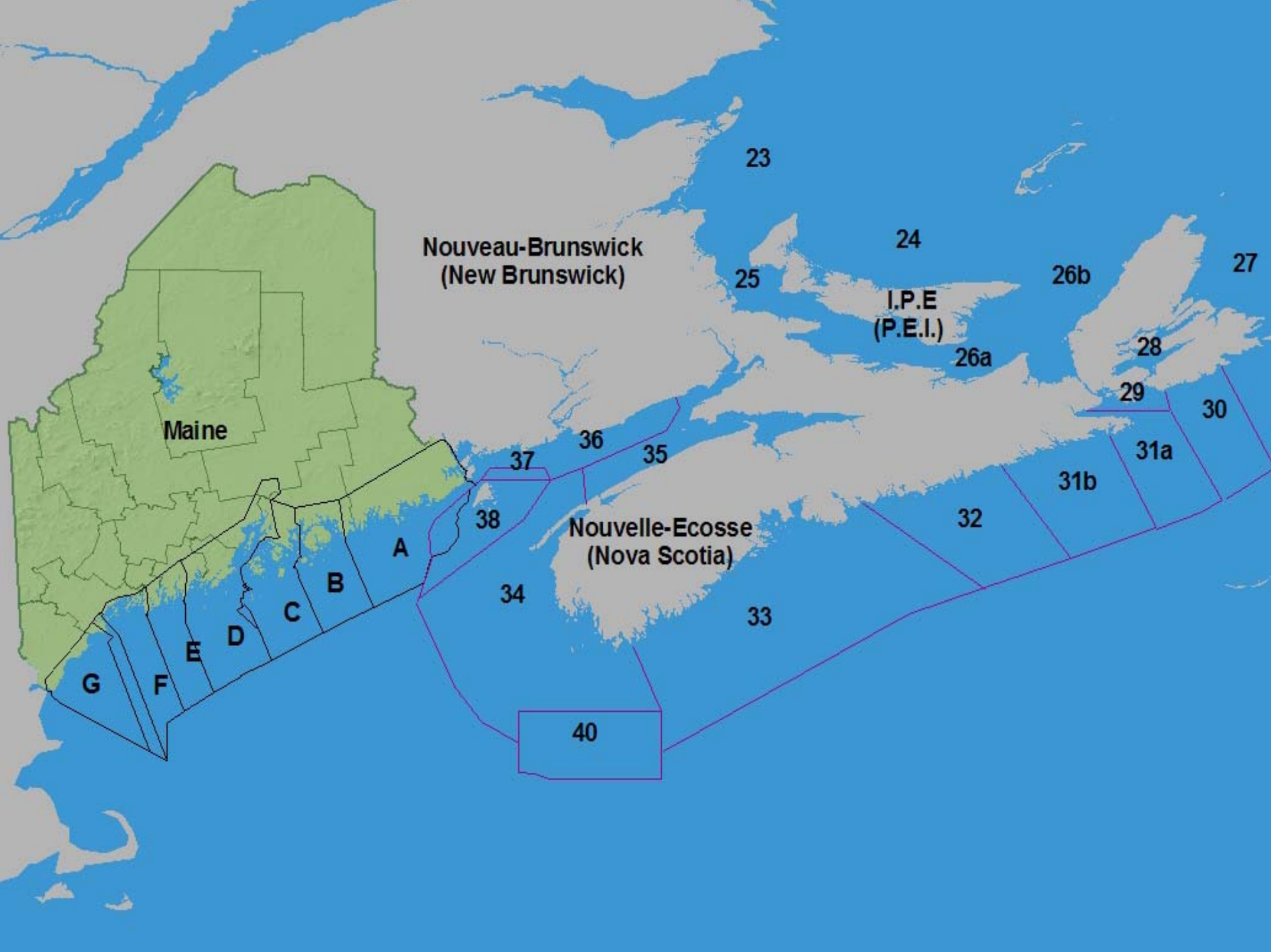
# Dead Lobsters in Traps



| | Scenario 1 | Scenario 2 | Scenario 3 |
|---|---|---|---|
| Traps | 800 | 400 | 200 |
| | | | |
| Total Pounds Caught | 30,000 | 30,000 | 30,000 |
| Total Fishing Days (May-Dec) | 240 | 240 | 240 |
| Avgerage  soak time (days) | 6 | 6 | 3 |
| Bushel Bait per 100 Trap Hauls | 3.74 | 3.74 | 2.94 |
| Price per Bushel Bait | $ 25 | $ 25 | $ 25 |
| | | | |
| Total Trap Hauls | 32,000 | 16,000 | 16,000 |
| Average Pounds per Trap Haul | 0.9 | 1.9 | 1.9 |
| Total Bait Used | 1,197 | 598 | 470 |
| | | | |
| Total Bait Bill | $ 29,920 | $ 14,960 | $ 11,760 |
| Savings | | $ 14,960 | $ 18,160 |
| | | | |
| Deads per 100 trap hauls | 1.04 | 1.04 | 0.52 |
| losses (numbers) | 333 | 166 | 83 |
| losses (pounds) | 433 | 216 | 108 |

# Experimental Implications

- Local Impacts on Catch Rates
- Migration > Depletion
- Lower Trap Densities = Higher Catch Rates
  - Not all areas were created equally
- **Cumulative impacts are about the same**
- **Catch is impacted by soak**
- $$$ savings potential with reducing traps
  - Biological impacts would be neutral


Nouveau-Brunswick
(New Brunswick)
Maine
Nouvelle-Ecosse
(Nova Scotia)
I.P.E
(P.E.I.)
23
24
25
26a
26b
27
28
29
30
31a
31b
32
33
34
35
36
37
38
40
A
B
C
D
E
F
G

# Lobster Effort Survey

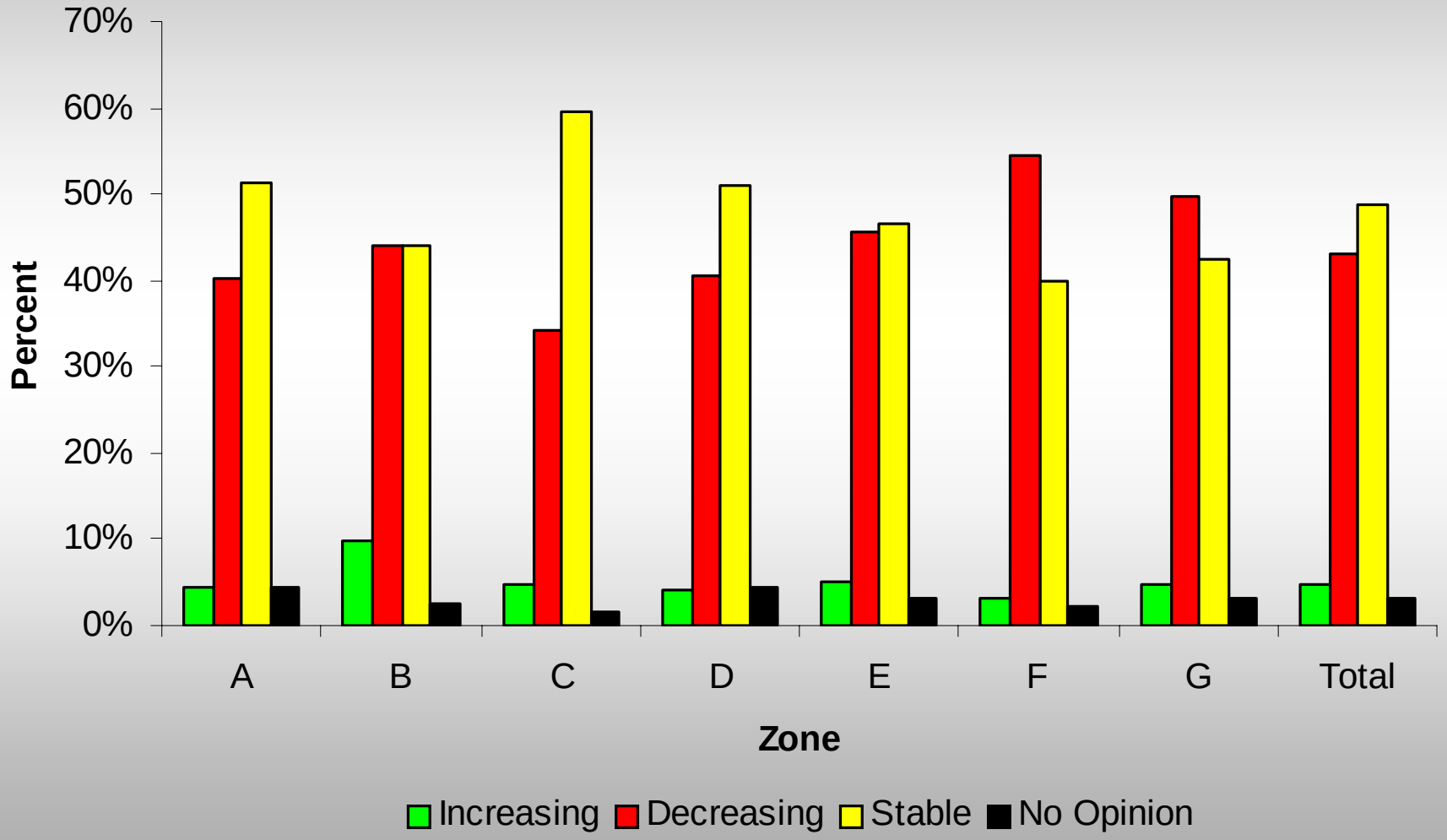
- The questionnaire was sent to 6,832 license holders and 2,381 responded, a 35% return rate.

| | | Increasing | Decreasing | Stable | No Opinion |
|---|---|---|---|---|---|
| 1 | Based on your fishing experience do you feel the lobster resource is: | **5%** | **43%** | **49%** | **3%** |

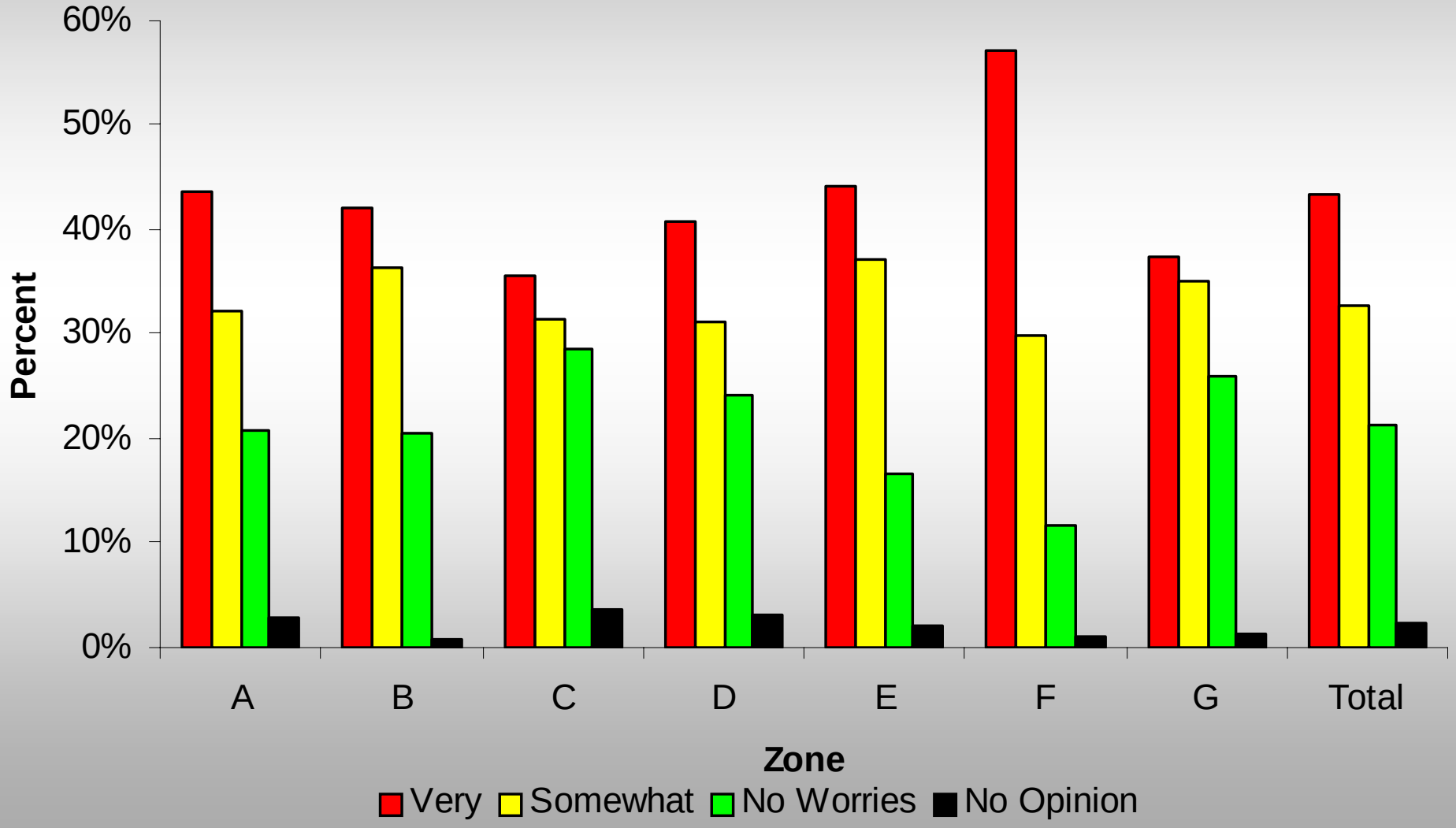
| | | Very Much | Somewhat | Not Much | No Opinion |
|---|---|---|---|---|---|
| 2 | How concerned are you that the cost associated with the amended Atlantic Large Whale Take Reduction Plan (ALWTRP) could impact how you fish? | **55%** | **23%** | **19%** | **3%** |
| 3 | Could the supply or price of herring for bait impact your decisions on how to fish? | **58%** | **32%** | **8%** | **1%** |

| | | Very | Somewhat | No Worries | No Opinion |
|---|---|---|---|---|---|
| 4 | How worried are you about the number of traps fished in your area? | **43%** | **33%** | **21%** | **2%** |

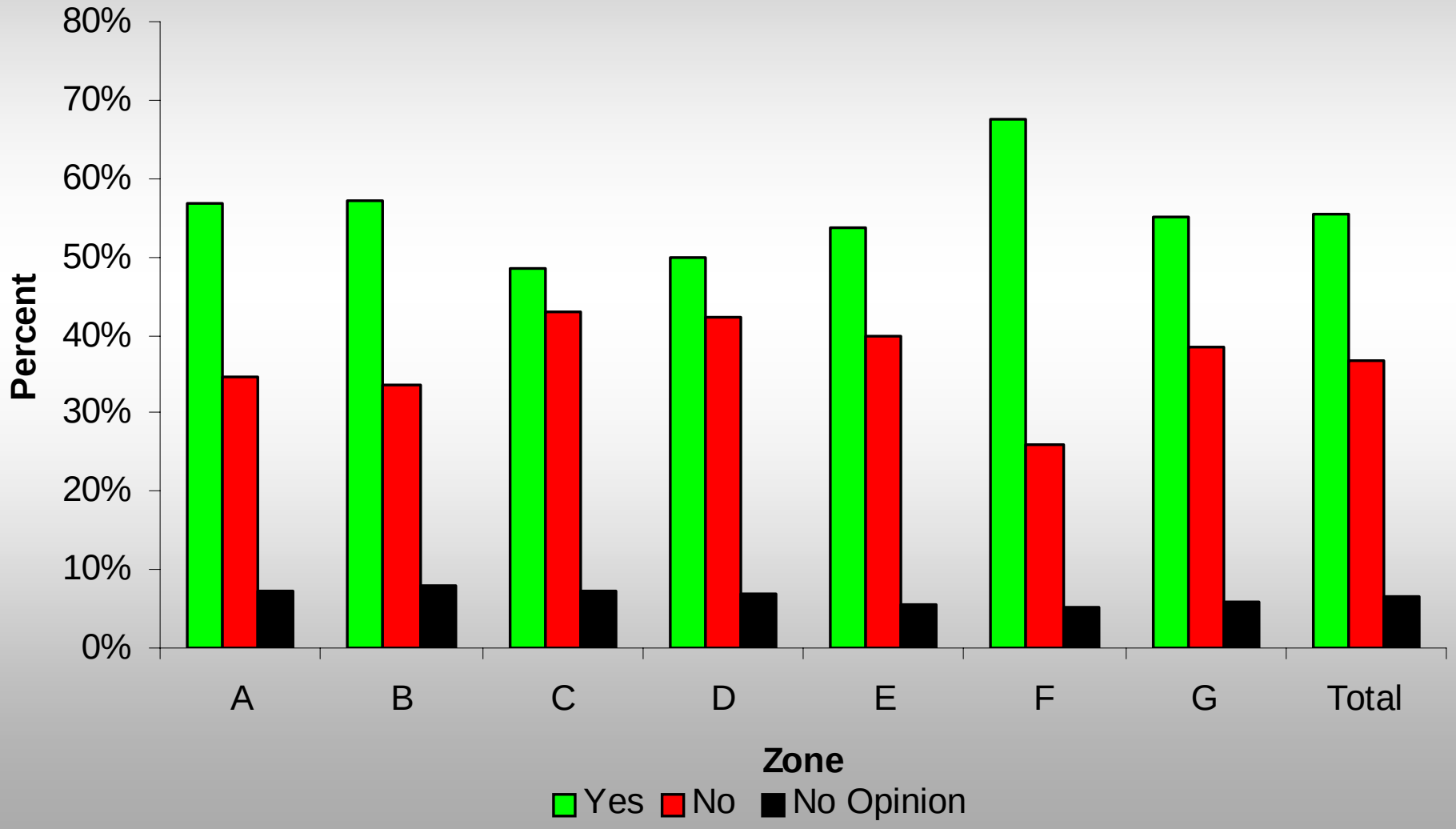
# 1. Based on your fishing experience do you feel the lobster resource is:



# 4. How worried are you about the number of traps fished in your area?

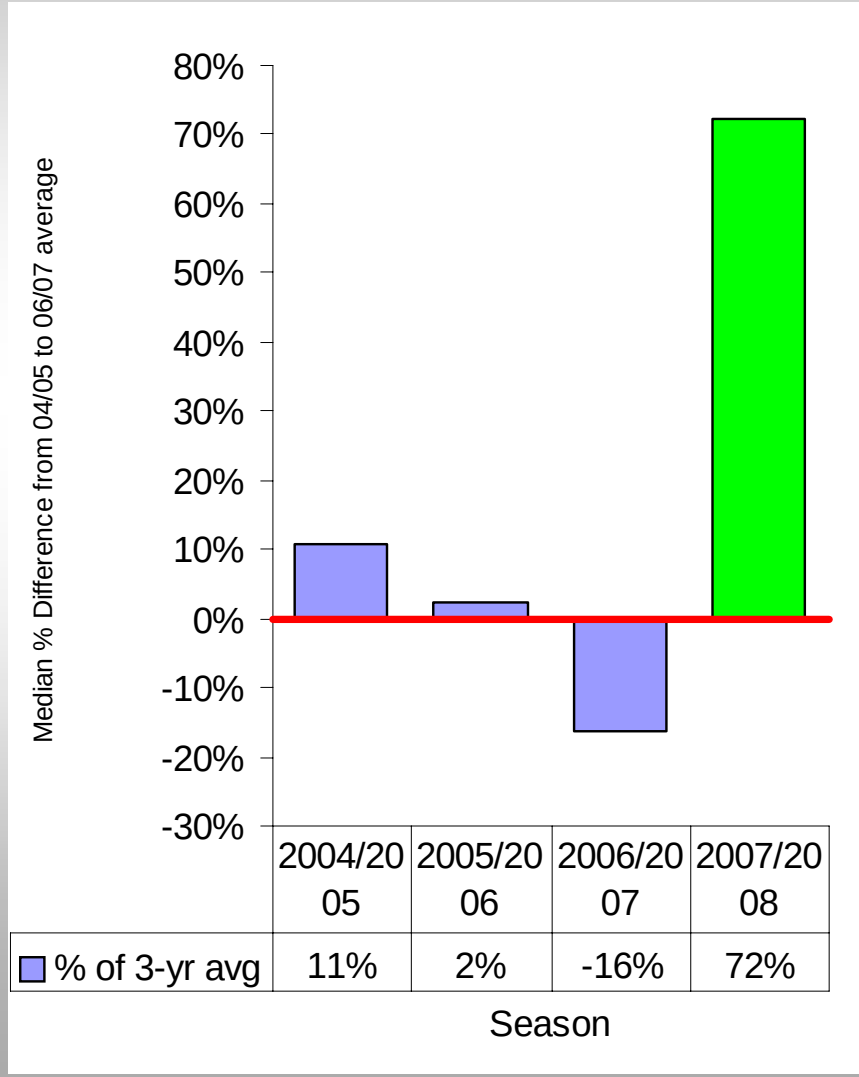


# 5. Would you support reducing the number of traps in the water in your area?

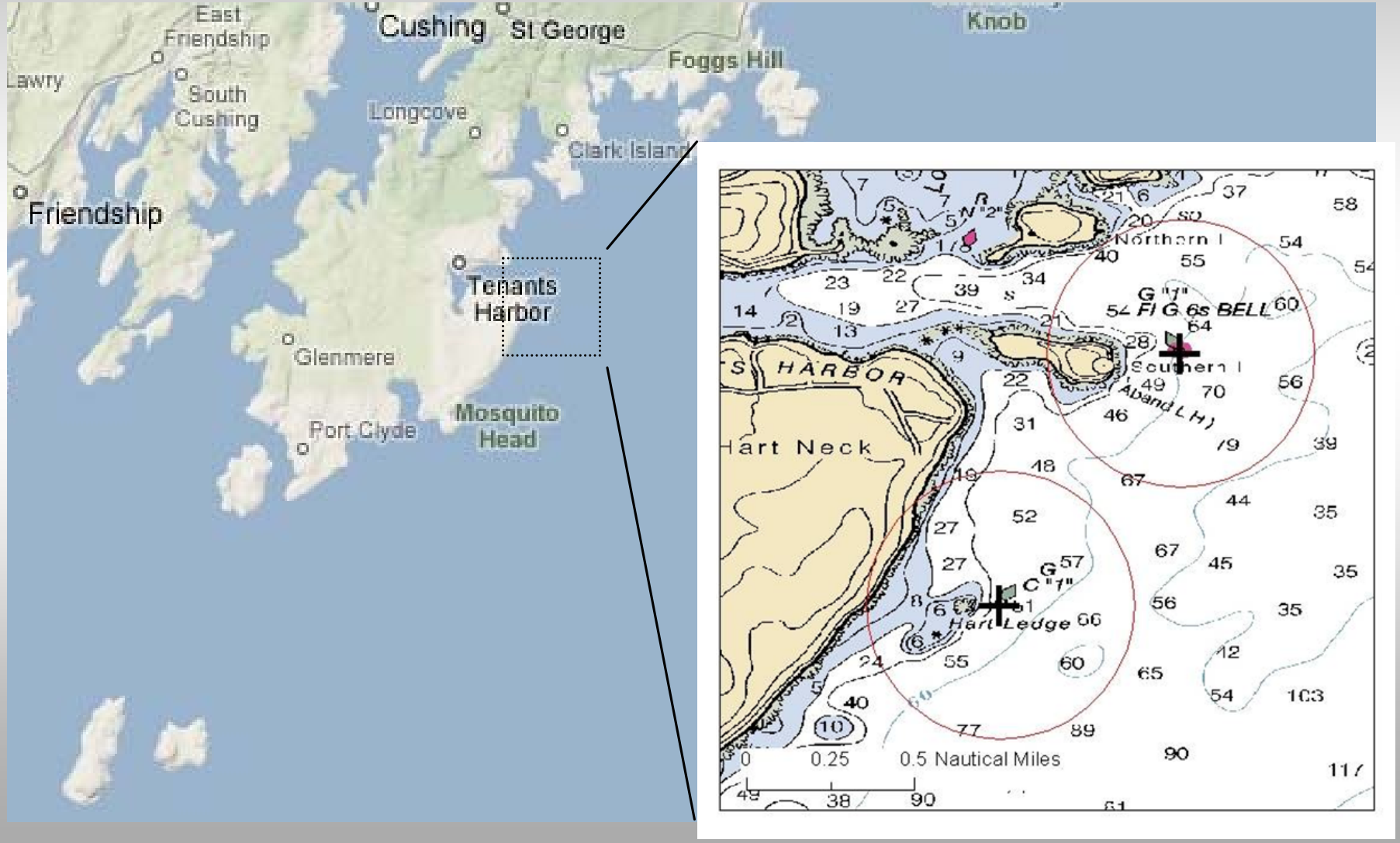


# Changes to Monhegan Area

- Spring 2007 went to State Legislature
- Changed Statute
- Reduced traps to gain days
- Increased season 2-months, half the traps
- 07/08 72% increase
- 08/09 $$ disaster



# Next Steps


East Friendship
Cushing
St George
Knob
Foggs Hill
Lawry
South Cushing
Longcove
Clark Island
Friendship
Tenants Harbor
Glenmere
Port Clyde
Mosquito Head
Northern I
G "1"
Fl G 6s BELL
Southern I
Aband L H
HARBOR
Hart Neck
G "1"
C "1"
Hart Ledge
0
0.25
0.5 Nautical Miles

# Interactions Between Pilot Whales and Pelagic Longlines: Lessons Learned and Future Plans

Andy Read, Kim Urian, Danielle Waples, Lynne Williams & Ari Friedlaender

Nicholas School of the Environment
Duke University

# Background

Pilot whales interact with pelagic longline gear in two ways:

Entanglement, which leads to the death or injury of whales

and

Depredation, which leads to loss or damage of catch

# The Premise

Depredation likely leads to entanglement,

*so*

Solving the depredation problem should solve entanglement,

*but*

Pilot whales will be highly motivated to approach gear

# Of course, it's not just pilot whales…

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## Press Release

### Conservation Groups Sue to Protect False Killer Whales in Hawai'i

*Longline fishery killing whales at twice sustainable levels*

**March 17, 2009**

**Honolulu, HI** -- Seeking an end to the continuing slaughter of false killer whales (*Pseudorca crassidens*) in the waters of Hawai'i, Earthjustice, representing a coalition of conservation groups, filed suit in federal court in Honolulu today against the National Marine Fisheries Service, challenging the agency's failure to devise a plan to protect the whales from the Hawai'i-based longline fishery. The coalition includes Hui Malama i Kohola, the Center for Biological Diversity, and Turtle Island Restoration Network.

False killer whale -- click image for hi-res version
(c) Robin W. Baird/www.cascadiaresearch.org

Each year, the Hawai'i-based longline fleet hooks and entangles false killer whales, resulting in serious injury or death through drowning. The Fisheries Service's own studies show that, for nearly a decade, the Hawai'i longline fishery has been killing Hawai'i's false killer whales at rates far beyond what the population -- which currently numbers only about 500 -- can sustain.

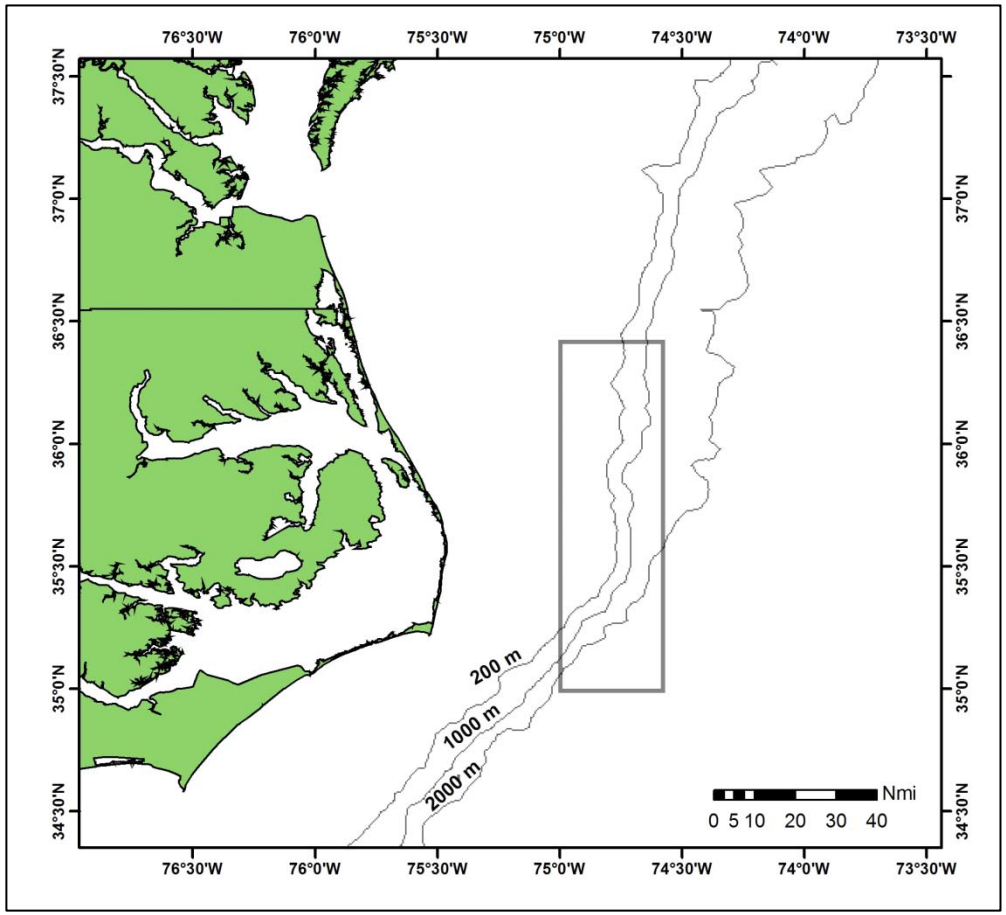
"In 1994, Congress amended the Marine Mammal Protection Act to require the Fisheries Service to try to eliminate marine mammal death and serious injury in commercial fisheries," explained David Henkin, an attorney with Earthjustice who is representing the coalition in court. "For years, the agency has ignored its legal duty to develop a plan to reduce the longline fishery's deadly interactions with false killer whales and other marine mammals. Hawai'i's marine mammals are paying with their lives for the Fisheries Service's refusal to comply with the law."

**RELATED INFO**

- **TAKE ACTION:**
  Take action: Speak out for the wolves!
- **DONATE NOW:**
  Gray Wolves Deserve Our Help
- **CASE:**
  Protecting Hawai'i's False Killer Whales
- **ISSUE:**
  Wildlife
  Oceans
- **REGION:**
  Pacific Islands
- **OFFICE:**
  Mid-Pacific
- **FEATURE:**
  Protecting False Killer Whales in Hawai'i

Done

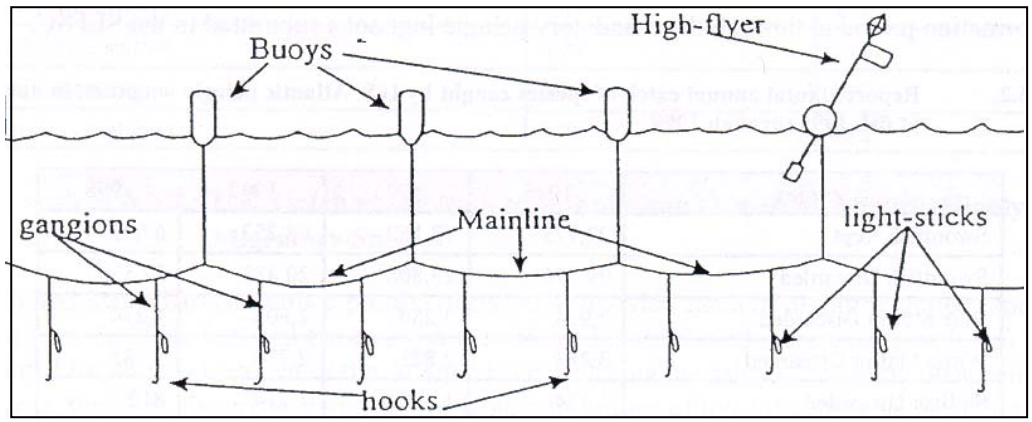
# Cape Hatteras Special Research Area



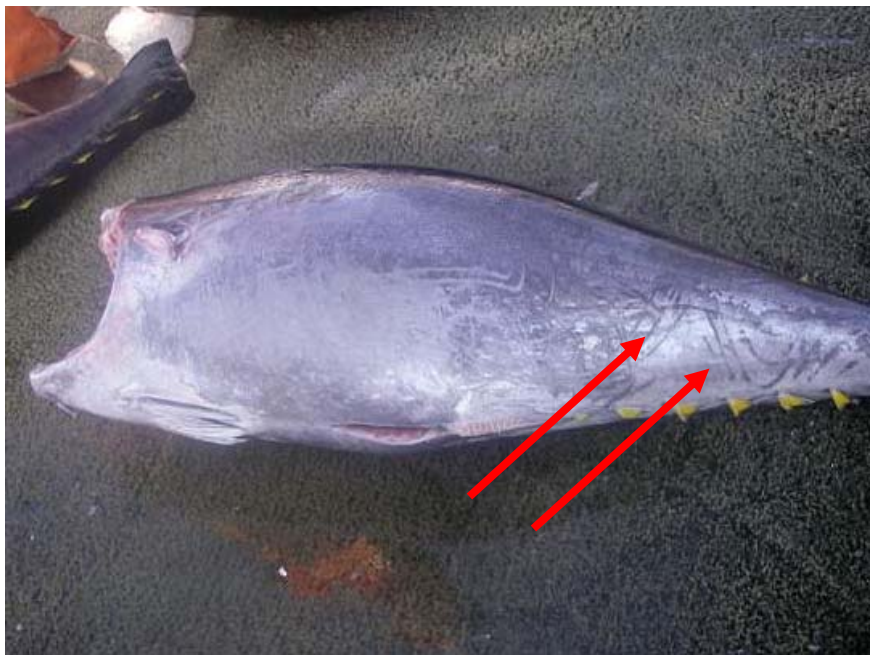
# Cape Hatteras Pelagic Longline Fishery

## Target Species:

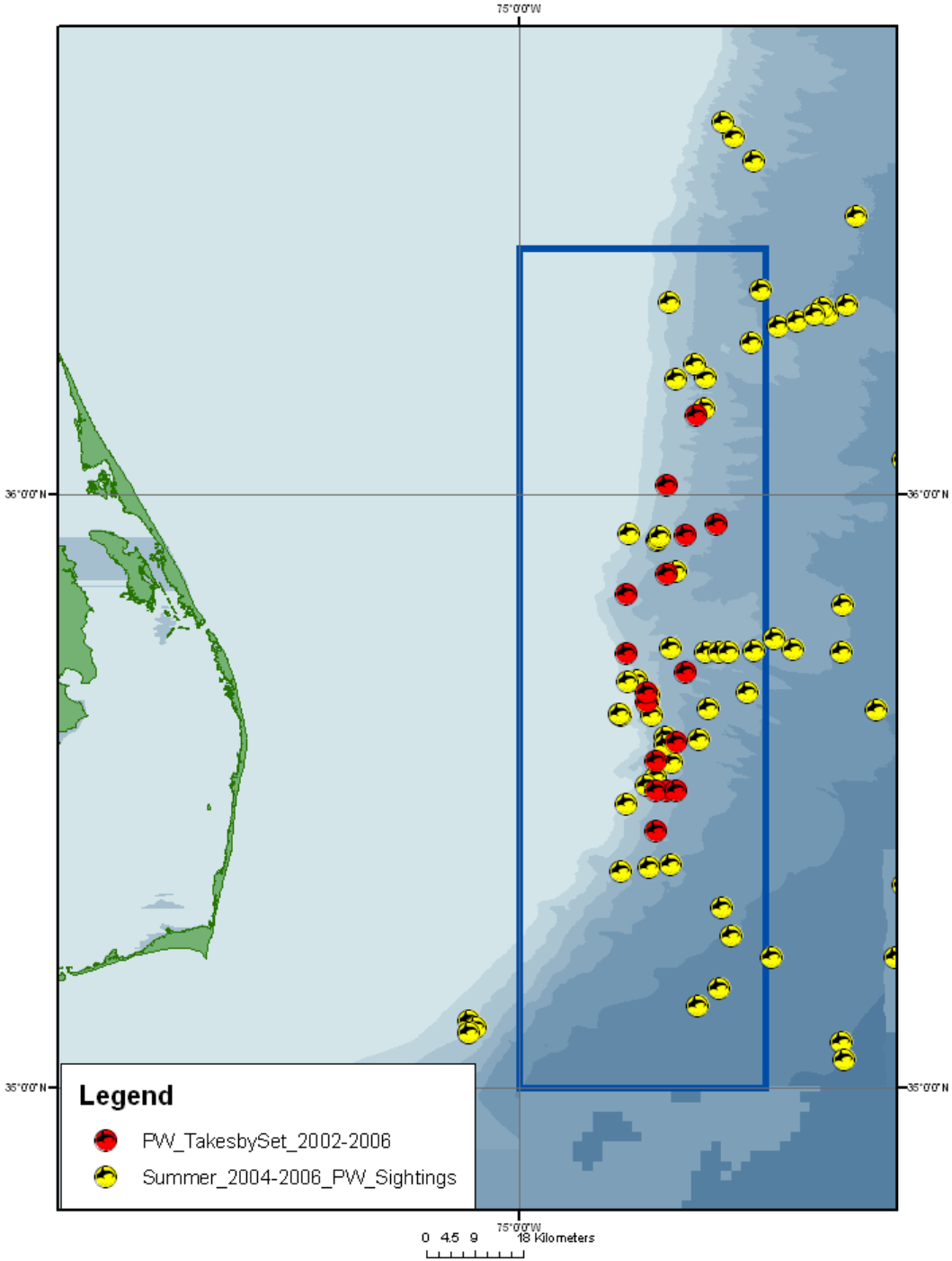
Yellowfin tuna
Big-eye tuna
Swordfish



# Depredation of tuna from pelagic longlines by pilot whales off Cape Hatteras



# Observed takes of pilot whales in the pelagic longline fishery off Cape Hatteras




(Data courtesy of SEFSC)

Healed scars of *past* entanglements from pilot whales stranded along the Outer Banks, NC in January 2005

# Research Questions

1. Which species of pilot whale is present in the CHSRA?

2. How prevalent is depredation in the population?

2. Are individual whales resident in the CHSRA?

3. How do pilot whales detect longline gear?

4. When do pilot whales interact with gear?

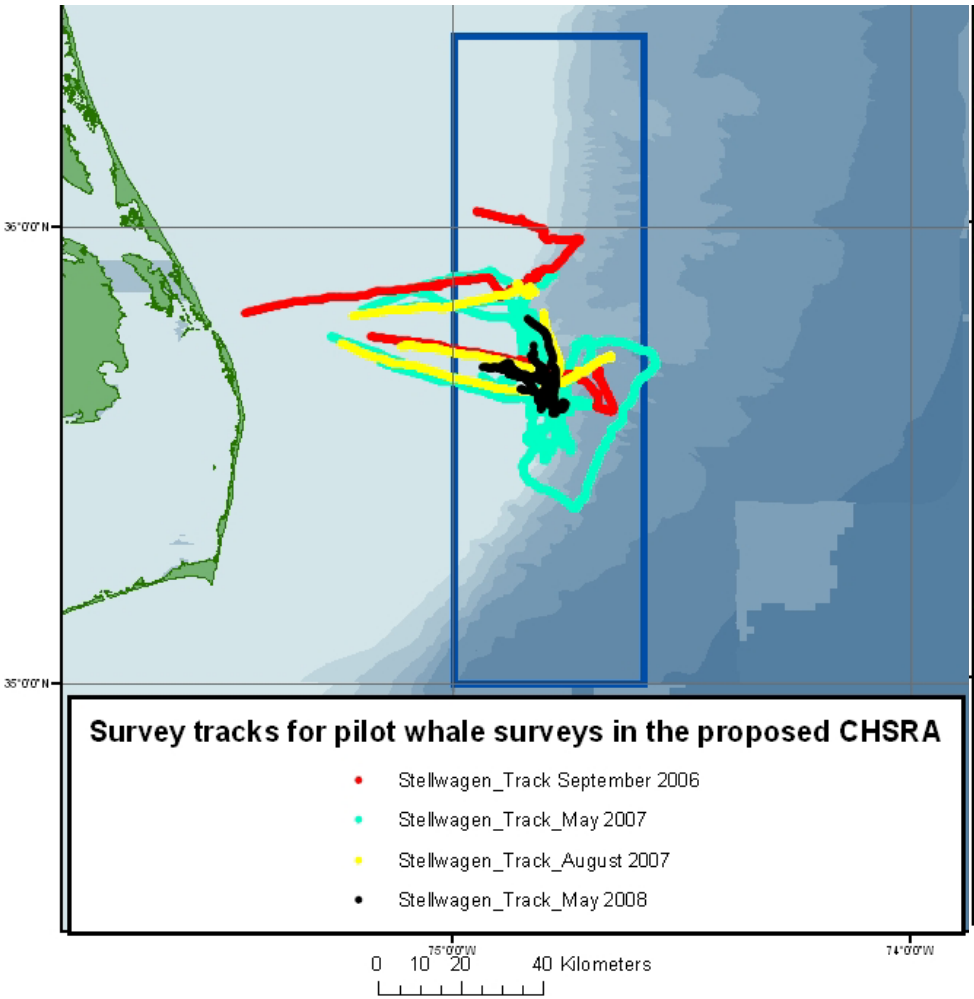
5. How can we deter pilot whales from depredation?

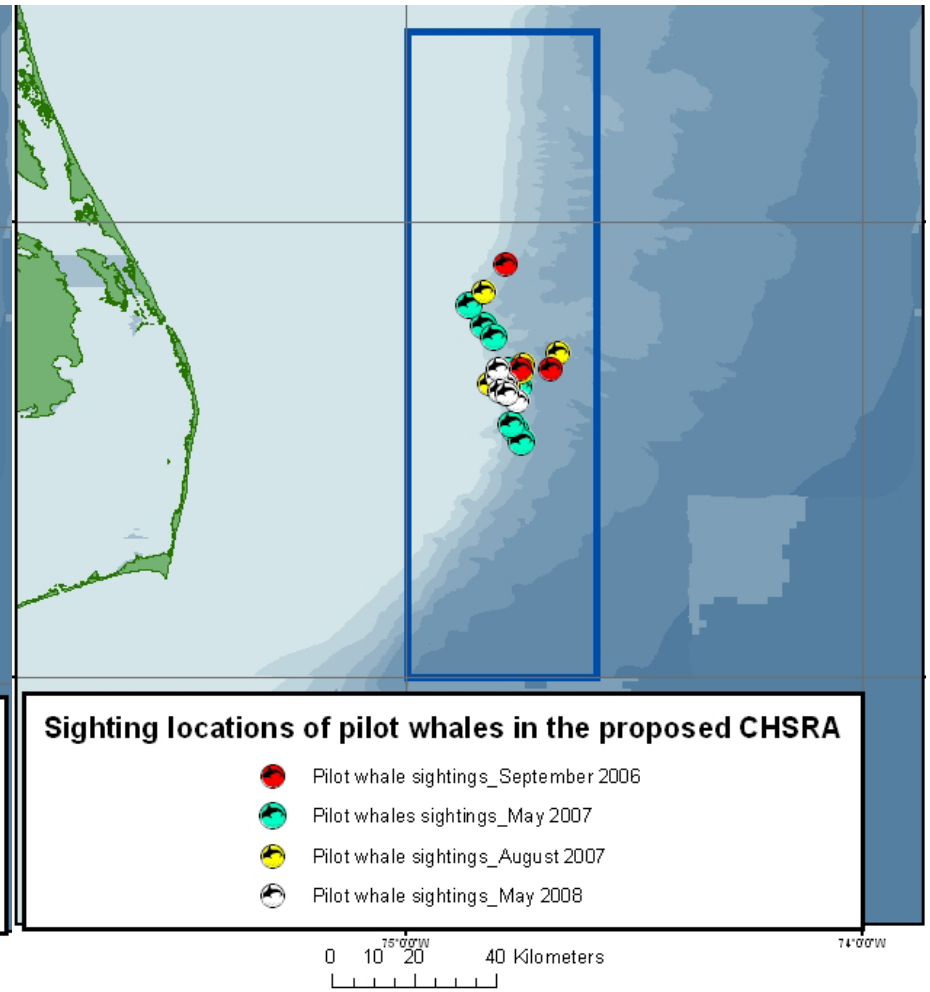
# Research Vessel

# Survey Effort (2006 to 2008)

| Month | Survey Days | Sightings | Biopsy samples | Images |
|---|---|---|---|---|
| September-06 | 2 | 3 | 6 | 669 |
| May-07 | 7 | 9 | 28 | 6,241 |
| August-07 | 4 | 8 | 17 | 5,045 |
| May-08 | 5 | 6 | 11 | 4,432 |
| **Total** | **18** | **26** | **62** | **16,387** |

# Survey Effort and Sightings of Pilot Whales



SEA WOLF

TUNA FEVER

# Some Entanglement Scars Are Caused by Troll Gear

# Biopsy Sampling – Which Species?

62 tissue samples provided to Dr. Patty Rosel (SEFSC) for species identification

All samples were from short-finned pilot whales *Globicephela macrorhychus*

39 males
23 females

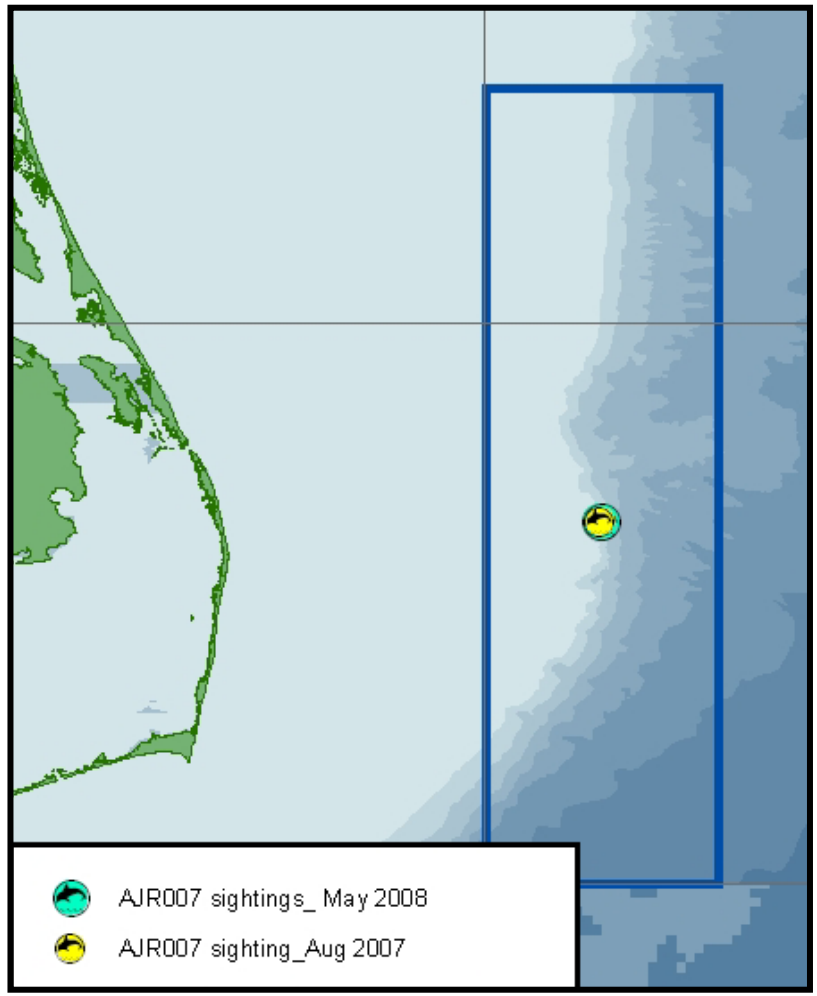
# Prevalence of Depredation - SIA

| | BigEye Tuna | YellowFin Tuna |
|---|---|---|
| **October 2006** | 45 | 30 |
| **May 2007** | 24 | 47 |
| **Total** | **69** | **77** |

**Pilot whale samples**
**62 from biopsy samples**
**9 from stranded pilot whales**

# Photo-ID – Patterns of Residency

# Photo-ID – Patterns of Residency



# Acoustic Recorders –Depredation Patterns

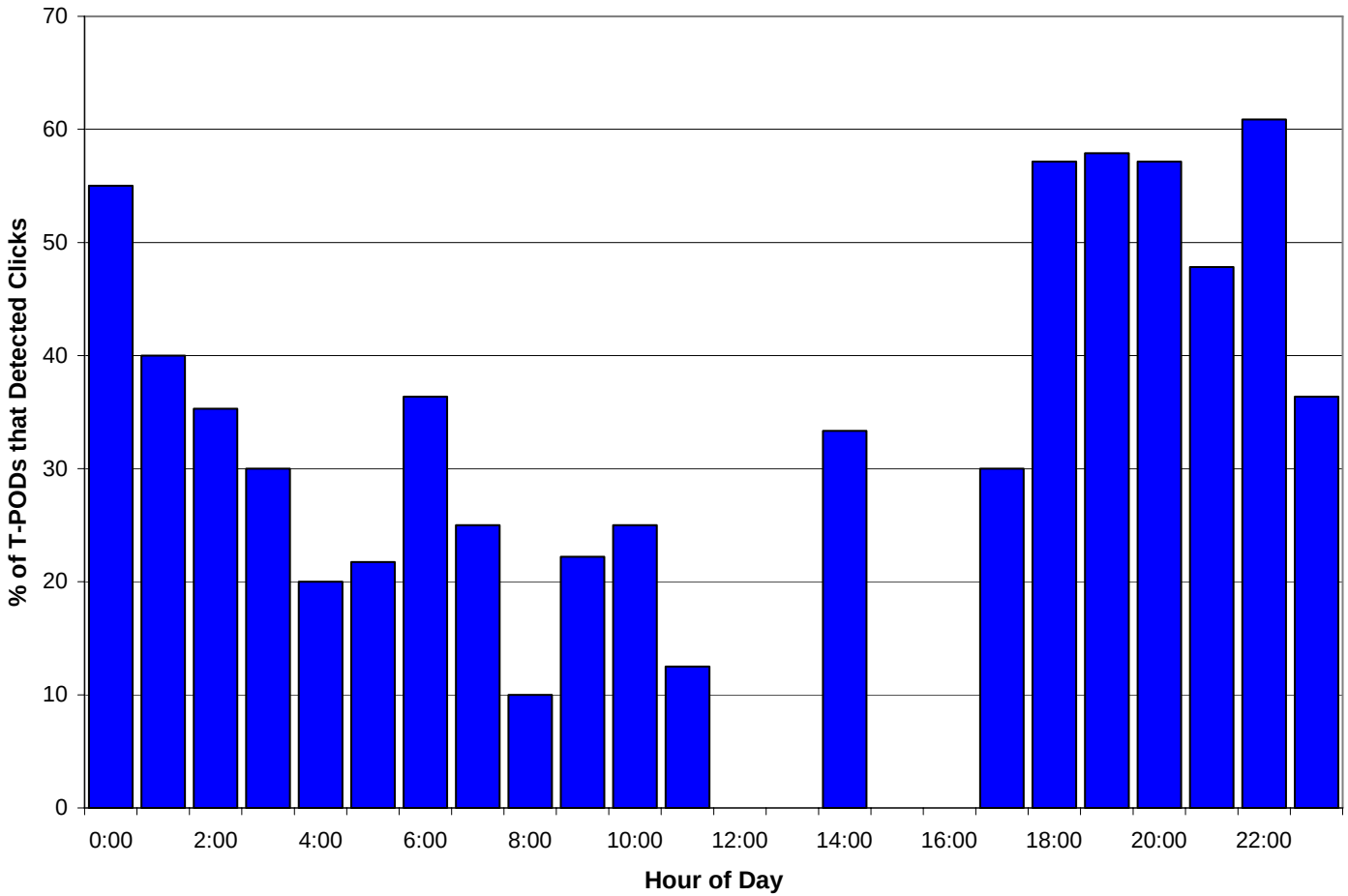
## High Frequency Recorders

- Neutrally buoyant
- Weight: 9 pounds
- Dimensions: 8 x 15 inches
- Record actual sounds of whales and gear
- Data must be downloaded after gear is retrieved each day

## Data Loggers (T-PODs)

- Positively buoyant
- Weight: 6.4 pounds
- Dimensions: 23 x 4 inches
- Only record the *occurrence* of echolocation
- Can record for an entire trip

# Acoustic Recorders –Depredation Patterns




Fishermen deployed T-PODs on 28 longline sets from September 7th 2006 to June 20th 2007

# Interactions With Gear – DTags

Data are collected with multi-sensor DTags attached with suction cups.

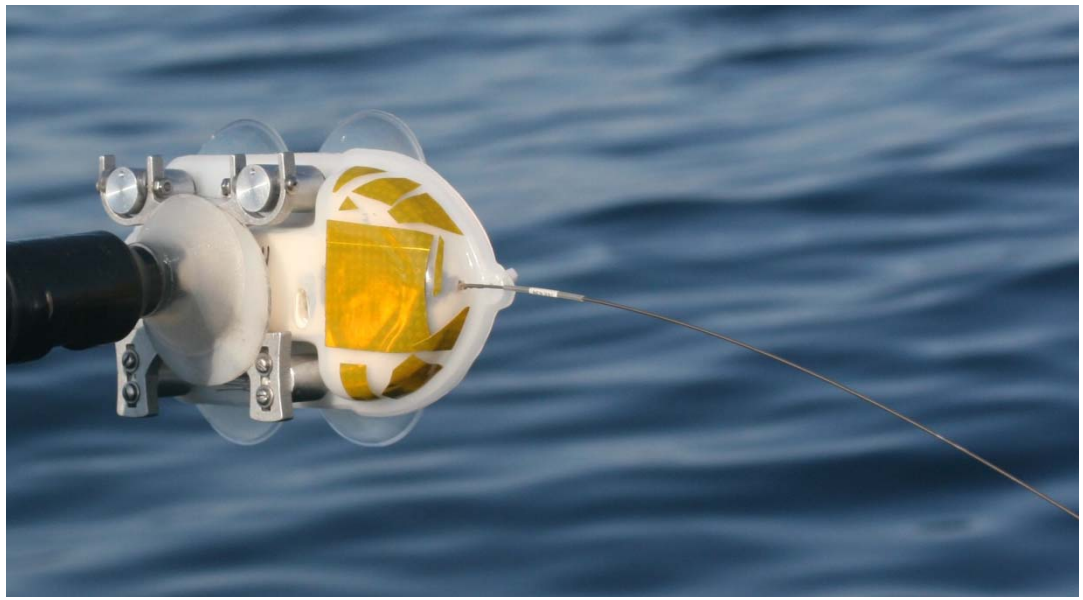
Each tag records:

(i) sound with 12-16 bit resolution at sampling rates between 32-96 kHz

(ii) depth, and

(iii) orientation of the whale: pitch, roll and heading

Whales are tracked and tags are recovered using a VHF transmitter in each tag



Developed by Mark Johnson & Peter Tyack
Woods Hole Oceanographic Institution

# DTag Deployments May 2008

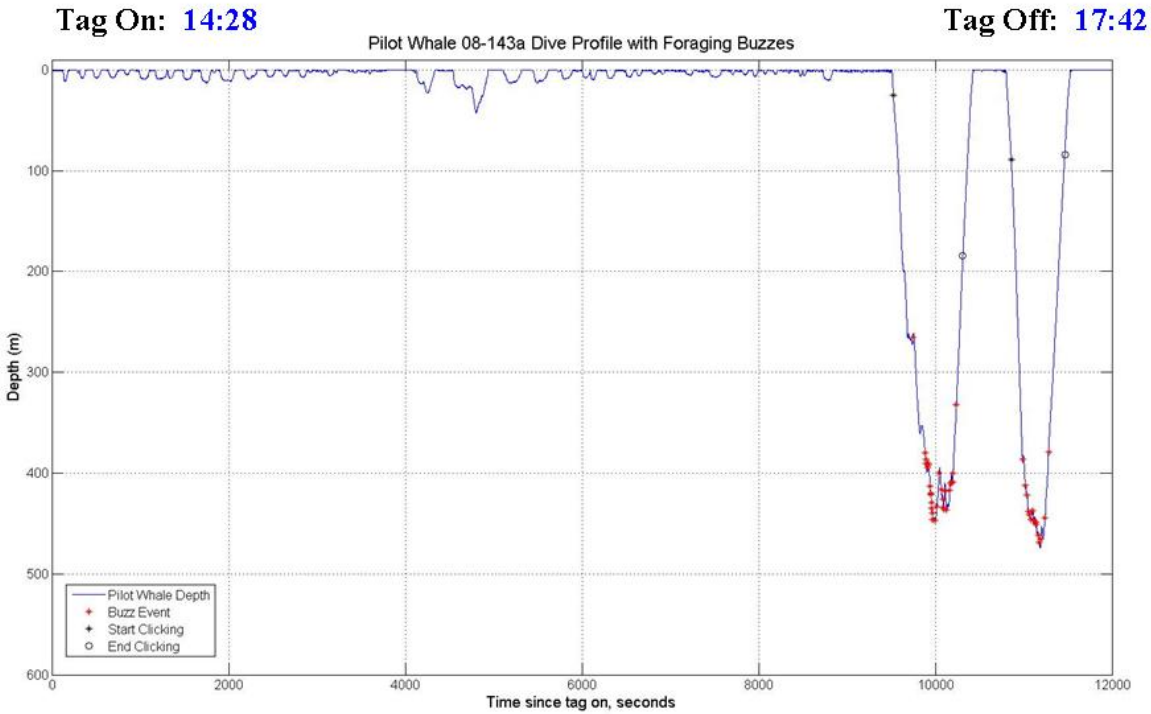
Five DTags over three days

Deployments from 2 – 16 hours

Maximum depth ~ 600 m

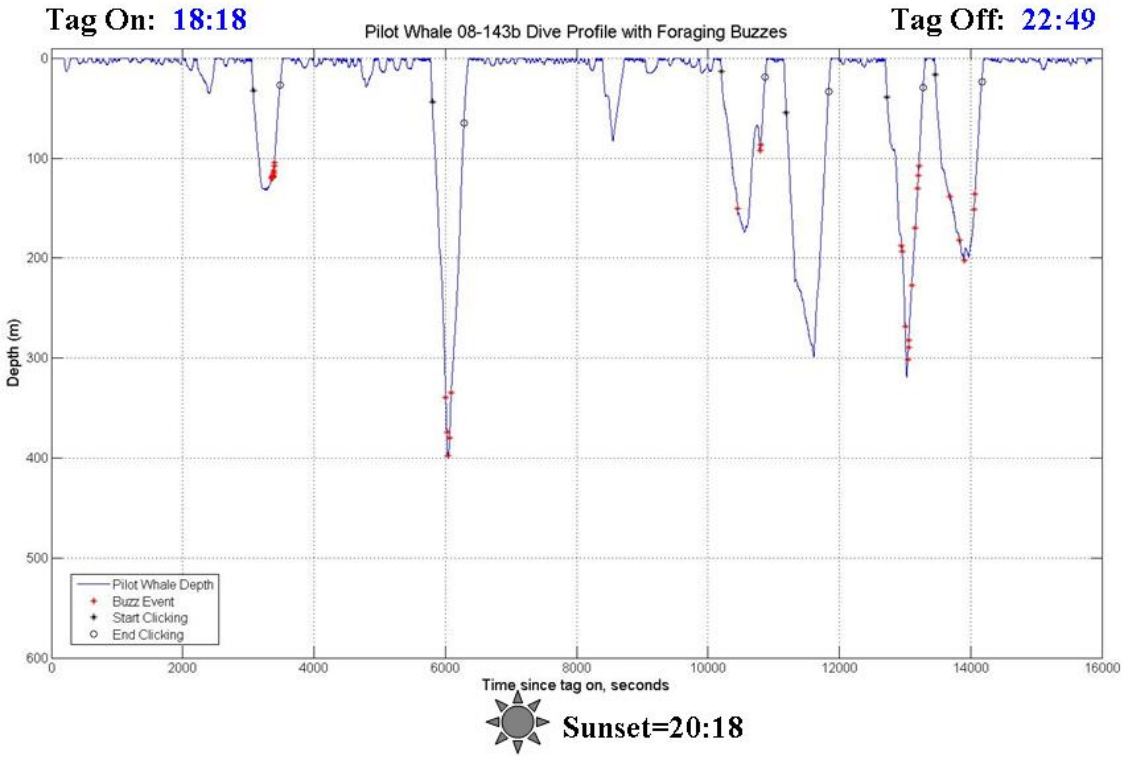
Pilot Whale Depth Record (Gm143a)
May 22, 2008

Total time= 3 hours 14 minutes



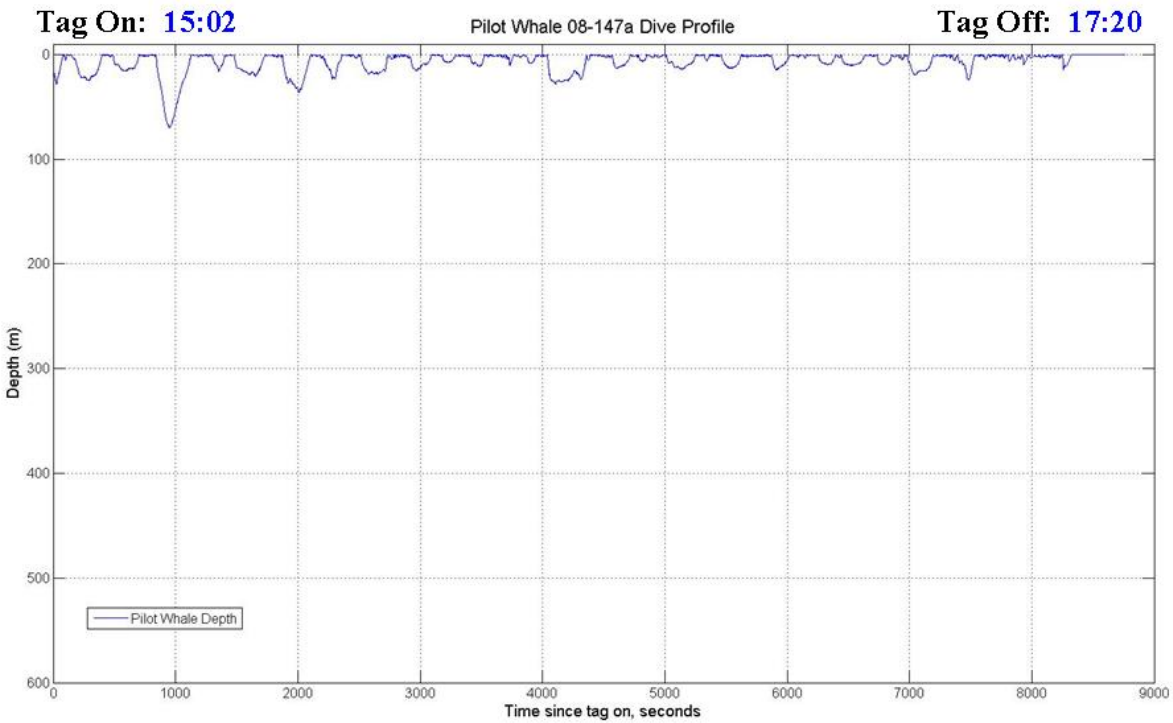
Pilot Whale Depth Record (Gm143b)
May 22, 2008

Total time= 4 hours 31 minutes



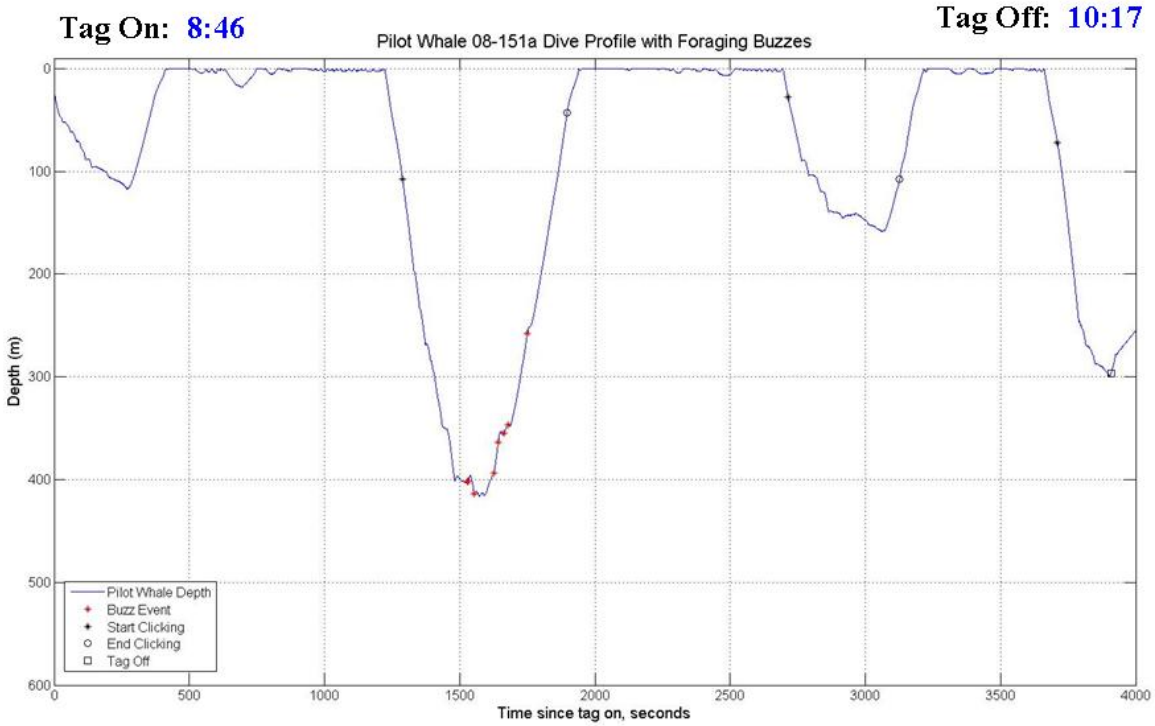
Pilot Whale Depth Record (Gm147a)
May 26, 2008

Total time= 2 hours 18 minutes



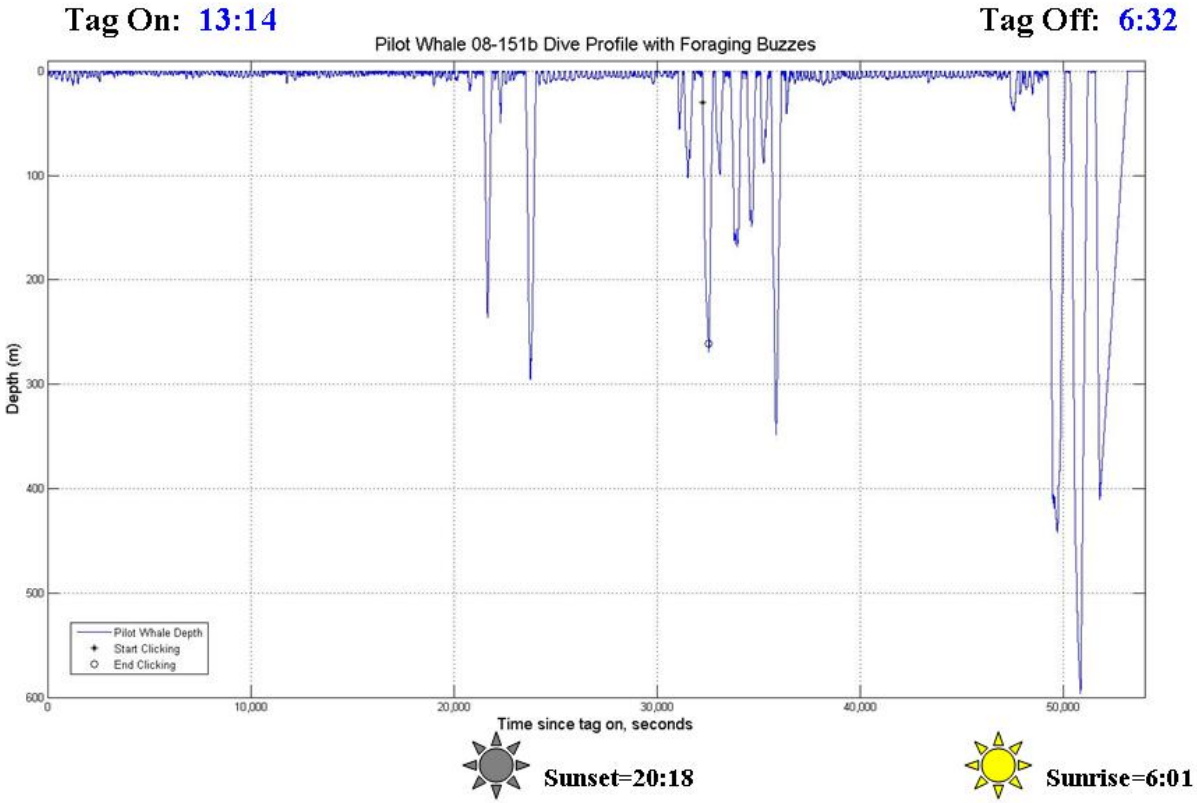
Pilot Whale Depth Record (Gm151a)
May 30, 2008

Total time= 1 hour 31 minutes

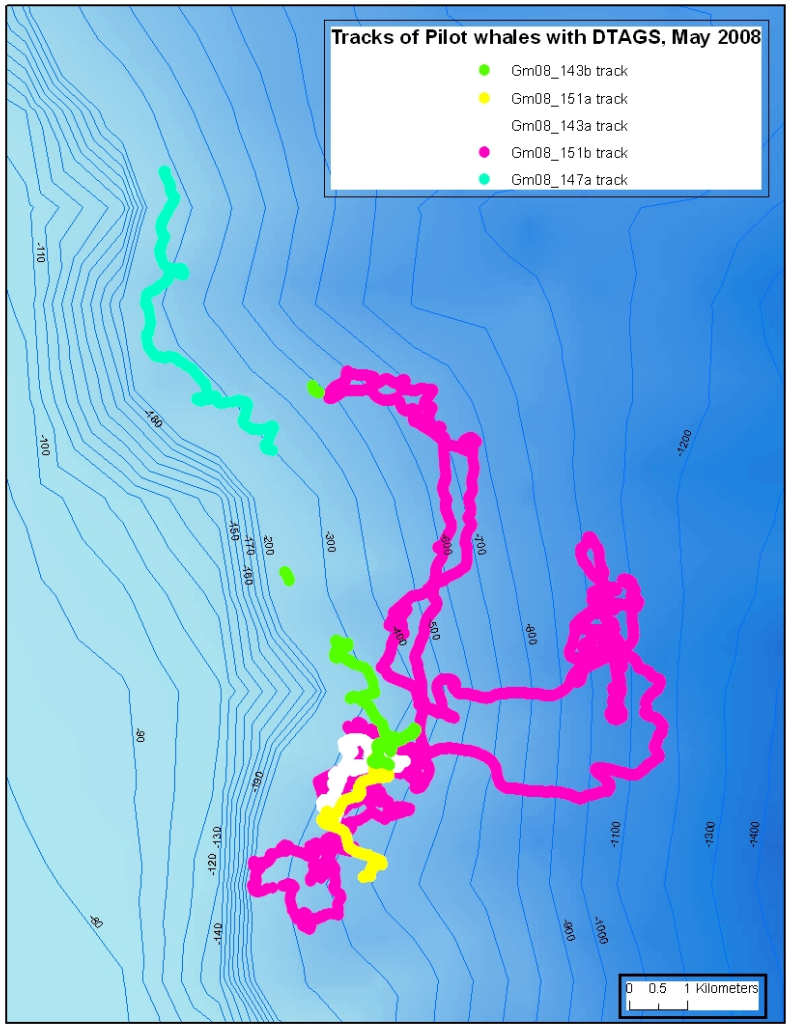


Pilot Whale Depth Record (Gm151b)
May 30-31, 2008

Total time= 16 hours 18 minutes



# Movements of Tagged Whales



# Underwater Pole-Camera

# Lessons Learned

All pilot whales sampled to date within the CHSRA have been *Globicephala macrorhynchus*

Short-finned pilot whales occur frequently within the CHSRA; some individuals are likely to be resident

Pelagic longline are often set in the same location within the CHSRA

Pilot whales and other odontocetes occur frequently around longline gear during all phases of fishing

Pilot whales interact with a variety of other gear types within the CHSRA

# Future Work

More DTag deployments

Stable isotope analysis

Studies of social structure

## Potential Measures to Deal With Depredation:

(1)Aversive Stimuli

(2)Quiet Fishing Technology

(3)Protective Gear Technology

## Potential Measures to Deal With Entanglement:

(1)Circle Hooks

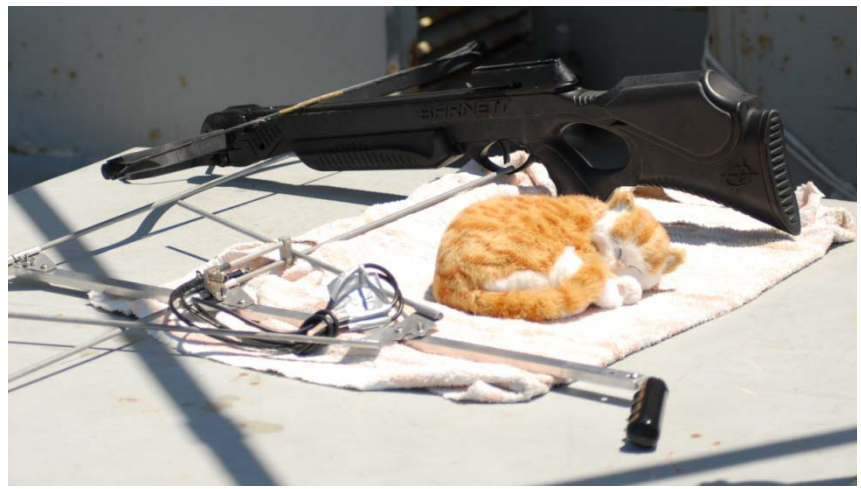
(2)Weak Hooks or Weak Links

# Thanks to:


The Wanchese Pelagic Longline Fleet:
Captain Dewey Hemilright
Captains Chris Hanson, Matt Huth and Jumbo Elliott
Willie Etheridge

Collaborators:
Alex Loer & Jim Moir (R/V Stellwagen)
Peter Tyack, Alex Bocconcelli, Laela Sayigh & Eric Dawe (WHOI)
Catherine McClellan, Lesley Thorne, Leigh Torres, Todd Chandler & Dave Johnston (Duke)
Lance Garrison, Keith Mullen, Kathy Foley, Annie Gorgone & Patty Rosel (NMFS SEFSC)
Laura Engleby & Vicki Cornish (NMFS SER)
Nick Tregenza (Chelonia Inc.)
David Mann (USF)
Tim Werner (NEA)

Funding Agencies:
NMFS Southeast Regional Office
Consortium for Wildlife By-Catch Reduction
North Carolina Sea Grant

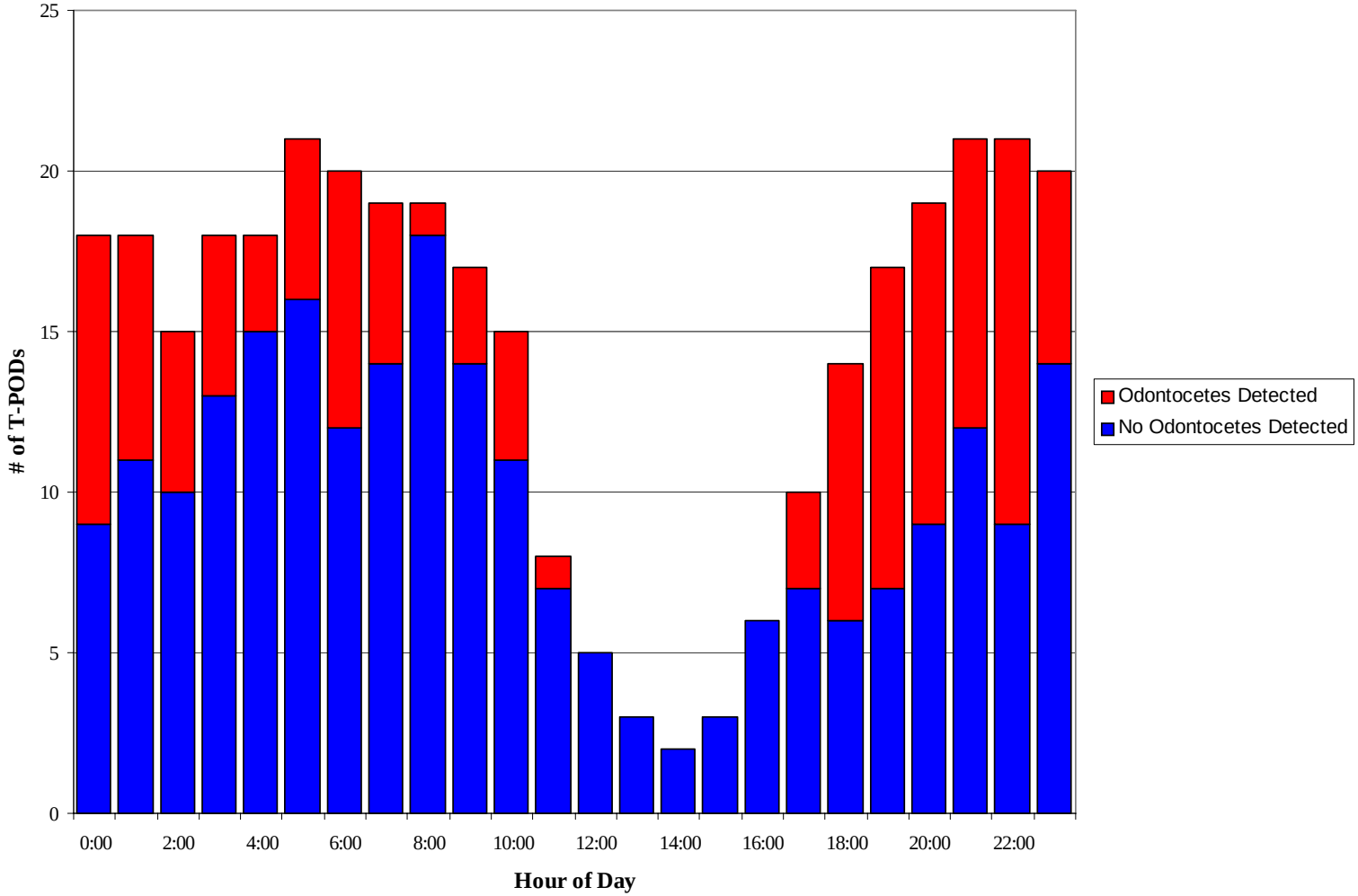



# Pilot Whales

*Globicephala melas* (long-finned)

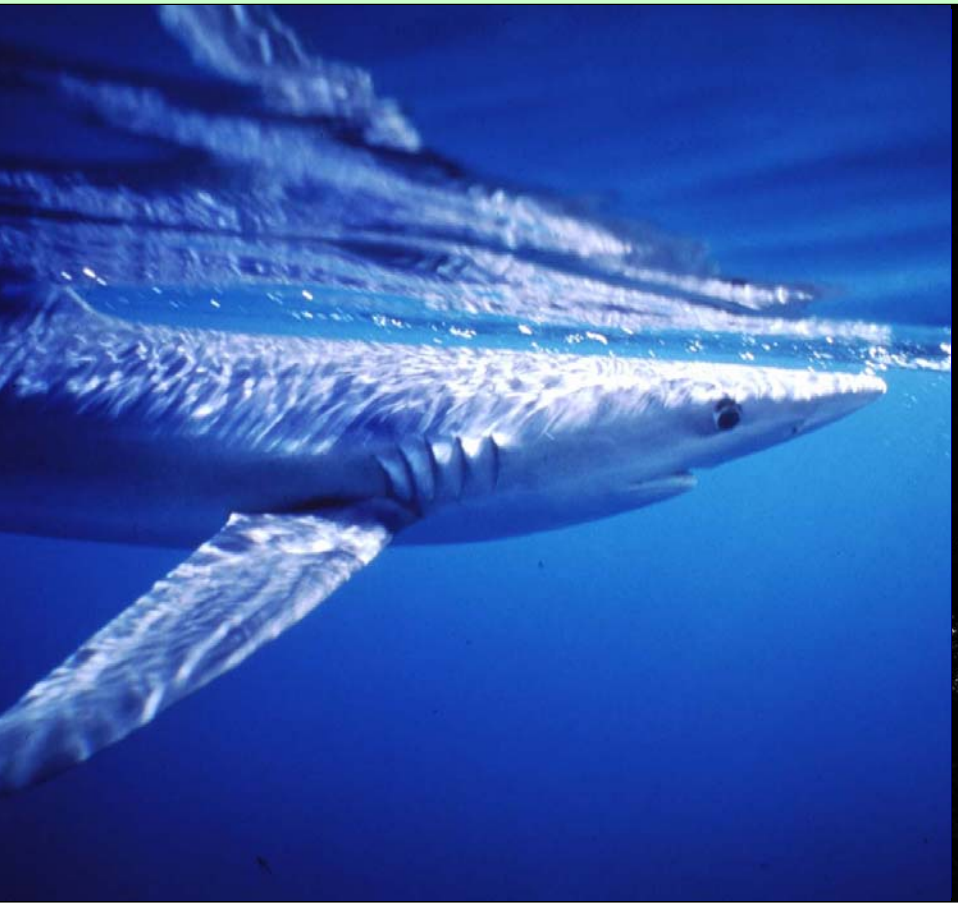
*Globicephala macrorhynchus* (short-finned)

# Number of T-POD recorders detecting echolocation clicks by time of day




Fishermen deployed T-PODs on 28 longline sets from September 7th 2006 to June 20th 2007

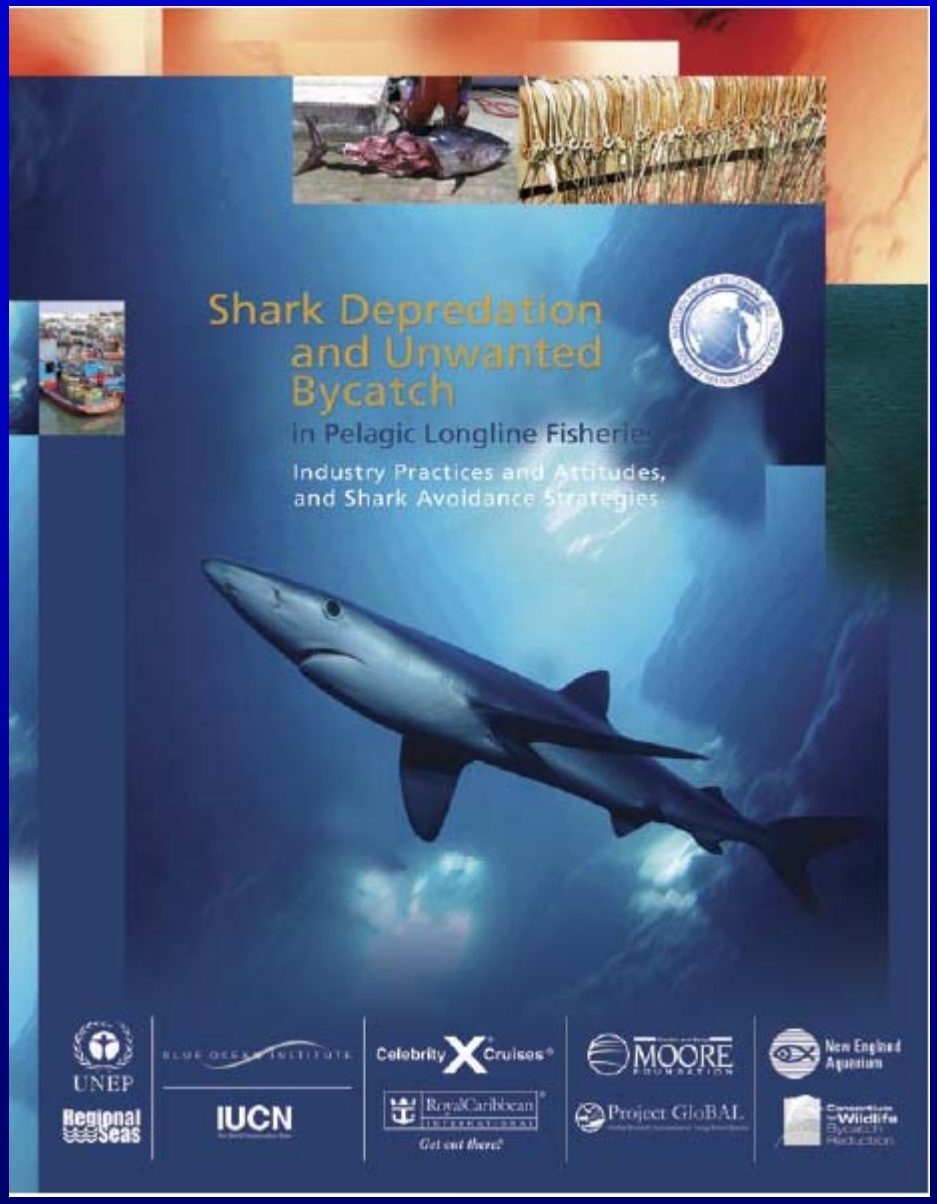
# Shark bycatch and depredation in longline fisheries: progress and research gaps in reducing shark interactions



New England Aquarium

**Dr. John Mandelman**

Edgerton Research Laboratory



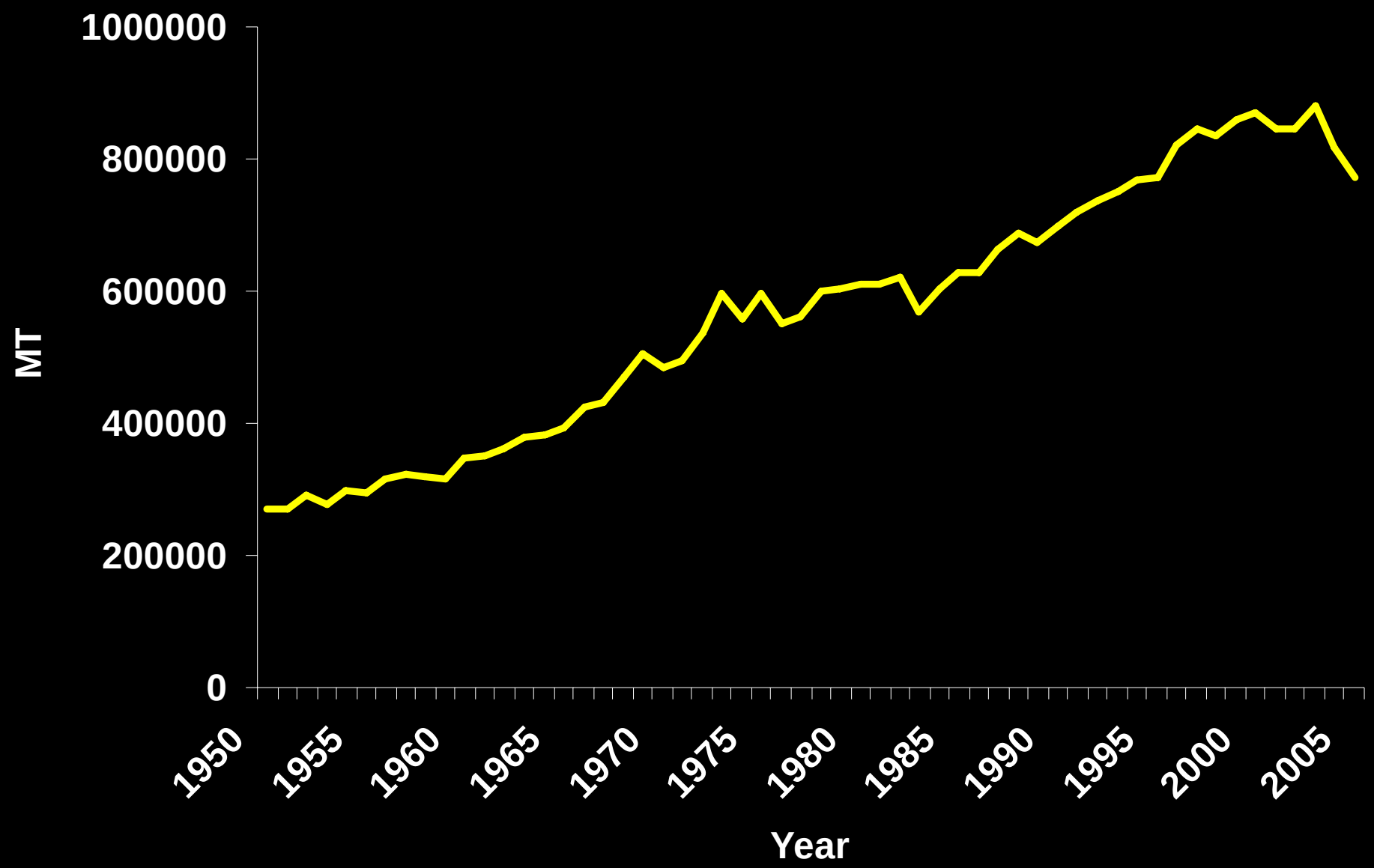

- U.S. Atlantic, &…
- Australia
- Peru
- U.S. Pacific (Hawaii)
- S. Africa
- Japan
- Palau

Gilman, E., Clarke, S., Brothers, N., Alfaro-Shigueto-J., Mandelman, J., Mangel, J., Petersen, S., Piovano, S., Thomson, N., Dalzell, P., Donoso, M., Goren, M., Werner, T. 2007. *Shark Depredation and Unwanted Bycatch in Pelagic Longline Fisheries: Industry Practices and Attitudes, and Shark Avoidance Strategies*. Western Pacific Regional Fishery Management Council, Honolulu, USA.

# Outline

- Shark bycatch in pelagic longline fisheries
- Research to date (Consortium funded and other)
- Research needs and future objectives

http://www.fao.org/DOCREP/003/X2098E/X2098E10.htm

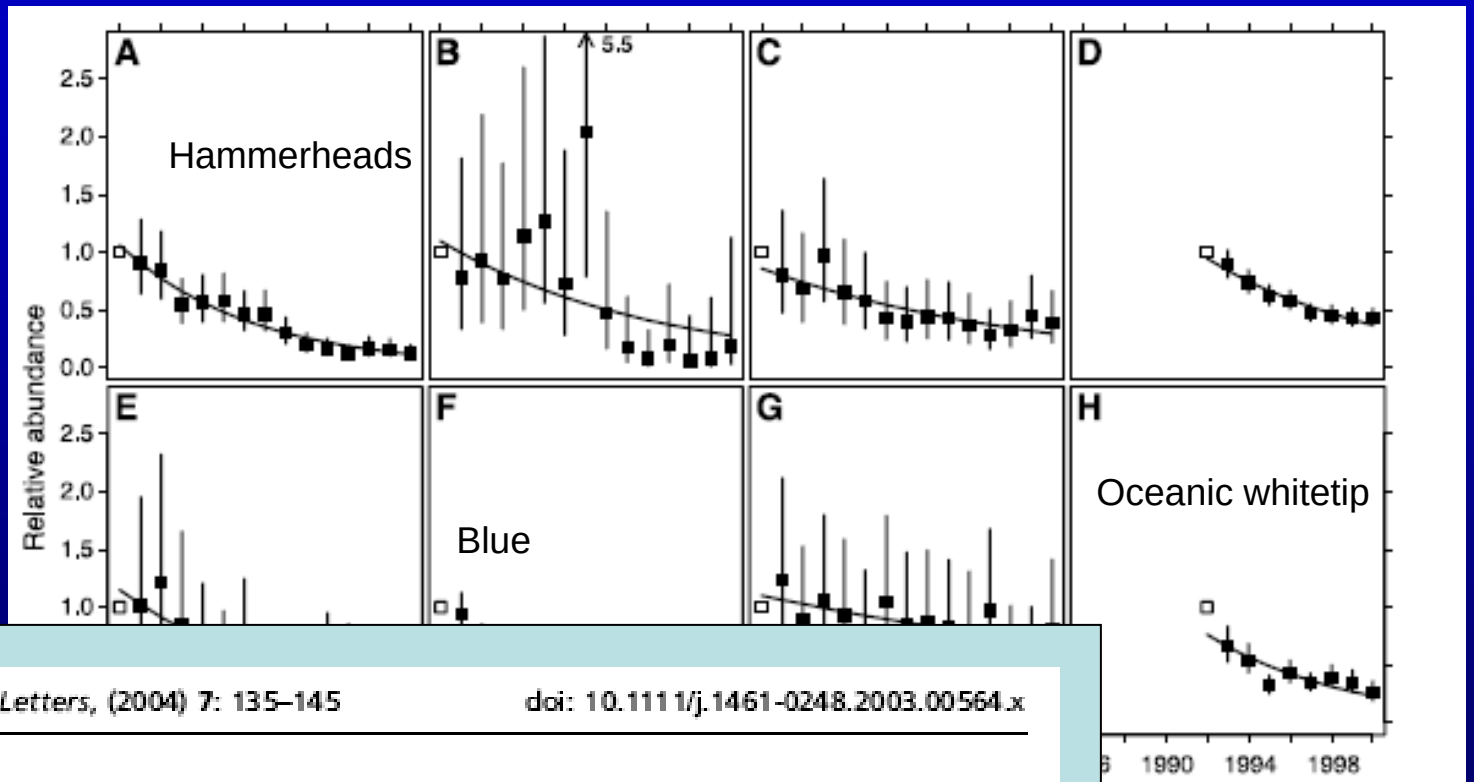



Data from FAO

# Population trends

## Collapse and Conservation of Shark Populations in the Northwest Atlantic

Julia K. Baum,* Ransom A. Myers, Daniel G. Kehler, Boris Worm, Shelton J. Harley, Penny A. Doherty




*Ecology Letters*, (2004) 7: 135–145 doi: 10.1111/j.1461-0248.2003.00564.x

## Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico

**Baum and Myers, 2004**

(A) hammerhead, (B)
d; and oceanic shark
h species, the overall
trend (solid line) and individual year estimates (■ ± 95% CI) are shown. Relative abundance is initially set to 1, to allow comparisons among species.

# Change in CPUE for pelagic sharks

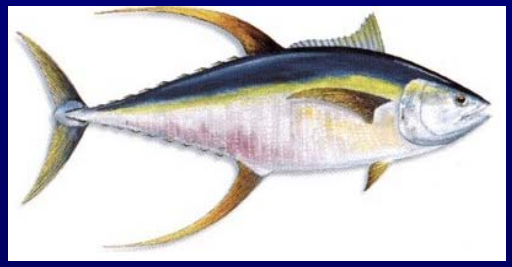
Table 2.—Published estimates of changes in catch rates for pelagic sharks in the western North Atlantic Ocean according to Cortés et al. (2007).

| Species | Cortes et al. (2007) Observer 1992-2005 | Cortes et al. (2007) Logbook 1992-2005 | Cortes et al. (2007) Logbook (G+C) 1986-2005 | Baum et al. (2003) Logbook 1986-2000 | Baum and Myers (2004) Survey Data 1950's vs 1990's |
|---|---|---|---|---|---|
| Blue shark | 52%↓ | 73↓ | 91%↓ | 60 %↓ | n/a |
| Mako sharks | 48 %↓ | 1 %↓ | 62 %↓ | 30 %↓ | 45 %↓ |
| Thresher shark | 99%↑ | 52 %↓ | 87 %↓ | 80 %↓ | n/a |
| Silky shark | 46 %↓ | 50 %↓ | 48 %↓ | n/a | 91 %↓ |
| Oceanic whitetip | 9 %↓ | 57 %↓ | 75 %↓ | 70 %↓ | 99 %↓ |

Cortes et al (2007)

# Another Problem =

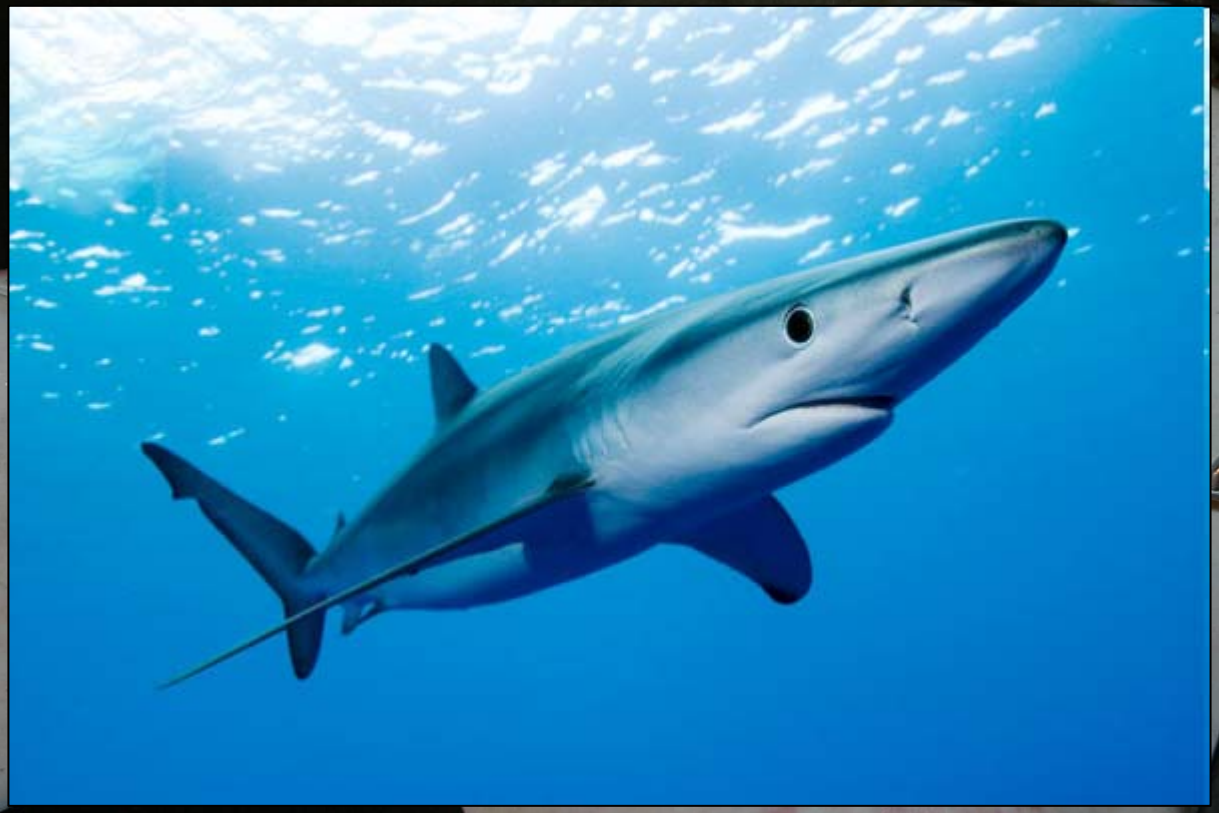
A substantial contributor to fishing mortality for elasmobranchs is the multinational commercial pelagic longline industry that targets tuna and swordfish, but often catch sharks and rays as bycatch (Myers and Worm 2003; Tavares and Arocha 2007)



**Tuna (Family: Scombridae)**

**Swordfish (*Xiphias gladius*)**

# Bycatch mortality

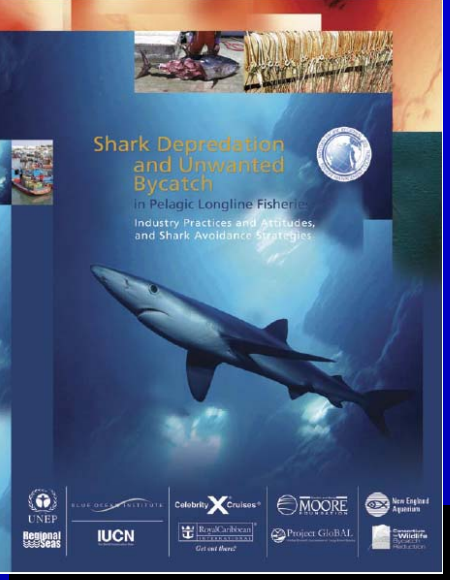


Exhaustive exercise potentially lethal in fishes (Black 1958; Wood et al. 1983)

# U.S Pelagic LL catch (1992-2003)

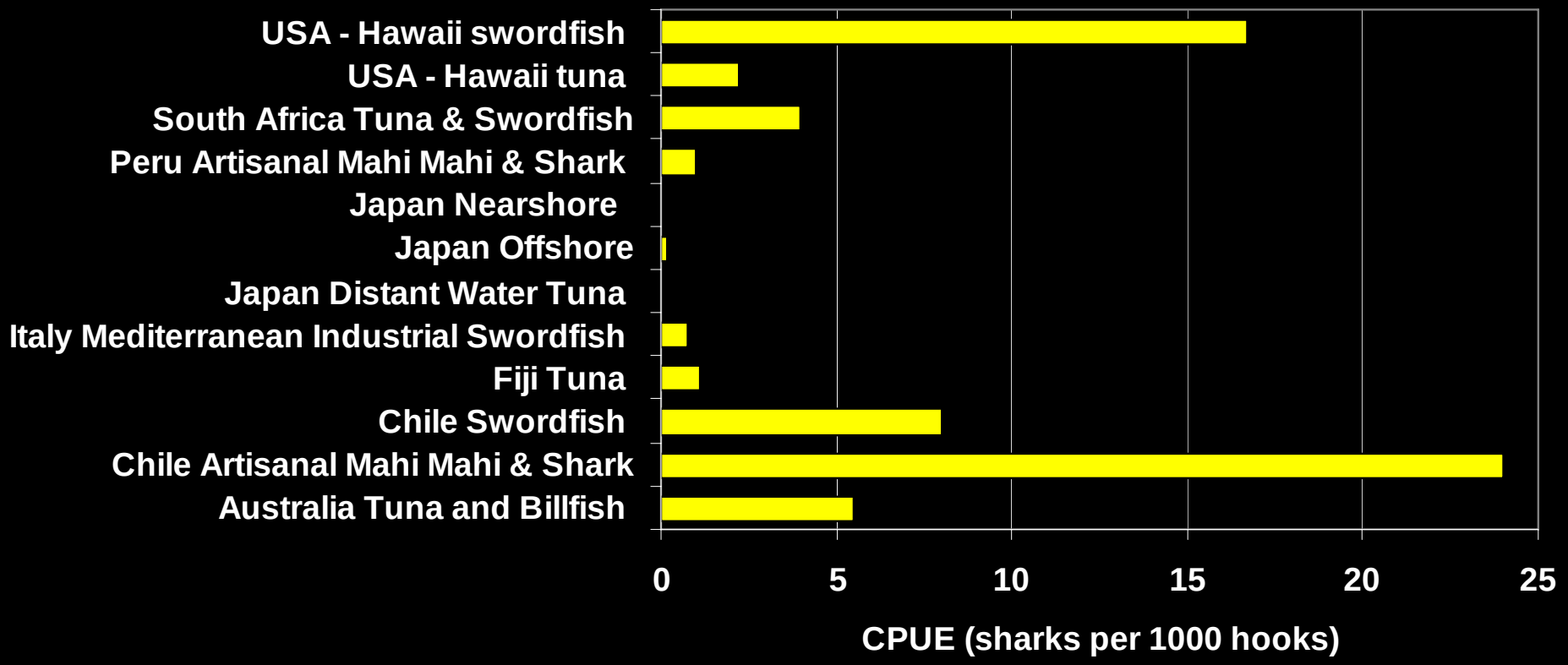
| Species/group | % overall catch |
|---|---|
| Swordfish | 27.3 |
| Sharks/rays | 24.8 |
| Yellowfin/bigeye/bluefin tuna | 21.1 |
| Finfish | 17.8 |
| Other tunas | 3.9 |
| Other billfish | 3.5 |
| Unknown spp | 1 |
| Marine turtles, mammals, birds | 0.7 |

(Mandelman et al. 2008, Abercrombie et al. 2005)



Photos from Martinez (2002)

## Shark Catch Rates - Longline Fisheries



**Incidental catch associated with swordfish longline fisheries in the south-west Atlantic Ocean**

*Mar. Freshwater Res.*, 1998, 49, 633–9

Yamandú H. Marín, Federico Brum, Luis C. Barea and Julio F. Chocca

Longline fishery off Uruguay

**Fig. 1.** Survey area and operation zones.

**Sharks comprise up to 75% of catch**

IUCN – World Conservation Union

Species Survival Commission - Shark Specialist Group

| Category | Sharks | Batoids | Holocephali | Total |
|---|---|---|---|---|
| Critically Endangered | 8 | 11 | 0 | 19 |
| Endangered | 8 | 15 | 0 | 24 |
| Vulnerable | 29 | 38 | 0 | 67 |
| Near Threatened | 60 | 34 | 1 | 95 |
| Least Concern | 88 | 46 | 9 | 143 |
| Data Deficient | 132 | 57 | 18 | 207 |
| Totals | 325 | 202 | 28 | 555 |

Slide courtesy of Dean Grubbs

VULNERABLE

*Isurus oxyrinchus*

VULNERABLE

*Alopias vulpinus*

NEAR THREATENED

*Prionace glauca*

ENDANGERED

*Sphyrna lewini*

# “Depredation” is another common shark “interaction” in pelagic longline fisheries

•‘Depredation’ = partial or complete removal of hooked fish and bait from fishing gear

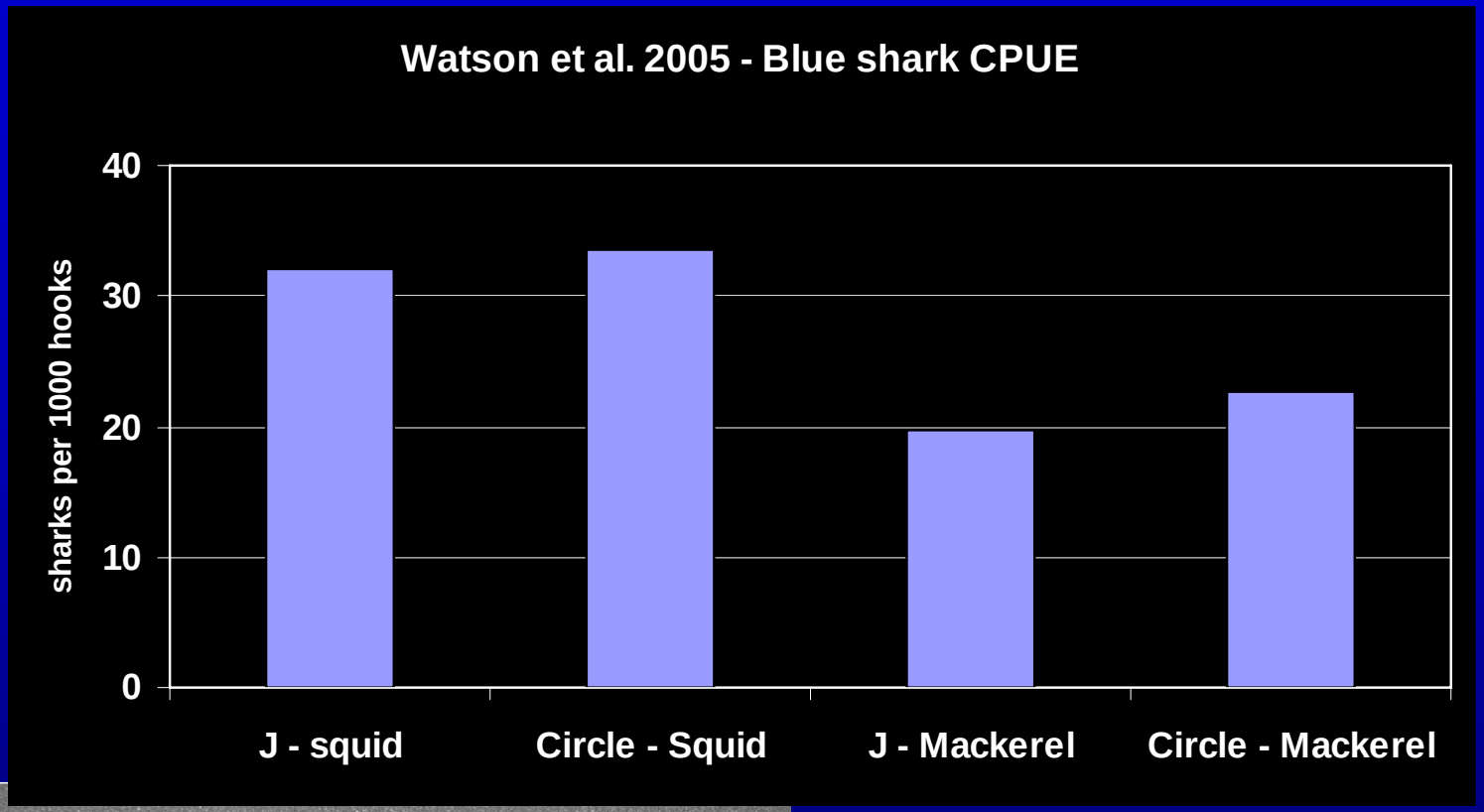
# Shark interactions in pelagic longline fisheries

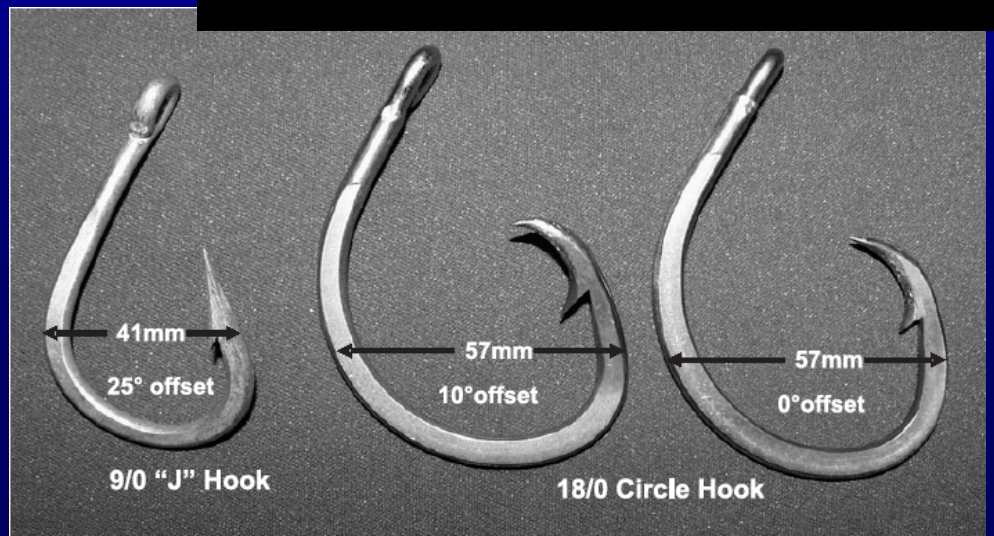
**Shark Interactions**

| | Directed Landings | Bycatch | Depredation |
|---|---|---|---|
| Detrimental to shark populations? | ✔ | ✔ | ✔ |
| Detrimental to the commercial fishing industry? | ✔ | ✔ | ✔ |

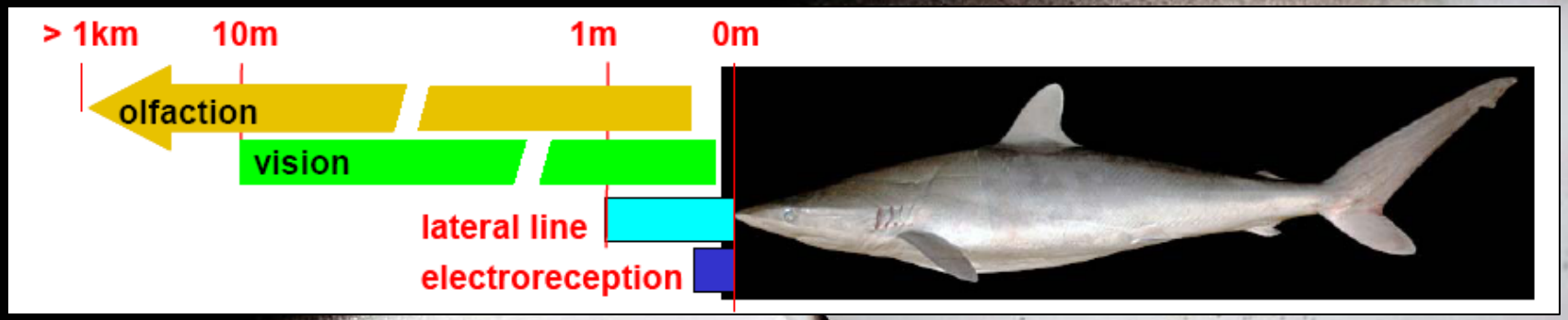
# Shark bycatch reduction progress?

# Bait and Hook Type



# Electroreceptors



WWF for a living planet

SMART GEAR THE INTERNATIONAL COMPETITION

Bycatch | About Smartgear | Winners | Enter | search

Home > Winners > 2006

Winners
- 2007
- 2006
  - Grand Prize Winner
    - Implementing the Winning Idea
  - Runner-Up Winners
    - Implementing the Winning Idea
- 2005

# WWF's International Smart Gear Competition - 2006 Winners

## Grand Prize Winner ($25,000) - DETERRING SHARKS WITH MAGNETS

**Michael Herrmann, United States**

Mr. Herrmann's winning entry proposes a solution to reduce the bycatch of sharks on longlines, which has driven some shark species to the brink of extinction. Mr. Herrmann proposes taking advantage of sharks' unique biology in order to deter them from taking the bait of tempting

Read more>>

Very promising for recreational, but not commercial, fisheries…

# Periodic Table

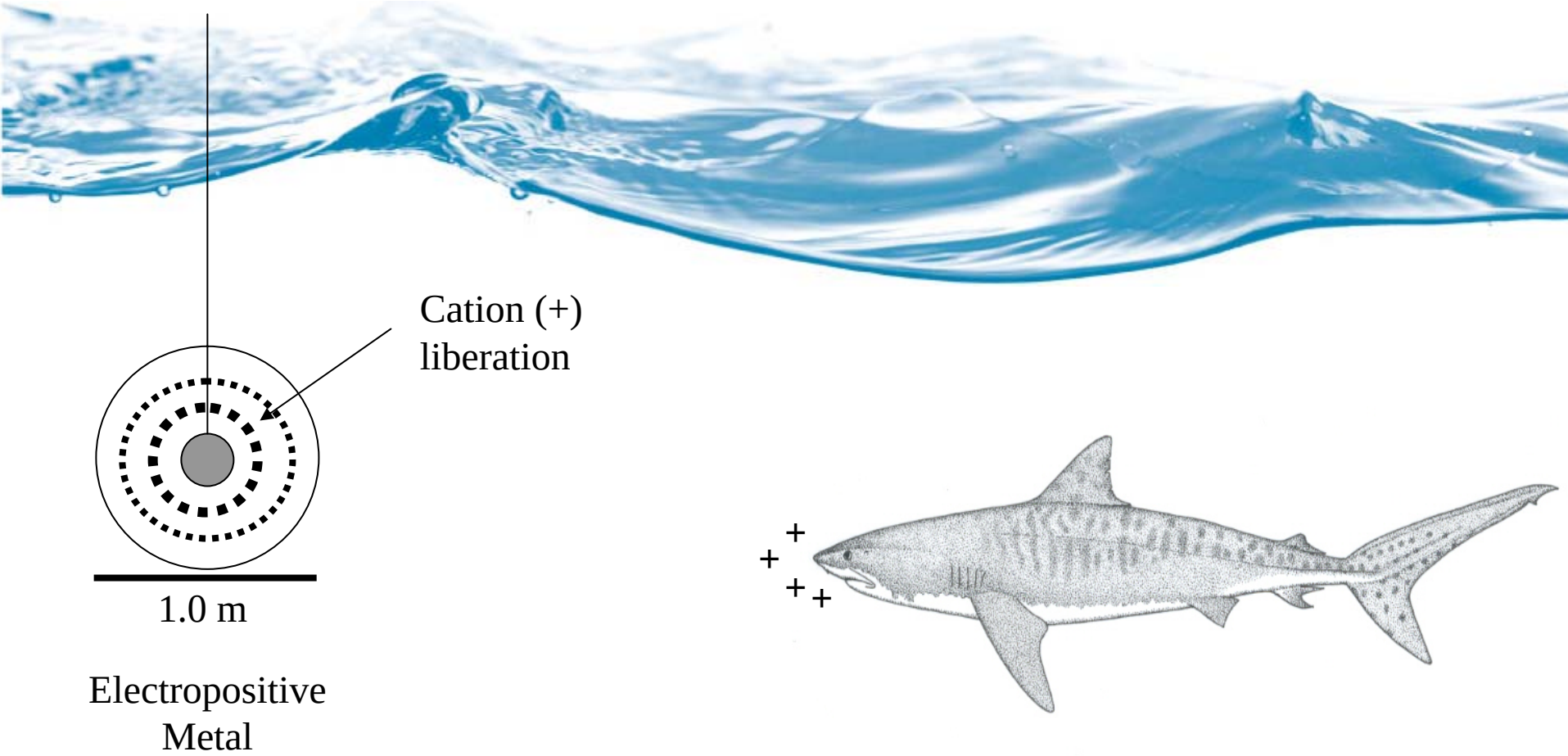
electronegativity

low — high

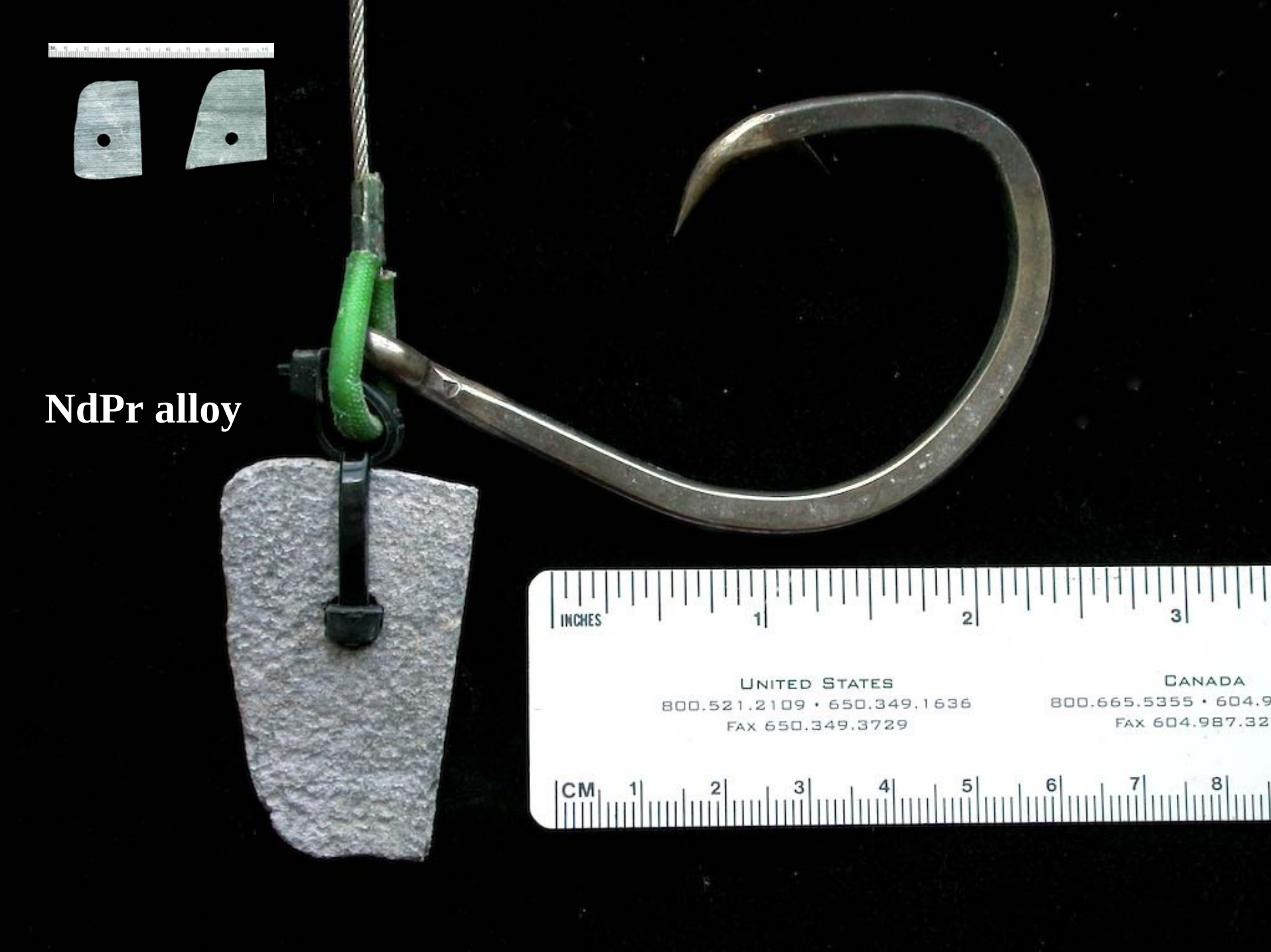
| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 H 2.1 | | | | | | | | | | | | | | | | | 2 He - |
| 3 Li 1.0 | 4 Be 1.5 | | | | | | | | | | | 5 B 2.0 | 6 C 2.5 | 7 N 3.0 | 8 O 3.5 | 9 F 4.0 | 10 Ne - |
| 11 Na 0.9 | 12 Mg 1.2 | | | | | | | | | | | 13 Al 1.5 | 14 Si 1.8 | 15 P 2.1 | 16 S 2.5 | 17 Cl 3.0 | 18 Ar - |
| 19 K 0.8 | 20 Ca 1.0 | 21 Sc 1.3 | 22 Ti 1.5 | 23 V 1.6 | 24 Cr 1.6 | 25 Mn 1.5 | 26 Fe 1.8 | 27 Co 1.9 | 28 Ni 1.9 | 29 Cu 1.9 | 30 Zn 1.6 | 31 Ga 1.6 | 32 Ge 1.8 | 33 As 2.0 | 34 Se 2.4 | 35 Br 2.8 | 36 Kr 3.0 |
| 37 Rb 0.8 | 38 Sr 1.0 | 39 Y 1.2 | 40 Zr 1.4 | 41 Nb 1.6 | 42 Mo 1.8 | 43 Tc 1.9 | 44 Ru 2.2 | 45 Rh 2.2 | 46 Pd 2.2 | 47 Ag 1.9 | 48 Cd 1.7 | 49 In 1.7 | 50 Sn 1.8 | 51 Sb 1.9 | 52 Te 2.1 | 53 I 2.5 | 54 Xe 2.6 |
| 55 Cs 0.7 | 56 Ba 0.9 | 57 La* 1.1 | 72 Hf 1.3 | 73 Ta 1.5 | 74 W 1.7 | 75 Re 1.9 | 76 Os 2.2 | 77 Ir 2.2 | 78 Pt 2.2 | 79 Au 2.4 | 80 Hg 1.9 | 81 Tl 1.8 | 82 Pb 1.9 | 83 Bi 1.9 | 84 Po 2.0 | 85 At 2.2 | 86 Rn 2.4 |
| 87 Fr 0.7 | 88 Ra 0.9 | 89 Ac~ 1.1 | 104 Rf - | 105 Db - | 106 Sg - | 107 Bh - | 108 Hs - | 109 Mt - | 110 --- - | 111 --- - | 112 --- - | | 114 --- - | | 116 --- - | | 118 --- - |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lanthanides * | 58 Ce 1.1 | 59 Pr 1.1 | 60 Nd 1.1 | 61 Pm 1.2 | 62 Sm 1.2 | 63 Eu 1.1 | 64 Gd 1.2 | 65 Tb 1.2 | 66 Dy 1.2 | 67 Ho 1.2 | 68 Er 1.2 | 69 Tm 1.2 | 70 Yb 1.2 | 71 Lu 1.3 |
| Actinides ~ | 90 Th 1.3 | 91 Pa 1.5 | 92 U 1.7 | 93 Np 1.3 | 94 Pu 1.3 | 95 Am 1.3 | 96 Cm 1.3 | 97 Bk 1.3 | 98 Cf 1.3 | 99 Es 1.3 | 100 Fm 1.3 | 101 Md 1.3 | 102 No 1.5 | 103 Lr - |

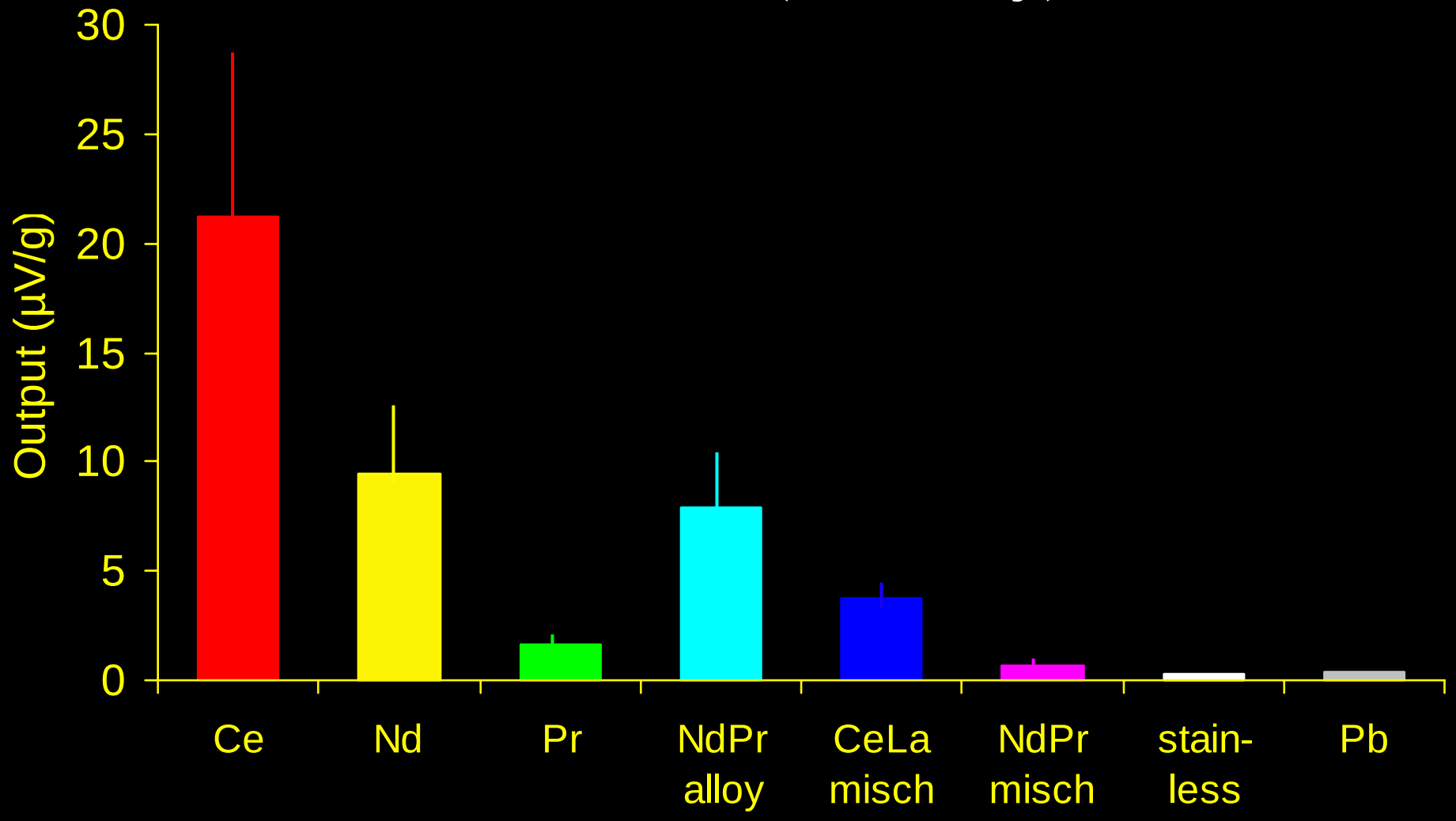
# Hypothesized mechanism




Slide courtesy of Patrick Rice and Shark Defense LLC


NdPr alloy
INCHES
1
2
3
UNITED STATES
800.521.2109 • 650.349.1636
FAX 650.349.3729
CANADA
800.665.5355 • 604.9
FAX 604.987.32
CM
1
2
3
4
5
6
7
8

# E-field trials (reactivity)



NOAA Technical Memorandum NMFS-PIFSC-16

November 2008

# Shark Deterrent and Incidental Capture Workshop
April 10–11, 2008

Compiled and Edited by

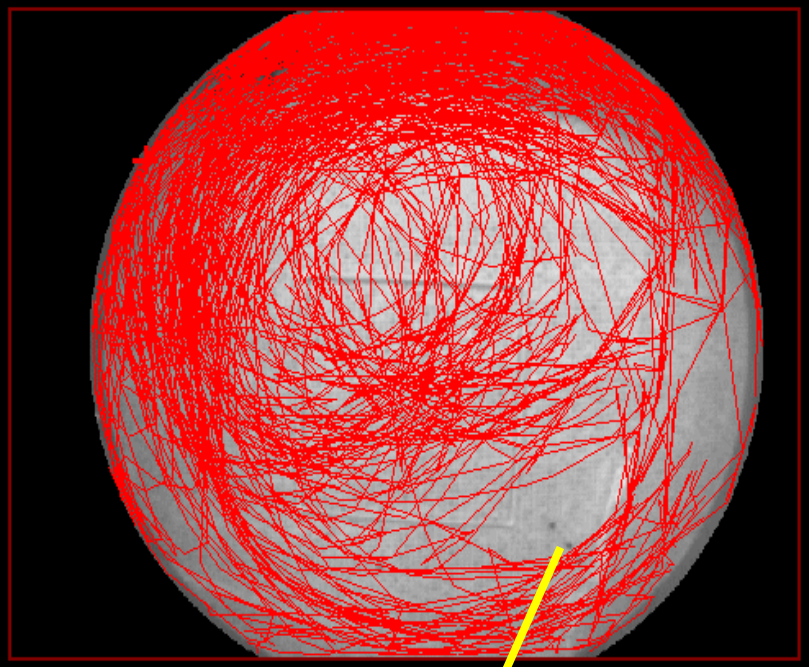
Yonat Swimmer, John H. Wang,
and Lianne McNaughton

Pacific Islands Fisheries Science Center
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

# Research findings of note

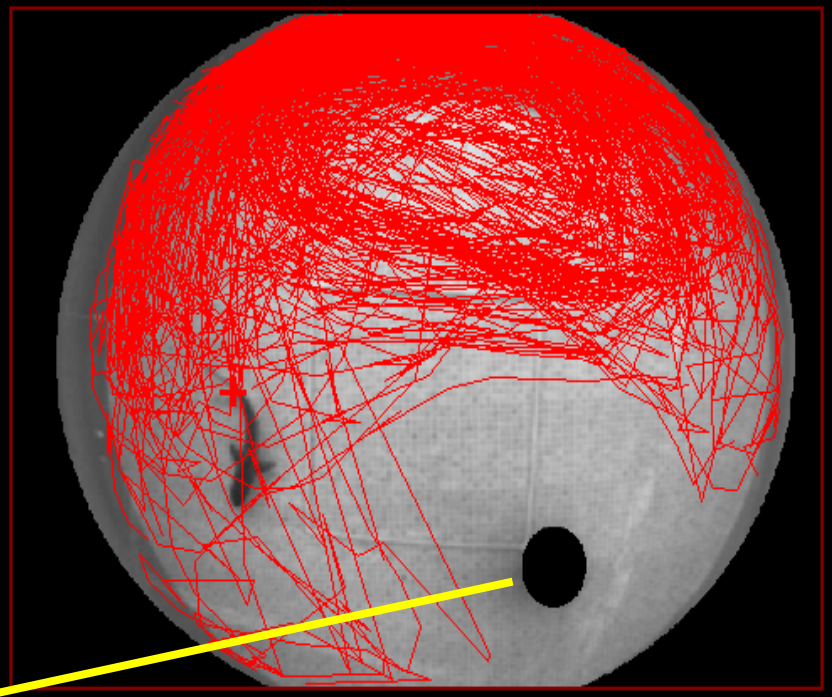
- High interspecific (and interstudy) variability in responses to like alloys.
- Trop. & subtrop. Carcharhinids have been more successfully deterred by alloys.
- Field tests have not necessarily corresponded w/ lab results for like species (e.g. Pacific spiny dogfish).

# Repulsive distance experiments



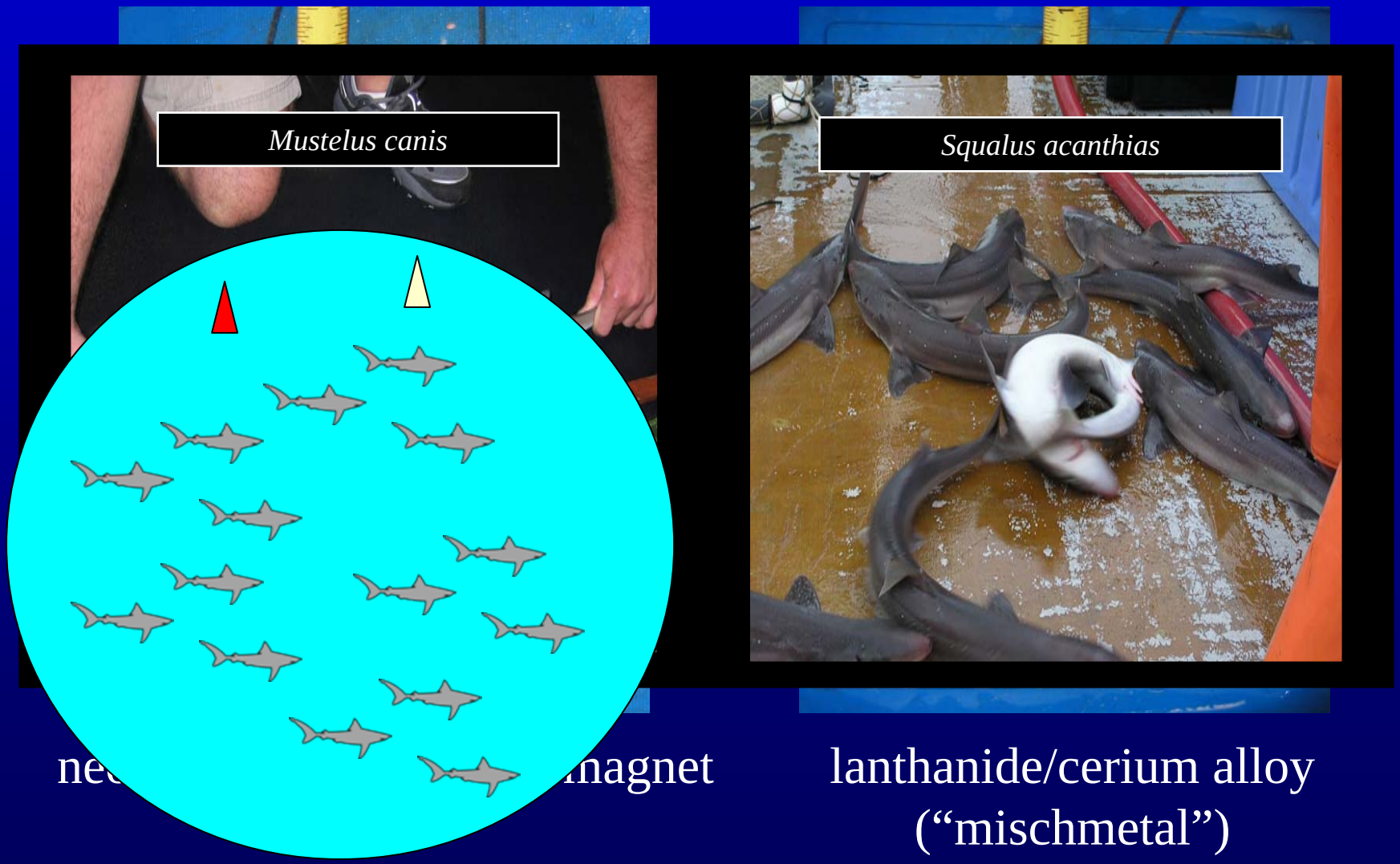
Clear zone of repulsion about 60 cm in diameter.

3 lead fishing weights



3 electropositive metal ingots (2 cm x 2 cm 10 cm)

Baits (squid) were “protected” by the rare earth metals and corresponding stainless steel decoys of equal size & dimension.

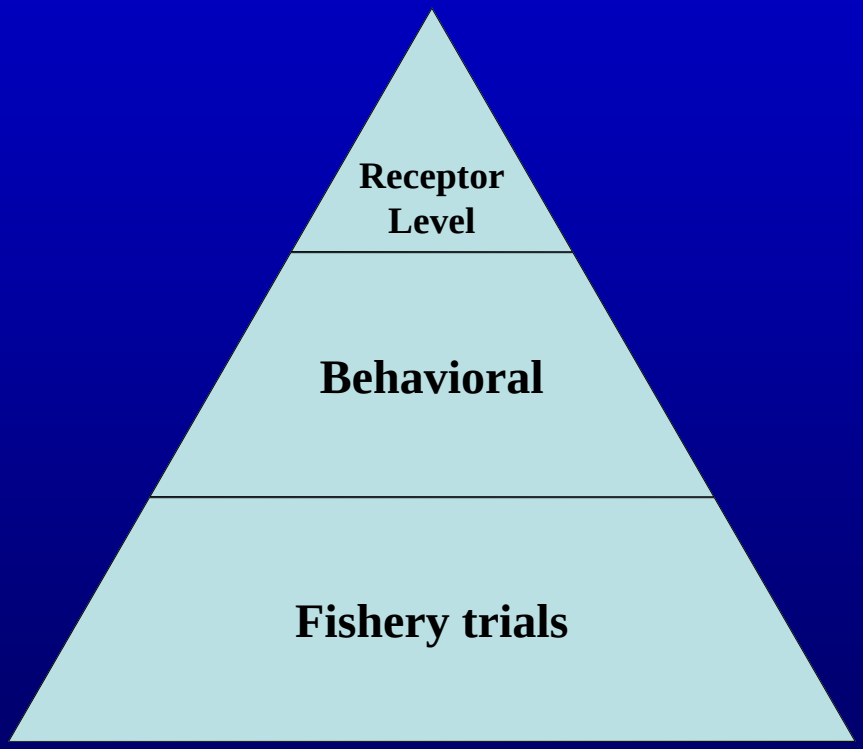



ne nagnet

lanthanide/cerium alloy (“mischmetal”)

# Research priorities

- E – fields details.
- Anatomical & Electrophysiological studies (why do species differ?).
- Uniform environments (to extent possible) for behavioral studies.
- Field investigations should center on most effective metal types and species most successfully repelled in lab.

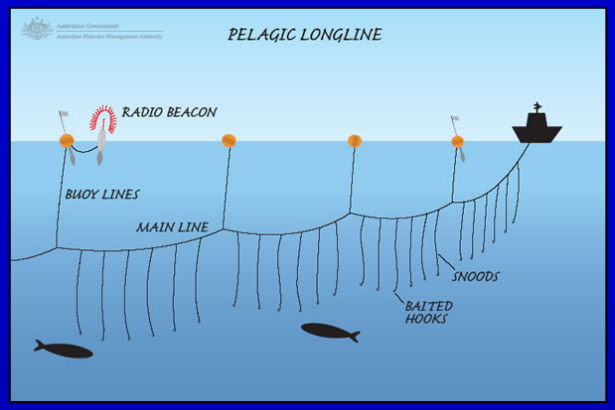


# Potential collaborative model

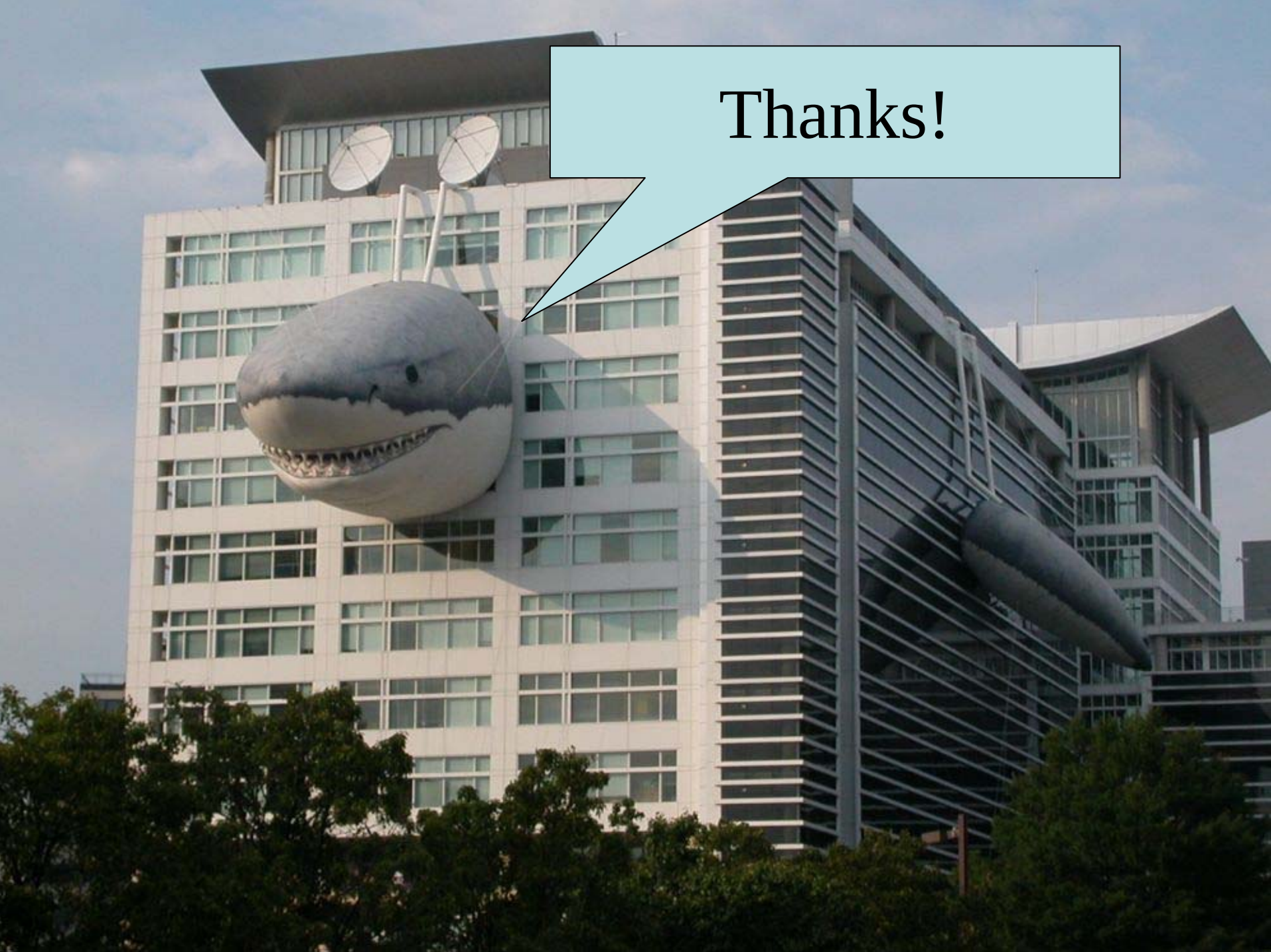
## NEAq * FAU * VIMs

- Florida Atlantic University
  Electrophysiology and anatomy, and more in-depth e-field tests for new metals (e.g. Mg).
- VA Institute of Marine Science

  Lab based tests for various proxy species (e.g. spiny and smooth dogfish, sandbar shark, southern ray, clearnose skate); base for field trials.



# Ultimate Goal: integration into LL fisheries; R & D for application in alternative fisheries


Thanks!