Sperm Whale and Fishery Interactions in the Gulf of Alaska:

Cooperative Research between scientists, fishermen and government

NOAA-SPLASH

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and
Aaron Thode, Scripps Institution of Oceanography

Collaborators

The Southeast Alaska Sperm Whale Avoidance Project (SEASWAP) Team

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Co-Investigators
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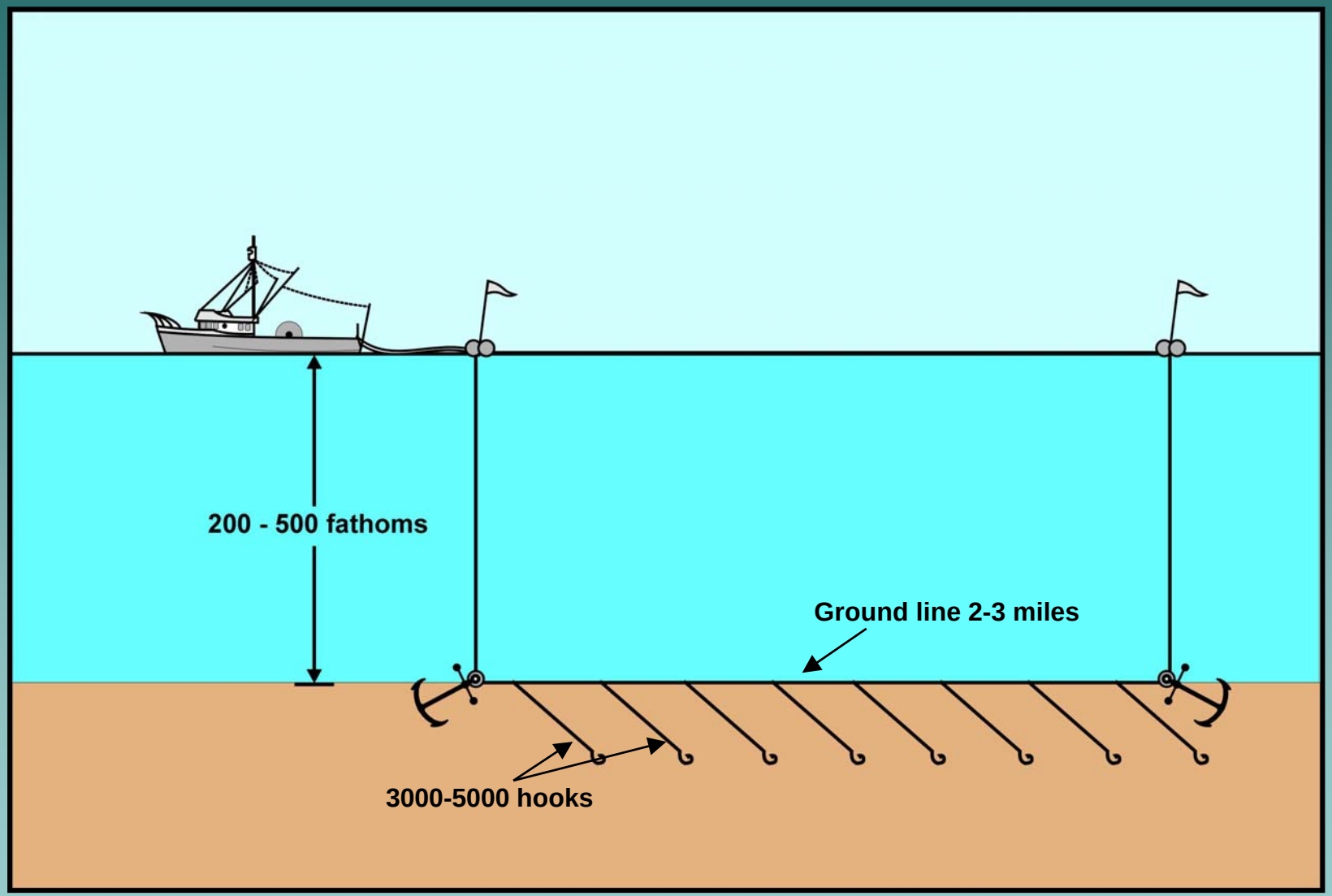
Three Year Study Funded by North Pacific Research Board

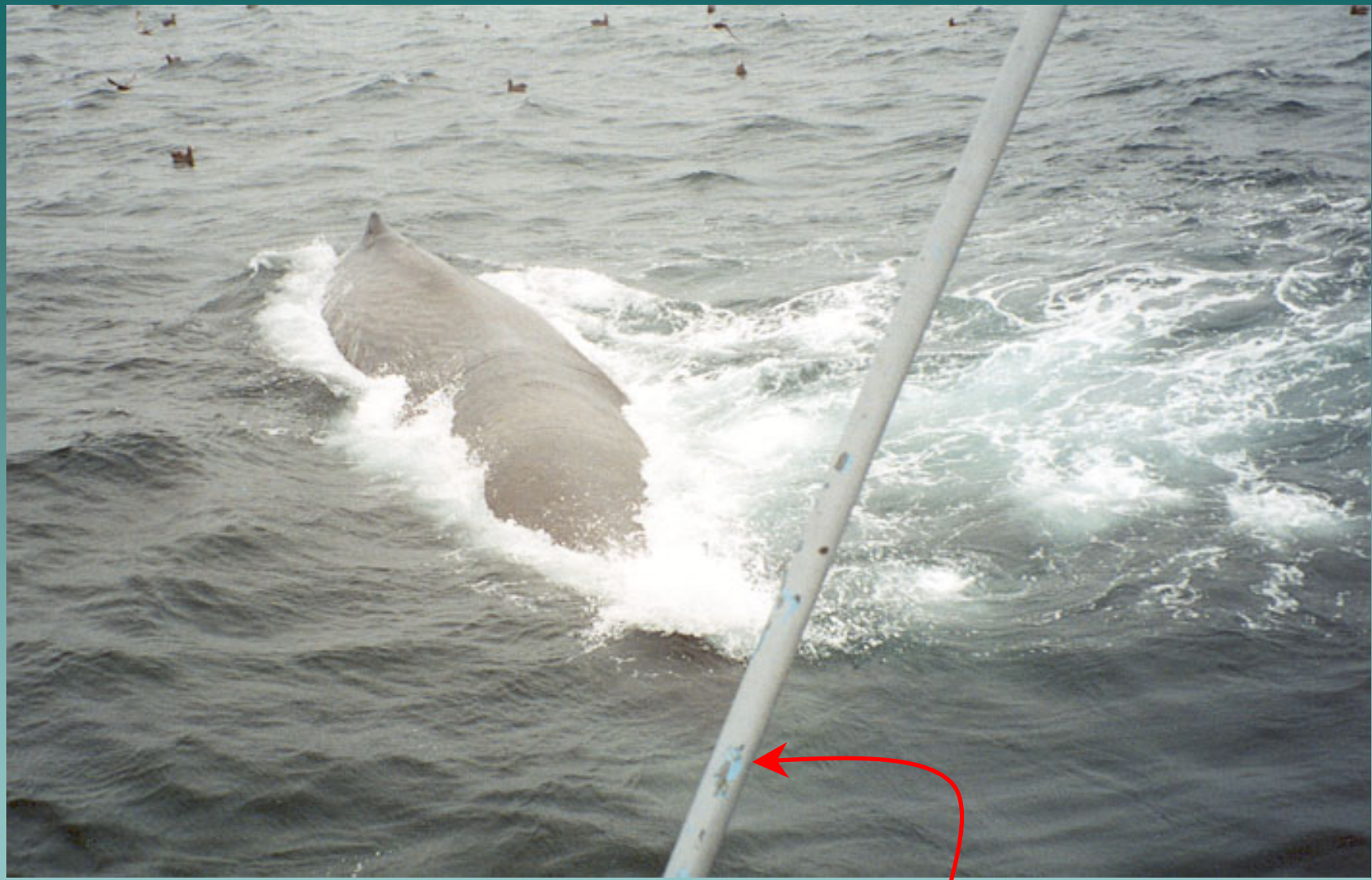
Longline Operations



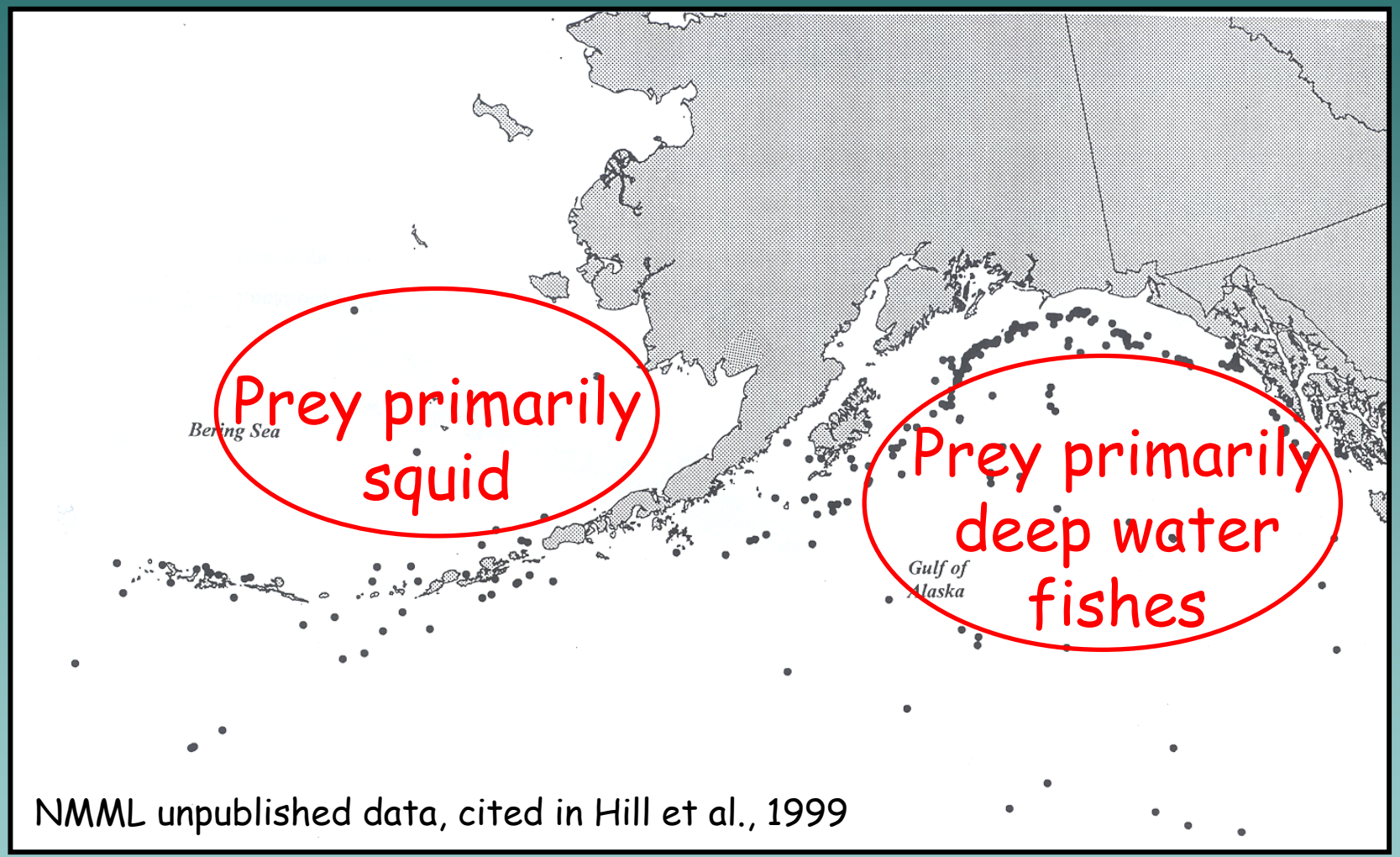
Sablefish Depredation

Sablefish 2003 quota 5,880 mt in eastern Gulf of Alaska;
Over 500 permit holders
Price $3-$4 US per pound

Halibut Depredation

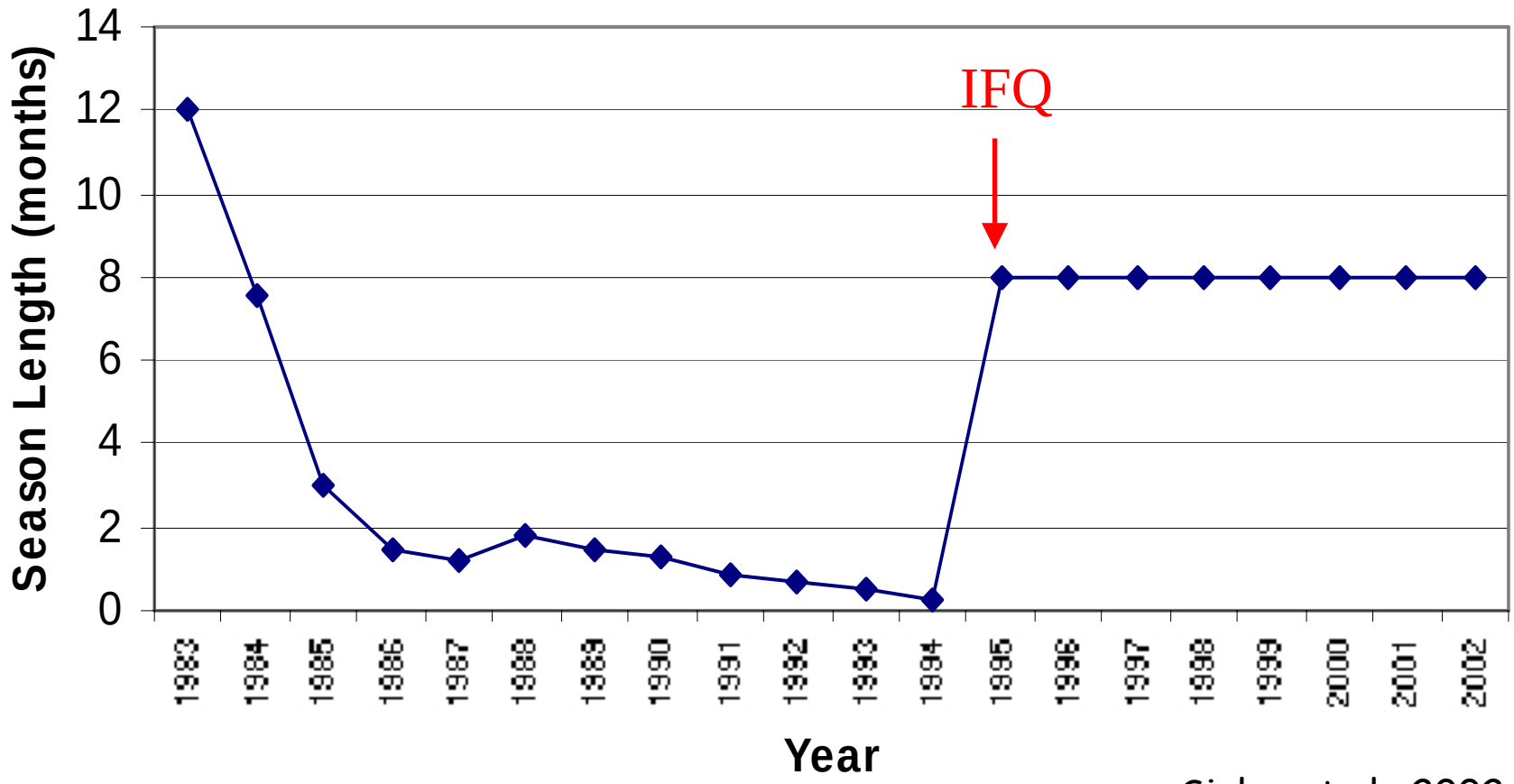

Vessel Stabilizer Pole

Sperm Whale Sightings (1958-1995)



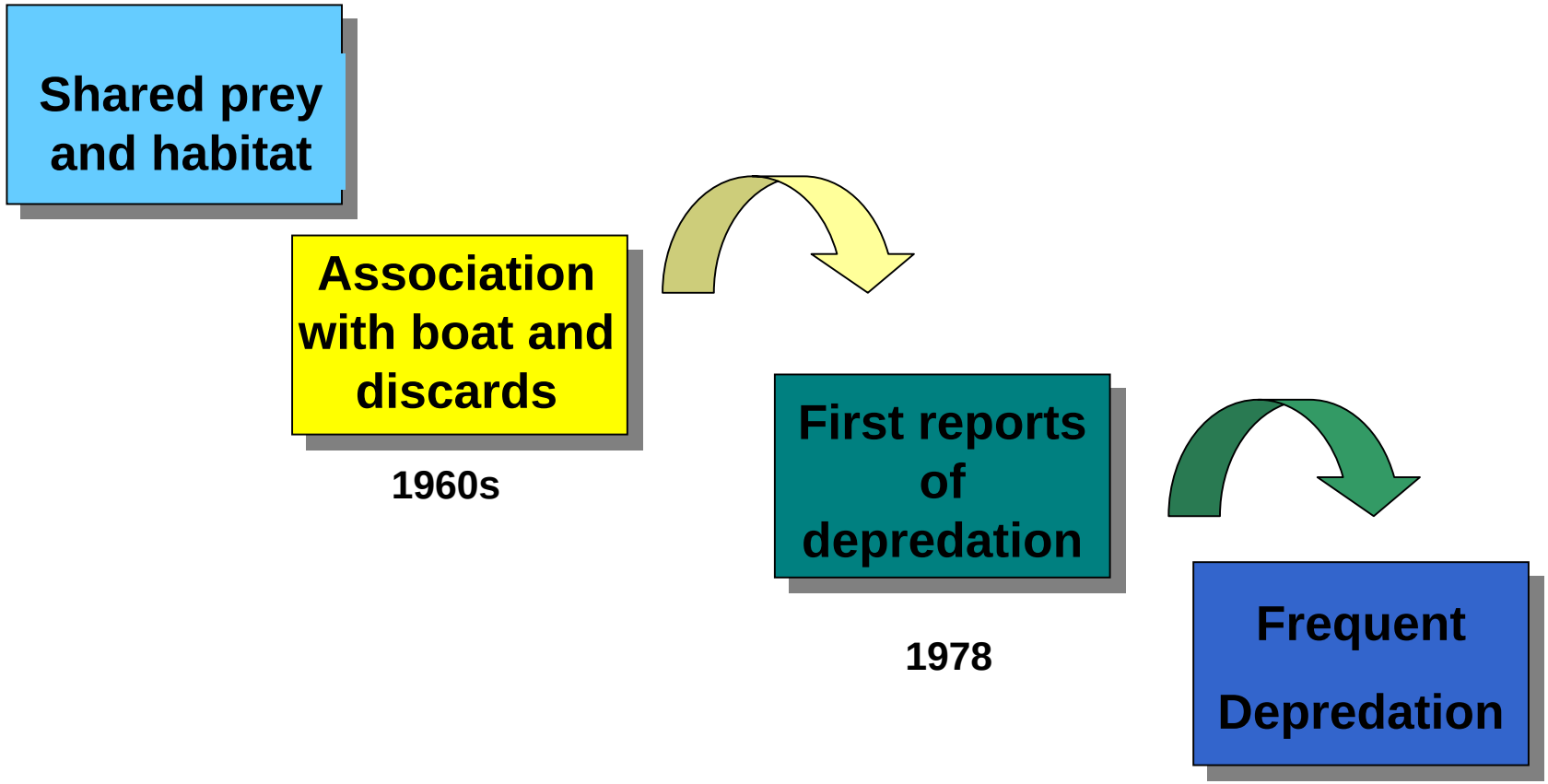
NMML unpublished data, cited in Hill et al., 1999

GOA Sablefish Season Length



Sigler et al., 2002

Sperm Whale-Longline Interactions in Gulf of Alaska



To date no known serious injury to whales but economic loss to fishermen

Goals

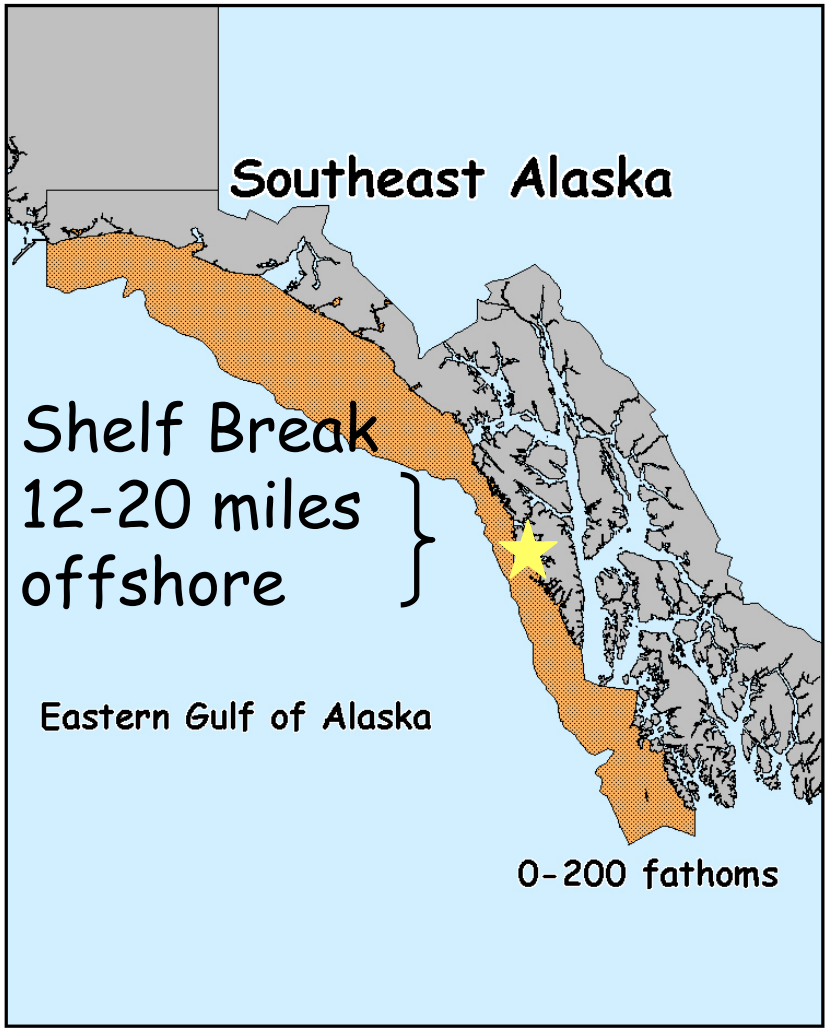
To cooperatively investigate this problem in the hopes of recommending deterrents to reduce depredation

1) Greater understanding of sperm whales in the GOA
   - Using genetics and photo identification

2) Spatial and temporal patterns of sperm whales and fishing behavior (interactions)
   - Using a core team of fishermen collecting data

3) Acoustics of vessels and whales (Aaron Thode)
   - Using hydrophones during fishing operations and when whales present without vessels

Study Area and Vessels

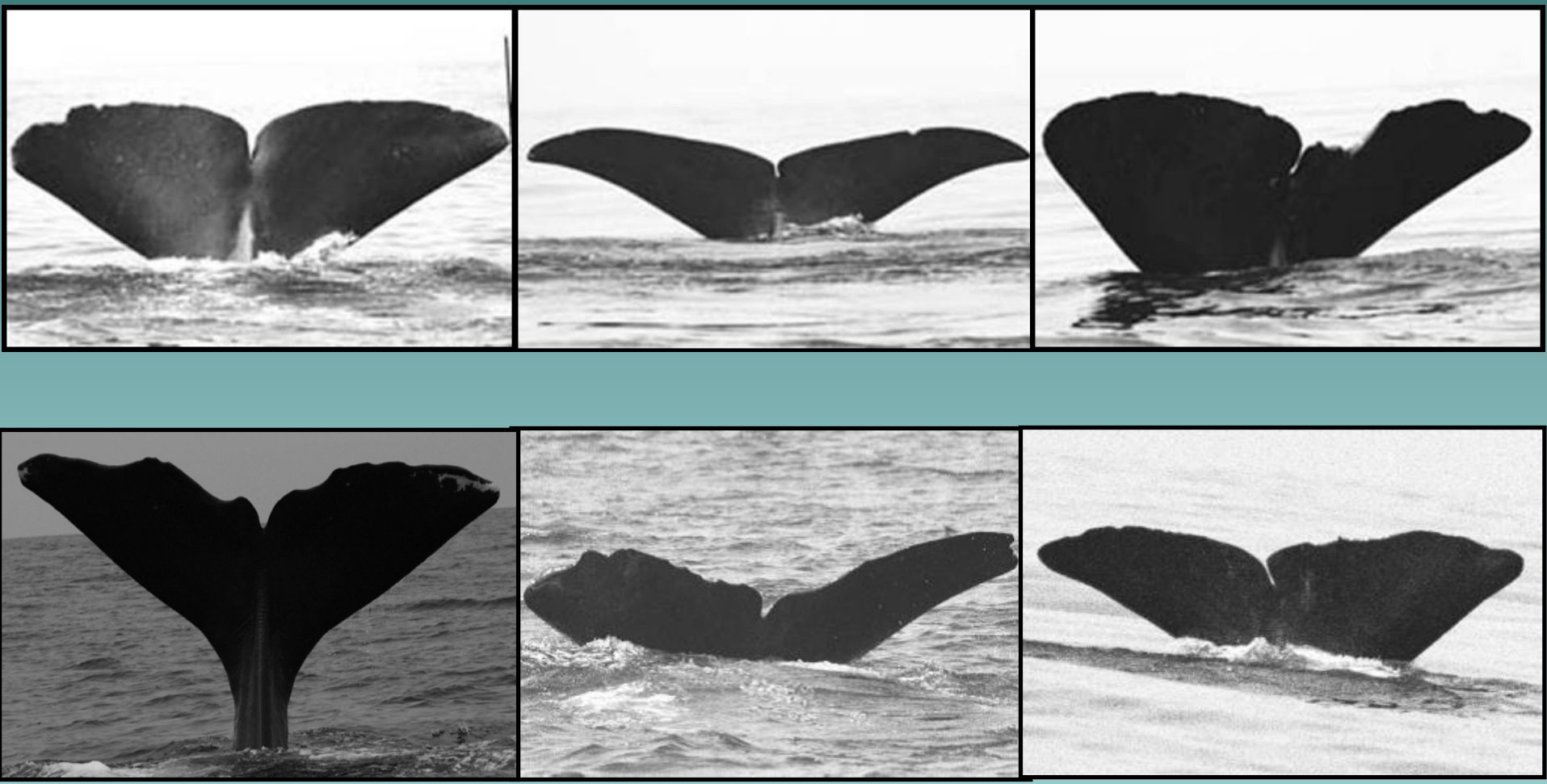


Small boats (<18 m)
unobserved

Genetic Sampling Techniques

Whales Identified by Shape and Nicks on Trailing Edge of Flukes

n=90 (65, 128 Bayesian CI)



Sablefish Fishing Interactions with Whales

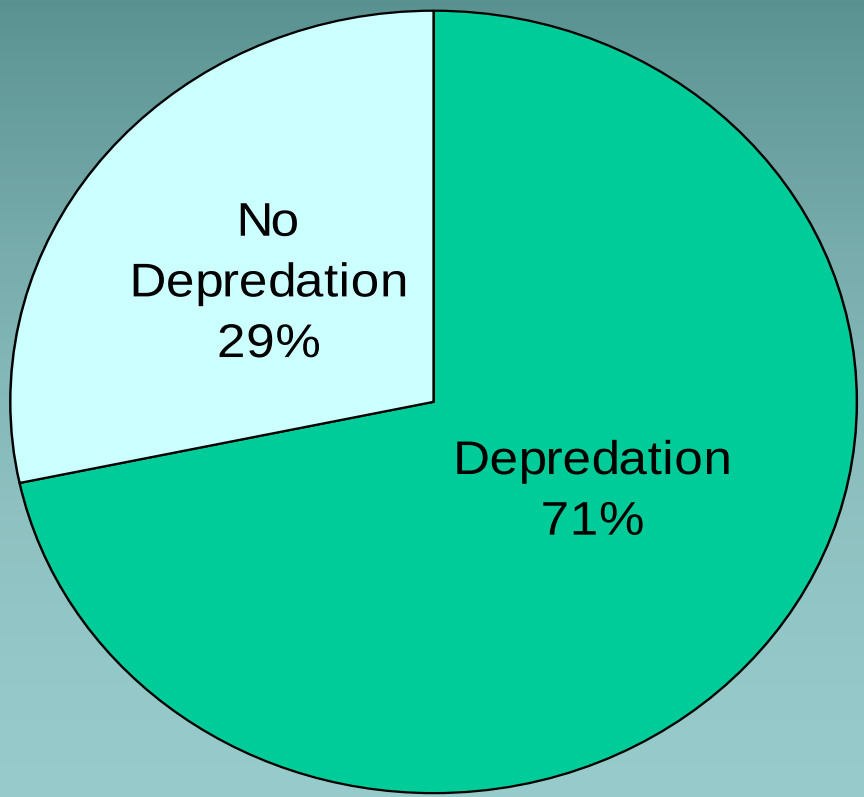
Percentage of sets (n=124) where whales were present at the set, soak, haul or joined the haul.

Whales	Set	Soak	Start Haul	During Haul
Not Present	90.2%	93.4%	85.2%	68.6%
Present	9.8%	6.6%	14.8%	31.4%

1/3 of sets had whales nearby; overall 22% depredation

Depredation

Sets (n=39) evaluated for depredation when whales present during haul



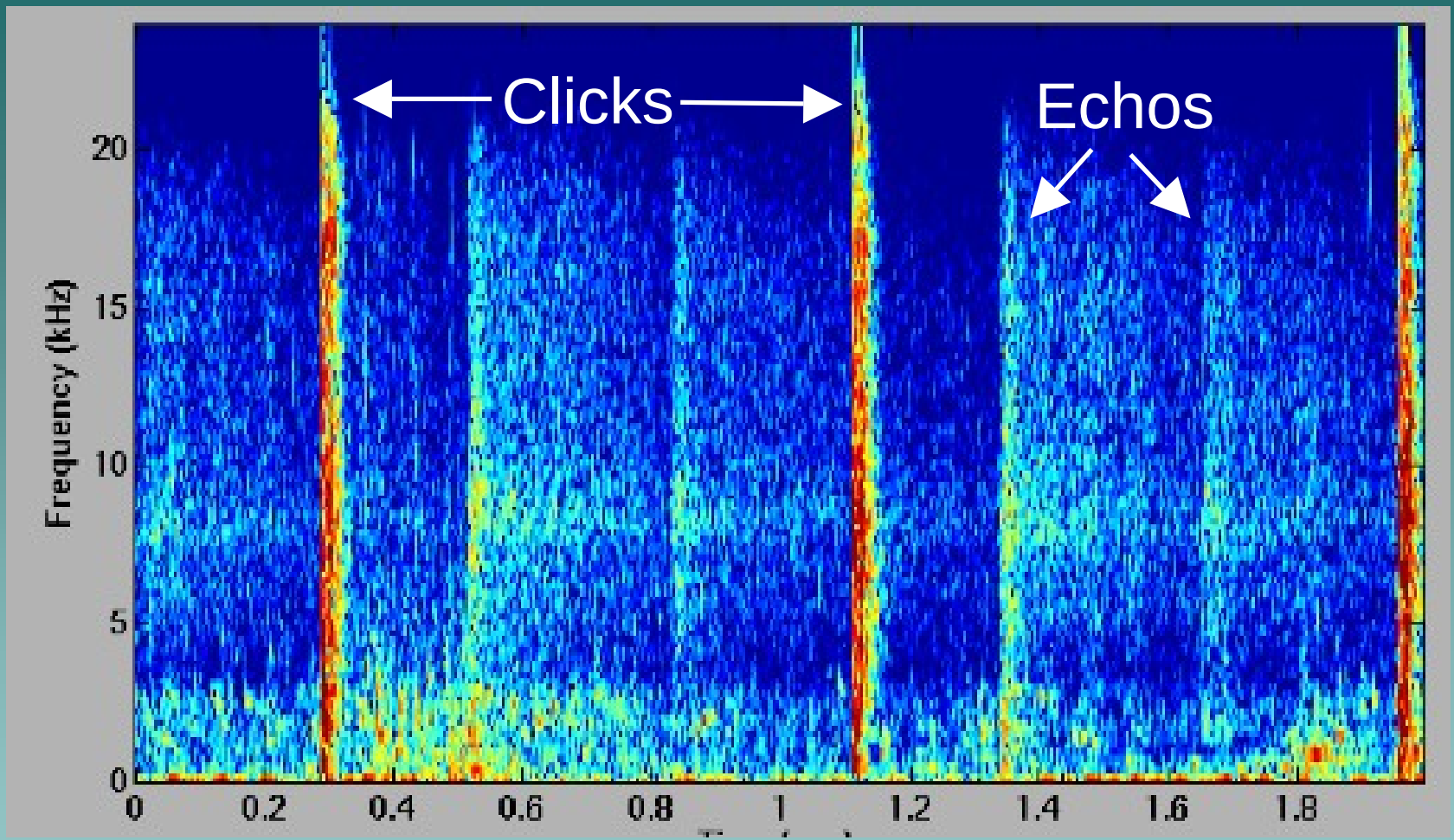
3% reduction in catch when whales present at haul (regardless if evidence of depredation)

Whales not attracted to specific vessels

If whales joined during the haul, depredation likely.

Other Results/Summary

- Whales found feeding offshore when no fishing boats present; presumed to be eating fish
- Depredation lowest early in season (March)
- Not all whales near vessels were eating fish off longline gear (could be eating discard or 'spin-offs')
- Conflict is overlap spatially and temporally for same resource (sablefish and halibut)
- Whales were very vocal; clicks generated echos off ocean floor
- Acoustic component added in 2004; can track whales at depth with hydrophones


Clicks
Echos
Frequency (kHz)
20
15
10
5
0
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8

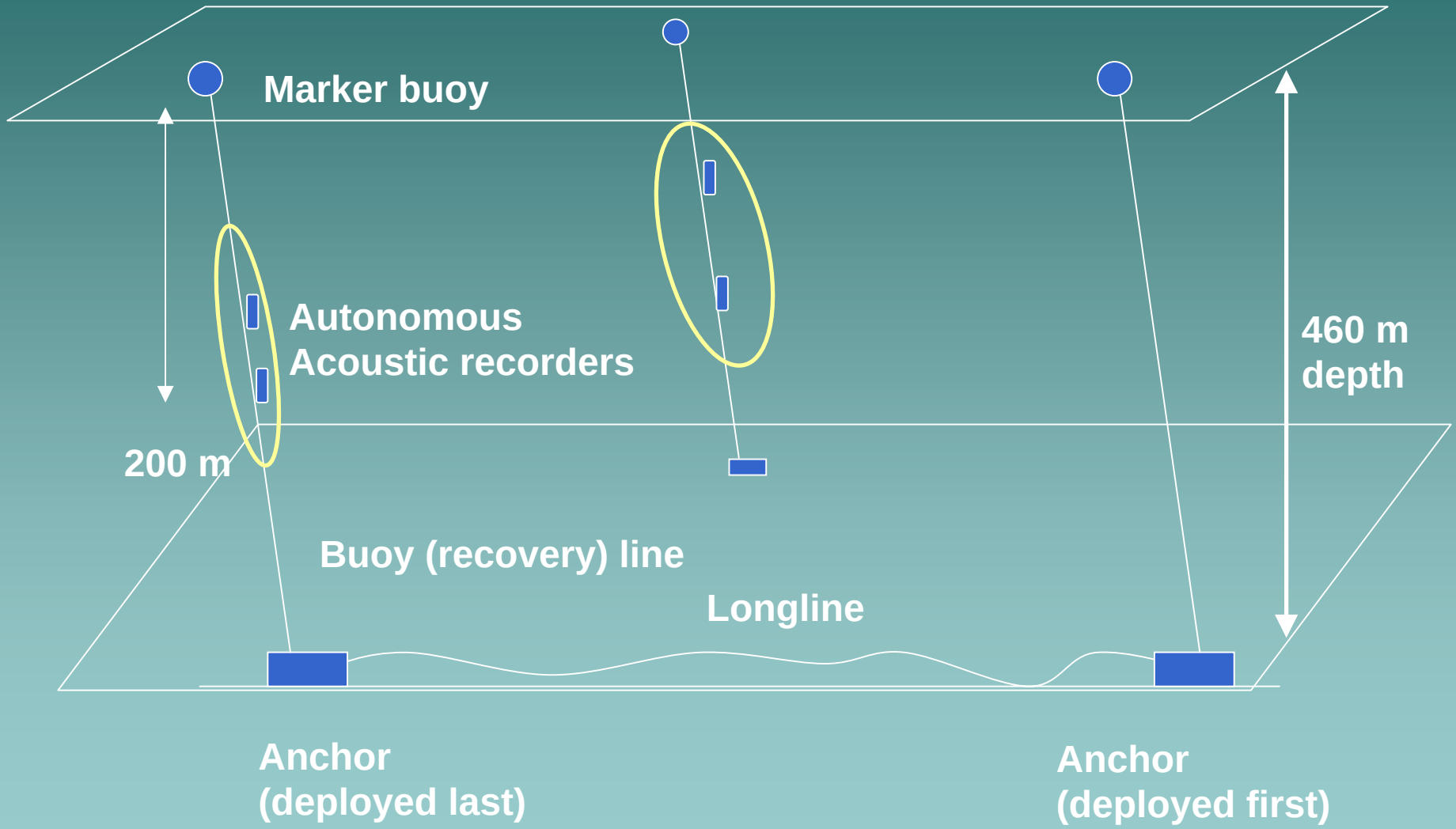
Goal: Understanding the Problem

- Need observations before modifying gear, testing deterrents
- How are whales finding gear?
  - **What sounds are acoustic cues?**
  - **How far away can whales detect gear?**
- How are whales taking fish?
  - **Visual or acoustic?**
  - **What depth are they taking fish?**
- Is avoidance a viable strategy?
  - **How far away can we hear whales with hydrophones?**

Three strategies being integrated together

- “Bugging” of longline gear to monitor entire deployment
  - When do animals arrive?
  - At what range can they detect gear?
  - At what depth are the whales foraging?
- Analysis of recordings from small boat
  - **Natural diving behavior**
- Towed acoustic array
  - Detection distance, increase encounter rate

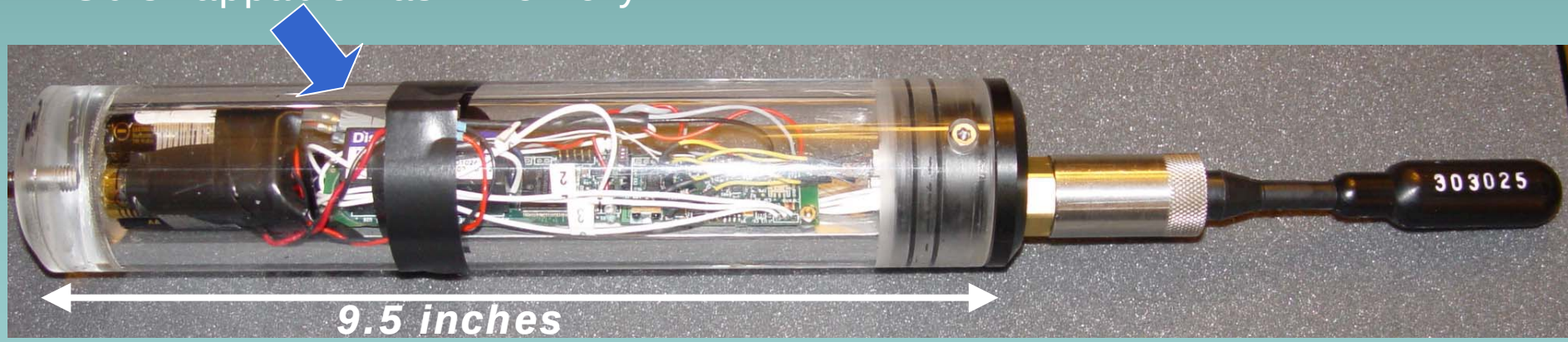
Anchor lines converted to listening and tracking stations



Marine mammal acoustic tags converted into autonomous recorders

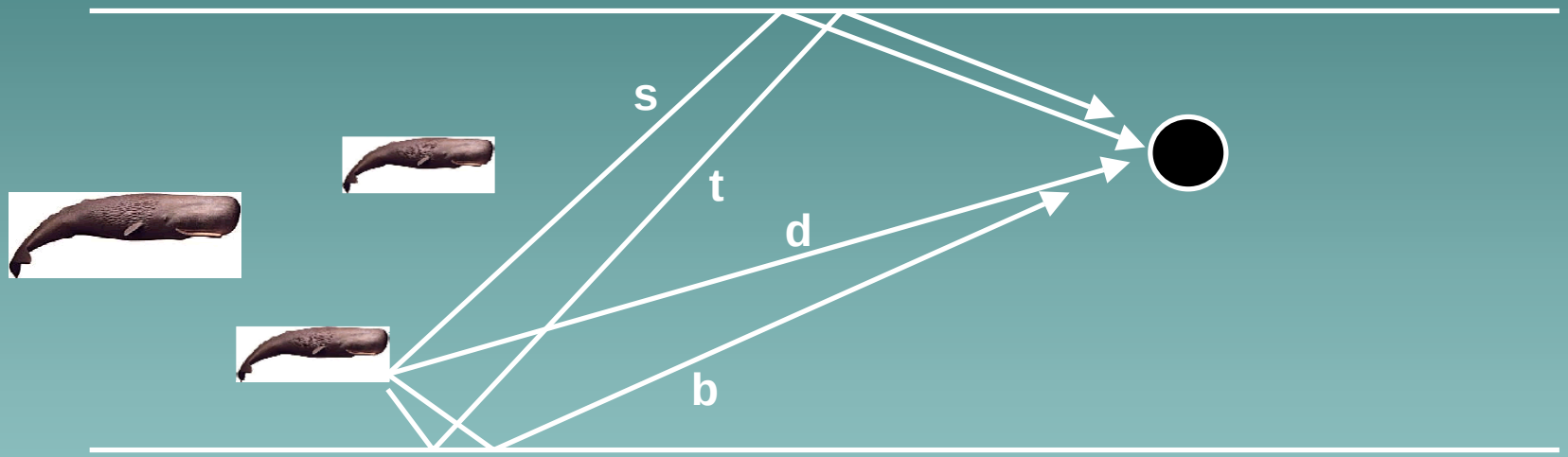
-At 15 kHz sampling rate can record for 17 hrs.
-Auxiliary pressure, temperature, and inclinometer
-Powered by 4 AAA batteries

1 Gb swappable flash memory

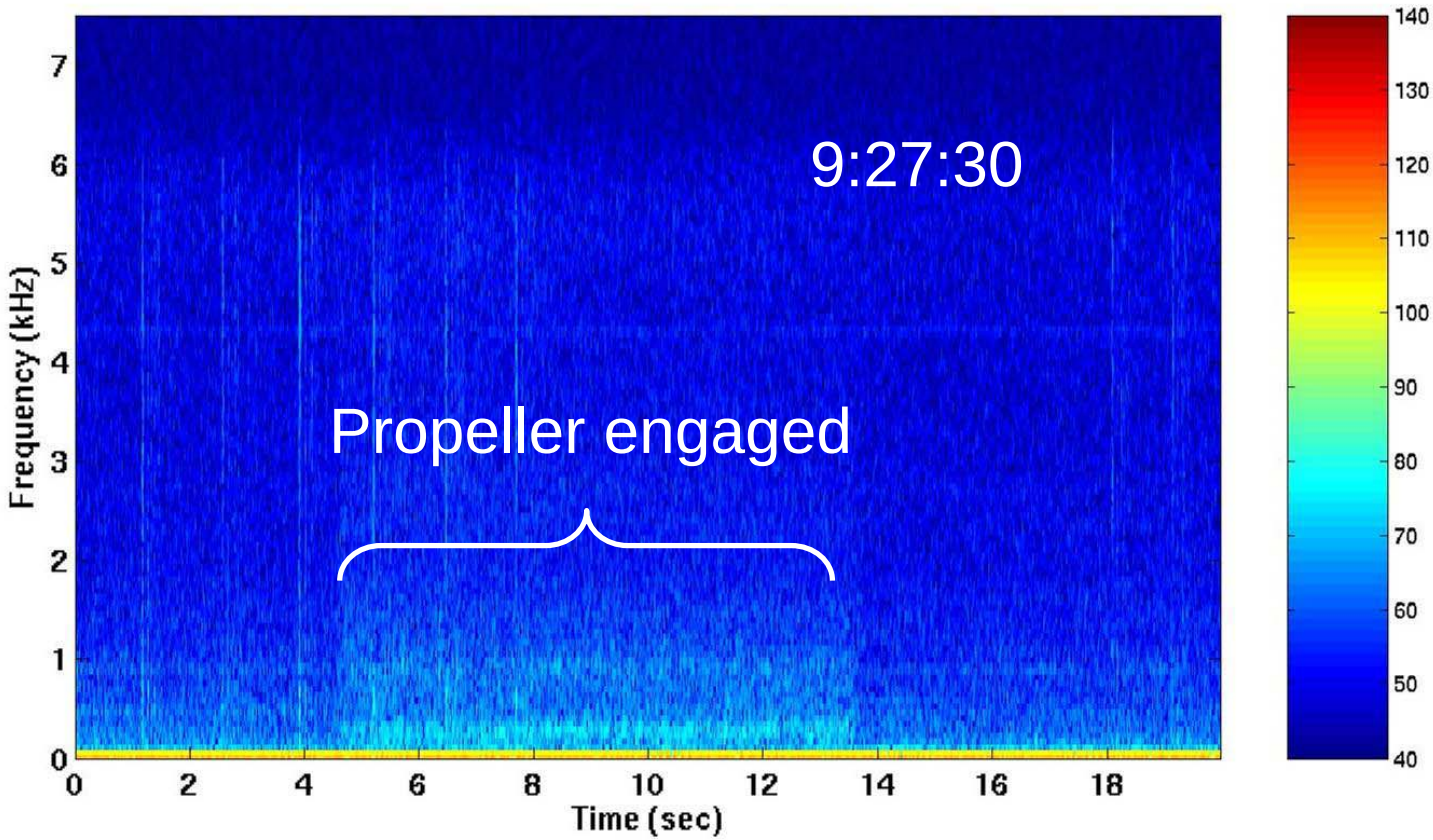


Bill Burgess, Greeneridge Sciences

Echoes permit animal range and depth to be derived using single hydrophone

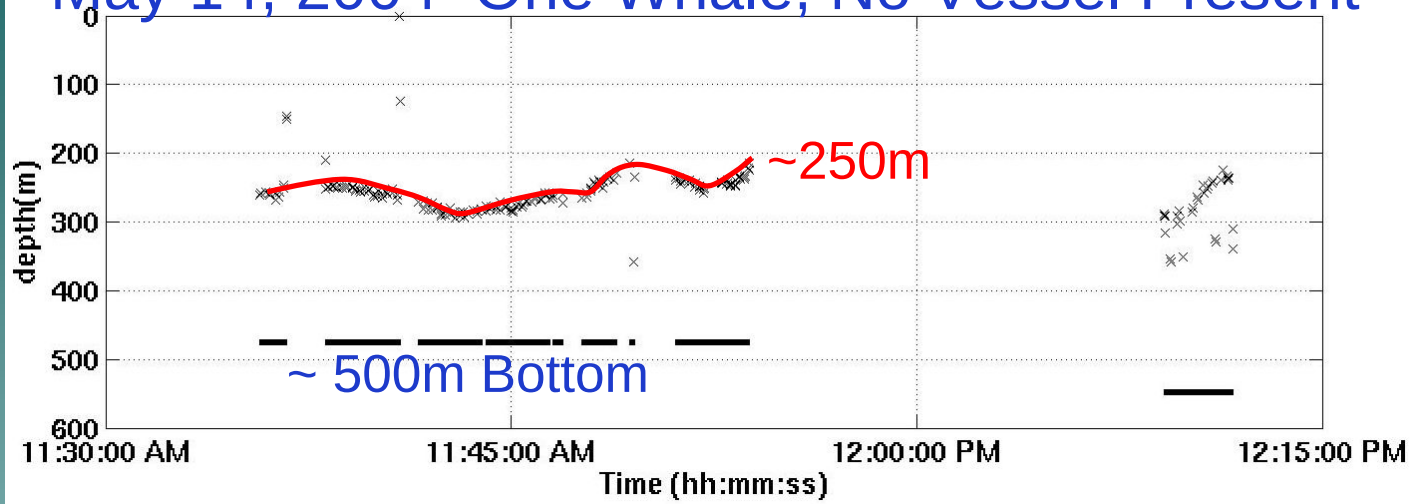


Boat makes distinctive sound when hauling longline-engine engage/disengage

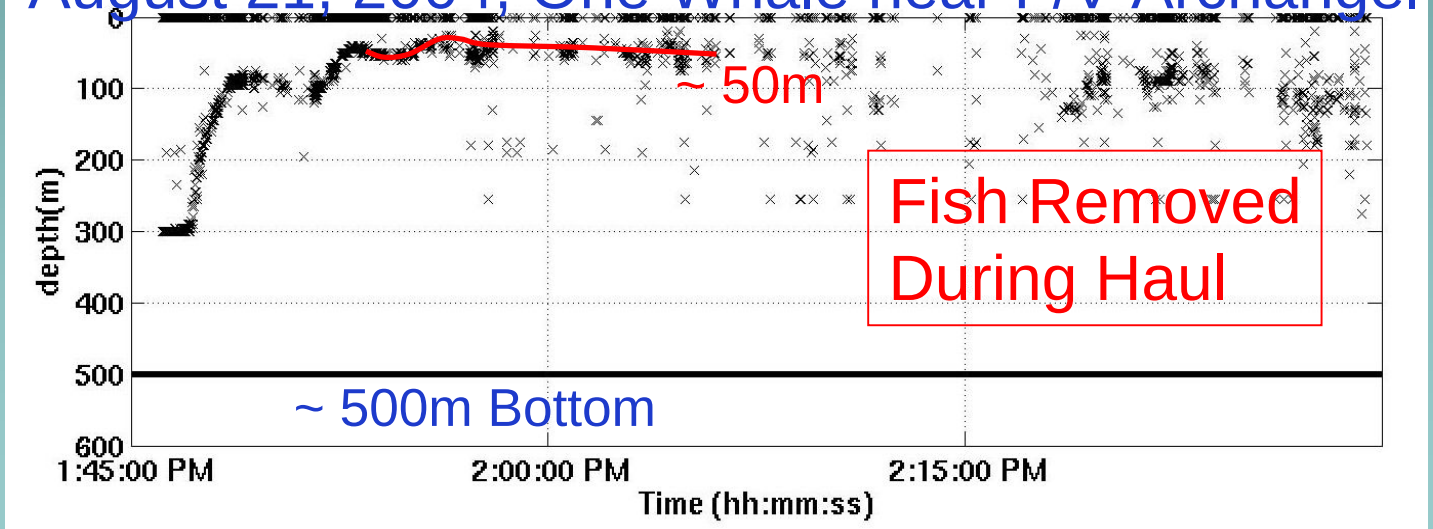


What Depth?

May 14, 2004 One Whale, No Vessel Present



August 21, 2004, One Whale near F/V Archangel



Tentative acoustic observations:

- How are whales finding gear?
  - No distinctive sounds by longline alone or hydraulics
  - Strongest candidate: way boat is handled
  - Detection range analysis requires bathymetry (added 2005)
- How are whales taking fish?
  - Visual or acoustic? Very active acoustically with “creak” sounds associated with feeding
  - What depth are they taking fish? 50 m vs. 250 m
  - Are whales targeting dropped fish? Probably
- Is avoidance a viable strategy?
  - Whale detection range at least 4 nm
  - No reaction from whales to fishing when 10 nm away

Next Steps:

- Determine how far away a whale can hear a fishing vessel hauling gear.
  - If further than 5 nm, listening won't work for avoidance
- Gain a better understanding of the number of fish that normally are released alive (dropped or 'spin-offs') and if 'creaks' indicate feeding.
  - Will refine depredation rates
- Test various gear modifications and hauling behaviors.
  - Gangion lengths
  - Acoustic reflectors along groundline
  - Haul in circle without engaging/disengaging engine
  - Fish early in the season
  - Listen prior to setting gear
- May need to test acoustic deterrents

Participants or Advocates for Cooperative Research:

- North Pacific Research Board
- Alaska Longline Fishermen's Association
- Petersburg Vessel Owner's Association
- University of Alaska Southeast
- Alaska Department of Fish and Game
- National Marine Fisheries Service
- International Pacific Halibut Commission
- Marine Conservation Alliance
- Alaska Sea Grant