FISHERMEN & SCIENTISTS RESEARCH SOCIETY

20th Annual Conference
February 20 - 21, 2013 Truro, NS

Building Observing System Deployed on Lobster Traps along the Northeast Atlantic Shelf

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http://www.nefsc.noaa.gov/epd/ocean/MainPage/tilt/shtcm.html

Funding: Northeast Consortium, eMOLT project

Abstract

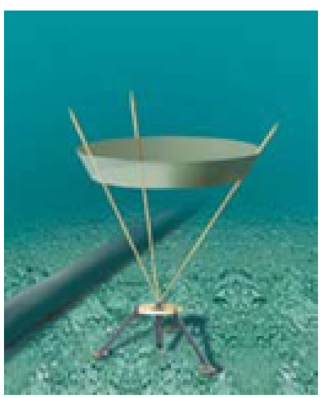
During eMOLT (Environmental Monitors on Lobster Traps): bottom currents project we developed an inexpensive instrument for measuring currents from lobster traps. The operation of the instrument is based on the drag principle of a buoyant cylindrical pipe. Following a test deployment of 10 instruments in 2008 the design was improved and we deployed a current observing system consisting of 50 instruments in 2010 for two months and 40 instruments for 9 months in 2011 with the help lobstermen volunteers. The deployment sites were distributed around the Gulf of Maine in the depth range from 10 to 300m. The instruments were also equipped with a sensor measuring the tilt of the trap on the bottom thus allowing us to detect its movement. On average in 6% of time the traps was on a side or upside down with Tilt > 45 deg. The probability ranged from 0% for the majority of lobstermen to as much as 25, 30, or even 100% for a few. Comparison with the meteo data from the National Data Buoy Center showed the movements of the traps in response to high wind and wave events. In some cases lobster traps moved every 12h in response to tidal currents. We present comparison of our observations with the FVCOM GOM3 30 year hind cast simulations. We also present progress in the further instrument development.

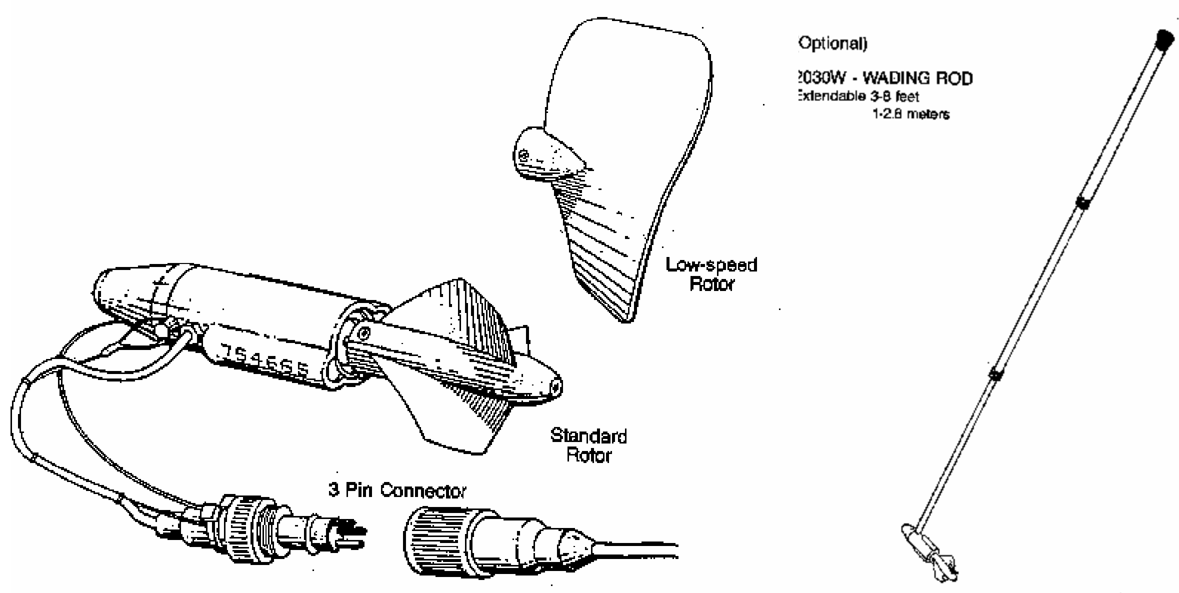
Motivation

Provide fishermen, researches, educators with accurate and affordable means of measuring currents

Original motivation was to help Gulf of Maine Lobstermen to estimate near bottom currents and to asses a sinking ground line issue

Available instrumentation for measuring currents:
1. **Acoustic current meters $10K (Sontek, Nortek, YSI, RDI, now Teledyne)**
2. **Vane on a stick $500 (General Oceanics)**
3. **Piece of chalk $1**

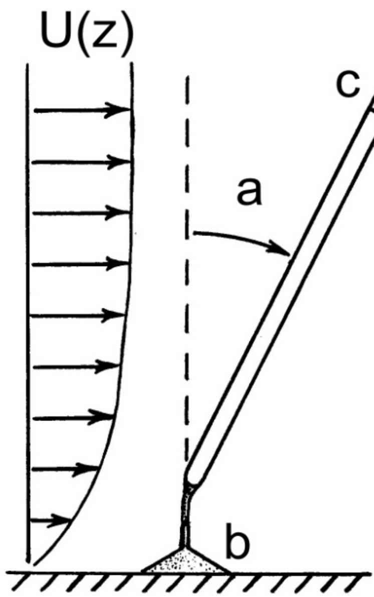




SeaHorse Tilt Current Meter: (~$500) Physical Principle

Cons: Limited range of currents 5-70 cm/s; somewhat nonlinear response; does not have integrated compass (presently); limited memory (32,000 samples).

Pros: Low cost; light (15lb weight); easy to deploy recover; sleek (does not trap seaweed); adequate accuracy for research; easy to interface with PC; battery lasts years.



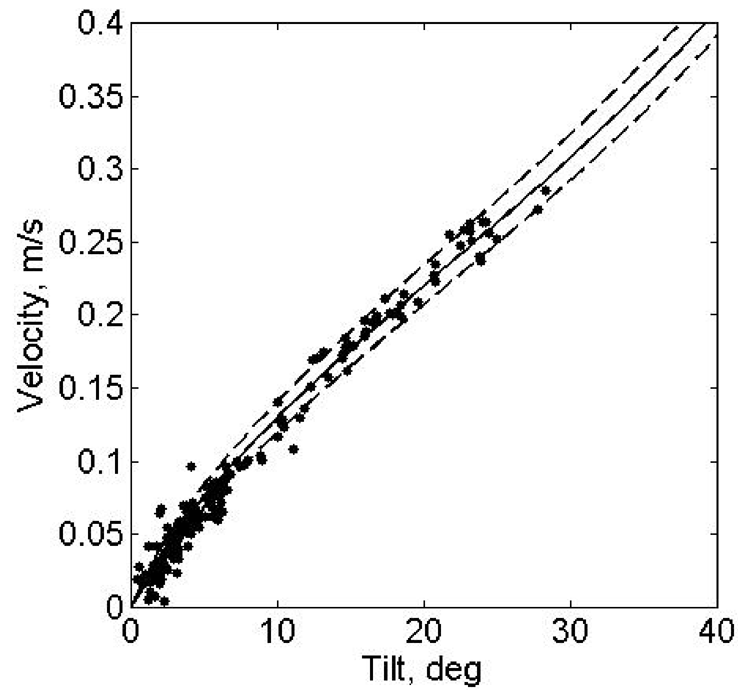


Fig. 1. Left panel: Sketch of a tilt current meter. The velocity profile U(z) causes the device to tilt (a) from the vertical direction. The device is attached to the base (b) resting on the bottom. The electronics package is located at the top of the device (c). Right panel: Calibration of the "SeaHorse" Tilt Current Meter against an acoustic current meter. Error bars are 2 cm/s.

Calibration off URI/GSO pier

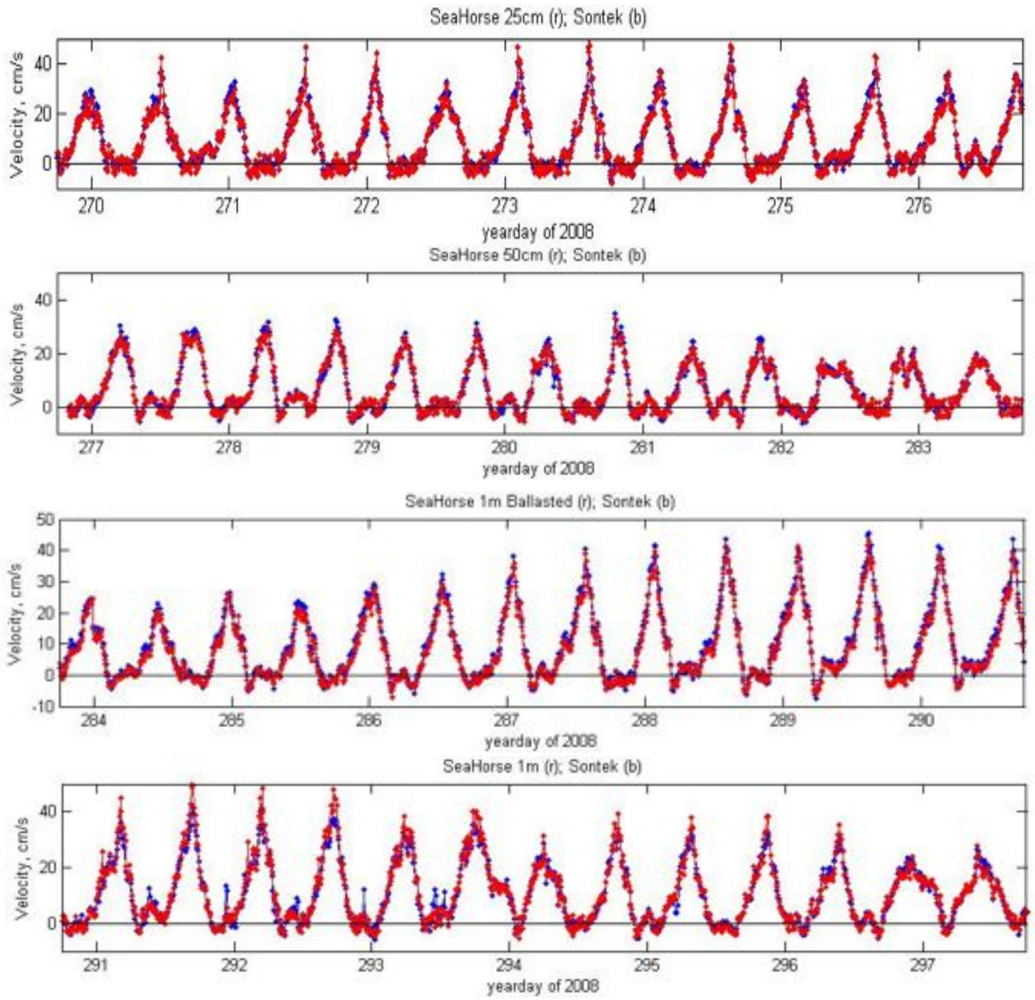
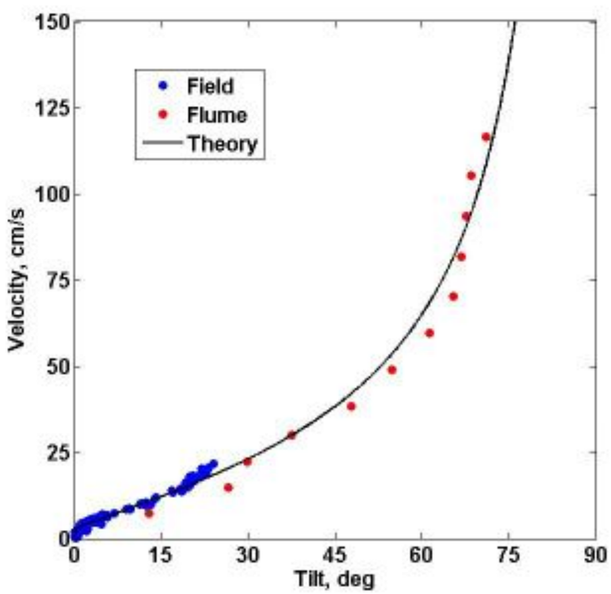
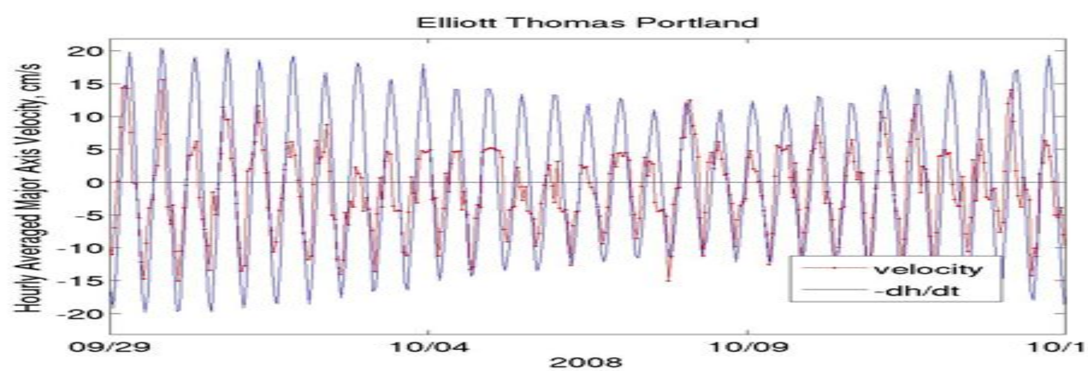


Fig. 3. Velocity component along a major tidal axis, positive is approximately southward (magnetic azimuth 154 degrees). Time is in yeardays, UTC (Greenwich Time).

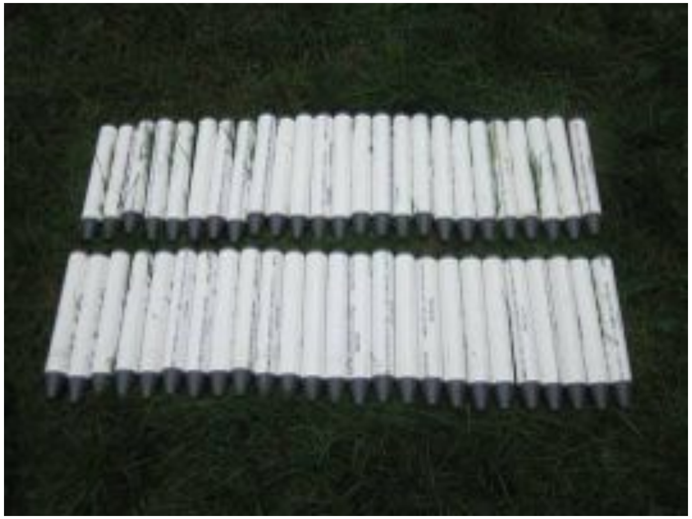
Pilot Deployment on Lobster Traps: Fall 2008, 10 SeaHorses

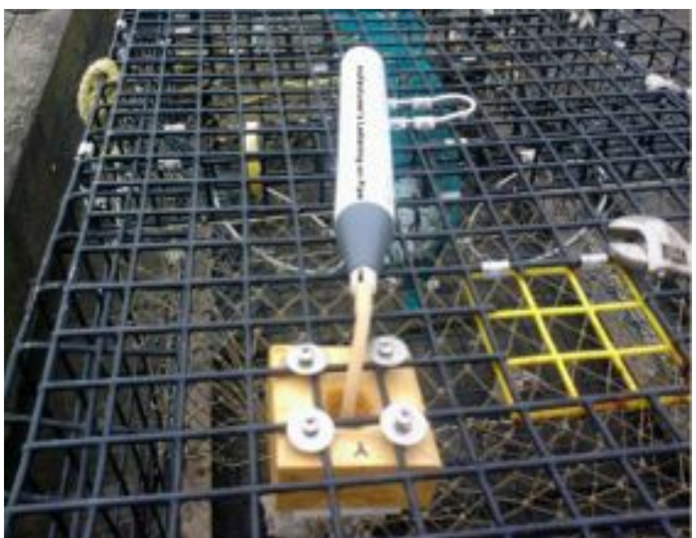


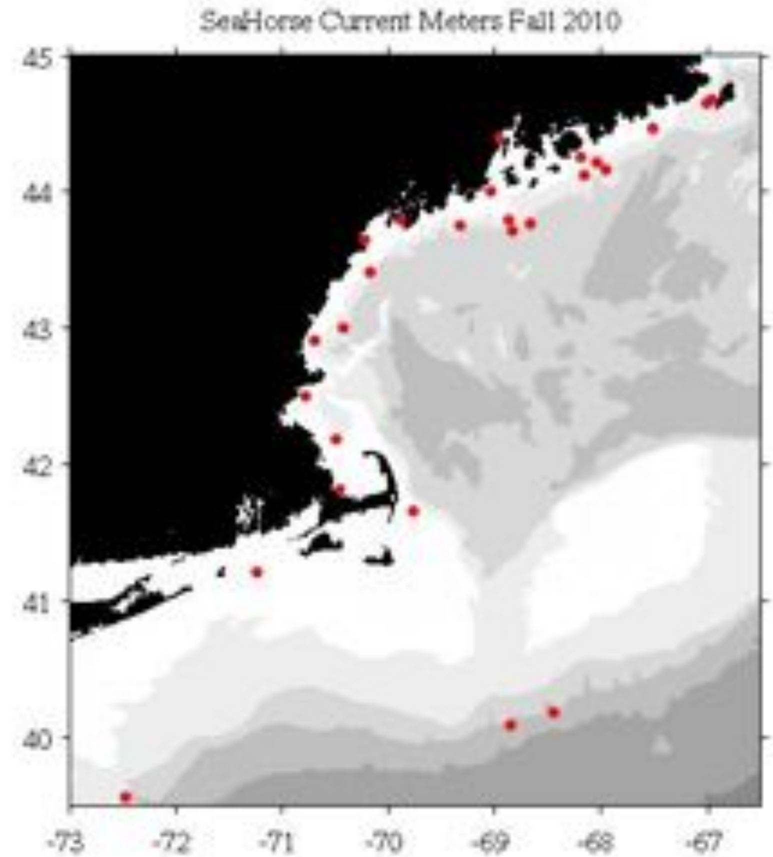


10-15 cm/s at majority of sites
Lobster Traps sometimes land upside down

Deployment on Lobster Traps: Fall 2010, 50 SeaHorses





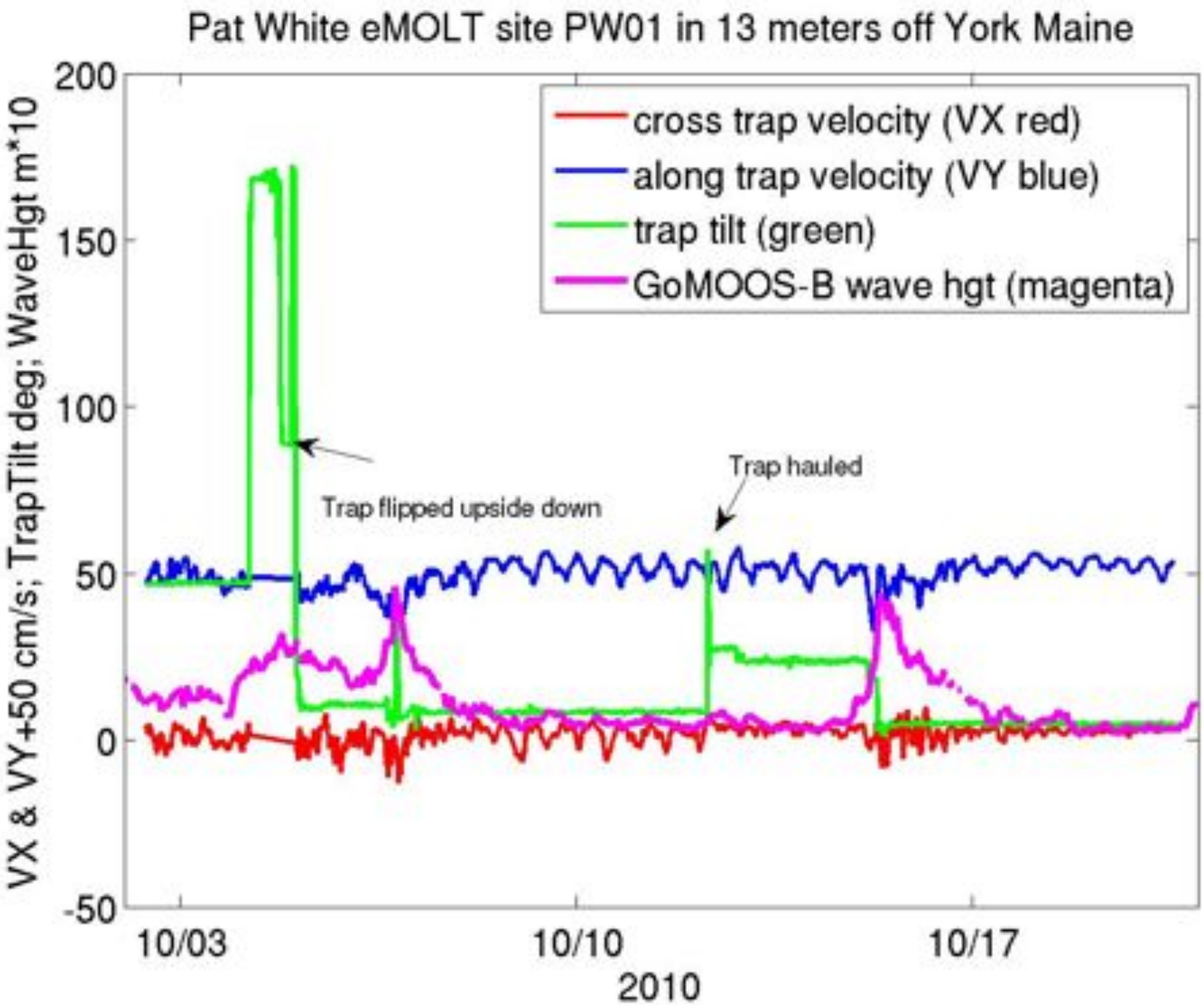


New:
More robust, sensor inside protective case
More sensitive, optimized for weaker bottom currents

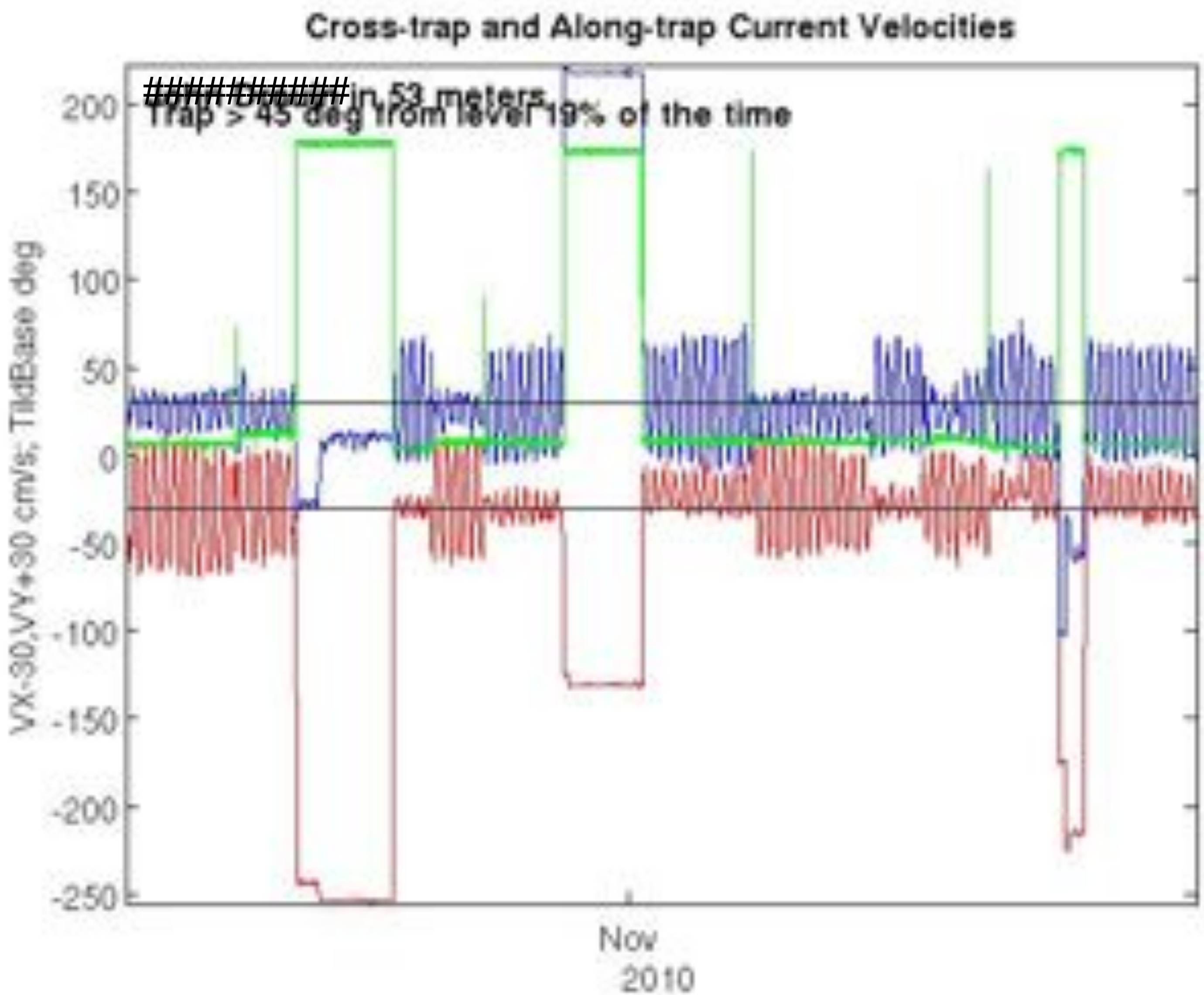
2nd sensor on the trap to log its orientation: goal is to study relationship between landing position, the currents and the catch.

Absolute direction from tidal analysis

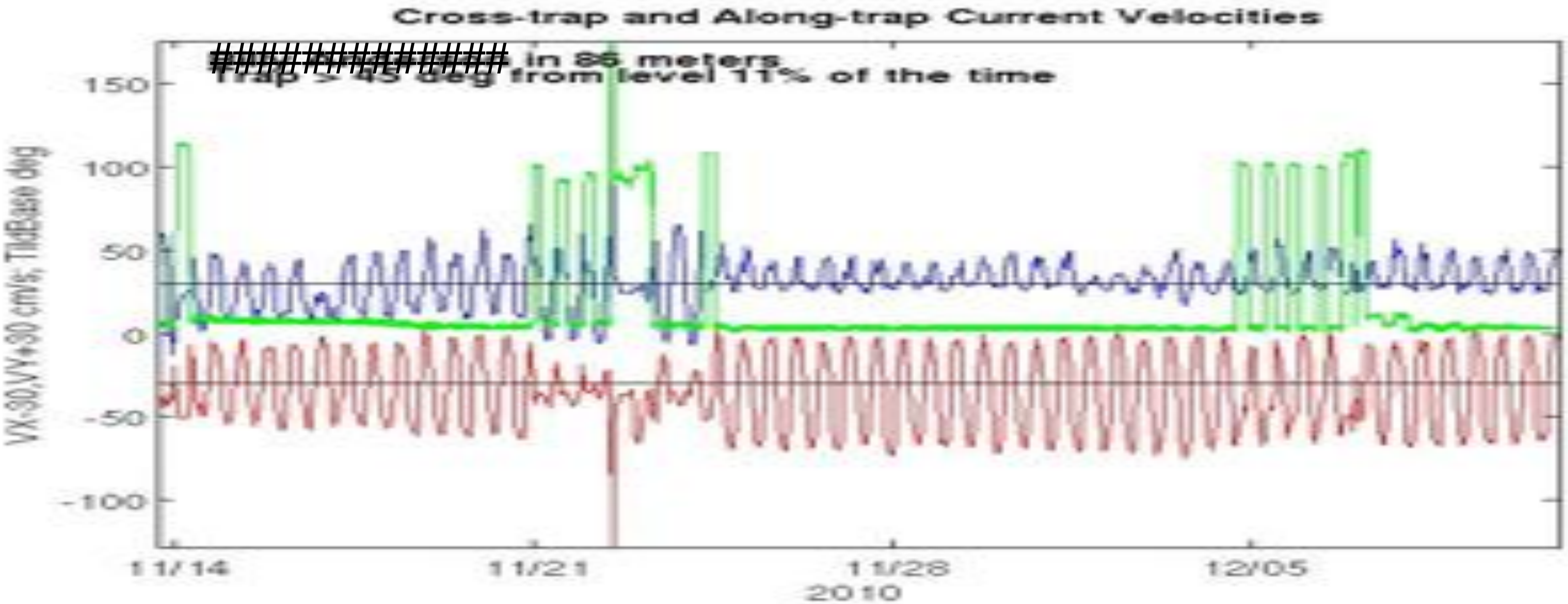
Currents and Trap Orientation Analysis



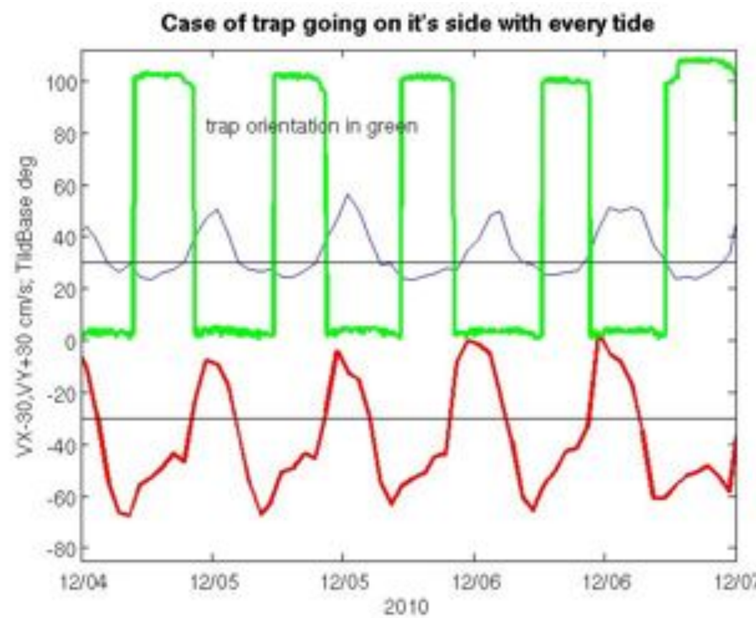
Currents and Trap Orientation Analysis



Currents and Trap Orientation Analysis



Trap flipping on a side during each tide



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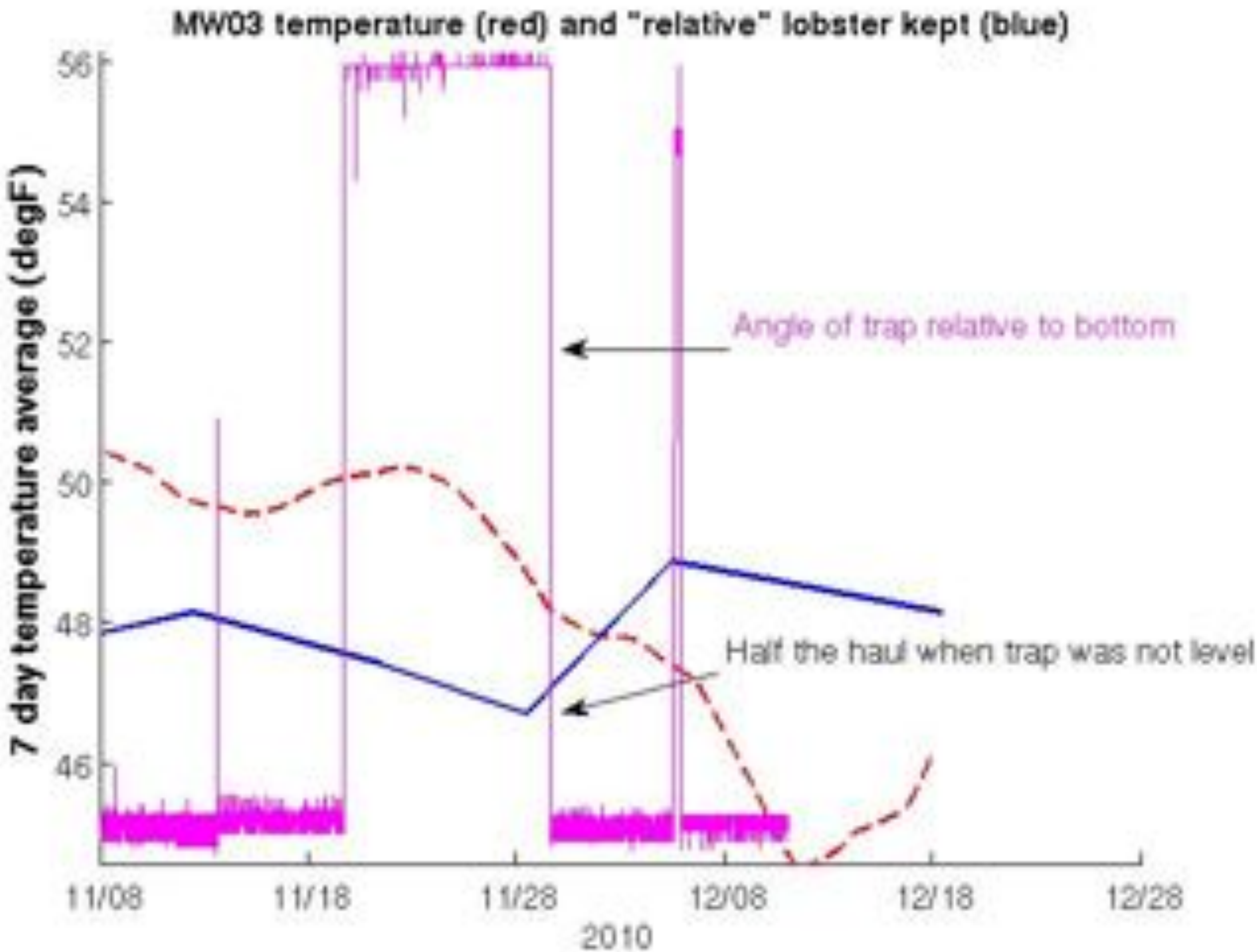
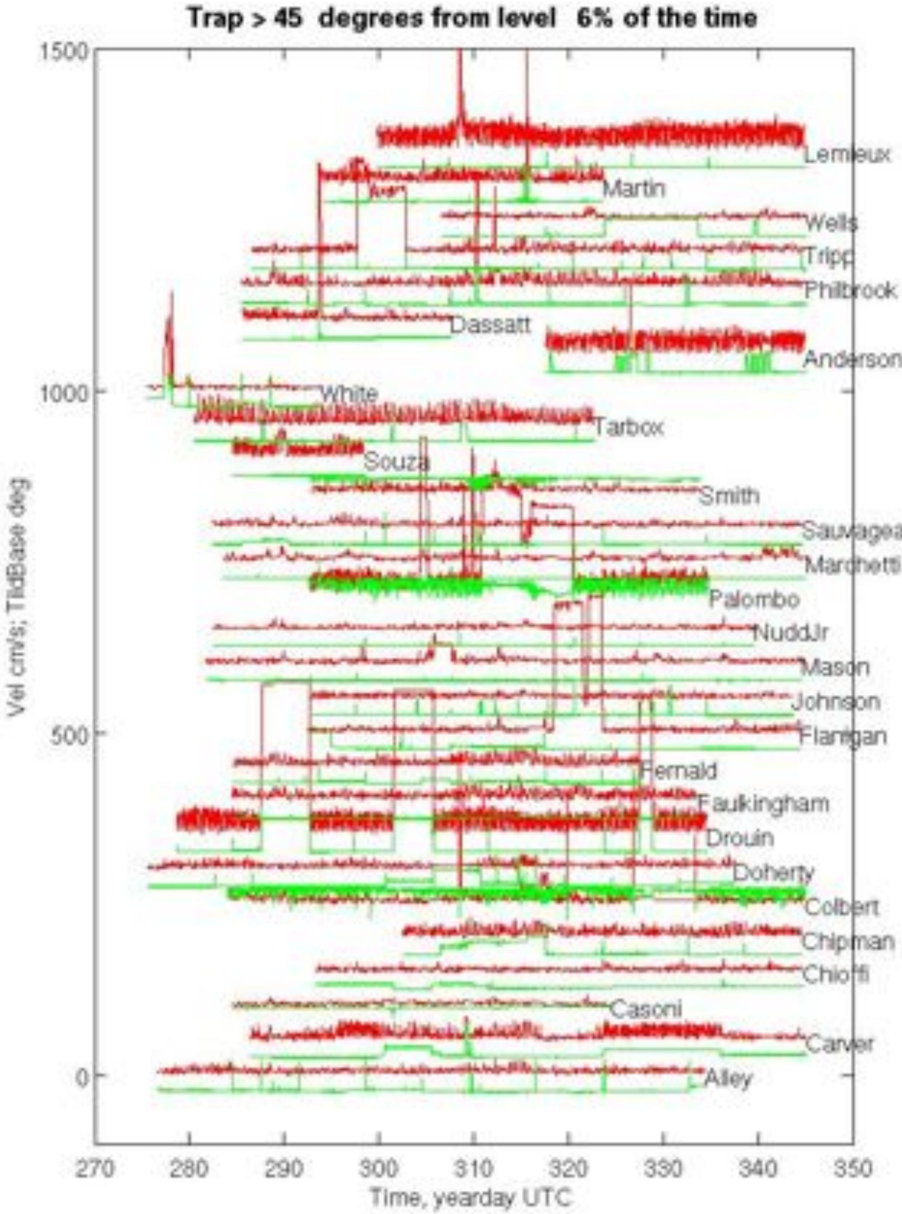


Summary of Trap Landing

http://www.nefsc.noaa.gov/epd/ocean/MainPage/tilt/shtcm.html



At present of 50 instruments distributed to lobstermen 29 were returned with data record, 9 were never deployed.

On average in 6% of time the traps was on a side or upside down, with Tilt > 45 deg.

The probability ranged from 0% for majority of lobstermen to as much as 25, 30, or even 100%.

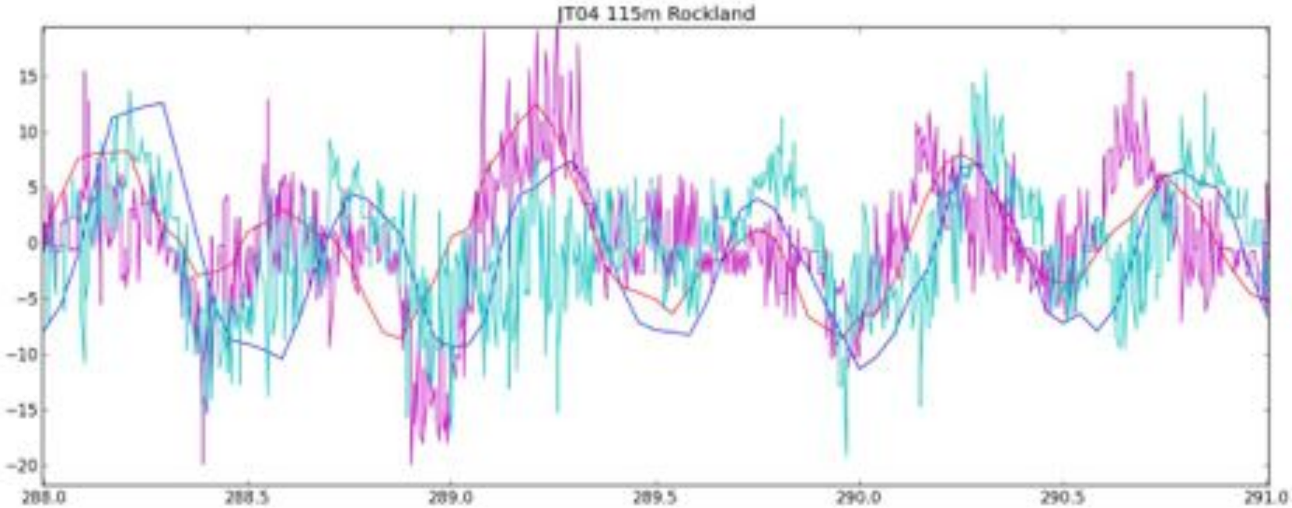
3 Lobstermen by mistake cut the tape securing the orientation sensor – we diagnosed good landings.

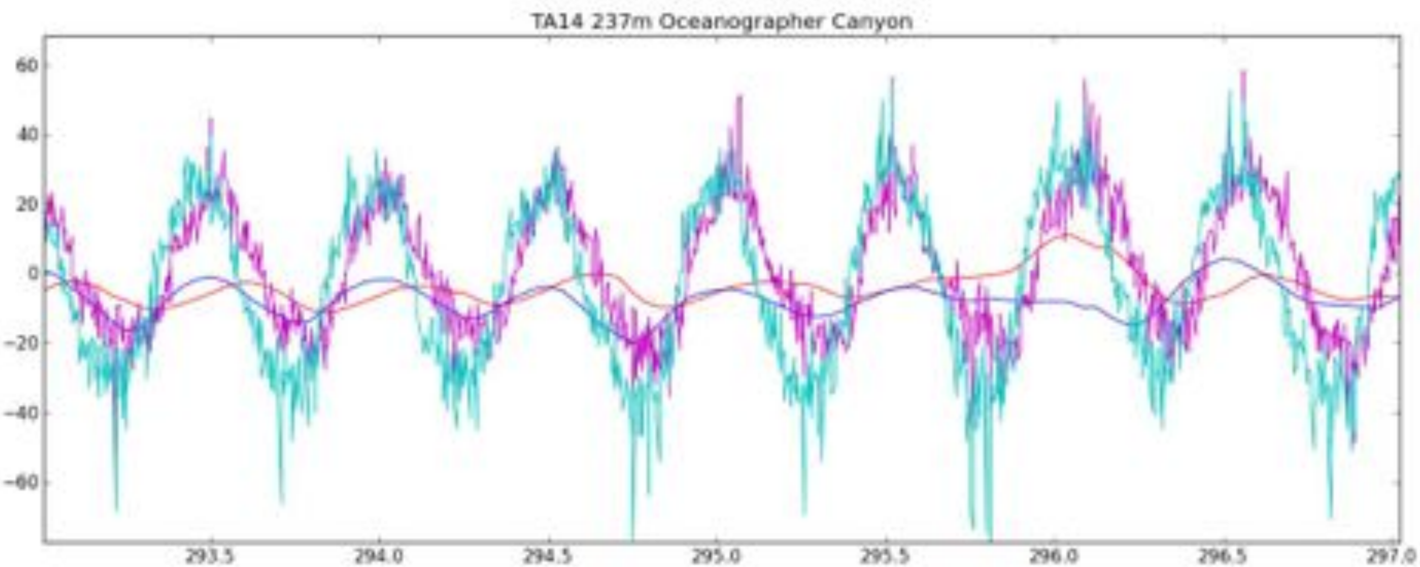
The probability of bad landing maybe slightly higher as we did not have records of deployment/recovery in many cases and identified bad landings only within good velocity data time periods. Need for good note keeping.

We received the catch information only from a few lobstermen – insufficient for making any conclusions.

To understand better the bad landing probability please send us information on your trap design and catch information if available.

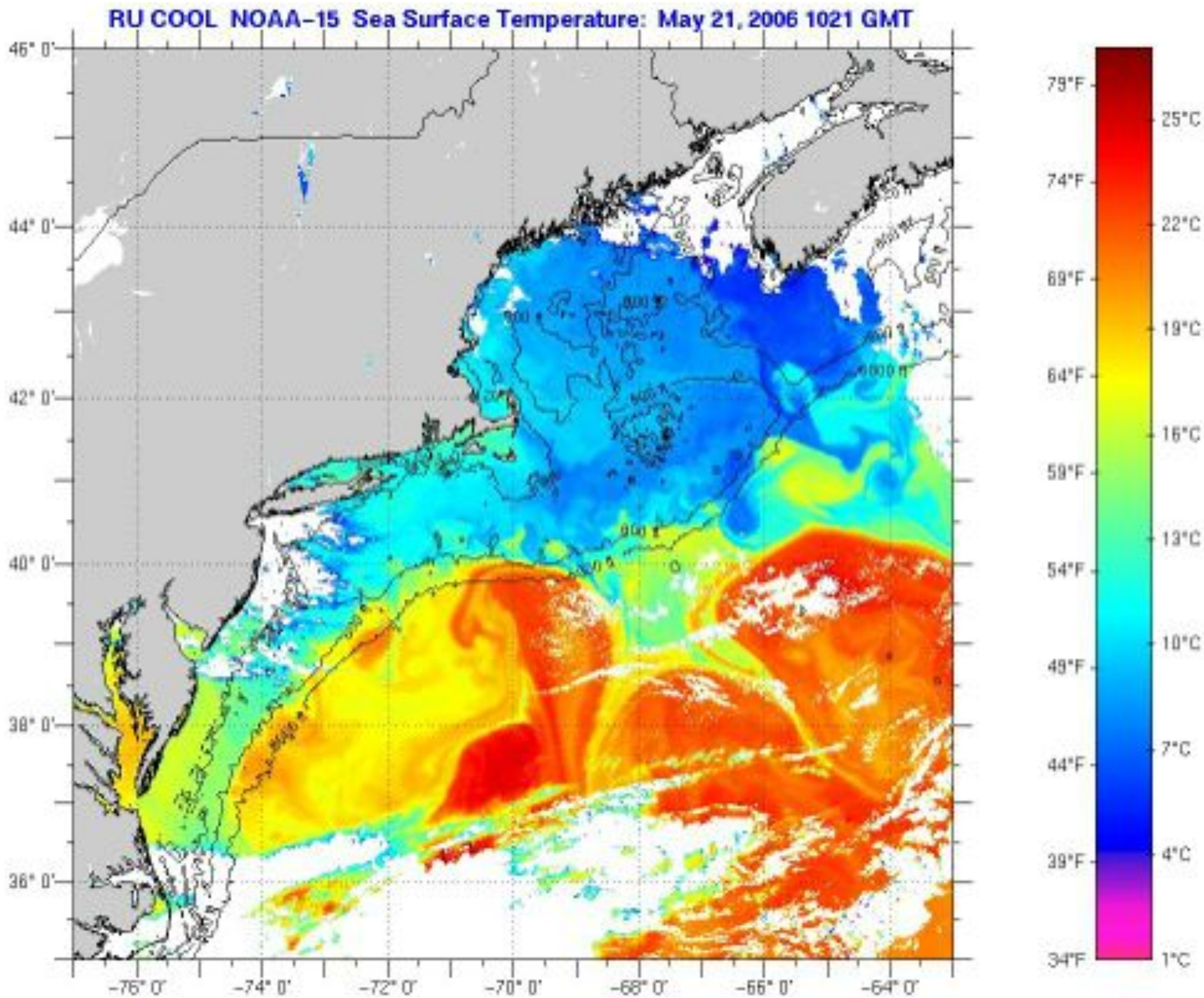
Comparison with FVCOM GoM3 30 year hindcast:
Nearshore – agreement acceptable
Deep – agreement unsatisfactory -> need more observations





Observations are consistent with Moody et al (1984) M2 amp ~ 25 cm/s

Satellite View of Sea Surface Temperature: Eddy Exchange Across Shelfbreak, Strong Impact on Fisheries



A schematic diagram showing important cross-shelf exchange processes across the shelfbreak in the Middle Atlantic Bight

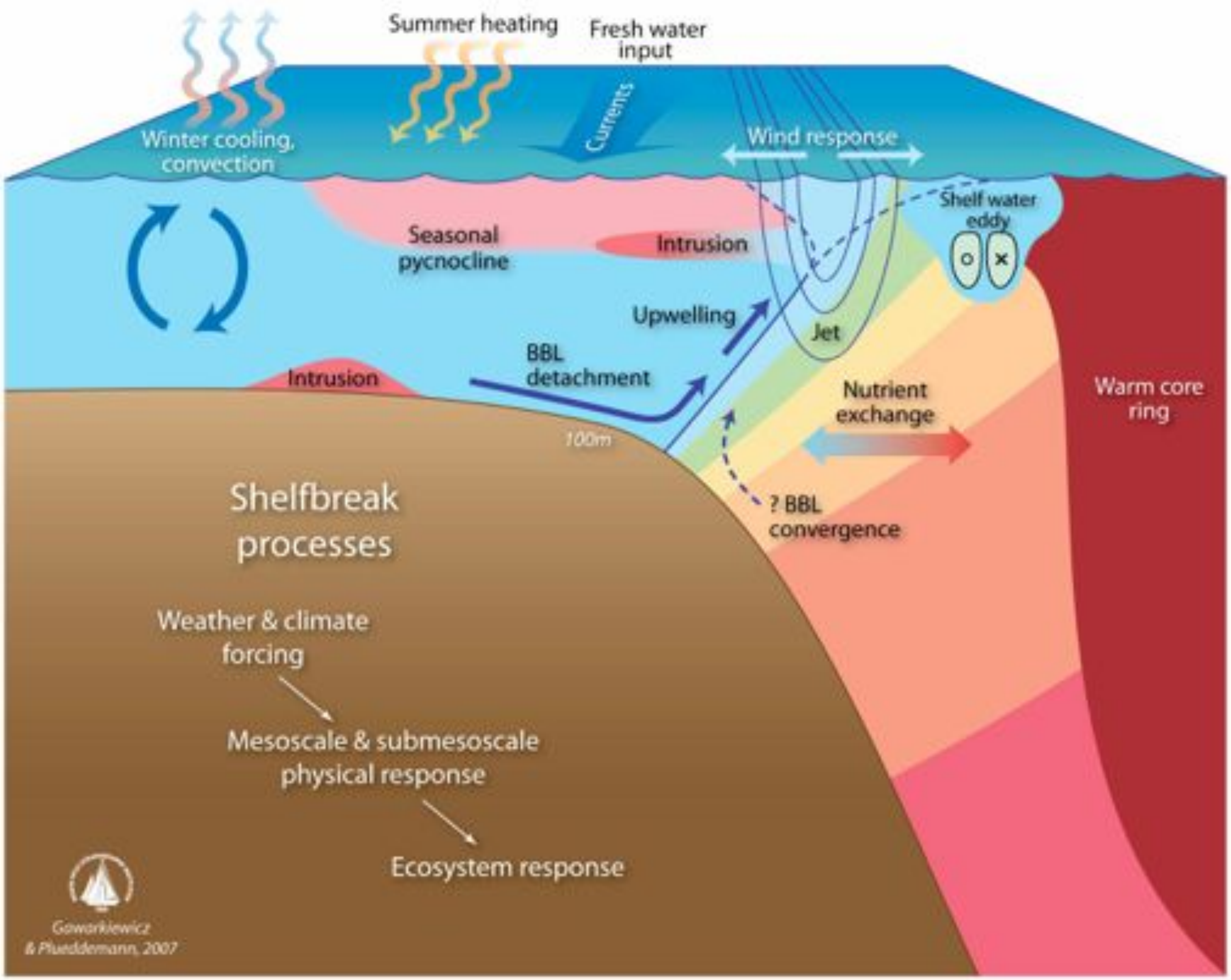


Figure from NSF OOI Pioneer Array white paper.

Integrated Ocean Observing System
NSF Ocean Observatories Initiative:
Pioneer Array – Focus on Shelfbreak Exchange

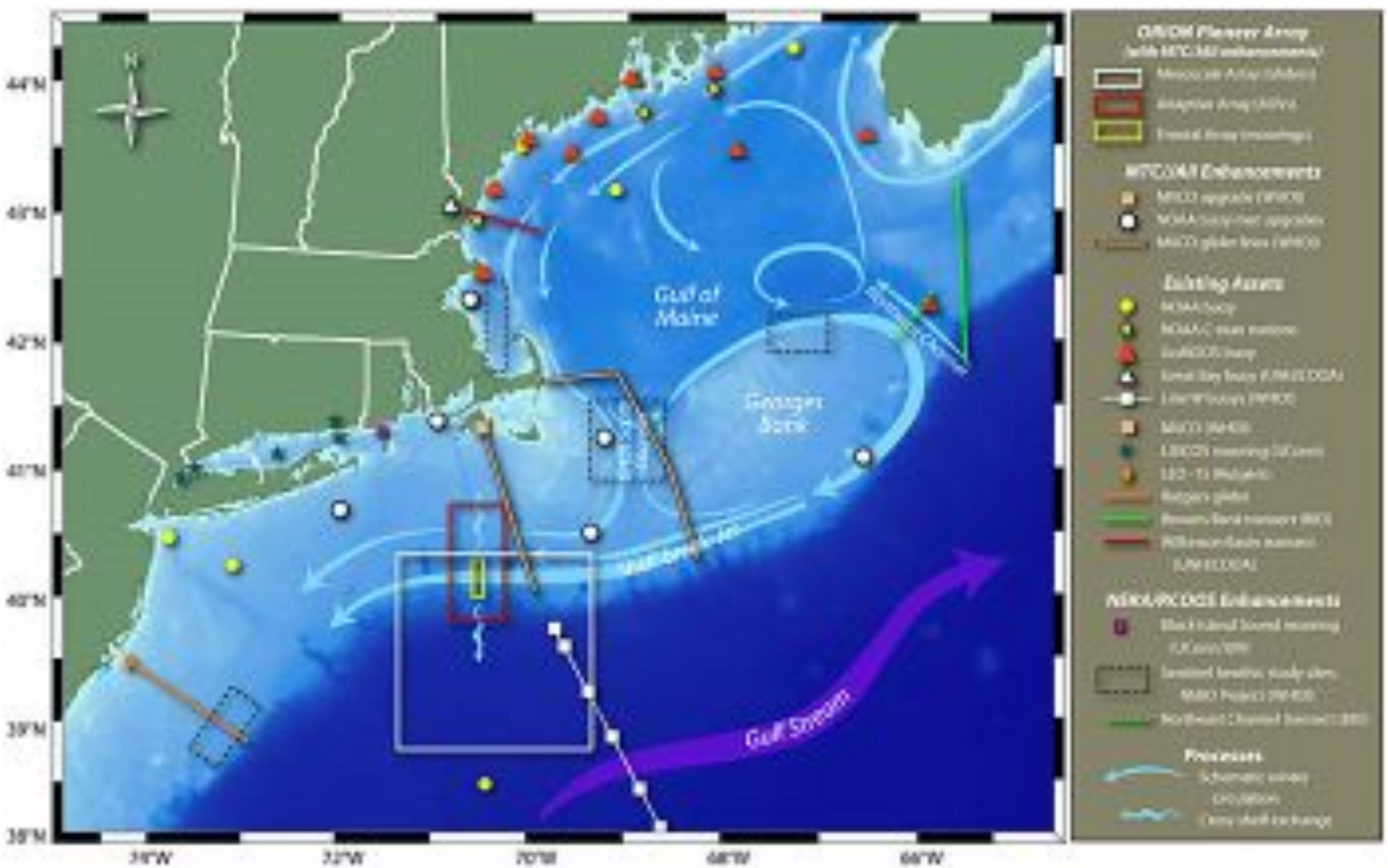
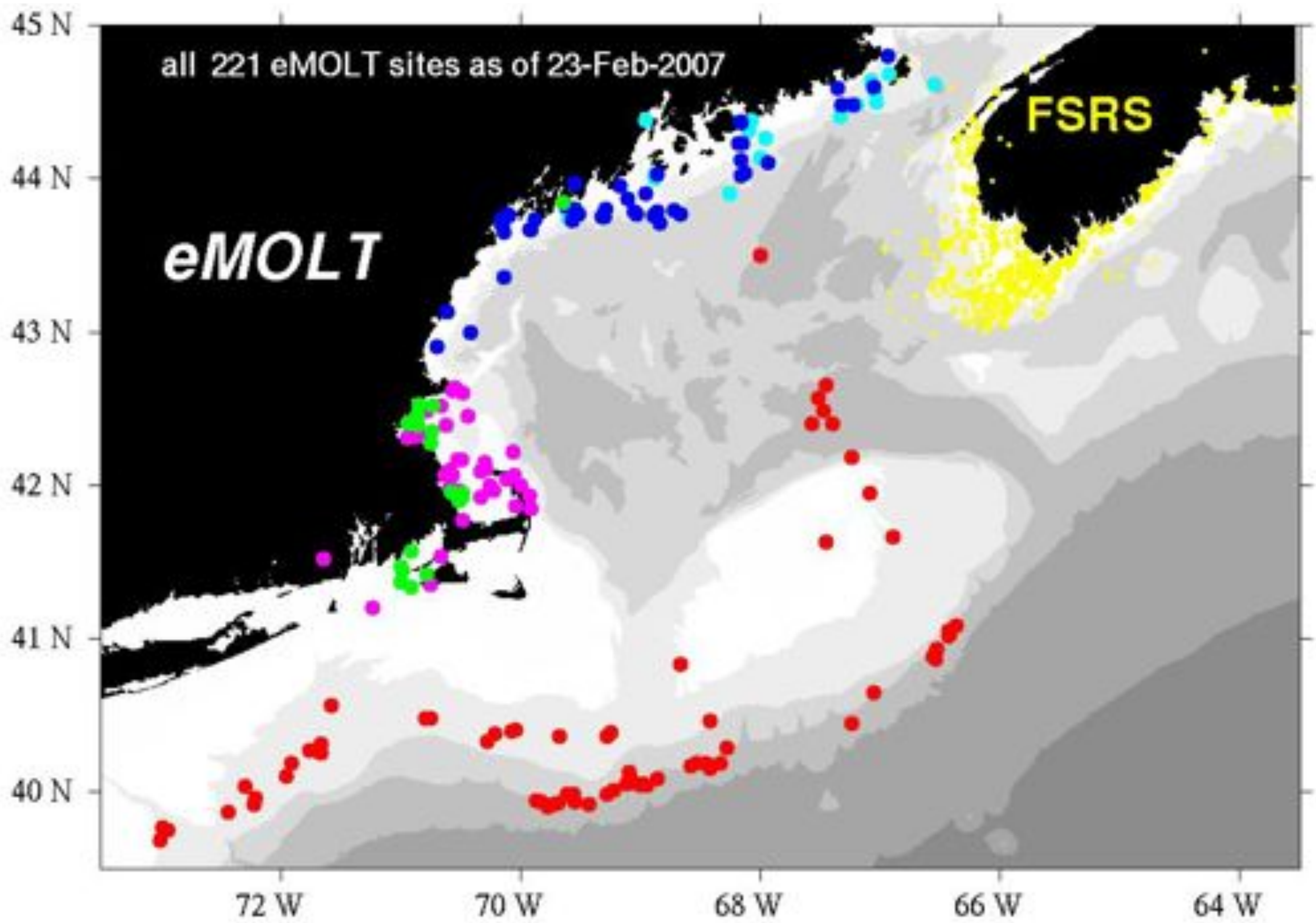
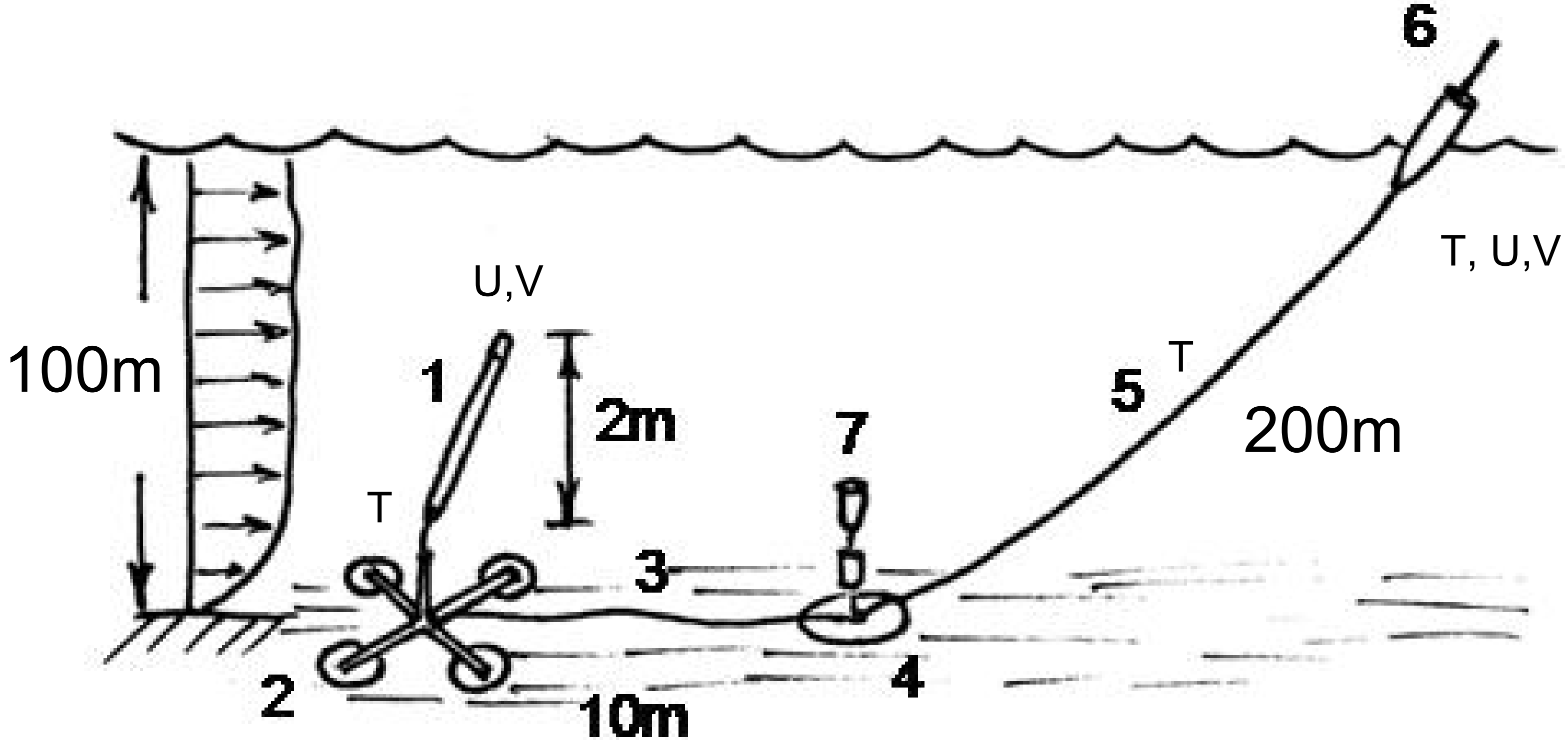


Figure from NSF OOI Pioneer Array white paper.

Can Fisheries Contribute to Observations? Yes
eMOLT & FSRS multiyear sites



Typical Mooring: Continuous Deployment for 6mo-1yr
Cost < $1000



Sketch of a mooring: SeaHorse tilt current meter (1), mooring base with weights (2), line (3) to a secondary weight (4), line (5) to a surface buoy (6), and a submerged backup buoy (7) with timed release.

Summary

Project of deploying 50 current meters was largely a success:
all instruments worked in a wide range of depths and bottom environments,
obtained data on trap landings.

Need to compare currents with tidal models, catch information, and check the trap design at a few sites with bad landings.

Progress in the instrument design, new electronics package integrated with compass and unlimited memory.

Available commercially from Okeanolog.com (under $500), contact Sheremet.

Efforts to establish long term monitoring sites to be integrated into nationwide Ocean Observing Systems.

PIs gratefully acknowledge funding from the Northeast Consortium, eMOLT grant.