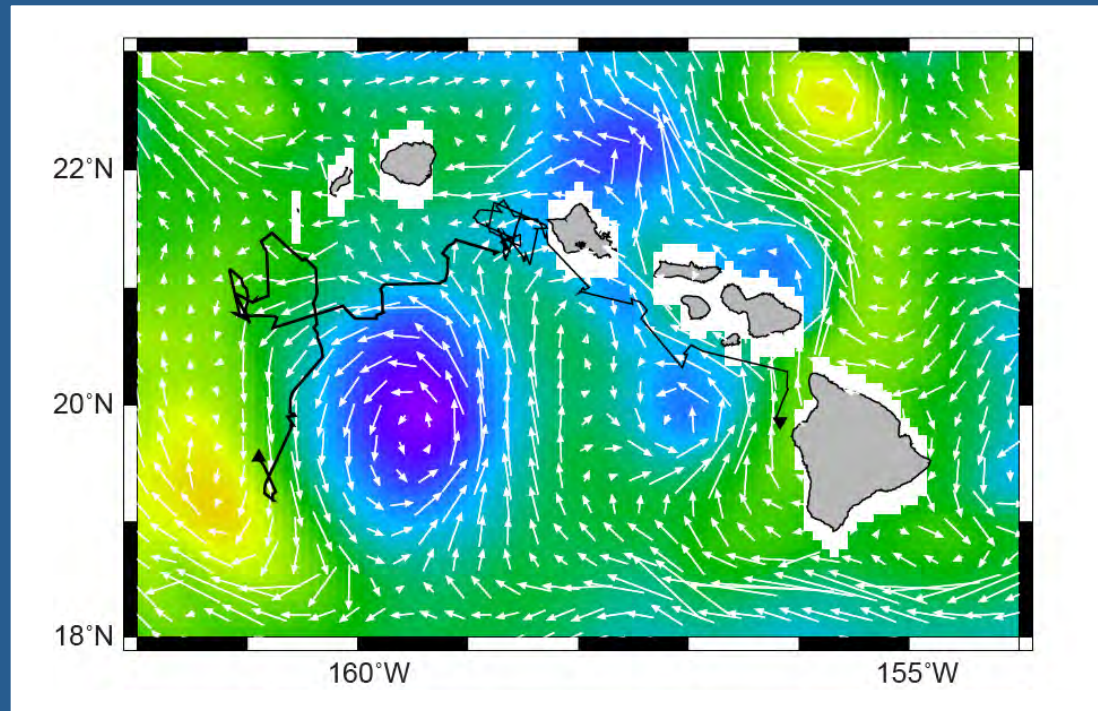


Hawaiian Lee Eddies and Examples of their Biological Significance



Phoebe Woodworth, Michael P. Seki, and Jeffrey J. Polovina

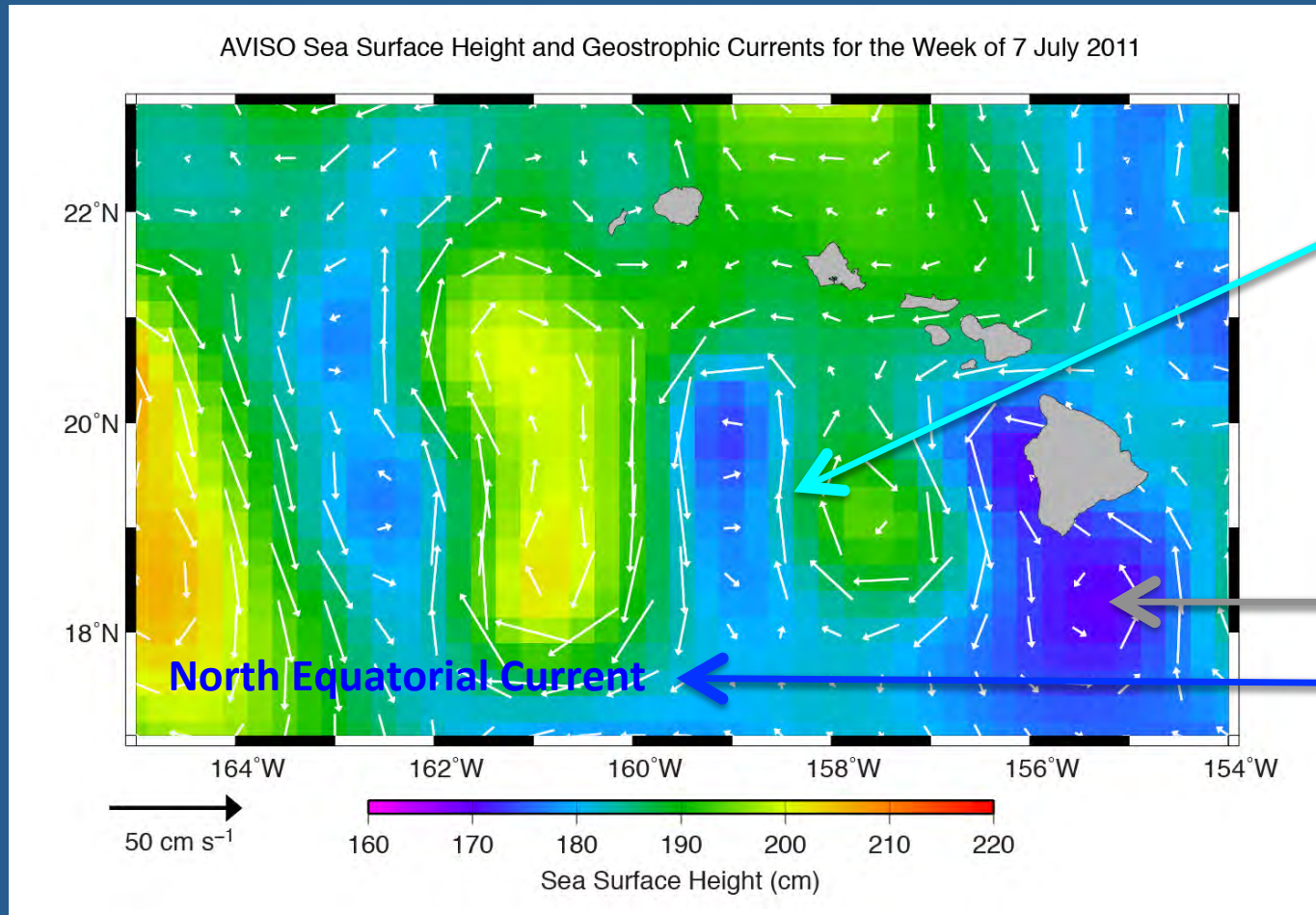
Pacific Islands Fisheries Science Center

NMFS - NOAA

Outline

- Eddy Overview
 - Generation and propagation
 - Structure
- Overview of previous work
 - Nutrients and plankton
 - Higher trophic levels, including the 1995 Hawaii International Billfish Tournament
- Biological Significance
 - Case Study 1: Melon-headed whale foraging
 - Case Study 2: Observations from the Kona seaglider
- Conclusions

Eddy Overview – Generation & Propagation



Northeasterly
Trade Winds

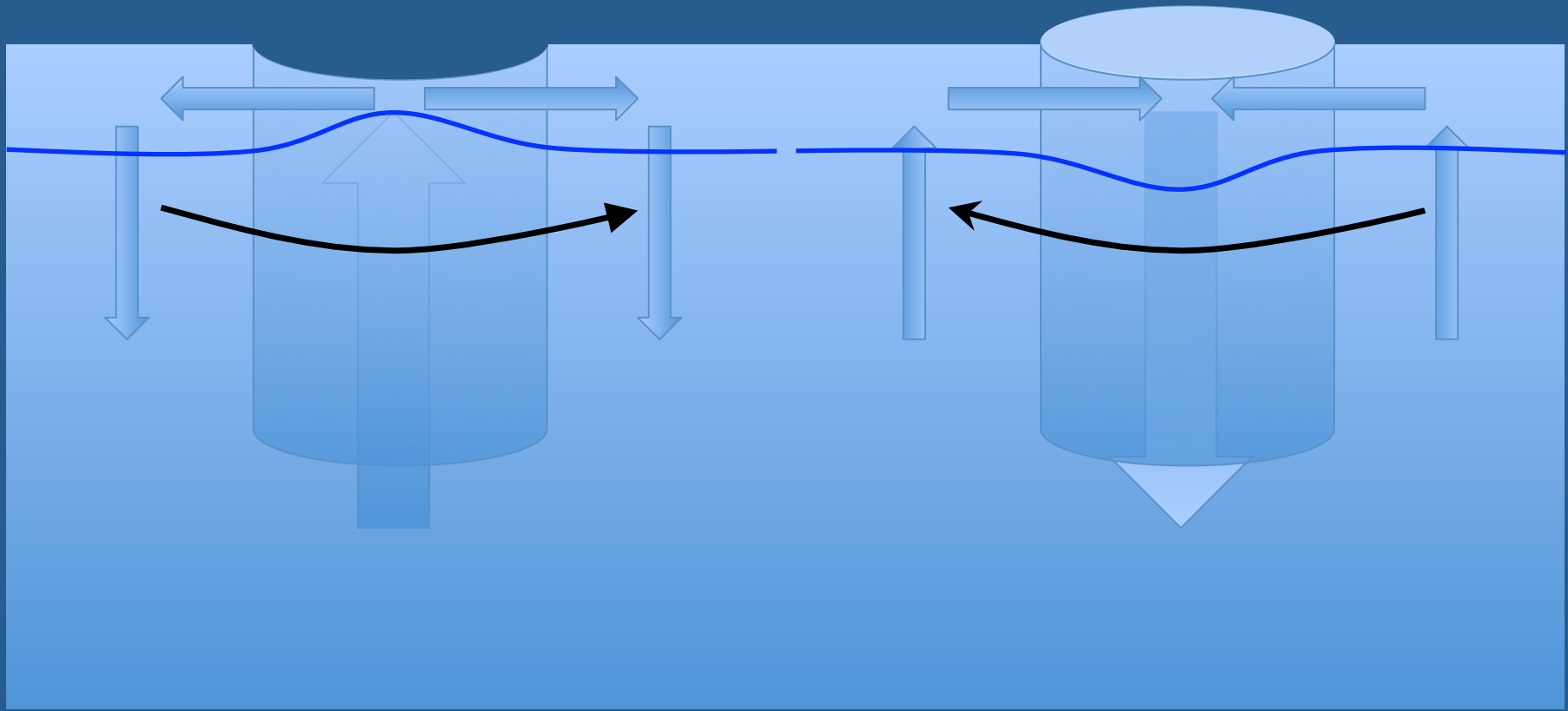
Propagation

North Equatorial Current

Eddy Overview - Structure

Cold-core Cyclonic Eddy

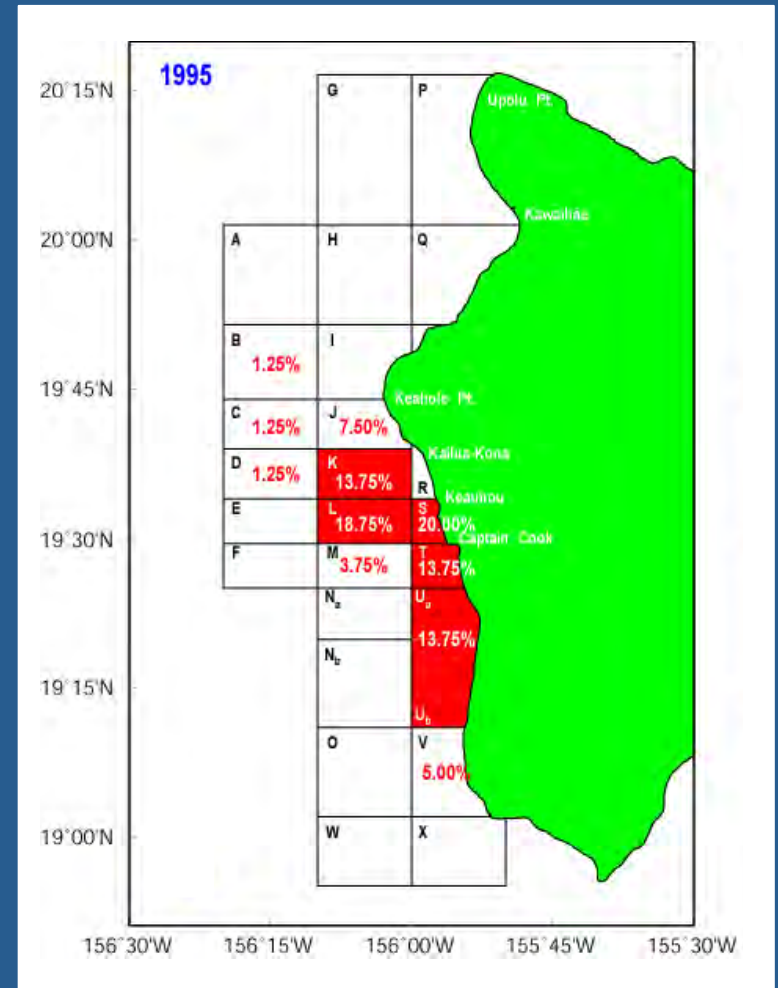
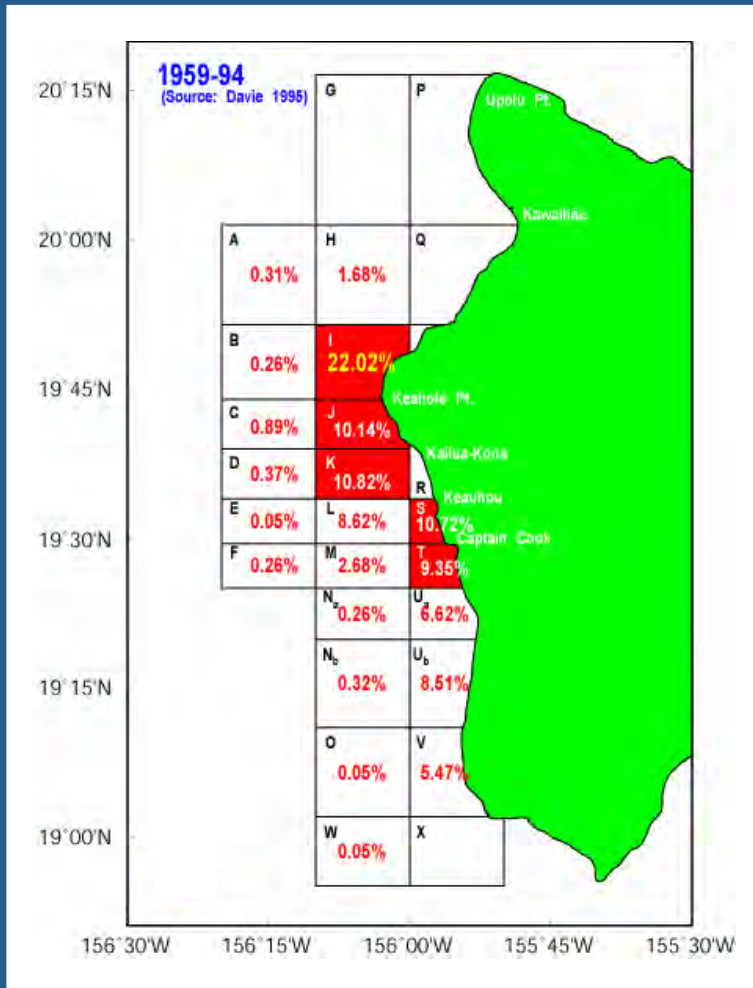
Warm-core anticyclonic Eddy



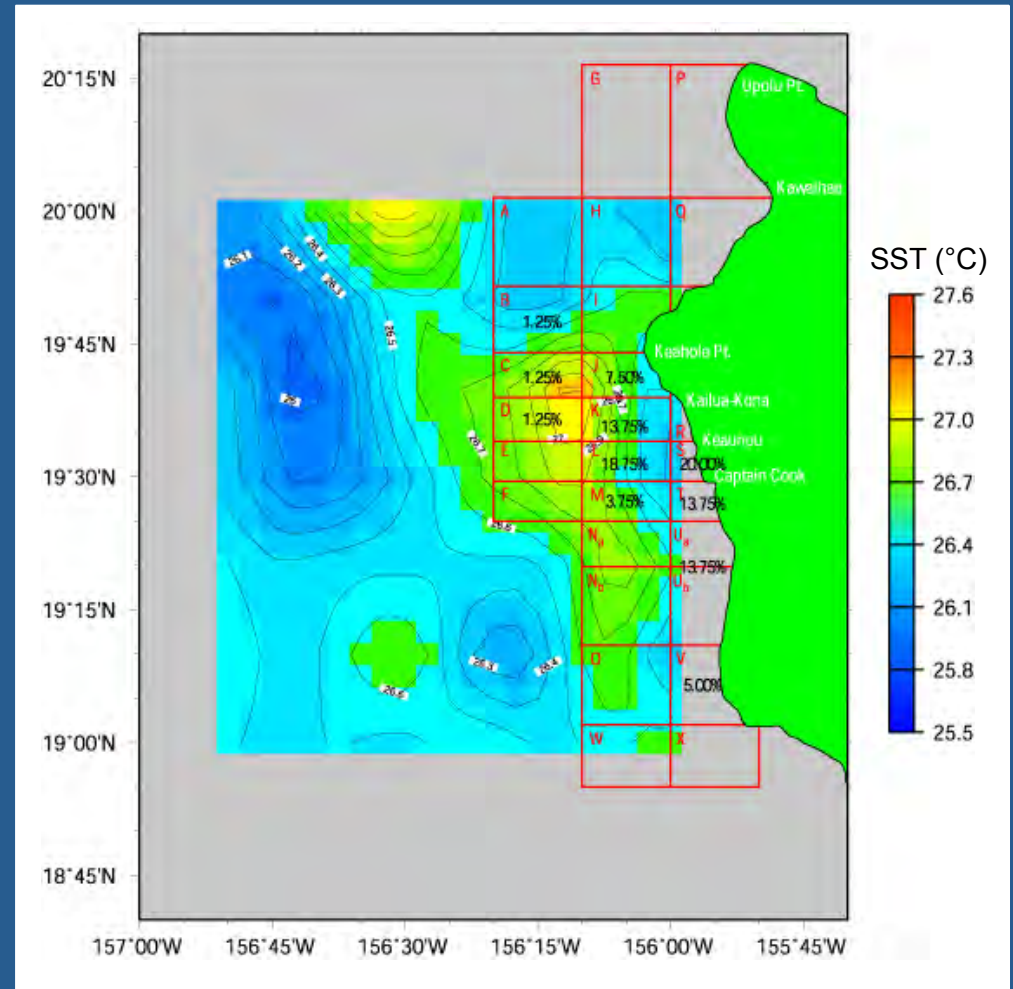
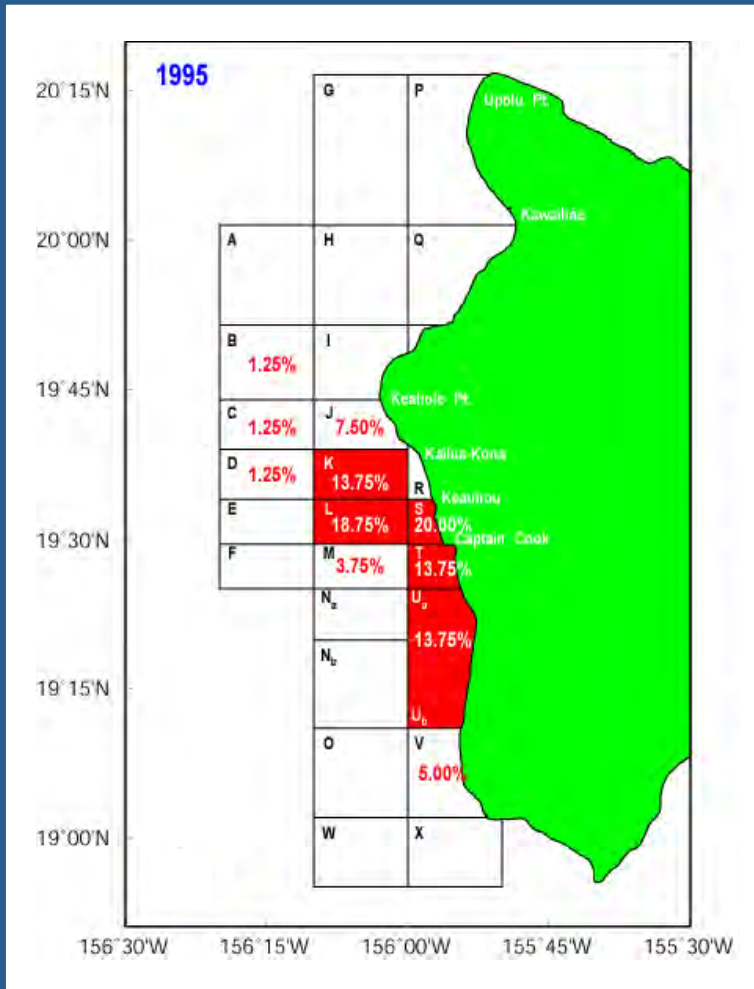
Previous Work

- Nutrients and phytoplankton
 - Multiple surveys of cyclonic eddies in Hawaiian waters
 - E-Flux and EDDIES programs
- Higher trophic level associations
 - Tuna and marlin
 - Sea turtles
 - Seabirds
 - Cetaceans

Background – 1995 HIBT

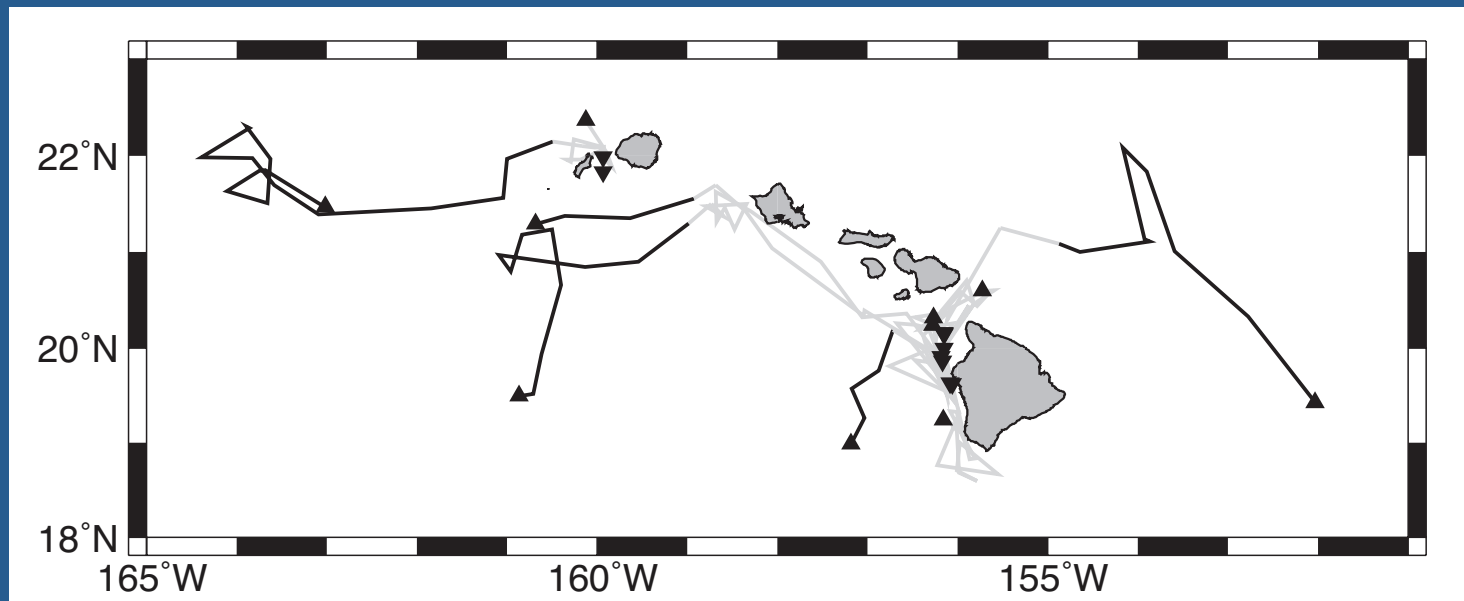


Background – 1995 HIBT

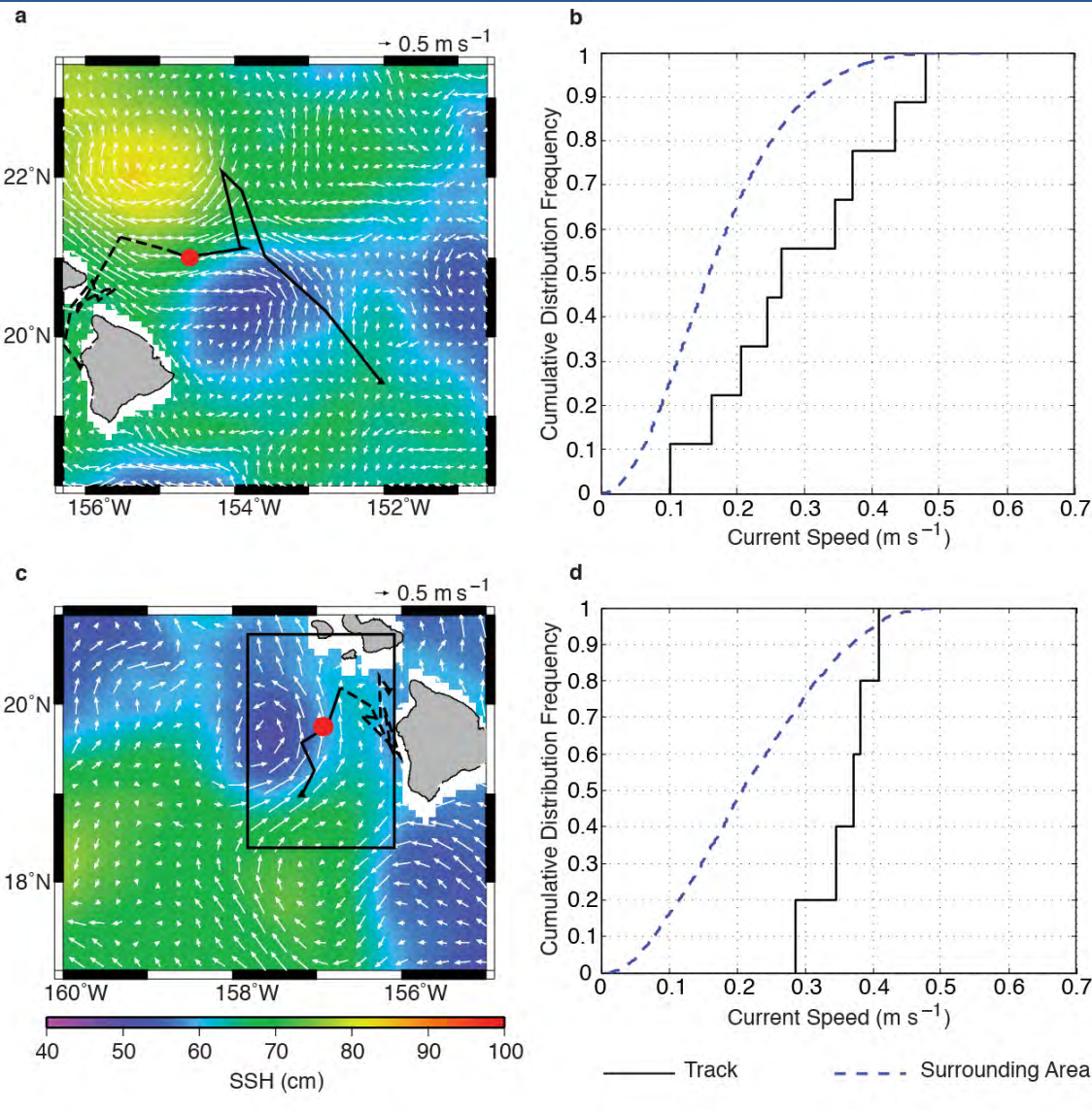


Case Study 1: Melon-Headed Whale Foraging

- 10 melon-headed whales tagged off Kona and Kauai in 2008
 - Positions filtered, best daily position use based on Argos Location Class
 - 5 tracks contained offshore components (depth > 3,000 meters)
 - Offshore components examined in relation to HYCOM current data



Cyclonic Eddies



Start: 2 Jul 08 (12 Jul 08)
 End: 20 Jul 08
 Length: 1061 km (599 km)
 47% of time offshore
 Mean Current Magnitudes:
 0.29 m s⁻¹ (Track)
 0.17 m s⁻¹ (SA)
 $\rho = 3.2 \times 10^{-2}$

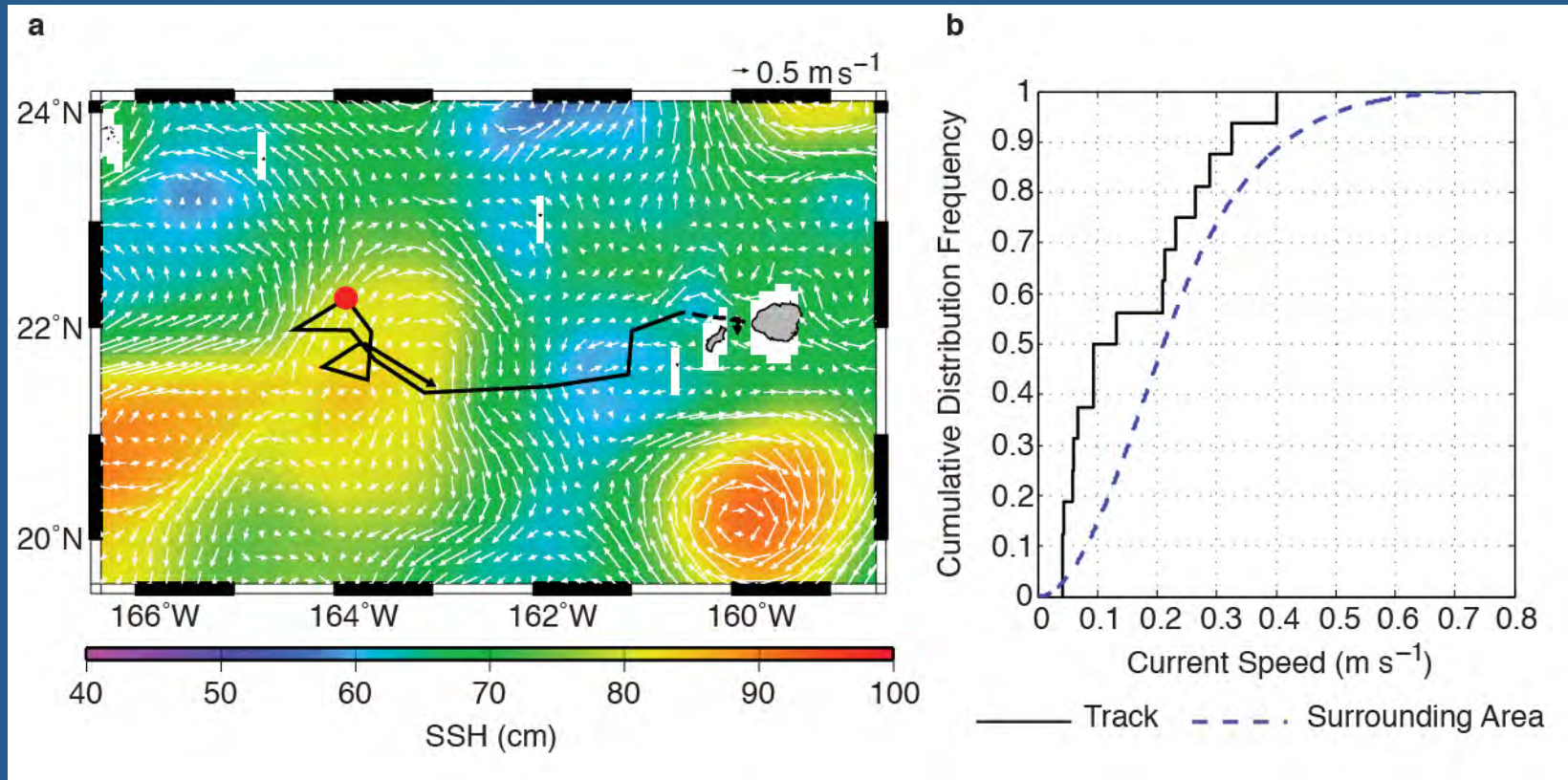
Start: 10 Dec 08 (20 Dec 08)
 End: 24 Dec 08
 Length: 543 km (160 km)
 33% of time offshore
 Mean Current Magnitudes:
 0.36 m s⁻¹ (Track)
 0.22 m s⁻¹ (SA)
 $\rho = 5.3 \times 10^{-3}$

Anticyclonic Eddy

Start: 25 Jun 08 (29 Jun 08)
End: 14 Jul 08

Length: 889 km (819 km)
80% of time offshore

Mean Current Magnitudes:
0.16 m s⁻¹ (Track)
0.23 m s⁻¹ (SA)
 $\rho = 1.8 \times 10^{-2}$

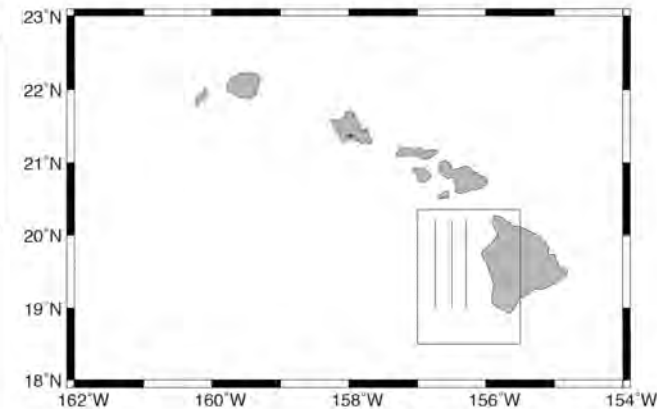
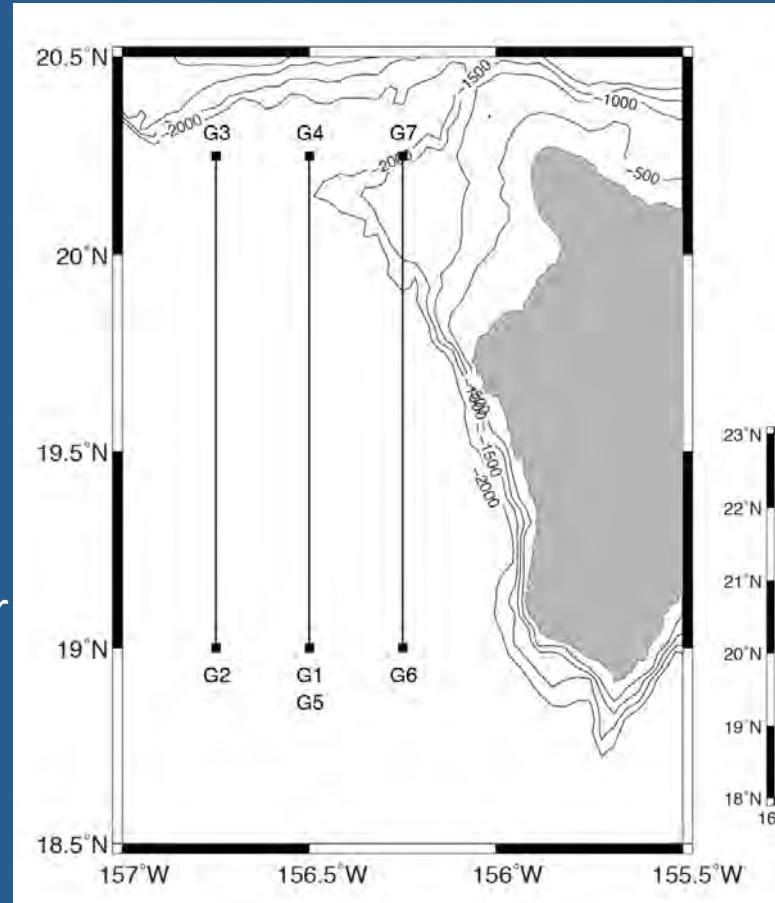


Case Study 2: Kona Seaglider

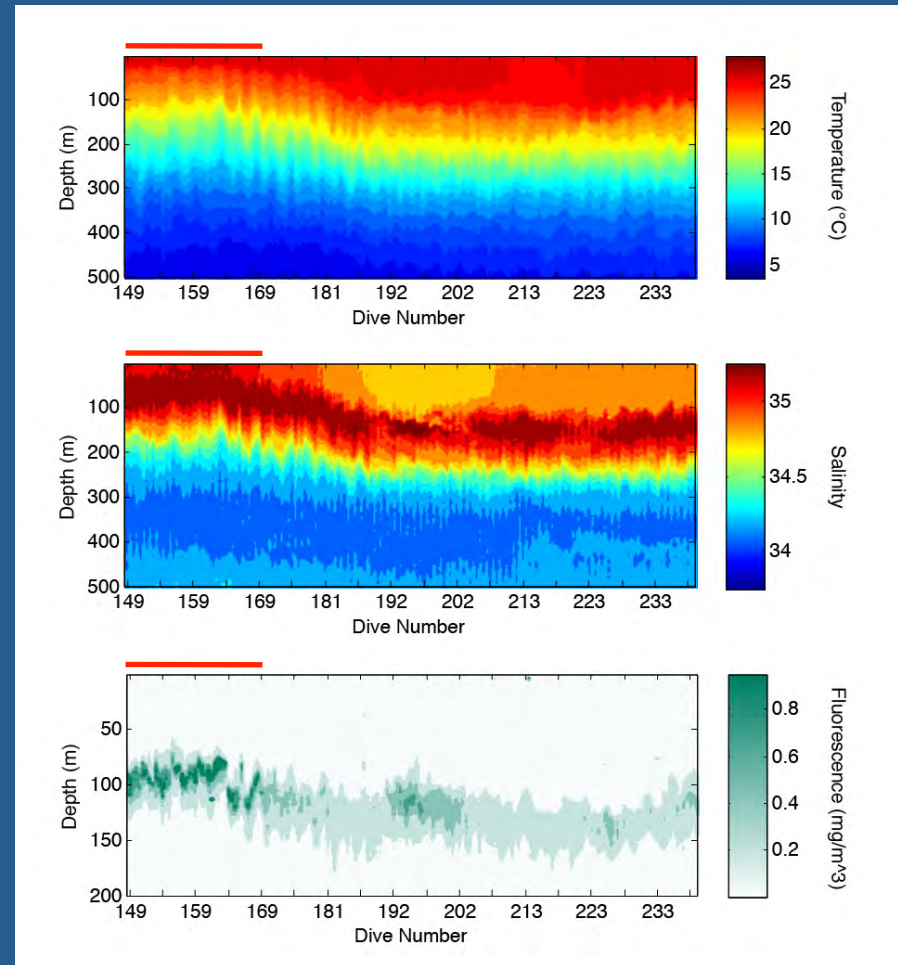
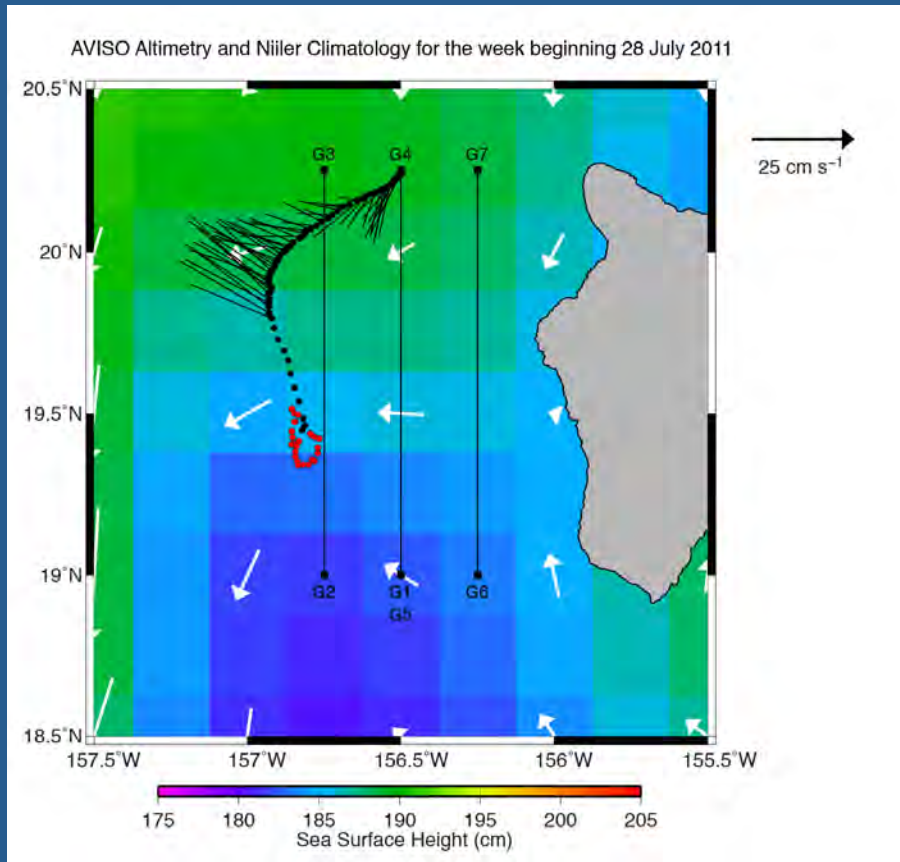


The Kona IEA Seaglider is a collaboration between PIFSC and Bruce Howe and the UH SOEST Ocean Glider group.

- Data Recorded:
- Temperature
 - Conductivity
 - Fluorescence
 - Colored dissolved organic matter
 - Green backscatter
 - Ambient sound*



Upwelling and Primary Production



Conclusions

- Continually recurring phenomena
- Upwelling makes nutrients available, leads to enhanced primary production
- Enhanced/aggregated plankton may attract higher trophic level species
- Two potential habitats
 - Edges of cyclonic eddies
 - Centers of anticyclonic eddies

Acknowledgements

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Lucas Moxey of NOAA's OceanWatch for providing altimetry data

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