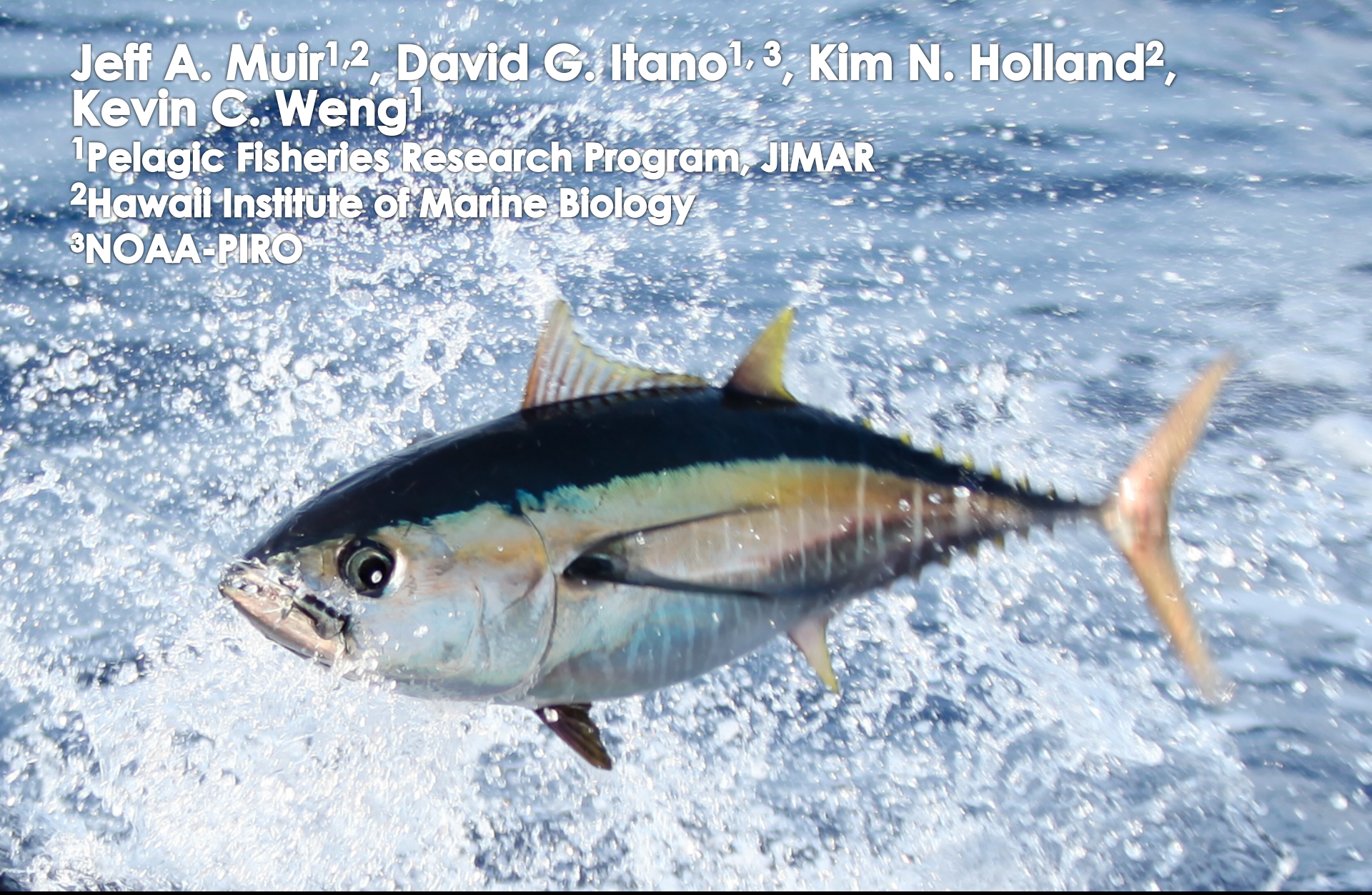
Jeff A. Muir[1,2], David G. Itano[1, 3], Kim N. Holland[2], Kevin C. Weng[1]
[1]Pelagic Fisheries Research Program, JIMAR
[2]Hawaii Institute of Marine Biology
[3]NOAA-PIRO



Bigeye resident at seamount >6 months

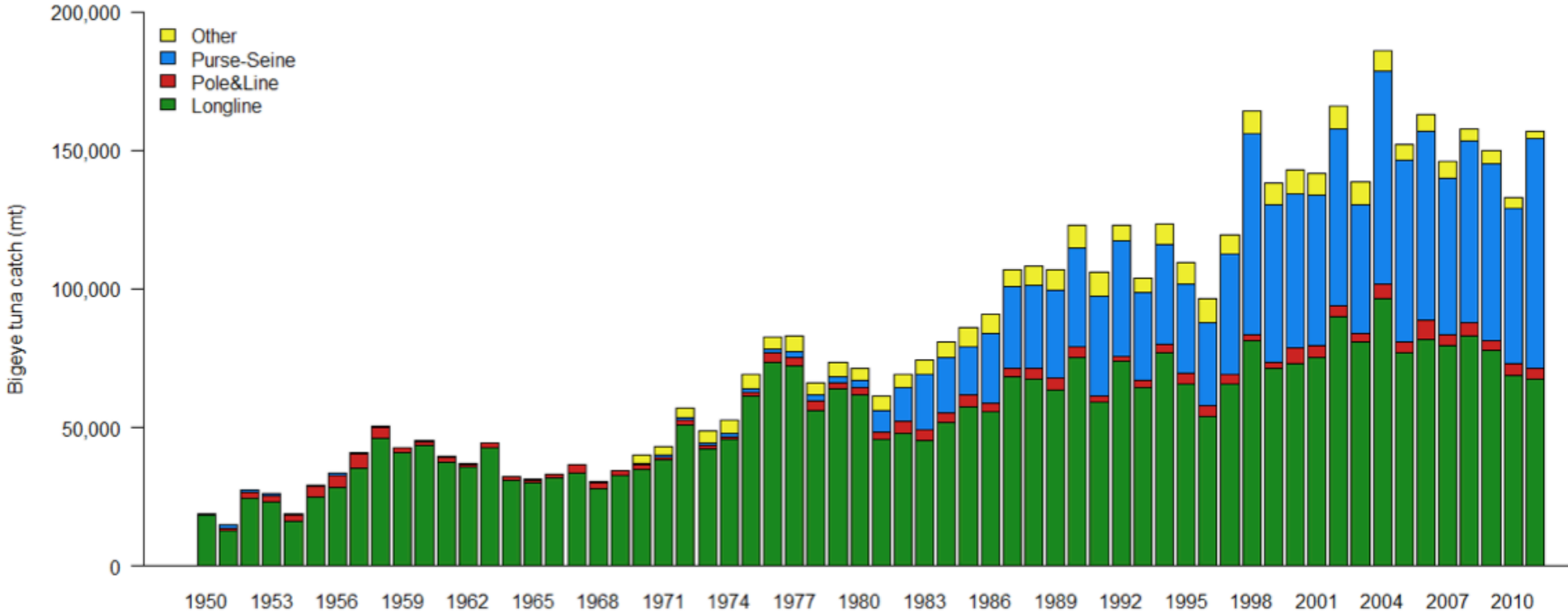
Funding

NOAA PACIFIC ISLANDS FISHERIES SCIENCE CENTER
NATIONAL MARINE FISHERIES SERVICE

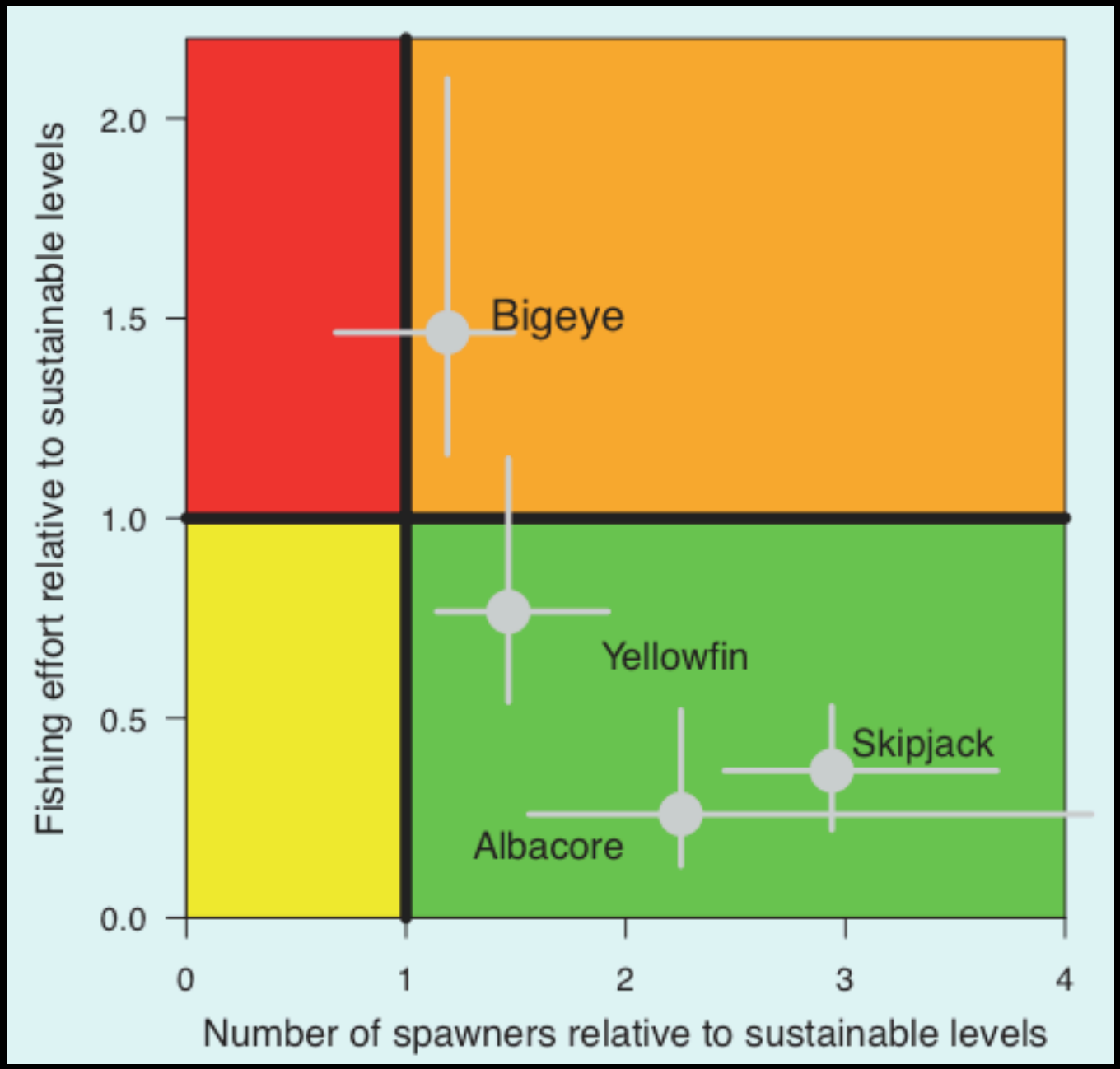
Pelagic Fisheries Research Program
Joint Institute of Marine and Atmospheric Research
School of Ocean and Earth Science and Technology • University of Hawai'i at Mānoa

Background

bigeye catch increases



Shelton Harley, Peter Williams and John Hampton. WCPFC-SC8-2012/SA-WP-02


Fishing effort relative to sustainable levels
2.0
1.5
1.0
0.5
0.0
Bigeye
Yellowfin
Skipjack
Albacore
0
1
2
3
4
Number of spawners relative to sustainable levels

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Hawaii-based longline fishing prohibited for bigeye tuna next week

Advertiser Staff

Cross fishery

- Cross Seamount fishery important locally, landings about 450,000 lbs/yr.
- Diverse and unique fishing methods: mainline + gangion (like longline); troll, handline, jig, dangler, vertical longline, pole and line.
- Fishery has supported 5-20 vessels per year, constant fishing pressure. More vessel being built for fishery.
- Both fishermen and scientists have raised concerns about excessive exploitation.
- Tangled longline gear and snagging on bottom is common.
- BET not studied on any seamount at fine spatial (<10') or temporal (<1mo.) scales.

Prior research

- Seamounts cause huge increase in catchability of tunas (Itano and Holland 2000).
- Cross Seamount fishery is predominantly for bigeye.
- Transfer from Cross Seamount to inshore Hawaii fishery is low (Sibert et al. 2000).
- Residency of bigeye at seamount is higher for bigeye than yellowfin(Adam et al. 2003)
- Overexploitation of bigeye unlikely due to high emigration and natural mortality (Sibert et al 2000).
- "individuals arrive …. remain a few days or weeks, and then leave" (Sibert et al 2000).

Questions

- Residency period at seamount, vulnerability to overexploitation
- Behavior and vulnerability to gear types
- Interpretation of acoustic surveys
- Interpretation of archival tag records

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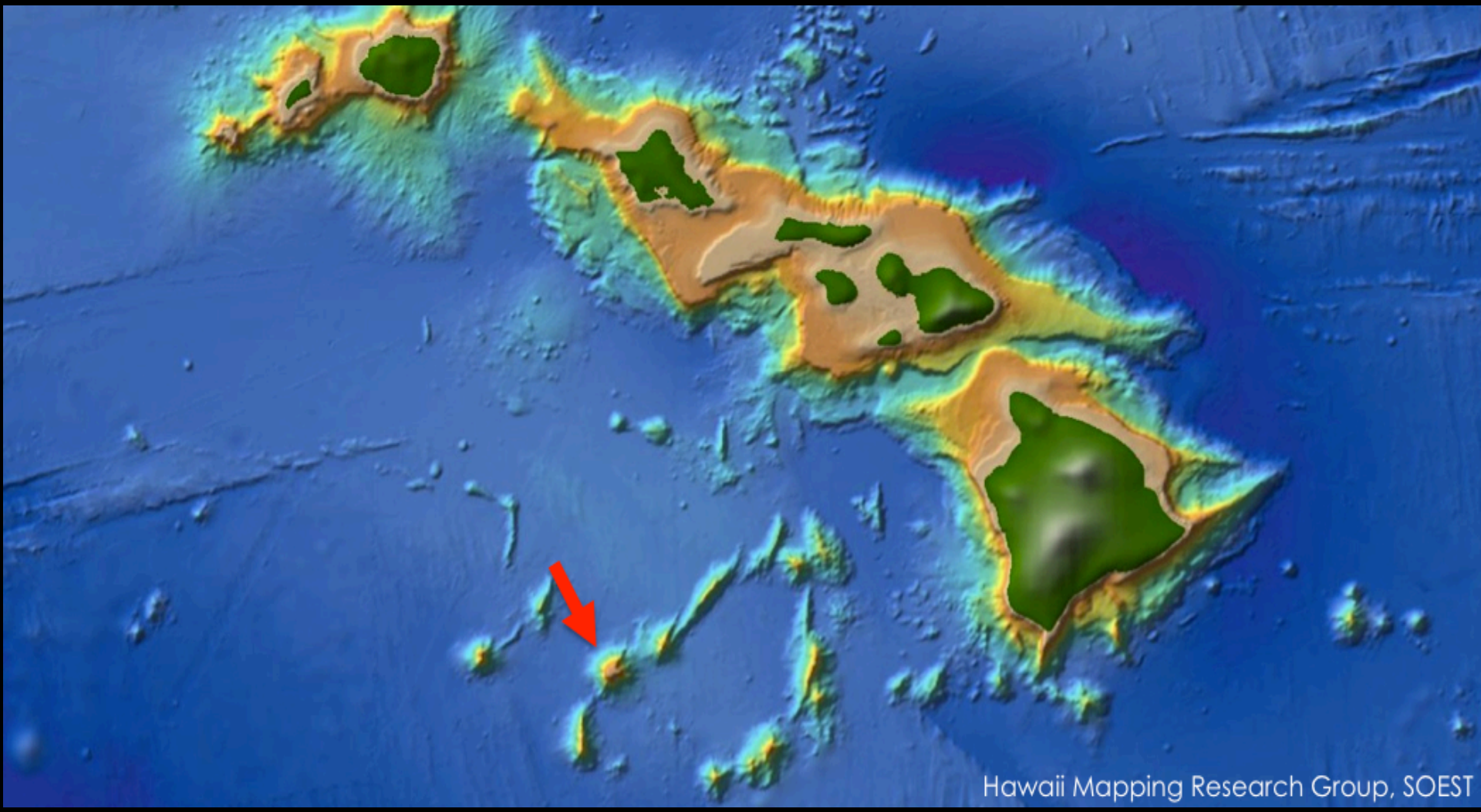
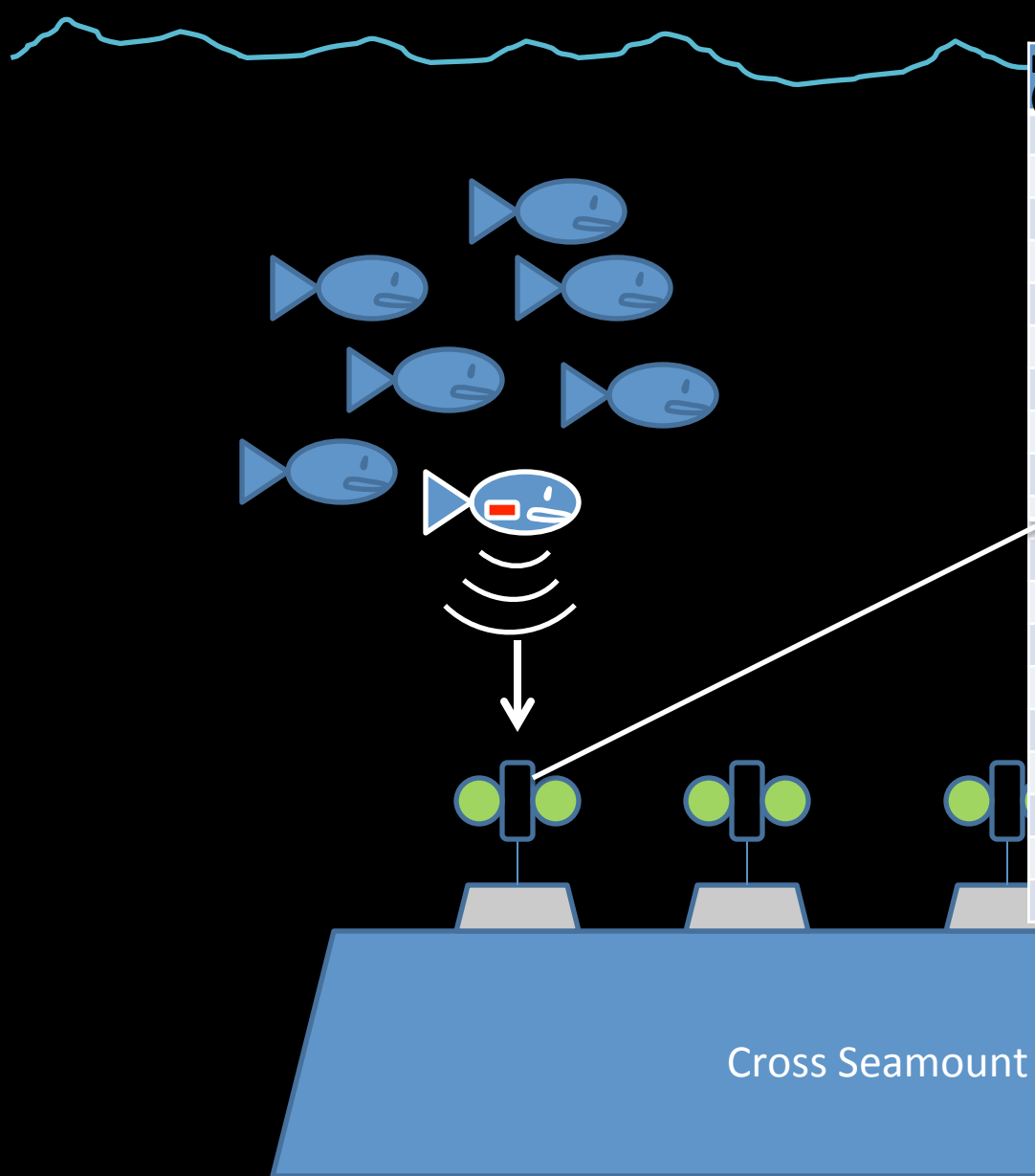


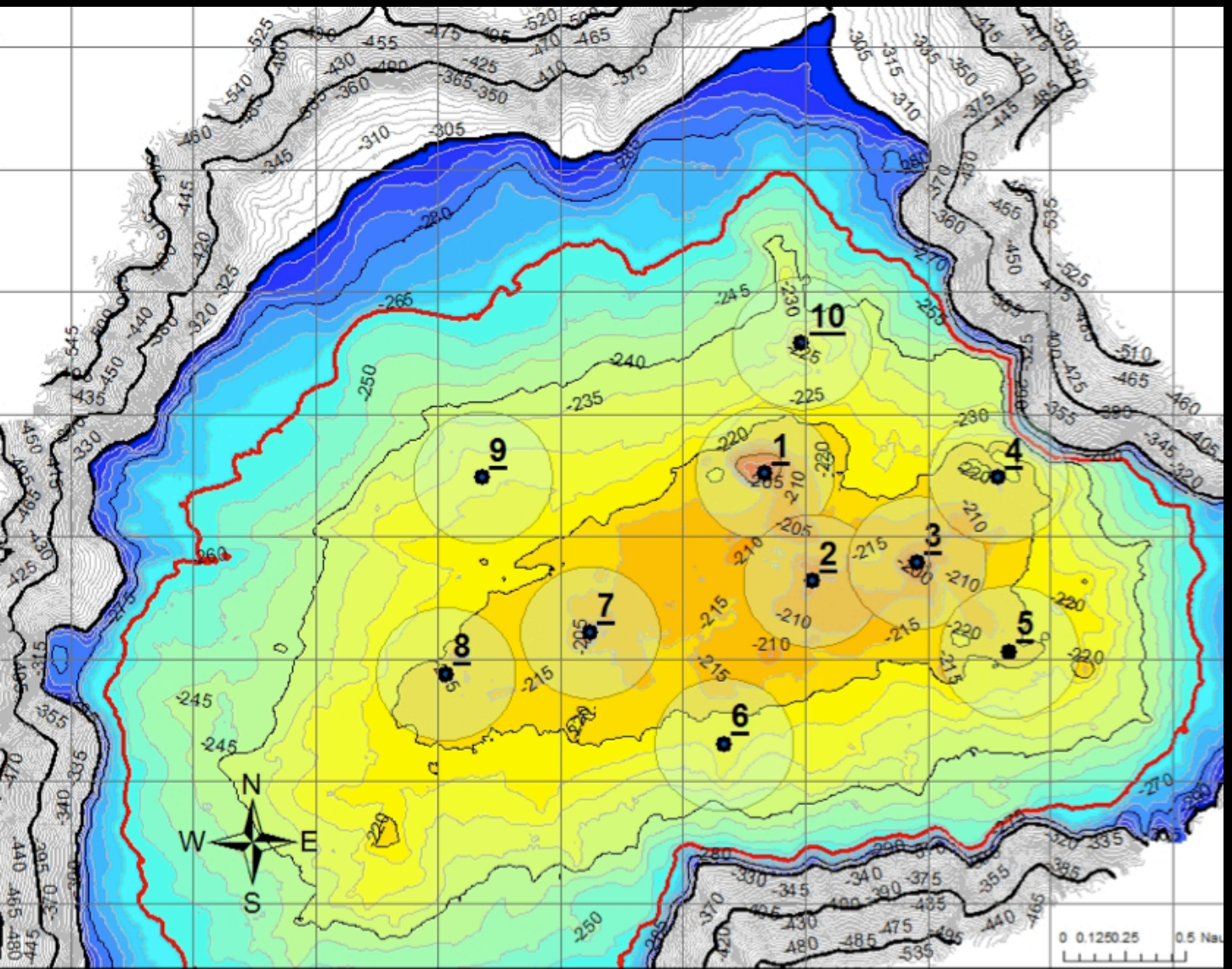
Study Area: Cross Seamount

Methods

How Acoustic Tagging Works

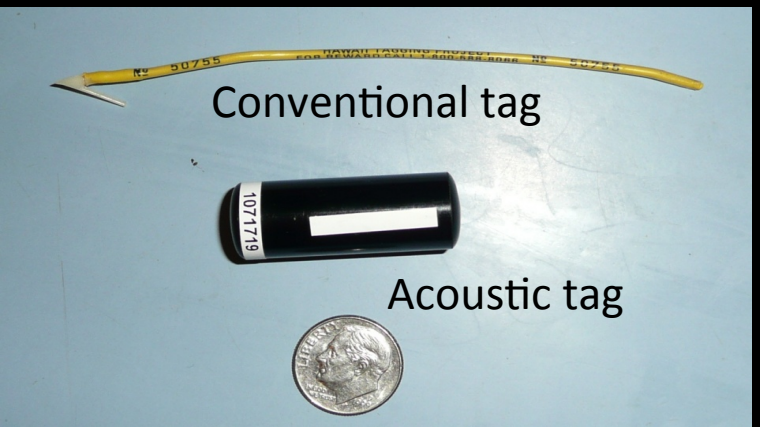


Date (UTC-10:00)	Time (UTC-10:00)	Transmitter	Depth (m)
5/24/2010	9:40:12	A69-1105-210	159.7665
5/24/2010	9:59:52	A69-1105-217	162.2435
5/24/2010	10:00:17	A69-1105-220	310.8635
5/24/2010	10:00:23	A69-1105-210	165.959
5/24/2010	10:02:57	A69-1105-217	161.005
5/24/2010	10:03:05	A69-1105-222	169.6745
5/24/2010	10:03:47	A69-1105-208	163.482
5/24/2010	10:04:49	A69-1105-220	310.8635
5/24/2010	10:05:06	A69-1105-222	147.3815
5/24/2010	**10:05:24**	**A69-1105-220**	**310.8635**
5/24/2010	10:07:36	A69-1105-208	148.62
5/24/2010	10:08:05	A69-1105-220	310.8635
5/24/2010	10:08:53	A69-1105-210	190.729
5/24/2010	10:09:03	A69-1105-220	310.8635
5/24/2010	10:10:23	A69-1105-220	310.8635
5/24/2010	10:10:28	A69-1105-222	141.189
5/24/2010	10:10:36	A69-1105-208	137.4735
5/24/2010	10:11:30	A69-1105-220	310.8635
5/24/2010	10:12:51	A69-1105-220	302.194



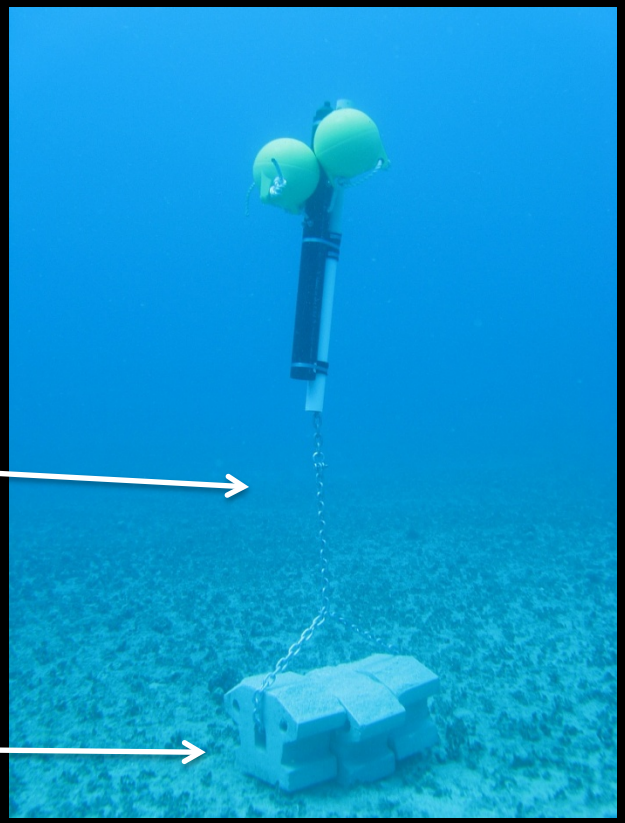
- 160 nautical miles SSW of Oahu
- 45 km^2 summit
- 400 m average depth
- Surrounding areas 4000-5000 m
- Hosts variety of pelagic and demersal fish and sharks

Tagging



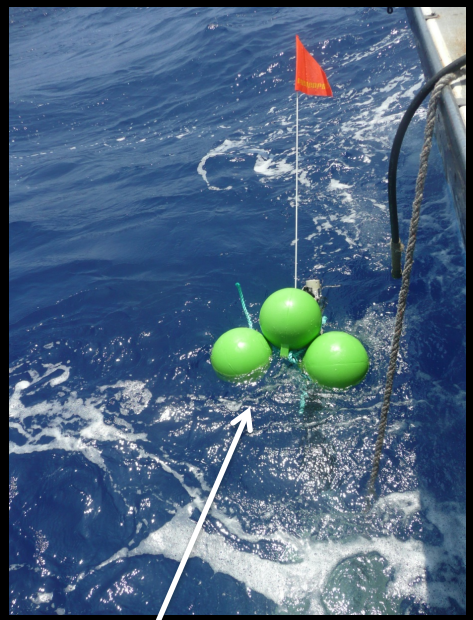
Receiver Deployment

Sonardyne release and Vemco receiver



Low profile design

80 kg concrete anchor

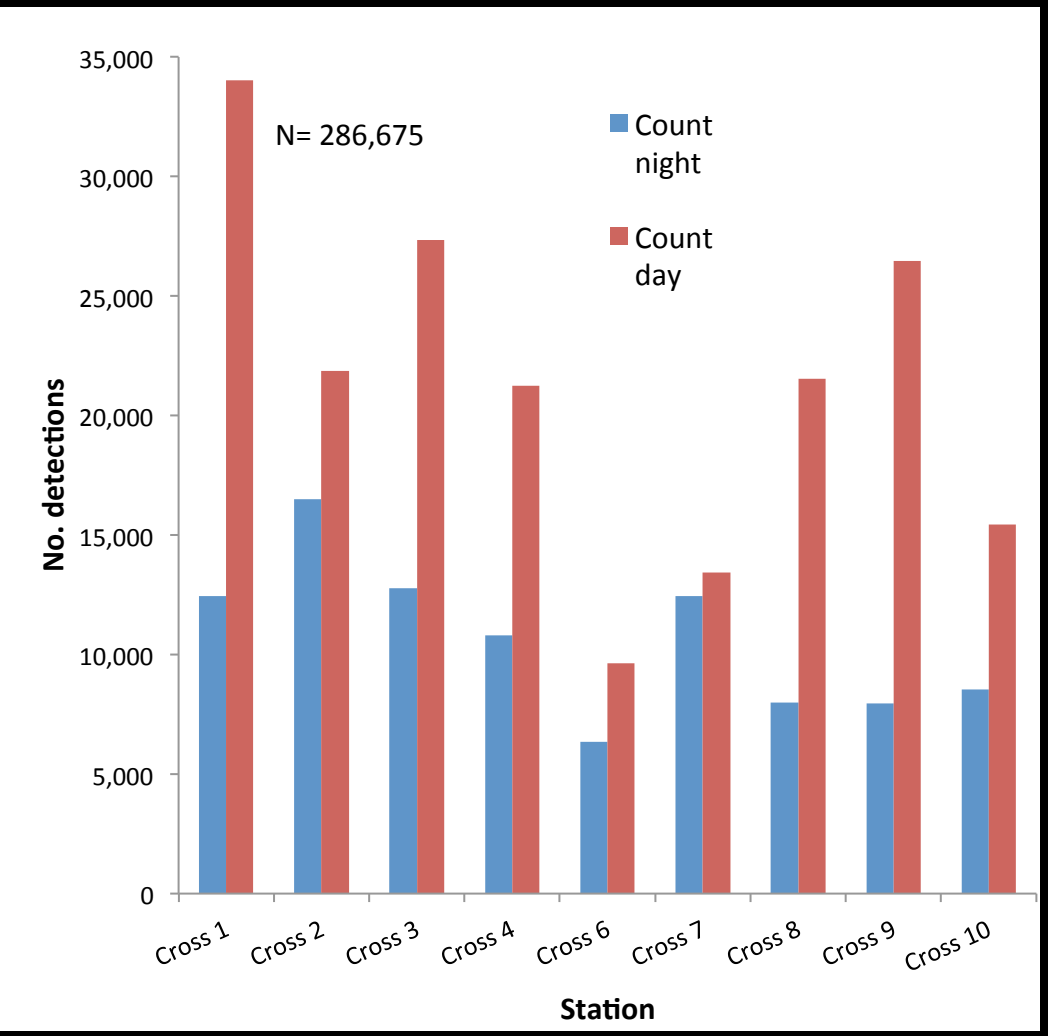


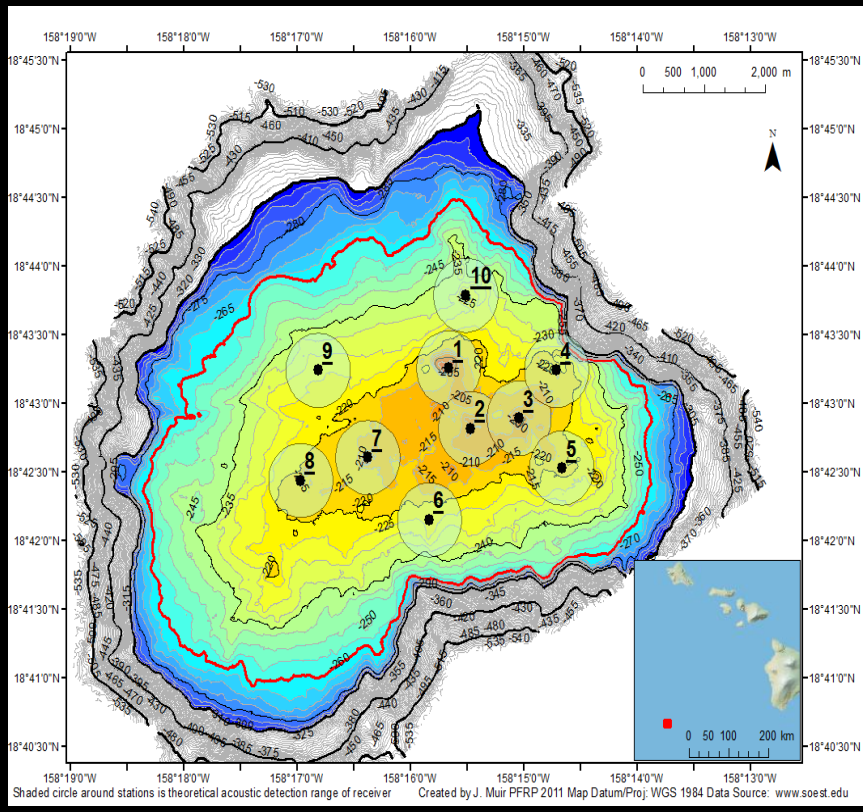
Buoys on surface during retrieval

April 2010 - Array of 10 Vemco receivers on acoustic releases at depths of 357-409 m
May 2010 - 22 tagged BET, 59-95 cm FL
April 2011- Receiver array downloaded (1 lost)
April 2011- 9 BET tagged, most larger (83-110 cm)
May 2012- Receiver array downloaded (2 lost)

Results

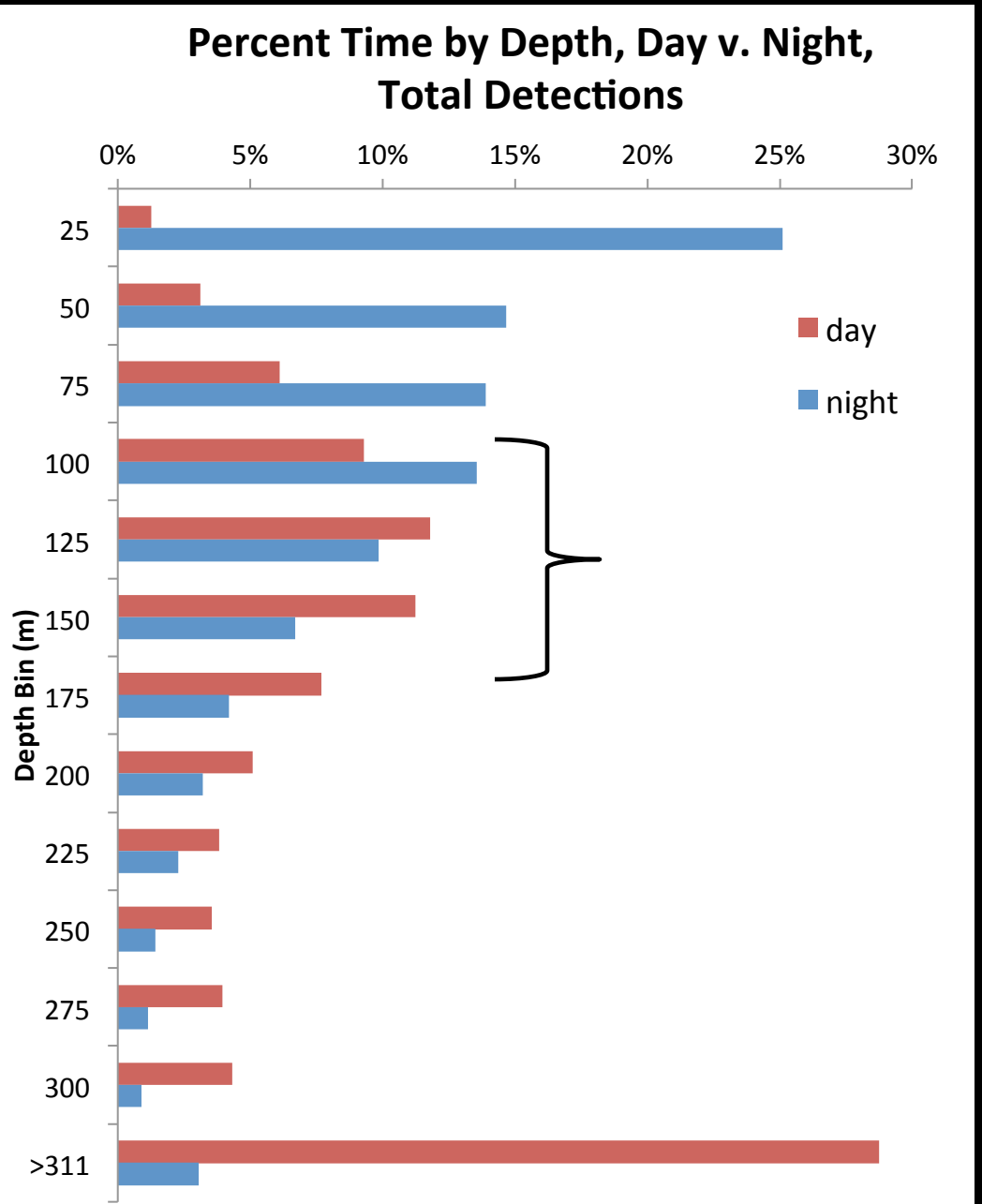
Total detections by station, day and night

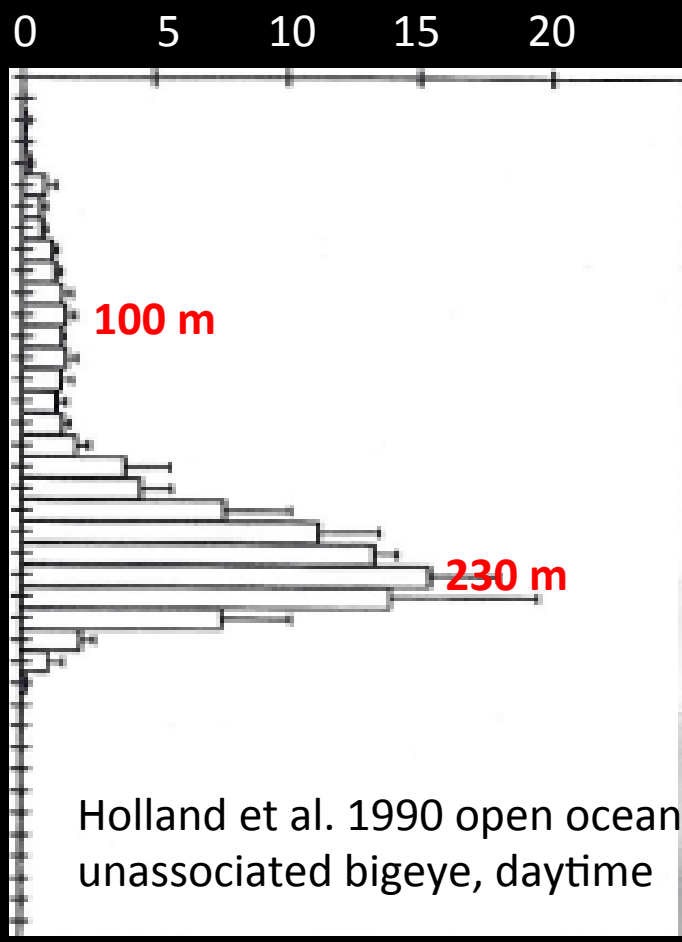




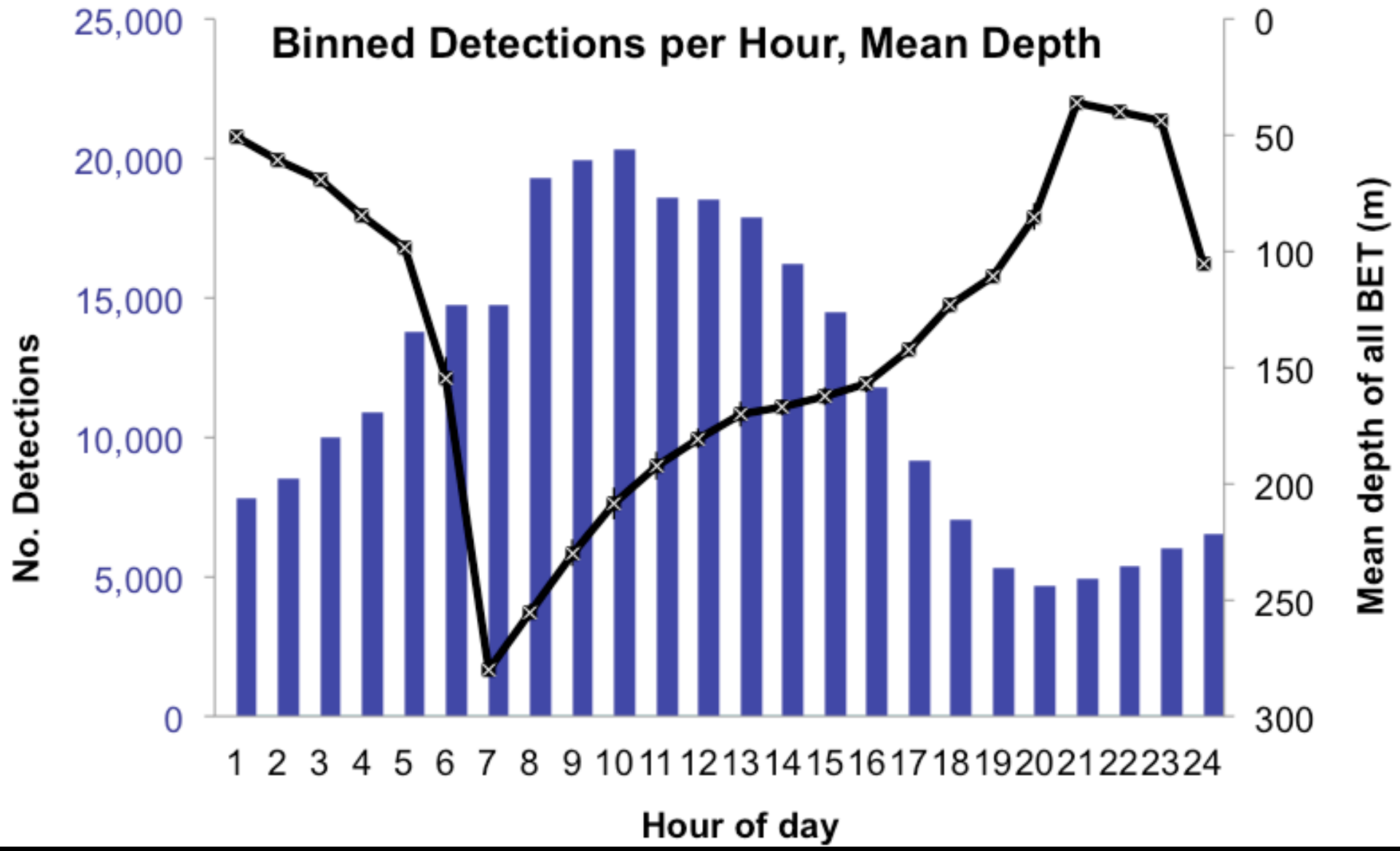
Summit detections night> flank detections night; (t(6) = 4.25, p <.002)

Detections day > detections night; (t(8) = 4.52, p <.001)

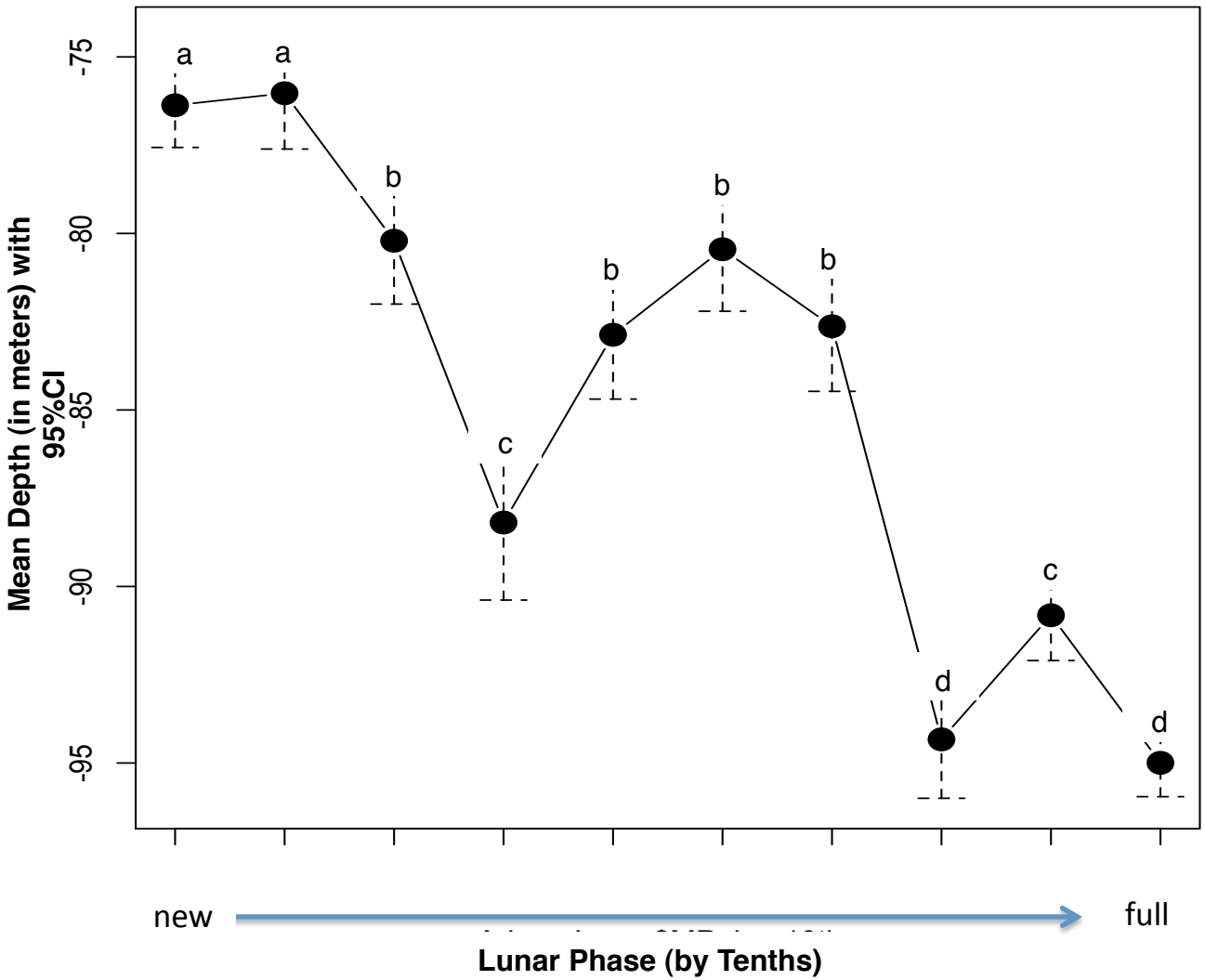




First evidence of a seamount's affect on vertical behavior of bigeye!

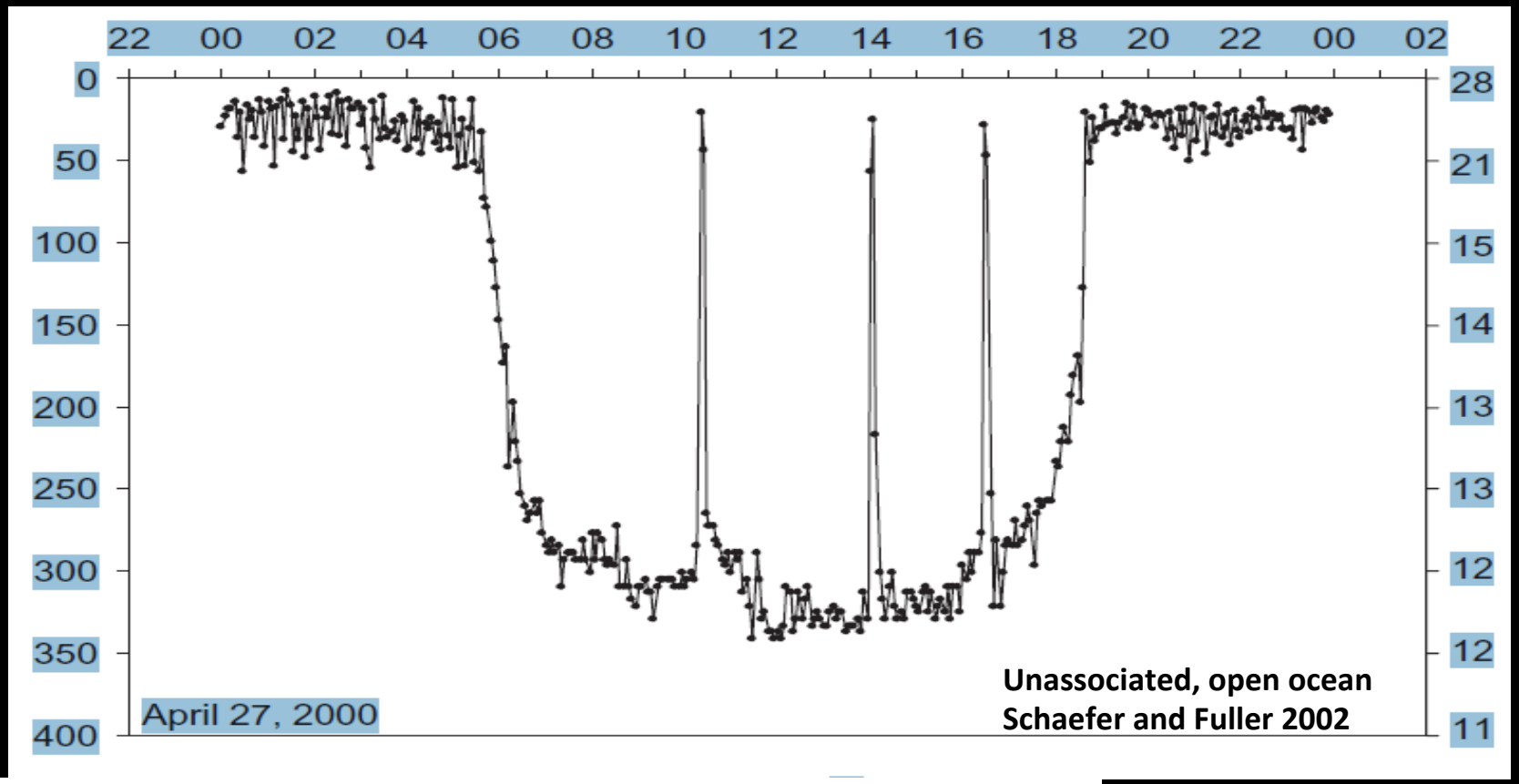

Binned Detections per Hour, Mean Depth
No. Detections
25,000
20,000
15,000
10,000
5,000
0
Mean depth of all BET (m)
0
50
100
150
200
250
300
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Hour of day

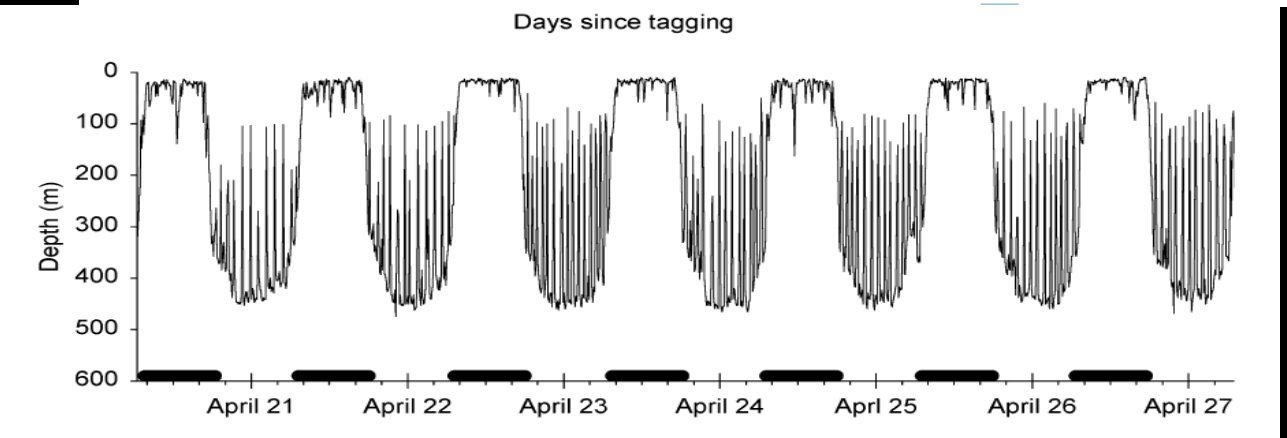
Mean Nightime Depth vs. Lunar Illumination



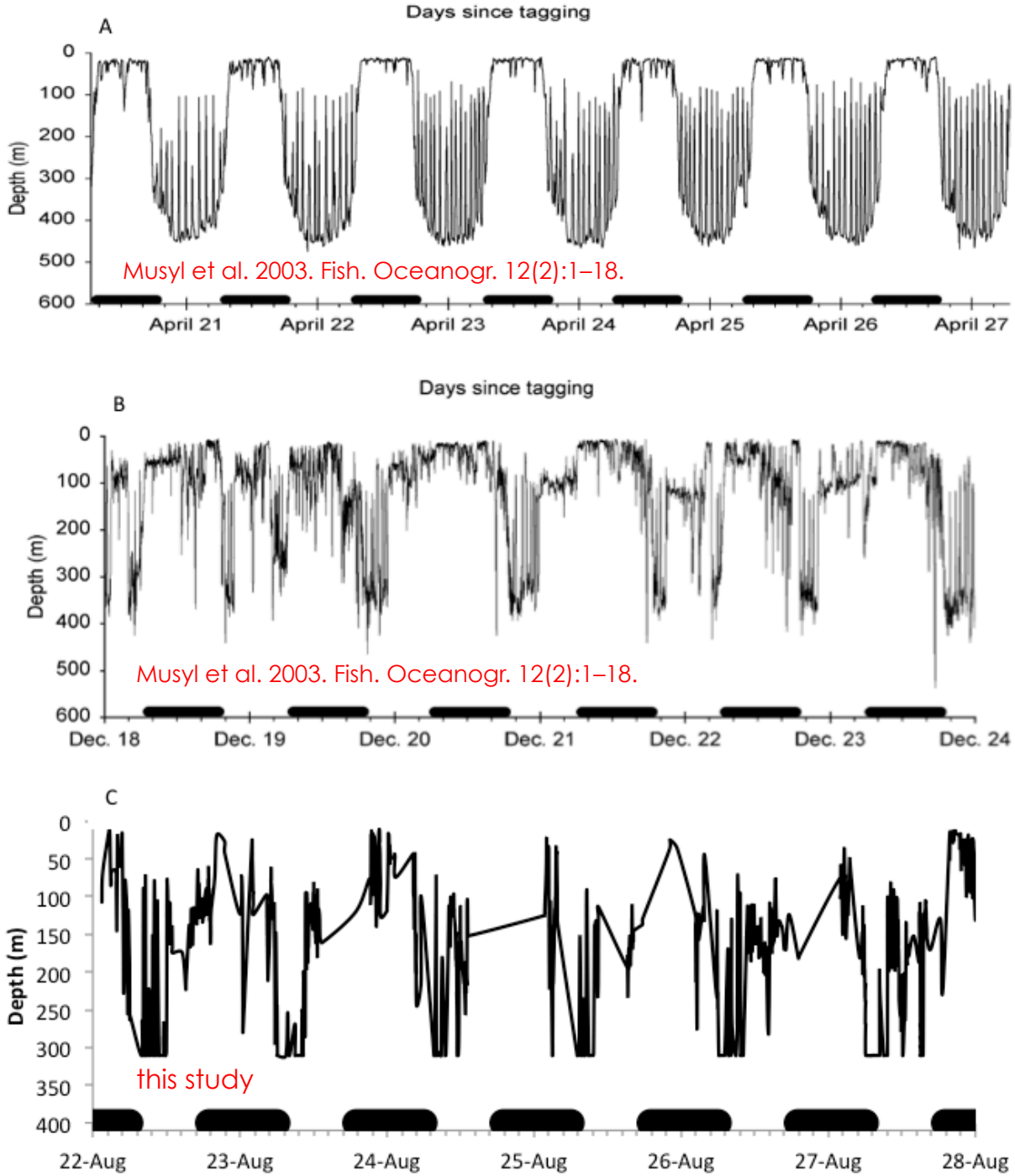
Depth full moon > depth new moon; ANOVA (f(9,2)= 109.19, <.001)

"Typical" Vertical Behavior of Bigeye



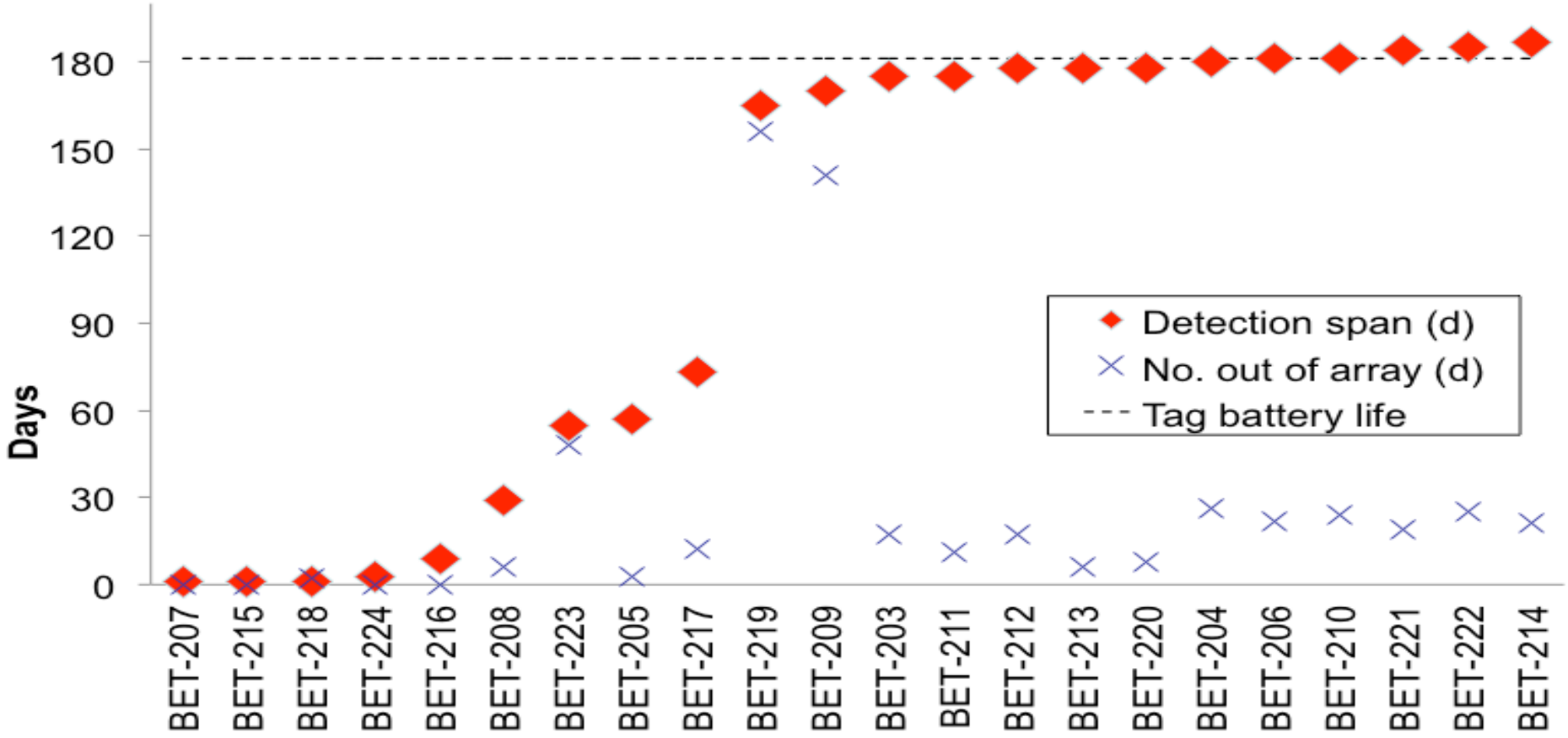


Unassociated, open ocean
Musyl et al. 2003

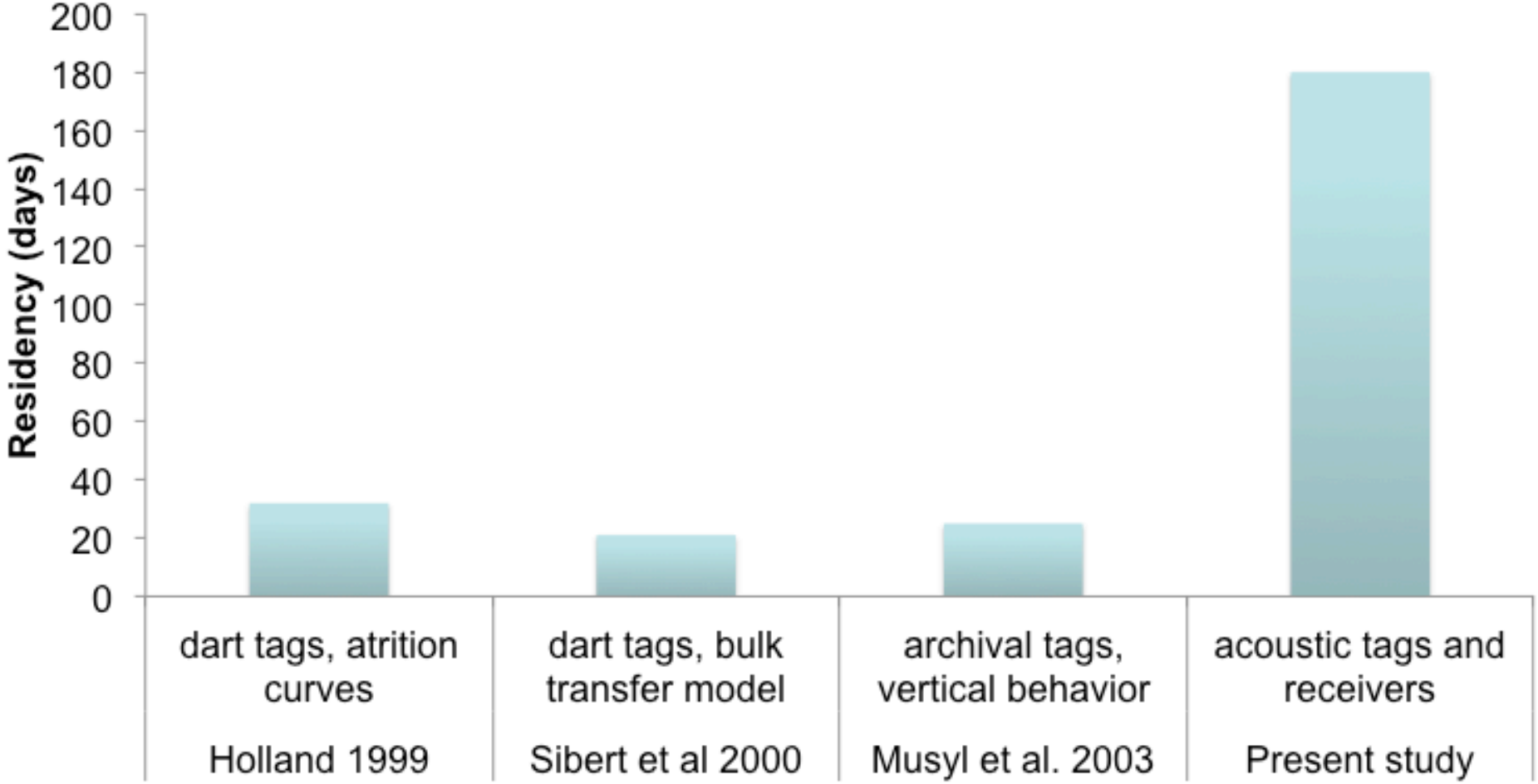


Archival records provide continuous, detailed vertical behavior, but poor geoposition, hampering understanding of FAD associated vs. pelagic behavior.

Our data for behavior while associated with Cross Seamount matches archival data for periods that were assumed to be FAD or seamount associated.



The long residency times combined with short departures indicate that turnover of bigeye at Cross Seamount is lower than previously thought, and stock assessment may be warranted



Estimates of residency of bigeye tuna at Cross Seamount using various methods. Direct observation via acoustic tags shows much longer residence times, indicating that bigeye tuna may be more vulnerable to over-exploitation than previously thought.

Conclusions

- Bigeye tuna have surprisingly long residence times at seamounts, with limited departures, making them highly vulnerable to fishing.
- Do not stay deep all day while at seamount – more vulnerable to surface gear types.
- Detailed behavioral observations can improve discrimination between species in sonar surveys.
- Associated vs. pelagic behavioral data can improve the interpretation of archival tag records.
- The combination of acoustic tagging, archival tagging and multi-frequency sonar surveys enables a more complete understanding of bigeye biology and could enable stock assessment.

Acknowledgements

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- J Muir conducted this work as an MSc candidate in the Natural Resource and Environmental Management Program (NREM) at the University of Hawaii under John Yanagida and Tomoaki Miura.

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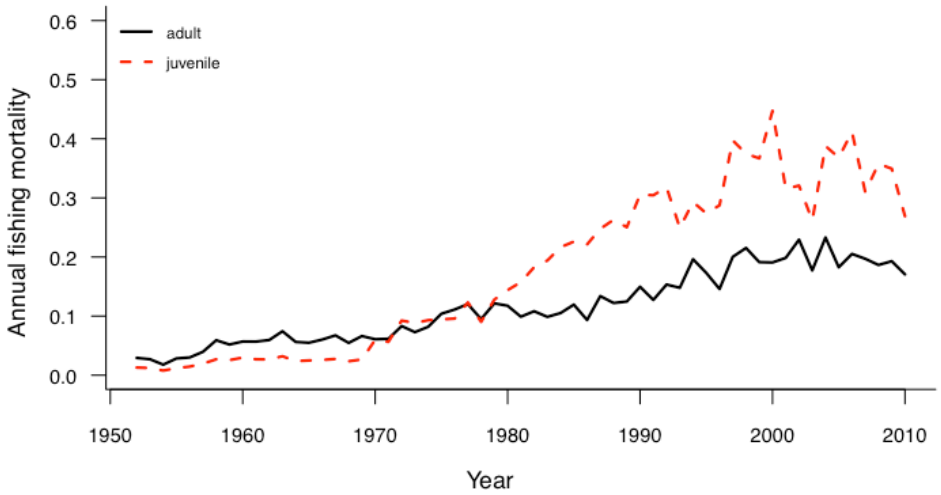
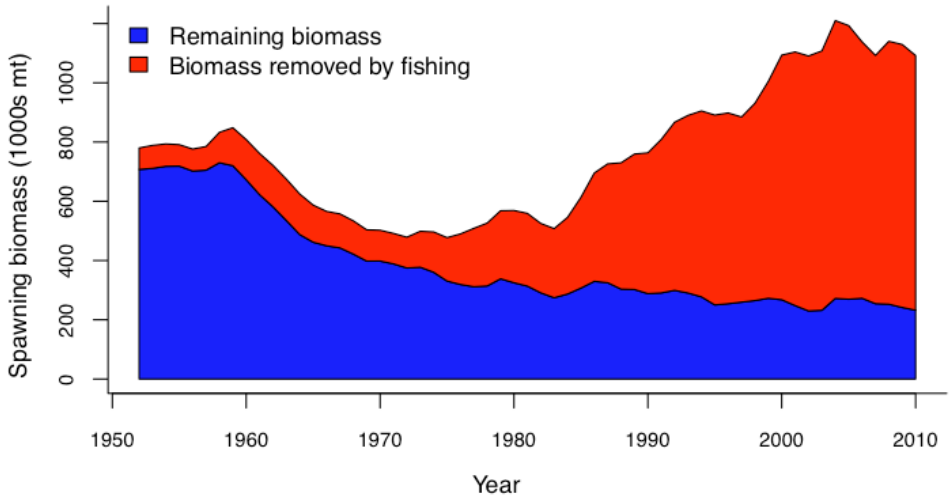
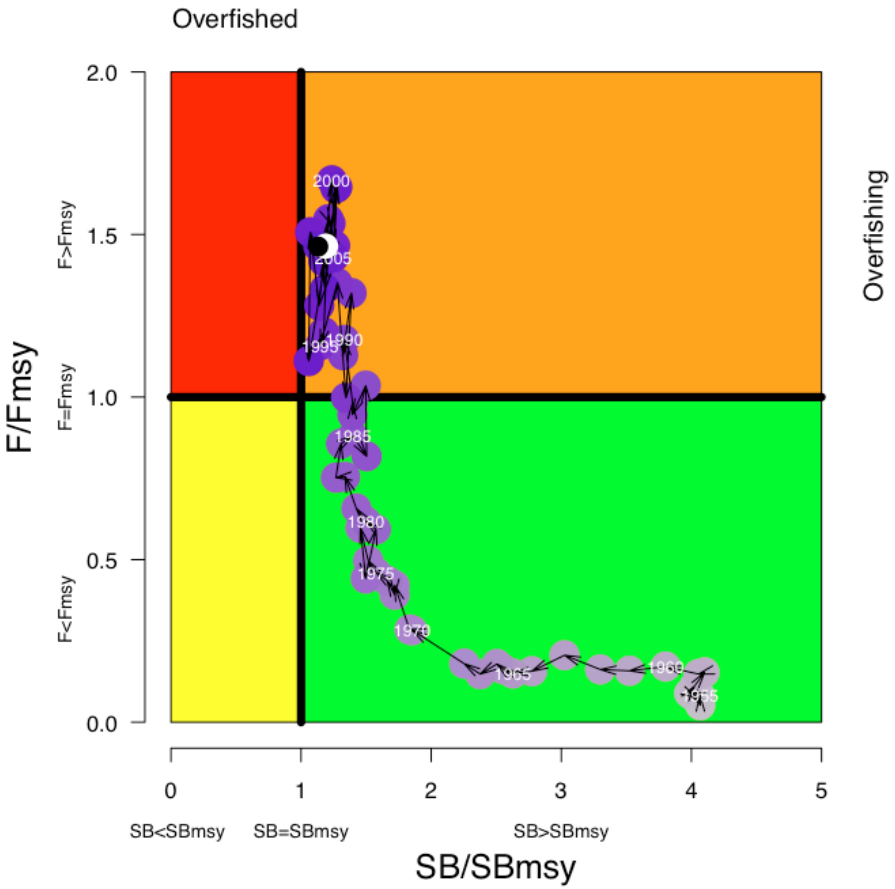
overfishing continues







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