U.S. Navy Marine Species Monitoring Program

This is a work product for the purpose of technical review. All data and information in this presentation is preliminary and should not be cited or reproduced without first contacting the presenter. All field work is conducted under appropriate permits under ESA/MMPA.

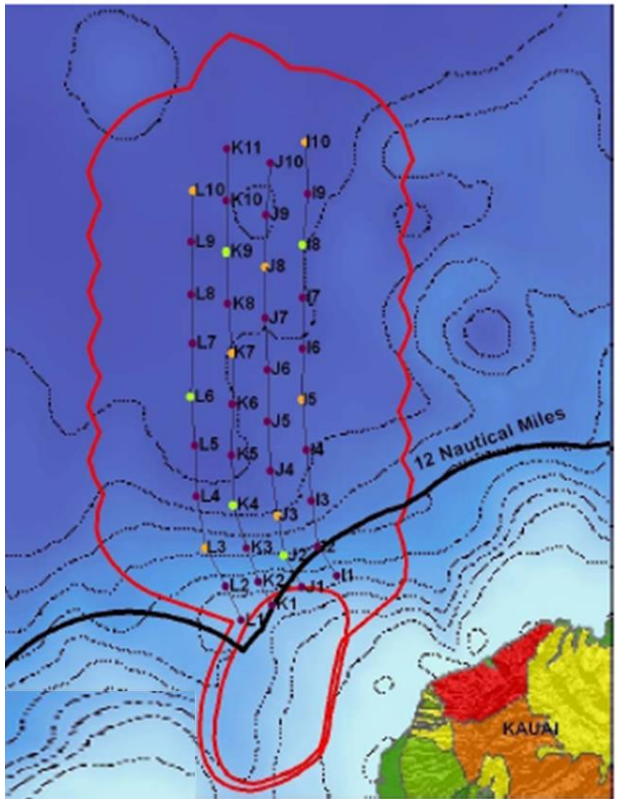
Please visit the US Navy Marine Species Monitoring Program web portal for additional information on this project – www.navymarinespeciesmonitoring.us

US Navy Marine Species Monitoring Program – Annual Technical Review Meeting
San Diego, CA *19-21 March 2018*

Marine Mammal Monitoring on Navy Ranges (M3R)
Passive Acoustic Monitoring of Abundance on the Pacific Missile Range Facility (PMRF)

David J. Moretti, Ronald Morrissey, Susan Jarvis, Nancy DiMarzio, Elena McCarthy, Stephanie Watwood, Karin Dolan

18 March 2018



Objective

- Maintain IA compliant monitoring system
- Estimate abundance on near-continuous (daily/monthly/yearly) time scale
- Estimate sonar use on same time-scale
- Inform development of PMRF *Md* risk function

IA Compliance

- Application for ATO under Risk Management Framework has been submitted
- NUWC IA authority is working on consolidating the packages along with Seneca Lake and Dodge Pond as Class D closed enclaves to provide an initial ATO ot through 2019
- New compliant switches procured and will be installed in May 2018.
- New software build and subsequent Initial Readiness Review (IRR) and Test Readiness Review (TRR) to be completed Q2 with install in May

Broadband Recording (Packet Recorder)

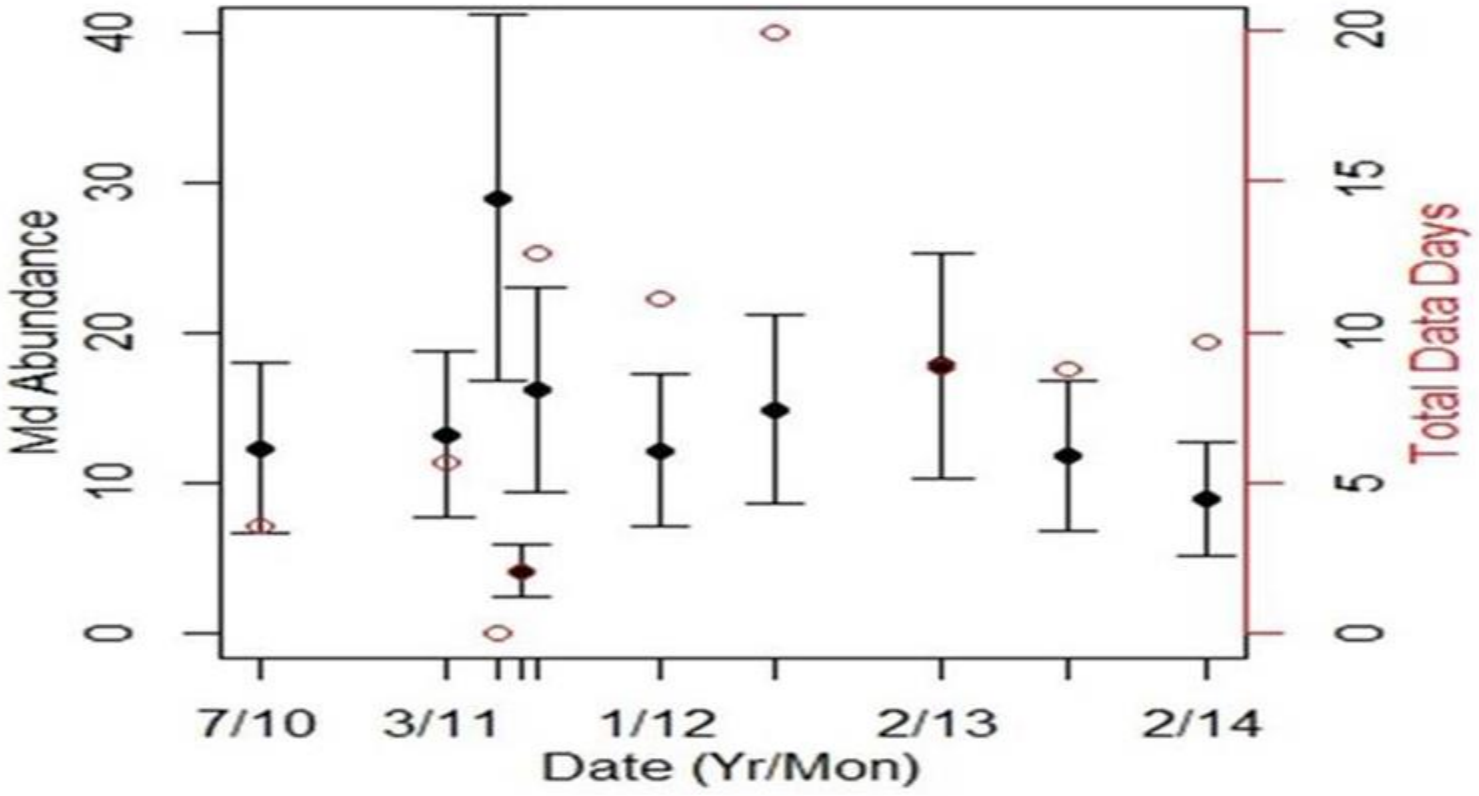
Packet Recorder:

- Software changes to eliminate drops complete (Matsuyama/Morrissey)
- Integration of X3 compression underway via LMR (Morrissey Matsuyama.

A/D System Board Resets (<1 per hour)

- Software to reduce reset time compete via Range programs (Morrissey)
- Investigation to eliminate resets underway via LMR (Morrissey/Matsuyama)
    - M3R A/D board and interface cable to SPAWAR

Abundance from M3R Archives



Abundance estimates for 2010 - 2014

Abundance via M3R Archives 2015-2017

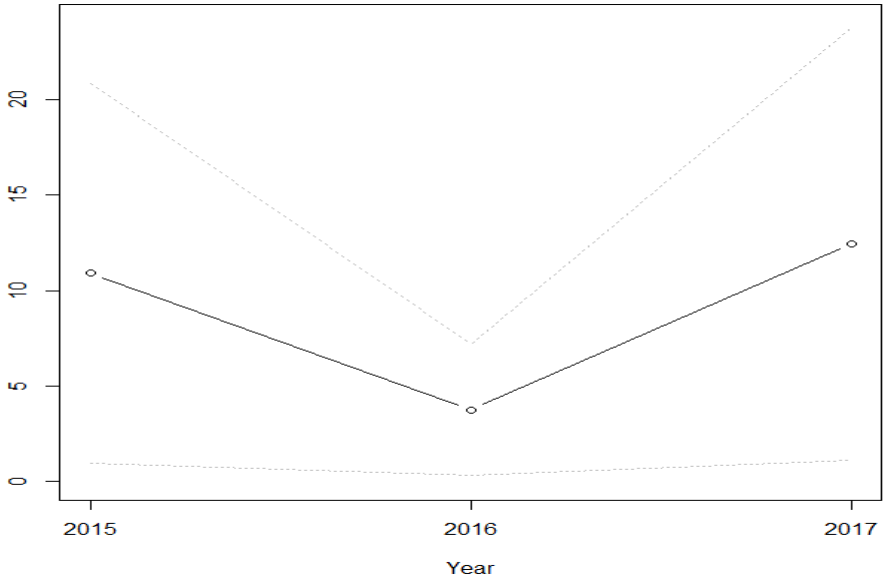
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Data Days
2015	NA	NA	NA	NA	NA	NA	NA	NA	11.38	6.66	NA	NA	7
2016	NA	5.07	NA	NA	NA	NA	NA	2.57	NA	NA	NA	NA	27
2017	NA	7.96	11.24	12.02	12.12	16.56	14.20	13.08	NA	NA	NA	NA	182
Mean	NA	6.51	11.24	12.02	12.12	16.56	14.20	7.82	11.38	6.66	NA	NA	

<u>Archive Data</u>

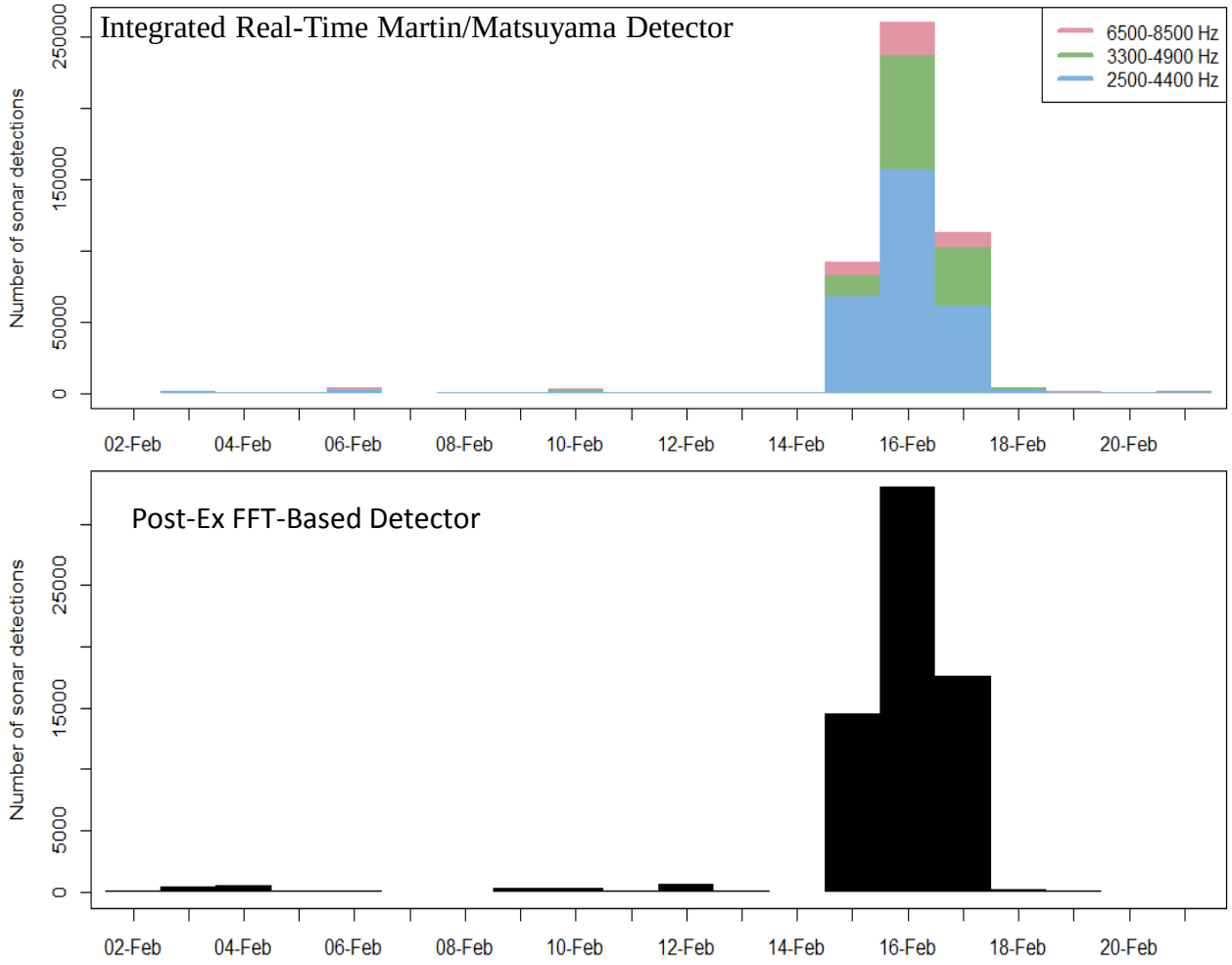
Cetacean Detection Reports

- FFT-Based
  - Cetacean Vocalizatons
  - Verification
  - sonar
- SVMJ-Based
- SPAWAR Low Frequency

Sonar Detection Reports

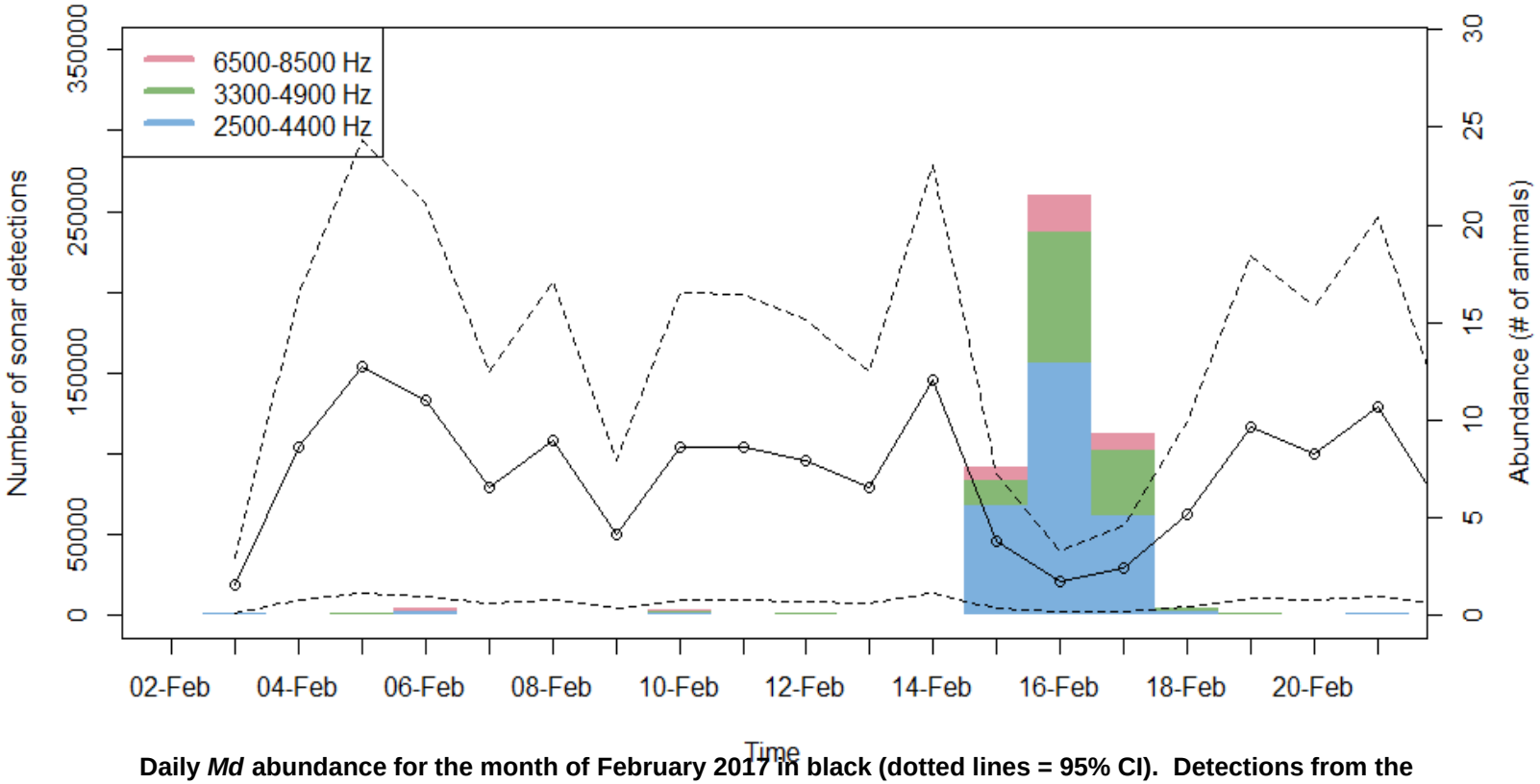


Tracking Sonar



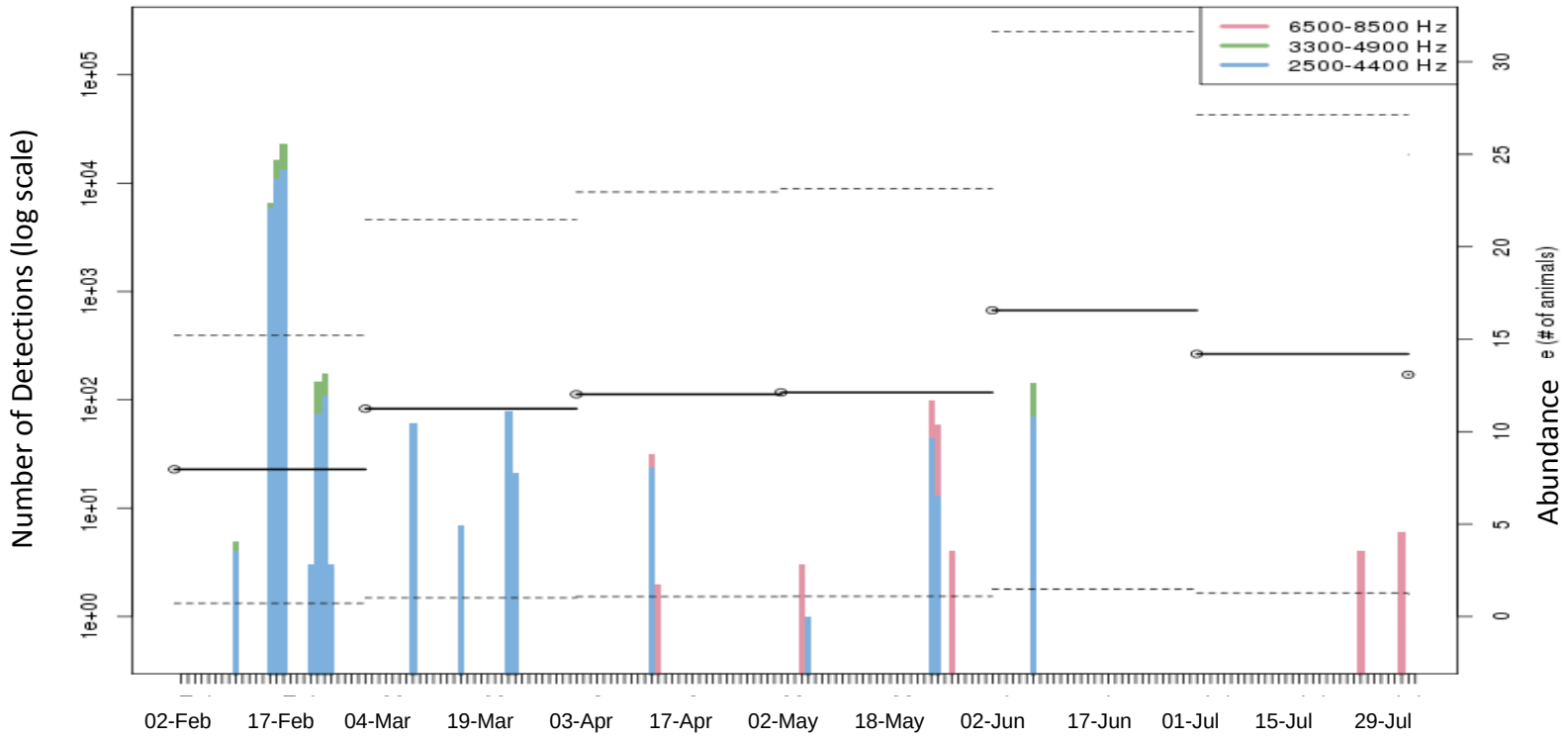
Comparison of M3R integrated SPAWAR real-time detector and post-ex FFT-Based Detector for February 2017 at PMRF both via ESTCP

February 2017 *Md* Abundance vs. SONAR



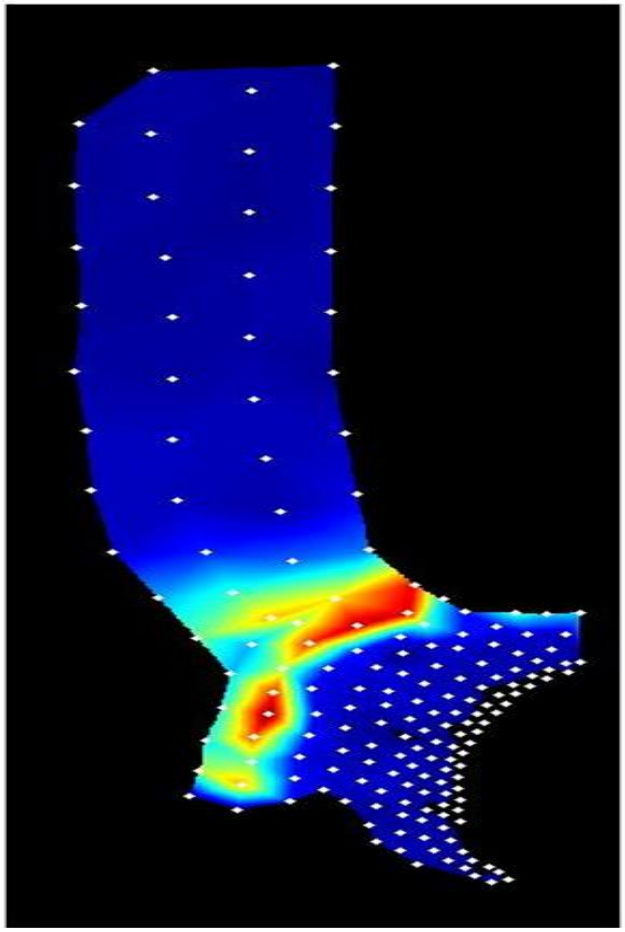
Daily *Md* abundance for the month of February 2017 in black (dotted lines = 95% CI). Detections from the real-time sonar detector for all range hydrophone are presented by the colored bars.

2017 6-Month Abundance vs. Sonar Detections



Montly *Md* abundance in black (dotted lines = 95% CI). Detections from the sonar detector for all range hydrophone are presented by the colored bars on a log scale.

Md Risk Function Development (via LMR NUWC/SPAWAR/St. Andrews)



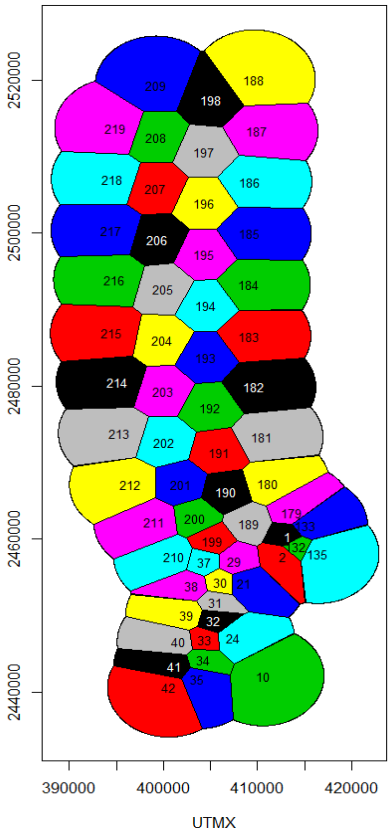
Challenges

- Relatively low abundance
- Asymmetric animal distribution
- Asymmetric hydrophone spacing

PMRF *Md* behavioral risk function

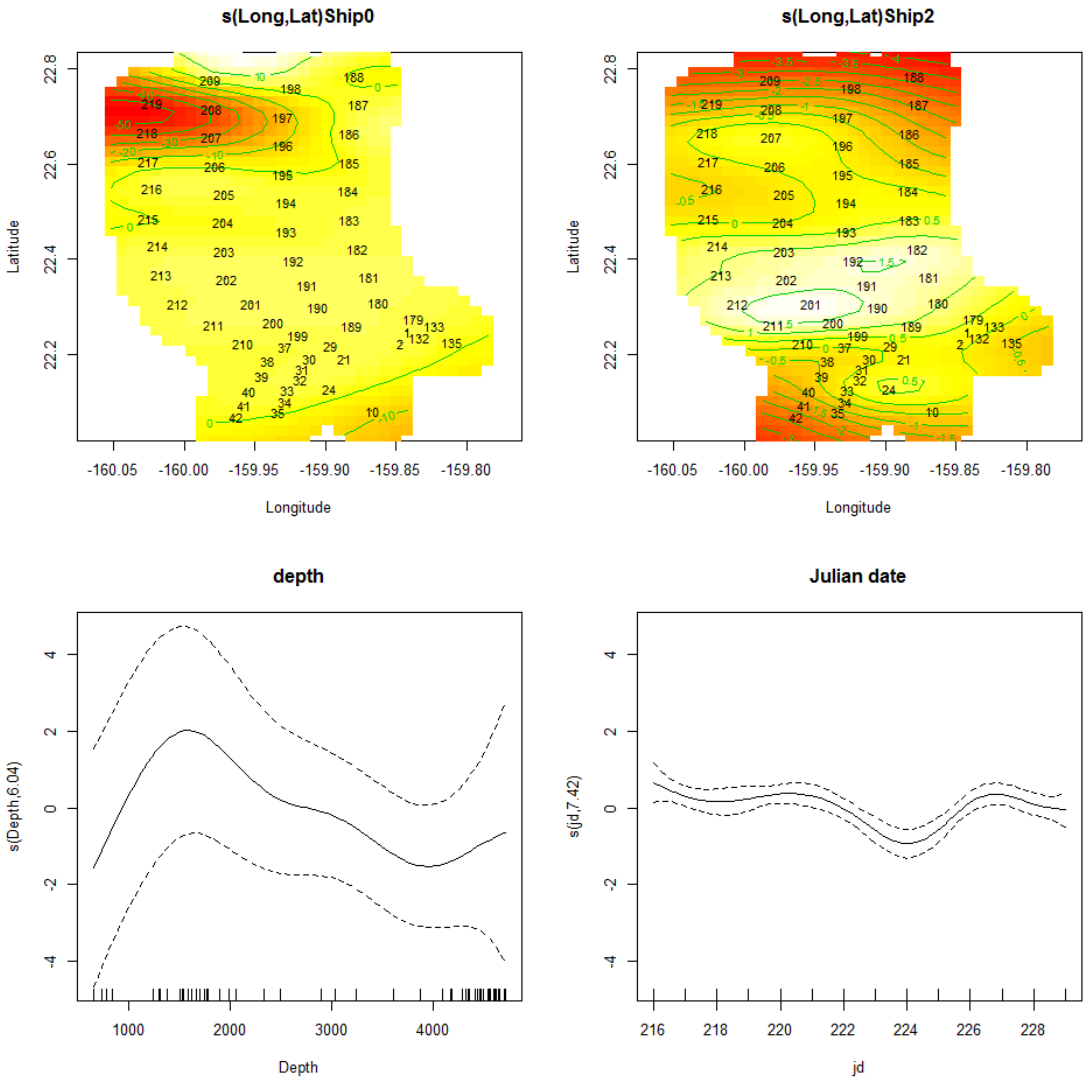
Approach

- Begin with SPAWAR SCC data for BSURE and selected BARSTUR hydrophones
- Account for non-uniform hydrophone spacing by including spatial model (tessellation-based partitions)
- Use a Generalized Additive Modelling (GAM) framework to account for spatial and temporal variation, and residual temporal correlation in dive starts
- Apply to long-term continuous data



Locations (jittered) of the 62 hydrophones includes in the SPAWAR dataset, with simple tesselation tiles on the left and improved tiles (assuming a 6.5km effective detection radius) on the right.

Spatial Smooth



Partial fit plots for smooths from binomial GAM, on the scale of the logistic link function. The 2-dimensional spatial smooth terms (Longitude,Latitude) is illustrated in the heat plot showing a 2-D spatial smooth with hydrophone locations. Contour lines in heat plots represent surfaces at +/- 0.5, 1, 1.5 standard errors. Vertical lines in the smooth for covariates depth and Julian date indicate locations of observations

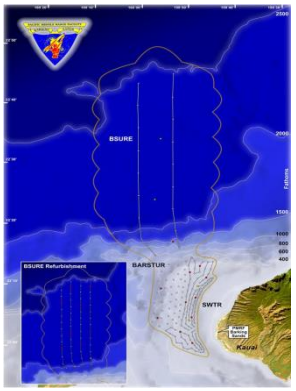
Summary

- IA ATO moving via Risk Management Framework
- Recorder issues resolved
- X3 compression underway (via LMR)
- Software to reduce effect of A/D reset compete
- Development of software to eliminate the issue underway (via LMR)
- Both research and operational system in-place with continuous archives on operational system
- Semi-automatic methods to extract *Md* abundance and sonar presence being applied.
- Must verify sonar detector performance
- Derivation of correction factor for *Md* detector FA and PD to be completed in FY18
- Derivation of *Md* risk function underway (via LMR)

Issues: High personnel turnover is occurring at PMRF. Effect unknown.

Acknowledgements

Thanks to PAC Fleet Environmental



Thanks Pacific Missile Range Facility (PMRF)

Thanks to LMR and ONR for supporting tools and data