

Revised Stock Boundaries for False Killer Whales in Hawaiian Waters

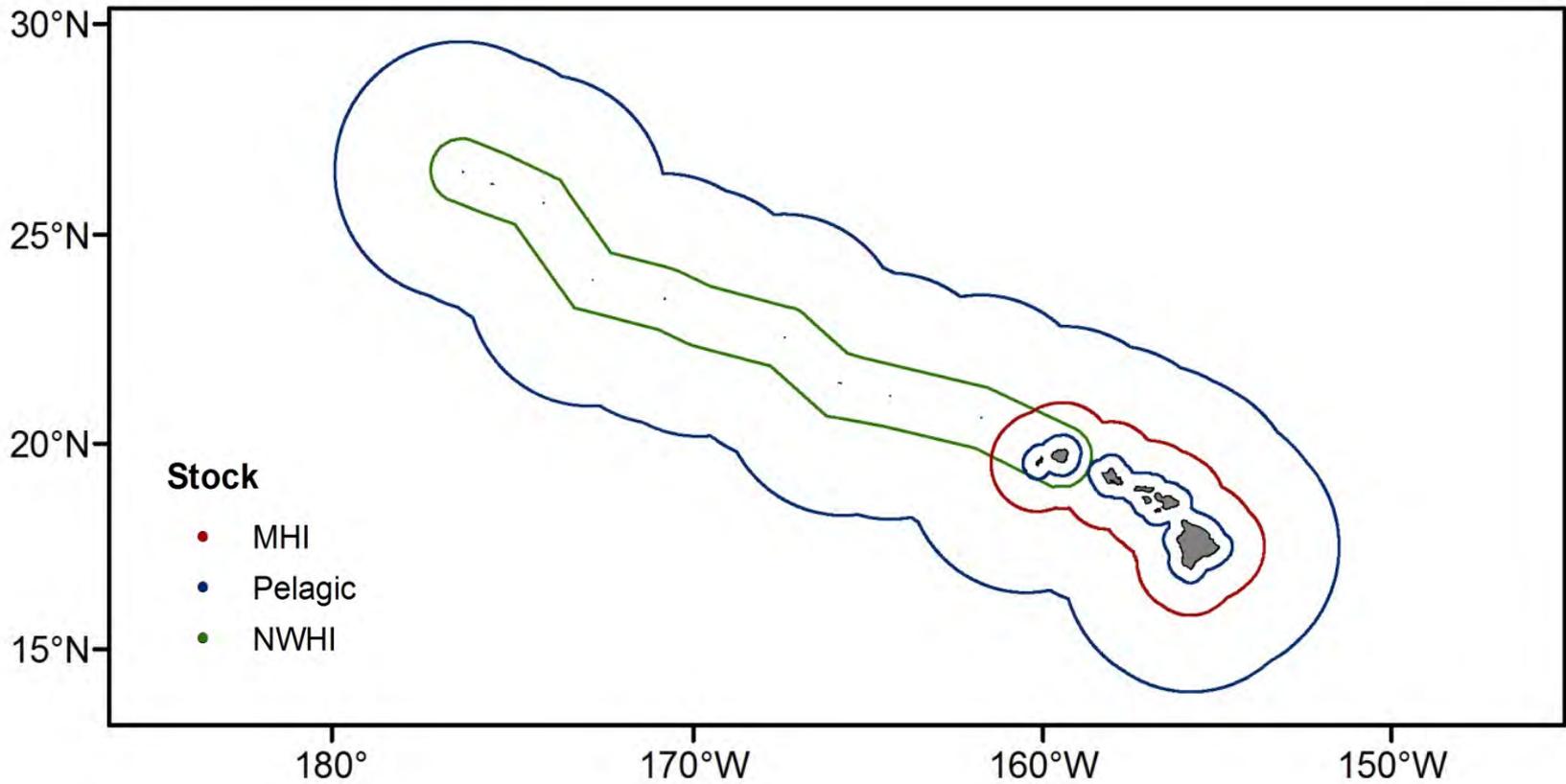


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*False Killer Whale Take Reduction Team Meeting
29 April 2015*

Pre-2015 HI FKW Boundaries

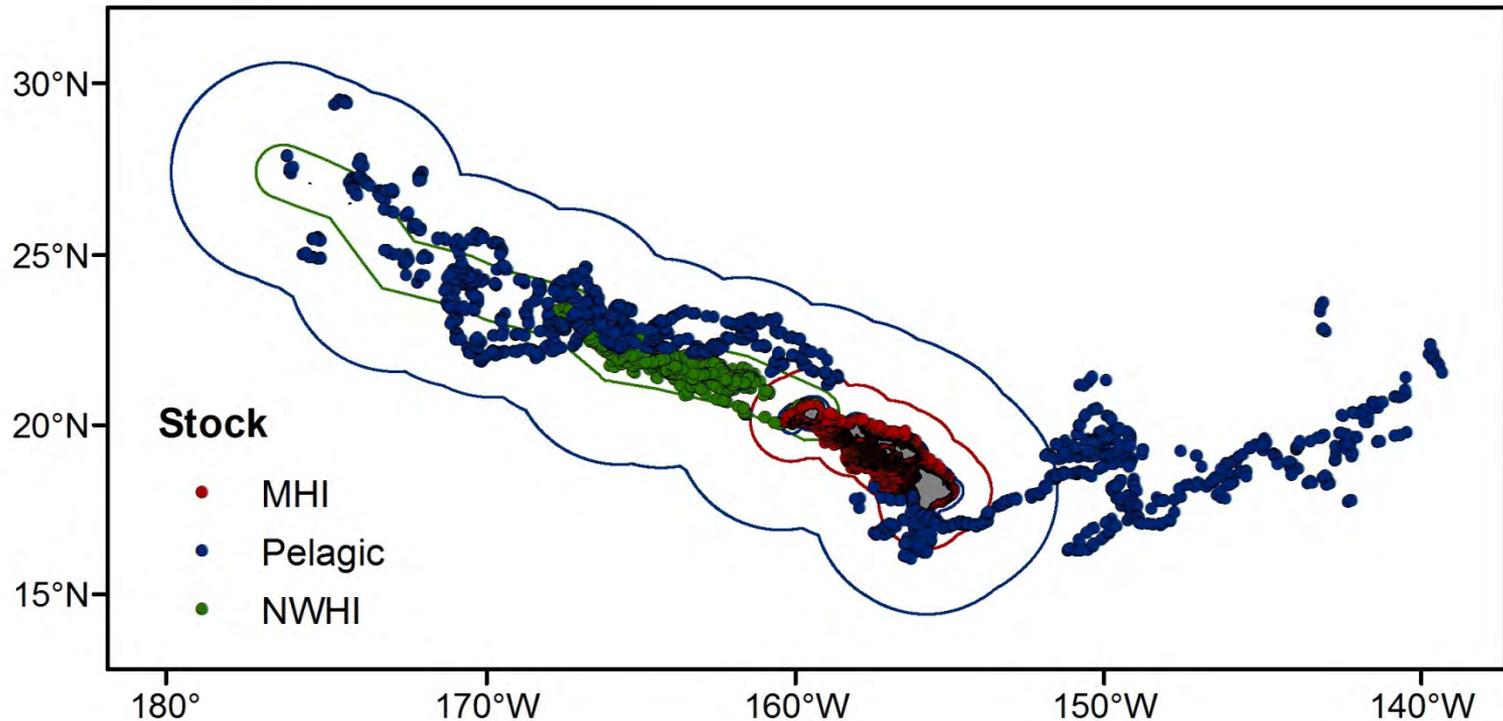


Relevant Data Additions

Stock	No. (years) of previous tracks	No. (years) of current tracks	No. of current CRC tracks	No. of current PIFSC tracks
MHI	11 (2007-2009)	31 (2007-2014)	31	0
Pelagic	1 (2008)	6 (2008-2014)	4	2
NWHI	2 (2010)	6 (2010-2013)	4	2

- ❖ MHI stock: Analysis of high-use areas by social cluster (Baird et al. 2012)
- ❖ NWHI stock: Sighting data from CRC

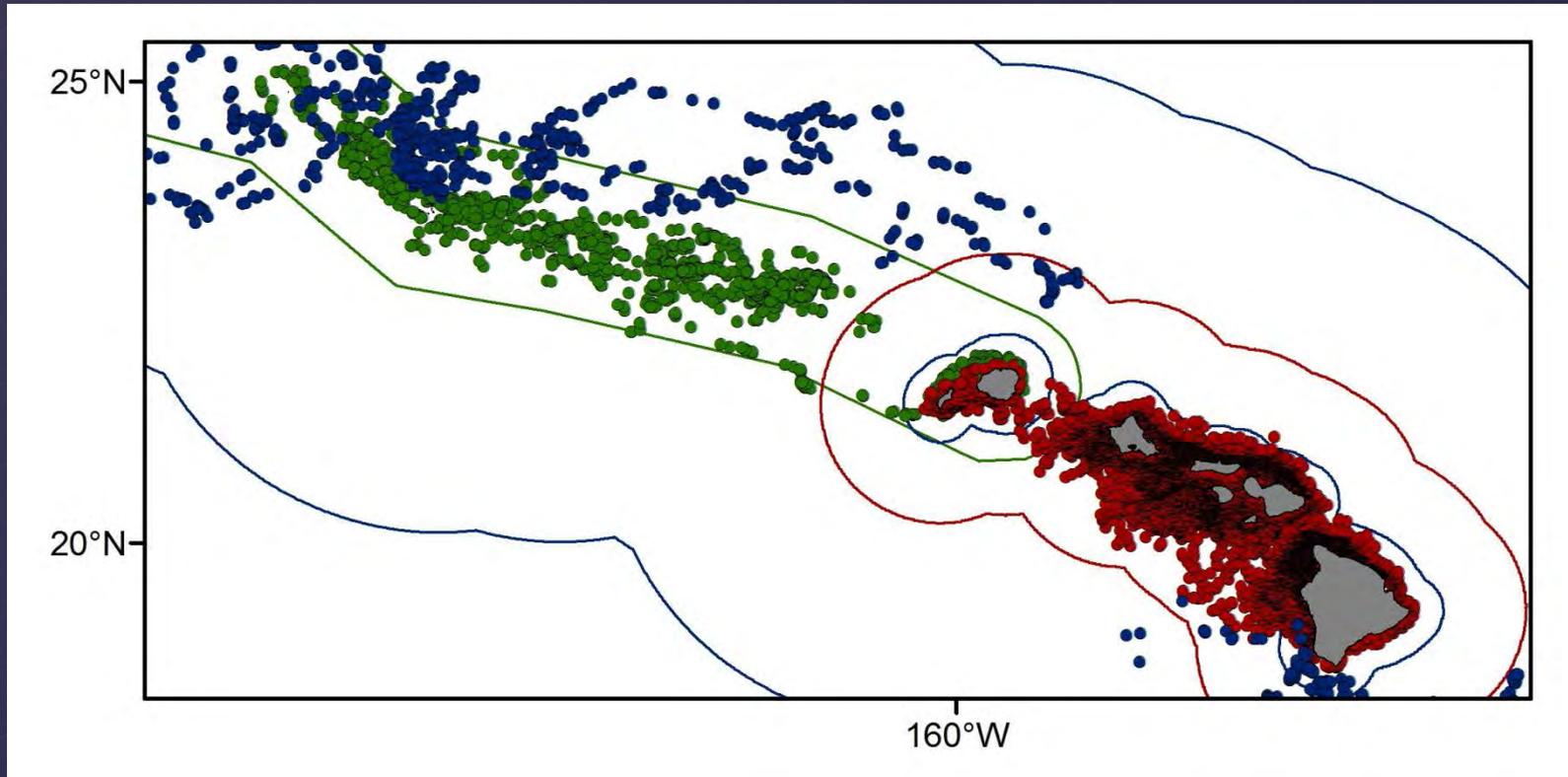
Telemetry Data by Stock



MHI n=31 • Pelagic n=6 • NWHI n=6

Some individuals tagged within same group

Stock Boundaries Need Revision

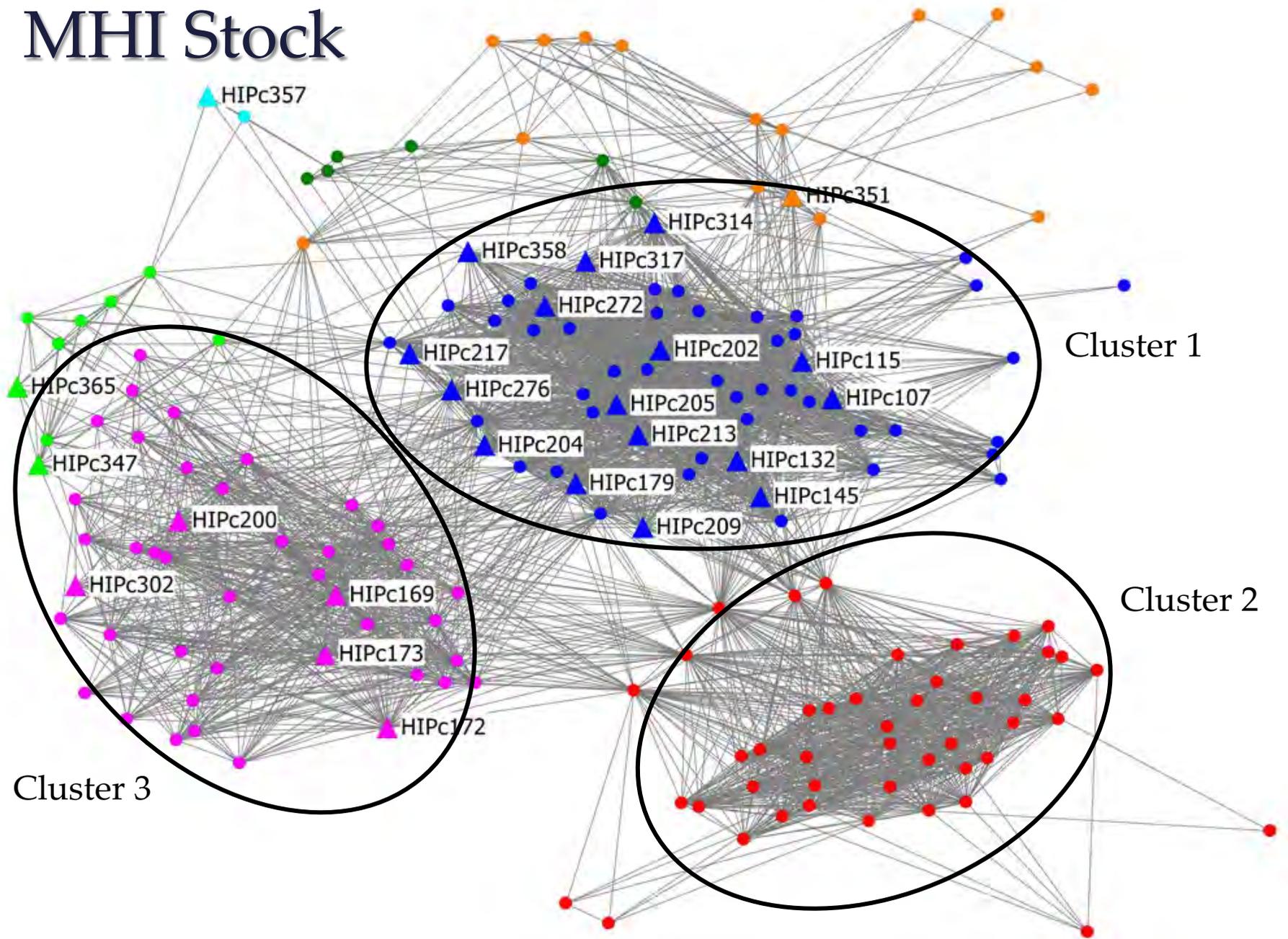


- ❖ MHI stock boundary could be contracted along windward sides
- ❖ Pelagic stock boundary could be moved closer to shore
- ❖ NWHI stock boundary could be widened in eastern portion
- ❖ Considerable uncertainty in these data for each of the stocks

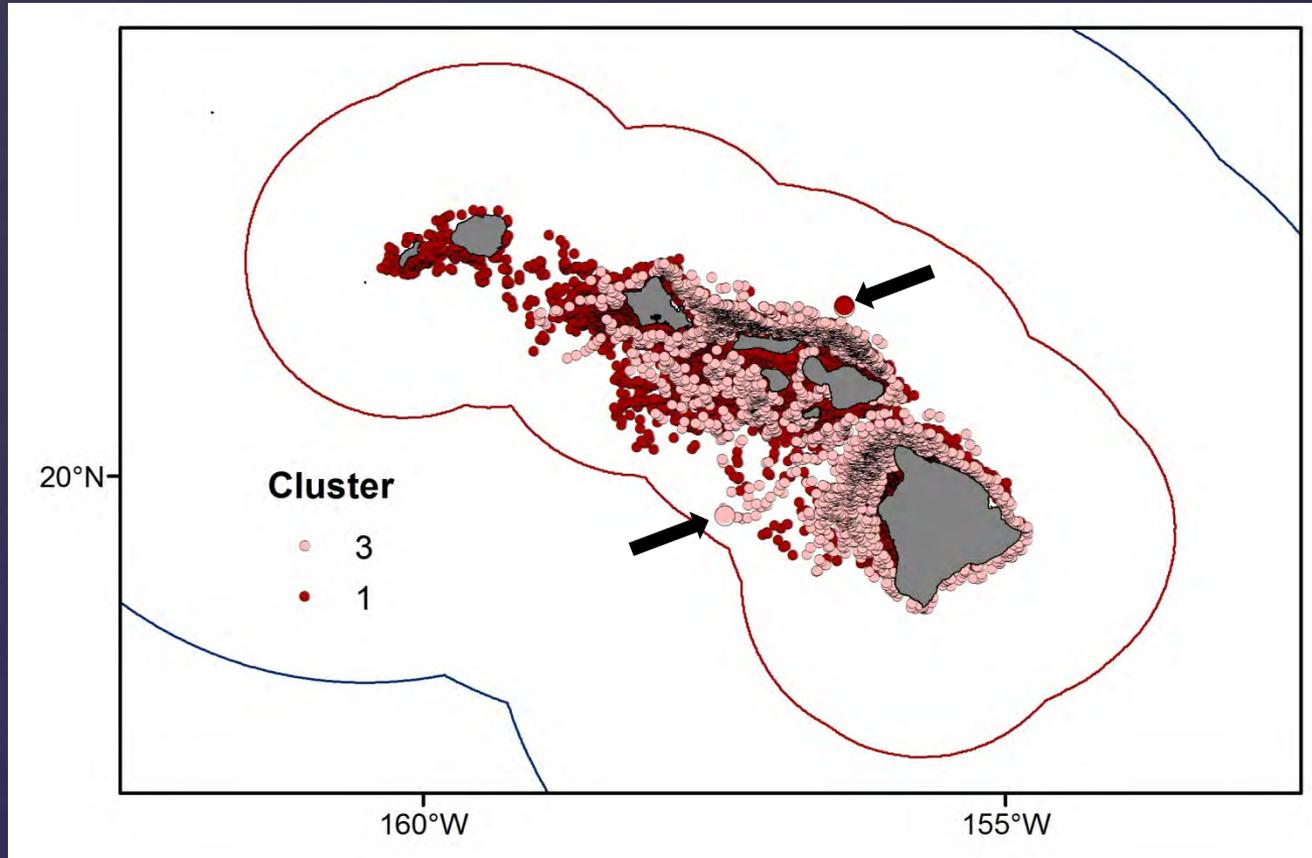
Working Group Formed

- ❖ Objective: Establish scientifically-defensible stock boundaries that appropriately reflect uncertainty
- ❖ Revised boundaries should be robust to routine inputs from ongoing data collection so that frequent revision is not required
- ❖ Working Group convened between April and October 2014
- ❖ Stock boundary options presented to the PSRG via webinar on 27 October 2014
- ❖ Stock boundaries finalized shortly thereafter

MHI Stock



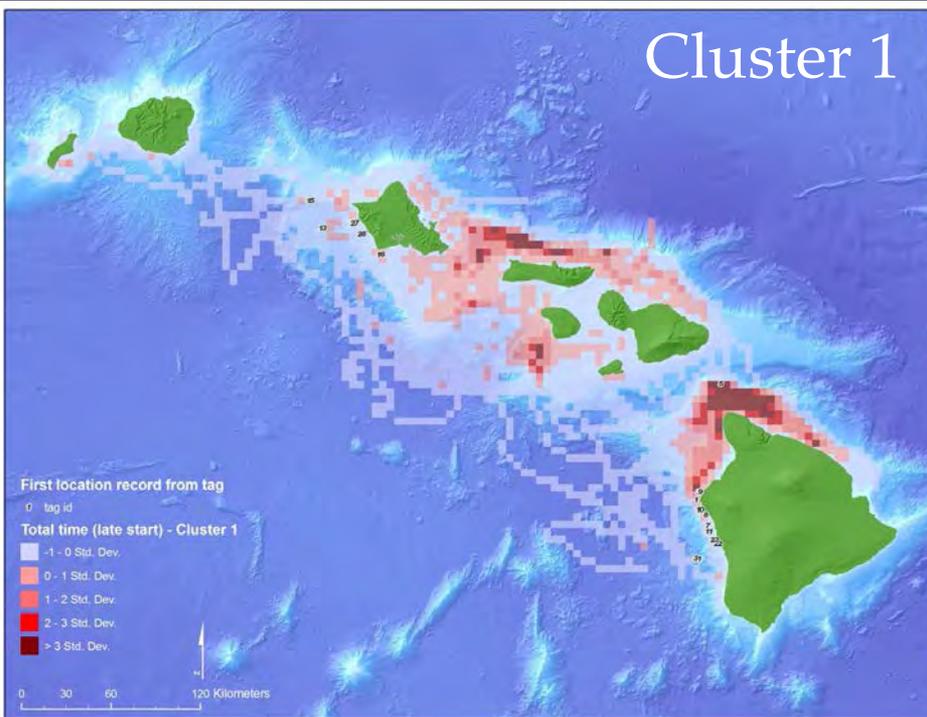
MHI Stock



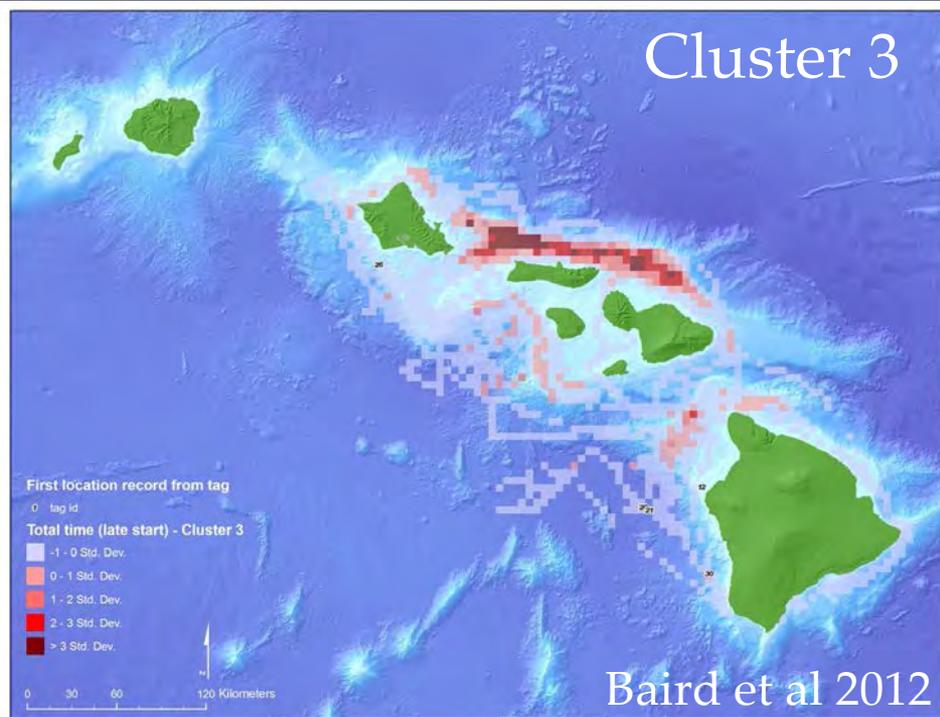
- ❖ Of 31 MHI tagged individuals: Cluster 1 (23), Cluster 3 (8), and Cluster 2 (0)
- ❖ All Cluster 1 and 3 locations within existing boundary
- ❖ Less offshore movement on windward sides
 - ❖ Max distance leeward: 114.9 km, max distance windward: 51.4 km

High-use Areas by Cluster

Cluster 1



Cluster 3

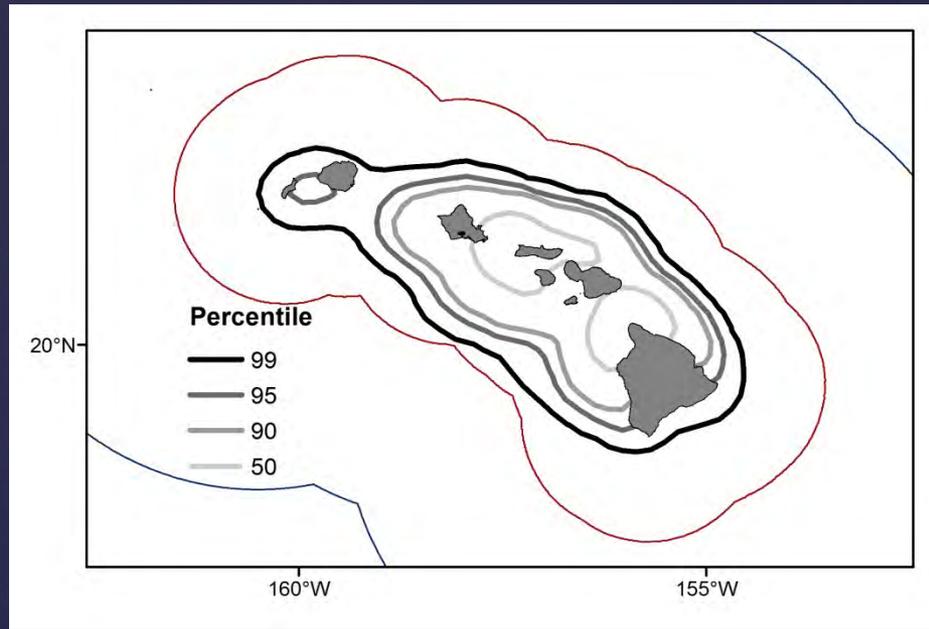
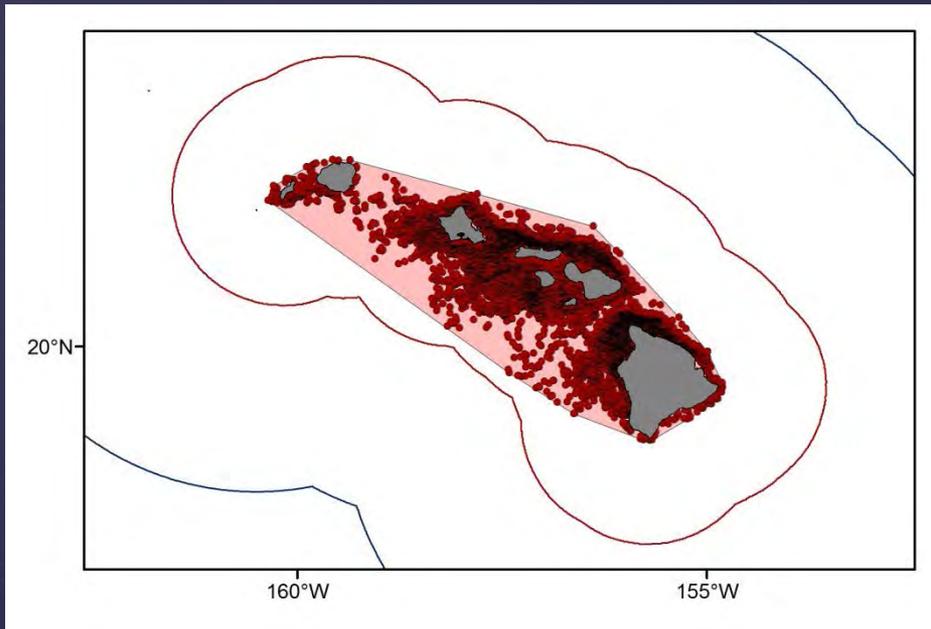


Baird et al 2012

- ❖ Clusters 1 and 3 differ in high use areas
- ❖ Common high use area (“hot spot”) off Northern Molokai and Maui
- ❖ Range and high-use areas of Cluster 2 unknown
- ❖ Sighting data suggest Cluster 2 seen more often than expected off Hawaii, less than expected off Oahu and Maui

Data-defined Boundary?

- ❖ Considered boundaries based on *extent* (minimum convex polygon; MCP) and *density* (kernel density; KD)

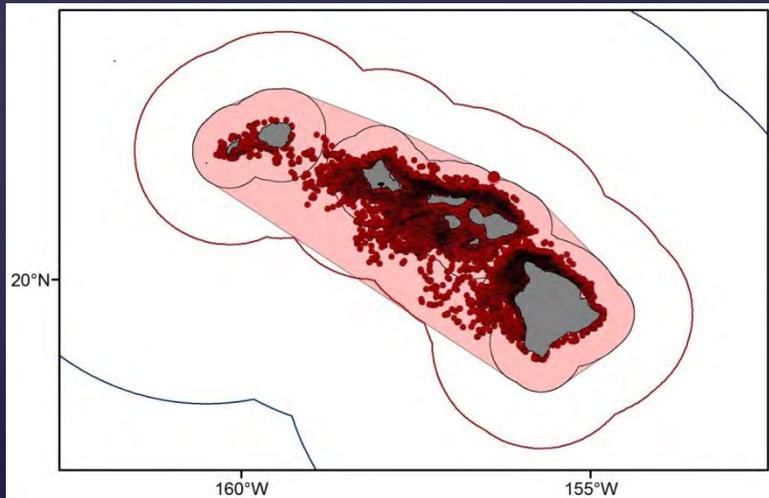


- ❖ MCP too close to shore in some areas
- ❖ KD produced complex shape
- ❖ Limited Cluster 3 data, no Cluster 2 data, and seasonal bias (88.6% of locations from August-January)

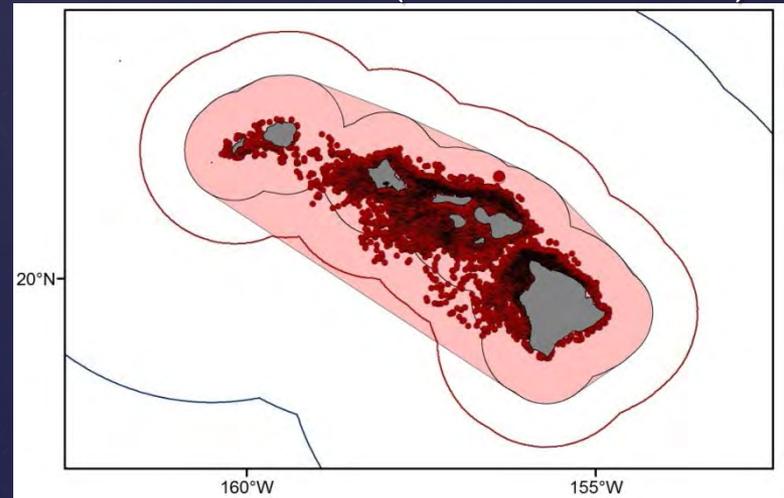
Boundary Criteria and Shape

1. Reflect greater use of leeward area
 2. Appropriately account for FKW “hot spot”
 3. Incorporate uncertainty in spatial use of Clusters 2 and 3 and in seasonality of use by all clusters
- ❖ Bounding a radius around MHI by an MCP, along with a buffer for uncertainty, produces a shape meeting criteria

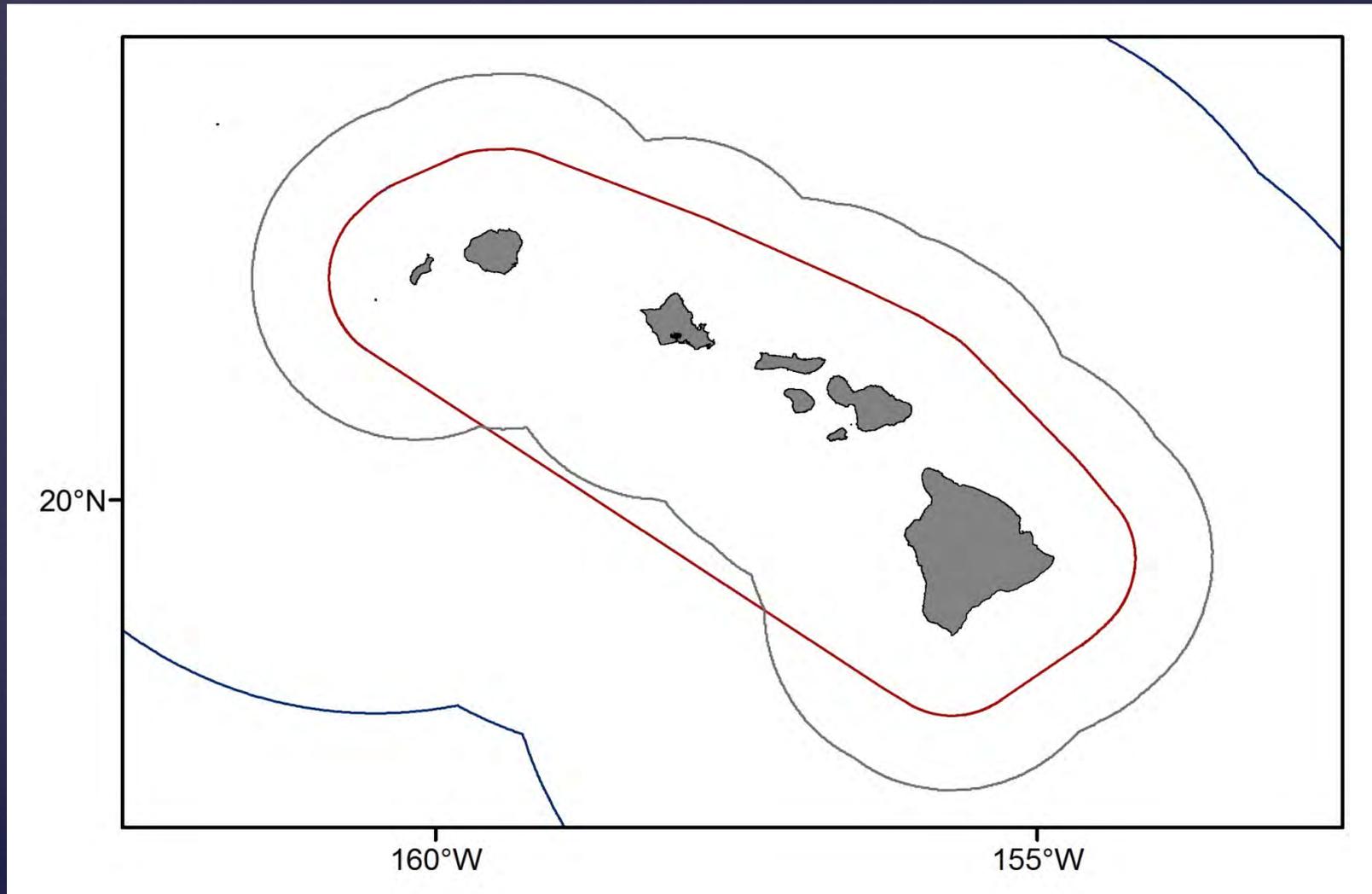
52-km radius



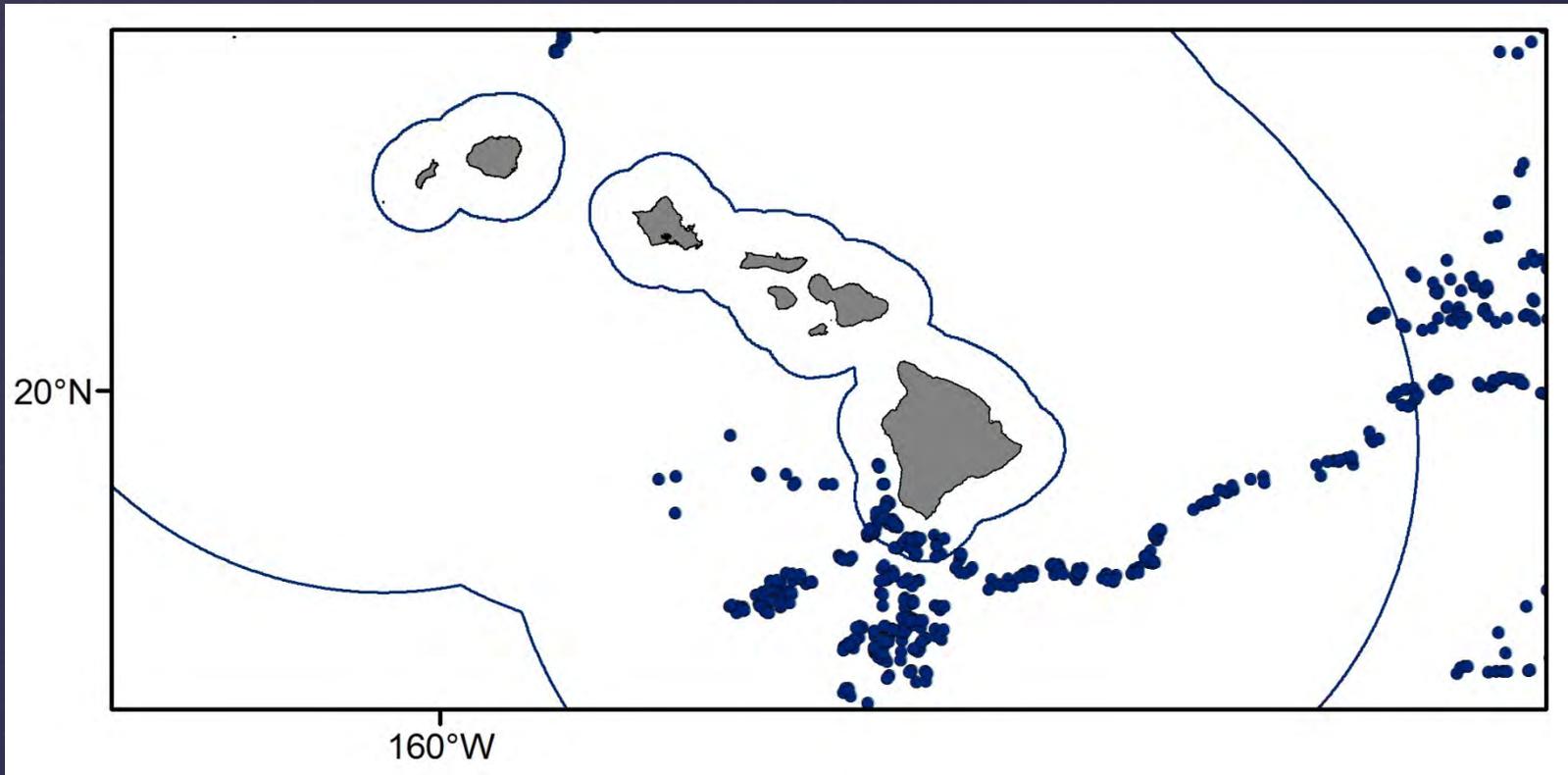
20-km buffer (72-km radius)



Revised MHI Stock Boundary

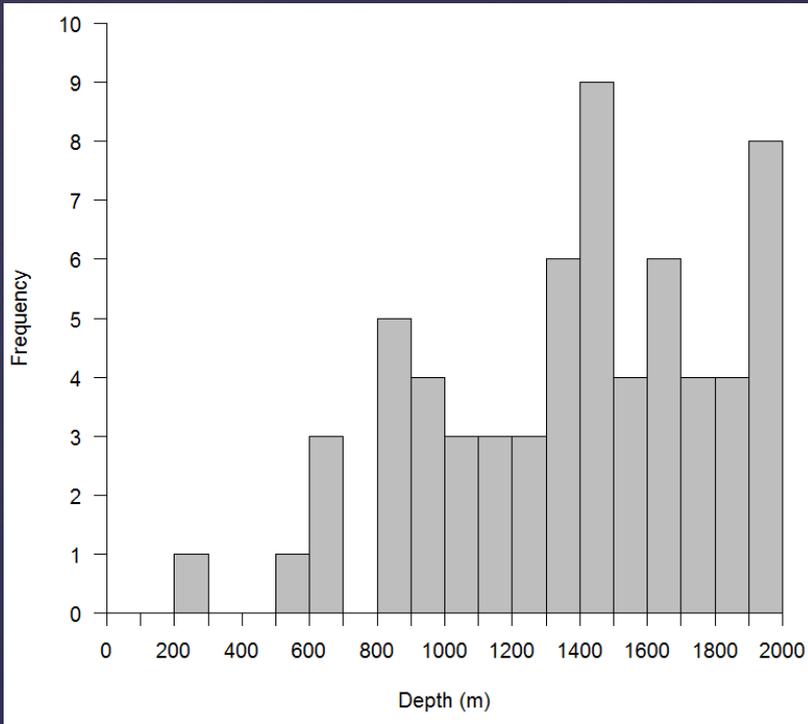


Pelagic Stock

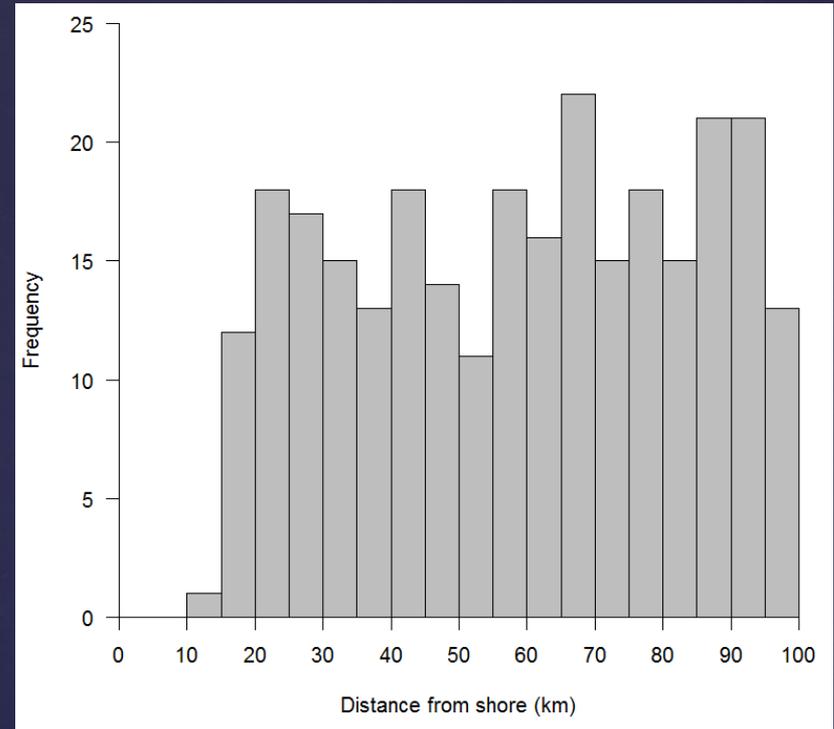


- ❖ Group of pelagic individuals tagged 22.8 km offshore of Hawaii, came within 11.4 km of shore
- ❖ Can occur in shallow waters close to shore
- ❖ Nearshore sightings rates suggest this is infrequent around MHI
- ❖ Main question: should there be an inner pelagic boundary?

Nearshore use of depth and DFS

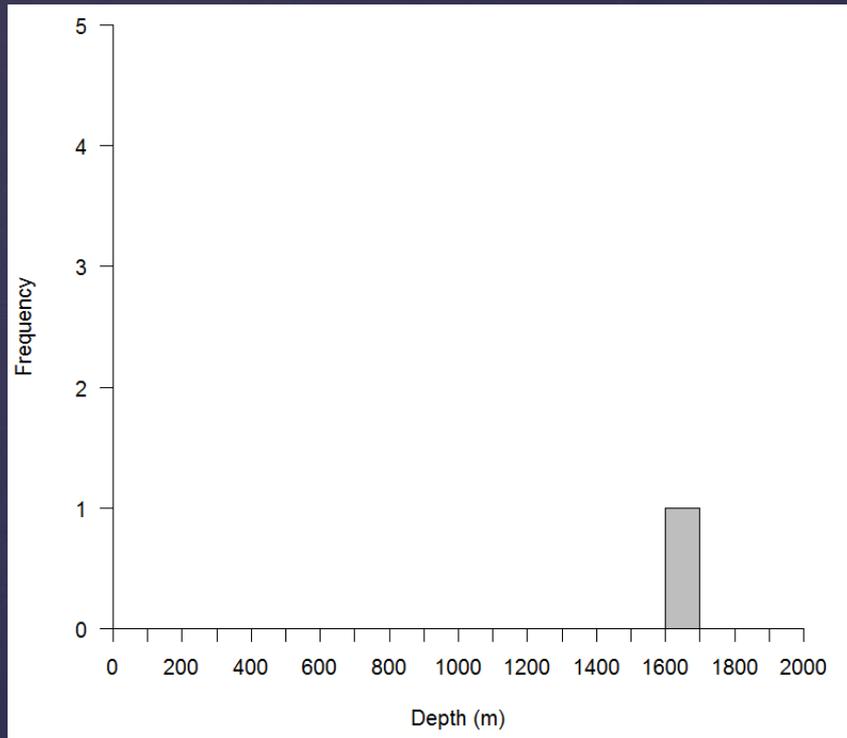


5.7% of locations <2000 m

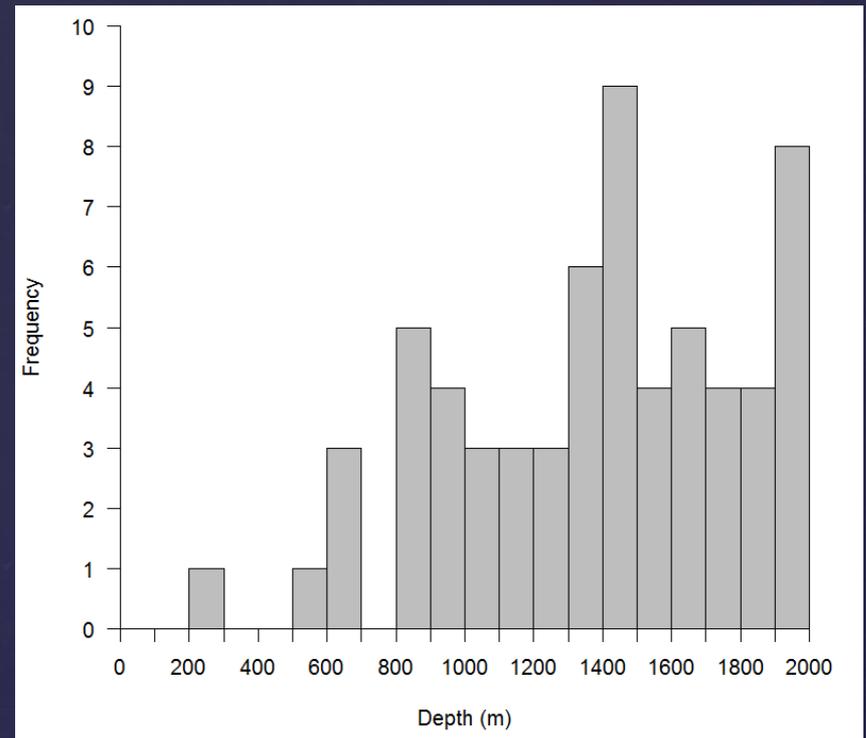


24.2% of locations <100 km

Nearshore Depth Use off Kona and NWHI



0.3% of locations <2000 m

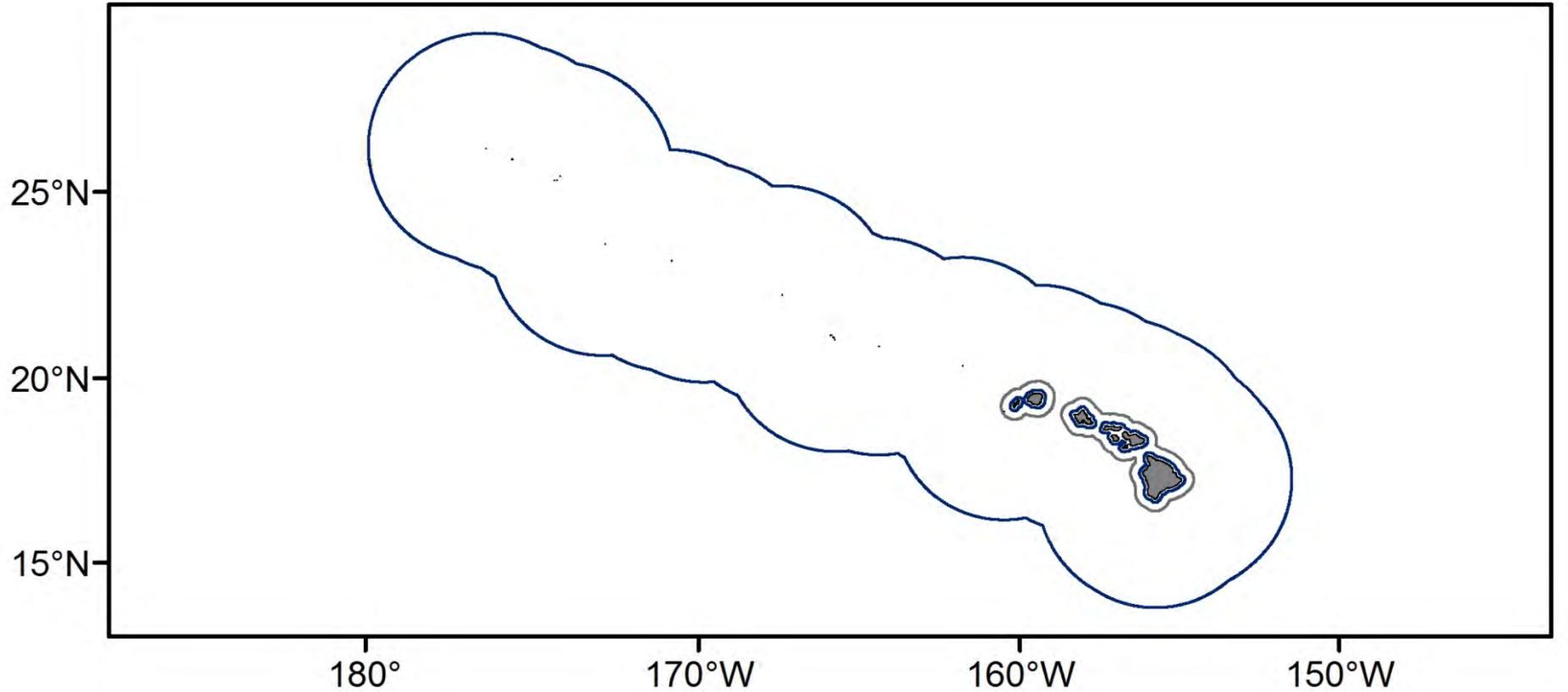


8.2% of locations <2000 m

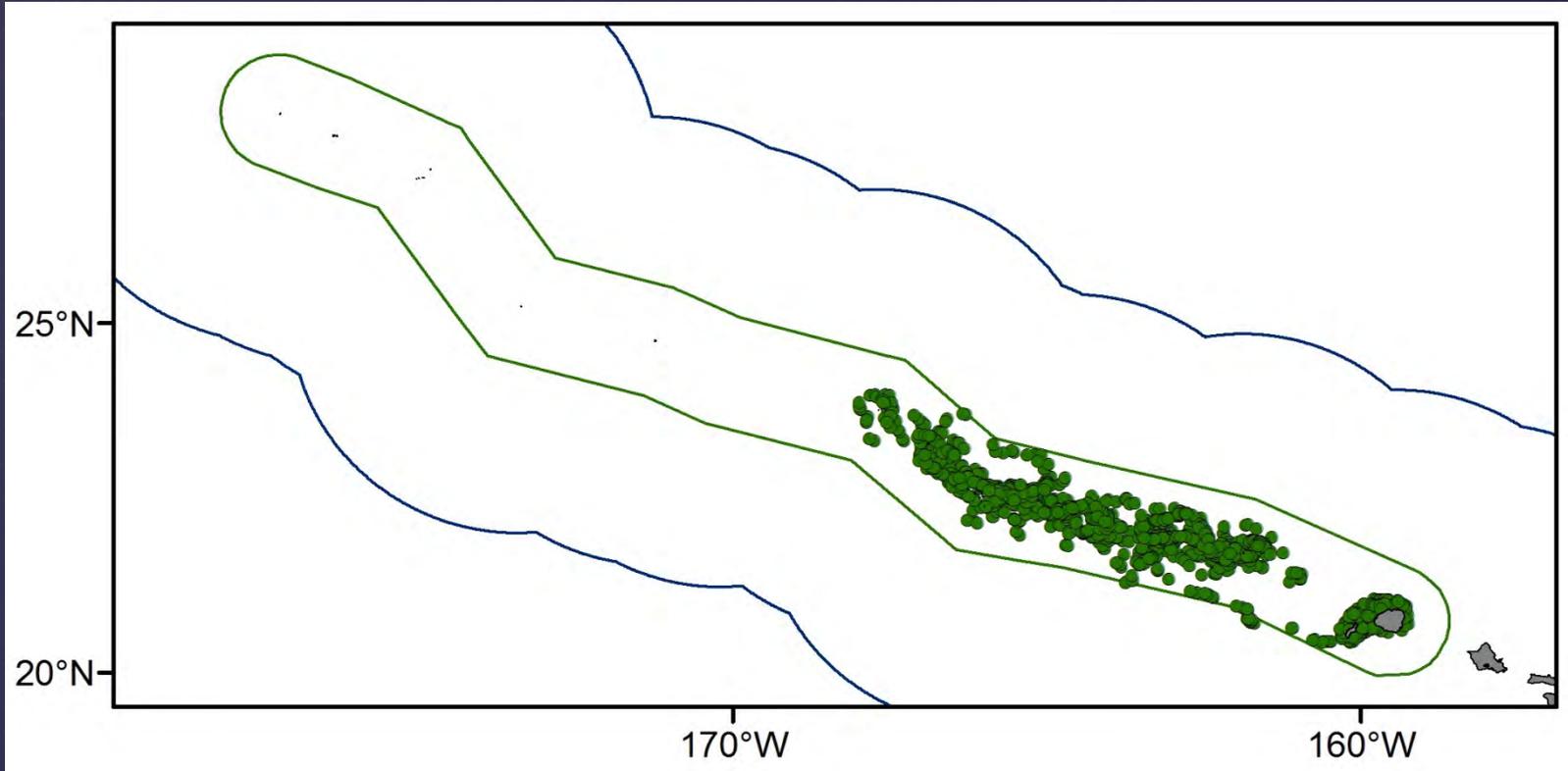
Defining Pelagic Inner Boundary

- ❖ Data do not support inner boundary around NWHI
- ❖ Did not want depth-based inner MHI boundary because of complexity of shape
- ❖ Considered depth-based DFS inner MHI boundary that would include some low probability of occurrence
- ❖ Decided on maximum extent DFS inner boundary (with no buffer) of 11 km from shore

Revised Pelagic Stock Boundary



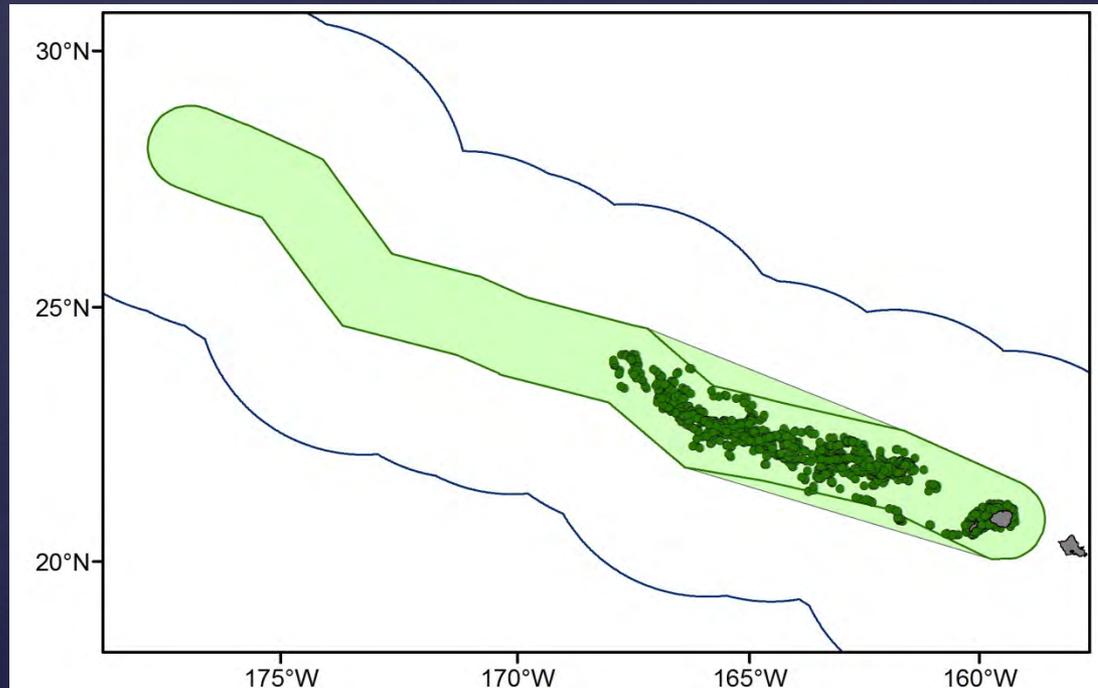
NWHI Stock



- ❖ NWHI stock boundary considerations: radius (width) and eastern and western extents
- ❖ Tag data too sparse to inform a new boundary shape
- ❖ Do indicate stock ranges outside of existing boundary

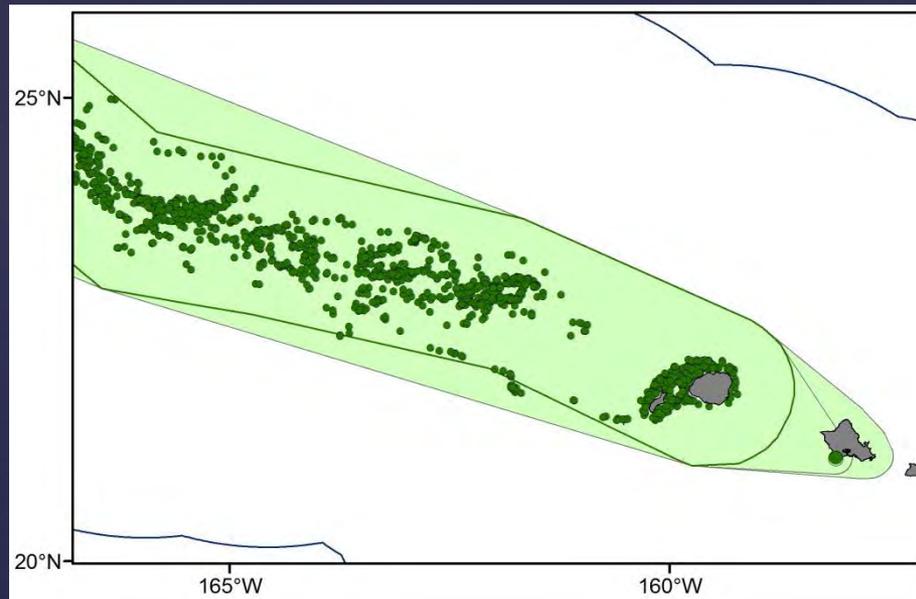
Boundary Width

- ❖ Considered expanding boundary uniformly to most distant location plus a radial buffer for uncertainty
- ❖ Decided against expanding boundary uniformly
- ❖ Removed two vertices from existing boundary to accommodate available locations



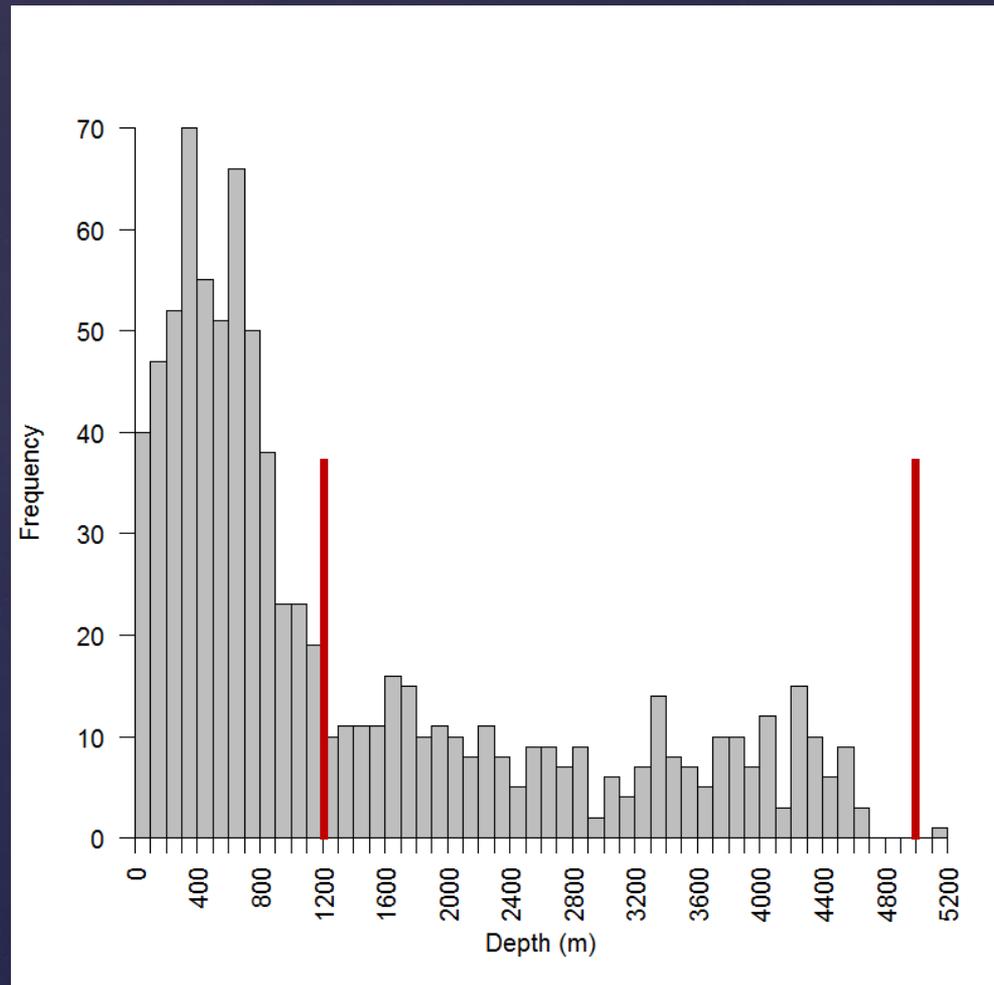
NWHI Eastern Extent

- ❖ Sighting of NWHI FKW made off Barber's Point, Oahu in April 2013
- ❖ Considered options for accounting for this sighting

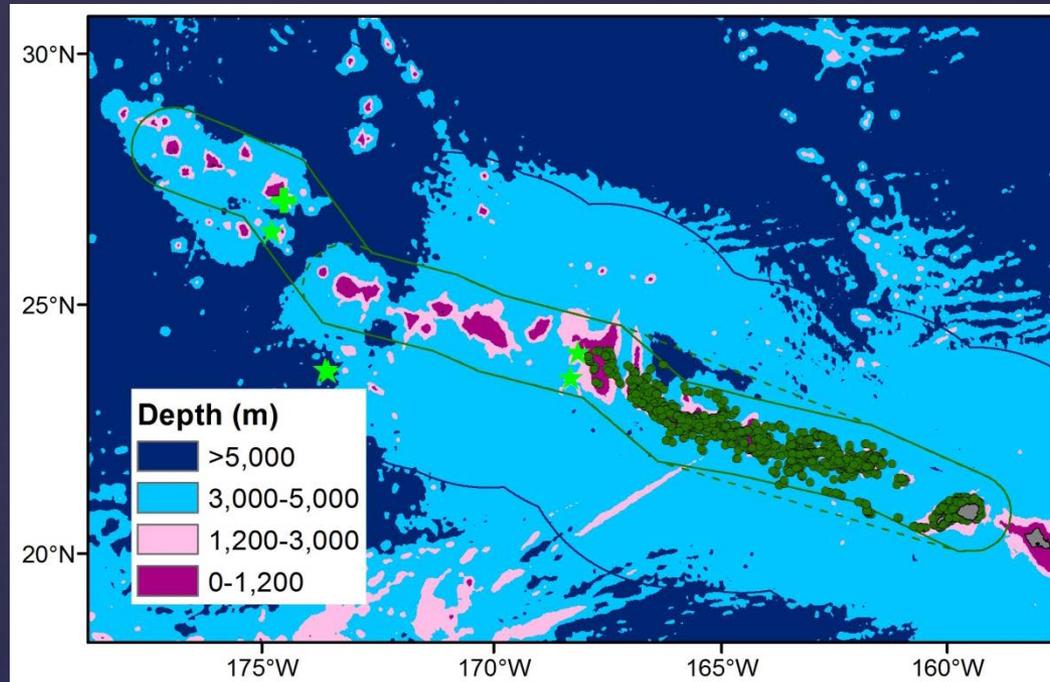


- ❖ Of 67 sightings off SW Oahu, only one of NWHI stock
- ❖ Sighting regarded as a rare event that need not be reflected in stock boundary

Western Extent: Consider Depth

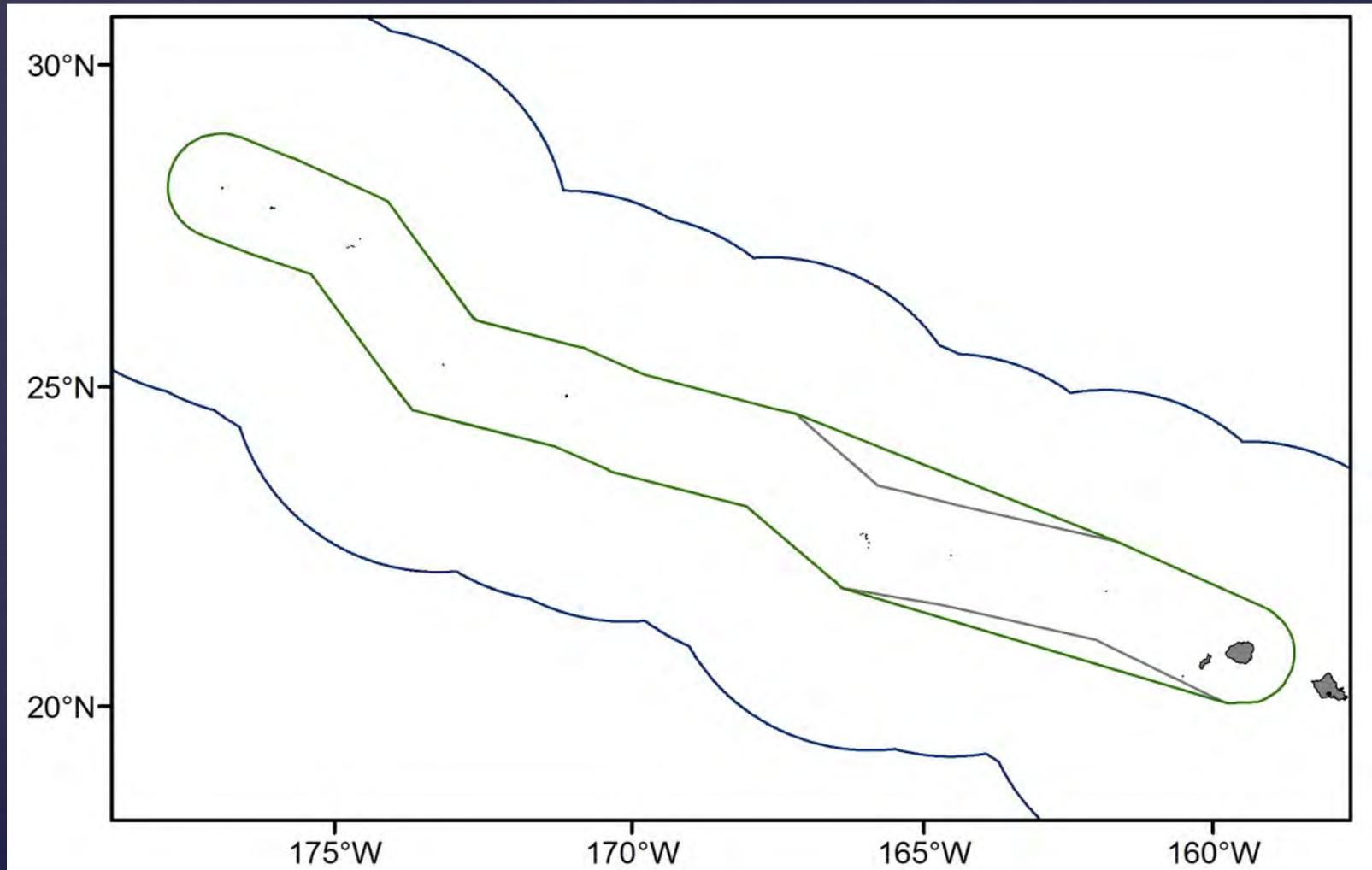


NWHI Western Extent

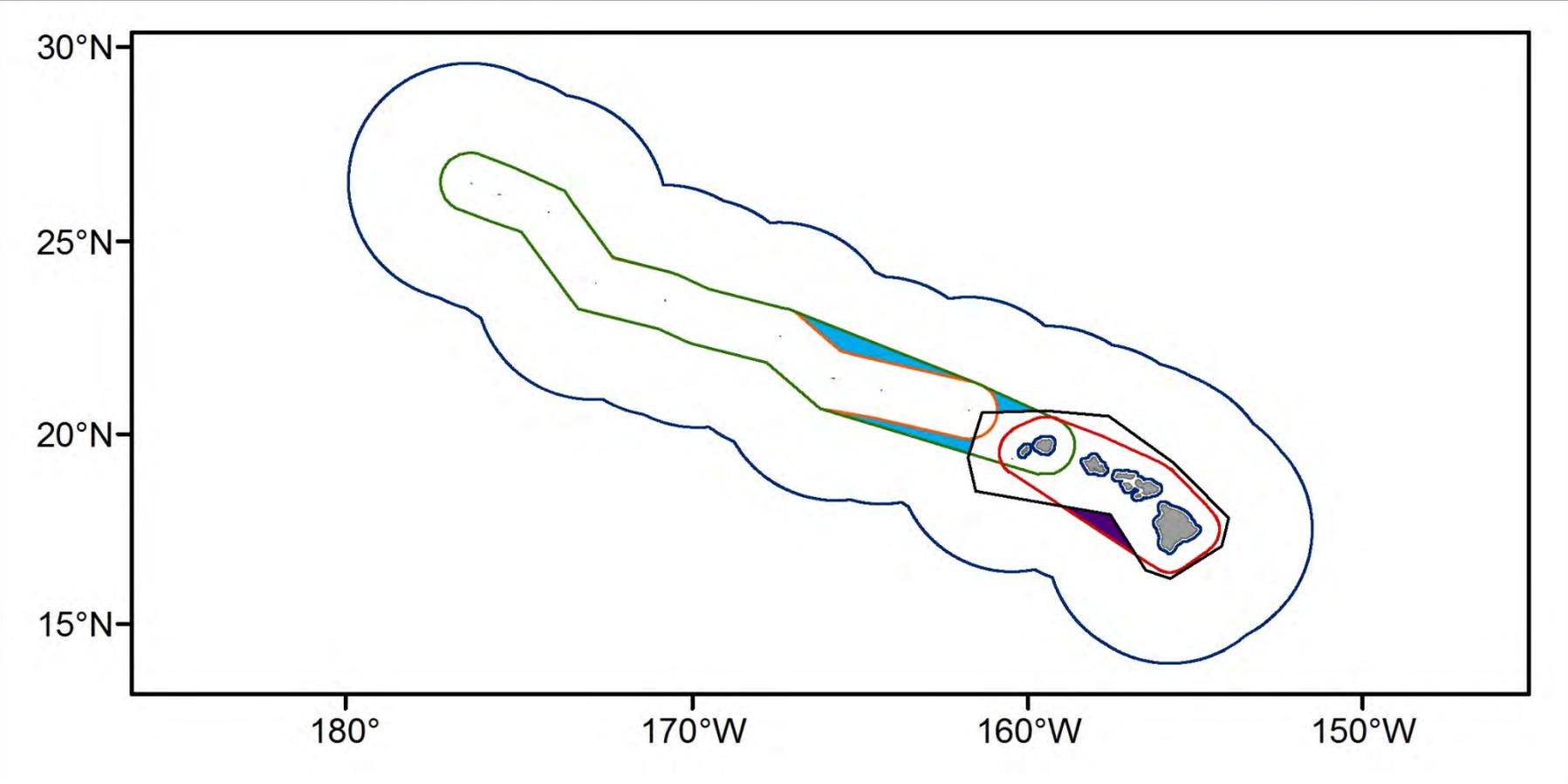


- ❖ Considered truncating western extent to exclude what may be unfavorable habitat
- ❖ Acoustic data may be useful in the future to confirm NWHI FKW presence in western portion
- ❖ Given uncertainty and potential for more information, decided western extent should remain unchanged

Revised NWHI Stock Boundary



Overlap in Longline Fishing Areas



Revised Abundance Estimates

Stock boundaries needed to determine:

1. Distance of survey effort (encounter rate)
2. Area of stock range (abundance)

Stock	N	CV	95% CI
Pelagic	1,540	0.67	470-5,047
NWHI	617	1.11	107-3,554

Navy, NGA, GEBCO

Google earth

Working Group Conclusions

- ❖ Stock boundaries not empirically derived, but were determined using best available scientific information
- ❖ Given existing uncertainty, boundaries robust to modest addition of new data
- ❖ Future collection of substantial data will likely require further boundary revisions (NWHI) or could allow data-derived boundaries (MHI)
- ❖ Revised boundaries reflect full range of stock and are associated with average density estimate
 - ❖ Appropriate in the context of HI-based longline fisheries
 - ❖ Data too limited to pursue probabilistic occurrence and density