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Fishery interactions for three populations of false killer whales in Hawai‘i: assessment using dorsal fin line injuries

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False Killer Whale Dorsal Fin Disfigurements as a Possible Indicator of Long-Line Fishery Interactions in Hawaiian Waters[1]

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Abstract: Scarring resulting from entanglement in fishing gear can be used to examine cetacean fishery interactions. False killer whales (*Pseudorca crassidens*) are known to interact with the Hawai'i-based tuna and swordfish long-line fishery in offshore Hawaiian waters. We examined the rate of major dorsal fin disfigurements of false killer whales from nearshore waters around the main Hawaiian Islands to assess the likelihood that individuals around the main islands are part of the same population that interacts with the fishery. False killer whales were encountered on 11 occasions between 2000 and 2004, and 80 distinctive individuals were photographically documented. Three of these (3.75%) had major dorsal fin disfigurements (two with the fins completely bent over and one missing the fin). Information from other research suggests that the rate of such disfigurements for our study population may be more than four times greater than for other odontocete populations. We suggest that the most likely cause of such disfigurements is interactions with longlines and that false killer whales found in nearshore waters around the main Hawaiian Islands are part of the same population that interacts with the fishery. Two of the animals documented with disfigurements had infants in close attendance and were thought to be adult females. This implies that even with such injuries, at least some females may be able to produce offspring, despite the importance of the dorsal fin in reproductive thermoregulation.

Incidental mortality in fisheries is probably the greatest conservation concern for cetaceans worldwide (Read et al. 2003). Identifying fishery interactions can be done in a variety of ways: (1) using observers on fishing vessels (e.g., Jefferson et al. 1994); (2) examination of wounds, scars, or entangled gear on beach-cast animals (e.g., Friedlaender et al. 2001); (3) observations of animals in the wild with entangled fishing gear (e.g., Knowlton and Kraus 2001); or (4) questionnaire surveys of fishermen (e.g., Baird et al. 2002). Each of these methods has advantages and disadvantages: (1) observer programs provide the most comprehensive and quantitative data but are expensive, particularly when fishing fleets are large; (2) only a small proportion of dead animals ever wash up on a beach, and beach-cast animals are easily damaged by scavengers, obscuring marks; (3) observations of animals in the wild with entangled fishing gear are opportunistic and likely reflect only a small proportion of animals entangled, even for large and easily observed species; and 4) questionnaire surveys often suffer from a strategic response bias, with fishermen unlikely to provide information that could result in negative management actions. Rates and patterns of entanglement-related scarring visible in photographs of animals in the wild have also been used to assess the frequency of non-

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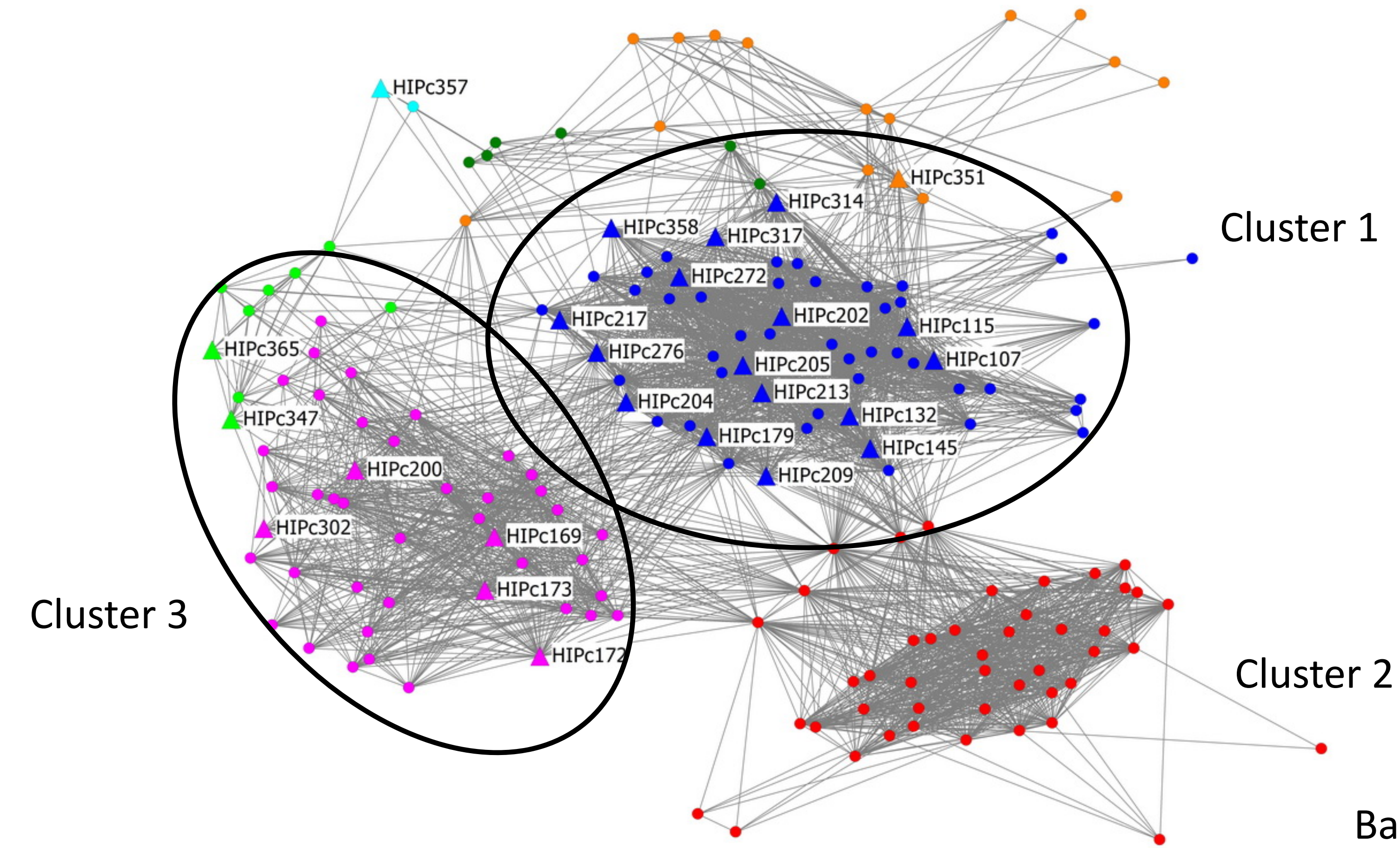
Figure 1. (*Top*) False killer whale (catalog no. HIPc177) with missing dorsal fin. (*Middle*) False killer whale (catalog no. HIPc166) with dorsal fin bent over to right with injury at base of leading edge of fin. (*Bottom*) False killer whale (catalog no. HIPc186) with dorsal fin bent over to left with injury at base of leading edge of fin.

FIGURE 2. Hooked false killer whale from the Hawai'i long-line fishery, showing linear mark along side of body apparently as a result of long-line abrasion. Examination of a high-resolution scan of the original photo shows that the mark is not equally dark along the irregular surface of the body, and it clearly extends into the shadowed area of the back, indicating that the mark is not a shadow from the longline. Photo by Eric Forney, courtesy NOAA Fisheries, Pacific Islands Region.

What have we learned since 2005?

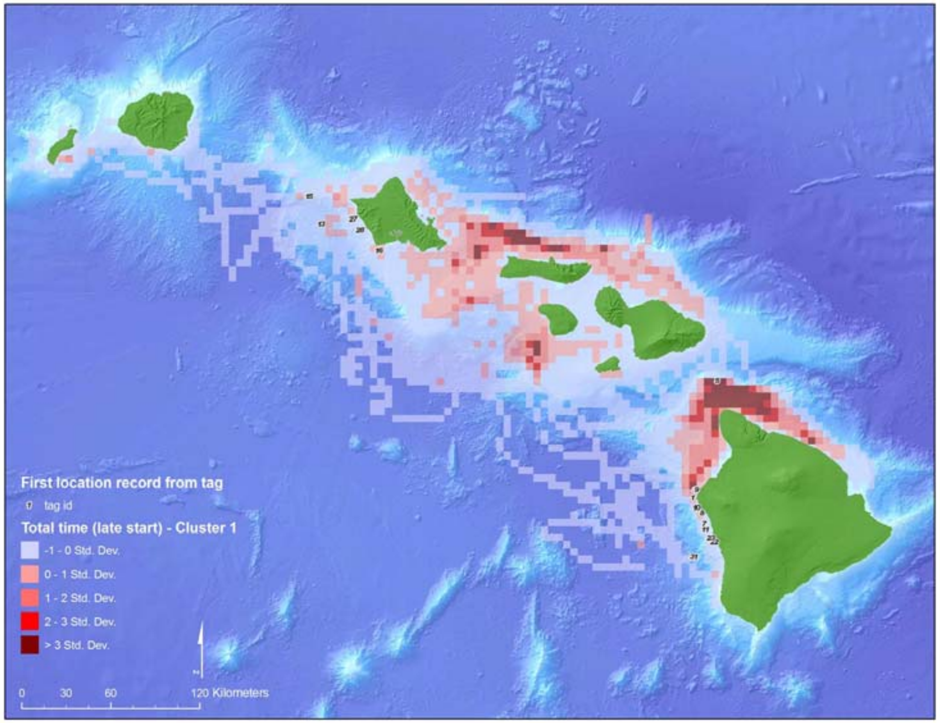
- genetically differentiated pelagic, MHI, and NWHI insular populations (Chivers et al. 2007, 2010, Martien et al. submitted)
- the MHI insular population is divided into at least three distinct social groupings (Clusters 1, 2 and 3)



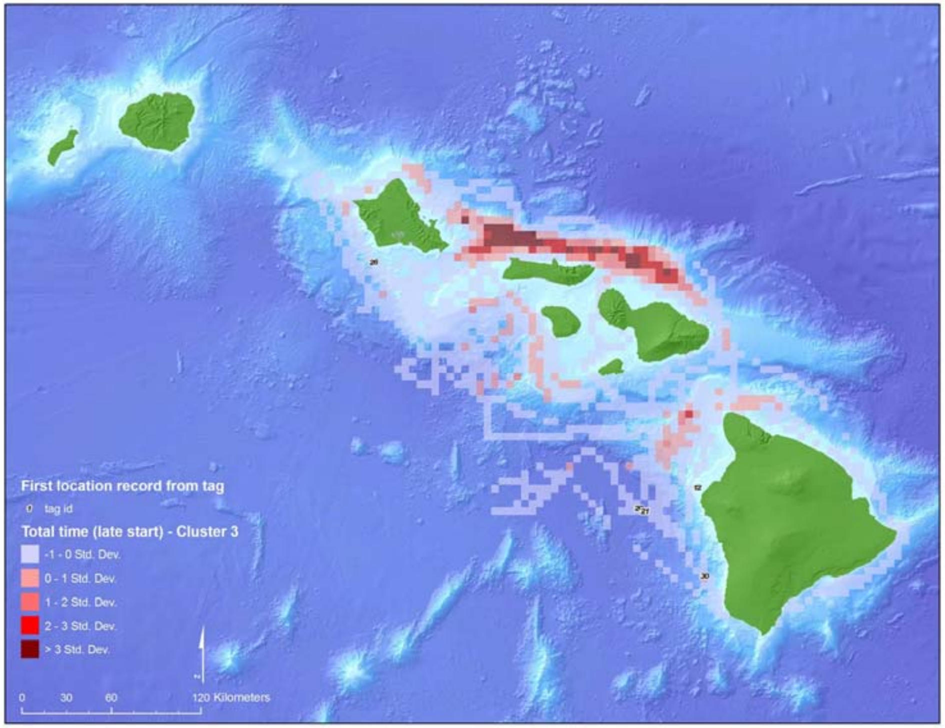
Baird et al. 2012

What have we learned since 2005?

- high use areas of Cluster 1 and 3 have been identified and differ somewhat – nothing known about Cluster 2 distribution



Cluster 1

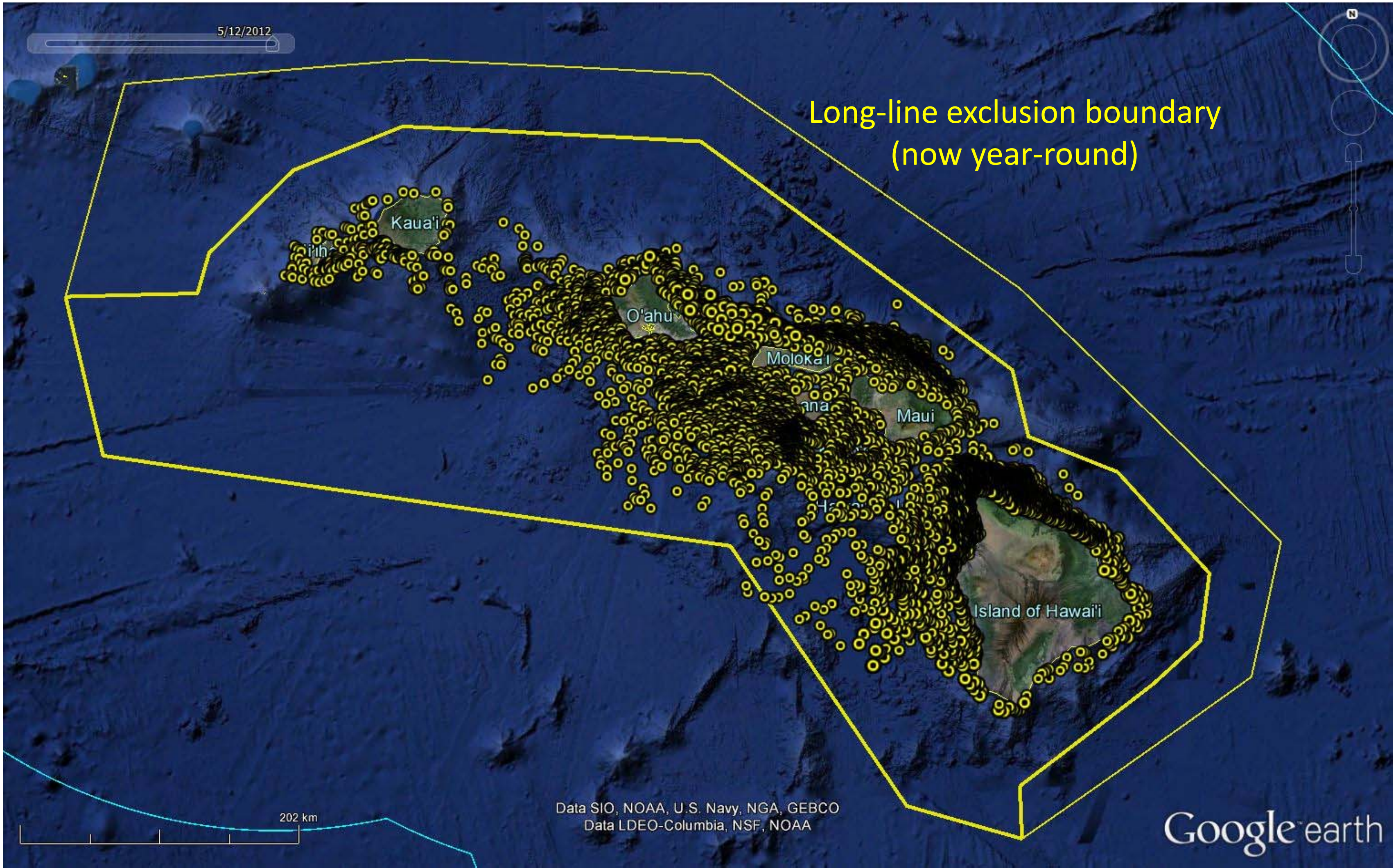


Cluster 3

Baird et al. 2012

What have we learned since 2005?

• range of MHI insular population (at least cluster 1 and 3) extends to ~122 km offshore, so limited overlap with longline fishery



What have we learned since 2005?

- Bycatch of pelagic population above Potential Biological Removal (PBR) level, inside U.S. EEZ

- MHI insular population declined between 1980s and 2000s, and was listed as Endangered in 2012 (Reeves et al. 2009, Baird 2009, Oleson et al. 2010)

- Risk-factors identified for MHI insular population include interactions with a variety of near-shore fisheries

Stranding of false killer whale*, South Point
October 6, 2013

HIPc162
MHI insular
Cluster 3
Seen 2003, 2004, 2007, 2009, 2011

*Kristi West, HPU

Line injuries on the dorsal fin as an indicator of fishery interactions

Data Sources

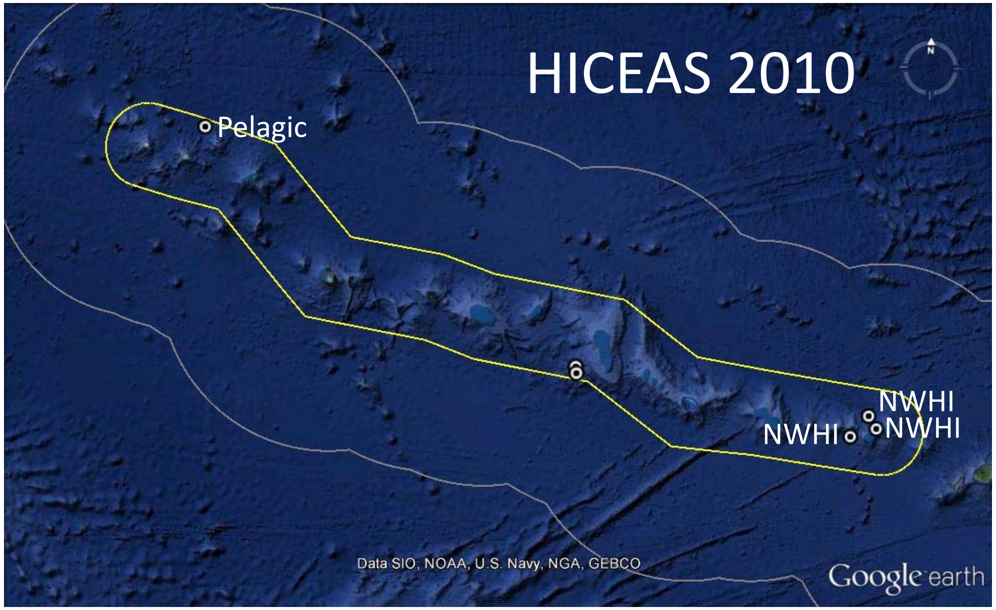
PIFSC/SWFSC

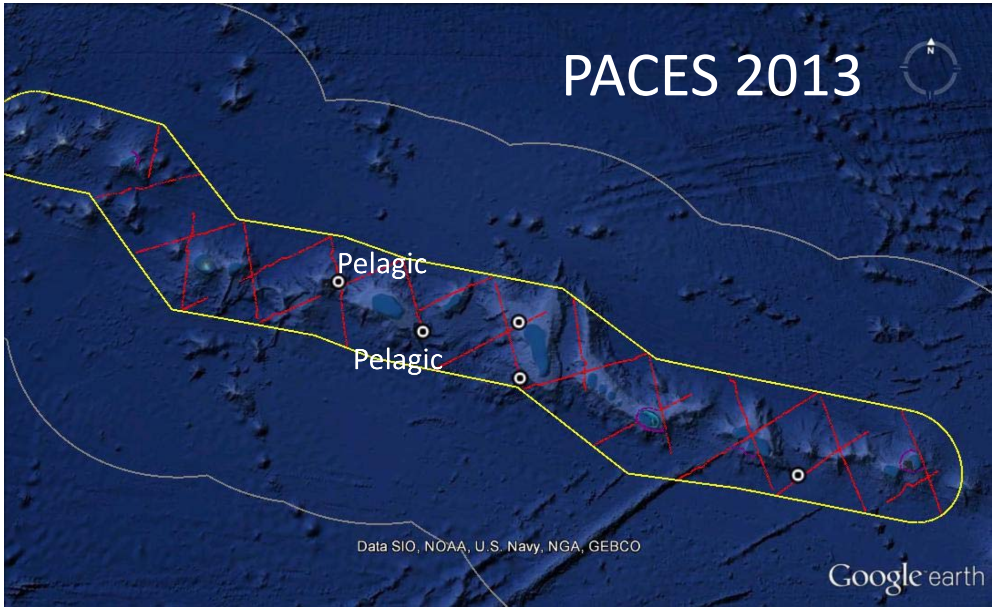
- HICEAS – 2010
- PACES – 2013

encounters with photos and biopsies to confirm population identity, both pelagic and NWHI populations

CRC/WDF/WWRF

encounters with photos and biopsies to confirm population identity, pelagic, NWHI, and MHI insular populations





Catalog sizes*

Pelagic – 73 individuals (2005-2013)

NWHI insular – 63 individuals (2006-2013)

MHI insular – 148** individuals (2006-2013)

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*Distinctive and very distinctive individuals only, excluding re-sightings
**Since over 8-year span likely includes individuals born since 2006 and those that died before 2013

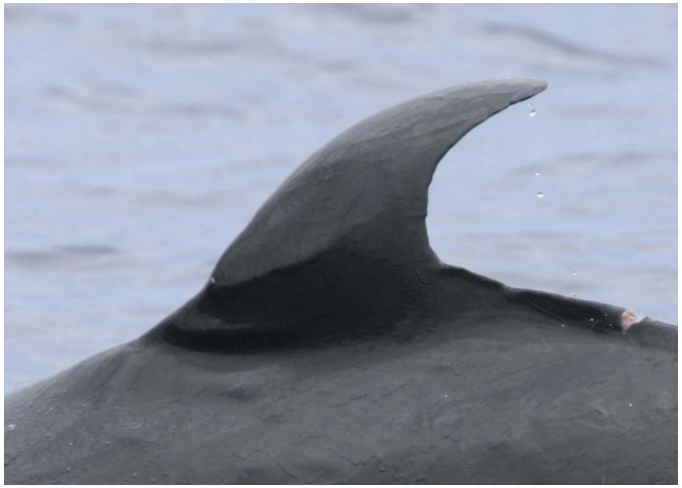
Scoring of dorsal fin injuries for consistency with fisheries interactions

Choosing all photos from each catalog of animals with possible line-related injuries visible in a typical photo

Independent scoring by six* individuals as:
3 – consistent
2 – possibly consistent
1 – not consistent

Using average of scores for each whale

***Robin Baird, Amanda Bradford, Annie Gorgone, Ed Lyman, Erin Oleson, Sabre Mahaffy**

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Individuals chosen for scoring

Pelagic – 4 of 73 individuals (5.5%)

NWHI insular – 2 of 63 individuals (3.2%)

MHI insular – 13 of 148 individuals (8.8%)

False killer whale fisheries interaction scoring

19 individual whales
Minimum scores (all 19) range = 1-3
Maximum scores (all 19) = 3
Grand Mean score = 2.56

By population (grand mean, range)
- **Pelagic = 2.25 (range of means 2.17 – 2.5)**
- **NWHI = 2.17 (range of means 2.17 - 2.17)**
- **MHI = 2.72 (range of means 2.33 - 3.0)**

3 – consistent
2 – possibly consistent
1 – not consistent

False killer whale fisheries interaction scoring

Chose 2.5 as cutoff (at least 3 out of 6 "consistent" and 3 "possibly consistent")

By population ≥ 2.5

- **Pelagic = 1 of 73 (1.4%)**
- **NWHI = 0 of 63 (0%)**
- **MHI = 12 of 148 (8.1%)**

3 – consistent
2 – possibly consistent
1 – not consistent

HIPc316

3 – consistent
2 – possibly consistent
1 – not consistent

Mean score = 3.0 consistent with fishery interaction

Factors influencing scores:

- availability of left- and right-side photos
- photo quality

3 – consistent
2 – possibly consistent
1 – not consistent

Scores ≥ 2.5 by MHI social cluster

Cluster 1 – 2 of 66 individuals (3.0%)

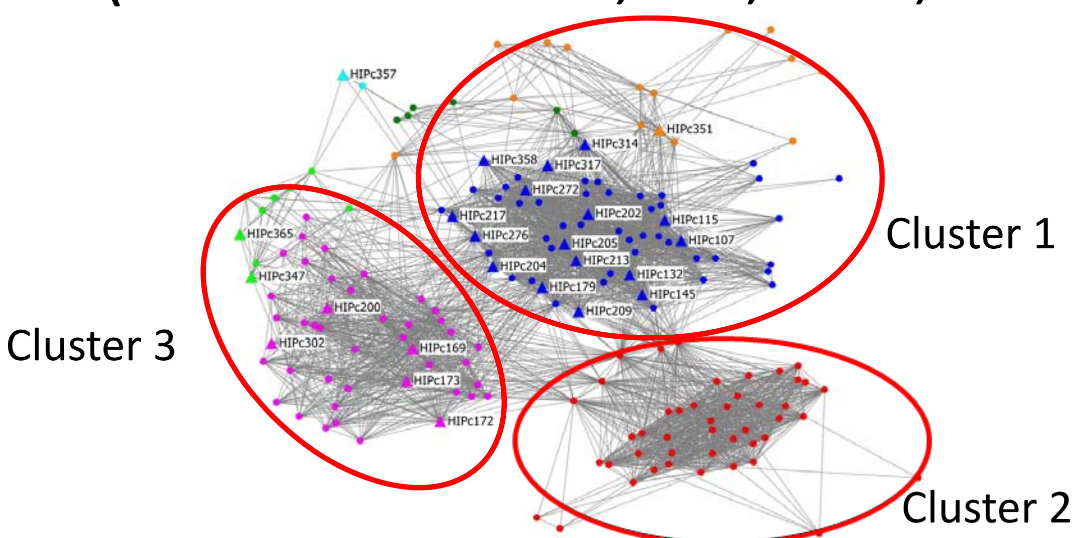
(mean scores 2.67, 3)

Cluster 2 – 3 of 41 individuals (7.3%)

(mean scores 2.67, 2.67, 2.83)

Cluster 3 – 7 of 41 individuals (17.1%)

(mean scores 2.5, 2.5, 2.67, 2.83, 2.83, 2.83, 3.0)



3 – consistent
2 – possibly consistent
1 – not consistent

What does this mean?

- Higher proportion of individuals with injuries consistent with fisheries interactions (FI) for MHI suggests either FIs may be occurring more often (per individual) than for pelagic or NWHI individuals, or when interactions occur, there is higher likelihood of mortality for pelagic animals

- Higher proportion of FI line injuries for Cluster 3 (17.1%) and Cluster 2 (7.3%) individuals suggest FIs may be occurring disproportionately in those social groups

Table 3. Model averaged estimates of false killer whale annual survival by social cluster, using data from 1998 through 2012.

Cluster	Estimate	SE	CV
1	0.973	0.01	0.01
2	0.965	0.015	0.016
3	0.951	0.023	0.024

Baird et al. 2013. Preliminary survival and abundance estimates for main Hawaiian Island insular false killer whales based on mark-recapture analyses of individual photo-identification data. PSRG-2013-14 .

What next?

- Assessment of mouthline or other body injuries that may be indicative of fisheries interactions
- Examination of overlap of MHI insular individuals with State fisheries

Implications for management*

- Expansion of membership and scope of Take Reduction Team and Take Reduction Plan
- Recovery planning for MHI insular population should take into account differences in fisheries interactions by social cluster
- Monitoring of population trends should take into account social groupings

*Views expressed not necessarily representative of NMFS or NMFS co-authors