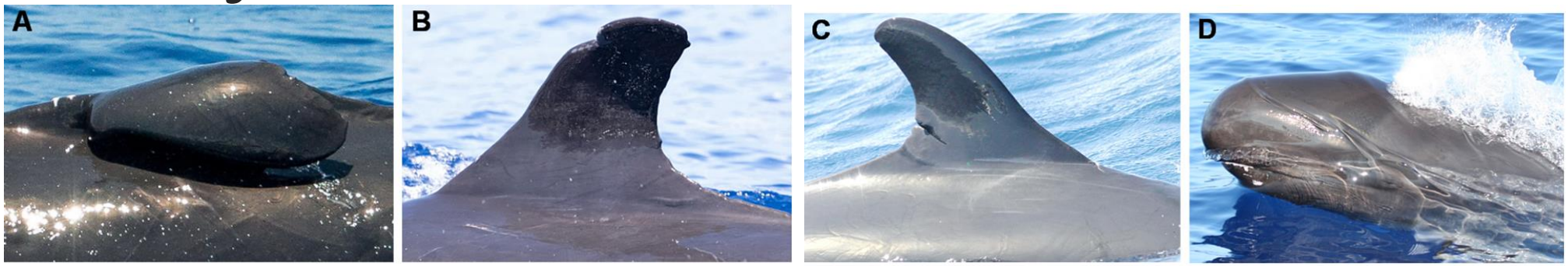
Hawaiian False Killer Whale Mouthline & Dorsal Fin Injuries from Fisheries Interactions



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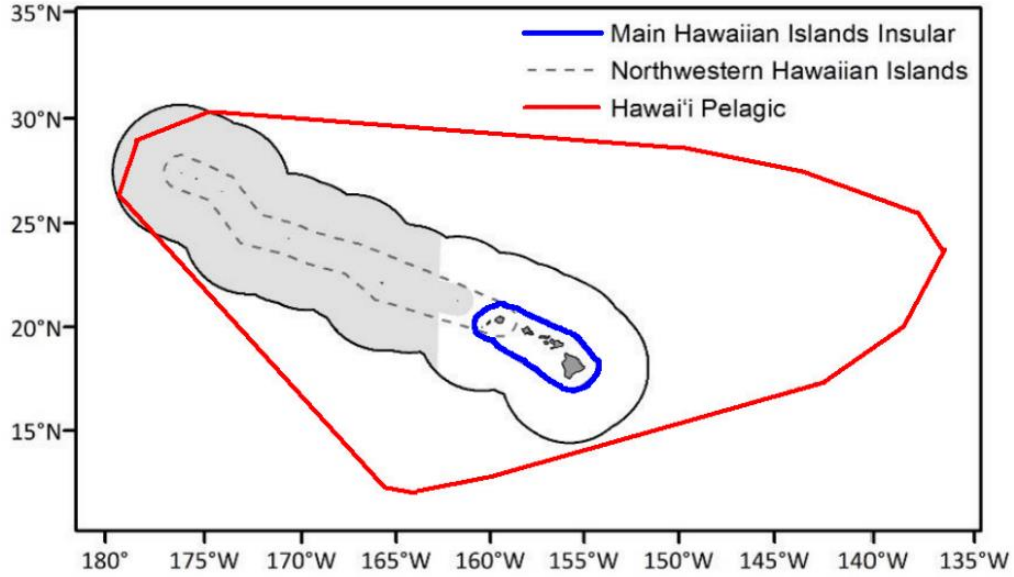
Hawaiian false killer whales (*Pseudorca crassidens*)

- Long-lived and slow-to-reproduce, with strong social bonds between individuals
- Three stocks in Hawai‘i: Hawai‘i Pelagic, Northwestern Hawaiian Islands (NWHI), & Main Hawaiian Islands (MHI) Insular
- Diet includes pelagic and reef-associated game fish
- Insular Hawaiian false killer whales are the most well-characterized population in the world



Overlap with fisheries varies by stock

Main Hawaiian Islands (MHI) Insular

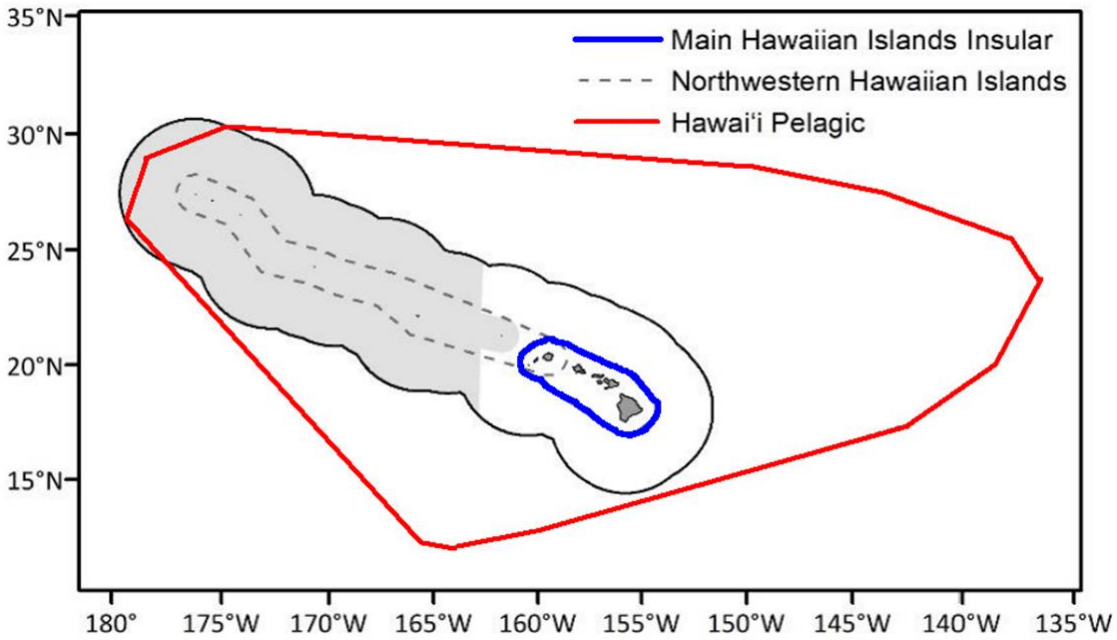
- Endangered (listed in 2012), and ongoing evidence that population is in decline
- High overlap (mostly nearshore, some limited overlap with U.S. longline)
- No observer coverage for nearshore fisheries, 13.5% in U.S. deep-set longline currently

Hawai‘i Pelagic

- Strategic stock under the MMPA, and primary focus of the false killer whale TRT
- High overlap (nearshore, U.S. longline, and foreign)
- 100% observer coverage in U.S. shallow-set longline, 13.5% in U.S. deep-set longline, and none for nearshore fisheries

Northwestern Hawaiian Islands (NWHI)

- Population trend unknown
- No fisheries overlap in most of range

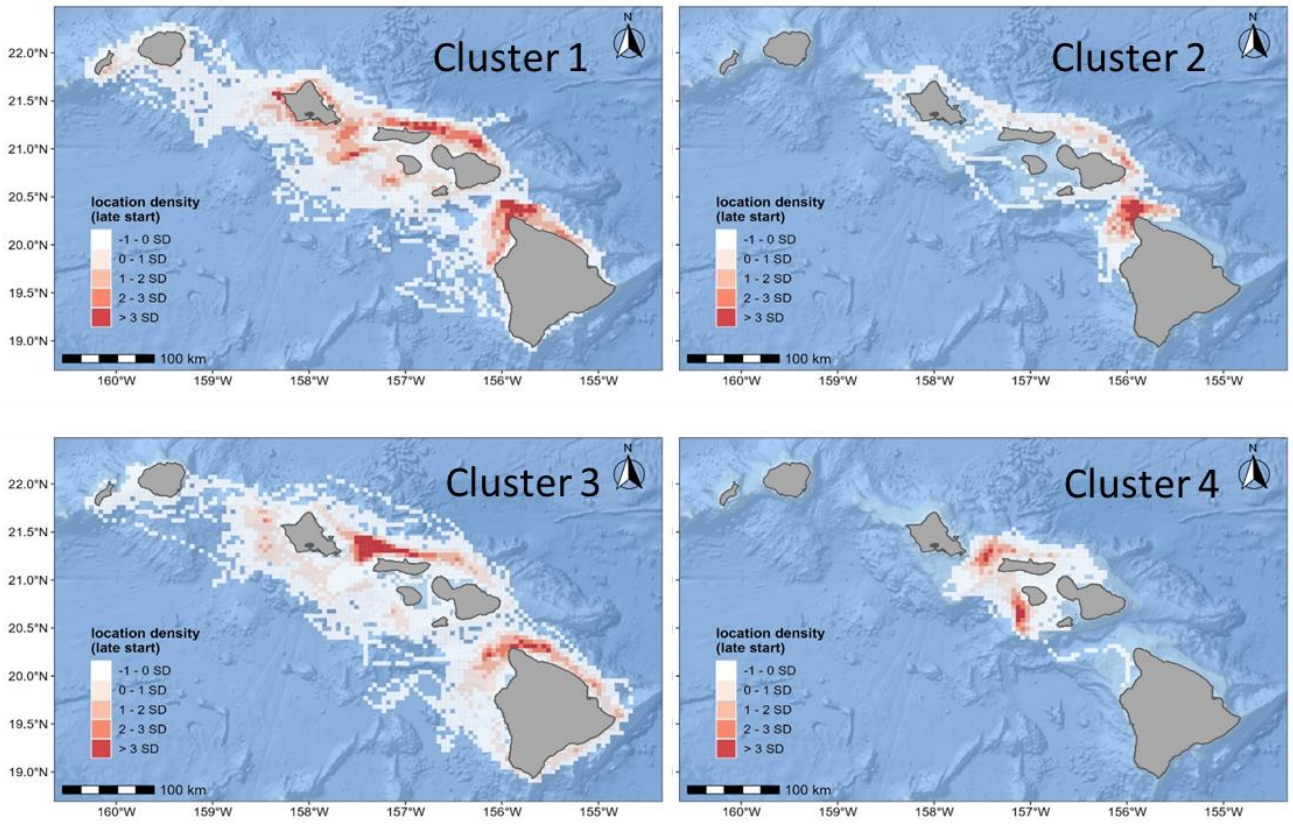


Fisheries interactions in Hawai‘i

- Fisheries interaction: depredation, hooking, or entanglement
- Documented among many protected species
- Previous work shows high rate of injuries for false killer whales, especially for MHI stock
- Deep-set longline fishery most implicated in FKW interactions based on observer data (235.5 estimated takes from 2017-2021 both inside and outside EEZ)

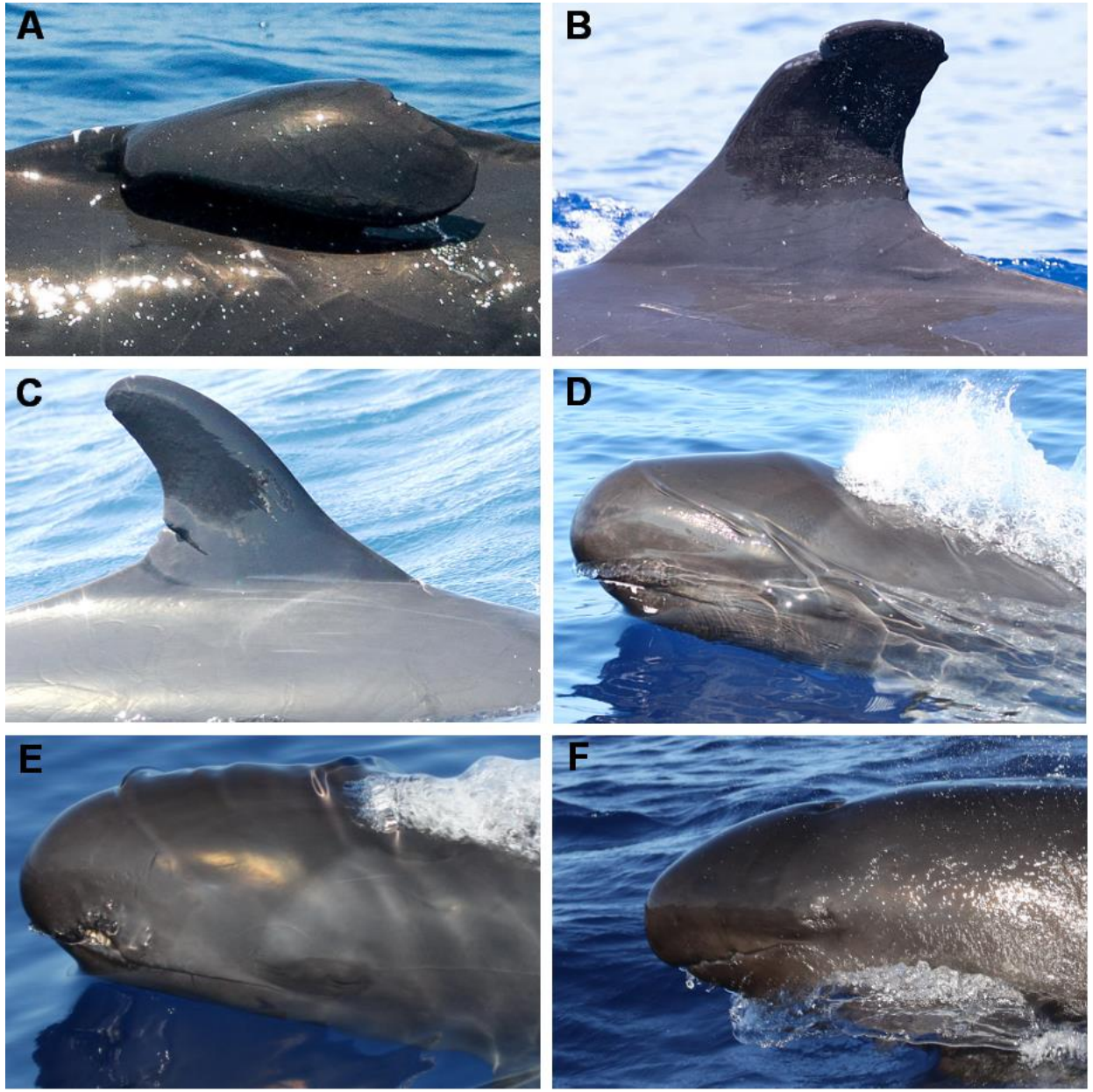
Goals of this work

- Investigate patterns among three stocks with different levels of overlap with fisheries
- Investigate patterns among and within MHI social clusters, and among Hawai‘i pelagic stock groups
- Investigate differences in injury rates between sexes and any interaction between sex and age
- Narrow time frame of when injuries occur for individuals with sightings before/after injury acquisition
- Assess biases and limitations



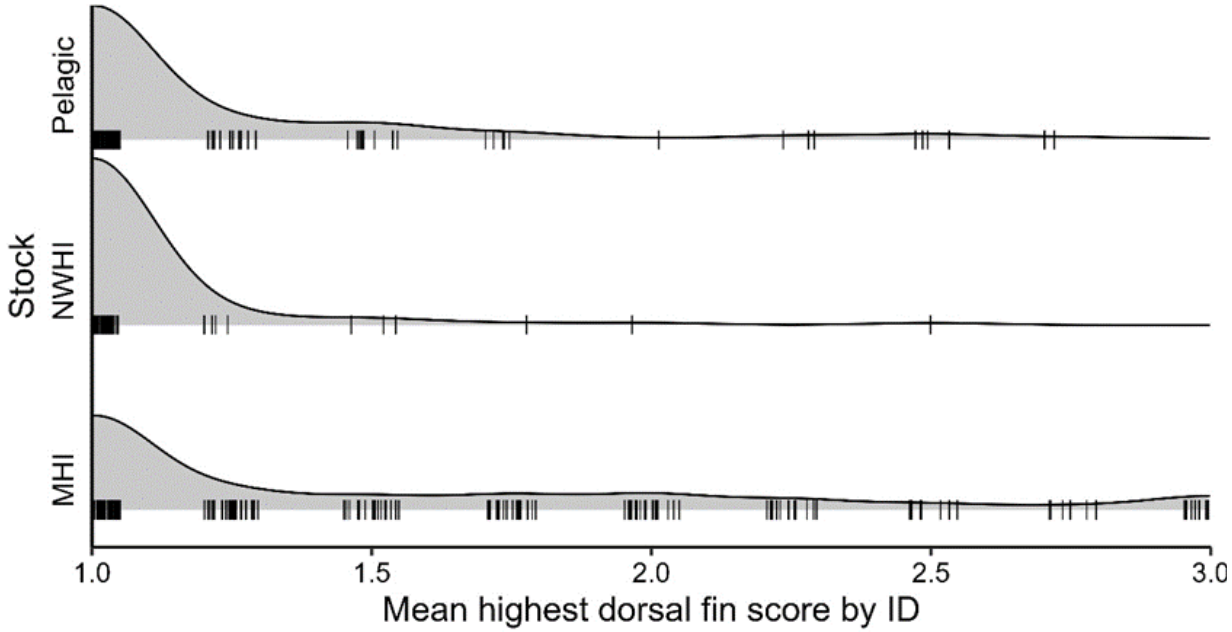
Methods

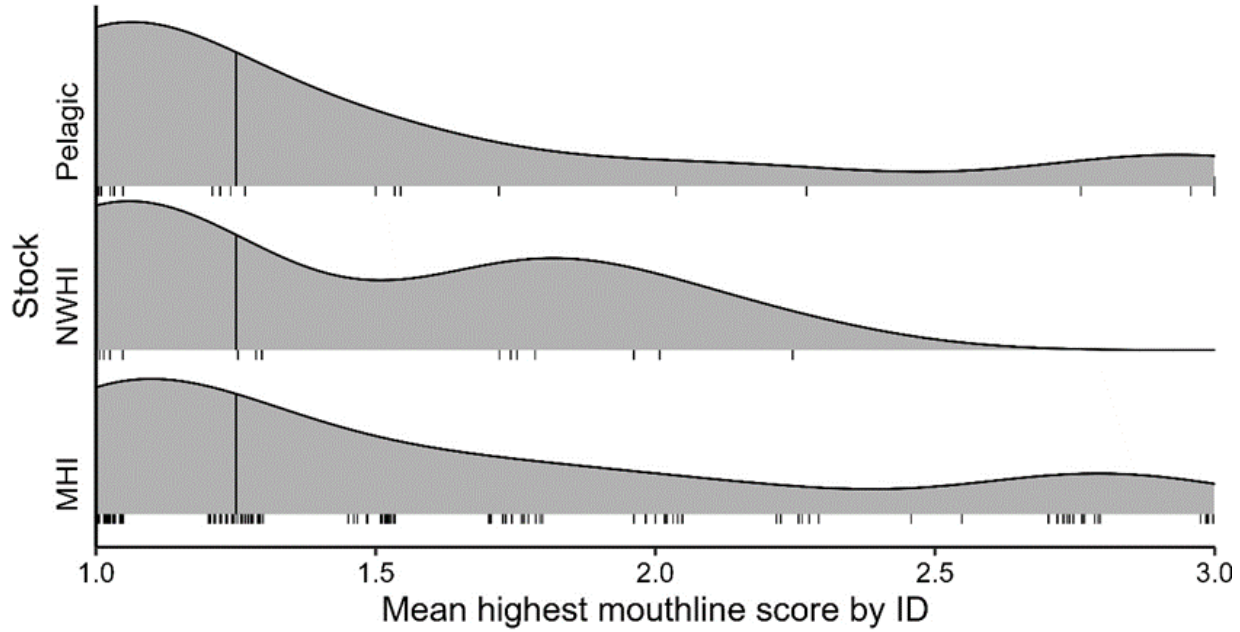
- Photos from 1999-2021 for all three populations
- Dorsal fin and mouthline injuries scored by four reviewers as *not consistent* (1), *possibly consistent* (2), or *consistent* (3) with fishery interactions
- Mean score calculated and individuals with scores ≥ 2.5 considered *consistent with fishery interactions*
- Analysis restricted based on photo quality, animal distinctiveness, & proportion of mouthline visible



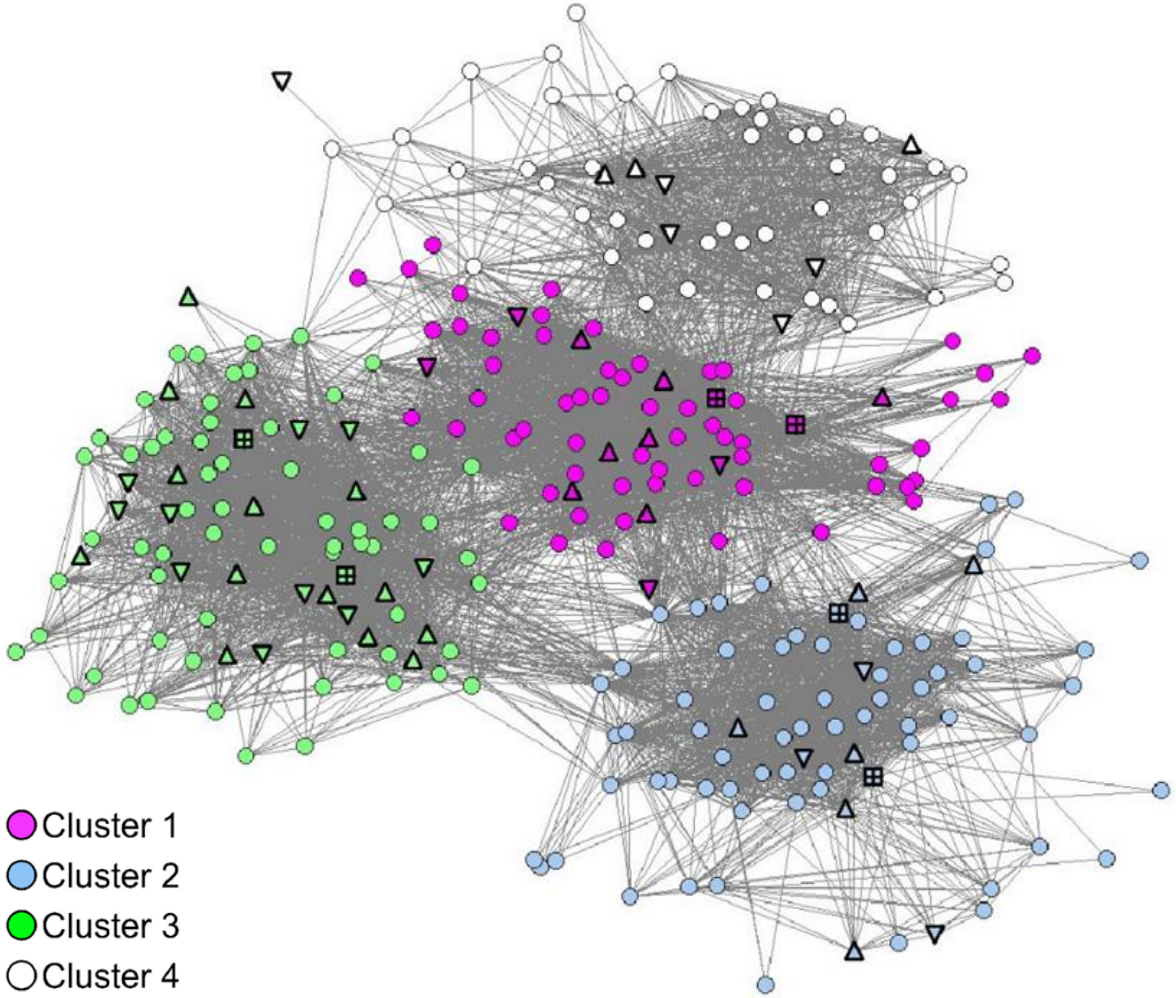
Fisheries interactions vary among stocks

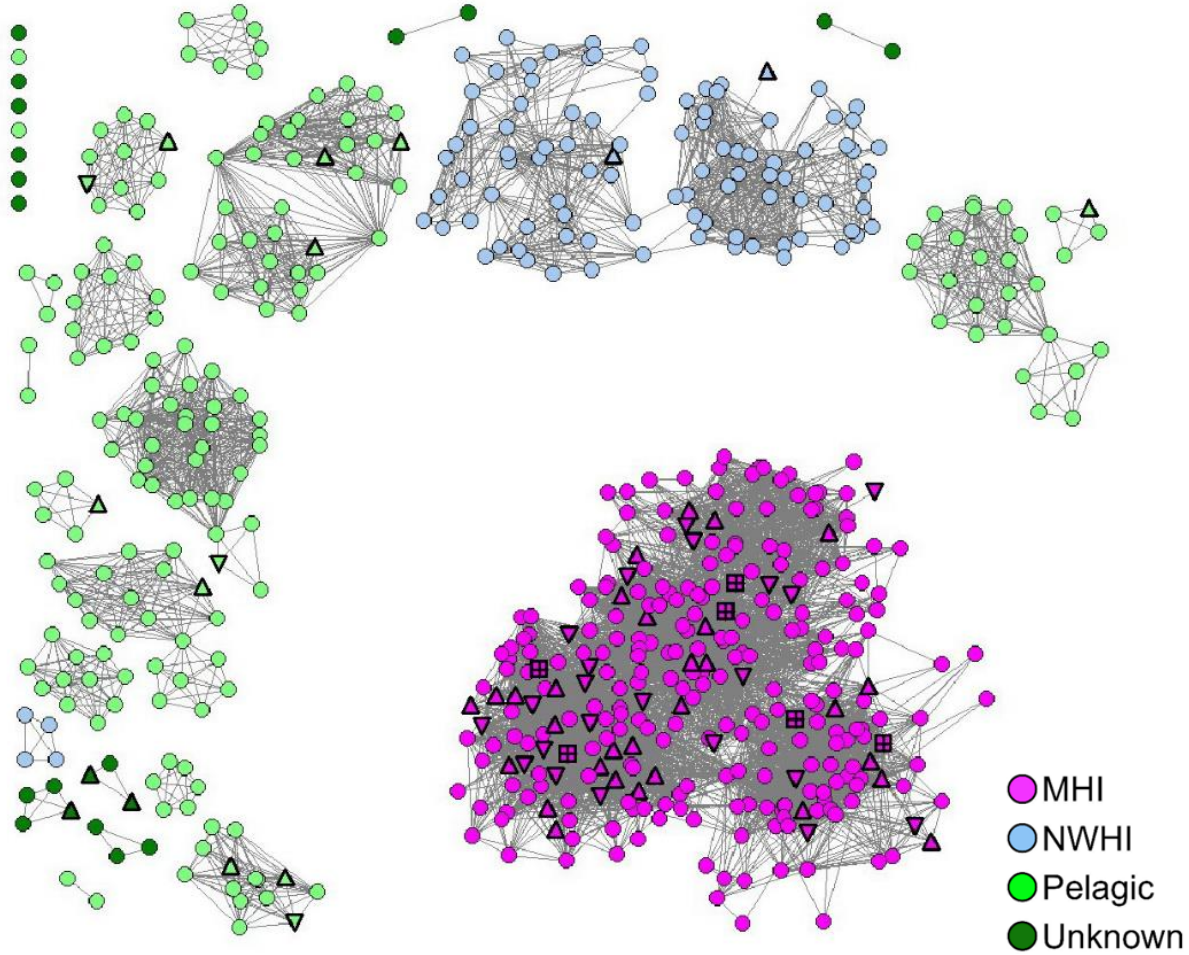
Stock	# with dorsal fins assessed	# (%) with dorsal fin injuries consistent with fisheries interactions	# with mouthlines assessed	# (%) with mouthline injuries consistent with fisheries interactions	# with both assessed	# (%) with either/both injury types consistent with fisheries interactions
MHI	274	35 (12.8%)	154	26 (16.9%)	153	44 (28.7%)
NWHI	87	1 (1.1%)	17	0 (0.0)%	16	0 (0.0%)
Pelagic	134	7 (5.2%)	24	3 (10.7%)	17	0 (0.0%)





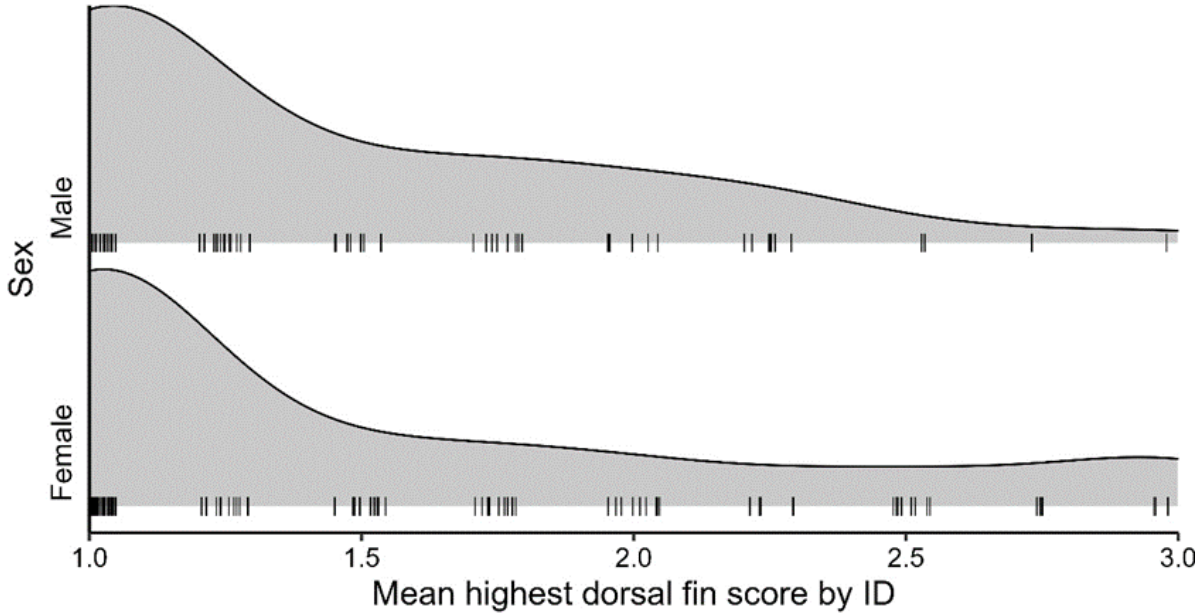
Fisheries interactions were present in all MHI social clusters, but not all Hawai‘i pelagic stock clusters

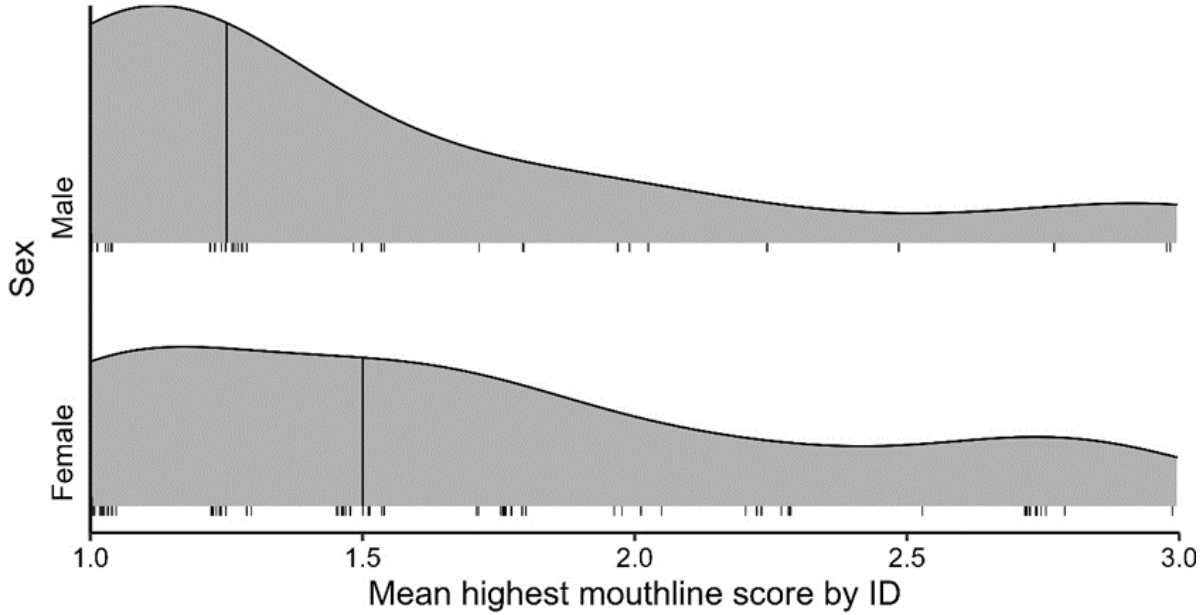




Fisheries interactions vary between sexes, and begin to appear at young ages

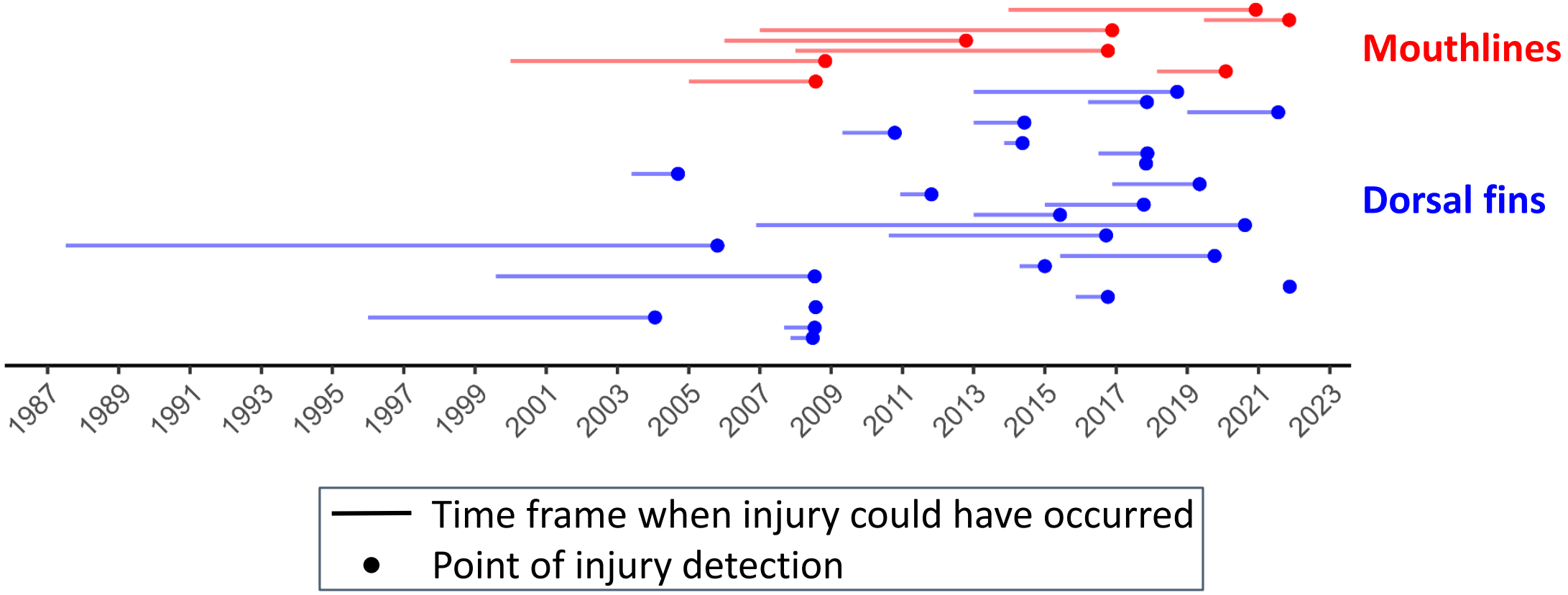
- Females have significantly higher rates of dorsal fin injuries than males
- The earliest detected injuries began to appear at young ages (two years for dorsal fin, four years for mouthline)
- Interaction between sex and age – adult females have more dorsal fin injuries





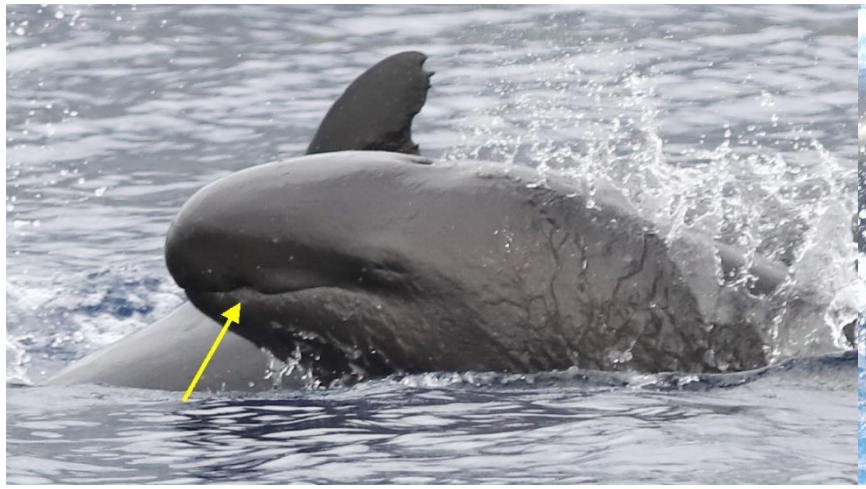
Fisheries interactions occurred throughout the study period, and some animals had multiple injuries

- Able to narrow down when injuries happened for 23 individuals with dorsal injuries, and eight individuals with mouthline injuries



Limitations and biases

- **Better photos & more photos = more likely to detect an injury**
- Number of high-quality photos varies between stocks and clusters



31 Jan 2020

10 Sep 2021

19 Sep 2021

Conclusions

- Results systematically underestimate the true impact of fisheries interactions
- MHI false killer whales regularly interact with fisheries
- Injuries are dispersed throughout the social network
- Injuries were first acquired at early ages, and throughout the study period
- Current management approaches are not preventing interactions within the MHI stock