Estimates of non-U.S. longline interactions with Hawai‘i pelagic false killer whales Pseudorca crassidens within the assessment area 2012–2024

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Executive Summary

This report quantifies non-U.S. longline fishing effort and associated false killer whale *Pseudorca crassidens* (FKW) interactions within the Hawai‘i pelagic FKW assessment area from 2012 to 2024. Coarse-resolution regional fisheries management organization effort data were apportioned to the assessment area using Global Fishing Watch vessel activity data, and FKW interactions were estimated by applying Hawai‘i deep-set longline (DSLL) observer program interaction rates to non-U.S. effort.

Non-U.S. longline effort averaged approximately 9% of total longline effort within the assessment area over the study period, ranging from 6.3% to 14.5% annually. Five nations operated within the assessment area: the People's Republic of China, Japan, the Republic of Korea, Chinese Taipei, and Vanuatu. Estimated annual FKW interactions attributable to non-U.S. fleets ranged from 2.6 to 6.1 (mean 4.1) using a pooled DSLL interaction rate. Elevated interactions are estimated during 2017–2021 followed by a decline through 2022–2024.

Introduction

Hawai‘i pelagic false killer whales *Pseudorca crassidens* (FKW) are not listed as endangered under the Endangered Species Act. They are considered a "strategic stock" under the Marine Mammal Protection Act (MMPA), which establishes a potential biological removal (PBR) level representing the maximum human-caused mortality and serious injury (MSI) a stock can sustain while recovering to or maintaining an optimum sustainable population. The False Killer Whale Take Reduction Team (FKW TRT) was established in 2010 in response to unsustainable bycatch levels by the Hawai‘i-based deep-set longline (DSLL) fishery, and the resulting 2012 Take Reduction Plan was designed to reduce MSI below PBR within the U.S. exclusive economic zone (EEZ) around Hawai‘i.

In 2023, NOAA Fisheries expanded the Hawai‘i pelagic FKW stock assessment area to encompass not only the EEZ around Hawai‘i but also high-seas waters to the east and south (Carretta et al., 2024; Oleson et al., 2023). This expanded area more accurately reflects the biology and ecology of the stock but introduces non-U.S. longline fishing effort into the assessment area, resulting in an underestimate of total bycatch if only U.S. fleet activity is considered. Accurately characterizing non-U.S. fishing impacts within the assessment area is therefore necessary to reduce uncertainty in total MSI estimates, which directly influences PBR calculations and the degree of management action required under the MMPA.

This report provides annual estimates of non-U.S. longline fishing effort and associated FKW interactions within the Hawai‘i pelagic FKW assessment area for 2012–2024, extending the analysis of Ahrens et al. (2026) by one additional year. Consistent with that analysis, FKW interaction rates from the Hawai‘i-based DSLL observer program are applied to non-U.S. effort estimates, as the DSLL fishery most closely resembles non-U.S. tuna-target longline operations in the assessment area with respect to target species, gear configuration, and spatial distribution outside the EEZ.

Methods

Data sources

Non-U.S. longline fishing effort was obtained from two complementary public data sources. Fishing nation flag-specific monthly catch and effort data (in number of hooks deployed), aggregated to a 5°×5° grid, were obtained from the Western and Central Pacific Fisheries Commission (WCPFC) and the Inter-American Tropical Tuna Commission (IATTC) for 2012–2024. WCPFC 5°×5° data exclude records where fewer than three vessels of a given nation fished within a given cell to protect data confidentiality; annual metadata provided with the WCPFC data indicate that the reported 5°×5° effort covers approximately 86.5% (CV = 0.008) of total effort on average. IATTC public domain data were assumed to reflect total effort as no comparable metadata on coverage were available. Data were spatially filtered to the set of 5°×5° cells intersecting the Hawai‘i pelagic FKW assessment area boundary.

Fine-resolution (0.01°) estimates of fishing effort (in hours fished) were obtained from Global Fishing Watch (GFW) for the same time period, filtered to longline vessel activity (deep and shallow set) within the bounding box of the 5°×5° cells described above. Data from 2012–2020 were downloaded from the GFW website (March 3, 2021 update); data for 2021–2024 were accessed via the GFW 4Wings API version 3 using the *gfwr* package (Clavelle et al., 2025). GFW effort estimates are derived from Automatic Identification System (AIS) vessel tracking data, with fishing activity identified through a neural network classifier, vessel registry cross-referencing, and expert review (Kroodsma et al., 2018).

FKW total interaction rates were estimated from the U.S. Pacific Islands Regional Observer Program (Pacific Islands Regional Office, 2025), which—until recently—provided approximately 20% observer coverage of the DSLL fleet. This coverage has declined in recent years. For each year from 2012 to 2024, the interaction rate was calculated as the total estimated number of FKW interactions divided by the total number of hooks deployed by the DSLL fleet. Estimates of interactions were obtained from Pacific Islands Fisheries Science Center data reports, and internal reports (Cooper, In prep.; McCracken & Cooper, 2022). Interactions included allocated unidentified "blackfish" interactions (McCracken, 2010). The total number of hooks deployed by the DSLL fleet obtained from the DSLL logbook (Pacific Islands Fisheries Science Center, 2025).

Apportionment of non-U.S. effort to the assessment area

Since the 5°×5° RFMO effort data are too coarse to directly allocate fishing effort to the irregular boundary of the FKW assessment area, GFW fine-resolution data were used to

estimate the fraction of effort within each 5°×5° cell that fell inside the assessment area boundary. For each 5°×5° cell, each 0.01° GFW estimate was classified as inside or outside the assessment area and summed to produce flag-specific, cell-specific, monthly proportions of effort within the assessment area. These proportions were then applied to the corresponding regional fishery management organization (RFMO)-reported hook totals to estimate the number of hooks fished inside the assessment area for each flag, cell, and month.

In cases where RFMO effort was reported for a given flag-cell-month combination but no corresponding GFW estimate was available (10.05% of total RFMO hooks), the flag-specific annual proportion for that cell was substituted. In cases where GFW effort was present but no RFMO effort was reported (5.54% of GFW hours fished), no effort was assumed, as these instances likely reflect either GFW classification artifacts (e.g., transiting vessels misclassified as fishing) or cells excluded from RFMO reporting under the three-vessel confidentiality rule.

Estimation of FKW interactions

Annual non-U.S. effort within the assessment area was aggregated across all flags and multiplied by DSLL FKW interaction rates (interactions per hook) to produce annual estimates of FKW interactions attributable to non-U.S. longline operations. The DSLL interaction rate was selected as the most appropriate proxy for non-U.S. fleet interaction rates given the similarity in target species (bigeye and yellowfin tuna) and the predominantly deep-set gear configuration of non-U.S. tuna longline operations in the assessment area. Interactions were estimated using a single pooled mean rate calculated across all years applied uniformly to each year's non-U.S. effort. All interactions were conservatively assumed to constitute mortality or serious injury (MSI), consistent with the absence of data on post-interaction animal status from non-U.S. observer programs.

For the pooled mean interaction rate, the mean was calculated across annual rate estimates and the associated standard error was derived from the variance among those annual estimates. These standard errors are slight underestimates in years where unidentified "blackfish" are allocated to FKW, as uncertainty in that allocation is not formally propagated.

Results

Estimated annual FKW interactions attributable to non-U.S. longline operations varied across years (Table 1 and Figure 1). The pooled mean DSLL interaction rate, estimates range from 2.6 (SE = 1.10) in 2024 to 6.1 (SE = 2.51) in 2020, with a mean of 4.1 interactions per year.

Table 1. Annual non-U.S. longline fishing effort and estimated false killer whale *Pseudorca crassidens* (FKW) interactions within the Hawai‘i pelagic false killer whale assessment area, 2012–2024. Non-U.S. hooks (millions) reflect total estimated non-U.S. longline effort apportioned to the assessment area. Non-U.S. effort (%) is the percentage contribution of non-U.S. hooks to total longline effort within the assessment area. Estimated FKW interactions are presented for a pooled mean DSLL interaction rate applied uniformly across all years. SE = standard error.

Year	Non-U.S. hooks (millions)	Non-U.S. effort (%)	Mean	SE
2012	6.03	14.5	4.6	1.89
2013	4.28	10.2	3.2	1.34
2014	4.91	9.5	3.7	1.54
2015	3.53	8.3	2.7	1.11
2016	3.74	7.0	2.8	1.17
2017	6.99	11.3	5.3	2.19
2018	7.71	12.4	5.8	2.42
2019	6.23	8.7	4.7	1.95
2020	8.02	11.6	6.1	2.51
2021	6.29	8.1	4.8	1.97
2022	4.64	6.3	3.5	1.45
2023	4.39	6.4	3.3	1.38
2024	3.50	7.3	2.6	1.1

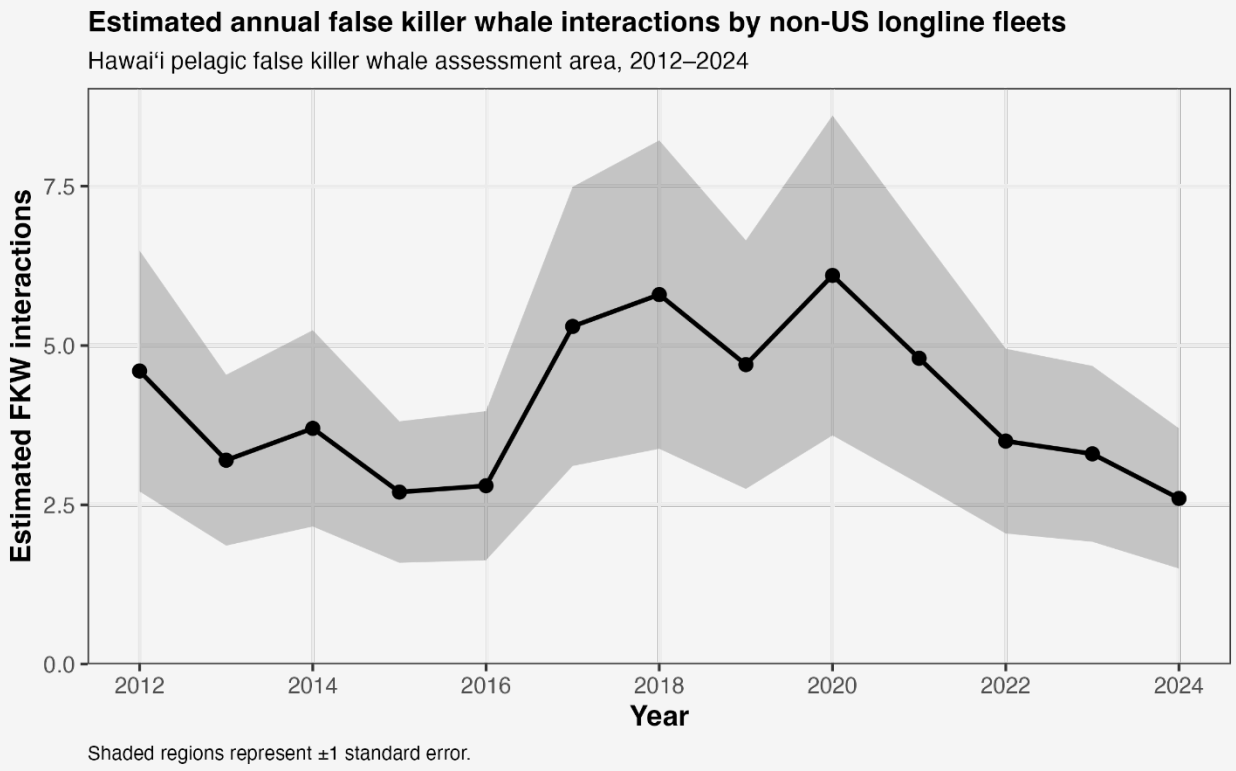

Figure 1. Estimated annual false killer whale *Pseudorca crassidens* interactions by non-U.S. longline fleets within the Hawai‘i pelagic false killer whale assessment area from 2012 to 2024. Estimates are derived by applying a pooled mean DSLL interaction rate, calculated across all years, to annual non-U.S. longline effort apportioned to the assessment area using Global Fishing Watch vessel activity data and regional fishery management organization reported effort. Shaded regions represent ±1 standard error. Standard errors for the pooled mean rate estimates reflect among-year variance in annual DSLL interaction rates. All interactions are conservatively assumed to constitute mortality or serious injury.

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