Supplemental materials for:

Baird, R.W., D.B. Anderson, M.A. Kratofil, and D.L. Webster. 2021. Bringing the right fishermen to the table: indices of overlap between endangered false killer whales and nearshore fisheries in Hawai'i. Biological Conservation 108975

Comparison of FOIs with other measures of fishing effort

We assessed correlation among FOIs for each fishing effort measure by computing one-tailed Pearson correlation coefficients. FOIs were highly correlated for the three effort measures used (correlation coefficients 0.79 to 0.90; n=90).
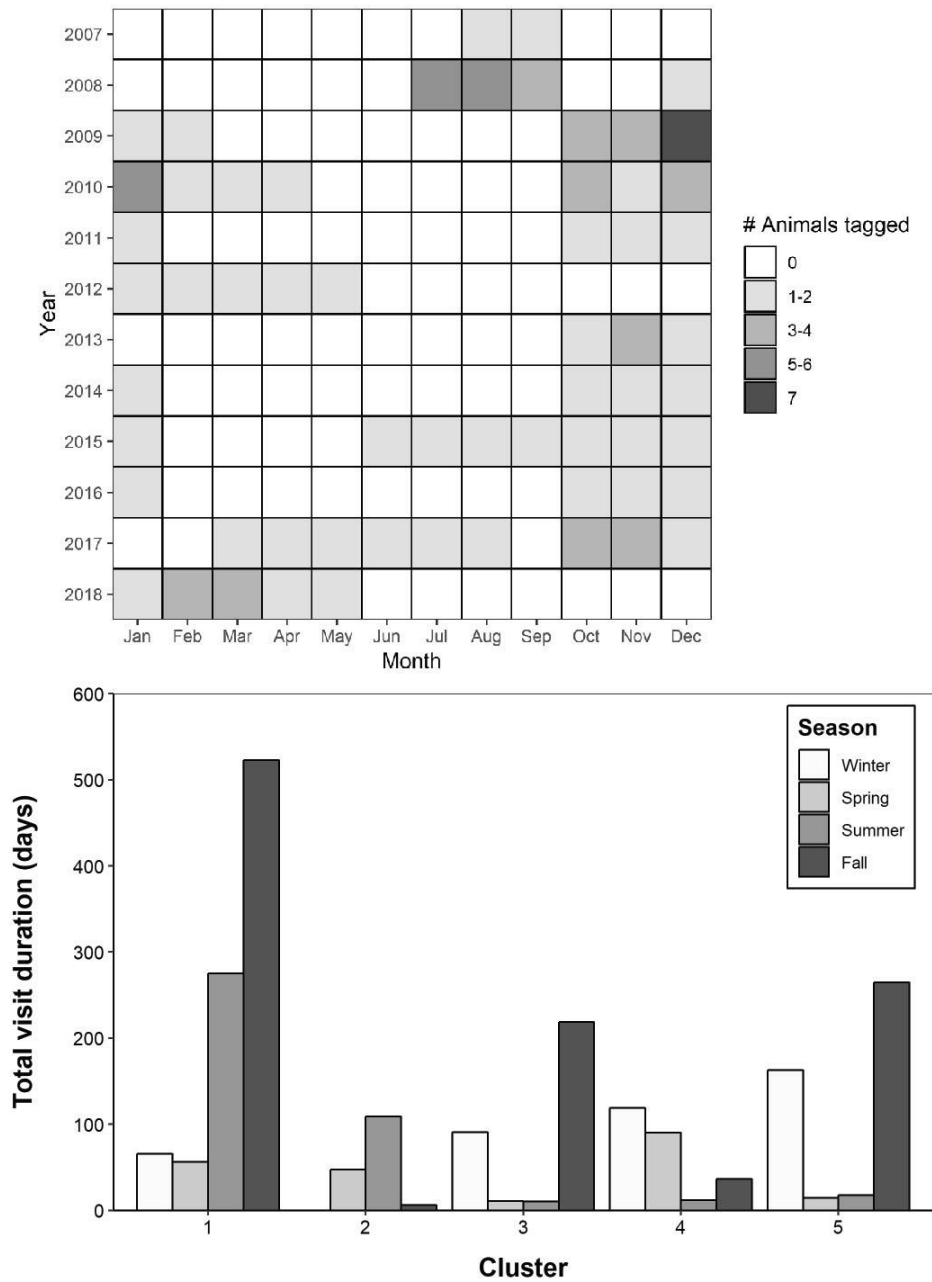
Supplemental figures

Fig. S1. Top. A heatmap showing the number of tagged false killer whales from the main Hawaiian Islands insular population used in analyses, after controlling for pseudoreplication. Bottom. Total visit duration by social cluster broken down by oceanographic season (after Flament 1996): winter – Feb-Apr; spring – May-Jul; summer – Aug-Oct; fall – Nov-Jan. Note: PcTag031 is included in this graph as a member of Cluster 5 (see Baird et al. 2019).
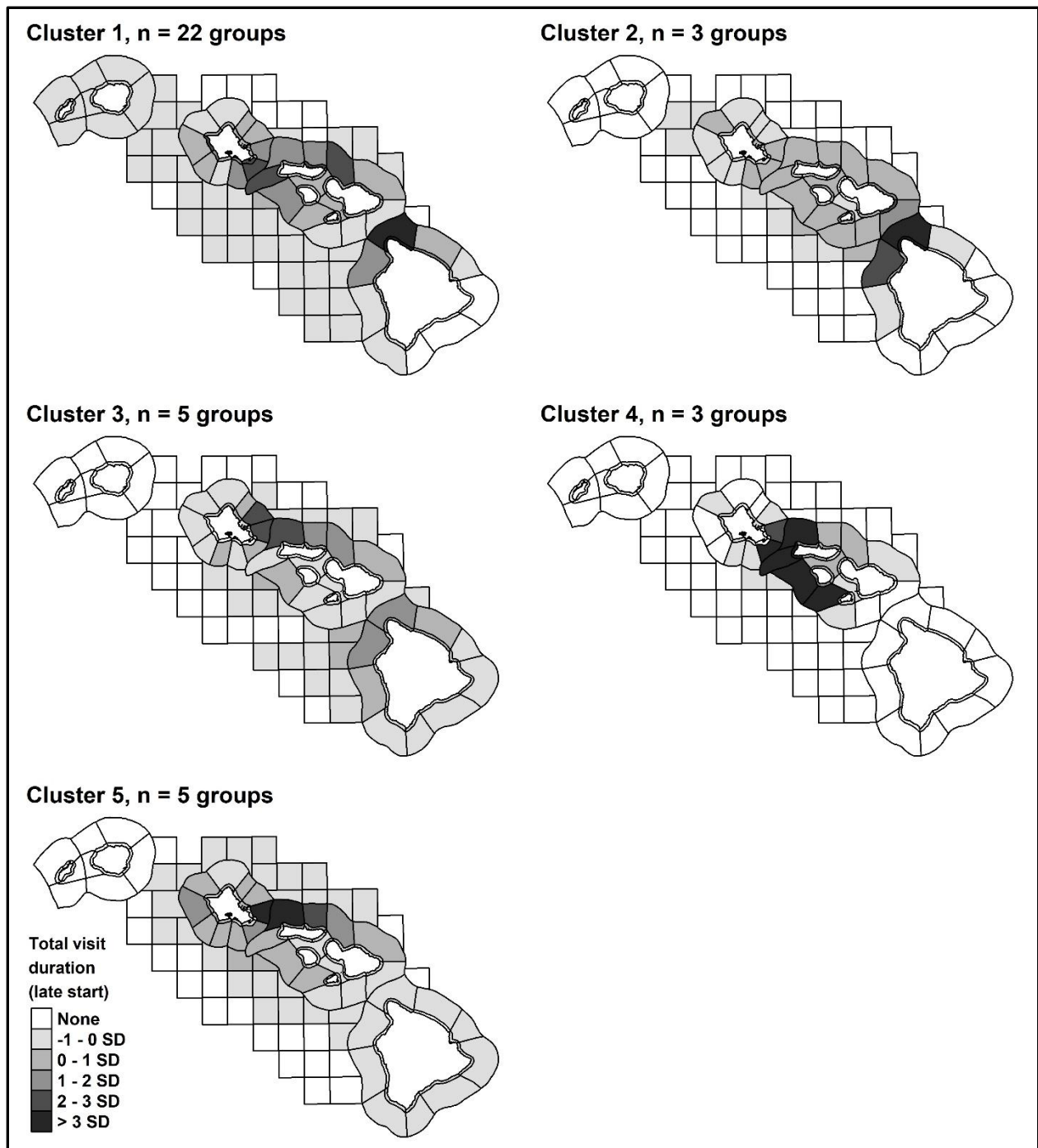
Fig. S2. False killer whale spatial distribution among the Hawai'i commercial fisheries statistical areas by social cluster. Spatial distribution represented as total visit duration adjusted with a "late start" to account for potential bias associated with the island the animal was tagged at. Total visit duration was adjusted for the size of each area (km^2) and shades represent standard deviations above or below the mean value.
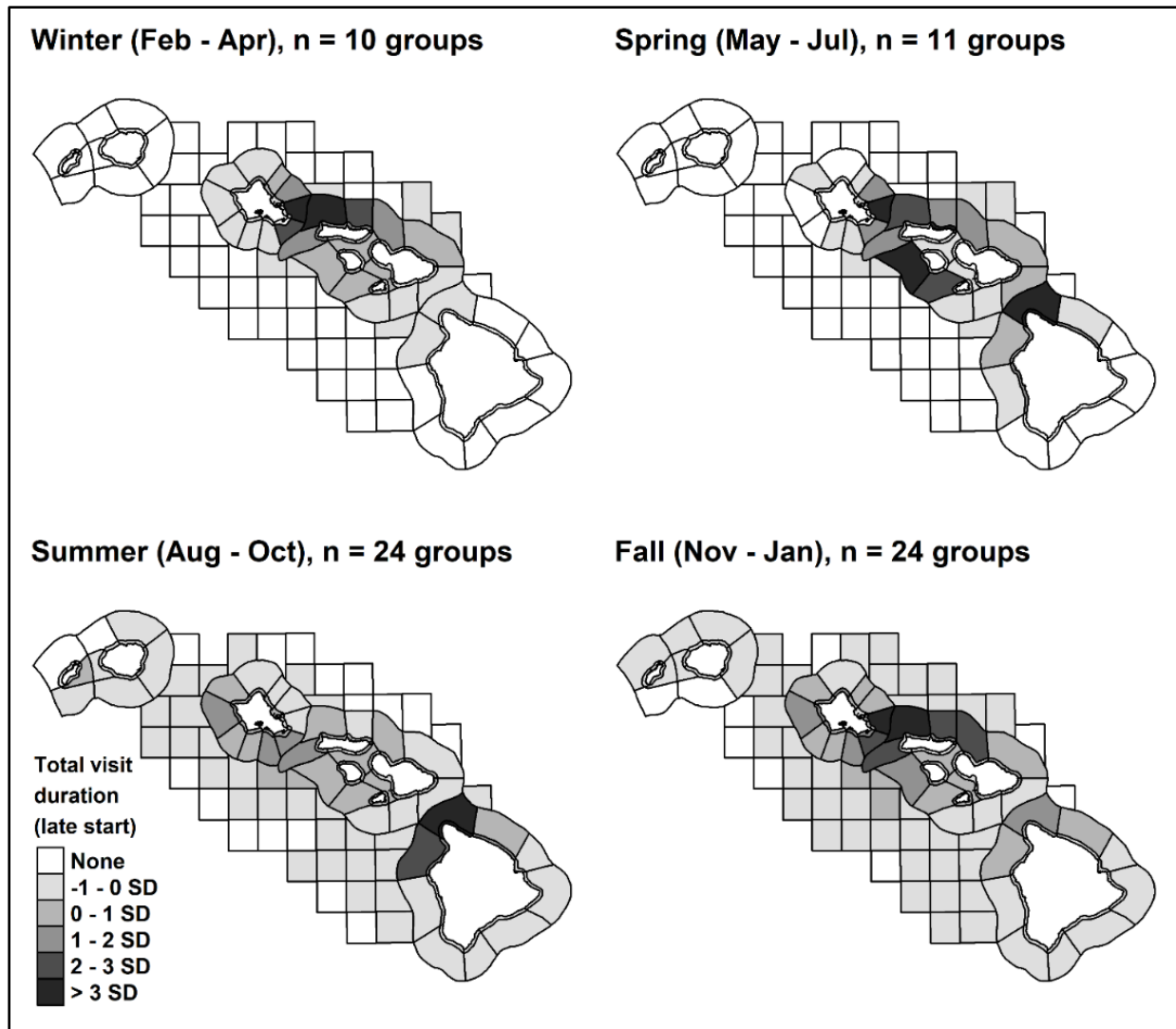
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Fig. S3. False killer whale spatial distribution among the Hawaiʻi commercial fisheries statistical areas by season. Spatial distribution represented as total visit duration adjusted with a "late start" to account for potential bias associated with the island the animal was tagged at. Total visit duration was adjusted for the size of each area (km^2) and shades represent standard deviations above or below the mean value. All social clusters were pooled. Seasons were defined as oceanographic season (after Flament 1996): winter – Feb-Apr; spring – May-Jul; summer – Aug-Oct; fall – Nov-Jan.
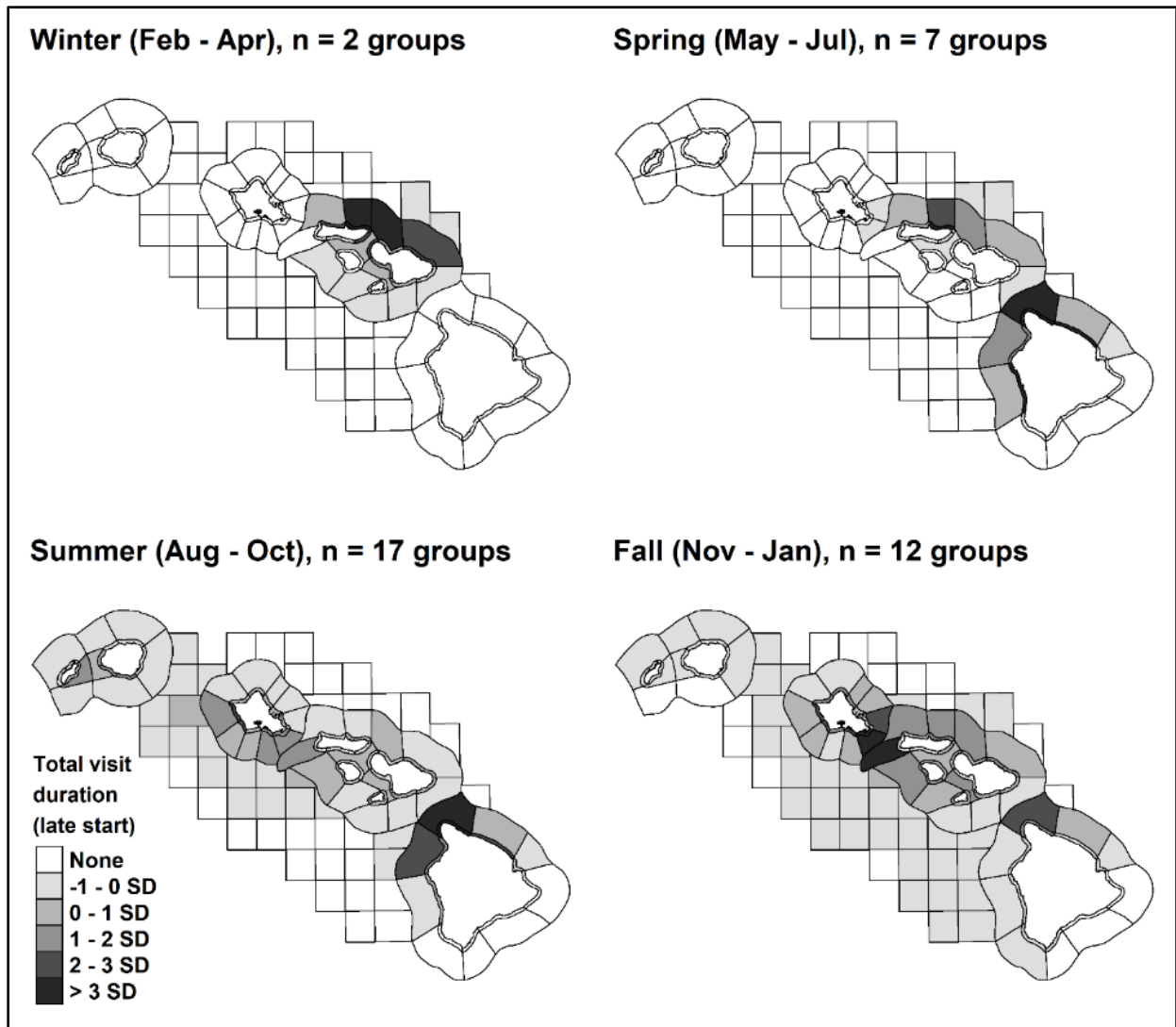
Fig. S4. False killer whale use of Hawai'i commercial fisheries statistical areas by season restricted to individuals from Cluster 1, to remove the potential influence of social cluster. Spatial distribution represented as total visit duration adjusted with a "late start" to account for potential bias associated with the island the animal was tagged at. Total visit duration was adjusted for the size of each area (km^2) and shades represent standard deviations above or below the mean value. Seasons were defined as oceanographic season (after Flament 1996): winter – Feb-Apr; spring – May-Jul; summer – Aug-Oct; fall – Nov-Jan.
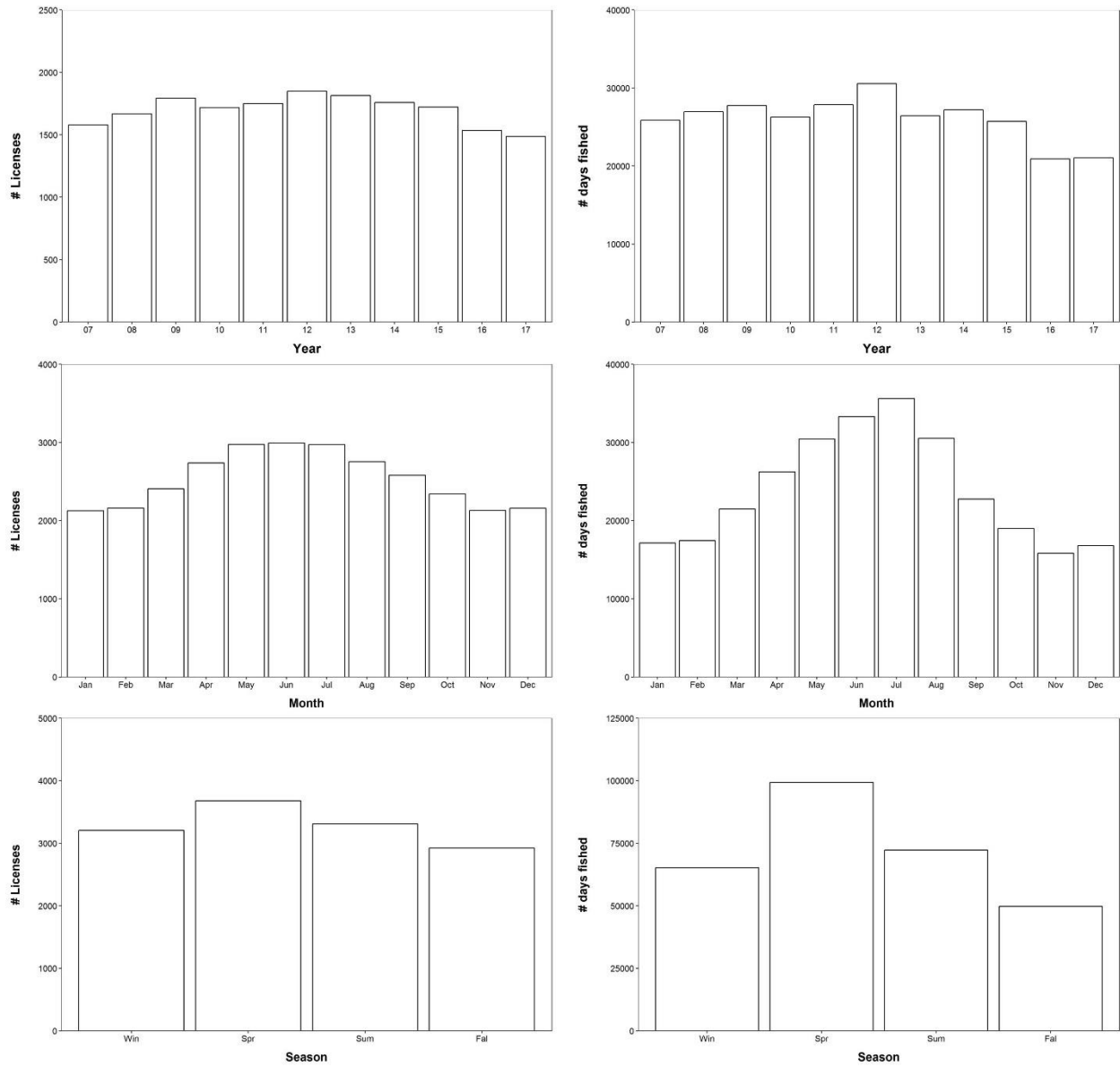
Fig. S5. Inter-annual and seasonal measures of fishing effort for the period 2007-2017, restricted to fisheries noted in Table 1. Left: Number of licenses by year (top), month (middle), and season (bottom). Right: Days fished by year (top), month (middle), and season (bottom). Seasons were defined as oceanographic season (after Flament 1996): winter – Feb-Apr; spring – May-Jul; summer – Aug-Oct; fall – Nov-Jan.

Fig. S6. Seasonal variation in fishing effort for the period 2007-2017 by Hawaiʻi fisheries statistical areas, based on catch (top), days fished (middle), and licenses (bottom), corrected for the size of areas. Seasons were defined as oceanographic season (after Flament 1996): winter – Feb-Apr; spring – May-Jul; summer – Aug-Oct; fall – Nov-Jan.

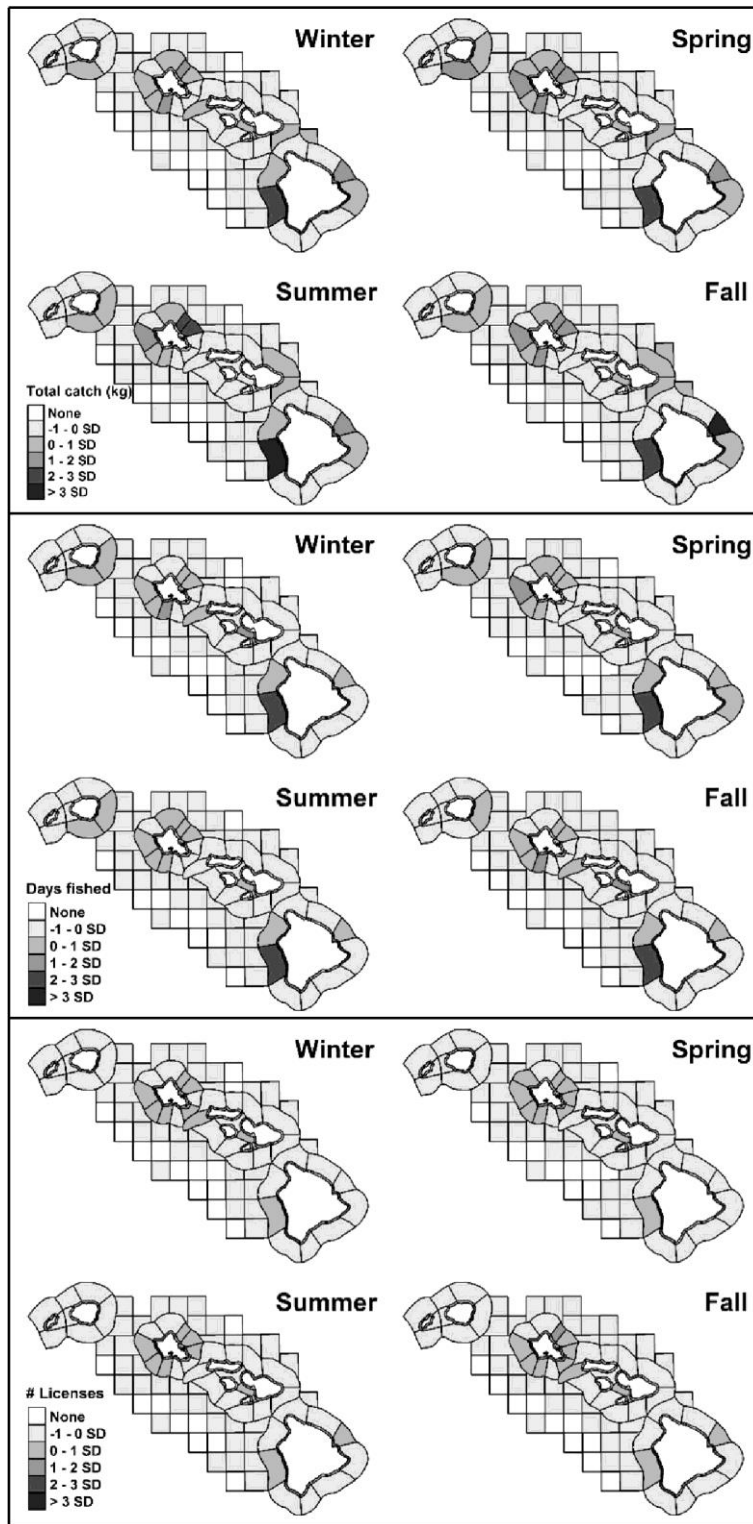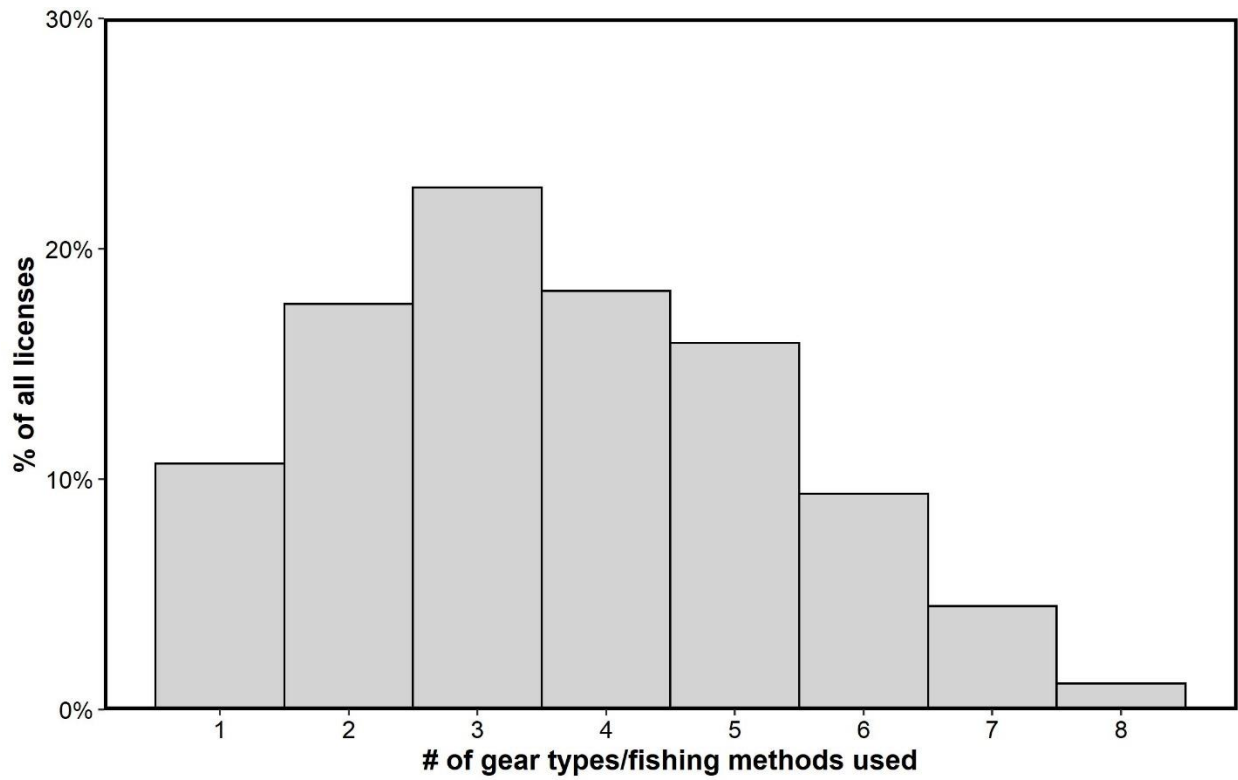**Fig. S7.** The number of gear types/fishing methods used by individual license holders, restricted to those that fished an average of at least one day per month over the entire study period (2007-2017).
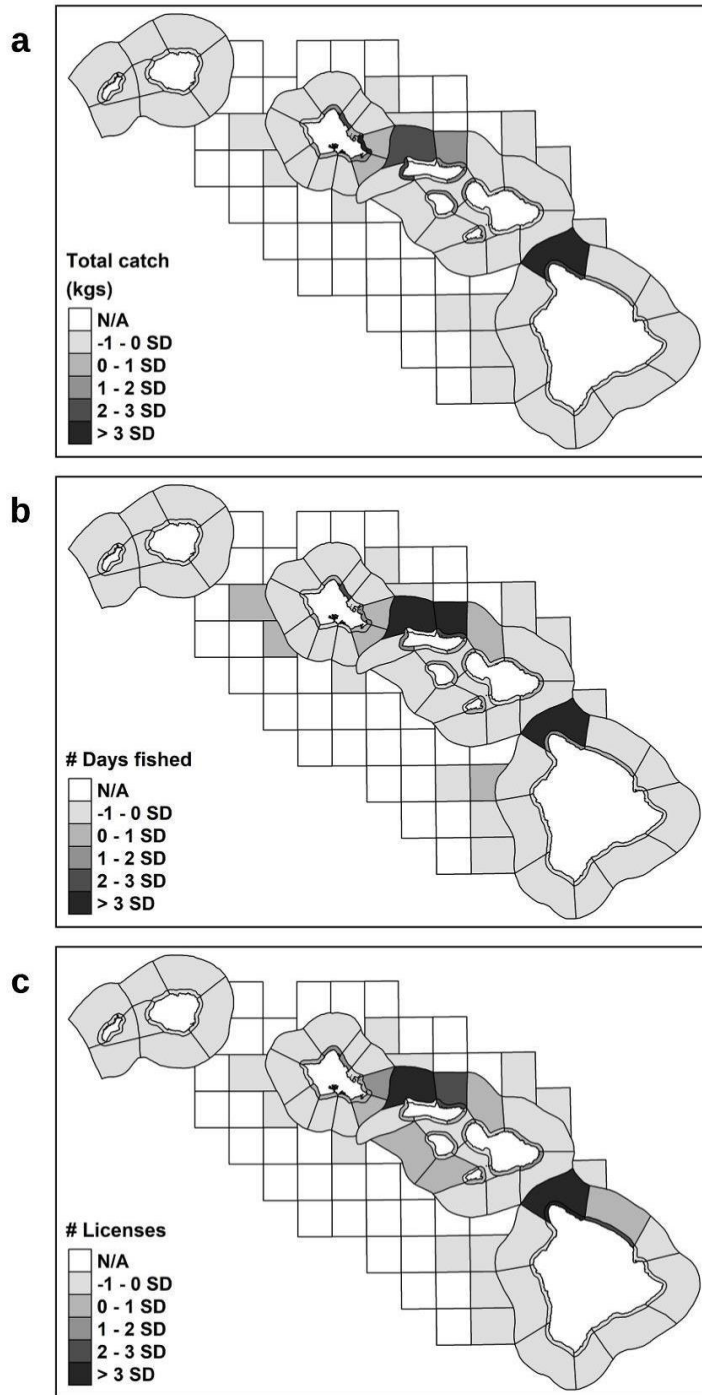
Fig. S8. Fishery overlap indices using the Hawai'i commercial fisheries statistical areas, with values shown as SDs above and below the mean value. Three indices are shown, based on number of (a) total catch (kgs), (b) number of days fished, and (c) number of unique fishing licenses. Areas with fewer than three licenses or with less an average of one day of fishing effort per month area are shown as N/A. Fishery areas shown are all those with overlap from satellite-tagged false killer whales from the main Hawaiian Islands population.

Table S1. Prey species documented in the diet of main Hawaiian Islands insular false killer whales. Data from stomach contents from K. West et al. unpublished, U. Hawaiʻi. Photographic data from Baird et al. (2008), Baird (2016), and unpublished data.

English name	Hawaiian name	Scientific name	Type of evidence
Yellowfin tuna	Ahi	*Thunnus albacares*	Photos, stomach
Bigeye tuna	ʻAhi poʻonui	*Thunnus obesus*	Photos
Albacore tuna	ʻAhi palaha	*Thunnus alalunga*	Photos
Skipjack tuna	Aku	*Katsuwonus pelamis*	Photos
Scrawled file fish	Loulu or Oilepa	*Aluterus scriptus*	Photos
Broadbill swordfish	Aʻu ku	*Xiphias gladius*	Photos, stomach
Dolphin fish	Mahimahi	*Coryphaena hippurus*	Photos, stomach
Wahoo	Ono	*Acanthocybium solandri*	Photos
Lustrous pomfret	Monchong	*Eumegistus illustrus*	Photos
Opah		*Lampris guttatus*	Photos, stomach
Threadfin jack	Kagami ulua	*Carangoides otrynter*	Photos
Blue-green snapper	Uku	*Aprion virescens*	Photos
Milkfish	Awa	*Chanos chanos*	Photos
Amberjack	Kāhala	*Seriola quinqueradiata*	Photos
Giant trevally	Ulua aukea	*Caranx ignobilis*	Photos
Unidentified jack		*Caranx sp.*	Stomach
Shortbill spearfish	Aʻu	*Tetrapterus angustirostris*	Stomach
Bonefish	Oio	*Albula spp.*	Photos, stomach
Diamondback squid		*Thysanoteuthis rhombus*	Stomach
Purpleback flying squid		*Sthenoteuthis oualaniensis*	Stomach

Table S2. Three measures of fishing effort data for the Hawaiʻi commercial fisheries statistical areas from 2007-2017, restricted to fisheries whose primary catch are pelagic fish known to be false killer whale prey (see Table 1). The top 30 areas (based on number of licenses in decreasing order) are shown, representing 84.2% of the total catch during this period. See Figure 1 for locations and boundaries of areas.

Area #	Description	Area size km²	FKW % of time in cell	Fishery effort data		
				% of overall catch	# licenses	# days fished
121	Kona offshore	2,376	0.61	17.7	1,228	59,442
423	Waiʻanae N offshore	1,453	2.91	5.7	838	16,017
101	Kona nearshore	248	0.14	3.0	708	12,099
122	Kona N offshore	2,171	5.59	2.8	600	12,166
421	Pearl Harbor offshore	727	0.97	2.7	543	9,679
422	Waiʻanae S offshore	856	1.01	2.4	501	6,013
427	Kāneʻohe offshore	786	1.99	3.6	431	6,151
425	Oʻahu N offshore	1,584	0.50	4.4	424	7,711
424	Oʻahu NW offshore	1,099	1.22	1.2	405	3,701
126	Puna offshore	2,449	0.23	6.4	380	10,337
426	Kāneʻohe N offshore	518	0.68	2.5	378	3,835
520	Kauaʻi S offshore	1,926	0.04	5.3	374	12,344
331	Penguin Bank offshore	1,107	4.50	0.9	371	6,033
125	Hilo offshore	1,132	0.19	5.8	369	8,617
328	Lānaʻi W offshore	1,909	7.04	1.5	318	6,192
403	Waiʻanae nearshore	92	0.22	0.8	314	4,275
320	ʻAuʻau Channel S	538	0.73	0.7	308	6,634
120	S Point W offshore	2,118	0.03	1.4	294	3,914
100	S Point W nearshore	187	0.05	1.1	290	3,760
524	Kauaʻi E offshore	2,131	0.12	3.7	286	12,210
429	Oʻahu SE offshore	563	2.78	0.2	281	1,561
323	Maui NE offshore	2,431	4.02	3.1	278	6,653
428	Oʻahu E offshore	644	5.00	0.5	274	1,489
420	Honolulu offshore	773	1.54	0.4	234	2,121
102	Kohala S nearshore	204	0.21	0.7	220	4,710
106	Puna nearshore	220	3.51	1.7	213	5,569
327	Lānaʻi S offshore	1,356	0.82	0.6	213	4,112
452	Penguin Bank west tip	934	0.02	0.7	213	1,202
324	Maui SE offshore	1,338	0.68	2.1	209	3,516
504	Kauaʻi E nearshore	140	0.04	0.9	208	3,485

Table S3. Fishery overlap indices (FOI) for the 30 commercial fisheries statistical areas with the highest levels of fishing effort (shown in Table S2) scaled to the value off Kona (area 121).

Area #	Description	Fishery overlap indices		
		catch	days fished	licenses
121	Kona offshore	1.0	1.0	1.0
423	Wai'anae N offshore	24.0	29.0	11.4
101	Kona nearshore	13.1	11.1	3.9
122	Kona N offshore	63.0	49.1	20.6
421	Pearl Harbor offshore	34.0	32.0	11.8
422	Wai'anae S offshore	34.0	45.4	11.3
427	Kāne'ohe offshore	47.9	95.4	28.1
425	O'ahu N offshore	5.0	9.6	3.6
424	O'ahu NW offshore	63.0	69.8	13.2
126	Puna offshore	1.0	2.1	1.2
426	Kāne'ohe N offshore	35.7	78.8	16.5
520	Kaua'i S offshore	0.3	0.4	0.3
331	Penguin Bank offshore	328.8	156.1	52.4
125	Hilo offshore	2.1	4.6	2.2
328	Lāna'i W offshore	167.3	138.1	55.6
403	Wai'anae nearshore	210.4	132.1	37.2
320	'Au'au Channel S	135.0	47.4	21.1
120	S Point W offshore	0.7	0.8	0.2
100	S Point W nearshore	16.0	16.0	4.3
524	Kaua'i E offshore	1.1	1.1	0.9
429	O'ahu SE offshore	1591.0	733.9	84.2
323	Maui NE offshore	37.0	57.7	28.5
428	O'ahu E offshore	1077.1	1208.9	135.7
420	Honolulu offshore	360.1	217.8	40.8
102	Kohala S nearshore	107.6	50.2	22.2
106	Puna nearshore	318.9	146.0	58.2
327	Lāna'i S offshore	89.5	169.4	19.8
452	Penguin Bank west tip	4.6	4.6	2.5
324	Maui SE offshore	16.9	33.6	11.7
504	Kaua'i E nearshore	22.7	20.3	7.0

Table S4. Percentage of total catch by fishery method for each of the 30 commercial fisheries statistical areas with the highest FOI values (sorted by decreasing FOI as per Table 2). See Fig. 1 for area locations. Only fisheries with catch representing more than 1% of the total catch in an area are included. Area 121, offshore Kona, is included for comparison.

Area #	Troll lure	Troll bait	Rod & reel, cast, jig	Deep-sea handline	Palu-ahi	Ika-shibi	Aku boat	Troll stick
332	67.95	25.81	0.43	0.32	0.46	0.00	4.49	0.32
333	66.04	29.81	1.78	1.45	0.87	0.00	0.00	0.00
123	67.21	11.80	2.15	2.78	2.92	13.15	0.00	0.00
313	75.43	19.51	0.92	4.14	0.00	0.00	0.00	0.00
406	72.95	11.27	6.68	9.10	0.00	0.00	0.00	0.00
311	69.78	5.62	6.00	18.60	0.00	0.00	0.00	0.00
103	68.70	23.89	0.28	4.76	2.29	0.00	0.00	0.00
405	61.34	1.56	3.73	33.37	0.00	0.00	0.00	0.00
408	50.58	16.11	31.10	2.21	0.00	0.00	0.00	0.00
428	66.67	17.39	0.82	0.23	0.52	0.00	14.33	0.03
104	27.99	0.18	0.83	0.17	70.83	0.00	0.00	0.00
314	89.96	3.54	1.93	4.58	0.00	0.00	0.00	0.00
304	33.67	45.66	0.47	19.71	0.37	0.11	0.00	0.00
306	91.84	6.01	0.76	1.38	0.00	0.00	0.00	0.00
409	45.19	27.30	21.29	6.22	0.00	0.00	0.00	0.00
429	71.29	13.89	1.42	6.00	0.17	0.03	7.10	0.04
303	78.13	4.03	12.62	5.06	0.00	0.00	0.00	0.00
309	80.44	18.39	0.61	0.55	0.00	0.00	0.00	0.00
301	15.64	3.55	39.15	41.54	0.00	0.00	0.00	0.00
188	73.31	13.62	1.46	0.55	6.28	2.68	0.00	2.09
322	54.91	39.00	2.05	0.46	0.55	2.79	0.00	0.05
402	42.90	5.60	43.63	5.59	0.24	0.31	0.48	0.00
360	62.99	37.01	0.00	0.00	0.00	0.00	0.00	0.00
455	97.71	1.01	0.00	0.00	0.00	0.00	0.00	0.70
400	15.34	2.84	56.64	11.03	0.94	12.75	0.00	0.00
407	39.35	32.45	18.96	7.13	0.00	2.00	0.00	0.00
124	46.52	11.52	0.69	2.36	5.72	18.19	0.00	14.66
302	67.26	5.48	19.49	7.64	0.00	0.00	0.00	0.00
453	95.84	4.11	0.00	0.00	0.00	0.00	0.00	0.00
305	85.21	4.03	1.95	8.80	0.00	0.00	0.00	0.00
121	47.69	4.96	1.05	1.65	23.48	18.26	0.00	2.52