Yaquina Head Seabird Colony

Yaquina Head Outstanding Natural Area, Newport, Oregon

2021 Season Summary


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DECEMBER 2021

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Project Overview

Yaquina Head Outstanding Natural Area (YHONA) is home to some of Oregon's largest and most publically visible seabird colonies, and has included over 60,000 Common Murres (*Uria aalge*) in peak attendance years. The seabird colonies surrounding Yaquina Head present a unique opportunity for research and monitoring given their close proximity to viewing platforms and intensive oceanographic studies of surrounding waters. From 1980 to 2010 the common murre population at Yaquina Head experienced rapid growth and reproductive success however, there has been significant fluctuation and reproductive failures over the last 8-10 years. The 2021 field season was the 15th consecutive year of murre productivity monitoring; a collaborative effort between Oregon State University, U.S. Fish and Wildlife Service, and the Bureau of Land Management. In combination with similar studies conducted by Julia Parrish of the University of Washington from 1998 – 2002, our investigation of seabirds at Yaquina Head has contributed to a 20-year time series of observation.

In general, we are interested in how seabird breeding chronology, reproductive success, diet, and foraging activities are affected by changing ocean conditions. However, another important dynamic occurring at Yaquina Head is murre depredation coincident with increasing bald eagle (*Haliaeetus leucocephalus*) interactions. Our study objectives include quantifying the effects of bald eagles and other sources of predation on or disturbance to seabirds during the breeding season. Modified SARS-CoV-19 restrictions in 2021 allowed us to resume a more "typical" monitoring season, with increased personnel and observation hours from 2020.

Observations were conducted from the public viewing deck at the base of the lighthouse. Construction modified the viewing deck slightly from previous years making the viewing platform slightly lower. Plots were monitored from May through August approximately four days per week (every other day). Common murre monitoring began on 17 May, however eggs were not confirmed until 31 May when two eggs were sighted on the Colony Rock sub colony. Within our study plots we closely observed breeding birds, documented when eggs were laid and the monitored the progressive success of the breeding pair through egg incubation and chick rearing. Simultaneously, we observed disturbances to the breeding colony and recorded the frequency, duration and consequences (e.g., loss of eggs or chicks) of these events. We also collected Brandt's (*Phalacrocorax penicillatus*) and pelagic (*P. pelagicus*) cormorant data during the 2021 breeding season. Cormorant monitoring began on 30 May and the earliest chicks were

confirmed by 28 June and 1 July (Brandt's and pelagic respectively). This was the 14th consecutive year of collecting reproductive success data for both species at Yaquina Head.

We conducted chick provisioning watches one day per week over four weeks from 26 July to 16 August. During the watches we collected chick feeding frequency from sunrise to sunset, which provided an indirect indication of local prey availability and foraging success. Additionally, we collected photos for prey identification using a digital camera (Canon 600/F4 lens with a 2x converter on a Canon 1D X Mark II) to photograph fish in the bills of murres returning to the colony after foraging trips. These data allowed us to analyze the birds' diet and provided information about foraging and oceanographic conditions adjacent to these seabird colonies.

Yaquina Head is located within the larger California Current System (CCS), which means that the Oregon coast experiences cyclic seasonal localized up- and downwelling events, which greatly impact coastal primary productivity and the marine food web (upwelling is typically associated with high productivity and fruitful commercial fishing areas). In 2021 the CCS entered a second La Niña/ ENSO (ENSO (El Niño Southern Oscillation) -neutral year and conditions on the central Oregon coast were 'typical', meaning there were no anomalous oceanographic conditions locally. Although a considerable heat wave developed off Oregon and Washington in June/July coastal impacts were relatively minor, likely due to strong coastal upwelling.

Results

In 2021 we logged approximately 165 hours of observation between 17 May and 6 August. Common murre chicks were first observed on 28 June with **a median hatch date of 19 July**. Both were later than the long-term means, 19 June and 5 July, respectively. **Common murre hatching (0.64 ± 0.09, $n_{plots} = 9$) in 2021 was relatively high, and reproductive success (0.47 ± 0.08) was approximate to the long-term mean (0.43; Fig. 1)**. Typically, 12 plots are monitored but only 9 of these plots were attended in 2021 (Fig. 2). The relatively successful productivity of murres in 2021 follows nearly failed breeding attempts in 2020 and is in contrast to the more extreme successes and failures we have observed variably at the site since 2011.

Throughout our study period we documented 55 disturbance events (**0.33/hour**) where a minimum of **228 murre eggs and 9 adult murres** were depredated (Table 1). Chicks were not observed during any documented disturbance event; eagle disturbances tapered in frequency over our study period with the last active disturbance observed in mid-July. Anecdotally, this was in keeping with disturbance activity in recent years. The 2021 rate of **murre egg depredation (1.38 eggs/hr)** was lower than the long-term mean (with and without the highest rate of egg depredations in 2020). Occasionally disturbance events were already in progress when observers arrived at the colony and not all predation events were observed, therefore, the rate of egg and adult murre loss should be considered conservative estimates. **Bald eagles were again the dominant disturbance source (96.4% of events), instigating all but two observed disturbance events.**

In contrast to 2020, active disturbance events observed in 2021 did not include large groups of eagles; every observed event was instigated by one or two eagles in all but one case, where one adult and two sub adults disturbed the colony. In 2021, sub adult bald eagles were the primary predator in 64.6% of disturbances where monitors were present for the start of the event, whereas adult bald eagles were the primary predator 45.8% of these times. Sometimes aggregations of eagles were responsible for a disturbance event, hence the discrepancy in the aforementioned primary predator proportions. During 20.8% of observed disturbance events, eagles hunted in small groups (>1 individual); 9.1% of events were instigated by mixed age groups (adults and sub adult eagles). We also observed a minimum of **520 western gulls, 28 turkey vultures (*Cathartes aura*), and 3 American crows (*Corvus brachyrhynchos*)** present over all disturbance events. There were no disturbances caused by brown pelicans (source of devastating disturbance in 2012), although pelicans were observed roosting on the north and east ends of Colony Rock sub colony.

Murre diets vary annually and are generally dominated by either herring or sardines (Clupeidae), Pacific sand lance (*Ammodytes hexapterus*), or smelt (Osmeridae), but occasionally occur in relatively equal proportions in a given year. We were able to collect prey data in 2021, with 88 unique identified items (Fig. 5). Consistent with the majority of our study years, smelts were the most abundant in the murre diets, comprising 43.1% of our sampled prey items. Juvenile salmon (Salmonidae) accounted for 15.9% of sampled murre diets, the highest of our

study; these are grouped under the "other" category. For the second consecutive year we did not observe any flatfish in our sampled diet; a notable shift from 2018 and 2019 (Fig. 3).

Both Brandt's and pelagic cormorants at Yaquina Head had a productive year in 2021. **Brandt's cormorant's reproductive success (2.69 fledglings/nest) was the highest in our study and average brood size (2.27 chicks/nest) was higher than the long-term mean (Table 2).** Median hatch date was 5 July, four days earlier than the long term mean for Brandt's cormorants at YHONA. Pelagic cormorants also had a successful year at YHONA in 2021, with higher than average reproductive success **(1.75 fledglings/nest)** and average brood size of (**2.59chicks/nest;** Table 3). Median hatch date for pelagic cormorants was 8 July, ten days earlier than the long-term mean (18 July).

Summary and Future Directions

Oceanographic conditions off Yaquina Head in 2021 were neutral to favorable; effects of an offshore heatwave were mitigated by strong coastal upwelling. Smelts, sand lance and herring have historically comprised murre diets off Oregon and Washington (as described in Gladics et al 2015). Accordingly, the sampled murre diet in 2021 were smelt dominated, and did not indicate anomalous or unfavorable foraging conditions for the murres. Bald eagle disturbances were common at Yaquina Head in 2021, although we did not observe egg depredation or eagle aggregations anywhere near that observed in 2020 suggesting that visitors and park attendance may have an indirect effect on murre productivity via passive predator control (described in Hentati-Sundberg et al 2021). Despite regular disturbances and egg depredation, murres were able to successfully fledge chicks in 2021. Since 2017, annual median hatch dates have been long term median hatch date for murres. Greater murre reproductive success may be associated with later hatch dates and presumably later laying dates which could be a response to frequent disturbances earlier in the nesting season.

Long-term research and monitoring efforts at YHONA are becoming increasingly valuable to oceanographic research and monitoring off Oregon, joining efforts such as monitoring along the Newport Hydrographic Line and a wide array of other research conducted by NOAA Fisheries, Oregon State University, USFWS and others, including the cabled ocean observing system offshore of Yaquina Head (Endurance Array http://ceos.oregonstate.edu/ooi & http://oceanobservatories.org/array/coastal-endurance/).

Data
California Current Integrated Ecosystem Assessments
https://www.integratedecosystemassessment.noaa.gov/regions/california-current/cc-seabirds

Presentations
Klunis, L., Orben, RA. 2021. Time Series of Pelagic and Brandt's Cormorant Reproductive Success from 2007 - Present, Oregon State University Summer Research Symposium 2021,

Publications
Weber, ED, et al…C Horton**,** RA Orben, JM Porquez, …. State of the California Current 2019-2020: Back to the Future with Marine Heatwaves? Frontiers in Marine Science. https://doi.org/10.3389/fmars.2021.709454

Harvey, C.J., Garfield, N., Williams, G.D., Tolimieri, N. 2021. Ecosystem Status Report of the California Current for 2020-21: A Summary of Ecosystem Indicators Compiled by the California Current Integrated Ecosystem Assessment Team (CCIEA). NOAA Technical Memorandum NMFS-NWFSC ; 171. Doi: https://doi.org/10.25923/x4ge-hn11

In preparation
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Harvey, C.J., Garfield, N., Williams, G.D., Tolimieri, N. 2022. Ecosystem Status Report of the California Current for 2021-22: A Summary of Ecosystem Indicators Compiled by the California Current Integrated Ecosystem Assessment Team (CCIEA). NOAA Technical Memorandum NMFS-NWFSC.

Acknowledgements
Monitoring in 2021 was funded by the USFWS and BLM through a 5-year CESU agreement (2021-2025) between USFWS and OSU. The NSF Research Experience for Undergraduates through Hatfield Marine Science Center supported funding for Laney Klunis and Aidan Cox (NSF OCE-1758000). The BLM and Environment for the Americas provided funding for Ed Kim. Data collected during the 2021 field season would not have been possible without the support of the Bureau of Land Management (Katherine Fuller, Matthew Betenson, Jay Moeller, Meredith Matherly, Alyssa Uhen, and the staff at YHONA).

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Table 1. Preliminary summary metrics from studies of Common Murres at Yaquina Head colony, 2007-2021

Observation				Hatch Date					Predation Rate # per hour[c] (total #)		
Year	Hours	Days	# plots	1st	Med	Hatching Success[a]	Reproductive Success[b]	# disturbances	Egg	Chick	Adult
2007	149	30	11[d]	6/20	6/27	0.70 (+ 0.05 SE)	0.54 (+ 0.07 SE)	23	0.21 (32)	0.00 (0)	0.06 (9)
2008	117	35	11[d]	6/10	6/23	0.86 (+ 0.04 SE)	0.77 (+ 0.05 SE)	20	0.21 (25)	0.00 (0)	0.04 (5)
2009	140	53[f]	10[e]	6/17	6/24	0.86 (+ 0.03 SE)	0.77 (+ 0.04 SE)	27	0.36 (50)	0.00 (0)	0.04 (6)
2010	223	56	11[d]	6/24	7/8	0.87 (+ 0.04 SE)	0.68 (+ 0.04 SE)	20	1.07 (239)	0.04 (10)	0.00 (0)
2011	372	79	11[d]	6/28	7/8	0.36220 (+ 0.07 SE)	0. 22 (+ 0.05 SE)	186	2.78 (1034)	0.38 (142)	0.19 (70)
2012	264	53	12	6/25	6/28	0.46 (+ 0.09 SE)	0.27 (+ 0.06 SE)	220	2.69 (710)	1.16 (305)	0.17 (46)
2013	200[g]	62	12	6/24	7/4	0.41 (+ 0.09 SE)	0.24 (+ 0.09 SE)	80	1.47 (275)	0.22 (40)	0.18 (33)
2014	156	51	12	6/29	7/3	0.23 (+ 0.13 SE)	0.17 (+ 0.11 SE)	75	1.37 (215)	0 (0)	0.16 (25)
2015	110	46	12	NA	NA	0.00 (+ 0.00 SE)	0.00 (+ 0.00 SE)	65	3.27 (360)	0 (0)	0.22 (24)
2016	243	74	13[h]	6/28	7/5	0.03 (+ 0.02 SE)	0.02 (+ 0.02 SE)	132	4.21 (1023)	0.03 (7)	0.28 (67)
2017	203	99	10[i]	NA	NA	0.00 (+ 0.00 SE)	0.00 (+ 0.00 SE)	107	2.38 (483)	0 (0)	0.07 (15)
2018	307	80	19[i]	7/7	7/15	0.51 (+ 0.04 SE)	0.79 (+ 0.04 SE)	120	0.78 (239)	0.04 (6)	0.15 (23)
2019	183	40	12[i]	7/1	7/9	0.69 (± 0.04 SE)	0.79 (± 0.04 SE)	30	0.26 (47)	0 (0)	0.08 (14)
2020	55.25	36	12[i]	6/28	7/14	0.015 (± 0.04)	0.029 (± 0.09)	32	12.14 (671)	0 (0)	0.20 (11)
2021	164.9	52	9	6/19	7/5	0.64 (±0.09)	0.47 (±0.08)	55	1.38 (228)	0 (0)	0.05 (9)

[a]Chicks hatched per eggs laid (mean among plots)
[b]Chicks fledged (>15 days old) per eggs laid (mean among plots)
[c]Total # observed taken/total # observation hours
[d]Two adjacent plots (CR5 & CR6) were combined because of a low number of visible eggs to follow
[e]Two sets of adjacent plots (CR2 & CR3, CR5 & CR6) combined due to low number of visible eggs to follow
[f]Thick fog limited observations to very short time periods or prevented observations altogether during some days in July – much more so than in previous years.
[g]Observation hours for disturbance were lower (186 hours, 58 days) because a data book was lost in the field and could not be recovered.
[h]Of the original 12 plots, two adjacent plots (CR2 & CR3) were combined, CR5 was excluded because no eggs within view survived long enough to be mapped within the plot, CR6 was excluded because only one egg was laid within view of observers, and 3 new plots were added on Lower Colony Rock, Satellite Rock, and Flat Top Rock.
[i] Viewing was restricted to ground level at Yaquina Head. We were not able to use the lighthouse gallery deck as an observation point to look down on the colony. This new viewpoint did not permit observations of FT2 nor the south end of Flat Top Rock. All or a portion of plots from previous years were viewed, however, pairs from some were combined because there were too few pairs (< 10) followed in some plots (FT3,4,5,&6). Additionally, two new plots were added, one each on Whale Rock and Lion's Head Rock, although with < 10 pairs in each, these plots were combined in final analyses.

Table 2. Reproductive metrics of Brandt's cormorants at the Yaquina Head colony, 2008-2019

Year	# Nests	Median Hatch Date	Average Brood Size	Fledge Success[a]	Reproductive Success[b]
2008	71	7/8	2.38	0.23	0.55
2009	4	7/11	1.60	0.50	1.00
2010	47	6/30	1.51	0.17	0.25
2011	93	7/11	1.54	0.27	0.42
2012	33	7/20	1.15	0.16	0.18
2013	123	7/9	1.05	0.54	0.57
2014	60	7/3	1.87	0.45	0.72
2015	84	7/21	2.33	0.73	1.70
2016	46	6/27	1.65	0.53	0.87
2017	86	7/6	1.73	0.51	0.79
2018	61	7/10	2.08	0.89	1.69
2019	35	7/5	2.49	0.86	2.11
2020	47	7/13	2.23	0.34	1.12
2021	33	7/5	2.27	0.87	2.7

[a](# of chicks that survive to >25 days old)/(# of chicks hatched)
[b](# of chicks that survive to >25 days old)/(# of nests)

Table 3. Reproductive metrics of pelagic cormorants at the Yaquina Head colony, 2008-2019

Year	# Nests	Median Hatch Date	Average Brood Size	Fledge Success[a]	Reproductive Success[b]
2008	20	7/8	1.80	0.44	0.84
2009	12	7/23	1.83	0.09	0.14
2010	26	7/21	1.52	0.28	0.35
2011	6	7/18	0.33	0.00	0.00
2012	16	7/20	2.63	0.40	1.06
2013	16	7/9	2.69	0.79	2.13
2014	34	7/3	2.29	0.53	1.21
2015	11	7/24	0.09	0.00	0.00
2016	30	7/13	2.17	0.63	1.37
2017	46	7/18	2.00	0.75	1.65
2018	37	7/6	2.76	0.86	2.27
2019	28	NA[c]	1.86	0.32	0.61
2020	24	7/5	3.3	0.73	2.48
2021	37	7/8	2.59	0.82	1.73

[a](# of chicks that survive to >25 days old)/(# of chicks hatched)

[b](# of chicks that survive to >25 days old)/(# of nests)

[c]Pelagic cormorant chicks were present in many nests when monitoring began in 2019, therefore we did not feel our sample would reflect an accurate hatch date.

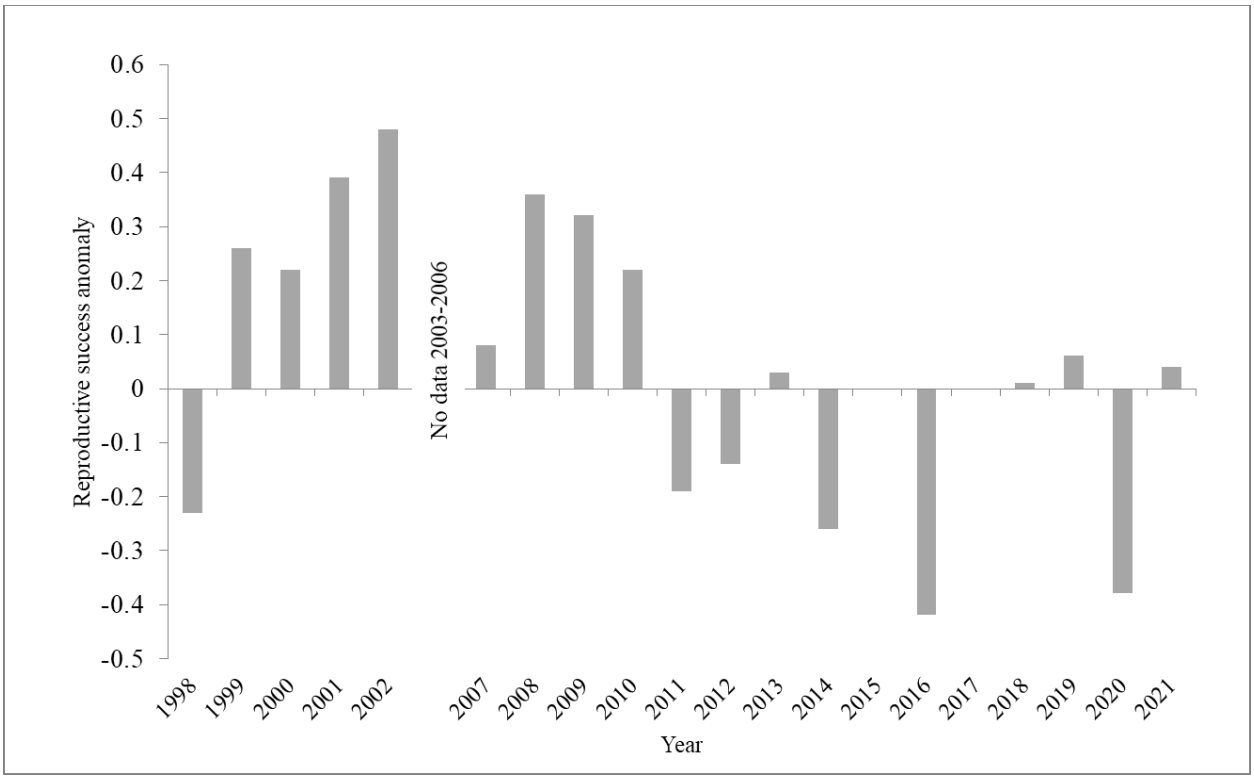

Figure 1. Long term common murre reproductive success (~0.43) with yearly anomaly. Although murre productivity was near the mean in 2021, mean reproductive success of the study has generally declined in the past decade.

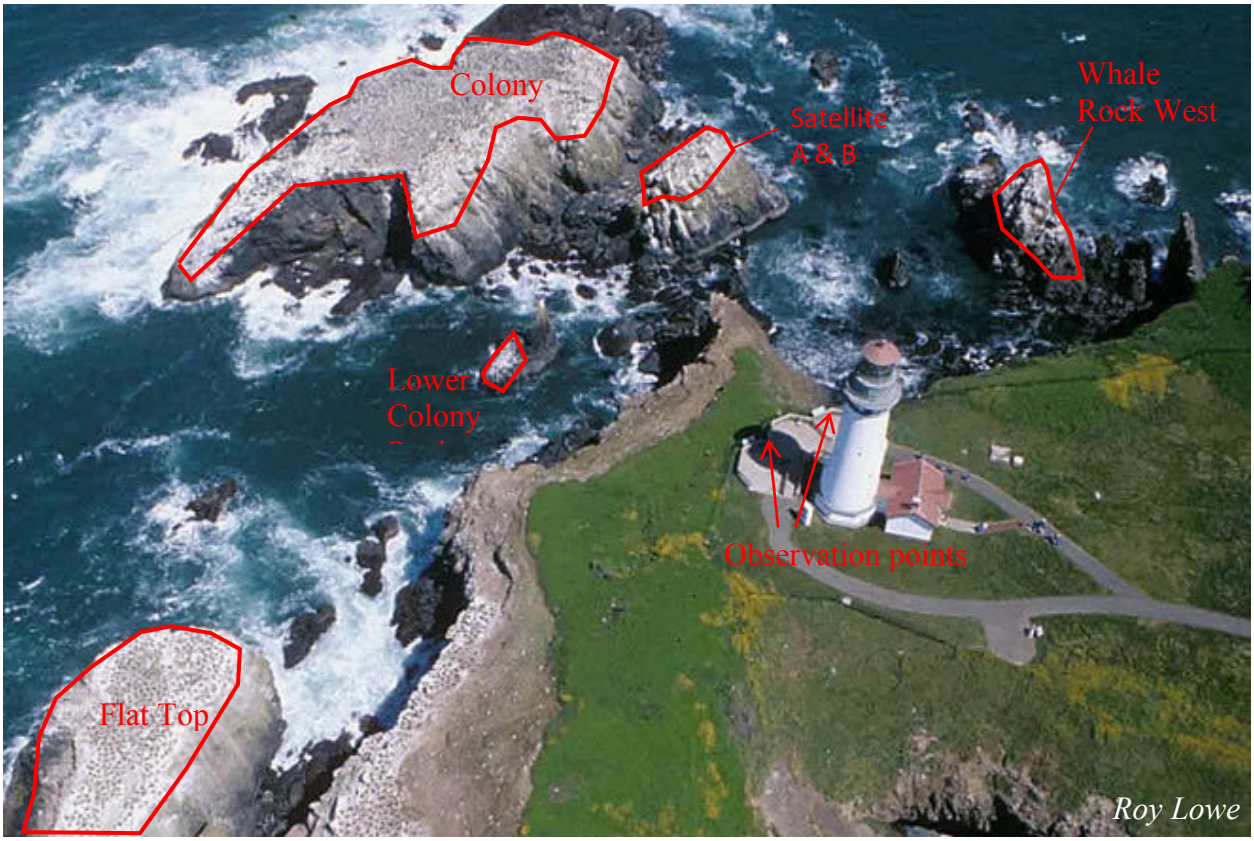

Figure 2. 2021 common murre study plots included three on Colony Rock, two on Satellite, and one on Flat Top, Lower Colony, and Whale Rock West. In addition, we monitored one plot of common murres on Stegosaurus Rock (not pictured, on the south end of Yaquina Head). Typically, three additional plots on Colony Rock are monitored, but these were void of birds in 2021.

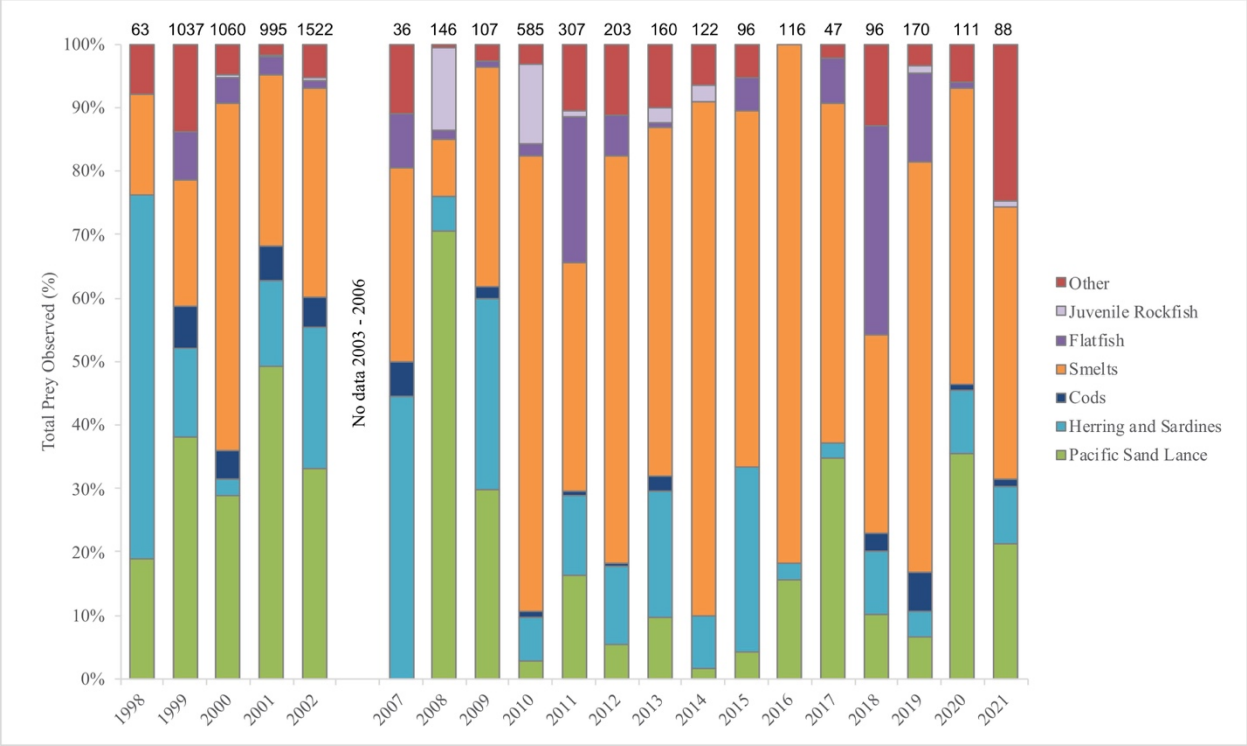

Figure 3. Diets of common murre chicks (% occurrence) 1998-2021, number of identified individual prey items indicated above each bar. Diet in 2008, a particularly cold-water year, stands out with a high proportion of sand lance, 2010 diets had a pulse of juvenile rockfish and began a period of mostly smelt dominated diets that continued through 2016, with the exception of 2011. 2011 was also notable for increased consumption of flatfish during an upwelling relaxation period. Diets in 2016 had the highest percentages of smelt in the time series. In 2018, the highest rate of flat fish provisions was observed. In 2019 we observed a return to smelt dominated diets. In 2021 diet proportions reflected many previous years with smelt comprising most of the sampled diet. A high proportion of "other" in 2021 reflects a higher than average detection of juvenile salmon (~15.9% of all prey items identified)