Yaquina Head Seabird Colony Monitoring
2014 Season Summary

Robert Suryan, Ian Throckmorton, Amanda Gladics
Department of Fisheries and Wildlife, Oregon State University,
Hatfield Marine Science Center, Newport, Oregon,
rob.suryan@oregonstate.edu, 541-867-0223

Jessica Porquez
Marine Resource Management, College of Earth, Ocean, and Atmospheric Sciences,
Oregon State University, Hatfield Marine Science Center, Newport, Oregon

Lucila Fernandez
Environment for the Americas, BLM Yaquina Head Outstanding Natural Area, USFWS
Oregon Coast National Wildlife Refuge Complex, and Oregon State University, Hatfield
Marine Science Center, Newport, Oregon

Alessandra Jimenez
National Science Foundation, Research Experience for Undergraduates, Hatfield Marine
Science Center, Newport, Oregon & Whitworth University, Spokane, Washington

November 2014

Project Overview

Yaquina Head Outstanding Natural Area (YHONA) is home to some of Oregons's largest and most publically visible seabird colonies, including over 60,000 Common Murres (*Uria aalge*). 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. Additionally, this has been one of the most rapidly growing and productive murre colonies on the Oregon coast. In the past 4 years however, reproductive success has been greatly reduced and colony size has fluctuated markedly. Summer 2014 was the 8th consecutive year of collaboration between Oregon State University, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Combined with similar studies conducted by Julia Parrish (University of Washington) at YHONA from 1998 to 2002, we are now developing a much needed time series investigation for the Oregon Coast (currently at 13 years). Unfortunately, no reproduction and diet data (other than stable isotope samples) were collected at YHONA from 2003-2006, a timeframe containing highly anomalous ocean conditions. 2014 was a mixed year in regards to environmental conditions. Following the La Niña influenced 2011, neutral ENSO conditions persisted in 2012 and 2013. Early models suggested that weak El Niño conditions were likely to develop during the spring or summer of 2014, but conditions in the NE tropical Pacific remained below the El Niño threshold throughout the summer and into the early fall. The conditions in 2014 started with a slightly later than average spring transition but average upwelling winds during May through July, somewhat similar to the conditions during 2012. Observations of bottom water offshore from the Yaquina Head colonies continued to be nearly 1.5°C colder than average through March, 2014. Therefore, these continue to be interesting years to capture seabird responses to environmental variability on the central Oregon coast.

In general, we are interested in how seabird breeding chronology, reproductive success, diet, and foraging activities are affected by changing ocean conditions. Furthermore, we wish to quantify the effects of bald eagles and other sources of predation on or disturbance to seabirds during the breeding season. At YHONA, we monitored 12 plots on Colony Rock and Flattop Rock (Fig. 1) throughout the breeding season (April-August). Within these plots, we closely observed breeding birds (Fig. 2), watching and recording when eggs were laid and then following the success of each breeding pair through egg incubation and chick rearing. Simultaneously, we watched for disturbances to the breeding colony and recorded the frequency, duration, and consequences (e.g., loss of eggs or chicks) of these events. For prey identification, we used a digital camera and spotting scope (digiscoping; Fig. 3) to photograph fish in the bills of murres returning to the colony. This information allows us to analyze the birds' diet and provide information about foraging conditions and link to oceanographic investigations adjacent to these seabird colonies. We also conducted observations to estimate the time elapsed between chick feeding events, which can be used as a proxy for prey availability near the colony.

Results

In 2014 we logged 156 hours during 51 days of observations between 21 May and 31 July (Table 1). Common Murre chicks were first observed on 29 June and **median**

hatch date was 3 July, similar to some previous years but a week later than we observed in 2012. Colony Rock and Flattop Rock were again relatively synchronous in median hatch date (Colony = 4 July, Flat Top = 2 July). Among plots, only 23% (± 0.13 SE, 0.00-0.86 range) of the eggs laid hatched a chick (hatching success) and 17% (± 0.11 SE, 0.00-0.81 range) of the eggs laid produced chicks that fledged (reproductive success; chicks ≥ 15 days were considered fledged; Table 1). **Reproductive success in 2014 was the lowest recorded for this colony during 13 years of data collection, maintaining a 4 yr run (2011-2014) of low reproductive success that is less than half the success for the first four years of our study (2007-2010, Table 1)**.

During 156 hours of observation, we witnessed 75 disturbance events where a minimum of 215 eggs, and 25 adult murres were taken (Table 1). There were no observations of chicks taken. Like the previous two seasons, much of the reproductive loss in 2014 was due to egg predators. The total number of disturbances and the rate of murre egg and adult loss in 2014 was again high like the previous four years, which were all 3-10 times higher than 2007-2009. Disturbance rates first began to increase in 2010, and then greatly escalated in 2011 and 2012. **Lower rates for egg and chick loss in 2014 (Table 1) are possibly an artifact of reduced predator observation effort and that many disturbance events were already in progress when observers arrived early in the morning.** Therefore, the rates of egg and chick loss should be considered conservative estimates. The rate of adults killed per hour of observation was similar to those observed in 2013. **Bald Eagles (*Haliaeetus leucocephalus*) were again the dominant disturbance source (Fig. 5, 49%, 36 of 75 disturbances), but there was a high number of disturbances for which the primary cause remained unknown (47%, 35 of 75). In many cases, these disturbance events were initiated prior to observers arriving for the day, and were likely also caused by eagles.** The frequent disturbances to Flat Top resulted in total reproductive failure for those plots (reproductive success = 0.00 ± 0.00 SE) – this was the first year that we observed complete failure of either sub-colony. There were no dramatic disturbances caused by brown pelicans, and pelicans were not observed landing on the colony until the majority of murres had fledged.

Murre diets have varied annually. Preliminary results of forage fish species consumed in 2014 included smelt (Osmeridae) and secondarily Pacific herring or sardine (Clupeidae) and Pacific sand lance (*Ammodytes hexapterus*) (Fig. 6). Since we generally focus our diet data collections on Flat Top rock, the total failure of Flat Top prior to chick rearing provided an added challenge for diet data collection this year. We were still able to collect sufficient samples from birds returning to Colony Rock, but the longer distance between our observation point and the birds reduced the quality of the photos. **A notable difference in diets in recent years has been the dominance of smelt since 2010 (with minor exception of 2011). Prior to this period, annual diet composition varied between dominance of smelt, sand lance, and clupeids, or occasionally relatively equal proportions of each in a given year.**

For a fifth year we also conducted chick provisioning rate watches. Typically, we conduct four per year throughout chick rearing, and we were able to complete all four watches in 2014. Observers recorded the frequency that adult murres were delivering food to chicks at selected nests. Chick feeding rates (also foraging trip duration) are a good overall measure of food availability and will be a valuable metric to compare among years. We also collected feathers of beach-cast murre chick carcasses for stable isotope analyses of diet composition and nutrient sources. Interesting patterns are developing from analyses of these data that we look forward to reporting on.

We have been monitoring Brandt's and Pelagic Cormorant nests over the years and have begun to summarize these data. Cormorant reproductive success in 2014 was below 1 chick pre nest for each species (Tables 2 and 3).

Summary and Future Directions – Project Integration

We continue to see shifting dynamics between murres and eagles, along with secondary predators. Although disturbance and predation rates have been variable in the past four years, the disturbance activity has remained elevated compared to the early years of our study (2007-2009). The predation rates in 2010-2014 have ranged from 4 to 10 times the average disturbance rate (disturbances/hour of observation) during 2007-2009. Additionally, these elevated disturbance rates appear to be consistently taking a toll on reproductive output of the colony. If high disturbance rates, along with low reproductive success continues it is possible that we will begin to observe consequences in the overall size of the colony. Murre diets over the past few years reflected more warm water associated smelt in 2010 vs. cooler water associated sand lance (and fewer smelt) in 2011, which is consistent with El Nino vs. La Nina influenced summers, respectively. During both 2012 and 2013 the El Nino conditions were neutral, and the diets also reflected an intermediate proportion of prey species and both years were relatively similar in murre diet composition. Despite the neutral conditions recorded during 2014, the diets reflected elevated smelt levels more typical of warmer water conditions.

We will continue studies in 2015 with the ultimate goal of continuing long-term monitoring at this site. We will continue to analyze our archived data of cormorant reproductive success data and look forward to adding prior and future time series to cormorant data in Tables 2-3. We will continue to explore using remote cameras for data collection and with the extension of fiber optic cables to the headland in the coming years we will evaluate possibilities to connect cameras to internet access. An internet connected camera would enhance our data collection opportunities and provide an excellent public education and outreach tool. Also in 2015, we will initiate a multi-species at-sea tracking and habitat use study funded by the U.S. Bureau of Ocean Energy Management, and intend to include common murres among the focal species. The study will include tagging individual murres with GPS tracking and time-depth recording devices with remote data download to provide greater insights into murre foraging ecology.

Long-term research and monitoring efforts at YHONA are becoming increasingly valuable to oceanographic research and monitoring off Oregon, such as the Newport Hydrographic Line and a wide array of other research conducted by NOAA Fisheries and Oregon State University, including the cabled ocean observing system offshore of Yaquina Head (Endurance Array http://www.whoi.edu/page.do?pid=29616 & http://www.nanoos.org/about_nanoos/intro.php).

Publications

Gladics, A. J., R. M. Suryan, R. D. Brodeur, L. M. Segui, and L. Z. Filliger. 2014. Constancy and change in marine predator diets across a shift in oceanographic conditions in the Northern California Current. Marine Biology 161:837-851. DOI:10.1007/s00227-013-2384-4

Gladics, A. J., R. M. Suryan, J. K. Parrish, C. A. Horton, E. A. Daly, and W. T. Peterson. In press. Environmental drivers and reproductive consequences of variation in the diet of a marine predator. Journal of Marine Systems. http://dx.doi.org/10.1016/j.jmarsys.2014.06.015

In the News

OSU Research Office - Terra Newsletter & Magazine

http://www.osualum.com/controls/email_marketing/admin/email_marketing_email_viewer.aspx?sid=359&gid=34&eiid=4066&seiid=3523&usearchive=1&puid=060054ba-ae76-4b2e-900b-d43c0b9a09d0

http://oregonstate.edu/terra/2014/10/a-rocky-outlook/

Acknowledgements

Data collection during the 2014 field season would not have been possible without the support of the Bureau of Land Management (Tim Fisher, Katherine Fuller, Jay Moeller and staff at the Yaquina Head Outstanding Natural Area) and the U.S. Fish and Wildlife Service (Roy Lowe, Dawn Harris, Shawn Stephensen, Rebecca Chuck, and Amelia O'Connor of the Oregon Coast National Wildlife Refuge Complex, and Roberta Swift USFWS Migratory Birds and Habitat Programs – Pacific Region). We thank Cheryl Horton for continued guidance and advice on field operations. We also thank Suzanne Pargee, Sarah Pond, Meagan Campbell, Tessa Diehl, Liana Housten, Chase Cobb and Jen Rothe for help conducting provisioning rate observations. Funding for these studies was provided by the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Environment for the Americas (through support of an undergraduate intern), and the National Science Foundation (through the Research Experience for Undergraduate program).

Table 1. Preliminary summary metrics from studies of Common Murres at the Yaquina Head colony, 2007-2014.

	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	0.36 (+ 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)

[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) were combined because of a 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.

Table 2. Preliminary summary metrics from studies of Brant's cormorants at the Yaquina Head colony, 2014

Year	**# Nests**	**Median Hatch Date**	**Reproductive Success[a]**
2014	60	7/3	0.72

[a]Chicks fledged (≥25 days old); mean among nests

Table 3. Preliminary summary metrics from studies of pelagic cormorants at the Yaquina Head colony, 2014

Year	**# Nests**	**Median Hatch Date**	**Reproductive Success[a]**
2014	34	7/3	0.97

[a]Chicks fledged (≥25 days old); mean among nests

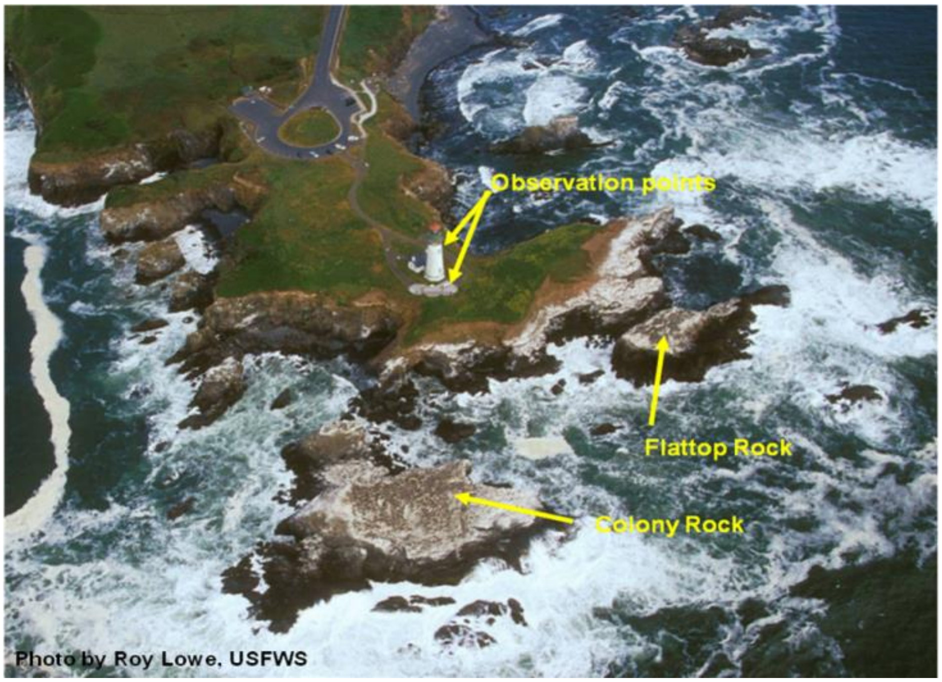

Figure 1. Study plots on Colony and Flattop Rocks.

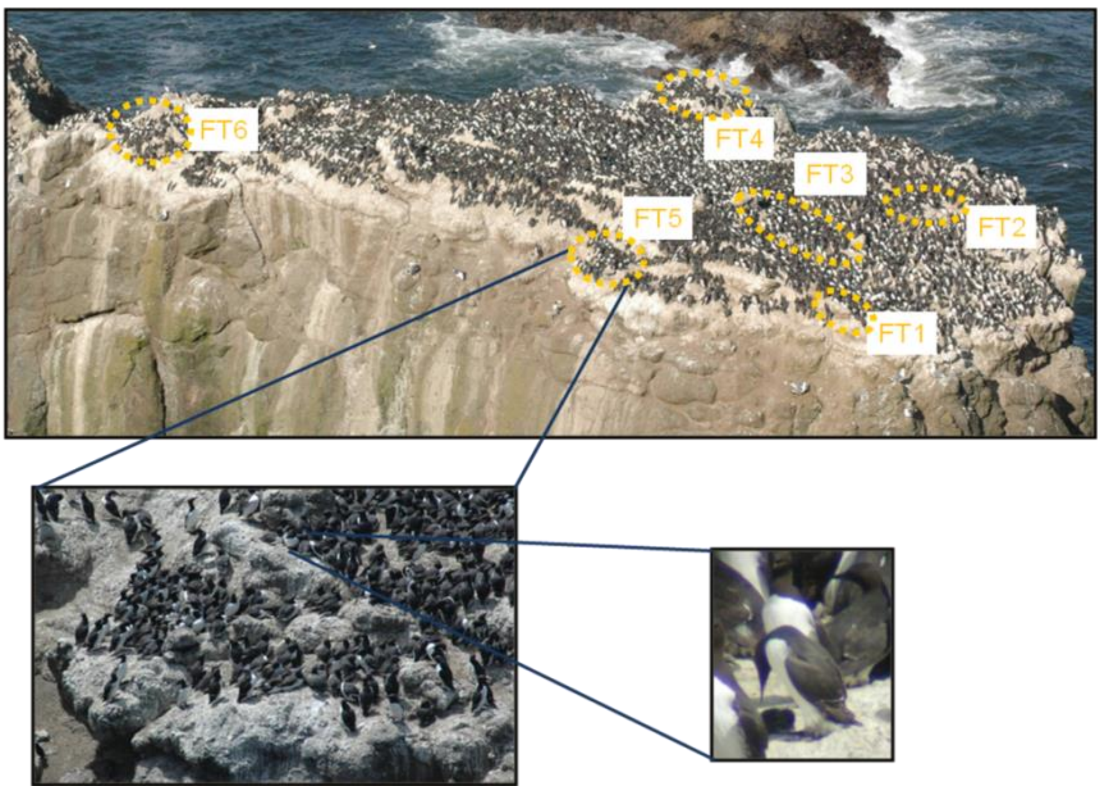

Figure 2. Close-up of Flattop Rock, plot #5, and an adult with a young chick

Figure 3. Digiscoping techniques for photographing and identifying forage fish delivered by adult murres to feed their chicks on the colony.

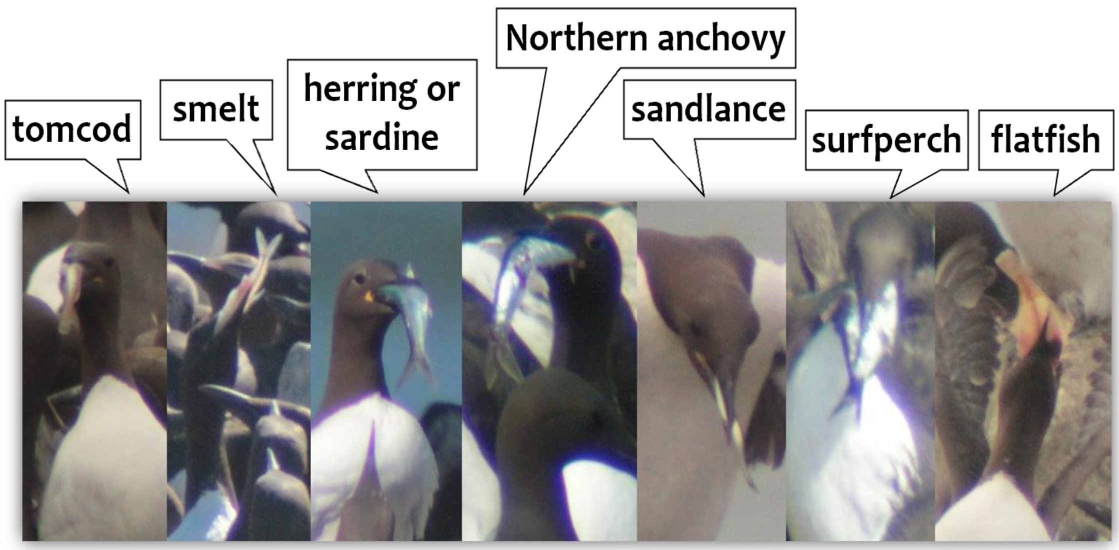

Figure 4. Prey photos taken from the observation deck at the base of the lighthouse.

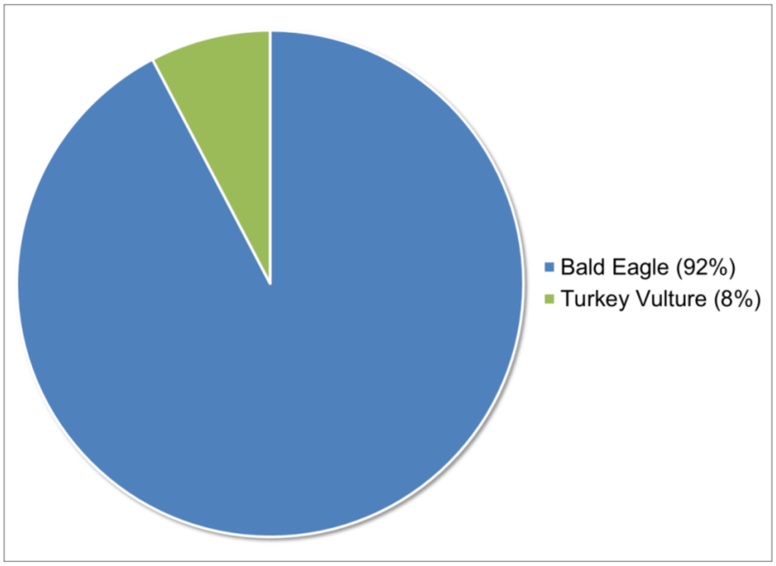

Figure 5. Identifiable sources of disturbance to Common Murres at Yaquina Head in 2014. A total of 75 disturbances were recorded, and the source of the disturbance was identified in 39 instances**.** Many of the disturbances in which the cause could not be determined were initiated before observers arrived in the morning, and were likely caused by eagles.

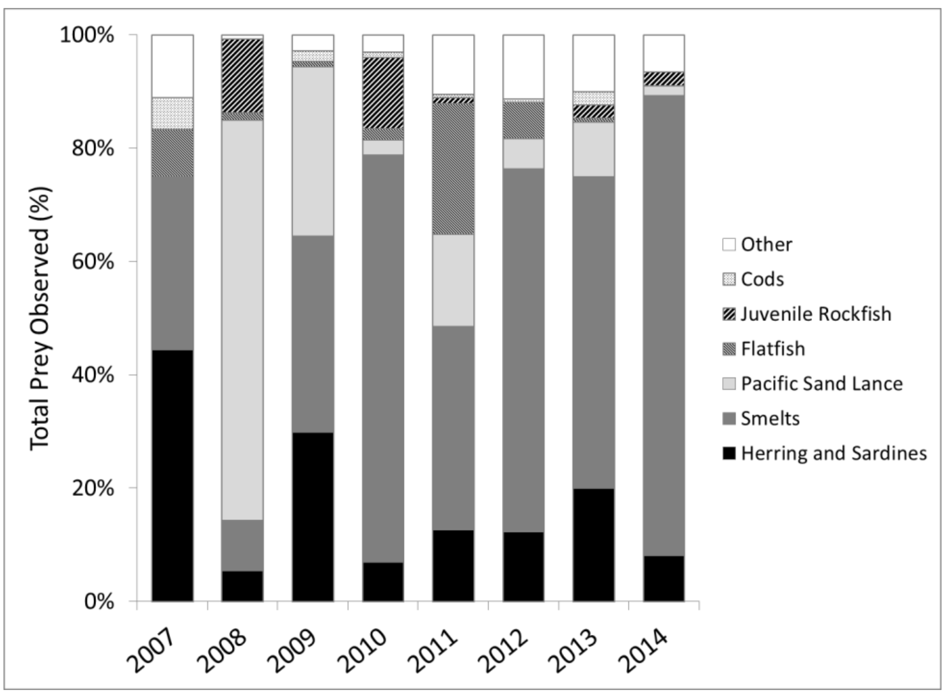

Figure 6. Diets of Common Murres (% occurrence) during 2007-2014. Diet in 2008 stands out as a remarkable year for sandlance, 2010 diets had a remarkably high percentage of smelts and unusually high amount of juvenile rockfish, 2011 is notable for an increased consumption of flatfish, and preliminary data show 2014 as another season dominated by smelts.