

INVESTIGATION OF A LARGESCALE COMMON MURRE (*Uria aalge*) MORTALITY EVENT IN CALIFORNIA IN 2015

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Background Information

- Beginning in August 2015, a large number of Common Murres (*Uria aalge*) were reported dead on north central and central California beaches.
- Beachcast bird survey programs reported higher than average deposition from August through November with combined deposition greater than 5,686 at rates greater than 3 standard deviations above regional long-term mean.
- Local rehabilitation centers collectively received more than 1,200 live stranded debilitated murres from Sonoma County to Los Angeles County during August–December.
- The majority of the birds examined via necropsy were hatch year birds.
- Internal examinations revealed that the majority of the birds examined showed signs of emaciation.
- There was a large, concurrent die-off of murres in Alaska and Washington.
- No major die-offs of other seabirds were reported during these months.

Beached Bird Survey Data

- Beachcast bird survey data was collected and compiled by two effort-based beached bird programs:
 - Beach Watch** (Gulf of the Farallones National Marine Sanctuary and Farallones Marine Sanctuary Association; Mendocino through San Mateo Counties)
 - BeachCOMBERS** (Moss Landing Marine Labs and Monterey Bay National Marine Sanctuary; Santa Cruz through Ventura Counties)
- Beach Watch reported 530 dead murres in August, 1,316 in September, 971 in October, 208 in November, and 51 in December. This event was 9 times greater than the long-term average rate (4.74 birds/km surveyed and 0.46 birds/km, respectively) for the time of year (Figure 2). Age class of beach cast Common Murres shifted as the event progressed, which affected more hatch year birds (or young of year) more than 75% in August, to end of the event, which affected more of the older, second-year birds 50% adult or after hatch year birds.
- BeachCOMBERS reported 165 dead murres in August, 750 in September, 1,070 in October, and 722 murres in November. The central coast region event was 6 times greater than the long-term average rate (6.34 birds/km surveyed and 0.86 birds/km, respectively) for the same time of year (Figure 2). The south coast region event was 28 times greater than the long-term average rate (3.10 birds/km surveyed and 0.10 birds/km, respectively).

Rehabilitation Center Data

- Concurrent with the large deposition of beachcast birds, International Bird Rescue (IBR) and other coastal wildlife rehabilitation centers collectively received 1271 live stranded debilitated murres from Sonoma County to Los Angeles County between August and December (Figure 3).
- Numbers of intake were much higher among rehabilitation centers from Sonoma to Monterey County (Figure 3).
- 59.5% of 509 murres presented to IBR's San Francisco Bay center were after hatch year (AHY) adults as determined by plumage wear and supra-orbital ridge development (Figure 4).
- AHY murres entered care at 59-75% of wild mean mass.
 - Admission body weight: mean +/-SD = 685 +/- 83.7g, median = 675g, mode = 650g, n = 274
 - Published wild mean body mass = 1022g (Newman 1998)
 - Nadir of fat mass in AHY COMU = 675g (Duerr and Klasing 2015)
- AHY birds were admitted with generally poor plumage condition, often with stripped flight feathers and worn or broken contour feathers.
- HY birds largely presented as older chicks in poor nutritional condition.
- 148 birds were euthanized due to extremely poor plumage, other remained in care up to 3 months awaiting molt.
- Stranded murres responded well to supplemental food
- Small numbers of birds presented for rehabilitation tested positive for avian pox and others showed infection with hemoparasites.



Figure 1. Beachcast hatch year Common Murre.

Examination of Carcasses

- To determine the probable cause of death, as well as age and sex, external and internal examinations were performed at two separate facilities:
 - USGS NWHC** (U.S. Geological Survey, National Wildlife Health Center, Madison, WI; n=7)
 - CDFW MWVRC** (CA Department of Fish and Wildlife, Marine Wildlife Veterinary Care and Research Center, Santa Cruz, CA; n=17)
- Necropsy results from NWHC:
 - Age: 5/7 (71%) were "immature" based on plumage and presence/absence of bursa (Figure 5)
 - Sex: 4/7 (57%) male, 2/7 (29%) female, 1/7 unknown (Figure 5)
 - Molting status: One bird collected in early August had flight feathers in pin which were almost fully grown, while those submitted in late August were either not molting or were molting coverts
 - Gross findings: Emaciation, melena, and wet lungs were consistent findings
 - Samples from birds necropsied at NWHC were tested at NWHC for histopathology and diagnostic testing, and additional samples were sent to NOAA's Northwest Fisheries Science Center for harmful algal bloom testing.
- Necropsy results from MWVRC:
 - Age: 11/17 (65%) were hatch year birds, 6/17 (35%) were adult birds were hatch year birds determined by: head plumage, supraorbital ridge, and bursa of fabricus (Nevins and Carter, 2003 wing plumage and culmen length (Pyle pers. comm. Nov, 24, 2015; Figure 5).
 - Sex: 9/17 (53%) male, 4/17 (35%) female, 2/17 (12%) unknown (Figure 5)
 - Molting status: Most of the birds examined also exhibited signs of active molting (94%).
 - Gross findings: Emaciation, and melena were consistent findings.
 - Samples from birds necropsied at MWVRC were sent to UCSC Kudela Laboratory for harmful algal bloom testing.

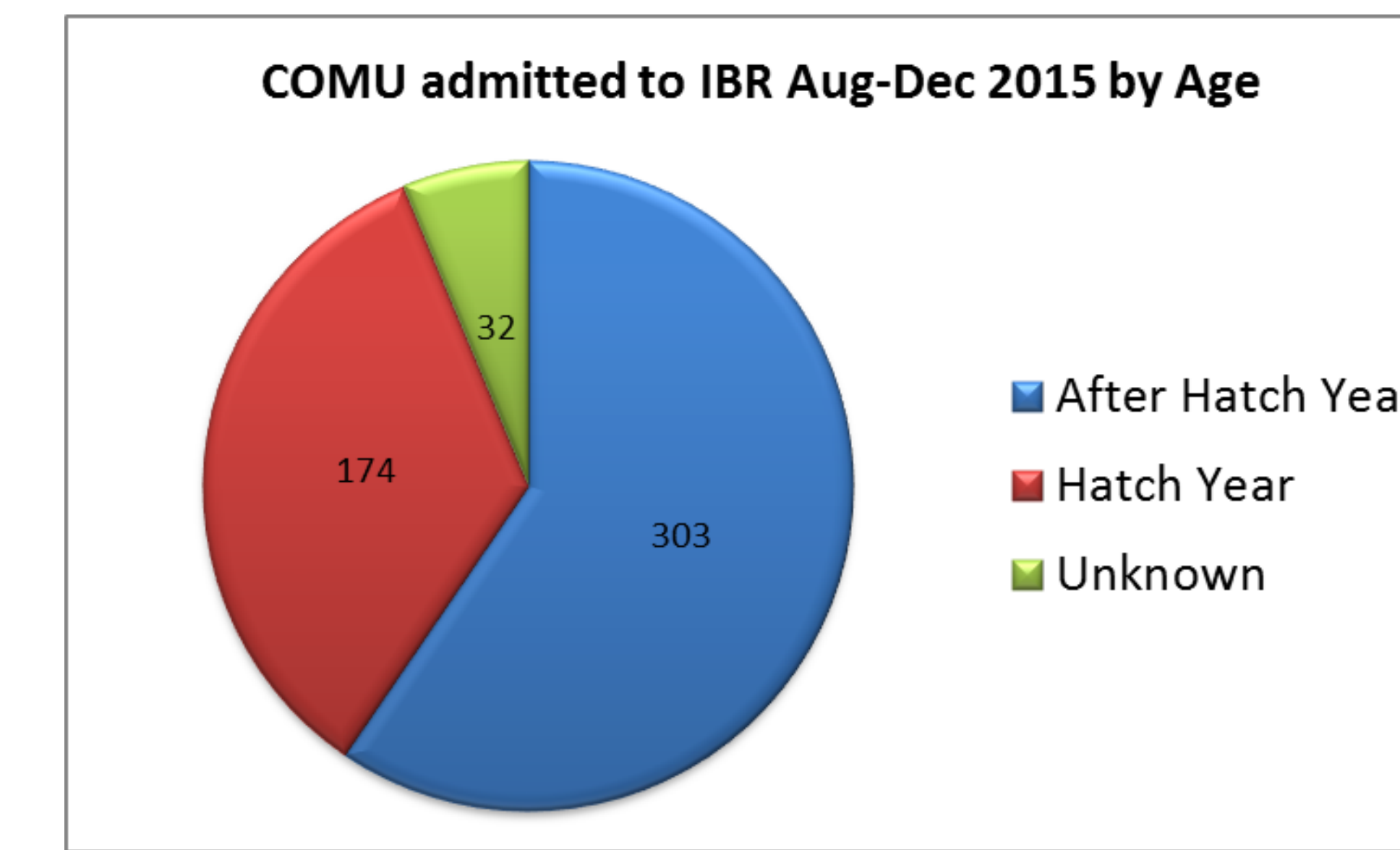


Figure 4. COMU admitted to IBR Aug-Dec 2015 by age.

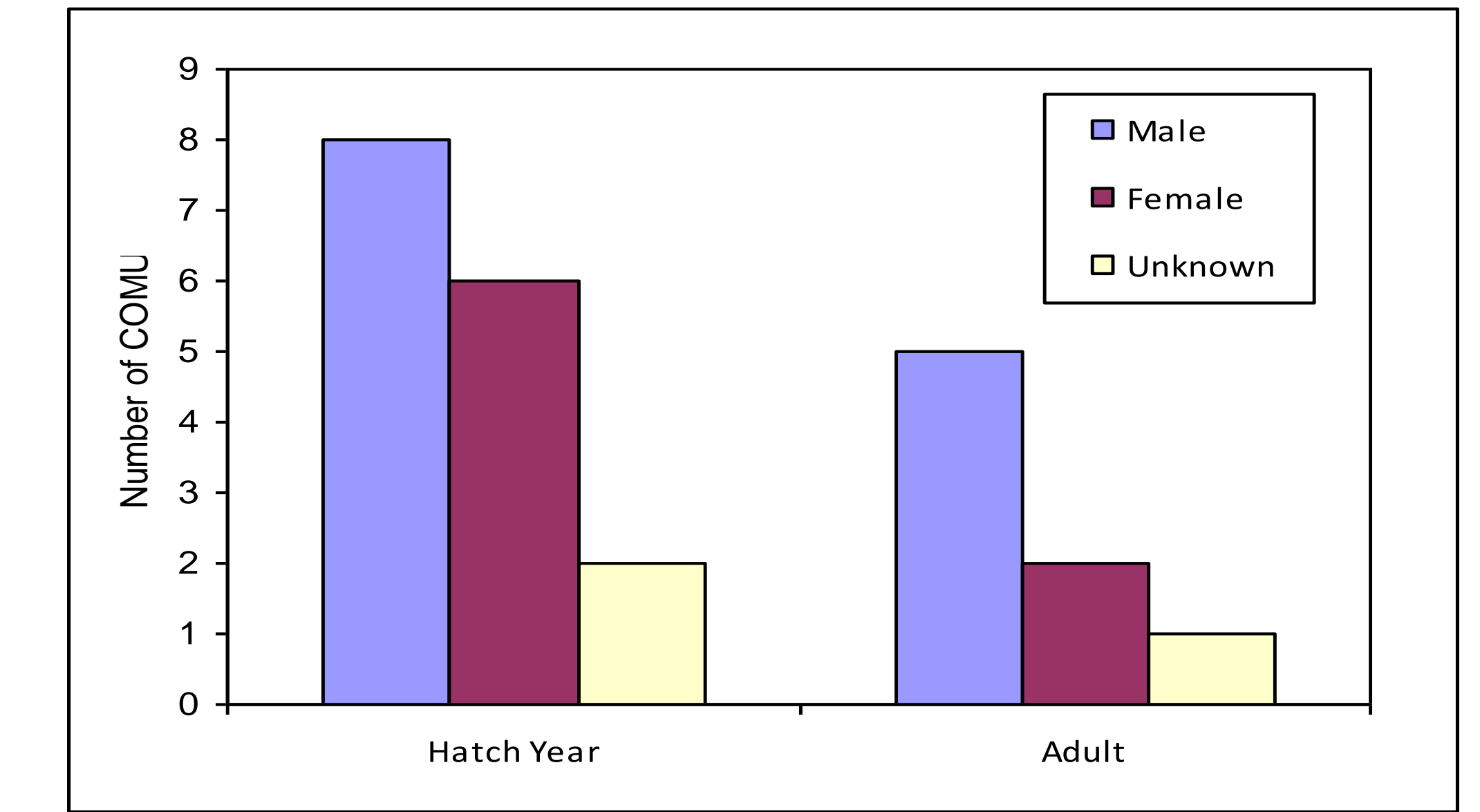


Figure 5. Age and sex of COMUs examined by MWVRC and NWHC

Infectious Disease and Harmful Algal Bloom Toxins

- To further investigate cause of death, histopathology and diagnostic testing was performed at two facilities:
 - USGS NWHC** (Madison, WI; diagnostic testing, histopathology; n=7)
 - NOAA Northwest Fisheries Science Center** (Seattle, WA; harmful algal bloom toxin testing; n=7)
 - UCSC Kudela Laboratory** (University of California, Santa Cruz, harmful algal bloom toxin testing; n=16)
- NWHC Findings
 - Histopathologic findings: Splenic and bursal lymphoid depletion, renal urate accumulation (sign of dehydration), and seawater aspiration (terminal drowning) were consistent findings
 - Diagnostic tests performed included avian influenza matrix RT-PCR (10), Domoic acid ELISA (5), routine bacterial culture (5), liver lead (3), West Nile virus (2), parasitological examination (1), and liver heavy metals panel (1)
 - Arsenic was mildly elevated compared to two COMU tested from AK (CA bird = 2.80ppm dry weight; AK birds = 2.14ppm and 1.41ppm dry weight – reference range not established and significance unknown)
 - Parasitological exam revealed low numbers of cestodes and nematodes (*Contracaecum* sp. and *Synhimantus* sp.)
 - All other laboratory results negative
- NOAA NWFSC Findings:
 - DA was detected at low levels (6.5ppb) in the cloacal contents of one animal
- UCSC Kudela Laboratory Findings:
 - Liver (n=16), Kidney (n=14) and cloacal contents (n=14) were analyzed for domoic acid by LCMS.
 - 81% of birds showing signs of DA presence
 - 11 of 14 tested birds had DA presence in the cloacal contents (79%)
 - 4 of 14 birds had DA presence in the kidney tissue (29%)
 - 4 of 16 birds had DA presence in the liver tissue (25%)
 - Values ranged from:
 - trace - 103.52 (ppb) in the cloacal contents
 - 5.15-82.91 (ppb) in the kidney tissue
 - 3.71-17.07 (ppb) in the liver tissue

Summary

- The event appears to have peaked in the north central coast during September, then central coast in October, and in November in southern CA with more than 7,122 birds affected.
- Many of the dead and debilitated murres were juveniles (young of the year) and all birds examined were thin or emaciated and starvation is the most likely cause of death, with larger proportion of adults toward the end of the event.
- No clear cause for the emaciation including infectious processes has been identified.
- Harmful algal bloom toxins may not have caused direct mortality but may have contributed to decline in these birds.
- Investigation into the causes of this event are ongoing, but we believe that limited prey abundance or availability was likely the primary driver of the event. It is unclear why other piscivorous birds and mammals were not similarly affected, but one explanation is that catastrophic wing feather molt reduced the ability of murres to move quickly to new prey patches while also increasing energetic costs. Other possible contributing factors may include effects of domoic acid or other harmful algal bloom toxins and increased murre population size.

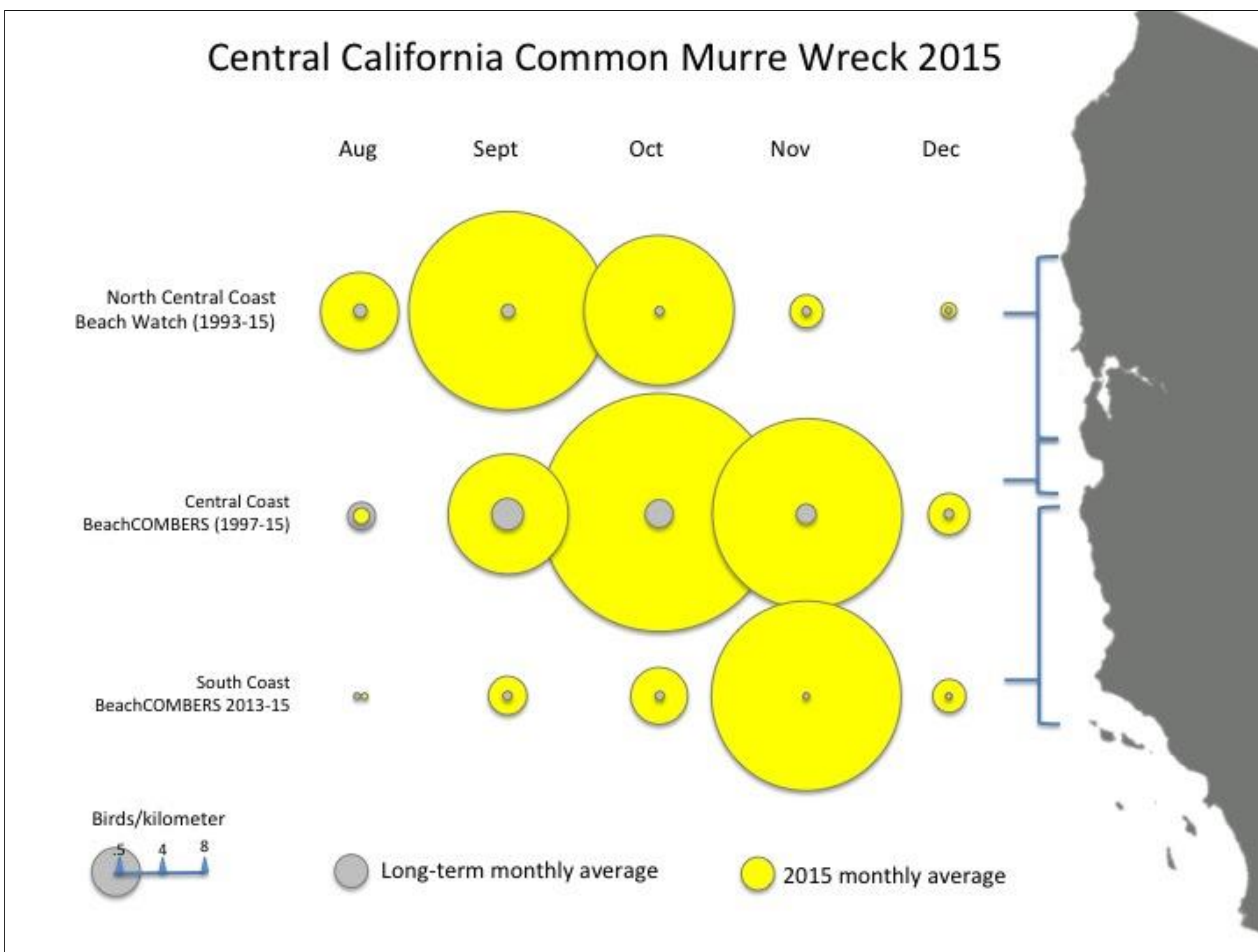


Figure 2. Effort-based beached bird program dead murre deposition (murres/kilometer) long-term average and 2015 monthly average.

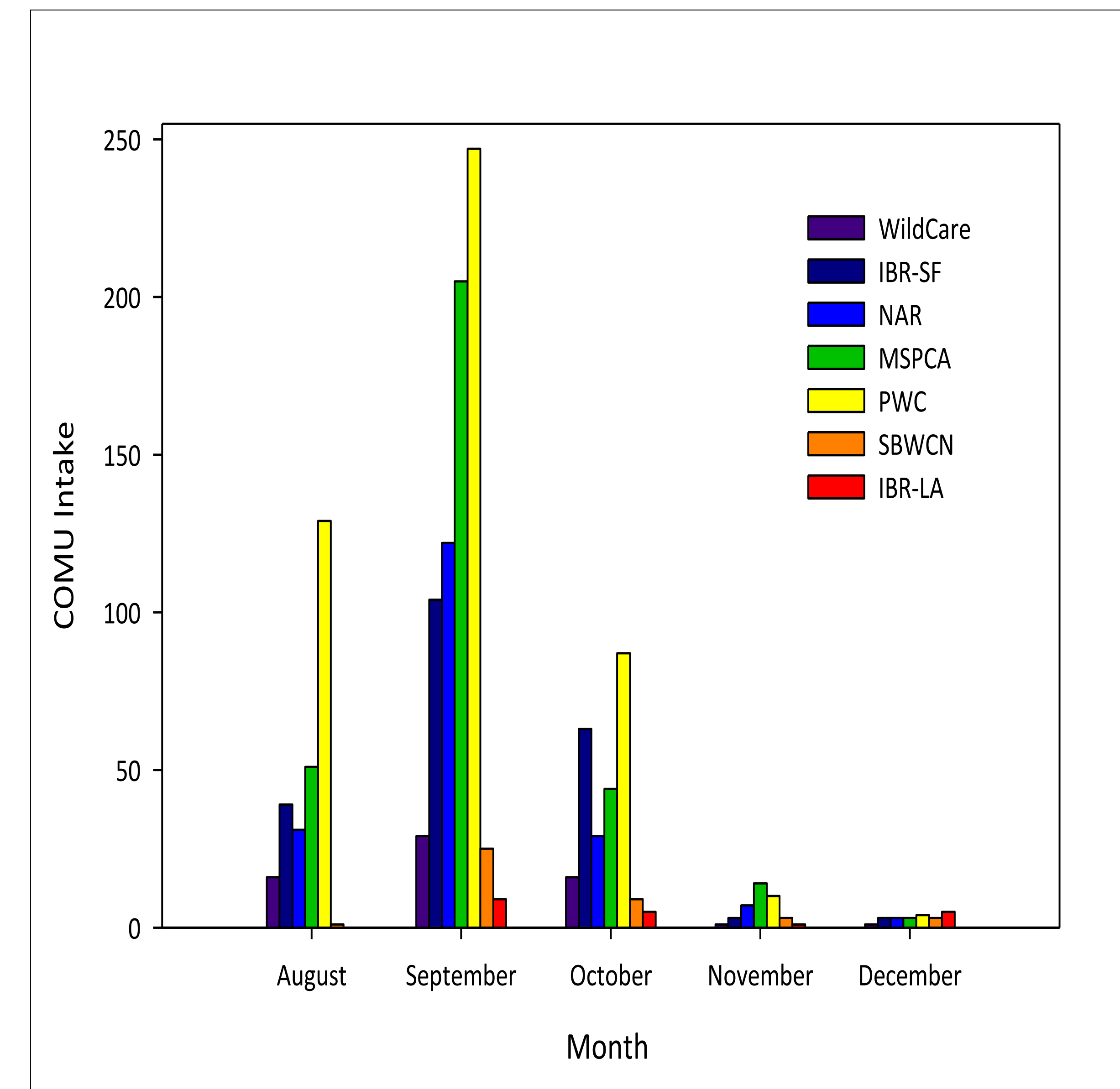


Figure 3. Intake of COMU to Rehabilitation Centers (listed north to south: WildCare – Marin County, IBR-SF – Solano County, NAR – Santa Cruz County, MSPCA – Monterey County, PWC – San Luis Obispo County, SBWCN – Santa Barbara County, IBR-LA – Los Angeles County).

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