



Preliminary Report:  
Mortality of Northern Fulmar (*Fulmarus glacialis*) in  
Monterey Bay during winter 2003

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Northern fulmars are migratory seabirds which nest on islands from British Columbia, Canada to Alaska. The North Pacific population is estimated at 1.4 million breeding individuals<sup>1</sup>. The species is polymorphic, with geographic differences in the ratio of light to dark morphs among range; Bering Sea colonies have few dark morphs (0 - 0.2%), whereas Aleutians birds are mostly dark morphs (99%), and the gulf of Alaska and B.C. colonies are 75-85 % dark. Fulmars disperse south from nesting areas during winter, and are common off the west coast of North America during October through March<sup>2</sup>. Winter mortality of fulmars along the California coast is well documented, and has been reported as “episodic” during some years, such as 1976<sup>3,4</sup>.



During 31 October and 1 November, hundreds of dead and live fulmars began washing up on beaches in the Monterey Bay National Marine Sanctuary. The IBRRC wildlife rehabilitation center alerted state fish and game biologists. On 2 November 2003, Jack Ames (CDFG), Josh Adams, and Hannah Nevins (MLML) collected 166 dead fulmars from sandy beaches in Monterey Bay. We dissected all birds with help from staff at California Dept. of Fish and Game, Marine Wildlife Veterinarian Care and Research Center,

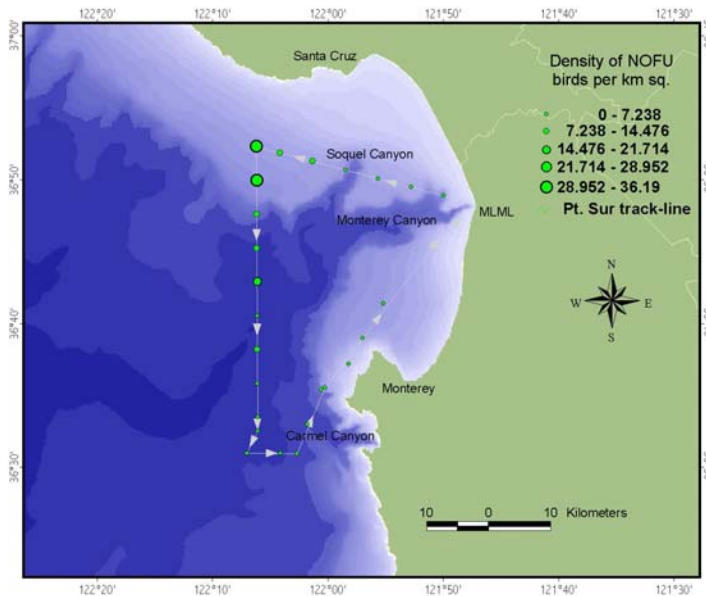
Santa Cruz, and MLML. Pathologist Jim Hill led the disease investigations. On 5 November 2003, Jim Harvey and MLML students conducted a ship-based survey to determine the relative abundance of northern fulmars in Monterey Bay. During the week of 1-7 November, Beach COMBERS surveyors walked beach segments to determine the abundance of dead fulmars on beaches and collected an additional 20 samples for examination. Since September, Scott Hatch (USGS-Alaska Science Center) has tracked satellite-tagged fulmars from the Semidi Islands in the Gulf of Alaska. His results may help elucidate factors affecting the birds as they made their annual migration south. The results of these many aspects of an unusual mortality event will increase our understanding of how natural mortality factors affect seabirds.

The proportion of color morphs, 92% dark and 8% light, indicate that these birds were from colonies in the Gulf of Alaska. Bill length, depth, and width were similar to measurements from this breeding area, the smallest fulmars in the North Pacific. Small samples of muscle were saved frozen for later genetic analyses by Scott Hatch.



Necropsies of 178 birds indicated most were young-of-the-year (96% HY) and 8 were older than 1 year (4% AHY) based on molt. The sex ratio was not different within age groups (HY: 65 F, 67 M, 46 U; AHY: 3 M, 2 F, 3 U). The young birds had new feathers with little wear and rounded primaries. Often the two outermost primaries (P10 and P9) were still in the process of growing, as the shafts were not entirely exposed. The older birds were best distinguished by worn feathers and alternating covert tracks molting in both the upper and under-wing. No birds were considered mature and all had small, undifferentiated gonads (male: ave. length  $[\pm \text{SD}] = 3.0 \pm 1.3$ , width =  $1.1 \pm 0.4$  mm,  $n = 69$ ; Female: ave. length =  $9.6 \pm 3.1$ , width =  $4.1 \pm 1.5$  mm, largest follicle = 0.03 mm,  $n = 66$ ).

Body mass (males  $453 \pm 60$  g,  $n = 32$ ; female  $383 \pm 42$  g,  $n = 41$ ) was lower than reported for breeding birds from the Semidi Islands, AK (males  $649 \pm 52$  g,  $n = 47$ ; females  $577 \pm 53$  g,  $n = 57$ ). Subcutaneous fat reserves were essentially nil for all birds. Pectoralis muscles also were atrophied, indicating protein catabolism during the starvation event. Livers were small, with sharp-edges, indicating wasting of this organ. Proventriculi and gizzards contained plastic and hard part remains, many birds contained feathers suggesting they may have ingested these as they starved. Some stomachs contained squid beaks, but none contained fresh prey. Dr. Jim Hill's (CDFG-MWVCR) analyses of histology and disease screening are still pending.



The at-sea survey team found high densities ( $>20$  km<sup>2</sup>) of live fulmars in waters over the north shelf region of Monterey Bay. Individual fulmars were seen feeding on jellyfish gonads and picking ecto-parasites of sunfish (*Mola mola*). Several were noted as lethargic or sick and we counted a few dead fulmars floating on the surface of the water.

In summary, the majority of fulmars examined during this die-off were young birds in poor body condition. The ratio of color morphs indicated that these birds originated from colonies in the Gulf of Alaska. Persistent storms along their migration pattern, as indicated in satellite telemetry studies by Scott Hatch (USGS) may have contributed to this starvation event, either by preventing foraging or reducing prey availability. No

apparent disease factors were immediately identified as contributing to this mortality event by necropsy result by Dr. Hill are pending (CDFG). Plastic loads in stomachs seemed high, but detailed analysis is needed. A concentration of live animals within the bay, may have also contributed to high deposition rates observed by beach COMBER survey teams (10- 20 birds per km). These combined results are similar to those found by researchers examining the 1976 fulmar die-off, indicating that these events may be cyclic.

*Coastal Ocean Mammal and Bird Education and Research Surveys (BeachCOMBERS) is a volunteer beach survey program designed to monitor natural and human-related mortality in the Monterey Bay National Marine Sanctuary. Beach COMBERS strives to build a network of citizens, scientists, and resource managers. Beach COMBERS is supported in part by a research grant from MBNMS through the Science Integrated Monitoring Network. For more information, visit the following links:*

<http://bonita.mbnms.nos.noaa.gov/research/bchmon.html>

<http://www.mbnms-simon.org/>

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<sup>1</sup> Hatch, S. A. & Nettleship, D. N. 1998. Northern Fulmar (*Fulmarus glacialis*). In The birds of North America, No. 361 (A. Poole and F. Gill, eds.) The Birds of North America, Inc., Philadelphia, PA.

<sup>2</sup> Roberson, D. Monterey Birds (2<sup>nd</sup> edition). Monterey Peninsula Audubon Society 2002.

<sup>3</sup> Harrington-Tweit, B. A seabird die-off on the Washington coast in mid-winter 1976. Western Birds 10 (2): 49-56.

<sup>4</sup> Stenzel, L. E., Page, G. W., Carter, H. R., and Ainley, D. A. 1988. Seabird Mortality in California as witnessed through 14 years of Beached Birds Censuses. Report to NOAA-GFNMS.