Summary of Southern Sea Otter Mortality Investigations in 2013

Melissa A. Miller, Erin Dodd, Francesca Batac, Colleen Young, Michael D. Harris, Jessica Kunz, and Laird Henkel

California Department of Fish and Wildlife
Office of Spill Prevention and Response
Marine Wildlife Veterinary Care & Research Center
1451 Shaffer Road
Santa Cruz, California 95060

May 2014

California Department of Fish and Wildlife
Office of Spill Prevention and Response Technical Report 14-1

Summary

Three hundred Southern sea otter carcasses were examined by California Department of Fish and Wildlife scientists during 2013. In this total were 53 animals that received more detailed postmortem examinations, including 19 tagged animals, one animal outside the subspecies' normal range, 11 animals that had histology samples taken due to special circumstances, and 22 fresh-dead animals collected from throughout the sea otter range in California as "random-source" cases for full postmortem examinations, theoretically providing a comparatively unbiased index of current causes of sea otter mortality. The remaining 247 otters received basic gross examinations. Of the 22 random-source cases, 36% (n=8) were confirmed or suspected shark bite cases. This is a decrease from 52% (n = 17 out of 33) of random fresh cases that were shark bitten during 2012. The primary cause of death for the remaining 14 random-source sea otters encompassed 10 additional mortality categories, including presumed boat-strike for one animal and confirmed gunshot for another. Microscopic examination and supplemental testing are required to diagnose some health conditions affecting sea otters. Limited microscopic examination will be performed for some, but not all sea otters necropsied during 2013. Our understanding of factors contributing to sea otter mortality continues to evolve through time as additional knowledge is gained, new disease processes are identified, and more diagnostic tests become available; therefore, categories may be revised for future mortality summaries.

Introduction/Background

The California Department of Fish and Wildlife (CDFW) has been investigating causes of mortality in Southern sea otters (*Enhydra lutris nereis*) since 1968, initiated in response to State Senate Concurrent Resolution 74. Investigating causes of sea otter mortality is important for: 1) identifying factors limiting population recovery, 2) informing best achievable care of captive sea otters, including animals recovered during oil spills, 3) tracking mortality trends and better characterizing disease processes and emerging threats, and 4) assessing, and when possible, mitigating anthropogenic sources of mortality. Although it is not a primary focus of the California Department of Fish and Wildlife, investigations of sea otter mortality can also help identify emerging health risks for humans living along the land-sea interface of California.

Investigations of sea otter mortality are currently conducted by the Department's Office of Spill Prevention and Response, at the Marine Wildlife Veterinary Care & Research Center (MWVCRC) in Santa Cruz, in collaboration with partners at the US Geological Survey (USGS) and the Monterey Bay Aquarium (MBA). These groups collectively respond to every report of a stranded sea otter, which may be recovered dead or alive. Most stranding recoveries in California involve collection and examination of dead otters (Pattison et al. 1997, Kreuder et al. 2003, Miller et al. 2013). Of the few that strand alive, most die soon after stranding or are humanely euthanized. Sea otters that strand alive with treatable health conditions undergo rehabilitation at the MBA and may be released or maintained in captivity. The extent of examination and sampling of cases has varied over the years, but since 2010, every 3rd fresh-dead otter older than 1 year was examined by a pathologist at the MWVCRC, and more abbreviated necropsies were performed on all other cases. In 2013, the sampling protocol was reduced to every 4th fresh-dead otter older than 1 year to be examined by a pathologist at the MWVCRC with limited histology. All other cases received gross necropsies that were completed by a sea otter biologist and/or veterinary pathologist, and in some cases, samples for limited histopathology or diagnostic testing were collected, depending on the nature of each case and collaborator requests.

Stranding Response

During 2013, biologists from the CDFW, USGS, and MBA (and in rare cases other colleagues) responded to 340 strandings of live and dead sea otters throughout California. Sea otters were recovered primarily from San Mateo County southward through Santa Barbara County (the current established Southern sea otter range). One extralimital (outside the established range limits) stranding from Orange County was also recovered and examined in 2013.

Of the 340 stranded sea otters recovered during 2013, 333 animals were found dead, stranded live and died later, or were euthanized. The remaining 7 stranded animals were successfully rehabilitated at the MBA. MWVCRC staff performed postmortem examinations on 300 of the 333 cases. Gross exam data on all stranded animals is archived by USGS. Additional information on all 2013 strandings (i.e., age, sex, and location) can be found in the California Sea Otter Stranding Network annual report, provided by USGS at: http://www.werc.usgs.gov/project.aspx?projectID=232.

Detailed Postmortem Examinations

Detailed necropsies were performed by a veterinary pathologist and/or technical staff at the MWVCRC on 53 sea otters in 2013. These included 20 special request cases (such as tagged wild animals that had been observed extensively during field investigations), 22 wild, random-source animals (every 4th fresh carcass), and 11 animals that had histology samples taken due to special circumstances, such as an unusual/atypical presentation. Special request cases included: USGS-tagged study animals (17 plus one fetus), MBA-tagged study animals (2), and an extralimital animal (1).

Detailed necropsies performed at the MWVCRC generally included a thorough gross necropsy, a standard suite of photographs, collection of major tissues for microscopic examination (histology), collection of swabs for bacterial and/or fungal culture, and collection of samples for additional diagnostic tests (e.g., for biotoxins) pending future funding. Due to budget constraints, histology sampling in 2013 was reduced compared to previous years (Miller et al. 2013) to collecting specific tissues needed to clarify gross findings and/or confirm the cause of death. Postmortem radiographs were performed for some cases, as directed by the case history, stranding location, and presentation. Preliminary results presented in this report may be further refined following completion of additional tests. In some cases, the cause of mortality is listed as “possible” (suspected, but further testing required to confirm, where possible, or final confirmation not possible due to test or sample limitations), or “presumptive” (based on sufficient indirect evidence).

We limit further discussion of causes of mortality to the 22 random-source animals receiving detailed necropsies during 2013, as the most representative cases receiving detailed exams. Necropsy results for special request animals will be provided to the requesting agency, and findings for tagged study animals will be summarized in final reports for applicable field studies.

Random-Source Necropsies

Because a systematic sampling scheme is used to select for random-source sea otters for detailed necropsy (every 4th fresh animal), these necropsies provide a relatively unbiased index of current causes of sea otter mortality. However, due to a relatively small sample size, the full suite of factors that are affecting the Southern sea otter population during a given year may not be fully represented. During 2013, fresh, random-source animals were unevenly distributed by county of stranding (Table 1) with two strandings in Santa Cruz, twelve in Monterey, and eight in San Luis Obispo Counties. One or two fresh, random cases were submitted for postmortem examination each month, except for September, when four cases were submitted. A summary of preliminary causes of mortality based on gross necropsy findings is provided in Table 2.

Table 1. Number of random-source source sea otter necropsies by month and County of stranding.

Month	San Luis Obispo Co.	Monterey Co.	Santa Cruz Co.	TOTAL
January	1	1	0	2
February	1	1	0	2
March	0	2	0	2
April	0	1	0	1
May	1	1	0	2
June	0	1	0	1
July	0	2	0	2
August	1	0	0	1
September	0	2	2	4
October	1	0	0	1
November	1	1	0	2
December	2	0	0	2
TOTAL	8	12	2	22

Table 2. Primary cause of death for 22 fresh-dead, random-source wild Southern sea otters examined at the CDFW MWVCRC during 2013.

Cause of Mortality (Category)	Cause of Mortality (Type)	Number	Percent
Trauma	Shark Attack	8	36.4%
Other	Cardiomyopathy Syndrome	3	13.6%
Other	Gastric Perforation or Gastritis	2	9%
Other	Endocarditis - Vegetative	2	9%
Infectious	Septicemia - Bacterial	1	4.5%
Other	Dermatitis - Proliferative	1	4.5%
Other	Pulmonary Emphysema	1	4.5%
Trauma	Boat Strike - Presumptive	1	4.5%
Trauma	Fight Trauma	1	4.5%
Trauma	Gunshot - Bullet Recovered	1	4.5%
Poisoning/Toxins	Microcystin Intoxication - Possible	1	4.5%
Total		**22**	**100.0%**

More than a third (36%) of the random-source otters that received full examinations died with suspected (7) or confirmed (1) shark bite. Shark-bitten sea otters were recovered from Santa Cruz (1) Monterey (2) and San Luis Obispo Counties (5), and more were female (5) than male (3). Shark bite cases occurred in March, and July through December, with one case identified each month except in

December, when there were two cases. All of these shark bite cases were presumed to be the result of attacks by great white sharks (*Carcharodon carcharias*), based on observed trauma (Appendix A).

The gunshot case was recovered at Asilomar State Beach in September 2013. Two additional gunshot cases were also recovered around the same time, but are not included here because they were not random-source cases. All three gunshot cases from 2013 are currently being investigated by the U.S. Fish and Wildlife Service and the National Wildlife Forensic Laboratory. The presumed boat strike case was recovered near Moss Landing (Monterey County) in May. In addition, one of the random-source cases had indications of a prior sublethal boat strike (healed arm bone fractures and internal scars consistent with a propeller strike); this carcass was also recovered near Moss Landing.

One case in 2013 was identified as possible microcystin intoxication. This carcass was recovered at Salinas River State Beach, near Moss Landing, in January 2013. Two additional cases include microcystin intoxication as a possible contributing factor (pending diagnostic testing).

Because sea otters have a polygynous mating system, deaths of female sea otters is of greater importance for limiting population recovery than males. Ten of the 22 random-source cases were females.

Discussion

Since 2009, shark-associated sea otter mortality has increased, and shark bite continued to be the leading cause of death for Southern sea otters during 2013, although the proportion of shark bite mortalities in our small sample size of random-source cases decreased from 2012 levels (Miller et al. 2013). Studies to determine why there has been an increase in shark bite mortality in recent years are in progress.

It is important to note that acute lesions, including shark bite or boat strike, may mask significant, underlying disease. Many of the otters that died from shark bite during 2013 had other significant, pre-existing health problems that could have eventually led to their death, had the animals had not been killed by sharks. It should also be noted that biotoxins are important contributors to cardiovascular disease in sea otters, and many cases of cardiovascular disease in sea otters may result from chronic or recurrent biotoxin exposure.

Consistent with past mortality surveys, infectious disease continues to be an important cause of death for Southern sea otters: 14% of fresh, random-source otters with full necropsies succumbed to bacteria, parasites or fungi as a primary cause of death. Additional animals had infectious agents as a contributing cause of death.

The only sea otter deaths identified through random-source necropsies during 2013 that were directly anthropogenic were one suspected boat-strike case and one gunshot case. However, as discussed in last year's report (Miller et al. 2013), other causes of sea otter death (or sub-lethal morbidity), such as bacterial infection, protozoal encephalitis and domoic acid exposure may be indirectly anthropogenic. In addition, microcystin is a toxin produced by freshwater cyanobacteria, and in many areas freshwater cyanotoxin production can be facilitated or exacerbated by human land use practices.

Additional detail on causes of mortality, including contributing/secondary causes of death, will be provided in future summary publications that address trends in Southern sea otter mortality in greater detail.

Disclaimer

Information in this report is preliminary and should not be cited without permission from the CDFW. Microscopic examination and supplemental testing is required to diagnose some health conditions affecting sea otters. Because testing is still being completed, and because our understanding of factors contributing to sea otter mortality evolves through time as greater knowledge is gained, categories may be revised for future mortality summaries.

Acknowledgments

Investigations of sea otter mortality at the MWVCRC were funded by the CDFW Oil Spill Prevention Administrative Fund and the California Sea Otter Fund (through donations from California tax payers). We thank the many volunteers and staff who helped with sea otter mortality investigations during 2013, particularly Angie Reed, Fernando Lopez, Ben Shaw, Molly Spitler, Amy Wells, and Jack Ames.

Literature Cited

Kreuder C., M.A. Miller, D.A. Jessup, L.J. Lowenstine, M.D. Harris, J.A. Ames, T.E. Carpenter, P.A. Conrad, and J.K. Mazet. 2003. Patterns of mortality in southern sea otters (*Enhydra lutris nereis)* from 1998-2001. Journal of Wildlife Diseases 39: 495-509.

Miller, M.A., E. Dodd, F. Batac, C. Young, M.D. Harris, J. Kunz, E. Berberich, and L. Henkel. 2013. Summary of southern sea otter mortality investigations in 2012. California Department of Fish and Wildlife, Office of Spill Prevention and Response Technical Report 13-1. 7 pp.

Pattison, C.A., M.D. Harris, and F.E. Wendell. 1997. Sea Otter, *Enhydra lutris*, Mortalities in California, 1968 through 1993. California Fish and Game, Marine Resources Division Administrative Report 97-5.

Appendix A. Images from selected necropsies.

Image 1. External wound from a white shark attack.

Image 2. Heart muscle pallor and mottling, and cardiac enlargement characteristic of cardiomyopathy syndrome.

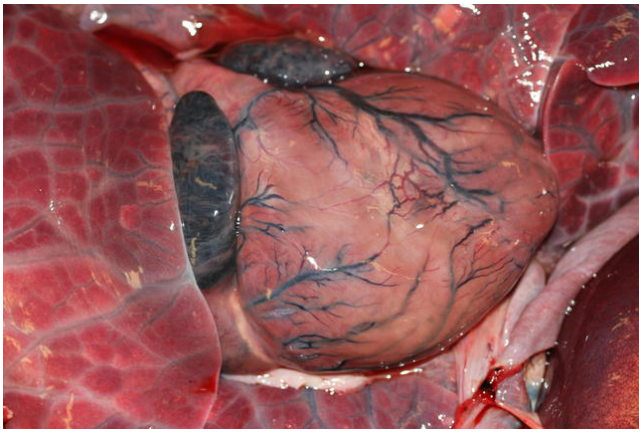

Image 3. Subcutaneous air trapping caused by a tear in the chest wall due to presumed boat strike.