

## WHALE TALES: CETACEAN STRANDING RESPONSE AND MEDICINE IN THE PACIFIC NORTHWEST

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### MARINE MAMMAL STRANDINGS:

Marine mammal strandings have long attracted the attention of the general public.<sup>1</sup> Stranded marine mammal carcasses once were used as food and some of the first laws enacted in New England Colonies were to establish the ownership of beached whale carcasses. Later stranded marine mammals provided animals for museums, live displays and scientific information about little-known species. Today they still provide us with important data on marine mammals and marine mammal populations. Strandings help us to document range expansions for marine mammal species and provide details on marine mammal growth rates, age at maturity, gestation, reproductive season and longevity. Stranded marine mammals also help expand our understanding of marine mammal mortality factors including infectious diseases, toxins and human-caused mortality.

In the United States, the Marine Mammal Protection Act (1972) gave the federal government jurisdiction over marine mammals, including stranded ones. An amendment in 1992 established a Marine Mammal Health and Stranding Response Program to (1) facilitate the collection and dissemination of reference data on the health of marine mammals and health trends of marine mammals in the wild; (2) correlate the health of marine mammals and marine mammal populations, in the wild, with available data on physical, chemical, and biological environmental parameters; and (3) coordinate effective responses to unusual mortality events by establishing a process in the Department of Commerce. Currently the National Marine Fisheries Service (NMFS) within the Department of Commerce oversees marine mammal stranding networks throughout the United States and all cetacean stranding response is authorized by the NMFS.

### THE PACIFIC NORTHWEST:

#### Organization

The Northwest Regional Marine Mammal Stranding Network was formed in the early 1980's and is composed of volunteers based at academic institutions, state and federal agencies, museums, enforcement agencies, veterinarians and private citizens to respond to or provide advice on marine mammal strandings as coordinated through the NMFS' Marine Mammal Health and Stranding Response Program based in Seattle, Washington. The area covered by this stranding network includes the nearshore and shoreline waters of Oregon and Washington, including the inland waters of Washington State. In British Columbia, the Canadian Department of Fisheries and Oceans is responsible for stranded marine mammals.

#### Cetaceans Species

A total of 23 species of cetaceans have stranded in the Pacific Northwest (Table 1), however 4 species comprise over 70% of the strandings.<sup>2</sup> The most commonly stranded cetaceans include harbor porpoises (*Phocoena phocoena*; 34% of cetacean strandings), gray whales (*Eschrichtius robustus*; 23% of strandings), Dall's porpoise (*Phocoenoides dalli*; 12% of strandings) and Pacific white-sided dolphins (*Lagenorhynchus obliquidens*; 4% of strandings). Mass strandings in the Pacific Northwest, strandings of two or more animals of the same species excluding cow-calf pairs, have been documented for harbor porpoise, killer whales (*Orcinus orca*), rough-toothed dolphins (*Steno bredanensis*) and sperm whales (*Physeter macrocephalus*).

#### Stranding Trends

Strandings have increased from an annual stranding rate of approximately 1.5 cetaceans/year from the 1930's through the 1970's to nearly 36 per year from the 1980's through the current decade.<sup>2</sup> This trend of increased reported strandings corresponds to the formation of a formal stranding network and a heightened interest and dedication by the public and government agencies in reporting and documenting strandings.

#### Spatial Distribution of Strandings

Strandings do not occur uniformly over the landscape. Where cetaceans strand is defined by where animals spend time, where tides and currents tend to move and leave animals, where people occur to find and report strandings as well as other unknown factors. In the Pacific Northwest, the spatial distribution of stranding events differs between Washington and Oregon as well as within each state. Since the 1930's the majority of cetacean stranding events have occurred in Washington (56%) compared to Oregon (44%).<sup>2</sup> Within Washington, three hot spots for strandings include Willapa Bay/Long Beach peninsula, the San Juan Islands

archipelago and the far northwest coast of the state. Hotspots for cetacean strandings in Oregon include northern and central Lincoln County, Clatsop /northern Tillamook Counties, southern Lincoln County /northern Lane County and Coos County.

| Family         | Species                      | Number of Strandings |
|----------------|------------------------------|----------------------|
| Balaenopterid  | Blue whale                   | 1                    |
|                | Fin whale                    | 8                    |
|                | Humpback whale               | 6                    |
|                | Minke whale                  | 21                   |
| Eschrichtiidae | Gray whale                   | 200                  |
| Physeteridae   | Sperm whale                  | 18                   |
|                | Pygmy sperm whale            | 8                    |
| Ziphiidae      | Baird's beaked whale         | 4                    |
|                | Cuvier's beaked whale        | 17                   |
|                | Stejneger's beaked whale     | 13                   |
|                | Hubb's beaked whale          | 2                    |
| Delphinidae    | Killer whale                 | 16                   |
|                | False killer whale           | 3                    |
|                | Short-finned pilot whale     | 7                    |
|                | Risso's dolphin              | 9                    |
|                | Pacific white-sided dolphin  | 34                   |
|                | Bottlenose dolphin           | 1                    |
|                | Common dolphin               | 5                    |
|                | Rough-toothed dolphin        | 3                    |
|                | Striped dolphin              | 12                   |
|                | Northern right whale dolphin | 8                    |
| Phocoenidae    | Harbor porpoise              | 303                  |
|                | Dall's porpoise              | 107                  |

Table 1: Species and occurrence of cetaceans stranded in the Pacific Northwest from 1930-2002. (Adapted from Norman et al., 2002)

## DISEASES DIAGNOSED OF NOTE

### Marine Mammals as Sentinels

Marine mammals are important sentinel species that tell us about potential negative impacts on animal and marine ecosystem health and ultimately allow us to better understand, manage or mitigate anthropogenic stressors.<sup>3</sup> Cetaceans are charismatic species that stimulate great interest in people. They have long life spans, are long-term coastal residents, feed at a high trophic level, and have unique fat stores that can serve as depots for anthropogenic toxins. They also are exposed to environmental stressors such as chemical pollutants, harmful algal biotoxins, and emerging or resurging pathogens, most of which can impact people. Understanding the health of marine mammals ultimately allows us to better conserve their populations, design a healthy ocean and improve and protect human health. Over the past several decades, many important diseases and toxins have been diagnosed in marine mammals that are important to marine mammal conservation and human health or tell us something about the health of our marine ecosystem.

### *Cryptococcus gattii*

Over the last decade there has been an epidemic of cryptococcosis in humans and companion animals in British Columbia, Washington State and Oregon. The disease, caused by *Cryptococcus gattii*, has caused mortality in Dall's porpoises, harbor porpoises and Pacific White Sided dolphins.<sup>4</sup> Porpoises generally presented in fair to good body condition and the most significant gross lesions were localized to the respiratory and hemolymphatic systems. Within all animals, nodular to diffuse granulomatous pneumonia and mediastinal lymphadenitis were consistently observed with massive accumulations of yeast. In more severely affected animals, prescapular, retropharyngeal and mesenteric lymph node involvement also was noted. Intensive environmental cultures have identified Douglas fir, alder and cedar trees as environmental sources of the fungus.

### Marine *Brucella*

In addition to the six recognized species of *Brucella*, several new species (species naming is still being debated) have been identified in marine mammals. While marine *Brucella* is considered endemic in harbor seals in the Pacific Northwest, little information exists on infection in cetaceans. Antibodies to *Brucella* have been identified in four stranded killer whales yet complete necropsies failed to detect discernible lesions that could be directly attributed to brucellosis.<sup>5</sup> Marine *Brucella* has caused placentitis and abortion in bottlenose dolphins in California and has the potential to cause reproductive failure or reduced fecundity in cetaceans in the Pacific Northwest, however more work needs to be done to understand the significance of *Brucella* antibodies in killer whales and the prevalence and epidemiology of marine *Brucella* infection in other cetacean species.

### **Salmonella**

Routinely, samples of intestinal contents from cetaceans stranded in the Pacific Northwest are inoculated into selenite broth for selective isolation of *Salmonella* spp. A variety of isolates have been recovered from harbor porpoises, including *S. Enterica*, *S. Javiana*, *S. Newport*, and *S. Typhimurium*.<sup>6</sup> Interestingly, in most cases, there were no overt pathological lesions associated with recovery of bacteria. The terrestrial or marine origin of these *Salmonella* isolates is unknown, but deserves further research.

### **Sarcocystis neurona and Toxoplasma gondii**

A recent study found cetaceans and pinnipeds from the Pacific Northwest infected with the protozoal parasites *Sarcocystis neurona* and *Toxoplasma gondii* with many animals presenting with dual infection.<sup>7</sup> Interestingly, polyparasitism was associated with more severe protozoal encephalitis and higher mortality than animals infected with only one protozoa species. Despite the behavioral and dietary differences between cetaceans and pinnipeds sampled, relative rates of infection with *S. neurona* and *T. gondii* were indistinguishable between the two groups. Molecular genotyping of *T. gondii* isolates found a high prevalence of Type I alleles, which is consistent with the identification of a genotype bearing Type I lineage alleles associated with a 1995 human toxoplasmosis outbreak in the Pacific Northwest; one of the largest outbreaks of human toxoplasmosis ever reported. Finding these parasites in numerous pinnipeds and cetaceans from the Pacific Northwest indicates pervasive contamination of marine waters by these zoonotic agents, which is a serious public health and conservation threat for the region.

### **Sonar**

On May 5, 2003, the US Navy vessel USS Shoup conducted a swept channel exercise in San Juan County, Washington, which included deployment of active, mid range tactical sonar (system AN/SQS-53C).<sup>8</sup> At the time of deployment, agitated and avoidance behavior were exhibited by a pod of southern resident killer whales and a Minke whale (*Balaenoptera acutorostrata*) within the vicinity of the USS Shoup and sonar was detected by submerged hydrophones and was audible to humans above the water surface.

Between 2 May and 2 June 2003, the Northwest Marine Mammal Stranding Network reported 14 stranded harbor porpoises. Eleven carcasses were recovered. Comprehensive necropsies were conducted on ten animals and computerized tomography scans, were conducted on 7 carcasses and 1 decapitated head. Trauma and infectious disease caused the death of 5 of the 10 porpoises but a cause of death could not be determined in the remaining 5 animals. Based on the extent of autolysis and nature of the post mortem findings, there was insufficient evidence to confirm or discount the possibility that the porpoise strandings were related to acoustic trauma; however, the animals recovered in the northern Pacific Ocean did not feature any of the lesions as described in beaked whales stranded in the Bahamas and Canary Islands. This episode resulted in closer cooperation between the US Navy and NMFS in the elective use of sonar when marine mammals are known to be present.

### **Persistent Organic Pollutants**

High levels of persistent organic pollutants (POPs), including dichlorodiphenylethanes (DDTs), polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs), have been detected in cetaceans from the Pacific Northwest and killer whales from the region have been declared some of the most PCB contaminated marine mammals in the world.<sup>9</sup> These chemicals accumulate in cetacean blubber stores and are mobilized during times of fasting, starvation, lactation or stress, which can redistribute them and compromise the animal's cellular and humoral immunity, potentially increasing their susceptibility to infectious diseases and neoplasia or causing reproductive impairment.

In the Pacific Northwest, levels of DDT and PCBs in cetacean blubber appear to be decreasing while PBDE levels appear to be increasing. Interestingly, cetaceans that spend more time on the outer coast of California and the Pacific Northwest tend to have higher DDT burdens while animals that spend more time in the inland waters of Washington and British Columbia and further north have higher PCB levels. Concerns

about high levels of POPs in cetaceans from the Pacific Northwest are mirrored by concern for ingestion by local people, especially those that consume high levels of fish in their diet including Northwest tribal members. The removal of these degradation-resistant compounds from the ecosystem is a win-win example of the "One Health" concept in that it benefits human health, wildlife health and ecosystem health.

### **Trauma**

Trauma is a major wildlife mortality factor and has been documented as a cause of death for numerous stranded cetaceans in the Pacific Northwest. At times the source of trauma can be identified as anthropogenic, as in the case of boat strike, which has killed fin whales and killer whales, or in the case of entanglement in derelict or active fishing gear. Other times the trauma is thought to be a natural process such as the interspecific trauma due to killer whale predation on harbor and Dall's porpoise.

### **LIVE CETACEAN STRANDINGS**

Live cetacean strandings are rare events in the Pacific Northwest and rehabilitation centers capable of treating live stranded cetaceans are few. Both the Point Defiance Zoo and Aquarium and the Vancouver Aquarium have the facilities and husbandry and veterinary expertise needed to treat live-stranded cetaceans. A harbor porpoise calf that live-stranded in August 2008 was successfully rehabilitated at the Vancouver Aquarium where it now resides. A lone orphan female juvenile northern resident killer whale that was found alone and geographically separated from her natal pod in 2002 was successfully rehabilitated and returned to her pod. Post-release monitoring has demonstrated she is still traveling with her pod.<sup>10</sup>

### **THE ROLE OF VETERINARIANS IN MARINE MAMMAL STRANDINGS**

Veterinarians often play an important role in responding to live and dead stranded cetaceans. For dead animals, they are able to conduct or lead necropsies. When live animals strand, veterinarians help to assess condition determine the level of interaction required and ultimately help treat animals taken into captivity. In 2009 the National Marine Fisheries Service developed a protocol for responding to live marine mammal strandings. These protocols balance the need for standardized procedures while allowing flexibility to address specific needs of different situations for diverse species and habitats, as well as unforeseen circumstances. Veterinarians work with the NMFS and stranding networks to help determine (1) What are the species and group composition involved in the event? (2) Is the situation caused by human activities or a natural event? And (3) Are resources available to ensure the safety and welfare of both the animals and the responders? Intervention can be dangerous for the animals and human responders and response operations are only approved if it will be safe for the animals, stranding responders and the public.

### **SO YOU WANT TO PARTICIPATE?**

Veterinarians interested in participating in local stranding networks should contact their regional stranding network (<http://www.nmfs.noaa.gov/pr/health/networks.htm>).

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