

Southern Resident Killer Whale (*Orcinus orca*) Stranding Event Expert Review Summary, September 21, 2016

Background: On August 23, 2016 the Marine Mammal Health and Stranding Response Program (MMHSRP) of National Marine Fisheries Service (NMFS) held a conference call with an expert panel of five veterinarians, veterinary pathologists, and biologists to review and discuss the information available for the stranding of a tagged southern resident killer whale (*Orcinus orca*) that occurred on March 30, 2016. The Northwest Fisheries Science Center had deployed a satellite-linked limpet-style tag on killer whale L95 on February 23, 2016. The last transmission received from L95's tag was on February 26, 2016, with subsequent re-sighting of the whale alive the next day, suggesting signal loss was due to a premature tag detachment. The carcass was recovered by the Department of Fisheries and Oceans (DFO) off Nootka Island, British Columbia on March 30, 2016 and the necropsy was conducted on April 1, 2016 by Dr. Stephen Raverty, DVM, PhD, Dip ACVP; Animal Health Center, British Columbia Ministry of Agriculture and Lands, British Columbia, Canada.

An overview of the case was presented by Drs. Brad Hanson and Stephen Raverty and findings were discussed with the group. After the call NMFS requested the expert panel provide written comments regarding the Final Report AHC 16-1760 of the findings from the killer whale stranding of NMFS Case #L95. A summary of those written comments are included below.

Summary and Conclusion:

The expert panel was asked whether they agreed with the gross necropsy, histopathology, and overall summary findings from the killer whale stranding of NMFS Case L95, AHC Case 16-1760 final report.

In general the panel found the gross necropsy and histopathology findings to be accurate with the summary report being well prepared and documented the salient gross and histopathological findings.

The experts agreed with the major findings highlighted in the report for the killer whale which included lesions associated with the tag attachment site which was interpreted as vasculitis with invasive fungal hyphae morphologically consistent with mucormycosis and lesions in the lung which were interpreted as a fungal bronchopneumonia consistent with mucormycosis. Additional findings included fibrinous peritonitis and splenomegaly. There was some non-consensus over whether there were two independent fungal infections occurring simultaneously or one infection (i.e. the tag site infection) that spread to the lungs or vice versa. Additionally, there was concern that there may have been an underlying immunosuppression in the whale based upon thin body condition observed several days after tagging that could have predisposed the whale to susceptibility to the fungal infections. However, the experts did agree that the tag loss, tag petal retention with biofilm formation or direct pathogen implantation, and development of a fungal infection at the tag site contributed to the illness, stranding, and death of this whale. During the review it was noted that the tag had encountered the water on the first unsuccessful tagging attempt and although the tag was disinfected with alcohol on the boat this introduction of a tag with sea water contamination could have contributed to introducing fungi deep into the tag site. Additionally, the tag location, which was lower on the dorsal fin and at the caudal edge of the

fin, placed the tag in close proximity to large bore vessels which could have facilitated the spread of the fungal infection throughout the vascular system as compared to a placement near more superficial smaller vessels.

In summary the expert panel determined that even though the killer whale presented in moderate to advanced decomposition at the time of necropsy there was sufficient evidence as determined by gross dissection, radiographs, MRI and histopathology of the tag site to implicate the tag attachment site as a source of fungal infection to the whale. This fungal infection contributed to illness in the whale and most likely contributed to its death. Additional contributors to death included the fungal bronchopneumonia, poor body condition and possible immunosuppression.

Seven other killer whales have been tagged previously with similar tags which have not resulted in death in those whales. Additionally, limpet-style tags have been deployed on over 500 cetaceans without any documented mortalities, and the one quantitative assessment of survival rates of tagged versus untagged short-finned pilot whales and false killer whales found no difference in survival rates. See below reports for details

(http://www.cascadiaresearch.org/reports/Andrewsetal2015_NOPP.pdf and http://www.cascadiaresearch.org/Hawaii/Bairdetal_LIMPETtagging_Dunedin.pdf).

There were several factors in this case that may have predisposed this whale to a fungal infection at the tagging site including incomplete disinfection of the tag after seawater contamination, retention of the tag petals which may have allowed for formation of a biofilm or direct pathogen implantation, placement of the tag lower on the body and near large bore vessels which increased the chance of fungal dissemination through the blood system, poor body condition, and possible immunosuppression.

The experts suggested some possible mitigation measures to use in future tagging events of killer whales including:

- Implantable tags that are exposed to seawater during tagging should not be used and should be brought back to the laboratory to investigate the electronics and tag attachment viability and re-sterilized at the laboratory prior to use. For researchers working with non-ESA species and working in remote locations where lab re-sterilization is not feasible, tags exposed to seawater should be soaked in appropriate fungicidal disinfectants for appropriate contact times (~10-20 mins) prior to re-deployment.
- Consultation with cetacean anatomists to determine the optimal location for tag placement in relation to dorsal fin vasculature is recommended to minimize the possibility of spread of pathogens from localized infections at the tag site.
- The process by which whale body condition is evaluated and criteria for target animal selection prior to tagging should be re-evaluated so as to minimize the chance of tagging an animal nutritionally compromised or in poor health.
- The panel strongly recommends re-evaluating tag designs for killer whales to minimize impacts to the tagged individuals, currently a tagging workshop is planned by the International Whaling Commission (IWC) in spring 2017 and presentation of this case at that workshop would be of value. Additionally, discussions should be conducted with the

tag manufacturer to determine if there was a change in manufacturing that could have contributed to tag failure.

- Some of the panel members felt that if the southern resident killer whale population is being impacted by environmental factors that are causing population-wide malnutrition and the overall population is in relatively poor general health, then the idea of implanting tags in these animals should be revisited, whether or not this tag cause the death of this particular individual. It may be prudent to not resume invasive tagging and use non-invasive assessment tools such as photogrammetry over multiple seasons as a less risky source of useful information if the population is truly in a fragile state.
- Lastly, the panel strongly recommends that NMFS will utilize the above recommendations and those from the IACUC review now, and others from the IWC tagging meeting (or other reviews) later, to modify current tagging methods and evaluate appropriate mitigation measures for future tagging of ESA species.

Lay-language summary

National Marine Fisheries Service, Department of Fisheries and Oceans, Canada and the Animal Health Center, British Columbia Ministry of Agriculture and Lands, Canada investigated the recent stranding of a resident killer whale. This adult male killer whale was identified as L95, a 20 year old whale. The animal had been tagged by National Marine Fisheries Service using a satellite-linked limpet-style tag approximately 5 weeks prior to death. After a thorough necropsy and investigation including an expert review of findings there was sufficient evidence to implicate the tag attachment site as a source of fungal infection to the whale. This fungal infection contributed to illness in the whale and played a contributory role in its death. Seven other killer whales have been tagged previously with similar tags which have not resulted in death in those whales. There were several factors in this case that predisposed this whale to a fungal infection at the tagging site and NMFS is reviewing the findings from this case and developing mitigation factors to limit the impacts of future tags and tagging on southern resident killer whales.