The Canadian Field-Naturalist

Note

Epimeletic behaviour in a Southern Resident Killer Whale (*Orcinus orca*)

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Shedd, T., A. Northey, and S. Larson. 2020. Epimeletic behaviour in a Southern Resident Killer Whale (*Orcinus orca*). Canadian Field-Naturalist 134(4): 316–320. https://doi.org/10.22621/cfn.v134i4.2555

Abstract

Southern Resident Killer Whale (SRKW, *Orcinus orca*) may be found year round in the Salish Sea. These orcas comprise three matrilineal pods (J, K, and L) and were listed as Endangered under the Canadian *Species at Risk Act* in 2003 and under the United States *Endangered Species Act* in 2005 because of prey scarcity, vessel noise and disturbance, small population size, and exposure to toxins. Since 1993, the Whale Museum has been operating Soundwatch, a boater education program for vessels. Soundwatch personnel are on the water in the central Salish Sea throughout the summer educating boaters on how to maneuver near marine mammals legally and documenting vessel regulation violations and marine mammal presence and behaviour. Starting on 24 July 2018, Soundwatch documented an adult female SRKW of J pod (J35) carrying a dead neonate calf. J35 continued to carry her dead calf for 17 consecutive days covering ~1600 km. Her story riveted the attention of the people of the Salish Sea as well as people around the world, evoking empathy for J35 and her loss as well as the plight of the Endangered SRKW population. Here, we tell her story and evaluate whether the behaviour J35 displayed toward her dead calf was an example of epimeletic behaviour, animal grief.

Key words: Animal grief; epimeletic behaviour; *Orcinus orca*; Southern Resident Killer Whale

The Southern Resident Killer Whale (SRKW) population is a distinct population of Killer Whale (*Orcinus orca*) that ranges widely along the west coast of North America. They aggregate in the summer months in the United States–Canada transboundary region of the Salish Sea near southern Vancouver Island; these waters include the Southern Strait of Georgia, Puget Sound, the Southern Gulf Islands, the San Juan Islands, and the Strait of Juan de Fuca (Hauser *et al.* 2007). SRKWs are a fish-eating ecotype of orcas that specialize primarily in Chinook Salmon (*Oncorhynchus tshawytscha*), which is estimated to make up 90% of their summer diet (Ford and Ellis 2006; Hanson *et al.* 2010). In the summer months, most SRKWs typically aggregate in the waters of the central Salish Sea, often along the western nearshore area of San Juan Island to feed on returning salmon runs (Ford and Ellis 2006; Hanson *et al.* 2010; Olsen *et al.* 2018).

SRKWs are socially segregated into three pods (J, K, and L), which are structured by matrilines (Parsons *et al.* 2009). Since 1976, the 74 whales making up the current (October 2020) population have been photo-identified, with each member given an identity based on unique physical characteristics, making each whale easily identifiable for tracking by the Center for Whale Research and others (J Pod = 24, K Pod = 17, L Pod = 33 individuals of all ages; Center for Whale Research 2020). In 2003, the SRKWs were listed as Endangered under Canada's *Species at Risk Act* (SARA; SARA Registry 2019) and, in 2005, the population was listed as Endangered under the United States *Endangered Species Act* (ESA; Krahn *et al.* 2004). Under SARA, the population's Critical Habitat was delineated as the transboundary waters of Haro Strait, Boundary Pass, the eastern portion of Juan de Fuca Strait, and southern portions of the Strait of Georgia (Fisheries and Oceans Canada 2017). Under the ESA, the population's critical habitat was established as all inland waters of Washington State, because of this area's importance to the whales for foraging for Chinook Salmon (Krahn *et al.* 2004).

A contribution towards the cost of this publication has been provided by the Thomas Manning Memorial Fund of the Ottawa Field-Naturalists' Club.

Three main risk factors have been identified as threatening SRKWs: limited prey, toxic contaminants, and vessel disturbance with its associated presence and noise pollution (Krahn *et al.* 2004). Studies in both Canada and the United States have shown that increased vessel traffic and incidents of boats not adhering to vessel regulations and/or whale guidelines regarding noise pollution near orcas are associated with an increase in the amount of time SRKWs spend travelling and, thus, a decrease in the amount of time spent foraging and resting (COSEWIC 2008; Lusseau *et al.* 2009; Noren, *et al.* 2009; Seely *et al.* 2017). In addition, this population is hypothesized to be most impacted by food limitation, with declines in Chinook Salmon strongly correlated with increased mortality, decreased fecundity, changes in social cohesion, and decreases in adult size (Ford *et al.* 2009; Parsons *et al.* 2009; Ward *et al.* 2009; Fearnbach *et al.* 2011; Foster *et al.* 2012; SRKW Workgroup 2020). In several recent cases, declines in the body condition of individual SRKWs have been documented preceding mortality (Fearnbach *et al.* 2018). In addition, reproductive success in SRKWs has been limited, with only seven successful births leading to young surviving between 2012 and 2019; 72% of the calves being male has resulted in a sexual skew in the population that limits its reproductive potential and chances of recovery (Center for Whale Research 2020; Marine Mammal Commission 2020).

Orcas and other animals with a high level of social structure are thought to have larger brains, with cognitive capacities similar to humans. SRKWs have been reported as staying in tight social structures or pods for their entire lives and often showing signs of affection and caring for each other, such as food sharing (Ford *et al.* 2009; Parsons *et al.* 2009; Ward *et al.* 2009). Furthermore, post-reproductive matriarch whales help kin raise their offspring, presumably to enhance the survival of younger females' offspring; they are also repositories of ecological information, such as foraging sites, that benefit the entire matriline (Wright *et al.* 2016; Nattrass *et al.* 2019).

Caring and emotional responses are thought to be an indicator of higher cognitive function (Simmonds 2006). Several animal species have been described as showing signs of emotions, such as stress, aggression, grief, and joy (Simmonds 2006). Emotions observed in cetaceans, particularly orcas, include parental love and prolonged grieving following the loss of a calf (Herzing 2000; Rose 2000). In fact, it is common enough that a term, epimeletic, is used to describe cetacean behaviour toward the dead or dying (Bearzi *et al.* 2017). Epimeletic refers to a range of behaviours displayed by distressed individuals in a social unit, such as a pod, including rescue attempts, attentiveness, postmortem carrying, carrying an impaired individual or surrogates for the dead, and other compulsive and apparently non-constructive behaviours (Bearzi *et al.* 2017). These behaviours are typically seen in healthy adults, usually females, and have no obvious benefit to the adult (Bearzi *et al.* 2017). Several reports of epimeletic behaviour in captive and free-ranging cetaceans exist, as well as several unpublished reports of SRKWs carrying dead neonates and one published record of epimeletic behaviour in orcas where a female (L72) was documented carrying a dead neonate in her mouth (Reggente *et al.* 2016, 2018; J. Hyde pers. comm. June 2019). Durban *et al.* (2016) also observed K27 carrying a dead neonate in their study on body condition.

The summer of 2018 was significant in the continued viability of the SRKW population because of the loss of three individuals. Here we report on J35 and her behaviour toward her dead neonate (see Appendix S1 for day-to-day field observations).

Soundwatch, an on-the-water boater education and research program, run through the Whale Museum in Friday Harbor, Washington, operates in the central Salish Sea in and around the Haro Strait Region (48°33′49.9″N, 123°13′47.7″W) from 1 May to 31 September under a federal research permit (National Marine Fisheries Service permit 21114; Seeley *et al.* 2017). Once J35 was observed carrying her dead neonate calf on 24 July, Soundwatch collaborated with other researchers and partners to observe and document her movements and behaviour (Figures 1 and 2). Our objectives were to (1) confirm the location of J35 daily, (2) confirm the presence or absence of her deceased calf at appropriate intervals, (3) monitor J35's health and behaviour, (4) work with whale watch companies to provide extra space as a protective buffer, and (5) educate private boaters on the unique situation. All data were collected by T.S. and A.N. and Soundwatch interns and volunteers. Identification of J35 was confirmed each day through binocular observations based on her natural individual markings.

J35 carried her dead neonate calf for 17 days, with Soundwatch directly tracking her location via the global positioning system (GPS) for eight days (88.8 h). Soundwatch was on the water with J pod for two days but did not directly monitor J35's position, resulting in only estimates of where she travelled. In addition, during this time there were seven days when J pod went west to the mouth of the Strait of Juan de Fuca and data received from Fisheries and Oceans Canada sightings indicated that the whales swam along the southern shore of Vancouver Island out to the mouth of the Strait of Juan de Fuca then back into the inland waters. From our GPS tracks and estimated route, we calculate that J35 carried her calf

Figure 1. Southern Resident Killer Whale (*Orcinus orca*) J35 carrying her calf on her rostrum while the calf was still buoyant. Photo: Taylor Shedd. Permit NMFS 21114.

Figure 2. Southern Resident Killer Whale (*Orcinus orca*) J35 carrying her calf by the pectoral fin in her mouth, making it difficult to determine proof of presence of the calf as it became more negatively buoyant. Photo: Taylor Shedd. Permit NMFS 21114.

for a minimum of 1090.57 km during the 17 days. Because J35, and her pod, were seen only a handful of times during one week in early August, she could have carried her calf for a minimum of ~1600 km.

J35 is not the first SRKW observed carrying a deceased calf, but this is the first documented case of a deceased neonate being carried for an extended period. In the past, other SRKW females (K27, J31, and L72), were observed carrying calves for a few hours or a few days (Durban *et al.* 2016; Reggente *et al.* 2016; J. Hyde pers. comm. June 2019). The extended duration in this case may be an example of epimeletic behaviour or behaviour consistent with grief and mourning; future incidents of this type of behaviour should be carefully documented.

There have been several other cases of odontoce-

tes carrying calves in advanced stages of decomposition for days and even weeks (Bearzi *et al.* 2017; Reggente *et al.* 2018). Only primates have been known to carry dead infants as long as cetaceans (Bearzi *et al.* 2017). The benefit of this type of behaviour to the individual performing it is unclear, although it has been speculated to be initially adaptive, as being attentive and caring for a weak or sick neonate may aid in its recovery (Bearzi *et al.* 2017). The reasons for extending the carrying behaviour after the carcass is markedly decomposed and then stopping are difficult to explain, although it is plausible that the mother continues this behaviour because of the emotional challenge of accepting the loss of her young. It is this extended period of apparent grieving by J35 for her calf that makes this carrying instance noteworthy. Observations of J35's laboured breathing and falling behind her pod suggest that she was struggling to keep her calf with her (see Appendix S1). Perhaps the tight social structure of some odontocetes, such as SRKWs, may make it possible for mothers to carry dead calves for protracted periods because the pod may offer assistance. Assisting and caring behaviour, such as prey sharing (Wright *et al.* 2016), has been observed within SRKW pods; however, no such assistance was directly observed in this case.

SRKWs are Endangered. The loss of even a single individual is critical, because the population is small and reproductively failing (Wasser *et al.* 2017). Conservation actions and human intervention, such as policy changes to increase prey availability and reduce stressors such as pollutants and vessel noise, are needed. Empathy toward individual animals and even populations or species can influence the likelihood of pro-environmental behaviours (Young *et al.* 2018). The story of J35 that we describe drew attention to and empathy for J35 and the SRKWs from people throughout the Salish Sea region and around the world.

Acknowledgements

Thanks to Jeanne Hyde, Jenny Atkinson, and the entire staff of the Whale Museum; Kristin Wilkinson, Lynne Barre, Brad Hanson, and John Durban with National Oceanic and Atmospheric Administration (NOAA); Dave Ellifrit and Michael Weiss with the Center for Whale Research; Jeff Friedman and all the captains of the Pacific Whale Watch Association; Joe Gaydos with SeaDoc Society; Deborah Giles with the University of Washington's Center for Conservation Biology and Wild Orca; Russ Mullins, Taylor Kimball, and Penny Becker with Washington Department of Fish and Wildlife (WDFW); and Holly Fearnbach with Sealife Rescue Response and Rehabilitation (SR3). Funding for Soundwatch is provided through contracts with NOAA and WDFW, as well as the Whale Museum's general operating budget.

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Received 28 May 2020
Accepted 21 October 2020
Associate Editor: W.D. Halliday

Supplementary Material:

Appendix S1. Field observations of J35, 24 July to 11 August 2018, and October 2020 update.