Destroying and Restoring Critical Habitats of Endangered Killer Whales

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Endangered species legislation in the United States and Canada aims to prevent extinction of species, in part by designating and protecting critical habitats essential to ensure survival and recovery. These strict laws prohibit adverse modification or destruction of critical habitat, respectively. Defining thresholds for such effects is challenging, especially for wholly aquatic taxa. Destruction of critical habitat (e.g., prey reduction and ocean noise) threatens the survival and recovery of the 75 members of the endangered southern resident killer whale population found in transboundary (Canada–United States) Pacific waters. The population's dynamics are now driven largely by the cumulative effects of prey limitation (e.g., the endangered Chinook salmon), anthropogenic noise and disturbance (e.g., reducing prey accessibility), and toxic contaminants, which are all forms of habitat degradation. It is difficult to define a single threshold beyond which habitat degradation becomes destruction, but multiple lines of evidence suggest that line may have been crossed already.

Keywords: environmental law, Endangered Species Act, habitat degradation, sustainability, Species At Risk Act

A group of scientists and lawyers from Washington state and British Columbia convened to discuss the US Endangered Species Act (ESA) and the Canadian Species At Risk Act (SARA) as they pertain to protection of critical habitats for the southern resident killer whale (SRKW) population. We aimed to identify specific, objective, broadly applicable guidelines under both statutes to identify excessive degradation of critical habitat. The endangered, transboundary (Canada–United States) SRKW population is a Pacific Northwest icon, and decisions about habitat protection have important implications for human activities. Habitat degradation has long been recognized as an important threat to biodiversity, but quantifying habitat loss is challenging for many mobile marine species.

Only 75 SRKW remain, including only 22 females capable of breeding. The population depends on a depleted prey resource, Chinook salmon. SRKW population dynamics are influenced by prey limitation, anthropogenic noise and disturbance, and toxic contaminants, which are all sublethal, habitat-level stressors. These whales are not hunted and are rarely killed directly by fishing gear, ship strikes, or other human activities.

Canada's SARA and the US ESA mandate designation and protection of critical habitat for endangered and threatened species and such habitat is defined geographically based on physical and biological features deemed necessary for the affected species' conservation (table 1). For SRKW, the United States defines critical habitat based on adequate Chinook salmon prey and on limited physical features of their environment. The US definition makes no explicit mention of sound, which is important to the whales' vital behaviors (e.g., foraging) but does require adequate "passage conditions." Canada defined critical habitat for resident killer whales in such a way to include sound explicitly. Agencies are charged with protecting critical habitat to prevent its "destruction" (Canada) or its "destruction or adverse modification" (United States).

Crucially, neither country has clearly defined minimal thresholds for destruction or adverse modification. Setting minimal thresholds for any particular risk factor can require years of study and can be complicated if multiple risk factors affect a species' habitat, particularly if those factors interact. Such is the case for this population. Vessel noise and disturbance disrupt the whales' foraging (Lusseau et al. 2009). Inadequate availability or accessibility of salmon reduces the whales' survival and reproduction (Ward et al. 2009, Ford et al. 2010). Whales in poor condition because of insufficient prey are especially susceptible to the debilitating effects of contaminants (Ross 2006).

In the United States, uncertainty regarding thresholds has meant that arguments about the nature and magnitude of impacts on critical habitat have sometimes continued for years or even decades and, ultimately, have been mediated by the courts. In one case involving proposed construction of a gravel terminal in SRKW critical habitat, the court rejected the

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Table 1. Standards under Canadian and US legislation to protect killer whales and their critical habitat.

	ESA	SARA
Goal/purpose	Species conservation (preventing extinction and providing for recovery)	Species conservation (preventing extinction and providing for recovery)
Scope	Endangered and threatened species and distinct population segments	Endangered and threatened species, subspecies, variety or geographically or genetically distinct populations
Criteria for designation of critical habitat	Habitat that contains the physical and biological features essential to survival and recovery, including for SRKW adequate prey and water quality and passage conditions to allow for vital behaviors, and that may need special management consideration or protection	Habitat necessary for survival and recovery, which includes the physical and biological features essential to conservation, as identified in the Recovery Strategy, including for southern residents adequate prey and acoustic quality
Critical habitat protections/Prohibitions	Destruction, adverse modification of habitat	Destruction of any part of critical habitat
Exceptions and limits to the protection of critical habitat	Agencies may permit harm to critical habitat but not to the extent that the harm appreciably reduces likelihood of survival and recovery in the wild	Agreements or permits may authorize an activity “affecting” critical habitat but cannot jeopardize survival and recovery of the species

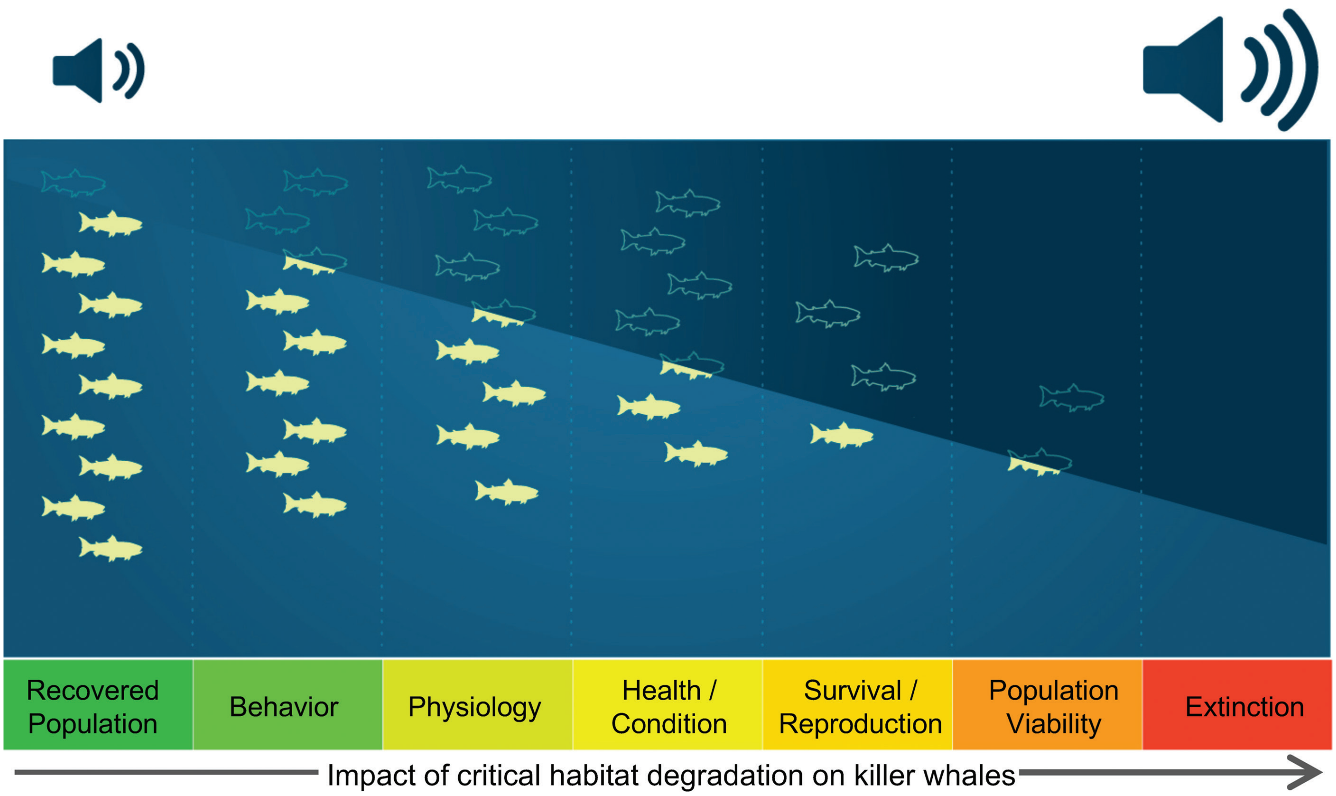

Figure 1. Adverse modification or destruction of critical habitat (e.g., prey limitation and ocean noise) threatens survival and recovery of the 75 members of the endangered southern resident killer whale (SRKW) population found in transboundary (Canada–United States) Pacific waters. The population’s dynamics are now driven largely by the cumulative effects of prey limitation (e.g., endangered Chinook salmon), anthropogenic noise and disturbance (e.g., reducing prey accessibility), and toxic contaminants, which are all forms of habitat degradation. It is difficult to define a single threshold beyond which habitat degradation becomes destruction, but multiple lines of evidence suggest that line may have been crossed already. As we move from left to right along the x-axis, the factual evidence linking human-caused destruction of critical habitat to impacts on SRKWs becomes harder to provide using empirical methods, but the legal standard of destruction becomes easier to satisfy. We found it helpful to acknowledge that these different ways of knowing require us to embrace “epistemic pluralism” (Levin et al. 2021). In the present article, the scientists, lawyers, and policymakers found common ground. Given the precautionary approach embedded in both statutes, the statutory threshold, and therefore the degree of proof required, should be understood to occur towards the left-hand side of figure 1, so that we minimize the odds of ever reaching the worst-case outcome—extinction.

construction permit in part on the basis of the development's potential addition to stressors the whales are facing, notwithstanding the difficulty in identifying a particular quantitative threshold for allowable harm. "Which raindrop caused the flood?" the court asked rhetorically, before noting that it is the government's obligation in all cases to prevent irreversible harm to the environment (*Preserve Our Island v. U.S. Army Corps of Engineers*, 2009 WL 2,511,953 [W.D. Wash. 2009]). Too often, the deluge of individual raindrops leads to bureaucratic paralysis when, absent explicit thresholds, decision-makers are loathe to impose restrictions on human activities. Their reluctance may prevent killer whale recovery.

The role of science in these situations is to quantify the conditions in an endangered species' critical habitat and relate those conditions to the species' behavior, physiology, body condition, vital rates, or trend in abundance and thereby provide indicators or thresholds to inform more effective management decisions. Figure 1 illustrates indicators or thresholds important to the SRKW population, and the best available science suggests that we have already exceeded some thresholds. Fluctuations in the availability of Chinook salmon in the whales' environment strongly influence the whales' survival and reproduction (Ward et al. 2009, Ford et al. 2010), and years of poor salmon return are associated with poor body condition of the whales and high miscarriage rates (Wasser et al. 2017). Vessel noise interferes with the whales' behavior and communication (Holt et al. 2008) and with their ability to feed (Lusseau et al. 2009). The whales lose approximately 23% of foraging opportunities each day (Joy et al. 2019), which exceeds the levels the population has the resilience to withstand sustainably (Williams et al. 2016). Legacy polychlorinated biphenyls affect the whales' reproduction (Desforges et al. 2018, Hall et al. 2018). Human-caused reductions in salmon availability through fishing, destruction of spawning habitat, and climate change amplify these other anthropogenic stressors. On the basis of these and related scientific findings, the Canadian government recently concluded (Government of Canada 2018) that this population faces imminent threats to its survival.

An SRKW population viability analysis quantified the relative importance of the three main threats to survival and recovery (Lacy et al. 2017). SRKWs will need a 30% increase in salmon abundance over long-term historic averages to buffer additional threats. That is a heavy lift and not likely to occur in the near future. Therefore, reducing vessel speeds, moving commercial and recreational whale-watching boats away from the whales, and closing some areas to fishing will be essential to the population's recovery.

Both SARA and the ESA are remarkable in their intent, but, ultimately, their effectiveness and value are a function of their implementation. Neither country is living up to the vision and standards set forth in these acts. It is difficult to determine precisely when habitat alterations have become sufficient to appreciably reduce the likelihood of survival and recovery, but the evidence reveals that we have crossed that line. A piecemeal approach to reviewing and approving individual proposed activities is failing to provide comprehensive, ecosystem-level protection. Activities that adversely modify or destroy critical habitat continue to be approved. Numerous proposals are pending to increase shipping noise in Salish Sea critical habitat (Gaydos et al. 2015). Efforts to ensure SRKW survival and recovery will require major habitat restoration efforts. Neither government should consider permitting additional habitat degradation until we have reduced noise levels and increased salmon abundance sufficiently to halt and reverse the SRKW decline. In order to fulfill our legal obligation to ensure SRKW survival and recovery, we must first restore prey availability and accessibility and the acoustic quality of critical habitat.

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