Killer Whale

(*Orcinus orca*)

State Status: Endangered for all populations, 2004
Federal Status: Endangered for the southern resident population, 2006
Recovery Plans: Federal, 2008

Figure 1. Southern resident killer whales (*photo by NOAA Fisheries*).

Killer whales, or orcas, are an iconic member of Washington's marine ecosystems. Three populations of the whales, known as the southern residents, transients, and offshores, regularly occur in the state (Wiles 2004). A fourth population, the northern residents, enters the state's waters rarely. These populations are not known to interbreed and are therefore considered distinct from one another.

The southern resident population is comprised of three social groups identified as J, K, and L pods (NMFS 2008). It occurs primarily in U.S. and Canadian waters in and around the San Juan Islands, including Haro Strait, Boundary Passage, and the eastern portion of the Strait of Juan de Fuca, from late spring to fall. During the rest of the year, K and L pods spend most of their time along the outer coast and travel extensively to sites as far north as northern British Columbia and as far south as Monterey Bay in California. J pod tends to remain in the Georgia Basin throughout the year, making trips to the outer coast in the winter. Southern resident killer whales feed primarily on chinook salmon, chum salmon to a lesser extent, and occasionally on other fish and squid. The population is highly social, with the three pods having 40 (L), 25 (J), and 20 (K) members in July 2012. The basic social unit within pods is called the matriline, which is usually composed of a female, her sons and daughters, and offspring of her daughters. Members maintain extremely strong bonds and individuals seldom stray from the group for more than a few hours. Permanent dispersal of individuals away from southern resident matrilines has never been recorded.

Transients move greater distances and tend to have larger home ranges than resident whales. Animals observed in Washington have also been recorded in California and southeastern Alaska. The state's transients feed largely on harbor seals, but other marine mammals such as sea lions, porpoises, whales, and small numbers of seabirds are also taken. Transient matrilines are also led by adult females, with group size usually numbering less than 10 individuals. However, unlike residents, permanent dispersal of members from matrilines appears common.

Due to a scarcity of sightings, much less information is available on the biology of offshore killer whales. Observations usually occur more than 15 km (9 mi) offshore and have been made from southern California to Alaska, including rare visits to the Georgia Basin. Animals typically congregate in groups of 20-75 animals and are believed to feed primarily on sharks and other fish (Ford et al. 2011).

Sexually maturity in killer whales occurs at about 12-16 years of age. For animals that survive their first

six months, average life span is 50-60 years for females and 29 years for males. Maximum life span is estimated at 80-90 years for females and 50-60 years for males. Most births take place from October to March, but can happen during any month.

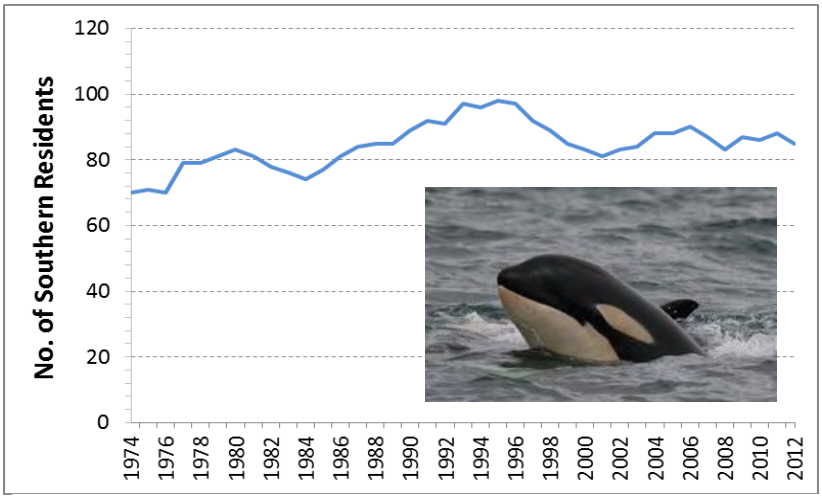

Figure 2. Population trend of southern resident killer whales, 1974-2012 (*photo by Robin Baird*).

Concern for Washington's killer whales focuses primarily on the southern residents (NMFS 2008). The population was heavily harvested for display in marine aquaria during the 1960s and early 1970s, when nearly 50 animals were captured. Census work began in 1974 and documented a total of 70 whales. The population generally increased in most years until 1995, when 98 animals were counted (Figure 2). It declined 17% from 1996-2001 to 81 whales and has since remained in the mid- to high 80s, with 85 individuals in July 2012. From July 1, 2011, to July 1, 2012, one birth (L119) and four deaths (J30, L5, L12, L112) occurred within the population.

Transients and offshore killer whales are thought to total at least 354 and 240 whales, respectively (Allen and Angliss 2013, Carretta et al. 2013), but only small portions of both populations normally occur in Washington at any one time. Trend information does not exist for these populations.

Killer whales in the Pacific Northwest face several important threats (NMFS 2008). Declines in chinook salmon have occurred during the past 150 years and may now be a limiting factor for the southern residents. Chemical contamination threatens both the southern residents and transients, despite the expansion of pollution controls in recent decades. Recent studies have found high levels of PCBs, DDTs, and PBDEs in both populations. Increased boat traffic, especially from commercial and recreational whale watchers, has caused greater underwater noise levels that may interfere with feeding and communication among the whales. The possibility of a major oil spill in the Georgia Basin (including Puget Sound) or along the outer coast is another threat.

Monitoring. Photo-identification work is continually conducted and the Center for Whale Research provides a complete annual count of the southern resident population and a record of recent births and deaths. Transients and offshores are also catalogued by this method, but efforts are much reduced.

Chinook salmon management. Chinook salmon are the main food of southern resident killer whales (Ford et al. 2010, Hanson et al. 2010). During 2011-2012, an expert science panel appointed by NOAA Fisheries and Fisheries and Oceans Canada evaluated whether chinook fisheries in Washington and elsewhere along the West Coast are having a negative effect on the southern resident population. The panel's final report (Hilborn et al. 2012) agreed with previous research linking southern resident survival rates to some indices of chinook salmon abundance, thus increases in chinook abundance would result in higher survival and population growth in the southern residents. However, there is considerable uncertainty about the nature of the relationships, meaning that reductions in chinook harvest would not necessarily result in equivalent increases in prey availability for the whales or their population growth.

Vessel impacts and regulations. NOAA Fisheries implemented new whale-watching regulations in 2011 that require most vessels to stay at least 200 yards from the whales and forbid vessels from intercepting the whales or parking in their path (www.bewhalewise.org). The state of Washington adopted a similar law in 2012 (http://wdfw.wa.gov/conservation/orca/). Both regulations are primarily enforced by WDFW through partial funding from NOAA Fisheries. The NOAA Fisheries Office of Law Enforcement also conducts patrols and coordinates with the U.S. Coast Guard to enforce the federal law. During 2012, WDFW conducted about a dozen dedicated patrols to enforce the whale-watching regulations, which was similar to the patrolling effort in 2011. During these patrols, several dozen warnings were given and six citations (including referrals to NOAA enforcement) were issued to boaters. Canada has not adopted a law similar to the U.S. and Washington regulations and continues to promote voluntary guidelines recommending vessels remain at least 100 m from the whales. The cross-border inconsistency in legal protection for the whales adds confusion for vessel operators and complicates enforcement efforts in U.S. waters.

Figure 3. Brochure for the revised *Be Whale Wise* viewing guidelines.

The Soundwatch Boater Education Program and Straitwatch continued to monitor boater compliance with the regulations in 2012, although both programs experienced reduced numbers of days on the water because of funding constraints. Soundwatch recorded an increase in vessel-whale incidents for the year, with the three most common infractions being vessels stopped within 200 yds of the whales (23% of all incidents), vessels parked in the paths (200-400 yds) of the whales (16%), and vessels motoring within 200 yds of the whales (14%) (Eisenhardt 2012). Private boaters committed 66% of all infractions.

Ayres et al. (2012) reported that levels of stress hormones in southern resident killer whales were correlated with changes in the availability of Fraser River chinook salmon, but not with greater vessel numbers. This suggests that reduced prey abundance has a greater physiological impact on the whale population than vessel traffic.

Marine pollution management. Undesirable levels of pollution and toxic chemical contamination remain a significant concern in Washington's inner marine waters (Puget Sound Partnership 2008, Norton et al. 2011). Land surface runoff and atmospheric deposition are the most important pathways into the environment for a variety of chemical pollutants that are potentially harmful to southern resident killer whales. Numerous efforts by governments, businesses, and citizens are underway to alleviate the problem, but expanded long-term programs are required. In combination, these efforts may lead to reduced loads of bioaccumulated contaminants in the whales. However, Alava et al. (2012) reported that the current guidelines for allowable polychlorinated biphenyl (PCB) levels in the marine environment (i.e., sediments and salmon) of British Columbia and Washington still greatly exceed those considered safe for southern resident whales. The Puget Sound Partnership has identified orcas as an indicator of the Puget Sound's health (http://www.psp.wa.gov/vitalsigns/orcas.php).

Oil spill prevention and response. State and federal agencies, industry, tribes, and other stakeholders continue their work to protect Washington's natural resources (including killer whales) from oil spills. In

2010, a rescue tug was permanently deployed at Neah Bay with funding provided by the commercial shipping industry under a new state law. Presence of the tug greatly reduces the threat of oil spills in killer whale habitat near the western end of the Strait of Juan de Fuca. Response planning, participation in oil spill drills, and outreach are ongoing. Among the many activities done in 2012 were the completion of a protocol to haze killer whales away from oil spills (NMFS 2012a) and preparation for an experimental test of the use of oikumi pipes as a hazing device to be conducted in 2013.

Research. A number of research projects involving the southern residents have been recently completed or are underway (NOAA Fisheries Service 2011). These include studies of diet and foraging behavior; health (i.e., physiology, energetics, stress, disease, and contaminant loads); whether chinook salmon abundance is a limiting factor; impacts from vessels; population monitoring and structure; seasonal distribution; and habitat use. A sampling of studies published on southern resident killer whales in 2012 included Alava et al. (2012), Ayres et al. (2012), Foster et al. (2012), and Mongillo et al. (2012).

Key research beginning in 2012 included the placement of satellite tags on two southern residents by NOAA Fisheries staff (http://www.nwfsc.noaa.gov/research/divisions/cb/ecosystem/marinemammal/satellite_tagging/2011-2012blog.cfm). J26 was tracked for just three days in February before its transmitter was lost. During this time, the whale traveled from the western Strait of Juan de Fuca to an area 30-80 km west of Cape Flattery. K25 was tagged on December 29 and moved from Vashon Island to the mouth of the Strait of Juan de Fuca during the three days before the end of 2012. Tracking of this individual continued into 2013.

Federal listing status. In 2011, NOAA Fisheries completed a 5-year review concluding that the southern residents should remain listed as endangered (NMFS 2011). However, in August 2012, NOAA Fisheries was petitioned to delist the southern resident distinct population segment (DPS), based on information suggesting it may not be distinct from other killer whale populations (NMFS 2012b). In response, NOAA Fisheries has initiated a new status review, with a final determination to be made by August 2013.

Strandings. A dead killer whale identified as L112, a 3-year-old southern resident female, washed ashore near Long Beach in February 2012. A necropsy revealed that the whale experienced extensive blunt trauma in the head, neck, and right side of the body, but the cause of death has not yet been determined.

Outreach. Numerous outreach efforts are underway. A few of these include the Soundwatch Boater Education Program, which promotes responsible boating and kayaking practices near the southern residents. Work continues on The Whale Trail, which is a series of sites in Washington and southern British Columbia where the public can watch for killer whales and other marine wildlife from shore (Figure 3). Thirty-two sites have been placed thus far in city, county, and state parks; on tribal lands; and on Washington ferries. The environmental education program Killer Whale Tales is operated by a non-profit and provides storytelling, lectures, and hands-on classroom exercises about killer whales for school children. The Seattle Aquarium and The Whale Museum also conduct educational programs and have exhibits on killer whales. NOAA Fisheries' Northwest Regional Office has developed five classroom lesson plans on killer whales for grades 9-12 that are available at http://www.nwr.noaa.gov/education/killer_whale_recovery_unit.html. Another non-profit, Orca Network, continues to post online sightings of killer whales and information about the species.

Partners and cooperators: NOAA Fisheries, Fisheries and Oceans Canada, Center for Whale Research, The Whale Museum, Orca Network, Seattle Aquarium, Puget Sound Partnership, Washington State Department of Ecology, U.S. Coast Guard, University of Washington, Olympic Coast National Maine Sanctuary, Cascadia Research Collective, Straitwatch, Cetus Research and Conservation Society, Pacific Whale Watch Association, Marine Resources Committee of San Juan County, Vancouver Aquarium,

SeaDoc Society, Portland State University, University of British Columbia, Parks Canada, Georgia Strait Alliance, Washington Environmental Council, and Coast Watch Society.

Literature Cited

Alava, J. J., P. S. Ross, C. Lachmuth, J. K. Ford, B. E. Hickie, and F. A. Gobas. 2012. Habitat-based PCB environmental quality criteria for the protection of endangered killer whales (*Orcinus orca*). Environmental Science & Technology 46:12655-12663.

Allen, B. M., and R. P. Angliss. 2013. Alaska marine mammal stock assessments, 2012. NOAA Technical Memorandum NMFS-AFSC-245, Alaska Fisheries Science Center, Seattle, Washington.

Ayres, K. L., R. K. Booth, J. A. Hempelmann, K. L. Koski, C. K. Emmons, R. W. Baird, K. Balcomb-Bartok, M. B. Hanson, M. J. Ford, and S. K. Wasser. 2012. Distinguishing the impacts of inadequate prey and vessel traffic on an endangered killer whale (*Orcinus orca*) population. PLoS ONE 7(6): e36842. doi:10.1371/journal.pone.0036842

Carretta, J. V., E. Oleson, D. W. Weller, A. R. Lang, K. A. Forney, J. Baker, Brad H., K. Martien, M. M. Muto, M. S. Lowry, J. Barlow, D. Lynch, L. Carswell, R. L. Brownell, Jr., D. K. Mattila, and M. C. Hill. 2013. U.S. Pacific marine mammal stock assessments: 2012. NOAA Technical Memorandum NMFS-SWFSC-504, Southwest Fisheries Science Center, San Diego, California.

Eisenhardt, E. P. 2012. 2012 Soundwatch Program annual contract report. The Whale Museum, Friday Harbor, Washington.

Ford, J. K. B., G. M. Ellis, C. O. Matkin, M. H. Wetklo, L. G. Barrett-Lennard, and R. E. Withler. 2011. Shark predation and tooth wear in a population of northeastern Pacific killer whales. Aquatic Biology 11:213-224.

Ford, J. K. B., B. M. Wright, G. M. Ellis, and J. R. Candy. 2010. Chinook salmon predation by resident killer whales: seasonal and regional selectivity, stock identity of prey, and consumption rates. DFO Canadian Science Advisory Secretariat Research Document 2009/101.

Foster, E. A., D. W. Franks , L. J. Morrell, K. C. Balcomb, K. M. Parsons, A. van Ginneken, and D. P. Croft. 2012. Social network correlates of food availability in an endangered population of killer whales, *Orcinus orca*. Animal Behaviour 83:731-736.

Hanson, M. B., R. W. Baird, J. K. B. Ford, J. Hempelmann-Halos, D. M. Van Doornik, J. R. Candy, C. K. Emmons, G. S. Schorr, B. Gisborne, K. L. Ayers, S. K. Wasser, K. C. Balcomb, K. Balcomb-Bartok, J. G. Sneva, and M. J. Ford. 2010. Species and stock identification of prey consumed by endangered southern resident killer whales in their summer range. Endangered Species Research. 11:69-82.

Hilborn, R., S. P. Cox, F. M. D. Gulland, D. G. Hankin, N. T. Hobbs, D. E. Schindler, and A. W. Trites. 2012. The effects of salmon fisheries on southern resident killer whales: final report of the independent science panel. Report to National Marine Fisheries Service, Seattle, Washington, and Fisheries and Oceans Canada, Vancouver, British Columbia.

Mongillo, T. M., E. E. Holmes, D. P. Noren, G. R. VanBlaricom, A. E. Punt, S. M. O'Neill, G. M. Ylitalo, M. B. Hanson, and P. S. Ross. 2012. Predicted polybrominated diphenyl ether (PBDE) and polychlorinated biphenyl (PCB) accumulation in southern resident killer whales. Marine Ecology Progress Series 453:263-277.

NMFS (National Marine Fisheries Service). 2008. Recovery plan for southern resident killer whales (*Orcinus orca*). Northwest Region, National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2011. Southern resident killer whales (*Orcinus orca*), 5-year review: summary and evaluation. Northwest Region, National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2012a. Oil spill emergency response killer whale – hazing implementation plan. Northwest Region, National Marine Fisheries Service, Seattle, Washington.

NMFS (National Marine Fisheries Service). 2012b. Listing endangered or threatened species: 90-day finding on a petition to delist the southern resident killer whale; request for information. Federal Register 77(228):70733-70736.

NOAA Fisheries Service. 2011. Southern resident killer whales research update. http://www.nwfsc.noaa.gov/publications/documents/SRKW%20Newsletter%202011.pdf.

Norton, D., D. Serdar, J. Colton, R. Jack, and D. Lester. 2011. Control of toxic chemicals in Puget Sound: assessment of selected toxic chemicals in the Puget Sound Basin, 2007-2011. Ecology Publication No. 11-03-055, Washington State Department of Ecology, Olympia, Washington, and King County Department of Natural Resources, Seattle, Washington. www.ecy.wa.gov/biblio/1103055.html.

Puget Sound Partnership. 2008. Puget Sound action agenda: protecting and restoring the Puget Sound ecosystem by 2020. Puget Sound Partnership, Olympia, Washington.

Wiles, G. J. 2004. Washington state status report for the killer whale. Washington Department of Fish and Wildlife, Olympia, Washington.