Periodic Status Review for the Marbled Murrelet in Washington

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Acknowledging the Indigenous People of the Pacific Northwest

Since time immemorial, Indigenous People have lived in the Pacific Northwest and hunted, fished, and gathered natural resources, traditional foods, and medicinal plants to support their diverse cultures. They were the original occupants and stewards of this land that all Washingtonians enjoy today.

The very survival of the Pacific Northwest Tribes is a testament of resiliency of what they have endured and continue to endure throughout generations on this landscape. Through many historical encounters of massacre, renunciation of religious freedom, systemic racism, cultural assimilation of native children through institutional residential schools, and the fight for their inherent rights and liberties, they have prevailed. Throughout this painful history brought by colonization, abrogated treaties, infringement of civil rights, and the salmon protests of the 1960s, the Northwest Tribes and the Washington Department of Fish and Wildlife (WDFW) have founded a commitment of respect, unity, and alliance informed by the realities of the past.

Today, tribal governments and WDFW work collaboratively to conserve and manage aquatic and terrestrial resources statewide and practice sound science to guide management decisions. The Tribes and WDFW work together to ensure the sustainability of fish, wildlife, ecosystems, and culture for the next seven generations and beyond.

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Executive Summary

The marbled murrelet (*Brachyramphus marmoratus*) is a small seabird that inhabits the nearshore marine environment in western North America. The species was listed as threatened under the U.S. Endangered Species Act in 1992 in Washington, Oregon and California, and subsequently listed by the Washington Fish and Wildlife Commission as threatened in 1993, primarily due to loss of old growth forest nesting habitat and mortality associated with net fisheries and oil spills. In 1997, Washington enacted State Forest Practices Rules to address impacts to murrelets from timber management on non-federal lands. Due to continued population decline of the species it was listed as endangered by the Washington Fish and Wildlife Commission in 2016.

Since 1993 nesting habitat losses due to timber harvest in Washington have been substantial and at-sea population monitoring from 2001 to 2024 indicated nearly a nearly 5.0% decline in the murrelet population annually. The 2023 population estimate for Washington was 4,400 birds (McIver et al. 2025), down from the estimated 7,500 in 2015.

Sustained low juvenile recruitment has been identified as a main cause of their decline, but research investigating the cumulative effects from threats on individuals and populations is ongoing. Vital demographic data are lacking, and nest success is influenced by both terrestrial and marine factors, such as the availability of nesting sites, amount of nesting habitat, nest predation, and prey availability and quality. Human marine activities appear to influence murrelet abundance and distribution in the Salish Sea. Declines in populations of forage fish species resulted in an increased consumption of lower trophic level food sources (invertebrates). Ultimately, changes to the marine food web may have influenced reproductive output. Federal and state landscape plans and Forest Practices Rules, implemented to help stem the loss of higher quality nesting habitat, have been beneficial but have not led to recovery goals being met.

The continued population decline indicates that marbled murrelets in Washington have become more imperiled since state listing in 1993. Without solutions that can effectively address these concerns in the short-term, it is likely the marbled murrelet could become functionally extirpated in Washington within the next several decades. Therefore, our recommendation is to maintain the marbled murrelet as an endangered species in Washington.

This is an update of the Periodic Status Review (PSR) for marbled murrelet in Washington that was published in 2016 (Desimone 2016). This revised PSR is largely based on the former document with updates on research efforts and management practices in Washington and assesses whether the marbled murrelet should maintain its status of endangered under state law.

Description and Legal Status

The marbled murrelet (*Brachyramphus marmoratus*) is a small seabird of the Alcidae family (Figure 1), inhabiting marine coastal waters in western North America. It has the unusual behavior among seabirds of flying considerable distances inland during the breeding season to establish nest locations.

Figure 1. Marbled murrelet, nonbreeding plumage.

The marbled murrelet was listed as threatened in 1992 under the U.S. Endangered Species Act in Washington, Oregon and California (USFWS 1992), and subsequently listed as state threatened by the Washington State Fish and Wildlife Commission in 1993 and then state endangered in 2016 due to continued population decline.

Distribution

Marbled murrelets are found in coastal marine areas (generally within 5 to 8 km of shore) from the Aleutian Islands of Alaska south along the Pacific coast to central California (Ridgley et al. 2007). In Washington, the current and historical marine distribution of the marbled murrelet includes the southern Salish Sea (Puget Sound, Strait of Juan de Fuca) and the outer coast (Pacific Ocean). The known nesting habitat distribution includes western Washington coniferous forest within about 55 miles of marine waters (Figure 2), which is the extent of the habitat analysis area as defined in the federal Northwest Forest Plan (Lorenz et al. 2021). Nest locations in Washington have been documented from near sea level to 4200 feet elevation and inland to 36.5 miles from nearest marine water. An audio detection 70 miles from marine waters has also been recorded (Huff et al. 2006). Murrelets from mainland Alaska to northern California (the main genetic unit) are genetically distinct from peripheral populations in the central and western Aleutian Islands and from central California (Friesen et al. 2007, Bloxton and Raphael 2009).

Natural History

Nesting habitat requirements. The species is unusual among alcids in that it does not nest in colonies at the marine-terrestrial interface. In the central and southern parts of its range, including Washington, the murrelet nests in coastal forests (Bradley and Cooke 2001, USFWS 2009, Barbaree et al. 2014). During April to mid-Septeber, breeding murrelets make daily flights from marine foraging areas to tend inland nest sites.

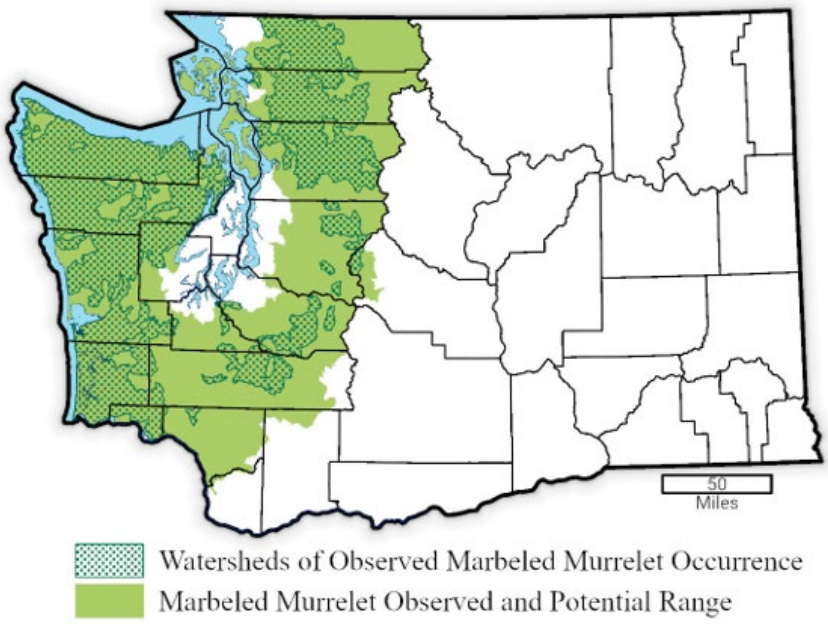

Figure 2. Approximate recent range of the marbled murrelet in Washington. Observed and potential species range boundary and observed marbled murrelet occurrence as depicted by the spatial extent of multiple ecological systems in HUC-12 watersheds. Site location data used to create this map are from the Wildlife and Survey Data Management database, Washington Department of Fish and Wildlife.

In Washington, marbled murrelets usually nest in older forests dominated by western hemlock, (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), Douglas-fir (*Pseudotsuga menziesii*) and western redcedar (*Thuja plicata*) trees. Nests are typically found on large, moss-covered branches of mature trees (e.g., 30-75 cm width, >150 years old) (Hamer & Nelson, 1995; Ralph et al., 1995; Nelson, 1997; Wilk et al., 2016), though younger western hemlock trees (70-100+ years old) with mistletoe (Arceuthobium tsugense) infection, moss, and epicormic branching have also been used for nesting in southwestern Washington and Oregon (Hamer & Nelson, 1995; Nelson & Hamer, 1995; Nelson & Wilson, 2002). Nesting habitat includes forest structure of sufficient height and depth to provide vertical and horizontal cover to the nest and nest tree. This structure appears to enhance microclimate conditions and minimizes predation risk by providing hiding cover (Raphael et al. 2002b, Meyer et al. 2004, Huff et al. 2006).

Foraging (marine) habitat and diet. Marbled murrelets forage in marine waters, usually within 2- 8 km of shore (Nelson 1997, Hebert and Golightly 2008, USFWS 2009). Marbled murrelets prey primarily on forage fish such as Pacific herring (*Clupea pallasii*), northern anchovy (*Engraulis mordax*), eulachon (*Thaleichthys pacificus*), Pacific sand lance (*Ammodytes hexapterus*), surf smelt (*Hypomesus pretiosis*), juvenile rockfish (*Sebastes* spp.), and juvenile salmon (*Oncorhynchus* spp.). In Washington, diet is dominated by Pacific sand lance and herring but also includes whitebait smelt, krill, and squid (Fountain et al. 2023). Their diet regularly comprises of 60-100% forage fish but larger zooplankton, such as krill and Mysiids, are also taken (Ralph et al.1995, Nelson 1997, Carter and Sealy 1986, Hobson 1990, Piatt et al. 2007, Fountain et al. 2023). Murrelets have occasionally been observed using larger freshwater lakes near marine areas for limited resting and foraging (Carter and Sealy 1986, WDFW Wildlife Surveys Data Management 2024) but surveys of lakes in western Washington have not resulted in the detection of murrelets.

Home range and site fidelity. The highest densities of marbled murrelets in Washington waters during the breeding season are found on the northern outer coast, northern Puget Sound, and the Strait of Juan de Fuca (Raphael et al. 2015, Lance et al. 2024, Lance and Pearson 2024). Larger areas of mature and old forests adjacent to those areas provide high quality potential nesting sites for murrelets. In Washington, straight-line distance from a known nest to the nearest marine shoreline ranged from 4–58 km (2.5-36.5 miles; WDFW Wildlife Surveys Data Management 2024). There is considerable variation in home range size and movement behavior across the species' range (Hull et al. 2001, Bloxton and Raphael 2009, Barbaree et al. 2015). In Washington, movements of radio-marked birds between the outer coast, Puget Sound, and Strait of Juan de Fuca were all observed within a season, indicating that some individuals incorporate substantial movements to secure food resources and may use portions of multiple marine regions in a single year, some traveling over 120 km (75 miles) from the nest on a single foraging trip with the average total commuting distance of about 53.5 km (33 miles) (Bloxton and Raphael 2009, Lorenz et al. 2017). The home range of adults can vary from 13 to 7,816 km2, averaging about 944-1802 km2, and includes marine water, land area, and travel corridors (Bloxton and Raphael 2009).

Marbled murrelets exhibit strong site fidelity to nesting areas, with some birds documented nesting in the same trees in successive years and re-use of the same nest (e.g., Bloxton and Raphael 2009, Burger et al. 2009, Hebert and Golightly 2006). Multiple pairs nesting within a forest stand is well documented (see Plissner et al. 2015). Marbled murrelets make social inland flights (usually multiple birds) to re-visit breeding areas in mid-winter (Naslund 1993, O'Donnell et al. 1995, Piatt et al. 2007).

Marbled murrelet adults are generally assumed not to disperse widely between populations (Peery et al. 2004, Becker and Beissinger 2006, Norris et al. 2007); however, some seasonal migration does occur in Washington, as birds from British Columbia move to the sheltered waters of Puget Sound in fall and winter (Beauchamp et al. 1999, Bertram et al. 2024). Within season movements are also known, especially in years with poor ocean conditions when many birds are not nesting (Garcia-Heras et al. 2024). Generally, within and between season movement and dispersal is poorly studied.

Reproduction and Survival

The marbled murrelet is believed to be a relatively long-lived seabird, but reliable longevity estimates are lacking. Their lifespan is expected to be in the range of 10 to 20 years (USFWS 2024) with estimated adult survival rates between 0.83-0.93 and fecundity between 0.12-0.23 offspring per female annually (Cam et al. 2003), with a fecundity of 0.20 (Beissinger 1995). Murrelets have a naturally low reproductive rate, with females typically producing a single large egg per season and can skip breeding in any given year due to high energy demands or in response to poor foraging conditions. Both parents provide food for the chick carrying a single whole fish carried crosswise in their beaks. Chicks must successfully fledge in a single flight to reach the ocean. Nest success depends on a combination of suitable nesting habitat, protection from predation and disturbance, and adequate foraging conditions within a reasonable commuting distance.

Diet shifts from historical marine trophic levels and murrelet productivity. Marbled murrelet populations have likely been negatively impacted by declines in forage fish availability since the mid-20th century, leading to reduced reproductive output. Studies have documented significant trophic level declines in murrelet diets, coinciding with collapses of key fisheries such as the Pacific sardine (*Sardinops sagax*; Becker and Beissinger 2006; Norris et al. 2007). This dietary shift is associated with drastic reductions in juvenile-to-adult ratios in central California, suggesting substantial reproductive declines (Peery et al. 2006a, b; Becker and Beissinger 2006), while adult survival rates appear to have remained relatively stable (Beissinger and Peery 2007). Reduced prey availability due to climate change and other factors has also been shown to affect breeding propensity (Betts et al. 2020, Garcia-Heras et al. 2024) However, murrelet productivity may be able to respond positively to increased ocean forage productivity and a higher proportion of mid-trophic level prey in their diet, particularly following periods of cooler ocean temperatures and increased prey availability (Becker et al. 2007).

Habitat and Population Status

Forest (Nesting) Habitat

Nesting habitat loss and subsequent fragmentation of remaining stands were identified as a primary factor leading to population declines and federal listing (USFWS 1997). It is estimated that between 12-18% of the original unmanaged old-growth forest remains in western Washington (Booth 1991). The Northwest Forest Plan (NWFP) is a landscape-based approach to managing federal lands, aimed at protecting threatened and endangered species while supporting social and economic sustainability. Following the plan researchers estimate the change in murrelet populations and the change in nesting habitat over time. A primary goal is to link murrelet population trends to the availability of nesting habitat. The aim is to stabilize and increase murrelet populations by preserving and improving nesting habitat conditions over time (Lorenz et al. 2021).

Washington nesting habitat. The majority (79%) of marbled murrelet nesting habitat in Washington is on federal land, mostly occurring in designated reserved areas. However, overall Washington continues to experience a net decline in habitat. The 2017 estimate of nesting habitat in the Washington NWFP area, for all land ownerships, was 935,980 acres (79% federal, 21% nonfederal lands) which is a 6.4% net loss from 1993 (Lorenz et al. 2021). Since 1993, loss of nesting habitat has resulted from timber harvest, wildfire, insect damage, and other unattributable causes (Lorenz et al. 2021). Most of this loss (63%) was attributed to timber harvest. On nonfederal land there has been a 23% decline in nesting habitat with 85% of that loss attributed to timber harvest. The largest habitat losses have occurred on privately owned lands (-30.49%) (Table 1, Lorenz et al. 2021). There has been an estimated net loss of 0.96% nesting habitat on federal lands with a slight increase estimated on non-reserved federal land (Lorenz et al. 2021).

Marine Habitat

Offshore wind patterns and climatic events such as El Niño and the Pacific Decadal Oscillation are key drivers of oceanic conditions along the Pacific coast, including sea surface temperatures and upwelling. Over recent decades, Pacific Northwest coastal ecosystems have experienced intensifying hypoxia, ocean acidification, and marine heatwaves due to climate change (Chan et al., 2008; Feely et al., 2008, 2016; Peterson et al., 2013; Koehlinger et al., 2023). Sea surface temperatures along the Pacific coast are projected to rise by 1.2°C to 3°C by the mid- to late-21st century (Mote and Salathe 2010, USGCRP 2017), with more extreme heat waves expected as climate change progresses (Bond et al. 2015, Leising et al. 2015, Barkhordarian et al. 2022, Leising et al. 2023).

The coastal waters of Washington have exhibited seasonally hypoxic conditions since at least 1950, and the lowest recorded dissolved oxygen levels of the California Current System. Since 1800, outer coastal water acidity in Washington has increased by about 10 to 40 percent, translating to a pH decline of -0.05 to -0.15. Elevated acidification levels in localized areas of Puget Sound have been documented to disrupt biogenic calcification processes in marine invertebrates, including pteropods and bivalves. These disruptions can lead to reduced shell integrity, impaired development, and increased mortality. Given the trophic importance of these calcifying organisms, such impacts may have cascading effects on forage fish populations that rely on them as a primary food source (Tillmann and Siemann 2011).

Changes in oceanic conditions have direct effects on some prey species and in turn their competitors and consumers (Mackas et al. 2007). Oceanic forage fish production on the outer coast of Washington is particularly influenced by both sea surface temperature and summer upwelling events. Lower sea surface temperatures and strong upwelling events have strong positive influences on forage fish populations.

Forage fish studies. The abundance, distribution, and quality of Washington's primary murrelet prey has not been studied in detail, although there have been efforts to map nearshore forage fish spawning habitat and there are annual surveys of Pacific herring spawning (location and biomass). Stocks of Pacific herring, the most common prey for marbled murrelets in Washington (Fountain et al. 2023), has

declined since 2013 with several stocks not having detectable spawning activity in 2016 (Sandell et al. 2019). Of the 18 stock aggregates, only four are classified as increasing or healthy (Sandell et al. 2019). Data are lacking for herring and other forage fish stocks for the Washington outer coast. Northern anchovy stocks, smelt species and sand lance populations and demographics have not been studied extensively in Puget Sound (Penttila 2007). Eulachon, an extremely energy dense prey species, was recently listed as endangered under the U.S. Endangered Species Act.

Population Status

The "at-sea" survey methods for monitoring population size and trends were devised for the NWFP because of the difficulty of finding murrelet nests over large tracts of potential nesting habitat. Standardized transect surveys for murrelets are conducted within 1.5 km ("inshore") and 1.5 to 5-8 km ("offshore") to detect birds on the water during the breeding season (Miller et al. 2006, Raphael et al. 2007, Falxa et al. 2016a). From 2000 to 2010, there was a 29% decline of the federally listed portion of the population (Washington to central California; Miller et al. 2012). Despite precipitous declines in Washington, the current annual estimates of the total population for the listed range between Washington and central California overall are relatively stable (show no clear trend) due to increases in Oregon and California (McIver et al. 2025). The marbled murrelet population in Canada has also continued to decline between 1.55% and 7% each year since 1990 (Pattison et al. 2024, Betram et al. 2015, Drever et al. 2021).

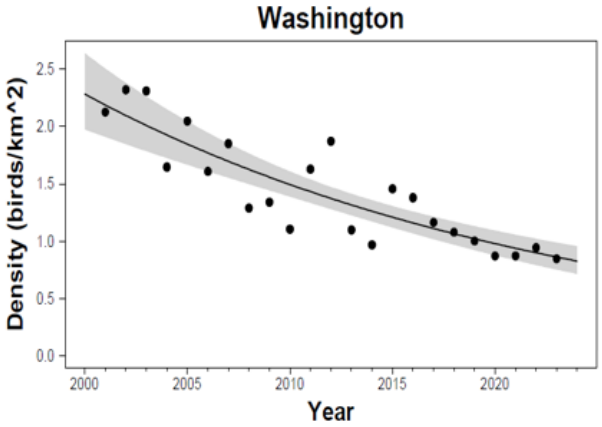

Figure 3. Marbled murrelet annual density estimates from 2001-2023 with 95 percent confidence intervals (gray) (McIver et al. 2025).

Washington population. Washington data has continued to show a significant downward trend since 2001. The overall annual rate of change in murrelet density in Washington for 2001-2023 was -4.1% (95% CI = -5.2 to -3.1; McIver et al. 2025). The 2024 population estimate for the Salish Sea and Puget Sound was 2,700 birds (CI=1,700-3,900) with a 4.6% annual decrease for the 2001-2024 period (Lance and Pearson 2024, McIver et al. 2025). The population estimate for the Washington outer coast for 2023 was 1,088 birds with a declining trend of 3.46% for the same interval (Lance and Pearson 2024). The total population estimate for Washington in 2023 (Salish Sea and outer coast combined) was 4,400 birds (95% CI = 3,667 to 5,500). The 23-year trend line represents a 44% decline in Washington marbled murrelet abundance from 2001-2023 (Figure 3). Since 2012, WDFW with funding from the US Navy, conducted non-breeding (Sept – March) at-sea murrelet monitoring in northern and central Puget Sound (Pearson et al. 2022, Pearson et al. 2024). Like trends from the breeding season, there were strong murrelet density declines across the entire non-breeding period (Sep and Apr) between 2012 and 2019, with declines most pronounced in the fall and early winter (Sep–Dec) survey windows when birds

molt and in the spring just prior to breeding (Mar-Apr) (Pearson et al. 2022, Pearson et al. 2024). Despite these declines, there was essentially no change in murrelet density in mid-winter (January—February) when overall density was lower (Pearson et a. 2022, Pearson et al. 2024).

Forest Habitat and Marine Abundance Correlations

Like all seabirds, murrelets spend most of their lives at-sea and consume marine prey and also depend on terrestrial environments for nesting. Foraging and nesting areas must be within daily commuting distance to allow adults to continue foraging while incubating eggs and rearing chicks. Research has shown that murrelet abundance at sea during the breeding season correlates with the presence of high-quality nesting habitat in adjacent terrestrial environments (Raphael et al. 2015, Lorenz et al. 2016, Raphael et al. 2016, Pastran et al. 2021). Terrestrial sites are more likely to be occupied by murrelets when they occur in areas with older forests that are closer to high-quality foraging areas (Betts et al. 2020). Murrelets are capable of long commutes, traveling up to 55 miles inland to reach suitable nesting sites in the northern part of their range, with shorter distances in the southern part (Raphael et al. 2018).

Additionally, murrelets do not always forage in marine waters nearest their nesting sites; for example, a commuting distance of 91 miles between foraging areas in Washington and nesting areas on Vancouver Island has been documented (Lorenz et al. 2017, Pastran et al. 2022). These long commutes may reflect unfavorable spatial relationships between nesting and foraging habitats in certain area. While not specifically documented for murrelets, the energetic demands of long commutes, combined with survival and reproduction costs, may lead to trade-offs that reduce reproductive output (Garcia-Heras et al. 2024), as seen in other seabird species (Elliott et al. 2014). Such trade-offs occur because adult birds adjust their behavior to meet increased energy demands, which can result in lower investment in self-maintenance or offspring provisioning (Elliott et al. 2014, Markones et al. 2010). This may be especially true for a species, like the murrelet, with high wing loading (larger body mass relative to wing area) which requires more energy.

Factors Affecting Continued Existence

The U.S. Fish and Wildlife Service assembled an expert panel of scientists to form a Recovery Implementation Team (USFWS 2012) to develop a prioritized list of actions to help stem the marbled murrelet population decline in the short term. They concluded that sustained low recruitment of young into the population is the main cause of decline, and identified five main mechanisms contributing to the decline: 1) ongoing and historical loss of forest nesting habitat; 2) low nest success from predation on eggs and chicks in nest; 3) changes in marine forage conditions affecting abundance, distribution and quality of prey; 4) post-fledging mortality; and 5) cumulative and interactive effects from factors on individuals and populations. These and other threats are summarized in the sections below.

Adequacy of Regulatory Mechanisms

Federal Critical Habitat. In Washington, federally designated critical habitat for the marbled murrelet spans about 1.6 million acres; 1.2 million of which are in National Forests (USFWS 2020) managed under the Northwest Forest Plan. These designated lands are considered essential for the conservation of the marbled murrelet. A significant portion of this critical habitat consists of young forests and areas that were previously logged that are located within Late-Successional Reserves. These areas are expected to serve as buffer habitats for existing mature forests and contribute to the future development of large, connected patches of suitable nesting habitat for murrelets. Due to factors such as past timber harvesting, wildfire activity, and natural features like subalpine regions and wetlands, only about 26% (311,000 acres) of the 1.2 million acres of designated critical habitat on federal lands in Washington is classified as potential murrelet nesting habitat (USFWS 2020).

Critical Habitat for marbled murrelets in marine areas has still not been designated; however, the northern outer Washington coast from Cape Flattery to Copalis has been designated as Olympic National Marine Sanctuary and National Wildlife Refuge and several marine reserves have been established and are managed by Washington Department of Natural Resources.

Federal habitat conservation plans and acquisitions. Thirteen Habitat Conservation Plans (HCPs), that include marbled murrelet as a covered species, have been implemented in Washington since the 1992 listing (USFWS 2024). These plans vary considerably in scale and scope of murrelet habitat protection and this variation is based on ownership objectives, forestry operations, capabilities, and geographic location. It is estimated that about 15.5% (approx. 213,000 ac) of the potential nesting marbled murrelet habitat in Washington currently exists on Washington Department of Natural Resources (WDNR)-managed lands; of this, about 40,000 acres are previously designated as marbled murrelet occupied habitat and deferred from harvest (Raphael et al. 2008). In December of 2019, the WDNR adopted a long-term conservation strategy amendment conserving an additional 148,000 acres through habitat relationship studies and surveys of reclassified habitat (WDNR 2019).

State Forest Practices Rules. The Washington Department of Natural Resources has implemented Forest Practices Rules (FPR) to complement federal marbled murrelet recovery efforts on state and private lands lacking federal agreements such as HCPs or Conservation Benefit Agreements (CBAs). These rules require landowners to identify potential murrelet habitat and conduct surveys to determine occupancy before any habitat-altering activities. Areas deemed "occupied" or un-surveyed but suitable, automatically trigger review under the State Environmental Policy Act, potentially limiting or precluding timber harvest within a 300-foot buffer zone. While harvest is permitted in areas deemed “not occupied” (following approved surveys) or under alternative plans like HCPs and CBAs, lower-quality habitat can be managed without surveys. Additionally, once a site is deemed “not occupied” it remains so in perpetuity with no opportunity to reassess over time, further contributing to habitat loss.

A key challenge of the FPR, coupled with existing land ownership patterns, is the potential for habitat fragmentation. Smaller occupied stands can become isolated, increasing their vulnerability to edge effects and wind disturbances, ultimately leading to habitat degradation and potentially impacting the breeding population. Outside of established federal or state plans, private landowners currently have limited incentives to actively manage and maintain marbled murrelet habitat, contributing to the ongoing challenge of habitat preservation and recovery.

Continued Risks and Threats

Ongoing loss of forest nesting habitat. From 1993 to 2017 across the entire Northwest Forest Plan area, there was a 5.16% net loss of nesting habitat on nonfederal lands and about 2.93% net gain on federal lands (Lorenz et al. 2021). Timber harvest has reduced habitat by 30% on nonfederal lands. Aside from harvest loss, degradation is occurring from chronic wind disturbances from smaller storms (WDNR 2008). Wind damage occurs more frequently along hard forest edges where there is significant contrast between older, interior forest conditions and adjacent recently harvested or younger regeneration stands. High contrast edges also affect interior forest microclimate well inside the forest edge, modifying sunlight, temperature and humidity, and may reduce moss and epiphyte abundance for development and maintenance of potential nesting platforms (Chen et al. 1995, van Rooyen et al. 2011).

Habitat fragmentation, forest edge, and predation. The interconnection of habitat fragmentation, forest edge, and predation contributes to reduced nesting success and population declines in marbled murrelets (USFWS 2024). Human-driven degradation of existing nesting habitat remains a persistent issue in Washington. Lorenz et al. (2021) reports ongoing high levels of fragmentation within the NWFP area, with approximately 88% of higher-probability nesting habitat in Washington classified as “edge” or “scatter,” representing intermediate and lower-quality habitat across all land ownerships.

Increased forest edge heightens nest vulnerability to predators, particularly corvids (jays, crows, and ravens) which has been identified as a leading cause of nest failure of murrelets (USFWS 2024). Increased edge also disrupts connectivity between foraging and nesting habitats, with murrelet inland detections, nest sites, and at-sea distributions being negatively impacted by large-scale habitat fragmentation (Valente et al. 2023).

Low reproductive success. At present population trend rates, adult birds in Washington do not appear to be replacing themselves (USFWS 2019, Lance and Pearson 2022, 2023, Pearson et al. 2022). This could be the result of low recruitment, but without reproductive information, it is unclear how low adult survival, post-fledging mortality, or birds emigrating out of state waters might contribute.

Genetic flow. Genetic differentiations relate to a species’ ability to adapt to both short- and long-term environmental changes. Although marbled murrelets in Washington, Oregon, and California are considered one genetic population; the most significant long-term decline in at-sea abundance is occurring in Washington. These declines could impact genetic diversity of the species over time, potentially reducing its ability to adapt to new challenges and cope with environmental fluctuations and disasters. (USFWS 2024).

Climate effects on marine habitat and prey. Anthropogenic climate change is causing a general warming of marine environments leading to an increase in the frequency and duration of marine heatwaves, a reduction in coastal upwelling, and changes in sea-surface temperature and salinity. These disruptions in the structure and function of marine ecosystems have been shown to reduce the amount and quality of food resources available to upper trophic predators, including seabirds like the marbled murrelet (Garcia-Heras et al. 2024) but may not have the same impact in tidally affected waters like the Puget Sound. Further, variable climate and extreme weather events may result in increased physiological stress and lead to greater risk(s) of morbidity or mortality events.

Oil and chemical pollution. Oil spills can harm marbled murrelets by causing direct morbidity or even mortality, reducing their fitness, and degrading marine foraging habitat. External oiling disrupts thermoregulation by altering feather structure, while ingested oil can lead to long-term health effects due to toxic hydrocarbon exposure (USFWS 2024). Although murrelets are vulnerable to oil spills and localized impacts can be severe, no documented injuries or mortalities have occurred in the past ten years across their entire range (USFWS 2024).

In Washington increasing tanker and freighter traffic in the Salish Sea presents ongoing risks (Van Dorp et al. 2014; WDOE 2024). From 2016 to 2024, the WDFW Oil Spill Team received 1,468 notifications of oil or chemical spills in Washington waters (D. Noviello, WDFW, pers. comm.). Further research found that forage fish in the Salish Sea, a key food source for murrelets, were 2-4 times more contaminated with persistent organic pollutants than those along Washington's outer coast, suggesting that murrelets in the Salish Sea face heightened exposure to pollution through their diet (Good et al. 2014).

Commercial fishing net mortality. Fishing net mortality, or "bycatch," of marbled murrelets is currently considered rare in Washington but is subject to periodic monitoring. A purse seine monitoring study from 1996 to 2000 had no marbled murrelets recorded during 1,442 purse seine sets (WDFW 2004). There have been no encounters with marbled murrelets in the fisheries managed by WDFW (Kwasi Addae, WDFW, personal comms). NOAA Fisheries' National Marine Fisheries Service modeled the probability of encountering murrelets during Treaty and non-Treaty commercial, ceremonial, and recreational fisheries based on actual encounter rates and murrelet densities from at-sea surveys, which indicated that interactions between marbled murrelets and gillnet fisheries are relatively rare (NMFS and BIA 2015).

Alternative energy projects. Wind energy projects within the range of marbled murrelets in Washington have been proposed in recent years. To date, one project with four wind turbines has been completed and is in operation within 2 km of the ocean, and a second project with 38 wind turbines has been completed in the flight path of murrelets with occupied sites located within an 8-kilometer radius (Anchor QEA 2019). Radar monitoring studies of murrelet flights have been conducted for proposed wind turbine sites (e.g., Hamer 2009), and found that murrelet-like targets can be detected. Although projects have previously been proposed, as of this publication there are no active offshore wind turbines in Washington state. However, there are currently active tidal energy projects in Washington waters,

particularly focused on the San Juan Islands and the Olympic Peninsula which could potentially impact murrelets and their prey.

Climate effects on forest habitat. Climate change is expected to lead to unprecedented losses of existing murrelet nesting habitat, exceeding any scale previously encountered by managers (Lorenz et al. 2021). Climate projections for the Pacific Northwest indicate significant changes in the 21st century, with warmer and drier summers and wetter winters, particularly in forested areas used by murrelets (Lorenz et al. 2021). Even though coastal areas will warm more slowly due to marine influences, more extreme heat events are expected, and weakening onshore winds will lessen the cooling effect of the ocean on coastal forests. This will lead to hotter droughts and higher tree mortality (Allen et al. 2015), which are already being observed in the Western U.S. (van Mantgem et al. 2009). The increased tree stress will reduce epiphyte growth, negatively impacting the availability of suitable nesting platforms for murrelets (van Rooyen et al. 2011). Models suggest that warmer, drier summers will lead to more frequent, intense fires, which will decrease the size and connectivity old-growth forests (Littell et al. 2013, Wan et al. 2019). Between 1993 and 2017, wildfires in Washington resulted in the loss of approximately 3,016 acres of marbled murrelet nesting habitat (USFWS 2024).

Pathogens of concern. Highly pathogenic avian influenza viruses (HPAIV) H5N1 clade 2.3.4.4b continue to have severe impacts on wild birds globally, particularly colonial nesting seabirds. In Washington, HPAIV has led to substantial mortality events, including a 2023 outbreak among Caspian erns that resulted in at least a 56% loss of the adult colony (Haman et al., 2024). While no cases have been confirmed in Alcids in Washington, the virus caused a major die-off of common murres in Alaska in summer 2023 (U.S. Department of Agriculture, Animal and Plant Health Inspection Service, April 2025) and was detected in several Alcid species in the Eastern North Pacific in spring 2025 (Katie Haman, WDFW, personal comms). The virus remains a serious threat to marine bird populations, including marbled murrelets.

Management Activities

Washington recovery prioritization. In collaboration with USFWS, WDFW has developed a list of actionable recovery and research priorities for marbled murrelets in Washington. This process involved reviewing existing literature on murrelet status and recovery, as well as gathering input from experts within and outside the agencies. The finalized list of actions and research objectives was evaluated and ranked by experts based on their potential to stabilize or increase murrelet populations in Washington within the next 10 years. WDFW will support and coordinate implementation efforts, monitor outcomes to assess progress , and collaborate with species experts and resource managers to ensure the list remains current and scientifically informed.

At-sea monitoring. Population monitoring continues to be essential for measuring effectiveness of conservation and recovery efforts. In 2015, the Northwest Forest Plan at-sea monitoring changed from annual to biannual surveys. Washington Department of Fish and Wildlife is responsible for implementing the surveys for state waters during the breeding season, alternating between Zones 1 and 2 in successive years (McIver et al. 2021).

Pacific Seabird Group Inland Survey Protocol revision. The Pacific Seabird Group marbled murrelet technical committee revised the terrestrial survey protocol, which was published in 2024 (Pacific Seabird Group 2024). Revisions to the survey protocol were made using best available science and updated statistical analysis.

Conclusion and Recommendation

Marbled murrelets continue to experience significant population declines across much of their range, with the steepest long-term declines in Washington (USFWS 2024). Their low reproductive rate means that high survival rates for young are essential for population growth. Despite initiatives such as federal forest management plans, habitat conservation strategies, and state Forest Practices Rules, habitat loss continues. Coupled with the reduction in prey availability and quality, these factors have likely adversely impacted nest success and the survival of juveniles. With projections of accelerated ocean warming and increased global timber demand, the threats to murrelets are expected to intensify, further jeopardizing the two key habitats on which they depend (Betts et al. 2020). Without effective, immediate solutions to address these pressing threats, the situation for marbled murrelets is likely to deteriorate, and the species could be lost from some regions in the coming decades. Therefore, we recommend maintaining the marbled murrelet's status as an endangered species in Washington.

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34.05.271(1)(c) RCW	Category Code
(i) Independent peer review: review is overseen by an independent third party.	i
(ii) Internal peer review: review by staff internal to the department of fish and wildlife.	ii
(iii) External peer review: review by persons that are external to and selected by the department of fish and wildlife.	iii
(iv) Open review: documented open public review process that is not limited to invited organizations or individuals.	iv
(v) Legal and policy document: documents related to the legal framework for the significant agency action including but not limited to: (A) federal and state statutes; (B) court and hearings board decisions; (C) federal and state administrative rules and regulations; and (D) policy and regulatory documents adopted by local governments.	v
(vi) Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under the processes described in (c)(i), (ii), (iii), and (iv) of this subsection.	vi
(vii) Records of the best professional judgment of department of fish and wildlife employees or other individuals.	vii
(viii) Other: Sources of information that do not fit into one of the categories identified in this subsection (1)(c).	viii

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