The Marbled Murrelet and Climate Change
A Position Paper from the Olympic Forest Coalition
UPDATED May 2023
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1.) Introduction

Ninety-five percent of seabirds are colonial,[1] nesting in tightly packed colonies either with their own kind or in mixed-species aggregations. The marbled murrelet (*Brachyramphus marmoratus*) is one of the world's few exceptions. There is no other bird that feeds in the ocean and commutes such long distances inland to nest sites. They are found throughout coastal Washington, Oregon,

[1] Schreiber, Elizabeth A. and Burger, Joanne (2001) Biology of Marine Birds, Boca Raton: CRC Press, ISBN 0-8493-9882-7

Northern California and British Columbia in preferred association with lower-elevation old-growth forests with well-developed epiphytic mosses. A small, solitary, and secretive bird with cryptic plumage and fast flight speed, murrelets nest on the largest limbs of coniferous trees up to 50 km inland from the ocean, and return to coastal waters to forage for food. Marbled murrelets are alcids (web-footed diving birds with short legs and wings that include auklets, murres, murrelets and puffins) and can be important initiators of mixed seabird feeding assemblages,[2] as well as good indicators of functioning old-growth forest.[3] Marbled murrelet populations in Washington State have been in a steep dive for most of the 21st century. While timber harvest is thought to be the main reason for their population decline, a study on Vancouver Island also showed higher predation of nests and eggs at forest edges, which suggests problems for marbled murrelets in fragmented forests.[4]

The Olympic Peninsula contains the largest contiguous areas of murrelet nesting habitat remaining in Washington. The Olympic National Forest contains 29 percent, Olympic National Park 43 percent, and the rest (28 percent) is owned by state, tribal and private entities.[5] However, the rate of habitat loss on non-federal lands, where much of the best old-growth habitat remains, has been 10 times greater than on federal lands.[6] Due primarily to extensive timber cutting over the past 190 years, up to 90 percent of marbled murrelet nesting habitat in Washington, Oregon, and California has been destroyed.[7] More than 9 percent of murrelet nesting habitat on state lands, and 37 percent of murrelet nesting habitat on other nonfederal lands, has been harvested over just the past 20 years.[8]

In addition to confirming these facts in the Federal Register, on its website, and in its 2019 Biological Opinion (on the Marbled Murrelet, Long-term Conservation Strategy Amendment to the 1997 Habitat Conservation Plan), the U.S. Fish and Wildlife Service (FWS) stated, “If this rate of loss continues, the conservation of the murrelet may not be possible because almost half of the higher-suitability nesting habitat is on non-federal lands.”[9] It recommends that “...recovery of the murrelet will be aided if areas of currently suitable nesting habitat on non-federal lands are retained until in-growth of habitat on federal lands provides replacement nesting opportunities.”

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[2] W. Ostrand 1999; R.J. Smith and Schaefer 1992 Wilson Bull. 104(4):738-743

[3] Audubon Wildlife Report 1989-90

[4] Nelson, SK and Hamer, TE. Nest Success and the Effects of Predation on Marbled Murrelets. USDA Forest Service Gen. Tech. Rep. PSW-152. 1995

[5] USFWS. Programmatic Forest Management Activities on the Olympic National Forest June 15, 2020 to June 15, 2030. Reference: 13410-2009-F-0388-R001

[6] USFWS 5-Year Status Review, Marbled Murrelet, May 2019. https://www.seattle.gov/light/skagit/relicensing/cs/groups/secure/@scl.skagit.team/documents/document/cm9k/ntcx/~edisp/prod571175.pdf

[7] 56 Fed. Reg. 28,362, 28,363-64 (June 20, 1991).

[8] Raphael, M.G., G.A. Falxa, D. Lynch, S.K. Nelson, S.F. Pearson, A.J. Shirk, and R.D. Young. 2016. Status and Trend of Nesting Habitat for the Marbled Murrelet Under the Northwest Forest Plan. Chapter 2, in Falxa, G.A. and M.G. Raphael, tech. coords.: Northwest Forest Plan—The First 20 Years (1994-2013): Status and Trend of Marbled Murrelet Populations and Nesting Habitat. Gen. Tech. Rep. PNW-GTR-933. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 132 pp.

[9] U.S. Fish and Wildlife Service. Endangered Species Act - Section 7 Consultation. BIOLOGICAL OPINION Reference: 0lEWFW00-2019-F-1650 x-reference: 1-3-96-FW-594 Washington State Department of Natural Resources Marbled Murrelet Long-term Conservation Strategy Amendment to the 1997 Habitat Conservation Plan.

This underscores the severity of the threat and the need to arrest the loss of suitable habitat on all lands, but especially on nonfederal lands and in the relatively near term (3 to 5 decades) in order to allow for this in-growth on federal lands to mitigate losses elsewhere.

The Endangered Species Act (ESA) defines “endangered” as “any species which is in danger of extinction throughout all or a significant portion of its range.” A threatened species is defined under the ESA as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." For an agency to acknowledge the murrelet’s impending extinction throughout a significant portion of its range when the remedy is so obvious—stop the loss of nesting habitat—it contradicts the congressional and judicial intent of the ESA “to halt and reverse the trend toward species extinction, whatever the cost.”[10]

Marbled murrelet on nest in old-growth tree.

Washington State’s Department of Natural Resources (DNR) manages 3 million acres of state lands in trust for common schools, state universities, other public institutions, and county services. About 2.1 million acres are forestlands. The benefits of mature and old growth forests are critical not only to recovery of a suite of listed species, but also to mitigating the impacts of climate change. Yet, the DNR continues to allow the logging of mature forests, including some old growth, by adopting forestry and carbon policies that favor timber and revenue-generating extractive forestry. **DNR does not have any enforceable policies[11] that adequately consider carbon-reducing methods of forest management on state lands.**

Yet in May 2022, without ceremony, Commissioner of Public Lands Hillary Franz commented in a DNR meeting that **DNR was removing protections on older forests - many of which have been in place for decades - because requirements to protect habitat for the threatened**

[10] *Tennessee Valley Auth. v. Hill*, 437 U.S. 153 (1978)
[11] SUPREME COURT OF THE STATE OF WASHINGTON. NO. 99183-9. *Conservation Northwest v. Commissioner of Public Lands Hilary Franz and Wahkiakum County*. Brief of Amici Curiae, Earth Law Center.

marbled murrelet had been federally removed as part of the incidental take permit that the DNR and FWS agreed to in the Long-Term Conservation Plan.[12] As a result, between May and December, each monthly auction included multiple parcels adding up to 15,000 acres of legacy forests sold and logged. In the three-month period ending on March 6, 2023 alone, the Washington State Board of Natural Resources approved 26 timber sales for auction. Fourteen of these 26 timber sales would collectively result in the destruction of an estimated 865 more acres of older legacy forests. These are carbon-dense forests that were selectively logged during the first half of the 20th Century. Prior to World War II, there were no chainsaws, and logging operations were labor intensive. There were also a lot of big trees, so loggers would often leave behind the smaller trees, defective trees, or trees that were difficult to access, or out-of-reach of their yarding systems. In other cases, trees were left behind as seed trees. Many of these forests closely resemble old growth. Because these forests were not re-planted, but instead allowed to grow back on their own, they exhibit much of the species diversity, genetic diversity, and structural complexity of the original native forest.[13]

As an example of the challenges to saving legacy forests, in February 2023 the Thurston County Board of County Commissioners wrote a second letter to DNR, which hadn't responded to their first, reminding them of their desire to protect the last Legacy Forests within Thurston County, and asking them specifically to stop the auction of "Juneau," a 95-acre parcel up for vote with the entire March 8 package. Juneau holds 38,200 megatons of stored carbon and stores 574 megatons per year. DNR in response to that letter agreed to "pause" the auction of Juneau in order to meet with the Commissioners.[14] In an exception to common practice with timber sales packages, Commissioner of Public Lands Hilary Franz moved to exclude it. While laudable, this should not be the exception.

The manner in which DNR has interpreted its trust mandate artificially constrains it from accounting for the public interest and responding to the climate crisis and species protection in a way that would benefit all the people of Washington—not to mention the species. Once logged, these mature forests cannot be replaced in the time frame necessary to help mitigate the most severe impacts of climate change or species declines, especially when the majority of climate models project decreased precipitation in summer by as much as 40 percent by 2080.[15]

The Biological goals that an Interagency Science Team[16] identified for DNR to consider in formulating the marbled murrelet's 2019 Long Term Conservation Strategy were to "...manage forest habitat to contribute to 1) a stable or increasing [murrelet] population; 2) an increasing geographic distribution; and 3) a population that is resilient to disturbance." But since timber harvest in, and fragmentation of, murrelet habitat continues to be **<u>the</u>** major factor in preventing

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[12] Franz, Hilary. Habitat Conservation on State Trust lands. https://www.dnr.wa.gov/programs-and-services/forest-resources/habitat-conservation-state-trust-lands

[13] https://www.wlfdc.org/legacy-forests?cid=05435b5e-7ac9-4d68-a2d6-1f4d97e11ba4&utm_campaign=6ae496c9-2f15-4788-9b4f-77aabef0ef13&utm_medium=mail&utm_source=so

[14] https://www.thejoltnews.com/stories/yesterday-was-good-for-legacy-forests-in-capitol-forest,9687

[15] USFWS 5-Year Status Review, Marbled Murrelet, May 2019. https://www.seattle.gov/light/skagit/relicensing/cs/groups/secure/@scl.skagit.team/documents/document/cm9k/ntcx/~edisp/prod571175.pdf

[16] Final State Trust Lands Habitat Conservation Plan AMENDMENT, Marbled Murrelet Long-term Conservation Strategy. Washington State Department of Natural Resources. December 2019.

these goals from being met or even trending positively in Washington, all the planning in the world won't help until this is addressed.[17]

This Position Paper will explain the Olympic Forest Coalition's (OFCO) research, findings, and recommendations for action in re-initiating consultation under Section 7 of the U.S. Endangered Species Act.

2.) Troubled History

In 1988, more than 40 Audubon chapters petitioned FWS to list the tri-state (WA, OR and CA) population of marbled murrelets.[18] When FWS failed to meet the ESA's statutory deadlines for responding to the petition, several of the groups sued to compel FWS to meet its legal obligations. The federal district court determined that the tri-state marbled murrelet population qualified for listing under the ESA, because marbled murrelet habitat in Washington, Oregon, and California constituted a significant portion of its range, and that the bird qualified for listing as a threatened species.[19] The court also found that all credible science supported a finding that the tri-state population was a distinct population, and that the Service failed "to establish the existence of any scientific dispute on this point."

Thus, in October 1992, citing the extensive harvest of late-successional and old-growth forest, the FWS listed marbled murrelets in Washington, Oregon, and California as threatened under the Endangered Species Act.[20]

A 2004 Evaluation Report commissioned by FWS in a lawsuit settlement recognized the tri-state region as a significant portion of the murrelet's range, and attributed the decline to loss of old-growth forest nesting habitat, adding, "It is unrealistic to expect that the species will recover before there is significant improvement in the amount and distribution of suitable nesting habitat."[21] Another independent report that same year separately verified that the tri-state population qualified as a distinct population segment.[22]

The ESA requires FWS to scrutinize and review the status of listed species "at least once every five years."[23] [24] On the basis of the 5-Year Status Review, FWS shall "determine . . . whether any such species should (i) be removed from such list; (ii) be changed in status from an endangered species to a threatened species; or (iii) be changed in status from a threatened species

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[17] https://www.fws.gov/species/marbled-murrelet-brachyramphus-marmoratus
[18] *Marbled Murrelet v. Lujan*, No. C91-522R, slip op. at 4 (W.D. Wash. Sept. 17, 1992).
[19] Marbled Murrelet, No. C91-522R, slip op. at 12.
[20] 57 Fed. Reg. 45,328, 45,330 (Oct. 1, 1992) and Rafael, Martin G. Conservation of the Marbled Murrelet under the Northwest Forest Plan. U.S. Department of Agriculture Forest Service, Pacific Northwest Research Station. 2006.
[21] *AFRC v. Hall,* 533 F. Supp. 2d 84, 88 (D.D.C. 2008) (recounting litigation and settlement history).
[22] C. McShane, et al., Evaluation Report for the 5-Year Status Review of the Marbled Murrelet in Washington, Oregon, and California at 6-34 (March 2004) (final conclusions).
[23] 16 U.S.C. § 1533(c)(2)(A).
[24] *Tennessee Valley Auth. v. Hill,* 437 U.S. 153, 184 (1978)

to an endangered species."[25] The history of 5- year status reviews of marbled murrelets is unfortunately marred with political interference[26] and litigation over ESA requirements.

In 2004, FWS sent a draft of its 5-Year Status Review to its headquarters in Washington DC, saying that due to loss of nesting habitat, the tri-state population continued to decline and was "**likely to become an endangered species** within the foreseeable future throughout all or a significant portion of its range." The draft review also verified that the marbled murrelet population in Washington, Oregon, and California was a distinct population segment under the ESA because of (1) "differences in conservation status between Canada and Washington, Oregon, and California"; (2) "difference in management between the U.S. and Canada," and (3) "differences in regulatory mechanisms between the U.S. and Canada."

Unfortunately, when the final 5-Year Status Review was released in Washington DC, it no longer considered the tri-state marbled murrelet population as a distinct population segment, even though the threat level hadn't changed. Officials justified this via the passage of a new law in Canada, (the Species at Risk Act) saying it would provide "equivalent protection" in British Columbia.[27] Thus, went the logic, if marbled murrelets could not be saved in the tri-state area, their loss would be ameliorated because their range now included (and depended upon the management of) the population in British Columbia. Also, this would facilitate avoiding a potential jeopardy opinion. The ESA does not allow for management of U.S. species on U.S. soil by a foreign government.

This stunning reversal was eventually linked to the spectacular and unprecedented interference and undermining of science by Julie MacDonald, then Department of the Interior Deputy Assistant Secretary for Fish, Wildlife and Parks. She was found to have "potentially jeopardized" 13 of 20 major FWS decisions that were re-opened for review at the request of Senator Wyden and several Congressmen.[28] The writer of this position paper, a former FWS employee, personally witnessed one incident with Ms. MacDonald and was told firsthand of several other times where she intimidated, threatened, and bullied FWS staff. I also witnessed firsthand her editing, reshaping and weakening of scientific findings and recommendations. The Inspector General's investigation report on her conduct also discredited the "arbitrary and unsupported" conclusions in the FWS's 2004 Status Review.[29] The 2004 Status Review did not identify climate change as a threat to the murrelet, but that was a common tactic; I saw references to climate change frequently excised from documents during the George W. Bush administration.

Undeterred by these findings, timber companies petitioned the FWS to delist the tri-state population of the murrelet.[30] FWS at first found their petition to contain "substantial"

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[25] 16 U.S.C. § 1533(c)(2)(B)(i)-(iii).
[26] Earthjustice, Washington Forest Law Center, Oregon Wild, Klamath-Siskiyou Wildlands Center, Center for Biological Diversity, Audubon Society of Portland, Seattle Audubon, EPIC, Conservation Northwest, Cascadia Wildlands, Washington Environmental Council, Olympic Forest Coalition, and Defenders of Wildlife. Comments on 2017 Marbled Murrelet 5-Year Status Review, June 19, 2017.
[27] Ibid.
[28] Office of Inspector General. Report of Investigation: Julie MacDonald, Deputy Assistant Secretary, Fish, Wildlife, and Parks. https://grist.org/wp-content/uploads/2007/03/doi-ig-report_jm.pdf
[29] Ibid.
[30] Earthjustice et al.

information, and replied that delisting might be warranted.[31] Another five-year review would provide the basis for a decision. In 2009, FWS concluded in a new 5-Year Status Review that the "**loss of Federal protective measures** afforded by the Act is likely to place the species at greater risk of extirpation in the coterminous United States." It also found the tri-state murrelets to be a valid distinct population, and responded to the timber petition by saying delisting was "not warranted." Finally, it added newly identified threats including abandoned fishing gear, harmful algal blooms, and observed changes in the quality of the bird's marine food supply.[32]

The same timber interests once again returned to court, and once again lost their challenges to the FWS' denial of the delisting petition.[33] [34]

Since then, a long line of reports and studies have all reached similar conclusions.

In 2015, a 20-Year Monitoring Report[35] under the Northwest Forest Plan recommended no more habitat loss, and to reduce fragmentation in order to conserve marbled murrelets. It said, "It can take more than 100 years for Class 2 habitat to become Class 3, and more than 200 years to become Class 4. The development of stands with old-growth characteristics necessary for murrelets is expected to take at least 100 to 200 years from the time of regeneration. If management for late-successional and old-growth forests continues, projections show substantial increases of forest exceeding 150 years in age by 2050 on western federal lands. Shorter term gains in habitat quality may occur as older forest fills in around existing suitable habitat and reduces edge and fragmentation effects in existing habitat, prior to the older forest developing the large limbs, nest platforms, and other characteristics of murrelet nesting habitat."

Also in 2015, the marbled murrelet was identified as a Species of Greatest Conservation Need under the Washington State Wildlife Action Plan,[36] and as a Priority Species under the its non-regulatory Priority Habitat and Species Program.[37] There is no lack of evidence for both state and federal agencies formally and repeatedly recognizing the dire circumstances for this species.

Trump-era ESA rollbacks exacerbated the murrelet's problems. In the name of "efficiency," the rollbacks made it harder to list species and to designate critical habitats for them. It also removed default protections for species such as prohibitions on killing and harm to species newly listed or reclassified as threatened, and it allowed federal agencies to conduct economic assessments when deciding whether or not to protect a species from activities like construction projects in critical habitats. They also weakened consultation and removed tools that scientists used to forecast future damage to species from climate change. These rollbacks would be subsequently vacated by the court during the Biden administration.

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[31] 73 Fed. Reg. 57,314, 57,316-17 (Oct. 2, 2008)
[32] Fish and Wildlife Service, Proposed Rule: Endangered and Threatened Wildlife and Plants; 12 Month Finding on a Petition to Remove the Marbled Murrelet (*Brachyramphus marmoratus*), 75 Fed. Reg. 3424 (Jan. 21, 2010)
[33] *AFRC v. Ashe*, 946 F. Supp. 2d 1 (D.D.C. March 30, 2013).
[34] Earthjustice et al.
[35] https://www.fs.usda.gov/r6/reo/monitoring/socio-economic.php
[36] https://wdfw.wa.gov/species-habitats/at-risk/swap
[37] https://wdfw.wa.gov/species-habitats/at-risk/phs

In May 2019, FWS published another 5-year Status Review[38] stating that loss rates continue at about the same pace, and that since listing in 1992, **recovery criteria including all 5 listing factors for this species had not been met.** It also offered a robust defense for the continuation of the murrelet's status as a distinct population segment. It reported that the relative ratio of potential nesting habitat on federal vs state/private lands changed from 1993 to 2012, from 59 percent to 66 percent. This reflected a significant decline in suitable nesting habitat on state/private lands from 41 to 34 percent due to continued harvesting of late-successional/old-growth forest. But despite conceding a "substantial downward trend," FWS recommended that the listing not be changed from threatened to endangered, while acknowledging that state endangered species statutes "provide relatively little protection to the species." This defies all logic except "other priorities are more pressing," and is unacceptable.

In December 2019, Washington's Board of Natural Resources adopted a long-term conservation strategy[39] for the marbled murrelet. The strategy[40] is the product of more than two decades of research and collaboration with scientists and community members throughout western Washington to develop a conservation plan for the federally threatened species.

Yet still, we are losing murrelet nesting habitat (and murrelets) at unsustainable rates, primarily due to timber harvest.

3.) ESA Implementation Concerns

The first major problem as we see it is the implementation and enforcement of the Endangered Species Act compared to its original intent and effectiveness. The ESA is the strongest and most comprehensive law in the world for protecting imperiled species and their habitats,[41] with many of its protections coming under Section 7 of the Act through consultation with either the U.S. Fish and Wildlife Service (FWS) or the U.S. National Marine Fisheries Service (NMFS). The purpose of consultation is to ensure that actions do not violate the Act's prohibitions on "jeopardizing" listed species or "destroying or adversely modifying" these species' critical habitats.[42] Because the prohibitions are broad, many people consider Section 7 as the primary tool for protecting species. Others believe it severely impedes economic development.

Despite the Trump-era rollbacks that were later vacated by the court, (and we note that the FWS's 2019 Biological Opinion is a Trump-era document), the ways in which government

[38] USFWS 5-Year Status Review, Marbled Murrelet, May 2019. https://www.seattle.gov/light/skagit/relicensing/cs/groups/secure/@scl.skagit.team/documents/document/cm9k/ntcx/~edisp/prod571175.pdf

[39] https://www.dnr.wa.gov/mmltcs

[40] Long Term Conservation Strategy for the Marbled Murrelet. Revised Draft Environmental Impact Statement. September 2018. https://www.dnr.wa.gov/publications/amp_sepa_nonpro_mmrevdeis_entire.pdf

[41] Bean MJ, Rowland (1997) The Evolution of National Wildlife Law (Praeger, Westport, CT)

[42] Malcolm, J. and Li, Ya-Weh. Data contradict common perceptions about a controversial provision of the US Endangered Species Act. Proceedings of the National Academy of Sciences of the United States of America, December 29, 2015. 112 (52) 15844-15849

regulators use this powerful tool is not well understood. Nor are the number of jeopardy findings, or the effects of Section 7 consultation on the conservation of listed species. A 2015 study by Malcolm and Li that analyzed all 88,290 consultations recorded by the Fish and Wildlife Service from January 2008 through April 2015 showed that, in contrast to conventional wisdom about Section 7 implementation, **no project was stopped or extensively altered** as a result of the FWS finding jeopardy or adverse modification during this period.[43] It also found that the average duration of consultation was well below the maximum time allowed by the Act.

These results discredit many industry claims about the onerous nature of Section 7, but they also raise questions as to how federal agencies could apply Section 7 to more effectively conserve species.[44] The total number of consultations during that 2008-2015 time period included 81,461 informal and 6,829 formal consultations, but the study excluded 110,850 consultations recorded as technical assistance during this time. Of the 6,828 formal consultations, only two (0.0023 percent) resulted in jeopardy, one of which also resulted in destruction/adverse modification of critical habitat. That consultation applied to a U.S. Forest Service proposal to apply fire retardants on national forests, and it resulted in jeopardy and/or adverse modification for 45 species. The Biological Opinion for that consultation was rejected by a court and redone in 2011,[45] and the revised consultation concluded no jeopardy or destruction/adverse modifications.

The only remaining consultation with a jeopardy conclusion during that 2008-2015 time period focused on the effects to the delta smelt (*Hypomesus transpacificus*) from a water management project in California's Central Valley. Even that project, however, was allowed to proceed if the permittees adopted Reasonable and Prudent Alternatives to minimize and partially offset the adverse effects of the project.[46] And many years later, the delta smelt's recovery is considered a failure because of poor implementation of a good plan.[47]

Things were different during previous years; for example from 1979 to 1981, the Fish and Wildlife Service completed 8,817 informal and 1,945 formal consultations, finding jeopardy for 173 projects (8.9 percent of formal consultations).[48] Of those 173 projects, 8 were cancelled or withdrawn, partly or entirely because of Section 7.[49] The percentage of jeopardy findings increased to 17.5 percent during 1987 to 1991—among the 2,000 total projects requiring formal consultation, 350 had jeopardy findings, of which 18 were stopped by Section 7 and another 35

[43] Ibid.
[44] Ibid.
[45] https://www.fs.usda.gov/sites/default/files/media_wysiwyg/fws_afr_bo_firsthalf.pdf
[46] Bean MJ, Rowland (1997) The Evolution of National Wildlife Law (Praeger, Westport, CT)
[47] Moyle, Peter. The Failed Recovery Plan for the Delta and Delta Smelt. https://californiawaterblog.com/2022/05/29/the-failed-recovery-plan-for-the-delta-and-delta-smelt/
[48] US House of Representatives (1982) H.R. Report 97-567, Part 1. House of Representatives, Committee on Merchant Marine and Fisheries, Endangered Species Act Amendments (US Government Printing Office, Washington, DC)
[49] Parenteau P (1982) Testimony of P. A. Parenteau, Vice President for Conservation, National Wildlife Foundation. Endangered Species Act Hearings Before the Subcommittee on Fisheries and Wildlife Conservation and the Environment, of the Committee on Merchant Marine and Fisheries. 22 February 1982 and 08 March 1982 (US House of Representatives, Washington, DC)

had the potential to ultimately be blocked.[50] For comparison, if the consultation process had not changed since 1987 to 1991, the study expected that nearly 1,200 consultations would have reached jeopardy conclusions, and more than 60 of those could have stopped a project during the period from 2008 to early 2015.[51] If the consultation process had not changed from 2005 to 2008, the study expected that there would have been approximately 490 jeopardy opinions.[52] Instead, there were two.

An unusual rebuke[53] to the aforementioned Malcolm and Li study publicly challenged their findings, but it must be acknowledged that this data-free rebuttal letter was authored by a team of attorneys who represent private developers and large landowners in litigation, permitting, and compliance counseling, and who have successfully sued the FWS to significantly reduce the size of critical habitat. In our opinion, the fact that their letter criticizing that study was also published in the Proceedings of the National Academy of Sciences reflects the pressure that developers and industries can bring to bear on regulatory agencies that in the past was unthinkable. Malcolm and Li issued a reply,[54] also published in PNAS, upholding their conclusion that the regulatory impact of the Section 7 consultation process has dropped.

For the public, to whose ultimate benefit the ESA supposedly accrues, the analysis by Malcolm and Li demonstrates an enormous and inexplicable reduction in endangered species protection and recovery. Answering *why* is something for sober reflection by law- and policy-makers and the Fish and Wildlife Service itself. Has this translated to Section 7 becoming a paper tiger that provides less protection for listed species? Based on the 2019 Biological Opinion and others, we believe so, but to answer that, several complex questions must be considered. In order to afford protection for the species intended by the Act, it's important to know first whether the species is improving, stable, or declining, as well as the robustness of the analyses that underlie the Section 7 consultation process. In the case of the marbled murrelet, its acknowledged dire population declines and the lack of scientific certainty in key areas make it obvious that protection for this species remains woefully inadequate. **Recovery is not even expected at current rates of decline.** This 2019 Biological Opinion reads more like a eulogy than a document with legal teeth.

Common sense as well as case law indicates that if, for whatever reason, the underlying science is deficient or incomplete, then the finding is likely to be deficient, too.[55] Unfortunately, chronic funding and staffing cuts[56] have eroded the Fish and Wildlife Service's abilities to manage its

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[50] Barry D, Harroun L, Halvorson C (1992) For conserving listed species, talk is cheaper than we think: The consultation process under the Endangered Species Act. Available at www.nativefishlab.net/library/textpdf/15635.pdf. Accessed August 17, 2015

[51] Malcolm, J. and Li, Ya-Weh. Data contradict common perceptions about a controversial provision of the US Endangered Species Act. Proceedings of the National Academy of Sciences of the United States of America, December 29, 2015. 112 (52) 15844-15849

[52] Ibid.

[53] Weiland, Paul et al. Analysis of data on endangered species consultations reveals nothing regarding their economic impacts. PNAS, March 2, 2016. 113 (12) E1593. https://doi.org/10.1073/pnas.1601137113

[54] Malcolm, JW, and Li, Ya-Wei. Reply to Weiland et al.: The point is to bring data to inform policy, not to rely solely on anecdotes. Proc Natl Acad Sci U S A. 2016 Mar 22; 113(12): E1594.

[55] Case Law, Endangered Species Act (partial record). https://nationalaglawcenter.org/aglaw-reporter/case-law-index/esa/

[56] Gerber, Leah. Conservation triage or injurious neglect in endangered species recovery. PNAS, March 14, 2016

workloads—the FWS' Recovery budget has been static for over two decades despite the increasing number of listed species in need of protection.[57] In fact, total spending for the Endangered Species Act over the past two decades would cover only about one-third of listed species' recovery needs. In 2016 (among the most current available numbers) nearly half the $1.4 billion federal investment into endangered species went to just 10 species, seven of them fish. Between 1998 and 2012, about 5 percent of ESA-listed species received more than 80 percent of ESA spending, while 80 percent of listed species received just 5 percent.[58]

Are agencies consulting with the Fish and Wildlife Service and National Marine Fisheries Service to the full extent required by law? The extent is not known, but we are aware that the U.S. Navy, for example, violated ESA Section 7(a)(2) by conducting Explosive Ordnance Disposal (EOD) training operations in Puget Sound, which "may affect" listed species, without having completed consultation.[59] We are also aware of other instances in the last decade, in which the Navy proceeded with its proposed actions before completing consultation. In one case, to avoid consulting, the Navy substituted an old Biological Opinion from an offshore training area (the Northwest Testing and Training Range) for a nonexistent BiOp, applying the marine one to terrestrial habitats (the 2014 Olympic MOA environmental assessment).[60] Their Finding of No Significant Impacts still stands despite the inexcusable procedural conduct. A proper Biological Opinion was retrofitted two years later. Do state and local governments and private parties comply with Section 7 requirements? Are those who are pursuing permits and/or funding from the federal government that trigger the requirement for consultation following through? The incidence of lawsuits to force the initiation or re-initiation of Section 7 consultations does not bode well for voluntary compliance.

Do Biological Opinions accurately describe the location and scope of projects? Not always. For example, in a 2015-2016 formal consultation with the U.S. Navy that included the marbled murrelet, the FWS depended almost wholly on the Navy to describe the scope of their project. Unfortunately, the Navy segmented its NEPA process into multiple separate analyses and used an old literature review (Manci et al. 1988) that is widely quoted in numerous DOD documents despite the existence of a more recent review, in order to support the claim that enough questions remain about effects on wildlife of jet noise and underwater explosions to warrant doing nothing about it. So, impacts to murrelets and other listed species that would likely otherwise have been found significant were segmented, underestimated, and they continue, largely unregulated.

113 (13) 3563-3566 https://doi.org/10.1073/pnas.1525085113

[57] Gilman, Sarah. Who Lives, and Who Dies: Is Conservation "Triage" a Good Idea, or a Dangerous One? All About Birds (online) June 6, 2018. Cornell Lab of Ornithology.

[58] Evans, Daniel M. et al. Species Recovery in the United States: Increasing the Effectiveness of the Endangered Species Act. Issues in Ecology, Winter 2016, Report No. 20. Ecological Society of America.

[59] Notice of Intent, Public Employees for Environmental Responsibility. https://peer.org/wp-content/uploads/attachments/08_29_7_notice_of_intent.pdf

[60] West Coast Action Alliance, various documents including internal emails.

Navy Growler taking off at Whidbey Island. Photo by Ken Lambert.

High-noise events like low-altitude overflights or in-water explosions cause birds to engage in energetically expensive escape or avoidance behaviors. This imposes an energy cost on the birds that, over the long term, may affect their survival or population growth. These birds may spend less time engaged in necessary activities like feeding, preening, or caring for their young, because they spend time in noise-avoidance activities, resulting in lower reproductive success and population fecundity.[61]

Although there is not extensive information available about how noise specifically affects marbled murrelets, other avian species have been studied in detail. Under the Endangered Species Act, noise can result in harassment or take if the character of the sound causes disturbance adequate to influence behavior or reproduction. For marbled murrelets, noise can induce behavioral responses such as hiding from the danger source (e.g. evoking cryptic behaviors like staying motionless), increasing the level of vigilance, altering communication with conspecifics, or removing themselves from the danger (e.g. flushing). These changes in behavior can either be undetectable to a human observer, or very obvious. Different avian species may respond differently to the same stimulus, but energetic costs through movement or displacement can change reproductive performance, especially where disturbance increases risk of predation or nest failure.[62] Early anecdotal evidence of noise tolerance came often from localities with roads or human facilities, and did not represent the murrelet population as a whole. Investigators did not distinguish between auditory and visual disturbance, and the studies themselves were not experimental. They were also not subject to detailed analyses of the birds' reactions to noise, nor did they preclude the possible effects of many more subtle consequences

[61] Golightly, Richard T. Marbled Murrelet Landscape Management Plan for Zone 6; Chapter 5, EVALUATION OF NOISE IMPACTS ON MURRELETS IN ZONE 6. May 2017. Department of Wildlife, Humboldt State University. https://www.parks.ca.gov/pages/29882/files/Z6-Plan_FINAL_MASTER_V14_07-17.pdf
[62] Ibid.

of noise disturbance, such as physiological effects.[63] In the case of Navy Growler jet expansions, an analysis found that a Biological Opinion[64] from the U.S. Fish and Wildlife Service had based its "may affect, but was not likely to adversely affect" determination on "grossly inaccurate information" from the Navy regarding the actual noise level of Growler jets.[65]

https://www.classaction.org/news/class-action-u.s.-navy-destroyed-property-values-with-excessively-noisy-flight-operations-around-wash.s-whidbey-island

Internal Navy emails obtained by the Olympic Forest Coalition[66] further revealed that:

> 1) The Navy failed to adequately describe the scope of their project, thus skewing the results. In one email obtained by OFCO, the Navy official in charge stated, "We are conducting these [ESA unpermitted] activities without coverage, so I assume they could continue, but we need to come to legal consensus."[67] It is not clear what if any monitoring and reporting were done on these uncovered takes.
>
> 2) After failing to adequately describe the project scope, the Navy **offered to write** important sections of the Biological Opinion for the FWS, which was running behind schedule and not meeting Navy deadlines. For a regulator to allow a regulated agency to

[63] Ibid.
[64] U.S. Fish and Wildlife Service Biological Opinion, August 12, 2010. Reference #13410-2009-F-0104.
[65] Washington Environmental Protection Coalition. 2.2 How the Navy Misled the US FWS on the Noise Level of Growler Jets. See: https://washingtonenvironmentalprotectioncoalition.org/2-how-growler-jets-harm-owls-and-other-wildlife/2-2-how-the-navy-mislead-usfw-on-jet-noise-levels
[66] Unclassified emails obtained via FOIA and internal channels by the Olympic Forest Coalition.
[67] Emails obtained by OFCO. Related news story: Jamail, Dahr. Emails Reveal Navy's Intent to Break Law, Threatening Endangered Wildlife. Truthout, May 9, 2016. https://truthout.org/articles/exclusive-emails-reveal-navy-s-intent-to-break-law-threatening-endangered-wildlife/

write sections of their own Biological Opinion clearly subverts the purpose of having the FWS oversee plans to protect endangered species from naval activities.

3) The Navy attempted to redefine the ESA definition of "harm" to wildlife in a way that would allow them a potentially far greater rate of takes to marbled murrelets and other endangered and threatened species. They did this by trying to separate harassment and animal behavior changes from the legal definition. A Navy employee involved in the negotiations wrote in an internal email about a disagreement with the FWS on what constituted hearing injury to marbled murrelets: "We have a difference of opinion on Permanent Threshold Shift (PTS) vs Temporary Threshold shift (TTS). Navy position is that PTS is permanent as a result of hair cell loss and would cause a loss in hearing at certain frequencies. This would be considered injury. In contrast, TTS is auditory fatigue and would not result in hair cell loss and thus is temporary and non-injurious. USFWS maintains that TTS is hair cell loss and thus is injury." It would be illegal to apply standards of harm from the Marine Mammal Protection Act to the Endangered Species Act.

4) Emails reveal that the Navy attempted to exert influence over how the FWS analyzes acoustical information by first using a non-peer-reviewed Navy *student* thesis to evaluate marbled murrelet thresholds for sonar (meaning how much damage sonar has on the bird, impacting its hearing and ability to navigate and recover from damage caused by the sounds) and then by performing the mathematical calculations themselves, that they subsequently directed the FWS to use. Internal Navy discussions via email also talked about the intimidation factor of high-level direct calls from the Pentagon to Fish and Wildlife Service field staff who were working on the Biological Opinion. Finally, Navy officials refused to accept FWS-requested mitigation measures and safety protocols for marbled murrelets, such as having FWS train and certify Navy lookouts, and towing hydrophones to listen for the presence of marine mammals in advance of bombing exercises.

5) FWS sent their draft Biological Opinion and other items to the Navy for their review,[68] saying, "Most documents will be in Word to allow for edits and comments in track changes."

Such apparent co-option of a federal wildlife agency is outrageous. Any evaluation of harm to a species that rules out standard definitions of harm while encouraging use of data more than 40 years old and prohibiting the presence of adequately trained observers neither gives the benefit of the doubt to the species, nor uses the best available information — and thus contributes nothing to prevention of harm, monitoring of take, or recovery of the species. It does, however, contribute to cumulative effects on the species.

While the FWS has been subjected to unsustainable and at times potentially illegal pressure, the optics of sending regulatory documents to the regulated party *for their edits* did not inspire public confidence in a fair and unbiased implementation of the ESA.

[68] Scafidi, Carolyn. USFWS. Sending final draft Opinion for your review. Email to Navy, March 28, 2016. Obtained via Freedom of Information Act (FOIA.)

It is apparent from this example alone that not all permittees fully comply with conservation requirements from Section 7 consultations or enter into agreements in good faith. To what extent are violations tracked and rectified? Again, the Navy's survey protocol before initiating underwater explosions in inland waters says: "We will assume that 78 percent of the murrelets that may occur within the range where injury could occur will be detected during the survey, and 22 percent will go undetected, and therefore may be subject to mortality and/or injury." Questioning this, a FWS biologist stated, "...we assume the monitoring would be 50 percent effective, but [the analysis in the Biological Opinion] does not state how this was determined."[69] This is unacceptable.

While both the FWS and NMFS have in the past made many of their Biological Opinions available online, the practice has become inconsistent. For example, on military consultations such as the above-mentioned that included the murrelet, the FWS' Washington Field Office refused OFCO's request for that Biological Opinion, and in a phone call asked us to get it from the Navy. Yet FWS did not invoke the deliberative process privilege stating the documents were pre-decisional, as was done in *United States Fish & Wildlife Serv. v. Sierra Club*.[70] There was no jeopardy conclusion for any species that might have caused the documents to be exempted from disclosure,[71] so there was no basis for withholding it. Unfortunately, the documents were unavailable online, as the Navy removed them after a minimal period of time. The Navy was also unresponsive to requests, including a FOIA. OFCO obtained the Opinions via private channels.

In 2018, the FWS concluded that Navy Growler operations at Whidbey Island were unlikely to jeopardize marbled murrelets. Their June 2018 Biological Opinion concluded that "...due to the relatively high densities of marbled murrelets in the action area and the large number of overflights per year, over thirty years, we conclude that sub-adult and adult marbled murrelets will be exposed to noise from Growler overflights year-round, during both the day and the night, over the thirty-year term of the proposed action."[72] It further explained that exposure to noise from Growler operations may cause delayed or missed nestling feedings during nesting season and "[a] portion of the marbled murrelets that are exposed to aircraft overflights in their marine habitat will respond by altering their normal foraging and resting behaviors," including by engaging in energetically costly behaviors such as diving or flying in response to noise.[73] FWS found that "Growler overflights will adversely affect marbled murrelets by increasing the likelihood of injury due to behavior responses that have energetic consequences for both adults and chicks," increasing susceptibility to injury or mortality from starvation or illness, and "the likelihood that some chicks will die from starvation, falling, or predation."[74] Despite these findings, FWS ultimately concluded that Growler expansion would not "appreciably reduce marbled murrelet numbers" or jeopardize their continued existence.[75] **At what point over thirty**

[69] Email obtained via FOIA: 20160408_NWTT opinion conservation measures murrelets albatross.
[70] https://scholar.google.com/scholar_case?case=12307120863200062203&q=141+S.+Ct.+777&hl=en&as_sdt=4006&as_ylo=2020
[71] https://scholar.google.com/scholar_case?case=492295044155083505 5&q=141+S.+Ct.+777&hl=en&as_sdt=4006&as_ylo=2020
[72] USFWS 2018 BiOp at 44.
[73] Ibid.
[74] Ibid at 52–53, 55.
[75] Ibid at 55.

years are these constant adverse effects, combined with steady decreases in habitat, expected by FWS to result in jeopardy? If such a limit has ever been established, it has never been shared with the public.

Washington's Attorney general Robert Ferguson disagreed with FWS's assessment, arguing in a lawsuit[76] filed in federal court on July 9, 2019 that the Environmental Impact Study completed by the Navy to gauge the impacts of an increase in Growlers on Whidbey was inadequate. The Attorney General later added to that lawsuit, specifically mentioning marbled murrelets affected by the Navy's violations of the Endangered Species Act.[77] His Notice of Intent letter stated that FWS's incidental take statement was unlawful, and "...violates the ESA and its implementing regulations by failing to establish a meaningful standard for re-initiation of consultation and by relying on an improper surrogate." Instead of setting a specific number of murrelets that may be harassed, injured or killed by the Navy's Growler operations without jeopardizing the species, the incidental take statement acknowledges the anticipated level of take as "a subset of adults and juvenile marbled murrelets exposed to 1,981,569 incidents (created by 2,899,530 pattern maneuvers) over thirty years."

In stating that neither FWS nor the Navy had established a meaningful standard for triggering re-initiation of consultation, Ferguson's letter criticized the use of "insufficiently defined surrogate species," and did not describe the "causal link between the surrogate and monitoring measures and take of marbled murrelets." Finally, it called out the failure to monitor impacts and the FWS's failure to "...explain sufficiently the impracticability of expressing the amount of take, or monitoring take-related impacts."[78] In specific reference to marbled murrelets, it concluded that the biological assessment was flawed and failed to address the aircraft's impact on the birds' survival and ability to reproduce. The commanding officer of Naval Air Station Whidbey then wrote in a letter stating, "there is no critical habitat designated for the marbled murrelet within the lands or waters on or near NAS Whidbey or the Outlying Field at Coupeville." **This is an example of why failure to designate marine critical habitat is detrimental to the murrelet's survival and recovery**.

Since neither the FWS nor NMFS have consistently made accessible to the public the monitoring reports required by Biological Opinions and Assessments, it is difficult to know whether permittees comply with the conservation requirements stated in them. In fact, according to a 2011 study[79] that explored court rulings on tracking these monitoring reports and the status of cumulative take, FWS "...lacks a systematic method for tracking the monitoring reports it requires in biological opinions, and the agency still has no means of tracking."

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[76] *State of Washington v. Navy*, Case 2:19-cv-01059 Document 1 Filed 07/09/19 https://agportal-s3bucket.s3.amazonaws.com/uploadedfiles/Another/News/Press_Releases/Wa%20v%20Navy%20complaint.pdf

[77] https://agportal-s3bucket.s3.amazonaws.com/uploadedfiles/Another/News/Press_Releases/AGO%20letter%20to%20Navy%20on%20ESA%207%209%202019.pdf

[78] Ibid.

[79] Totoiu, Jason. QUANTIFYING, MONITORING, AND TRACKING "TAKE" UNDER THE ENDANGERED SPECIES ACT: THE PROMISE OF A MORE INFORMED APPROACH TO CONSULTATION. Everglades Law Center, March 10, 2011. http://evergladeslaw.org/wp-content/uploads/2016/03/ENVTL-LAW.pdf

This makes it hard to know whether Reasonable and Prudent measures and other conservation commitments have actually been met, and whether or not they are effective in species recovery.[80] As a result, there has been a persistent knowledge gap on the marbled murrelet that exposes the FWS to unobserved declines and additional litigation. According to a 2009 Government Accountability Office (GAO) report,[81] "At the field offices GAO visited, Service biologists could not account for all required monitoring reports in 40 of 64 consultation files (63 percent) requiring such reports." However, the report subsequently noted that FWS fulfilled GAO's request to better understand "...the effects on species of actions subject to formal consultations," to continue to "...develop existing databases, in as strategic and expeditious a manner as possible, to enable systematic tracking of cumulative take for all species affected by formal consultations." Despite this, OFCO could still not obtain public documents.

To have so many fundamental questions about the implementation of the nation's most powerful species recovery tool reflects several problems, chiefly the immensity of the challenge to FWS due to insufficient funding, staffing and support, and the concerted pressure by developers and industry to weaken the Act. FWS' difficulties in meeting legal obligations that chronic lack of agency funding and staffing have created exacerbates the persistence of misinformation such as claims that Section 7 consultation is onerous.

The significant sudden drop in the number of jeopardy and destruction/adverse modification findings makes the answers to these questions especially important in evaluating how Section 7 consultations could be more effective in recovering listed species.[82]

While recovery is often a slow, incremental process, in the specific case of the marbled murrelet, the Olympic Forest Coalition agrees with the Fish and Wildlife Service's position that recovery will not be possible with current habitat loss rates under DNR's industry-friendly forest management schemes. We would also add that when combined with the almost complete exclusion of focus on the marine habitats so heavily relied upon by this species, the challenge is even greater.

[80] Schwartz MW (2008) The performance of the endangered species act. Annu Rev Ecol Evol Syst 39:279–299
[81] GAO. Endangered Species Act:The U.S. Fish and Wildlife Service Has Incomplete Information about Effects on Listed Species from Section 7 Consultations. May 21, 2009. https://www.gao.gov/products/gao-09-550
[82] Malcolm, J. and Li, Ya-Weh. Data contradict common perceptions about a controversial provision of the US Endangered Species Act. Proceedings of the National Academy of Sciences of the United States of America, December 29, 2015. 112 (52) 15844-15849

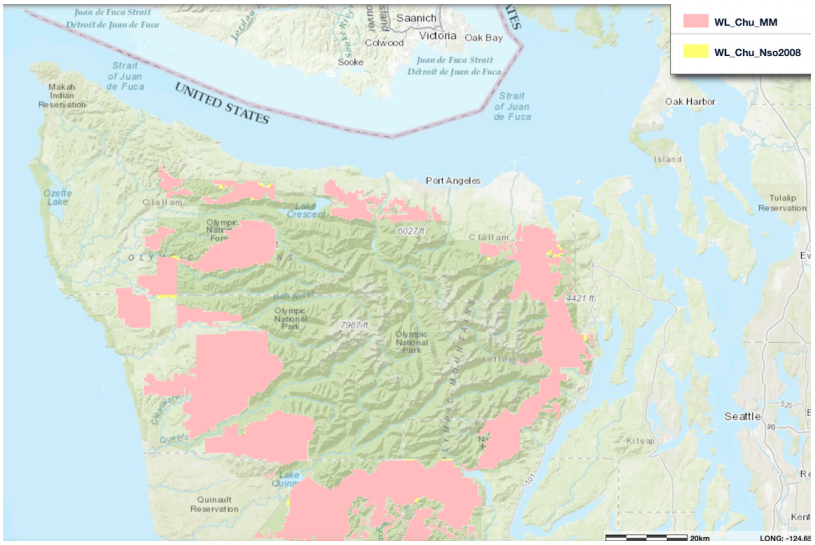

Figure 1: Critical habitat, marbled murrelet, Olympic Peninsula, WA (pink). Note the absence of marine critical habitat.

4.) Cumulative Effects Definition

The terms "cumulative effects," "cumulative impact," and "environmental baseline" have distinct regulatory meanings under the ESA and NEPA (National Environmental Policy Act). The ESA defines "cumulative effects" as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation."[83] This definition only pertains to ESA section 7 analyses and should not be conflated with NEPA's broader term "cumulative impact," which means "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[84] In 2013, the Ninth Circuit Court of Appeals clarified the definition in *Conservation Congress v. U.S. Forest Service, No. 12-16452 (9th Cir. 2013)*.[85]

However, under its implementing regulations, FWS has clearly created an affirmative duty to consider cumulative effects during formal consultation, despite no such mandate existing during informal consultation. Despite that, the 2019 Biological Opinion only addressed cumulative effects indirectly and obliquely.

Based on recent changes in the regulatory environment that repeal Trump-era ESA rollbacks, the FWS's responsibilities during the current re-initiation of formal consultation should include the formulation of a new Biological Opinion, based on new and existing knowledge in both habitats,

[83] 50 C.F.R. § 402.02.
[84] 40 C.F.R. § 1508.7.
[85] https://cdn.ca9.uscourts.gov/datastore/opinions/2013/06/13/12-16452.pdf

that advises DNR as to whether or not their actions, "taken together with cumulative effects,"[86] are "likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat."[87] Since the 2019 Biological Opinion did find adverse modification of habitat, the new one must consider cumulative effects as well, or there are likely to be challenges to the incidental take permit and its measures to minimize the incidental taking's impact, as well as terms and conditions that implement the measures.

We urge more caution in establishing take limits because the chronic lack of knowledge has not been sufficiently recognized as an impediment to recovery. FWS's regulations "authorize the use of habitat as a surrogate for expressing and monitoring the anticipated level of take, provided a clear standard is established for determining when the level of anticipated take has been exceeded."[88] **Since FWS cannot address take in numbers of birds harmed, and since monitoring remains vague, and especially, since murrelet populations are still rapidly declining in Washington State, the FWS cannot claim that a clear standard has been established. Logic argues that take limits are being chronically exceeded.**

Impacts to the species itself are analyzed via surrogate species that according to old references include the budgerigar and the California sea lion. Are there other surrogate species? If so, what are they? How recent is the research, and on what results are conclusions based? The 2019 Biological Opinion and the 2006 Harassment Guidance briefly mention the concept of surrogate species, but do not name them or cite or discuss any research. Nor does the incidental take permit mention surrogate species. While the use of surrogates as proxies is an ecological necessity in some cases, the reasoning and findings behind using an 800-lb mammal to sub for an 8-oz bird has never been explained. Has this research been peer-reviewed and cited in FWS regulatory documents, and if so, where?

Thus, we have 100 percent surrogacy in establishing take limits for a species that despite all measures, remains in precipitous decline, and for which clear standards for population stabilization and recovery have obviously not been established, given the lack of monitoring. The Washington State Attorney General argued, and the courts agreed, that FWS had relied "...on an improper surrogate" in its analysis for the Navy. No matter the legal separations between Habitat Conservation Plan (HCP) and non-HCP habitats, how is it possible to establish precise acreages of habitat that may be destroyed, or precise numbers of nesting trees that may be cut down each year, when best guesses aren't even coming close to saving the species? **Basing the protection, recovery and monitoring of a species on so many uncertainties without extra precaution is itself a form of cumulative harm.**

[86] 50 C.F.R. § 402.14(g)(4)
[87] 50 C.F.R. § 402.14(h)(3)
[88] USFWS. To: WASHINGTON DEPARTMENT OF NATURAL RESOURCES. Subject: NATIVE ENDANGERED & THREATENED SP. HABITAT CONSERVATION PLAN ENDANGERED & THREATENED WILDLIFE Permit Number: TE812521-1 Effective 11/14/2019; Expires 01/30/2067. https://www.dnr.wa.gov/publications/lm_mm_usfws_new_incidental_take_permit.pdf

5.) Threats

Please bear in mind that the conservation of seabirds including the marbled murrelet is not merely a matter of protecting and preserving nesting habitat, but of protecting migratory, foraging, and wintering habitat and assuring an adequate food supply. Assuring the latter can place marine birds in direct conflict with commercial and recreational fishers, and with other marine activities such as transportation of oil and other industrial products, use of personal watercraft and boats, and development of shoreline industries and communities. Climate change is also proving to be a major threat to forage food supplies and habitat via more powerful storms and terrestrial and marine heatwaves. Like any other conservation problem, the conservation of marine birds, and especially of the marbled murrelet with its unique dual habitat utilization, is a matter of involving all interested parties in solving a 'commons' issue that considers impacts cumulatively.[89] In other words, an ecosystem-scale approach.

Threats to marbled murrelets include:

> Habitat loss and fragmentation, mainly due to timber harvest and/or road construction, but also to wildfires, windthrow, disease, and insect outbreaks.
>
> Physical disturbance (includes visual disturbance, vessel and aircraft strikes and disturbance by motorized and non-motorized recreational, fishing and other boats).
>
> Noise (includes impulsive and non-impulsive sound both underwater and in-air, such as sonar, sonobuoy, torpedoes, missiles, gunnery exercises, electromagnetic effects, pile driving, vessel, aircraft and surface & underwater drone noise, and in-air and underwater munitions explosions, plus non-military noise disturbance from traffic, chainsaws, campgrounds, etc).
>
> Nest predation, nest failure.
>
> Fishing (includes changes in distribution and abundance of forage fishes and mortality from active and derelict fishing gear, especially gillnets).
>
> Contaminants (includes accumulation of metals, metalloids and organochlorines in tissues, and oil spills and chronic pollution from military and non-military sources).
>
> Climate change, including direct and indirect effects: changes in rainfall, insects and disease, windthrow of trees during large blowdown events and the edge effects it creates, plus changes in oceanic forage fish regimes. Climate change can also lead to changes in location and intensity of low-pressure systems on the ocean, leading to changes in patterns of upwelling, which lead to changes in nutrient flow and ultimately, to the forage fish that serve as murrelet prey.

[89] Steele, J.H., Thorpe, S.A., and Turekian, K.K. Encyclopedia of Ocean Sciences. Academic Press, 2001.

Habitat loss: As previously stated, the Olympic Peninsula contains by far the largest contiguous areas of murrelet nesting habitat, primarily old-growth forest, in Washington. Based on satellite imagery, of the 395,875 hectares of habitat in Washington assessed in 1995, 246,260 were on the Olympic Peninsula.[90] This was down from historic old-growth levels on the Olympic Peninsula, of 1,314,650 hectares at the turn of the 20th century. A report from 1940 said, "Practically all the old-growth Douglas-fir forests of western Washington were within 30 to 40 miles (50–65 km) of navigable waterways. Now western Washington, particularly in the vicinity of Puget Sound and Grays Harbor, is characterized by vast expanses of cut-over land largely barren of conifer growth."[91] In 1958, a period of relatively low lumber production, 2 billion board feet were harvested from private lands in western Washington, two-thirds of which was old-growth. By 1970, annual harvest from private lands had nearly doubled to 3.8 billion board feet, 80 percent of which was old-growth. At the same time, harvest from public lands in western Washington was accelerating, increasing from about 0.5 billion board feet in 1949 to 2 billion board feet in 1970. Most or all of this was probably old-growth, and timber harvests in Oregon, California and Alaska were almost as vigorous.

The U.S. Fish and Wildlife Service has repeatedly made it clear that if the current rate of loss continues, the conservation of the murrelet may not be possible because almost half of the higher-suitability nesting habitat is on non-federal lands where the losses are occurring.[92] Recovery requires time and requires allowing in-growth of suitable nesting habitat to occur on federal lands in order to make up for losses on state and private lands,[93] but the rate of timber harvest on state and private lands remains too high—ten times higher—to allow this to happen.

The two-paragraph analysis of cumulative effects in the FWS' June 2020 Biological Opinion[94] addressing forest management activities in the (federal) Olympic National Forest (ONF) noted only "...occasional use of chainsaws" near houses, and "...accidental or deliberate delivery of food subsidies to corvids and other murrelet nest predators." No other threats were mentioned. The latter, it correctly noted, increases nest predation, but other than a reference to nest failure being highest within 50 meters of a forest edge, **it did not acknowledge that nest predation is the number one cause of nest failure. This despite the fact that studies have shown that all murrelet nests that were more than 450 ft (137 m) from a forest edge were successful, or failed from reasons other than predation.[95] It seems obvious that that the ever-increasing**

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[90] C. John Ralph et al. USDA Forest Service. Ecology and Conservation of the Marbled Murrelet. Gen. Tech. Rep. PSW-152. 1995.
Compiled and edited by the interagency Marbled Murrelet Conservation Assessment Core Team.
[91] Ibid.
[92] U.S. Fish and Wildlife Service. Endangered Species Act - Section 7 Consultation. BIOLOGICAL OPINION Reference: 0lEWFW00-2019-F-1650 x-reference: 1-3-96-FW-594 Washington State Department of Natural Resources Marbled Murrelet Long-term Conservation Strategy Amendment to the 1997 Habitat Conservation Plan.
[93] Lorenz et al. Status and Trend of Nesting Habitat for the Marbled Murrelet Under the Northwest Forest Plan, 1993 to 2017. https://www.fs.usda.gov/r6/reo/monitoring/downloads/murrelet/20211101-lorenz-etal-2021-status-trend-marbled-murrlet-nesting-habitat-1993-2017-pnw-gtr998.pdf
[94] U.S. Fish and Wildlife Service. Endangered Species Act - Section 7 Consultation. BIOLOGICAL OPINION Reference: 0lEWFW00-2019-F-1650 x-reference: 1-3-96-FW-594 Washington State Department of Natural Resources Marbled Murrelet Long-term Conservation Strategy Amendment to the 1997 Habitat Conservation Plan.
[95] Raphael, Martin G.; Falxa, Gary A.; Burger, Alan E. 2018. Chapter 5: Marbled murrelet. In: Spies, T.A.; Stine, P.A.; Gravenmier, R.; Long, J.W.; Reilly, M.J., tech. coords. 2018. Synthesis of science to inform land management

amount of forest edge is causing unsustainable take. Forest edge increases with timber harvest. Reliance on these Trump-era Biological Opinions for reasonable and prudent measures will not recover the marbled murrelet.

The designation of critical habitat in 10 subunits of the ONF encompass 411,989 federal acres, but their fragmentation from historical timber harvesting has resulted in only 162,000 acres, or 39 percent of it, being suitable nesting habitat. Despite this and the conclusions in other documents that in-growth in federal forests will not be enough to save the species if harvest on non-federal lands continues at the current rates, the June 2020 Biological Opinion concluded, "...forest management activities on state and private lands within the action area are associated with HCPs, and therefore do not result in cumulative effects." Further, maps and data indicate that under the Long Term Conservation Strategy, DNR is able to harvest documented, current upland murrelet habitat in exchange for riparian buffers and other acres in the Long Term Forest Cover that may, slowly, grow into future murrelet habitat. These stands going up for harvest are too frequently the legacy forest stands that may have few nesting platforms now, but as anyone can imagine, an 80-year-old tree is much more likely to develop nesting structures than a 20-year-old tree.

While legal nuance highlights the differences between definitions of cumulative effects in the ESA and NEPA, benefits to the species are too often lost in the shuffle. How is it possible to say in one breath that federal forest in-growth will not happen in time to save the marbled murrelet, while in the next breath state the effects aren't cumulative? Regardless of legal definitions, it is mind-boggling when one reflects on the totality of threats to marbled murrelets, especially considering DNR's problematic management of HCP goals. It smacks of segmentation, and does not reflect the wisdom, methods or philosophy of a long-term ecosystem-scale management approach to recovery.

As an example, the *conservation* measures for marbled murrelets in this Opinion included: "No more than 930 murrelet Suitable Nesting Trees (SNT) shall be removed during this 10-year consultation. Of these, no more than 200 murrelet SNTs (an average of 20 per year) shall be removed during the murrelet nesting season." No citations were provided that justify this number of removals, or the fact that they could be conducted without consequence during nesting season. No removals of SNTs <u>at all</u> should be allowed during nesting season, and the number should be far less than 930 at any time. As previously stated, the use of surrogate species to arrive at such precise calculations makes little sense.

Unlike regions in Alaska where marbled murrelets have adapted to tundra nesting, there are no expansive tundra and tree scrub habitats in Washington, Oregon, or California to which they could behaviorally adapt for successful nesting.

The FWS' Guidance for Identifying Marbled Murrelet Nest Trees in Washington State[96] conflicts with at least two studies, one which says mistletoe is less important than epiphytic

within the Northwest Forest Plan area. Gen. Tech. Rep. PNW-GTR-966. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 301-370.

[96] https://wsdot.wa.gov/sites/default/files/2021-10/Env-FW-MAMU-Habitat-FWS.pdf

mosses, and another Olympic Peninsula study published in 2016[97] that further defined these trees, saying, "Nest sites had less canopy cover of the dominant conifers and fewer, but larger, trees than control sites. Nest sites also had greater percentages of trees with platforms >10 cm diameter and >15 cm diameter, and more platforms of these sizes than control sites. The mean diameter at breast height of nest trees was 136.5 cm (range = 84–248 cm) and all but one nest was in dominant or co-dominant tree species."

In light of recent Biological Opinions, how is this Guidance enforceable, and where is the peer-reviewed research and monitoring that documents the sustainability of these removal limits as well as not exceeding them?

Disturbance—physical: Loss of prey due to boat disturbance can represent a substantial energetic cost to adult marbled murrelets if they have to repeat foraging to capture another fish for a chick, especially if it is too late in the evening to get another prey item for delivery inland to the chick. Presumably, the cost to the chicks is even greater than for adults.[98] In Glacier Bay, Alaska, there was an observed average 40 percent decline in Kittlitz's murrelets in nearshore density because of vessel disturbance. Declines did not persist over the day, suggesting it was a temporary disturbance by these vessels, and birds likely returned to disturbed areas over a short period within a day. However, cumulative effects included a threefold increase in diving behavior and a thirty-fold increase in flying on days with higher rates of vessel traffic. These are the types of cumulative effects that are not being considered in FWS's Biological Opinions.

These disturbances are energetically costly; they negatively affect the birds' daily energy budgets when vessel activity reduces foraging behavior, and they increase behavior like flying, which is one of the most energetically demanding adaptations found in nature. Large and fast-moving vessels caused the greatest disturbance to Kittlitz's murrelets.[99] The abundance and distribution of the Kittlitz's murrelet is so geographically limited that little has been known about its habits until more recently, but the Fish and Wildlife Service uses observations about this species to support distance-from-boat recommendations on the marbled murrelet; the range of Kittlitz's overlaps with that of marbled murrelets in Alaska.[100]

A study in Harriman Fiord, Prince William Sound found that Kittlitz's murrelets tend to select turbid, cold, shallow, fresh water close to glaciers, and marbled murrelets are associated with deep, clear water far removed from glaciers.[101]

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[97] Wilk, RJ et al. Nesting habitat characteristics of Marbled Murrelets occurring in near-shore waters of the Olympic Peninsula, Washington. J. Field Ornithol. 87(2):162–175, 2016 DOI: 10.1111/jofo.12150.
[98] USFWS, Note to file. Summarizes Speckman, Piatt and Springer, 2004. Small boats disturb fish-holding marbled murrelets (p 33).
[99] Ibid, pages 346 and 352.
[100] USFWS, Note to file. Summarizes Entranco and Hamer. 2005. SR 104 – Hood Canal Bridge East-Half Replacement and West-Half Retrofit Project, Marbled Murrelet Hazing Report, (Entranco Inc. and Hamer Environmental 2005).
[101] Stephensen, S.W., Irons, D.B., Ostrand, W.D., and Kuletz, K.J. 2015. Habitat Selection by Kittlitz's Brachyrampus brevirostris and Marbled Murrelets B. marmoratus in Harriman Fiord, Prince William Sound, Alaska. Marine Ornithology 44: 31—42

A 2005 report[102] on marbled murrelet behavior at the Hood Canal (WA) bridge replacement project found that as time went on, most marbled murrelets (88 percent) became somewhat used to it and kept diving for food regardless of attempted hazing to move them away from pile-driving. They kept foraging as long as the prey was there, and also as long as they were at least 25 meters from the hazing boat.[103]

The two studies cited above occurred in inland waters that normally receive more boat traffic and disturbance than do most outer coastal waters where traffic is lighter and the birds are documented to be more skittish. For example, while marbled murrelets in Washington's San Juan Islands allowed much closer approach in boats, the birds' behavior was different offshore, as shown in another study on at-sea foraging behavior. In that study, the scientists found that birds were very sensitive to their passing vessel, and the response distance was doubled from 25m to 50m; 23 percent of the murrelets dived and 15 percent flew. Pairs resurfaced together, suggesting that they likely keep in visual contact underwater.[104] Thus, while marbled murrelet habituation to slower-moving inshore vessels appears possible to some degree, habituation to large vessels in offshore waters is unlikely due to the birds' random distribution, the often-higher speed of the vessel compared to those more inshore, and the larger wakes these vessels throw. Plus, in offshore waters it is more likely that the murrelets will be foraging for themselves and not holding fish in their beaks for feeding their young. Therefore, flush distances applied to murrelets in inland/nearshore waters that are foraging for their chicks would probably not apply in offshore areas.[105] Another study also concluded that faster boats caused a greater proportion of birds to flush at greater distances, and that almost all responses occurred at less than 50m from the boat.[106]

2. Noise: Road noise, boat traffic, air traffic, campground noise, chainsaws, pile-driving, sonar, sonobuoys, explosions, and other sources of noise, both in-air and underwater, negatively affect murrelets' selection of foraging and nesting habitat. Shock waves from military projectiles are poorly studied in relation to wildlife.[107] A 2020 study[108] on the hearing of great cormorants shows that they have a better sense of hearing in water than they do above the surface. It is another example of how underwater sound may be much more important to seabirds than previously thought.

For the issuance of federal incidental take permits for marbled murrelets under authority of the Endangered Species Act, the use of modeling to predetermine impacts has employed seabird surrogate species such as the California sea lion. As previously mentioned, there are obvious

[102] https://escholarship.org/uc/item/55q101cp
[103] USFWS, Note to file. Summarizes Entranco and Hamer. 2005. SR 104 – Hood Canal Bridge East-Half Replacement and West-Half Retrofit Project, Marbled Murrelet Hazing Report, p. 13-19 (Entranco Inc. and Hamer Environmental 2005)
[104] USFWS, Note to file. Summarizes Strachan, G., McAllister, M., and C. Ralph. 1995. Ch. 23 Marbled Murrelet At-Sea and Foraging Behavior (Strachan et al. 1995).
[105] Ibid.
[106] USFWS, Note to File. Bellefleur, Lee, and Ronconi. 2007. Impact of recreational boat traffic on Marbled Murrelets (Bellefleur et al. 2007).
[107] Ronald P Larkin. Effects of military noise on wildlife: a literature review. Center for Wildlife Ecology Illinois Natural History Survey. 1994.
[108] Larsen, ON et al. Amphibious hearing in a diving bird, the great cormorant (Phalacrocorax carbo sinensis). Journal of Experimental Biology (2020) 223 (6): jeb217265. https://doi.org/10.1242/jeb.217265

differences between murrelets and sea lions, not only in body mass and habitat selection but also in noise tolerance, frequencies perceived, and in temporary and permanent threshold hearing impacts.[109]

For example, researchers believe that under water, a California sea lion can hear sounds in the range of 1 to 40 kHz, with a peak sensitivity of 15 to 30 kHz. Sea lions generally vocalize between 1 to 4 kHz. Most birds can hear up to 3 kHz in air, and marbled murrelets vocalize between 480 and 11 kHz. While it's unknown how well they can hear under water, the aforementioned study on great cormorants suggests that they do hear better underwater, and are presumably more sensitive to underwater noise.[110]

The Fish and Wildlife Service has acknowledged that it cannot account for the interspecies hearing differences between murrelets and sea lions. During consultations, therefore, FWS must extrapolate from data on dissimilar species in order to arrive at predicted noise impacts to murrelets.[111] Despite all that, not even marine mammal impacts from underwater noise are well known.[112] Because noise in the marine environment is increasing, it should therefore be assumed that this will in turn have increasing impacts to murrelets.

In a marine environment, in-air noise in particular is expected to interfere with murrelet foraging when the sound overlaps in frequency with the frequency of murrelet calls, and is much louder than background noise levels. This situation can lead to "masking," in which murrelets cannot hear one another's calls above the noise. Murrelets frequently forage in pairs, perhaps engaging in cooperative foraging, and often call upon re-surfacing, apparently to assist in relocating one another. Activities that may lead to significant masking in the marine environment include pile driving and naval aircraft overflights.[113]

Underwater impulsive sound such as military sonar or pile-driving can injure, kill, or significantly alter the behavior of many marine species, including the murrelet. Navy sonar systems generate slow-rolling sound waves that top out at 235 decibels. The world's loudest rock bands top out at only 130.[114] Every 10 dB represents a doubling of sound intensity. Sonar sound waves travel for hundreds of miles, and can still reach 140dB as far as 300 miles from the source.[115] Knowledge is limited, but observed effects in marine mammals include erratic behaviors such as panic, jumping out of the water to get away from the noise, and beaching. Bleeding from the eyes and ears has also been observed. Effects on marbled murrelets are largely

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[109] Marbled Murrelet Effects Thresholds. https://wsdot.wa.gov/sites/default/files/2021-10/ENV-FW-MamuThresholds.pdf

[110] Larsen, ON et al. Amphibious hearing in a diving bird, the great cormorant (Phalacrocorax carbo sinensis). Journal of Experimental Biology (2020) 223 (6): jeb217265. https://doi.org/10.1242/jeb.217265

[111] Final Summary Report: Marbled Murrelet Underwater Noise Injury Threshold Science Panel, July 27-29, 2011. Prepared by Science Applications International Corporation (SAIC) for the US Navy NAVFAC Northwest. September 7, 2011.

[112] Erbe, Christine et al. The Effects of Ship Noise on Marine Mammals—A Review. Front. Mar. Sci., 11 October 2019. Sec. Marine Conservation and Sustainability, Volume 6 - 2019 | https://doi.org/10.3389/fmars.2019.00606

[113] USFWS 5-Year Status Review, Marbled Murrelet, May 2019.

https://www.seattle.gov/light/skagit/relicensing/cs/groups/secure/@scl.skagit.team/documents/document/cm9k/ntcx/~edisp/prod571175.pdf

[114] Does Military Sonar Kill Marine Wildlife? Scientific American, June 2009.

[115] Ibid.

unknown, but there is no doubt that noise can interrupt or stop foraging and feeding as well as cause injury. In 2015, Navy environmental analyses for Pacific waters from the Gulf of Alaska to Southern California and out to Hawaii predicted more than 12 million injuries and deaths to various marine mammals as a result of naval activity, but failed to adequately address marbled murrelets.[116]

NEPA segmentation of impacts that result in cumulative effects being split into multiple public processes should not be ruled out as a threat to marbled murrelets. For example, the Navy's 5,300 pilings installed throughout Washington's inland waters between 2013 and 2015 were divided into dozens of small environmental assessments that did not require biological opinions.[117] [118] In one example, a single pier improvement was split into seven EAs and EISs.[119] An internal email from Navy attorneys counseled that segmentation, while illegal, was nevertheless the recommended path.[120] Ethically, this is questionable at best. In another, the Navy issued itself a Categorical Exclusion from evaluating impacts to endangered species for Navy SEALs training in 8 locations throughout Puget Sound.[121]

Among its activities that trigger Section 7 consultations, the Navy conducts Explosive Ordnance Disposal Operation (EOD) in Puget Sound's Crescent Harbor and Oak Bay, and has ranges for underwater testing and training at Keyport, Dabob Bay, and near Quinault. The purpose of EOD training is to certify divers on locating and destroying or disabling mines with explosive underwater charges at three locations in Puget Sound.

The Navy also uses an offshore area roughly aligned with the Olympic Coast National Marine Sanctuary, which is known as Warning Area 237. The W-237 complex includes Warning Areas W-237A through W-237J. They are used for joint air/surface operations such as missile firings, air-to-surface bombing, air-to-air firing, combat tactics, intercepts, aerial refueling, instrument training, aerobatics, and formation flight training.

When a bomb detonates in air, a blast wave expands radially outward faster than the speed of sound. Air is highly compressed on the leading edge of the blast wave, creating a shock front. The body of the wave and the associated mass outward movement of ambient air (the "blast wind") follows this front. A blast wave can reflect off of, and flow around, solid surfaces. Reflected waves can be magnified 8 to 9 times, causing significantly greater injury. The medium through which the blast wave moves is also a factor. Water with its increased density allows for

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[116] U.S. Navy, environmental impact statements and analyses, 2015.
[117] Teachout, Emily, USFWS, and WFWO. Conducting Masking Analysis for Marbled Murrelets & Pile Driving Projects. Presentation for WSDOT biologists and consultants. November 2013. https://truthout.org/app/uploads/legacy/documents/7_USFWS-Conducting-Masking-Analysis-for-Marbled-Murrelets-and-Pile-Driving-Projects-November-19-2013.pdf
[118] WA Department of Transportation. Regulatory Issues associated with Pile Driving
[119] US Navy Region Northwest. NRNW In Water Construction Projects. XL spreadsheet. And US Navy, NRNW In-Water Construction Projects Summary. Powerpoint slide show.
[120] US Navy. Goodman, Layna and Carroll, LtCdr Frank. Unclassified memo. Proposed NEPA Approach for Planned Waterfront Projects Which May Require Environmental Impact Statements, Naval Base Kitsap at Bangor. March 6, 2012
[121] US Navy. Email, CATEX Navy Seals 11-13-2015. And Powerpoint: US Navy. Seals training - NSWG3 Training REQs_CATEX FY 16NW Finals.pdf

faster propagation and a longer duration of positive pressure, accounting for the increased severity of immersion blast injuries.

Regarding immersion blast injuries, while a 1982 study[122] using live sheep, dogs and monkeys found that hemorrhaging in and around the lungs was the primary cause of injury to submerged mammals (and, it could be extrapolated, to submerged birds), an observational 2005 study by a trauma MD described in-air blast injuries more fully.[123] The study found in post-mortem observations of human patients after bombings, that while autopsies showed a number of the dead had no evidence of penetrating wounds, they nonetheless had sustained lethal internal injuries. Major intra-abdominal, thoracic and lung injuries were described as classic for those typically found after a powerful explosion. If inferences on noise tolerance and blast injury resulting in temporary or permanent threshold shifts can be made between sea lions and marbled murrelets, then at least some inferences should be possible from examining injuries in human beings.

The most susceptible organs to primary blast injuries such as bruising, embolism, hemorrhage, mesenteric shearing, and perforation, are the gas filled structures: ears, lungs and gastrointestinal tract. The ears are the most sensitive, and tympanic membrane rupture can be used as a reliable marker of exposure to significant overpressure. Injury to the auditory system depends on the orientation of the ear relative to the blast. But severe pulmonary barotrauma can occur with disruption of the alveolar/capillary membrane, causing leakage of blood and interstitial fluid. Signs of lung disruption can occur as late as 48 hours after exposure. Central nervous system injury has also been documented via EEGs.[124]

Following in-water detonation, shock waves reflected backward off the water/air interface at the surface admix with the incident blast wave, increasing the blast loading effect. The resultant overpressures are greater at the 2-foot depth than at the surface and cause greater injury, for example, in humans treading water vertically, to the lower areas of the lung and to the abdomen. Delayed presentations of bowel injury such as hemorrhage and perforation are also expected in underwater blasts.

Thus, in the marine environment, marbled murrelets, which spend significant time underwater as they rely on diving to capture food for themselves and their chicks, are vulnerable to auditory and non-auditory injuries from high-pressure underwater blast waves, and to disturbance and auditory injuries from in-air blasts at distance.

Nest predation: In six separate studies that monitored predation rates at artificial murrelet nests, 78 percent of 3,276 nests were disturbed (equating to nest failure) during the monitoring period.[125] Predators are primarily jays, crows, and ravens. Some factors associated with other

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[122] Goertner, John. Prediction of Underwater Explosion Safe Ranges for Sea Mammals. Naval Surface Weapons Center, August 1982.
[123] CT Born. BLAST TRAUMA: THE FOURTH WEAPON OF MASS DESTRUCTION. Scandinavian Journal of Surgery 94: 279–285, 2005. Orthopaedic Trauma Service, Department of Orthopaedic Surgery,
Rhode Island Hospital, Brown University, Medical Office Center, Providence, RI,
[124] Ibid.
[125] Jonathan H Plissner et al. A Review of Marbled Murrelet Research Related to Nesting Habitat Use and Nesting Success. For Oregon Dept of Forestry, September 2015.

causes of nest failure (e.g., nest abandonment, non-viable egg, death of adult) are represented by studies of artificial nests. Also, nest stands adjacent to areas providing additional food resources for corvids (e.g., near human settlements, or regenerating stands with berry-producing vegetation) were found to have higher nest failure rates or stronger edge effects on predation rates than was found for other stands.[126] Numerous studies over decades have proven again and again the correlation between forest fragmentation and "edge effects" that include nest predation.

Strong nest-site fidelity in murrelets has been posited based on observations that murrelets have been recorded in the same forest stands in California, Oregon, and Washington for more than 20 years.[127] Site fidelity can reduce potential reproductive effort by (1) increasing the chances of breeding with the previous year's mate; (2) reducing the need to locate a suitable nest site every year; and (3) increasing the birds' familiarity with nearby marine and terrestrial environments.[128] Divoky and Horton (1995)[129] described many patterns of the biology of alcids and explained how marbled murrelets are likely to compare to other members of the family. However, none of the non- *Brachyramphus* alcids for which extensive data were available are cryptic, solitary nesters, so the assumption of comparability of aspects of life-history between murrelets and other alcids, especially important aspects such as fidelity, may not be correct. Observed fidelity to the same nest-cup in successive years appears to be lower for murrelets than that for other alcids, possibly because of high rates of predation observed at murrelet nests.[130]

If nest-sites are limiting, it follows that the loss of nesting habitat reduces the long-term reproductive potential of a population; this problem could especially be relevant for murrelets, which generally nest in older trees that take many years to develop. Because the loss of old-growth nesting habitat results in the displacement of breeding birds until the habitat can re-grow and age, murrelets either must have some flexibility in nest-site fidelity or many in heavily logged or fire-prone areas must be nonbreeding birds. **High nest-site fidelity makes it difficult for breeding murrelets to move to new areas and breed after habitat loss**, whereas low nest-site fidelity may make them more adaptable to habitat loss. **Thus, loss of nesting habitat is likely to affect murrelets more than more adaptable birds.** The effect of habitat loss on fidelity also depends on the scale of the fidelity (i.e., whether the fidelity is to a nesting branch, a nest-tree, a forest stand, or a watershed).[131]

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[126] Ibid.
[127] Ibid.
[128] Ibid.
[129] Divoky, G. J., and M. Horton. 1995. Breeding and natal dispersal, nest habitat loss, and implications for Marbled Mur- relet populations. Pp. 83–87 in C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, Technical Editors. Ecology and conservation of the Marbled Murrelet. USDA Forest Service, Pacific Southwest Research Station, Albany, CA. General Technical Report PSW-GTR-152.
[130] Nelson, SK and Hamer, TE. 1995b. Nest success and the effects of predation on Marbled Murrelets. Pp. 89-97 in C. J. Ralph, G. L. Hunt, Jr., M. G. Raphael, and J. F. Piatt, Technical Editors. Ecology and conservation of the Marbled Murrelet. USDA Forest Service, Pacific Southwest Research Station, General Technical Report PSW-GTR-152, Albany, CA.
[131] Jonathan H Plissner et al. A Review of Marbled Murrelet Research Related to Nesting Habitat Use and Nesting Success. For Oregon Dept of Forestry, September 2015.

Contaminants—oil spills: The Exxon Valdez oil spill of 1989 caused the largest single mortality of murrelets, killing between 8,000 and 12,000 in Prince William Sound,[132] [133] a figure representing about 5 to 10 percent of the then-population in the affected area. Alcids had the highest rate of mortality, as compared to the population at risk. Of six species of small alcids, marbled murrelets suffered the highest mortality.[134] In addition, some murrelets were sub-lethally oiled and were probably physiologically affected after the immediate oiling event. Some were affected in foraging areas by increased human activity associated with cleanup and monitoring.

Murrelets did not respond well to rehabilitation efforts during the Exxon Valdez oil spill. Only 3 of 33 marbled and 2 of 6 Kittlitz's murrelets survived to be released, compared to 51 percent released of all 1,630 treated birds. Wood and Heaphy (1991)[135] concluded that murrelets had a low tolerance for capture and rehabilitation. Necropsies revealed enlarged adrenal glands, indicating stress-induced mortality.[136]

Oil pollution has had significant impacts on murrelet populations in Prince William Sound, central California, and western Washington. However, these effects have probably been felt only sporadically by local populations. If murrelet populations were in better health, oiling mortality might be naturally recoverable within several years to decades, depending on the size and nature of the mortality event. **However, when oiling mortality is considered as a cumulative effect with other anthropogenic factors and affects small, declining populations of murrelets, the relative effects of oil pollution will become greater and recovery may not be possible**.[137]

Fisheries Bycatch—Gill Nets, purse seines, trawls, recreational fishing, derelict fishing gear: Seabird populations in general are declining faster than other bird groups, and bycatch in fisheries is identified as one of the main causes of decline.[138] Mortality due to accidental capture in gill nets and other fishing gear is one of the major threats to marbled murrelet populations.[139] Anecdotal evidence from the past suggested that hundreds to thousands of murrelets were caught in gill-net fisheries in coastal areas of Alaska during the 1970's. Quantitative data on seabird bycatch from Prince William Sound in 1990 and 1991 reveal that these earlier estimates were probably of the right order of magnitude.[140] A global review of incidental catch of seabirds in gillnet fisheries identified 148 species of seabird species susceptible to bycatch in gillnets, 81 of

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[132] National Park Service (greater than 8,400)
[133] Carter, Harry R. and Kuletz, Katherine J., and Isleib, M.E. "Pete." Mortality of Marbled Murrelets Due to Oil Pollution in North America. Chapter 26, USDA Forest Service Gen. Tech. Report PSW-152. 1995
[134] Ford and others, 1991a, Piatt and others 1990a
[135] https://www.fs.usda.gov/psw/publications/documents/psw_gtr152/psw_gtr152_chap26.pdf
[136] Carter, Kuletz and Isleib, 1995
[137] Piatt and others 1991, Singer and Carter 1992
[138] Croxall, J.P., Butchart, S.H.M., Lascelles, B., Stattersfield, A.J., Sullivan, B., Symes, A., Taylor, P., 2012. Seabird conservation status, threats and priority actions: a global assessment. Bird Conserv. Int. 22, 1–34. https://www.cambridge.org/core/journals/bird-conservation-international/article/seabird-conservation-status-threats-and-priority-actions-a-global-assessment/29944BD8AA1EED41210B777389F34952
[139] Carter, Harry R. and Kuletz, Katherine J., and Isleib, M.E. "Pete." Mortality of Marbled Murrelets Due to Oil Pollution in North America. Chapter 26, USDA Forest Service Gen. Tech. Report PSW-152. 1995
[140] Piatt, John F. and Naslund, Nancy. Abundance, Distribution, and Population Status of Marbled Murrelets in Alaska. Chapter 28, USDA Forest Service Gen. Tech. Report PSW-152. 1995

which have been recorded caught. The highest densities of susceptible species occur in temperate and sub-polar regions of both hemispheres, with lower densities in tropical regions. Gillnet fisheries are widespread and particularly prevalent in coastal areas. A review of reported bycatch estimates suggests that at least 400,000 birds of all kinds die in gillnets each year. Highest bycatches have been reported in the Northwest Pacific, Iceland, and the Baltic Sea. The magnitude of this phenomenon is poorly known for all regions, and population modeling to assess effects of gillnet bycatch mortality on seabird populations has rarely been feasible. There is a need for more data to advance the development of bycatch mitigation measures.[141]

Climate change: Here is some good news, caveated with "if we can make it happen." A study[142] published in 2017 predicted that negative effects of climate change on 30-year population trends of old-growth-associated birds should be dampened in landscapes with high proportions of old-growth forest. In fact, it found that for particularly temperature-sensitive species, **the relationship between warming and population declines was not only reduced but reversed, in old-growth-dominated landscapes.**

When snow builds up in the fall and winter, and then melts off in the summer, a lot of it soaks into the ground and replenishes the groundwater supply. But when large stretches of a watershed are logged, the snow will melt earlier and faster—too fast for enough of it to soak into the ground—and if the groundwater isn't sufficiently recharged, there's less water in reserve to feed the streams during the hottest months when there is very little rain.[143] As water levels drop, those streams become even more vulnerable to air temperatures. Warmer waters put salmon at risk, and as the fish decline, everything they feed on — including communities and the forest itself — becomes more vulnerable too. Better forestry practices can lessen these impacts.[144]

Direct and indirect effects of climate change on nesting habitat are well-documented elsewhere. See section 8 on marine heatwaves.

6.) Marine Habitat and Cumulative Effects Concerns

There is insufficient scientific peer-reviewed or gray literature or other pertinent information, including Traditional Ecological Knowledge, on the at-sea aspects of the lives of marbled murrelets. Scientific knowledge of the murrelet's terrestrial aspects is more complete, but still limited due to the bird's cryptic and elusive nature. Lack of scientific certainty has repeatedly proven over many years to be an exploitable advantage by powerful industries who view ESA-listed species and critical habitat as impediments to profit.

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[141] Zydelis, R., Small, C., and French, G. The incidental catch of seabirds in gillnet fisheries: A global review. Elsevier. Biological Conservation, November 2012.
[142] Matthew Betts, Ben Phalan, Sarah JK Frey, and Josee S Rousseau. Old-growth forests buffer climate-sensitive bird populations from warming. Diversity and Distributions · December 2017 DOI: 10.1111/ddi.12688
[143] Cruickshank, Ainslie. Fish in hot water: decades of logging tied to warmer temperatures in unprotected salmon-bearing streams. The Narwhal, March 7, 2023. https://thenarwhal.ca/logging-warming-waters/
[144] Ibid.

In its August 2016 critical habitat ruling for the marbled murrelet, the Fish and Wildlife Service again failed to acknowledge impacts to murrelet populations in marine habitats. It stated, "Because this rule reconsideration addresses the 1996 final critical habitat, as revised in 2011 (October 5, 2011; 76 FR 61599), which designated critical habitat only in the terrestrial environment, the following section will solely focus on the terrestrial nesting habitat features."[145] The murrelet's Recovery Plan also limits itself to the terrestrial environment for "habitat-based" recovery actions in inland forests.

The Service's 2019 Biological Opinion, along with its predecessor, excludes the marine habitats in which the marbled murrelet spends 80 to 95 percent of its life. These marine areas are often directly adjacent to the forested habitats in which the murrelet spends only 5 to 20 percent of its life.[146] Yet on page 17 the Opinion states, "The jeopardy analysis in this Opinion emphasizes the range-wide survival and recovery needs of the listed species and the role of the action area in providing for those needs." If marine habitats are excluded, then how can the jeopardy analysis claim to be fully range-wide?

A study published in the journal The Condor in 2019[147] confirmed, via use of radio telemetry to track the movements and habitat use of marbled murrelets in coastal Oregon, that the availability of suitable nesting habitat was indeed a key limiting factor. Thus, reasoning that nesting habitats are more limiting than marine habitats to the complete exclusion of the latter may have seemed expeditious in analyses back in 1996, at the publication of the final critical habitat rule, but a quarter century later, much has changed. When the onset of severe and persistent marine heatwaves, along with acceleration of other climate change-driven effects such as storms and ocean acidification are combined with highly increased disturbance levels from marine traffic, Navy sonar, sonobuoys, and weapons testing above and beneath the sea surface, in Puget Sound plus in three Habitat Conservation Plan (HCP) units (Columbia, South Coast, and Straits), and from the outer coastline to 100+ miles offshore, it makes no sense anymore to ignore the marine habitats that are so influential but are also becoming destabilized. They are no longer reservoirs of respite from threats encountered on land, and impacts from there should concomitantly decrease the allowable take in forested habitats.

Despite these additional complexities, nesting habitat remains the loss leader and must be addressed with these other factors augmenting, not weakening, conservation measures.

On page 11 of that abovementioned critical habitat determination, the Service confirmed: "Because we did not designate critical habitat in the marine environment, that aspect of the species' life history or available data will not be discussed further, unless it is pertinent to the terrestrial habitat." It is now pertinent.

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[145] 50 CFR Part 17, [Docket No. FWS–R1–ES–2015–0070; 4500030114] RIN 1018–BA91 Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Marbled Murrelet https://www.fws.gov/sites/default/files/federal_register_document/2016-18376.pdf

[146] Teachout, Emily, U.S. Fish and Wildlife Service. Impulsive Underwater Sound – Evaluating its Effects on the Marbled Murrelet. July 2011

[147] Nelson, S. K., Ackerman, J. T., & Marshall, K. N. (2019). Habitat selection and movement patterns of Marbled Murrelets during the nesting season in Oregon, USA. The Condor, 121(4), duz037. doi: 10.1093/condor/duz037

Excluded in that 2019 Biological Opinion were analyses of chronic auditory and physical effects, the latter in the form of sub-lethal and lethal injuries; plus non-chronic auditory effects and non-physical behavioral effects that could affect murrelets' ability to nest and feed their young. Climate change-driven marine heatwaves were mentioned (page 23) but not considered in recommendations. Nor were oil spills, chronic oil pollution, gill nets, pile-driving, noise from aircraft, ships, submarines, sonar, sonobuoys, drones, explosions of military ordnance during frequent training, and effects from pollution by heavy metals or other ordnance products. These occur not only in Puget Sound and the Strait, but also in the military operations area that overlaps the Olympic Coast National Marine Sanctuary. All of them influence whether the birds will come ashore to nest.

A study published in 2016[148] concluded, "While past conservation efforts have focused on protecting terrestrial nesting habitat, we echo many past studies calling for future efforts to protect marine habitat for murrelets, as the current emphasis on terrestrial habitat alone may be insufficient for conserving populations. In particular, marine areas in close proximity to old-growth nesting habitat appear important for murrelets during the breeding season and should be priorities for protection."

On page 31, the 2019 Biological Opinion acknowledges, "Marbled murrelets are likely to experience changes in foraging and breeding ecology as the climate continues to change." As merely an observation without a recommendation or conservation measure, this is inadequate and must be rectified. An incidental take permit for timber harvest that does not properly consider these additional stresses would be invalid. If the structure or process that led to such an agreement is flawed, it must be rectified.

The Opinion states, on page 17, "The revised definition [of adverse modification of habitat] states: "Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species." With the obvious degradation of marine habitat from, among other things, Navy flights, sonar, and weapons training that now exceeds by 400 percent the increase that was promised to the public in their 2014 environmental assessment, and with the ocean-driven influence on murrelet nesting abundance in forests, **the 2019 Biological Opinion neither fully meets the definition of adverse habitat modification nor considers cumulative take**.

On its website, the FWS also acknowledges that terrestrial "...habitat modeling, which has been conducted through 2018, indicated the amount of suitable nesting habitat has declined since the species was listed, mainly due to timber harvest and wildfires."[149] In considering the full picture of take, it is expected that current levels of timber harvest, unsustainable even when considered alone, would be compensatorily reduced in concert with addressing all the threats.

[148] Lorenz, TJ and Bloxton, TD. Marine Habitat Selection by Marbled Murrelets (*Brachyramphus marmoratus*) during the Breeding Season. PLOS One, Sept 2016. https://doi.org/10.1371/journal.pone.0162670
[149] https://www.fws.gov/species/marbled-murrelet-brachyramphus-marmoratus

Another study published in The Condor in 2018[150] used stable isotope analysis to examine murrelets' foraging behavior and prey selection, finding that the birds feed primarily on small fish and krill, and that **the availability of suitable foraging habitat was a key factor in murrelet distribution and abundance**. A study published in 2003[151] found that murrelets selected cooler locations when upwelling was low, and locations closer to nesting habitat when upwelling was high. Interactions among variables were important; murrelet habitat selection for prey and fronts changed among different sea surface temperatures, distance to nesting habitat, upwelling intensity, and overall prey availability.

While kelp forests are known to benefit diving seabirds via protection and prey abundance, it appears to be unknown whether the proximity of substantial kelp forests to old growth forests provides an ecological or physical habitat connection that can be exploited by marbled murrelets. Further study is needed. It also appears to be unknown whether increased competition by common murres, rhinoceros auklets, or other seabirds affects the ability of the relatively fewer number of marbled murrelets to hold their own in mixed species feeding assemblages.

A more recent and very important study[152] confirmed that ocean conditions combined with old-forest nesting habitat influences the murrelets' long-term occupancy dynamics, and in particular, found that ocean conditions are a key driver of those dynamics. This study by Oregon State University was based on two decades of murrelet surveys at nearly 20,000 sites in the Oregon Coast Range, and found that the same ocean conditions that influence salmon returns, **including the forage fish that murrelets need** to successfully nest, **had a huge influence on the likelihood that murrelets would come inland to breed**. Given that these prey items tend to be less abundant when ocean temperatures are high, changing climate conditions could reduce prey availability as well as the tendency for murrelets to nest in the future.

On page 17, the 2019 Biological Opinion states: "In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the species' current status, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of listed species in the wild." The Opinion contradicted itself because it did not properly consider the cumulative effects of timber harvest *and* marine impacts together, within the two linked ecosystems that the murrelet depends upon for survival.

To issue an incidental take permit for timber harvest without considering the cumulative take resulting from marine as well as forest threats, or without designating marine critical habitat, would likely be too permissive with take, thus repeating a mistake. Without a true ecosystem

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[150] Piatt, J. F., Fadely, B. S., & Lensink, C. J. (2018). Stable isotope analysis reveals marine and terrestrial sources of nutrients in the diet of Marbled Murrelets in the Pacific Northwest. The Condor, 120(4), 801-812. doi: 10.1650/condor-18-80.1

[151] Becker, Benjamin H and Beissinger, Steven R. Scale-dependent habitat selection by a nearshore seabird, the marbled murrelet, in a highly dynamic upwelling system. Marine Ecology Progress Series, U.C. Berkeley. Vol. 256: 243–255, 2003

[152] Betts, Matthew G. et al. Squeezed by a habitat split: Warm ocean conditions and old-forest loss interact to reduce long-term occupancy of a threatened seabird. Society for Conservation Biology, August 22, 2020. https://doi.org/10.1111/conl.12745

approach that regulates timber harvest while incorporating cumulative take, this flawed, stove-piped approach will not only *not* arrest annual rates of murrelet population decline in Washington of up to 7.31 percent,[153] it will seal the bird's fate as currently predicted, of extirpation, by mid-century.

The precautionary principle, or precautionary approach, has emerged over the past several decades as a widely and increasingly accepted general principle of environmental policy, law, and management.[154] The Fish and Wildlife Service has adopted, in various forms over these same decades, an integrated ecosystem management approach[155] to conservation and restoration of species and their habitats. Combined with the precautionary principle, it has the capacity to "...mitigate uncertainty, and provides for action to avoid serious or irreversible environmental harm in advance of scientific certainty of such harm."[156] The one indisputable scientific certainty that exists about murrelet populations in Washington is their continuing precipitous decline. While acceptance of precaution as a governance and/or management tool is highly inconsistent across biodiversity-related policy sectors, the very nature of Endangered Species Act policy makes precaution and an ecosystem approach a priority.

NOAA has designated nearshore critical marine habitat in Washington for the green sturgeon, humpback whale, various rockfish, and other species. **In this regard, the Fish and Wildlife Service does not lack the authority to correct the decades-long deficiency by designating critical habitat in appropriate marine areas as required by the needs of the species**.

7.) Diversity and Distribution

A 2007 study[157] examined how oceanographic and terrestrial features influence marine habitat selection by radio-tagged marbled murrelets, and how selection varies temporally with reproductive status. Murrelet marine habitat selection was simultaneously affected by sea surface temperature and nearshore environment characteristics, as well as distance to nest site for breeders, with less influence by physical oceanographic features, Murrelets were generally

[153] Pearson, Scott F and Lance, Monique M. 2016 Washington At-Sea Marbled Murrelet Population Monitoring: Research Progress Report. April 2017. https://wdfw.wa.gov/sites/default/files/2019-09/Pearson%20and%20Lance_2017_Washington%202016%20murrelet%20population%20monitoring%20research%20progress%20report.pdf

[154] Cooney, R. (2004). *The Precautionary Principle in Biodiversity Conservation and Natural Resource Management: An issues paper for policy-makers, researchers and practitioners*. IUCN, Gland, Switzerland and Cambridge, UK. xi + 51pp.

[155] https://nespguidebook.com/ecosystem-services-and-federal-agencies/us-fish-and-wildlife-service/ and http://www.nativefishlab.net/library/textpdf/11650.pdf

[156] Ibid.

[157] Barret, Jennifer. The Influence of Oceanographic and Terrestrial Attributes on Marbled Murrelet Marine Habitat Selection During the Breeding Season. Simon Fraser University, 2008.

associated with areas characterized by higher relative tidal speeds, greater depths, steeper ocean floor slopes, and less freshwater inflow or proximity to sandy beaches. Depending on sea surface temperature, murrelets change their foraging tactics as local conditions change. The study suggested that availability of suitable nesting habitat within proximity of profitable marine foraging areas is critical for recovery of the species.

A study published in 2015[158] observed several regional hotspots of higher murrelet abundance at sea. Terrestrial attributes made the strongest contribution, especially the amount and cohesiveness of suitable nesting habitat in proximity to each segment, whereas marine attributes explained less of the spatial and temporal variations in murrelet abundance. At-sea hotspots of murrelet abundance thus reflect not only suitable marine foraging habitat, but the proximity of suitable inland nesting habitat.

Of concern is a study[159] published in the journal Molecular Ecology in 2018, that used genetic markers to examine the population structure and genetic diversity of marbled murrelets across their range. It found that the species exhibited low genetic diversity and a high degree of population differentiation, indicating that populations may be isolated and vulnerable to local threats.

A sample of 45 nests in the Pacific Northwest were located a mean distance of 16.8 km (10.4 miles) inland. However, chicks have been located as far inland as 63 km (39 miles).[160] Median age of the forest stand in which nests were located was 522 years, with the youngest stand age reported as 180 years old and the oldest (on the mainland coast of British Columbia) 1,824 years old.[161] Thus, (and again) the distribution and abundance of murrelets on the water is influenced by the proximity of old-growth forest.

At sea, marbled murrelets are concentrated closer to the shore in summer (April to September) than in winter (October to March.)[162] Observations during surveys have also found that they are more abundant near the entrances to major rivers and bays. Aerial marine surveys of the Oregon coast, Washington outer coast, and shores of the western Strait of Juan de Fuca were conducted in August/September 1993.[163] Resulting abundance estimates in 1993 for marbled murrelets were as follows:

Oregon	6,400 – 6,800
Washington	3,400 – 3,600

[158] Raphael, MG et al. Habitat associations of marbled murrelets during the nesting season in nearshore waters along the Washington to California coast. Journal of Marine Systems, June 2014. www.elsevier.com/locate/jmarsys
[159] Taylor, S. A., White, C., Doherty, P. F., & Marzluff, J. M. (2018). Population genomics of Marbled Murrelets: Demographic connectivity and implications for conservation. Molecular Ecology, 27(4), 856-871. doi: 10.1111/mec.14495
[160] Hamer, T.E. and Nelson, S.K. Characteristics of Marbled Murrelet Nest Trees and Nesting Stands, USDA Forest Service Gen. Tech. Rep. Chapter 6, PSW-152. 1995.
[161] Ibid.
[162] Piatt et al. 2007a; Piatt et al. 2007b
[163] Varoujean, D.H and Williams, W.A. Abundance and Distribution of Marbled Murrelets in Oregon and Washington Based on Aerial Surveys. USDA Forest Service Gen. Tech. Rep. Chapter 31, PSW-152. 1995.

While the 1993 report suggested that aerial surveys underestimate abundance by about 5 to 10 percent compared to boat-based surveys, it concluded that the murrelet's population size at that time had "…probably not decidedly changed over the last 10 years in either Oregon or Washington." A few years later, a team of researchers found a decline of nearly 30 percent in Washington, Oregon and Northern California between 2000 and 2010.[164] More recent data extending this time series to 2022 showed a different pattern, with losses in Washington but gains in Oregon and California, and no evidence of a trend over the entire sample range.[165] Decreases in at-sea populations for all 6 monitored zones during that period went from an average of 23,673 marbled murrelets in 2002 to 16,700 in 2010. In particular, there were annual declines in Washington marine waters of 7.31 percent. This equates to a 50% population decline in these zones over that decade. Given their low productivity as determined by juvenile-to-adult ratios at sea, the murrelets are not replacing themselves.[166]

A series of federal policies and ecosystem management guidelines governing land use on 19 national forests and 7 Bureau of Land Management districts, totaling 24 million acres of federal lands in the Pacific Northwest, was adopted in 1994 as the outcome of studies and hearings in response to the over-harvesting of old-growth forests that threatened the continued existence of some threatened and endangered species. It became a 100-year federal roadmap to protect older forests, called the Northwest Forest Plan,[167] and monitoring marbled murrelet populations and habitats is part of it. In 2019, however, a paper was published in the Proceedings of the National Academy of Sciences that showed that old forest is still declining across the Pacific Northwest more than 25 years into the Northwest Forest Plan.[168]

A 1997 permit exempted the incidental take of northern spotted owls, marbled murrelets and other federally-listed species within the range of the northern spotted owl in Washington associated with forest and non-forested resource management on state lands managed by WDNR, in accordance with the 1997 HCP.

By 2006, a report on required monitoring under the Northwest Forest Plan that was conducted over the first 10 years, showed "…at-sea murrelet populations appear to be stationary, but recruitment is very low and demographic models predict a 4 – 6% annual rate of decline."[169] Loss of nesting habitat due mainly to timber harvest was cited, along with a strong and positive correlation between at-sea population estimates and the amount of adjacent nesting habitat. (Again.) This supported "…the idea that amounts of nesting habitat are a primary driver in wide-

[164] Sherri L. Miller et al. Recent Population Decline of the Marbled Murrelet in the Pacific Northwest. The Condor, Vol. 114, No. 4 (November 2012), pp. 771-781
[165] McIver et al. 2021, 2023
[166] Final Summary Report: ENVIRONMENTAL SCIENCE PANEL FOR MARBLED MURRELET UNDERWATER NOISE INJURY THRESHOLD. July 2011. Presentation by E. Teachout, USFWS.
[167] Northwest Forest Plan web site by US Forest Service: https://www.fs.usda.gov/detail/r6/landmanagement/planning/?cid=fsbdev2_026990
[168] Phalan, Benjamin T et al. Impacts of the Northwest Forest Plan on forest composition and bird populations. PNAS, February 4, 2019 116 (8) 3322-3327 https://doi.org/10.1073/pnas.1813072116
[169] Raphael, Martin G. Conservation of the Marbled Murrelet under the Northwest Forest Plan. US Department of Agriculture Forest Service. Conservation Biology, Volume 20, No. 2, April 2006.

scale murrelet population distribution."[170] It also concluded that conditions at sea such as temperature regimes, prey availability, and pollutants continue to affect murrelet populations.

And again, net losses of about 2 percent of habitat on federal lands and about 27 percent on nonfederal lands were documented between 1993 and 2012. Fire was the major cause of habitat loss on federal lands, but it was timber harvest on nonfederal lands. The study concluded that conservation of suitable nesting habitat is key to murrelet conservation, but marine factors, especially factors that contribute to murrelet prey abundance, may play a role in murrelet distribution and trends.[171]

All of these studies add incremental yet significant weight, via finding after finding, that points to unsustainable declines in murrelet populations due to unsustainable timber harvest on non-federal lands.

By 2015, scientists at the Washington Forest Law Center were trying to alert the State Commissioner of Public Lands and the Division Manager at the Fish and Wildlife Service of alarming declines in murrelet populations. A September 22, 2015 letter submitted on behalf of more than a dozen organizations and individuals stated that their goal was to synthesize the State's Long Term Conservation Strategy with "…the urgency with which more effective conservation mechanisms must be implemented on state lands if we are to prevent the extirpation of the murrelet from Washington State." The letter insisted that errors in the State Department of Natural Resources' habitat modeling must be addressed, and said the best available science points to the critical role that state lands play in recovering murrelet populations.[172] At-sea surveys indicated that the murrelet population in Washington State was "…the smallest since monitoring began." Among other things that the Northwest Forest Plan effectiveness monitoring team reported: "…the total of 4,998 birds in 2014 is 48 percent of the estimated Washington population in 2001." The team found strong evidence for a 5.1 percent decline per year from 2001-2013.[173] Further, the letter added, "If the murrelet population decline persists at the current rate of -5.1 percent per year, then the Washington population will equal roughly 1,039 birds in three decades and 365 birds in five decades. If the current population is declining as much as 7.7 percent annually, then the statewide population will equal roughly 452 birds in three decades and 91 birds in five decades."[174]

According to a 2011-2012 aerial survey report by the Bureau of Ocean Energy Management, "…marbled murrelets have a restricted nearshore distribution and are rarely encountered at sea more than 5 km from shore and very often are found in shallow waters, 0.1 – 2 km from shore. Given this distribution at sea, our survey design …was not appropriate for accurately depicting

[170] Ibid.
[171] Falxa, G.A. and Raphael, M.G. Northwest Forest Plan| The First Twenty Years (1994-2013): Status and Trend of Marbled Murrelet Populations and Nesting Habitat. May 26, 2015 (Draft copy obtained via FOIA).
[172] Whittaker, Kara. Washington Forest Law Center. Letter to Peter Goldmark, DNR Commissioner of Public Lands, and Bridget Moran, Division Manager, USFWS. September 22, 2015.
[173] Ibid.
[174] Ibid.

the true distribution of this species."[175] This survey was a series of 32 low-altitude transects flown during all 4 seasons over a two-year period, from Fort Bragg, CA to Grays Harbor, WA. The majority of Washington's coastline was thus not covered by this survey.

In its 2016 Biological Opinion for the US Navy's Northwest Training and Testing Range operations,[176] the Fish and Wildlife Service referred to this study when it revised its own previous findings: "Although we have previously assumed that marbled murrelets would not be present farther than five miles from shore,[177] a recent survey report prepared for the Bureau of Ocean Energy Management and supporting geospatial data prompted us to reevaluate this assumption. This dataset includes observations of marbled murrelets at four different locations ranging from 13 to 32 nautical miles[178] from shore during November of 2011 and February of 2012. Given that these data were collected via aerial surveys, and with [the] Beaufort Sea State ranging up to 5,[179] it is very likely that the density and distribution of marbled murrelets were underestimated. Aerial surveys have been documented to result in marbled murrelet density estimates less than half of those generated from boat-based surveys, likely due to a variety of factors including marbled murrelet avoidance diving in front of the airplane and high sensitivity to visibility conditions.[180] We were unable to find any boat-based survey datasets covering the (Navy) activity area at these or greater distances from shore during the months of January through April."

In its 2019 Biological Opinion, the USFWS determined that "...issuance of the proposed HCP amendment "may affect, and is likely to adversely affect" the murrelet and designated critical habitat for the murrelet." Yet the 250-page document contained a summary of just 231 words on climate change, with a single 9-word sentence addressing marine environments: "Changes in the marine environment affect murrelet food resources."[181] **The Olympic Forest Coalition urges the Fish and Wildlife Service to perform a robust analysis of <u>all</u> threats including climate change, for the upcoming Section 7 formal consultation, and to adopt a policy of reducing future takes permitted <u>in all habitats</u> until the marbled murrelet population is stabilized and recovering.**

[175] Adams, J. et al. US Department of the Interior, Bureau of Ocean Energy Management OCS Study. Pacific Continental Shelf Environmental Assessment (PaCSEA). Aerial Seabird and Marine Mammal Surveys off Northern California, Oregon, and Washington, 2011-2012. (Page 33)
[176] US Fish and Wildlife Service. Biological Opinion, 2016. US Navy Northwest Training and Testing, July 21, 2016 (Pages 69-70)
[177] US Fish and Wildlife Service. Biological Opinion, 2010. US Pacific Fleet Northwest Training Range Complex in the Northern Pacific Coastal Waters off the States of Washington, Oregon and California and activities in Puget Sound and Airspace over the State of Washington. August 12, 2010.
[178] Nm = nautical miles. 13-32 nm = approximately 15-37 statute miles.
[179] Beaufort sea state 5 means moderate waves of 6.6 feet (2m), many whitecaps, spray possible, and wind speeds of 17-21 knots (19-24 mph). Visual cues on land would be small trees beginning to sway. In this active sea state environment, marbled murrelets would be very hard to spot, especially from the air.
[180] Strong et al. 1995, pp. 347-348; but see Henkel et al. 2007, p. 148-149, for a contrasting result.
[181] 15.1.6 Summary of Climate Change Effects to Murrelets, 2019 Opinion, page 141.

Seabirds and sperm whale, Aleutians, ca 2005.

8.) Marine Fronts, Heatwaves, and Productivity

Much effort has been devoted to identifying correlations between seabird abundance and fronts, or those gradients in the seawater column that exhibit dramatic changes in temperature, density, or current velocity. Like atmospheric fronts in air, a marine front is a boundary between two distinct water masses. Front formation depends on multiple physical processes, including wind, tide, topography, ice, convergence zones, and planetary-scale forces. Small differences in these lead to a wide range of front types. They can be as narrow as a few hundred meters and as wide as several tens of kilometers. While most fronts form and dissipate relatively quickly, some can persist for long periods of time.

There is a considerable range of variation in the strength of seabird responses to fronts. The factors behind the range of response are of interest themselves. Nevertheless, fronts are important determinants of prey capture. Two hypotheses have been proposed to account for this: (1) that frontal zones enhance primary production, which in turn increases prey supply, e.g. boundaries of cold- or warm-core rings in areas such as the Gulf Stream; and (2) that frontal zones serve to concentrate prey directly into exploitable patches, e.g. current rips among the passages between islands.[182]

While specific knowledge of the interactions between murrelets and marine fronts is lacking, the 2019 Biological Opinion did not acknowledge the existence of these fronts or their relationship to seabird distribution.

Topographic features such as islands, and also bathymetry such as seamounts, serve to deflect currents and can be sites of strong horizontal and vertical changes in current velocity, thus concentrating prey through a variety of mechanisms. Seamounts are often sites of offshore

[182] Balance Ainley and Hunt 2001 Seabird Foraging Ecology.

seabird aggregation, likely related to the fact that they support increased prey density and heightened migratory activity for marine organisms that comprise the deep scattering layer.[183] The deep scattering layer, so called because it scatters or reflects sound waves, causing echoes in sonar and depth sounders, is a layer in the ocean that consists of a high density of marine animals whose depth rises and falls daily, via diurnal vertical migration. It was discovered in World War 2 through the use of sonar, as ships found a layer that scattered the sound and was thus sometimes mistaken for the seabed. It is a horizontal zone of living organisms, usually schools of forage fish, copepods, ctenophores, and squid, typically occurring at 300-500 meters and up, and is intricately linked with the production of forage fish.

In this oceanwide diurnal vertical migration, hordes of sea animals in every ocean and freshwater body on earth migrate to the surface each night to feed and mate before retreating to the depths by dawn. The effort is costly; estimates suggest that over a year, the collective energy spent commuting by zooplankton alone is equal to about a year's worth of energy consumption in the United States.[184] [185]

The 2019 Biological Opinion did not consider ocean or nearshore topography in discussions of the forage fish productivity that supports murrelet populations.

The 2019 Biological Opinion did not acknowledge the fact that that models assessed by the Intergovernmental Panel on Climate Change estimate that global ocean surface temperatures will rise between 1 and 6º C by 2100.[186]

Western Washington's outer coast is a dynamic region characterized by seasonal upwelling that predominates during summer, interrupted by occasional periods of downwelling. A study[187] published in February 2023 that examined spring-to-fall water temperature records collected along this coast from 2001–2015 (April to October) at four nearshore locations (Cape Elizabeth to Makah Bay), spanning one degree of latitude and located within 15 km of the shore, found strongly correlated nearshore 10-to-20-day warming events that were about twice the seasonal temperature range normally found at a 40-meter depth. While the focus was on 2014 and 2015, the study also found large positive temperature events in 2013, which were potentially related to the early stage of the marine heatwave, and in 2011, which did not have a documented marine heatwave. This indicated that while nearshore short-term warm events occur during periods of large-scale offshore marine heatwave events, **they can also occur in the absence of a large-scale marine heatwave event**, especially when downwelling-favorable winds occur during the summer/early fall. Ecosystem adaptations to short- and long-term warming should probably be

[183] Ibid.
[184] https://www.smithsonianmag.com/science-nature/what-drives-aquatic-animals-to-make-vertical-migrations-180979172/
[185] https://hakaimagazine.com/videos-visuals/the-big-lives-of-tiny-creatures/
[186] NOAA Southwest Fisheries Science Center, Environmental Research Division, and Joint Institute for Marine and Atmospheric Research, University of Hawaii at Manoa, quoted in: Elliott Hazen et al. Predicted habitat shifts of Pacific top predators in a changing climate. Nature Climate Change. 23 SEPTEMBER 2012 | DOI: 10.1038/NCLIMATE1686
[187] Koehlinger JA, Newton J, Mickett J, Thompson L, Klinger T (2023) Large and transient positive temperature anomalies in Washington's coastal nearshore waters during the 2013–2015 northeast Pacific marine heatwave. PLoS ONE 18(2): e0280646. https://doi.org/10.1371/journal. pone.0280646

considered as separate but related stressors. The impact of marine heatwaves on local ecosystems depends in part on the ability of the ecosystem to adapt to long term warming. Within Large Marine Ecosystems, the threat to organisms from marine heatwaves **will increase even if the ecosystems are able to adapt to long-term warming**. This includes the California Current Large Marine Ecosystem that encompasses the Washington Shelf.

A second example are topographic features in relatively shallow water, including depressions in the tops of reefs, rocks and ridges across the slopes of marine escarpments, which may physically trap euphausiids (a shrimplike, planktonic marine crustacean of an order that includes krill, a favorite murrelet food) as they attempt to migrate downward in the morning from the surface where they feed at night. A third effect is the downstream eddy effect of islands that occur in strong current systems.[188] Thus, local manmade structures such as the Hood Canal Bridge, or the bridge over the Port Townsend Cut, located in areas of strong current, can create fronts that attract prey and in turn, seabirds such as the marbled murrelet.

Warm ocean temperature extremes, known as marine heatwaves, can dramatically impact the overall health of marine ecosystems around the globe, including changing the regional distribution of marine species, altering primary productivity, and increasing the risk of negative human-wildlife interactions.[189] Despite numerous ways of measuring marine heatwaves in surface waters, such as via temperature and salinity with moored buoys, underwater gliders, and aggregated surface observations, temperature extremes on the ocean bottom along continental shelves are not well understood, except in the context that bottom marine heatwaves can occur independently of surface heatwaves. A study[190] published in March 2023 found that not only does bottom marine heatwave intensity vary strongly with depth (from 0.5 to 3 degrees C) but they can be more intense, persist longer than, and can exist without, surface marine heatwaves. The deeper the water, the less synchronicity between surface and bottom heatwave events. Compared to the Atlantic coastline where the continental shelf ranges in width from 135 km in Maine to 420 kilometers in Florida, Washington's continental shelf is narrow, from 13 to 65 km. Thus, heated bottom water rising from depth will do so closer to the coast.

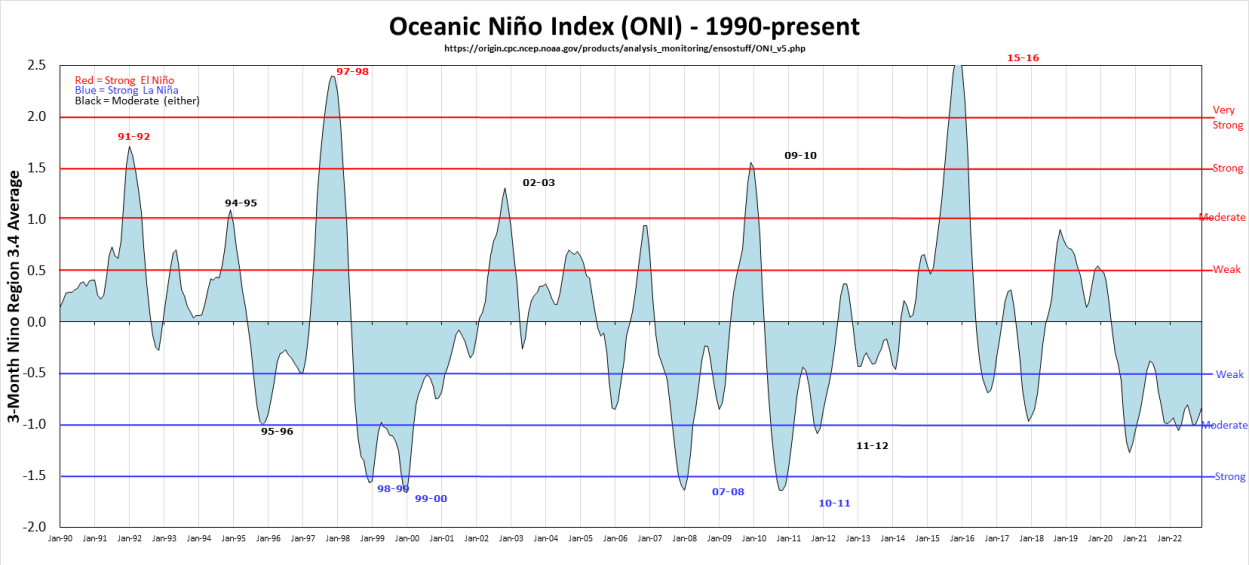
During late 2013, a warm temperature anomaly developed in near-surface (upper ~100m) waters well offshore in the Gulf of Alaska (GOA) which grew to encompass a large area of the northeast Pacific Ocean. In 2014–2016, an unprecedented heatwave in the North Pacific Ocean triggered sharp changes in ecosystems of the GOA, impacting fisheries management and seabird and marine mammal survival. This marine heatwave was unprecedented since record-keeping began 150 years ago, and noteworthy in its intensity, geographical extent, depth range, and persistence, with evidence of shifts in species distribution and reduced productivity.

The overall change in magnitude and rate of temperature change from the most recent cold anomaly (ca. 2007–2012) to the peak warm anomaly (2014–2016) exceeded any previous warming event in the GOA. The marine heatwave analysis using the daily mean central GOA sea surface temperatures indicated a prolonged period of increased temperatures in the central GOA

[188] Ibid.
[189] Amaya, D.J., Jacox, M.G., Alexander, M.A. et al. Bottom marine heatwaves along the continental shelves of North America. Nat Commun 14, 1038 (2023). https://doi.org/10.1038/s41467-023-36567-0
[190] Ibid.

from 2 May 2014 to 13 January 2017, with heatwave conditions persisting for 815 of the 917 days, in 14 events of greater than 5 days.[191] Maximum temperature anomalies at times exceeded 3–6˚C throughout the range of the heatwave from southern California to the GOA, and extended to depths of approximately 50–200 meters.[192] [193]

This also corresponded with an intense El Niño as shown in the diagram below, but as previously mentioned, nearshore marine heatwaves that affect murrelets can occur in the absence of a large-scale marine heatwave event.



Source: NOAA Climate Prediction Center

The impacts of ENSO (El Niño Southern Oscillation) on coastal upwelling[194] in equatorial regions and along the west coast of the U.S. have long been known, as well as its influence on reductions in phytoplankton biomass. Historically, coastal upwelling has brought cold, nutrient-rich bottom water to the surface, encouraging a spring and fall bloom of planktonic forms both plant and animal. The cycle begun by this upwelling underpins the rich productive ecosystems from Washington to California. But when upwelling is atrophied or ceased altogether by an El Niño, it forces fish, seabirds and marine mammals to move offshore to find food or die. Intense El Niño events severely impact seabird populations, often months in advance of peak temperature anomalies. The trophic mechanisms responsible for these impacts are unknown, but are assumed to operate at seasonal scales and to be linked to pelagic ocean productivity changes.[195]

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[191] Barbeaux SJ, Holsman K and Zador S (2020) Marine Heatwave Stress Test of Ecosystem-Based Fisheries Management in the Gulf of Alaska Pacific Cod Fishery. Front. Mar. Sci. 7:703. doi: 10.3389/fmars.2020.00703

[192] Zaba KD, Rudnick DL. The 2014–2015 warming anomaly in the Southern California Current System observed by underwater gliders. Geophys Res Lett. 2016; 43(3):1241–8.

[193] Wells BK, Schroeder ID, Bograd SJ, Hazen EL, Jacox MG, Leising AW, et al. State of the California Current 2016–2017: still anything but "normal" in the north. CalCOFI Rep. 2017; 58:1–55.

[194] Ribic CA, Finley DG and Spear LB; "Effects of El Niño and La Niña on seabird assemblage in the Equatorial Pacific", Marine Ecology Progress series: 1992, vol 80.

[195] Devney, Carol & Short, Michael & Congdon, Bradley. (2009). Sensitivity of tropical seabirds to El Nino precursors. Ecology. 90. 1175-83. 10.1890/08-0634.1.

The exceptional 2014-2016 El Nino event was linked to marine heatwaves, coral bleaching, floods, and droughts worldwide.[196] Globally, over the last century, the annual number of marine heatwave days has increased by more than 50 percent,[197] and future projections indicate order of magnitude increases in the number of marine heatwave days by the end of the century, even under scenarios of strong greenhouse gas emissions mitigation.[198] The so-called Pacific blob in 2015-2016 was caused by an extreme El Niño event covering 10 percent of the northern Pacific and lasting over 200 days.[199] Its negative impacts upon seabird populations were so severe that they may take decades to recover, if at all.[200]

2022 marked the hottest temperatures ever recorded in our already profoundly altered ocean ecosystems.[201] One effect is that less mixing in the ocean means the surface layer absorbs less carbon dioxide from the atmosphere, which increases global warming. Nearer to land, impacts from forest cutting can exacerbate this by warming adjacent waters by several degrees, adversely altering salmon habitat. A February 2023 study[202] found higher stream temperatures in watersheds—by more than 4 degrees C—where there had been more logging. As trees are cut down along waterways, small streams are exposed to more direct sunlight, while logging across watersheds can change the way water flows throughout the whole system.[203] This reduces the capacity of terrestrial ecosystems to survive and recover from adverse weather cycles.

The warm cycle ENSO is impactful, but the cold cycle is also responsible for heatwaves worldwide.[204] Looking beyond the end of 2016 in the Pacific, the effect of the subsequent cold cycle ENSO event, La Niña, was found to be responsible for the 2017-2018 heatwave in the Gulf of Alaska through a complex interaction of surface temperature, wind, currents and bathymetry.[205]

The following is intended to provide supporting evidence on why global warming, and in particular, changes in both large-scale and local ocean conditions, must be factored in and not

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[196] Sen Gupta, A., Thomsen, M., Benthuysen, J.A. et al. Drivers and impacts of the most extreme marine heatwave events. Sci Rep 10, 19359 (2020). https://doi.org/10.1038/s41598-020-75445-3

[197] Oliver, E. C. J. et al. Longer and more frequent marine heatwaves over the past century. Nat. Commun. 9, 1324 (2018).

[198] Frölicher, T. L., Fischer, E. M. & Gruber, N. Marine heatwaves under global warming. Nature 560, 360–364 (2018).

[199] Di Lorenzo, E. & Mantua, N. Multi-year persistence of the 2014/15 North Pacific marine heatwave. Nat. Clim. Change 6, 1042–1047 (2016).

[200] Schoen SK, Arimitsu ML, Marsteller, CE, PiattJF. Nov 2022, "Lingering impacts of the 2014-2016 northeast Pacific marine heatwave on seabird demography in Cook Inlet, Alaska (USA)"; Maine Ecology Progress Series

[201] Cheng, L., Abraham, J., Trenberth, K.E. et al. Another Year of Record Heat for the Oceans. Adv. Atmos. Sci. (2023). https://doi.org/10.1007/s00376-023-2385-2 https://link.springer.com/article/10.1007/s00376-023-2385-2

[202] Dylan Stuart Cunningham et al. Forestry influences on salmonid habitat in the North Thompson River Watershed, British Columbia. Canadian Journal of Fisheries and Aquatic Sciences 14 February 2023. https://doi.org/10.1139/cjfas-2022-0255

[203] Cruickshank, Ainslie. Fish in hot water: decades of logging tied to warmer temperatures in unprotected salmon-bearing streams. The Narwhal, March 7, 2023. https://thenarwhal.ca/logging-warming-waters/

[204] Gupta et al.

[205] Jeong H.,Park H-S, Stuecker, MF and Yeh, SW. "Distinct impacts of major El Niño events on Arctic temperatures due to differences in eastern tropical sea surface temperatures"; Science Advances, 26 Jan 2022, vol 8, # 4.

ignored or minimized in Section 7 consultations going forward, especially with a species that uses both marine and terrestrial habitats. In particular, this discussion is intended to highlight the risks to embattled marbled murrelet populations, which rely on forage fish for survival.

These events all occurred within, and for some years after, the time-frame of the 2014–2016 marine heatwave, and over an enormous spatial range involving three large marine ecosystems (the Gulf of Alaska, the California Current System, and the Bering Sea). **Results of multiple investigations call for an explanation that is plausible for all species and regions, that involves water temperature as a driving force—either directly or indirectly**.[206] Reduction in primary marine productivity, and ultimately in zooplankton or forage fish biomass, has been implicated in past seabird die-offs and reproductive failures. Temperature-enhanced competition for food should therefore be of the utmost concern when considering marbled murrelet population survival.

The prolonged heatwave reduced phytoplankton biomass and restructured zooplankton communities in favor of lower-calorie species, while it simultaneously increased metabolically driven food demands of ectothermic (animals that rely on external sources for body heat) forage fish. In response to that, forage fish quality and quantity diminished. Similarly, large ectothermic groundfish increased their demand for forage fish, resulting in greater top-predator demands for diminished forage fish resources. **A study[207] published in January 2020 suggested that these bottom-up and top-down forces created an "ectothermic vise" on forage species leading to their system-wide scarcity, and resulting in mass mortality of murres and many other bird, fish, and mammal species in the region during 2014–2017**.

Here is how it happened: In 2017 a groundfish survey indicated that GOA Pacific cod (*Gadus macrocephalus)* had experienced a 71 percent decline in abundance from the previous 2015 survey. In addition, the fish had moved to deeper waters, but the temperatures at the new depth remained up to 2º C warmer than what Pacific cod, which have a narrow temperature tolerance for egg development and larval survival, would have experienced on average over the previous decade. This suggested that recruitment is sensitive to temperature.

The GOA Pacific cod fishery supports a $103 million fishery which is 29 percent of the groundfish harvest value in the GOA.

The condition of the cod as well as southern rock sole (in weight and length) was at record lows in 2015 and 2016 during the heatwave, with a return to positive condition in 2017. But the catch in 2017 was less than 60 percent of the total allowable catch. The marine heatwave came to an end in the spring of 2017 as large portions of the GOA cooled to average sea surface temperatures; however, some warmth remained at depth.[208] This portends a slow recovery for fishery stocks and marine food web dynamics. It also gives a preview of impacts facing this

[206] Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, Arimitsu ML, et al. (2020) Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15(1): e0226087. https://doi.org/10.1371/journal. pone.0226087
[207] Ibid.
[208] Ibid.

region due to climate change. Climatologists predict it is a precursor to more common occurrence of marine heatwaves for this region.[209]

A study published in August 2020[210] demonstrated that an increase in metabolic demand during this extended marine heatwave, as well as a reduced prey supply, explained the decline in GOA Pacific cod biomass through increased mortality, but also, via historically low recruitment coinciding with the heatwave. It was the first study to directly link adult Pacific cod mortality to decreased abundance via insufficient prey to meet increased energetic demands during an extended warm period. The foraging demand never dropped below 70 percent of maximum demand, indicating a sustained demand for prey resources, especially during the winter months when demand typically falls.

As an example of the different metabolic needs, a murre (seabird) typically needs to eat 56 percent of its body weight daily. To maintain body mass, this translates to catching around 60 to 120 high-lipid forage fish per day. Under normal circumstances, an ectothermic cod of similar size would only need to eat 0.4 to 1.5 percent of its body mass daily, or about 1 to 3 high-quality forage fish per day.[211] According to the study (Piatt et al), this is the ultimate "Achilles heel" for murres, (and presumably other high-metabolic seabirds), and one that sets it far apart from competing ectothermic groundfish and endothermic marine mammals including large cetaceans (eating 1 to 2 percent of body mass per day), or small cetaceans and pinnipeds (5 to 15 percent of body mass per day). If murres can't fully meet this food demand every day, they lose body condition quickly and jeopardize survival. If they can't find any food for 3 to 5 days, they will die of starvation.

A large die-off of planktivorous Cassin's auklets (*Ptychoramphus aleuticus*) occurred from central California to British Columbia in the winter of 2014–2015, followed by a large die-off of rhinoceros auklets (*Cerorhinca monocerata*) in the same region during 2016.

The alcid family that includes murrelets has a high rate of energy expenditure during flight due to their flapping, non-gliding technique. For marbled murrelets, the distance between nesting sites and feeding areas increases this expenditure. Long flights are energetically costly; they increase the risk of predation from aerial predators, and they detract from time spent in other activities such as foraging. Those factors may result in a trade-off between reproductive investment and adult survival.[212]

Ecosystem-scale responses to this heatwave varied in both expression and timing. Phytoplankton biomass in the northeast Pacific transition zone waters (the region where the North Pacific subtropical and subpolar gyres meet) was lower in winter 2014 than in any year measured since

[209] Walsh et al., 2018
[210] Barbeaux SJ, Holsman K and Zador S (2020) Marine Heatwave Stress Test of Ecosystem-Based Fisheries Management in the Gulf of Alaska Pacific Cod Fishery. Front. Mar. Sci. 7:703. doi: 10.3389/fmars.2020.00703
[211] Piatt, J. F., Parrish, J. K., Renner, H. M., Schoen, S. K., Jones, T. T., Arimitsu, M. L., et al. (2020). Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014–2016. PloS One 15:e0226087.
[212] Cindy L. Hull, Gary W. Kaiser, Cecilia Lougheed, Lynn Lougheed, Sean Boyd, and Fred Cooke. Intraspecific Variation in Commuting Distance of Marbled Murrelets (*Brachyramphus marmoratus*): Ecological and Energetic Consequences of Nesting Further Inland. The Auk, 118(4):1036-1046. 2001.

1997.[213] In 2015, the largest and most widespread harmful algal bloom in recorded history—a bloom of *Pseudonitzschia*—extended from California to the Aleutian Islands. Rather than lasting a few weeks as is typical, this event persisted from May to October and produced the highest concentrations of domoic acid ever recorded. Domoic acid is a potent neurotoxin linked since the late 1990s to massive seabird and marine mammals dieoffs on the west coast.[214]

Mesozooplankton, which are a functionally diverse group of metazoan grazers largely composed of copepods that occupy multiple trophic levels in planktonic food webs, appeared abundant during the heatwave, although the size of the copepods was smaller than average.[215] In summer 2015, the acoustic biomass of euphausiid (krill) appeared moderate, relative to other years sampled outside the heatwave, but forage fish were scarce, with pollock and cod nearly absent from surface trawl surveys, despite being abundant in the years before and after the heatwave. Both capelin and Pacific sand lance were also lacking in seabird and groundfish diets in 2015, compared to years before and after the heatwave (2013 and 2017 respectively). In fact, capelin all but disappeared from seabird diets at Middleton Island in the GOA in the first year of the heatwave in 2014, and remained so through 2017.

As an example of harmful algal bloom consequences, in 2011 and 2012, paralytic shellfish poisoning was identified as the cause of up to 21 percent of nesting mortalities in Kittlitz's murrelet, a very closely related species to the marbled murrelet. This likely resulted from chicks being fed sandlance infected with *Alexandrium* species.[216] In addition, harmful algal blooms in 2007 and 2009 caused molting alcid species to die of hypothermia after the dinoflagellate *Akashiwo sanguinea* produced a protein that coated new feathers and reduced waterproofing.

In general, forage fish-eating seabirds fared poorly during the heatwave, while mixed fish and zooplanktivorous seabirds fared better. Seabirds in the western GOA had good reproductive success in the first year of the heatwave, but showed widespread reproductive failures in 2015.[217] [218] This included common murres, which experienced a record die-off in the GOA during the winter of 2015–2016.[219] Emaciation, characterized by moderate-to-severe pectoral muscle atrophy and absence of subcutaneous, epicardial, and visceral fat reserves, was the most significant postmortem finding contributing to death in the majority of birds necropsied. Of 3,365 murres examined at rehabilitation centers, 8 percent were dead on arrival or euthanized immediately; 47 percent were described primarily as emaciated.[220] Between 91 and 99 percent of

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[213] Piatt et al.
[214] Adriana C Bejarano et al. Production and Toxicity of the Marine Biotoxin Domoic Acid and Its Effects on Wildlife: A Review. Human and Ecological Risk Assessment: An International Journal Volume 14, 2008 - Issue 3, June 2007.
[215] Barbeaux et al.
[216] USFWS 5-Year Status Review, Marbled Murrelet, May 2019. https://www.seattle.gov/light/skagit/relicensing/cs/groups/secure/@scl.skagit.team/documents/document/cm9k/ntcx/~edisp/prod571175.pdf
[217] Renner, H., Rojek, N., and Kettle, A. (2017). "Seabird monitoring summary for the Western Gulf of Alaska," in Ecosystem Status Report 2018: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, eds S. Zador and E. Yasumiishi (Anchorage, AK: North Pacific Fishery Management Council).
[218] Zador, S., and Yasumiishi, E. M. (2017). Ecosystem Status Report 2017: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. Anchorage, AK: North Pacific Fishery Management Council.
[219] Piatt et al, 2020.
[220] Ibid.

the birds were classified as "starving" in Oregon, Washington, and Alaska. Hundreds to thousands of young-of-the-year California sea lions (*Zalophus californianus*) died in 2014 and 2015, and Guadalupe fur seals (*Arctocephalus townsendi*) died in large numbers and experienced reproductive failures during 2015.[221] Steller sea lion (*Eumetopias jubatus*) surveys showed declines in numbers of pups and adults between 2015 and 2017 throughout the GOA where recent counts had previously been trending upwards.[222]

Humpback whale calf production in Glacier Bay was high in 2014 but declined dramatically in 2015–2017.[223] An unusually large number (79) of fin, humpback and gray whale carcasses were documented throughout the western GOA in 2015–2016, the deaths mostly for "unexplained" reasons, and mostly in the GOA.[224] This was accompanied by a >50 percent decline in summer populations of humpback whales, with evidence of malnutrition ("skinny whales").

A common thread to most of these events was that they involved either a loss in marine productivity or a mass mortality of higher trophic-level animals, both of which point to problems in food production or availability. All the vertebrate predators affected also share a common dietary dependence on a few key forage species, and according to Piatt et al, this points to a bottleneck in the forage base.[225]

Between summer 2015 and spring 2016, about 62,000 dead or dying common murres (*Uria aalge*), the trophically dominant fish-eating seabird of the North Pacific, washed ashore on beaches from California to Alaska. Studies show that only a fraction of birds that die at sea typically wash ashore, so the total mortality was estimated to approach 1 million birds, two-thirds of which were adults, a substantial blow to breeding populations. Additionally, 22 complete reproductive failures were observed at multiple colonies region-wide during 2015 and after the 2016– 2017 mass mortality event. The magnitude, duration and spatial extent of this die-off, associated with multi-colony and multi-year reproductive failures, was, as the study put it in unusually frank terms, "unprecedented and astonishing."[226] Aerial surveys in Alaska estimated that the number of mortalities was more than three times greater than during the Exxon Valdez oil spill. Estimates for the GOA suggest that **as much as one quarter of all murres breeding there and in the southeast Bering Sea were killed**.[227] It remains to be seen when (or whether) murre populations in Alaska will recover from the heatwave in light of predicted global

[221] Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, Arimitsu ML, et al. (2020) Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15(1): e0226087. https://doi.org/10.1371/journal. pone.0226087
[222] Zador, S., and Yasumiishi, E. M. (2017). Ecosystem Status Report 2017: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. Anchorage, AK: North Pacific Fishery Management Council.
[223] Neilson, J., Gabriele, C., and Taylor-Thomas, L. (2017). "Humpback Whale Calving and Juvenile Return Rates in Glacier Bay and Icy Strait," in Ecosystem Status Report 2018: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report, eds S. Zador and E. Yasumiishi (Anchorage, AK: North Pacific Fishery Management Council).
[224] Zador, S., and Yasumiishi, E. M. (2016). Ecosystem Status Report 2016: Gulf of Alaska, Stock Assessment and Fishery Evaluation Report. Anchorage, AK: North Pacific Fishery Management Council.
[225] Piatt et al.
[226] Piatt JF, Parrish JK, Renner HM, Schoen SK, Jones TT, Arimitsu ML, et al. (2020) Extreme mortality and reproductive failure of common murres resulting from the northeast Pacific marine heatwave of 2014-2016. PLoS ONE 15(1): e0226087. https://doi.org/10.1371/journal. pone.0226087
[227] Ibid.

warming trends and the associated likelihood of more frequent heatwaves. In Washington and elsewhere on the West Coast, there is no comparable model to estimate total mortality.

The Fish and Wildlife Service may be ill-equipped to address an increasing frequency of extreme heatwaves on marbled murrelets except through stronger conservation measures in both terrestrial and marine habitats, with the totality of effects considered cumulatively.[228] Quantification could be difficult because so relatively little is known about the needs of marbled murrelets compared to the availability of, for example, ecosystem information provided to GOA groundfish fisheries managers (e.g., Pacific cod, walleye pollock, flatfish, and rockfish). By comparison, the latter is arguably some of the most comprehensive data in the world, providing a wealth of information on ecosystem dynamics and trends to decision-makers during the management process.[229] Even so, fishery management was severely challenged in 2017 during the abrupt and unexpected 71 percent decline in GOA Pacific cod abundance following that marine heatwave.[230] The majority of regulated fisheries worldwide are managed through single-species stock assessments with assumptions of a steady ecological state around mean conditions.[231] As wildlife managers know, this will not be so steady in future years. An ecosystem approach to species management that considers these widespread climate-induced trophic interactions and embodies the precautionary principle can help reduce such surprises.

9.) Indigenous Traditional Ecological Knowledge

In 2022, the White House Office of Science and Technology Policy (OSTP) and the Council on Environmental Quality (CEQ) issued a memorandum titled Indigenous Traditional Ecological Knowledge and Federal Decision Making, that recognizes the importance of ITEK and committing to elevating its role in Federal scientific and policy processes.[232]

Neither the Final 1997 HCP, its Amendment, the Biological Opinions discussed in this letter, nor the OESF Land Plan or other associated documents appear to have incorporated any Indigenous Traditional Ecological Knowledge.

As defined by the Convention on Biological Diversity of 1992, Article 8 (j), Traditional Ecological Knowledge refers to the knowledge, innovations and practices of indigenous and

[228] Holsman et al., 2019c
[229] Zador and Yasumiishi, 2017
[230] Barbeaux et al., 2017
[231] Skern- Mauritzen et al., 2016
[232] Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships, 86 Fed. Reg. 7,491 (Jan. 26, 2021); Executive Order 13,985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government, 86 Fed. Reg. 7,009 (Jan. 20, 2021); Executive Order 14,031: Advancing Equity, Justice, and Opportunity for Asian Americans, Native Hawaiians, and Pacific Islanders, 86 Fed. Reg. 29,675 (May 28, 2021).

local communities around the world. Developed from experience gained over centuries and adapted to local culture and environment, Traditional Ecological Knowledge (TEK) is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language and practices. [233] [234] [235]

TEK should be understood as a knowledge system including: (i) the knowledge based on empirical observations essential for survival (species taxonomy, distribution and life cycles); (ii) the understanding of ecological processes and natural resource management (practices, tools and techniques); (iii) the socio-economic organization necessary for effective coordination and co-operation (rules and taboos) and (iv) the worldview or 'cosmovision' (religion, belief and ethics) (Berkes, 1999). [236] [237] [238]

10.) Conclusions and Recommendations

The aforementioned Malcolm and Li ESA implementation analysis[239] amply shows that at the national level, the effectiveness of both formal and informal consultation has declined through time, as has the percentage of jeopardy opinions. At a time when threats are not only increasing but multiplying, sometimes exponentially, it does not make sense to relax or abandon principles or protection via lack of specificity, inadequate setting and monitoring of take, or warranted but precluded determinations, such as in the FWS' response to a petition to up-list the marbled murrelet to endangered. While we understand that static or reduced funding and staffing have hampered the Fish and Wildlife Service's capacities to implement and enforce the Endangered Species Act, the lack remains unacceptable.

In addition to scant knowledge compared to what exists for other species, the murrelet's recovery is made more challenging by the need to address its protection in two habitats, one terrestrial and the other marine.

On February 9, 2023, the U.S. Fish and Wildlife Service published proposed revisions[240]

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[233] https://www.nps.gov/subjects/tek/index.htm
[234] https://www.ecologyandsociety.org/vol12/iss2/art34/
[235] An example: https://crosscut.com/environment/2023/03/human-elements-reviving-indigenous-methods-habitat-restoration
[236] Berkes, F. (1999) Sacred Ecology: Traditional Ecological Knowledge and Management Systems, Philadelphia and London; Taylor & Francis.
[237] United Nations (1992) Convention on Biological Diversity [Accessed Nov 15, 2012 from http://www.cbd.int/doc/legal/cbd-en.pdf].
[238] Environmental Justice Organisations, Liabilities and Trade. Mapping Environmental Justice: Traditional Ecological Knowledge (definition). http://www.ejolt.org/2013/02/traditional-ecological-knowledge/
[239] Malcolm, J. and Li, Ya-Weh. Data contradict common perceptions about a controversial provision of the US Endangered Species Act. Proceedings of the National Academy of Sciences of the United States of America, December 29, 2015. 112 (52) 15844-15849
[240]https://www.endangeredspecieslawandpolicy.com/assets/htmldocuments/NewBlogs/EndangeredSpecies/Proposed%20Rule%202-9-23.pdf

to its regulations governing incidental take and enhancement of survival permitting under Endangered Species Act (ESA) section 10. If finalized, the regulations would "...do away with the distinction between candidate conservation agreements with assurances and safe harbor agreements, clarify that incidental take permits no longer need to have a federally listed species as the "lead" species, codify aspects of the agency's five-point policy that provide detail on the necessary components of habitat conservation plans, and make a number of other significant, as well as administrative and ministerial, changes." The proposed regulatory changes are intended to "...reduce costs and time." **Changes in any regulations or management affecting marbled murrelet and other listed species should be clearly explained, either in the new Biological Opinion or in associated documents**.

Our concern is that although some of the proposed changes may look sensible as worded, that further "streamlining" of ESA implementation may further weaken it. Therefore, the Olympic Forest Coalition urges the U.S. Fish and Wildlife Service to carefully consider informed public comments, incorporate all new and updated information during consultation, and to implement the following actions:

1.) Reduce habitat loss where it can make the most difference. DNR and private lands are disproportionately important to murrelet conservation. From a temporal perspective, *existing* habitat on DNR-managed lands is needed to serve as a "bridge" to support the murrelet population while it is most vulnerable to extirpation over the next 30-50 years. DNR's incidental take permit is valid through January of 2067,[241] which is beyond the anticipated date of functional extinction for the murrelet in Washington. This permit "...does not restrict the Permittee from engaging in land transfers, dispositions, and acquisitions," acknowledges "...incidental take of murrelets in the form of harm and harass associated with the removal of up to 38,774 raw acres of habitat" plus new roads and "yarding corridors," and further allows that "...the amount of habitat degraded [by] edge effects is approximately 6 percent of adjusted acres of habitat per decade." While take is calculated in numbers of acres rather than in numbers of birds, neither the permit nor the Biological Opinion appear to be allowing enough protection, given the murrelet's plunging population numbers, especially in Washington.

For a species like this in a race against time, the restoration of lower-quality habitat over these decades does not adequately mitigate for the loss of existing higher-quality habitat now. In the best-case scenario, much of the habitat slated for harvest is currently of higher quality than the habitat that will eventually replace it over time. Therefore, we support the Conservation Alternative suggested by the Western Forest Law Center as submitted in their technical comments on the Long-Term Conservation Strategy, that overcome the inadequacies in the HCP.[242]

[241] USFWS. To: WASHINGTON DEPARTMENT OF NATURAL RESOURCES. Subject: NATIVE ENDANGERED & THREATENED SP. HABITAT CONSERVATION PLAN ENDANGERED & THREATENED WILDLIFE Permit Number: TE812521-1 Effective 11/14/2019; Expires 01/30/2067. https://www.dnr.wa.gov/publications/lm_mm_usfws_new_incidental_take_permit.pdf

[242] Whittaker, Kara. Washington Forest Law Center. Technical comments, Marbled Murrelet Long Term Conservation Strategy.

2.) Protect older forests where the best habitat is. FWS should urge DNR to protect all older forests on a watershed, not patchwork basis. While we support DNR's proposed reassessment of older forests as an excellent first step in addressing the climate crisis, setting aside only 10,000 acres of public land for sequestering carbon is not enough. The threshold of age on DNR-managed land should be at least 90 years (and probably 80 years) for protecting older forests, which means many more acres. The Olympic Forest Coalition supports a 10 percent reduction in DNR's harvestable base every five years for the next 20 years, using the oldest DNR forests for this 40 percent. We would then pause the reduction in harvestable lands to assess whether the State was meeting its Greenhouse Gas (GHG) targets. Also: Congress cannot expect Washington forests to offset the entire nation's GHG emissions without offering compensation.

3.) Honor the original intent of the HCP. FWS should urge DNR to interpret and apply the HCP to provide the maximum environmental protection by honoring protective set-asides, prohibiting new roads, and/or abandoning roads that may already cross these lands. Marbled murrelet and other threatened and endangered species management and protection should be a priority.

4.) Reclassify tri-state murrelets as endangered. Given that FWS must use the same criteria as for initial listing during a 5-year status review, the best available science has demonstrated that FWS should recommend a change in murrelet status from threatened to endangered. (And FWS has acknowledged that itself.) Endangered species "means any species which is in danger of extinction throughout all or a significant portion of its range," especially in Washington State.[243] New information that has become available since the USFWS 2009 5-Year Status Review indicates that up-listing the murrelet is now warranted for the following reasons:

> A. the extent and duration of the ongoing population decline (a loss of 44 percent of the population size over the past 15 years alone in Washington at an average annual rate of 4.4 percent; (Lance & Pearson 2016);
>
> B. the extent and duration of past nesting habitat loss—
>
> 1. an overall loss of 90 percent of old-growth forests in Washington and Oregon (Booth 1991) and 85-96 percent in California (USFWS 1997)
>
> 2. statistically significant declines in habitat in all three states since that time (12 percent net loss from 1993-2012; (Raphael et al.);
>
> C. future loss of nesting habitat due to natural disturbances such as fire, windthrow, and disease (some of which are likely to be exacerbated by more extreme climatic conditions);
>
> D. ongoing, widespread fragmentation effects within remaining nesting habitat (higher nest predation rates, shifts in microclimatic conditions, and windthrow);

[243] 16 U.S.C. § 1533(c)(2)(B)(iii); see 16 U.S.C. § 1532(6)

E. a shift in prey base timing and availability and foraging trophic level associated with forage fish depletion, higher water temperature and acidity (associated with lower reproductive success);

F. continued human disturbance, mortality, and pollution on marine waters (commercial vessel traffic, oil and chemical pollution, commercial fishing bycatch, shoreline alteration, military exercises);

G. wind turbine energy facilities (mortality due to collision, as well as habitat fragmentation); and

H. inhibited genetic flow (loss of genetic variability and adaptability).

I. State regulations inadequately protect marbled murrelets on private forest lands. As previously stated, more than 9 percent of murrelet nesting habitat on state lands and 37 percent of murrelet nesting habitat on other nonfederal lands has been harvested over the past 20 years. Both the Oregon and California state Endangered Species Acts allow for take; in fact, OR's law has no take prohibition at all.[244] Take of murrelets in Washington is also not entirely prohibited[245] because under the Forest Practice Rules,[246] some suitable habitat may be harvested without review.[247] Also, rule exemptions, inadequate buffers around occupied nest sites, inadequate timing restrictions during nesting season, and more problems contribute to reduced protection. And finally, WDFW rates the marbled murrelet's sensitivity and exposure to climate change as only "moderate" but provides no data.[248]

J. Nest predation: A study[249] published in the Condor found that Marbled Murrelets nesting within campgrounds are at greater risk of predation, due to an increased concentration of predators such as Steller's Jay that benefit from the bounty of food left by humans. This harmful effect of increased nest and chick predation could extend outward from the campground for up to one kilometer (.62 miles).

5.) Revise the Recovery Plan. Because it is more than 10 years old and information on threats and population has changed, a revision is warranted. It must include more thorough analyses of threats in marine habitats and those currently segmented within the HCP.

6.) Cumulatively assess adverse impacts to murrelets in nesting and foraging habitats by considering <u>all</u> needs and <u>all</u> threats in both environments, while strengthening prohibitions on

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[244] ORS 496.182
[245] WAC 222-10-042, 222-16-080
[246] https://www.dnr.wa.gov/about/boards-and-councils/forest-practices-board/rules-and-guidelines/forest-practices-rules
[247] See Earthjustice et al.
[248] https://wdfw.wa.gov/species-habitats/species/brachyramphus-marmoratus#climate
[249] Goldenberg, William et al. Steller's Jay (Cyanocitta stelleri) space use and behavior in campground and non-campground sites in coastal redwood forests. The Condor, 118(3):532-541 (2016). https://doi.org/10.1650/CONDOR-15-187.1 https://bioone.org/journals/the-condor/volume-118/issue-3/CONDOR-15-187.1/Stellers-Jay-Cyanocitta-stelleri-space-use-and-behavior-in-campground/10.1650/CONDOR-15-187.1.short

take in both. Implications are for less destruction and fragmentation of old-growth forest habitat mitigating effects of increased anthropogenic threats in marine habitats.

7.) Link climate change to HCP goals. In the new Biological Opinion, a more robust assessment of climate change is needed that includes drought-related fire, mortality, insects and disease, and increases in extreme flooding, landslides and windthrow events in the short term (10 to 30 years), but also the impacts of marine heatwaves. Information on marine threats in general as well as murrelet life history including reproduction, remains insufficient, and more research on these topics is needed.

8.) Clarify surrogate species policy. The reliance on surrogate habitats and surrogate species to establish take levels should have resulted in a far, far more cautious approach than has been adopted. Since suppositions about murrelet reactions to noise and other disturbances have not mitigated their continuing population declines, (and because of well-documented Navy interference writing a Biological Opinion on 1,981,569 anticipated take incidents), FWS should proactively reduce levels of <u>all</u> allowed incidental take in forests, including that within the HCP, in order to compensate for the lack of information and obvious shortcomings of current take levels in <u>all</u> habitats. In addition, criteria for adoption of surrogate species should be tightened beyond merely describing "the causal link between effects to the surrogate and take of the listed species." When using a surrogate to assess numerical take, FWS should adopt the five steps described by Murphy and Weiland that include justification, a structured deductive process, a clear description of similarities and differences in responses, articulate the implementation and monitoring, and assure that consultation will be reinitiated if it's not working.[250]

9.) Designate marine critical habitat. Changes in food regimes are occurring now, and they affect nest selection. We support designation of marine critical habitat *and* national monument status for identified critical marine habitats on the outer coast, in similar fashion to the (2013) designation of the San Juan Islands National Monument. Permanent protection of these areas is needed for many reasons, not least among them that Presidential Executive Order 13795, signed by president Trump on April 28, 2017, removed moratoriums on coastal areas, including National Marine Sanctuaries, for oil and gas leasing within the range of the listed murrelet population. Consequently, it is foreseeable with an industry-oriented administration that new offshore oil and gas platform and transportation development may occur off the coasts of Washington, Oregon, and California in habitat used by murrelets.

10.) Use the precautionary principle. When seeking comments and data on the amount of privately held land that contains listed and non-listed species, FWS should specify that in the absence of such data (especially if it is being withheld), agency decisions will be more conservatively guided by the Precautionary Principle.

11.) Acknowledge the consequences of extinction. Include in this formal consultation and its Biological Opinion a frank, informed discussion on the consequences of extirpation of murrelets

[250] Murphy, Dennis D and Weiland, Paul S. The use of surrogates in implementation of the federal Endangered Species Act—proposed fixes to a proposed rule. J Environ Stud Sci 4, 156–162 (2014). https://doi.org/10.1007/s13412-014-0167-y

from Washington, and impacts of the extinction of this distinct population segment on forest ecology and the regulatory environment.

12.) Be more transparent. Make all pertinent public documents on marbled murrelet consultation, monitoring, and status reports easily available to the public online.