Citizens of Ebey's Reserve (COER) June 2019 Comments on:

Northwest Training and Testing Supplement Environmental Impact Statement
June 12, 2019

The following are Citizens of Ebey's Reserve (COER) comments on the application of the Endangered Species Act (ESA) as it applies to marbled murrelets referenced in the Northwest Training and Testing Environmental Impact Statement. These comments build upon and incorporate here by reference the comments COER submitted on the draft EIS in February 2017.

In addition, the following comments build upon and incorporate here by reference the October 2018 ESA-related comments COER submitted on the Final EIS for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island (NASWI), because the impacts of both EISs affect the murrelet population in Washington State. We especially reference within those comments, and incorporate here, Appendix E.2-B: *Navy's Northwest Training and Testing EIS: An Analysis of the Biological Opinion and Impacts on Marbled Murrelets*, by Dr. Robert Dillinger (November 27, 2018).

Part 1: Washington's Marbled Murrelets:

Can They Withstand More Takings?

This analysis examines the California, Oregon, Washington distinct population segment (tri-state DPS) for the marbled murrelet as it relates to the Navy's Northwest Training and Testing (NWTT) environmental impact statement and attendant U.S. Fish and Wildlife Service's (USFWS) biological opinion (BiOp). Because the Final EIS for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island (NASWI) and its BiOp also address Washington (Zones 1 and 2) marbled murrelets, the import of this examination applies to those two documents as well.

Two questions are the primary focus: (1) whether the murrelets composing this DPS can withstand any additional takings without risk of population collapse, and (2) whether the putative takings are credible or so speculative that it calls into question USFWS policy to err on the side of caution when confronted by major uncertainties.

The examination is broken into three parts. Part I examines the importance of the tri-state DPS and how the Washington sub-population may affect the viability of the entire DPS. In that regard, it is noteworthy that the State of Washington has listed the state's population of marbled murrelets, not as threatened, but as endangered. Part II examines the impacts of the NWTT activities on the marbled murrelets in Washington State and teases apart the reasonable knowns from the assumption-heavy speculations. Of additional interest is whether the most current and applicable scientific literature has been satisfactorily recognized and applied. Finally, Part III examines whether the putative impacts are sufficiently developed to achieve or exceed a modest threshold of scientific credibility.

It is important to begin this examination with a clear understanding that the Service is very concerned about the status of the tri-state DPS status, as explained in the Synthesis of the 5-year review (USFWS 2009, p. 68):

> However, **we remain concerned about the apparent substantial downward trend of the population** and the species' continued vulnerability from a broad range of threats across its entire listed range. Although some threats have been reduced, most continue unabated and **new threats now strain the ability of the murrelet to successfully reproduce**. In summary, if reproductive success continues to be too low to sustain the population, the observed population trends continue to decline significantly and manmade and natural threats continue at current or increased levels, a change in listing status to endangered may be warranted in the future.

It is further important to understand that the status of Washington State's two subpopulations (Zones 1 & 2) is so fragile that Washington has already listed its marbled murrelet subpopulations as endangered. Basically, the tri-state DPS of marbled murrelets is being killed by duck bites, under the misguided logic of "what real damage can this one duck bite do?"

DPS Analysis

> **Question 1.—*Is the tri-state distinct population segment essential to the survival and recovery of the coastwide species and would the demise of that DPS threaten the survival of the species?***

[Yes.]

In numerous places within the marbled murrelet recovery plan and its 5-year reviews, as well as in its USFWS Biological Opinion for the NWTT (BiOp) environmental impact statement (EIS), USFWS (or the Service) has stipulated that the marbled murrelets in California, Oregon and Washington compose a "distinct population segment" (DPS) that must be protected to assure the species long-term survival, as clearly established in the Service's 5-year review: *"The coterminus United States population of murrelets [i.e., the tri-state DPS] is also considered significant in accordance with the criteria of the DPS Policy, as the loss of this distinct population segment would result in a significant gap in the range of the taxon and the loss of unique genetic characteristics that are significant to the taxon."* (USFWS 2009, p. 12) This is further explained on pages 11 and 12:

> Loss of the DPS would result in a significant gap in the range of the murrelet. This gap is significant because the Washington, Oregon, and California area accounts for roughly 18 percent of the total coastal distribution of the species, encompassing 17 degrees of latitude. In addition, the Washington, Oregon, and California area is located at the southern-most extent of the range. This DPS contains an ecologically distinct forest system, the coastal redwood zone. Citing Noss 1994, Fraser (1999, p. 50), declares that in order to maintain opportunities for speciation and future biodiversity, the conservation of peripheral and disjunct populations is critical. **Recovery of species without the conservation of these peripheral populations may be impossible if these populations are eliminated or severely damaged** (Fraser 1999, p.50).

Question 2.—Are there sub-populations within the tri-state DPS?

[Yes.]

As examined in detail below, FWS clearly considers the six Conservation Zones (Figure 1) composing the tri-state DPS to be "subpopulations," as stated in the BiOp (USFWS 2016, Appendix D, p .6):

> The 1997 *Recovery Plan for the Marbled Murrelet* (USFWS 1997) identified six Conservation Zones…Recovery zones are the functional equivalent of **recovery units** as defined by Service policy (USFWS 1997, p. 115). …For the purposes of consultation, the Service treats each of the Conservation Zones as separate sub-populations of the listed murrelet population.

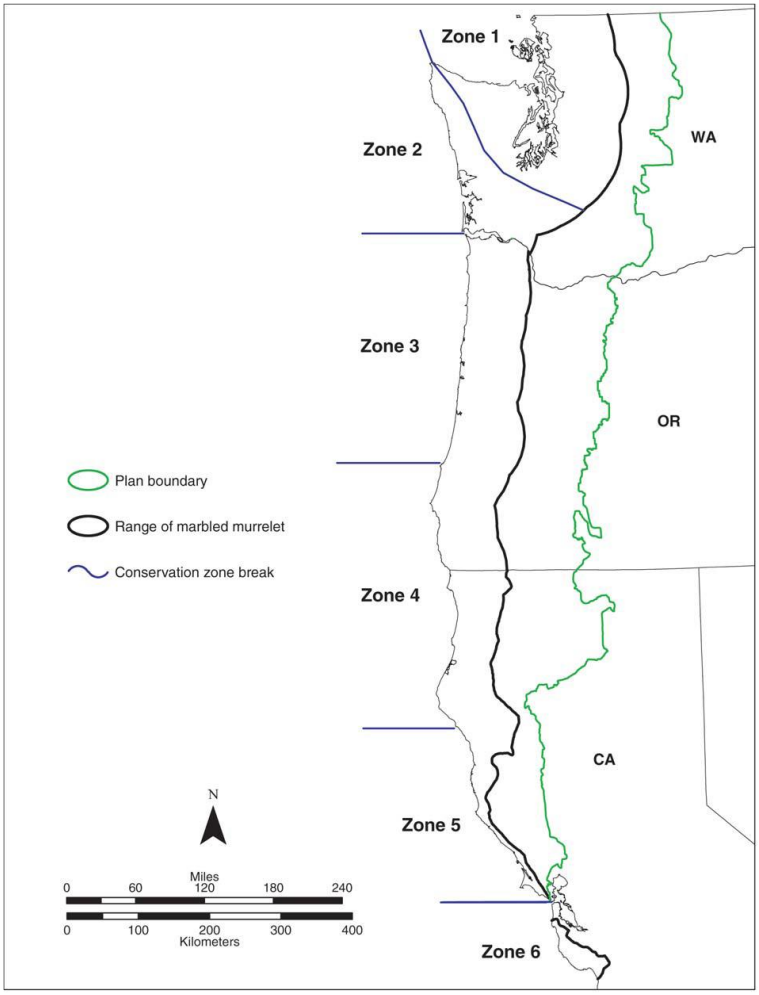

Figure 1. Map of the six Conservation Zones (from the BiOp, Figure 6; USFWW 2016, p. 66)

The Endangered Species Act Consultation Handbook[1] (p. xvii) defines "recovery units" as *"management subsets of the listed species that need to be identified for recovery management purposes…*[and they] *will be called a 'recovery unit' instead of a 'population'."*

This definition tacitly implies biological importance to the subpopulation unit and a need for discrete monitoring and management. Murrelets in Washington State are split as two subpopulations occupying Zones 1 and 2 (Figure 1), and are listed by the State of Washington as "endangered" due to their very fragile status.

> **Question 3.—Are the subpopulations essential to the survival and recovery of the tri-state DPS; i.e., is it likely that the demise of one or more sub-populations (zones) would threaten the survival of the tri-state DPS?**

[*Yes*.]

Murrelets are believed to be philopatric, meaning they return to their natal nesting area to nest as adults. This strategy tends to ensure nesting success in the sense that the returning adult obviously fledged successfully from that area and survived to sexual maturity, and hence, it is returning to nest in a tried and proven location. Such a strategy helps reproductive success. It also allows localized adaptations to that particular habitat. Murrelets in Washington, for example, are adapted to commuting a greater sea-to-nest distances than elsewhere (Hamer 1995). So, localized adaptations are important to the overall breeding success.

The five-year review of the marbled murrelet recovery plan states (USFWS 2009, p. 25), *"The current information on murrelet genetics indicates that (1) there is clinal genetic variation in the species from the Aleutian Islands to central California."* That means there are graduated genetic differences between subpopulations north and south reflecting adaption to local north-south habitat differences. Gene flow from small levels of migration in and out across the clines preserves genetic variation. Were spatial gaps to develop (i.e., fragmentation of the distribution), it could thwart gene flow and lead to reproductive isolation and the loss of heterozygosity (genetic variation).

Recognizing these geo-genetic differences, USFWS (2009, p. vi) notes the importance of treating the subpopulations as separate units to provide necessary individualized attention to their unique differences. Under "Actions Needed" the plan lists, "*1. Establish six Marbled Murrelet Conservation Zones…and develop landscape-level management* ***strategies for each Zone****…"*

Population biology is based on the established understanding that healthy populations are not only adapted to their particular environment but that their gene pool contains the sufficient heterozygosity (genetic variation) needed to ensure the species ability to adapt to temporal changes in habitat and environment, including but not limited to climate change impacts. As populations dwindle in size, and spatial gaps develop between subpopulations (reproductive isolation), forces such as genetic drift and inbreeding are exerted on the gene pool. Such forces reduce essential genetic variability, which can lead to fixation of alleles (i.e., suppression of heterozygosity).

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[1] https://www.fws.gov/endangered/esa-library/pdf/esa_section7_handbook.pdf

Distributional gaps are therefore a concern to species survival. As the 5-year review of the marbled murrelet recovery plan (USFWS 2009, p. 12) unequivocally concluded, "*The coterminus United States population of murrelets is also considered significant in accordance with the criteria of the DPS Policy, as the loss of this distinct population segment would result in a significant gap in the range of the taxon and the loss of unique genetic characteristics that are significant to the taxon.*"

Conclusion: Accepting the USFWS concern that the gap created by loss of the tri-state DPS would put the coastal population at risk, it follows that a significant subpopulation gap within the tri-state DPS would similarly put the DPS at risk of collapse, and of course, that could create the domino effect putting the coastwide species at risk.

- The USFWS-recognized and accepted significant downward breeding population trend of Washington's two subpopulations, puts Washington's murrelets in a unique position of concern, not reflected in the Oregon and northern California subpopulations.
- Based largely on the downward population line in Washington, USFWS has expressed concerns that the entire species may need to be reclassified as "endangered" rather than "threatened."

Question 4.—Of the six subpopulations composing the DPS, are the two Washington State sub-populations (Zones 1 and 2) the most fragile and imperiled, and if so, do they need particular emphasis on protection?

[Yes.]

Fragmentation is already evident in the central California (Zone 6) murrelet subpopulation (USFWS 2009, p. 12), but the population there is too small to show a trend. Nevertheless, northern California (Zone 5) is showing a significant downward trend of 9.1% over the most current 10-year evaluation period ending 2013. Washington's marbled murrelets, however, are declining at a far more accelerated rate. Table 2 of Appendix D in the NWTT BiOp reveals that the breeding season densities of marbled murrelets (number/km^2 of sea waters) between 2001 and 2013 have decreased by 32.8% in Zone 1, and by 50.0% in Zone 2, while over the same period, densities increased by 6.2% in Zone 3 (Oregon) and by16.1% in Zone 4 (northern California/southern Oregon). Including the latest 2014 and 2015 survey data, FWS shows in Table 3 (Appendix D, NWTT BiOp) that the average rate of decline from 2001 to 2015 has been 5.3% per year in Zone 1 and 2.8% per year in Zone 2, whereas Zones 3 and 4 are stable.

Hence, while the marbled murrelets across the west coast of the U.S. are federally listed as "threatened," Washington State has appropriately listed the Washington's murrelets (Zones 1 and 2) as "endangered."

The USFWS attributes much of the murrelet's problems to loss of breeding habitat. Table 4 in the BiOp (Appendix D, page 9) examines loss of that habitat from 1993 to 2012. Zones 1 and 2 lost about 27%, whereas Zones 3 and 4 lost about 25%. That is not a significant difference. Furthermore, Zones 1 and 2 combined have about twice the "*high quality nesting habitat*" of Zone 3 and about 12 times that of Zone 4 (2012 data, Table 1, Appendix D, BiOp). So while the nesting habitat statistics for Zones 1 and 2 are much better than for Zones 3 and 4, the breeding population sizes are the inverse. The most recent (2015) survey estimates are 7494 murrelets for

Zones 1 and 2 combined versus 17,584 murrelets for zones 3 and 4 combined (Table 3 of the BiOp).

Nesting habitat, then, by acreage and by percent loss, does not explain the alarming downward trend in Zones 1 and 2, where clearly something(s) else is going on that gravely threatens the future of Washington's murrelets.

As stated in the 2004 and 2009 FWS 5-year reviews of the marbled murrelet, as well as in the NWTT BiOp (Appendix D, page 4-5), USFWS clearly believe that an 18% gap in the distribution of the marbled murrelet is "significant" and would put the species in jeopardy (USFWS 2009, page 12):

> Loss of the DPS would result in a **significant gap** in the range of the murrelet. This gap is significant because the Washington, Oregon, and California area accounts for roughly 18 percent of the total coastal distribution of the species, encompassing 17 degrees of latitude. In addition, the Washington, Oregon, and California area is located at the southern-most extent of the range.

Hence, as viewed by USFWS, loss of the tri-state DPS, representing 18% of the total coastal distribution, would create a significant gap. By comparison, note that the Zones 1 and 2 compose 60% of the tri-state DPS total potential nesting habitat (i.e., 1343/2227 from Table 1 of Appendix D of the NWTT BiOp). It follows that loss of Zones 1 and 2, representing about 60% of the tri-state breeding area, would similarly create a major gap in the tri-state DPS, which would put the DPS at grave risk, especially given the existing fragmentation in the tri-state area. Continuing the above quote, USFWS (2009, page 12) goes on to state:

> This DPS contains an ecologically distinct forest system, the coastal redwood zone. Citing Noss 1994, Fraser (1999, p. 50), declares that in order to maintain opportunities for speciation and future biodiversity, the conservation of peripheral and disjunct populations is critical. Recovery of species without the conservation of these peripheral populations may be impossible if these populations are eliminated or severely damaged (Fraser 1999, p.50)[…]
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> Conclusion: We consider the Washington, Oregon, and California population of murrelets to be a valid distinct population segment under the 1996 DPS Policy. This population of murrelets is discrete based on differences in conservation status, management of habitat, and regulatory mechanisms between the United States and Canada that would result without the Federal protective measures afforded by the Endangered Species Act in the United States. The coterminus United States population of murrelets is also considered significant in accordance with the criteria of the DPS Policy, as the **loss of this distinct population segment would result in a significant gap in the range of the taxon and the loss of unique genetic characteristics that are significant to the taxon.**

Geographic gaps in distribution within the DPS, if manifested, would impede gene flow essential to protecting genetic variability. It follows, then, that extirpation or functional extirpation[2] of Washington's subpopulations could create a geographic gap within the tri-state DPS that could threaten the entire DPS, as stated in USFWS (2009, page 25), *"… it is reasonable to expect that additional fragmentation could isolate remaining populations genetically and demographically, ultimately increasing the risk of local extinctions (Peery et al. in press, p.19)."*

Nest success rates[3] (BiOp, Appendix D, p. 11) in northwest Washington was documented at just 0.20—i.e., 2 chicks fledging from 10 nest starts (Bloxton and Raphael 2005, p. 5). In central California, it was 0.16 (Peery et al. 2004, p. 1098), and in northern California it was 0.31 to 0.56 (Hebert and Golightly 2006, p. 95). No studies Oregon were available.

Furthermore, the Service (BiOp, Appendix D, p. 12) expresses concern that the current estimates for murrelet juvenile ratios[4] **(Ŕ)** *"appear to be well below what may have occurred prior to the murrelet population decline (Beissinger and Peery 2007, p. 298)…Therefore, the best available scientific information … indicates that the murrelet reproductive rate is generally insufficient to maintain stable population numbers throughout all or portions of the species' listed range.*" And in regard to Washington's two subpopulations, BiOp further reaches this conclusion:

> Considering the best available data on abundance, distribution, population trend, and the low reproductive success of the species, the Service concludes the murrelet population within the Washington portion of its listed range currently has little or no capability to self-regulate, as indicated by the significant, annual decline in abundance the species is currently undergoing in Conservation Zones 1 and 2.

Conclusion: Washington murrelets are at grave risk of actual or functional extirpation, which would create an extensive gap within the tri-state DPS and threaten its future viability, let alone recovery. Clearly there is a need for much more aggressive protection measures in Zones 1 and 2.

Question 5.— Do the NWTT exercises in Washington create a more potent threat to Zone 1 and 2 murrelets than presumed by the NWTT BiOp?

[Yes]

Even though the Service declared a need to "*develop landscape-level management strategies for each Zone,"* in the final analysis it failed to honor that and treated the tri-state DPS as an aggregated whole. That is, instead of examining the tensile strength of each link in the chain, it

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[2] As used here, functional extirpation refers to a population reproductive threshold that once crossed below, the species or population may not be able to recover from and reestablish its historic population levels but manages to exist indefinitely in a crippled state.

[3] Nest success is the annual number of known hatchlings departing from the nest (fledging) divided by the number of nest starts.

[4] The juvenile ratio (**Ŕ**) is calculated from marine survey data of the total number of 1-year old murrelets enumerated divided by the tally of all murrelets older than age 1.

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focused on the average of all the links and thereby masked the weak link—i.e., Zones 1 and 2—with stronger links (Zones 3-5) that mask the problems in Zones 1 and 2. That mistaken inattention to Zone 1 and 2 landscape-level differences discounts the impacts exerted by the NWTT and opens the door to extirpation of Zone 1 and 2 murrelets, which ultimately threatens the entire tri-state DPS.

That oversight is examined further in Parts II and III, below, specifically the potentials for damage to the marbled murrelets imposed by the NWTT exercises, whether they were adequately addressed by the NWTT BiOp, and to what extent the important USFWS policy of erring on the conservative side of caution has been actually applied or disregarded.

Part 2: Assessment of Projected Impacts

Parts 2 and 3 examine the U.S Fish and Wildlife Service's shortcomings in its Biological Opinion (BiOp) evaluating the impacts of the Navy's NWTT activities on marbled murrelets.

Segmentation: Increased Growler training activities from Naval Air Station Whidbey Island are an important component of the NWTT impacts on marbled murrelets. The increase in Growler numbers at NASWI, however, was not part of the NWTT EIS. Instead the additional jet impacts were examined in a separate EIS, which raises the question of unlawful segmentation. Segmentation divides the overall impacts on a species into smaller impacts that mask cumulative effects, which in total, could be objectionable.

In regard to previous consultations the BiOp (p 95) explains, "*Within the Inland Waters Subunit, the Service has conducted 44 formal consultations in Puget Sound (35) and Hood Canal (9) and 1,289 informal consultations.*" It goes on from there to conclude the following:

> In general, any loss of murrelet reproduction associated with disturbance effects caused by the proposed Federal actions was considered insufficient to increase the present rates of observed population declines at the Conservation Zone and range-wide scales. The consulted-on projects were also not anticipated to result in a significant reduction in marbled murrelet numbers or distribution because most of these projects were not likely to cause direct mortality to adult breeding marbled murrelets or to eggs and chicks, and the patches of nesting habitat removed as a result of the Federal actions were typically widely dispersed over a large managed landscape. In addition, many of the documented occupied stands are located in Conservation Easements and in other set-asides that will continue to provide nesting opportunities for marbled murrelets.

That conclusion may be reasonable enough for a single given action, but actions that overlap with other actions affecting the same group of animals become additive. Hence, takings under a proposed action are not singular but need to be added to the cumulative takings of all the existing actions. Given the large number of consultations, many ongoing activities must overlap those examined in this supplemental EIS, yet there is no consideration or enumerative presentation of the takings previously directly or indirectly allowed. There is no analysis of numbers allowed previously, or how to prioritize and retrofit to acceptable levels. Examination of each increment of loss fails to consider all the increments as a whole and total effect or take.

The delisting criteria for marbled murrelet recovery are [BiOp p 253]:

> General criteria for murrelet recovery and delisting are established under the murrelet recovery plan. More specific delisting criteria are expected to be developed in the future to address population, demographic, and habitat-based recovery criteria (USFWS 1997b, p. 114-115). The general criteria include:
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> • Documenting stable or increasing population trends in population size, density, and productivity in four of the six Conservation Zones for a 10-year period; and
>
> • Implementing management and monitoring strategies in the marine and terrestrial environments to ensure protection of murrelets for at least 50 years.

That concluding bullet seems to call for bringing the Navy into the planning process, so that mitigation of their activities can be fully realized and applied. Instead the Service admits *"Past Navy training activities have not been considered a significant factor influencing the reproduction, numbers, and distribution of the murrelet."* [BiOp, page 254]. The segmentation of past naval actions may indeed have been individually concluded to be not significant, but what is the cumulative effect and how has segmentation masked that?

2.1 Insignificance in Doubt

The BiOp identified the following 23 Navy actions that could impact marbled murrelets and/or their food supply. Of these, the BiOp only identified 5 action types (first 5 bullets in in bold-font) as having the potential to physically harm (injure or kill) marbled murrelets (see Table 2.1 below). Some of the other actions were found to not coincide with murrelet presence and hence were discounted. But for other activities the impact was decided to be insignificant. For example, although various toxicants result from naval activities, no losses were assigned. This puts unknowns and error on the side of the Navy rather than the resource.

- **Sonar**
- **Underwater Explosions**
- **Helicopter Use in Inland Waters**
- **In-Air Explosions**
- **Non-Explosive Projectiles: Offshore Area**
- Other Non-Explosive Practice Munitions (Bombs and Missiles)
- Vessel Noise
- Ingestions of Debris in the Marbled Murrelet
- Electromagnetic Energy, Lasers, and Electromagnetic
- Radiation -- Offshore Area and Inland Waters
- Electromagnetic Energy, Lasers, and Electromagnetic
- Radiation -- Olympic MOAs
- Ground-Based Noise and Visual Disturbance In-Water Devices
- Seafloor Devices
- In-water Disturbance in Inland Waters -- Divers and Swimmers
- In-water Disturbance in Inland Waters -- Strike by Military
- Expended Material and Their Fragments
- Helicopter Use in the Offshore Area

- Aircraft Strikes
- Aircraft Use over the Olympic MOAs
- Entanglement
- Air Pollutants
- Sediment and Water Quality

Table 2.1—The five Navy action types with potential to harm (kill or injure) and projected losses (deaths) anticipated over 20 years (see BiOp Tables 48 and 50)

Type of Action (expected over 20 years	Extent of Action (on average)	Number of birds harmed
Sonar		
MF8 Sonar	**Zone 1:** 40 hours per year of MF8 sonar emissions (half in the summer, half in the winter)	2.4
Underwater Explosions		
E3 Detonations	**Zone 1:** 6 detonations (3 at each site) per year at both the Hood Canal and the Crescent Harbor EOD sites	6.4
Helicopter Use in Inland Waters		
Helicopter Rotor Wash	Zone 1: 110 events per year at Crescent Harbor and at Navy 7 training areas	13.2[a]
In-Air Explosions		
E3 Explosions	**Zones 2-6:** 15 counts (explosive sonobuoys) per year of E3 detonations within 50 nm from shore in the Offshore Area Subunit during the winter	7.7
E4 Explosions	**Zones 2-6:** 24 counts (explosive sonobuoys) per year within 50 nm from shore in the Offshore Area Subunit during the winter	
E1 Medium-caliber Projectile Explosions, Strikes, Fragment, and Shock Waves	**Zones 2-6:** 416 projectiles per year (on average over a 5-year period) within 50 nm from shore in the Offshore Area Subunit during the winter	37.6
E3/E5 Large-caliber Projectile Explosions, Strikes, Fragment, and Shock Waves	**Zones 2-6:** 21 projectiles per year within 50 nm from shore in the Offshore Area Subunit	9.6
Non-Explosive Projectiles		
Small-caliber Non-Explosive Projectiles: Physical Strikes	**Zones 2-6:** 1,697 instances (8,485 small-caliber non-explosive projectiles) per year within 50 nm from shore, in the Offshore Area Subunit during the winter	34.8
Medium-caliber Non-explosive Projectiles: Strikes & Projectile Shock Waves	**Zones 2-6:** 600 instances (3,000 medium-caliber non-explosive projectiles) per year within 50 nm from shore the Offshore Area Subunit during the winter	
Large-caliber Non-explosive Projectiles: Strikes & Shock Waves & Muzzle Blasts	**Zones 2-6:** 41 instances (205 large-caliber non-explosive projectiles) per year within 50 nm from shore in the Offshore Area Subunit during the winter	
Total Harms (Deaths)	**Zones 1-6**	**111.8**

[a] Noted as harass.

In evaluating the impacts of Navy actions on marbled murrelets, the removal (harm or kill) estimates were largely based on (1) murrelet survey data, and (2) data the Navy provided on the size of the detrimental impact area for a given action (e.g., an explosion). The problem is that (1)

murrelets are not stationary and fixed into a stationary even distribution, and (2) the effects of impactful naval activities was based largely on weak surrogate to non-surrogate species and speculative correlations.

Furthermore, it is hard to believe that the other 17 naval actions will produce no direct mortalities or injuries, let alone no losses from indirect effects diminishing adult well-being and reproductive success. Depressed recruitment is responsible for the declining population of Washington murrelets, so any impacts on reproduction are of grave importance and certainly should not be assumed to be inconsequential without good reason.

Zone 2 is the weakest of all zone subpopulations (except 6) and may be where most of the activity is to occur. It should have 0 removals (deaths). BiOp Table 50 shows a significant decline in Zone-1 marbled murrelets over 20 years and attributes the projected removals (deaths) to Navy actions. Three problems: (1) it focuses only on direct marine exposures and discounts terrestrial exposure to electronic warfare (EW) activities of Growlers from NASWI, (2) it ignores about 10-14 of the full list of 24 actions, and (3) ignores the multiplier effect of lost production on recruitment. It also ignores the segmentation problem that hides the overall impact of many other actions accounted for separately.

It is hard to believe that with the thousands of war practice activities anticipated each year that only 5-6 birds will be directly harmed each year. In Zone 1 the Service estimates (Table 50) that only 11 birds will be removed (deaths) over the next 20 years. While the direct-take estimates were produced through an impressively judicious biometric exercise, the output of the modeling is only as good as the veracity of the assumptions and data going in. Given that the assumptions were based on fragmentary information, often weak surrogate and non-surrogate species, and sometimes baseless guesswork, the precision of those estimates gives a false impression of their credibility. A range for each precise estimate would have been more informative and less misleading as to the confidence of the estimates.

The greatest takings (injure, kill, or harass) numbers, however, from the proposed actions are likely to be losses due unexamined effects, such as interference with the feeding of young chicks. Those takings are numerous and the Service should give the benefit of doubt to the murrelets, rather than to the Navy.

2.2 Overarching BiOp Shortcomings

Significance Versus Uncertainty. The BiOp failed to define what numbers would constitute a significant take or impact. Significance is never established after the results are observed because it opens the door to conclusion gerrymandering. In evaluating the impacts, the Service failed (in many cases) to identify the extensive uncertainty in their "insignificant" and "discounted" conclusions. When uncertainty was too great, the proper finding should have been "unresolved." Then, in the cumulative analysis the proper evaluation should have been to aggregate all the unresolved effects and follow the Service's protocol of erring on the side of the resource.

The quotation below (BiOp, pp.100-101) unbelievably attempts to assign validity to a rather incredible assumption that the unresolved/unknown effects of an action will have no effect, i.e., an insignificant impact that will be dismissed (see bold).

> If exposure of a listed resource to a given stressor was extremely unlikely to occur, **we concluded that the effects of that stressor on the listed resource were**

> **discountable.** If we were unable to conclude the effect was discountable, we assumed the listed resource was likely to be exposed to the potential stressor(s) and we evaluated the consequence of that exposure accordingly.
>
> Similarly, if we determined, based on the best available information, **that we could not meaningfully measure, detect, or evaluate** the effect of a stressor, we concluded the effect was **insignificant.** If we were unable to reach either of these conclusions (i.e., insignificant or discountable), we then, as required, gave that resource the benefit of the doubt by considering the effect to be adverse.

First, to paraphrase the above: Situation A: If murrelets were extremely unlikely to be exposed to a military activity, we (the Service) conclude potential effects were discountable—i.e., zero or negligible. Situation B: If murrelets were likely to be exposed but we **could not measure, detect, or evaluate** the effect, we conclude the effect is insignificant. Situation C: When we **could not either discount or measure, detect, or evaluate**, we gave the benefit of a doubt to the murrelets and assumed an adverse effect, as required by law. As page 93 of the BiOp explains (footnote 2): "*In accordance with Service national policy (USFWS and NMFS 1998, p. 1-6) and congressional intent [H.R. Conf. Rep. No. 697, 96th Congress, 2nd Session 12 (1979)], the following analysis relies on best available information and provides the benefit of the doubt to the listed species **in light of uncertainty or data gaps** (see also p. 19952, middle column, of the preamble to the implementing regulations for section 7 of the ESA at 50 CFR 402; 51 FR 19926).*"

There are two problems with that:

(1) While the Service may not always be able to "*measure or detect*" a potential impact, it would always be able to "*evaluate*"--i.e., attempt to unravel and understand, even though in the end no conclusion was evident. Hence, either Situation A or B would always be met, and Situation C: (benefit of doubt to the murrelets) would never be met, unless the Service arbitrarily made no attempt to "evaluate" the effect. In fact, in many places in the BiOp, the Service admitted to major informational gaps, but used extremely fragmentary and weak information to reach a conclusion of an insignificant impact (Scenario B) that was clearly unjustified and should have provided the benefit of doubt to the resource (Scenario C). In spite of the lack of any research documenting the effect of many naval activities (e,g., explosions, sonar, toxin accumulation, and others), we found no situation in the BiOp where the benefit of a doubt (Situation C) was accorded to the resource.

(2) There is no discussion about how, in the absence of **measure, detect, or evaluate,** the Service quantified the magnitude of the effect. However, this problem seems moot given that there were no situations found where the Service did not **measure, detect, or evaluate.** Hence, it follows that situation C appears to be contrived and misrepresents actual practice; i.e., the benefit of a doubt never went to the murrelets.

Back to situation B, where the best available information provides no meaningful insight on a potential impact, is it reasonable and appropriate to assume the impact is zero? If the Service was to truly err on the side of the resource, the resource should get the benefit of the doubt in these situations, or to be fair, at least half the time…but none of the time?

It may be reasonable to treat a relatively stable and healthy resource with a measure of freedom when dealing with unknowns and uncertainties, but that cannot be said for Washington's endangered unstable, unhealthy, and declining sub-population. This tri-state DPS cannot afford a cavalier conclusion that blithely assumes insufficient information equates an "insignificant effect" (i.e., trace-level or zero).

The Accumulative Effects introduction makes this important statement [BiOp p 251]:

> Factors affecting murrelet fitness and survival in the marine environment include: reductions in the quality and abundance of murrelet forage fish species through overfishing and marine habitat degradation; murrelet by-catch in gillnet fisheries; murrelet entanglement in derelict fishing gear; oil spills; and high levels of underwater sound pressure generated by pile-driving and underwater detonations (USFWS 2009a, pp. 27-67). While all of these factors are recognized as stressors to murrelets in the marine environment, **the extent that these stressors affect murrelet populations is unknown** (USFWS 2012b). As with nesting habitat loss, marine habitat degradation is most prevalent in the Puget Sound area where anthropogenic activities (e.g., shipping lanes, boat traffic, shoreline development) are an important factor influencing the marine distribution and abundance of murrelets in Conservation Zone 1 (Falxa and Raphael 2015, p. 163).

All those factors are relevant and important, but USFWS admits "*the extent that these stressors affect murrelet populations is unknown*" in spite of hundreds to thousands of research publications to provide insight on those impacts. By comparison, there are only a handful of studies that specifically examine the direct and indirect impacts of such things as detonations on murrelets or the impacts of toxic explosive residues on juveniles and adults or how they bioaccumulate in their food chain, etc., yet the Service somehow manages to precisely enumerate (by fractions) the numbers of murrelets that each Navy exercise will inflict on murrelets. Those enumerations, derived from fragmentary research and weak extrapolations, are difficult to accept when, at the same time, the Service realistically finds it is unable to assess or quantify the effects of any one of these other non-Navy sources of harm for which there is abundant research. So, on the one hand the Service admits that well-documented research is insufficient to project an effect, while on the other hand with the weakest of documentation the Service machinates and predict precise murrelets losses for each of 23 discrete Navy actions.

Assumption on Murrelet Distribution. The BiOp assumes even distributions of birds across the zone (x birds/nm^2): "*We estimated marbled murrelet exposure"* to bullets and blasts based on the number of such events in the area and *"assuming an even distribution [of murrelets] in time and space.*" [BiOp, page 202]

If that distribution is patchy, the possibility for impacting more birds goes up if the Navy actions happen to overlap with areas of bird concentration. Without knowing where within a zone the Navy actions may focus, and without knowing where concentrations of birds may occur, it's not possible to assess the odds of overlap and the resulting take.

Distribution is an important consideration. The BiOp (page 191) notes, "*In order for marbled murrelets to be stuck by projectiles, those projectiles need to occur in marbled murrelet habitat, while marbled murrelets are in the path of the projectile. We estimated marbled murrelet exposure to projectiles based on the number of projectiles proposed for use* ***and assuming an***

even distribution in time and space." If that distribution is tends to clump, say in an area where prey is abundant, then the take could be higher, even much higher.

Page 29 of the Preliminary Consultation:

> Data from Washington show that marbled murrelets exhibit considerable seasonal and daily variation in their use of specific foraging areas (Speich and Wahl 1995). Marbled murrelets have the ability to fly long distances to reach suitable habitat or areas with high productivity, even during the breeding season (Ralph *et al*. 1995), commuting up to 145.5 km from nest to sea in northeastern Washington but averaging a mean distance of 53.5 km (Lorenz *et al*. 2016).

This validates movements making distribution an always a changing dynamic.

> We expect marbled murrelet density to be higher during winter in the nearshore waters of northern and eastern Puget Sound. Many of the Navy's training and testing activities will occur in these areas. (BiOp, page 77)
>
> We estimated marbled murrelet exposure to non-explosive practice bombs based on the number of bombs proposed for use and assuming an even distribution in time and space. (BiOp, page 202)

Offshore Distribution of Marbled Murrelets. The BiOp, Appendix A, develops a detailed analysis of marbled murrelet densities by season and area. The end product is estimates of the number of murrelets per square nautical mile, e.g., page 8:

> Therefore, to estimate summer marbled murrelet density within three nm of the coast, we seeded our marbled murrelet population density model using data from 2009-2013 surveys from Conservation Zone 2, which yielded **a mean estimate of 1.29 groups of two marbled murrelets per nm^2** (Falxa et al. 2015, p. 12). This estimate applied to both the "reasonable worst-case" and the "reasonably certain" scenarios.

And this from page 13:

> This process yielded starting winter density estimates of 0.059 groups per nm2 for the reasonable worst-case scenario and 0.073 groups per nm2 for the "reasonably certain" scenario.

There is a problem. It assumes the birds are distributed evenly across the area. There is no research data presented to support that assumption; rather, marbled murrelets are recognized as patchily distributed.[5] Factors that can drive distribution from random to patchy concentration include prey distribution and avoidance of disturbing activities leading to concentrations

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[5] Ministry of Environment, Lands and Parks, Resources Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee, Inventory Methods for Marbled Murrelets in Marine and Terrestrial Habitats. 2001. Standards for Components of British Columbia's Biodiversity. No. 10. (page 1) https://www.for.gov.bc.ca/hfd/library/documents/bib90252.pdf

elsewhere, presence/absence of predators, weather conditions, etc. Burger (1995)[6] reported a high degree variation in marine distribution densities of marbled murrelets in British Columbia. The 1.29 birds/nm^2 may be far greater in some areas and less in others. This means that the impacts of a Navy action could be far greater than expected, and it inserts considerable uncertainty into the direct removals (deaths) estimates. The level of uncertainty generated should give the benefit of doubt to the resource, but instead, because an evaluation was weakly attempted, the benefit of doubt went to the Navy action.

There are a number of studies indicating that marbled murrelets tend to clump in areas where food sources are abundant, which is logically predictable. What this means in terms of analyzing Navy actions is that a murrelet hit (birds in way of action) becomes less likely to occur but when a hit occurs the consequences are likely to be far greater due to the greater concentration (density).

Failure to Account for Lost Production. Marbled murrelet populations are sensitive to small increases in adult mortality (Piatt and Naslund 1995) and population dynamics are most strongly affected by adult survivorship (Beissinger 1995). The direct 20-year takings estimated in the BiOp (57.7 groups of 2 birds/group) accounted for only a portion of the total takings because their progeny was ignored—i.e., progeny the "taken" birds (birds removed from the breeding population) would have produced had they survived and reproduced. Yet the BiOp (page 77) recognizes that small increases in adult mortality are problematic to recruitment:

Many threats to adult murrelets tend to occur in the marine environment. Marbled murrelet populations are sensitive to small increases in adult mortality (Piatt and Naslund 1995) and population dynamics are most strongly affected by adult survivorship (Beissinger 1995)."

The table below examines those unrealized recruits to the population. Using BiOp estimate of 58 "taken" groups (i.e, pairs at 1:1 sex ratio) over the 20-year period or 2.5 pairs taken every year over the period.

Year	Calculation	Unrealized Recruits
1	2.5 pairs @ 0.58 R/year × 20 years	11.60
2	2.5 pairs @ 0.58 R/year × 19 years	11.02
3	2.5 pairs @ 0.58 R/year × 18 years	10.44
4	2.5 pairs @ 0.58 R/year × 17 years	9.86
5	2.5 pairs @ 0.58 R/year × 16 years	9.28
Subtotal:		***52.2***
6	Likewise for 15 years	8.70
7	Likewise for 14 years	8.12
8	Likewise for 13 years	7.54
9	Likewise for 12 years	6.96
10	Likewise for 11 years	6.38

[6] Burger, A.E. 1995. Marine Distribution, Abundance, and Habitats of Marbled Murrelets in British Columbia. Chapter 29. USDA Forest Service Gen. Tech. Rep. PSW-152. https://www.fs.fed.us/psw/publications/documents/psw_gtr152/psw_gtr152_chap29.pdf

Subtotal:		***37.7***
11	Likewise for 10 years	5.80
12	Likewise for 9 years	5.22
13	Likewise for 8 years	4.64
14	Likewise for 7 years	4.06
15	Likewise for 6 years	3.48
Subtotal:		***23.2***
16	Likewise for 5 years	2.90
17	Likewise for 4 years	2.32
18	Likewise for 3 years	1.74
19	Likewise for 2 years	1.16
20	Likewise for 1 years	0.58
Subtotal:		***8.7***
Total		***121.8***

Further assume that taken birds are removed from the breeding population, and a fledge rate recruited to the population of 0.2/pair per year. Hence, 1 pair would produce 0.2 recruits/year and 2.8 pairs would produce 2.9 × 0.2 = 0.58 recruits (R) per year.

In addition to the 121.8 unrealized recruits to the population are the 116 original birds (58 groups) taken, as well as unquantified birds from 2nd generation birds (i.e., unrealized progeny of the unrealized 1st unrealized generation) that add to the unrealized recruits (about 10 birds). One could argue that the unrealized production metrics are biased high because not all the affected birds would be necessarily temporarily or permanently removed from the breeding population, or that all the affected birds would have bred and nested had they not be "taken."

However, one might alternatively argue that the fledging rate of 0.2 is too low (i.e., it is based on a miniscule sample size of just 10 monitored nests). Furthermore, we assumed 58 pairs were taken, but if instead it was 116 individuals taken, where each individual was one member of 116 discrete pairs, then the take numbers above would potentially double (i.e., the 2.5 pairs/year in the table would be 5.0 pairs/year). However, the elephant in the room is whether the BiOp's 57.7 pair take estimate (rounded to 58 in table above) is reasonably accurate. If as COER asserts, it is not, those unrealized takings in the table above could be far greater. That seems highly likely for four very important reasons:

- Breaking naval actions into discrete segments that mask the total impact (as discussed in Section 2.1)
- Assuming unknown impacts will be have no effect (as discussed in Section 2.2)
- Assuming the unknown distribution of murrelets in offshore waters is an even distribution when it may be greatly uneven as discussed in Section 2.3)
- Failure to account for the wide spectrum of indirect effects on reproductive capacity (as examined in Section 3 below).

Ingestion of Debris and Toxins. Did the Service adequately address toxins from detonations entering the food chain of murrelets or directly entering the body? No. There was no analysis of

the amount of toxic material, its geographic extent, its temporal pervasiveness, its toxicity to murrelets, or its presence in the food chain.

The Service admits that murrelets will be exposed to contaminants focusing almost entirely on plastics consumed by fish, then possibly eaten by and bioaccumulated in murrelets (BiOp, pages 223-225). There is no analysis of how much plastic is added to the Zone 1 & 2 waters via Navy actions, and importantly, no discussion at all about what sort to chemical contaminants may be entering the food chain from explosive byproducts.

The Navy has a history of resisting revealing information on contamination situations that complicate its activities. A recent example is the controversy surrounding its use of fire-fighting foam containing per- and polyfluoroalkyl substances (PFAS), which **are** known to be bioaccumulative, persistent, and toxic health hazards. The Navy did not reveal or actively examine the contamination at NASWI's Ault Field or at Outlying Field Coupeville for years after it was aware of this serious problem.

Absent 1) a listing and examination of potential contaminants that could result from explosions, 2) any examination of what levels of plastic and other contaminants are present in murrelet prey and whether any such contaminant has a naval fingerprint, and/or 3) data or analysis of contaminants present in murrelet tissues, the Service's conclusion below but falls short. Unstated is the unscientific and unsupportable assumption that whatever the unknown effect may be, it can be ignored (zero) because "*there is insufficient information.*" Hence, the Service avoids giving the resource the benefit of the doubt (as discussed in Section 2.3).

> 10.4.6.1.1.1.3 Conclusion
>
> Given the information regarding the degradation of plastic in the oceanic environment and the bioaccumulation of associated contaminants through the marine food web, we conclude that marbled murrelets are likely exposed to these contaminants. Given the information presented above, this exposure can adversely affect individuals. However, at this time, **there is insufficient information** to determine whether the effects of this exposure would result in fitness consequences to individuals. [BiOp, page 225]...

Naval Vessel and Aircraft Harassment. In the Gulf of Alaska marbled murrelets are found at densities of 0.151 birds/km^2 at 100–350 km offshore, at 0.547 birds/km^2 from 50–100 km offshore, increasing to 1.360 between 0–50 km offshore (John F. Piatt, John F., and Nancy L. Naslund. 1995. Chapter 28. Abundance, Distribution, and Population Status of Marbled Murrelets in Alaska. USDA Forest Service Gen. Tech. Rep. PSW-152. Figure 2: https://www.fs.fed.us/psw/publications/documents/gtr-152/chap28.pdf).

And in that source this on page 292:

> Following the Exxon Valdez oil spill in Alaska, boat activity increased greatly in Prince William Sound and Kachemak Bay because of rescue and clean-up efforts.

> There, Kuletz (1994) found that murrelet numbers were negatively correlated with numbers of boats and low-flying aircraft.

And this, as well (Harry R. Carter, Harry R. and Katherine J. Kuletz. 1995. Mortality of Marbled Murrelets Due to Oil Pollution in North America. Chapter 26. USDA Forest Service Gen. Tech. Rep. PSW-152. Page 264. https://www.fs.fed.us/psw/publications/documents/gtr-152/chap26.pdf):

> Murrelets also were affected in foraging areas by increased human activity, associated with clean-up and monitoring programs.…In 1989, repeated surveys at Naked Island (in central Prince William Sound) and in Kachemak Bay (in lower Cook Inlet) showed a decrease in the number of murrelets with an increase in boat traffic over the course of the summer (Kuletz, in press). Similarly, land-based counts showed a similar relationship between murrelet numbers and boat and low-flying aircraft counts per hour.

And this:

> I used Kendall's tau-b correlation to test for a correlation between the number of boats and aircraft present and the number of murrelets counted that hour or on each transect. [page 8]
>
> In 1989 murrelet counts showed a negative relationship with boat traffic during offshore surveys (Fig. 4). At Outside Bay, the number of boats on or near the transect ranged from 0 - 4 per day. The number of murrelets was negatively correlated with the number of boats on or near the transect (n = 27, tau =-0.516, P= 0.0011). At Kachemak Bay, the number of boats per transect ranged from 0 - 8, and murrelet numbers were again negatively correlated (n = 70, tau = -0.206, P = 0.030). Land-based counts of murrelets in Outside Bay were also negatively correlated with the number of boats and low flying aircraft in the bay during each count (Fig. 5; n = 55, tau-b = -0.214, P = 0.038). [page 10]
>
> The low numbers of murrelets observed when boat traffic was high suggested that boat activity can affect murrelet numbers in nearshore waters, and human disturbance probably influenced murrelet activity at Naked Island in 1989. [page 13]

Outside Bay in Prince William Sound had none to a few spots of light oiling, and was used to test effects of boats and aircraft surveys on observed numbers of murrelets. Figure 6 shows that at 0 to 1 boats or low-flying aircraft (BLFA)/hour about 55 murrelets were counted, dropping to about 22 birds at 2–3 BLFA/hour, and to only about 7 birds at 4–5 BLFA/hour. http://www.arlis.org/docs/vol1/36773267.pdf (BiOp pages 4-343 & 344 in the EIS as a lot more on this.

2.3. Action-Specific Shortcomings

The Service recognized that murrelets would be impacted by the Navy actions in Zones 1 & 2.

> We expect marbled murrelet density to be higher during winter in the nearshore waters of northern and eastern Puget Sound. Many of the Navy's training and testing activities will occur in these areas. (BiOp page 77).
>
> In our previous consultations on Navy activities, we determined that mortality, injury, and disturbance of the murrelet were likely to occur from elevated underwater sounds and detonations (BiOp page 83).

Near-Harm Exposure to Bullets and Blasts. Page 28 of Prelim Consultation notes the following:

> Stumpf *et al.* 2011 found inland flight heights of marbled murrelets to range **from 643 feet to 938 feet above ground level**, however, the data were compiled from a single location on the Olympic Peninsula when analyzing flight heights of marbled murrelets transiting between foraging areas in the open ocean and inland nesting sites. Sanzenbacher *et al.* 2014, observed significant differences in flight altitudes between 2 sights near coastal waters in comparison to a single site further inland away from the water indicating that marbled murrelets may fly at higher altitudes over sites located farther inland than at sites closer to the coast. **Alcid flight patterns in the marine environment are often closely associated with the surface of the water (US Fish and Wildlife Service 2010)**, likely to optimize energy expenditure (increased lift from the interaction of air currents and wave action) or to escape from aerial predators by diving."

This sea-level flight behavior puts murrelets directly in harm's way of all Navy actions, and was a complication to the stationary uniform distribution pattern used by the Service in computing birds harmed.

The Service failed to consider the indirect effects of its no-explosive projectiles and explosions (see Table 2.1) on murrelets within or just beyond the action area that may not have been directly harmed but were directly within the area of potential action and likely harassed. And it ignores those birds distressed at the sending end of the action. These birds will likely be harassed by the considerable number and distribution of these vessels and war actions. The number of birds affected would far exceed the numbers directly harmed, and while not physically hit, the effects of iterative exposure to audio and visual distress events should have been addressed.

Under BiOp section 15 the Service examines sonar and detonation and projectile effects. Visual and noise effects of boats, EMR vehicles, human presence, and aircraft disturbance could affect feeding success and displacement, nestling care, nest abandonment, mating and nesting behavior, etc., but were largely not considered. For example, boat and EMR vehicle encounters and exposures were largely ignored, yet could impact murrelets.

Sonar. In considering NR.1sonar, the BiOp concludes (page 141):

> Other than sonobuoys, sonar use in the Offshore Area Subunit involves mobile sources (e.g., hull-mounted, towed devices, etc… Marbled murrelets are also highly mobile because they are carried by the currents and they dive and chase after prey. Given those

> factors, marbled murrelet exposure to sonar SPLs at distances and durations that are likely to cause injury is extremely unlikely to occur in the Offshore Area Subunit. For that reason, the effects of proposed sonar use, other than sonobuoys, on the marbled murrelet in the Offshore Area Subunit **are considered discountable.**

There is no substantive information presented to document the distribution (where the birds are), what the density is, whether distribution is patchy or randomly homogenous in offshore areas. This dearth of knowledge cannot with any sense of scientific efficacy be interpreted to mean the impact on offshore murrelets is zero (0).

The Service admits it has no information on sonar impacts and damage on marbled murrelets: "*There are no published studies specific to sonar and its effects on marbled murrelets, or any other seabird*." (BiOp page 132) Instead, it used information from other birds, relying on two sources. One was Dooling et al. (2000) who compared primarily songbird hearing to reptiles (https://link.springer.com/chapter/10.1007%2F978-1-4612-1182-2_7). This was a very weak source.

The other source, Crowell et al. (2015), examined the in-air audiogram of 10 species, mostly ducks, but found, "*The red-throated loon (*Gavia stellata*) and northern gannet (*Morus bassanus*) exhibited the highest thresholds while the lowest thresholds belonged to the duck species*." They further reported that "*All species tested shared a common region of the greatest sensitivity, from 1000 to 3000 Hz, **although audiograms differed significantly across species***. (https://link.springer.com/article/10.1007/s00359-015-1024-5)

Neither source examined an acceptable marbled murrelet surrogate, but the BiOp used the findings to assign hearing sensitivity values to murrelets, in spite of Crowell's pointing out the significant differences across species. However, the Service did waffle a bit on its conclusion: "*When sonar operates at frequencies between 0.5 kHz and 10 kHz (low- and mid-frequencies) **we expect** marbled murrelets can hear it and if cumulative SELs exceed 220 dB SEL we expect them to experience auditory injury."* (BiOp page 132)

The Service goes on to make assumptions about exposure to potentially damaging sonar that have no research substantiation behind them.

> The Service coordinated with the Navy to develop thresholds for onset of injury to marbled murrelets (Table 16). **The Service asked the Navy to provide** the range to effects (i.e., the distance from the sonar source at which injury of marbled murrelets is likely to occur) for sonar **assuming** marbled murrelet exposure occurred for a single ping, 5 minutes of pinging, and 30 minutes of pinging. Because marbled murrelets are highly mobile, we used the range to effects for single ping and 5 minutes, **assuming** that marbled murrelets would not be exposed for durations longer than that by mobile sonar. For stationary sources of sonar (pierside), **we assumed** they may be exposed to up to 5 minutes of sonar pings because sources of prey may attract them within an exposure area. (BiOp, p 133)

In that paragraph, there is a lot of assumption largely based on conjecture without any substantiation. And so it goes in the paragraphs that follow, concluding with this:

> There are several activities using very high- and high-frequency sonar that were categorized by the Navy as "de minimis" **(well outside the hearing range of the bird)** and had operational parameters that **the Navy did not anticipate would result in any exposure**. **No detailed information on quantity, duration, etc., was provided** by the Navy. The Navy did note that these activities could emit sonar intermittently for 8 hours per day, could continue for up to 40 hours, and could be operated infrequently and intermittently for multiple, consecutive weeks. **The Navy determined that the potential effects from these emissions were <u>discountable</u> to marbled murrelets**. Based on the information that we do have on these emissions, it appears that peak sound levels will not exceed 160 dB peak and therefore will not operate at frequencies, and for durations, that would exceed the threshold for auditory injury (220 dB SEL re: 1µPa2-sec). **Therefore, we anticipate that while exposure may occur, the effects would be <u>insignificant</u>**.

Not only is this more of the disturbing conjecture problem discussed above, but it seems to hand over the Service's job of analyzing the biological effects to the Navy with the Service presumably providing the rubber stamp. The BiOp goes on to recognize that murrelet exposure was not fully evidenced and hence evaluated because "*not all of this information* [exposure] *was provided to the Service due to classification of the data*."

Yet, based on very fragmentary non-surrogate information leading to unjustified conjecture, the Service and the Navy conclude the effects of most sonar types are "*discountable*" and/or "*insignificant*,", and hence tally to zero (except for the minor impacts of MF8 above). This is clearly a case where the benefit of the significant doubt should go to the resource until the impacts can be meaningfully evaluated.

Murrelet Exposure to EMR in the Olympics MOA. Based on and accepting the scant research findings in BiOp Section 10.4.7 and all its subsections, these things stand out in regard to the Electromagnetic Warfare (EW) training in the Olympic National Forest:

The emitters will operate between 8 and 16 hours each day for 260 days each year (Navy 2014). Emitters are expected to be energized, emitting signals at 90-300 watts and at a frequency range of 4 to 8 GHz (4 to 8 billion Hz) about 45 minutes of every hour on site.

The Service concluded that marbled murrelets will be intermittently exposed to EMR as they fly to forest areas, whether during nesting or at other times, but points out, "*There are no published studies that document the effects of EMR on marbled murrelets.*" The scant literature on impacts of radiation on other birds is very limited and at frequencies multiples less than the Navy's range. Only two studies were noted by the Service that approached the Navy's proposed range.

Of those two studies, the Service notes Bruderer et al. (1999, pp. 1016-1017) as the single study closest to the Navy's proposed EMR actions. That study aimed the ex-military tracking radar emitter at unmentioned bird species in flight to determine if it altered their flight behavior. The emitter emitted EMR directionally at 9 GHz, similar to that proposed by the Navy. The radar provoked no measurable changes in the behavior of the birds in terms of flight direction or vertical speed. That is hardly useful information in light of the myriad of potential impacts on health, well-being and reproduction. As noted by the Service, "*EMR has been correlated with physiological and developmental changes (For example: Fernie and Bird 2000; Fernie and*

Reynolds 2005), and behavioral changes (e.g., Balmori 2005; Rejt et al. 2007) in birds. More generally, lower frequency (50 Hz to 1.1GHz) EMR has been correlated with altering the function of cellular calcium channels (Pall 2013; Rao et al. 2008)." Note these are impacts documented for much lower frequencies than those to be used by the Navy.

The other study (Balmori 2005) examined white stork responses to EMR from cellular towers at frequencies of 900 MHz and 1.8 GHz (still well below the Navy's range). The storks nesting within 200 m of the antennas had significantly lower productivity at both the tested frequencies than did storks nesting further than 300 m from the antenna. This suggests chronic exposures to EMR at 900 MHz or more may be deleterious to bird nesting success.

The Navy claims its beams will be aimed above the forest canopy, but no information was presented to validate that none of the periphery and diffusion of the beam will enter the canopy and at what power level.

The Service concluded, "*The best-available commercial and scientific information indicates that the effects of brief, intermittent exposures to EMR frequencies in the range of 4 to 8 GHz are likely to be insignificant to birds in flight*." That conclusion is without any scientific information to support it other than burning is unlikely. The research on birds at lower EMR frequencies shows biological effects that could affect murrelet health and reproduction. Given the existing literature points to potential EMR impacts, the Service's conclusion is scientifically unwarranted.

Furthermore, no information was presented to validate that radiation will not diffuse into the canopy where nearby murrelet nesting is documented.

The BiOp indicates, "*Since the emissions are directional and pointed skyward, marbled murrelets will only be exposed when their flight paths intersect with a beam of EMR. The EMR emitters will be energized intermittently, and produce EMR with frequencies between 4 and 8 GHz. The best-available commercial and scientific information indicates that the effects of brief, intermittent exposures to EMR frequencies in the range of 4 to 8 GHz are likely to be insignificant to birds in flight. Physical effects, such as tissue heating or burns, are considered to be discountable, because an exposure lasting a few seconds (as is the case with a bird in flight) would be too brief to manifest these effects.* No commercial or scientific information was presented to validate that conclusion.

Even worse, the Service failed to consider any other potential effects as possibly meaningful. Just because burning may not occur is hardly reason to conclude that organs are totally unaffected or how iterative exposure may exacerbate the impacts.

The BiOp goes on "*Based on this analysis, the Service agrees with the Navy's determination that use of the mobile emitters for EW training will have insignificant effects on marbled murrelets.*" The Navy is the authority to determine biological impacts on marbled murrelets, and the Service is just a rubber stamp?

Murrelet Exposure to EW Training in the Olympic MOA. The Navy proposes to use the three mobile EMR emitters to be stationed intermittently at 15 different sites in the Olympic MOA. In its analysis of the effects, the Service considered the impacts of radiation exposure and ground-based noise and visual disturbances on marbled murrelet nesting. It did not address the above-ground-level altitude or the noise levels and duration related to the Growlers specifically participating in EMR-related activities or the impacts on marbled murrelets. The BiOp did note

on page 50 (section 6.1.1) that in the Olympic MOA there will be overflights for EW activities and Air Combat Maneuvers as close as 1,200 ft above ground level.

The Service acknowledges (BiOp page 231 that "*motorized equipment in close proximity to marbled murrelet habitat can disrupt normal marbled murrelet nesting behaviors,*" and that murrelet "*nesting behaviors may be disrupted by above-ambient sounds or visual disturbances that occur in close proximity to an active nest or when the activity occurs within the line-of-sight of a nesting marbled murrelet.*" For ground-based activities, the Service used "*a threshold distance of 110 yards (100 m) to evaluate if marbled murrelet habitat will be exposed to potentially disruptive activities.*"

The Service noted that 3 of the Navy's 15 proposed emitter sites are within close proximity to potential marbled murrelet nesting habitat (sites 5, 8, and 15), and 6 more are between "close proximity" and <1 mile from known occupied marbled murrelet nesting stands in the Olympic National Forest or state lands managed by the Washington Department of Natural Resources. The Service did not note how many nest might be in the <1-mile area, nor did it note the distribution of the mobile emitters usage of the 9 potentially impacted sites, presumably because the Navy intends to have flexibility in how often and when it uses a given site.

The Navy did validate its intent to use the sites for 260 days/year—i.e., every weekday of the year—for 8 to 16 hours each day used. Although not stated in the BiOp, presumably that is 3 mobile emitters on site each weekday of the year, which amounts to each of the 15 sites being used every fifth weekday (15/3) or once a week. However, distributional clumping, i.e., heavy use some weeks, light use other weeks, seems likely. Even if use was evenly distributed, activity once a week during nesting is not an insignificant frequency for a noise-sensitive and activity-sensitive bird. And once the emitter is on site, the disturbance that day goes on for 8-16 hours (presumably that does not include setup and takedown time).

The EW mobile emitter training impacts focused only on disturbance caused by the presence of the emitter vehicle and crew activities. The discussion overlooked the noise of EW training Growlers in the air nearby, e.g., whether the jests would be approaching the emitter vehicle, for how long, and at what altitude. However, the BiOp did mention on page 50 (section 6.1.1) that in the Olympic MOA there will be overflights for EW activities and Air Combat Maneuvers **as close as 1,200 ft above ground level**. That elevation would be extremely noisy (e.g., >92 dB) and in combination with the ground-level disturbances for 8-16 hours of the day should be of great concern to the Service.

Curiously, the Service ascribes those disturbances as "*short-term exposures*," the potential nesting habitat located in close proximity to emitter sites as "*limited*," the likelihood of disrupting marbled murrelet nesting as "*discountable*." and murrelet response to distant sounds or activity as "*insignificant*."

It further highlights the importance of one question asked before: Why was there not a pre-BiOp a definition of how many birds lost defines "significant," and the maximum numbers of exposures to an activity that can be "discounted." Significance is never established after the results are observed because it opens the door to conclusion gerrymandering.

That aside, if there were three nest failures in Zone 1 that occurred each year, is that insignificant or discountable? How does each failure that year, multiply because the nestlings failed to join the breeding population. How trivial do those ghost losses become over 10-15 years? The onus is on

the Service to establish meaningful thresholds for insignificance takings. But there were no estimates of nest failures to EW activities, just an overall estimate of 11 removals (deaths) over 20 years or about 0.5 birds per year due to direct exposure to a Navy activity in Zone.

PART 3: NAVY IMPACTS ON RECRUITMENT

The BiOp (page 267) discusses incidental take.

> 14 INCIDENTAL TAKE STATEMENT
>
> Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined under section 3(19) of the ESA to mean "…harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Harm is further defined by the Service as an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). **Harass is defined by the ESA as an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).** Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be a prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The Service's analysis of harms (BiOp Tables 48 & 50) was based on bird density in the area of the stressor: *"The area of effect, density of birds within the area of effect, and number of instances of the stressor were used to compute the cumulative probability of exposure and number of birds exposed, as explained in Appendix H…"* (Appendix A, page 20 BiOp).

In regard to impacts of the Navy's actions on marbled murrelets, the Service concludes *insignificance*, largely based on its estimates of trivial direct mortality of adults, eggs, or chicks.

> *9.5.4.2 Marbled Murrelet*
>
> In general, any loss of murrelet reproduction associated with disturbance effects caused by the proposed Federal actions was considered insufficient to increase the present rates of observed population declines at the Conservation Zone and range-wide scales. The consulted-on projects were also not anticipated to result in a significant reduction in marbled murrelet numbers or distribution **because most of these projects were not likely to cause direct mortality to adult breeding marbled murrelets or to eggs and chicks,** and the patches of nesting habitat removed as a result of the Federal actions were typically widely dispersed over a large managed landscape. In addition, many of the documented occupied stands are

> located in Conservation Easements and in other set-asides that will continue to provide nesting opportunities for marbled murrelets. [BiOp, page 96]

While the Service made an attempt to estimate the direct takes (injury or death) from bullets, blasts, and collisions (as discussed in Part 2), the far greater impacts on marbled murrelets may be due to secondary impacts on murrelet life history as it relates to documented recruitment inadequacies in Zones 1 & 2, where "recruitment" is the number of new birds annually entering the breeding population. See also the BiOp for the Final EIS for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island (NASWI), discussing noise impacts upon murrelets attempting to feed chicks and their tendency to drop or swallow prey in response to noise disturbances, causing missed or delayed feedings and chick mortality.

3.1 Breeding Habitat

Analyses of the diminution of breeding populations from southeast Alaska to California always highlight logging and loss of breeding habitat. Certainly that is important. The logging most often depicted as a major player occurred in the early 1900s, but the impact on murrelet recruitment should have stabilized by the mid-1900s. So, habitat lost then would not seem to explain declines in the current century. Nevertheless, the Service attributes (BiOp page 77) much of the murrelet's current problems to loss of breeding habitat.

> The Olympic MOAs special use airspace is located over the northwestern portion of the Olympic Peninsula (Figure 2)…Most of the forested lands in the northwestern portion of Conservation Zone 2 occur on public (Federal and state) lands, while most of the forested lands in the southwestern portion are privately owned. Extensive timber harvest has occurred throughout Conservation Zone 2 in the last century, but the greatest losses of suitable nesting habitat occurred in the southwest portion of Conservation Zone 2 (USFWS 1997, p. 127). Murrelet conservation is largely dependent upon Federal lands in the northern portion of Conservation Zone 2 and on non-Federal lands in the southern portion.

While breeding habitat is surely of critical importance, the extent to which breeding habitat losses have constrained reproduction and reduced current marbled murrelet numbers is unclear.

Table 4 in the BiOp examines loss of that habitat from 1993 to 2012. Zones 1 and 2 lost about 27%, whereas Zones 3 and 4 lost about 25%. That is not a significant difference. Furthermore, Zones 1 and 2 compose 60% of the tri-state DPS total potential nesting habitat (i.e., 1343/2227 from BiOp Table 1), or combined about twice the "*high quality nesting habitat*" of Zone 3 and about 12 times that of Zone 4.

So although the nesting habitat statistics for Zones 1 and 2 are much better than for Zones 3 and 4, the breeding population sizes are the inverse. The most recent (2015) survey estimates are 7494 murrelets for Zones 1 and 2 combined versus 17,584 murrelets for zones 3 and 4 combined (Table 3 of the BiOp).

High quality nesting habitat, then, by acreage and by percent loss, does not explain the alarming downward trend in Zones 1 and 2. Clearly something else is going on that gravely threatens the future of Washington's murrelets. That conclusion is further evidenced by an extremely low nest

success rate; i.e., the annual number of known hatchlings departing from the nest (fledging) divided by the number of nest starts.

Nest success rates (BiOp, Appendix D, p. 11) in in northwest Washington was documented at just 0.20—i.e., 2 chicks fledging from 10 nest starts (Bloxton and Raphael 2005, p. 5) compared with 0.31 to 0.56 in northern California (Hebert and Golightly 2006, p. 95). No studies Oregon were available. The low success rate in Washington is particularly mysterious because the breeding habitat itself is so unspoiled and relatively abundant. Potential causes for the low nesting success include predation, parental abandonment, insufficient nutrition, chick stress, and air-borne and/or food-source toxins; Navy actions could be a partial or major contributor to nesting failures.

Populations at the periphery of a species range push their genetic ability to exist there because of the stressors exerted by a less than ideal or optimum environment. These populations are more vulnerable to natural or anthropogenic impact, which may explain part of the weak recruitment and status of the central California (Zone 6) sub-population, which is at the southern edge of the species range. The Washington sub-populations (Zone 1 & 2) are well to the north and separated from Zone 6 by three relatively stable sub-populations (Zones 3-5). Hence, peripheral stressors would not seem to be the cause of the threatened status of Washington's murrelets.

Other factors must be constraining breeding and recruitment to the marine environment, such as (1) adult well-being, (2) breeding/nesting suppression, (3) nestling care, and (4) nestling stress and mortality. A large portion of the Zone 1 and 2 breeding habitat is within the Navy's Olympic MOA, as discussed in the BiOp (pages 82-83). Hence, Navy activities in that MOA can affect those and other aspects of murrelet recruitment, as discussed in the sections that follow.

Conservation Zones 1 and 2 are within the action area. Conservation Zones 3, 4, and 5 are between the shoreline and the action area, but are not within the action area. However, we expect that activities occurring in the action area offshore of Conservation Zones 3, 4, and 5 could affect marbled murrelets associated with these Zones. Additionally, we expect that individual marbled murrelets from any of the Conservation Zones (1 through 6) could occur in the action area due to the birds' transient nature. (BiOp p 65)

3.2 Impacts on Marine Environment

Toxins. The other major environmental key to strong versus weak recruitment is the marine environment, which ensures the adult's ability to secure food ensuring its well-being, which in turn is fundamental to successful mating, nesting, and rearing and fledging of chicks able to recruit to the marine habitat. The Service recognizes this iteratively:

> Many threats to adult murrelets tend to occur in the marine environment…Reductions in prey quantity and quality in marine areas, inland and offshore, are expected to affect marbled murrelet fitness because they rely on both areas for sources of prey. We expect that degraded marine habitat reduces the quantity and quality of prey abundance for marbled murrelets (BiOp page 77).
>
> The final Recovery Plan for the marbled murrelet outlines the conservation strategy for the species (USFWS 1997b). Of the primary recovery plan recommendations, the most pertinent to the needs of marbled murrelets within the action area are 1) protect the quality of the marine environment essential for marbled murrelet

> recovery, and 2) reduce adult and juvenile mortality in the marine environment (BiOp page 83).

In spite of this acknowledgment, the Service only cursorily examined the indirect impacts of Navy actions on the marine environment. Major potential impacts include toxins that could bioaccumulate within the murrelet food chain and ultimately impact adult murrelet well-being and/or depress egg viability and chick survival. The BiOp improperly omitted any discussion of how toxins from naval actions may be degrading marine environment for murrelets. Before PFAS were discovered in our Whidbey Island drinking water everyone assumed the water was fit to drink. It follows that lack of knowledge does not negate detriment. This is a credible and important information gap the Service failed to give to the resource.

Harassment: The Service acknowledges that naval activities can displace murrelets to undisturbed areas where stressors are mitigated but food supply can be less abundant or absent. The Service assumes that such displacements will be short-lived and that the birds will return when the naval activity ceases. That remains highly speculative and without any research to validate if and how long that repatriation might take. Furthermore, the Service failed to enumerate how Navy activities (primarily detonations) may inflict mortality on the murrelet's prey. These amount to additional credible and important information gaps the Service failed to give to the resource.

Overflights and Sonar Impacts on Prey: Growler overflights may transfer noise into the water and impact murrelet ability to locate prey. See the BiOp for the Final EIS for EA-18G "Growler" Airfield Operations at Naval Air Station Whidbey Island (NASWI), discussing noise impacts upon murrelets attempting to feed chicks and their tendency to drop or swallow prey in response to noise disturbances, causing missed or delayed feedings and chick mortality. It could also displace the birds to other areas (harassment). Similarly, as iteratively presumed by the Service, murrelets will react negatively to sonar activities and seek to avoid them. Yet the Service was unable to validate such assumptions, how murrelet prey may be affected, and how murrelet feeding can be jeopardized. Absent such knowledge, the Service just assumed the detriments were negligible.

3.3 Impacts on Adult Well-Being and Health

Aside from direct takings (harms), adult well-being may be affected by Navy activities in a wide variety of ways, including impacts on the marine environment (toxins, feeding harassment, and feeding displacement. Weakened murrelets will be subject to increased susceptibility to predation, disease, and health debilitation, which thwarts mating, nesting, and nestling care. Hence, these ignored yet important potential impacts were assumed to be insignificant because they were not known one way or the other.

3.4 Impacts on Breeding & Nesting

The following list include some of the potential impacts of the NWTT training activities that could be detrimental to marbled murrelets but were considered in aggregate to be insignificant because they were unknown.

- Growler Overflights: noise & hearing loss as impacts danger avoidance
- EMR (electromagnetic radiation): direct mortality, subliminal injury,
- Harassment: Feeding displacement (time/energy lost, diminished prey available in secondary area)
- Detonations – Injury/death/displacement from explosion + feeding displacement. Injuries compromising feeding success.
- Toxins: reducing food availability, bio-accumulation
- Predation. An injured or harassed bird forced into abnormal behaviors is more likely to succumb to predation.

3.5 Impacts on Adult Nestling Care

For a bird sensitive to noise and human activity, harassment from any or all of the proposed Navy activities can profoundly affect reproductive success in a wide variety of ways, including failure to breed and nest, nesting displacement, egg-laying and hatching success, provisioning of nestlings,, nest abandonment, health of nestlings, and failure to fledge and join the breeding population. For example, as discussed on BiOp page 76:

> A reliable prey supply is critical during the breeding season when energy demands are highest (Hull et al. 2001) and provisioning parents are traveling approximately 50 miles (80 km) inland to feed chicks, if not further. Because marbled murrelets only deliver a single fish per trip to the nest, and must rely on high-energy flapping flight, they may be especially sensitive to commuting costs (Hull et al. 2001). Due to the energetic costs and risks associated with commuting, a breeding marbled murrelet may be faced with a tradeoff between seeking an optimal inland nesting site, characterized by low predation danger, suitable microhabitat features and close proximity to flyways (Ralph et al. 1995), and remaining within reasonable distance of a profitable marine foraging patch (Barrett 2008, p. 3).

Feeding (one fish per nest visit) demands considerable flight energy for the parents. In Southeast Alaska the mean daily marine commuting distance (over the ocean) between at-sea locations and nest sites was shorter in 12.0 to 20.0 km (Barbaree, B.A., et al. 2015)[7], who further report:

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[7] Barbaree, B.A., et al. 2015. MARINE SPACE USE BY MARBLED MURRELETS BRACHYRAMPHUS MARMORATUS AT A MAINLAND FJORD SYSTEM IN SOUTHEAST ALASKA. Marine Ornithology 42: 1–10. https://sora.unm.edu/sites/default/files/MO_43_1_1-10.pdf

> Increased marine home range sizes and commuting costs to nest sites may affect the allocation of energy to incubation and chick provisioning (Ricklefs 1983, Eberl & Picman 1993). Thus, one might expect nesting murrelets to adopt behavioral strategies that optimize foraging efficiency and compensate for increased commuting costs, such as foraging closer to inland flyways (Peery et al. 2009), altering provisioning rates or payload size, or replenishing body reserves during the post-breeding period (Hull et al. 2001).

Naval activities that iteratively move parental birds to escape harassment and seek out alternative and perhaps non-ideal feeding areas can increase energy costs and diminish prey needed for the parents' own energy demands as well as the prey with which to provision the chicks.