

DRAFT
5-YEAR REVIEW

April 21, 2004

Species reviewed: Marbled Murrelet/*Brachyramphus marmoratus*

Year completed: 2004

FR Notice: *FR Volume 68, Number 76, Document 03-9671, pages 19569 to 19571*
FR Volume 68, Number 143, pages 44093-44094

Lead Field Office: Oregon Fish and Wildlife Office, Region 1

Name of Reviewer(s): Paul Phifer and Brian Cox

Cooperating Field Office(s): Western Washington Fish and Wildlife Office
Arcata Fish and Wildlife Office

Lead Region: Region 1

Cooperating Regional Office(s): N/A

BACKGROUND

1. Existing Recovery Priority Number: 3
2. Most recent Species Status as reported to Congress in the Biennial Report:

Species Status (i.e., I, D, S, etc.)

D Fiscal Yr 2003, Recovery Report to Congress Data Call

Recovery Achieved (i.e., 1, 2, 3, or 4; FWS only)

1 Fiscal Yr 2003, Recovery Report to Congress Data Call

3. Listing History

3. A. Original Listing:

FR Volume 57, Number 191, pages 45328 to 45337; October 1, 1992;
Determination of Threatened Status for the Washington, Oregon, and California
Population of the Marbled Murrelet

3. B. Revised Listing: N/A

4. Associated Listings: N/A
5. Review History:
This is the first 5-year review for this species since publication of the 1997 Recovery Plan.
6. Recovery Plan or Outline:
Issuing/Lead Region: Region 1, USFWS, Portland, OR.

Recovery Plan Document Citation:

U.S. Fish and Wildlife Service. 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon and California. 203 pp.

Reference Point Documents:

Lank, D.B., N. Parker, E.A. Krebs, and L. McFarlane-Tranquilla. 2003. Geographic distribution, habitat selection, and population dynamics with respect to nesting habitat characteristics of Marbled murrelets (*Brachyramphus marmoratus*). Ctr. Wildlife Ecol. Simon Fraser University, Vancouver, British Columbia.

McShane, C., T. Hamer, H. Carter, G. Swartzman, V. Friesen, D. Ainley, R. Tressler, K. Nelson, A. Burger, L. Spear, T. Mohagen, R. Martin, L. Henkel, K. Prindle, C. Strong, and J. Keany. 2004. Evaluation report for the 5-year status review of the marbled murrelet in Washington, Oregon, and California. Unpublished report. EDAW, Inc. Seattle, Washington. Prepared for the U.S. Fish and Wildlife Service, Region 1. Portland, Oregon.

U.S. Fish and Wildlife Service. 1992. Endangered and threatened wildlife and plants; determination of threatened status for the Washington, Oregon, and California population of the marbled murrelet. Federal Register Vol. 57. No. 191:45328-45337. October 1, 1992.

U.S. Fish and Wildlife Service. 1997. Recovery plan for the threatened marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon and California. 203 pp.

U.S. Forest Service. 1995. Ecology and conservation of the marbled murrelet. Ralph, C. John, George L. Hunt, Martin G. Raphael, John F. Piatt, editors. PSW Research Station, Berkeley, CA.. 420 pp.

REVIEW

8. Application of the 1996 Distinct Population Segment (DPS) Policy to DPS-listings made prior to enactment of the policy

8. A. Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

No. The Service did not reexamine the DPS classification of the marbled murrelet (murrelet) subsequent to its original listing. In 1992, a court found that, as the murrelet qualifies for listing as a threatened species throughout a significant portion of its range, “there is no need to consider the alternative basis of whether the tri-state population is a distinct population segment”¹.

As part of this 5-year review process, the DPS classification and listing status are assessed in light of the current regulatory status (e.g., the federal and state listings of the murrelet as threatened).

7. B. Does the original listing meet the DPS policy with regards to the Discreteness and Significance elements of the 1996 policy?

Yes, see Section 13.B.

9. New Information: Improved Analyses. Have any improved analytic methods resulted in relevant new information?

Yes, inland survey methods for murrelets have improved since the species was listed in 1992, reducing the detection error rate (i.e., classifying sites as occupied when they are unoccupied) from approximately 15% to 4%.

10. New Information: Biology and Habitat

10. A. Is there relevant new information regarding the species’ abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g. age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends?

Yes, there is better information on species’ abundance and demographic features. Data collected in 2000-02 for the Effectiveness Monitoring Program (2003) have shown higher mean numbers of murrelets at sea in some conservation zones by 2002, however, the large confidence intervals and short time frame (i.e., only three years of data) prohibit a population trend from being scientifically deduced at this time (Table 1). Other studies, more limited in geographic scope and with differing methodologies, have reported either no evidence of change in

¹ Marbled Murrelet v. Lujan, U.S. District Court, Western Washington District at Seattle. No. C91-522R. September 17, 1992.

population, a possible decline, or an actual measured decline (Table 2). These studies also include large confidence intervals.

Table 1

Region ¹	Year(s)	Density birds/km ²	Number of Birds ²	95% Confidence Interval	Source
Total	2000	2.06	18,600	11,638 – 30,728	Huff et al. 2003, Peery pers. comm. 2003
Total	2001	2.52	22,700	15,259 – 32,920	Huff et al. 2003, Peery pers. comm. 2003
Total	2002	2.69	24,400	14,817 – 35,209	Huff et al. 2003, Peery pers. comm. 2003

Source: Adapted from McShane et al. 2004

¹ Includes all of Washington, Oregon and California.

² Numbers rounded to nearest 100 birds.

³ CZ6 was not surveyed in 2000, 2001, or 2002 under the Effectiveness Monitoring Program. However, this zone was surveyed by Peery et al. in these years. Values are from: Z. Peery, pers. comm., November 20, 2003 and are revised from the data presented in Peery et al. (2002 and 2003).

Table 2

Washington	1996-1999	Marine surveys	No evidence of change	Thompson 1997-1999
	1972-1993	Marine surveys	Possible decline	Speich and Wahl 1995
Oregon	1992-1996	Marine surveys	>50% decline	Strong 2003a
	1997-2003	Marine surveys	No clear change	Strong 2003b
California	1995-2001	Occupied detections	Probable decline, Santa Cruz mountains	Suddjian 2001

Source: adapted from Lank et al. 2003

The low fecundity levels across Washington, Oregon, and California, as determined through nest success values (i.e., the number of fledglings per breeding pair of murrelets per year), indicate a population that is not stable through reproduction (Beissinger and Peery 2003). Unadjusted or adjusted adult:juvenile ratios detected at sea, as an indirect index of breeding success, have suggested generally low breeding success from California to southern British Columbia. Within the 3-state range, lowest ratios were found in central California and highest ratios in Washington (Bradley 2002, Golightly et al. 2002, Peery et al. in prep.). In general, both radio telemetry and at-sea survey methods indicate murrelet breeding success appears to decline from north to south.

10. B. Is there relevant new information regarding the species' genetics, genetic variation, or trends in genetic variation (e.g. loss of genetic variation, genetic drift, inbreeding, etc.)?

Yes. Several studies produced since 1992 provide new information on murrelet genetics. Results of a number of studies, including several types of molecular markers and varying methods of data analysis, all indicate statistically significant genetic structure exists in murrelets, with populations from California and the Aleutian Islands differing both from each other and from populations in British Columbia and mainland Alaska (McShane et al. 2004). It is important to note, however, that samples from Washington and Oregon are not included in any of these analyses, and that sample sizes from some areas in the Aleutian Islands and California are low. Genetic divergence of Aleutian and Californian populations is consistent both with the lower population sizes and densities in these areas, and with their non-central locations within the species' range.

Friesen et al. (1996a) published a preliminary analysis of genetic variation among murrelet populations as part of a taxonomic reassessment of the long-billed murrelet. They compared genetic variation among 43 murrelets sampled from the western Aleutian Islands to Oregon. No statistically significant geographic structure (i.e., population structure or population differentiation) was found. Geographic variation in allozymes was moderate and statistically significant ($P < 0.01$), but sample sizes were too small to compare individual populations.

Friesen's ongoing study of genetic variation in murrelets involves analysis of more rapidly evolving molecular markers (5 microsatellite loci and the mitochondrial control region) from murrelets sampled between the western Aleutian Islands and central California (Friesen et al. 2003, Friesen and Piatt 2003). Preliminary results support previous indications that significant population genetic structure exists within murrelets. Murrelets in the Aleutian Islands have unique control region haplotypes², and murrelets in California have unique intron alleles and control region haplotypes (Friesen and Piatt 2003); although these haplotypes/alleles do not form distinct clades (phylogenetic groups) on the haplotype/allele trees, several occur at high frequency.

Congdon et al. (2000) compared sequence variation in 9 nuclear introns among 120 murrelets sampled between the western Aleutian Islands and northern British Columbia, and found moderate and statistically significant population structure. In pairwise comparisons of populations, murrelets from the Aleutian Islands were significantly differentiated from those elsewhere (most $P < 0.05$), whereas little or no differentiation was apparent among populations between the Alaskan Peninsula and northern British Columbia. Most genetic data for murrelets also demonstrate a significant isolation-by-distance effect³, with pairwise estimates of

²Haplotypes' are variants (~ alleles) of non-recombining, haploid genomes such as vertebrate mtDNA.

³Isolation by distance is an increase in genetic divergence with increasing geographic distance between populations, usually attributed to a decrease in gene flow with distance.

F_{st} increasing with geographic distance between population pairs (Mantel's tests, $P < 0.05$) (Congdon et al. 2000).

Genetic variability in all types of markers that have been screened in murrelets is similar to other species, with no evidence of either population genetic bottlenecks or inbreeding (McShane et al. 2004). Inbreeding depression and interspecific hybridization are not an immediate threat. Genetic variation in neutral molecular markers in murrelets is similar to that in other species of seabirds, including several species with large and/or increasing population sizes; thus, population-level variation is not an immediate concern (McShane et al. 2004).

10. C. Is there relevant new information regarding taxonomic classification or changes in nomenclature?

Yes, the AOU recognized the marbled and long-billed murrelets as separate species in 1997. Until 1997, long-billed murrelets, mostly found in northeastern Asia, and marbled murrelets were considered to be 2 races of the same species, despite morphological distinctions. Genetic research indicates marbled and long-billed murrelets are genetically distinct and have probably been reproductively isolated for 5-6 million years (Friesen et al. 1996b).

10. D. Is there relevant new information regarding the species' spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.)?

Yes, there is new information which corroborates the descriptions of murrelet distributions and historic ranges detailed in the 1992 listing.

Information indicates most murrelets nest within 37 miles (60 km) of the coast (Miller and Ralph 1995); the Service (1997) considers 50 miles (80 km) as the maximum inland distance for determining habitat suitability and amount within the listed range. Commuting distances are, however, extremely variable, with birds in Washington tending to commute larger distances than those in Oregon and California. In Washington, occupied habitat has been documented 52 miles (84 km) from the coast; a grounded murrelet fledgling was found 62 miles (100 km) from the ocean, the maximum inland distance murrelets have been found within the listed range (Hamer 1995).

10. E. Is there relevant new information addressing habitat or ecosystem conditions (e.g. amount, distribution, and suitability of the habitat or ecosystem)?

Yes, based on available information in the 3-state area, it is estimated there are currently 2,223,048 acres of suitable murrelet nesting habitat (McShane et al.

2004). The estimate of suitable habitat for Washington and California is fairly complete for most land ownerships; however, the estimate does not include suitable habitat on privately owned lands in Oregon and does not account for some private lands in Washington.

Based on the current estimate, about 91% of murrelet suitable habitat is located on Federal land; State, County, and private lands account for about 8%; and Tribal lands contain about 1% (McShane et al. 2004). About 47% of the suitable habitat occurs in Washington, 35% in Oregon, and 18% in California.

During and since the listing, there have been other estimates of suitable murrelet habitat in Washington, Oregon, and California, Table 3.

Table 3. Estimates of old-growth/suitable murrelet habitat within the listed range, 1992-2003.

Year and Source	Est. of Suitable Murrelet Habitat (ac)		
	Washington & Oregon	California	Total
1992 Source: the Service (1992), based on acres of old growth in WA & OR	3,400,000	No estimate provided	3,400,000
1994 Source: USFS and BLM (1994), based on spotted owl habitat requirements	N/A	N/A	2,500,000
1995 Source: Perry (1995)	1,542,996	819,472	2,362,469
1996 Source: the Service (1996), based on acres of old-growth forest in WA & OR and acres of old-growth coastal redwood in CA	3,400,000	70,000	3,470,000
2003 Source: McShane et al. 2004	1,829,462	393,586	2,223,048

Adapted from McShane et al. 2004

N/A – not applicable

Some administrative units use northern spotted owl habitat definitions as a surrogate for murrelet habitat. Because northern spotted owl habitat is often defined at 80 years old and murrelet habitat typically does not develop by that time, the current estimate of 2.2 million acres is almost certainly an overestimate of suitable habitat for those ownerships reporting acres. Extrapolating from survey results, it is estimated about 820,768 acres, or 34% of the estimated suitable habitat, is likely to be occupied by murrelets (McShane et al. 2004).

Murrelets are thought to be highly vulnerable to nest predation (U.S. Fish and Wildlife Service 1997). While the extent of the effects of forest modification on murrelet nest success or how these effects may have changed since the 1992 listing is not known, in murrelet nests with known outcomes, predation has

consistently been the most significant cause of nest failure. The factors affecting rates of predation on murrelet nests (suspected to be the primary type of predation, though adult predation does occur) are not fully clear, yet key elements seem to be proximity to humans, abundance of avian predators, and proximity and type of forest edge to the nest (McShane et al. 2004). Most active murrelet nests in Washington, Oregon, and California have failed (42-85%)(Table 4), and 17 of 23 (74%; Nelson pers. comm. 2004) of these failures have resulted from predation (based on nests in which it was possible to determine if predation was a factor) (Nelson and Hamer 1995, Hamer and Meekins 1999, Manley and Nelson 1999, Hebert and Golightly 2003, Nelson and Wilson 2002, Peery et al. in prep.). In a study of artificial nests in Washington and Oregon, 81-86% were disturbed or depredated (Marzluff et al. 1999, Luginbuhl et al. 2001).

Table 4. Number of successful and failed murrelet nests by state¹.

Location	Number of Successful Nests	Number of Failed Nests			Total Nests	Nest Failure Rate
		Eggs Lost	Chicks Lost	Total Failed Nests		
Washington ²	4	1	2	3	7	42%
Oregon ³	9	4	8	12	21	57%
California ⁴	8	32	13	45	53	85%
Total	21	37	23	60	81	61%

Source: Adapted from McShane et al. 2004

¹ Includes only nests with known outcomes and known stage of failure.

² Sources: Sources: Hamer and Meekins 1999, Washington Department of Fish and Wildlife, unpubl.

³ Sources: Hamer and Nelson 1995, Nelson and Wilson 2002, unpubl.

⁴ Sources: Singer et al. 1995, Singer et al. 1997, Hebert and Golightly 2003, Peery et al. in prep.; Burkett 2004 pers. comm.

11. New Information: Threats

11. A. Is there relevant new information regarding the magnitude or imminence of previously identified threats to the species?

Yes.

- Several threats have decreased since the listing (McShane et al. 2004). These include:
 - The rate of annual habitat loss, particularly on Federal lands, has declined.
 - The adequacy of regulatory mechanisms has improved due to the federal and state listings and other state and federal regulation, especially the Northwest Forest Plan. In this 5-year review, the inadequacy of regulatory mechanisms threat situation is assessed in light of the existing regulatory status.

- New gill-netting regulations in northern California and Washington have reduced the threat to murrelets.
- Some threats are continuing or there is insufficient information to determine whether a change in magnitude or imminence has occurred (McShane et al. 2004). These include:
 - The historic loss/modification of habitat has not been offset by development of new habitat.
 - There is more information confirming the high threat predation poses to the murrelet (see information below), however, there is no direct evidence that predation on adult murrelets and murrelet nests has increased in severity since the listing.⁴
 - Threats from oil spills continue but are unpredictable and effects are variable.

11. B. Is there relevant new information regarding new threats to the species?

No.

12. New Information: Conservation Efforts

12. A. Is there relevant new information regarding implementation of conservation measures that benefit the species?

Yes. The Northwest Forest Plan was implemented in 1994 and encompasses most of the range of the murrelet in the 3-state area. The murrelet Recovery Plan (1997:88) states the Northwest Forest Plan, “In developing the strategy for marbled murrelet nesting habitat on Federal lands, the key components were (1) stabilization or improvement of nesting habitat through protection of all occupied sites (both current and future), (2) development of future habitat in large blocks (creating more interior habitat and thereby possibly decreasing avian predation), and (3) improvement of distribution of habitat, thereby improving distribution of marbled murrelet populations...The plan designed a network of Late-Successional Reserves, in part, around older forests containing suitable marbled murrelet nesting habitat and areas known to be currently occupied by marbled murrelets. Though much of the forest habitat contained within the Late-Successional Reserves is not currently suitable nesting habitat, it would be allowed to grow and develop characteristics that would make it suitable.”

Washington

- 1997 Washington State Forest Practices Rules developed to protect suitable habitat on state lands and private land ownerships over 500 acres.

⁴ For example, Raphael et al. 2002a.

- 1997 Washington Department of Natural Resources HCP covering 1.4 million acres are within the range of the murrelet.
- Simpson (2000), Plum Creek (1996), Port Blakely (1996) and Murray Pacific (1993) HCPs covering approximately 450,000 acres within the range of the murrelet.
- City of Seattle HCP (2000) covering 91,000 acres and city of Tacoma HCP (2001) covering 14,000 acres.
- Enlarged riparian protection buffers as part of state forest practices rules.
- Reduced use of gill-net fishery within coastal waters, though murrelet mortality still occurs.

Oregon

- State listed as threatened in 1992, but applies only to state-owned lands.
- No current HCPs for murrelets.
- No Forest Practices Rules requiring survey or protection of suitable habitat on private lands prior to harvest.
- Enlarged riparian buffers of fish-bearing streams (1997).

California

- State listed as endangered in April 1992. This listing applies to all lands.
- Enforces all federal ESA “take” prohibitions, including disturbance-induced harm and harass under section 9 of the ESA.
- 1999 Pacific Lumber Company HCP (19,000 acres)
- 1999 State Redwoods Park murrelet protection management plan.
- Gill-net fishing has been prohibited or has not occurred for many decades in northern California. In central California (Zone 6 and farther south), gill-net fishing increased in the late 1970s, decreased by the late 1980s, and was prohibited in 2002.

12. B. Is there relevant new information regarding the effectiveness of the conservation measures being implemented?

Yes. Conservation measures have been implemented since the 1992 listing, however, in most cases, we are not yet able to determine the effectiveness of these measures.

The annual rate of habitat loss, centrally due to the implementation of the Northwest Forest Plan on federal lands in 1994 (McShane et al. 2004) has been significantly reduced. Roughly 80 percent of the murrelet’s critical habitat (3,015,700 out of 3,887,800 acres) is in Late-Successional Reserves within the range of the Northwest Forest Plan (NWFP), and these acres are to be managed “to protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth related species” (USFS and BLM 1994:C 9). Further, preproject surveys for behavior

indicating murrelet occupancy are required across the range of the NWFP on land deemed potential habitat. If behavior indicating occupancy is found (e.g., discovery of a nest or chick, or murrelets flying below forest canopy within a stand of suitable habitat), “all contiguous existing and recruitment habitat for marbled murrelets (i.e., stand that are capable of becoming marbled murrelet habitat within 25 years) within a 0.5-mile radius will be protected” (USFS and BLM 1994:C 10). While the effect of the NWFP on the long-term survival of the murrelet is unknown, its effectiveness in reducing the rate of annual habitat loss seems clear.

Nine Habitat Conservation Plans (HCPs) (7 in Washington, 1 in Oregon, and 1 in California) have been implemented pertaining to the murrelet. At most, these HCPs set aside from development 16,000 acres that are not currently suitable murrelet habitat, so that at some point in the future they may become suitable. It is unclear when and how many of these acres will eventually become murrelet habitat.

The rate of murrelet mortality from gill-netting is assumed to be reduced given the new restrictions in Washington and California. It is difficult, however, to truly assess the effectiveness of these regulations in limiting murrelet mortality given the difficulty gathering corroborating empirical evidence.

13. New Information: Application of the DPS policy

13. A. Is there relevant new information with respect to the appropriate application of the DPS policy to the listed entity under review?

Yes, see Section 13.B.

13. B. Given the updated information, is the listed entity consistent with the DPS policy with regards to the Discreteness and Significance elements?

1) Is the currently listed murrelet population discrete according to the 1996 DPS Policy?

Yes. There are differences in conservation status between Canada and Washington, Oregon, and California. The U.S. has a smaller population of murrelets (approximately 24,000; Huff et al. 2003, Peery pers. comm. 2003), than in Canada (approximately 66,000; Burger 2002). Further, estimates of loss of old-growth forests in the U.S. Pacific Northwest since pre-industrial times (National Research Council 2000), as compared to the amount of forests within the range of the murrelet in British Columbia that have become unsuitable due to anthropogenic causes (e.g., industrial logging and urbanization) (Demarchi and Button 2001a,b as adapted by Burger 2002), show a higher percentage of murrelet habitat has been lost in Washington, Oregon, and California.

There is also a difference in management between the U.S. and Canada. This difference is clearly indicated by the central recovery goal in the 2003 Canadian Marbled Murrelet Assessment (Canadian Marbled Murrelet Recovery Team 2003)—“to down-list the species from Threatened to Special Concern, by creating conditions that will limit the decline of the BC population and its nesting habitat to less than 30% over three generations (30 years), during the period 2002 to 2032.” In effect, Canada is managing for a decline in habitat and number of murrelets because it acknowledges harvest of murrelet habitat will continue (Canadian Marbled Murrelet Recovery Team 2003). No similar acceptable loss of population numbers or habitat is planned for in the United States.

Finally, there are differences in regulatory mechanisms between the U.S. and Canada. Canada has no equivalent to the Northwest Forest Plan (1994) that protects over 90 percent of the murrelet’s suitable habitat in Washington, Oregon, and California. British Columbia is currently in the process of revising its Identified Wildlife Management Strategy (IWMS), under which the murrelet is a Red species, meaning it is either endangered or threatened (Guy pers. comm. 2004, BC Species and Ecosystems Explorer 2004). Under this revised strategy, it is proposed approximately half of the murrelet’s range will be under a strategic land use planning process that establishes wildlife habitat areas (WHAs) for the murrelet. As of this writing, the exact elements of this strategy are uncertain (Guy pers. comm. 2004).

Canada also recently enacted the Species at Risk Act (SARA) designating the murrelet as a threatened species⁵. SARA’s prohibitions against killing, harming, harassing, capturing, or taking a listed species, its protection of critical habitat, and its legal enforcement measures (e.g., inspections) will come into effect June 1, 2004⁶.

As of this writing, it is unclear how implementation of SARA, the Canadian murrelet recovery strategy, and British Columbia’s revised IWMS will interact and affect on-the-ground management of the murrelet and its habitat. Given that the new Canadian recovery strategy equates a 30 percent decline in murrelet habitat and population numbers over 30 years with the ability to uplist the murrelet to Special Concern, we assume there is and will continue to be a significant difference between Canada’s and the U.S.’s management of the murrelet.

2) *Is the currently listed murrelet population significant according to the 1996 DPS Policy?*

⁵ SARA defines a “threatened species” as, “a wildlife species that is likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction” (SARA 2(1)).

⁶ http://www.sararegistry.gc.ca/the_act/HTML/Guide_e.cfm, last checked April 23, 2004.

Yes. Loss of the DPS would result in a significant gap in the range. This gap is significant because the Washington, Oregon, and California area is a large fraction of the range, roughly 18% of the total coastal distribution, encompassing 17 degrees of latitude.

Loss of the Washington, Oregon, and California population would eliminate genetic structural components that are statistically significantly different than those found in British Columbia, the Alaska mainland, and the Aleutian Islands, see Section 10.B (Congdon et al. 2000, Friesen et al. 2003, Lank et al. 2003). This loss would be significant as it would reduce the evolutionary potential of the entire metapopulation (McShane et al. 2004). Theoretically, if populations differ genetically, loss of a population will reduce the species' genetic resources and therefore its potential to adapt and evolve. The amount of variation that is lost will depend on the extent of genetic divergence among populations, and to the extent that differences are adaptive, local adaptations will also be lost. Extensive evidence exists for the loss both of neutral variation (Daugherty et al. 1990) and of local adaptations (Greig 1979) following loss of a population in genetically structured species.

Estimates of F_{st} and its analogs for murrelets indicate that approximately 90% of their neutral genetic variation is contained within populations, and approximately 10% is distributed among populations in California, British Columbia/mainland Alaska, and the Aleutian Islands (McShane et al. 2004). Thus, loss of any of these populations will reduce the species' resources and compromise its long-term viability.

14. New Information: Other. Is there any additional, relevant, new information not addressed in questions 9.A. -13. A.?

No.

15. Using Recovery Criteria

15. A. Does the species have a recovery plan that was written in accordance with Recovery Planning Guidance and that has up-to-date recovery criteria (with downlisting and/or delisting criteria, and in some cases uplisting criteria) that address biological factors, conservation measures and the threats to the species?

Yes, the U.S. Marbled Murrelet Recovery Plan was published in 1997. It states,

“Specific delisting criteria can be developed when completion of some recovery tasks provides necessary information about murrelets and their biological requirements. Interim delisting criteria include:

- 1) Trends in estimated population size, densities and productivity have been stable or increasing in four of the six zones over a 10-year period, which should encompass at least one to two El Niño events.
- 2) Management commitments, including protection and monitoring in marine and terrestrial habitats, have been implemented to provide adequate protection of marbled murrelets in the six Marbled Murrelet Conservation Zones for at least the near future (50 years).”

15. B. Does the updated information on the species indicate that any or all of the recovery criteria for downlisting, delisting or uplisting have been met?

No, there is no compelling evidence from the updated information that the trends in estimated population size, densities and productivity have been stable or increasing in four of the six conservation zones over a 10-year period.

It is unclear whether the current management commitments are adequate to protect the murrelet in the six conservation zones for the next 50 years. Attainment of this goal cannot be assured prior to its completion.

16. Synthesis

16. A. **Biological Assessment:** Given the updated information, particularly information presented in question 10, summarize the biological status of the species.

The murrelet is a small, dove-sized seabird that inhabits the coastal forests and nearshore marine environment along the Pacific coast of North America from southern California to southern Alaska and the Aleutian Islands. Throughout most of its breeding range, the murrelet uses old-growth coniferous forest habitat for nesting and forages in the nearshore marine environments. In Washington to California, only tree-nesting is known.

Current estimates are that 2,223,048 acres of suitable murrelet nesting habitat exist (McShane et al. 2004), and some genetic structural differences have been found between murrelets in California, British Columbia and mainland Alaska, and the Aleutian Islands (McShane et al. 2004). There is insufficient information to determine a population trend in Washington, Oregon, and California (see Section 10.A). Current estimates (Huff et al. 2003, Peery pers. com. 2003) of the Washington, Oregon, and California murrelet population is 24,400 birds, with a 95% confidence interval of 14,817 to 35, 209 birds (see Section 10.A).

16. B. 1. **Threats Assessment (5-Factor Analysis):** Given the updated information, particularly information presented in question 11, provide an analysis of the threats to the species in the context of the 5 listing factors.

- a) the present or threatened destruction, modification, or curtailment of its habitat or range;

The original listing states, “The principal factor affecting the marbled murrelet in the three-state area, and the main cause of population decline has been the loss of older forests and associated nest sites.”⁷ This historic loss of habitat continues to pose a threat to the murrelet population in Washington, Oregon, and California.

New information supports the general association of murrelet nesting preferences and older forests (Lank et al. 2003), and the positive relationship between numbers of murrelets found at sea, and inland sites with larger patches of old-growth that have relatively low levels of fragmentation and isolation (Meyer and Miller 2002, Meyer et al. 2002, Miller et al. 2002, Raphael et al. 1995, Raphael et al. 2002b). This new information supports the conclusion that the past harvest of old-growth forests in the Washington, Oregon, and California range of the murrelet has significantly contributed to a commensurate decline in the number of murrelets. There is no compelling information indicating this situation has improved through the production of significant new suitable nesting habitat since listing (McShane et al. 2004).

The original listing also states, “Under current forest management practices, logging of the remaining older forests is likely to continue, except in areas with mandated protection.” The 1994 Northwest Forest Plan significantly reduced the rate of annual habitat loss on federal lands, yet some annual habitat loss or modification is estimated to be continuing, primarily on private or state lands (McShane et al. 2004). Using the recent past as a guide, it is estimated 0.5% to 1% of suitable habitat will be lost or modified each year for the near future (McShane et al. 2004). While it is expected the development of new habitat will, sometime in the future, surpass the annual loss or modification of habitat, there is insufficient information to determine precisely when this will occur or what the status of the murrelet will be when this happens.

- b) overutilization for commercial, recreational, scientific or educational purposes;

These elements were not identified as threats in the original listing and no new information to change this conclusion has surfaced.

- c) disease or predation;

Disease was not identified as a threat in the original listing and there is insufficient information to determine if disease is currently a threat to the murrelet.

⁷ 57 FR 45328.

The original listing states, “ Predation is an additional threat to the continued existence of the murrelet.” New information confirms the importance of predation in limiting murrelet nest success, with recent studies indicating nest failure rates due to predation of 68% to 100% (Hebert and Golightly 2003, Peery et al. in prep.) in real nests, and 81% to 86% in artificial nests (Luginbuhl et al. 2001, Marzluff and Restani 1999). The factors affecting rates of predation on murrelet nests (suspected to be the primary type of predation, though adult predation does occur) are not fully clear, yet key elements seem to be proximity to humans, abundance of avian predators, and proximity and type of forest edge to the nest (McShane et al. 2004).

d) the inadequacy of existing regulatory mechanisms; and

To determine whether inadequate regulatory mechanisms pose a threat to the murrelet, we analyzed the current regulatory situation, including the federal and state listings of the murrelet.

It is assumed the current threat posed by the inadequacy of existing regulatory mechanisms has been reduced since the listing, but not eliminated, due to the federal and subsequent state listings (i.e., as threatened in Washington and Oregon), the implementation of the Northwest Forest Plan in 1994, implementation of Habitat Conservation Plans on private lands, and gill-netting restrictions in Washington and California.

e) other natural or manmade factors affecting its continued existence.

We assessed the following factors: gill-netting, oil spills, forest fires, and murrelet population decline.

The threat posed by gill-netting mortality is assumed to be reduced given the new regulatory mechanisms in California and Washington. The reduction of this threat is difficult to confirm with empirical evidence given how difficult it is to collect such information.

There is insufficient information to determine whether the threat from oil spills or forest fires has changed since the listing. As there have been several oil spills and large catastrophic forest fires since 1992 with confirmed and estimated murrelet mortality or loss of suitable habitat (McShane et al. 2004), these threats are presumed to be unchanged since the listing.

Although the existing long-term population data for Washington, Oregon, and California can not be used to empirically identify a three-state trend, several leading murrelet experts believe the data suggest a decline across the southern range (Lank et al. 2003, McShane et al. 2004). For example, Lank et. al. (2003) state in their summary that, “Marine census data suggests all Marbled Murrelet

populations are declining in numbers.” Several other studies have found or estimated a decline in specific areas across Washington, Oregon, and California, Table 2 (Section 10.A). A declining population is a threat, as opposed to an outcome of other threats, when it contributes to a species’ endangerment.

Possibly exacerbating this potential decline are the estimated low fecundity levels across the same range. As determined through nest success values (i.e., the number of fledglings per breeding pair of murrelets per year), fecundity levels indicate a population that is not stable through reproduction (Beissinger 2003, Golightly et al. 2002).

16. B. 2. Describe any interactions, additive and/or synergistic effects of these threats.

The original listing described oil spill and gill-netting mortality as “additive” to the central threat of habitat loss and modification. This description continues to appear accurate, although the threat of gill-netting mortality is assumed to be reduced.

16. C. **Conservation Efforts:** Given the updated information, particularly information presented in question 12, summarize the conservation efforts.

There are new restrictions in Washington and California that are believed to have reduced murrelet gill-net mortality. Implementation of the Northwest Forest Plan in 1994 has decreased the loss or modification of murrelet habitat on federal lands. Nine Habitat Conservation Plans have been implemented across Washington, Oregon, and California, and the species has been listed as threatened by both the state of Washington and Oregon.

17. Result

17. A. Given your responses to questions 15 B., and/or 16.A.-16.C., does the 5-year review indicate that a change in classification is warranted?

No. The threat situation has not changed such that the murrelet DPS is no longer likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

17. B. Based on this review indicate the appropriate Recovery Priority Number for the species.

2

17. C. If applicable, indicate the Listing and Reclassification Priority Number.

Reclassification (Uplisting from Threatened to Endangered) Priority Number: _____

Reclassification (Downlisting from Endangered to Threatened) Priority Number: _____

Delisting (Removal from list regardless of current classification) Priority Number: _____

18. Future Actions

More information for the next review is needed concerning:

- Genetic differences across the range
- Regulatory effectiveness and conservation status of the murrelet in Canada
- Natal and adult movement and dispersal, affects on the rates of immigration/emigration
- Habitat quality, quantity and trends
- Further information on the effects of predation across the range
- Population trends
- Linking site specific information to landscape characteristics.

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U.S. FISH AND WILDLIFE SERVICE
SIGNATURE PAGE for 5-YEAR REVIEW

Marbled Murrelet/*Brachyramphus marmoratus*

CURRENT CLASSIFICATION Threatened

5-Year Review Result X No Change in Status
 Delist
 Endangered to Threatened
 Threatened to Endangered

APPROPRIATE LISTING/RECLASSIFICATION PRIORITY NUMBER N/A

REVIEW CONDUCTED BY Paul Phifer and Brian Cox

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date _____

Do not Approve _____ Date _____

Cooperating Field Supervisor, Fish and Wildlife Service

Concur _____ Date _____

Not concur _____ Date _____

Lead Regional Director, Fish and Wildlife Service

Concur _____ Date _____

Not concur _____ Date _____