

Marbled Murrelet 5-Year Review Process: Overview

August 31, 2004

Process for Conducting the Marbled Murrelet 5-Year Review

In response to a settlement agreement with the American Forest Resources Council et al., the U.S. Fish and Wildlife Service (Service) initiated a 5-year review of the marbled murrelet (*Brachyramphus marmoratus*) in January 2003. A 5-year review, as required for all listed species under the Endangered Species Act, is supposed to assess the best available information on how the listed species has fared since its original listing or previous review, and consider whether it is listed appropriately.

The Service, through Federal Register notices, twice solicited information (in April and July of 2003) from all interested sources to assist with this review. The Service also met directly with the relevant land management agencies and with the interested publics, i.e., the U.S. Forest Service, the Bureau of Land Management, and the National Park Service, to clarify the intent and information requirements of the 5-year review. Nearly 500 documents were received through these requests for information.

The Service assigned over a dozen biologists to conduct the 5-year review. These biologists were asked, among other things, to determine the current amount and distribution of available murrelet habitat, the adequacy of existing regulatory mechanisms for the murrelet since its listing, and the possible population trends of murrelet numbers in Washington, Oregon, and California.

In July of 2003, the Service decided to seek external assistance in the scientific review of the available information. A request for proposals was publicly posted, asking for a contractor to facilitate a panel of scientific experts who would evaluate, synthesize, and interpret the information pertaining to the relevant scientific issues. The threats (excluding the inadequacy of existing regulatory mechanisms) to murrelets and any changes since the 1992 listing were also evaluated. In September, 2003, EDAW, Inc. (an international environmental consulting company) was awarded the contract and established a team of scientists representing a range of disciplines and species knowledge.

EDAW, Inc. held a series of internal meetings and a public meeting to discuss their review process. EDAW's team reviewed each submitted document and prepared a draft report by March, 2004. EDAW's draft report was reviewed by several Service biologists, and particular sections of the report were sent for outside peer review by EDAW. EDAW revised their report based on the received comments and provided a final version in March, 2004. EDAW also completed an administrative record that contains a review of each of the 1,100 documents they had available to them, notes from each internal and external meeting, and copies of all documents they reviewed.

Following the completion of EDAW's evaluation report, the Service initiated steps to complete its regulatory requirements for a 5-yr review under the ESA. Throughout the 5-year review, the Service sought to answer three questions:

- 1) Does the currently listed distinct population segment meet the criteria established in the Service's 1996 Distinct Vertebrate Species Policy?
- 2) Is there new information about the threats or population status of the murrelet?
- 3) If so, does the new information suggest that a change in listing status is warranted?

To address these questions, a panel of Service managers met for a 1.5-day, facilitated session in late March 2004. These managers had access to a range of background materials which included the EDAW evaluation report, a report by Lank et al. (2003), and a series of comments, reports, and analyses submitted by stakeholders during the two Federal Register notices. In the meeting, the managers were guided through a series of decision exercises in which they were asked to clarify ambiguous terms, examine their assumptions, and clearly articulate the justification for their positions. The Service managers applied their expertise with Service policies and the Endangered Species Act to determine whether the current murrelet distinct population segment meets the criteria in the 1996 Distinct Vertebrate Species Policy, and whether new information suggests a change in listing status is warranted.

The attached Marbled Murrelet 5-Year Review summarizes the key information considered and the results of the Service's deliberative process.

Marbled Murrelet 5-Year Review Chronology

March 26, 2002	Suit filed by Western Council of Industrial Workers, American Forest Resource Council, Swanson Group, Inc., Rough & Ready Lumber Co. against the Department of the Interior
January 14, 2003	Settlement agreement signed by plaintiffs and defendant; approved by the Court
April 21, 2003	Service publishes FR notice initiating the status review and requesting information from the public
June 20, 2003	Settlement agreement amended extending 5-year review deadline until April 30 th , 2004; approved by the Court
July 9, 2003	Service publishes request for proposals (RFP) to assist with scientific evaluation of available information
July 25, 2003	Service publishes 2 nd FR notice extending the deadline for submittal of information
September 19, 2003	Service awards EDAW, Inc. the murrelet scientific review contract for \$348, 916
December 17, 2003	EDAW holds public meeting to present and discuss murrelet status information
January/February, 2004	EDAW submits draft chapters for review/comment by the Service; EDAW solicits peer reviews for major science issues
March 25, 2004	EDAW submits final status report w/ all attachments to the Service
March 29 & 30, 2004	Service Region 1 Managers' Decision Panel Meeting to address distinct population segment and 5-year review issues
April 1, 2004	EDAW provides completed administrative record to the Service
April 15, 2004	Service makes final payment to EDAW completing their contract
April 27, 2004	Service forwards its final draft 5-year review document to DC for review
April 30, 2004	Settlement agreement deadline for completion of 5-year review. Service asked to delay finalizing 5-year review document as Department of Interior requests a 120-day settlement agreement extension in order to "review the information currently before the Service for consistency with all applicable statutes, regulations, and Fish and Wildlife Service policies, including those for peer review."

5-YEAR REVIEW

August 31, 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

Marbled Murrelet 5-Year Review

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?

No, 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

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

differing methodologies, have reported either no evidence of change in 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 F_{st} increasing with geographic distance between population pairs (Mantel's tests, $P < 0.05$) (Congdon et al. 2000).

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.

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.
- 1997 Washington Department of Natural Resources HCP covering 1.4 million acres are within the range of the murrelet.

⁴ For example, Raphael et al. 2002a.

- 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. Of particular importance is the recent entry into force of Canada’s Species At Risk Act.

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?

Discreteness: A population segment of a vertebrate species may be considered discrete if it satisfies either one of the following conditions:

1. It is markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, or behavioral factors. Quantitative measures of genetic or morphological discontinuity may provide evidence of this separation.

2. It is delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4(a)(1)(D) of the Act.

The currently listed murrelet population is not discrete according to the 1996 DPS Policy.

(a) **Biological Issues:** There is no marked separation of physical, physiological, ecological or behavioral differences at the border (Note: This is a wide ranging species and there are some north to south physical and ecological differences across its range. For example, there are some north to south differences in topography, terrestrial forest habitat, and marine conditions. There is no significant evidence of genetic or morphological discontinuity between populations at the U.S.-Canadian border.)

(b) **International Border Issues:** There are no differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms across the international border that are significant in light of section 4(a)(1)(D) of the Act.

(b)(1) *Control of exploitation.* There is no difference across the international border in control of exploitation that is significant in light of section 4(a) (1) (D) of the Act. That is to say that if there exist any differences in control of exploitation, those differences are not the result of inadequate existing regulatory mechanisms so as to place the species at risk of being listed as threatened or endangered. In fact, there are virtually no differences in control of exploitation. On both sides of the international border, the murrelet is protected against illegal exploitation. Under the ESA, prohibitions are enforced against illegal take, harassment, hunting, and commercial trafficking. Penalties include fines of up to \$50,000 and one year in prison. Canada's Species At Risk Act (SARA) recently entered into force. Under this statute, the marbled murrelet is classified as a "threatened" species. 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." It is illegal to kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species, or to possess, collect, buy, sell or trade an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species, or any part or derivative of such an individual. Violations are punishable by fine of not more than \$250,000 or to imprisonment for a term of not more than five years, or both. In both the U.S. and Canada, exploitation is controlled under statutes implementing migratory bird treaties.

(b)(2) *Management of Habitat.* There is a difference in management of habitat for the marbled murrelet between the U.S. and Canada. In the U.S. Northwest, habitat is managed under the Northwest Forest Plan, habitat conservation plans, and state endangered species acts, forest practice rules and timber harvest plans. In Canada, murrelet habitat appears to be managed in accordance with the goals

of the 2003 Canadian Marbled Murrelet Assessment (Canadian Marbled Murrelet Recovery Team 2003). British Columbia is currently in the process of revising its Identified Wildlife Management Strategy (IWMS), under which it is proposed approximately half of the murrelet range will be under a strategic land use planning process that establishes wildlife habitat areas (WHAs) for the murrelet. The differences in management of habitat are not significant in light of section 4(a) (1) (D) of the Act. That is to say that those differences do not reflect the inadequacy existing regulatory mechanisms so as to place the species at risk of being listed as threatened or endangered. For example, the scheme of habitat management on the U.S. side is quite sophisticated. The adoption of the Northwest Forest Plan has greatly reduced the annual rate of habitat loss since 1994. Nonetheless, estimated potential total loss of suitable murrelet habitat since listing of the species is about 10% of the current estimate of suitable habitat. The Canadian recovery plan, by comparison, states as a central recovery goal 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), roughly the same habitat loss in arithmetical terms as that experienced during the period 1992 to 2003 in the U.S. In any event, both the U.S. and Canadian schemes acknowledge and allow continued harvest of murrelet habitat.

(b)(3) *Conservation Status.* In the U.S., the marbled murrelet is classified as “threatened;” that is, a “species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.” In Canada, under SARA, the species is classified as “threatened;” that is, “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.” These are roughly equivalent definitions.

There are differences in population numbers between Canada and Washington, Oregon, and California. The continental U.S. has a smaller population of murrelet (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. However, there is no accepted protocol by which these statistics yield a meaningful comparison of conservation status across the border for purposes of the DPS policy.

(b)(4) *Regulatory Mechanisms.* The regulatory mechanisms existing on each side of the border have been described above. The differences in these mechanisms are hardly significant in the abstract. They are not significant at all in light of

section 4(a) (1) (D) of the Act. That is, those differences do not reflect the inadequacy of any existing regulatory mechanisms so as to place the species at risk of being listed as threatened or endangered.

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

Not Applicable. If the population is not discrete, then the question of significance is never reached as both discreteness and significance must be met.

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.”⁵ 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

⁵ 57 FR 45328.

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.

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.

REFERENCES

19. List all information and data sources used in this review, and provide file locations if these sources will not be filed with the review. Include on this list any experts used and their affiliations and note whether they provided information or if they acted as peer-reviewers, or both.

- 1) Beissinger, S.R., and M.Z. Peery. 2003. Range-wide analysis of juvenile ratios from marbled murrelet monitoring programs: implications for demographic analyses. Unpublished report, University of California, Dept. of Environmental Science, Policy, and Management, Berkeley, California.
- 2) Bradley, R.W. 2002. Breeding ecology of radio-marked marbled murrelets (*Brachyramphus marmoratus*) in Desolation Sound, British Columbia. Department of Biological Sciences. Burnaby, BC, Simon Fraser University, 86 pp.
- 3) Burger, A.E. 2002. Conservation assessment of marbled murrelets in British Columbia, a review of biology, populations, habitat associations and conservation. Pacific and Yukon Region, Canadian Wildlife Service, 168 pp.
- 4) Burkett, Esther, Biologist, CDFG, Sacramento, CA; phone conversations and meetings with Harry Carter, Biologist, HSU, Davis, CA; March-May 2003, 16 March 2004.
- 5) Canadian Marbled Murrelet Recovery Team. 2003. Marbled Murrelet Conservation Assessment 2003, Part B: Marbled Murrelet Recovery Team Advisory Document on Conservation and Management. Canadian Marbled Murrelet Recovery Team Working Document NO. 1.
- 6) Congdon, B.C., J.F. Piatt, K. Martin, and V.L. Friesen. 2000. Mechanisms of population differentiation in marbled murrelets: historical versus contemporary processes. *Evolution* 54(3): 974-986.
- 7) Daugherty, C.H., A. Cree, J.M. Hay, and M.B. Thompson. 1990. Neglected taxonomy and continuing extinctions of tuatara (*Sphenodon*). *Nature* 347:177-179.
- 8) Demarchi, D.A., and A.A. Button. 2001a. Marbled Murrelet nesting habitat capability in British Columbia: Map 2 – weighted average capability. Map @ 1:300,000. Resources Inventory Branch, Ministry of Environment, Lands, and Parks, Victoria, BC.

- 9) Demarchi, D.A., and A.A. Button. 2001b. Marbled Murrelet nesting habitat capability in British Columbia: Map 2 – weighted average suitability. Map @ 1:300,000. Resources Inventory Branch, Ministry of Environment, Lands, and Parks, Victoria, BC.
- 10) Friesen, V.L., T.P. Birt, Z. Peery, and S. Beissinger. 2003. Conservation genetics of marbled murrelets in northern California. Kingston, Ontario, Queen's University, 37 pp.
- 11) Friesen, V.L., and J.F. Piatt. 2003. A genetic study to aid in the restoration of murrelets, guillemots and murrelets to the Gulf of Alaska. Restoration project 00169 final report. Exxon Valdez Trustee Council, Anchorage, AK.
- 12) Friesen, V.L., A.J. Baker, and J.F. Piatt. 1996a. Phylogenetic relationships within the Alcidae (Charadriiformes: Aves) inferred from total molecular evidence. *Molecular Biology and Evolution* 13(2): 359-367.
- 13) Friesen, V.L., J.F. Piatt, and A.J. Baker. 1996b. Evidence from cytochrome B sequences and allozymes for a 'new' species of alcid: the long-billed murrelet. *The Condor* 98:681-690.
- 14) Golightly, R.T., P.N. Hebert, and D.L. Orthmeyer. 2002. Evaluation of human-caused disturbance on the breeding success of marbled murrelets (*Brachyramphus marmoratus*) in Redwood National and State Parks, California. Arcata, CA, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, U.S. Geological Survey, California Department of Fish and Game, and California Department of Parks and Recreation, 61 pp.
- 15) Greig, J.C. 1979. Principles of genetic conservation in relation to wildlife management in Southern Africa. *Sout African Journal of Wildlife Research* 9:57-78.
- 16) Guy, Stewart. Chief, Biodiversity Branch, Ministry of Water, Land and Air Protection, British Columbia. Personal Communication. March 16, 2004.
- 17) Hamer, T.E. 1995. Inland habitat associations of marbled murrelets in western Washington. Pp. 163-175 In: *Ecology and conservation of the marbled murrelet* (C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, eds.). U.S. Forest Service, Gen. Tech. Rep. PSW-GTR-152, Pacific Southwest Research Station, Albany, California.
- 18) Hamer, T.E., and D. J. Meekins. 1999. Marbled murrelet nest site selection in relation to habitat characteristics in western Washington, 1998 Report. Mount Vernon, WA, Hamer Environmental, 26 pp.

- 19) Hamer, T.E., and S.K. Nelson. 1995. Characteristics of marbled murrelet nest trees and nesting stands. In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, eds.). U.S. Forest Service, Gen. Tech. Rep. PSW-GTR-152, Pacific Southwest Research Station, Albany, California.
- 20) Hebert, P.N., and R.T. Golightly. 2003. Breeding biology, and human-caused disturbance to nesting of marbled murrelets (*Brachyramphus marmoratus*) in Northern California: progress report 2002. Unpublished draft report, Humboldt State University, Dept. of Wildlife, Arcata, California.
- 21) Huff, M., P. Jodice, J. Baldwin, S. Miller, R. Young, K. Ostrom, C.J. Ralph, M. Raphael, C. Strong, and C. Thompson. 2003. Draft Marbled murrelet effectiveness monitoring northwest forest plan 2002 annual summary report. 29pp.
- 22) 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.
- 23) Luginbuhl, J.M., John M. Marzluff, Jeffrey E. Bradley, Martin G. Raphael, and Daniel E. Varland. 2001. Corvid survey techniques and the relationship between corvid relative abundance and nest predation. *Journal of Field Ornithology* 72(4): 556-572.
- 24) Manley, I.A., and S.K. Nelson. 1999. Habitat characteristics associated with nest success and predation at marbled murrelet tree nests (Abstract). *Pacific Seabirds* 26:40.
- 25) Marzluff, J.M., and M. Restani. 1999. The effects of forest fragmentation on rates of avian nest predation and parasitism. College of Forest Resources, Univ. of Washington, Seattle. Unpublished report.
- 26) Marzluff, J.M., J.M. Luginbuhl, J.E. Bradley, E. Neatherlin, M.G. Raphael, D.M. Evans, D.E. Varland, L.S. Young, S.P. Horton, and S.P. Courtney. 1999. The influence of stand structure, proximity to human activity, and forest fragmentation on the risk of predation to nests of marbled murrelets on the Olympic Peninsula. Unpublished report. Sustainable Ecosystems Institute and University of Washington College of Forest Resources, Seattle, WA.
- 27) 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.
- 28) Meyer, C.B., and S.L. Miller. 2002. Use of fragmented landscapes by marbled murrelets for nesting in southern Oregon. *Conservation Biology* 16(3), 755-766.
- 29) Meyer, C.B., S.L. Miller, and C.J. Ralph. 2002. Multi-scale landscape and seascape patterns associated with marbled murrelet nesting areas on the U.S. west coast. *Landscape Ecology* 17: 95-115.
- 30) Miller, S.L., and C.J. Ralph. 1995. Relationship of marbled murrelets with habitat characteristics at inland sites in California. Pp. 205-218 In: *Ecology and conservation of the marbled murrelet* (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.). Gen. Tech. Rep. PSW-GTR-152. Albany, CA. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. 420 pp.
- 31) National Research Council, Committee on Environmental Issues in Pacific Northwest Forest Management. 2000. *Environmental Issues in Pacific Northwest Forest Management*. National Academy Press, Washington, DC, 259 pp.
- 32) Nelson, S.K. 2004. Research Associate, Oregon State University. Personal communication. April 26, 2004.
- 33) Nelson, S.K. 1997. Marbled Murrelet (*Brachyramphus marmoratus*). In: *Birds of North America*, No. 276 (A. Poole and G. Gill, eds.). Academy of Natural Sciences, Philadelphia, and American Ornithologists' Union, Washington, DC.
- 34) Nelson, S.K., and T.E. Hamer. 1995. Nest success and the effects of predation on marbled murrelets. Pp. 89-97. In: *Ecology and conservation of the marbled murrelet* (C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, eds.). U.S. Forest Service, Ge. Tech. Rep. PSW-GTR-152, Albany, California.
- 35) Nelson, S.K., and A.K. Wilson. 2002. Marbled murrelet habitat characteristics on state lands in western Oregon. Corvallis, OR, Oregon Cooperative Fish and Wildlife Research Unit, Oregon State University, Department of Fisheries and Wildlife, 151 pp.
- 36) Peery, M.Z., S.R. Beissinger, S.H. Newman, E.B. Burkett, and T.D. Williams. In preparation. Applying the declining population paradigm: diagnosing causes of poor reproduction in the marbled murrelet. Completed manuscript, 2003. Submitted to *Conservation Biology*, 31 pp.
- 37) Peery, M.Z., S.R. Beissinger, B.H. Becker, and S.H. Newman. 2002. Marbled murrelet (*Brachyramphus marmoratus*) demography in Central California: 2001

Progress Report. Prepared for the California Department of Fish and Game, US Fish and Wildlife Service, California State Parks.

- 38) Peery, Zach, Graduate Student, UC, Berkeley, CA; phone conversation with Harry Carter, Biologist, Richmond, BC; 25 November 2003.
- 39) Perry, D.A. 1995. Status of forest habitat of the marbled murrelet. In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.). Gen. Tech. Rept. PSW-GTR-152. Albany, California. Pacific Southwest Experiment Station, Forest Service, U.S. Dept. Agric. 420 pp.
- 40) Raphael, M.G., J. A. Young, and B.M. Galleher. 1995. A landscape-level analysis of marbled murrelet habitat in western Washington. Pp. 177-190 In: Ecology and conservation of the marbled Murrelet (C.J. Ralph, J.G.L. Hunt, M.G. Raphael, and J.F. Piatt, eds.). Pacific Southwest research Station, Forest Service, U.S. Department of Agriculture, Albany, CA.
- 41) Raphael, M.G., D. Evans Mack, J.M. Marzluff, and J. Luginbuhl. 2002a. Effects of forest fragmentation on populations of the marbled murrelet. *Studies in Avian Biology* 25: 221-235.
- 42) Raphael, M.G., D. Evans Mack, and Brian A. Cooper. 2002b. Landscape-scale relationships between abundance of marbled murrelets and distribution of nesting habitat. *Condor* 104(2), 331-342.
- 43) Singer, S.W., E.E. Burkett, and J.B. Bulger. 1997. Marbled murrelet nest-finding efforts - effectiveness of various techniques and the discovery of a new type of nest. Pacific Seabird Group Annual Meeting, Portland, OR.
- 44) Singer, S.W., D.L. Suddjian, and S.A. Singer. 1995. Fledging behavior, flight patterns, and forest characteristics at marbled murrelet tree nests in California. *Northwestern Naturalist* 76: 54-62.
- 45) Speich, S.M., and T.R. Wahl. 1995. Marbled murrelet populations of Washington – marine habitat preferences and variability of occurrence, Pp. 313-326 In: Ecology and conservation of the marbled murrelet (C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt, eds.). General Technical Report PSW-GTR-152. Forest Service, Albany CA.
- 46) Strong, C.S. 2003a. Decline of the marbled murrelet population on the central Oregon coast during the 1990's. *Northwestern Naturalist* 84: 31-37.
- 47) Strong, C.S. 2003b. Marbled murrelet abundance and reproductive indices in Oregon during 2002. Unpublished report. Portland, OR, Oregon Department of Fish and Wildlife, and U.S. Fish and Wildlife Service, 14 pp.

- 48) Suddjian, D.B. 2003. Ten years of monitoring marbled murrelets at the south fork of Butano Creek, San Mateo County, California, 1992-2001. Davenport, CA, Big Creek Lumber Company, 125 pp.
- 49) Thompson, C.W. 1997. Distribution and abundance of marbled murrelets and Common Murres on the outer coast of Washington. 1997 report to the Tenyo Maru Trustee Council. WA Dept. of Fish & Wildlife. 91 pp.
- 50) U.S. Fish and Wildlife Service. 1997. Recovery Plan for the marbled murrelet (*Brachyramphus marmoratus*) in Washington, Oregon, and California. USFWS Region 1, Portland, OR. 261 pp.
- 51) U.S. Fish and Wildlife Service. 1996. Formal consultation on 1996-1998 treaty commercial salmon net fisheries in Areas 4, 4A in coastal waters and areas 4B, 5, 6C and 6D in the Strait of Juan de Fuca (Biological opinion). Unpublished report, U.S. Fish and Wildlife Service, Olympia, Washington.
- 52) USFS and BLM (U.S. Bureau of Land Management). 1994. Final supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl (Northwest Forest Plan). Portland, Oregon. 2 vol.
- 53) USFS and BLM. 2004. Final supplemental environmental impact statement to remove or modify the survey and manage mitigation measure standards and guidelines: Forest Service National Forests in Regions 5 and 6 and Bureau of Land Management Districts in Washington, Oregon, and California within the Range of the Northern Spotted Owl. January 2004. Forest Service - U.S. Department of Agriculture Bureau of Land Management - U.S. Department of Interior.

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

Regional Director, Fish and Wildlife Service

Concur *D. B. Allen* Date *1/1/04*

Not concur _____ Date _____

* The Washington, Oregon, and California population does not satisfy the criteria for designation as a Distinct Population Segment (DPS) under the Service's 1996 DPS Policy. There will be no change in the species status pending the completion of a range-wide status review.