WASHINGTON STATE DEPARTMENT OF Natural Resources

U.S. FISH & WILDLIFE SERVICE

Occupied Sites

Focus Paper #4

The purpose of this focus paper is to describe the scientific methods used to identify sites occupied by marbled murrelets (occupied sites) for purposes of protecting these sites under the long-term conservation strategy.

What are occupied sites?

Occupied sites represent the best information we have about where murrelets might be nesting. They are forested areas where evidence of either murrelet nests, eggs, or chicks have been found or where murrelet nesting behaviors have been observed.

Murrelet nests are difficult to find. A set of criteria is used in the field to determine if a forest stand is likely to be used by murrelets for nesting (see box). Certain behaviors, which have been documented at active nest sites, are used during audio-visual survey as indicators of occupancy.[1] These behaviors also have been associated with purposes other than attending an active nest, suggesting that the stand has some importance for breeding.

Because of the difficulty in finding the specific tree within a forest stand that a marbled murrelet might be using as a nest tree, most occupied sites are determined through observation of marbled murrelets flying below, through or into or out of the forest canopy, and/or marbled murrelets circling above a forest stand within one tree height of the top of the canopy. This type of observation is documented as an "occupied

Occupied sites are contiguous areas of habitat where at least one of the following occurs:

1. **A murrelet nest is located**
2. **Downy murrelet chicks or eggs or egg shell fragments are found**
3. **Marbled murrelets are detected flying below, through into or out of the forest canopy**
4. **Marbled murrelets are heard calling from a stationary location within habitat**
5. **Marbled murrelets are seen circling above a stand within one tree height of the top of the canopy.**

[1] Only trained, certified murrelet surveyors are qualified to identify murrelet nesting evidence and behaviors.

detection." A majority of the occupied sites mapped on DNR lands were identified through occupied detections.[2] Few occupied sites have been documented by finding the actual nest, murrelet chicks or egg shell fragments, or by calling from a stationary location. Nest sites are confirmed only when an actual nest is identified in a tree platform. Out of the 5,202 occupied detections in Washington State, only 51 are associated with confirmed nests; of those, 13 are on DNR-managed lands.

How are occupied sites delineated for purposes of conservation planning?

At the signing of DNR's Habitat Conservation Plan (HCP) in 1997, few occupied sites had been identified and little was known about murrelet nesting habitat in Washington State, including on DNR-managed lands. In granting DNR an Incidental Take Permit for marbled murrelets, the U.S. Fish and Wildlife Service (USFWS) agreed to an interim marbled murrelet conservation strategy to gather knowledge about marbled murrelet habitat needs before developing a long-term habitat conservation strategy. Part of this interim strategy included a habitat relationship study and an intensive survey program of potential nesting habitat (HCP 1997). DNR's survey program had begun in 1994, anticipating the need for information about marbled murrelet occupancy for the development of an HCP. As a result of the HCP survey effort, 401occupied sites, totaling 44,723 acres, were identified on DNR-managed lands. These occupied sites range in size from under 5 acres to 3,100 acres, and are between 0 and 53 miles from marine waters.

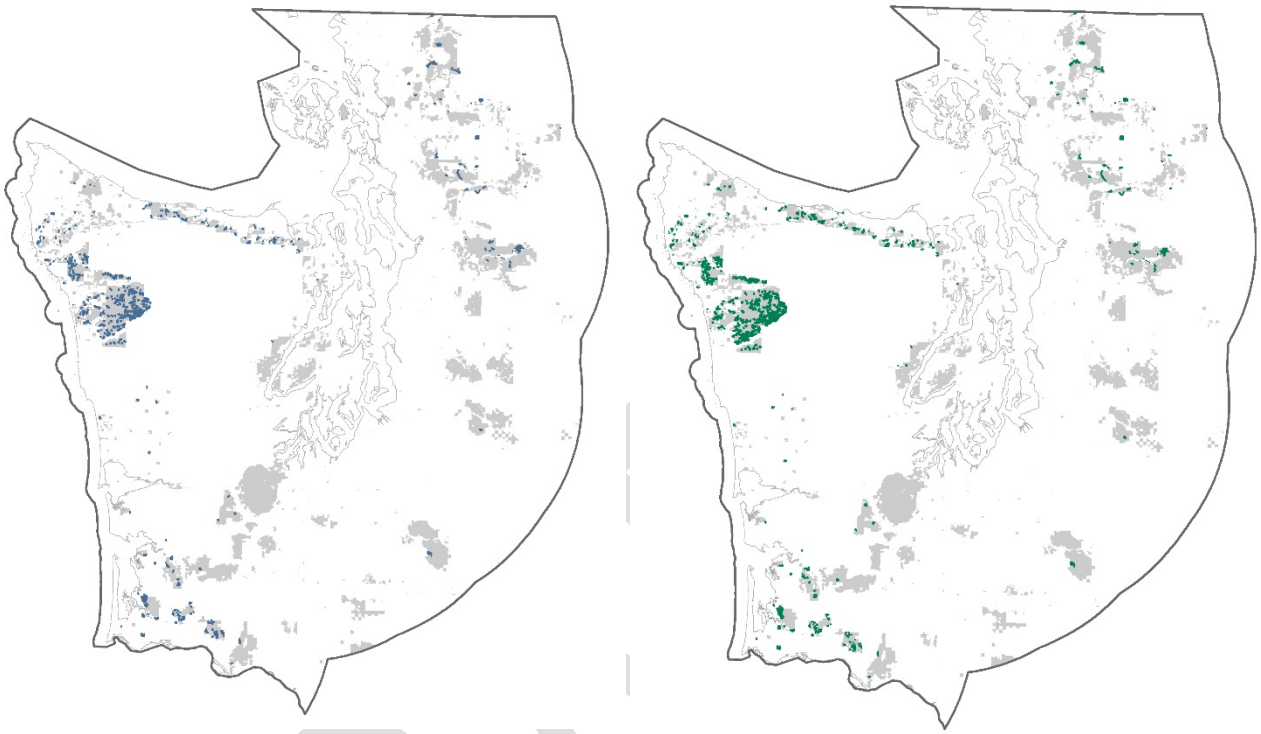
Occupied sites identified within the Straits, Olympic Experimental State Forest (OESF), South Coast and Columbia HCP planning units were reviewed and adjusted by a "Science Team" put together in 2004 by DNR to develop recommendations for marbled murrelet conservation (Raphael and others 2008). The Science Team recommended increasing the total occupied site acres on DNR managed lands to approximately 60,000 acres; this was an increase of approximately 16,000 acres over what was delineated as occupied under the HCP, based on the initial survey effort. Occupied sites in the North and South Puget HCP planning units were delineated by DNR staff in the field based on platform-bearing trees or through the inspection of color orthophotos.

For purposes of conservation planning, there are therefore two "sets" of occupied sites to consider. The initial set of occupied sites (44,723 acres) are those delineated under the HCP survey effort. The second iteration of occupied sites (60,918 acres) incorporates the work of the Science Team.

[2] The Washington Department of Fish and Wildlife maintains a database of occupied detections.

Figure 1. Mapped Occupied Sites on DNR-Managed Lands:

a) HCP survey sites **b) Science Team delineated sites**



How did DNR select habitat to survey?

The interim habitat conservation strategy focused the department's survey efforts on marbled murrelet habitat known as "reclassified habitat;" see Attachment 1 for a stepwise explanation of how this habitat was defined.

"Reclassified habitat" is a term to describe high quality marbled murrelet habitat identified by predictive models. This habitat was expected to contain 95% of the occupied sites found in surveys.

Briefly, reclassified habitat was identified through the use of a habitat relationship study predictive model (Prenzlow Escene 1999). Two classes of habitat were identified based on this model:

1. **Marginal habitat**: defined as those lands expected to contain a maximum of five percent of the occupied sites on DNR-managed lands within each planning unit. These areas were made available for harvest. All known occupied sites were deferred from harvest and were not included in this habitat designation. Harvest of marginal habitat is permitted under the interim strategy incidental take permit.

2. **Higher-quality habitat:** defined as those lands expected to contain at least 95 percent of the occupied sites on DNR-managed lands within each planning unit. This habitat is frequently referred to as "reclassified habitat."

The interim strategy directed DNR to survey all reclassified habitat acres using survey protocols developed by the Pacific Seabird Group. Based on the observations made at each survey site, each location within reclassified habitat would be determined to be "occupied" or "surveyed, unoccupied." Survey results were then submitted to Washington State Department of Fish and Wildlife (WDFW), which is charged with stewardship of all marbled murrelet survey data.[3]

How did DNR conduct surveys?

Marbled murrelet surveys to identify occupied sites were conducted in each HCP planning unit between 1994 and 2009. Surveys were conducted according to inland survey protocols developed and updated by the Pacific Seabird Group (PSG), Marbled Murrelet Technical Committee, or other methods approved by USFWS.[4] These protocols were updated over time, with DNR using the most current protocol. Most surveys were conducted for two years (usually 5 visits per year) or until murrelets were observed flying within the forest canopy (i.e., occupied behavior), whichever was sooner. The layout of survey sites and stations was planned by DNR staff using aerial photography and GIS mapping techniques. Field-location of survey stations, and the actual murrelet surveys were conducted by several private consulting firms (Resources Northwest, Inc.; Hamer Environmental; and Turnstone Environmental Consultants, Inc.) with substantial review by the contractor and DNR staff.

Survey results are summarized in Table 1, with explanations for each planning unit provided below.

Results

DNR completed marbled murrelet surveys for the South Coast and Columbia planning units in 2002 and for the Straits planning unit in 2003. The OESF inventory surveys were almost (80 percent) complete in 2002 and were discontinued because DNR requested to USFWS that it was reasonable to enter into the long-term planning process with the understanding that a multi-agency science team could adequately develop a conservation strategy without completing the surveys (DNR –USFWS 2003). The 2008 Science Team Report considered unsurveyed acres in the broader context of its landscape scale recommendations. The surveys were targeted to reclassified habitat identified through the habitat relationship studies for these planning units. Habitat was identified through an alternative process in North and South Puget Planning units (see below) beginning in 2007. Results are summarized in Table 1.

[3] Authority is granted to WDFW under WAC 222-16-010 *General definitions. "In determining the existence, location and status of occupied marbled murrelet sites, the department shall consult with the department of fish and wildlife and use only those sites documented in substantial compliance with guidelines or protocols and quality control methods established by and available from the department of fish and wildlife."

[4] Pacific Seabird Group survey protocols from Ralph and others (1994, 1995b, 1996, 1997, 1998) and Evans Mack et al., (2000, 2003). Sampling design approved by DNR and USFWS was used for habitat in the Natural Resource Conservation Areas and Natural Area Preserves.

Table 1. Survey Results Summary by Planning Unit

Planning Unit	Results			
	Approximate Acres of Habitat Identified[a]	Approximate Surveyed Acres	Occupied Sites (in Acres)	Unsurveyed Acres
OESF	54,500	39,500	21,583[b]	15,000
Straits	15,600	15,600	3,384	0
South Coast and Columbia (Southwest WA)	27,000	27,000	5,406	0
North Puget	30,000 *Note: "Suitable and potential habitat"*	17,500	5,600	[c]
South Puget[d]	674 *Note: "Suitable habitat"*	579	579	[e]

[a] See footnote #8, explaining how acres of identified habitat were adjusted by the Science Team based on a review of the survey results and habitat relationship studies.
[b] Total occupied sites include those sites also identified by surveys conducted by the Washington Department of Fish and Wildlife in 2001-2002 in response to the Tenyo Maru oil spill disaster. Protocols for the surveys conducted by WDFW are described in http://www.darrp.noaa.gov/northwest/tenyo/pdf/ten-mmfnl0203.pdf.
[c] As of February 2014, in the North Puget Planning Unit, 4,300 acres of identified "suitable habitat" remained unsurveyed. Also, there remained 17,300 acres of "potential habitat" that needed to be field verified and classified as suitable habitat or unsuitable habitat. Based on previous field inspections of potential habitat, it is estimated that 30% to 50% of potential habitat in NPPU could be identified as suitable habitat.
[d] All surveys in the South Puget planning unit were conducted with radar.
[e] There are 2,131 "potential habitat" acres identified through a methodology agreed to by USFWS and DNR (see below). Only a portion has been surveyed.

North Puget HCP Planning Unit

In the case of the North Puget planning unit (NPPU), the reclassified habitat model did not perform well due to the low number of occupied sites found in the habitat relationship study. Higher quality marbled murrelet habitat was discovered scattered throughout areas in the planning unit. These pockets of higher quality habitat were not identified by the reclassified habitat model, and thus were not scheduled to be surveyed. USFWS and DNR agreed to a different approach to identifying habitat for the surveys (known

as "reclassified plus"). A detailed reporting of this habitat selection for survey can be found in the "Final NPPU Marbled Murrelet Concurrence Letter," dated February 23, 2007.

Briefly, all areas identified by various data sources (reclassified modeling efforts, local knowledge, and professional judgment) were mapped as "potential habitat." These potential habitat areas were field checked to meet the HCP definition of suitable habitat (stands containing on average at least of two, 7-inch platforms per acre, greater or equal to five-acre patches, within 50 miles of marine water).[5] If these criteria were found on site, then the stand was scheduled for survey. Additionally, any new areas found to meet the suitable habitat definition outside mapped potential habitat were not scheduled for survey, but were deferred for consideration under the long-term conservation planning process. A total of 71 occupied sites[6]were delineated through these survey efforts (see Table 1).[7]

South Puget HCP Planning Unit

The South Puget HCP planning unit (SPPU) is unique within the DNR's HCP planning units. Although it is within the breeding range of the marbled murrelet, the adjacent offshore population of murrelets is extremely low. Low population numbers and limited suitable habitat within the planning unit indicate that the probability of inland detections of murrelets is very low. This suspicion is corroborated by the fact that murrelet detections on non-DNR lands adjacent to the SPPU have been low. Without an adequate number of inland detections, the habitat relationship study outlined in the HCP is not appropriate. In lieu of the habitat relationship study, the DNR and USFWS developed an alternate methodology to identify potential murrelet habitat in the SPPU. This alternate methodology applies known features of murrelet habitat to existing forest inventory data to develop models and screening tools that identify areas of potential murrelet habitat. This alternate methodology also incorporates local and historical knowledge of known habitat areas. A detailed reporting of this habitat selection for survey can be found in the "Final SPPU Murrelet Habitat Identification Concurrence Letter," dated July 16, 2009. Potential habitat was selected from the following sources:

- DNR's Weighted Old Growth Habitat Index,
- DNR's Forest Resources Inventory System (FRIS) Age Data,
- Low-level aerial surveys (Burger 2004),
- Forest Practices Board Manual Inventory Model Method for identifying marbled murrelet habitat,
- Local knowledge and professional judgment.

As in the NPPU, these potential habitat areas were to be field checked to meet the HCP definition of suitable habitat under the interim strategy (see above and Attachment). Surveys of suitable habitat have not been conducted in the SPPU due to difficulty identifying habitat. However, a one-time pilot project using radar surveys was initiated in 2007 with the attempt to document murrelet presence within the planning unit. This project and subsequent suitable habitat mapping identify five individual sites in South Puget, totaling approximately 580 acres (see footnote #6).

[5] HCP Chapter IV, pages 40-42.
[6] The number of occupied sites is based on how they are delineated in DNR's GIS as of the date of this paper.
[7] "Suitable habitat acres" is subject to change due to ongoing field work related to timber sales.

Does DNR still survey?

DNR is not currently conducting analysis area-wide surveys. In the North Puget planning unit, DNR continues to conduct some site-specific surveys related to timber sales. New occupied site boundaries are determined by DNR and USFWS on a case-by-case basis, in consultation with the Washington Department of Fish and Wildlife.

How accurate are occupied site delineations?

There are two primary areas of uncertainty related to accurately identifying occupied sites. First, there is uncertainty with the accuracy of modeling high quality (reclassified) habitat, where inventory surveys were targeted. The Science Team addressed this by comparing color orthophotos and using limited field verification, resulting in redelineation of habitat as necessary (adding approximately 16,000 acres).[8] As described above, uncertainties with the modeling efforts in North Puget resulted in occupied sites being field-delineated in that planning unit.

Second, there is some uncertainty built into the application of survey protocols. The protocols were revised annually by Pacific Seabird Group throughout and after the DNR surveys were conducted; earlier surveys were not necessarily consistent with the most current protocols. Because murrelets may occupy a site one year and not the next, the 2003 Pacific Seabird Group survey protocols, which came out after DNR surveys under the interim strategy were concluded, recommended that surveys take place over two consecutive years.. The revised protocol recommended a change from a minimum of four site visits to five visits per year. Based on the 2003 protocol, the Science Team evaluated the older DNR surveys and estimated potential error rates, making adjustments to recommended habitat conservation as necessary (see Appendix F of Raphael and others 2008 for detailed description).

How does the long-term conservation strategy address occupied sites?

Occupied site data are a key component of the habitat classification model being used under the analytical framework for the long-term marbled murrelet long-term conservation strategy (see Focus Paper #3, “Estimating the Location and Quality of Stands of Marbled Murrelet Habitat”). For purposes of the long-term conservation strategy, all survey-verified occupied sites are valued as high quality habitat.

Occupied sites are variable; the structure, availability, and complexity of habitat varies across DNR-managed lands within the range of the marbled murrelet, and the birds appear to use a range of habitat quality. For example, although the occupied sites were located in the high quality (reclassified) habitat in the OESF, even the marginal habitat in the OESF planning unit was of relatively higher quality compared to habitat in other planning units. The Straits planning unit includes occupied sites with little or no structure, perhaps because of a large, adjacent marine population of birds.

[8] The HCP surveys identified 38,563 acres of high quality habitat in OESF, Straits, South Coast and Columbia planning units. The Science Team identified 54,924 acres in these planning units (an additional 16,361 acres).

DNR has analyzed known occupied sites based on their size, number and type of detections, and forest structure in order to rank these sites based on quality. All of the conservation approaches being developed for the long-term strategy protect occupied sites, but with different strategies. Some conservation alternatives protect strategically located sites or groups of sites within larger habitat areas that include buffers and/or security forests. Other alternatives focus conservation on the occupied sites as currently mapped. All of the alternatives propose to include lands beyond occupied sites that provide marbled murrelet habitat value (see Focus Paper #2, “Areas of Long-Term Forest Cover”).

DRAFT

Attachment 1:

The Reclassified Model under the Interim Strategy

The interim marbled murrelet strategy in the 1997 State Trust Lands HCP provides five steps to guide the DNR in protecting the marbled murrelet on DNR-managed trust lands in the area covered by the HCP, while participating in collection of the information needed to develop a long-term conservation strategy. DNR relied upon these steps to develop a "model" that predicts murrelet occupancy at the stand level. The information below describes these steps that will assist DNR in developing the long-term conservation strategy.

1. Defer suitable habitat blocks

During development of the interim strategy in 1997, DNR and USFWS agreed to a conservative definition of suitable habitat, prior to developing the DNR predictive model. The conservative nature of the suitable habitat definition was intended to ensure that DNR avoided "take" of habitat prior to the completion of predictive model. Once the predictive model was developed, it reclassified the definition of habitat from suitable habitat to "Reclassified Habitat and Marginal Habitat."

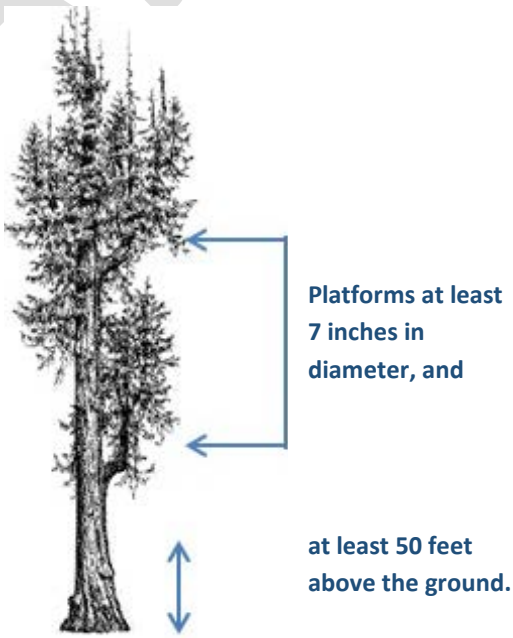
Interim strategy suitable habitat definition

A contiguous forested area meeting all of the three criteria for suitable habitat is:

- At least five acres in size,
- Contains an average of at least two potential nesting platforms per acre, and
- Located within 50 miles of marine waters.

Potential nesting platforms

For the interim strategy, suitable platforms were considered to be a large limb or other structure at least 50 feet above ground and at least 7 inches in diameter.



2. Conduct habitat relationship studies

In 1994, DNR initiated Habitat Relationship Studies in each planning unit to collect forest data from 54 plots located in stands with a range of habitat quality characteristics. DNR surveyed each of these plots to determine which were occupied.

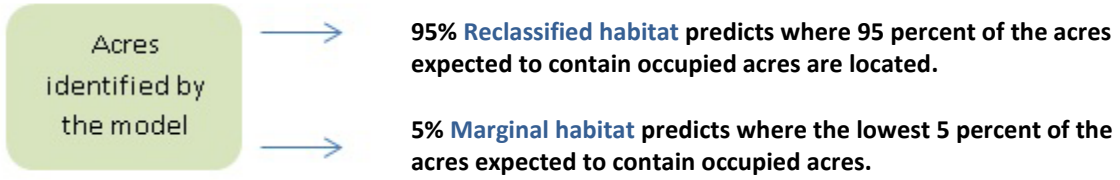
DRAFT

Finally, DNR compared the data collected and the occupancy status to evaluate which data might predict occupancy. Based on these studies, DNR developed new criteria to predict occupancy (Prenzlow-Escene 1999).

DNR developed several methods to apply these new criteria to DNR's inventory data (Prenzlow-Escene 1999). Within each planning unit, the models sorted through DNR's inventory data to identify those places with any probability of occupancy.

3. Identify and release marginal habitat (lower quality)

Within each planning unit, DNR sorted the acres identified by the model to determine potential habitat quality from low to high. The HCP allowed lower quality areas, commonly referred to as marginal habitat, to be made available for harvest. The higher quality areas, commonly referred to as the reclassified habitat, were surveyed.



4. Survey reclassified habitat (higher quality)

DNR conducted surveys on higher quality reclassified habitat.[9]

5. Develop a long-term conservation strategy

The information obtained during the previous steps, as well as other research efforts, shall be used to develop a long-term conservation strategy within each planning unit.

DRAFT

[9] In accordance with the HCP, surveyed, unoccupied habitat outside of Southwest Washington could be released for harvest if it is was not within 0.5 mile of an occupied site and at least 50 percent of the suitable marbled murrelet habitat on DNR-managed lands in the watershed administrative unit remained after harvest. Within southwest Washington, release of surveyed, unoccupied habitat is subject to the process used by DNR and USFWS to develop the long-term strategy. (HCP pp. IV-40, step 4)

Literature cited

Bradley, J.E. and J. M. Marzluff. 2003 Rodents as nest predators: Influences on predatory behavior and consequences to nesting birds. Auk 120 4 1180

Evans Mack, D., W. P. Ritchie, S. K. Nelson, E. Kuo-Harrison, P. Harrison and T. E. Hamer. 2003 Methods for surveying marbled murrelets in forests, a revised protocol for land management and research Marbled Murrelet Technical Committee Pacific Seabird Group Technical Publication Number 2. Available from http://www.pacificseabirdgroup.org.

Horton, S. 2008. Ecology and Conservation of Marbled Murrelets on the Western Olympic Peninsula: Temporal and Spatial Variation in Inland Activity and Implications for Forest Management University of Washington Ph.D

Lance, M.M. and S. F. Pearson. 2005. At-Sea Marbled Murrelet Population Monitoring Washington Department of Fish and Wildlife Olympia, WA

Luginbuhl, J.M., J.M. Marzluff, J. E. Bradley, M. G. Raphael and D. E. Varland. 2001. Corvid Survey Techniques and the Relationship Between Corvid Relative Abundance and Nest Predation. Journal of Field Ornithology 7:2 4 556

Marzluff, J.M., J. M. Luginbuhl, J. E. Bradley, M. G. Raphael, D. M. Evans and D. Varland. 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: annual report, June 25th, 1999

Marzluff, J.M., M. G. Raphael and R. Sallabanks. 2000. Understanding the Effects of Forest Management on Avian Species. Wildlife Society Bulletin 28 4 1132

Prenzlow-Escene, D. 1999. Marbled murrelet forest habitat relationships studies. Olympia, WA Washington Department of Natural Resources Marbled murrelet forest habitat relationships studies.

Thompson, C.W. 1999. Distribution and Abundance of Marbled Murrelets and Common Murres on the Outer Coast of Washington-Summer 1997 throughWinter 1998-1999 Washington Department of Fish and Wildlife Olympia, WA

Ralph, C. J., S. K. Nelson, M. M. Shaughnessy, S. L. Miller, and T. E. Hamer. 1994. Methods for surveying for marbled murrelets in forests — a protocol for land management and research. Pacific Seabird Group, Marbled Murrelet Technical Committee. Technical paper No. 1, revision. 48 pp. [available from USDA Forest Service, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, CA].

Ralph, C. J., S. K. Nelson, S. L. Miller, and T. E. Hamer. March 8, 1995b. Letter to marbled murrelet surveyors and managers providing additions to the 1994 inland survey protocol. Pacific Seabird Group, Marbled Murrelet Technical Committee, Inland Survey Protocol Subcommittee. 5 pp. + attachments. [available from USDA Forest Service, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, CA].

Ralph, C. J., S. K. Nelson, S. L. Miller, and T. E. Hamer. April 24, 1996. Letter to marbled murrelet surveyors and managers providing clarification and updates for the 1994 protocol and 1995 protocol letter. Pacific Seabird Group, Marbled Murrelet Technical Committee, Inland Survey Protocol Subcommittee. 2 pp. [available from USDA Forest Service, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, CA].

DRAFT

Ralph, C. J., S. K. Nelson, S. L. Miller, and T. E. Hamer. April 24, 1997. Letter to marbled murrelet surveyors and managers providing clarification and updates for the 1994 protocol and subsequent protocol letters. Pacific Seabird Group, Marbled Murrelet Technical Committee, Inland Survey Protocol Subcommittee. 2 pp. [available from USDA Forest Service, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, CA].

Ralph, C. J., S. K. Nelson, S. L. Miller, and T. E. Hamer. March 11, 1998. Letter to marbled murrelet surveyors and managers providing clarification and updates for the 1994 protocol and subsequent protocol letters. Pacific Seabird Group, Marbled Murrelet Technical Committee, Inland Survey Protocol Subcommittee. 2 pp. [available from USDA Forest Service, Redwood Sciences Laboratory, 1700 Bayview Dr., Arcata, CA].

Washington State Department of Natural Resources 1997. Final Habitat Conservation Plan. Olympia, WA.

Washington State Department of Natural Resources. February 23, 2007. "North Puget Planning Unit Interim Strategy." Letter to Ken Berg, USFWS.

Washington State Department of Natural Resources. July 16, 2009. “Final SPPU Murrelet Habitat Identification Concurrence Letter.” Letter to Ken Berg, USFWS.

Washington State Department of Natural Resources. April 8, 2003. Letter from DNR to USFWS re: discontinuing surveys in OESF.

DRAFT