

# Science

## FINDINGS

### INSIDE

<i>Keeping Watch on the Seas and in the Trees</i> .....	2
<i>Why the Decline?</i> .....	3
<i>Putting Habitat on the Map</i> .....	4
<i>Exploring Future Trends</i> .....	5

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*"Science affects the way we think together."*

Lewis Thomas

## From Trees to Seas—Marbled Murrelet Numbers Are Down



Nick Hatch

*A marbled murrelet in its nest, hidden on a large mossy branch of a hemlock tree. Adult females lay one egg a year.*

*"In order to see birds it is necessary to become a part of the silence."*

—Robert Wilson Lynd (1879–1948),  
Irish journalist and essayist

The marbled murrelet (*Brachyramphus marmoratus*) spends most of its time diving and foraging in the coastal waters of the Pacific Northwest. Although most seabirds nest on rocks along the shore or on the nearby coast, the marbled murrelet is unique in that it nests on large branches in older conifer trees as far as 50 miles inland from the ocean.

"For centuries, ornithologists had no idea where marbled murrelets nested," says Marty Raphael, a research biologist with the U.S. Forest Service Pacific Northwest (PNW) Research Station. "They'd see these small birds on the water, but it was just rumors and speculation about where they were going when they flew inland. It wasn't until 1975 that the first nest was found. One day a logger was climbing a tree and saw a murrelet sitting on a limb. He knew there was a mystery about this bird, so he caught it and brought it to an expert."

### IN SUMMARY

*In 1992, the marbled murrelet population in the Pacific Northwest was listed as threatened under the federal Endangered Species Act, along with the northern spotted owl and Pacific salmon. These designations were embodied in the 1994 Northwest Forest Plan, which takes an ecosystem approach to managing about 25 million acres of federal lands, with a goal of maintaining and restoring these species' habitats and populations.*

*Scientists with the Pacific Northwest and Pacific Southwest Research Stations as well as the U.S. Fish and Wildlife Service and Washington State Department of Fish and Wildlife have found that, despite the plan's conservation efforts, marbled murrelet populations declined almost 30 percent from 2000 to 2010 in Washington, Oregon, and northern California.*

*Although reasons for this decline are unclear, logging of large, older coniferous forest on nonfederal lands within the murrelet's range is one likely cause, along with wildfire, windstorms, increased predation on murrelet eggs and chicks, and changing ocean conditions. Suitable nesting habitat is well protected on federal lands; however, about a third of this suitable nesting habitat occurs on nonfederal lands, where protections are less and losses are much greater than for federally managed habitat.*

In 1992, the Endangered Species Act (ESA) listed marbled murrelets as threatened in the Pacific Northwest, two years after listing northern spotted owls. Loss of habitat from logging, plus mortality from oil spills and gill nets, were cited as the primary factors contributing to the murrelet's decline. To protect habitat for these species and Pacific salmon, President Clinton appointed a team to recommend alternatives for managing federal forest lands in Washington, Oregon, and northern California. That initiative resulted in the 1994 Northwest Forest Plan, which takes an ecosystem approach to managing about 25 million acres of federal lands. One of the plan's objectives was to support stable or increasing populations of marbled murrelets by conserving their nesting habitat.



## KEY FINDINGS



- From 2000 to 2010, marbled murrelet populations declined by almost 30 percent in Washington, Oregon, and northern California.
- The size of murrelet populations depends on the quality and quantity of nesting habitat.
- Large, older coniferous forests are well protected by late-successional reserves and other protected federal lands. However, more than one-third of this murrelet nesting habitat occurs on nonfederal land, which is not as well protected and is experiencing losses at a much faster rate than federally protected habitat.
- Changing ocean conditions may also contribute to shrinking murrelet populations by reducing the quality and quantity of the bird's prey.

## KEEPING WATCH ON THE SEAS AND IN THE TREES

**H**ow have the birds fared in the 19 years since the Northwest Forest Plan went into effect? To find out, scientists with the PNW Research Station and U.S. Fish and Wildlife Service (USFWS) have been monitoring murrelet populations and their nesting habitat. Because the birds spend time at sea and on land, the marbled murrelet effectiveness monitoring program has two teams. One, led by Raphael, assesses murrelet nesting habitat on land. The other team, and the program itself, is led by Gary Falxa, a fish and wildlife biologist with the USFWS. This team

monitors murrelet populations by surveying coastal waters of the Pacific Northwest.

Falxa describes some of the challenges the monitoring teams face: "Getting accurate population estimates of a seabird the size of a quail over a large expanse of water is a challenge, given the bird's patchy and sparse distribution. But counting murrelets in nesting habitat can be even more challenging, given the millions of forest acres and the birds' cryptic behavior. Murrelets typically fly inland in low light and are very secretive around their nests to avoid predators."

Raphael adds: "The traditional way people study wildlife—going out and catching the species they see during the daylight—doesn't work with murrelets because they're completely cryptic. You just can't find them."

The developers of a USFWS 1997 Recovery Plan laid out six conservation zones to reflect



Monique Lance, Washington Dept. of Fish and Game

Survey crews conduct at-sea murrelet population surveys off the coast, from Washington to northern California.

### *Purpose of PNW Science Findings*

To provide scientific information to people who make and influence decisions about managing land.

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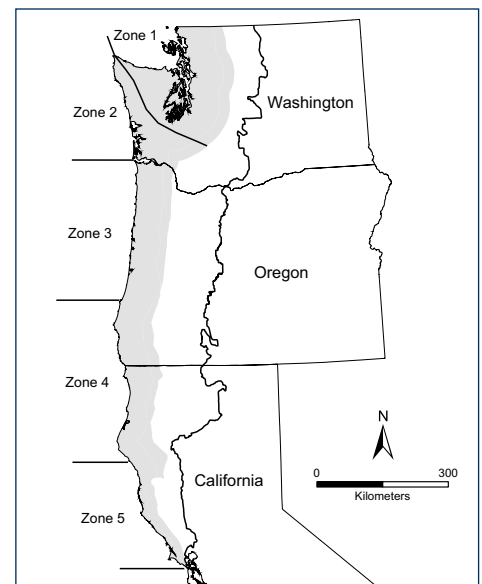
the different ecological characteristics of the species' broad range. The Northwest Forest Plan murrelet population monitoring program adopted five of these zones, which include coastal waters and forest areas up to 50 miles inland that overlap the plan area. "Very different things are happening in different parts of the range," Raphael explains. "For example, Puget Sound is a tidal system, where the production of fish and krill that murrelets eat depends on upwelling that comes from the tide. In the ocean, the upwelling comes from winds that cause cold water to rise to the surface bringing nutrients to the fish that the birds eat."

The ongoing surveys are conducted by the Washington Department of Fish and Wildlife and Crescent Coastal Research. Jim Baldwin is a Forest Service statistician who helped design the at-sea population surveys. "Because the murrelet is associated with old-

growth forest, this study was potentially controversial, and we knew we most likely would have to defend the results," Baldwin recalls. "We needed to be sticklers about having a stable, consistent, dependable, efficient design; but we also had to use limited resources wisely and efficiently."

For quality assurance, the at-sea survey crews are trained and tested each year on the survey protocol before being sent out to count the small birds on the water while they hunt for fish.

The habitat monitoring team selected Maxent, a state-of-the-art species distribution model, to identify and map suitable forest nesting habitat. The model used PNW's Gradient Nearest Neighbor vegetation maps, ground-based vegetation data, satellite data, murrelet biological characteristics, and climate and topographic data.



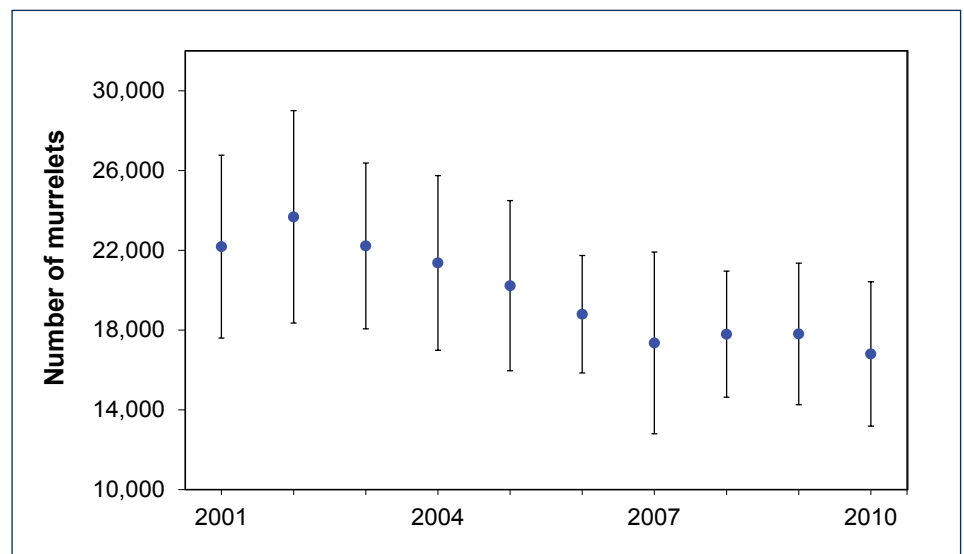
*The five marine marbled murrelet conservation zones adjacent to the Northwest Forest Plan area. The breeding range within the plan area is shaded, and the plan boundary is outlined.*

## WHY THE DECLINE?

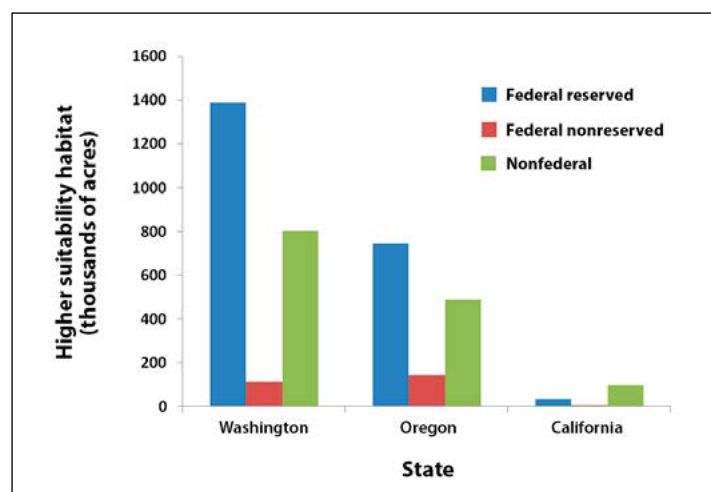
**T**he annual surveys revealed that from 2000 to 2010, marbled murrelet populations decreased by 3.7 percent a year, or almost 30 percent overall, in the Northwest Forest Plan area. These declines coincided with reductions in the amount of suitable nesting habitat. Although most (64 percent) of the estimated higher-quality habitat in the plan area was on federal lands in 1994–96, the team found that a substantial amount (36 percent) was on nonfederal lands. By 2006–07, higher suitability nesting habitat in the plan area had decreased to 3.5 million acres. The team was struck by how much suitable nesting habitat was lost during this period, particularly on nonfederal lands, where the amount of habitat declined by 30 percent compared to 3 percent on federal lands.

On federal land, wildfire and windstorms are the main culprits behind lost nesting habitat for the murrelet. On nonfederal land, the loss primarily is due to logging. Only a small percentage of old-growth coastal forest remains in the plan area, and it is not contiguous. The fragmented nature of the remaining suitable habitat creates more forest edges, where the risk of predation on murrelet eggs and chicks is higher. The situation is not helped by the fact that much of the remaining suitable nesting habitat is in parks and other popular recreation areas where food and trash left behind by campers and other visitors attract jays, crows, and ravens, which prey on murrelet eggs and chicks.

In these areas, efforts are being made to educate hikers and campers about the importance of packing out their trash. Moving campgrounds and picnic areas to locations outside



*From 2001 to 2010, marbled murrelet population declined about 30 percent in Washington, Oregon, and northern California.*



*Baseline amount (1994–96) of higher suitability murrelet habitat by ownership and state.*

of the murrelet's nesting habitat is another option, as is managing to create larger forest patches with more core area and less edge.

Poor reproduction also may be responsible for murrelet population declines. Scott Pearson, a research scientist with the

Washington Department of Fish and Wildlife, notes: "Murrelets only lay one egg a year; it takes several years to reach breeding age, and the survival of that egg and chick is relatively low. You can expect population decreases if you have low recruitment, low adult survival, or both."

Changes in the marine environment may also be harming murrelets. Overfishing, warmer coastal waters, and more frequent El Niño events may be reducing the quality and quantity of their prey. Entangling fishnets and oil spills are some of the other hazards the birds encounter.

## PUTTING HABITAT ON THE MAP

**I**n the short term, the objective of the Northwest Forest Plan is to conserve remaining habitat on federal land. To that end, the plan appears successful, with almost 90 percent of higher quality habitat on federal lands protected.

Ultimately, though, the plan is a long-term strategy that is expected to realize its full potential after a century or more. In that time, previously cut-over forest stands within areas protected by the plan will mature and begin to develop the large-limb nesting platforms and other characteristics of suitable murrelet habitat. By 2050, under current management scenarios, the number of trees more than 150 years old is expected to increase substantially. Shorter-term gains in murrelet populations and habitat quality may occur as older forest fills in around existing suitable habitat and reduces edge and fragmentation effects. As quality nesting habitat in federal forest reserves increases over time, the amount of nesting habitat on nonfederal may become less critical.

Timing may be the issue. More than one-third of the higher suitability habitat is on non-federal lands and is rapidly degrading. Will there be enough suitable habitat in the near term to sustain the lineage? Given declining murrelet population trends, as well as habitat loss, in many areas it is not certain if the populations will persist to benefit from future increases in habitat. Preventing further loss of suitable habitat over the next 30 to 50 years is critical. The states are stepping in to help.

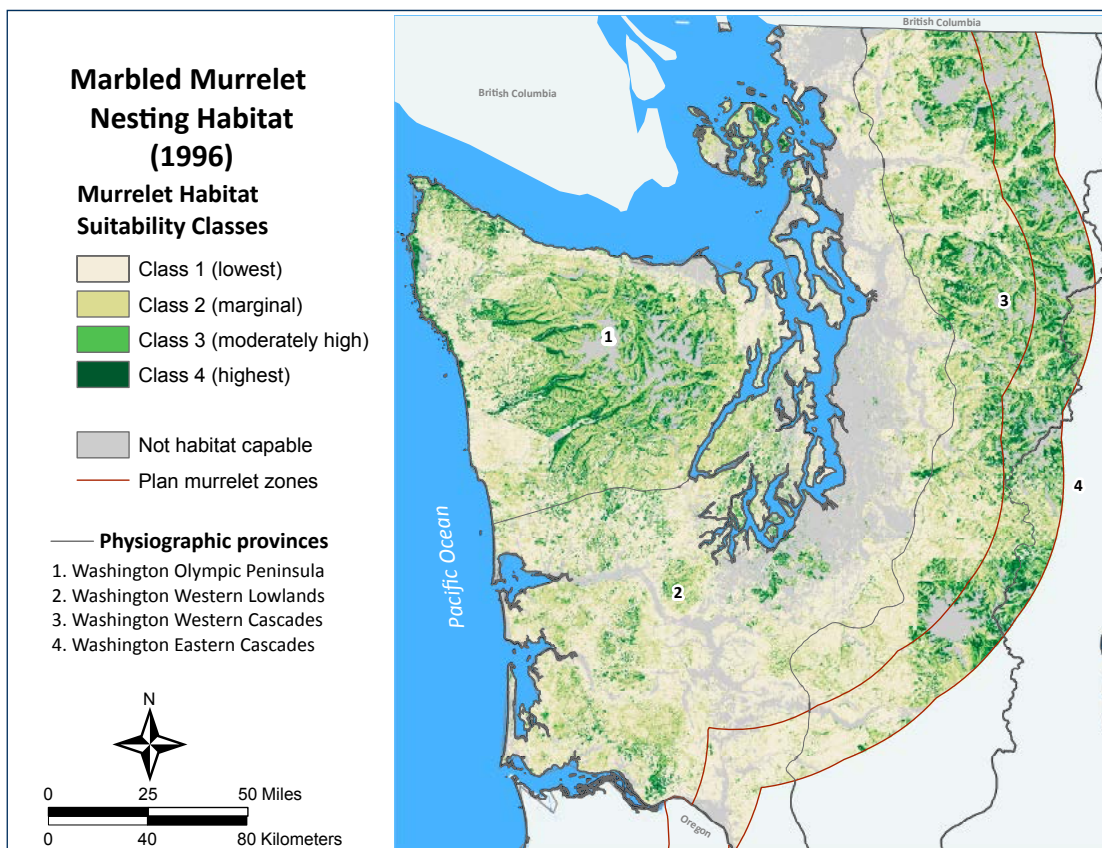
The Washington State Department of Natural Resources (DNR) is using these findings to devise a murrelet habitat conservation plan on state lands. "The habitat maps developed by Dr. Raphael have been very helpful as DNR con-

siders development of its Marbled Murrelet Conservation Strategy," notes Peter Harrison, project manager for the DNR's Marbled Murrelet Long-Term Conservation Strategy. "Dr. Raphael's habitat maps are an important tool that can help us place our conservation efforts in strategic locations to provide the most conservation with the least impact to DNR's trust beneficiaries." Harrison continues: "Combined with DNR's existing murrelet data sets, these habitat maps will provide a solid scientific foundation on which DNR can build a conservation strategy in support of DNR's 1997 State Trust Lands Habitat Conservation Plan to minimize and mitigate impacts on this threatened species."

In Oregon, the governor's office used the information to assess the ecological effects

of proposed alternatives for managing lands under the 1937 Oregon & California Lands Act. This "O&C" land is a checkerboard pattern of different ownerships. To support this effort, the scientists developed detailed "wall-to-wall" maps of marbled murrelet and northern spotted owl habitat, both current and 50 years into the future, under seven different land management scenarios. The governor's task force used this information to better inform discussions about the feasibility of the proposed alternatives and to weigh consequences of each alternative on timber revenue as well as conservation value.

Pacific Northwest federal fire planners also have used the habitat maps to inform fire-fighting efforts around sensitive wildlife habitats.



*Suitable nesting habitat for the marbled murrelet in Washington as of 1996.*

## EXPLORING FUTURE TRENDS—UPS AND DOWNS?

“When managers see a decline, they usually want to do something to reverse it,” Pearson observes. “But they can reverse the decline only if they understand the mechanisms that are driving it.”

The effectiveness monitoring group is investigating the relationships between the quantity and quality of inland forest, ocean conditions, and population densities and trends at sea in the Northwest Forest Plan area. It will integrate the results of the population and nesting habitat monitoring programs, as well as available oceanographic data. A primary goal of this work will be to understand the causes of the population decline observed and to provide information that may point to ways to better conserve the marbled murrelet and other resources in the plan area.

It is especially important to continue monitoring the murrelet to determine if the observed population decline continues or reverses. “We observed a strong population decline through 2010, but in the last couple of years we found population increases in some areas where we previously saw declines,” Raphael notes. “We need more years of monitoring to understand normal population fluctuations. It’s possible that, rather than a steady decline, we’ll see a long-term series of ups and downs. But if the forest recovers over time, we believe that will likely lead to stronger murrelet populations.”

In late 2013, the team will begin a new habitat status and trend analysis for the first 20 years of the Northwest Forest Plan, comparing base-



Josh London, NOAA

*Marbled murrelet in breeding plumage.*

line forest conditions in 1993 in the entire plan area to conditions in 2012. Results of murrelet population monitoring in 2013 and beyond will help further clarify population status and trend, as will data analysis underway that is exploring the potential causes for the increased population estimates in 2011–12.

Falxa concludes: “One long-term objective of the program is to understand the relationship between population trends and nesting habitat conditions. If habitat models can predict where murrelets nest—a big *if*—and if there is a relationship between nesting habitat trends

and population trends—another big *if*—then eventually monitoring nesting habitat trends might tell us how murrelet populations are doing. This in turn would allow us to reduce the at-sea monitoring effort, which would be cost-efficient, and link more directly to the forest conditions that federal land managers have control over.”

*“Long-term conservation success hinges on public understanding and community support.”*

—Stephen W. Kress, National Audubon Society

## FOR FURTHER READING

Miller, S.L.; Raphael, M.G.; Falxa, G.A., [et al.]. 2012. Recent population decline of the Marbled Murrelet in the Pacific Northwest. *Condor*. 114: 771–781. <http://www.treesearch.fs.fed.us/pubs/42450>.

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Joan O’Callaghan writes and edits publications about a variety of issues, including environmental protection, resource conservation, and energy efficiency. Her company, Communications Collective, is based in Bethesda, Maryland.



## LAND MANAGEMENT IMPLICATIONS



- Land managers can use the results from this research to evaluate the Northwest Forest Plan’s success in meeting its conservation objectives and to understand the factors that may be influencing the decline of marbled murrelet populations and habitat.
- If habitat losses continue at the rate observed from 1994–96 to 2006–07, development of 20 percent of federally protected lower suitability land into higher suitability condition over the next 50 years would balance losses of murrelet nesting habitat from federal lands during that period.
- Raising the awareness of campers and other visitors in parks and other popular recreation areas about the effects of their activities on attracting murrelet predators, moving campgrounds to locations outside of murrelet nesting habitat, and managing forests to develop larger habitat patches may reduce murrelet nest predation and improve murrelet nesting success.





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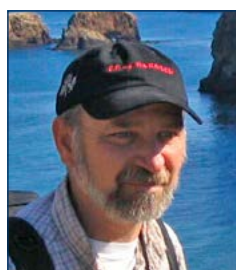


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