

Chapter 25

Pollution and Fishing Threats to Marbled Murrelets

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Abstract: The principal pollutant threats to Marbled Murrelets are chlorinated organic effluent discharges from chlorine bleach pulp mills located in California, Washington, and British Columbia. The distribution of murrelets away from riverine input of agricultural chemicals reduces the threat from these pollutants. Plastic ingestion does not appear to pose a serious threat to murrelets, as it does for other species of small alcids. Significant threats from oil pollution are present because of heavy oil tanker, commercial shipping, and barge traffic along the Pacific coast. Commercial fishing threats have been significantly reduced in California, Oregon, and Washington because of regulation and banning of gill-net fisheries, but thousands of murrelets are still killed annually in Alaska.

Persistent organochlorine pollutants in the environment are represented by pesticides, herbicides, polychlorinated biphenyls (PCB), and pulp mill discharges containing polychlorinated dibenzo-dioxins (PCDD) and polychlorinated dibenzo-furans (PCDF). Organochlorine pesticide use has been reduced during the past two decades, with the prohibition of use of DDT, dieldrin, kepone, and chlordane in the United States and Canada, although methoxychlor and dicofol continue to be used in selected agricultural areas. The herbicides 2,4-D and 2,4,5-T were used extensively in reforestation projects in the Pacific Northwest, and 2,4-D continues to be used. 2,4-D poses a potential risk because of the presence of PCDD as contaminants of manufacture and incineration product after burning of clearcut slash piles. Within the range of Marbled Murrelets, PCDD and PCDF represent the most prevalent pollutant risk.

Point Sources of Organochlorine Pollutants

Kraft Pulp Mills

Bleached paper grade pulp mills using chlorine bleaches have a wide distribution along the Pacific coast of North America (fig. 1), with two mills in southeastern Alaska, eleven in coastal British Columbia, seven in Washington State, four in Oregon and three in coastal California (Colodey and Wells 1992). The chlorine bleach process extracts pigmented plant lignins, and produces chlorinated effluents containing dioxins and furans which have been discharged to the environment at levels resulting in significant injury to fisheries, birds (Great Blue Herons [*Ardea herodias*], cormorants, and grebes), and estuarine environments (Colodey and Wells 1992, Elliott and

others 1989, Whitehead 1989, Whitehead and others 1991). The PCDD and PCDF bioaccumulate in the sediments, fish populations, and in fish-eating birds, causing reproductive impairments in bird populations with reduced breeding success, as well as malformations and embryo mortality in Great Blue Herons (Bellward and others 1990, Elliott and others 1989, Hart and others 1990). No specific residues or breeding impairment have been identified in Marbled Murrelets, but murrelets feeding locally in the areas of historic effluent discharge would be at risk of exposure through bioaccumulation in forage fish. In a study of coastal aquatic birds in British Columbia, Whitehead and others (1991) found the highest levels of dioxins in Western Grebes, which have a prey base

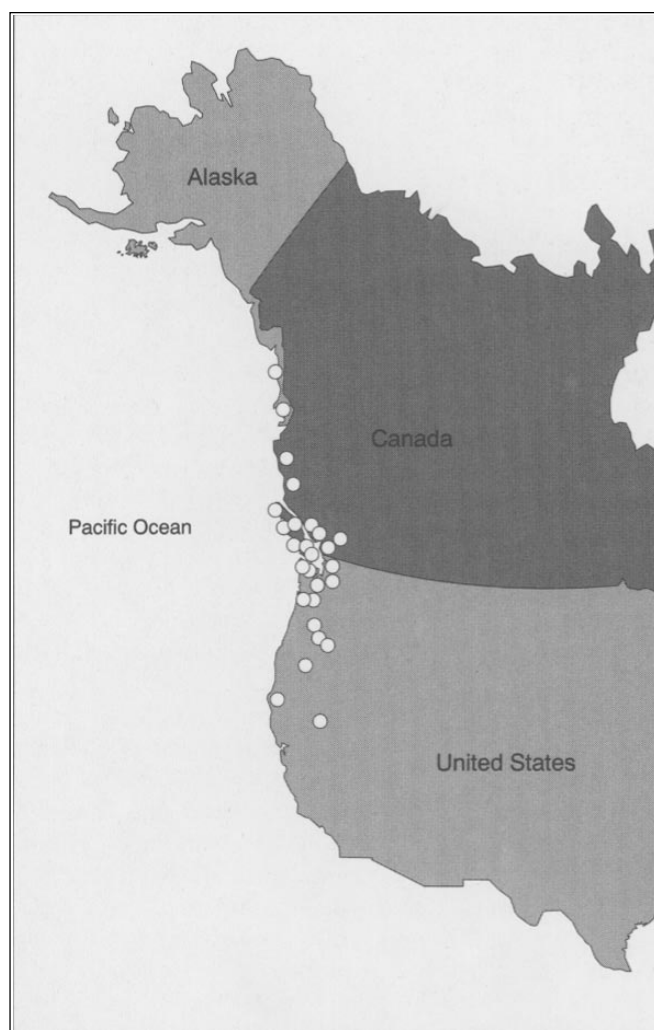


Figure 1—Distribution of paper grade pulp mills active or recently closed which discharge chlorinated organics into estuarine environments on the Pacific Coast of North America.

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similar to that of murrelets, indicating that murrelets could be at risk from pulp mill effluents.

The discharges from the mills have generally been localized to the vicinity of less than 25 km from the mill (Colodey and Wells 1992), with variable local impact on wildlife populations. Since pulp mills and Marbled Murrelets are both distributed all along the Pacific coast, the discharges from these mills is of concern.

The mills most probably affecting murrelets would be those in southeast Alaska, British Columbia, Washington (Port Angeles, Bellingham, Everett and Grays Harbor), and California (Eureka). The distribution of murrelets in Washington is primarily in the Straits of Juan de Fuca and in the San Juan Islands (Speich and others 1992), with fewer birds in the more polluted areas of southern Puget Sound.

The high toxicity and very long environmental persistence of dioxins and furans has resulted in regulatory action reducing pulp mill effluent discharges, and is also resulting in changes in the bleaching processes used by paper-grade pulp mills to eliminate chlorine bleaches. Most mills in the United States and Canada continue to use chlorine bleaches, but effluent discharges in British Columbia were reduced by 75 percent between 1989 and 1991 (from 81.5 to 20.5 metric tons of chlorinated organics per day). It had been determined that most mills will retool to convert to oxygen bleaches or close down (Colodey and Wells 1992). The Ocean Falls mill in British Columbia closed in 1981, but persistent residues may still affect the population of murrelets using adjacent fjords (Burns and Prestash 1993, Manley and Kelson 1992).

Industrial Pollutant Discharges

Industrial discharges from the population centers of San Francisco Bay, California, Puget Sound, Washington, and Vancouver, British Columbia, have contaminated estuarine sediments with heavy metals, petroleum hydrocarbons, and PCB in addition to PCDD and PCDF (Henny and others 1990, Hoffman and others 1986, Ohlendorf and Marois 1991, Phillips and Spies 1988, Riley and others 1983, Speich and others 1988). Marbled Murrelets may be only peripherally at risk, however. Their range is primarily in coastal areas, largely remote from populated areas, because historic logging near population centers has reduced nesting habitats. Pollutant monitoring of Pigeon Guillemots (*Cephus columba*) in Washington indicated that birds resident in the Straits of Juan de Fuca were less contaminated than those resident near Seattle, presumably because contaminated forage fish do not move widely throughout Puget Sound (Calambokidis and others 1985). Murrelet risk would be expected to be broadly similar to the risk to guillemots.

Non-Point Discharges

Discharges from Rivers

The major rivers with historic pollutant discharges in the murrelet range are the Sacramento-San Joaquin

(California), Columbia (Oregon, Washington), and Fraser (British Columbia). The Copper River, in Alaska, was a source of mining discharge, but probably not currently a risk factor for murrelets. Most other rivers within the murrelet range have little agriculture, or mining pollutant inputs which would affect murrelets.

The current distribution of murrelets at the mouths of these rivers is generally low, probably because they are human population centers where there has been a historic reduction of murrelet nesting habitat.

Global Bioaccumulation of Organochlorines in the Food Web

Murrelets are probably at low risk from global food web bioaccumulation of pollutants because of their foraging habits, prey size and the distribution of prey in coastal habitats. Most fish eaten by murrelets are juveniles of commercial species, or ground fish without a wide pelagic distribution. The background global organochlorine input into the seabirds of the North Pacific has resulted in a modest increase in organochlorine pollutants in seabird eggs over the past two decades (Elliott and others 1989), but the levels remain below those generally considered to be of threshold biological significance.

Plastics and Small Floating Marine Debris

Ingestion of floating bits of plastic, rubber filaments, and fishing line has been documented in many seabirds, most commonly in species preying on plankton. Day and others (1982, 1985) documented plastic ingestion by 50 species, including eight species of alcids: Cassin's (*Ptychoramphus aleuticus*), Least (*Aethia pusilla*), Parakeet (*Cyclorhynchus psittacula*), and Rhinoceros (*Cerorhinca monocerata*) auklets; Dovekie (*Alle alle*); Common Murre (*Uria aalge*); and Tufted (*Fratercula cirrhata*) and Horned (*Fratercula corniculata*) puffins. Day (1980) also examined 61 Marbled Murrelets, 16 Ancient Murrelets (*Synthliboramphus antiquus*), 5 Kittlitz's Murrelets (*Brachyramphus brevirostris*) and 18 Pigeon Guillemots and found no plastic or other foreign objects present in their upper digestive tracts. The lower risk to murrelets and guillemots is probably due to a combination of their coastal foraging and a diet restricted to fish, thereby reducing the likelihood of inadvertent ingestion of foreign objects.

Oil Pollution Threats

Documentation of oil spills along the Pacific coast since 1968 have demonstrated significant threats to seabirds in California, Oregon, Washington, British Columbia, and Alaska (see also Carter and Kuletz, this volume). Small numbers of murrelets (fewer than 10 birds) were recovered oiled after spills from the tankers *Blue Magpie*, Oregon, 1983; *Puerto*

Rican, California, 1984; *ARCO Anchorage*, Washington, 1985; and *Apex Houston*, California, 1986 (Bayer 1988, Burger and Fry 1993, Kittle and others 1987; Page and others 1990, Point Reyes Bird Observatory 1985). Mortality estimates of larger numbers have been made for recent spills, extrapolating from recovery experiments which demonstrate that fewer than 10 percent of oiled murrelets are likely to be recovered after spills, because of their small size, likelihood of scavenging by predators, and other factors (ECI 1991). About 170-200 murrelets were estimated to have been oiled following the *Nestucca* spill, Washington, 1989 (Burger 1990; Rodway and others 1989, 1992), and approximately 8,400 killed after the *Exxon Valdez*, Alaska, 1989 (Piatt and Naslund, this volume), representing approximately 3.4 percent of the Alaska population. About 45 Marbled Murrelet carcasses were recovered following the *Tenyo Maru* spill, Washington 1992 (U.S. Fish and Wildlife Service, Ecological Services, Olympia, Washington).

Continuing threats to murrelets from oil pollution vary among different areas of the Pacific coast, in direct proportion to the probability of an oil spill and the local murrelet population vulnerability.

Three areas of Alaska have significant vulnerability: Lower Cook Inlet, Prince William Sound, and the Alexander Archipelago. Lower Cook Inlet receives the majority of cargo shipping traffic within the state. Offshore oil deposits within Cook Inlet have recently been discovered which could be developed within 10 years. Prince William Sound has a very high density of murrelets and transits up to 700,000,000 bbl of crude oil annually from the pipeline terminal at Valdez. The Alexander Archipelago in Southeast Alaska supports the largest population of murrelets in the state (>180,000; 57 percent of total population)(Piatt and Naslund, this volume), and has a large number of ship transits, including fishing, cargo, and passenger vessels.

Threats from oil pollution in British Columbia appear to be highest around Vancouver Island, because of the coincidence of tanker and barge traffic through the Strait of Juan de Fuca and high populations of murrelets on the west side of the island. Murrelets in lower densities also breed in the Queen Charlotte Islands, but ship traffic and tanker traffic are less. The very large volume of crude oil traffic from Alaska to California occurs more than 100 km offshore, reducing the threat from tanker spills.

The smaller populations of murrelets in Washington in the Strait of Juan de Fuca remain at considerable risk because of both tanker traffic and large volumes of commercial shipping (cargo and fishing) into Seattle, Tacoma, and Vancouver. The local, inshore distribution of murrelets makes them particularly vulnerable to spills in coastal areas.

Tanker and barge traffic in coastal waters of California, Oregon, and Washington pose significant threats to murrelets. Barges are used to enter smaller ports, and are often towed in near-shore waters. While the tonnage of oil transported by barge is much less than that conveyed by tanker, the *Apex Houston* (approximately 10,000 dead birds) and *Nestucca*

(>50,000 dead birds) spills have demonstrated barge traffic to be of high risk to murrelets along the Pacific coast. A potential threat to the small northern California murrelet population may emerge if the offshore oil reserves present off Mendocino and Humboldt counties are developed following the possible end to a federal moratorium on drilling after year 2002.

Commercial Fishing Threats

Relatively large numbers of Marbled Murrelets have been recorded killed in gill-nets in British Columbia and Alaska (Carter and others, this volume; Carter and Sealy 1984; DeGange and others 1993; Mendenhall 1992; Piatt and Naslund, this volume; Wynne and others 1991, 1992), with smaller numbers caught in Washington (Speich and Wahl 1989), and California (Carter and others, this volume). Recent fishing closures and regulations have reduced the threats in California, but significant threats continue to exist for murrelet populations in Alaska, British Columbia, and Washington.

Alaska

Salmon gill-net bycatch of murrelets in Alaska is estimated at 3,300 birds annually by Piatt and Naslund (this volume), based upon observer program data of Wynne and others (1991, 1992), and extrapolations using current fishing permit and fishing effort data. The approximate distribution of murrelet mortality is: Lower Cook Inlet, 1,100 birds; Prince William Sound, 1,000; Alaska Peninsula, 300; and Southeast Alaska 900; these were primarily Marbled Murrelets, and the vast majority being adults. This total of 3,300 birds represents approximately 1.7 percent of the Alaska population killed on an annual basis in the drift-net fishery. The set-net, pound-net, and seine-net fisheries may also contribute to mortality, but no quantitative data are available on these fisheries.

British Columbia

Carter and Sealy (1984) reported a large bycatch of murrelets in the Barkley Sound salmon fishery in 1979-1980, with approximately 4 percent (360 birds) of the local Marbled Murrelet population killed that season, plus loss of chicks in nests from loss of adults. The potential for a large continued bycatch exists, but data are lacking, as there is not a current seabird observer program. High densities of murrelets and high fishing effort do not always coincide, possibly minimizing the risk in some areas, but alcids and salmon frequently take the same prey species (Burger, this volume b). The highest population densities of murrelets occur along the west coast of Vancouver Island, with lower densities along the mainland coast and Queen Charlotte Islands.

Washington

With current information, it is not possible to determine the extent of mortality on Marbled Murrelets in Washington. The salmon fishery in Washington has declined in recent years, and may pose much less risk to murrelets than in

British Columbia or Alaska. Plenert (U.S. Fish and Wildlife Service 1993b) indicated that U.S. Fish and Wildlife Service anticipated an incidental take of five murrelets from the 1993 all-citizens fishery, and another five murrelets from the tribal fishery, levels not thought to be injurious to the murrelet population. The greatest threat from fisheries bycatch is in the eastern Strait of Juan de Fuca and the San Juan Islands, where the largest murrelet population is located.

Oregon

Gill-net fishing has been prohibited along the outer coast of Oregon and in estuaries and bays since 1942 (Nelson and others 1992). A gill-net fishery exists in the Columbia River, but no murrelet bycatch has been recorded during observer programs in 1991-1993 (Jefferies and Brown 1993).

California

Gill-net fishing is prohibited north of Point Reyes, Marin County, and prohibited in waters less than 40 fathoms from Point Reyes south to Santa Cruz County, and in waters less than 30 fathoms south to Point Conception, largely to prevent bycatch of birds and sea otters. If these restrictions are maintained, the threat to murrelets from net fisheries is largely eliminated.

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