

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

REPORT TO THE
FISH AND GAME COMMISSION:
A STATUS REVIEW OF THE
MARBLED MURRELET
(Brachyramphus marmoratus)
IN CALIFORNIA

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REPORT TO THE FISH AND GAME COMMISSION:

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EXECUTIVE SUMMARY

This report was prepared in response to a petition received by the Fish and Game Commission from Mr. Peter W. D. Paton of the Redwood Region Audubon Society to list the Marbled Murrelet (*Brachyramphus marmoratus*) as a Threatened Species.

On June 29, 1990, pursuant to Section 2074.2 of the Fish and Game Code, the Commission determined that the petition contained sufficient information to indicate that the petitioned action may be warranted. Pursuant to Section 2074.6 of the Fish and Game Code, the Department undertook a review of this petition. Based on the best scientific information available on the Marbled Murrelet, the Department has evaluated whether, in fact, the petitioned action should be taken. Information and comments on the petitioned action and the species in question were solicited from interested parties, management agencies, and the scientific community.

This report presents the results of our review and analysis.

FINDINGS

The Marbled Murrelet is a small seabird that ranges along the Pacific coastline from the Aleutian Archipelago in Alaska to central California. It is approximately robin-sized and short and chunky in appearance with a large head, thick neck, and stubby wings. Winter coloration is dark above and white below, and breeding plumage is black-brown barred above and brown mottled below. The legs are set far back on the body, making the birds very maneuverable in the water but clumsy on land., Flight is fast and direct. Food consists mainly of small fish obtained by diving from the surface. When at sea, murrelets generally reside in nearshore areas with rocky and sandy substrate.

Marbled Murrelets are the only members of the family Alcidae (which includes auks, murrelets, and puffins) that nest in trees. During the breeding season they range up to 50 km (31 mi) inland and occupy old-growth coastal coniferous forests. In California, they nest on large, horizontal, moss-covered limbs of old Douglas-fir (*Pseudotsuga Menziesii*) situated within virgin coastal conifer forest. They lay a single egg per year in a mossy depression on a large horizontal limb. Each adult pair alternates between brooding and resting activities, flying between the nest tree and the coast, and changing duties once a day, usually in the early morning. After hatching, both adults feed the nestling by carrying small fish inland to the nest. At fledging, the young bird must fly from the tree to the coast where it joins the adults floating on the sea surface. These birds are long-lived. They do not breed until several years old and adults do not necessarily breed every year.

Historically, the Marbled Murrelet occurred in California from Monterey County to the Oregon border, where it lived and foraged along the near shore coastline and nested in the old-growth coastal coniferous forests that formed a continuous strip along the western slope of the Coast Range. Presently only about 3.5% of this old-growth nesting habitat remains in California, and the Marbled Murrelet population has been greatly reduced. Their historical breeding population in California is estimated to have been about 60,000 individuals. Their current breeding population in California is estimated to be 1,650 to 2,000 individuals.

During the last three years, the Department's Nongame Bird and Mammal Section has sponsored several projects to study the status, distribution, and biology of Marbled Murrelets in California. The major cause of decline has been the removal and severe fragmentation of old-growth coastal coniferous forests needed by the species for nesting, by commercial timber harvest over the last 150 years. Studies have shown that murrelets do not exhibit significant activity indicating nesting in second-growth coastal coniferous forests.

The present population of Marbled Murrelets in California is divided between three remaining isolated areas: 1) northern Santa Cruz and southern San Mateo counties; 2) south central Humboldt County; and 3) northern Humboldt and Del Norte counties to the Oregon border. These areas are isolated from each other enough to limit genetic exchange and make recolonization unlikely should one of the populations be extirpated. The northern-most California population is also isolated from the remaining murrelets to the north, since the next large healthy breeding population is found in the Puget Sound area.

The birds in California are breeding in remaining patches of old-growth coastal coniferous forest. Only 3.5% of the original old-growth coastal coniferous forest remains, about 70,000 acres. Of these remaining areas, 60,000 acres are in State or federal parks, where logging is precluded. The rest of the remaining old-growth habitat (about 10,000 acres) is under private ownership as commercial timberland. Logging continues, and there are existing plans to harvest the remaining privately-owned property within the next few years. Some plans have already been approved, and some have been held pending the outcome of the both the State and Federal listing processes.

If the species is not protected by listing and the planned harvest occurs, we expect that the California population of Marbled Murrelets could be substantially reduced, to fewer than 1000 individuals. This would severely effect the viability of the three isolated breeding populations, and accelerate their extirpation. The elimination of these three southern-most populations would be a major reduction in the North American range of the species.

Marbled Murrelets in California will not be adequately preserved by depending solely on remaining old-growth coastal coniferous forest maintained on parkland. Recreational use on the forest floor does not seem to directly disturb birds nesting high above in the canopy, but indirect effects may be substantial. Both nests found recently in California on park property failed due to predation by corvids (ravens and jays). In a park situation where human food and garbage are readily available, the population levels of corvids are unnaturally high. Increased nest predation can substantially impact long-lived species like Marbled Murrelets that have naturally low reproduction rates. State Park and National Park Service management directives are not

necessarily oriented towards wildlife management unless a species is State or federally listed as Threatened or Endangered. Funds for management cannot be easily derived otherwise.

The Marbled Murrelet is considered one of the most sensitive seabirds in North America because of its susceptibility to oil spill accidents from oil tanker traffic or oil drilling activities. Drilling off the north coast of California has been repeatedly considered as a viable energy option, and will continue to be so considered in the future. More Marbled Murrelets were killed in the Exxon Valdez oil spill in Prince William Sound, Alaska, than we have in our entire population in California. Any one of the State's murrelet populations could be extirpated by a single oil spill, and one substantial spill could entirely eliminate the species from the State.

Gill and drift netting also adversely impact Marbled Murrelets. Gill netting off the central California coast resulted in deaths of large numbers of Common Murres (a closely related species), as well as Marbled Murrelets, in the early 1980s. In response to losses of murrelets, gill netting was curtailed, and Marbled Murrelets benefited. Though gill netting is currently not a major mortality factor, its potential use in the future remains a significant concern.

During the 1990 breeding season, an El Niño type of oceanic event occurred off the coast of northern California and Oregon resulting in lack of nutrient upwelling and collapse of the anchovy population, a major food source for breeding murrelets. Subsequently the birds were dispersed widely out on the ocean, and less breeding activity was observed. Although this is a natural event that a healthy population of seabirds is able to withstand, the reduced numbers of murrelets puts them at special risk. Breeding population levels may already be too low to adequately recover from this type of environmental event and there is the potential for these events to occur in consecutive years.

Marbled Murrelets are threatened with extinction by the following factors (Title 14, Section 670.1): Their habitat and range have already undergone and are presently threatened with further destruction, modification, and curtailment; their remaining essential habitat is threatened by over-utilization for commercial (timber) and recreational (parks) purposes; they are faced with increased predation in parks where corvids have flourished; other natural occurrences (food web collapse) and human-related activities (oil spills and gill-netting) continue to adversely affect their existence; and, existing regulatory mechanisms are inadequate to insure their continued survival in California.

CONCLUSIONS

The Department concludes that the Marbled Murrelet is in serious danger of extinction in California because the species has probably declined by over 95% from historical levels, continues to decline to this day, and in our best professional judgment, seems highly likely to continue declining to the point of extinction in the foreseeable future. The petitioner has requested that the Marbled Murrelet be listed as Threatened. However, after reviewing the status of the Marbled Murrelet in California and based on the best available scientific information regarding the biology of this species, the Department

finds that listing as Endangered is the more appropriate action. This finding is based on the following:

1. Habitat modification and destruction has been extensive since the early 1800's and continues in the coastal coniferous forests. This once vast and continuous strip of vegetation ran along the western slope of the Coast Range from Monterey County to the Oregon border. It has since been extensively logged for timber production, such that only about 3.5% of the original acreage remains in old-growth, which is mostly scattered in parks and fragmented public and private parcels. A 300 mile gap exists between suitable habitat in Humboldt and San Mateo counties. The logging situation in Oregon and Washington is worse, and it will become worse in British Columbia and Alaska in the foreseeable future. In California, Marbled Murrelets nest only in old-growth coastal coniferous forests (greater than 150 years old). Logging plans exist for most remaining old-growth forests that are not in existing parks. There are no current plans to regenerate old-growth coastal coniferous forests, no management plans for remaining old-growth, and no current management opportunities for preserving Marbled Murrelet breeding habitat.
2. Continued elimination of the Marbled Murrelet's essential breeding habitat for commercial (timber) and recreational (park) purposes threatens the continuing existence of this species.
3. Natural predation on the Marbled Murrelet that occurs in unaltered and undisturbed old-growth coniferous forest would not normally be a threat to continued existence. However, under present conditions, much of this remaining old-growth coniferous forest occurs in federal, State, and local parks, where human visitation occurs. The remainder is severely fragmented. These human influences and alterations typically result in an artificial population increase of predatory corvids. This increases predation pressure on murrelet eggs, young, and adults during the breeding season. Both nesting attempts being monitored in California during 1989 were terminated by corvid predation.
4. There is no evidence to suggest that competition from other species threatens the existence of Marbled Murrelets. If habitat conditions and marine food availability should change in the future, this should be reevaluated.
5. Although there is no evidence that disease is a threat to the Marbled Murrelet, should an outbreak occur, the isolated fragmented population would be highly vulnerable to local extirpation.
6. Human-related activities pose a serious threat to the continued viability of Marbled Murrelets in California. An oil spill or other environmental contamination event resulting from industrial or shipping activity in nearshore waters will be of serious consequence, Murrelets are highly vulnerable to oil pollution and local extirpation or catastrophic extinction is a distinct possibility, Marbled Murrelets are also susceptible to mortality from gill and drift netting activities in nearshore waters.
7. Small population size makes the Marbled Murrelet highly susceptible to

extirpation due to natural occurrences, such as natural environmental occurrences causing the collapse of the food web. There is evidence that breeding activity is affected by fluctuations in the food supply.

8. It is estimated that less than 2,000 breeding Marbled Murrelets remain distributed within three isolated populations, the largest of which consists of about 1,000 individuals and the smallest, about 300 individuals. Historically, as many as 60,000 individuals may have bred throughout the old-growth coastal coniferous forest. Current low numbers, coupled with low reproductive rate and high fragmentation and isolation of nesting habitat, place the birds at risk of extinction due to biological and genetic factors associated with small population size. These factors seriously threaten the continued viability of this species in California.
9. In the absence of listing, existing regulatory mechanisms are inadequate to insure the continued survival of viable Marbled Murrelet populations in California.

RECOMMENDATIONS

1. The Commission should find that the petitioned action is warranted for the status of State Endangered.
2. The Commission should publish notice of its intent to amend Title 14 CCR 670.5 to add the Marbled Murrelet (*Brachyramphus marmoratus*) to its list of Threatened and Endangered Species,
3. The Department should establish the interagency coordination and commitment necessary to halt the continued loss and deterioration of Marbled Murrelet habitat and ensure the preservation of habitat deemed essential to maintaining the species in perpetuity.
4. All remaining old-growth coastal coniferous forest supporting Marbled Murrelets must be protected from any further modification. Private forested lands in this category could be secured through various actions including: 1) agreement with landowners as mitigation for harvest activities administered under the Forest Practices Act; 2) acquisition of conservation easements by responsible agencies; 3) development of a habitat conservation plan by the responsible agencies and the major industrial forest landowners; and 4) in-fee acquisition of Marbled Murrelet habitat by responsible agencies when other means are not feasible.
5. All logging or other destruction or modification of mature or approaching mature second-growth coastal coniferous forest should be limited, especially in areas adjacent to remaining old-growth. Consideration should be given to restoration of old-growth coastal coniferous forest habitat whenever possible.
6. Old-growth coastal coniferous forest areas of a size sufficient to maintain self-sustaining populations of the Marbled Murrelet should be identified and permanently preserved, This should include dispersal

corridors of suitable habitat along the western slope of the Coast Range to allow for increased gene flow between genetically isolated populations. The overall goal should be to physically eliminate isolation of fragmented populations by expanding existing habitat and by developing connecting habitat. Appropriate property should be purchased, protected and restored if necessary to accomplish this goal.

7. State, federal and private land maintenance and management activities should be conducted to minimize disturbance to breeding adults and existing or potential nest trees.
8. A population viability analysis of the Marbled Murrelet in California should be undertaken to determine the breeding population levels and management actions necessary to insure that the population will become healthy and viable and be able to naturally exist in perpetuity in the State. Ongoing basic research on the Marbled Murrelet should continue with support from the Department and other public and private organizations to determine specific information needed to conduct a population viability analysis and develop recovery and habitat conservation plans.
9. The Department should establish a recovery planning team to develop a comprehensive management plan for Marbled Murrelets that is specific to the situation in California and implement the plan.
10. The current gill netting prohibitions should be maintained along the coast of California within the range of the Marbled Murrelet.
11. Offshore oil drilling and nearshore transfer of oil and other toxic chemicals should be carefully controlled along the California coast within the range of the Marbled Murrelet.
12. Planned logging or any other further disruption of remaining old-growth coastal coniferous forest, within 25 miles of the coast, should be closely reviewed for presence or absence of Marbled Murrelet activity prior to approval of Timber Harvest Plans.

PUBLIC RESPONSES

During the twelve month review period, the Department contacted a number of affected and interested parties, invited comment on the petition, and requested any additional scientific information that may be available. A copy of the Public Notice and a list of parties contacted are contained in Appendix A. Copies of comments received and responses to those portions incorporating biological information are provided in Appendix B. Responses to non-scientific comments were not addressed in this analysis but will be addressed as part of the regulatory proceedings should the Commission find that the petition warrants action.

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I N T R O D U C T I O N

PETTITION HISTORY

On March 27, 1990, the Fish and Game Commission received a petition from Mr. Peter W.C. Paton of the Redwood Region Audubon Society at Eureka, California, requesting State listing of the Marbled Murrelet (*Brachyramphus marmoratus*) as a Threatened Species. The Department of Fish and Game reviewed the petition and recommended to the Commission that they accept it as complete pursuant to Sections 2072.3 and 2073.5 in the California Endangered Species Act (CESA). On June 29, 1990, the Commission accepted the Department's recommendation and designated the Marbled Murrelet as a Candidate Species as provided for in Section 2074.2 of CESA. That action initiated a twelve month review period, pursuant to Section 2074.6 of CESA, within which the Department must review the status of the subject species and provide a written report to the Commission. This report contains the results of the Department's status review, and a recommendation to the Commission, based on the best scientific information available, of whether or not the petitioned action is warranted. It also includes preliminary identification of the habitat that may be essential to the continued existence of the species and suggests management activities and other recommendations for recovery of the species.

DEPARTMENT REVIEW

During the twelve month review period, the Department contacted affected and interested parties, invited comment on the petition, and requested any additional scientific information that may be available. A copy of the Public Notice and a list of parties contacted are contained in Appendix A. Copies of comments received and responses to those portions involving biological information are provided in Appendix B. Responses to non-scientific comments are acknowledged, but not addressed in this document.

F I N D I N G S

LIFE HISTORY

Description

The Marbled Murrelet is a robin-sized seabird with a stubby appearance (Marshall 1988) due to its large head, short neck and tail, heavy compact body, small wings, and rear-placed legs. The adult is about 23 cm (9 in) long and weighs about 220 gr (7.7 oz). The bill is short, thin, and dark. The

sexes have identical plumages that vary seasonally. During the breeding season the adult is dark above (sooty brown with dark bars and possibly rufous-brown flecks) and heavily mottled below (light brown). In winter plumage the back, top of head, and eye areas are dark (brownish-gray); the throat, chest, and belly are white; there are two distinctive white streaks on the scapulars just above the wings; and a streak of white extends up the nape of the neck from the underparts. Fall juvenile plumage is much like adult winter plumage, except for faint brownish mottling on chest, breast and sides, but during the first winter it becomes mostly white below (National Geographic Society 1983, Marshall 1988).

The small wings and rear-placed legs allow the Marbled Murrelet to excel in underwater maneuvering (Marshall 1988). On the water surface the bird is in a prone position, but on land it stands. It has poor walking and standing capabilities due to very weak legs that are set too far back on the body for good balance. It walks very clumsily, and on land attempts to escape in a prone position by propelling itself with its wings. During flight the small-surfaced wings beat very rapidly and appear to have a whirling motion. It can easily take off from the water, but has more difficulty on land. The call uttered during flight is a sharp, shrill "keer-keer" that resembles a gull flight call. At the nest soft buzzy calls have been heard (Marshall 1988).

Taxonomy

The Marbled Murrelet is a distinct species that is native to the northern Pacific rim. It is a member of the family Alcidae (auks, murrelets, and puffins) of the Order Charadriiformes (shorebirds, gulls, auks and allies). It was first described as a species (*Colymbus marmoratus*) by Gmelin in 1789 and eventually included in the genus *Brachyramphus* (described by Brandt in 1837) in a subsequent designation (by Gray in 1840) (American Ornithologists' Union 1957, 1983). There are two recognized subspecies, *B. m. marmoratus* in North America and *B. m. perdix* in Asia, which differ in bill length, body weight and distribution (Marshall 1988).

Biology

Food Habits and Foraging Behavior . The Marbled Murrelet feeds mostly on small schooling fish, which it captures underwater (Bent 1963). Marshall (1988) summarizes reported foods of Marbled Murrelets. They include: Sand Lance (*Ammodytes hexapterus*), Pacific Herring (*Clupea harengus*), Capelin (*Mallotus villosus*), other fish, *Euphasia pacifica* and *Thysanoessa spinifera* (marine crustaceans), and mysids and euphasiids (shrimp). Carter and Erickson (1988) report that in the early 1900s in Monterey County, Marbled Murrelet stomach contents included two to five 3 in (8 cm) long Sardines (*Sardinops sagax*) and a 6.5 in (1.7 cm) fish. Also, a 6 in (15 cm) needlefish (probably a sandlance) was discovered inside the bill of a collected individual. Later in the 1970s, in the same area, birds were feeding mainly on Northern Anchovies (*Engraulis mordax*), which had replaced Sardines as the primary midwater schooling fish after Sardines were commercially fished out. Ralph et al. (1990) report that a Marbled Murrelet enroute to a nest site bounced off a mist net and dropped a whole Northern Anchovy that weighed 10 grams (0.35 oz) and was 113 mm (4.5 in) long. A direct observation was made of an individual repeatedly diving into and through a small school of fish that was hovering in a mass near the surface of the water (Bent 1963).

Ralph et al. (1990) report on Marbled Murrelet diving behavior. Data gathered using radio-transmitters that only operated when the birds were on the surface, indicated that dives were generally short, averaging 14 seconds with rests in between averaging 17 seconds. The longest dive observed was 69 seconds. There were two types of diving patterns. The first consisted of repeated short dives (8 seconds) and short rest periods (7 seconds) followed after a while by a long, 20 minute rest period. The second diving pattern consisted of longer dives (20-30 seconds) and varying surface rest periods (4-183 seconds). They felt it likely that the shorter dives were to pursue prey closer to the surface. The foraging periods were crepuscular, with the birds resting for long periods during the day and not diving at night. When pursued by boat, birds that were initially together were typically separated when they surfaced and called to locate each other,

In summer, birds can be seen on the ocean immediately offshore, just outside the surf line (Marshall 1988). During the breeding season, birds occur in pairs or singles while feeding. In early spring, adults feed in pairs and subadults feed singly, whereas in early July, while adults are feeding young, there are small, mixed groups and loose aggregations of adults and subadults. They seldom feed in flocks, but while loafing three to 55 individuals may congregate (Marshall 1988).

Reproduction. Marbled Murrelet nesting chronology is summarized by Marshall (1988). Pairs are formed and only one egg is laid beginning as early as mid-April. Nesting activities continue over an extended period until late September. Both sexes incubate the egg in 24 hr shifts, with changes taking place daily. Singer and Naslund (pers. commun. 1990) observed that adults switched incubation duties at dawn each day at two nests they monitored. The egg hatches in 30 days and the young fledge about 28 days thereafter. Both adults feed the chick at least once per day and sometimes twice, but only one fish is carried to the nest at a time. Fledglings reach the sea by flying. After the nesting season fledglings with juvenal plumage and a residual egg tooth appear with adults at sea in flocks. They do not breed until after several years. As subadults they remain at sea throughout their first summer.

Carter and Erickson (1988) determined breeding dates in California as follows: egg laying from 15 April to 12 July; hatching from 15 May to 10 August; and fledging from 12 June to 20 September, and sometimes into October. Juvenal-plumaged, hatching-year birds can be seen from 1 June to 25 October, making the season very protracted. They feel that this long season could allow for a second clutch in years when high chick productivity for alcids is possible in California.

From California north through British Columbia, Marbled Murrelets have only been known to nest in large, old-growth coastal coniferous trees (Marshall 1988). In Alaska, ground nests were discovered, but they were located in tundra areas on islands with no trees and no ground predators. Marbled Murrelets have adapted to ground nesting in the treeless or scrub regions in the northern portion of their range; use both trees and the ground in forest-tundra transition areas; and in the southern portion of their range they nest only in trees.

Where trees are required (including California), it is critical that the nest be located on a vegetated branch of a conifer with an open crown that can provide easy access for adults and a clear flight path for juveniles (Carter

activity at inland sites resumes slightly during October and then continues sporadically during the winter.

On a daily basis, during the summer months in inland areas, Marbled Murrelets are five to six times more active during the morning hours than during evening hours (Paton and Ralph 1988). In the morning, flight activity starts about 40 minutes before sunrise and continues until 90 minutes after sunrise, with a peak between 30 minutes before and 30 minutes after sunrise. In the evening, the activity period is shorter, with the peak between 20 min before and after sunset. On foggy mornings flight activity starts later, but continues for a longer period (Paton and Ralph 1988, Ralph et al. 1990). It appears that Marbled Murrelet flight activity patterns are closely tied to light conditions with fairly regular activity peaks, There is only a short period during these crepuscular times for silent exchange of incubating individuals and feeding of young (Ralph et al. 1990).

Paton and Ralph (1988) describe types of flight behavior observed in Marbled Murrelets, Flying above the canopy in a straight direction is the most common type observed, followed by circling above the canopy, flying through to below the canopy, and circling below the canopy. Only rarely were murrelets observed silently landing in trees, remaining for a few minutes, and then leaving, usually without vocalizing until some distance away. These trees are not necessarily nest trees. Birds landing in trees tended to fly through canopy gaps and tended to land along the edges of these gaps (Ralph et al. 1990).

The majority of birds were observed as singles or pairs, although up to seven were once observed. More than four in one flock is very rare (Paton and Ralph 1988). The most common vocalization uttered during flight is the "keer" call, with one to three calls most commonly heard in a row, but up to nine in a row can be heard. The sounds of wing-beats can sometimes be heard from non-calling birds. There also is a mechanical jet-like sound that is emitted when the bird enters a steep dive toward the surface of the water from high in the sky. Individuals that silently landed in trees, whether single or members of pairs, did not vocalize while flying, but did vocalize a few times after landing (Ralph et al. 1990). Sometimes they landed repeatedly in the same tree.

On the ocean, birds with radio-transmitters appeared to be crepuscular in their activities, foraging actively with repeated dives at dawn and at dusk, but they did not dive at night and rested for long periods during the day (Ralph et al. 1990). When dives of short duration were repeated, it appeared that birds were feeding on prey close to the surface. When birds were pursued by boat, they dove, and then when they surfaced they called to locate one another.

During the 1989 field season (Ralph et al. 1990) none of the birds that were captured and equipped with a radio transmitter went inland. However, they did disperse readily up and down the coast for varying distances. In one case an individual moved 42 km (26 mi) north of the capture site. During the 1990 field season (Ralph et al. 1991), captured and radio-tagged birds also moved extensively, and one with a brood pouch was located inland on one occasion.

Carter and Erickson (1988) feel that Marbled Murrelet flight activity occurring regularly at the same locations over several years indicates that

nesting areas are well established and are used traditionally. Flight activity in and over old-growth forests can occur inland during every month of the year. It is expected that where high levels of flight activity are occurring, nesting is occurring nearby. Where low levels of activity are occurring, birds may be in transit between ocean and inland areas. When this is the case, birds are heard faintly from very high overhead. Birds flying just above or below the canopy, circling, and showing regular activity over time indicates a nesting area, especially when this regular and extensive flight activity occurs between May and July. During the non-breeding season, flight activity in the same area may be very fleeting or non-existent. The time of the observation also may indicate flight activity level, as birds are more active at dawn than at dusk. Except that large numbers of observations indicate high levels of activity, it is not possible to determine how many individuals observed flying actually are breeding. Both sub-adults and non-breeding adults may be involved in inland flight activities, visiting nesting areas with breeders.

Comparisons of relative flight activity before and after logging of old-growth show that birds do not use logged areas or second growth areas for breeding (Carter and Erickson 1988, Ralph et al. 1990). In fact, areas with formerly high activity levels have little or no activity after logging.

Singer and Naslund (pers. commun. 1990) describes Marbled Murrelet flight activity patterns in the vicinity of two nests. During the period of morning activity, several distinct types of flight patterns occurred near the nest. "Tail-chasing" involves the pair flying one closely behind the other at moderate to high speed through the canopy. "Buzzing" involves a single bird flying 15-20 m (16-21 yds) high through the forest while making a buzzing sound with its wings. "Stall-flight" involves a low flying individual or pair hovering over a branch or landing momentarily before flying on. "Fly-bys" involve a single bird flying silently by the nest tree at nest height, staying just outside or going through the crown.

Singer and Naslund found that birds are unpredictable in their flight direction as they leave and return to the nest, but they do tend to use the most direct and least obstructed path. The birds are more maneuverable in landing and take-offs than formerly thought. At one of the nests, the birds typically arrived from and departed to the west, flying over the tops of younger trees, landing on the branch near the trunk and walking to the nest, and then walking toward the trunk again before leaving in the same direction. Occasionally these birds would just drop off the east side of the nest. At the other nest, the birds typically landed and departed from a location on the branch half-way between the trunk and the nest, arriving from the south or southwest and flying up and down a creek canyon.

Mortality Factors and Predation. Marbled Murrelets are subject to the same naturally occurring mortality that affects all small inshore seabirds and forest-nesting birds. This may include disease, catastrophic weather events, fire, starvation due to food chain collapse, habitat loss, competition and general predation. Predators include mammalian predators on land, aquatic predators at sea, and avian predators in both cases. When population levels are large, healthy and well distributed, these naturally occurring events can cause little damage. The population dynamics are naturally geared to withstand and recover from such losses.

The problem with mortality factors and predation usually arises when they are artificially induced by humans and the species being preyed upon have population levels that are low and/or restricted. Known human-induced mortality factors for Marbled Murrelets include oil spills and gill netting, and potential factors include aquaculture, toxic chemicals in the food chain, unnatural food chain collapse due to global environmental alterations, and habitat destruction. When a population is at a low level, fragmented, and restricted in distribution and habitat requirements, human-induced mortality factors can result in extirpation or outright extinction. (see Carter and Erickson 1988, Marshall 1988, Paton and Ralph 1988, and Ralph et al. 1990 and 1991).

Singer and Naslund (pers. commun. 1990) report an apparent case of artificially-increased naturally-occurring predation on Marbled Murrelets in Big Basin State Park. Both Marbled Murrelet nests under observation during the 1989 breeding season were predated by corvids, a single Raven (*Corvus corax*) in one case and several Stellar's Jays (*Cyanocitta stelleri*) in another. Both nests were located within human use areas, but the murrelets did not seem to respond to noise from the ground. Returning adults finding an empty nest did not stay, and re-nesting did not occur at either site. Singer and Naslund feel that these predatory corvids occur in abnormally high numbers in parks where human use occurs, due to the availability of food handouts and garbage. Ravens were not observed nesting in Santa Cruz County until 1987, and one pair successfully nested near a picnic area in 1989. There also has been a correlation with an increase in Corvids and a decrease in passerine bird species. This observation does not bode well for the prospect of maintaining viable Marbled Murrelets populations in public parks, and argues against establishing visitor facilities within old-growth stands.

ESSENTIAL HABITAT

The Marbled Murrelet is dependent on two different habitats for its continued survival in California. The bird is basically a seabird and feeds entirely in the ocean. However, during the breeding season, nests are built in old-growth conifer forests situated near the ocean, and the birds travel back and forth between the nest and the nearshore feeding areas.

In a study which included observations based from shore, Ralph et al. (1990) found that during the breeding season, there were high numbers of Marbled Murrelets at sea within 0.6 km (0.37 mi) of the coast in nearshore areas with a mix of sandy and rocky substrate and that within this area the density of birds was fairly even. In a parallel study conducted further offshore, at more than 0.8 km (0.5 mi) from the coast, Ralph et al. (1990) found that most birds occurred between 0.8 and 1.4 km (0.5 and 0.9 mi) off the coast, although some were further out. They conclude that the majority of the birds are within 3.0 km (1.9 mi) of the coast during the breeding season, but that they move further offshore as the weather cools in the fall. Where the birds are specifically located during any one season is most likely a response to the availability of food items.

In an effort to determine whether or not Marbled Murrelets are restricted to breeding in coastal old-growth conifers, Ralph et al. (1990) established a set of transects. These were located between Del Norte and Santa Cruz counties in

mature second-growth forests within 27 km (16.7 mi) of the ocean. Of the 47 transects, no murrelets were detected in 80% of them. In 20% (nine) of the transects, birds were detected, but in six of these nine transects there was nearby old-growth that the birds were probably in transit to and from. In three transects where there was residual (fragmented) old-growth within or near predominantly second-growth stands, a few birds were detected. They could have been in transit over the stand, or could be visiting the residual old-growth but were not believed to be nesting there or in the adjacent mature second-growth with structural characteristics similar to that of old-growth. Mature second-growth does not appear to support breeding when it occurs isolated from old-growth or residual (fragmented) old-growth stands.

Paton and Ralph (1988) identify the primary disturbance to old-growth coniferous forests as logging. Lack of disturbance is characterized as resulting in a dense canopy closure with very large trees present (>1.5 m (4.9 ft) dbh). In survey comparisons, transects with high detection rates of Marbled Murrelets were those that had a larger concentration of very large trees than those transects with low detection rates or where no birds were detected. When the number of detections are compared with the size of the old-growth stands, those larger than 200 ha (500 ac) had the greatest Marbled Murrelet activity, whereas those with less than 40 ha (100 ac) had little or no activity. The majority of the sites with birds were in Redwood predominant forests, but this was not exclusive since these forests often contain Douglas-fir and Port Orford Cedar (*Chamaecyparis Lawsoniana*) as well.

Specific nests found by Singer and Naslund (pers. commun. 1990) in the southern part of Big Basin Redwoods State Park were located in a 1000 ha (2470 ac) stand of old-growth in the Pacific Forest Province Ecosystem. The dominant tree species are Coast Redwood and Douglas-fir, with an understory of Tanbark-Oak (*Lithocarpus densiflora*) and California Wax-Myrtle (*Myrica californica*) and a shrub layer of huckleberry (*Vaccinium*). They describe the climate as cool and Mediterranean, with high humidity, mild winters, and low summer temperatures. In the summer there is morning and evening coastal fog or low clouds. Annual rainfall of 125 to 150 cm (49 to 58 in) occurs primarily between November and May. The southern range of the Marbled Murrelet coincides with this ecosystem, which is noted for its large long-lived coniferous trees with a typical canopy of 50 to 75 m (164 to 246 ft) high.

Along coastlines with well-developed coniferous forests from British Columbia south, Marbled Murrelets are known to nest only in old-growth forests (usually defined as >200 yrs old). All nests in coniferous forest biomes have been found in trees with old-growth characteristics. Downy young have been found only in old-growth, and grounded fledglings have been found in or near old-growth forest. Inland observations of adults have been associated with old-growth forests. During the nesting season, murrelets mainly occur offshore opposite old-growth forest stands, particularly in the southern part of the range.

Some anatomical factors found in murrelets indicate evolution to adapt to older forest conditions (Marshall 1988). The bird's breeding plumage is cryptically colored and provides camouflage when resting on moss and wood. The species may need elevation (provided by taller old-growth trees) in order to gain flight, and the legs of the bird are not adapted for burrowing as occurs with other alcids.

In the southern portion of its range, the nesting requirements for Marbled Murrelets are very narrowly defined as a moss-covered limb of an adequate size for a nest with adequate space for ingress and egress. These characteristics do not occur in a young forest with no moss-covered limbs and no space between trees or breaks in the canopy. Current studies indicate that Marbled Murrelets are no longer found where old-growth forests have been cut.

DISTRIBUTION AND ABUNDANCE

In California, the Marbled Murrelet is strictly associated with inshore coastal areas and old-growth coastal coniferous forest, in particular Redwood with Douglas-fir. It has been documented that cutting of virgin forest inhabited by Marbled Murrelets has resulted in their disappearance from the area and that these birds do not use second-growth stands of timber (see Marshall 1988, Carter and Erickson 1988, Paton and Ralph 1988, and Ralph et al. 1990 and 1991).

Historical Distribution

Prior to human alteration, the northern California coastline from the Oregon border south to Monterey County supported a wide strip of old-growth Redwood forest on the west slope of the Coast Range. A similar old-growth coniferous forest continued north along the coast through Oregon, Washington, and British Columbia to Alaska. The Marbled Murrelet is adapted to use this strip of forest for breeding and the adjacent inshore, rocky and sandy coastal areas for feeding and wintering. Historically they could be found along the California coast using old-growth coniferous forest from Monterey County north to the Oregon border (Fig. 1). Grinnell and Miller (1944) state that along this coastline strip, Marbled Murrelets were found "regularly," were "plentiful" during winter, and were sometimes found up to 25 miles (40 km) inland during summer.

Carter and Erickson (1988) state that Marbled Murrelets originally bred in Monterey County, as shown by over 100 adult and juvenile specimens taken during the breeding and wintering seasons along the coast south of Point Hobos between 1890 and 1940. This intensive and long-term scientific collecting in the early 1900s may have extirpated the small breeding population of Marbled Murrelets south of Monterey Bay, the southern-most tip of their historical distribution area. Marbled Murrelets also were reported as common in northern Monterey Bay and near the Golden Gate in the late 1800s and early 1900s. A lack of historical records along the Mendocino coast is probably due to the extensive logging of coastal old-growth coniferous forests that took place there prior to any major ornithological surveys.

Historical Abundance

Wholesale logging of virgin coastal old-growth conifer forests began in the early 1800s, prior to ornithological surveys of the area. Thus, the historical abundance of Marbled Murrelets can only be estimated based on extrapolation from currently known population numbers in relation to remaining available nesting habitat. Several major assumptions must be made to arrive at an estimate of historical population abundance in this manner.

**HISTORICAL DISTRIBUTION
OF THE
MARBLED MURRELET
IN CALIFORNIA**

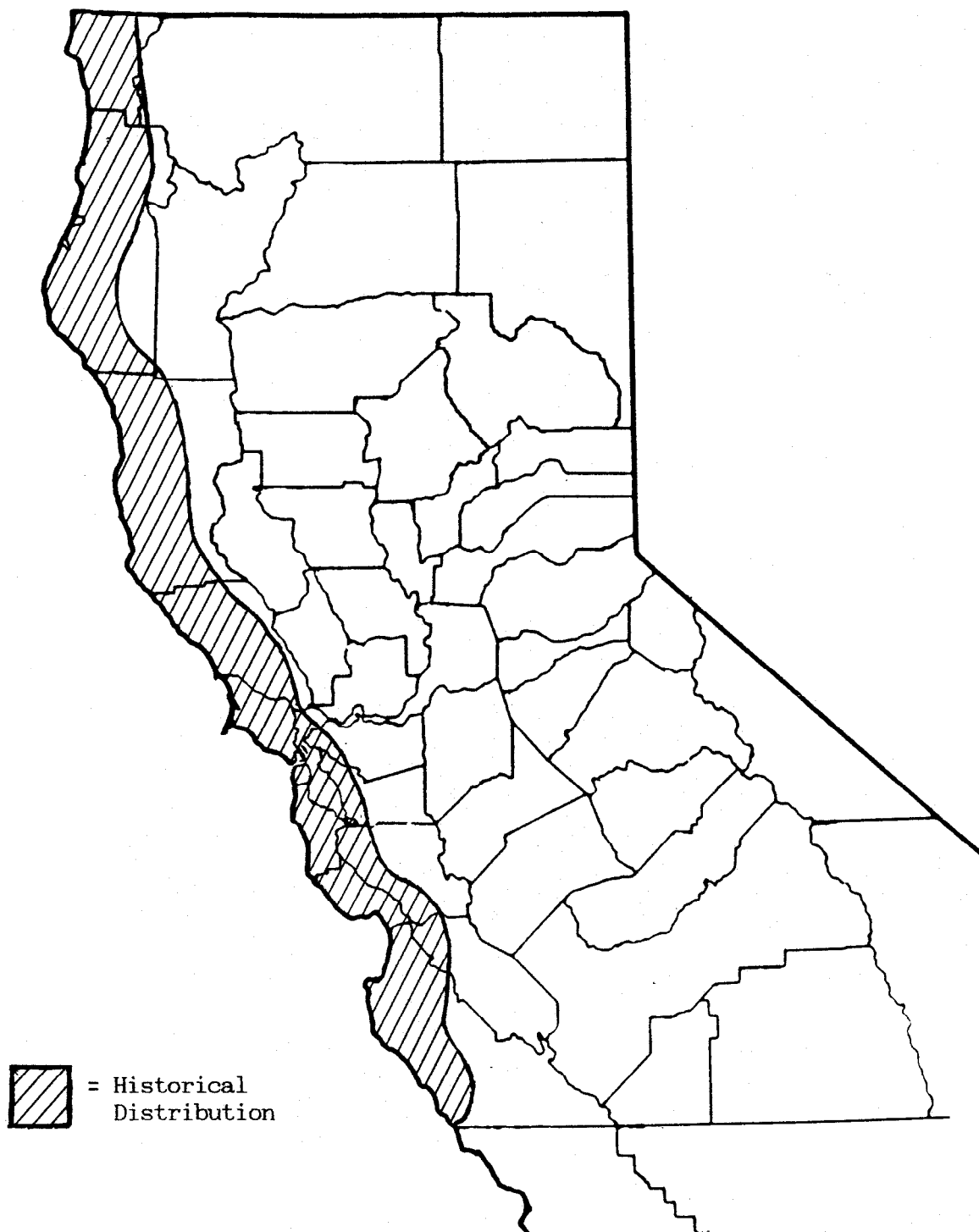


Figure 1. Historical distribution of the Marbled Murrelet in California, based on Grinnell and Miller (1944) and original extent of old-growth coastal coniferous forest.

First, all evidence indicates that Marbled Murrelets are dependent solely on coastal old-growth coniferous forest. In California, we know that only 3.5% of this habitat type remains in old-growth and that murrelets are presently breeding there. A second assumption is that the Marbled Murrelet population declines in proportion to the removal of old-growth coniferous forest and that the original forest and offshore habitat was suitable. Finally, it is assumed that availability of nest sites is now, and was historically, the limiting factor on Marbled Murrelet abundance, rather than the available food supply in the nearby inshore ocean, and that the amount of food available now is similar to that available historically. Lacking data to the contrary, these assumptions are considered reasonable.

While each of the above assumptions, if taken individually, would result in a population estimate considerably lower or higher than what historically occurred, if taken in the aggregate, they probably result in a population estimate that is somewhere near reality. The assumptions that make the estimate too high are balanced by those that make the estimate too low. Given this, our best estimate is that approximately 60,000 individuals were historically found along the coast of California.

Current Distribution

There are presently three separate populations of Marbled Murrelets remaining in California (Carter and Erickson 1988, Paton and Ralph 1988, Ralph et al. 1990 and 1991). They are associated with the three largest remaining blocks of old-growth coastal conifer forest, and are separated by areas of unused second growth (Fig. 2). These areas of separation may be substantial enough to prevent movement of individuals between populations.

The largest remaining breeding area in California is located in Del Norte and northern Humboldt counties, making up a band along the coast from the Smith River to just south of Trinidad at Little River and up to 15 km (9.3 mi) inland (Carter and Erickson 1988). Specific localities include Jedediah Smith State Park and surrounding area, Del Norte Coast Redwoods State Park and Wilson Creek area, Redwood Experimental Forest to the mouth of the Klamath River, Prairie Creek State Park, Redwood National Park, and the area east of Trinidad (Paton and Ralph 1988).

The smallest remaining breeding area is an isolated locality in south central Humboldt County on the Van Duzen and upper Eel rivers between 20 and 40 km (12-25 mi) inland (Carter and Erickson 1988). Specific localities include the Salmon Creek drainage and Elk's Head Spring, Grizzly Creek State Park, and Humboldt Redwoods State Park and vicinity (Paton and Ralph 1988).

The southern-most remaining breeding area is located in southern San Mateo and northern Santa Cruz counties between the cities of La Honda and Santa Cruz and as far as 20 km (12 mi) inland (Carter and Erickson 1988). Specific localities include Portola State Park and vicinity, Butano State Park and vicinity, and Big Basin State Park (Paton and Ralph 1988).

Current Abundance

Present population estimates for Marbled Murrelets in California have been made based on counts from at-sea seabird surveys made from boats during the spring and summer months of 1979, 1980, and 1989 by the U.S. Fish and Wildlife

**CURRENT DISTRIBUTION
OF THE
MARBLED MURRELET
IN CALIFORNIA**

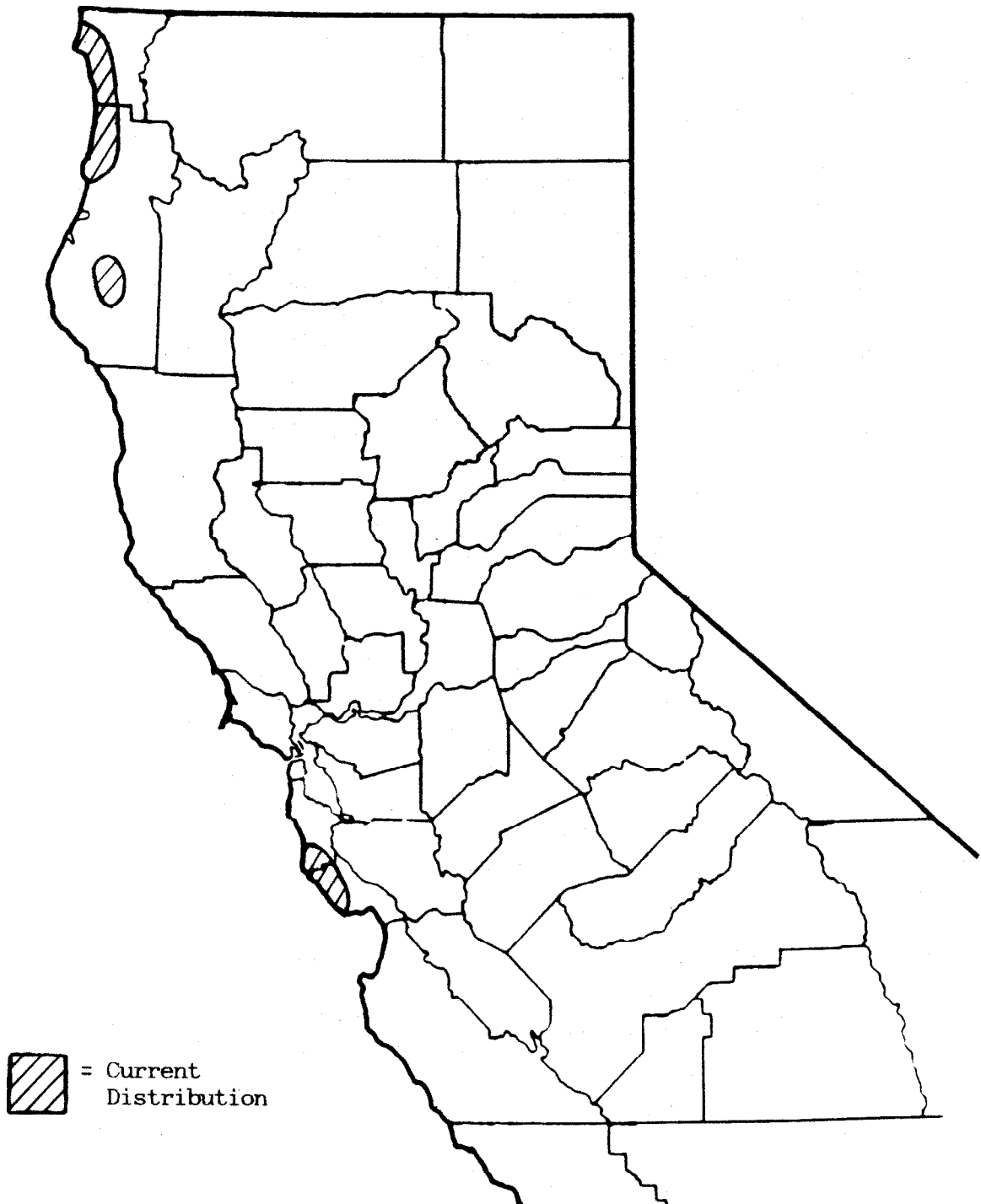


Figure 2. Current distribution of the Marbled Murrelet in California, based on Carter and Erickson (1988), Paton and Ralph (1988), Ralph et al. (1990 & 1991) and present extent of old-growth coastal coniferous forest.

Service. Counts of birds were treated similarly to obtain an overall estimate for the current abundance of Marbled Murrelets in California, SOWLS et al. (1980) counted 185 Marbled Murrelets in 1979 and 385 in 1980. Their original state-wide estimate, after adjusting for methods of counting and other factors, was 2000 individuals.

Carter and Erickson (1988) reexamined the original 1979-80 raw data; discussed methods with the original collectors; readjusted data for overlap, inconsistencies, and further knowledge of breeding behavior that has been collected since that time; and I a revised estimate. They felt that 383 individuals were sighted overall during the 79-80 survey and derived a breeding bird population estimate of 1650 Marbled Murrelets in California.

Carter et al. (1990) observed a total of 580 Marbled Murrelets in recent at-sea surveys conducted during 1989, and derived an overall estimate of 1821 Marbled Murrelets in California, similar to the prior estimates of the 1650-2000 birds. They feel that the rough nature of these estimates does not allow for an actual assessment of recent population trends. However, the magnitude of difference between historical estimates and current estimates is substantial, indicating a long-term severe decline. The best current population estimate remains between 1650 and 2000 Marbled Murrelets in California (Ralph pers. commun.)

THREATS

Habitat Destruction and Fragmentation

The major cause of decline- for the Marbled Murrelet in California has been the destruction and fragmentation of the coastal old-growth coniferous forest nesting habitat (Carter and Erickson 1988). The remnant murrelet populations are still dependent on this habitat for successful reproduction, and threats continue on the remaining 70,000 acres (3.5% of original), Approximately 10,000 acres of the remaining breeding habitat is on private timber company property that is scheduled to be logged in the foreseeable future. If a large amount of this habitat is removed, what remains will support a smaller number of murrelets. This could result in a critical lowering of the current population size, which could result in the eventual loss of the three remaining populations, The future viability of Marbled Murrelets in the state would be even more seriously endangered than at present.

Besides the central California population being isolated from the northern California populations, it is now apparent that the northern California populations are becoming isolated from the rest of the population that extends northward to Alaska (Ralph et al. 1991). The major population of Marbled Murrelets occurs from Alaska to southern British Columbia and northern Washington in the Puget Sound area. South of that the birds are found only in very small pockets and scattered numbers until the northern California population. Logging of coastal old-growth coniferous forests in Oregon and Washington has already been largely completed, resulting in the decline and severe fragmentation of the population there. Logging in British Columbia's coastal old-growth coniferous forest is continuing, and will eventually result in further decline of the species.

Fragmentation of the remaining nesting habitat also is having an effect on the suitability of habitat for murrelet nesting. The exact size of an old-growth stand that will be used by murrelets for nesting is unknown, except that it is documented that activity is much more likely in large stands than in small stands (Ralph et al. 1990).

The suitable size of remaining habitat fragments is reduced further by the edge effect. For a certain distance in from the edge of a fragment toward the center, the effects of the adjacent habitat are apparent and adversely affect suitability of the fragment, until far enough into the stand when old-growth parameters prevail as if undisturbed. This edge area must be subtracted from the remaining acreage as unusable in order to determine how much usable old-growth remains (Laurance and Yensen 1991). Besides the size of the fragment, the shape becomes very important in this edge effect. Longer edges resulting from linear habitat patches means that more acreage becomes unusable and must be removed from consideration. Applying this concept to the remaining coastal old-growth coniferous forest substantially reduces available nesting habitat for Marbled Murrelets.

Oil Pollution

The Marbled Murrelet is considered one of the most vulnerable species in North America to oil spill accidents from tanker traffic or oil drilling activities. They are particularly vulnerable because they concentrate in inshore waters very close to land (Marshall 1988). As with other small alcid, it is expected that they would die shortly after being oiled and may be found dead on beaches (Carter and Erickson 1988). Oil effects seabirds by destroying the insulation ability of their feathers with the resulting heat loss causing an increase in metabolic rate to use stored energy (Sowls et al. 1980). As the reserves are depleted and the bird cannot or will not feed, they die of hypothermia. If the bird does feed, drink or preen, oil is directly ingested, which hinders water absorption across the intestinal wall, causing dehydration, and directly effects egg formation and viability.

In California, to date, oiling events have occurred outside the breeding range or outside the breeding season, but the potential effect on breeding populations is substantial (Carter and Erickson 1988). A particularly damaging event in northern California was the 1937 Frank H. Buck oil spill, when dead Marbled Murrelets were found on beaches in the San Francisco and Bolinas areas. In central California, many oil soaked murrelets were found on beaches in Santa Cruz County in 1947 and at Morro Bay in the 1950s.

Drilling off the north coast of California has been repeatedly considered as a viable energy option, and will continue to be so considered in the future. Outer continental shelf oil development lease sales have been proposed for central California and for northern California as far north as Trinidad (Carter and Erickson 1988). Although not presently occurring, if this development proceeds, the threat to Marbled Murrelets in California will increase substantially as these lease sales are located offshore in coastal regions where murrelets concentrate, particularly during the breeding season. Any oil spilled off the coast in the vicinity of San Mateo and Santa Cruz counties could eliminate the isolated population breeding there. Any oil spilled south of Trinidad, could easily drift northwards throughout the area of highest population density, between Eureka and Crescent City.

Any one of the State's murrelet sub-populations could be extirpated by a single oil spill, and one substantial spill could eliminate the species from the State (Ralph et al. 1991). More Marbled Murrelets were killed in the Exxon Valdez oil spill in Prince William Sound, Alaska (Piatt et al. 1990), than we have in our entire population in California. In the vicinity of this spill, an estimated 11,000 to 15,000 murrelets were at risk, and during the immediate impact an estimated 7,000 were killed by oiling. The longer term impacts of this spill on murrelet reproduction and population viability remain unknown.

Gill-net Fishing Mortality

Gill and drift netting adversely impact Marbled Murrelets. Significant gill-net mortalities have occurred in nearshore areas in British Columbia and Alaska (Carter and Erickson 1988). Marbled Murrelets were the most frequently killed alcid in a salmon gill-net mortality study in British Columbia during 1979-80 (Marshall 1988). Most of these casualties occurred at night. It was estimated that 7.8% of the fall population and 6.2% of the breeding population were killed in one year. In Prince William Sound, Alaska, 600-800 per year were taken in gill nets (Marshall 1988).

Gill netting off the central California coast resulted in deaths of large numbers of Common Murres (*Uria aalge*), a closely related species, as well as Marbled Murrelets, in the early 1980s. A few deaths of murrelets in gill nets were directly observed by monitors (Carter and Erickson 1988). In addition, an estimated 150 to 300 dead murrelets were found in the Monterey Bay area between 1979 and 1987, where central California gill net fishing was concentrated.

In response to losses of Murres, gill netting was curtailed, and Marbled Murrelets have benefited as well (Carter and Erickson 1988). Eventually restrictions occurred to deeper and deeper water so there is, in effect, little or no nearshore gill netting at present in central California. In addition, closures have been made to exclude areas of highest seabird and marine mammal mortality. Although gill netting is currently not a major mortality factor in California, its potential use in the future remains a significant concern.

Predation

Although a large portion of the remaining old-growth coastal conifer forest is seemingly protected in existing state and national parks, this alone will not necessarily protect the Marbled Murrelet from extinction. Recreational use on the forest floor does not seem to directly disturb birds nesting high above in the canopy, but indirect effects may be substantial. Both nests found in California in parks have failed due to predation by corvids (Singer and Naslund, pers. commun. 1990) These common birds, including jays and ravens, often occur in unnaturally high population levels in a park situation where human food and garbage is readily available.

Increased levels of predation can substantially impact nesting birds, especially long-lived, low reproducing species like Marbled Murrelets. A breeding pair only produces one young per year and may not breed every year. Abnormally high predation means that more nests will fail in parks than in wilderness situations. Relying on existing park situations alone will result

in an inability for the population to replace itself rapidly enough to maintain viability. The final result is the long-term continued decline and eventual extirpation from California.

Environmental Variation

During the 1990 breeding season, an El Niño type of oceanic event occurred off the coast of northern California and Oregon, resulting in a lack of nutrient upwelling (Ralph et al. 1991) and a collapse of the anchovy population (Armor pers. commun.), a major food source for breeding Marbled Murrelets. Subsequently the birds were more spread out in the ocean, occurred farther offshore, and less breeding activity occurred (Ralph et al. 1991).

Although this is a natural event that a healthy population of seabirds is able to withstand, the already reduced numbers of murrelets puts them at special risk. Breeding population levels may already be too low to adequately recover from this type of environmental perturbation, especially if it occurs for several years in a row. The small numbers of remaining murrelets could be reduced to such a small population over a several year event that there will be no viable population to recover when conditions improve.

Chronic Pollution and Toxic Chemicals

Although large oil spills are a visible cause of death, low-level chronic oil pollution, small oil spills, and the build-up of other pollutants in the environment, such as pesticides and their residues, heavy metals, and by-products of industry, probably pose a more serious long-term threat to seabirds (Sowls et al. 1980). Marbled Murrelets, like most seabirds, are long-lived and feed at the top of the oceanic food chain. They are thus subject to the well-known effect of the concentration of toxics as these chemicals move up each step of the food chain. When chemical concentration is sufficiently high, reproduction is impaired and death may occur. In the past, this has been shown to effect breeding of the closely related Common Murre on the Farallon Islands in California. Marbled Murrelets most likely have been affected in the past, and now that their numbers are so low, the continued threat of chronic low-level pollution in the future remains of serious concern.

CURRENT MANAGEMENT

There are currently no official or mandated management programs specifically directed to preserve the Marbled Murrelet. Mostly, this is because the species is not yet specifically listed by either the State or federal governments as Threatened or Endangered. As a State Candidate species, the Marbled Murrelet is protected from direct take under CESA, but biological consultation is not mandated in advance of any project unless the species is actually listed. Thus, mitigation measures or project alternatives are not mandated, but left up to the discretion of the decision-making body. In such cases, the decision is often based on local economic considerations rather than available scientific information and overall welfare (statewide) for a particular species.

The U.S. Fish and Wildlife Service has recently opened an official status review of the Marbled Murrelet in California, Washington, and Oregon, in

response to a petition received from the public requesting federal listing of the species. The Department of Fish and Game responded to their inquiry with a letter regarding listing (Appendix C) and provided all available information. This is an official status review, but in the meantime, the Marbled Murrelet remains on the Federal Candidate List (Category 2). As a federal candidate species, it must be addressed in environmental documents where impact could occur, but any mitigation or project alternatives remain optional on the part of the decision-making body.

The State Department of Parks and Recreation has written a letter to the Department of Fish and Game in support of the petition requesting listing of the Marbled Murrelet. A large percentage of the remaining coastal coniferous old-growth forest is located in parks, but they are unable to justify spending funds on specific management for this species on park property until the bird is officially listed.

A substantial amount of the remaining nesting habitat for Marbled Murrelets is on private timber land. The California Department of Forestry and Fire Protection has been making decisions on Timber Harvest Plans based on presence or absence of the bird, although it is not mandated that they do so. They have denied several recent plans involving large tracts of virgin, coastal old-growth coniferous forest with evidence of murrelet use.

In response to these decisions, private timber companies appealed these denials to the State Board of Forestry. In some cases the Board upheld the denial, and in others the denial was overturned. This resulted in further law suits and further confusion regarding the official status of the Marbled Murrelet.

The State Board of Forestry has an official list of "Sensitive Species" based on the management of wildlife habitats under the Forest Practice Act. The list now contains only a few bird species. The Wildlife Habitat/Forest Practice Task Force (1990) recommended officially including the Marbled Murrelet on this list. This was strongly supported by the Department of Fish and Game in specific correspondence and rule making language specifically addressing the Marbled Murrelet issue (Appendix D), as well as in broader comments addressing all species that may be affected by forest practices on private timber land in California.

The Marbled Murrelet was recently listed by the State Board of Forestry as a "Sensitive Species" and language was adopted that requires a survey, under certain circumstances, prior to submittal of a Timber Harvest Plan for logging of private property containing old-growth coastal coniferous forest. Survey protocol is provided by the Pacific Seabird Group's and U.S. Forest Service's guide for surveying Marbled Murrelets at inland sites (Paton et al. 1990, Ralph 1991). This document provides directions, based on the best available scientific information, on how to determine whether or not murrelets are using a particular old-growth stand, Although future modification of procedures may be necessary based on ongoing research studies, for the time being this is the accepted protocol for searching for murrelets.

Use of this protocol is now mandated by the State Board of Forestry, but it only indicates probable presence or absence of the species in the proposed harvesting area. Adding the Marbled Murrelet to the "Sensitive Species" list does not provide mandatory protection, any required or suggested mitigation,

or a statewide recovery plan. Whether or not the Timber Harvest Plan is accepted or denied remains the option of the decision making body, unless the Marbled Murrelet receives official State or Federal listing as Threatened or Endangered.

A proposed interim management plan for Marbled Murrelets in Oregon has been drafted by the Oregon Department of Game and Fish (C. Bruce pers. commun.). It was originally intended that this plan would also apply to California and Washington, but only information from Oregon was immediately available and subsequently used in the draft. The conclusions of this document do not necessarily apply to the situation in California and the plan has not been accepted or authorized by the Department of Fish and Game. We feel that a comprehensive management plan for California Marbled Murrelets, using California data, should be developed as part of recovery planning activities. Further field study is necessary before a comprehensive plan to preserve California's Marbled Murrelets can be developed.

A L T E R N A T I V E S T O T H E P E T I T I O N E D A C T I O N

If the Commission should choose not to list the Marbled Murrelet, it is the Department's opinion that this bird would be deprived of protection provided through recognition and formal consultation available to a listed species. When a species is listed as Threatened or Endangered, a higher degree of urgency is mandated, and protection and recovery receives more attention from the Department and other agencies than for a non-listed species.

In the absence of listing, it would be possible to devise a management plan for this species after further study. However, this Departmental status review indicates that the future existence of this species is already seriously in jeopardy. Despite good intentions on the part of the Department and the Commission, promises of management and protection for a non-listed species do not have the weight of law behind them, and thus seldom receive high priority in the eyes of other agencies, especially in these times of limited funding. Without the benefits of listing and the cooperation of other agencies in preservation and recovery actions, the species could decline further until their populations are no longer viable, and they will no longer be able to exist in perpetuity. Eventually extinction would occur.

The petitioner has requested listing of the Marbled Murrelet as Threatened, but the Department recommends to the Commission that it be listed as Endangered. Whether listed as State Threatened or Endangered, the Marbled Murrelet would receive special consideration and protection under the California Endangered Species Act (CESA) and the California Environmental Quality Act (CEQA). The Department's status review indicates that the continued existence of the Marbled Murrelet is seriously endangered throughout its range in California, as well as in adjoining states, and that listing as Endangered is appropriate.

P R O T E C T I O N S R E S U L T I N G F R O M L I S T I N G

If listed, the Marbled Murrelet will receive protection from take during development activities subject to CEQA and be subject to formal consultation requirements under CESA. They will also be eligible for the allocation of resources by government agencies to provide protection and recovery. During the CEQA environmental review process listed species receive special consideration, and protection and mitigation measures can be implemented as terms of project approval. Species that are not listed do not readily receive protection. The status of listing provides a species with recognition by lead agencies and the public, and significantly greater consideration is given to the Department's recommendations resulting from project environmental review.

Listing this species increases the likelihood that State and Federal land and resource management agencies will allocate funds towards protection and recovery actions that benefit the Marbled Murrelet. With limited funding and a growing list of Threatened and Endangered Species, priority has been and will continue to be given to species that are listed, Those that are not listed, although considered to be of concern, are rarely given serious consideration under these circumstances.

E C O N O M I C C O N S I D E R A T I O N S

Designation of the Marbled Murrelet as Threatened or Endangered will formally subject it to CESA and CEQA, These acts would prohibit its taking and possession except as may be permitted by the Department, and subject it to formal consultation procedures. CEQA presently requires local governments and private applicants undertaking projects to consider *de facto* endangered species to be subject to the same requirements under CEQA as though they were already listed by the Commission in Section 670.2 (CEQA Guidelines, Section 15380, CCR). The Marbled Murrelet has qualified for protection under CEQA Guidelines Section 15380 for several years.

Required mitigation as a result of lead agency actions under CESA and CEQA, whether or not the species is listed by the Commission, may increase the cost of a project. Such costs may include, but are not limited to, development of management plans, purchasing or restoring additional habitat, and long-term monitoring of mitigation sites. Project modification to avoid impacts may be a less costly alternative than implementing required mitigation, The total expenses incurred in hiring consultants, preparing management plans, purchasing or restoring habitat, and long-term monitoring may be more costly than setting aside coastal old-growth coniferous forest habitat for the Marbled Murrelet. Lead agencies may also require additional measures to be employed should the mitigation project fail, resulting in additional expenditures of funds by the project proponent.

Listed status could result in significant adverse economic effects on businesses or significant cost to private persons or entities, especially in the private timber industry. This could result in loss of jobs, lower profits for companies, and reduction in the regional economy. However, only 3.5% of the original old-growth coniferous forest is remaining due to past logging activities. Private timber companies own vast tracks of second growth sustainable forest that are unsuitable for Marbled Murrelets. These companies

could offset losses by careful management of these second-growth sustainable forests. By switching from foreign to domestic log processing there would be fewer losses of jobs. Sales of old-growth property to entities interested in preservation is also a possibility. If the remaining percentage of old-growth in private ownership is not harvested, the overall economic effect on these large companies could be partially mitigated by some change of direction.

Listing of the Marbled Murrelet as Threatened or Endangered could result in additional expenditures of funds for purchase of privately owned habitat by the Department and other pertinent agencies. Restoration and expansion of coastal old-growth coniferous forest by purchase of large tracts of adjacent second growth, if approaching the mature stage, may be a necessary recovery action for this species. Purchase of old-growth property will ease any losses the private timber landowner faces from not harvesting old-growth. Donation of property could result in reduction of corporate taxes.

A potential economic benefit of listing for the local economy and the Department could result from viewing and interpretation activities involving Threatened and Endangered wildlife. Persons interested in such activities would spend money in local communities for food and lodging. This bird could be included in wildlife interpretation programs and thus contribute to public education about Threatened and Endangered species. Increased public education could result in increased contributions to the Income Tax Check-off program, which would in turn provide further funding for management and recovery activities for all listed species. Private landowners could also potentially benefit economically from increased tourism, interpretation, and educational activities. Companies that opt for preservation of ancient forests and Threatened or Endangered species will be favorably perceived by the general public.

C O N C L U S I O N S

Based on this status review of available scientific information, we conclude that the Marbled Murrelet is seriously endangered throughout its range in California due to loss of habitat, change of habitat, habitat fragmentation, loss of genetic viability, danger of catastrophic oil spills or environmental contamination, and predation. This species has declined as a result of extensive alteration of the coastal coniferous old-growth forest that historically extended along the western Coast Range from the Oregon border to Monterey County. This bird is completely dependent on and adapted to breeding in coastal old-growth coniferous forests, does not breed in second growth forests, and is now restricted to isolated fragments and thin strips of remaining habitat along the western slope of the Coast Range. The extreme fragmentation of its range has resulted in an isolated restricted population in northern Santa Cruz County and southern San Mateo County with little or no possibility of gene flow with the nearest populations, isolated in Humboldt and Del Norte counties. These isolated populations are highly vulnerable to extirpation. There is no suitable habitat between. As any population is extirpated, there is no possibility of natural recolonization of the area due to the strict breeding habitat requirements of this species. Severe population fragmentation lowers the overall viability of the species, and under these conditions it cannot be expected to survive over the long-term. In our professional judgment, the Marbled Murrelet qualifies for listing as Endangered under the California Endangered Species Act,

RECOMMENDATIONS

PETITIONED ACTION

1. The Commission should find that the petitioned action is warranted for the status of State Endangered,
2. The Commission should publish notice of its intent to amend Title 14 CCR 670.5 to add the Marbled Murrelet (*Brachyramphus marmoratus*) to its list of Threatened and Endangered Species.

RECOVERY AND MANAGEMENT ACTIONS

The Department's objective is the protection of a sufficient number of Marbled Murrelets in permanently protected sites to insure their long-term survival in their native habitat and range. In order to achieve recovery all remaining populations must be protected, monitored and proven to be self-sustaining to the satisfaction of the Department and the Commission. At the successful conclusion of a standardized monitoring program, the Department may develop appropriate downlisting or delisting criteria and reexamine the status of the Marbled Murrelet. When, in the Department's judgment recovery goals and downlisting or delisting criteria have been met, it will make recommendations to the Commission regarding changing the status of this species.

In order to achieve management and recovery objectives, the following actions should be taken:

1. The Department should establish the interagency coordination and commitment necessary to halt the continued loss and deterioration of Marbled Murrelet habitat and ensure the preservation of habitat deemed essential to maintaining the species in perpetuity.
2. All remaining old-growth coastal coniferous forest supporting Marbled Murrelets must be protected from any further modification. Private forested lands in this category could be secured through various actions including: 1) agreement with landowners as mitigation for harvest activities administered under the Forest Practices Act; 2) acquisition of conservation easements by responsible agencies; 3) development of a habitat conservation plan by the responsible agencies and the major industrial forest landowners; and 4) in-fee acquisition of Marbled Murrelet habitat by responsible agencies when other means are not feasible,
3. All logging or other destruction or modification of mature or approaching mature second-growth coastal coniferous forest should be limited, especially in areas adjacent to remaining old-growth. Consideration should be given to restoration of old-growth coastal coniferous forest habitat whenever possible.
4. Old-growth coastal coniferous forest areas of a size sufficient to maintain self-sustaining populations of the Marbled Murrelet should be identified and permanently preserved. This should include dispersal corridors of suitable habitat along the western slope of the Coast Range to allow for increased gene flow between genetically isolated

populations. The overall goal should be to physically eliminate isolation of fragmented populations by expanding existing habitat and by developing connecting habitat. Appropriate property should be purchased, protected and restored if necessary to accomplish this goal.

5. State, federal and private land maintenance and management activities should be conducted to minimize disturbance to breeding adults and existing or potential nest trees,
6. A population viability analysis of the Marbled Murrelet in California should be undertaken to determine the breeding population levels and management actions necessary to insure that the population will become healthy and viable and be able to naturally exist in perpetuity in the State, Ongoing basic research on the Marbled Murrelet should continue with support from the Department and other public and private organizations to determine specific information needed to conduct a population viability analysis and develop recovery and habitat conservation plans.
7. The Department should establish a recovery planning team to develop a comprehensive management plan for Marbled Murrelets that is specific to the situation in California and implement the plan.
8. The current gill netting prohibitions should be maintained along the coast of California within the range of the Marbled Murrelet.
9. Offshore oil drilling and nearshore transfer of oil and other toxic chemicals should be carefully controlled along the California coast within the range of the Marbled Murrelet.
10. Planned logging or any other further disruption of remaining old-growth coastal coniferous forest, within 25 miles of the coast, should be closely reviewed for presence of absence of Marbled Murrelet activity prior to approval of Timber Harvest Plans.

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