

Supplement to *Cosco Busan Oil Spill Draft Natural Resource Damage Assessment Restoration Plan/ Environmental Assessment*, dated September 19, 2011

Revised Proposal Summary for Restoration of Marbled Murrelets

The United States Fish and Wildlife Service (USFWS), the National Park Service (NPS), the Bureau of Land Management (BLM), the National Oceanic and Atmospheric Administration (NOAA), the California Department of Fish and Game (CDFG), and the California State Lands Commission (CSLC) are the Trustees for the Cosco Busan oil spill and have received comments and new information that are pertinent to potential options for restoring Marbled Murrelets injured by the spill. Consequently, they have prepared, and invite public review and comment on a document to replace the Marbled Murrelet portion of the draft Damage Assessment and Restoration Plan/Environmental Assessment (DARP/EA) found in Section 4.3.1.9 that was issued in September 2011.

The new document does not differ from the original in its summary of the injuries to Marbled Murrelets from the oil spill, nor has the injury quantification discussion changed. However, it has been rewritten to discuss a wider range of possible restoration measures and geographic locations to restore and compensate for the injury to murrelets. In particular, the Trustees have added two potential measures to the project that were not specifically addressed in the original Draft DARP/EA. The additional potential measures are conditioned taste aversion (CTA) and jay removal. In addition, the Trustees will consider implementing restoration actions in a larger geographic area which includes Marbled Murrelet Zones 4, 5, and 6.

The Trustees will defer selection of restoration projects and issuance of a final DARP/EA so that the public will have an opportunity to review and comment on the revised section regarding Marbled Murrelets.

The revised portion of the draft DARP/EA is available at:

http://www.dfg.ca.gov/ospr/Science/cosco_busan_spill.aspx

Additional information relevant to this issue has been placed in the Administrative Record, which may be accessed at:

Public comments on this revised marbled murrelet restoration proposal may be submitted by email, fax, or mail to:

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Comments are due by January 27, 2012.

4.3.1.7 Marbled Murrelets

Background

The Marbled Murrelet is a small seabird in the alcid family found along the Pacific Coast from Alaska to northern California. At sea, it feeds by diving for small fish in near-shore waters, typically within 5 km of the coastline. Unlike most alcids, the Marbled Murrelet nests up to 50 km (most within 30 km) inland in late-successional and old-growth coniferous forests. In California, it nests almost exclusively in redwoods (*Sequoia sempervirens*) 200 years old and older (Nelson 1997). Like most alcids, the Marbled Murrelet is a long-lived slow-reproducing species, laying only one egg per year.

Conservation Issues

The Marbled Murrelet is listed as a “threatened” species under the federal Endangered Species Act and as “endangered” under state law. The North American Waterbird Conservation Plan

considers it a species of “high concern,” while the National Audubon Society has placed it on its “yellow list” for species that are declining or rare. In California (Figure 8), fewer than 5,000 birds nest in Humboldt and Del Norte Counties (Marbled Murrelet Conservation Zone 4), while a much smaller population of less than 500 birds nests in the Santa Cruz Mountains south of the San Francisco Bay area (Zone 6). There are even fewer murrelets in Zone 5 (Mendocino, Sonoma, and Marin Counties). The Northwest Forest Plan estimated the population for all of Zone 5 at 48 birds, most of which presumably occur from the Gualala River north (USDA and USDI 1994). A DNA study has shown that the Santa Cruz Mountain population is genetically distinct from the others (Hall et al. 2009).

The population of Marbled Murrelets in California is declining. The primary factors affecting murrelet populations throughout California are decreased availability of suitable nesting habitat (old-growth forest) and predation by corvids (USFWS 2009). Nest predation risk appears to be related to proximity to humans (recreation sites and housing), proximity and type of forest edge to the nest, and abundance of avian predators (USFWS 2009). As a consequence of dramatic increases in corvid abundance (i.e., Stellar’s Jays and Common Ravens) in California, and especially in the Santa Cruz mountains, high corvid densities are observed around campgrounds and picnic areas located in or adjacent to murrelet nesting habitat (Peery and Henry 2010). The



Figure 8: Marbled Murrelet conservation zones

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most recent 5-year review of the species found that the Santa Cruz Mountain population is experiencing near-zero reproduction and declining at 15% per year, consistent with the annual adult mortality rate (USFWS 2009).

Injury Assessment

During the spill, three murrelets were collected oiled and dead. Based on the Ford Report (see Appendix B), which utilized the Beached Bird Model, the trustees estimate that 13 Marbled Murrelets were likely to have been killed by the spill.

During the spill, aerial surveys for Marbled Murrelets and other species were conducted over ocean waters on five different days (November 8, 9, 13, 15, and 21). Murrelets were observed in unusually high numbers off the southern Marin County coast. On the first three dates, only two birds were seen, but the flights were short and covered a small area. More extensive flights on November 15 and 21 counted 20 and 57 murrelets, respectively, as detailed in Table 2 and Figure 9.

Table 2: Results of Marbled Murrelet Aerial Surveys

	Area Surveyed (km ²)	MAMU counted	MAMU/ km ²
Nov 8	6.4	0	0
Nov 9	2.8	2	0.71
Nov 13	6.0	0	0
Nov 15	21.5	20	0.93
Nov 21	44.6	57	1.28

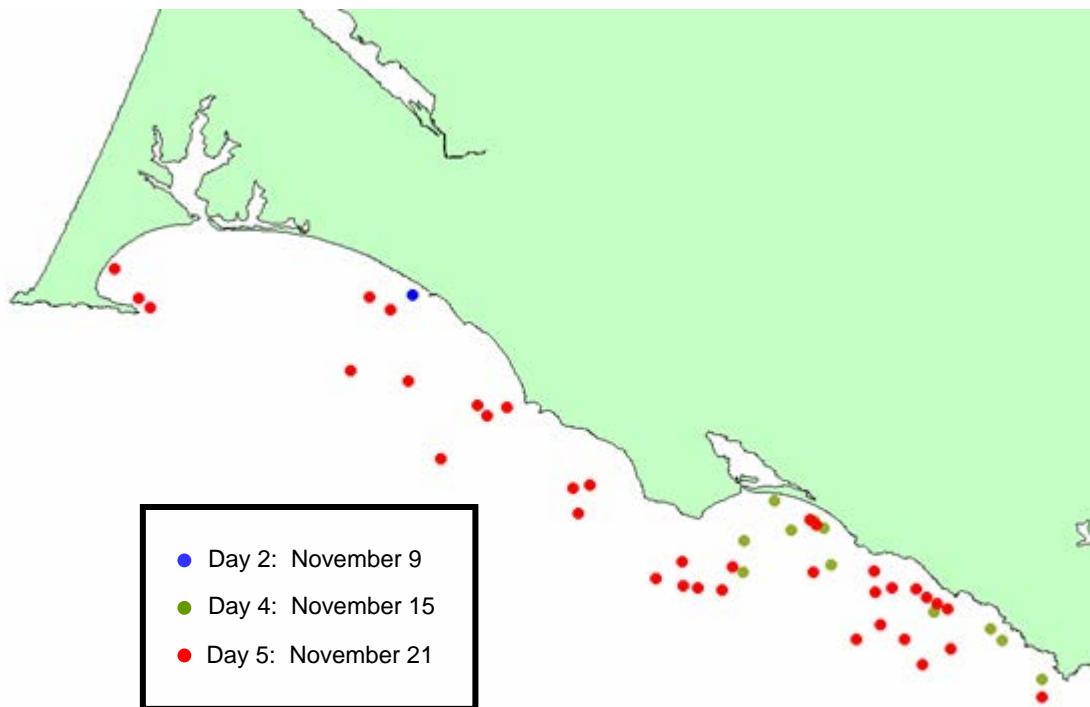


Figure 9: Location of Marbled Murrelets detected on aerial surveys after the spill.

DNA analyses of the three Marbled Murrelets collected during the spill indicate they came from northern California or points further north, and not from the Santa Cruz Mountain population. However, because birds from both populations are known to spend the winter in this area, and because birds from the Santa Cruz Mountains would have likely been in such a minority as to be missed by the sample size of three birds, the Trustees will assume birds from both populations were affected by the spill and will consider restoration actions in both areas.

Restoration Alternatives

Traditionally, two types of projects have been employed to benefit the Marbled Murrelet population when it has been impacted by an oil spill: (1) the protection of nesting habitat via acquisition of conservation easements or fee title to old-growth forests in danger of being logged; and (2) management of corvid populations to reduce their numbers around campgrounds in prime murrelet breeding areas to reduce predation on murrelet nests (eggs and chicks).

Recently, however, new research has revealed additional restoration actions that may also provide benefits to Marbled Murrelets and may enhance existing corvid management efforts (see R. Golightly comment http://www.dfg.ca.gov/ospr/Science/cosco_busan_admin.aspx; Z. Peery, pers. comm.). These include conditioned taste aversion (CTA) and jay removal. Both of these measures are essentially new forms of corvid management to protect murrelets and offer the promise of additional reductions in jay predation of murrelet nests. Increasing murrelet productivity in the short-run is vital to sustaining the species (Peery and Henry 2010). Studies and experiments regarding these methods are currently on-going.

Given the dire condition of the Marbled Murrelet population in both the Santa Cruz Mountains and in northern California, and given that new restoration methods may be developed at any time, the Trustee Council is proposing a comprehensive and flexible Marbled Murrelet Restoration Project.

PREFERRED PROJECT	SPECIES BENEFITS
Marbled Murrelet Restoration Project	Marbled Murrelet

Proposed Preferred Alternative

Marbled Murrelet Restoration Project

This project is designed to restore Marbled Murrelets using a variety of actions. These actions may be implemented anywhere in California where Marbled Murrelets may benefit (i.e., Zones 4, 5, or 6). The actions most likely to be implemented are described in detail below, and an assessment of their environmental effects is provided. If new restoration methods are developed following release of this Environmental Assessment, additional environmental compliance will be conducted as appropriate.

Nest predation by corvids, especially ravens and jays, is thought to be one of the primary causes for low productivity among Marbled Murrelets in California. Hebert and Golightly (2007) documented murrelet nest depredation by Steller's Jays and Common Ravens and recommended that steps be taken “to minimize anthropogenic activities that may increase local corvid densities

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or disturb murrelets during the early incubation period.” Corvids are the predators having the greatest impact to Marbled Murrelets (USFWS 2009).

Actions that would be implemented under the preferred project consist of expanding current corvid management efforts to additional areas as well as including additional corvid management measures. The current efforts are designed to increase Marbled Murrelet productivity by managing corvid populations in certain campgrounds where breeding murrelets, human trash and food scraps, and corvids coincide. Reducing human food subsidies is critical to reducing corvid predation pressure on murrelet nests, as these subsidies are a root cause of high corvid abundances. Such projects are already underway in the Santa Cruz Mountains (at Big Basin Redwoods, Butano, and Portola State Parks, and at Memorial and Pescadero Creek County Parks) and at Redwood National and State Parks in Humboldt and Del Norte Counties. Humboldt Redwoods and Grizzly Creek State Parks in Humboldt County meet these conditions but neither park has a dedicated corvid management program.

Current corvid management efforts include:

- education of campers and visitors regarding the effects of human food waste;
- “soft” enforcement of food storage regulations to reduce human food waste;
- improvements to garbage receptacles;
- improvements to food storage lockers; and
- removal of ravens and/or their nests.

While education efforts and improvements to garbage infrastructure have resulted in substantial reductions in relative densities of jays in the Santa Cruz mountain parks since 2003, jay densities are still over 7 times higher than in similar habitats without food subsidies (Suddjian 2010). In Redwood National and State Parks jay numbers in campground areas were 5 times higher than in control areas (Bensen 2008). The Trustees believe additional measures to decrease predation risk to murrelet nests is warranted to restore murrelets.

Under the proposed Marbled Murrelet Restoration Project, the existing efforts described above would be expanded into new areas within Marbled Murrelet Zones 4, 5 and 6 and/or augmented by the new measures listed below:

- conditioned taste aversion (CTA);
- removal of jays and/or their nests; and
- installation of food waste receptacles at water spigots (grates).

These new measures provide additional ways to address predation risk. Installation of food waste receptacles within camping and picnic areas is an additional means to improve infrastructure to reduce the amount of human food subsidies available to corvids; the effects of grates are considered to be similar to and consistent with other measures to improve infrastructure to reduce the amount of food waste in current corvid management efforts. CTA addresses predation risks by jays to murrelet eggs. Jay removal addresses high jay densities to reduce predation risk to murrelet nests (eggs and chicks).

Conditioned taste aversion (CTA) involves training jays to avoid Marbled Murrelet eggs by exposing them to painted chicken eggs (colored to mimic murrelet eggs) that contain carbachol

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shortly before the start of, and during, the murrelet incubation period. Carbachol is a drug that mimics the action of the neurotransmitter acetylcholine. It causes jays and many other species to experience temporary discomfort, nausea, and possibly vomiting when ingested. In humans, carbachol is used primarily to treat glaucoma (in eye drops) or used in eye surgery. In horses, it is given to treat colic. Treated eggs would be secured with zip-ties to branches >3 meters above the ground. Eggs would be placed in forested areas surrounding the campgrounds and picnic sites and up to 2 km away. The density of eggs placed in the forest would vary depending on jay densities, with average egg densities anticipated to be <2 eggs/ha. Jays that ingest carbachol-treated eggs are expected to associate the unpleasant experience with murrelet eggs such that they modify their behavior and avoid ingesting actual murrelet eggs they encounter in the future.

Recent cage and field studies suggest that it may be possible to safely train a large number of jays in the wild to avoid murrelet eggs (Gabriel and Golightly 2011). Gabriel and Golightly (2011) observed subdued activity, beak wiping, and vomiting in jays ingesting carbachol-treated eggs but did not observe any lasting ill effects. The advantage of this CTA approach is that it is a non-lethal predator management action that has been successfully tested on other predator species (Conover 1990; Avery et al. 1995, Cox et al. 2004). CTA would be implemented in a phased approach, with initial experimental applications to Butano and Portola State Parks and Memorial, Sam McDonald, and Pescadero Creek County Parks (all in San Mateo County), and then Big Basin State Park (San Mateo and Santa Cruz Counties). If effectiveness monitoring (see *Performance Criteria and Monitoring* section below) indicates success and funding is available, CTA may be expanded to other applicable murrelet nesting habitats in Marbled Murrelet Zones 4-6. This measure will be subject to additional environmental review and/or permitting as needed (e.g., Migratory Bird Treaty Act and CEQA).

Jay removal involves the humane trapping and subsequent euthanasia of up to several hundred jays from one or more campgrounds. As jays quickly learn to avoid traps, multiple methods will likely be necessary including baited walk-in traps, noose carpets, mist nets, and bow nets. The goal would be to reduce jay numbers in old-growth forest around campgrounds to more closely resemble jay densities observed in similar habitats without human-food subsidies. The advantage of this approach is that it immediately and directly addresses on-going jay predation pressure on murrelet nests including eggs and chicks. Methods will be consistent with the recommendations of the American Veterinary Medical Association Guidelines on Euthanasia (2007). This measure will be subject to additional environmental review and/or permitting as needed (e.g., Migratory Bird Treaty Act and CEQA).

For all Murrelet Restoration Project measures implemented, corvids and Marbled Murrelets will be monitored (see *Performance Criteria and Monitoring* section below) for the duration of the project and the associated data will be used to inform management decisions and implementation of further project components.

Additional measures may be developed in the future. These measures could augment corvid management, enhance or protect Marbled Murrelet nesting habitat, improve murrelet foraging at sea, increase murrelet productivity or survival, or perhaps achieve murrelet restoration through other avenues. If the Trustees consider implementing any such measures, the Trustees or project implementer would undertake additional environmental review, including public comment, as

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appropriate. The environmental assessment here is restricted to the most likely methods, delineated by the bullets above.

Affected Environment

This project would be located in one or more of the campgrounds and surrounding areas described above, or potentially at any campground, picnic area, or similar site near where Marbled Murrelets are likely to nest, in Marbled Murrelet Conservation Zones 4, 5, or 6. These are areas comprised of old growth and large second growth redwood and Douglas fir forests.

Environmental Consequences (Beneficial and Adverse)

This project is intended to improve Marbled Murrelet nest success through a decrease in predation caused by jays and ravens. Any improvement in nest success will help forestall, and potentially help reverse, the decline of the Marbled Murrelet species in California. Sustaining a Marbled Murrelet population through the next few decades will enable future Marbled Murrelets to access increasing amounts of protected old growth forest and second growth forest as they mature into suitable nesting habitat.

The educational components of the project will attempt to teach the public about imbalances in the ecosystem that may be caused as different species respond positively and negatively to human actions. Specifically, the public will learn how seemingly innocuous interactions with wildlife (e.g., feeding jays at a picnic table) or poor housekeeping at a campsite (e.g., leaving a bag of chips on a table) sustains corvid populations at unnaturally high levels, which in turn can have immediate and long-term negative consequences for the Marbled Murrelet. To the extent that humans adjust their behavior favorably to these messages, there may be a corresponding benefit to the environment.

As described below, corvid management measures to reduce human food subsidies to corvids (e.g., education, soft enforcement, improvements to garbage protection and food storage, and installation of food waste receptacles at water spigots) as well as on-going raven removal will have minimal, negative direct impacts on campers or on jays, ravens, and possibly other animals that scavenge food waste at campgrounds. Any adverse impacts are anticipated to be less than significant.

Campers may experience more rules and restrictions upon their food management and may be subject to an enforcement action should they fail to comply. Although this may inconvenience some campers, such measures are already in place, to a degree, in order to avoid attracting bears to the campgrounds. To date there have been no reported complaints regarding the current corvid management efforts described above. Other campers may experience the positive benefit of having a cleaner camping environment and having fewer jays and ravens surrounding their picnic table. The adverse and beneficial effects to campers would therefore be less than significant.

Reducing human food subsidies in and around campgrounds and picnic areas is intended to displace those corvids that have become dependent on human-food subsidies. Returning jay densities in murrelet nesting habitat in the vicinity of the campgrounds to levels present in similar habitat without human food subsidies will reduce nest predation risk for murrelets. The foraging ecology of jays in old growth forest habitat surrounding campgrounds and further

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removed from campgrounds is currently under investigation in Zones 4 and 6. Preliminary data indicate that jays with territories >1 km from campgrounds do not travel to forage in campgrounds (Will Goldenberg, pers. comm). Steller's Jays are common and a widely distributed species (Alaska, south to Nicaragua). The reduction in human food subsidies in murrelet nesting habitat is a small fraction of the human food subsidy available to jays from other campgrounds and picnic areas outside of murrelet habitat, and sources such as birdfeeders, etc. In addition, the number of jays potentially affected is a small portion of the regional population of jays. Therefore, any adverse impacts to jays that utilize food subsidies at campgrounds are anticipated to be less than significant.

Ravens have much larger home ranges than jays. Current monitoring indicates that the relative abundance of ravens is much lower than jays, so fewer individuals will likely be affected either by reductions in foraging opportunities around campgrounds or by lethal removal actions. Ravens are abundant in California and the small numbers removed from campgrounds will not adversely impact any regional raven populations. The adverse effects to ravens would therefore be less than significant.

In toxic doses, carbachol stimulates all bodily secretions, produces severe gastrointestinal colic, diarrhea and shortness of breath, increases then slows heart rate, and can cause respiratory paralysis or heart block. A recent study found that jays ingesting egg contents treated with 24 mg or 32 mg of carbachol may vomit or experience gastrointestinal discomfort resulting in subdued activity up to several hours, and beak wiping which may last from several minutes, up to an hour (Gabriel and Golightly 2011). Based on an average weight of 115 g for jays, ingestion of the entire 24 mg treated egg would result in an available dose of 209 mg/kg. Most of the jays in the study consumed only a fraction of the available dose. Gabriel and Golightly (2011) reported that there were no jay mortalities at either dose, no observable lasting adverse effects, and all experimentally-dosed jays were later released back into the wild and subsequently re-sighted alive. The toxicity of exposure of birds to carbachol-treated eggs would vary with the dose of carbachol ingested as well as the frequency and duration of the exposure. However, with this aversive 24 mg dose, conditioning is expected such that birds will avoid ingestion of additional treated eggs, limiting their exposure. Therefore, no significant adverse effects are expected for jays ingesting carbachol-treated eggs. Conditioned jays that will no longer ingest murrelet eggs are unlikely to suffer from food deprivation as bird eggs are not a major food source for jays and murrelet eggs are themselves, relatively rare among forest birds.

Other avian egg predators that may be exposed to carbachol-treated eggs include Gray Jays (*Perisoreus canadensis*), ravens, and possibly crows. Gray Jays occur in coastal coniferous forests along the coast from Alaska to Mendocino County, California and are uncommon in Redwood National and State Parks near the southern extent of their range. They are smaller than Steller's Jays (75 g vs. 115 g) so ingestion of an entire carbachol-treated egg would result in a larger dose. However, the dose received by a Gray Jay would be within the range of doses safe for Steller's Jays as determined in Gabriel and Golightly (2011). Therefore, the Trustees anticipate that even if Gray Jays ingested the contents of treated eggs, there would be no significant adverse effect to individuals or regional populations. Ravens and crows are larger than Steller's Jays so they would effectively receive a smaller dose. It is not certain that this dose would induce aversion. If ravens and crows that ingest carbachol-treated eggs are successfully

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conditioned to avoid murrelet eggs, they are unlikely to suffer from food deprivation because they are omnivores with diverse diets like jays. Murrelet eggs are likely to make up a very small portion of their diet. The Trustees anticipate that any adverse effects to other corvids are less than significant.

In a pilot experiment, 214 carbachol-treated eggs were placed in a systematic grid covering 428 ha (Gabriel and Golightly 2011). In addition to corvids, black bears (*Ursus americanus*) and small mammals were suspected of predating the eggs in the pilot study. Given the large size of bears, relative to the dose of carbachol, no adverse effects to bears is expected from ingestion of treated eggs and therefore effects are expected to be less than significant.

Raccoons (*Procyon lotor*), Virginia opossums (*Didelphis virginiana*), ringtail cats (*Brassariscus astutus*), weasels and mink (*Mustela spp.*), fishers (*Martes pennanti*), pine martens (*M. americana*), spotted skunks (*Spilogale gracilis*), and to a lesser extent striped skunks (*Mephitis mephitis*) potentially could encounter and opportunistically ingest treated eggs. The safe and lethal doses are unknown. Raccoons and opossums are common, occurring over a widespread geographical area. Given the limited geographical area in which eggs will be placed and low densities of treated eggs, the number of animals potentially exposed will be small relative to the local and regional population levels. Any adverse impacts are expected to be less than significant for raccoons and opossums.

Dogs, cats, and ferrets are carnivores that respond to known emetics (Andrews and Horn 2006), and it is expected that ringtails, weasels, mink, fishers, pine martens, and skunks also have the ability to vomit. Based on a cited report of nausea and vomiting in dogs dosed with 3 mg/kg carbachol (Naunyn-Schmiedeberg's Archiv fuer Experimentelle Pathologie und Pharmakologie. Vol. 164, Pg. 346, 1932), it is anticipated that ingestion of treated egg contents would cause gastrointestinal stimulation resulting in nausea or vomiting. As vomiting purges the body of toxic substances and reduces exposure, it is unlikely that a lethal dose would be ingested in these wild carnivores. If ingestion of carbachol-treated eggs results in successful conditioning to avoid murrelet eggs, it is unlikely that these carnivores would suffer from food deprivation because eggs are a minor portion of the diet and they are highly unlikely to encounter murrelet nests. Fishers are not present in the Santa Cruz Mountains (i.e., Murrelet Conservation Zone 6) and are rare in Redwood National Park. If present in the project area, it is unlikely that fishers will encounter treated eggs as they forage mostly on the ground. Given the limited geographical area in which eggs will be placed and low densities of treated eggs, the number of animals potentially exposed will be small relative to the regional population levels for these predatory mammals. Therefore, any adverse impacts are expected to be less than significant.

Rodents, such as rats (*Rattus spp.*), woodrats (*Neotoma spp.*), deer mice (*Peromyscus spp.*), house mice (*Mus musculus*), Douglas' squirrel (*Tamiasciurus douglasii*), Northern flying squirrel (*Glaucomys sabrinus*), Western gray squirrel (*Sciurus griseus*), and chipmunks (*Tamias spp.*) also may encounter and ingest treated eggs. The lethal dose is 40 mg/kg for rats (Journal of Pharmacology and Experimental Therapeutics. Vol. 58, Pg. 337, 1936) and 5 mg/kg for mice (The Merck Index: Encyclopedia of Chemicals, Drugs and Biologicals S. Budavari (ed.), Rahway, NJ, 1989). Mice and rats, and presumably squirrels and chipmunks, are physically unable to rid themselves of toxic substances by vomiting (Andrews and Horn 2006). Partial

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consumption of treated egg contents for these small rodents species could result in a lethal dose. These rodent species are common in forested habitats. Given the relatively small geographical area in which treated eggs will be available, limited duration of potential egg exposure, the low density of treated eggs, and the limited number of individuals potentially exposed to eggs relative to the rodent population levels, any adverse effects to rodents are expected to be minor, short-term, and less than significant to the local and regional populations.

The minimum lethal human dose for carbachol has not been delineated. However, given that treated eggs will be secured with zip-ties to branches >3 meters above the ground, at very low densities (<2 eggs/ha), and non-depredated eggs will be removed at the end of the murrelet incubation period, it is highly unlikely that humans will encounter, much less ingest, treated eggs.

Jay removal around campgrounds to more quickly reduce jay densities to levels observed in similar habitats without human-food subsidies is expected to benefit murrelets by reducing jay predation on eggs and chicks. Humane trapping methods will minimize adverse impacts to other non-targeted forest birds that will be released if captured. Removal of jays from campground areas may also provide benefits to other forest nesting birds by reducing their predation risk. Jays are common around campgrounds in murrelet habitat, especially in the Santa Cruz Mountains (Suddjian 2010), but the numbers removed will not adversely impact any regional populations. The adverse effects to jays would therefore be less than significant.

Probability of Success

The success of camper education and garbage control relies on several linkages: the link between project tasks and an actual reduction in food waste; the link between a reduction in food waste and an actual reduction in corvid numbers; and the link between a reduction in corvid numbers and an actual reduction in nest predation.

The first two linkages have been demonstrated in the Santa Cruz Mountains, where education and outreach efforts, combined with improved garbage facilities, has led to a substantial drop in relative jay density at the campgrounds (Suddjian 2010).

The final link between corvid numbers and actual nest predation is difficult to measure directly because Marbled Murrelet nests are difficult to find and study. However, experiments with artificial eggs have found that predation pressure declines with decreasing corvid density (Raphael et al. 2002). Thus, the changes to food storage and food waste infrastructure in campgrounds and camper education to reduce human-food subsidies for corvids has a reasonable probability of success over the long-term.

The success of CTA has been demonstrated in a cage study and a pilot field study in Zone 4 (Gabriel and Golightly 2011). It is not known whether a larger-scale implementation exposing jays to treated mimic eggs will result in concomitant increases in murrelet productivity. Even if CTA is completely successful, if jay densities are high enough, predation pressure on chicks may offset increases in egg survival. Jay removal to reduce jay densities near campgrounds in murrelet nesting habitat is expected to decrease predation pressure on murrelet nests. Preliminary research by Peery (pers. comm. 2011) has found that naïve jays are remarkably easy to capture

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near campgrounds. There is some uncertainty as to the duration of benefits for both of these projects. Specifically, the duration of conditioning in wild jays is not fully understood. Nor, as to the jay removal component of the project, is the response of non-territorial jays that may backfill into a removal area known. Given these unknowns and uncertainties, the Trustees intend to conduct pilot evaluations in a few selected areas prior to full-scale implementation.

Performance Criteria and Monitoring

Because Marbled Murrelet nests are difficult to find, and nest predation difficult to study directly, the success of the project will be monitored through Marbled Murrelet surveys, corvid surveys, and annual progress reports from the land managers on the implementation of the corvid management tasks. A strong emphasis will be put on post-breeding at-sea surveys for murrelets, as these surveys are the easiest way to monitor murrelets, including juveniles and determine reproductive rates. Monitoring for potential non-target species effects, for example installing cameras focused on mimic eggs to identify predators, will be included as part of conditioned taste aversion implementation.

Evaluation

The Trustees have evaluated this project using the threshold and additional screening criteria developed to select restoration projects and concluded that this project is consistent with and meets the objectives of these selection factors. They believe that this type and scale of project, if successful, will effectively provide appropriate compensation for all Marbled Murrelets injured as a result of the spill and have therefore identified this project as the preferred alternative.

Other Restoration Projects Considered

The Trustees have identified as the preferred project, a project that includes corvid management actions in Zones 4 through 6.

OTHER PROJECTS CONSIDERED	SPECIES BENEFITS
Corvid management at Humboldt Redwoods and Grizzly Creek SPs	Marbled Murrelet
Breeding habitat protection via acquisition or easement (various sites)	Marbled Murrelet

Corvid management at Humboldt Redwoods and Grizzly Creek State Parks

This was the preferred project in the initial version of this section of the Draft DARP. It is retained in this version, but expanded upon to include a broader geographic area and a wider array of murrelet conservation measures. Given the critical condition of the Marbled Murrelet in California, the Trustees believe that greater flexibility in addressing the species' conservation needs is necessary.

Breeding habitat protection via acquisition or easement

This project is not excluded under the current proposed project, but is part of it, should a suitable parcel become available. As land acquisition or conservation easements may only be undertaken from a willing seller and such opportunities are limited and difficult to predict, the Trustees anticipate that the Murrelet Restoration Project will initially focus on corvid management measures. Any acquisition or easement if undertaken, is not expected to result in any significant adverse impacts; public lands are not under consideration so there would be limited adverse impacts to recreational uses. If a specific

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parcel(s) is identified, depending on the circumstances, further environmental analysis may be undertaken.

CITATIONS:

- American Veterinary Medical Association [AVMA] Guidelines on Euthanasia [June 2007].
http://www.avma.org/issues/animal_welfare/euthanasia.pdf
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