EVALUATIONS OF BENEFITS TO SEABIRDS AND WATERFOWL FROM PROPOSED MARINE PROTECTED AREAS AND SPECIAL CLOSURES IN THE NORTH CENTRAL STUDY REGION, CALIFORNIA

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In this document, proposed marine protected areas (MPAs) for the MLPA North Central Coast Study Region (NCCSR) are evaluated for their potential benefits to seabirds, waterfowl, and shorebirds in relation to Goal 2 of the California Marine Life Protection Act. Evaluations follow the methods described in "Methods Used to Evaluate Draft MPA Proposals in the North Central Coast Study Region."

Evaluations include all species combined (where appropriate) and species most likely to benefit. For seabirds, evaluations are subdivided by subregions (or bioregions; North, South and Farallon Islands) because of the large differences in species abundances between these areas. For waterfowl, comprehensive and standardized data were available only for the coastal estuaries from Bodega Bay to Rodeo Lagoon. Because of the relatively small portion of the coast these encompass, evaluations of waterfowl in the estuaries were not subdivided by subregions.

Eleven species of seabirds from three families breed in the NCCSR. Over forty more species occur as migrants or in winter. In addition, the Black Oystercatcher, while technically a "shorebird", is often lumped with the seabirds because of their strictly coastal distribution and association with seabird breeding colonies. As upper trophic level predators, seabirds are important components of marine ecosystems. Seabird diets vary, but generally include various juvenile fish and invertebrates that are locally abundant. In central California, important seabird prey include rockfish, anchovies, various flatfish, cottids, tomcod, krill, mysid shrimp and squid, among others (e.g., Ainley et al. 1990). Seabirds have been recognized as an efficient monitoring tool for ocean conditions and, in some cases, for predicting stocks of important fisheries (e.g., Ainley and Boekelheide 1990, Cairns 1992, Sydeman et al. 2001, Mills et al. 2007, Roth et al. 2007). Ecologies of the different species of seabirds vary. For example, some species forage primarily at the ocean surface, while most species dive to various depths. Many species such as albatrosses, shearwaters, and petrels only come to land to breed and spend the remainder of their lives at sea. Many other species, such as most pelicans, cormorants, and gulls, come to shore on a daily basis to rest, preen, or bathe. For pelicans and cormorants, trips ashore are essential for survival because their wettable plumage must be dried to avoid hypothermia. For most species, preferred breeding habitats are on offshore rocks, islands, or mainland cliffs free of mammalian predators.

Over 25 species of waterfowl (geese and ducks), ten loons and grebes, five herons and egrets, and nearly 30 "shorebirds" (plovers, sandpipers) occur in the NCCSR. Most species occur as migrants or over-winter in the region. Nearshore outer coast waters or estuaries are the principal habitats of these birds. Loons, grebes and some of the "diving ducks" (e.g., scoters, scaup, bufflehead, mergansers) mainly dive for small fish. Many of the diving ducks prey on shellfish, worms and other benthic prey. Most shorebirds forage on intertidal mudflats where they prey on small shellfish, worms, and other benthic invertebrates. A few species, including the Black Turnstone, Ruddy Turnstone, Surfbird, Black Oystercatcher, and Wandering Tattler are primarily rocky intertidal species, while the Snowy Plover occurs on sandy beaches. The coastal estuaries of the NCCSR are recognized for high diversity and

abundance of wintering and migrant waterfowl and shorebirds (Shuford et al. 1989, Kelly and Tappen 1998).

Seabirds and other waterbirds may benefit in several ways from marine protected areas in the NCCSR. For example, most species are known to be sensitive to human disturbance to varying degrees (summarized in Carney and Sydeman 1999). Impacts of human disturbance are known to be greatest at breeding sites, where reproduction can be dramatically affected. Because most seabirds are colonial breeders (e.g., nesting in high concentrations), high proportions of populations can be affected by severe or frequent disturbances. Similarly, seabirds and other waterbirds often concentrate at resting sites ("roosts") and foraging areas where they can be sensitive to disturbance (e.g., Jaques et al. 1996, Kuletz 1996, Rodgers and Schwikert 2002, Jaques and Strong 2002, Speckman 2004, Peters and Otis 2006). Because of these sensitivities, many observers have recommended disturbance-free "buffer zones" or other management actions around colonies, roosts, or important foraging areas (Carney and Sydeman 1999, Jaques and Strong 2002, Rodgers and Schwikert 2002, Ronconi and St. Clair 2002).

At seabird and other waterbird breeding colonies, roosts, and foraging areas, impacts to birds tend to be most pronounced when humans enter the immediate area. Responses vary by species and location, but for many species, intrusion results in most if not all birds fleeing from the immediate area. Birds on nests often will flee, leaving the eggs or chicks behind. During that time, nest contents are susceptible to predators such as gulls. While some birds return to nests once an intruder has gone, others tend to abandon nesting efforts. For example, Brandt's Cormorants have been observed to abandon nests en masse from even single events of human intrusion to the colony (McChesney 1997). Many studies have documented reductions in breeding success and colony attendance, as well as colony abandonment, resulting from human intrusion (Carney and Sydeman 1999). Birds disturbed at foraging areas can incur high energetic costs, with high energy utilization spent while fleeing and reduced energy intake because of lost foraging time. Thus, disturbance can lead to low fitness of individual birds, leading to abandonment of popular foraging areas or starvation (Davidson and Rothwell 1993).

Although often not as easily identified, activities such as close approaches to colonies, roosts, and foraging areas or loud noises can evoke responses similar to direct human intrusions. Close approaches can include humans on foot, boats, low-flying aircraft, motor vehicles, surfers, or other sources (e.g., Jaques et al. 1996, Carney and Sydeman 1999, Jaques and Strong 2002). Studies of such disturbances on seabirds and other waterbirds have shown various results that often depend on species, location, habitat, and level of habituation to human activity. However, several studies have shown reductions in breeding success or population sizes as a result of such human disturbance (e.g., Wallace and Wallace 1998, Carney and Sydeman 1999, Thayer et al. 1999, Beale and Monaghan 2004, Bouton et al. 2005, Rojek et al. 2007). In some cases, reductions in breeding success from disturbance can occur in the absence of visible behavioral changes (Beale and Monaghan 2004).

Disturbance at breeding sites prior to or early in the breeding season can also preclude site use. For example, upon arriving at the colony site to breed, Brown Pelicans will abandon the site quickly if disturbed (Anderson and Keith 1980). Brandt's Cormorants also will abandon disturbed sites for long periods, sometimes lasting years (McChesney 1997, pers. obs.; Wallace and Wallace 1998). When protected from disturbance, seabirds can quickly colonize desirable habitats.

Seabirds and other waterbirds may benefit from MPAs if restrictions on fishing result in reduced boating activities and resulting disturbances at breeding colonies, roosts, and in some cases, foraging areas. For example, at study colonies in central California, most boats observed approaching close to colonies are recreational fishing boats that are either fishing or transiting between nearby fishing spots (USFWS unpubl. data; G. McChesney, pers. obs.). At Point Reyes in 2007, 93% (n = 43) of vessels approaching within 1,500 feet of colonies were either private or charter fishing boats. Most boats remained beyond the limits of the Point Reyes Headlands Marine Conservation Area, which does not permit recreational fishing within 1,000 feet of most of the headlands. However, since MPAs do not restrict access, their utility for protecting seabird colonies may be limited.

Seabirds and other waterbirds also may benefit from MPAs if increases in their forage base occur as a result of the MPAs. Since the seabird species most likely to benefit mainly forage on juvenile fish, increased recruitment of prey species would be a needed result to benefit these seabird species. These species are sensitive to changes in prey availability that can have dramatic effects on breeding success, survivorship, and population status (Ainley and Boekelheide 1990, Nur and Sydeman 1999, Sydeman et al. 2001). For example, the Pelagic Cormorant and Pigeon Guillemot colonies at the South Farallon Islands have undergone declines in reproductive performance and population size, apparently due to decreased prey availability. These reductions are consistent with a decline in the numbers of juvenile rockfish fed to chicks that began in the early 1990s (Sydeman et al. 2001, Warzybok et al. 2007). For waterfowl, the eelgrass beds of the coastal estuaries provide food that is crucial for Brant and several species of dabbling ducks. The eelgrass beds also provide spawning habitat for Pacific herring. Several species of waterfowl, including Brant, scaup, Bufflehead, and Surf Scoters, feed extensively on herring roe, while loons, grebes and cormorants prey on adult herring (Kelly and Tappen 1998). Protection and restoration of eelgrass beds, as well as assuring an abundance of spawning herring, would provide direct benefits to these birds.

METHODS

Seabird Breeding Colonies

Data used for these analyses mainly were from colony survey data in the draft NOAA Biogeographic Assessment for the Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sanctuaries provided to the MLPA process. Included are population estimates from the last statewide seabird colony survey in 1989 (Carter et al. 1992) except for colonies with more recent estimates (up to 2004) provided by several sources. For breeding colonies, species most likely to benefit include Brandt's Cormorant, Pelagic Cormorant, Double-crested Cormorant, Common Murre, and Pigeon Guillemot because of their higher sensitivity to disturbance from boating and other human activities (Carter et al. 1984, McChesney 1997, Wallace and Wallace 1998, Carney and Sydeman 1999, Ronconi and St. Clair 2002, Rojek et al. 2007; G. McChesney, pers. obs.). Brandt's Cormorant, Double-crested Cormorant, and Common Murre breed in dense concentrations mainly on the flatter or more gently sloped portions of offshore rocks but sometimes on steep cliffs, including on the mainland. Pelagic Cormorants nest in lower density clusters on cliff ledges. Pigeon Guillemots nest underground in rock crevices or burrows, but congregate on the ground surface and waters adjacent to colonies. These

congregations will flush and scatter at the approach of boats (see Ronconi and St. Clair 2002 for the similar Black Guillemot).

Evaluations included all proposed MPAs, including SMRs, SMCAs, and SMPs. However, SMPs are not viewed as a benefit to seabirds since disturbance and take of prey species from recreational activities may increase impacts to seabirds. Thus, in relation to benefits to seabirds, comparisons between MPA proposal packages did not include SMPs. Because SMCAs permit certain types of fishing activities, they may not benefit seabirds to the same level as SMRs and not all SMCAs were included in comparisons between proposals. Because boat-fishing for groundfish and other nearshore fish, urchin, and abalone have been the most commonly observed fishing causing disturbance to seabird colonies in central California (at least from Point Reyes south; USFWS, unpubl. data), benefits to colonies and roosts from SMCAs prohibiting these activities may be similar to SMRs, although this may vary by location. Thus, proposed SMCAs prohibiting boat-fishing for groundfish and other nearshore fish, urchin, and abalone were not treated separately from proposed SMRs in comparisons.

Evaluations include numbers of species (species diversity), numbers of birds, and percentages of subregional populations breeding within each MPA proposed (Tables 2-6) and subregional totals for each draft MPA proposal (Table 7). A comparison of proposals is also provided. In this document, percentages cited are the percentages of the subregional populations. Seabirds were examined on the subregional level because of substantial differences in species abundances between subregions. However, one breeding species, the threatened Marbled Murrelet, is not included because these birds nest inland in old-growth forests.

Major Seabird Roosts

Seabirds come to land and rest, or roost, on a variety of habitats including offshore rocks, coastal cliffs, beaches and river mouths. Not all species regularly roost on land outside the breeding colonies but for some species it is energetically essential to come to land daily or nearly so to rest, sleep, preen, or dry their feathers. Many birds actually spend a substantial part of their time on land at roosts during both the breeding season and nonbreeding season. In the NCCSR, common seabirds at roost sites include Brown Pelican, three species of cormorant, and four species of gulls, among others. Access to undisturbed roosting habitat near major foraging areas is important during all parts of the seabird life cycle.

In the NCCSR, little broad-scale data are available on seabird roost sites, although several are recognized as important. However, broad-scale data is available for the endangered Brown Pelican from surveys conducted intermittently from 1986 to 2000 by D. L. Jaques and others. These surveys were conducted in the fall during the period of peak pelican abundance. Since pelicans often share roost sites with other seabirds, roost sites for the Brown Pelican were used as a surrogate for all seabirds. Pelicans also serve as a good indicator species for roosts because of their high sensitivity to disturbance (Anderson and Keith 1980, Jaques et al. 1996, Jaques and Strong 2002, Rodgers and Schwikert 2002). In the recovery plan for the endangered California Brown Pelican, protection of roost sites was identified as a primary objective (USFWS 1983).

Data for this evaluation were obtained from a summary of major pelican roosts between Bodega and Cambria (San Luis Obispo County) prepared for the Gulf of the Farallones National Marine Sanctuary,

augmented with additional data from roosts between Bodega and Point Arena (D. L. Jaques, Pacific Eco Logic, Astoria, Oregon, unpubl. data). Data were available for major roosts (i.e., >100 birds) only and categorized as: >100 birds; >500 birds; or >1000 birds. Evaluations were based on the numbers of major roosts in each roost size category included within each proposed MPA. MPA categories were treated the same as for Seabird Breeding Colonies (above).

Seabird Foraging Areas

Focal species most likely to benefit from increases in forage base were examined: Brandt's Cormorant, Pelagic Cormorant, and Pigeon Guillemot. During the breeding season, these species mainly forage within a few miles of colonies (Briggs et al. 1987, Ewins 1993, Hobson 1997, Mason et al. 2007). Along the mainland coast, most foraging occurs within about one mile from shore. In areas with broad continental shelves, birds forage farther from shore more often, especially Brandt's Cormorants (Briggs et al. 1987, Ainley et al. 1990). At the offshore Farallon Islands, Pelagic Cormorants and Pigeon Guillemots forage mainly within a radius of about 3 miles from the colony. Brandt's Cormorants also forage largely within this zone, but will forage more widely when prey resources near the islands are low, commuting as far as the mainland coast (Ainley et al. 1990).

The favored foraging habitats for Pelagic Cormorants and Pigeon Guillemots are among submerged reefs, where they feed on juvenile rockfish, other small fish, and certain invertebrates (Ainley et al. 1990; Appendix 2). Brandt's Cormorants feed over a variety of habitats, including submerged reefs and soft bottom habitats, but prefer midwater depth zones over soft bottom where they feed on a wide variety of prey including juvenile rockfish, anchovies, Pacific tomcod, sanddabs, and squid (Ainley et al. 1990, Wallace and Wallace 1998; Appendix 2). Because of their lower dependency on prey such as rockfish and ability to feed on more mobile prey such as anchovies, Brandt's Cormorants may not benefit from the MPAs proposed as much as Pelagic Cormorants and Pigeon Guillemots.

Species that were not evaluated typically forage more widely, often beyond the 3-mile state limit, and on more mobile prey such as anchovies and sauries, or krill (Ainley et al. 1990). Exceptions to this are the Double-crested Cormorant and the federally threatened Marbled Murrelet. Coastal breeding Double-crested Cormorants are localized and forage mainly on fish in estuarine habitats (Ainley et al. 1990). The southernmost population of the Marbled Murrelet nests inland in old-growth forests of the Santa Cruz Mountains, near the southern limit of the NCCSR. Birds forage in adjacent nearshore habitats, mostly on juvenile fish and krill (Becker et al. 2007). Murrelets may benefit from MPAs if recruitment and availability of their preferred prey (e.g., juvenile rockfish) increase as a result of MPAs. Also, murrelets can be impacted from boat disturbance at foraging areas (Kuletz 1996, Speckman et al. 2004), so reductions in boating activity may provide benefits to the species.

To evaluate proposed MPAs, GIS software were used to create buffers along three miles of coast and to one mile offshore from colonies in the North and South subregions. This is thought to encompass most of the foraging ranges for these species during the breeding season. In the Farallon Islands subregion, buffers included all areas within three miles of the islands based on known foraging distributions (Ainley et al. 1990; Draft NOAA Biogeographic Assessment). For the Brandt's Cormorant, we recognize that a buffer of three miles encompasses a smaller portion of the foraging range, but outside of

this range these birds likely forage more on pelagic wetfish and other more mobile species less likely to benefit from these proposed MPAs.

The three mile by one mile colony buffers were overlaid with proposed MPAs and the area of overlap determined. For each species, proportions of the foraging range overlapping MPAs were then weighted based on the proportion of the subregional population breeding at that colony. Final weighted values are reported.

MPA categories were treated in a similar fashion as for Seabird Breeding Colonies (above). Because these seabirds will benefit most from protection of prey species most likely to benefit (i.e., less mobile groundfish), SMCAs not permitting fishing of groundfish were considered beneficial for improving seabird forage base. MPAs permitting take of pelagic wetfish (e.g., anchovies, sardines, squid) may decrease forage base for certain species of seabirds, including the Brandt's Cormorant. However, since pelagic wetfish are not considered species most likely to benefit from these MPAs because of their highly mobile behavior, SMCAs allowing take of wetfish were still considered beneficial to the seabird species evaluated.

Wintering Waterfowl

The coastal estuaries of the NCCSR are recognized for high diversity and abundance of waterfowl, with migrant and wintering populations numbering in the tens of thousands (Shuford et al. 1989; Kelly and Tappen 1998; USFWS, unpubl. data). Since the 1980s, the U.S. Fish and Wildlife Service has conducted an annual aerial survey of wintering waterfowl (swans, geese and ducks) in the following NCCSR estuaries: Bodega Bay; Tomales Bay; Abbott's Lagoon; Drakes and Limantour Esteros (combined); Bolinas Lagoon; and Rodeo Lagoon. Although these surveys likely underestimate population sizes of at least some species (Kelly and Tappen 1998), they provide the most comprehensive data set available for this evaluation.

For waterfowl evaluations, the following species most likely to benefit from MPAs were examined: Brant; Greater Scaup; Surf Scoter; and Bufflehead. These four species are among the most abundant birds wintering in the estuaries and are mainly coastal in winter. Brant, a California Bird Species of Special Concern (Davis and Deuel 2008), feed almost entirely on eelgrass during migration and winter. Local wintering populations of Brant historically were much higher than currently, a result of a shift to wintering mainly in Baja California following overhunting and reductions in eel grass beds in California and farther north (e.g., Shuford et al. 1989, Davis and Deuel 2008). Also, all four species (among others) feed on the roe of Pacific herring, which spawn in eelgrass beds (Kelly and Tappen 1998).

For each species in each estuary, mean counts from 2000 to 2007 were used for evaluations. Percentages of the regional estuarine populations occurring in each proposed MPA were estimated and reported. Count data were not partitioned by area of each estuary. Thus, to provide percentage of regional populations occurring in each proposed MPA, count data for the estuary were adjusted in proportion to the percent area of the estuary covered in the proposed MPA. While this technique does not account for variable distribution within an estuary (e.g., Kelly and Tappen 1998), other adjustments may be less appropriate without more spatially accurate data. For example, in Tomales Bay, highest

densities of most diving ducks, loons, grebes and Brant occur in the northern half of the bay (Kelly and Tappen 1998).

In survey data, scaup and scoters were recorded as "scaup sp." and "scoter sp." Although two species of scaup (Greater and Lesser Scaup) and three species of scoter (Surf, Black, and White-winged) occur, over 95% of scaup and scoters wintering in the estuaries are Greater Scaup and Surf Scoter, respectively (Shuford et al. 1989, Kelly and Tappen 1998). Thus, for analyses all scaup and scoters were considered to be these two most abundant species.

Because of the potential impacts of commercial or recreational take of forage species or , disturbance to habitat or birds (e.g., Kelly and Tappen 1998), evaluations did not include draft proposed MPAs with levels of protection of moderate or lower.

RESULTS

Seabird Breeding Colonies

Numbers of breeding seabirds and numbers of species breeding in each subregion are summarized in Table 1, and numbers of each species at each colony are in Appendix 1. Twelve species, and over 335,000 birds, breed within the NCCSR. Abundances and species diversity vary between subregions. Overall abundance and diversity is highest in the Farallon Islands Subregion. Total numbers of breeding birds are lower in the North subregion than in the other two subregions but this is not true for all species. This is mainly reflected by the lack of breeding Common Murres, the most abundant species in the South and Farallon subregions which nest in large, dense colonies. However, the Pelagic Cormorant predominates in this subregion where abundant cliff-breeding and rocky foraging habitats exist. The South Subregion also has several large colonies.

Numbers and percentages of subregional populations of all species, and species most likely to benefit for each MPA proposal are summarized in Tables 2-4. Comparisons between MPA proposals that include only SMRs and SMCAs with take activities not believed to impact seabirds are shown in Table 5. MPAs that encompass the 20 largest colonies in the NCCSR are in Table 8. These 20 colonies include 99% of all the seabirds breeding in the NCCSR. In particular, major concentrations occur at: Fish Rocks; Gualala River area; Russian River area (Russian River Rocks, Arched and Gull Rocks); Bodega Rock; Bird Rock (off Tomales Point); Point Reyes; Drakes Bay area (Point Resistance to Double Point); mouth of the Golden Gate; Devil's Slide; and the Farallon Islands.

North subregion – Total numbers of breeding birds (356-1251) and species (4-6) included in MPAs varied between proposals (Table 5). Proposal 4 covers the greatest number of total birds, 16.5% of the subregional population of all seabirds, while Proposal 2-XA contained the fewest (4.7%). Lower numbers of birds in Proposal 2-XA largely resulted from the exclusion of the Russian River SMCA from total numbers because of allowed fishing activities that may cause disturbance to nesting seabirds. Within the Russian River SMCA of all proposals, the Russian River Rocks colony contains some of the largest numbers of seabirds, including Pelagic and Double-crested Cormorants, breeding in the North

subregion. Other proposed SMCAs not included in totals because of allowed take activities included Saunders Reef (Proposals 1-3 and 4), and Sea Lion Cove (Proposal 4).

Although Brandt's Cormorants are somewhat less common and more local in the North subregion than elsewhere in the NCCSR, they are still the second most abundant species in the subregion (Table 1). However, no proposed MPAs covered a significant Brandt's Cormorant colony, although fairly small numbers breed at Russian River Rocks (within proposed Russian River SMCAs) in some years.

For Pelagic Cormorants, largest numbers within the NCCSR breed within the North subregion, where they are the most numerous species (Table 1). They are mostly found at numerous relatively small colonies, although some colonies contain high concentrations (Appendix 1). Numbers of Pelagic Cormorants within MPA proposals varied, ranging from 229 (Proposal 2-XA) to 572 (Proposal 4) breeding birds or 4.7 to 16.5% of the subregional population, respectively. Larger numbers in Proposal 4 resulted mainly from colonies covered within Stewarts Point SMR.

Double-crested Cormorants nest in fairly small numbers in the North subregion, with the largest concentration near the Russian River mouth (Russian Gulch to Shell-Wright Beach Rocks; Appendix 1). Inclusion of nesting Double-crested Cormorants occurred only at the Russian River Rocks colony (Russian River SMCAs) of all proposals, but in Proposal 2-XA this MPA was excluded from totals because of allowed take activities. Pigeon Guillemots are scattered at many fairly small colonies throughout the North subregion. Numbers of this species included in proposed MPAs were fairly small and similar between proposals, ranging from 73-85 birds or 9.5-11.1% of the subregional population. Common Murres do not breed in the North subregion.

Compared to the South and Farallon subregions, proposed MPAs in the North subregion covered substantially fewer birds and lower proportions of subregional populations for all species. No proposals encompass the largest and most diverse seabird colony in the subregion, Fish Rocks, with about 900 breeding birds of nine species. Other major colonies not included in any proposals are Gualala Point Island (5 species, 324 birds, mostly Brandt's Cormorants), Arched/Gull Rock complex (7 species, 641 birds), Bodega Rock (4 species, 778 birds, mostly Brandt's Cormorants), and Bird Rock (7 species, 894 birds).

South subregion - Total numbers of breeding birds included in MPA proposals ranged from 43,061 to 68,424, or 60-96% of the subregional populations for all species (Table 5). All proposals cover the largest and most diverse (9 species) seabird colony in the subregion, Point Reyes. For all birds and for species most likely to benefit, numbers of birds covered fell within two groups: lower coverage in Proposals 1-3 and 2-XA; and greater coverage in Proposal 4. Differences mostly resulted from the inclusion of a higher level of protection Double Point SMCA in Proposal 4 that covers the large Double Point Rocks breeding colony (>16,000 birds; Appendix 1). The Double Point SMCA in Proposal 1-3 also included this colony, but allowed take activities within that proposal led to exclusion of the SMCA from totals. Other SMCAs excluded from comparisons because of allowed take activities were: Montara SMCA (Proposal 1-3); Pillar Point SMCA (Proposal 2-XA); and Devil's Slide SMCA (Proposal 4).

For individual species, differences between proposals reflected differences in total numbers of breeding birds. Ranges for numbers of birds and percentages of subregional populations were: Brandt's Cormorant, 1160-1812 birds (60-96%); Pelagic Cormorant, 266-334 birds (30-38%); Common Murre, 40810-65229 birds (62-99%), and Pigeon Guillemot, 616-743 birds (47-57%). Double-crested Cormorants do not breed on the outer coast of the South Subregion, although colonies occur close by within San Francisco Bay and Merced Lake in San Francisco.

Farallon Islands subregion – Two recognized colonies occur within this region. The North Farallon Islands is made up of four islets. The South Farallon Islands includes the main island of Southeast Farallon, West End, and several smaller islets including Sugarloaf and Saddle Rock. Owing to an abundance of varying breeding habitat types and close access to abundant food, the South Farallon Islands is not only the largest seabird breeding colony in the NCCSR but is the largest colony in the contiguous United States. Birds breed over most of these islands, with higher concentrations on the north and west sides of the islands. The North Farallon Islands is the second largest colony in the NCCSR and is primarily comprised of Common Murres, which nest in high densities on all islets.

All MPA proposals surround the entirety of both the North and South Farallon Islands as SMRs. Thus, all proposals cover 100% of the breeding birds on the islands.

Major Seabird Roosts

All roosts included in evaluations are shown in Appendix 3. Numbers of roosts within each proposed MPA are summarized in Table 7. A comparison of roost coverage by draft MPA proposal is shown in Table 8.

North subregion – The only major roost included within MPA proposals was within the Russian River SMCAs (Russian River Rocks), which was proposed for all three proposals. However, the proposed Russian River SMCA of Proposal 2-XA has take provisions that exclude this roost from the list of roosts to benefit from the MPA (Table 8).

South subregion – Major Brown Pelican roosts (all >100 birds) included within MPA proposals were located at Point Reyes, Double Point Rocks (Stormy Stack), and Devil's Slide Rock and Mainland. Proposals 1-3 and 2-XA contained one roost (Point Reyes) considered to benefit from MPAs while Proposal 4 contained two roosts (Point Reyes, Double Point) considered to benefit from MPAs. Pelican roosts within proposed Double Point and Montara SMCAs in Proposal 1-3, and the roost at Devil's Slide SMCA of Proposal 4, were not included in Table 8 because of allowed take activities that may disturb roosting seabirds.

Farallon Islands subregion – All proposal captured the very large pelican roost (>1000 birds) at the South Farallon Islands.

Seabird Foraging Areas

Weighted contributions to seabird foraging areas for species most likely to benefit are summarized for each draft MPA proposal in Tables 9-11, and comparisons between draft MPA proposals are shown in Table 12.

North subregion - Weighted foraging areas ranged 1.0-1.15 for Brandt's Cormorant, 0.75-1.61 for Pelagic Cormorant, and 0.56-0.89 for Pigeon Guillemot. For Pelagic Cormorant and Pigeon Guillemot, overall values were highest in Proposal 4. For Brandt's Cormorant, values were equally high in both Proposals 1-3 and 4. Values were lowest for all species in Proposal 2-XA.

Coverage of Brandt's Cormorant foraging area mainly occurred in the Bodega Head area. For Pelagic Cormorants and Pigeon Guillemots, highest values occurred mainly in the Point Arena and Black Point to Stewarts areas. Compared to the South and Farallon subregions, weighted foraging areas were low in the North subregion because fewer large seabird colonies occurred within proposed MPAs. Values were also lower than in the previous draft of proposed MPAs.

South subregion – For all species, Proposal 4 had the highest and Proposal 2-XA had the lowest weighted foraging area values. Weighted foraging areas ranged 3.18-4.91 for Brandt's Cormorant, 2.40-3.56 for Pelagic Cormorant, and 3.65-4.98 for Pigeon Guillemot.
Weighted foraging areas ranged from 2.68 to 4.81 for the Brandt's Cormorant, from 2.03 to 3.21 for Pelagic Cormorant, and from 3.11 to 4.82 for Pigeon Guillemot. Higher values in Proposal 4 mainly reflected the larger MPA at Double Point.

Farallon Islands subregion – All MPA proposals covered the same areas and thus had equal weighted foraging areas for all Farallon Islands breeding seabirds. Because the three species evaluated principally breed on the South Farallon Islands, foraging area values were highest in MPAs in the SE Farallon group. Among the three subregions, foraging area coverage was by far the highest in the Farallon subregion.

Wintering Waterfowl

Mean abundances for most waterfowl species were highest in Tomales Bay, followed by Drakes/Limantour esteros, Bodega Bay or Bolinas Lagoon (species dependent), and Rodeo Lagoon (Appendix 4). Differences in abundances depend largely upon estuary size but also on habitats and food availability. Tomales Bay is the largest estuary but also provides diverse habitats, ranging from vast shallow waters, eelgrass beds, and deep water channels. While Bolinas Lagoon is important for certain species of dabbling ducks, abundances of diving ducks and Brant were relatively low.

Evaluations for wintering waterfowl are shown in Table 13. Although displayed in the table, SMCAs in Drakes Estero were not included in totals because of allowed mariculture or other take allowed because these activities disturb waterfowl foraging habitat and cause disturbance to foraging and resting waterfowl. Total percentages of regional estuarine waterfowl populations covered in beneficial MPAs range 4.7-11.5% for Brant, 3.9-9.1% for Greater Scaup, 4.2-9.2% for Surf Scoter, 11.2-16.7% for Bufflehead, and 7.3-12.2% for all waterfowl species combined. Percentages were highest in Proposal 4 and lowest in Proposal 2-XA. Differences between proposals largely resulted from the size of the SMRs

in Drakes and Limantour esteros (included in all proposals) and inclusion of a small SMR at the south end of Tomales Bay (Proposal 4).

Although waterfowl densities in northern Tomales Bay are among the highest in the study region (Kelly and Tappen 1998), no MPAs were proposed for that area. Disturbance to birds from increasing numbers of sportfishing and other recreational boats, disturbance to eelgrass beds, and overharvest of Pacific herring are concerns in this area (Kelly and Tappen 1998). If shellfish harvest and mariculture is discontinued in Drakes Estero in the future, waterfowl wintering there will receive the benefits equivalent of a SMR.

Special Closures

Seabird colonies with proposed special closures, including closure distances, are shown in Table 6. Of the 20 largest breeding colonies in the NCCSR, six have been proposed for special closures with small to moderate differences between proposals. Proposal 4 provides the only proposed special closure in the North subregion, with 300 foot closures surrounding both Arched and Gull Rocks just south of the Russian River mouth. These closures will help protect two of the largest seabird colonies in the North subregion where disturbance from boating activities may cause impacts. Year-to-year movement of the cormorant colonies in this area (USFWS, unpubl. data) may reflect disturbance.

In the South subregion, all proposals included closures surrounding Stormy Stack (within Double Point Rocks; 300 feet) and Devil's Slide Rock (300 or 1,000 feet). Both Proposals 1-3 and 4 included special closures at Point Reyes Headlands (1,000 feet), the largest colony in the subregion and third largest in the NCCSR. Proposals 1-3 and 2-XA contained special closures at Point Resistance (500 and 300 feet, respectively). All colonies with proposed special closures in the South subregion contain nesting Brandt's Cormorants and Common Murres, two of the most sensitive species to boat disturbance. Although the Point Reyes proposed closures cover much of the seabird nesting area, they do not cover the largest concentration of seabirds (mainly Common Murres, Brandt's Cormorants, and Pigeon Guillemots) of the west end of the headlands.

In the Farallon subregion, proposals were similar but varied somewhat. All proposals would assist protection of the two largest seabird colonies in the NCCSR. At the North Farallon Islands, the only difference was whether the North islet ("North Farallon") was surrounded by a 300 foot or 1,000 foot closure. All the North Farallon Islands contain large numbers of nesting murres, and greater distances would provide added protection from disturbance.

At the South Farallon Islands, all proposals extend the closure of the current Farallon SMCA to include all of the southern portion of the islands (Mirounga Bay) and seaward of Saddle (or, Seal) Rock. This will extend protections to breeding Common Murres on Saddle Rock and to an expanding Brandt's Cormorant colony on the south shore of SE Farallon. In addition, the special closure in Proposal 1-3 includes the northeast side of SE Farallon from the east side of Fisherman's Bay to East Landing. This area contains some of the greatest densities of seabirds (including murres and Brandt's Cormorants) on the South Farallon Islands and inclusion would increase protection for seabirds. Areas not included in any proposals are Fisherman's Bay on the north side and East Landing. The East Landing area contains the lowest numbers of seabirds on the islands, thus leaving this open is of lower concern. The

Fisherman's Bay area is fairly important to seabirds, but densities of murres and cormorants are lower than at most other portions of the islands.

Special closures may have greatest benefits to protecting seabirds when the colony is not already within a high level of protection MPA because these MPAs will likely lead to reduced boating activity. However, MPAs will not protect colonies from recreational boating activities, anchoring, or other non-take activities. While seasonal closures during the breeding season protect colonies during their most critical time of year, most colonies are attended by seabirds most of the year either simply for breeding site defense (murres, cormorants at some colonies), colony prospecting, or roosting (e.g., pelicans, cormorants, gulls). Also, Brown Pelicans, which breed outside the area, are at peak abundance during the fall months following breeding. Thus, the year-round closures proposed will provide considerably higher benefits to seabirds than seasonal closures.

Closure distances of 300 feet are lower than what is often recommended for protection of seabird breeding and roosting sites (Carney and Sydeman 1999, Jaques and Strong 2002, Rodgers and Schwikert 2002, Ronconi and St. Clair 2002). For example, closures at Three Arch Rocks, Oregon, and Protection Island, Washington, are 500 feet and 600 feet, respectively. Studies at Common Murre colonies in the NCCSR have shown that about 68% of boat disturbances occurred within about 300 feet of colonies, 70% within about 500 feet, and 92% within about 1,000 feet. Thus, 300 foot closure distances should eliminate the majority of disturbances and 1,000 foot closures should eliminate nearly all boat disturbances to murres and most other species.

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Table 1. Numbers of breeding seabirds of 12 species within each of the three bioregions of the NCCSR.[1]

Bioregion	No. Species	Total	LHSP	ASSP	BRCO	PECO	DCCO	BLOY	WEGU	COMU	PIGU	CAAU	RHAU	TUPU
North	11	7588	110	15	2344	2823	450	129	927	0	768	P[2]	11	15
South	9	71321	0	65	2963	887	0	19	452	65609	1316	0	6	4
Farallon Islands	12	256645	1400	1990	17116	504	1122	30	15127	199328	541	18843	516	128
Total	12	335554	1510	2070	22423	4214	1572	178	16506	264937	2625	18843	533	147

[1] Species codes: LHSP – Leach's Storm-Petrel, ASSP – Ashy Storm-Petrel, BRCO – Brandt's Cormorant, PECO – Pelagic Cormorant, DCCO – Double-crested Cormorant, BLOY – Black Oystercatcher, WEGU – Western Gull, COMU – Common Murre, PIGU - Pigeon Guillemot, CAAU - Cassin's Auklet, RHAU - Rhinocerso Auklet, TUPU - Tufted Puffin.
[2] P - Probably breeding.

Table 2. Proposal 1-3 summary of numbers of breeding birds, percent of subregional totals, and combined total for all birds and for species most likely to benefit. See Table 1 for species codes. Proposed MPAs not shown did not include breeding colonies for any of these species.

Name	No. Species	Total Birds	Total Birds Pct	BRCO	BRCO Pct	PECO	PECO Pct	DCCO	DCCO Pct	COMU	COMU Pct	PIGU	PIGU Pct
North subregion													
Pt Arena SMR[1]	3	122	1.6%	0	0.0%	66	2.3%	0	0.0%	0	-	47	6.1%
Saunder's Reef SMCA[2]	2	75	1.0%	0	0.0%	62	2.2%	0	0.0%	0	-	13	1.7%
Rocky Pt. to Horseshoe Pt. SMR	4	273	3.6%	0	0.0%	227	8.0%	0	0.0%	0	-	29	3.8%
Russian River SMCA[1]	6	344	4.5%	P[3]	-	88	3.1%	231	51.3%	0	-	5	0.7%
Bodega Head SMR	4	121	1.6%	0	0.0%	103	3.7%	0	0.0%	0	-	2	0.3%
South subregion													
Point Reyes SMR	9	43061	60.4%	1160	39.1%	266	30.0%	0	-	40810	62.2%	616	46.8%
Double Point SMCA[2]	6	16235	22.8%	328	11.1%	9	1.0%	0	-	15818	24.1%	22	1.7%
Montara SMCA[2]	5	1354	1.9%	692	23.4%	114	12.9%	0	-	380	0.6%	160	12.2%
Fitzgerald SMR	2	7	0.01%	0	0.0%	5	0.6%	0	-	0	-	2	0.3%
Farallon Islands Region													
North Farallon SMR	6	72203	28.1%	102	0.6%	62	12.3%	0	0.0%	71929	36.1%	42	7.8%
SE Farallon SMR	12	184442	71.9%	17014	99.4%	442	87.7%	1122	100.0%	127399	63.9%	499	92.2%

[1] Numbers adjusted from whole colony estimates to reflect the portion of the colony covered by the MPA only.
[2] Not included in Table 5 because benefits to seabirds are reduced by allowed take activities.
[3] P, present in some years but not present in the most recent year with available count data.

Table 3. Proposal 2-XA summary of numbers of breeding birds and percent of subregional totals for all birds and for species most likely to benefit. See Table 1 for species codes. Proposed MPAs not shown did not include breeding sites for any of these species.

Name	No. Species	Total Birds	Total Birds Pct	BRCO	BRCO Pct	PECO	PECO Pct	DCCO	DCCO Pct	COMU	COMU Pct	PIGU	PIGU Pct
North subregion													
Pt Arena SMR[1]	3	122	1.6%	0	0.0%	66	2.3%	0	0.0%	0	-	47	6.1%
Black Point SMR	4	113	1.5%	0	0.0%	60	2.1%	0	0.00	0	-	24	3.1%
Russian River SMCA[1,2]	6	344	4.5%	P[3]	-	88	3.1%	231	51.3%	0	-	5	0.7%
Bodega Head SMR	4	121	1.6%	0	0.0%	103	3.7%	0	0.0%	0	-	2	0.3%
South subregion													
Pt Reyes Headlands SMR	9	43061	60.4%	1160	39.2%	266	30.0%	0	-	40810	62.2%	616	46.8%
Pillar Point SMCA[2]	2	7	0.01%	0	0.0%	5	0.6%	0	-	0	-	2	0.3%
Farallon Islands subregion													
North Farallon SMR	6	72203	28.1%	102	0.6%	62	12.3%	0	0.0%	71929	36.1%	42	7.8%
SE Farallon SMR	12	184442	71.9%	17014	99.4%	442	87.7%	1122	100.0%	127399	63.9%	499	92.2%

[1] Numbers adjusted from whole colony estimates to reflect the portion of the colony covered by the MPA only.
[2] Not included in Table 5 because benefits to seabirds are reduced by allowed take activities.
[3] P, present in some years but not present in the most recent year with available count data.

Table 4. Proposal 4 summary of numbers of breeding birds and percent of subregional totals for all birds and for species most likely to benefit. See Table 1 for species codes. Proposed MPAs not shown did not include breeding sites for any of these species.

Name	No. Species	Total Birds	Total Birds Pct	BRCO	BRCO Pct	PECO	PECO Pct	DCCO	DCCO Pct	COMU	COMU Pct	PIGU	PIGU Pct
North subregion													
Point Arena SMR[1]	3	122	1.6%	0	0.0%	66	2.3%	0	0.0%	0	-	47	6.1%
Sea Lion Cove SMCA[2]	4	131	1.7%	0	0.0%	106	3.8%	0	0.0%	0	-	12	1.6%
Saunder's Reef SMCA[2]	2	75	1.0%	0	0.0%	62	2.2%	0	0.0%	0	-	13	1.7%
Del Mar Landing SMR	1	9	0.12%	0	0.0%	9	0.3%	0	0.0%	0	-	0	0.0%
Stewarts Point SMR	4	368	4.9%	0	0.0%	306	10.8%	0	0.0%	0	-	31	4.0%
Russian River SMCA[1]	6	344	4.5%	P[3]	-	88	3.1%	231	51.3%	0	-	5	0.7%
Bodega Head SMR	4	121	1.6%	0	0.0%	103	3.7%	0	0.0%	0	-	2	0.3%
South subregion													
Pt Reyes SMR	9	43061	60.4%	1160	39.2%	266	30.0%	0	-	40810	62.2%	616	46.8%
Double Point SMCA	6	25363	35.6%	652	22.0%	68	7.8%	0	-	24419	37.2%	127	9.7%
Devil's Slide SMCA[2]	5	1354	1.9%	692	23.4%	114	12.9%	0	-	380	0.6%	160	12.2%
Farallon Islands subregion													
N Farallon SMR	6	72203	28.1%	102	0.6%	62	12.3%	0	0.00%	71929	36.1%	42	7.8%
SE Farallon SMR	12	184442	71.9%	17014	99.4%	442	87.7%	1122	100.0%	127399	63.9%	499	92.2%

[1] Numbers adjusted from whole colony estimates to reflect the portion of the colony covered by the MPA only.
[2] Not included in Table 5 because benefits to seabirds are reduced by allowed take activities.
[3] P, present in some years but not present in the most recent year with available count data.

Table 5. Comparison between proposals of numbers and percentages of seabirds breeding within proposed MPAs in each bioregion and total, North Central Coast Study Region.[1]

Name	No. Species	Total Birds	Total Birds Pct	BRCO	BRCO Pct	PECO	PECO Pct	DCCO	DCCO Pct	COMU	COMU Pct	PIGU	PIGU Pct
North subregion													
Proposal 1-3	6	935	12.3%	P[2]	-	484	17.1%	231	51.3%	0	-	83	10.8%
Proposal 2-XA	6	356	4.7%	0	0.0%	229	8.1%	0	0.0%	0	-	73	9.5%
Proposal 4	6	1251	16.5%	P[2]	-	572	20.3%	231	52.9%	0	-	85	11.1%
South subregion													
Proposal 1-3	9	43068	60.4%	1160	39.2%	271	30.6%	0	-	40810	62.2%	618	50.0%
Proposal 2-XA	9	43061	60.4%	1160	39.2%	266	30.0%	0	-	40810	62.2%	616	46.8%
Proposal 4	9	68424	95.9%	1812	61.2%	334	37.7%	0	-	65229	99.4%	743	56.5%
Farallon Islands subregion													
Proposal 1-3	12	256645	100.0%	17116	100.0%	504	100.0%	1122	100.0%	199328	100.0%	541	100.0%
Proposal 2-XA	12	256645	100.0%	17116	100.0%	504	100.0%	1122	100.0%	199328	100.0%	541	100.0%
Proposal 4	12	256645	100.0%	17116	100.0%	504	100.0%	1122	100.0%	199328	100.0%	541	100.0%
NCCSR Total													
Proposal 1-3	12	300648	89.6%	18276	81.5%	1259	29.9%	1353	86.1%	240138	90.6%	1242	47.3%
Proposal 2-XA	12	300062	89.4%	18276	81.5%	999	23.7%	1122	71.4%	240138	90.6%	1230	46.9%
Proposal 4	12	326033	97.2%	18928	84.4%	1410	33.5%	1359	86.5%	264557	99.9%	1369	52.2%

[1] Does not include birds breeding at colonies within State Marine Parks or State Marine Conservation Areas with allowed activities that may impact seabird breeding colonies (see Tables 2-4).

[2] P, present in some years but not present in the most recent year with available count data.

Table 6. The 20 largest seabird colonies in the North Central Coast Study Region and those included within the boundaries of proposed MPAs and Special Closures. Numbers of breeding birds for each species at each colony are shown in Appendix 1.

Colony Name	Proposal 1-3		Proposal 2-XA		Proposal 4	
	MPAs	Special Closures	MPAs	Special Closures	MPAs	Special Closures
North subregion						
Point Arena	Point Arena SMR (part)[2]		Point Arena SMR (part)[2]		Point Arena SMR (part)[2]	
Sea Lion Rocks to Arena Cove						
Fish Rocks						
Collins Landing to Gualala River						
Gualala Point Island						
Russian Gulch						
Russian River Rocks	Russian River SMCA (part)[2]		Russian River SMCA (part)[2,3]		Russian River SMCA (part)[2]	
Arched Rock\Gull Rock[1]						300 ft.
Bodega Rock						
Dillon Beach Rocks						
Bird Rock						
South subregion						
Point Reyes	Point Reyes SMR	1,000 ft.	Point Reyes Headlands SMR		Point Reyes SMR	1,000 ft.
Point Resistance		500 ft.		300 ft.	Double Point SMCA	
Millers Point Rocks					Double Point SMCA	
Double Point Rocks	Double Point SMCA	300 ft. (Stormy Stack)		300 ft. (Stormy Stack)	Double Point SMCA	300 ft. (Stormy Stack)
Lobos Rock and Land's End						
Seal Rocks						
Devil's Slide Rock & Mainland	Montara SMCA[3]	1,000 ft. (Devil's Slide Rock)		300 ft. (Devil's Slide Rock)	Devil's Slide SMCA[3]	1,000 ft. (Devil's Slide Rock)
Farallon Islands subregion						
North Farallon Islands	North Farallon SMR	1,000 ft. (North) 300 ft. (remainder)	North. Farallon SMR	300 ft.	North Farallon SMR	1,000 ft. (North) 300 ft. (remainder)
South Farallon Islands	SE Farallon SMR	300 ft. (part)	SE Farallon SMR	300 ft. (part)	SE Farallon SMR	300 ft. (part)

[1] Arched Rock and Gull Rock are considered as a "colony complex."
[2] Part of colony included in proposed MPA.
[3] Allowed take activities may impact seabird breeding colonies.

Table 7. Summary of numbers of major Brown Pelican roosts by roost size category included within proposed MPAs in the North Central Coast Study Region. Draft MPAs not containing major Brown Pelican roosts are not shown.

MPA Name	Roost Size	No. Roosts
North subregion		
Proposal 1-3		
Russian River SMCA	>100	1
Proposal 2-XA		
Russian River SMCA[1]	>100	1
Proposal 4		
Russian River SMCA	>100	1
South subregion		
Proposal 1-3		
Point Reyes SMR	>100	1
Double Point SMCA[1]	>100	1
Montara SMCA[1]	>100	1
Proposal2-XA		
Pt Reyes Headlands SMR	>100	1
Proposal 4		
Point Reyes SMR	>100	1
Double Point SMCA	>100	1
Devil's Slide SMCA[1]	>100	1
Farallon Islands Region		
Proposal 1-3		
SE Farallon SMR	>1000	1
Proposal 2-XA		
SE Farallon SMR	>1000	1
Proposal 4		
SE Farallon SMR	>1000	1

[1] Not included in Table 8 because benefits to seabirds are reduced by allowed take activities.

Table 8. Numbers of major Brown Pelican roosts included in each MPA proposal, North Central Coast Study Region.

Proposal	Roost Size	No. Roosts
North subregion		
Proposal 1-3	>100	1
Proposal 2-XA	-	0
Proposal 4	>100	1
South subregion		
Proposal 1-3	>100	1
Proposal 2-XA	>100	1
Proposal 4	>100	2
Farallon Islands subregion		
Proposal 1-3	>1000	1
Proposal 2-XA	>1000	1
Proposal 4	>1000	1

Table 9. Proposal 1-3 weighted contributions to foraging areas for three species of breeding seabirds within each proposed MPA. MPAs not shown did not contribute to foraging area for any of these species.

MPA Name	Brandt's Cormorant	Pelagic Cormorant	Pigeon Guillemot
North subregion			
Pt Arena SMR	0.00	0.31	0.17
Saunder's Reef SMCA[1]	0.00	0.13	0.15
Del Mar Landing SMP[1]	0.01	0.01	0.01
Rocky Pt. to Horshoe Pt. SMR	0.00	0.36	0.17
Gerstle Cove SMR	0.00	0.00	0.00
Russian River SMR	0.07	0.05	0.01
Russian River SMCA	0.16	0.15	0.04
Bodega Head SMR	0.71	0.18	0.12
Bodega Head SMCA			
South subregion			
Point Reyes SMR	2.38	1.82	2.84
Point Reyes SMCA	0.57	0.44	0.68
Drakes Estero SMR	0.00	0.00	0.01
Double Point SMCA	0.46	0.08	0.09
Montara SMCA	0.56	0.31	0.51
Fitzgerald SMR	0.25	0.15	0.13
Farallon Islands subregion			
N Farallon SMR	0.07	1.43	0.90
SE Farallon SMCA	5.26	4.64	4.88
SE Farallon SMR	5.31	4.68	4.93

[1] Not included in Table 12 because of allowed take of forage species likely to benefit.

Table 10. Proposal 2-XA weighted contributions to foraging areas for three species of breeding seabirds within each proposed MPA. MPAs not shown did not contribute to foraging area for any of these species.

MPA Name	Brandt's Cormorant	Pelagic Cormorant	Pigeon Guillemot
North subregion			
Pt Arena SMR	0.00	0.34	0.18
Black Point SMR	0.00	0.23	0.34
Gerstle Cove SMR	0.00	0.001	0.00
Russian River SMCA[1]	0.16	0.15	0.04
Bodega Head SMR	0.70	0.12	0.12
Bodega Head SMCA	0.30	0.05	0.07
South subregion			
Pt Reyes Headlands SMR	2.36	1.81	2.83
Pt Reyes Headlands SMCA	0.56	0.43	0.68
Estero de Limantour SMR	0.00	0.00	0.01
Montara SMR	0.25	0.14	0.13
Pillar Point SMCA	0.00	0.01	0.002
Farallon Islands subregion			
North Farallon SMR	0.07	1.43	0.90
SE Farallon SMR	5.30	4.68	4.92
SE Farallon SMCA	5.28	4.66	4.90

[1] Not included in Table 12 because of allowed take of forage species likely to benefit.

Table 11. Proposal 4 weighted contributions to foraging areas for three species of breeding seabirds within each proposed MPA. MPAs not shown did not contribute to foraging area for any of these species.

MPA Name	Brandt's Cormorant	Pelagic Cormorant	Pigeon Guillemot
North subregion			
Point Arena SMR	0.00	0.33	0.17
Sea Lion Cove SMCA[1]	0.00	0.04	0.02
Saunders Reef SMCA	0.00	0.13	0.14
Del Mar Landing SMR	0.02	0.02	0.03
Stewarts Point SMR	0.00	0.55	0.26
Salt Point SMP[1]	0.00	0.22	0.06
Gerstle Cove SMR	0.00	0.00	0.00
Russian River SMCA	0.16	0.15	0.04
Bodega SMR	0.95	0.23	0.18
South subregion			
Point Reyes SMCA	0.58	0.44	0.69
Point Reyes SMR	2.41	1.85	2.88
Drakes Estero SMR	0.00	0.00	0.01
Double Point SMCA	0.97	0.41	0.56
Duxbury SMCA[1]	0.31	0.03	0.05
Devils Slide SMCA	0.78	0.45	0.69
Fitzgerald SMR	0.16	0.10	0.09
San Gregorio SMR	0.01	0.30	0.05
Farallon Islands subregion			
North Farallon SMR	0.07	1.43	0.90
SE Farallon SMCA	5.26	4.64	4.88
SE Farallon SMR	5.28	4.66	4.90

[1] Not included in Table 12 because of allowed take of forage species likely to benefit.

Table 12. Comparisons of MPA proposals to total contributions of weighted foraging areas for three species of breeding seabirds in the North Central Coast Study Region. Does not include areas within SMPs or SMCAs permitting take of forage species likely to benefit (see Tables 9-11).

Proposal	Brandt's Cormorant	Pelagic Cormorant	Pigeon Guillemot
North bioregion			
Proposal 1-3	1.15	1.09	0.56
Proposal 2-XA	1.00	0.75	0.72
Proposal 4	1.14	1.61	0.89
South bioregion			
Proposal 1-3	4.21	2.80	4.27
Proposal 2-XA	3.18	2.40	3.65
Proposal 4	4.91	3.56	4.98
Farallon Islands bioregion			
Proposal 1-3	10.64	10.75	10.71
Proposal 2-XA	10.65	10.76	10.72
Proposal 4	10.61	10.73	10.68

Table 13. Comparison of percentages of estuarine wintering waterfowl populations occurring within proposed MPAs, North Central Coast Study Region. Includes species most likely to benefit and all waterfowl species combined.

Proposal	Brant	Greater Scaup	Surf Scoter	Bufflehead	All Species
Proposal 1-3					
Drakes Estero SMCA[1]	10.3	8.6	9.3	24.6	16.0
Drakes Estero SMR	5.9	4.9	5.3	14.1	9.2
Total	**5.9**	**4.9**	**5.3**	**14.1**	**9.2**
Proposal 2-XA					
Drakes Estero SMCA[1]	11.5	9.8	10.3	27.4	17.9
Estero de Limantour SMR	4.7	3.9	4.2	11.2	7.3
Total	**4.7**	**3.9**	**4.2**	**11.2**	**7.30**
Proposal 4					
Tomales Bay SMR	3.3	4.2	3.9	2.7	3.7
Drakes Estero SMCA[1]	10.3	8.6	9.3	24.6	16.0
Drakes Estero SMR	5.9	4.9	5.3	14.1	9.2
Total	**9.3**	**9.1**	**9.2**	**16.7**	**12.2**

[1] Not included in total because of allowed take activities.

Appendix 1. List of seabird breeding colonies within the MLPA North Central Coast Study Region. Includes total colony size (total number of breeding birds) and numbers of breeding birds of each species. Colonies are listed north to south along the mainland, then Farallon Islands. The top 20 colonies in the study region are shown in bold.[1]

Colony Name	California Colony Code	No. Species	Total Colony Size	% of Regional Pop.	Leach's Storm-Petrel	Ashy Storm-Petrel	Brandt's Cormo-rant	Double-crested Cormo-rant	Pelagic Cormo-rant	Black Oyster-catcher	Western Gull	Common Murre	Pigeon Guille-mot	Cassin's Auklet	Rhino-ceros Auklet	Tufted Puffin
North subregion																
Point Arena	**ME-384-01**	**4**	**217**	**0.065%**	**-**	**-**	**-**	**-**	**154**	**7**	**4**	**-**	**52**	**-**	**-**	**-**
Sea Lion Rocks	ME-384-02	4	131	0.039%	-	-	-	-	106	4	9	-	12	-	-	-
Sea Lion Rocks to Arena Cove	**ME-384-03**	**3**	**203**	**0.060%**	**-**	**-**	**-**	**-**	**183**	**4**	**16**	**-**		**-**	**-**	**-**
Moat Cove	ME-384-04	1	10	0.003%	-	-	-	-	H	-	-	-	10	-	-	-
Section 30 Cove	ME-384-05	2	50	0.015%	-	-	-	-	42	-	-	-	8	-	-	-
Saunders Landing	ME-384-06	2	28	0.008%	-	-	-	-	20	-	-	-	8	-	-	-
Iverson Point	ME-384-07	2	47	0.014%	-	-	-	-	42	H	-	-	5	-	-	-
Triplett Gulch	ME-384-08	3	178	0.053%	-	-	-	-	119	H	4	-	55	-	-	-
Fish Rock Cove	ME-384-09	2	34	0.010%	-	-	H	-	33	1	-	-		-	-	-
Fish Rocks	**ME-384-10**	**9**	**905**	**0.270%**	**100**	**-**	**368**	**-**	**123**	**6**	**170**	**-**	**119**	**P**	**4**	**15**
Collins Landing to Gualala River	**ME-384-11**	**3**	**281**	**0.084%**	**-**	**-**	**-**	**-**	**187**	**4**	**H**	**-**	**90**	**-**	**-**	**-**
Gualala Point Island	**SO-384-01**	**5**	**324**	**0.097%**	**-**	**-**	**264**	**-**	**4**	**1**	**26**	**-**	**29**	**-**	**-**	**-**
Del Mar Point	SO-384-02	1	9	0.003%	-	-	-	-	9	-	-	-		-	-	-
Sea Ranch	SO-384-03	4	153	0.046%	-	-	-	-	84	11	16	-	42	-	-	-
Black Point to Stewart's Point	SO-384-04	4	62	0.018%	-	-	-	-	40	4	6	-	12	-	-	-
Stewart's Point to Rocky Point	SO-382-01	4	86	0.026%	-	-	-	-	66	1	4	-	15	-	-	-
Horseshoe Cove	SO-382-02	3	125	0.037%	-	-	-	-	121	-	2	-	2	-	-	-
Cannon Gulch to Stump Beach	SO-382-03	3	95	0.028%	-	-	-	-	79	14	-	-	2	-	-	-
Gerstle Cove to Stillwater Cove	SO-382-04	4	142	0.042%	-	-	-	-	110	6	16	-	10	-	-	-
Bench Mark 125 to Timber Cove	SO-382-05	4	106	0.032%	-	-	-	-	62	2	32	-	10	-	-	-
Windermere Point to Jewell Gulch	SO-382-06	4	49	0.015%	-	-	-	-	40	1	6	-	2	-	-	-
Northwest Cape Rocks	SO-382-07	2	53	0.016%	-	-	-	-	H	1	52	-		-	-	-
Russian Gulch	**SO-382-08**	**5**	**376**	**0.112%**	**-**	**-**	**-**	**80**	**227**	**7**	**42**	**-**	**20**	**-**	**-**	**-**
Russian River Rocks	**SO-382-09**	**6**	**414**	**0.123%**	**-**	**-**	**P**	**238**	**125**	**2**	**44**	**-**	**5**	**-**	**-**	**-**
Goat Rock to Peaked Hill	SO-382-10	2	7	0.002%	-	-	-	-	-	1	6	-		-	-	-
Arched Rock[2]	**SO-382-11**	**4**	**481**	**0.143%**	**-**	**-**	**436**	**-**	**9**	**-**	**34**	**-**	**2**	**-**	**-**	**H**
Peaked Hill	SO-382-12	4	53	0.016%		-	-	-	44	1	6	-	2	-	-	-
Gull Rock[2]	**SO-382-13**	**7**	**160**	**0.048%**	**10**	**-**	**P**	**68**	**44**	**2**	**34**	**-**	**2**	**-**	**-**	**-**
Shell-Wright Beach Rocks	SO-382-14	5	200	0.060%	-	-	-	32	55	20	88	-	5	-	-	-
Duncan Point to Arched Rock	SO-382-15	3	174	0.052%	-	-	-	-	136	4	34	-	H	-	-	-
Bodega Head	SO-380-01	4	121	0.036%	-	-	-	-	103	6	10	-	2	-	-	-
Bodega Rock	**SO-380-02**	**4**	**778**	**0.232%**	**-**	**-**	**722**	**-**	**-**	**H**	**24**	**-**	**30**	**-**	**2**	**-**

Colony Name	California Colony Code	No. Species	Total Colony Size	% of Regional Pop.	Leach's Storm-Petrel	Ashy Storm-Petrel	Brandt's Cormo-rant	Double-crested Cormo-rant	Pelagic Cormo-rant	Black Oyster-catcher	Western Gull	Common Murre	Pigeon Guille-mot	Cassin's Auklet	Rhino-ceros Auklet	Tufted Puffin
Bodega Harbor	SO-380-03	2	14	0.004%	-	-	-	-	-	-	12	-	2	-	-	-
Pinnacle Rock	SO-380-04	5	84	0.025%	-	-	-	-	51	2	2	-	27	-	2	-
Sonoma-Marin County Line	MA-380-01	4	128	0.038%	-	-	H	-	84	5	14	-	25	-	-	-
Dillon Beach Rocks	**MA-380-02**	**6**	**230**	**0.069%**	**-**	**-**	**P**	**32**	**143**	**3**	**32**	**-**	**20**	**-**	**-**	**-**
Tomales Point	MA-380-03	3	150	0.045%	-	-	-	-	141	3	6	-	H	-	-	-
Bird Rock	**MA-380-04**	**7**	**894**	**0.266%**	**-**	**15**	**550**	**-**	**37**	**6**	**168**	**-**	**115**	**-**	**3**	**H**
Elephant Rock Complex	MA-380-05	2	36	0.011%	-	-	-	-	H	-	8	-	28	-	-	-
South subregion																
Point Reyes	**MA-374-01**	**9**	**43,061**	**12.833%**	**-**	**15**	**1,160**	**-**	**266**	**6**	**178**	**40,810**	**616**	**-**	**6**	**4**
Coast Campground South	MA-374-02	1	63	0.019%	-	-	-	-	-	-	-	-	63	-	-	-
Point Resistance	**MA-374-03**	**4**	**7,177**	**2.139%**	**-**	**-**	**28**	**H**	**H**	**H**	**8**	**7,091**	**50**	**-**	**-**	**-**
Millers Point Rocks	**MA-374-04**	**6**	**1,951**	**0.581%**	**-**	**-**	**296**	**-**	**59**	**1**	**30**	**1,510**	**55**	**-**	**-**	**-**
Double Point Rocks	**MA-374-05**	**6**	**16,235**	**4.838%**	**-**	**50**	**328**	**-**	**9**	**H**	**8**	**15,818**	**22**	**-**	**-**	**-**
Stinson Beach to Rocky Point	MA-374-06	1	6	0.002%	-	-	-	-	-	-	6	-		-	-	-
Gull Rock Area	MA-374-07	4	23	0.007%	-	-	-	-	9	1	6	-	7	-	-	-
Muir Beach Headlands to Tennessee Cove	MA-374-08	4	97	0.029%	-	-	-	-	42	1	20	-	34	-	-	-
Bird Island	MA-374-09	3	62	0.018%	-	-	P	-	-	1	56	-	5	-	-	-
Point Bonita	MA-374-10	3	171	0.051%	-	-	-	-	95	-	10	-	66	-	-	-
Bonita Cove	MA-374-11	3	10	0.003%	-	-	-	-	2	-	6	-	2	-	-	-
Point Diablo Bluffs and Needles	MA-374-12	2	49	0.015%	-	-	-	-	15	-	34	-	H	-	-	-
Fort Point Rock to Helmut Rock	SF-374-01	1	6	0.002%	-	-	-	-	-	-	6	-		-	-	-
Lobos Rock and Land's End	**SF-374-02**	**3**	**270**	**0.080%**	**-**	**-**	**238**	**-**	**-**	**-**	**14**	**-**	**18**	**-**	**-**	**-**
Seal Rocks	**SF-374-03**	**3**	**233**	**0.069%**	**-**	**-**	**184**	**H**	**-**	**3**	**46**	**-**	**H**	**-**	**-**	**-**
Eel Rock Cliffs	SF-372-05	1	9	0.003%	-	-	-	-	9	-	-	-	H	-	-	-
Mussel Rock Area	SM-374-01	2	11	0.003%	-	-	-	-	-	1	-	-	10	-	-	-
Mori Point	SM-372-01	2	49	0.015%	-	-	-	-	31	-	-	-	18	-	-	-
San Pedro Rock	SM-372-02	3	142	0.042%	-	-	H	-	H	2	12	H	128	-	-	H
Devil's Slide Rock and Mainland	**SM-372-03**	**5**	**1,354**	**0.404%**	**-**	**-**	**692**	**-**	**114**	**H**	**8**	**380**	**160**	**-**	**-**	**-**
Pillar Point	SM-372-04	2	7	0.002%	-	-	-	H	5	-	-	-	2	-	-	-
Seal Rock Cliffs	SM-372-06	4	174	0.052%	-	-	37	-	123	H	2	-	12	-	-	-
Martin's Beach	SM-372-07	3	129	0.038%	-	-	H	-	108	1	-	-	20	-	-	-
Pomponio Beach to Pescadero Beach	SM-370-01	2	22	0.007%	-	-	-	-	-	2	-	-	20	-	-	-
Pigeon Point	SM-370-02	2	10	0.003%	-	-	-	-	-	H	2	-	8	-	-	-
Farallon subregion																
North Farallon Islands	**SF-FAI-01**	**6**	**72,203**	**21.518%**	**-**	**-**	**102**	**-**	**62**	**-**	**32**	**71,929**	**42**	**36**	**-**	**-**
South Farallon Islands	**SF-FAI-02**	**12**	**184,442**	**54.966%**	**1,400**	**1,990**	**17,014**	**1,122**	**442**	**30**	**15,095**	**127,399**	**499**	**18,807**	**516**	**128**
TOTAL	-	12	335,554	100.00%	1,510	2,070	22,419	1,572	4,214	178	16,506	264,937	2,625	18,843	533	147

[1] P, Present in small numbers but not estimated, or present during the period 1989-2004 but not breeding in last year surveyed;
H, historically nesting species (prior to 1989).
A dash (-) indicates the species has not been recorded breeding at the colony.
[2] Arched Rock and Gull Rock are considered a "colony complex."

Appendix 2. Known important prey items of Brandt's cormorant, pelagic cormorant, and pigeon guillemot in north-central California. Most fish taken by seabirds are in the juvenile stage.[1]

Species	Fish	Preferred foraging habitat
Brandt's cormorant	**Fish** Short-belly rockfish *Sebastes jordani* Yellowtail rockfish *Sebastes flavidus* Other rockfish *Sebastes* spp. Pacific sandlance *Ammodytes hexapterus* Plainfin midshipman *Porichthys notatus* Speckled sanddab *Citharichthys stigmaeus* *Hemilepidotus* spp. White seaperch *Phanerodon furcatus* Northern anchovy *Engraulis mordax* Pacific herring *Clupea pallasi* Pacific staghorn sculpin *Leptocottus armatus* *Hemilepidotus* spp. (Cottidae) Other sculpins (Cottidae) Pacific tomcod *Microgadus proximus* Northern Pacific hake *Merluccius productus* Shiner perch *Cymatogaster aggregata* Pacific tomcod *Microgadus proximus* Spotted cusk-eel *Chilara taylori* Butter sole *Isopsetta isolepis* Rex sole *Glyptocephalus zachirus*	Soft bottom

	English sole *Parophrys vetulus* **Invertebrates** Market squid *Loligo opalescens*	
Pelagic cormorant	**Fish** Short-belly rockfish *Sebastes jordani* Yellowtail rockfish *Sebastes flavidus* Other rockfish *Sebastes* spp. Sculpins (Cottidae) *Coryphopterus nicholsii* *Chilara taylori* **Invertebrates** Mysid shrimp *Spirontocaris* sp.	Submerged reefs
Pigeon guillemot	**Fish** Rockfish *Sebastes* spp. Pacific sanddab *Citharichthys sordidus* Blennies (Clinidae) Sculpins (Cottidae) Gunnels (Pholidae) Spotted cusk-eel *Chilara taylori* **Invertebrates** Red octopus *Octopus rufescens*	Submerged reefs

[1] Data on seabird prey items from Ainley et al. (1990) and PRBO Conservation Science (unpubl. data).

Appendix 3. Major Brown Pelicans roosts in the North Central Coast Study Region. Relative roost sizes are categorized as >100, >500, and >1000 birds. Data from D. L. Jaques (Pacific Eco Logic, Astoria, Oregon).

SITE NAME	ROOST SIZE
North bioregion	
Gualala Point Island	>100
Russian River Rocks	>100
Arched Rock	>100
Gull Rock (Russian River area)	>100
Bodega Rock	>100
Bodega Bay	>100
Tomales Bay	>100
Dillon Beach Rocks	>100
Bird Rock (Tomales Point)	>500
Tomales Point (south of Bird Rock)	>100
South bioregion	
Point Reyes	>100
Point Resistance	>100
Millers Point Rocks	>100
Double Point Rocks	>100
Bolinas Lagoon	>100
Gull Rock area (Marin Co.)	>100
Rodeo Lagoon	>100
Bird Island (Point Bonita)	>100
Seal Rocks	>500
San Pedro Rock	>100
Devil's Slide Rock & Mainland	>100
Pillar Point Harbor Jetty	>500

Farallon bioregion	
South Farallon Islands	>1000

Appendix 4. Average numbers (2000-2007) of waterfowl of species most likely to benefit from MPAs and of all waterfowl species combined from winter surveys of the coastal estuaries, North Central Coast Study Region (U.S. Fish and Wildlife Service, unpubl. data).

Estuary Name	**Brant**	**Greater Scaup**	**Surf Scoter**	**Bufflehead**	**All Species**
Bodega Bay	313	794	325	511	2436
Tomales Bay	904	7325	1669	2386	14194
Rodeo Lagoon	0	15	0	10	110
Bolinas Lagoon	40	338	59	173	3379
Drakes/Limantour Estero	245	1321	351	1945	6775