California MLPA Master Plan Science Advisory Team, Marine Bird and Mammal Work Group Summary of Guidelines and Evaluation Methods for Marine Birds and Mammals in the MLPA South Coast Study Region

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Marine protected areas (MPAs) may benefit marine birds and mammals by protecting their forage base and by potentially reducing human disturbance to roosting and haul-out sites, and breeding colonies or rookeries. To evaluate the protection afforded by proposed MPAs to birds and mammals the MLPA Master Plan Science Advisory Team (SAT):

- Identifies proposed MPAs or special closures [1] that contribute to protection of birds and mammals.
- Identifies focal species likely to benefit from MPAs and for which data are available.
- Analyzes the proportion (of total numbers of individuals) of breeding bird/mammal at colonies and rookeries potentially benefiting by proposed MPAs.
- Analyzes the proportion of nearby foraging areas protected by MPAs, defined by evaluating protection of buffered areas around colonies.

This evaluation focuses on pinnipeds (seals and sea lions), nearshore delphinids (e.g., coastal bottlenose dolphin), and birds, including seabirds, shorebirds, and waterfowl [2]. Population, as used in this evaluation, refers to the number of animals that use a site for breeding or resting. Evaluations are focused on three subregions; the northern Channel Islands, the southern Channel Islands and mainland coast, and all the Channel Islands and the mainland coast. Evaluations include numbers of species (species diversity), numbers of individual birds or mammals, and percentages of subregional populations breeding within individual proposed MPAs and within all proposed MPAs. Species evaluated are limited to those identified as likely to benefit from MPAs and special closures with an emphasis on species identified as most likely to benefit.

The SAT evaluation for marine birds and mammals focuses on:

1. Protection of seabird breeding colonies and pinniped rookeries based on population size, location and species composition

This analysis examines whether MPAs and special closures proposals will benefit the species identified as likely to benefit. Evaluations are based on the numbers of animals in the MLPA South Coast Study Region, and the proportion within each subregion, and within the proposed MPA or special closure area. For each colony within a proposed protection area, the SAT considers the likely affect of the specific protections or regulations identified (e.g., no-entry zones) that would reduce human disturbance, and whether the MPA or special closure area affects significant numbers of animals. Special closure areas will provide maximum benefit by minimizing disturbance caused by boats, irrespective of vessel type. MPAs that restrict fishing

[1] Special closures are not MPAs, but could restrict access to discrete areas to prevent human disturbance to colonies, rookeries, haul-outs, and roosts. Special closures may be included in future rounds of the marine birds and mammals evaluations if included in MPA proposals; they would be evaluated with regard to marine birds and mammals using similar methods as used for MPAs.

[2] Cetaceans are included only in foraging analyses (i.e., 3 and 4), because their relatively large-scale movements make it unlikely they would directly or measurably benefit from the size of MPAs being defined.

or other activities in waters surrounding colonies would provide less benefit than no-entry zones but likely would provide a benefit by reducing the numbers of boats approaching and lingering near colonies. Possible benefits of reduced disturbance include increased bird/mammal productivity, colony/population size, and species diversity[3] [4].

Data used for these assessments comes from the National Oceanic and Atmopsheric Administration (NOAA)/U.S. Fish and Wildlife Service (USF&WS) bird colony database[5], from pinniped data compiled from Mark Lowry and Sharon Melin (NOAA Fisheries), and other sources. The SAT evaluates total numbers of seabirds and pinnipeds, and the proportions of subregional (i.e., northern Channel Islands, southern Channel Islands and mainland coast, or all Channel Islands and mainland coast) breeding populations for each species, and for all species combined, within each proposed MPA or special closure. The size of special closures vary, but usually range between 300 and 1000 feet.

2. Marine bird and pinniped resting (roost/haulout/raft) locations based on population size, location and species composition

Many marine birds and pinnipeds require areas close to foraging locations where they can safely come to shore to rest, sleep, dry (i.e., cormorants, pelicans), or molt (some pinnipeds). Frequent disturbance at resting sites results in high levels of energy expenditure that can lead to poor body condition and/or cause animals to abandon the area.[3][4]

The methods the SAT uses to assess roosting areas and haulout sites are similar to those used for colonies/rookeries. For seabirds, the SAT uses data on major Brown Pelican roosts, which also serve as a surrogate for other species. For pelicans, major roosts have been categorized as those typically containing: 1) 100-500 birds; 2) 500-1,000 birds; and 3) > 1,000 birds. For pinnipeds, total numbers and the proportions of subregional populations for each species and for all species combined are evaluated.

3. Marine bird and pinniped near-colony/rookery foraging concentrations based on population size, location and species composition

As upper trophic level predators, seabirds and marine mammals require an abundance of resources for survival and reproduction. With long life expectancies (>20 years), low annual productivity, and high site fidelity, these animals are subject to population level impacts from reduced prey supplies or disturbance at foraging areas. High levels of disturbance at foraging areas can cause increased energy expenditure leading to poor body condition; this can be especially detrimental for species with long migration routes that may not have sufficient

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[3] Carney, K.M. and W.J. Sydeman. 1999. A review of human disturbance effects on nesting colonial waterbirds. Waterbirds 22:68-79.

[4] Rojek, N.A., M.W. Parker, H.R. Carter, and G.J. McChesney. 2007. Aircraft and vessel disturbances to Common Murres *Uria aalge* at breeding colonies in central California, 1997–1999. Marine Ornithology 35: 67–75.

[5] Original data is from Carter 1980 and Sowles 2000. These data were then updated in 2004 with information mostly in Baja California from Wolfe SG 2002 using the same format.

energy reserves to complete migration. Thus, protection of important prey species and foraging areas could have benefits, especially to species with limited foraging distributions.

For breeding species, the SAT will focus on five seabird and one marine mammal species most likely to benefit based on limited foraging ranges. For birds, this analysis focuses on the pelagic cormorant, Brandt's cormorant, pigeon guillemot, California least tern, and bald eagle. For pinnipeds, this analysis focuses on the harbor seal. These species mainly forage in nearshore waters within a few miles of colonies. However, other species are likely to benefit (e.g., double-crested cormorant, Forster's tern, caspian tern, black skimmer, Guadalupe fur seal, northern fur seal, long-beaked common dolphin and coastal bottlenose dolphin).

Evaluations of benefits to marine birds and mammals near colonies is based on whether or not proposed regulations may benefit forage species (Table 1) or foraging habitats, how much foraging area will be protected near breeding areas, and how many animals stand to benefit. Zones extending three miles alongshore and to three miles offshore (the main foraging range of these species when breeding) from breeding colonies/rookeries are used to examine the numbers of birds/mammals utilizing the area within the proposed MPA.

4. Marine bird and mammal neritic foraging based on location, bird density, and species composition

There are many hydrographic features within the neritic zone of state waters that will concentrate the prey of many marine birds and mammals. Retention areas and thermal fronts adjacent to upwelling centers and river plumes are known to concentrate prey. These areas are often referred to as 'hot spots', or areas of high trophic transfer, as they provide essential foraging opportunities to upper trophic level predators. While the types of prey typically found at hot spots are highly mobile (e.g., anchovies, squid, and krill), they will benefit from MPAs protecting hot spots as they have a high probability of being concentrated in these areas. Any protection given to hot spots will ultimately translate into added marine bird and mammal protection. At-sea densities for the following 11 species will be plotted over proposed MPAs to determine the number of species and densities likely to benefit: western grebe, sooty shearwater, brown pelican, Brandt's cormorant, red phalarope, Heerman's gull, California gull, western gull, black-legged kittiwake, caspian tern, and cassin's auklet. At-sea distributions from Mason et al. (2007) will be used for these analyses. Additionally, at-sea densities or encounter rates of California sea lion and coastal bottlenose dolphin will be plotted over proposed MPAs to evaluate potential benefits. Data available from the Channel Islands National Marine Sanctuary (CINMS) will be used for evaluation.

5. Estuarine protection for resident and migrant shorebirds and waterfowl

The SAT evaluates whether proposed MPAs provide protection to the inhabitants of estuarine areas. There are many human activities, including hunting, that take place within estuaries and have adverse effects on shorebird and waterfowl populations. Estuaries provide critical resting and foraging habitat for resident and migrant birds and protecting this habitat will have direct

benefit to these populations. Data from Audubon Christmas Bird Counts will be plotted over proposed MPAs to determine the abundance and number of species likely to benefit.

Table 1. Known important prey items of bald eagle, Brandt's cormorant, California least tern, pelagic cormorant, pigeon guillemot, harbor seal, California sea lion, and coastal bottlenose dolphin in southern California. Most fish taken by seabirds are in the juvenile stage.[1]

Species	Prey	Preferred Foraging Habitat
Bald Eagle	**Fish** Rockfish *Sebastes* spp. Surfperch (Embiotocidae) Pile Perch *Damalichthys vacca* Cabezon *Scorpaenichthys marmoratus* Midshipman *Porichthys* spp. California sheephead *Semicossyphus pulcher* Pricklebacks (Stichaeidae) **Invertebrates** California mussel *Mytilus californianus* Other bivalves Limpets Sea urchin *Strongylocentrotus* spp. **Marine birds** Eared Grebe *Podiceps nigicollis* Sooty Shearwater *Puffinus griseus* Cormorants *Phalacrocorax* spp. California Gull *Larus californicus* Common Murre *Uria aalge* Rhinoceros Auklet *Cerorhinca monocerata* Cassin's Auklet *Ptychoramphus aleuticus* Waterfowl (ducks, scoters, mergansers)	
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*	Soft bottom

	Shiner perch *Cymatogaster aggregata* Pacific tomcod *Microgadus proximus* Spotted cusk-eel *Chilara taylori* Butter sole *Isopsetta isolepis* Rex sole *Glyptocephalus zachirus* English sole *Parophrys vetulus* **Invertebrates** Market squid *Loligo opalescens*	
California Least Tern	**Fish** California killifish (*Fundulus parvipinnis*) Sculpins (Cottidae) Surfpersh (Embiotocidae) Silverside smelt (Atherinidae) Anchovy (*Anchoa sp.*) Northern Anchovy (*Engraulis mordax*) Pacific Saury (*Cololabis saira*) – not in good years Cabezon (*Scorpaenichthys marmoratus*) Rockfish (*Sebastes sp.*)	Estuarine/lagoons and nearshore coastal
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
Harbor seal	**Fish** Rockfish *Sebastes* spp. Pacific sandlance *Ammodytes hexapterus* Plainfin midshipman *Porichthys notatus* Speckled sanddab *Citharichthys stigmaeus* *Hemilepidotus* spp. 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* Spotted cusk-eel *Chilara taylori* Butter sole *Isopsetta isolepis* Rex sole *Glyptocephalus zachirus* English sole *Parophrys vetulus* Salmonid Lamprey Hagfish Walleye pollock Starry flounder, *Platichthys stellatus* Pileperch, *Rhacochilus (Damalilicthys) vacca* **Invertebrates** Mysid shrimp *Spirontocaris* spp. Market squid *Loligo opalescens* Octopoda spp. Crustacea Bivalve mollusc	
California sea lion	**Fish** Northern anchovy Pacific whiting Jack mackerel Rockfish spp. Pacific (chub) mackerel Blacksmith Senorita Plainfin midshipman **Invertebrates** Market squid Octopus spp. Squid spp. Pelagic red crab	
Coastal bottlenose dolphin	**Fish** Croaker spp., Family Sciaenidae Barracuda, *Sphyraena argentea* Jack mackerel, *Trachurus symmetricus* **Invertebrates** Market squid, *Loligo opalescens*	

[1] Data on seabird prey items from Ainley et al. (1990) and PRBO Conservation Science (unpubl. data). Data on Bald Eagle prey items, limited to marine prey items only, from Erlandson, J.M., T.C. Rick, P.W. Collins, and D.A. Guthrie. 2007. Archaeological implications of a bald eagle nesting site at Ferrelo Point, San Miguel Island, California. Journal of Archaeological Science 34: 255-271.

Sources for Table 1: Ainley, D.G., C.S. Strong, T.M. Penniman, and R.J. Boekelheide. 1990. The feeding ecology of Farallon seabirds. Pp. 51-127 in (D.G. Ainley and R.J. Boekelheide, eds.), Seabirds of the Farallon Islands: Ecology, Dynamics, and Structure of an Upwelling-system Community. Stanford University Press, Stanford, California. Data on California Least Tern prey items from Robinette, D. 2003. Partitioning of food resources by four sympatric terns (Aves: Laridae) breeding in southern California. Master's Thesis. California State University, Long Beach; Robinette, D. and J. Howar. 2008. Monitoring and management of the California Least Tern colony at Purisima Point, Vandenberg Air Force Base, 2007. Unpublished Report, PRBO Conservation Science, Petaluma, CA. Data on harbor seal prey items from Harvey JT, Helm R, Morejohn G. (1995) Food habits of harbor seals inhabiting Elkhorn Slough, California. Calif. Fish and Game. 81:1-9; Antonelis, G.A. and C.H. Fiscus. 1980. The Pinnipeds of the California Current. CalCOFI Rep., Vol. XXI. Data on California sea lion prey items from Lowry MS, BS Stewart, CB Heath, PK Yochem, and JM Francis. 1991. Seasonal and annual variability in the diet of California

sea lions *Zalophus californianus* at San Nicolas Island, California, 1981-1986. Fishery Bulletin, U.S. 89:331-336. Data on coastal bottlenose dolphin prey items from Schwartz, M. L., A. A. Hohn, H. J. Bernard, S.J. Chivers, and K. M. Peltier. 1992. Stomach contents of beach-cast cetaceans collected along the San Diego County coast of California, 1972-1991. NMFS-SWFSC- Administrative Report LJ-92-18. 33pp.