

California MLPA Master Plan Science Advisory Team
Evaluation of Benefits to Marine Mammals from Round 3 Proposed Marine
Protected Areas and Special Closures
October 14, 2010

The objective of this evaluation is to assess what benefits associated with goals 1, 2 and 4 of the California Marine Life Protection Act (MLPA) are achieved by proposed marine protected areas (MPAs) and special closures as they apply to marine mammals in the MLPA North Coast Study Region (NCSR). Proposed MPAs are evaluated for benefits for pinnipeds (seals and sea lions) and cetaceans (whales and porpoises). These animals are long-lived, produce few offspring and would benefit from placement of MPAs because of the reduction of disturbance from human activities.

Pinnipeds feed at sea and congregate onshore at traditional locations to rest at 'haulout sites' and to breed at 'rookeries'. These terrestrial sites are within intertidal or supratidal zones of the mainland and on islands. A range of substrates are represented at these sites, including hard rock, cobble and sand. Pinnipeds would benefit from the reduction of disturbance on or adjacent to rookeries or haulout sites. Vessel traffic, including motorized and non-motorized traffic, can cause significant levels of disturbance to marine mammals (e.g. Allen et al. 1985, Suryan and Harvey 1999, Thompson et al. 2001, Johnson and Acevedo-Gutierrez 2007). Disturbances can lead to reductions in productivity or site abandonment. Disturbances at foraging areas can disrupt feeding activities and cause animals to leave the area, further reducing feeding and leading to additional energy expenditures. Although MPAs do not restrict human access or vessel transit, the restrictions on allowable activities within MPAs are likely to result in fewer extractive users that access these areas. The proposed MPAs would provide protection only against consumptive activities. Non-consumptive activities such as kayaking and surfing can still create disturbances to marine mammals. This can be addressed through the use of no-entry special closure areas. Special closures are considered to provide the greatest benefit to marine mammals, followed by state marine reserves (SMRs).

Five pinniped species occur in the NCSR: Steller and California sea lions, northern fur seals, harbor seals, and elephant seals. Northern fur seals are rare and are generally seen offshore, and elephant seals only occur (and breed) at one location (Castle Rock) and are otherwise rare and found offshore. Species most likely to benefit include the two locally common and breeding pinnipeds, Steller sea lions and harbor seals, and the seasonally common and non-breeding California sea lion.

Most cetaceans (whales and dolphins) travel large distances and are not typically associated with a site that might be considered within the MPA framework. In the NCSR, summering gray whales and resident harbor porpoises are exceptions to the typical cetacean pattern as they are locally common and depend upon specific areas of the near-shore waters in this region. While gray whales typically migrate through the NCSR during the winter and spring, there is a small population that feed along our coast during the summer months. Northern California is the southern terminus of a subgroup of the gray whale population called the Pacific Coast Feeding Aggregation (PCFA) that forgo a full summer migration to Arctic seas and forage on benthic, epibenthic and swarming invertebrates along the coasts of Southeast Alaska, British Columbia, Washington, Oregon and northern California (NOAA, 2002). Harbor porpoise are locally resident and abundant in the nearshore waters throughout the year and are included in our analyses. Harbor porpoise breed and feed in nearshore waters. Gray whales and harbor

porpoise would benefit from the placement of MPAs because of the reduction of disturbance from human activities.

Methods

Evaluations follow the methods described in the *Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA North Coast Study Region*. The evaluation includes analyses of the potential benefits to pinnipeds at: 1) breeding, 2) resting areas, and 3) nearshore foraging, and to 4) pinnipeds and cetaceans at neritic foraging areas.

Our analyses consider pinniped haulout sites, rookeries and forage areas that have been proposed with very high levels of protection (state marine reserves (SMR) or special closure areas) and do not include MPAs with lower levels of protection. We assume that most activities that affect pinnipeds on land would be reduced by these levels of protection. We recognize that protection of an area as a SMR does not address all potential sources of human activities, and that no-entry special closures would provide the highest level of benefit to marine mammals. We also recognize that lower levels of protection may provide some measure of protection. Data that directly evaluate potential impacts to pinnipeds in the NCSR are limited. Therefore these analyses provide a summary of the potential added value to pinnipeds due to proposed SMRs and special closures.

Population in this evaluation refers to the number of animals that use a site for breeding or resting. A haulout site is a location where seals and sea lions come onshore to rest. A rookery is a location where seals and sea lions come onshore to give birth, raise their young and breed. Many sites serve as both haulouts and rookeries.

Rookery and Hot Spot Analyses

For rookeries, or breeding sites, the two species most likely to benefit from MPAs include Steller sea lions and harbor seals. These species are sensitive to disturbance from human activities - particularly when breeding.

Analyses of pinniped rookery and haulout counts are drawn from survey data provided by Mark Lowry from NOAA Fisheries (pers. com.). Because harbor seal census data were collected just after pupping, during the molt period, systematic documentation of rookery locations in the NCSR is not available. We have conservatively characterized harbor seal haulouts of over 20 animals as rookeries.

There are two Steller sea lion rookeries and 62 harbor seal rookeries in the NCSR. Proposed MPAs and special closures that captured these rookeries were identified (Table 1). The two Steller sea lion rookeries were identified as hot spots due to their significance to the region and to the threatened eastern stock of Steller sea lions. Four hot spots were identified for harbor seal haulouts based on the large number of harbor seals that breed in these areas. Proposed MPAs and special closures that captured these hot spots were identified (Table 3).

Resting (Haulout) Sites

California sea lions, Steller sea lions and harbor seals will likely benefit from MPAs that protect haulout sites. Evaluation of the Round 3 MLPA North Coast Regional Stakeholder Group (NCRSG) MPA Proposal considers the total number of each species of pinniped, and calculates this as a percentage of the total number of pinnipeds within the NCSR for each proposed MPA and proposed special closure (Table 4). A comparison between Proposal 0 (existing MPAs), NCRSG MPA Proposal and the Round 3 NCRSG Special Closure Recommendation, with respect to the number of pinniped species, the number of each species of pinniped, and the percentage of the study region is presented in Table 5.

Foraging Areas

Harbor seals are the species most likely to benefit from potential increases to their forage base provided by MPAs. In nearshore areas, harbor seals typically forage near their haulout or rookery sites, and may repeatedly visit specific foraging areas (Jones 1981, Harvey and Torok 1994, Harvey et al. 1995, Thompson et al. 1998). Harbor seals forage on prey that is locally abundant, and they feed over a variety of habitats where they pursue rockfish, anchovies, squid and other prey (Table 9.1 in *Draft Methods Used to Evaluate Marine Protected Area Proposals in the MLPA North Coast Study Region*).

Steller sea lions are also likely to benefit during the breeding season from increases to their nearshore forage base provided by MPAs. During this time, adult females forage close to the rookery and consistently return to the rookery to care for their pups (Reimer et al., 2001).

To evaluate the effectiveness of MPAs to capture these foraging areas, buffers were created along three miles of coast and out to three miles offshore from haulouts and rookeries for harbor seals (rookeries only for Steller sea lions). These buffers were overlaid with proposed MPAs and special closures and the area of overlap determined. The proportion of the harbor seal and Steller sea lion foraging range overlapping proposed MPAs and special closures was then weighted based on the proportion of the study region population present within that proposed MPA or special closure. These weighted foraging indexes for SMRs and special closures for harbor seals (Table 6) and Steller sea lions (Table 7) are provided. The values are unitless but are useful to compare between proposals.

Neritic Foraging Areas

In addition to feeding near rookeries and haulouts, pinnipeds, whales and porpoises feed in other parts of nearshore waters. Neritic hot spots have been identified as places where pinnipeds, harbor porpoises and gray whales congregated during at sea systematic transect surveys (Strong, C., unpublished data). The neritic hot spots foraging analysis included plotting densities of these species over proposed MPAs and special closures to determine the area of neritic foraging hot spots protected for pinnipeds, harbor porpoises and gray whales. Hot spots were identified as areas with the top 10% of the density of observed pinnipeds (all species), harbor porpoises and gray whales (Appendix A). Our evaluation included the area of foraging 'hot spots' captured in proposed SMRs and special closures and the expected number of animals per area (Table 9).

In addition to the neritic transect surveys, gray whale foraging areas were also evaluated by plotting maximum densities of gray whales obtained from 12 years of shore-based surveys (Goley, P.D., unpublished data) over proposed SMRs and special closures. Five shore sites were identified from which whales were counted during the summer months: Point St. George, Crescent City Overlook, Klamath River mouth, Wedding Rock and Trinidad Bay and a three mile buffer was described around these sites. The proportion of the foraging range overlapping proposed MPAs and special closures was then weighted based on the average maximum count of whales during the summer months at each observation site in each MPA. The percentage of each observation area was then multiplied by the maximum number of whales counted at each site during the summer months (Table 8). The values are unitless but are useful for comparison between proposals.

Results

Three species of pinnipeds occur regularly in the north coast study region (California sea lion, Steller sea lion, harbor seal). Steller sea lions are locally abundant and are known to breed in the study region. There are two Steller sea lion rookeries in the study region (Sugarloaf Island and Southwest Seal Rock). These are biologically significant as they are two of the most southern rookeries of this threatened species. Harbor seals are also known to pup in the area and we estimate that there are 62 rookeries in the NCSR. Harbor seals are also locally abundant and known to breed in the region. California sea lions do not breed in the area, but are seasonally abundant on nearshore rocky haulouts.

Rookeries and Hot spots

Steller sea lions

The NCRSG MPA Proposal does not include any Steller sea lion rookeries within SMRs.

The NCRSG Special Closures Recommendation includes special closures that would protect the Steller sea lion rookeries on both Southwest Seal Rock and Sugarloaf Island year round (Tables 1 and 2). These two sites were also identified as pinniped hot spots (Table 3).

Harbor seals

The NCRSG MPA Proposal includes a very limited number (6 of 62) of harbor seal rookeries in proposed SMRs and special closures (Tables 1 and 2).

Of the 4 harbor seal rookeries that were identified as pinniped hot spots due to large numbers of breeding seals, one (vicinity of Castle Rock) was captured by the NCRSG MPA Proposal and the NCRSG Special Closures Recommendation. The mouth of the Eel River, Arcata Bay and South Humboldt Bay were not included in a proposed SMR or proposed special closure in Round 3. The NCRSG Special Closure Recommendation includes Castle Rock harbor seal rookery as a special closure, which does provide some protection for harbor seals.

Resting Sites

Analysis of Round 3 proposed SMRs and special closures

The NCRSG MPA Proposal includes four SMRs that provide benefits to a small portion of the NCSR population of harbor seals (1.5%), California sea lions (0.2%) and Steller sea lions (7.1%) at resting sites, which is less than many of the draft proposals in Round 2. The NCRSG Special Closures Recommendation also provides benefits to a small portion of the NCSR population of harbor seals (6.6%) and California sea lions (10.9%), and a large portion of the NCSR population of Steller sea lions (50.8%).

Nearshore Foraging Analysis

Harbor seals

The potential benefit from SMRs and special closures protecting likely foraging areas for Pacific harbor seals is summarized by the weighted foraging index (Table 6). Harbor seal rookeries and haulouts were included in only three SMRs in the NCRSG MPA Proposal. The 3 mile buffer around rookeries and haulouts intersected, to a very small extent, five of the proposed SMRs. This resulted in very low foraging indexes in the NCSR. Of the 1563 square miles identified as foraging areas, only 1.6% was captured by SMRs and special closures.

While proposed special closures benefit a small proportion of harbor seals within the area they surround with a 300 ft no entry zone, they provide a very limited benefit to the majority of foraging areas for harbor seals.

Steller sea lions

The potential benefit from proposed SMRs and special closures protecting likely foraging areas for Steller sea lions is summarized by the weighted foraging index (Table 7). Steller sea lion foraging indices were calculated for proposed SMRs. Given that no SMRs captured rookeries, there is little overlap between adjacent proposed SMRs leading to low foraging indices for Steller sea lions. Of the 47.4 square miles identified as foraging areas, only 10.1% was captured by SMRs and special closures.

While proposed special closures benefit Steller sea lions on the rock they surround with a 300 ft. no entry zone, they provide a very limited benefit to foraging areas for Steller sea lions.

Gray whales

The potential benefit from recommended special closures protecting foraging areas for gray whales during the summer months was negligible (weighted foraging index = 0.01). None of the buffered feeding areas were intersected by proposed SMRs in the NCRSG MPA Proposal (Table 8). Of the 99 square miles identified as foraging areas, only 0.07% was captured by SMRs and special closures.

Neritic foraging analysis

The potential benefits from MPAs and special closures protecting important foraging areas for all pinnipeds, harbor porpoise and gray whales based on at-sea transects was very low (Table 9 and Appendix A). When considering SMRs and special closures only, area of overlap with marine mammal neritic foraging areas was 5.51 square miles (about half what some of the Round 2 proposal achieved). The NCRSG MPA Proposal captured harbor porpoise foraging hot spots and only the False Klamath Rock Seasonal Special Closure intersected with gray whale hot spots. This analysis measures important foraging area at sea, and because special closures encompass little ocean surface, they contribute little to this analysis.

Summary

The NCRSG MPA Proposal and NCRSG Special Closures Recommendation include the addition of SMRs not currently in the network and special closures. Some of the SMRs and special closures proposed will benefit marine mammals by reducing disturbance at pinniped haulouts and rookeries. Additionally, the proposed networks provide very limited potential foraging benefits to marine mammals. The protection of Southwest Seal Rock and Sugarloaf Island Steller sea lion rookeries are noteworthy. These proposed special closures will provide tremendous benefit to the threatened Steller sea lions in the NCSR. When considering the combined impacts of the proposed SMRs and the special closures to the percentage of pinniped populations, the NCRSG MPA Proposal and the NCRSG Special Closures Recommendation offer some protection.

It is noteworthy that the NCRSG MPA Proposal does not provide a significant benefit to harbor seals with only 1.5% of the NCSR harbor seal population included in the NCRSG MPA Proposal and 6.6% included in the NCRSG Special Closures recommendation. Three of the harbor seal breeding hot spots were not included in NCRSG MPA Proposal and NCRSG Special Closures Recommendation. Harbor seals are considered one of the species most likely to benefit from MPAs and they play a significant role in the marine ecology of northern California. They reside in the NCSR year round, forage in the nearshore waters, and are dependent upon the local coastline and nearshore rocks to breed, molt and rest.

Pinniped and gray whale foraging areas did not significantly benefit from protection in the NCRSG MPA Proposal and NCRSG Special Closures Recommendation. We identified marine mammal foraging areas by creating 3 mile buffers around Steller sea lion and harbor seal rookeries as well as by identifying at-sea foraging hot spots for pinnipeds and cetaceans and identifying buffered zones around nearshore gray whale foraging areas. When considering proposed SMRs, the weighted foraging indexes were very low suggesting that the NCRSG MPA Proposal and NCRSG Special Closures Recommendation do not provide benefits to the foraging habitat that marine mammals in the NCSR depend upon. Steller sea lions, harbor seals, harbor porpoise and gray whales were identified as species most likely to benefit from MPAs, yet their foraging areas were largely missed by proposed MPAs.

Given that there are few SMRs that directly overlap with the identified marine mammal breeding or foraging hot spots, there is little protection to neritic or near shore marine mammal foraging hot spots offered in the NCRSG MPA Proposal and NCRSG Special Closures

Recommendation. In addition to the substrate required for breeding and resting, marine mammals are utterly dependent upon marine resources to feed. While special closures offer protection to pinnipeds on rookeries or haulouts, they contribute little to protection of the foraging areas. The 300 ft buffer currently proposed for special closures does offer some protection from direct disturbance to pinnipeds, which is very beneficial. However, this 300 ft buffer does not significantly contribute to protecting the foraging areas which are the 3 miles surrounding the rookeries/haulouts. These concerns would be addressed by including foraging areas within SMRs or modifying the special closures to include a no-entry zone of 1000 ft as has been implemented in other regions. These actions would contribute to increased weighted foraging indexes and would provide greater benefits to local marine mammals. While some rookeries and haulouts receive benefits from the NCRSG MPA Proposal, it has missed the opportunity to significantly improve benefits for harbor seals, specifically in protecting their foraging areas, or capture foraging areas for cetacean species over the existing MPAs.

Table 1. Comparison of number of rookeries within proposed MPAs by species and total number of rookeries within the north coast study region.

Name	Steller Sea Lion Rookeries	Harbor Seal Rookeries
Proposal 0		
Mackerricher SMCA ^a	0	3
Point Cabrillo SMCA ^a	0	1
NCRSG MPA Proposal		
Big Flat SMCA ^a	0	1
Vizcaino SMCA ^a	0	1
Ten Mile SMR	0	2
Point Cabrillo SMR	0	1
Special Closures		
Southwest Seal Rock Special Closure	1	0
Castle Rock Special Closure	0	1
Sugarloaf Island Special Closure	1	0
Rockport Rocks Seasonal Special Closure	0	1
Vizcaino Rock Seasonal Special Closure	0	1
Total Availability in Study Region	2	62

Note: Proposed MPAs and special closures not included in the table do not contain rookeries.

^a *Not included in Table 2 because benefits to marine mammals are reduced by allowed take activities.*

Table 2. Summary comparison of number of rookeries within proposed SMRs and special closures by species and total number of rookeries within the north coast study region.

Name	Total Pinniped Rookeries	Steller Sea Lion Rookeries	Harbor Seal Rookeries
Proposal 0	0	0	0
NCRSG MPA Proposal	3	0	3
Special Closures	5	2	3
Study Region Total	64	2	62

Table 3. Proposed special closures and SMRs containing pinniped population hot spots

Name	Population Hot Spots					
	SW Seal Rock	Sugarloaf Island	Vicinity of Castle Rock, Crescent City	South Bay, Humboldt Bay	Arcata Bay, Humboldt Bay	Mouth of the Eel River
Proposal 0						
NCP				South Humboldt Bay SMRMA ^a		
Special Closures	Southwest Seal Rock Special Closure	Sugarloaf Island Special Closure	Castle Rock Special Closure			

^a Designation does not provide benefits to marine mammals because of allowed take activities, but is included for reference only. Only special closure or SMR designation is considered to provide benefits to marine mammals.

Table 4. Number of animals and percentage of study region population within proposed MPAs and special closures

	Name	California Sea Lion	California Sea Lion %	Steller Sea Lion	Steller Sea Lion %	Harbor Seal	Harbor Seal %
Proposal 0	Point Cabrillo SMCA ^a	0	0.0%	0	0.0%	310	3.3%
	MacKerricher SMCA ^a	0	0.0%	0	0.0%	48	0.5%
NCP	Reading Rock SMCA ^a	3	<0.1%	4	0.1%	42	0.4%
	South Cape Mendocino SMR	25	0.2%	0	0.0%	14	0.2%
	Sea Lion Gulch SMR	0	0.0%	347	7.1%	0	0.0%
	Big Flat SMCA ^a	0	0.0%	16	0.3%	34	0.4%

	Name	California Sea Lion	California Sea Lion %	Steller Sea Lion	Steller Sea Lion %	Harbor Seal	Harbor Seal %
	Vizcaino SMCA ^a	54	0.4%	1	<0.1%	322	3.4%
	Ten Mile SMR	0	0.0%	0	0.0%	78	0.8%
	Point Cabrillo SMR	0	0.0%	0	0.0%	48	0.5%
Special Closures	Southwest Seal Rock Special Closure	5	<0.1%	1182	24.1%	0	0.0%
	Castle Rock Special Closure	1291	9.8%	716	14.6%	513	5.4%
	Sugarloaf Island Special Closure	56	0.4%	591	12.1%	20	0.2%
	Steamboat Rock Seasonal Special Closure	25	0.2%	0	0.0%	0	0.0%
	Rockport Rocks Seasonal Special Closure	0	0.0%	0	0.0%	66	0.7%
	Vizcaino Rock Seasonal Special Closure	58	0.4%	0	0.0%	25	0.3%

Notes: Proposed MPAs and special closures not included in the table do not contain pinniped haulouts or rookeries.

^a Designation does not provide benefits to marine mammals because of allowed take activities, but is included for reference only, and does not contribute to Table 5. Only special closure or SMR designation is considered to provide benefits to marine mammals.

Table 5. Comparison of number of species and number of animals at haul outs within proposed SMRs and special closures and total number of pinnipeds within the north coast study region.

	Number of Species	Animals (% of regional population)			Proposal Total Pinnipeds
		California Sea Lion	Steller Sea Lion	Harbor Seal	
Proposal 0	0	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
NCP	3	25 (0.2%)	347 (7.1%)	140 (1.5%)	512 (1.9%)
Special Closures	3	1435 (10.9%)	2489 (50.8%)	624 (6.6%)	4548 (16.5%)
Study Region Total	3	13200	4904	9451	27555

Table 6. Comparison of the harbor seal foraging index within proposed SMRs and special closures.

MPA Proposal	MPA Name	Weighted Forage Area	Sum of weighted area in SMRs
Proposal 0	Punta Gorda SMR	0.08	0.08
NCP	South Cape Mendocino SMR	0.05	1.17
	Mattole Canyon SMR	0.39	
	Sea Lion Gulch SMR	0.33	
	Ten Mile SMR	0.41	
	Point Cabrillo SMR	0.01	
Special Closures	Castle Rock Special Closure	<0.01	<0.01
	False Klamath Rock Seasonal Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	
	Steamboat Rock Seasonal Special Closure	<0.01	
	Rockport Rocks Seasonal Special Closure	<0.01	
	Vizcaino Rock Seasonal Special Closure	<0.01	

Table 7. Comparison of the Steller sea lion foraging index within proposed SMRs and special closures in the north coast study region.

	Name	Weighted Forage Area	Sum of weighted area in SMRs or special closures
Proposal 0	None	0.00	0.00
NCP	Point St. George Reef Offshore SMCA	0.44	0.58
	South Cape Mendocino SMR	0.58	
Special Closures	Southwest Seal Rock Special Closure	<0.01	0.01
	Steamboat Rock Seasonal Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	

Table 8. Gray whale foraging index within proposed SMRs and special closures

Name	SMR or Special Closure Name	Whales Weighted Forage Area
Proposal 0	None	0.00
NCP	None	0.00
Special Closures	Castle Rock Special Closure	0.01

Table 9. Neritic foraging hot spot area protection and number of animals at sea in proposed SMRs and special closures

Name	Area (sq. mi)	Average Number of Animals Sighted in Hot Spots		
		All Pinnipeds	Harbor Porpoise	Gray Whale
Proposal 0	-	-	-	-
NCP	5.28	55.1	-	-
Special Closures	0.23	2.2	-	0.1

Note: a dash indicates the area is not a hot spot for that species or group of species.

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Appendix A

Table A1. Neritic foraging hot spot area and average number of animals at sea in proposed MPAs and special closures

Name	Area (sq. mi)	All Pinnipeds	Harbor Porpoise	Gray Whale
Average Number of Animals Sighted				
Proposal 0 (none)				
NCP				
Reading Rock SMCA	7.73	-	26.96	-
Samoa SMCA	15.67	-	82.16	-
South Cape Mendocino SMR	3.94	52.57	-	-
Mattole Canyon SMR	1.34	2.51	-	-
Vizcaino SMCA	20.68	30.74	-	-
Special Closures				
False Klamath Rock Seasonal Special Closure	0.07	-	-	0.09
Steamboat Rock Seasonal Special Closure	0.05	0.64	-	-
Sugarloaf Island Special Closure	0.09	1.24	-	-
Rockport Rocks Seasonal Special Closure	0.01	0.07	-	-
Vizcaino Rock Seasonal Special Closure	0.01	0.05	-	-

Note: Only MPAs with overlap of 'hot spot' foraging areas are included. A dash indicates the area is not a hot spot for that species or group of species.

^a *Designation does not provide benefits to marine mammals because of allowed take activities, and is not included in Table 9. Only SMRs and special closures, combined by proposal, are included in Table 9.*