

California MLPA Master Plan Science Advisory Team
Evaluation of Benefits to Marine Mammals from Round 2 North Coast
Regional Stakeholder Group Draft Marine Protected Area Proposals and
Associated Special Closures
Revised July 1, 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) 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 placements 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, 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 closures. 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) nearshore foraging, and 3) resting areas, and to 4) pinnipeds and cetaceans at neritic foraging areas.

Our analyses consider pinniped haul out sites, rookeries and forage areas that have been proposed with very high levels of protection (state marine reserves (SMR) or special closures) 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 are 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. Draft MPA proposals and draft 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. Draft MPA proposals and draft special closures that captured these hot spots were identified (Table 2).

Resting Sites

California sea lions, Steller sea lions and harbor seals will likely benefit from MPAs that protect haulout sites. Evaluations of the complete of MPA draft proposals consider the total number of each species of pinniped, and calculate this as a percentage of the total number of pinnipeds within the NCSR for each proposed MPA (Appendix A), and proposed special closure (Table 3). A comparison between the draft MPA proposals that included SMRs and special closures, 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 4.

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). Buffers measuring three-miles-by-three-miles were overlaid with 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 MPA or special closure. These weighted foraging indexes for SMRs and special closures for harbor seals (Tables 5 and 6) and Steller sea lions (Tables 7 and 8) 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 the 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 B). 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 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 10). The values are unitless but are useful for comparison between proposals.

Results

Three species of pinnipeds occur regularly in the NCSR (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

No proposals include Steller sea lion rookeries as SMRs.

Ruby Draft MPA Proposal 1 (Ruby 1) and Sapphire Draft MPA Proposal 1 (Sapphire 1) provide the greatest benefit to Steller sea lions as they include special closures that would protect the Steller sea lion rookeries on both Southwest Seal Rock and Sugarloaf Island. These two sites were also identified as pinniped hot spots. Ruby Draft MPA Proposal 2 (Ruby 2) and Sapphire Draft MPA Proposal 2 (Sapphire 2) only include the Steller sea lion rookery on Sugarloaf Island (Tables 1 and 2). This has been identified as one of the two hot spots for pinnipeds.

Harbor Seals

The current MPA proposals include a very limited number of harbor seal rookeries in proposed SMRs and special closures (Tables 1 and 2). Ruby 1 and Sapphire 1 include 3 of 62 and 2 of 62 of the harbor seal rookeries respectively whereas Ruby 2 and Sapphire 2 each protect 1 of 62 rookeries.

Of the four harbor seal rookeries that were identified as pinniped hot spots, three were not captured by any proposal. The mouth of the Eel River, Arcata Bay and South Humboldt Bay

were not included in an SMR or a special closure in any draft MPA proposal. Ruby 1, Sapphire 1 and Sapphire 2 included Castle Rock harbor seal rookery as a special closure, and therefore provide the best protection of the proposals.

Resting Sites

Analysis of Proposed SMRs within Draft MPA Proposals

Sapphire 1 proposes the highest number of SMRs providing the most benefits for pinnipeds in the NCSR (Table 3), which include Reading Rock, South Cape Mendocino and Petrolia Lighthouse. These SMRs account for 6.8% of the region's population of California sea lions, 13% of Steller sea lions and none of the region's harbor seals. Ruby 1 proposes SMRs providing benefits to pinnipeds at two locations, South Cape Mendocino and Petrolia Lighthouse, which account for 0.2% of the region's population of California sea lions, 0.2% of Steller sea lions and none of the region's harbor seals. Ruby 2 also proposes two SMRs providing benefits to pinnipeds at South Cape Mendocino and Petrolia Lighthouse, but shifted the position of the Petrolia Lighthouse SMR the north compared to Ruby 1 thereby accounting for 2.5% the region's population of California sea lions, 7.1% of Steller sea lions and still none of the region's harbor seals. Sapphire 2 proposes 1 SMR providing benefits to pinnipeds at South Cape Mendocino accounting for 0.2% of the region's population of California sea lions and none of the region's Steller sea lions or harbor seals (Table 4).

Analysis of Proposed Special Closures Associated with Draft MPA Proposals

Ruby 1 proposed the highest number of special closures (8) that benefit pinnipeds in the NCSR including both Steller sea lion rookeries (Table 3). These special closures account for 18.5% of the region's population of California sea lions, 50.9% of the Steller sea lions and 6.6% of the region's harbor seals. There were 2 special closures proposed in Ruby 2 that benefit pinnipeds including one Steller sea lion rookery, which accounted for 0.9% the region's California sea lions, 10.1% of the region's Steller sea lions and 0.5% of the region's harbor seals. Sapphire 1 proposed 5 special closures, which include the two Steller sea lion rookery locations and accounted for 10.9% the region's population of California sea lions, 50.8% of Steller sea lions and 5.9% of the region's harbor seals. Sapphire 2 proposed 5 special closures that benefit pinnipeds including the two Steller sea lion rookeries and was the only proposal to include a harbor seal hot spot at Castle Rock (seasonal closure), This proposal would benefit 10.4% of the region's population of California sea lions, 26.7% of Steller sea lions and 5.6% of the region's harbor seals.

Sapphire 1, including associated special closures, would benefit 21.8% of pinnipeds in the region and Ruby 1 had 20.3% whereas Sapphire 2 would benefit 11.7% and Ruby 2 would benefit 5.2% (Table 4).

When ranking the proposals in relation to the percentage of the pinniped populations protected, Sapphire 1 would benefit 63.7% of the region's Steller sea lions, whereas Ruby 1 would benefit 51.1%, Sapphire 2 would benefit 26.7% and Ruby 2 would benefit 19.2%.

Ruby 1 would benefit 18.7% of the region's California sea lions, and Sapphire 1 would benefit 17.6%, Sapphire 2 would benefit 10.6% and Ruby 2 would benefit 3.4%.

Draft MPA proposals would only benefit 5.6% to 6.6% of the region's harbor seals, with the exception of Ruby 2, which would benefit only 0.5%.

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 (Tables 5 and 6). Harbor seal rookeries and haulouts were not included in any SMRs in the current draft proposals, but the 3 mile buffer around them intersected, to a small extent, with some of the proposed SMRs. This resulted in consistently low foraging indexes in the NCSR. Currently Ruby 1 and Sapphire 1 have somewhat higher (1.12 and 1.29) weighted foraging indexes than Ruby 2 and Sapphire 2 (0.76 and 0.75).

While proposed special closures benefit harbor seals on the rock currently allowing a 300 foot "no entry" zone, they provide a very limited benefit to foraging areas for harbor seals.

Steller sea lions: The potential benefit from SMRs and special closures protecting likely foraging areas for Steller sea lions is summarized by the weighted foraging index (Tables 7 and 8). 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.

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

Gray whales: The potential benefit from SMRs and special closures protecting foraging areas for gray whales during the summer months was negligible in all proposals (weighted foraging index = 0.01). None of the buffered feeding areas were captured by any proposal nor intersected by any adjacent SMRs (Table 9).

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. When considering SMRs and special closures only, area of overlap with marine mammal numbers was greatest for Sapphire Draft MPA Proposal 1 (9.7 square miles), and then by Sapphire Draft MPA Proposal 2 (9.6 square miles), and then by the Ruby proposals (5.5 square miles each), (Table 10 and Appendix B). None of the proposals captured harbor porpoise hot spots and few captured 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 four draft MPA proposals for MPA networks in the NCSR include the addition of SMRs not currently in the network and new 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 limited potential foraging benefits to marine mammals.

Of the four draft MPA proposals evaluated during Round 2 of the NCSR review process, the SMRs and special closures described in Ruby Draft MPA Proposal 1 and Sapphire Draft MPA Proposal 1 provide the most potential benefits to marine mammals. The protection of Southwest Seal Rock and Sugarloaf Steller sea lion rookeries, followed by the combined protections afforded to pinniped rookeries and haulouts are noteworthy in these two proposals.

When considering the combined impacts of the proposed SMRs and the special closures to the percentage of pinniped populations, Ruby 1 and Sapphire 1 offer the greatest protection and are very similar, however Sapphire 1 protects a higher proportion of the NCSR Steller sea lion population (64%) than Ruby 1 (51%). These high percentages reflect the inclusion of the two major Steller sea lion rookery hot spots in these two proposals. These proposed special closures will provide tremendous benefit to the threatened Steller sea lions in the NCSR.

It is noteworthy that no proposals provide a significant benefit to harbor seals with only between 6.6% and 0.5% of NCSR harbor seal population included in the current draft MPA proposals. Three of the harbor seal breeding hot spots were not included in any proposed MPA. Harbor seals 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. They are considered one of the species most likely to benefit from MPAs.

Pinniped and gray whale foraging areas did not significantly benefit from protection in the current draft MPA proposals. We identified marine mammal foraging areas by creating three 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 in all proposals suggesting that the proposals did not provide benefits to the foraging habitat that marine mammals in the NCSR depend upon.

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 current draft MPA proposals. 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 foot buffer currently proposed for special closures does offer some protection from direct disturbance to pinnipeds which is very beneficial. However, this 300 foot buffer does not significantly contribute to the protecting the foraging areas, which are the three miles surrounding the rookeries/haulouts.

These concerns would be addressed by including these areas as SMRs or modifying the special closures to include a no-entry zone of 1000 feet 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.

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Tables

Table 1. Numbers of pinniped rookeries within proposed special closures

Draft Special Closure Proposal	Total Pinniped Rookeries	Steller Sea Lion Rookeries	Harbor Seal Rookeries
Proposal 0 (no special closures)	0	0	0
Ruby Draft MPA Proposal 1 - Special Closures	5	2	3
Ruby Draft MPA Proposal 2 - Special Closures	2	1	1
Sapphire Draft MPA Proposal 1 - Special Closures	4	2	2
Sapphire Draft MPA Proposal 2 - Special Closures	2	1	1
Study Region Total	64	2	62

Table 2. Proposed special closures and SMRs containing pinniped population hot spots

		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						
Ruby 1	Southwest Seal Rock Special Closure	Sugarloaf Island Special Closure	Castle Rock Special Closure	South Humboldt Bay SMRMA ^a		
Ruby 2		Sugarloaf Island Special Closure				
Sapphire 1	Southwest Seal Rock Special Closure	Sugarloaf Island Special Closure	Castle Rock Special Closure	South Humboldt Bay SMRMA ^a		
Sapphire 2		Sugarloaf Island Special Closure	Castle Rock Special Closure (seasonal)			

^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 3. Number of animals and percentage of study region population within proposed special closures

Special Closure Name	California Sea Lion	California Sea Lion %	Steller Sea Lion	Steller Sea Lion %	Harbor Seal	Harbor Seal %
Ruby 1 Special Closures						
Southwest Seal Rock Special Closure	5	0.0%	1182	24.1%	0	0.0%
Castle Rock Special Closure	1291	9.8%	716	14.6%	513	5.4%
Flatiron Rock Special Closure	930	7.1%	0	0.00%	0	0.0%
False Cape Rock Special Closure	77	0.6%	6	0.1%	0	0.0%
Sugarloaf Island Special Closure	56	0.4%	591	12.1%	20	0.2%
Steamboat Rock Special Closure	25	0.2%	0	0.0%	0	0.0%
Rockport Rocks Special Closure	0	0.0%	0	0.0%	66	0.7%
Vizcaino Rock Special Closure (seasonal)	58	0.4%	0	0.0%	25	0.3%
Ruby 2 Special Closures						
Sugarloaf Island Special Closure	56	0.4%	591	12.1%	20	0.2%
Vizcaino Rock Special Closure (seasonal)	58	0.4%	0	0.0%	25	0.3%
Sapphire 1 Special Closures						
Southwest Seal Rock Special Closure	5	0.0%	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 Special Closure	25	0.2%	0	0.0%	0	0.0%
Vizcaino Rock Special Closure (seasonal)	58	0.4%	0	0.0%	25	0.3%
Sapphire 2 Special Closures						
Castle Rock Special Closure (seasonal)	1291	9.8%	716	14.6%	513	5.4%
Sugarloaf Island Special Closure	56	0.4%	591	12.1%	20	0.2%
Steamboat Rock Special Closure	25	0.2%	0	0.0%	0	0.0%

*Notes: Proposed special closures not included in the table do not contain pinniped haulouts or rookeries.
Draft special closure proposals are paired with draft MPA proposals and contribute to totals in Table 5.*

Table 4. Pinnipeds at haulouts contained in SMRs and special closures

	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%)
Ruby 1	3	2467 (18.7%)	2504 (51.1%)	624 (6.6%)	5595 (20.3%)
Ruby 2	3	449 (3.4%)	939 (19.2%)	45 (0.5%)	1433 (5.2%)
Sapphire 1	3	2326 (17.6%)	3125 (63.7%)	558 (5.9%)	6009 (21.8%)
Sapphire 2	3	1397 (10.6%)	1307 (26.7%)	533 (5.6%)	3237 (11.7%)
Study Region Total	3	13200	4904	9451	27555

Table 5. Harbor seal foraging index within proposed SMRs

MPA Proposal	MPA Name	Weighted Forage Area	Sum of weighted area in SMRs
Proposal 0	Punta Gorda SMR	0.08	0.08
Ruby 1	Pyramid Point SMR	0.05	1.12
	South Cape Mendocino SMR	0.05	
	Mattole Canyon SMR	0.38	
	Petrolia Lighthouse SMR	0.42	
	Ten Mile SMR	0.32	
Ruby 2	Pyramid Point SMR	0.04	0.76
	South Cape Mendocino SMR	0.05	
	Mattole Canyon SMR	0.38	
	Petrolia Lighthouse SMR	0.29	
Sapphire 1	Mattole Canyon Offshore SMR	0.48	1.29
	Petrolia Lighthouse SMR	0.47	
	Pyramid Point SMR	0.07	
	Reading Rock SMR	0.00	
	South Cape Mendocino SMR	0.05	
	Ten Mile SMR	0.22	
Sapphire 2	Mattole Canyon Offshore SMR	0.48	0.75
	South Cape Mendocino SMR	0.05	
	Ten Mile SMR	0.22	

Table 6. Harbor seal foraging indexes within proposed special closures

Draft Special Closure Proposal	Special Closure Name	Weighted Forage Area	Sum of weighted area
Proposal 0	None	0.00	0.00
Ruby 1 - Special Closures	Castle Rock Special Closure	<0.01	<0.01
	False Cape Rock Special Closure	<0.01	
	False Klamath Rock Special Closure	<0.01	
	Flatiron Rock Special Closure	<0.01	
	Green Rock Special Closure	<0.01	
	Rockport Rocks Special Closure	<0.01	
	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	
	Vizcaino Rock Special Closure (seasonal)	<0.01	
Ruby 2 - Special Closures	False Klamath Rock Special Closure	<0.01	<0.01
	Sugarloaf Island Special Closure	<0.01	
	Vizcaino Rock Special Closure (seasonal)	<0.01	
Sapphire 1 - Special Closures	Castle Rock Special Closure	<0.01	<0.01
	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	
	Vizcaino Rock Special Closure (seasonal)	<0.01	
Sapphire 2 - Special Closures	Castle Rock Special Closure (seasonal)	<0.01	<0.01
	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	

Table 7. Comparison between draft MPA proposals of the Steller sea lion foraging index within proposed SMRs in the north coast study region.

MPA Proposal	MPA Name	Weighted Forage Area	Sum of weighted area in SMRs only
Proposal 0	None		0
Ruby 1	Point St. George Reef SMCA	0.54	0.61
	South Cape Mendocino SMR	0.61	
Ruby 2	South Cape Mendocino SMR	0.61	0.67
Sapphire 1	South Cape Mendocino SMR	0.67	0.67
Sapphire 2	South Cape Mendocino SMR	0.67	0.61

Table 8. Steller sea lion foraging indexes within proposed special closures

Draft Special Closure Proposal	Special Closure Name	Weighted Forage Area	Sum of weighted area
Proposal 0	None	0.00	0.00
Ruby 1 - Special Closures	Southwest Seal Rock	<0.01	
	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	0.01
Ruby 2 - Special Closures	Sugarloaf Island Special Closure	<0.01	<0.01
Sapphire 1 - Special Closures	Southwest Seal Rock	<0.01	
	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	0.01
Sapphire 2 - Special Closures	Steamboat Rock Special Closure	<0.01	
	Sugarloaf Island Special Closure	<0.01	<0.01

Table 9. Gray whale foraging index within proposed SMRs and special closures

Draft MPA Proposal	MPA or Special Closure Name	Whales Weighted Forage Area
Proposal 0	None	0.00
Ruby 1	False Klamath Cove SMCA ^a	0.79
	Castle Rock Special Closure	0.01
Ruby 2	None	0.00
Sapphire 1	Wilson Rock SMCA ^a	1.04
	Castle Rock Special Closure	0.01
Sapphire 2	Wilson Rock SMCA ^a	1.04
	Castle Rock Special Closure (seasonal)	0.01

^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 10. Neritic foraging hot spot area protection and number of animals at sea in proposed SMRs and special closures

Draft MPA Proposal	Area (sq. mi)	Average Number of Animals Sighted in Hot Spots		
		All Pinnipeds	Harbor Porpoise	Gray Whale
Proposal 0	-	-	-	-
Ruby 1	5.54	53.3	-	-
Ruby 1 - special closures	0.32	2.2	-	0.1
Ruby 2	5.54	53.3	-	-
Ruby 2 - special closures	0.17	1.3	-	0.1
Sapphire 1	9.74	69.3	-	-
Sapphire 1 - special closures	0.15	1.9	-	-
Sapphire 2	9.63	69.2	-	-
Sapphire 2 - special closures	0.14	1.9	-	-

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

Appendix A

Table A1. Number of animals and percentage of study region population within proposed MPAs

MPA 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%
Ruby 1						
False Klamath Cove SMCA ^a	337	2.6%	242	4.9%	126	1.3%
South Humboldt Bay SMRMA ^a	0	0.0%	0	0.0%	1151	12.2%
South Cape Mendocino SMR	25	0.2%	0	0.0%	0	0.0%
Petrolia Lighthouse SMR	0	0.00%	9	0.2%	0	0.0%
Vizcaino SMCA ^a	54	0.4%	1	0.0%	388	4.1%
Ten Mile SMCA ^a	0	0.0%	0	0.0%	78	0.8%
MacKerricher SMCA ^a	0	0.0%	0	0.0%	310	3.3%
Point Cabrillo SMCA ^a	0	0.0%	0	0.0%	48	0.5%
Ruby 2						
South Cape Mendocino SMR	25	0.2%	0	0.0%	0	0.0%
Petrolia Lighthouse SMR	310	2.4%	348	7.1%	0	0.0%
Vizcaino SMCA ^a	54	0.4%	1	0.0%	388	4.1%
Sapphire 1						
Wilson Rock SMCA ^a	337	2.6%	242	4.9%	126	1.3%
Reading Rock SMR	556	4.2%	288	5.9%	0	0.0%
Reading Rock SMCA ^a	3	0.0%	1	0.02%	13	0.1%
South Humboldt Bay SMRMA ^a	0	0.0%	0	0.0%	1151	12.2%
South Cape Mendocino SMR	25	0.2%	0	0.0%	0	0.0%
Petrolia Lighthouse SMR	310	2.4%	348	7.1%	0	0.0%
Big Flat SMCA ^a	0	0.0%	16	0.3%	56	0.6%
Vizcaino SMCA ^a	112	0.9%	1	0.0%	413	4.4%
Ten Mile SMCA ^a	0	0.0%	0	0.0%	78	0.8%
MacKerricher SMCA ^a	0	0.0%	0	0.0%	310	3.3%
Point Cabrillo SMCA ^a	0	0.0%	0	0.0%	48	0.5%
Sapphire 2						
Wilson Rock SMCA ^a	337	2.6%	242	4.93%	126	1.3%
Reading Rock SMCA ^a	559	4.2%	289	5.89%	13	0.1%
South Cape Mendocino SMR	25	0.2%	0	0.00%	0	0.0%
Petrolia Lighthouse SMCA ^a	310	2.4%	348	7.10%	0	0.0%

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MPA Name	California Sea Lion	California Sea Lion %	Steller Sea Lion	Steller Sea Lion %	Harbor Seal	Harbor Seal %
Big Flat SMCA ^a	0	0.0%	16	0.3%	56	0.6%
Vizcaino SMCA ^a	54	0.4%	1	0.0%	322	3.4%
Ten Mile SMCA ^a	0	0.0%	0	0.0%	78	0.8%
Point Cabrillo SMCA ^a	0	0.0%	0	0.0%	48	0.5%

Note: Proposed MPAs not included in the table do not contain pinniped haulouts or rookeries.

^a *Not included in Table 4 because benefits to marine mammals are reduced by allowed take activities. Only SMRs counted in Table 4.*

Appendix B

Table B1. Neritic foraging hot spot area and average number of animals at sea in protected areas

MPA name	Area (sq. mi)	Average Number of Animals Sighted in Hot Spot		
		All Pinnipeds	Harbor Porpoise	Gray Whale
Proposal 0				
MacKerricher SMCA ^a	0.50	-	-	-
Ruby 1				
False Klamath Cove SMCA ^a	5.83	-	-	5.8
Mattole Canyon SMR	1.21	2.2	-	-
Reading Rock Nearshore SMCA ^a	3.18	-	19.2	-
Reading Rock Offshore SMCA ^a	5.76	-	35.1	-
Samoa SMCA ^a	15.66	-	82.2	-
South Cape Mendocino SMR	4.34	51.1	-	-
Vizcaino SMCA ^a	26.81	60.5	-	-
Ruby 2				
Mattole Canyon SMR	1.21	2.2	-	-
Reading Rock Nearshore SMCA ^a	2.97	-	17.9	-
Reading Rock Offshore SMCA ^a	4.43	-	26.8	-
South Cape Mendocino SMR	4.34	51.1	-	-
Vizcaino SMCA ^a	26.81	60.5	-	-
Sapphire 1				
Mattole Canyon Offshore SMR	5.00	13.1	-	-
Reading Rock SMCA ^a	7.61	-	47.2	-
South Cape Mendocino SMR	4.73	56.2	-	-
Vizcaino SMCA ^a	27.30	61.4	-	-
Wilson Rock SMCA ^a	6.89	-	-	6.8
Sapphire 2				
Mattole Canyon Offshore SMR	4.89	12.9	-	-
Reading Rock SMCA ^a	7.61	-	47.1	-
South Cape Mendocino SMR	4.74	56.3	-	-
Vizcaino SMCA ^a	15.10	4.7	-	-
Wilson Rock SMCA ^a	6.89	-	-	6.8
Ruby 1 - Special Closures				
False Cape Rock Special Closure	0.09	0.2	-	-
False Klamath Rock Special Closure	0.07	-	-	0.1

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MPA name	Area (sq. mi)	Average Number of Animals Sighted in Hot Spot		
		All Pinnipeds	Harbor Porpoise	Gray Whale
Rockport Rocks Special Closure	0.01	0.1	-	-
Steamboat Rock Special Closure	0.05	0.6	-	-
Sugarloaf Island Special Closure	0.09	1.2	-	-
Vizcaino Rock Special Closure (seasonal)	0.01	0.1	-	-
Ruby 2 - Special Closures				
False Klamath Rock Special Closure	0.07	-	-	0.1
Sugarloaf Island Special Closure	0.09	1.2	-	-
Vizcaino Rock Special Closure (seasonal)	0.01	0.1	-	-
Sapphire 1 - Special Closures				
Steamboat Rock Special Closure	0.05	0.6	-	-
Sugarloaf Island Special Closure	0.09	1.2	-	-
Vizcaino Rock Special Closure (seasonal)	0.01	0.1	-	-
Sapphire 2 - Special Closures				
Steamboat Rock Special Closure	0.05	0.6	-	-
Sugarloaf Island Special Closure	0.09	1.2	-	-

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 10. Only SMRs and special closures, combined by proposal, are included in Table 10.*