# California MLPA Master Plan Science Advisory Team
## Draft Analysis of Military Use Areas in the MLPA South Coast Study Region
### *April 13, 2009 Draft*

The Marine Life Protection Act (MLPA) Blue Ribbon Task Force (BRFT) has requested that the MLPA Master Plan Science Advisory Team (SAT) provide descriptions and analyses of the military use areas located in the MLPA South Coast Study Region (SCSR). Specifically, the SAT was asked to describe and analyze:

- the ecological characteristics of the island and mainland areas used by the military,
- habitats represented in these areas, and
- ecological linkages between these and other southern California sites and particularly between the islands and the mainland coast.

The SAT also was asked to include any other important considerations for effective MPA network design. The following represents the SAT response to the BRFT request. Emphasis has been placed on the military use areas at San Clemente Island and San Nicolas Island because of their large size, location with respect to the SCSR, and the significant roles these islands play in meeting the objectives of the MLPA, particularly with regard to the size and spacing guidelines developed by the SAT for the SCSR.

**Figure 1[SA1]. Military Use Areas (red) in the MLPA South Coast Study Region**
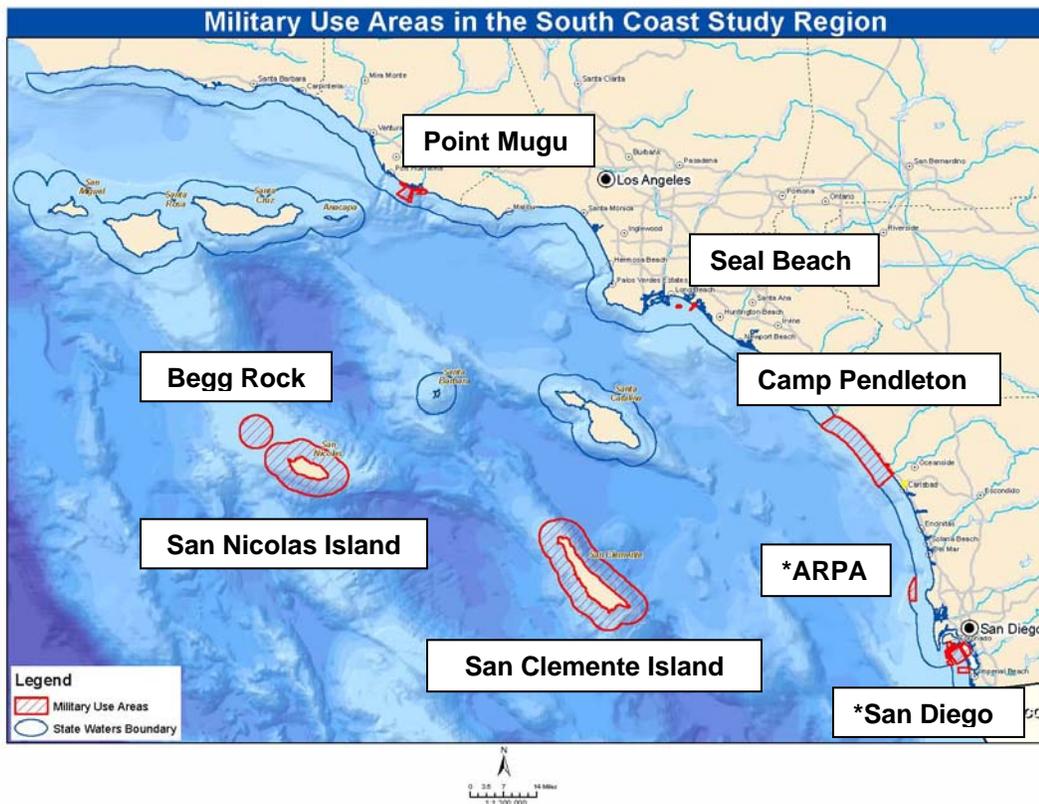


*ARPA is the Advanced Research Project Agency Area. "San Diego" includes military use areas at North Island and Silver Strand.*

Eight important military use areas identified by the U.S. Department of Defense in the SCSR include Point Mugu, Seal Beach, Camp Pendleton, Advanced Research Projects Agency (ARPA) Training Area and San Diego (including North Island and Silver Strand), San Clemente Island, and San Nicolas Island and Begg Rock (Figure 1). A variety of military activities occur in these designated military use areas some of which impact marine organisms and their habitats. Together, the eight military use areas identified represent a total of ~~462~~ 469.5 square miles (mi[2]) or ~~20~~20% of the ~~2297.5~~2,350.9 mi[2] in state waters in the SCSR. The military use areas that include the greatest amount of area are San Clemente Island (~~208~~192.2 mi[2]) and San Nicolas Island (125.2 mi[2]), Camp Pendleton (64.4 mi[2]), and Begg Rock (~~163~~38.0 mi[2]). The two island areas account for 37~~43~~ mi[2] or 79~~80~~% of areas in the SCSR used by the military.

The SAT conducted a preliminary habitat analysis using interim seafloor habitat data, which was presented to the BRTF on February ~~1~~26, 2009. The interim habitat data set contained both coarse scale and fine scale data, gathered at different resolutions and "stitched" together to form a continuous surface. The interim data likely overestimated the amount of rocky seafloor and several areas were known to have different habitat than indicated on the interim seafloor habitat map. However, the interim data were the only continuous seafloor habitat data available to the SAT when the BRTF made ~~their initial~~ its request for an analysis of military use areas.

Since the initial request by the BRTF, the sea floor habitat data were updated with high resolution data from side-scan sonar mapping contracted by the State of California ~~conducted by R. Kvitek (California State University, Monterey Bay)~~. The updated seafloor habitat data distinguish hard and soft seafloor habitats. The bathymetry data ha~~s~~ve a depth dependent resolution consisting of 2 meter (m), 5m and 10m bands. These bands were combined and resolved to a final interpolated resolution of 2m. Focal statistics, along with algorithmic clustering or neighborhood functions, were applied in order to, as much as possible, remove imperfections or topological errors in the data.

The updated seafloor habitat data have two major limitations, both of which are related to areas where data could not be collected. Given the available resources provided at the outset of the mapping effort, priorities were established to ensure that more critical areas were mapped first. The recent seafloor mapping effort focused on the mainland of the SCSR and Santa Catalina Island, while the northern Channel Islands, San Clemente Island, and San Nicolas Island were mapped in the recent effort. Also, data were not collected in shallow nearshore areas, which are inaccessible to vessels with sonar equipment.

Figure 2 shows locations mapped using side-scan sonar. Because there are large gaps in the fine-scale habitat map, the SAT determined, during its meeting on April 1, 2009, that a habitat analysis based on the fine-scale data alone was not suitable for an evaluation of military use areas. The SAT recommended that staff assemble the best available information about seafloor habitats, including fine-scale and coarse-

scale data. Staff is in the process of assembling the best available habitat data, but the information will not be fully integrated fully prior to the BRTF meeting on April 15, 2009.

**Figure 2. Map of seafloor habitats from side-scan sonar mapping efforts. Mapped habitats are hard bottom (red) and soft bottom (tan). Areas in light blue (state waters) and dark blue (federal waters) were not mapped.**



The SAT recommended, for the purpose of reporting on habitats in military use areas, modifications to the evaluation based on fine-scale habitat data:.

- Average kelp area provides a rough estimate of nearshore hard bottom (0-30 m). However, kelp canopy may overestimate hard bottom in areas where kelp grows on mudstone, etc., and kelp canopy may underestimate hard bottom in areas where other conditions, such as strong ocean currents or sedimentation, inhibit growth of kelp on hard bottom.
- The SAT will report nearshore soft and hard bottom habitats as a linear measure drawn along the coast at depths at 10 - 30 m depth. The linear estimate of nearshore habitats will be constructed from the best available habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.

- For the purpose of this evaluation, the SAT will report area at depth zones of 30-100 m, 100-200 m and 200-1000 m without distinguishing between soft and hard bottom within these depth zones.

In the future, the SAT will strive to distinguish soft and hard bottom for evaluations of habitat representation and replication, as well as spacing, to the extent possible based on the best available data. Appendix A of this document is the SAT analysis based on coarse-scale seafloor habitat data, which classify hard and soft bottom throughout the SCSR, including nearshore and island areas.

The five bioregions identified for the SCSR contain different amounts of marine habitats identified by the SAT as important for MPA planning (Table 1). These habitats include consideration of bottom type, depth, and biogenic habitat. The eight military use areas also are of different sizes and occur throughout the region, therefore their impact on the MLPA planning process will differ by bioregion.

[1]**Table 1. Amount of Available Habitat in the SCSR by Bioregion**

| Habitat | East Channel Islands | Mid Channel Islands | West Channel Islands | North Mainland | South Mainland | Total |
|---|---|---|---|---|---|---|
| Sandy & gravel beaches (miles) | 61.4 | 27.5 | 40.7 | 102.5 | 147.5 | 379.6 |
| Rocky intertidal & cliff (miles) | 62.3 | 83.9 | 75 | 30.6 | 28.9 | 280.7 |
| Linear kelp (miles) | 49.4 | 24.1 | 70.4 | 24.2 | 30.1 | 198.2 |
| [2]Average kelp area (square miles) | 4 | 1.1 | 10.3 | 2.7 | 2.8 | 20.9 |
| [3]Linear nearshore hard bottom (miles) | 36.3 | 18.8 | 31.2 | 10.4 | 28.1 | 124.7 |
| [3]Linear nearshore soft bottom (miles) | 59 | 59.4 | 60.9 | 121.6 | 117.5 | 418.5 |
| [4]Area 30 - 100 m (square miles) | 96.2 | 181.4 | 283.4 | 228.3 | 133.9 | 923.2 |
| [4]Area 100-200 m (square miles) | 72.6 | 62.6 | 71.7 | 30.6 | 47.6 | 285 |
| [4]Area 200-1000 m (square miles) | 205.4 | 83.71 | 29.31 | 24.5 | 70.8 | 413.6 |
| [5]Total area (square miles) | 422.6 | 365.2 | 499.8 | 477.3 | 586 | 2,350.9 |
| [6]ESI shoreline length (miles) | 126.1 | 111.4 | 115.9 | 174 | 519.1 | 1,046.5 |

*[1]Revised habitat analysis based on fine-scale seafloor habitat data derived from side-scan sonar mapping. The fine-scale habitat map includes neither nearshore areas due to physical limitations of this mapping technique nor some areas around the Channel Islands (Figure 2).*
*[2]Average kelp area is reported and provides a rough estimate of nearshore hard bottom (0-30 m). However, kelp canopy may overestimate hard bottom in areas where kelp grows on mudstone, etc., and kelp canopy may underestimate hard bottom in some areas where other conditions, such as strong ocean currents or sedimentation inhibit growth of kelp on hard bottom.*
*[3]Nearshore soft and hard bottom habitats are reported as a linear measure drawn along the coast at depths from 10 to 30 m. The linear estimate of nearshore habitats is based on the best available habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*
*[4]For the purpose of this evaluation, the SAT will report area at depth zones of 30-100 m, 100-200 m and 200-1000 m without distinguishing between soft and hard bottom within these depth zones.*
*[5]The total area (square miles) is estimated as the area of seafloor plus the area in estuaries. For bioregions with estuaries, the total area is greater than the sum of areas within all depth zones.*
*[6]The ESI (Environmental Sensitivity Index) shoreline length (miles) may be greater than the sum of shoreline lengths for sandy and gravel beaches, and rocky intertidal and cliff. Other types of shoreline (e.g., hardened shores, estuaries and coastal marshes, etc.) also occur in the SCSR but are not included in this analysis.*

## Habitat Representation in the Military Use Areas

The military use areas contain more than 25% of three different habitat types in SCSR state waters (Table 2): kelp (28% of linear kelp and 35% of kelp area) nearshore hard bottom (32% of the linear measure), and seafloor habitat at 200-1000 m depth (28%).

**[1]Table 2. Percentage of Available Habitats Identified for the South Coast Study Region found in the Eight Military Use Areas**

| Habitat | South Coast Study Region Total | Military Use Areas Total | Percent in Military Use Areas |
|---|---|---|---|
| Sandy & gravel beaches (miles) | 379.6 | 64.3 | 17% |
| Rocky intertidal & cliff (miles) | 280.7 | 52.6 | 19% |
| Linear kelp (miles) | 198.2 | 56.1 | 28% |
| [2]Average kelp area (square miles) | 20.8 | 7.3 | 35% |
| [3]Linear nearshore hard bottom (miles) | 124.7 | 40.1 | 32% |
| [3]Linear nearshore soft bottom (miles) | 418.5 | 57 | 14% |
| [4]Area 30 - 100 m (square miles) | 923.2 | 161.6 | 18% |
| [4]Area 100-200 m (square miles) | 285 | 61.4 | 22% |

| Habitat | South Coast Study Region Total | Military Use Areas Total | Percent in Military Use Areas |
|---|---|---|---|
| [4]Area 200-1000 m (square miles) | 413.6 | 115.2 | 28% |
| [5]Total area (square miles) | 2,350.9 | 469.5 | 20% |
| [6]ESI shoreline length (miles) | 1,046.4 | 132.2 | 13% |

[1]*Revised habitat analysis based on fine-scale seafloor habitat data derived from side-scan sonar mapping. The fine-scale habitat map includes neither nearshore areas due to physical limitations of this mapping technique nor some areas around the Channel Islands (Figure 2).*

[2]*Average kelp area is reported and provides a rough estimate of nearshore hard bottom (0-30 m). However, kelp canopy may overestimate hard bottom in areas where kelp grows on mudstone, etc., and kelp canopy may underestimate hard bottom in some areas where other conditions, such as strong ocean currents or sedimentation inhibit growth of kelp on hard bottom.*

[3]*Nearshore soft and hard bottom habitats are reported as a linear measure drawn along the coast at depths from 10 to 30 m. The linear estimate of nearshore habitats is based on the best available habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*

[4]*For the purpose of this evaluation, the SAT will report area at depth zones of 30-100 m, 100-200 m and 200-1000 m without distinguishing between soft and hard bottom within these depth zones.*

[5]*The total area (square miles) is estimated as the area of seafloor plus the area in estuaries. For bioregions with estuaries, the total area is greater than the sum of areas within all depth zones.*

[6]*The ESI (Environmental Sensitivity Index) shoreline length (miles) may be greater than the sum of shoreline lengths for sandy and gravel beaches, and rocky intertidal and cliff. Other types of shoreline (e.g., hardened shores, estuaries and coastal marshes, etc.) also occur in the SCSR but are not included in this analysis.*

Of the five bioregions located in the SCSR, military use areas account for the greatest percentage of all mapped habitats in the East Channel Islands Bioregion (50~~44.9~~%) and the West Channel Islands Bioregion (~~26.9~~33%; Table 3). The total mainland area identified as important for military use amounts to 17~~9~~% with more than two-thirds of this located in Camp Pendleton in the South Mainland Bioregion.

The percentages of different habitat types located in the military use areas differ by bioregion (Table 3). In particular, the military use areas in the East Channel Islands Bioregion and the West Channel Islands Bioregion, which include San Clemente Island, San Nicolas Island, and Begg Rock, contain large percentages of certain habitat types. No military use areas were selected for consideration in the Mid Channel Islands Bioregion.

In the East Channel Islands Bioregion, large percentages of important habitats are within in the San Clemente Island military use area, including ~~more than 50% of kelp,~~56% of rocky shores, 67% of the linear measure of kelp and 90% of the aerial kelp canopy, 85% of the linear nearshore hard bottom habitat ~~(0-30mproxy, )~~and 52% of the

seafloor habitat at 30-100 m depth. In addition, 40% of the sandy and gravel beaches, 45% of the seafloor habitats at 200-1000 m depth are included in the San Clemente Islands military use area. Based on coarse-scale data (Appendix A), state waters around San Clemente are likely to contain more than 50% of the hard bottom habitat (0-30 m) in the East Channel Islands Bioregion.

In the West Channel Islands Bioregion, San Nicolas Island and Begg Rock military use areas include more than 530% of kelp and more than 25% of beaches, nearshore hard and soft bottom habitats, and over 30% of seafloor habitats at 30-200 m depth and over 75% of the deep seafloor habitat (200-1000 m). San Nicolas Island and Begg Rock were not mapped using side-scan sonar during the state's recent mapping effort. Consequently, most seafloor habitats around these features are not classified as hard or soft for this evaluation. Coarse-scale data (Appendix A) suggest that over 35% of shallow hard bottom habitat (0-30 m) and over 50% of the hard bottom habitat (30 – 100 m) are included in these military use areas for the West Channel Islands Bioregion. Also, coarse-scale data suggest that over 25% of soft bottom habitat (0-200 m) and over 70% of deep soft bottom habitat (>200 m) within the West Channel Islands Bioregion found in military use areas at San Nicolas Island and Begg Rock.

Habitat types with the greatest representation in military use areas in the South Mainland Bioregion include sandy and gravel beaches (16%), nearshore soft bottom habitats (19%) and soft bottom at 30-100 m depth (15%). The percentage of different habitat types contained within the military use areas located in the North Mainland is much less compared with the East Channel Islands and West Channel Islands Bioregions. Military use areas contribute no more than 5% of any habitat type within the North Mainland Bioregion and no more than 24% within the South Mainland Bioregion (Table 3). Coarse-scale data (Appendix A) suggest that, at Point Mugu, Seal Beach, Camp Pendleton and San Diego military use areas, unclassified habitat is likely to be soft bottom habitat. At the ARPA Area, the unclassified habitat is likely to be a mix of hard and soft bottom (30-100 m).

[1]**Table 3. Percentage of the Available Habitat Types Identified for the SCSR found in the Eight Military Use Areas by Bioregion**

| Habitat | East Channel Islands Bioregion | Mid Channel Islands Bioregion | West Channel Islands Bioregion | North Bioregion | South Bioregion |
|---|---|---|---|---|---|
| Sandy & gravel beaches (miles) | 40% | 0% | 26% | 5% | 16% |
| Rocky intertidal & cliff (miles) | 56% | 0% | 21% | 0% | 6% |
| Linear kelp (miles) | 67% | 0% | 30% | 0% | 6% |
| [2]Average kelp area (square miles) | 90% | 0% | 34% | 0% | 6% |
| [3]Linear nearshore | 85% | 0% | 25% | 0% | 5% |

| Habitat | East Channel Islands Bioregion | Mid Channel Islands Bioregion | West Channel Islands Bioregion | North Bioregion | South Bioregion |
|---|---|---|---|---|---|
| hard bottom (miles) | | | | | |
| [3]Linear nearshore soft bottom (miles) | 24% | 0% | 27% | 4% | 19% |
| [4]Area 30 - 100 m (square miles) | 52% | 0% | 31% | 1% | 15% |
| [4]Area 100-200 m (square miles) | 48% | 0% | 33% | 3% | 5% |
| [4]Area 200-1000 m (square miles) | 45% | 0% | 78% | 0% | 0% |
| [5]Total area (square miles) | 50% | 0% | 33% | 2% | 15% |
| [6]ESI shoreline length (miles) | 48% | 0% | 23% | 3% | 8% |

[1]*Revised habitat analysis based on fine-scale seafloor habitat data derived from side-scan sonar mapping. The fine-scale habitat map includes neither nearshore areas due to physical limitations of this mapping technique nor some areas around the Channel Islands (Figure 2).*

[2]*Average kelp area is reported and provides a rough estimate of nearshore hard bottom (0-30 m). However, kelp canopy may overestimate hard bottom in areas where kelp grows on mudstone, etc., and kelp canopy may underestimate hard bottom in some areas where other conditions, such as strong ocean currents or sedimentation inhibit growth of kelp on hard bottom.*

[3]*Nearshore soft and hard bottom habitats are reported as a linear measure drawn along the coast at depths from 10 to 30 m. The linear estimate of nearshore habitats is based on the best available habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*

[4]*For the purpose of this evaluation, the SAT will report area at depth zones of 30-100 m, 100-200 m and 200-1000 m without distinguishing between soft and hard bottom within these depth zones.*

[5]*The total area (square miles) is estimated as the area of seafloor plus the area in estuaries. For bioregions with estuaries, the total area is greater than the sum of areas within all depth zones.*

[6]*The ESI (Environmental Sensitivity Index) shoreline length (miles) may be greater than the sum of shoreline lengths for sandy and gravel beaches, and rocky intertidal and cliff. Other types of shoreline (e.g., hardened shores, estuaries and coastal marshes, etc.) also occur in the SCSR but are not included in this analysis.*

## Ecological Characteristics of the Military Use Areas

The military use areas include key habitats in each bioregion and, in some cases, significant amounts of certain key habitat types within a bioregion and even within the entire SCSR. Because of the amount of habitat captured within their boundaries and their unique biological features, the military use areas at San Nicolas Island, Begg Rock, and San Clemente Island will certainly play important roles within their respective bioregions in meeting the objectives of the MLPA. The military use areas on the mainland also might contribute to MLPA objectives depending on the location, size, and spacing of MPAs in submitted MPA proposals.

### San Nicolas Island, Begg Rock and San Clemente Island

San Nicolas and San Clemente Islands are two of the eight offshore islands commonly known as the Channel Islands. A variety of metrics and published studies of marine communities have found that each of the eight Channel Islands and to a greater extent all of the islands of the San Diegan Province (the warmer parts or warm temperate waters of the SCSR that include Santa Catalina and San Clemente Islands) are unique (Seapy and Littler 1980, Engle 1993, Engle 1994, Pondella et al. 2005) and this distinctiveness is not a function of distance between the islands (Pondella et al. 2005). Each island differs in some degree from other islands, even those within the same bioregion, in terms of exposure to ocean thermal and circulation conditions, coastal topographic features such as shelf profile and substratum composition, exposure to wave action, and in the distance from influence of the densely populated southern California mainland; each island also supports different species, assemblages and species densities and biomass. Consequently, in developing proposals to meet the objectives of the MLPA, the following points need to be considered when assessing the role of the military use areas on San Nicolas Island, Begg Rock and San Clemente Island:

*Distinct Geographic Features*

As indicated, each island has geographic features, related to shore and coastline topography and orientation and location with respect to prevailing swell patterns in the SCSR that contribute to its distinct character. These conditions affect the nature of the biological communities that characterize the islands.

- The eastern shoreline of San Clemente Island is protected from most prevailing swell patterns and generally receives little wave exposure. This 'lee' effect results in the structuring of species assemblages and the resultant warm-water, wave-protected communities are duplicated only on the lee side of Santa Catalina Island in the entire SCSR.

- The western or windward side of San Clemente Island includes substantial bedrock, has a more gradual slope, and receives more wave exposure compared to any other site in its bioregion. The western or windward side of Santa Catalina Island is different in character, containing less bedrock and more boulders and with a more steeply sloping shoreline.

- San Nicolas Island and Begg Rock are farthest offshore and are more exposed to open ocean conditions than any of the Channel Islands. The orientation of San Nicolas Island, with respect to the prevailing swell patterns creates exposure to more severe sea states and wave conditions along both sides of the island. There are fewer coves and wave protected areas on San Nicolas Island.

*Distinct Biotic Features*

The placement in the ocean climate of SCSR makes these islands unique in terms of the biota they support within their bioregion. Both islands contain different mixtures of warm and cold temperate species distributed across their waters compared to other islands within their respective bioregions. The two islands also play important roles in supporting bird and mammal populations in the SCSR (see Marine Birds and Mammals Section below). Selected examples include:

- The unique northern range extensions of Panamic species to San Clemente Island [e.g., Panamic arrow crab (*Stenorhynchus debilis*), Warty sea slug (*Pleurobranchus areolatus*), Arbacia sea urchin (*Arbacia incisa*), Guadalupe cardinalfish (*Apogon guadalupensis*), Pink cardinalfish (*A. pacificus*), Swallow damselfish (*Azurina hirundo*), Purple brotula (*Oligopus diagrammus*) (Engle and Richards 2001; Richards and Engle 2001)].

- The only consistent resident breeding population of the Southern sea otter (*Enhydra lutris nereis*) in the SCSR occurs on San Nicolas Island.

- The largest remaining remnant populations of the endangered black abalone (*Haliotis cracheroidii*) are found on San Nicolas Island. San Clemente Island once supported some of the highest densities of black abalone in the region along portions of its western coastline. Because of the availability of suitable habitat and its remoteness and inaccessibility, San Clemente Island represents a possible site for efforts to recover populations of this now rare species.

- San Clemente Island supports a remnant population of the endangered white abalone (*Haliotis sorenseni*).

- San Clemente Island supports the largest known populations of the rare purple hydrocoral, excluding populations found on the Farnsworth Bank pinnacle.

- Populations of the only rock-based morph, and one of only two known locations for the sand-based morph, of Elk Kelp (*Pelagophycus porra*) in the Channel Islands (Miller and Dorr 1994, Miller et al. 2000) occur on San Clemente Island.

- Unusual, deep eelgrass communities (*Zostera marina*) are abundant on San Nicolas Island (Engle and Miller 2005).

- Large aerial coverage of kelp (*Macrocystis pyrifera*) communities occur on San Clemente and San Nicolas Islands. Together, these two islands have large kelp bed areas and together contribute 4648.3% of the total kelp coverage for the Channel Islands. The kelp beds at San Clemente Island account for 9089% of the kelp bed habitat in the East Channel Island Bioregion whereas San Nicolas Island kelp beds makes up 34% of the total kelp coverage in the West Channel Island Bioregion. These island kelp habitats occur in significantly deeper water than most kelp habitats due to water clarity.

- The entire waters of both San Clemente and San Nicolas Islands (including Begg Rock) were designated *Areas of Special Biological Significance* in 1974 to preserve their biologically unique and sensitive marine ecosystems for future generations.

*Remoteness and Accessibility*

San Clemente Island, San Nicolas Island, and Begg Rock are the most isolated and remote islands and features in the SCSR. This isolation from the mainland makes them particularly important to the MPA process due to their reduced exposure to the abundant anthropogenic stressors common to SCSR coastal waters. To amplify:

- Their remote nature (distance from the mainland) makes these island habitats less accessible to fishing and fished species show signs of less fishing pressure [e.g., larger kelp bass (Young 1963) and sheephead (Hamilton et al. 2007), abundant giant seabass, and large lobsters are found on San Nicolas and San Clemente Islands].

- These island populations and communities are least likely to be influenced by the effects of mainland pollutants, which are readily carried offshore by runoff from storm events.

- These islands are the least impacted by invasive species, which generally have been brought into our region through shipping and often enter through mainland ports (e.g., the recent introduction of *Sargassum filicinum*) (Miller and Engle, in press).

- Because of their remoteness, these islands represent some of the better locations in the SCSR to evaluate the effects of anthropogenic stressors on marine populations and communities.

- They have unique larval sink and source processes (see section below on Ecological Linkages Between San Clemente Island and San Nicolas Islands and Other Southern California Mainland and Island Sites).

*Begg Rock*

Begg Rock, which is included in the San Nicolas Island military use area, is a unique, small island habitat that comes to the surface approximately 10 miles off the west coast of San Nicolas Island. It is characterized by its sheer, pinnacle-like profile and supports a unique invertebrate assemblage, which includes purple hydrocoral, shallow aggregations of *Metridium* and other anemones.

**Mainland Military Use Areas**

Because the mainland military use areas account for much less of the habitat available in the North Mainland and South Mainland Bioregions, these regions will receive less attention here. In the North Mainland Bioregion, the single military use area around Point Mugu includes coastal wetlands habitat and provides important habitat for marine birds (see Marine Bird and Mammal section below). Four military use areas (Seal Beach, Camp Pendleton, ARPA Training Area, and San Diego) are located in the South Mainland Bioregion. Camp Pendleton, and the coastline to the north and south of this military use area, is characterized mostly by sandy beaches and intermittent low-lying soft rocky benches. These habitats support kelps and other hard-substratum inhabitants and are subject to more soft sediment influence than the better known, persistent rocky

substratum communities that characterize headlands and other areas in the SCSR. As with Point Mugu, Camp Pendleton includes important coastal wetlands habitat. The offshore ARPA Training Area, although small in its overall extent, accounts for most of the hard bottom habitat (30-100 m) contributing to the 19% of this habitat in the South Mainland Bioregion. Similarly, the military use areas at (1) Camp Pendleton, and (2) North Island and Silver Strand, located near San Diego Bay, include the majority of nearshore soft bottom habitat in military use areas, contributing to 14% and 4% 24% of this habitat type, respectively, in this bioregion (Table 3). All military use areas in the South Mainland Bioregion provide important areas for marine birds (see Marine Bird and Mammal section below).

**Ecological Linkages between San Clemente Island and San Nicolas Island and Other Southern California Mainland and Island Sites**

Connectivity through larval movement was evaluated in the SCSR through realistic model simulations using Regional Ocean Modeling System (ROMS)[1]. The model assumes larvae and some weakly swimming young life stages behave as particles, simply transported through ocean circulation. The circulation model is based on data gathered during the period of 1996 – 2003, including strong El Niño and La Niña events. Model simulations are done for several representative populations (see Table 4).

Modeling results (Table 4) suggest that there is limited recruitment from San Clemente Island to other areas of the SCSR. Most recruitment from San Clemente Island appears to be local, that is, the recruiting young were spawned by adults resident in suitable habitats around the island. For some species, including kelp bass and lingcod, adults from San Clemente Island contribute to local recruitment but not to recruitment in other locations in the study region. However, for lingcod, the model also predicts that San Clemente receives some recruits from populations at San Nicolas, Santa Barbara, and Santa Catalina islands. For cabezon and blue rockfish, the model predicts that adults on San Clemente Island also contribute a limited number of recruits to Santa Catalina Island. For rockfish, the mainland (particularly north from San Mateo Point to Santa Barbara) and most of the Channel Islands serve as sources of larvae that recruit at San Clemente Island. For species with longer pelagic larval duration, such as red sea urchin, the model predicts only limited local recruitment to San Clemente Island, plus limited recruitment from Santa Catalina, San Nicolas and Santa Barbara islands. Generally, San Clemente Island appears to have high local recruitment and tends to receive some larvae from other places in the study region, but the dispersal model suggests that this island has a limited role as a source of larvae to other places in the study region, with the strongest connections to Santa Catalina, which lies within the same bioregion (East Channel Islands).

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[1] Researchers are S. Mitarai, D. Siegel, J. Watson of University of California, Santa Barbara and C. Dong & J. McWilliams of University of California, Los Angeles

Modeling results suggest that San Nicolas Island is connected to some of the other Channel Islands though the exchange of larvae and also receives larvae that originate along the mainland coast (Table 4). For some representative species, such as cabezon, lingcod and blue rockfish, adults on San Nicolas Island may produce young that recruit locally, while some young may be transported to nearby islands, including Santa Barbara, San Clemente and Santa Catalina Islands. Adults of species such as cabezon from San Nicolas Island also produce young that may be transported to San Miguel Island, which is in the same West Channel Islands Bioregion. Young of these species (represented by cabezon, lingcod and blue rockfish) produced in other locations, particularly the mainland coast north of San Mateo Point, may be carried on currents to San Nicolas Island where they may settle and grow. For some species, such as kelp bass, local recruitment is limited, but populations on San Nicolas Island receive young that originate from the mainland coast, primarily between San Mateo Point and Port Hueneme, and on the northeastern side of Santa Catalina Island. For species with longer pelagic larval duration, such as red sea urchin, the model suggests that local adult populations contribute to recruitment at Santa Catalina and Santa Barbara Islands, but local recruitment from San Nicolas Island and recruitment from other areas of the SCSR are limited. However, because the dispersal model does not fully incorporate the effects of nearshore circulation processes, local recruitment may be underestimated – for both San Nicolas and San Clemente Islands.

**Table 4. Larval Connectivity for San Clemente Island (SCI) and San Nicolas Islands (SNI). Listed are Modeling Results for Several Representative Species.**

| San Clemente Island | | |
|---|---|---|
| ***Species*** | ***From SCI*** | ***To SCI*** |
| Kelp Bass | To SCI only | From SCI only |
| Lingcod | To SCI only | Limited from southern islands: SCI, SNI, Santa Barbara Island, and Santa Catalina Island |
| Red Sea Urchin | A tiny bit of recruitment to SCI | A small amount of recruitment from Santa Catalina Island, SCI, SNI and Santa Barbara Island |
| Cabezon | To SCI and a bit to Santa Catalina Island | From mainland from San Mateo Point to Santa Barbara and all islands except San Miguel and Santa Rosa islands |
| Blue Rockfish | To SCI, a bit to Santa Catalina Island | From mainland north of San Mateo Point, from islands but not Santa Rosa Island |
| San Nicolas Island | | |
| ***Species*** | ***From SNI*** | ***To SNI*** |
| Kelp Bass | Very little local recruitment | From NE Santa Catalina Island and mainland coast from San Mateo Point to Port Hueneme |

| Red Sea Urchin | To Santa Catalina Island and Santa Barbara Island, mostly | From no locations in the SCSR |
|---|---|---|
| Lingcod | To all southern islands: SNI, Santa Barbara Island, SCI and Santa Catalina Island | From mainland from Santa Monica Bay to Santa Barbara, a bit from islands: Santa Cruz Island, Anacapa Island, SNI and Santa Barbara Island |
| Cabezon | To San Miguel Island and all southern islands: SNI, Santa Barbara Island, SCI, Santa Catalina Island | From mainland from San Mateo Point to Santa Barbara and some from islands: Santa Cruz Island, Anacapa Island, N Santa Rosa Island, SNI, and Santa Barbara Island |
| Blue Rockfish | To all southern islands: SNI, Santa Barbara Island, SCI and Santa Catalina Island | From mainland from Palos Verdes Point to Point Conception, and islands: Santa Cruz Island, Anacapa Island, N Santa Rosa Island, SNI, and Santa Barbara Island |

## Marine Birds and Mammals

There are seven species of marine birds and four species of marine mammals that breed, rest and forage in the military use areas in the SCSR. The birds are: Brandt's cormorants (*Phalacrocorax penicillatus*), western gulls (*Larus occidentalis*), California least terns (*Sternula antillarum browni*), western snowy plovers (*Charadrius alexandrinus nivosus*), black oystercatchers (*Haematopus bachmani*), ashy storm-petrels (*Oceanodroma homochroa*), Xantus's murrelets (*Synthliboramphus hypoleucus*). The marine mammals include: California sea lions (*Zalophus californianus*), Pacific harbor seals (*Phoca vitulina richarii*), northern elephant seals (*Mirounga angustirostris*) and southern sea otters (*Enhydra lutris nereis*).

Brandt's cormorants are endemic to marine habitats along the west coast of North America (Wallace and Wallace 1998) while western gulls are endemic to the California Current System (Pierotti and Annett 1995). Neither species is listed under state or federal endangered species acts. However, Brandt's cormorants were listed in the U.S. Fish and Wildlife Service's Seabird Conservation Plan as having a moderate conservation concern due to their vulnerability to human-caused disturbance (USFWS 2005). California least terns were listed as endangered under both the U.S. and California Endangered Species Acts after losing much of their breeding habitat to coastal development and increased use of coastal beaches in the 1950s and 1960s (Thompson et al. 1997). Western Snowy Plovers require breeding habitat similar to that of least terns and have been listed as a threatened species under the U.S. Endangered Species Act (Powell and Collier 2000). Black oystercatchers are listed as a species of

conservation concern by the U.S. Fish and Wildlife Service (USFWS) and named a focal species for priority conservation action (Tessler et al. 2007). Ashy Storm-Petrels are considered a species of conservation concern by both the UFWS and California Department of Fish and Game (Brown et al. 2003) and a petition to list the bird as threatened or endangered has been submitted to the U.S. Secretary of Interior (Wolf 2007). Xantus's murrelets are listed as threatened under California's Endangered Species Act and are candidates for listing under the U.S. Endangered Species Act (Burkett et al. 2003). A resident breeding population of the southern sea otters (*Enhydra lutris nereis*), listed as threatened under the U.S. Endangered Species Act of 1973, occurs on San Nicolas Island. This population is classified as a non-essential experimental population because of the history of translocation of sea otters to this location. Except for southern sea otters, none of the other marine mammals listed in this document are listed under state or federal endangered species acts. However, all marine mammals are protected under the U.S. Marine Mammal Protection Act.

Table 4 lists the species utilizing habitat on each military property in southern California and shows the percent that each area's bird and mammal populations contribute to the total populations for the respective MLPA bioregion and the SCSR.

- San Nicolas Island supports the majority of the western gulls and western snowy plovers and a large proportion of the California sea lions (44%), Pacific harbor seals (26%) and northern elephant seals (35%) for the West Channel Islands Bioregion. The island also supports a large proportion of the SCSR's populations of western gull, California sea lion (66%), and northern elephant seal (20%) and the only consistent resident breeding population of the southern sea otter.

- San Clemente Island supports all of the Brandt's cormorants and black oystercatchers, the majority of the ashy storm-petrels and western gulls, and a large proportion of Xantus's murrelets in the East Channel Islands Bioregion. San Clemente Island supports all of the Northern elephant seals in the East Channel Islands Bioregions as well as 97% of the California sea lions and 33% of the Pacific harbor seals. These are 21%, 5% and 4% of the SCSR population for Northern elephant seals, California sea lions and Pacific harbor seals, respectively.

- Point Mugu supports a large proportion of the California least terns and western snowy plovers for the North Mainland Bioregion and a large proportion of the western snowy plovers from the SCSR.

- Camp Pendleton and the Navy's property in San Diego Bay support large proportions of the California least tern and western snowy plover populations for both the South Mainland Bioregion and the SCSR.

Marine mammal rookeries (breeding sites) are not included in Table 3 because data on population estimates for these rookeries were not available. However, the location of rookeries within the SCSR has been well documented.

- San Clemente Island supports all of the California sea lion and northern elephant seal rookeries in the East Channel Islands Bioregion.

- San Nicolas Island supports 44% and 35% of the breeding population of California sea lions and northern elephant seals, respectively, in the West Channel Islands Bioregion.
- Point Mugu supports one of ~~two~~ three Pacific harbor seal rookeries in the North Mainland Bioregion, with only ~~three~~ four existing for the entire SCSR. Pacific harbor seal rookeries are not well documented among the Channel Islands and so only the total population information is provided.

**Table 4. Breeding and haul-out population estimates for marine birds and mammals, dependent on military properties in southern California, categorized within MLPA bioregions. Also shown are the percent that each local population contributes to the total bioregion population and total population for a given species in the SCSR.**

| | Population | Percent of Bioregion Population | Percent of South Coast Study Region Population |
|---|---|---|---|
| **West Islands Bioregion** | | | |
| *San Nicolas Island* | | | |
| Brandt's Cormorant | 290 | 5.4 | 5 |
| Black Oystercatcher | 2 | 3.8 | 2.4 |
| Western Gull | 2,800 | 70.7 | 28.1 |
| Western Snowy Plover | 44 | 89.8 | 9.5 |
| California Sea Lion | 51,397 | 44.4 | 41 |
| Pacific Harbor Seal | 784 | 20.3 | 10.2 |
| Northern Elephant Seal | 11,301 | 36.7 | 36.6 |
| **East Islands Bioregion** | | | |
| *San Clemente Island* | | | |
| Ashy Storm-Petrel | <100 | ~50 | 3.2 |
| Brandt's Cormorant | 40 | 100 | 0.7 |
| Black Oystercatcher | 4 | 100 | 4.9 |
| Western Gull | 112 | 68.3 | 1.1 |
| Xantus's Murrelet | 20 | 28.6 | 1.1 |
| California Sea Lion | 5184 | 97 | 5 |
| Pacific Harbor Seal | 104 | 35 | 1.4 |
| Northern Elephant Seal | 196 | 100 | 21 |
| **North Mainland Bioregion** | | | |
| *Point Mugu Navy* | | | |
| California Least Tern | 760 | 40 | 5.5 |
| Western Snowy Plover | 60 | 40.3 | 12.9 |
| **South Mainland Bioregion** | | | |
| *Seal Beach Navy* | | | |
| California Least Tern | 332 | 2.8 | 2.4 |
| *Camp Pendleton* | | | |
| California Least Tern | 3,208 | 27 | 23.3 |

| Western Snowy Plover | 117 | 43.8 | 25.2 |
|---|---|---|---|
| *San Diego Navy (all)* | | | |
| California Least Tern | 2,948 | 24.8 | 21.4 |
| Western Snowy Plover | 56 | 21 | 12 |

## Summary

### Habitat Features

Together, the military use areas represent a total of 414 469.5 mi$^2$ or 18.020% of the 2297 2,3350.9 mi$^2$ in state waters of the SCSR. The military use areas including the greatest amount of area are San Clemente Island (188.0192.2 mi$^2$), San Nicolas Island (134.025.2 mi$^2$). Camp Pendleton (64.4 mi$^2$), and Begg Rock (38 mi$^2$), The two island areas and Begg Rock account for 322 373 mi$^2$ or 77.89% of military use areas in the SCSR.

Military use areas account for the greatest percentage of the East Channel Islands Bioregion (5044.9%) and West Channel Islands Bioregion (3326.9%) (Table 3). The total mainland area assigned to military use amounts to only 9.0 % of mapped habitats, with more than two-thirds of this located in Camp Pendleton in the South Mainland Bioregion.

The military use areas in the East Channel Islands Bioregion and the West Channel Islands Bioregion, which include San Clemente Island, San Nicolas Island, and Begg Rock, contain large percentages of certain habitat types. No military use areas were selected for analysis from the Mid Channel Islands Bioregion.

In the East Channel Islands Bioregion, large percentages of important habitats are within in the San Clemente Island military use area, including 56% of rocky shores, 67% of the linear measure of kelp and 90% of the aerial kelp canopy, 85% of the linear nearshore hard bottom habitat and 52% of the seafloor habitat at 30-100 m depth. In addition, 40% of the sandy and gravel beaches, 45% of the seafloor habitats at 200-1000 m depth are included in the San Clemente Islands military use area. In the West Channel Islands Bioregion, San Nicolas Island and Begg Rock military use areas include more than 30% of kelp and more than 25% of beaches, nearshore hard and soft bottom habitats, and over 30% of seafloor habitats at 30-200 m depth and over 75% of the deep seafloor habitat (200-1000 m).

The military use areas contribute no more than 5% of any habitat type within the North Mainland Bioregion and no more than 1926% within the South Mainland Bioregion (Table 3). Habitat types with the greatest representation in military use areas in the South Mainland Bioregion include nearshore soft bottom habitat (1926%), beaches (16%) and seafloor habitats at 30 – 100 m depth (15%). Military use areas at Camp Pendleton and San Diego Bay, including North Island and Silver Strand, include 1926%

of the nearshore soft bottom habitat in the South Mainland Bioregion. Camp Pendleton includes coastal wetlands habitat and the coastline to the north and south of this military use area, is characterized mostly by sandy beaches and intermittent low-lying soft rocky benches.

Because of their geological makeup and geographic features (e.g., ocean circulation and thermal conditions, shore and coastline topography and orientation, and location with respect to prevailing swell patterns), San Clemente Island, San Nicolas Island, and Begg Rock, contain important and sometimes large amounts of habitat that is often unreplicated or poorly replicated in the SCSR.

Their large distances from the mainland reduce exposure of these islands to the abundant anthropogenic stressors common to SCSR coastal waters.

### *Biotic Features*

These islands are unique in terms of the biota they support within their bioregion. Both islands contain different mixtures of warm and cold temperate species distributed across their waters compared to other islands within their respective bioregions.

The entire waters of both Islands (including Begg Rock) are *Areas of Special Biological Significance* in recognition of their biologically unique and sensitive marine ecosystems.

San Nicolas Island supports the only resident breeding population of the southern sea otter (*Enhydra lutris nereis*) and the largest remaining remnant populations of the endangered black abalone (*Haliotis cracheroidii*) in the SCSR and supports unusual, deep eelgrass communities (*Zostera marina*).

San Clemente Island supports the largest known populations of the rare purple hydrocoral (excluding populations found on the Farnsworth Bank pinnacle), a remnant population of endangered white abalone, and populations of the only rock based morph and one of only two known locations for the sand-based morph of the Elk Kelp (*Pelagophycus porra*).

The kelp beds at San Clemente Island account for 9089% of the kelp bed habitat in the East Channel Island Bioregion whereas San Nicolas Island kelp beds makes up 34.5% of the total kelp coverage in the West Channel Island Bioregion. These island kelp habitats occur in significantly deeper water than most kelp habitats due to water clarity.

### *Linkages and Connectivity*

Modeling results suggest San Clemente Island has high local recruitment and tends to receive larvae from other places in the study region, but has a limited role as a source of larvae to other places in the study region, with the strongest connections to Santa Catalina Island in the same East Channel Islands Bioregion.

Modeling results suggest that San Nicolas Island is connected to some of the other Channel Islands though the exchange of larvae and also receives larvae that originate along the mainland coast.

### *Marine Birds and Mammals*

San Nicolas Island and San Clemente Island include important habitats and rookeries for marine birds and mammals.

San Nicolas Island supports the majority of the western gulls and western snowy plovers for the West Islands Bioregion and also supports a large proportion of the SCSR's western gull, population. It also supports a large proportion of the SCSR's California sea lion, and northern elephant seal populations.

San Clemente Island supports all of the Brandt's cormorants, black oystercatchers, and northern elephant seals, the majority of the ashy storm-petrels, western gulls, and California sea lions, and a large proportion of Xantus's murrelets and Pacific harbor seals for the East Islands Bioregion. San Clemente Island supports all of the California sea lion and northern elephant seal rookeries in the East Channel Islands bioregion.

San Nicolas Island supports 4412% of the California sea lion and 2635% of the northern elephant seal breeding populations in the West Channel Islands Bioregion and San Clemente Island supports 15% oall of the California sea lion and 3% of the northern elephant seal rookeries in the East Channel Islands Bioregion.

The military use area around Point Mugu includes one of three four Pacific harbor seal rookeries in the SCSR.

The military use area around Point Mugu and all military use areas in the South Mainland Bioregion provide important areas for marine birds. Point Mugu supports a large proportion of the western snowy plovers, and Camp Pendleton and the Navy's property in San Diego Bay support large proportions of the California least tern and western snowy plover populations for the SCSR

### Conclusions

Because the military use areas include large amounts of key habitat and contain unique biological communities within the SCSR, these areas will play significant roles in meeting the science objectives of the Marine Life Protection Act (MLPA).

The military use areas on San Nicolas Island (including Begg Rock) and San Clemente Island are particularly important to meeting MLPA objectives within the West Channel Islands and East Channel Islands Bioregions.

Contributions to the MLPA made by any proposed closures in military use areas can best be determined in the context of the alternative MPA proposals for the entire SCSR. Consequently, the SAT recommends that any proposed closures in military use areas be considered as part of the full SAT evaluation of these alternative MPA proposals. The full SAT evaluation is needed to assess the contribution of proposed closures in military use areas to ecosystem protection within each bioregion and the entire SCSR, and to determine the role of proposed closures in military use areas as part of an integrated regional network of MPAs.

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**Appendix A. Habitat Analysis Using Interim (Coarse-scale) Seafloor Habitat Data**

Together, the eight identified military use areas represent a total of 462 mi$^2$ or 20% of the 2297.5 mi$^2$ of mapped habitats in state waters in the SCSR. The military use areas that include the greatest amount of area are Camp Pendleton (63.8 mi$^2$), San Clemente Island (208 mi$^2$) and San Nicolas Island and Begg Rock (163 mi$^2$). The two island areas account for 371 mi$^2$ or 80% of the mapped habitats in the SCSR, which are used by the military.

The five bioregions identified for the SCSR contain different amounts of marine habitats identified by the SAT as important for MPA planning (Table A1). These habitats include consideration of bottom type, depth and biogenic habitat.

**Table A1. Amount of Available Habitat in the SCSR by Bioregion**

| Habitat Type | East Channel Islands Bioregion | Mid Channel Islands Bioregion | West Channel Islands Bioregion | North Mainland Bioregion | South Mainland Bioregion |
|---|---|---|---|---|---|
| Sand and Gravel Beaches (linear miles) | 61.39 | 27.51 | 40.70 | 102.51 | 147.70 |
| Rocky Shores (linear mi) | 62.31 | 83.92 | 75.01 | 30.40 | 28.88 |
| Kelp (linear miles) | 49.40 | 24.13 | 70.38 | 24.23 | 30.07 |
| Kelp Area (square miles) | 3.14 | 0.86 | 8.11 | 2.87 | 2.91 |
| Nearshore hard bottom (linear miles) | 71.65 | 43.07 | 42.85 | 13.19 | 28.68 |
| [1]Hard 0-30m (square miles) | 25.27 | 12.58 | 46.07 | 31.35 | 46.72 |
| Hard 30-100m (square miles) | 89.28 | 16.79 | 41.24 | 22.63 | 13.59 |
| Hard 100-200m (square miles) | 55.22 | 9.70 | 6.90 | 2.39 | 0.77 |
| Hard 200-3000m (square miles) | 84.41 | 9.85 | 0.13 | 1.01 | 1.20 |
| Nearshore soft bottom (linear miles) | 4.31 | 36.06 | 72.44 | 117.93 | 128.58 |
| [1]Soft 0-30m (square miles) | 3.69 | 25.07 | 70.13 | 155.09 | 245.27 |
| Soft 30-100m (square miles) | 15.26 | 186.94 | 250.01 | 215.82 | 148.57 |

| | | | | | |
|---|---|---|---|---|---|
| Soft 100-200m (square miles) | 15.58 | 34.47 | 54.30 | 21.23 | 21.44 |
| Soft 200-3000m (square miles) | 129.89 | 67.89 | 29.12 | 22.03 | 68.56 |
| [2]Totals (miles) | 123.70 | 111.43 | 115.71 | 132.91 | 176.57 |
| [3]Totals (square miles) | 418.61 | 363.30 | 497.90 | 471.56 | 546.12 |

[1]*Barriers to mapping nearshore habitats limit the accuracy of classification of hard and soft bottom habitat at 0-30 m. The SAT developed a proxy for nearshore soft and hard bottom habitats as a linear measure drawn along the coast at depths at 10 - 30 m depth. The linear estimate of nearshore habitats was constructed from all habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*
[2]*Total mapped shoreline type (miles)*
[3]*Total mapped area of bottom type (square miles)*

The military use areas contain more than 25% of seven different habitat types available in all SCSR state waters (Table A2). These include kelp (28% of linear kelp and 33% of kelp area), hard bottom 0-30m proxy (27%), hard bottom 30-100m (34%), hard bottom 100-200m (30%), hard bottom 200-3000m (32%), soft bottom 100-200m (25%), and soft bottom 200-3000m (30%).

**Table A2. Percentage of Available Habitats Identified for the SCSR Found in Military Use Areas**

| Habitat Type | South Coast Study Region Total | Military Use Areas Total | Percent in Military Use Areas |
|---|---|---|---|
| Sand and Gravel Beaches (linear miles) | 379.81 | 64.47 | 17% |
| Rocky Shores (linear mi) | 280.51 | 52.55 | 19% |
| Kelp (linear miles) | 198.21 | 56.10 | 28% |
| Kelp Area (square miles) | 17.89 | 5.86 | 33% |
| Nearshore hard bottom (linear miles) | 199.44 | 52.90 | 27% |
| [1]Hard 0-30m (square miles) | 161.98 | 31.82 | 20% |
| Hard 30-100m (square miles) | 183.53 | 62.08 | 34% |
| Hard 100-200m (square miles) | 74.98 | 22.35 | 30% |
| Hard 200-3000m | 96.60 | 30.52 | 32% |

| (square miles) | | | |
|---|---|---|---|
| Nearshore soft bottom (linear miles) | 359.33 | 44.55 | 12% |
| [1]Soft 0-30m (square miles) | 499.25 | 79.56 | 16% |
| Soft 30-100m (square miles) | 816.60 | 104.20 | 13% |
| Soft 100-200m (square miles) | 147.03 | 36.32 | 25% |
| Soft 200-3000m (square miles) | 317.50 | 95.45 | 30% |

[1]*Barriers to mapping nearshore habitats limit the accuracy of classification of hard and soft bottom habitat at 0-30 m. The SAT developed a proxy for nearshore soft and hard bottom habitats as a linear measure drawn along the coast at depths at 10 - 30 m depth. The linear estimate of nearshore habitats was constructed from all habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*

Of the five bioregions located in the SCSR, military use areas account for the greatest percentage of all mapped habitats in the East Channel Islands Bioregion (50%) and the West Channel Islands Bioregion (33%; Table A3). The total mainland area identified as important for military use amounts to only 9.0% of mapped habitats with more than two-thirds of this located in Camp Pendleton in the South Mainland Bioregion.

The percentages of the mapped habitat of different types located in the military use areas differ by bioregion (Table A3). In particular, the military use areas in the East Channel Islands Bioregion and the West Channel Islands Bioregion, which include San Clemente Island and San Nicolas Island respectively, include large percentages of certain habitat types. No military use areas were selected for consideration in the Mid Channel Islands Bioregion. In the East Channel Islands Bioregion, more than 50% of kelp, rocky shores, shallow hard bottom habitat (0-30m proxy and 0-30m), and soft bottom habitats at all depths (0-30m proxy, 0–30m, 30–100m, 100–200m, and 200–3000m) are included in the San Clemente Island military use area. The contribution of the San Nicolas Island and Begg Rock military use areas to habitat availability in the West Channel Islands Bioregion is less, but includes more than 50% of hard bottom habitat (30–100m) and more than 25% of beaches, kelp, hard bottom habitats at 0-30m proxy, 0–30m and 30–100m depth and soft bottom habitats (30-100m, 100-200m and 200-3000m).

The percentage of different habitat types contained within the military use areas located in the North Mainland and South Mainland Bioregions is much less compared with the East Channel Islands and West Channel Islands Bioregions. The military use areas contribute no more than 5% of any habitat type within the North Mainland Bioregion and no more than 24% within the South Mainland Bioregion (Table A3). Habitat types with the greatest representation in military use areas in the South Mainland Bioregion

include soft bottom at 0-30m depth (24%), hard bottom at 30-100m depth (21%), and beaches (16%).

**Table A3. Percentage of the Available Habitat Types Identified for the SCSR found in the Eight Military Use Areas by Bioregion**

| Habitat Type | East Channel Islands Bioregion | Mid Channel Islands Bioregion | West Channel Islands Bioregion | North Mainland Bioregion | South Mainland Bioregion |
|---|---|---|---|---|---|
| Sand and Gravel Beaches (linear miles) | 40% | 0% | 26% | 5% | 16% |
| Rocky Shores (linear mi) | 56% | 0% | 21% | 0% | 6% |
| Kelp (linear miles) | 67% | 0% | 30% | 0% | 6% |
| Kelp Area (square miles) | 89% | 0% | 35% | 0% | 8% |
| Nearshore hard bottom (linear miles) | 50% | 0% | 40% | 0% | 0% |
| [1]Hard 0-30m (square miles) | 56% | 0% | 35% | 0% | 3% |
| Hard 30-100m (square miles) | 41% | 0% | 56% | 0% | 21% |
| Hard 100-200m (square miles) | 39% | 0% | 9% | 0% | 2% |
| Hard 200-3000m (square miles) | 36% | 0% | 6% | 0% | 0% |
| Nearshore soft bottom (linear miles) | 86% | 0% | 25% | 4% | 15% |
| [1]Soft 0-30m (square miles) | 88% | 0% | 18% | 2% | 24% |
| Soft 30-100m (square miles) | 83% | 0% | 27% | 2% | 13% |
| Soft 100-200m (square miles) | 100% | 0% | 37% | 1% | 6% |
| Soft 200-3000m (square miles) | 57% | 0% | 74% | 0% | 0% |

[1]*Barriers to mapping nearshore habitats limit the accuracy of classification of hard and soft bottom habitat at 0-30 m. The SAT developed a proxy for nearshore soft and hard bottom habitats as a linear measure drawn along the coast at depths at 10 - 30 m depth. The linear estimate of nearshore habitats was constructed from all habitat data in the depth zone from 0 – 30 m, including kelp canopy, and fine-scale and coarse-scale seafloor habitat data.*