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Habitat Conditions: Sandy Shores

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2.1.3 Sandy Shores

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Habitat Description

Sandy shores are complex, highly dynamic environments that link marine and terrestrial ecosystems and provide important ecological functions, including increased coastal resilience. Sandy shore habitats include the intertidal beach, coastal strand, fore dunes, coastal dunes, and stabilized dunes. Sandy shores are the most prominent habitat along the Santa Monica Bay shoreline, extending for over fifty miles. Santa Monica Bay beaches are highly prized for their social uses and their substantial contributions to California's economy, and are also unique and biologically diverse ecosystems when in a more natural, less disturbed condition.

When evaluating these habitats, the Bay can be divided into northern and eastern regions at the point where Sunset Blvd meets the Pacific Coast Highway (PCH). In the north (north of Sunset Blvd to the Ventura County line), the shoreline is backed by the Santa Monica Mountains, compressing development between this and a narrow intertidal beach. Exceptions exist where creek mouths have created more expansive sandy habitats, such as at Topanga, Malibu Lagoon, and Zuma Beach. Sediment for beaches in this region historically came from several short, steep, mostly seasonal streams and erosion of the unstable cliffs and bluffs east of Point Dume. However, sediment input to the system has been reduced dramatically east of Point Dume due to development, including cliff stabilization and dams on Malibu Creek (Orme et al. 2011). Alongshore transport of sediment in this region is south and eastward. In the east (south of Sunset Blvd to the Palos Verdes Peninsula), the shoreline is backed by coastal bluffs north of the Santa Monica pier, and several dune systems to the south. However, development now obscures most of these dune systems sitting between beaches and the bluffs. Historic sediment sources for beaches in this region came from the Ballona Creek or the Los Angeles River, when it flowed out through Ballona Creek. Now, despite stormwater runoff during rains and some dry-weather flow, Ballona Creek delivers little sediment to nearby beaches due to the heavily channelized watershed and trapped sediments behind debris basins in the upper watershed (Orme et al. 2011).

Sandy shore habitats are naturally dynamic. On natural intertidal beaches, sand is eroded in winter and deposited in summer, resulting in dramatic seasonal changes in beach slope and width. In the coastal strand and dune habitats, wind shifts the sand around, causing migration of the dunes themselves over time. In the Bay, sandy shore habitats were historically highly productive. The intertidal beach supported up to 90 species of

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macroinvertebrates, including two clams that previously supported commercial fisheries (Allen and Pondella 2006). Intertidal beaches are also important spawning habitat for the California grunion (*Leuresthes tenuis*), an endemic fish in the silverside family (Martin 2015, see Section 3.2 for more), while dozens of species of shorebirds use intertidal beaches and the coastal strand for foraging or roosting. These habitats are also nesting sites for two federally listed birds, the California least tern (*Sterna antillarum browni*, endangered) and the western snowy plover (*Charadrius alexandrinus nivosus*, threatened) (Carreker 1985, Lafferty 2001, U.S. Fish and Wildlife Service 2007). Finally, dune habitats are home to rare wildlife species, such as the silvery legless lizard (*Anniella pulchra*) and endangered El Segundo blue butterfly (*Euphilotes battoides allyni*), that live in the native vegetation.

However, sandy shore habitats are also some of the most disturbed in the Santa Monica Bay and its watershed. Marina development and other major coastal construction projects have altered our historic shorelines (Flick 1993). All of the stabilized dunes are disconnected from beach habitats by roads and parking lots (Cooper 1967). In many places, the shoreline has been further altered to maximize the width of the dry sand areas that are beneficial for recreational uses, but also bury coastal strand habitats (Flick 1993, Orme et al. 2011). Regular grooming (raking and grading of sand) to remove trash and kelp wrack prevents the establishment of coastal strand plants and the formation of coastal dunes. Infrastructure, such as roads, bike paths, volleyball courts, and jetties, also alters the natural movement of sand and formation of dunes. These activities have left the majority of sandy shore habitats in the Bay less able to provide physical and ecological services, dramatically reducing the number of species they support (Dugan and Hubbard 2009). Recent research on storm and El Niño impacts to shorelines warns of climate change related effects in the future.

Southern California beaches, in general, are very different than they were a century ago. Thirty-two percent of the Southern California coastline is now armored (e.g., seawalls, riprap), a majority of the easily accessible beaches are mechanically raked and graded, and the sediment deficit for beach sand budgets has been over a million cubic meters of sand per year for more than 50 years (Gittman et al. 2015; Orme et al. 2011). The understanding of physical dynamics and long-term changes in the extent of beach habitats in Southern California is relatively detailed and advanced (Orme et al. 2011). The interpretation of decades of aerial photographs and comparisons to mapping done from the 1850s to the 1870s has provided a good basis for quantifying beach change over time (Orme et al. 2011). The effects of reductions in sediment supply caused by dams to the state's beaches have also been quantified (e.g., Willis and Griggs 2003).

Ecological research in the region has allowed the identification and quantification of two of the major stressors on sandy beach ecosystems in southern California: beach grooming (Dugan et al. 2003), and coastal armoring (Dugan et al. 2008). A major gap in our understanding of the ecological impacts of beach nourishment is limiting the ability to inform coastal policy at this time. A major, long-term (~1970–1978) ecological survey effort of a number of beaches in the Southern California Bight followed the 1969 Santa Barbara oil spill. Many of these sites have been re-surveyed in recent years, and comparative analyses of changes in the intertidal species richness of beaches across more than three decades are in preparation (Schooler et al. 2015, in prep.). Santa Monica Bay's beaches rank very low in species richness, comparatively. Assessing how far the baseline has shifted for beach ecosystems over longer periods is challenging. However, a historical ecology analysis by Hubbard et al. (2013) of distribution patterns for two species of beach invertebrates over several decades in the Bight found that they had been extirpated from about 60% of their historically occupied beaches in the Bight, including all former sites in the Santa Monica littoral cell.

While research in Southern California on shoreline processes, restoration activities, and impacts caused by human activities on the ecological processes of intertidal beach habitat is extensive, ecological monitoring across all the zones in sandy shore habitat and encompassing the full range of ecosystem services is limited in Southern California, and particularly in Santa Monica Bay. More comprehensive monitoring is needed to establish baselines and impacts to sandy shore habitats and track trends. Outreach and education, including citizen science programs, are also needed. To help provide some basic data, a pilot citizen science program, called All Ashore, is being developed. In this program, scientists collaborate with volunteers to assess the natural features of beaches, human uses, current management policies, and coastal development. These include the physical aspects of the beach, types of beach zones present, plants and animals on the beach, and human uses and influences on the ecological functions. Professional-level quantitative data are also needed to provide more fine-tuned information. Monitoring of sandy shore habitats in Marine Protected Areas will help, but these studies are limited to intertidal beach habitats. Ecological monitoring in sandy shore habitats has not been a high funding priority in the past, but needs to become so in the future to ensure quality data for future status and trends assessments.

Status and Trends

Extent

This category tracks changes in the area of sandy shores that provides ecosystem functions and services to wildlife. Our assessment encompasses all the zones from the intertidal beach to stabilized dunes. One indicator comprises this category: area of sandy shore habitats. However, this indicator was not scored, so this category was also not scored (Table 2.1.3).

Area of Sandy Shore Habitats

Sandy shore habitats in Santa Monica Bay are vastly different today from what they were prior to the 1900s. While a return to a pre-1900s condition may not be possible or reasonable to expect, significant opportunities to improve ecosystem functions of these habitats do exist. For example, human use, when well-managed, does not necessarily preclude beach habitats from providing a nesting function to the least tern, as the colony at Venice Beach has demonstrated in the past. This indicator tracks changes in the spatial extent of functioning sandy shore habitats, and in doing so, will help track progress toward restoration of ecosystem functions.

Data that can describe this indicator include interpretation of decades of aerial photographs, historic mapping, and field surveys. Orme et al. (2011) quantified change in the width of intertidal beach and sparsely vegetated coastal strand habitats in Santa Monica Bay from the 1920s/40s to 2002 (historic data at Santa Monica Bay beaches go back to 1926/27, except for Paradise Cove and Zuma beach, where the historic record starts in 1944 and 1947, respectively). However, this study did not assess the functionality of the habitats measured. Stein et al. (2014) compared historic mapping with contemporary geographic information system (GIS) data to assess changes in the area of vegetated sandy shore habitats (coastal strand, fore dunes, coastal dunes, and stabilized dunes) in the eastern region of the Bay.

Definitions of functional habitat still need to be defined for many of the zones. In addition, thresholds have not been established. For these reasons, this indicator is not scored. However, a summary of the data that do exist is presented below, with the presence of native vegetation used as a proxy for functional habitat in the coastal strand and dune zones, and beach width used as a proxy for intertidal beach habitat.

Bay-wide, Stein et al. (2014) documented losses of vegetated sandy shore habitats (coastal strand, fore dunes, coastal dunes, and stable dunes) as high as 90% since the late 1800s.

North Region

Since the 1920s/40s, the north region overall experienced no significant net loss of intertidal beach width, due to the predominately undisturbed natural sediment budgets. However, erosion east of Lechuza Point and at Big Rock are likely due to reduced sand supplies, berm manipulation, beach grooming, and riprap placement (Orme et al. 2011).

Beach managers have taken steps to improve the functionality of intertidal beach habitat by altering grooming practices such that kelp wrack and grunion eggs are left undisturbed below the semilunar high tide mark during the grunion season (March through August). In addition, restoration at Malibu Lagoon has also improved the functionality of the barrier beach, coastal strand, and fore dune habitat present there.

The semilunar high tide mark is the wrack line left by the high tide that occurs around the new and full moon of each month.

East Region

Since the 1920s, the east region has seen an overall net gain in beach width due to extensive beach nourishment projects (Orme et al. 2011). However, this expansion does not indicate an expansion in the functional area of intertidal beach and coastal strand habitats, but rather a loss of coastal strand habitat and the creation of a near ecological desert of non-intertidal beach habitat. This conclusion is corroborated by extensive losses, as much as 90%, of the vegetated sandy shore habitats (vegetated coastal strand, fore dunes, coastal dunes, and stable dunes) throughout the Bay since the late 1800s (Stein et al. 2014).

However, as in the north, beach managers have taken steps to improve the functionality of intertidal beach habitats by altering grooming practices such that kelp wrack and grunion eggs are left undisturbed below the semilunar high tide mark during the grunion season. In addition, restoration of portions of the stabilized dunes at the Ballona Wetlands Ecological Reserve, in front of LAX, and along the shoreward face of the remnant dunes at Dockweiler Beach and Redondo Beach, has also improved the functionality of this habitat.

Vulnerability: POOR to FAIR (trend not assessed, LOW confidence)

Extensive loss of functional habitats makes these systems vulnerable to changes, such as sea level rise, particularly those backed by development and infrastructure. These changes may then lead to additional modification of sandy shore habitats, such as coastal armoring. However, it is also possible to make beaches less vulnerable to such changes through protection and improved management. This category comprises three indicators that are designed to measure these vulnerabilities: (1) beachfront development, (2) coastal armoring, and (3) habitat protection. However, two of these have not been fully developed. As a result, only the coastal armoring indicator is used for this assessment.

Based solely on the coastal armoring indicator, beach vulnerability in the north is in FAIR condition, while vulnerability in the south is in POOR condition. Trends were not assessed, due to lack of temporal data. Confidence in the score for this category is LOW for both regions, despite moderate confidence in the coastal armoring indicator score, because only one of the three indicators contributed to the category score (Table 2.1.3). For example, if information on beachfront development can be used in this assessment, the condition in the north would likely be assessed as poor because of the prominent existence of beachfront properties known in that area.

Beachfront Development

Not only does beachfront development potentially cut off sandy shore habitats from a source of fresh sediment, it can also prevent these habitats from migrating seaward as sea level rises, possibly resulting in the complete loss of sandy shore habitats if unmanaged. Tracking changes in coastal development will assist in monitoring risk related to “coastal squeeze,” or the reduction in available beach habitat from both the seaward and landward edges. The metric for this indicator has yet to be developed, but will likely include the percentage of sandy shoreline backed by development and infrastructure, the width of the sandy shoreline shoreward of the development, and the ease of relocating this infrastructure. Data collection will likely consist of digitizing past and present satellite imagery or aerial photos.

HABITAT CONDITIONS: Sandy Shores

Coastal Armoring

Structures placed on the beach alter the natural accretion and erosion and the long-shore transport of sediment. The metric used is the percentage of the shoreline that has been armored (e.g., jetties, groins, and riprap). The National Oceanographic and Atmospheric Administration (NOAA) Office of Oil Spill Response and Restoration collects data on shoreline habitat, including artificial structures, to include in their Environmental Sensitivity Index maps to assist them in damage assessment and restoration planning in the case of an oil spill or some other accident. The maps specify the shore-most habitat and are updated approximately every seven years, depending on the availability of state and federal funds. Data from 2010 were available for this assessment. Thresholds for distinguishing poor, fair, and good condition have yet to be developed. However, for this assessment, a threshold of 28% was used to distinguish poor from fair because this is the average level of armoring in the state (Gittman et al. 2015).

North Region

In the north, 25% of the shoreline is armored by length. Armoring is typically riprap placed parallel to shore in the upper intertidal area to prevent erosion of landside infrastructure and property, such as homes and the Pacific Coast Highway. The exceptions are the three state beaches at Topanga, Malibu Lagoon, and Zuma. Much of this shoreline is already inundated at high tide and is extremely vulnerable to further erosion as sea level rises. However, there is still potential for improvement in how coastal processes are managed in this region. Based on this assessment, the armoring indicator in this region is ranked as FAIR. Trends were not assessed. Confidence in this assessment is MODERATE due to the lack of established thresholds (Table 2.1.3).

East Region

In the east, 35% of the shoreline is armored by length. Groin fields and jetties protecting the mouths of Marina del Rey and King Harbor prevent sand from moving down current. Note that the length of armored shorelines is possibly overestimated because the length of the artificial structures in this region (perpendicular to shore and extending inland) adds to the total shoreline length. However, the beaches in this region are broad (due to decades of beach replenishment projects), and infrastructure is set much further back from the intertidal area, making this region less vulnerable to erosion caused by changing sea level and therefore less at risk for further armoring (although future replenishment to retain the beach width is likely (Orme et al. 2011)). There is also the potential for change and improvement in how natural coastal processes are managed in this region. Based on this, armoring in this region is POOR (i.e., there is significant armoring). Trends were not assessed. Confidence in this assessment is LOW due to the lack of established thresholds and some uncertainty in the data for this region (Table 2.1.3).

Habitat Protection

Because beach recreation and tourism are valuable uses of the beach, managing these uses in concert with managing the natural resources is critical for restoring functions to sandy shore habitats. Possibilities include establishing enclosures to protect overwintering western snowy plover and nesting least terns, eliminating grooming in sensitive areas and restoring habitat in areas that will be protected from future human-caused degradation.

The use of enclosures to protect nesting shorebirds from human disturbance has been criticized for concentrating nests and increasing predator success. The solution to this is to continue the use of enclosures (which effectively protect nesting birds from most human disturbance) and implement predator deterrent strategies.

This indicator will be measured by the percentage of habitat under various levels of protection. These levels have yet to be defined, but would be based on the types of activities restricted and the duration of the restrictions (e.g., year-round enclosures are more protective than seasonal enclosures because they allow growth of coastal strand vegetation and encourage continued use of this habitat by the western snowy plover). Because this indicator is not fully developed, it is not scored for this assessment.

Structure and Disturbance: POOR to FAIR and IMPROVING (LOW Confidence)

Healthy sandy shore habitats need a natural supply of sediment, a source of nutrients, and areas where ecological processes and native vegetation growth can occur undisturbed. This category assesses the level of structural integrity and disturbance, or protection of it. This category comprises four indicators: (1) sediment supply, (2) beach management practices, (3) nutrient inputs, and (4) invasive vegetation.

For this assessment, only the beach management practices indicator was scored. Based on this indicator, the beach structure and disturbance category is in FAIR condition in both the north and the east. The condition is also IMPROVING in both regions of the Bay. Confidence in this assessment is LOW despite moderate confidence in the indicator assessment due to the reliance on only one of the four indicators that comprise this category for the overall score (Table 2.1.3).

Sediment Supply

Santa Monica Bay has its own littoral cell (the Santa Monica Cell) that extends from Point Mugu (north of the Santa Monica Bay study area) to the Palos Verdes peninsula and encompasses all of the beaches along Santa Monica Bay. In the north, the Zuma subcell operates as a distinct compartment, but still part of the larger cell. Bluff erosion is the most important natural input of sand to this littoral cell, followed by rivers. Dams and other water structure controls in Malibu Creek and bluff erosion controls (e.g., seawalls) elsewhere in the Bay have reduced this natural input by 31% (Patsch and Griggs 2007). This has been replaced and surpassed by beach replenishment projects, which contribute 66% to the total sand budget annually and account for a 158% increase in sediment supply (Patsch and Griggs 2007). However, beach replenishment projects have been shown to erode quickly and are not likely to be cost-effective strategies in the future (Orme et al. 2011). Efforts to remove dams in the Malibu Creek watershed may result in an increased supply of sediment. However, climate change will also likely intensify erosion concerns through changes in storm frequency and intensity, as well as changes to wave attenuation and sea level rise. For these reasons, changes to the sediment budget in the Bay need to be evaluated. However, a consistent monitoring program for this metric and thresholds has not been established yet. As a result, it was not scored in this assessment.

Beach Management Practices

Sandy shores are highly managed in Santa Monica Bay. Historically, many aspects of beach management have been primarily geared toward human use and recreation, not the protection of natural resources and functioning ecosystems. Several activities that occur in sandy shore habitats have been conducted in ways that could harm ecosystem functions in these habitats. Three activities in particular can cause the loss of ecological function in the intertidal beach and coastal strand habitats: grooming (raking and grading the sand), driving, and beach replenishment (the addition of sand). In the intertidal beach and coastal strand habitats, beach grooming removes trash and resurfaces the beach for joggers and volleyball players, but can also remove vegetation and beach wrack and disturb grunion eggs, invertebrates, and birds if not done carefully. The construction of berms out of sand during the winter to protect infrastructure has similar effects. Emergency and maintenance vehicles are sometimes necessary to protect human life and property. However, when driven in sensitive areas or too fast, these vehicles can result in the death of wildlife, such as the threatened western snowy plover (Ryan et al. 2010). Nourishment buries organisms and can disrupt coastal processes.

In addition to these, foot traffic off designated paths is an important metric in dunes, and dogs are worth considering in all habitats because of the risk they pose to protected species. In the dune habitats, foot traffic in undesignated areas can destroy native vegetation and cause erosion. In all sandy shore habitats, dogs, particularly off-leash, can flush roosting birds, disturb resting marine mammals, chase lizards and mammals, and occasionally kill wildlife (Ryan et al. 2010).

All of these activities can be conducted in ways that reduce the level of disturbance in sandy shore habitats, and if followed, will greatly improve ecosystem functions. Including this indicator and monitoring these activities will encourage and reward shifts toward best practices. Some BMPs for grooming, vegetation management, and driving practices have already been developed in collaboration with the Los Angeles County Department of Beaches and Harbors, which is responsible for managing most beaches in the Bay (except smaller beaches in the north region and Santa Monica State Beach).

While the metric for this indicator is not fully developed, a few components are known. For beach raking and grading during grooming, and the addition of sand during beach replenishments, the location, timing, and frequency are important factors to consider. Similarly, location, speed, and vehicle size are important factors in driving practices. For dogs, enforcement needs to be considered. Erosion control measures, invasive species management, and the provision of visitor access are important factors in dune management. Nevertheless, in the absence of a standardized metric, this indicator was scored based on current management practices using expert knowledge and best professional judgment. Also, notice that, although the assessment of this indicator below was done by region, beach management practices may differ more as a result of different jurisdiction than the beaches' geographic locations or physical characteristics.

North Region

In the north, grooming and driving in the mid-beach zone occur frequently at Zuma, infrequently at Malibu State Beach, and rarely elsewhere. However, the intertidal beach is avoided during grunion season to protect these fish and leave kelp wrack (Martin et al. 2006). Sand berms are created prior to the wet season at Zuma to protect low-lying infrastructure, which causes significant disturbance. Sediment replenishment at Zuma has occurred in the past and is possible in the future, but has not occurred in many years. While dogs are not allowed on state beaches, off-leash dogs are common at many of the semi-secluded beaches in the area. Pioneer trails through dunes are less common here and do not contribute significantly to erosion.

Based on this, the status of beach maintenance practices in the north is FAIR. However, changes in beach grooming practices made in the last several years to better protect grunion and western snowy plovers have resulted in IMPROVING conditions. Confidence in this assessment is MODERATE because knowledge of current beach management practices is good and the impacts are well-understood.

East Region

In the east, grooming of coastal strand habitat is frequent, and emergency vehicles are common. However, the intertidal beach is avoided during grunion season to protect these fish and leave kelp wrack (Martin et al. 2006). In addition, sand berms are created prior to the wet season in three locations to protect low-lying infrastructure. Nourishment throughout the region has occurred in the past. In 2012, a section of Redondo Beach was nourished with dredge spoils from Marina del Rey. Dogs are not allowed on these beaches, but rules are poorly enforced, particularly early in the morning or late in the evening. In addition, pioneer trails cutting through remnant coastal dunes at Dockweiler State Beach and at a few locations in Redondo Beach indicate a need for more paths for public access.

To the contrary, there have been restoration efforts in the back dune habitat areas in the Ballona Reserve and the LAX Dune Preserve. These areas also exhibit a lack of vehicular traffic, a small number of pioneer trails, and restricted public access.

Based on these assessments, the status of beach maintenance practices in the east is FAIR. Changes in beach grooming practices made in the last several years to better protect grunion and western snowy plovers have resulted in IMPROVING conditions. Confidence in this assessment is MODERATE because knowledge of current beach management practices is good and the impacts are well-understood (Table 2.1.3).

Nutrient Inputs

Native coastal strand and dune vegetation are a source of nutrients, provide a habitat for wildlife, and stabilize slopes. In the intertidal beach, nutrients arrive to the system in the form of kelp wrack (marine algae deposited on the beach by the tides). Kelp wrack supplements the intertidal area with nutrients, prevents desiccation, and can even contribute to dune formation.

Quantitative data would ideally be used to measure this indicator. However, a long-term monitoring program at all the Bay's beaches and across all sandy habitat zones to collect these data does not currently exist. Until quantitative data exist, this indicator will be measured by the presence of different wrack species and driftwood in the intertidal beach, and select native plant species of the coastal strand and dune habitats. Examples of natives include beach burr (*Ambrosia chamissonis*), red sand verbena (*Abronia maritima*), and beach salt bush (*Atriplex leucophylla*) in the coastal strand; Southern California morning glory (*Calystegia macrostegia*), beach evening primrose (*Camissoniopsis cheiranthifolia*), California poppy (*Eschscholzia californica*), and bush lupine (*Lupinus chamissonis*) in coastal dunes; and coast buckwheat (*Eriogonum latifolium*), Southern California silver lotus (*Acmispon argophyllus*), coyote bush (*Baccharis pilularis*), and goldenbush (*Isocoma menziesii*) on the stabilized dunes. Due to the lack of data on wrack and vegetation, this indicator was not scored (Table 2.1.3).

Invasive Vegetation

Invasive plants often do not provide healthy functions to native habitats and frequently crowd out native plants. This indicator will be measured by the presence of invasive species in coastal strand and dune habitats. Examples of invasive include European sea rocket (*Cakile maritima*) and iceplant (*Carpobrotus edulis*). Due to the lack of data, this indicator was not scored (Table 2.1.3).

Biological Response: POOR to FAIR and DECLINING (MODERATE Confidence)

This category measures changes in fauna communities and shifts in ecosystem functions (vegetative communities are included in the structural category above). The four indicators that comprise this category are: (1) nursery function for fish, (2) roosting and foraging function for birds, (3) nursery function for birds, and (4) native fauna. In the future, additional indicators should be added to incorporate dune habitats.

Based on these indicators, mainly based on the condition of bird roasting and nursery, biological response is in FAIR but DECLINING condition in the north and POOR and DECLINING condition in the east. Confidence in this assessment is MODERATE for both regions because of the moderate confidence in the majority of the indicators that comprise this category (Table 2.1.3).

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Nursery Function for Fish

California grunion lay their eggs in the upper intertidal on full or new moons. Two weeks later, on the next spring tide, the eggs are washed back into the ocean and hatch into larval grunion. This unique behavior makes adult grunion vulnerable to predation and a unique recreational fishery, and their eggs and larvae become vulnerable to land-based activities, such as grooming if it occurs in the upper intertidal (for more on grunion, see Section 3.2). While changes in grunion runs are more likely to be caused by changing ocean conditions, overfishing, and habitat shifts, this is still an important function of beaches in Santa Monica Bay that warrants inclusion in this habitat assessment. One beach-specific factor that may affect the condition of grunion runs is the loss of sandy beaches due to erosion or armoring. This indicator is measured by the mean size of grunion runs during five-year periods that coincide with the State of the Bay Report's cycle. Grunion Greeters (another citizen science monitoring program) collect information about the size of grunion runs using the Walker Scale throughout the season; past and present data are both available. The Walker Scale rates the size of grunion runs on a scale of 0–5, with 5 indicating the most spawning activity possible and 0 indicating no spawning activity. For this assessment, the following thresholds were used: scores of one or less are considered poor, scores of two or three are considered fair, and scores of four or five are considered good.

The median grunion run size has declined from a 2 on the Walker Scale (approximately 500–1000 fish spawning at once for up to one hour) to a 1 on the Walker Scale (approximately 100–500 fish spawning at different times for up to one hour) between the 2004–2009 and 2010–2014 time periods. The nursery function of intertidal beaches for fish in the Santa Monica Bay is in FAIR but DECLINING condition. Confidence in this estimate is MODERATE because, although high-quality data and established thresholds are available for this assessment, there are still many uncertainties regarding whether and how much the current grunion run condition is related to disturbances specific to beaches in the Bay (Table 2.1.3).

Roosting and Foraging Function for birds

Santa Monica Bay is an important overwintering habitat for the western snowy plover (U.S. Fish and Wildlife Service 2007) and other shorebirds. However, human activities, dogs, and beach grooming easily disturb shorebirds, particularly roosting plovers. The Los Angeles Audubon monitors overwintering western snowy plover populations monthly, and data are available dating to 2004. However, statewide data (for comparison) are more limited. In addition, the Los Angeles and Palos Verdes Audubon collect Christmas counts of shorebirds in the region. The number of roosting western snowy plover observed during the winter surveys (January) and the number of shorebirds observed during Christmas counts are the metrics for this indicator. Thresholds for either metric have not been fully developed. However, for this assessment, the average number of western snowy plover observed per site in Region 5 (Santa Barbara and Ventura Counties) in 2010 (35.8 adults) and the average number observed per site in Region 6 (Los Angeles, Orange, and San Diego Counties) in 2010 (12.7 adults) were used as the upper and lower thresholds, respectively. Christmas counts of shorebirds were not obtained in time for this assessment.

Roosting Western Snowy Plover: The two persistent sites in the north (Zuma Beach and Malibu Lagoon/Carbon Beach) exceed the average number of birds per site in Region 5, whereas the five persistent sites in the east (Santa Monica State Beach North, Dockweiler State Beach North and South, Hermosa Beach North, and Point Fermin/Cabrillo Beach) fall below the average number of birds per site in Region 5, but above the average for Region 6. As such, the north region is estimated to be in GOOD condition, while the east region is estimated to be in FAIR condition.

Both regions have begun to recover following a decline in numbers from 2006 to 2007. The overwintering populations at the five persistent sites in the east region demonstrate a steady INCREASE. At 149 adults in 2014, these populations have surpassed the numbers observed in the previous high of 124 in 2005. On the other hand, the overwintering populations at the two persistent sites in the north region have been in a steady DECLINE since 2012. Here, the total number of adults dropped from 163 in 2012 to 98 in 2014. Confidence in the assessment for both regions is MODERATE due to the use of data from only persistent sites in the analysis (this can be corrected in future assessments) and the reliance on unproven thresholds (Table 2.1.3).

Nursery Function for Birds

Beaches in the Santa Monica Bay historically provided nesting habitat for the western snowy plover and the California least tern (Phillip Williams and Associates 2006; Ryan et al. 2010). Currently, only one least tern nesting colony at Venice Beach is active. Researchers have observed possible nesting attempts by western snowy plover at a few of the persistent roosting sites, but no successful nests have been observed since monitoring began in 2004 (Ryan and Stacey 2010). This indicator comprises two different metrics: (1) the number of western snowy plover observed during the breeding window and (2) the numbers of nesting least tern pairs and least tern fledglings.

Breeding Western Snowy Plover: The number of western snowy plover expected per site in Region 5 (Santa Barbara and Ventura Counties) and Region 6 (Los Angeles, Orange, and San Diego Counties) during the breeding window (May) of 17.1 and 6.0 are used as the high and low thresholds, respectively. One western snowy plover was observed in the last five years (2010–2014) across all 10 sites surveyed in the North Bay during the summer window. In the South Bay, four were observed over the same time period and across all 14 sites surveyed. These numbers are much lower than expected based on the numbers observed per site in either Region 5 or 6, and therefore, the status of this metric for both regions is POOR. Currently, the appearance of a snowy plover during the summer in both regions is so sporadic that trends cannot be assessed. Confidence in the assessment for both regions is HIGH because the data are clear, despite the lack of proven thresholds.

HABITAT CONDITIONS: Sandy Shores

Least tern nesting pairs and fledglings: The numbers of least tern nesting pairs and fledglings at the Venice Beach colony are compared with the number of nesting pairs and fledglings statewide and over time. In 2007, Venice Beach held 17% of statewide nesting pairs and produced 6% of the state's least tern fledglings. However, the nesting population at the Venice colony has declined sharply since 2008. By 2014, it supported less than 1% of statewide nesting pairs. The number of fledglings produced has declined along with the number of nesting pairs. The colony did not produce a single fledgling from 2009 to 2012 (Figure 2.1.3). This is attributed primarily to predation on least tern eggs by crows (Ryan and Vigallon 2013). More recent data were not available for this report, but a crow aversion pilot experiment was implemented in 2014 by Loyola Marymount University. As a result, the status of least tern nesting success in the east region is in POOR condition and DECLINING. Confidence in this assessment is MODERATE due to the lack of accepted thresholds, despite high-quality data. The north region was not scored for least terns, because there is no nesting colony in this region.

The nursery function for birds provided by coastal strand habitat in the north region is in POOR condition. Trends could not be assessed. Confidence is MODERATE and based on the western snowy plover breeding metric. The nursery function for birds in the east region is also in POOR condition, with a DECLINING trend and MODERATE confidence based on the scores of both of the metrics (Table 2.1.3).

Native Fauna

The presence of native fauna, such as dune beetles, beach hoppers, sand crabs, lizards, mammals, and terrestrial birds, indicates a functioning ecosystem, but is not currently part of a monitoring program in Santa Monica Bay. Thresholds also need to be developed to interpret these data, since neither the data nor the thresholds exist for this report.

However, recent sampling of intertidal beaches throughout Southern California indicates that urban sandy shore habitats, such as those in Santa Monica Bay, have notably low invertebrate diversity (Schooler and Dugan unpublished data). Shorebird density and diversity in urban coastal strand habitats are also well below regional averages (Schooler and Dugan unpublished data). For these reasons, the native fauna indicator in Santa Monica Bay is in POOR condition. Trends were not assessed due to a lack of historic data. Confidence in this assessment is MODERATE due to a lack of established thresholds.

Table 2.1.3. Indicators, Related Management Actions, and Status and Trends for Sandy Shore Habitats

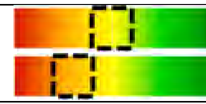
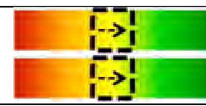
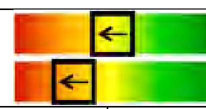
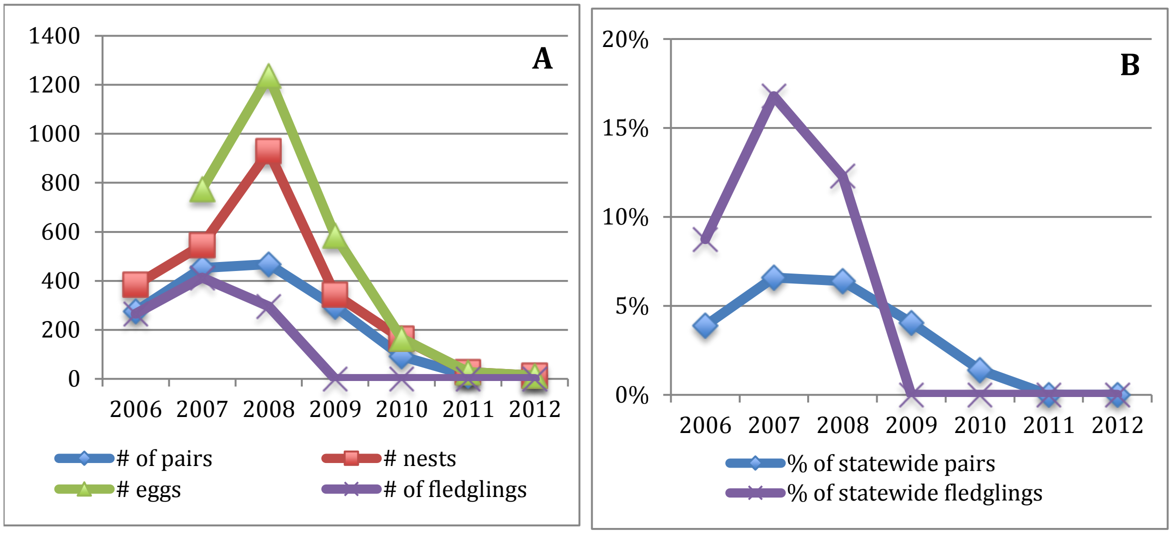
INDICATOR	*METRIC*	*RELATED MANAGEMENT*	*SCORE*			*CONFIDENCE*
1 Habitat Extent *(Spatial Indicators related to extent, accessibility, availability, and temporal variability)*			SMB:			NOT SCORED
1.1 Area of Beach Habitats	Area of beach habitats providing ecosystem functions by type.	SMBRC: BRP Goal 8.				NOT SCORED
2 Habitat Vulnerability *(Spatial Indicators related to disturbance potential)*			North: East:			LOW LOW
2.1. Beachfront Development	Percentage of beach shoreline with beachfront infrastructure.					NOT SCORED
2.2 Coastal Armoring	Percentage of shoreline that has been armored.		North: East:	STATUS: Fair Poor	TREND: No Data No Data	MODERATE MODERATE
2.3 Habitat Protection	Percentage of habitats under various levels of protection.					NOT SCORED
3 Structure and Ecological Disturbance *(Physical, chemical, and biological properties that impact condition of habitat)*			North: East:			LOW LOW
3.1 Sediment Supply	This indicator needs to be further developed.					NOT SCORED
3.1 Beach Management Practices	The metric for this indicator needs to be further developed.	SMBRC: BRP Milestone 8.2b	North: East:	STATUS: Fair Fair	TREND: Improving Improving	MODERATE MODERATE
3.2 Nutrient inputs	Presence of beach wrack and select native plant species.	SMBRC: BRP Milestone 6.5b				NOT SCORED
3.2 Invasive Species	Presence of invasive plant species.	SMBRC: BRP Milestone 6.5b				NOT SCORED
4 Biological Response *(Changes to individuals, populations, communities, and ecosystems in response to changes in habitat quality)*			North: East:			MODERATE MODERATE
4.1 Nursery Function for Fish	Median grunion run size.	SMBRC: BRP Milestone 8.2a	SMB:	STATUS: Fair	TREND: Declining	HIGH
4.2 Roosting Function for Birds	Number of western snowy plover observed in winter surveys. Winter shorebird counts not scored.	SMBRC: BRP Objective 8.2. USFWS & CDFW: Endangered Species Recovery Plan	North: East:	STATUS: Good Fair	TREND: Declining Improving	MODERATE MODERATE
4.3 Nursery Function for Birds	Number of western snowy plover observed in summer surveys, number of California least tern nesting pairs and fledglings.	SMBRC: BRP Objective 8.2. USFWS & CDFW: Endangered Species Recovery Plan	North: East:	STATUS: Poor Poor	TREND: No Data Declining	MODERATE MODERATE
4.4 Native Fauna	Presence of native fauna.		SMB:	STATUS: Poor	TREND: No Data	MODERATE

Figure 2.1.3. Least Tern Nesting Success at the Venice Beach Colony. Chart A depicts numbers observed at the Venice colony. Chart B depicts the Venice colony's contribution to statewide least turn nesting. Both charts indicate a steady decline in all metrics since 2007/08. Courtesy: Los Angeles Audubon Society.



Conclusions and Next Steps

Changes in traditional beach grooming practices to protect grunion and avoid roosting and nesting shorebirds demonstrate that it is possible for beach recreation and beach ecology to co-exist. More restoration efforts and best management practices should be carried out throughout Santa Monica Bay, as the overall ecological condition of this habitat is at the lower end compared to other habitats in the Bay. To support future decisions regarding beach management and restoration, comprehensive monitoring in Santa Monica Bay covering all the sandy shore habitats is needed to establish baselines and impacts to sandy shore habitats and track trends. To help provide some basic data, a pilot citizen science program called All Ashore is being developed, but robust, quantitative data are needed to supplement the citizen science program. Ecological monitoring in sandy shore habitats has not been a high funding priority in the past, but needs to become so in the future to ensure quality data for future status and trends assessments. Increasing the research needed to establish thresholds for many of the indicators used in this assessment should also be a priority.

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