California MLPA Master Plan Science Advisory Team
Draft Background Information on Beach Manipulation Activities in the MLPA South Coast Study Region

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Sandy beaches in the MLPA South Coast Study Region (SCSR) support very high levels of recreation and human use. These coastal areas are managed with a wide variety of approaches and techniques, ranging from modest to intensive activities, on both seasonal and year-round schedules. Widespread management activities conducted by a multitude of state and federal regulatory agencies for SCSR beaches include nourishment, grooming, public safety programs, breaching of impounded water bodies, construction of winter sand berms, contouring of berms, filling of beach pools and removal of wind-blown sand drifts. The MLPA Master Plan Science Advisory Team (SAT) is tasked with providing scientific information about how these beach manipulation activities impact the surrounding ecosystems and how those impacts relate to meeting the goals of the MLPA through the design and implementation of marine protected areas (MPAs).

A key caveat to this summary is that jurisdiction of the MLPA begins seaward of the mean high tide line or the mouth of a coastal river[1]. Therefore, most attention should be paid to those activities that are 1) related to MPA planning (i.e., occurs below the mean high tide line, or directly impacts the environment below the mean high tide line), and 2) those activities for which spatially explicit information exists so that it can be mapped and determined as to whether the activity occurs at a given site. Spatial data are available showing some of the historic and current locations of beach nourishment activities (Figure 1). Spatial data are also available for beach erosion concern areas, coastal and potential offshore sediment sources, offshore disposal sites and related data used to identify areas of potential sediment management activities in California[2].

Beach Nourishment

Beach nourishment (i.e., replenishment) is the term used to describe the introduction of sand onto a beach to supplement a diminished supply of natural sediment, for the purpose of beach restoration, enhancement or maintenance[3]. Beach nourishment is commonly used to protect the shoreline and support recreational needs. Beach nourishment projects involve sediments from at least one dredge site or a terrestrial source, and take many forms including the placement of sand in the intertidal and subtidal zones using dump trucks, dredges, pipelines, and barges[4]. While offshore deposits of sand in depths up to about 100 feet are generally the nearest source of suitable quality sand, the use of sediments from harbor dredging and flood control projects is often viewed as the most cost-effective means of nourishment.

Review of existing information indicates that beach nourishment activities in California occur mostly below the mean high tide line. However, the California Fish and Game Commission

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[1] California Fish and Game Code, Section 2852(c).

[2] California Coastal Sediment Management Workgroup (CSMW). 2008. Draft California Beach Restoration Survey (http://dbw.ca.gov/csmw/pdf/DraftCBReS_2008_12052008.pdf)

[3] California Department of Boating and Waterways and California State Coastal Conservancy. 2002. California Beach Restoration Study. Sacramento, California.

[4] CSMW. Results from CSMW Task 3, Table 2 (http://dbw.ca.gov/csmw/PDF/TABLE2TASK3CSMW.pdf).

does not have authority to permit or prohibit beach nourishment in the marine or estuarine environment. The MLPA cannot supersede otherwise lawful activities that are not within the authority of the California Fish and Game Commission to regulate. Accordingly, the only appropriate evaluation the SAT may conduct under the MLPA regarding beach nourishment projects is an analysis of where these activities occur and the potential impacts on associated living marine resources.

Living marine resources associated with beach habitats are affected both positively and negatively as a result of beach nourishment projects[5]. Negative effects are generally short-lived relative to the expected renourishment interval[5,6], however comprehensive biological impact assessments on the effects of associated biological resources are limited[5,7,8]. The disturbances created by beach nourishment activities cause immediate ecological damage to the associated sandy beach habitats and biota of "receiver" sites and to subtidal "borrow" or sand source sites[9]. Documented impacts to receiver beaches can include near complete mortality of resident intertidal biota, which can lead to lasting reductions in abundance and biomass, significant declines in shorebird use, and alterations to the habitat (i.e., decreased sediment quality and increased intertidal slopes)[10,11]. Subsequent ecological recovery can be protracted, particularly in the face of repeated nourishment or bypassing episodes[12]. Beach nourishment may also potentially damage adjacent marine habitats such as rocky reefs, estuary mouths, surfgrass beds and kelp forests due to an increase in sediment transport and the generation of turbidity plumes. To protect water quality and avoid turbidity plumes, the sand used in beach nourishment is often limited to 20% fine sediment[13]. However, appropriately applied nourishment can restore degraded sandy intertidal habitat for subsequent colonization and use by marine animals and birds[14].

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[5] National Research Council. 1995. Beach nourishment and protection. National Academy Press, Washington, D.C., 352 p.

[6] AMEC Earth & Environmental, Inc. 2005. Regional Beach Sand Project Year 4 (2004-2005) post-construction monitoring report for intertidal, shallow subtidal, and kelp forest resources and Comprehensive Analysis Report (2001-2005). Prepared for San Diego Association of Governments (SANDAG), San Diego, CA.

[7] Green, K. 2002. Beach nourishment: A review of the biological and physical impacts. Atlantic States Marine Fisheries Commission Habitat Management Series #7 (http://www.asmfc.org/publications/habitat/beachNourishment.pdf).

[8] CSMW. *In preparation*. California Sediment Management Master Plan- review of biological impacts associated with sediment management and protection of California coastal biota. Prepared for CSMW under contract with Beach Erosion Authority for Clean Oceans and Nourishment.

[9] Peterson, C. H. and M. J. Bishop. 2005. Assessing the environmental impacts of beach nourishment. Bioscience 55(10):887-896.

[10] Peterson, CH, M.J. Bishop, G.A. Johnson, L.M. D'Anna, and L.M. Manning 2006. Exploiting beach filling as an unaffordable experiment: benthic intertidal impacts propagating upwards to shorebirds. Journal of Experimental Marine Biology and Ecology 338:206-221.

[11] Speybroeck, J., Bonte, D., Courtens, W., Gheskiere, T., Grootaert, P., Maelfait, J-P., Mathys, M., Provoost, P., Sabbe, K., Stienens, E.W.M., Van Lanker, V., Vicx, M., and S. Degraer. 2006. Beach nourishment: an ecologically sound coastal defence alternative? A review. Aquatic Conservation: Marine and Freshwater Ecosystems 16:419-438.

[12] Dolan, R., C. Donoghue and D. Stewart 2006. Long-term impacts of tidal inlet bypassing on the swash zone filter feeder *Emerita talpoida* Oregon Inlet and Pea Island, North Carolina. Shore & Beach 74: 23-27

[13] CSMW. Results from CSMW Task 5 (80/20 Coarse-to-Fines Rule of Thumb).

[14] SAIC. 2005. Coastal habitat study, 2003-2004: Influence of beach nourishment on biological resources at

Other Beach Manipulation Activities

As previously mentioned, a variety of other beach manipulation activities occur in SCSR beaches, including beach grooming, vehicle traffic for public safety purposes, breaching of impounded creek mouths, lagoons and outfalls, construction of winter sand berms to protect structures, contouring berms, filling of high beach pools and removal of wind-blown sand from paved areas. Many of these approaches involve intensive use of heavy equipment, including trucks, bulldozers, and grooming machines in the intertidal zones of beaches. These activities primarily take place above the mean high tide line outside the jurisdiction of the MLPA. However, several activities take place below the mean high tide line. For example, beach grooming does occur below the mean high tide line, particularly outside of grunion season, and sand is often collected below the mean high tide line to construct protective winter berms further up on the beach. These activities have the potential to negatively impact living marine resources associated with the sandy intertidal environment.

Beach grooming (i.e., mechanized maintenance) refers to removing debris (natural and unnatural) from sandy beaches using heavy equipment. Over 45% of the sandy coastline on the southern California mainland coast is mechanically maintained to remove beach wrack (primarily giant kelp and surfgrass) and trash at least seasonally[15]. There are many approaches to grooming including the removal of cobbles, kelp, carrion and large woody debris as well as specialized grooming machines (raking, sifting, smoothing). The disposal of wrack also varies widely among beaches and can include burial in the intertidal or supralittoral zones, removal from beach to land fills or transfer stations, and deposition downcoast.

Beach grooming can have negative impacts on the associated marine communities of beaches. For example, the removal of beach wrack by grooming is associated with decreased species richness, abundance, and biomass of intertidal macroinvertebrates and reduced prey resources for shorebirds and fish in southern California[15]. Shorebird abundance and diversity also are reduced on groomed beaches. Similarly, grooming over spawning sites for California grunion destroys eggs[16]. To minimize impacts associated with grooming during grunion season, many beach managers now restrict their grooming to well above high tide[16]. During the off-season, however, grooming occurs below the mean high tide and grooming protocols and equipment differ widely across locations in the SCSR.

The building of winter berms using intertidal sand involves heavy equipment and occurs routinely on many beaches along the coasts of Santa Barbara, Ventura, Los Angeles, Orange and San Diego counties (i.e., Zuma Beach, Mission Beach, Pacific Beach, etc.), and

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beaches in the City of Encinitas, California. Prepared for City of Encinitas by Science Applications International Corporation, January 2005 (http://www.ci.encinitas.ca.us/NR/rdonlyres/3C72EAB2-BF03-42EC-BAE9-E6F29805D17D/0/COASTAL_HABITAT_STUDYDec04.pdf).

[15] Dugan, J. E., D. M. Hubbard, M. D. McCrary, and M. O. Pierson. 2003. The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California. Estuarine, Coastal and Shelf Sciences 58S:25-40.

[16] Martin, K.T. Speer-Blank, R. Pommerening, J. Flannery and K. Carpenter. 2006. Does beach grooming harm grunion eggs? Shore & Beach 74(1):17-22.

emergency berm building can occur in numerous other locations. Berm building has negative effects on beach biota, including species of clams and crabs that may comprise the majority of intertidal biomass on southern California beaches[17].

Vehicle traffic along beaches associated with public safety is common in the SCSR. Although vehicle traffic is not synonymous with the activities described above which directly alter or remove habitat, it has the potential to cause ecological impacts to beach biota seaward of the mean high tide line. However, the extent, intensity, and locations of vehicle use in the SCSR are not well understood. As with other beach manipulation activities, regulating vehicle access to the shoreline for public safety is outside the purview of the MLPA and is certainly an important public service.

Recommendation

The beach manipulation activities described in this document impact living marine resources in different ways and to varying degrees, but they are outside the purview of the MLPA. Therefore, this information may be considered when siting and designing MPAs; however, guidance provided in the master plan for marine protected areas and other guidance provided by the SAT should be the primary factors informing MPA design. The SAT recommends that approximately 1.14 linear (statute) miles of sandy beach habitat be encompassed in an MPA to meet habitat representation guidance. While the upper beach, above mean high tide, is outside the purview of the MLPA, ecologically they are linked. Thus, in developing MPA proposals one may wish to consider siting MPAs along beaches that are adjacent to the 'upper beach' environment.

The appropriate management entities are also encouraged to collaborate and continue to develop and employ best management practices to ensure protections for marine life and habitats while maintaining beaches to serve public interest (e.g., public safety and beach access).

[17] Peterson, C.H., Hickerson, D. H.M. and G. G. Johnson. 2000. Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. Journal of Coastal Research. 16:368-37.

Figure 1. Draft map showing the locations of beach nourishment activities in the SCSR, and [inset map] regional sediment management sites related to beach nourishment activities in San Diego County.