Part V: Appendices

Appendix A: Acronyms

ACH	America's Cup Harbor
ASW	Anti-Submarine Warfare
BMP	Best Management Practice
CCA	California Coastal Act
CCC	California Coastal Commission
CCMP	California Coastal Management Plan
CDFG	California Department of Fish and Game
CDPH	California Department of Public Health
CDPR	California Department of Parks and Recreation
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CNPS	California Native Plant Society
CVN	Ocean Control Carrier (concept)
CVWR	Chula Vista Wildlife Reserve
CWA	Clean Water Act
CZARA	Coastal Zone Act Reauthorization Amendments
CZMA	Coastal Zone Management Act
DDT	Dichloro-diphenyl-trichloroethane
DNA	Deoxyribonucleic Acid
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FISC	US Navy Fleet and Industrial Supply Center
FY	Fiscal Year
GIS	Geographic Information System
IMO	International Maritime Organization
INRMP	Integrated Natural Resources Management Plan
LCP	Local Coastal Plan
LHA	Amphibious Assault Ship (General-Purpose)
LHD	Amphibious Assault Ship (Multi-Purpose)
MHHW	Mean Higher High Water
MHWS	Mean High Water, Spring
MLLW	Mean Lower Low Water
MLWS	Mean Low Water, Spring
MMPA	US Marine Mammal Protection Act
MOU	Memorandum of Understanding
MPA	Marine Protected Areas
MPRSA	Marine Protection, Research and Sanctuaries Act
MRFSS	Marine Recreational Fishery Sportfishing Survey
MSCP	Multiple Species Conservation Plan
NAB	Naval Amphibious Base
NASNI	Naval Air Station North Island
NAVSTA	Naval Station

NCMT	National City Marine Terminal
NEP	National Estuary Program
NEPA	National Environmental Policy Act
NIOC	Navy Installation Oversight Committee
NISA	National Invasive Species Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NRAD	Navy Research and Development
NRMP	Natural Resource Management Plan
NRRF	Naval Radio Receiving Facility
NS&T	National Status and Trends
NTC	Naval Training Center
NWR	National Wildlife Refuge
OPNAVINST	Chief of Naval Operations Instruction
OREHP	Ocean Resources Enhancement and Hatchery Program
PAHs	Polynuclear Aromatic Hydrocarbons
PBR	Potential Biological Removal
PCBs	Polychlorinated biphenyls
PERL	Pacific Estuarine Research Laboratory
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SANDAG	San Diego Association of Governments
SCB	Southern California Bight
SCCWRP	Southern California Coastal Water Research Project
SDG&E	San Diego Gas & Electric Company
SDRWPCB	San Diego Regional Water Pollution Control Board
SDSU	San Diego State University
SDUPD	San Diego Unified Port District
SLC	State Lands Commission
SMNWR	Sweetwater Marsh National Wildlife Refuge
SPAWAR	Space and Naval Warfare Command
SUBASE	Submarine Base
SWRCB	State Water Resources Control Board
TAMT	Tenth Avenue Marine Terminal
TBT	Tributyltin
TMDL	Total Maximum Daily Load
TOC	Technical Oversight Committee
UCSD	University of California, San Diego
USACOE	US Army Corps of Engineers
USCG	US Coast Guard
USDA	US Department of Agriculture
USDoD	US Department of Defense
USFWS	US Fish and Wildlife Service

Appendix B: Glossary

Abiotic A non-living component of the environment.

Adaptive Management A dynamic planning process that recognizes that the future cannot be predicted perfectly. In response to these imperfect predictions, planning and management strategies are modified frequently as better information becomes available. It is a continuous process requiring constant monitoring and analysis of past actions, which are then fed back into current decisions.

Algae Any of several groups of autotrophs (organisms that produce organic material from inorganic chemicals and energy) that lack the structural features (true leaves, roots, and stems) of the higher plants.

Annual Increment A management section addendum, prepared annually, to facilitate implementation of a Natural Resource Management Plan section. The annual increment concisely provides detail and cost estimates of proposed work or projects to be accomplished during a fiscal year.

Artificial Hard Substrate An artificial habitat that may consist of rock riprap, seawalls, pier pilings, floating docks, mooring systems, and derelict ships/ship parts.

Assessment An evaluation that can be based on a single measurement or observation, or can incorporate a series of observations to obtain a better estimate of a particular parameter; often an assessment or inventory serves as the first step towards establishing a monitoring project.

Baseline Serving as a basis, such as for a survey.

Bathymetry The science of mapping the contours of ocean floors or lake beds.

Bayscaping Appropriate native and water-conserving landscaping designs.

Beaches and Dunes Habitats along the shoreline that are subject to wind and wave turbulence, salt spray, shifting sands, high temperatures, and desiccation.

Benthic Occurring or related to the bottom of the sea.

Benthos All bottom habitats from intertidal to deeper dredged channels.

Best Management Practices Practical, economical and effective management or control practices that will reduce or prevent water pollution. Usually applied as a system of practices based on site-specific conditions rather than a single practice. They are usually prepared by state agencies for land disturbing activities related to agriculture, forestry, and construction.

Bight A bend or curve in the coastline.

Bioaccumulation A measure of bioavailability and thereby the potential for chronic or food web effects of sediment contaminants in long-term exposures.

Biodiversity The diversity of life and its processes; living organisms, the genetic differences among them and the communities and ecosystems in which they occur.

Biological Assessment A biological evaluation conducted as part of the interagency regulations under the Endangered Species Act. The purpose of the assessment is to allow the regulatory agency to determine whether or not the proposed action is likely to adversely affect the continued existence of a species listed as endangered or threatened, or proposed for listing.

Biomass The total weight of living organisms.

Biotic A living component of the environment.

Bittern The bitter liquid left after the crystallization of salt from brine.

Bloom	A sharp increase in the population of phytoplankton, as often occurs in the spring, summer, or fall in different parts of the Bay.
Brackish	Somewhat salty, but not as saline as open ocean water.
Candidate Species	Any species being considered by the Secretary of Interior or Commerce for listing under the Endangered Species Act as an endangered or a threatened species, but not yet the subject of a proposed listing.
Cetaceans	Marine mammals with extreme adaptations: the presence of a “blowhole” on the apparent top of the head, flippers as anterior swimming appendages, and horizontal flukes as posterior swimming appendages.
Chlorophyll	A green photosynthetic pigment.
Coastal Created Lands and Disturbed Uplands	Habitats created by deposition of dredged sediments from other locations.
Coastal Zone	An area specifically identified by a coastal state in its approved Coastal Zone Management Plan. It is an area of coastal waters and adjacent shorelines strongly influenced by each other, including islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. Excluded from the coastal zone are lands solely subject to or held in trust by the federal government, its officers or agents.
Coliform	A group of bacteria found in the large intestine of humans and other warm-blooded animals. Coliform counts are used to determine the degree to which water has been polluted by sewage.
Consensus	A decision-making process in which all parties involved explicitly agree on the final decision. Consensus decision making does not mean that all parties are completely satisfied with the final outcome, but that the decision is acceptable to all because no one feels that his or her vital interests or values are violated by it.
Conservation	The prudent care, protection, and management of natural resources that best reflect sound resources stewardship for present and future generations.
Copepod	A type of small, crustacean zooplankton.
Creosote	An oil, found in pier pilings, from which polycyclic aromatic hydrocarbons are released.
Critical Habitat	The geographic area in which are found those physical or biological features essential to the conservation of a species listed and published by the US Fish and Wildlife Service or the National Marine Fisheries Service under the authority of the Endangered Species Act.
Crystallizer	Salt ponds with highest salinity content. Final stage of salt extraction process.
CVN	Part of the Navy’s new, more modern fleet of deep-draft ships powered by nuclear energy.
Deep Subtidal	Bay habitat deeper than the approximate margin of the maintained channels (>20 ft [6 m]), and including the bottom sediments to the water surface.
Demersal Fish	Bottom-dwelling fish.
Deposit Feeders	Animals that ingest detritus and associated bacteria accumulating on and within the sediment.
Detritus	Fresh to partly decomposed plant and animal matter.
Diatoms	Single-celled algae with a two part, perforated, silicious shell. Diatoms are the most common type of phytoplankton in the estuary.

Dinoflagellate	A unicellular organism with two unequal flagella.
Dissolved Oxygen	The concentration of oxygen in water at a specified temperature and atmospheric pressure. It is used as a measure of the water's ability to support aquatic life. Low concentrations do not support fish or similar organisms.
Dredge Spoil	Bottom sediments or materials that have been excavated from a waterway.
Ecosystem	A unit of land or water comprising populations of organisms considered together with their physical environment and the interacting processes between them.
Ecosystem Function	Interacting processes by component parts and their environment. Without the vital processes, the system is dysfunctional or nonfunctional.
Ecosystem Management	Ecosystem management in the Department of Defense draws on a long-term vision of desired future ecological conditions, integrating ecological, economic and social factors. The goal of ecosystem management is to maintain and improve the native biological diversity and sustainability of ecosystems, while supporting human needs, including the military mission.
Eelgrass	Beds of aquatic plants, primarily represented by *Zostera marina*, extending from the low tide zone to primarily 6 to 10 ft (1.8 to 3.0 m), and less commonly to 15 ft (4.6 m).
Endangered or Threatened Species	A species of fauna or flora that has been listed by the US Fish and Wildlife Service or the National Marine Fisheries Service for special protection and management under the Federal Endangered Species Act, or by the California Fish & Game Commission for protection under the California Endangered Species Act.
Endemic	Restricted to a particular location; often refers to a species that is found only in certain locations.
Enhancement	To increase the function and values of a low quality or degraded wetland.
Entrainment	To carry along, drag, or trail, as in a current.
Environs	Surrounding area. Vicinity.
Epifauna	Marine animals that cling to the surface of rocks or other substrate to avoid being swept away by wave action.
Epiphyte	A plant that grows upon another plant, but is not parasitic upon it.
Estuary	A semi-enclosed body of water that has a free connection with the open ocean and within which sea water is measurably diluted with fresh water derived from land drainage. Estuaries are found at the mouths of rivers and streams and are subject to tidal conditions. They include five habitat types: 1) Upland, 2) Freshwater, 3) Intertidal, 4) Subtidal, and 5) Saltwater.
Exotic Species	Species that occur in a given place, area, or region as the result of direct or indirect, deliberate or accidental introduction of the species by human activity, and for which introduction has permitted the species to cross a natural barrier to dispersal. Also called non-native, non-indigenous, or alien.
Filter Feeders	Organisms that feed by filtering out small food items such as detritus and plankton that are suspended in the water column; distinguished from deposit feeders that glean such items from the bottom.
Fines	In aquatic ecology, bed materials less than 2 millimeters (mm) in diameter, including silt, clay, and fine organic materials.

Fish and Wildlife Cooperative Plan	A plan for the cooperative management of fish and wildlife on a military installation by the host military activity and the appropriate federal and state fish and wildlife agencies as required by the Sikes Act.
Fish and Wildlife Management	A coordinated program of actions designed to preserve, enhance and regulate indigenous fish and wildlife and their habitats, including conservation of protected species and non-game species, management and harvest of game species, bird aircraft strike hazard reduction, and animal damage control.
Food Web	An assemblage of organisms in an ecosystem, including plants, herbivores and carnivores, showing the relationship of who eats whom.
Footprint	The functional planning zone used in the San Diego Bay Integrated Natural Resource Management Plan; also the site covered or impacted by a project.
Fouling Organism	An invertebrate, such as a barnacle or shipworm, that bores into or encrusts on submerged surfaces such as boats and pilings.
Freshwater Marsh	Nontidal wetland dominated by persistent, emergent, non-woody vegetation.
Freshwater Wetlands and Riparian	Nontidal habitat areas supported at the entry points of freshwater tributaries.
Game Species	Fish and wildlife that may be harvested per applicable federal and state hunting and fishing laws.
Gastropods	Snails and other molluscs that typically possess a coiled dorsal shell and a ventral creeping foot.
Geographical Information System	A computer system used to overlay large volumes of spatial data of different kinds. The data are referenced to a set of geographical coordinates and encoded in digital format so that they can be sorted, selectively retrieved, statistically and spatially analyzed.
Goal	Broad statement of intent, direction and purpose. An enduring, visionary description of where you want to go. A goal is not necessarily completely obtainable.
Grounds	All land areas not occupied by buildings, structures, pavements, and other facilities. Depending on the intensity of management, grounds may be classed as improved, i.e. those near buildings, semi-improved, or unimproved.
Habitat	An area where a plant or animal species lives, grows, and reproduces, and the environment that satisfies their life requirements.
Habitat Conversion	An approach to manipulating habitat conditions in which a habitat is converted from one type to another in order to mimic a desirable natural habitat present at another location; also called "Habitat Replacement".
Habitat Creation	See "Habitat Conversion"; new habitat is not really created but is converted out of another habitat.
Habitat Enhancement	Habitat enhancement involves the rejuvenation and improvement of the natural system to increase the values it presently has and add new ones. For wetlands, increasing the functions and values of a low-quality or degraded wetland.
Habitat Replacement	See "Habitat Conversion".
Holoplankton	Zooplankton that spend their entire lives in the open water environment.
Hydrodynamic	The physical features of water motion.
Hypersaline	Saltier than sea water.

Ichthyoplankton	Planktonic larvae of fishes.
Infauna	Marine animals that burrow in substrata (e.g., gravel, sand, mud) to avoid disturbance by wave action and other physical stresses of the environment.
Injury	Any adverse change in a natural resource or impairment of a service provided by a resource relative to baseline, reference, or control conditions. Injury incorporates the concepts of "destruction," "loss", and "loss of use."
Integrated Natural Resources Management Plan	An integrated plan based on ecosystem management that shows the interrelationships of individual components of natural resources management (e.g. fish and wildlife, forestry, land management, public access) to mission requirements and other land use activities affecting an installation's natural resources.
Interstitial Fauna	Tiny invertebrates that live and move around in spaces between sediment grains or attach to the grains. They pass through standard sampling sieves.
Intertidal Flats	Muddy to sandy habitats between -2.2 and+7.8 ft (-0.7 and +2.4 m); normally devoid of flowering aquatic plants, but may include algae.
Inventory	A detailed list of items (e.g., organisms, habitats, boats) taken at a specific time and place; it often serves as the first step towards establishing a monitoring project.
Invertebrate	Animal lacking a backbone.
Isopods	Small, dorsoventrally flattened crustaceans such as the sea louse.
Landscape	This term is gaining increasing importance in conservation planning. The landscape contains more than one natural community or habitat and allows attention to be paid to both biodiversity and the need to link natural communities and habitats to support biodiversity.
Larva	Immature stage of an animal that looks different from the adult.
Life History	The phases that an organism may pass through during its life.
Listed	A plant or animal species that has been determined by the state or federal government to be threatened with extinction.
Littoral	Ocean habitat between the highest high and the lowest low tide lines.
Macroalgae	Seaweed.
Management	The application of skill or care in the manipulation, use, treatment or control of things or persons, or in the conduct of an activity, project, program, etc. Includes, but is not limited to, actions or methods such as: assessment, education, enhancement, inventories, laws, mitigation, monitoring, objectives, policies, protection, regulations, research, restoration, and surveys. Also called "stewardship".
Management Strategy	The combination of the objective(s) and policies used to describe the ways and means of managing.
Mariculture	The techniques applied to growing marine organisms in captivity.
Marine Protection Area	Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features that has been reserved by law or other effective means to protect part or all of the enclosed environment.
Marsh	More or less permanently wet area within the intertidal zone, typified by wetland plants within a muddy habitat.
Mean High Tide	A line in 1918 showing the area of the Bay to be 21 to 22 mi^2 (54 to 57 km^2).

Meiofauna — Microscale animals that live on the bottom, often used as a synonym of interstitial fauna.

Meroplankton — The larval forms of invertebrates that later settle to the bottom and become benthic juveniles and adults; also called "temporary plankton".

Mitigation — Mitigation is the avoidance, minimization, rectification, and reduction or elimination of negative impacts or compensation by replacement or substitution.

Moderately Deep Subtidal — A habitat extending from the approximate lower depth of most eelgrass to the approximate edge of the shipping channel (–12 to –20 ft/–4 to –6 m MLLW). It represents areas that generally have been dredged in the past but are not maintained as navigational channels.

Monitoring — A series of observations over time with the intent to assess change. Often an assessment or inventory serves as the first step towards establishing a monitoring project. Based on each one's purpose, the following types of monitoring are defined:

- **Trend monitoring:** Measurements that are made at regular, well-spaced time intervals in order to determine the long-term trend in a particular parameter.
- **Baseline monitoring:** Measurements used to characterize existing conditions (e.g., water quality, wildlife population, habitat quality) and to establish a data base for planning or future comparisons. While the intent is to capture much of the temporal variability of the constituents of interest, there is no explicit end point at which continued baseline monitoring becomes trend monitoring. Often used synonymously with "inventory monitoring" and "assessment monitoring".
- **Implementation monitoring:** Administrative determination taken to assess whether activities were carried out as planned (e.g., Best Management Practices, mitigation measures, permit conditions).
- **Effectiveness monitoring:** Measurements taken to evaluate whether specified individual management practices had the desired effect.
- **Project monitoring:** Measurements taken to assess the impact of a particular activity or project, such as on a before or after basis or on a control site versus impact site basis. May be considered by some agencies to be a subset of effectiveness monitoring.
- **Compliance monitoring:** Measurements taken to determine whether specified water-quality or other measurable criteria are being met. Usually the regulations associated with individual criterion specify the location, frequency, and method of measurement.

Mudflat — Part of the continuum from open water to dry land, rich in organic matter and microorganisms, generally exposed during all but highest tides.

Multiple Use — The sustainable use of natural resources for the best combination of purposes to meet the long-term needs of the Department of Defense and the public.

Natural Community — This term generally refers to a vegetation community, such as southern coastal sage scrub, but it is used to encompass all of the habitat, ecosystems, and plant and animal species found within the community.

Natural Resources — Landforms, soils, waters, and their associated flora and fauna.

Natural Resources Management Plan A five-year planning document that guides legally and ecologically sound, cost effective management of natural resources to maximize benefits for the installation and neighboring community. It addresses all land, agriculture, forest, fish, and wildlife and outdoor recreation resources of the installation. Superseded by Integrated Natural Resource Management Plan.

Natural Resources Management Procedural Manual Reference that provides comprehensive guidance for implementing requirements of pertinent laws, executive orders, and federal regulations, Department of Defense directives, Secretary of Navy and Naval Operations instructions.

Natural Resources Trustee Federal trustees are those agencies that have statutory responsibilities with regard to protection or management of natural resources or stewardship responsibilities as an manager of federally owned land. State agencies and Indian tribes may also be trustees.

Nematode An invertebrates with a cylindrical body, a conspicuous body cavity, and a complete digestive tract.

NIMITZ A class of carriers that are part of the Navy's new, more modern fleet of deep-draft ships powered by nuclear energy, referred to as CVNs.

Non-game Species Fish and wildlife species that are not harvested for recreational or subsistence purposes.

Nonpoint Source Pollution Pollution caused by diffuse sources that are not regulated as point sources and are normally associated with runoff from construction activities, urban, agricultural and silvicultural runoff, and other land disturbing activities such as military training and operations that disturb lands, soils, and waters. It can result from land runoff, precipitation, atmospheric deposition, or percolation.

Noxious Weeds Plant species identified by federal or state agencies as requiring control or eradication.

Objective Specific statement that describes a desired condition; can be quantitative.

Pelagic Living in the water column above the bottom of the ocean.

Phytoplankton Minute, floating aquatic plants.

Pickling Salt ponds with second highest salinity content.

Plankton Floating or drifting organisms, especially very small ones, found at various depths in the ocean and fresh water; includes protozoa, invertebrates, and larval forms of vertebrates.

Planning Level Survey An inventory of sensitive and significant resources (biological, cultural, or geological) that must be identified in order to prevent impairment of the military mission or meet regulatory requirements.

Policy Formally-adopted strategy or decision to carry out a course of action.

Polychaetes Segmented worms that have flat lateral extensions on each body segment.

Polychlorinated Biphenyls A group of man-made organic chemicals, including about 70 different, but closely related, compounds made up of carbon, hydrogen, and chlorine. If released into the environment, they persist for long periods of time and can concentrate in food chains. They are not water soluble and are suspected to cause cancer in humans. They are an example of an organic toxicant.

Polycyclic (polynuclear) Aromatic Hydrocarbons A class of complex organic compounds that are among the heaviest molecular fraction of petroleum hydrocarbons, some of which are persistent and/or cancer-causing. These compounds are released through fossil fuel combustion, spills of oil, gasoline, diesel and other petroleum products, creosote oil, and asphalt production.

Practical Salinity Unit	A standardized measure of salinity used to adjust different salinity measurements to a constant electrical conductivity, temperature, and pressure.
Primary	First stage of salt extraction process and least saline in Salt Ponds.
Prohibition	As used here, prohibition refers to laws in California that restrict activities directly affecting rare plants. This includes the Federal Endangered Species Act, the California Endangered Species Act, and the California Native Plant Protection Act.
Projects	Includes studies, plans, surveys, inventories, and land/water treatments as well as physical improvements.
Proposed Species	Any species of plant or animal that is proposed in the Federal Register to be listed under Section 4 of the Endangered Species Act.
Regulation	A rule prescribed for controlling some matter. Generally refers to statutory laws and administrative rules, policies, ordinances, permits and other restrictive conditions placed on an activity by a regulatory agency. While a law is a regulation, a regulation is not a law; a regulation is an interpretation of the law.
Regulatory Agency	A government agency delegated powers for implementing regulations, either directly as a decision-maker or enforcer of regulations (e.g., Environmental Protection Agency, Regional Water Quality Control Board, US Army Corps of Engineers) or indirectly as an advisor on regulations (e.g., National Marine Fisheries Service and US Fish and Wildlife Service on Clean Water Act, Sec. 404).
Renewable Natural Resources	Natural resources such as forests and wildlife that replace themselves in a relatively short time and are capable of providing sustained yields.
Research	A search or investigation undertaken to discover facts and reach new conclusions by the critical study of a subject or by a course of scientific inquiry.
Restoration	Habitat restoration implies returning certain habitats to their former historical condition. For wetlands, restoration means establishing wetland habitat at an upland site that previously supported wetlands.
Riprap	Layer of large, durable fragments of broken rock, specially selected and graded. Its purpose is to prevent erosion by waves or currents and thereby preserve the shape of a surface, slope, or underlying structure.
Riparian Areas	Areas closely related to or bordering rivers, streams, lakes, arroyos, playas, ravine bottoms, etc. Dominated by woody vegetation and nontidal water regimes.
River Mouths	Areas in which water from rivers flows into the Bay. They no longer have a natural role, and are controlled by dams or diversion.
Salinities	The total amount of salts in seawater.
Salt Marsh	A marsh area having high salinities in the ambient water and substrate, typical of estuarine areas, or other areas subject to flooding with ocean water, and characterized by thick mats of salt-loving plants.
Salt Works	A habitat consisting of shallow, open-water cells of different salinity levels interspersed with mudflats, dry dikes and salt marsh.
Seagrass	Any of various grasslike plants growing in or by the sea; especially eelgrass (*Zostera marina).*
Seaweed	Any macroscopic marine algae; such plants *en masse* or collectively.
Section 7	Section 7 of the Federal Endangered Species Act specifies that federal agencies must consult with the US Fish and Wildlife Service regarding activities that could affect listed species.

Section 9 Section 9 of the Federal Endangered Species Act prohibits violations of the act, including take of listed fish and wildlife species. It prohibits the destruction of listed plant species on federal land or on private land when done in knowing violation of a state law.

Section 10(a) Section 10(a) of the Federal Endangered Species Act provides for permits to take listed species under certain conditions.

Sediment Particles of organic or inorganic origin that accumulate in loose form.

Sensitive Highly responsive or susceptible to modification by external agents or influences.

Sensitive Habitat Land, water and vegetation needed to maintain one or more sensitive species.

Sensitive Species Those species federally listed as endangered or threatened under the Endangered Species Act, proposed for listing, or candidate status.

Sessile Attached to one place.

Shallow Subtidal Bay habitat extending from -2.2 to -12 ft (-0.7 to -3.7 m), and including the bottom sediments to the water surface.

Significant Resources identified as having special importance, or as having or likely to have more influence on a particular aspect of the environment than other components.

Sludge Semiliquid sewage that has been treated and partially decomposed by bacteria.

Species A group of individuals that have their major characteristics in common and (usually) can only breed with each other.

Species Abundance The distribution of the number of species and the number of individuals of each species in a community.

State Listed Species Any species of fish, wildlife or plant that is protected by an appropriate state agency as issued in a state's endangered species law and other pertinent regulations.

Stewardship The responsibility to inventory, manage, conserve, protect, and enhance the natural resources entrusted to one's care in a way that respects the intrinsic value of those resources, and the needs for present and future generations.

Stratification Separation of an aquatic community into distinguishable layers on the basis of temperature, light, vegetative structure and other such factors creating zones for different plant and animal types.

Strategy Explicit description of ways and means chosen to achieve objectives.

Structural Surrogates Habitats being added or modified in order to sustain endangered or other sensitive species.

Submergment Vegetation Plants that are rooted in and grow in the sediments at the bottom of a saltwater or freshwater body.

Substrate The material forming the bed of a body of water; the material upon which plants grow; or the nutrient medium or physical structure on which an organism feeds and develops.

Subtidal Area below the low tide zone in oceans and bays, not exposed to air.

Survey A comprehensive look or description; a written statement embodying the result of an inspection.

Suspension Feeders Animals that capture particles suspended in the overlying water either by filtering or other means.

Sustainability The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

Sustainable Management	Managing the use, development, and protection of natural and physical resources in a manner or at a rate that enables people and communities to provide for their social, economic, and cultural well-being, and for their health and safety while (1) sustaining the potential of natural and physical resources to meet reasonably foreseeable needs of future generations; (2) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and (3) avoiding, remedying, or mitigating any adverse effects of activities on the environment.
Sustainable Use	Use of an organism, ecosystem, or other renewable resource at a rate that does not exceed its capacity for renewal.
Take	The Federal Endangered Species Act defines take as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," with regards to threatened or endangered species.
Terrestrial Habitat	Habitats along Bay margins including riparian regions, fallowed agricultural lands, sandy beaches, foredunes, backdunes, coastal scrub, and eucalyptus groves.
Tidal cycle	A cycle in which differing amounts of Bay water leave the Bay, mix with ocean water and return with the next tide.
Tidelands	Land below the historic (1850) mean high tide line, some of which is now filled in and developed.
Tintinnid	A ciliate protozoan that secretes vase-like cases.
Toxic	Relating to or caused by a substance that is poisonous substance to a living organism.
Trophic level	Functional classification of organisms in an ecosystem according to feeding relations from first level autotrophs through herbivores and carnivores.
Turbidity	A measure of the amount of material suspended in the water. Increasing the turbidity of the water decreases the amount of light that penetrates the water column. Very high levels of turbidity can be harmful to aquatic life.
Unvegetated Shallow Soft-Bottom	Habitats in which the soft bottoms of unconsolidated sediment are unstable and shift in response to tides, wind, waves, currents, human activity, or biological activity.
Upland Transition	Habitat surrounding the upper edge of the marsh and the zone of highest tide, typified by non-wetland vegetation.
Vegetated Shallow Subtidal	A productive benthic habitat formed by beds of eelgrass.
Watchable Wildlife	Promotion of the recreational viewing of wildlife as a federal program.
Water Column	Pelagic open water environment.
Water Quality	The chemical, physical, and biological qualities of water.
Waterbirds	Birds that use moist to flooded conditions of wetlands. Nearly 800 species can be described as waterbirds, of which 260 inhabit North America. Birds lumped as "waterbirds" include cormorants, ibis, pelicans, herons, bitterns, kingfishers, cranes, rails, avocets, sandpipers and others as well as waterfowl.
Waterfowl	One of a group of migratory birds of the bird family Anatidae, which includes ducks, geese, and swans. In North America, this family is represented by 58 species, making it the most diverse family of waterbirds.
Watershed	An area of land draining water, organic matter, dissolved nutrients, and sediments into a lake, stream, or bay.

Wetlands Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions, such as swamps, marshes, and bogs.

Wetlands (designated) A wetland with one or more of the following attributes: 1) the land periodically supports water plants (hydrophytes), 2) the substrate is dominated by undrained hydric soil, or 3) the soil is periodically saturated or covered by shallow water.

Wildlife Management The practical application of scientific and technical principles to wildlife populations and habitats so as to manage such populations essentially for ecological, recreational, and/or scientific purposes.

Zooplankton Floating, often microscopic, animals and immature stages of large animals.

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Appendix D: Comprehensive Species List of San Diego Bay

PHYTOPLANKTON

Diatoms and Other Groups

Achnanthes sp.
Asterionella sp.
Biddulphia sp.
Ceratulina sp.
Chaetoceros sp.
Coenobiodiscus sp.
Coscinodiscus sp.
Ditylum sp.
Dunaliella sp.
Eucampia sp.
Fragilaria sp.
Grammatophora sp.
Gyrosigma sp.
Leptocylindrus sp.
Licomorpha sp.
Navicula sp.
Nitzschia sp.
Phaeodactylum tricornutum
Pleurosigma sp.
Rhizosolenia sp.
Skeletonema sp.
Stephanophysix sp.
Streptotheca sp.
Suriella sp.
Thalassionema sp.
Thalassiothrix sp.
other identified diatoms
unidentified tintinnids

Dinoflagellates

Ceratium sp.
Dinophysis sp.
Lingulodinium sp.
Gymnodinium oplendens
Noctulica sp.
Peridinium sp.
Prorocentrum sp.

ALGAE

Chlorophyta (Green Algae)

Bryopsidaceae
Bryopsis corticulans
Derbesia marina
Cladophoraceae
Chaetomorpha linum
Cladophora sp.
Ulotrichaceae
Ulothrix sp. woolly hair
Ulotricales sp.
Ulvaceae
Enteromorpha sp.
Ulva expansa sea lettuce
Ulva tacnista

Phaeophyta (Brown Algae)

Alariaceae
Egregia laevigaia
Eisenia arborea
Bangiacea
Porphyra perforta
Dictyotaceae
Dictyota flabellata
Ectocarpaceae
Ectocarpus spp.
Fucaceae
Fucaceae sp.
Sargassaceae
Sargassum agarhianum
* *Sargassum muticum* sargassum
Sargassum palmeri
Scytosiphonaceae
Colpomenia sinuosa
Endarachne binghamiae
Scytosiphon lomentaria

Rhodophyta (Red Algae)

Ceramiaceae
Aglaothamnium cordatum
Antithamnion sp.
Callithamnion sp. A.
Ceramium aerea
Ceramium eatonian
Griffithsia furcellata
Griffithsia pacifica
Tiffaniella snyderae
Dasyaceae
Dasya pacifica
Dasya sinicola var. *abyssicola*
Dasya sinicola var. *californica*
Gelidiacea
Gelidium nudifrons gelidium
Gelidium sp. A
Gigartinaceae
Gigartina spp. Turkish towel
Gracilariaceae
Gracilaria lemaneiformis
Gracilaria pacifica
Hypneaceae
Hypnea valentiae
Plocamiaceae
Plocamium sp.
Rhodomelaceae
Polysiphonia bajacali
Polysiphonia pacifica
Pterochondria woodii var. *pymaea*
Rhodomelaceae sp.
Rhodymeniaceae
Rhodymenia californica
Rhodymenia spp.
Sarcodiotheca gaudichaudii

PLANTS

Gymnosperms

Pinaceae
* *Pinus halapensis* aleppo pine

Dicots

Aizoaceae
* *Carpobrotus chilensis* sea fig
* *Carpobrotus edulis* sea fig, hottentot-fig
* *Mesembryanthemum crystallinum* ice plant, crystalline iceplant
* *Mesembryanthemum nodiflorum* little ice plant, slender-leaved iceplant
Anacardiaceae
Malosma laurina laurel leaf sumac
Rhus integrifolia lemonadeberry
* *Schinus molle* Peruvian pepper tree
* *Schinus terebinthifolius* Brazilian pepper tree
Apiaceae
* *Foeniculum vulgare* sweet fennel
Asteraceae
Amblyopappus pusillus coast weed
Ambrosia psilostachya western ragweed
Artemisia californica California sagebrush
Baccharis salicifolia mule fat
Baccharis sarothroides chaparral broom
* *Bassia hyssopifolia* bassia
* *Centaurea melitensis* star thistle, tocalote
* *Chrysanthemum carinatum* tricolor chrysanthemum
* *Chrysanthemum coronarium* garland chrysanthemum, crown daisy
* *Conyza canadensis* Canada horseweed
* *Cotula coronopifolia* brass buttons
Encelia californica California (coastal) encelia
Gnaphalium bicolor two-color cudweed
Gnaphalium californicus ladies' tobacco
Gnaphalium canescens beneolens everlasting cudweed
Heterotheca grandiflora telegraph weed
Isocoma menziesii golden bush
Isocoma menziesii var. *menziesii* golden bush
Jaumea carnosa jaumea
Pluchea sericea arrow weed
* *Senecio bulgaris* common groundsel
* *Sonchus asper* prickly sow thistle
* *Sonchus oleraceus* common sow thistle
Stephanomeria virgata rod wirelettuce
* *Taraxacum officinale* common dandelion
Xanthium strumarium cocklebur
Bataceae
Batis maritima saltwort
Boraginaceae
Amsinckia menziesii fiddleneck, ranchers fireweed
Heliotropium curassavicum Chinese parsley, salt hellotrope
Brassicaceae
* *Brassica nigra* black mustard
Cakile edentula sea rocket
Hutchinsia procumbens
* *Lobularia maritima* sweet allysum

* *Raphanus sativus* wild radish
Cactaceae
* *Opuntia ficus-indica* tuna
Opuntia littoralis coast prickly pear
Opuntia oricola chaparral prickly pear
Opuntia prolifera cholla
Capparaceae
Isomeris arborea bladderpod
Caprifoliaceae
Sambucus mexicana elderberry
Caryophyllaceae
Cardionema ramossisima tread lightly
Spergularia marina salt marsh sand spurry
* *Spergularia rubra* red sand spurry
Chenopodiaceae
Atriplex canescens
Atriplex canescens canescens shadscale
Atriplex lentiformis big saltbush
* *Atriplex lindleyi*
* *Atriplex semibaccata* Australian saltbush
Atriplex triangularis spearscale
Atriplex truncata
Atriplex watsonii Watson salt bush
Chenopodium californicum California goosefoot
* *Chenopodium murale* nettle-leaved goosefoot
Salicornia bigelovii annual pickleweed
Salicornia europaea saltflat annual pickleweed
Salicornia subterminalis glasswort
Salicornia virginica pickleweed
* *Salsola kali* Russian thistle
* *Salsola tragus* tumbleweed
Suaeda californica California sea blite
Suaeda esteroa estuary sea blite
Suaeda torreyana torry sea blite
Suaeda taxifolia woolly sea blite
Convolvulaceae
Calystegia macrostegia intermedia
south coast morning glory
Cressa truxillensis alkali weed
Crassulaceae
Crassula connata pigmy weed
Dudleya edulis fingertips
Cucurbitaceae
Marah macrocarpus Cucamonga manroot
Cuscutaceae
Cuscuta salina salt marsh dodder
Cuscuta salina var. *major* goldenthread
Euphorbiaceae
Croton californicus California croton
Euphorbia spathulata warty spurge
Fabaceae
* *Acacia melanoxylon* blackwood acacia
* *Astragalus* sp. milk-vetch
* *Lotus corniculatus* birdfoot trefoil
Lotus nuttallianus beach lotus
Lotus scoparius California broom
Lotus strigosus
* *Medicago polymorpha* burclover
* *Melilotus alba* white sweetclover
* *Melilotus officinalis* yellow sweetclover
* *Trifolium* spp. clover
Frankeniaceae
Frankenia palmeri yerba reuma
Frankenia salina alkali heath
Geraniaceae
* *Erodium botrys* longbeak stork's bill
* *Erodium cicutarium* redstem stork's bill
Hydrophyllaceae
Eucrypta chrysanthemifolia common eucrypta
Lamiaceae
* *Marrubium vulgare* horehound
Salvia mellifera black sage
Malvaceae
* *Malva parviflora* cheeseweed
Myoporaceae
* *Myoporum laetum* ngaio tree
Myrtaceae
* *Eucalyptus* spp. gum
Nyctaginaceae
Mirabilis californica California four o'clock
Onagraceae
Camissonia cheiranthifolia beach evening primrose
Camissonia cheiranthifolia suffruticosa beach evening primrose
* *Olea europaea* olive
Oxalidaceae
* *Oxalis pes-caprae* Bermuda buttercup
Papaveraceae
Eschscholzia californica California poppy
Plumbaginaceae
Limonium californicum sea lavender, western marsh rosemary
Polygonaceae
Eriogonum fasciculatum California buckwheat
Eriogonum parvifolium
Nemacaulis denudata denudata coast woolly-head
* *Polygonum arenastrum*
* *Polygonum aviculare*
* *Rumex crispus* curley dock
Salicaceae
Salix lasiolepis arroyo willow
Scrophulariaceae
Cordylanthus maritimus maritimus salt marsh bird's-beak
Solanaceae
Datura wrightii toluaca
Lycium brevipes var. *brevipes* desert- thorn
Lycium californicum California box thorn
* *Lycopersicon esculentum* tomatoe
* *Nicotiana glauca* tree tobacco
Solanum douglasii Douglas' nightshade
Tamaricaceae
* *Tamarix parviflora*
* *Tamarix* sp.
Urticaceae
* *Urtica urens* dwarf nettle
Verbenaceae
* *Lantana camara* lantana

Monocots

Araceae
* *Washingtonia filifera* California fan palm
Cyperaceae
Scirpus californicus California tule
Juncaceae
Juncus acutus spiny rush
Juncaginaceae
Triglochin maritima arrow grass
Liliaceae
Dichelostemma capitatum bluedicks
Yucca schidigera Mohave yucca
Poaceae
* *Avena fatua* wild oat
* *Bromus diandrus* ripgut brome
* *Bromus madritensis rubens* red brome
* *Cortaderia jubata* Pampas grass, Andes grass
* *Cynodon dactylon* bermuda grass
Distichlis spicata salt grass
* *Hordeum murinum* sterile barley, foxtail barley
* *Lolium perenne* English ryegrass
Monanthochloe littoralis shoregrass
Nassella pulchra purple needlegrass
* *Parapholis incurva* sickle grass
* *Pennisetum setaceum* crimson fountaingrass
* *Piptatherum miliaceum* smilo grass
* *Poa annua* annual bluegrass
* *Polypogon monspeliensis* rabbit foot grass, annual beard grass
* *Rhynchelytrum repens* natal grass
* *Schismus barbatus* common Mediterranean grass
Spartina foliosa cordgrass
Potamogetonaceae
Ruppia maritima ditch grass
Typhaceae
Typha domingensis southern cattail
Typha latifolia common cattail
Zosteraceae
Zostera marina eelgrass

ANIMALS

PORIFERA (SPONGES)

Halichondriidae
Halichondria bower bankia yellow sponge
Halichondria panicea crumb of bread sponge
Haliclonidae
Haliclona ecbasis
* *Haliclona* sp. haliclonid sponge
Hymeniacidonidae
Hymenicidon sp.
Leucosoleniidae
Leucosolenia eleanor white sponge
Leucosolenia sp.
Tetillidae
Tetilla mutabilis wandering sponge
unknown
Esperiopsis originalis digitate sponge

CNIDARIA (JELLYFISHES, CORALS)

Hydrozoa (Hydroids)

Campanulariidae
* *Obelia* sp.
Plumulariidae
Aglaophenia sp. ostrich plume hydroid
Plumularia sp. plumarid hydroid
Tubulariidae
Tubularia sp. naked hydroid
* *Tubularia crocea*
unknown
Abietinaria spp.
Bineria sp. A
Corymorpha palma white hydroid
Hydroid spp.

Scyphozoa (Scypomedusae, large jellyfish)

Phyllorhiza puctata
Rhizostome scyphomedusa

Anthozoa (Sea Anemones, Corals, Sea Pens)

Actiniidae
Epiactis prolifera proliferating anemone
Diadumenidae
Diadumene franciscana
Diadumene cf. *leucolena*
* *Diadumene lineatu*
unknown
Anthozoan spp.
Bunodeopsis sp.
Cerianthus (nr) *aestuari*
Edwardsiella californica
Harenactis attenuata
Pachycerianthus fimbriatus mud tube anemone
Renilla kollikeri sea pansy
Scolanthus sp.

PLATYHELMINTHES (FLATWORMS)

Polyclad spp. flatworm

NEMERTEA (RIBBONWORMS)

Nemertena spp.

ASCHELMINTHES

Nematoda (Roundworms)

Nematode spp.

SIPUNCULA (PEANUTWORMS)

Sipuculid sp.

ANNELIDA (SEGMENTED WORMS)

Oligochaeta (Earthworms)

Oligochaete spp. oligochaete

Polychaeta (Bristleworms, Fanworms, Clamworms)

Ampharetidae (Ampharetids)
Ampharetidae spp.
Ampharete labrops
Amphicteis scaphorbranchia
Arabellidae (Arabellids)
Arabella semimaculata
Arabella sp.
Drilonereis falcata minor
Drilonereis mexicana
Capitellidae (Capitellids)
Capitella capitata
Capitellidae spp.
Capitata ambiseta
Heteromastus sp.
Mediomastus acutus
Mediomastus ambiseta
Mediomastus californiensis
Mediomastus sp.
Neomediomastus sp.
Notomastus cf. *lineatus*
Notomastus tenuis
Scyphoproctus oculatus
Scyphoproctus spp.
Chaetopteridae
Chaetopterus variopedatus parchment tube worm
Cirratulidae (Cirratulids)
Caulleriella spp.
Chaetozone cf. *corona*

Chaetozone cf. *setosa*
Chaetozone cf. *spinosa*
Cirratulus cirratus
Cirratulidae, unidentified
Cirratulus spp.
Cirriformia luxuriosa
Cirriformia spriabranchiata
Cirriformia tentaculata
Tharyx parvus
Tharyx sp. A.B
Cossuridae (Cossurids)
Cossura candida
Cossura pygodactylata
Cossura sp.
Ctenodrilidae (Ctenodrilids)
Ctenodrilus serratus
Dorivilleidae (Dorvilleids)
Dorvillea articulata
Dorvillea longicornis
Dorvillea rudolphii
Ophryotrocha puerilis
Schistomeringos longicornis
Eunicidae (Eunicids)
Lysidice sp.
Lysippe labiata
Marphysa dysjuncta
**Marphysa sanguinea*
Marphysa stylobranchiata
Marphysa sp.
Flabelligeridae (Flabelligerids)
Brada pleurobranchiata
Flabelligerma essenbergae
Flabelligera infundibularis
Flabelligeridae sp.A
Flabelligeridae sp.B
Pherusa capulata
Pherusa cf. *neopapillata*
Pherusa sp.
Stylaroides sp.
Glyceridae (Glycerids)
Glycera americana
Glycera cf. *americana*
Glycera nana
Glycera rouxii
Glycera tenuis
Glyceridae spp.
Glycinda armigera
Goniadidae (Gonaidids)
Goniada brunnea
Goniada littorea
Goniada spp.
Hesionideae (Hesionids)
Gyptis arenicola glabra
Ophiodromus pugettensis
Lumbrineridae (Lumberinerids)
Lumbrineris acuta
Lumbrineris californiensis
Lumbrineris erecta
Lumbrineris latreilli
Lumbrineris minima
Lumbrineris zonata
Lumbrineris spp.
Maldanidae (Maldanids)
Maldanidae spp.
Malmgreniella macginitiei
Nicomache cf. l*umbricalis*
Praxilella affinis pacifica
Nephtyidae (Nephtyids)
Nephtys caecoides
Nephtys cornuta franciscanus
Nephtys parva
Nephtyidae spp.
Nereidae (Neriids)
* *Neanthes acuminata*
Neanthes caudata
Neanthes virens n
Nematonereis cf. *unicornis*
Nereis brandti
Nereis latescens
Nereis procera n
Nereidae spp.
Onuphidae (Onuphids)
Diopatra splendidissima
Diopatra tridentata
Diopatra spp.
Opheliidae (Opheliids)
Armandia bioculata
Polyopthalmus pictus
Orbiniidae (Orbinids)
Haploscolopos elongatus
Leitoscoloplos elongatus
Leitoscoloplos pugettensis
Naineris uncinata
Orbinidae spp.
Scoloplos acmeceps
Pectinariidae (Pectinarids)
Pectinaria californiensis
Phyllodocidae (Phyllodocids)
Anataides longipes
Eteone alba
Eteone californica
Eteone dilata
Eteone spp.
Eteone cf. *lighti*
Eumida bifliata
Phyllodocidae spp.
Pilargiidae
Sigambra tentaculata
Polynoidae (Polynoids)
Halosydna brevistosa
Halosydna johnsoni
Harmothoe cf. *hirsuta*
Harmothoe imbricata
Hesperonoe spp.
Malmgrenia nigralba
Polynoidae spp., sp. A.B.C. scale worm

Sabellidae (Sabellids)
Chone cf. *gracilis*
Chone cf. *mollis*
Euchone limnicola
Fabicinae sp.
Fabricia limnicola
Fabricinuda limicola
Megalomma circumspectum
Megalomma pigmentum
Sabella crassicornis
Sabellidae spp.
Sabellidae, unidentified
Serpulidae (Serpulids)
Crucigera sp.
Eupomatus sp.
Hydroides pacificus
Serpula vermicularis
Serpulidae spp.
Spirorbis eximius
Sigalionidae
Sthenelais tertiaglabra
Sthenelanella uniformis
Spionidae (Spionids)
Apoprionospio pygmaeus
Boccardia spp.
Boccardia truncata
Boccardiella hamata
Laonice cirrata
Microspio maculata
Nerinides cf. *acuta*
Nerinides pigmentata
Paraprionospio pinnata
Polydora cf. *cardalia*
Polydora cornuta
**Polydora ligni*
Polydora limnicola
Polydora nuchalis
Polydora quadrilobata
Polydora socialis
Polydora websteri
Polydora sp.
Prionospio cf. *heterobranchiata*
Prionospio lighti
Prionospio malmgreni
Prionospio pinnata
Prionospio pygmaeus
Prionospio steenstrupi
Pseudomalacocerus spp.
**Pseudopolydora paucibranchiata*
Rhynchospio glutaea
Rhyncospioarenicola pallidus
Scolelepis acuta
Scolelepis foliosa occidentalis
Scoleopis quinquedentata
Scolelepis tridentata
Spionidae spp.
Spiophanes missionensis
**Streblospio benedicti*
Sternaspidae (Sternaspids)
Sternaspis fossor
Syllidae (Syllids)
Autolytus spp.
Brania brevipharyngea
Brania spp.
Eusyllis assimilis
Exogone lourei
Exogone cf. *molesta*
Exogone uniformis
Odontosyllis parva
Odontosyllis phosphorea
Pionosyllis spp.
Syllidae spp.
Syllis gracilis
Trypanosyllis spp.
Typosyllis cf. *hyalina*
Terebellidae (Terebellids)
Amaeana occidentalis
Pista alata
Pista cf. *fasciata*
Pista sp.
Streblosoma crassibranchia
Terebellidae spp.
Terebellides californica
unknown
Aphelochaeta monilaris
Aphelochaeta multifilis
Aphelochaeta spp.
Apistobranchus spp.
Diplocirrus spp.
Eranno lagunae
Euclymeninae spp. indef.
Expolymnia spp.
Leitoscoloplos pugettensis
Levinsenia gracilis
Melinna oculata
Metasychis disparidentata
Montecellina sp. C
Montecellina dorsobranchialis
Montecellina tesselata
Myriochele sp. *M*
Paramage scutata
Parougia caeca
Pholoe glabra
Podarkeopsis glabra
Podarkeopsis perkinsi
Poecilochaetus johnsoni
Tenonia priops

ARTHROPODA

Mandibulata

Crustacea

Ostracoda (Ostracods)

Aspidochoncha limnoriae
Asteropella slatteryi
Bathyleberis spp.
Conchoecinae sp.
Cylindroleberis sp.
Cylindroleberis mariae
Euphilomedes carcharodonta
Euphilomedes producta
Parasterope barnsei
Philomedes spp.
Podocopidae sp.
**Redekea californica*
Rutiderma cf. *judayi*
Rutiderma lomae
Sarsiella spp.
Soleroconcha spp.

Copepoda (Copepods)

Cyclopoida
Cyclopoid spp.
Harpacticoida
Harpacticoid spp. harpacticoid
unknown
Parastephos esterlyi

Cirripedia (Barnacles)

Balanidae
**Balanus amphitrite* little striped barnacle
Balanus glandula acorn barnacle
Balanus regalio barnacle
**Balanus tintinnabulum* red and white barnacle
Megabalanus californianus red and white barnacle
Chthamalidae
Chthamalus sp. barnacle

Malacostraca

Cumacea (Cumaceans)
Campylaspis rubromaculata
Cumacea sp. unident.
Cyclaspis sp.
Diastylis sp.
Eudorella pacifica
Oxyurolostylis pacifica
Mysidacea (Mysids, Opossum Shrimps)
Acanthomysis macropsis
Archeomysis maculata
Heteromysis odontops
Holmesimysis sp.
Mysida sp. unident.
Mysidopsis californica
Mysidopsis intii
Neomysis kadiakensis
Neomysis sp.
Nebaliacea (Nebalians)
Epinebalia spp.
Nebalia daytoni
Nebalia pugettensis
Tanaidacea (Tanaids)
Leptochelia cf. *dubia*
Leptochelia sp.
**Tanaid* sp.
Tanaidacea sp. unident.
Zeuxo narmani

Isopoda

Bopyridae (Bopyrids)
Schizobopyrina striata
Janiridae (Janirids)
**Ias californica*

Limnoriidae (Limnorids)
*Limnoria quadripunctata
*Limnoria tripunciata
Munnidae (Munnids)
Aega sp. isopod
Munna spp.
Sphaeromatidae (Sphaeromids)
Cilicaea sculpta
*Sphaeroma quoyanum
*Sphaeroma walkeri s
Sphaeromatidae sp.
unknown
Austrosignum tillerae
Cirolana harfordi cirolanid
Edotea sp.
Paracerceis sculpta
Paranthura elegans anthurid
Seriolis carinata

Amphipoda (Amphipods)

Gammaridea (Gammarids)

Ampeliscidae (Ampeliscids)
Ampelisca brevisimulata
Ampelisca cristata
Ampelisca hancocki
Ampelisca sp.
Ampeliscidae spp.
Amphilochidae (Amphilodhids)
Amphilochidae spp.
Ampithoidae (Amphithoids)
Amphithoe sp.
Ampithoidae spp.
Aoridae (Aorids)
Acuminodeutopus heteruropus
Amphideutopus oculatus
Lembos macromanus
Microdeutopus schmitti
Rudilembroides stenopropodus
Corophiidae (Corophiids)
*Corophium acherusicum
*Corophium heteroceratum
*Corophium uenoi
Corophiidae spp.
Erichthonius brasiliensis
*Grandidierella cf. japonica
Dexaminidae (Desaminids)
Dexaminidae spp.
Eusiridae
Eusiridae spp.
Hyalidae (Hyalid)
Hyale frequens
Hyale spp.
Hyalidae spp.
Isaeidae (Isaeids)
Isaeidae spp.
Ischyroceridae
*Jassa marmorata (falcata)
Microjassa litotes
Leucothoidae (Leucothoids)
Leucothoe alata
Liljeborgiidae (Liljeborgiids)
Listriella goleta
Listrella spp.
Lysianassidae (Lysianassids)
Lysianassidae spp.
Orchomene pacifica
Orchomene pinguis
Orchomene sp.
Oedicerotidea (Oedicarotids)
Oedicerotidae spp.
Synchelidium rectipalmum
Synchelidium shoemakeri
Photidae
Photis sp.
Phoxocephalidae (Phoxocephalids)
Paraphoxus spp.
Pleustidae (Pleustids)
Parapluestes spp.
Pleustidae sp.
Podoceridae (Phodocerids)
*Podocerus brasiliensis
Pontogeneia
Pontogeneia minuta
Pontogeneia rostrata
Stenothoidae (Stenothoids)
*Stenothoe valida
unknown
Elasmopus rapax
Gammaridae spp.
Gammaropsis thompsoni
Heterophoxus oculatus
Monoculodes hartmanae
Synchelidium sp. gammarid
Tiron biocellata synophiid

Caprellidae (Caprellids, Skeleton Shrimp)

Caprellidae (Caprellids)
Caprella californica California skeleton shrimp
Caprella equilbra
Caprella mendax
Caprella spp.
Caprelliidae spp.
Mayerella banksia

Euphausiacea (Euphau)
Euphilomedes carcharodonta seed shrimp

Decapoda

Alpheidae (Alpheid shrimp)
Alpheus californiensis
Alpheus sp.A.
Alpheus sp.B.
Betaeus harrimani
Betaeus longidactylus long fingered shrimp
Betaeus sp.
Atyidae
Atyidae spp.
Callianassidae
Callianassa californiensis red ghost shrimp
Upogebia pugettensis callianassid shrimp
Crangonidae (Crangonid shrimp)
Crangon californiensis
Crangon franiscorum
Crangon spp.
Processa canaliculata
Hippolytidae (Hippolytid shrimp)
Heptocarpus cf. *taylori*
Heptocarpus sp. A
Heptocarpus spp.
Hippolyte california
Hipployte californiensis grass shrimp
Hippolyte spp.
Spriontocaris sp.
Majidae
Pugettia producta kelp crab
Pyromaia tuberculata
Palaemonidae
**Palaemon macrodactylus*
Palinaridae
Panulirus interruptus California spiny lobster
Pinnotheridae (Pinnotherid crab)
Hemigrapsus oregonesis mudflat crab
Pinnixa barnharti
Scleroplax granulata
Uca crenulata fiddler crab
Portunidae
Portunus xantusi swimming crab
Xanthidae
Cancer antennarius common rock crab
Cancer anthonyi rock crab
Lophopanopeus bellus diegensis xanthid mud crab
Lophopanopeus leucomanus white handed crab
Lophopanopeus sp. xanthid crab
unknown
Brachyurs sp. unident.
Caridea sp. unident.
Hemisquilla ensigera
Malacoplax californiensis mudflat crab
Nyeotrypaea californiensis
Pseudosquilla mamorata
Schmittius politus
Speocarcinus californiensis
Squilla polita
Urocaris infraspinis

Insecta

Coleoptera (Beetles)

Alleculidae (Comb-clawed beetles)
Hymenorus sp.
Anthicidae (Ant-like flower beetles)
Anthicus sp.
Ischyropalpus sp.
Mycenotarsus sp.
Notoxus monodon
Buprestidae (Metallic wood-boring beetles)
Acmaeodera labrinthica
Carabidae (Ground beetles)
Acupalpus sp.
Agonum sp.
Amara californica
Amara sp.
Anysodactylus sp.
Bembidion sp. minute ground beetle
Brachinus tschernkhi bombardier beetle
Bradycellus sp.
Calathus ruficollis ruficollis
Callida sp.
Calosoma frigidum
Calosoma semilaeve
Carabus nemoralis
Claenius sp.
Dyschurius sp.
Galeritula lecontei
Limnichus sp.
Loricera pilicornis
Microlestes sp.
Omophron ovale and *O. tanneri* round sand beetles
Pseudaptinus sp.
Pterostichus lustrans
Pterostichus sp.
Scarites subterraneus
Tachys corax
Tetragonoderus sp.

Cerambycidae (Long-horned beetles)
Crossidius testaceous testaceous
Chrysomelidae (Leaf beetles)
Altica sp. flea beetles
Chalepus sp.
Cryptocephalus sp.
Diabrotica undecimpunctata western spotted cucumber beetle
Diachus auratus
Donacia sp.
Epitrix sp.
Eurynephalla morosa
Eurynephalla sp.
Exema conspersa
Gastrophysa cyanea common green dock beetle
Longitarsus sp.
Metachroma californicus
Monoxia sp. alkali bugs
Pachybrachys sp.
Plataeumaris sp.
Trirhabda sp.
Cicindelidae (Tiger beetles)
Cicindela gabbi Gabb's tiger beetle
Cicindela haemorrhagica haemorrhagica
Cicindela hirticollis gravida sandy beach tiger beetle
Cicindela latesignata latesignata sand dune tiger beetle
Cicindela oregona
Cicindela trifaciata sigmoidea mudflat tiger beetle
Coccinellidae (Ladybird beetles)
Adalia bipunctata two-spotted ladybeetle
Auletobius sp.
Coccinella californica California ladybird
Coleomegilla fuscilabris
Cryptolaemus montrouzieri mealybug destroyer
Didion nanus
Hippodamia convergens convergent ladybird
Hyperaspidius comparatus
Hyperaspis fimbriolata
Microweisea sp.
Olla abdominalis ashy gray ladybird
Psyllobora vigintimaculata
Scymnus sp.
Curculionidae (Weevils, snout beetles)
Bagosus sp.
Endalus sp.
Sphenophorus discolor
Stenopelmus sp.
Trigonoscuta sp.
Tychius sp.
Dermestidae (Carpet beetles)
Anthremus verbasci
Dermestes canisus
Dermestes frischi
Dytiscidae (Predaceous diving beetles)
Agabus disintigratus
Hydroporus sp.
Laccophilus dicipiens
Rhantus hoppingi
Haliplidae (Crawling water beetles)
Haliplus sp.
Helodidae (Marsh beetles)
Cyphon sp.
Heteroceridae (Variegated mud-loving beetles)
Neoheterocerus sp.
Histeridae (Hister beetles)
Hypocaccus lucidulus
Neopachylopus sulcifrons
Saprinus lugens
Hydrophilidae (Scavenger water beetles)
Berosus sp.
Cercyon luniger
Enochrus hamiltoni pacificus
Paracymus elegans
Tropisternus salsamentus
Lathridiidae (Minute brown scavenger beetles)
Melanopthalma sp.
Leiodidae (Round fungus beetles)
unidentified specimen
Limnebiidae (Minute moss beetles)
Ochthebius rectus
Meloidae (Blister beetles)
Nemognatha sp.
Melyridae (Soft-winged flower beetles)
Amecocerus sp.
Endeodes basalis
Trichrochrous nigrinus
Mordellidae (Tumbling flower beetles)
Mordellistena sp.
Oedemeridae (False blister beetles)
Copidita quadrimaculata
Rhyzophagidae (Root-eating beetles)
Phyconomus maritima
Scarabaeidae (Scarab beetles)
Aegialia sp.
Aphodius sp.
Cotina texana
Cotinus mutabilis green fruit beetle
Parathyce palpalis
Phyllophaga sp.
Silphidae (Carrion beetles)
Nicrophorus marginatus red and black burying beetle
Nicrophorus nigritus black burying beetle
Silpha lapponica satin silphid
Staphylinidae (Rove beetles)
Aleochera sulcicollis
Bledius flavipennis
Bledius nr. *monstratus* spiny-legged rove beetle
Cafius canaescens
Cafius seminitens
Carpelimus sp.
Psamathobledius punctissimus salt marsh rove beetle
Staphylinus maxillosus
Stenus sp.
Tachinus sp.
Thinopinus pictus pictured rove beetle

Tenebrionidae (Darkling beetles)
Amphidora littoralis
Amphidora nigrapilosa black-haired darkling beetle
Blaptinus sp.
Coelus ciliatus ciliated dune beetle
Coelus globusus globose dune beetle
Conibius sp.
Coniontis sp.
Cratidus osculens woolly darkling beetle
Cryptadius inflatum
Eleodes armata armored stink beetle
Eleodes gracilis
Phaleria rotundata
Phloedes diabolicus
Stibia sp.

Diptera (Flies)

Agromyzidae (Leaf-miner flies)
Phytomyza albiceps
Anthomyiidae (Anthomyiid flies)
Fucella assimilis
Fucella rejecta
Fucella rufitibia
Asilidae (Robber flies)
Efferia sp.
Bombylidae (Bee flies)
Bombylius sp.
Exoprosopa sp. progressive bee fly
Calliphoridae (Blow flies)
Phaenicia sericata green bottle fly
Eucalliphora lilea common blow fly
Ceratopogonidae (Punkies, Biting Midges)
Culicoides variipennis occidentalis
Chloropidae(Fruit flies)
Hippelates sp.
Incertella sp.
Meromyza saltatrix
Siphonella sp.
Coelopidae (Seaweed flies)
Coelopa vanduzeei
Conopidae (Thick-headed flies)
Physocephala texana
Thecophora occidentalis
Culicidae (Mosquitos)
Aedes squamiger salt marsh mosquito
Culex pipiens
Dolichopodidae (Long-legged flies)
Asyndetus sp.
Hydrophorus praecox
Pelastoneurus cyaneus
Raphium sp.
Drosophilidae (Small fruit flies, pomace flies)
Drosophila sp.
Ephydridae (Shore flies)
Atissa littoralis
Brachydeutera argentata
Ceropsilopa coquilletti
Ceropsilopa dispar
Clanoneurum americanum
Ephydra milbrae salt marsh brine fly
Ephydra riparia
Lamproscatella dicheata
Mosillus tibialis
Notiphila erythocera
Notiphila pulchrifrons
Scatella obsoleta
Scatella paludum
Empididae (Dance flies)
Platypalpus sp.
Muscidae (Muscid flies)
Musca domestica house fly
Neriidae (Cactus flies)
Volucella mexicana cactus fly
Otitidae (Picture-winged flies)
Acrosticta rufiventris
Califortalis hirsutifrons
Ceroxys latiusculus
Phoridae (Hump-backed flies)
Dohrniphora cornuta
Pipunculidae (Big-headed flies)
Pipunculus ater
Psychodidae (Sand flies)
Pericoma sp.
Sarcophagidae (Flesh flies)
Sarcophaga sp.
Scatopsidae (Minute black scavenger flies)
Rhegmoclemnia melandria
Spaecoridae (Small dung flies)
Leptocera sp.
Stratiomyidae (Soldier flies)
Nemotelus tristis
Syrphidae (Syrphid flies)
Mesograpta marginata
Paragus tibialis
Tabanidae (Horse Flies, Deer Flies)
Tabanus punctifer big black horse fly
Tendipedidae (Water midges)
Chironimus sp.
Cricotopus spartinus
Tethinidae
Pelomyia coronuta
Pelomyiella melanderi

Hemiptera (True bugs)

Berytidae (Stilt bugs)
Jalysus wickhami
Coreidae (Leaf-footed bugs)
Leptoglossus clypealis western leaf-footed bug
Corixidae (Water boatmen)
Corisella inscripta
Trichocorixia reticulata saline water boatman
Trichocorixia verticalis californica salt marsh water boatman
Gerridae (Water striders)
Gerris remigis common water strider
Trepobates becki
Hebridae (Velvet water bugs)
Morrogota hebroides
Miridae (Leaf bugs, Plant bugs)
Creontiades sp.
Lygus hesperus
Lygus lineolaris tarnished plant bug
Melanopleurus sp.
Taylorilygus pallidus
Nabidae (Damsel bugs)
Nabis ferus linnaeus Damsel bug
Notonectidae (Backswimmers)
Buenoa sp. small backswimmer
Notonecta unifasciata single-banded backswimmer
Pentatomidae (Stink bugs)
Chlorochroa sp. green stink bug
Margantia histrionica Harlequin Cabbage Bug
Podisus sp. spined soldier bug
Rhytidolomia faeta
Poiariidae (Thread-legged bugs)
Emesinae sp.
Pyrrhocoridae (Red bugs, Stainers)
Largus cinctus ordered plant bug
Reduviidae (Assassin bugs)
Nabis sp.
Sinea sp.
Saldidae (Shore bugs)
Pentacora signoreti
Pentacora sphacelata
Saldula fernaldi Fernald's shore bug
Saldula luctosa salt marsh shore bug
Saldula opiparia
Saldula pallipes black shore bug
Tingidae (Lace bugs)
Corythuca sp.
Veliidae (Riffle bugs)
Microvelia sp.

Homoptera

Aleyrodidae (Whiteflies)
Trialeuodes vaporariorum
Aphididae (Aphids)
Aphise gossypii cottony aphid
Brachycaudis cardui thistle aphid
Brevicoryne brassicae cabbage aphid
Cercopidae (Froghoppers, Spittlebugs)
Aphrophora annulata annulate
Clastoptera lineatocollis
Cicadellidae (Leafhoppers)
Balchutha neglecta
Ballana vema
Ballana vesca
Carneocephalus sp.
Collandonus montanus
Draeculaecephala minerva
Empoasca alboneura
Empoasca decora
Eupteryx melissae
Hordnia circellata blue sharpshooter
Idiodonus sp.
Macrosteles fascifrons
Mormoria sp.
Penestragania robusta
Stragania sp. green leafhopper
Cicadidae (Cicadas)
Okanagana vanduzeei
Cixiidae (Cixiid planthoppers)
Oliarus sp.
Delphacidae (Delphacids, planthoppers)
Delphacodes propinqua
Deltocephalus minutus
Prokelisia salina
Stobaeria muiri
Diaspididae (Armored scales)
Haliaspis spartina cordgrass scale
Dictyopharidae (Dictyopharids, planthoppers)
Orgerius propius
Flatidae (Flatids, planthoppers)
Mistharnophantia sonorana
Issidae (Issids, planthoppers)
Danepteryx manca
Margarodidae (Giant coccids)
Icerya purchasi cottony-cushion scale
Membracidae (Treehoppers)
Spissistilus festinus three-cornered alfalfa hopper
Stictocephala sp. buffalo treehoppers
Pseudococcidae (Meally bugs)
Distichlicoccus salinus
Puto echinatus fluffy mealy bug
Psyllidae (Psyllids)
Craspedolepta martini
Craspedolepta pulchella

Hymenoptera

Apidae (Bees)
* *Apis mellifera* honey bee
Bombus sonorus Sonoran bumble bee
Bombus vosnesenskii yellow-faced bumble bee
Chalcididae (Chalcids, wasps)
Chalcidoidea chalcid
Formicidae (Ants)
* *Iridomyrmex humilis* Argentine ants
Pogonomyrmex californicus harvester ants
Ichneumonidae (Ichneumonids, wasps)
Ichneumonid sp.
Mutillidae (Velvet ants)
Dasymutilla sp.
Pompilidae (Spider wasps)
Hemipepsis sp. tarantula hawk
Sphecidae (Sphecids, wasps)
Ammophila sp. thread-waisted wasp
Bembix sp. sand wasp
Sphex ichneumonia golden digger wasp
Tiphiidae (Tipiids, wasps)
Methoca sp.
Vespidae (Vespids, wasps)
Polistes sp. paper wasp

Lepidoptera

Danaidae (Milkweed butterflies)
Danaus plexippus monarch
Geometridae (Geometer moths, Inchworms)
Caenurgia togataria
Perizoma custodiata
Hesperiidae (Common skippers)
Erynnis funeralis funereal duskywing
Hylephila phyleus fiery skipper
Panoquina errans wandering skipper
Panoquina panoquinoides salt marsh wanderingskipper
Pyrgus communis checkered skipper
Lycaenidae (Gossamer-winged butterflies)
Brephidium exilis Western pygmy blue
Strymon melinus common hairstreak
Noctuidae (Millers, Cutworms)
Tarachidia candefacta
Zale lunata Moon umber
Nymphalidae (Brush-footed butterflies)
Nymphalis antiopa mourning cloak
Vanessa annabella west coast lady
Vanessa atalanta red admiral
Vanessa cardui painted lady
Papilionidae (Swallowtails)
Papilio rutulus western tiger swallowtail
Papilio zelicaon anise swallowtail
Pieridae (Whites, Sulphurs, and Orange-tips)
Colias eurytheme
* *Pieris rapae* cabbage butterfly
Psychidae (Bagworm moths)
Pterophoridae (Plume moths)
Agdistis americana
Pyralidae (Snout moths)
Lipographa fenestrella salt marsh snout mouth
Lipographa truncatella
Synclita sp.
Sphingidae (Sphinx or Hawk moths)
Hyles lineata white-lined sphinx

Collembola

Poduridae (Collembola, Springtails)
Anurida maritima marine springtail
Archistoma interstitialis

Dermaptera (Earwigs)

Aeshnidae (Darners)
Aeshna multicolor blue darner
Anax junius common gree darner
Baetidae (Mayflies)
Callibaetis pacificus pacific spotted may fly
Chrysopidae (Green lacewings)
Chrysoperla carnea
Forficulidae (Earwigs)
* *Forficula auricularia* earwig
Hemerobiidae (Brown lacewings)
Hemerobius pacificus
Sympherobius sp.
Libellulidae (Common skimmers)
Libelluta saturata big red skimmer
Pachydiplax longipennis swift long-winged skimmer
Sympetrum sp.
Tarnetrum corruptum
Tramea lacerata jagged-edged saddlebag
Myrmeleontidae (Antlions)
Myrmeleon immaculatus

Odonata

Coenagrionidae (Narrow-winged damselflies)
Enallagama ceville
Ishnura barberi forktail damselfly
Ishnura denticollis forktail damselfly

Orthoptera

Acridiidae (Grasshoppers)
Chloealtis gracilis slant-faced grasshopper
Conozoa sulcifrons sulcifrons
Melanoplus cirereus
Melanoplus obespsolus
Orphulella pelidona
Psoloessa thamnogaea
Trimerotropis pallidipennis pallid-winged grasshopper
Gryllacrididae (Ground and Camel crickets)
Ceuthophilus californianus California camel cricket
Pristoceuthophilus sp. mushroom camel cricket
Stenopelmatus fuscus Jerusalem cricket
Gryllidae (Crickets)
Cycloptilum distinctum
Gryllus sp. field cricket
Oecanthus argentimus tree cricket
Mantidae (Mantids)
Litaneutria minor minor ground mantid

Mantodea

Mantidae (Mantids)
Stagmomantis californica California mantis
Stylopidae (Twised-winged parasites)
Elenchus sp.
Tubulifera (Thrips)
Leptothrips mali

Thysanura

Lepismatidae (Silverfish)
Allacrotelsa spinulata common/Becker's wife
Lepisma saccharina
Neomachilis sp.

Chelicerata

Arachnida (Spiders, Mites, Pseudoscorpions)

Agelenidae (Funnel web weavers)
Agelenopsis sp. grass spiders
Calilena sp.
Anyphaenidae
Teudis mordax
Araneidae (Orb weavers)
Araneus sp.
Argiope argentata silver argiope
Eustala conchlea
Mastophora sp. bola spider
Clubionidae (Sac spiders)
Ctenizidae (Trapdoor spiders)
Bothriocyrtum californicum California trapdoor spider
Aptostichus sp.
Dictynidae (Dictynids, spiders)
Dictyna agressa
Dictyna varyna
Tricholathys saltona
Dysderidae
* *Dysdera crocata*
Eremobatidae (Wind scorpions)
Eremobates sp.
Eriogonidae
Erigone dentosa
Walckeraeria sp.
Garypidae (Pseudoscorpions)
Garypus californicus
Linyphiidae
Bathyphantes sp.
Lycosidae (Wolf spiders)
Allopecosa kochi
Arctosa littoralis
Clubiona pomoa
Geolycosa sp. burrowing wolf spider
Lycosa sp. wolf spider
Pardosa ramulosa thin-legged wolf spider
Schizocosa mccooki
Oxyopidae (Lynx spiders)
Peucetia viridans green lynx spider
Philodromidae (Philodromid spiders)
Ebo pepinensis
Tibellus chamberlini

Pholcidae
Psilochorus sp.
Salticidae (Jumping spiders)
Metaphidippus sp. metaphid jumping spider
Pellenes elegans
Pseudicius sp.
Tetragnathidae (Large-jawed orb weavers)
Tetragnatha laboriosa long-jawed orb weaver
Theridiidae (Comb-footed spiders)
Crustulina sticta
Latrodectus mactans black widow
Steatoda fulva
Thomisidae (Crab spiders)
Misumenops lepidus
Xysticus gulosus
Zodariidae Araneida
Lutica abalonea sand spider
unknown
Clysosa sp.

MOLLUSCA

Gastropoda (Snails, Limpets, Sea Hares, Nudibranchs)

Acmeidae
Acmaea limatula file limpet
Acteocinidae
Acteocina culcitella
Acteocina inculta
Acteocina magdalenenis glassy bubble
Cylichna alba acteocinid
Cylichnella harpa
Cylichnella inculta
Aelidae
Aelidae spp.
Anaspidea
Aplysia californica California sea hare
Assimineidae
Assiminea californica assimineid snail
Caecidae
Caecum californicum California caecum
Fartulum occidentale caecid
Calyptraeidae
Crepidula fornicata
Crepidula onyx onyx slipper shell
Crepipatela lingulata half-slipper shell
Cephalaspidae
Aglaja diomedia tectibranch
Bulla gouldiana Gould's bubble
Chelidonura inermis large sea slug
Haminaea vesicula blister paper bubble
Cerithiopsidae
Cerithidea californica California horn shell
Cerithidea fuscata horn shell snail
Columbellidae
Columbellidae spp.
Mitrella carinata dove shell
Mitrella tuberosa
Fissurellaceae
Collisela depicta fissurellid
Lacunidae
Lacuna marmorata chink shell
Nassariidae
Nassarius medicus
Nassarius perpinguis
Nassarius tegula mud-dog whelk
Naticidae
Neverita reclusiana
Nudibranchia
Discodoris sandiegensis San Diego sea slug
Nudibranch spp.
Olividae (Olive Shells)
Olivella baetica olive shell
Olivella sp. olive shell
Phasianellidae
Tricolia compta banded pheasant
Pyramidellidae
Odostomia sp. odostome
Turbonilla sp. pyramidellid
Rissoidae (Rissoid snail)
Alvinia spp.
Barleeia californica
Barleeia subtenuis
Rissoella sp.
Vitrinellidae
Vitrinorbis diegensis vitronorbis
Vitrinellidae spp. vitrinella
unknown
Aclis tectibranch
Acmira catherinae
Acmira horikoshii
Alabina spp.
Crucibulum spinosum cup and saucer limpet
Ophiodermella ophioderma penciled turret shell
Ophiodermella spp. turret shell
Philine sp.
Sulcoretusa xystrum
Tachyhynchus sp. turret shell

Bivalvia (Clams, Cockles, Mussels, Oysters, Shipworms)

Mactridae
Mactra californica California dish clam
Spisula catilliformis narrow dish clam
Spisula spp.
Myidae
Platyodon cancellatus checked borer
Mytilidae
Adula diegensis San Diego pea pod
**Geukensia (Ischadium) demissa* ribbed mussel
**Musculista senhousia* Japanese mussel
Mytilus edulis bay mussel
**Mytilus galloprovincialis*
Volsella flabellata(Modiolus modiolus) giant horsemussel
Psammobiidae
Gari californica sunset clam
Tagelus californianus
Tagelus subteres
Solenidae
Siliqua lucida solenid clam
Solen rosaceus rosy razor clam
Solen sicarius razor clam
Tellinidae
Macoma nasuta bent-nosed clam
Macoma secta sand-flat clam
Macoma yoldiformis tellinid clam
Teredinidae
**Lyrodus pedicellatus* southern shipworm
**Teredo navalis* shipworm
Veneridae
**Tapes japonica(semidecussata)* venerid clam
Tivela sp. venus clam
Veneridae spp.
unknown
Asthenothaerus villiosior clam
Calyptogenia sp. *A* clam
Chione undatella wavy cockle
Dhione fluctifraga smooth cockle
Laevicardium substriatum eggshell clam
**Theora fragilis* clam

Cephalopoda (Octopi, Squids)

Octopus bimaculatus two-spotted octopus
Octopus bimaculoides

ECHINODERMATA

Echinoidea (Sea Urchins, Sand Dollars, Heart Urchins)

Dendraster excentricus eccentric sand dollar

Holothuroidea (Sea Cucumbers)

Holothuroidea sp. sea cucumber
Leptosynapata albicans Southern California sea cucumber

Ophiuroidea (Brittle Stars, Serpent Stars)

Amphiodia (nr) *occidentalis* brittle star
Amphipholis pugetana brittle star
Axiognathus squamatus brittle star
Ophiactis simplex brittle star
Ophiuroidea sp.

PHORONIDA (PHORONIDS)

Phoronid spp.

ECTOPROCTA (BRYOZOA)

Amathia spp.
Bowerbankia spp.
Bryozoan spp.
Bugula californica
Bugula neritina
Celleporaria brunnea whitish brown bryozoan

Cheilostomata sp.
Crisia sp.
Cryptosula pallasiana
Cyclostome sp.
Thalamoporella californica
Zoobotryon verticillatum

CHORDATA

Urochordata (Sea Squirts, Compound Ascidians, Tunicates)

Ascidia zara tunicate
Ascidia sp.tunicate
Botrylloides diegensis tunicate
Botryllus schlosseri tunicate
Ciona intestinalis tunicate
Ciona savignyi tunicate
Microcosmus squamiger tunicate
Polyandrocarpa zorritensis tunicate
Styela canopus tunicate
Styela clava (formerly *barnharti*) tunicate
Styela montereyensis California styela
Styela plicata tunicate
Symplegma brakenhielmi tunicate

Cephalochordata (Lancelets)

Branchiostoma californiense lancelet

Vertebrata

Chondrichthyes (Sharks and Rays)

Carcharhinidae
Carcharhinus remotus narrowtooth shark
Galeorhinus zyopterus soupfin shark
Mustelus californicus gray smoothhound
Mustelus henlei brown smoothhound
Mustelus lunulatus sicklefin smoothhound
Prionace glauca blue shark
Triakis semifasciata leopard shark
Gymnuridae
Gymnura marmorata California butterfly ray
Heterodontidae
Heterodontus francisci California horn shark
Myliobatididae
Myliobatis californica bat ray
Platyrhinidae
Platyrhinoidis triseriata thornback
Rhinobatidae
Rhinobatus productus shovelnose guitarfish
Urolophus halleri round stingray
Zapteryx exasperatus banded guitarfish
Sphyrnidae
Sphyrna zygaena smooth hammerhead shark
Squalidae
Squalus acanthias spiny dogfish
Squatinidae
Squatina californica pacific angel shark

Osteichthyes (Bony Fishes)

Albulidae
Albula vulpes bonefish
Antherinidae
Atherinops affinis topsmelt
Atherinopsis californiensis jacksmelt
Atherinidae
Leuresthes tenuis California grunion
Batrachoididae
Porichthys myriaster specklefin midshipman
Porichthys notatus plainfin midshipman
Belonidae
Strongylura exilis California needlefish
Blennidae
Hypsoblennius gentilis bay blenny
Hypsoblennius jenkensi mussel blenny
Bothidae
Citharichthys stigmaeus speckled sand dab
Hippoglossina stomata bigmouth sole
Xysteurys liolepis fantail sole
Carangidae
Caranx caballus green jack

Caranx hippos crevalle jack
Trachurus symmetricus jack mackerel
Chanidae
Chanos chanos milkfish
Clinidae
Gibbonsia elegans spotted kelpfish
Gibbonsia montereyensis crevice kelpfish
Gibbonsia metzi striped kelpfish
Heterostichus rostratus giant kelpfish
Parachinus integripinnis reef finspot
Clupeidae
Clupea harengus pallasii pacific herring
* *Dorosoma petenense* threadfin shad
Sardinops sagax caeruleus pacific sardine
Cottidae
Leptocottus armatus staghorn sculpin
Scorpaena guttata spotted scorpionfish or sculpin
Scorpaenichthys marmoratus cabezon
Cynoglossidae
Symphurus atricauda California tonguefish
Cyprinodentidae
Fundulus parvipinnis California killifish
Embiotocidae
Amphistichus argenteus barred surfperch
Cymatogaster aggregata shiner surfperch
Damalichthys vacca pile surfperch
Embiotoca jacksoni black surfperch
Hyperprosopon argenteum walleye surfperch
Micrometrus minimus dwarf surfperch
Phanerodon furcatus white surfperch
Rhacochilus toxotes rubberlip surfperch
Engraulidae
Anchoa compressa deepbody anchovy
Anchoa delicatissima slough anchovy
Cetengraulis mysticetus anchoveta
Engraulis mordax northern anchovy
Girellidae
Girella nigricans opaleye
Gobiesocidae
Rimicola muscarum kelp clingfish
Gobiidae
* *Acanthogobius flavimanus* yellowfin goby
Clevelandia ios arrow goby
Gillichthys mirabilis longjaw mudsucker
Gobionellus longicaudus longtail goby
Ilypnus gilberti cheekspot goby
Lepidogobius lepidus bay goby
Quietula y-cauda shadow goby
* *Tridentiger trigonocephalus* chameleon goby
Hacnulidae
Haemulon flaviguttatum Cortez grunt
* *Poecilia latipinna* sailfin Molly
Hemiramphidae
Hyporhamphus rosae California halfbeak
Kyphosidae
Hermosilla azurea zebra perch
Labridae
Halichoeres semicinctus rock wrasse
Oxyjulis californica senorita
Mugilidae
Mugil cephalus striped mullet
Pleuronectidae
Hypsopsetta guttulata diamond turbot
Paralichthys californicus California halibut
Platichthys stellatus starry flounder
Pleuronectes vetulus English sole
Pleuronichthys coenosus C-O turbot
Pleuronichthys ritteri spotted turbot
Pleuronichthys verticalis hornyhead turbot
Pristipomatidae
Anisotremus davidsonii sargo
Xenistius californiensis salema
Sciaenidae
Atractoscion nobilis white seabass
Cheilotrema saturnum black croaker
Cynoscion parvipinnis shortfin corvina
Genyonemus lineatus white croaker
Menticurrhus undulatus California corbina
Roncador stearnsii spotfin croaker
Seriphus politus queenfish
Umbrina roncador yellowfin croaker
Scombridae
Sarda chiliensis pacific bonito
Scomber japonicus pacific mackerel
Scomberomorus sierra sierra
Scorpididae
Medialuna californiensis halfmoon
Serranidae
* *Morone (Roccus) saxatilis* striped bass
Paralabrax clathratus kelp bass
Paralabrax maculatofasciatus spotted sand bass
Paralabrax nebulifer barred sand bass
Sphyraenidae
Sphyraena argentea California barracuda
Stromateidae
Peprilus simillimus pacific butterfish
Syngnathidae
Bryx arctos snubnose pipefish
Hippocampus ingens pacific seahorse
Syngnathus auliscus barred pipefish
Syngnathus californiensis kelp pipefish
Syngnathus exilis barcheek pipefish
Syngnathus griseolineatus bay pipefish
Synodontidae
Synodus lucioceps California lizardfish

Reptilia (Reptiles)

Anniellidae
Anniella pulchra pulchra silvery legless lizard
Cheloniidae
Chelonia mydas green sea turtle
Colubridae
Thamnophis hammondii hammondii
Hammond's two-striped garter snake
Sceloporus
Phrynosoma coronatum blainvillei San Diego horned lizard
Scincidae
Eumeces skiltonianus interparietalis Coronado skink

Aves (Birds)

Gaviiformes

Gaviidae (Loons)
Gavia immer common loon
Gavia pacifica pacific loon
Gavia stellata red-throated loon

Podicipediiformes

Podicipedidae (Grebes)
Aechmophorus clarkii transitionalis Clark's grebe
Aechmophorus occidentalis occidentalis western grebe
Podiceps auritus cornutus horned grebe
!*Podiceps grisegena holboellii* red-necked grebe
Podiceps nigricollis californicus eared grebe
Podilymbus podiceps podiceps pied-billed grebe

Procellariiformes

Hydrobatidae (Storm-Petrels)
!*Oceanodroma melania* black storm-petrel

Pelecaniformes

Fregatidae (Frigatebirds)
!*Fregata magnificens* magnificent frigatebird
Pelecanidae (Pelicans)
Pelecanus erythrorhynchos American white pelican
Pelecanus occidentalis californicus brown pelican
Phalacrocoracidae (Cormorants)
Phalacrocorax auritus double-crested cormorant
Phalacrocorax pelagicus pelagic cormorant
Phalacrocorax penicillatus Brandt's cormorant
Sulidae (Boobies)
!*Sula leucogaster brewsteri* brown booby

Ardeiformes

Ardeidae (Herons)
Ardea alba egretta great egret
Ardea herodias wardi great blue heron
Botaurus lentiginosus American bittern
Bubulcus ibis ibis cattle egret
Butorides virescens anthonyi green heron
Egretta caerulea little blue heron
Egretta rufescens dickeyi reddish egret
Egretta thula thula snowy egret
Egretta tricolor ruficollis tricolored heron
!*Ixobrychus exilis hesperis* least bittern
!*Nyctansassa violaceus bancrofti* yellow-crowned night heron
Nycticorax nycticorax hoactli black-crowned night heron

Ciconiiformes

Ciconiidae (Storks)
!*Mycteria americana* wood stork
Threskiornithidae (Ibises)
Plegadis chihi white-faced ibis

Anseriformes

Anatidae (Swans, Geese, Ducks)
!*Aix sponsa* wood duck
Anas acuta northern pintail
Anas americana American wigeon
Anas crecca carolinensis green-winged teal
Anas clypeata northern shoveler
Anas cyanoptera septentrionalium cinnamon teal
Anas discors blue-winged teal
Anas penelope Eurasion wigeon
Anas platyrhynchos platyrhynchos mallard
Anas strepera strepera gadwall
Aythya affinis lesser scaup
Aythya americana redhead
Aythya collaris ring-necked duck
!*Aythya fuligula* tufted duck
Aythya marila nearctica greater scaup
Aythya valisineria canvasback
Branta bernicla hrota Atlantic race
Branta bernicla nigricans Black race
Branta canadensis Canada goose
Bucephala albeola bufflehead
Bucephala clangula common goldeneye
!*Bucephala islandica* Barrow's goldeneye
!*Chen hyperborea* snow goose
!*Chen rossii* Ross' goose
Clangula hyemalis oldsquaw
!*Dendrocygna bicolor* fulvous whistling duck
!*Histrionicus histrionicus* harlequin duck
Lophodytes cucullatus hooded merganser
Melanitta fuscai deglandi white-winged scoter
Melanitta nigra americana black scoter
Melanitta perspicillata surf scoter
Mergus merganser common merganser
Mergus serrator red-breasted merganser
Oxyura jamaicensis rubida ruddy duck
!*Somateria spectabilis* King eider

Falconiformes

Accipitridae (Hawks, Kites, Eagles))
Accipiter cooperii Cooper's hawk
Accipiter striatus velox sharp-shinned hawk
!*Aquila chrysaetos canadensis* golden eagle
Buteo jamaicensis calurus western red-tailed hawk
!*Buteo lagopus sanctijohannis* rough-legged hawk
Buteo lineatus elegans red-shouldered hawk
!*Buteo platypterus platypterus* broad-winged hawk
!*Buteo regalis* ferruginous hawk
!*Buteo swainsoni* Swainson's hawk
Circus cyaneus hudsonius northern harrier
Elanus caeruleus white-tailed kite

Cathartidae (Vultures)
Cathartes aura meridionalis turkey vulture
!*Gymnogyps californianus* California condor

Falconidae (Falcons)
!*Caracara plancus auduboni* crested caracara
Falco columbarius columbarius American merlin
Falco mexicanus prairie falcon
Falco peregrinus anatum peregrine falcon
Falco sparverius sparverius American kestrel

Pandionidae (Osprey)
Pandion haliaetus carolinensis osprey

Galliformes

Odontophoridae (Quail)
Callipepla californica californica California quail

Phasianidae (Pheasant)
Phasianus colchicus ring-necked pheasant

Gruiformes

Charadriidae (Plovers)
Charadrius alexandrinus nivosus western snowy plover
Charadrius montanus mountain plover
Charadrius semipalmatus semipalmated plover
Charadrius vociferus vociferus killdeer
!*Charadrius wilsonia beldingi* Wilson's plover
!*Pluvialis fulva* pacific golden-plover
Pluvialis squatarola black-bellied plover

Gruidae (Crane)
!*Grus canadensis* sandhill crane

Charadriiformes

Haematopodidae (Oystercatcher)
Haematopus bachmani black oystercatcher

Laridae (Terns, Skimmers and Jaegers)
Chlidonias niger surinamensis black tern
Larus argentatus smithsonianus herring gull
Larus atricilla laughing gull
Larus californicus californicus California gull
Larus canus brachyrhynchus mew gull

Larus delawarensis ring-billed gull
Larus glaucescens glaucous-winged gull
Larus heermanni Heerman's gull
Larus hyperboreus barrovianus glaucous gull
Larus occidentalis wymani western gull
Larus philadelphia Bonaparte's gull
Larus pipixcan Franklin's gull
Larus sabini Sabine's gull
Larus thayeri Thayer's gull
Rissa tridactyla pollicaris black-legged kittiwake
Rynchops niger niger black skimmer
!*Stercorarius longicaudus pallescens* long-tailed jaeger
Stercorarius parasiticus parasitic jaeger
Stercorarius pomarinus pomarine jaeger
Sterna antillarum browni California least tern
Sterna caspia caspian tern
Sterna elegans elegant tern
Sterna forsteri Forster's tern
!*Sterna fuscata oahuensis/crissalis* sooty tern
Sterna hirundo hirundo common tern
Sterna maxima maxima royal tern
Sterna nilotica vanrossemi gull-billed tern
Sterna paradisaea artic tern
!*Sterna sandvicensis acuflavida* sandwich tern
Rallidae (Coot, Gallinules, Rails)
Fulica americana americana American coot
Gallinula chloropus cachinnans common moorhen
†! *Laterallus jamaicensis coturniculus* black rail
Porzana carolina sora
Rallus limicola limicola virginia rail
Rallus longirostris levipes light-footed clapper rail
Recurvirostridae (Stilts, avocets)
Himantopus mexicanus mexicanus black-necked stilt
Recurvirostra americana American avocet
Scolopacidae (Sandpipers and Phalaropes)
Aphriza virgata surfbird
Arenaria interpres ruddy turnstone
Arenaria melanocephala black turnstone
Calidris alba sanderling
Calidris alpinia pacifica dunlin
Calidris bairdii Baird's sandpiper
Calidris canutus roselaari red knot
Calidris himantopus stilt sandpiper
Calidris mauri western sandpiper
Calidris melanotos pectoral sandpiper
Calidris minutilla least sandpiper
Calidris pusilla semipalmated sandpiper
Capella gallinayo delicata common snipe
Catoptrophorus semipalmatus inornatus willet
Limnodromus griseus caurinus short-billed dowitcher
Limnodromus scolopaceus long-billed dowitcher
Limosa fedoa fedoa marbled godwit
!*Limosa lapponica baueri* bar-tailed godwit
Numenius americanus long-billed curlew
Numenius phaeopus hudsonicus whimbrel
!*Phalaropus fuclicarius* red phalarope
Phalaropus lobatus red-necked phalarope (northern)
Phalaropus tricolor Wilson's phalarope
Philomachus pugnax ruff
Tringa flavipes lesser yellowlegs
Tringa incanus wandering tattler
Tringa macularia spotted sandpiper
Tringa melanoleuca greater yellowlegs
Tringa solitaria cinnamomea solitary sandpiper

Columbiformes

Columbidae (Pigeons, doves)
* *Columba livia* rock dove domestic pigeon
!*Streptopelia chinensis* spotted dove
Zenaida asiatica mearnsi white-winged dove
Zenaida macroura marginella mourning dove

Cuculiformes

Cuculidae (Cuckoos)
!*Coccyzus americanus occidentalis* yellow-billed cuckoo
Geococcyx californianus greater roadrunner

Strigiformes

Strigidae (Typical owls)
Asio flammeus flammeus short-eared owl
Athene cunicularia hypugaea burrowing owl
Bubo virginianus great horned owl
Tytonidae (Barn owls)
Tyto alba pratincola barn owl

Caprimulgiformes

Caprimulgidae (Nightjars)
Chordeiles acutipennis texinsis lesser night hawk
!*Chordeiles minor hesperis* common night hawk

Apodiformes

Apodidae (Swifts)
Aeroautes saxatalis saxatalis white-throated swift
Chaetura vauxi vauxi Vaux's swift
Trochilidae (Hummingbirds)
Archilochus alexandri black-chinned hummingbird
Calypte anna Anna's hummingbird
Calypte costae Costa's hummingbird
Selasphorus rufus rufous hummingbird
Selasphorus sasin Allen's hummingbird
Stellula calliope calliope hummingbird

Coraciiformes

Alcedinidae (Kingfisher)
Ceryls alcyon belted kingfisher

Piciformes

Picidae (Woodpeckers)
Colaptes auratus northern flicker

Passeriformes

Aegithalidae (Long-tailed tits)
Psaltriparus minimus melanurus bushtit
Alaudidae (Larks)
Eremophila alpestris horned lark
Bombycillidae (Waxwings)
Bombycilla cedrorum cedar waxwing
Phainopepla nitens lepida phainopepla
Corvidae (Jays, crows)
Aphelocona californica obscura scrub jay
Corvus brachyrhynchos hesperis American crow
Corvus corax clarionensis common raven
Emberizidae (Warblers, sparrows, blackbirds, allies)
Aimophila ruficeps canescens rufous-crowned sparrow
Agelaius phoeniceus neutralis red-winged blackbird
Agelaius tricolor tricolored blackbird
!*Ammodramus caudacutus nelsoni saltmarsh sharp-tailed sparrow*
Ammodramus sandwichensis Savannah sparrow
Ammodramus sandwichensis beldingi Belding's Savannah sparrow
Ammodramus sandwichensis rostratus large-billed Savannah sparrow
!*Calamospiza melanocorys* lark bunting
Dendroica coronata auduboni Audubon's warber (yellow-rumped)
Dendroica coronata hooveri myrtle warbler (yellow-rumped)
Dendroica nigrescens black-throated gray warbler
Dendroica occidentalis hermit warbler
Dendroica palmarum palmarum palm warbler
Dendroica petechia yellow warbler
Dendroica townsendi Townsend's warbler
Euphagus cyanocephalus Brewer's blackbird
Geothlypis trichas common yellowthroat
Icterus cucullatus nelsoni hooded oriole
Icterus galbula Baltimore oriole (northern)
Icteria virens auricollis yellow-breasted chat
Junco hyemalis dark-eyed junco
Molothrus ater brown-headed cowbird
Oporornis tolmiei tolmiei MacGillivray's warbler
Passerella iliaca fox sparrow
Passerella georgiana ericrypta swamp sparrow
Passerella lincolnii Lincoln's sparrow
Passerella melodia cooperi San Diego song sparrow
Pheucticus melanocephalus maculatus black-headed grosbeak
Pipilo maculatus megalonyx rufous-sided towhee
Pipilo chlorurus green-tailed towee
Piranga ludoviciana western tanager
Pooecetes gramineus vesper sparrow
Quiscalus mexicanus great-tailed grackle
Setophaga ruticilla American redstart
Spizella passerina arizonae chipping sparrow
Sturnella neglecta western meadowlark
Vermivora celata orange-crowned warbler
Vermivora luciae Lucy's warbler
Vermivora ruficapilla ridgwayi Nashville warbler
Vermivora virginiae Virginia warbler
Wilsonia pusilla Wilson's warbler
Xanthocephalus xanthocephalus yellow-headed blackbird*Zonotrichia atricapilla* golden-crowned sparrow
Zonotrichia leucophrys white-crowned sparrow
Fringillidae (Finches)
Carduelis lawrencei Lawrence's goldfinch
Carduelis pinus pinus pine siskin
Carduelis psaltria hesperophilus lesser goldfinch
Carduelis tristis salicamans American goldfinch
Carpodacus mexicanus frontalis house finch
!*Progne subis subis* purple martin
Riparia riparia riparia bank swallow
Stelgidopteryx serripennis northern rough-winged swallow
Tachycineta bicolor tree swallow
Tachycineta thalassina thalassina violet-green swallow
Hirundinidae (Swallows)
Hirundo pyrrhonota tachina cliff swallow
Hirundo rustica erythrogaster barn swallow

Laniidae (Shrikes)
Lanius ludovicianus loggerhead shrike
Mimidae (Mimic thrushes)
Mimus polyglottos polyglottos northern mockingbird
Oreoscoptes montanus sage thrasher
Toxostoma redivivum redivivum California thrasher
Motacillidae (Wagtails, pipits)
!*Anthus cervinus* red-throated pipit
Anthus rubescens pacificus American pipit
Muscicapidae (Gnatcatchers)
Polioptila caerulea blue-gray gnatcatcher
Polioptila californica California gnatcatcher
Passeridae (Old world sparrow)
* *Passer domesticus domesticus* house sparrow
Regulidae (Kinglets)
Regulus calendula calendula ruby-crowned kinglet
!*Regulus satrapa apache* golden-crowned kinglet
Sturnidae (Starlings)
* *Sturnus vulgaris vulgaris* European starling
Timaliidae (Babblers)
Chamaea fasciata henshawi wrentit
Troglodytidae (Wrens)
!*Campylorhynchus brunneicapillus sandiegoense* cactus wren
Cistothorus palustris marsh wren
Thryomanes bewickii Bewick's wren
Troglodytes aedon parkmanii house wren
Turdidae (Thrushes)
Catharus guttatus hermit thrush
Catharus ustulatus Swainson's thrush
!*Sialia currucoides* mountain bluebird
Turdus migratorius propinquus American robin
Tyrannidae (Flycatchers)
Contopus cooperi olive-sided flycatcher
Contopus sordidulus sordidulus western wood-pewee
Empidonax difficilis difficilis western flycatcher
Empidonax hammondii Hammond's flycatcher
!*Empidonax oberholseri* dusky flycatcher
!*Empidonax traillii* willow flycatcher
Empidonax wrightii gray flycatcher
Myiarchus cinerascens cinerascens ash-throated flycatcher
Sayornis nigricans semiatra black phoebe
Sayornis saya saya Say's phoebe
!*Tyrannus melancholicus satrapa* tropical kingbird
Tyrannus verticalis western kingbird
Tyrannus vociferans vociferans Cassin's kingbird
Vireonidae (Vireos)
Vireo bellii pusillus least Bell's vireo
Vireo gilvus swainsoni warbling vireo
Vireo solitarius solitarius solitary vireo(blue-headed)

Mammalia (Marine Mammals)

Cetacea

Delphinus delphis common dolphin
† *Eschrichtius robustus* gray whale
† *Grampus griseus* Risso's dolphin
Lagenorhynchus obliquidens Pacific white-sided dolphin
Tursiops truncatus common bottlenose dolphin

Carnivora

Phoca vitulina Pacific harbor seal
Zalophus californianus California sea lion

* - Non-native to San Diego Bay
† - extirpated from San Diego Bay
! - accidental, not regularly occuring at San Diego Bay

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Appendix E: Species and Their Habitats

Table E-1. San Diego Bay Plant Species and Their Habitats.

Exotic	Scientific Name	Common Name	Subtidal: Deep Subtidal (Hard / Soft Substrate) HS	Subtidal: Deep Subtidal SS	Subtidal: Shallow Subtidal (Hard / Soft Substrate) HS	Subtidal: Shallow Subtidal SS	Intertidal: Intertidal Rocky	Intertidal: Intertidal Sandy	Intertidal: Intertidal Mudflat	Intertidal: Salt Marsh	Intertidal: Artificial Structures	Intertidal: Upland Transitional	Upland: Dune	Upland: Freshwater Marsh	Upland: Riparian	Upland: Disturbed	Notes
ALGAE																	
	Chlorophyta	Green Algae															
	Bryopsis corticulans						■										
	Derbesia marina						■										
	Chaetomorpha linum				■	■	■										mat forming; opportunistic
	Cladophora sp.				■	■	■										mat forming; opportunistic; attached to artificial substrate
	Enteromorpha sp.				■	■	■			■							mud sediment surface; attached to artificial substrate
	Ulva expansa	sea lettuce			■	■	■										mat forming; opportunistic
	Phaeophyta	Brown Algae															
	Porphyra perforta										■						attached to piling surfaces or on hard, man made substrates at base of pilings
	Dictyota flabellata				■	■	■	■	■								rocky bottom
	Ectocarpus spp.				■	■	■										rocky bottom
	Fucaceae sp.																drift algae on bottom
	Sargassum agarhianum				■												rocky bottom
	Sargassum palmeri																mud sediment surface
	Colpomenia sinuosa				■		■										rocky bottom
	Rhodophyta	Red Algae															
	Aglaothamnium cordatum				■	■	■	■	■								rocky bottom
	Antithamnion sp.		■	■	■	■					■						attached to fixed object or plant; mud sediment surface
	Callithamnion sp. A										■						attached to piling surfaces or on hard, man-made substrates at base of pilings
	Ceramium eatonian				■	■	■										mat forming; opportunistic
	Griffithsia furcellata		■	■			■										only in clear quiet water
	Griffithsia pacifica		■	■			■										micro algae; rocky bottom
	Tiffaniella snyderae			■	■	■		■	■								psammophytic; mat forming; opportunistic
	Daysa sinicola var. *abyssicola*		■	■	■	■	■										microalgae; rocky bottom
	Daysa sinicola var. *californica*		■	■	■	■	■										microalgae; rocky bottom; succession mat
	Gelidium sp. A																mud sediment surface

Table E-1. San Diego Bay Plant Species and Their Habitats. (Continued)

SPECIES			HABITAT														
			Subtidal				Intertidal					Upland					
Exotic	Scientific Name	Common Name	Deep Subtidal HS	(Hard / Soft Substrate) SS	Shallow Subtidal HS	(Hard / Soft Substrate) SS	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Artificial Structures	Upland Transitional	Dune	Freshwater Marsh	Riparian	Disturbed	Notes
	Gelidium nudifrons				■	■											mat forming; opportunistic
	Gigartina sp.	Turkish towel			■	■	■										mat forming; opportunistic
	Gracilaria lemaneiformis				■	■											mat forming
	Gracilaria pacifica																mud sediment surface
	Hypnea valentiae		■	■		■	■	■	■								
	Plocamium sp.										■						attached to piling surfaces or on hard, man-made substrates at base of pilings; drift algae on bottom
	Polysiphonia bajacali		■	■	■	■					■						attached to fixed object in shallow subtidal
	Polysiphonia pacifica				■	■	■										attached to fixed objects or plants; rocky bottom
	Pterochondria woodii var. *pymaea*						■										opportunistic
	Rhodymenia sp.				■	■	■										rocky bottom
	Sarcodiotheca gaudichaudii																mud sediment surface
PLANTS—DICOTS																	Jepson description
*	*Mesembryanthemum crystallinum*	ice plant								■		■	■			■	coastal bluffs, disturbed ground common
*	*Mesembryanthemum nodiflorum*	little ice plant								■							coastal bluffs, margins of saline wetlands; uncommon
*	*Schinus molle*	California pepper tree										■		■	■	■	washes, slopes, abandoned fields; Jepson lists exotic
*	*Foeniculum vulgare*	sweet fennel										■	■			■	roadside waste places; invasive and abundant
	Amblyopappus pusillus	coast weed										■					coastal dunes, beaches, headlands
	Artemisia californica	California sagebrush										■					coastal sage near coast
	Baccharis sarothroides	chaparral broom										■	■			■	gravely sandy washes, roadsides
*	*Centaurea melitensis*	star thistle										■				■	disturbed fields, open woods; uncommon
*	*Chrysanthemum carinatum*	tricolor chrysanthemum										■				■	waste ground
*	*Cotula coronopifolia*	brass buttons										■					saline and freshwater marshes; common
	Heterotheca grandiflora	telegraph weed										■	■				disturbed area, dune, dry river bed
	Isocoma menziesii	golden bush										■	■				landward side of dunes, hillsides, arroyos
	Jaumea carnosa	jaumea								■							coastal salt marsh

Table E-1. San Diego Bay Plant Species and Their Habitats. (Continued)

SPECIES			HABITAT														Notes
			Subtidal				Intertidal					Upland					
Exotic	Scientific Name	Common Name	Deep Subtidal HS	(Hard / Soft Substrate) SS	Shallow Subtidal HS	(Hard / Soft Substrate) SS	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Artificial Structures	Upland Transitional	Dune	Freshwater Marsh	Riparian	Disturbed	
	Pluchea sericea	arrow weed										X					stream beds, washes, some saline; stabilizer; invasive
	Batis maritima	saltwort								X							salt marsh
	Heliotropium curassavicum	Chinese parsley										X					moist to dry saline soils; stabilizer; invasive
	Hutchinsia procumbens											X					alkaline flats, saline seeps
*	*Lobularia maritima*	sweet alyssum										X				X	waste places
	Cardionema ramosissimum	tread lightly										X	X				sandy beaches, dunes, bluffs
	Spergularia marina	salt marsh sand-spurrey								X		X	X				sandy coasts, salt marshes
	Atriplex canescens	salt bush										X					clay to gravelly flats
*	*Atriplex lindleyi*	salt bush										X				X	open disturbed
*	*Atriplex semibaccata*	Australian salt bush										X				X	waste places
	Atriplex truncata	salt bush										X					alkaline soils, flats
	Atriplex watsonii	Watson salt bush								X		X	X				sand dunes, salt marshes
	Salicornia bigelovii	animal pickleweed								X							salt marshes
	Salicornia europaea	salt flat annual pick-leweed								X		X					salt marsh, alkaline flat; stabilizer
	Salicornia subterminalis	glasswart								X		X					salt marsh, alkaline flat; stabilizer
	Salicornia virginica	pickleweed								X		X					salt marsh, alkaline flat; stabilizer
*	*Salsola kali*	Russian thistle								X		X				X	not listed in Jepson
	Suaeda californica	California sea-blite								X		X					margins of coastal salt marsh
	Cressa truxillensis	alkali weed								X		X					saline and alkaline soil; invasive
	Crassula connata	pygmy weed															open areas; locally abundant
	Cuscuta salina	salt marsh dodder								X		X		X			marshes, flats, ponds; common
	Lotus nuttallianus	beach lotus										X	X			X	beaches, coastal scrub, urban weedy; rare
	Lotus strigosus											X				X	coastal scrub, disturbed areas
	Frankenia palmeri	yerba reuma								X		X	X				alkali flats, dunes, coastal marsh; rare in CA
	Frankenia salina	alkali heath								X		X					salt marsh, alkali flats
	Salvia mellifera	black sage										X					coastal sage scrub, chaparral; stabilizer
	Camissonia cheiranthifolia	beach evening primrose										X	X				sandy slopes, flats, dunes

Table E-1. San Diego Bay Plant Species and Their Habitats. (Continued)

SPECIES			HABITAT														
			Subtidal				Intertidal						Upland				
Exotic	Scientific Name	Common Name	Deep Subtidal HS	(Hard / Soft Substrate) SS	Shallow Subtidal HS	(Hard / Soft Substrate) SS	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Artificial Structures	Upland Transitional	Dune	Freshwater Marsh	Riparian	Disturbed	Notes
	Camissonia cheiranthifolia suffruticosa											■	■				sandy slopes, flats, dunes
	Limonium californicum	sea lavender								■		■	■				coastal strand, salt marsh, beaches, bays, stabilizer
	Eriogonum fasciculatum	California buckwheat										■					dry slopes, washes, scrub canyons
	Eriogonum parvifolium											■					dunes, sea bluffs
	Nemacaulis denudata	thread stem										■	■				coastal strand, desert scrub, sandy
*	*Rumex crispus*	curly dock								■		■					disturbed places; abundant
	Salix lasiolepis	arroyo willow										■			■		shores, marshes, meadows, bluffs; stabilizer; invasive
	Cordylanthus maritimus maritimus	salt marsh bird's-beak								■							federally endangered; coastal salt marsh
*	*Nicotiana glauca*	tree tobacco										■			■	■	open disturbed flats
*	*Tamarix* sp.	tamarisk										■			■	■	often in saline habitats
PLANTS—MONOCOTS																	
	Juncus acutus	spiny rush								■							salt marshes, saline seeps; stabilizer
	Triglochin maritima	arrow grass								■		■					marshes, saline-alkaline margins and mud; stabilizer
	Yucca schidigera	Mohave yucca										■					chaparral, creosote scrub, dry
*	*Bromus madritensis rubens*	red brome										■				■	open disturbed
*	*Cortaderia jubata*	Pampas grass										■		■	■	■	disturbed sites, coastal habitat; invasive
	Distichlis spicata	salt grass								■		■		■	■		salt marsh, moist alkaline stabilizing; invasive
*	*Hordeum murinum*	sterile barley										■				■	moist disturbed
	Parapholis incurva	sickle grass								■							salt marsh above highest tide; Jepson lists exotic
*	*Polypogon monspeliensis*	rabbit foot grass										■		■	■		moist places, along streams, ditches
	Spartina foliosa	cordgrass							■	■							salt marsh, mud flats
	Ruppia maritima	ditch grass							■	■				■			marshes, ponds, sloughs; stabilizer
*	*Typha domingensis*	southern cattail												■	■		marshes; Jepson lists not exotic
	Typha latifolia	common cattail												■	■		marshes, ponds, lakes
	Zostera marina	eelgrass				■			■								shallow water, bays, estuaries

Table E-2. San Diego Bay Invertebrate Species and Their Habitats.

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
PHYLUM PORIFERA							
	Halichondria panicea					■	epifauna on pilings and floats
*	*Haliclona* sp.	haliclonid sponge			■	■	protected places on rocks, floating docks and tide pools; from midtidal zone to 20 ft (6 m) deep
	Hymenicidon sp.					■	epifauna on pilings and floats
	Tetilla mutabilis	wandering sponge		■			on surface
	Leucosolenia sp.					■	epifauna on pilings and floats
	Esperiopsis originalis	digitate sponge		■			
PHYLUM CNIDARIA							
*	*Obelia* sp.					■	epifauna on pilings and floats
	Aglaophenia sp.	ostrich plume hydroid				■	epifauna on pilings and floats
	Plumularia sp.	plumarid hydroid				■	epifauna on pilings and floats
	Tubularia sp.	naked hydroid			■	■	attached to almost any solid object continuously submerged in shallow water; commonly found on boat hulls
*	*Tubularia crocea*			■			
	Corymorpha palma	white hydroid		■			
	Epiactis prolifera	proliferating anemone	■		■		attached to rocks, large algae, and eelgrass; from between high and low tide line to 30 ft (9 m) deep
	Diadumene franciscana	anemone		■	■		
	Diadumene cf. *leucolena*	anemone		■	■		
	Cerianthus (nr) aestuari	burrowing anemone		■			
	Edwardsiella californica	burrowing anemone		■			
	Harenactis attenuata	burrowing anemone		■			
	Pachycerianthus fimbriatus	mud tube anemone		■			
	Renilla kollikeri	sea pansy		■			
	Scolanthus sp.	anemone		■			
PHYLUM PLATYHELMINTHES							
	Polyclad spp.	flatworms	■	■			both subtidal and intertidal
PHYLUM NEMERTEA							
	Nemertena spp.			■			both subtidal and intertidal
PHYLUM ASCHELMINTHES							
	Nematode spp.			■			both subtidal and intertidal
PHYLUM SIPUNCULA							
	Sipunculid sp.			■			
PHYLUM ANNELIDA							
	Oligochaete spp.	oligochaete		■			both subtidal and intertidal
	Ampharete labrops	ampharetid		■			
	Ampharetidae spp.	ampharetid		■			
	Amphicteis scaphorbranchia	ampharetid		■			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Arabella semimaculata	arabellid	X	X			
	Arabella sp.	arabellid	X				
	Drilonereis falcata minor	arabellid		X			
	Drilonereis mexicana	arabellid		X			
	Capitata ambiseta	capitellid		X			
*	*Capitella capitata*	capitellid	X	X			
	Capitellidae spp.	capitellid		X			
	Heteromastus sp.	capitellid		X			
	Mediomastus acutus	capitellid		X			
	Mediomastus ambiseta	capitellid		X			
	Mediomastus californiensis	capitellid		X			
	Mediomastus sp.	capitellid	X				
	Neomediomastus sp.	capitellid		X			
	Notomastus cf. lineatus	capitellid		X			
	Notomastus tenuis	capitellid		X			
	Scyphoproctus oculatus	capitellid		X			
	Scyphoproctus spp.	capitellid		X			
	Chaetopterus variopedatus	parchment tube worm		X	X		
	Caulleriella sp(p.)	cirratulid		X			
	Chaetozone cf. *corona*	cirratulid		X			
	Chaetozone cf. *setosa*	cirratulid		X			
	Chaetozone cf. *spinosa*	cirratulid		X			
	Cirratulidae, unidentified	cirratulid		X			
	Cirratulus sp(p.)	cirratulid					
	Cirriformia luxuriosa	cirratulid		X			
	Cirriformia spriabranchiata	cirratulid		X			
	Cirriformia tentaculata	cirratulid		X			
	Tharyx parvus	cirratulid		X			
	Tharyx sp. A.B.	cirratulid	X				
	Cossura candida	cossurid	X	X			
	Cossura pygodactylata	cossurid	X				
	Cossura sp.	cossurid	X				
	Ctenodrilus serratus	ctenodrilid		X			
	Dorvillea articulata	dorvilleid		X			
	Dorvillea longicornis	dorvilleid		X			
	Dorvillea rudolphii	dorvilleid	X	X			
	Ophryotrocha puerilis	dorvilleid		X			
	Schistomeringos longicornis	dorvilleid		X			
	Lysidice sp.	eunicid	X				
	Lysippe labiata	eunicid		X			
	Marphysa dysjuncta	eunicid		X			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
*	*Marphysa sanguinea*	eunicid		■			
	Marphysa sp.	eunicid	■				
	Marphysa stylobranchiata	eunicid	■	■			
	Brada pleurobranchiata	flabelligerid		■			
	Flabelligera infundibularis	flabelligerid	■				
	Flabelligeridae sp.A	flabelligerid	■				
	Flabelligeridae sp.B	flabelligerid	■				
	Flabelligerma essenbergae	flabelligerid		■			
	Pherusa capulata	flabelligerid		■			
	Pherusa cf. neopapillata	flabelligerid	■				
	Pherusa sp.	flabelligerid		■			
	Stylaroides sp.	flabelligerid		■			
	Glycera americana	glycerid	■	■			
	Glycera cf. *americana*	glycerid		■			
	Glycera nana	glycerid					
	Glycera rouxii	glycerid		■			
	Glycera tenuis	glycerid	■				
	Glyceridae spp.	glycerid		■			
	Glycinda armigera	glycerid		■			
	Goniada brunnea	gonaidid					
	Goniada littorea	gonaidid		■			
	Goniada sp.(p.)	gonaidid					
	Lumbrineris acuta	lumbrinerid		■			
	Lumbrineris californiensis	lumbrinerid		■			
	Lumbrineris erecta	lumbrinerid		■			
	Lumbrineris latreilli	lumbrinerid		■			
	Lumbrineris minima	lumbrinerid		■			
	Lumbrineris spp.	lumbrinerid					taxonomic status of species of the genus Lumbrineris is very uncertain; many of these species names may be incorrect.
	Lumbrineris zonata	lumbrinerid	■	■			
	Maldanidae spp.	maldanid	■	■			
	Malmgreniella macginitiei	maldanid		■			
	Nicomache cf. lumbricalis	maldanid		■			
	Praxilella affinis pacifica	maldanid		■			
	Nephtyidae spp.	nephtyid		■			
	Nephtys caecoides	nephtyid		■			
	Nephtys cornuta franciscanus	nephtyid		■			
*	*Neanthes acuminata*	neriid		■			
*	*Neanthes caudata*	neriid		■			
	Neanthes virens	neriid		■			
	Nematonereis cf. *unicornis*	neriid		■			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Nereidae spp.	neriid	■	■			
	Nereis brandti	neriid	■				
	Nereis latescens	neriid		■			
	Nereis procera	neriid		■			
	Diopatra sp(p.)	onuphid		■			
	Diopatra tridentata	onuphid		■			
	Armandia bioculata	opheliid		■			
	Polyopthalmus pictus	opheliid		■			
	Haploscolopos elongatus	orbinid		■			
	Leitoscoloplos elongatus	orbinid		■			
	Leitoscoloplos pugettensis	orbinid		■			
	Naineris uncinata	orbinid		■			
	Orbinidae spp.	orbinid	■	■			
	Scoloplos acmeceps	orbinid	■	■			
	Pectinaria californiensis	pectinariid		■			
	Eteone alba	phyllodocid		■			
	Eteone californica	phyllodocid		■			
	Eteone cf. *lighti*	phyllodocid		■			
	Eteone dilata	phyllodocid	■				
	Eteone sp.(p.)	phyllodocid		■			
	Phyllodocidae spp.	phyllodocid		■			
	Sigambra tentaculata	Pilargiidae		■			
	Halosydna brevistosa	polynoid		■			
	Halosydna johnsoni	polynoid		■			
	Harmothoe cf. *hirsuta*	polynoid		■			
	Harmothoe imbricata	polynoid		■			
	Hesperonoe sp (p.)	polynoid		■			
	Polynoidae spp., sp. A.B.C.	scale worm	■	■			
	Chone cf. *gracilis*	sabellid	■	■			
	Chone cf. *mollis*	sabellid		■			
	Euchone limnicola	sabellid	■				
	Fabicinae sp.	sabellid		■			
	Fabricia limnicola	sabellid	■	■			
	Fabricinuda limicola	sabellid		■			
	Megalomma circumspectum	sabellid		■			
	Megalomma pigmentum	sabellid		■			
	Sabella crassicornis	sabellid		■			
	Sabellidae spp.	sabellid		■			
	Sabellidae, unidentified	sabellid	■				
	Crucigera sp.	serpulid		■			
	Hydroides pacificus	serpulid		■			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Serpulidae spp.	serpulid		■			
	Sthenelais tertiaglabra	sigalionid		■			
	Sthenelanella uniformis	sigalionid		■			
	Apoprionospio pygmaeus	spionid		■			
	Boccardia spp.	spionid	■	■			
	Boccardia truncata	spionid		■			
	Boccardiella hamata	spionid		■			
	Laonice cirrata	spionid		■			
	Microspio maculata	spionid		■			
	Nerinides cf. *acuta*	spionid		■			
	Nerinides pigmentata	spionid		■			
	Paraprionospio pinnata	spionid		■			
	Polydora cf. *cardalia*	spionid		■			
	Polydora cf. *nuchalis*	spionid	■	■			
	Polydora cf. *socialis*	spionid		■			
	Polydora cornuta	spionid		■			
*	*Polydora ligni*	spionid	■	■			in soft fragile tubes covered with mud and attached to hard objects in protected places on mud and clay bottoms, near low tide line and shallow water
	Polydora limnicola	spionid	■				
	Polydora nuchalis	spionid	■				
	Polydora quadrilobata	spionid		■			
	Polydora socialis	spionid		■			
	Polydora sp.	spionid	■				
	Polydora websteri	spionid		■			
	Prionospio cf. *heterobranchiata*	spionid	■	■			
	Prionospio lighti	spionid		■			
	Prionospio malmgreni	spionid		■			
	Prionospio pinnata	spionid		■			
	Prionospio pygmaeus	spionid	■	■			
	Prionospio steenstrupi	spionid		■			
	Pseudomalacocerus spp.	spionid		■			
*	*Pseudopolydora paucibranchiata*	spionid		■			
	Rhynchospio glutaea	spionid		■			
	Scolelepis acuta	spionid		■			
	Scolelepis foliosa occidentalis	spionid		■			
	Scolelepis tridentata	spionid		■			
	Scoleopis quinquedentata	spionid		■			
	Spionidae spp.	spionid	■	■			
	Spiophanes missionensis	spionid	■	■			
*	*Streblospio benedicti*	spionid		■			
	Sternaspis fossor	sternaspid		■			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Autolytus spp.	syllid		X			
	Brania brevipharyngea	syllid		X			
	Brania spp.	syllid		X			
	Eusyllis assimilis	syllid		X			
	Exogone cf. *molesta*	syllid		X			
	Exogone lourei	syllid	X	X			
	Exogone uniformis	syllid		X			
	Odontosyllis parva	syllid		X			
	Odontosyllis phosphorea	syllid		X			
	Pionosyllis spp.	syllid		X			
	Syllidae spp.	syllid		X			
	Syllis gracilis	syllid		X			
	Trypanosyllis spp.	syllid		X			
	Typosyllis cf. *hyalina*	syllid		X			
	Amaeana occidentalis	terebellid		X			
	Pista alata	terebellid		X			
	Pista cf. *fasciata*	terebellid		X			
	Pista sp.	terebellid	X				
	Streblosoma crassibranchia	terebellid		X			
	Terebellidae spp.	terebellid		X			
	Terebellides californica	terebellid		X			
	Aphelochaeta monilaris			X			
	Aphelochaeta multifilis			X			
	Aphelochaeta sp(p.)			X			
	Apistobranchus sp(p.)			X			
	Diplocirrus sp(p.)			X			
	Eranno lagunae			X			
	Euclymeninae spp. indef.			X			
	Expolymnia sp(p.)			X			
	Leitoscoloplos pugettensis			X			
	Levinsenia gracilis			X			
	Melinna oculata			X			
	Metasychis disparidentata			X			
	Montecellina dorsobranchialis			X			
	Montecellina sp. C			X			
	Montecellina tesselata			X			
	Myriochele sp. M			X			
	Paramage scutata			X			
	Parougia caeca			X			
	Pholoe glabra			X			
	Podarkeopsis glabra			X			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Podarkeopsis perkinsi			■			
	Poecilochaetus johnsoni			■			
	Tenonia priops			■			
PHYLUM ARTHROPODA							
*	*Aspidochoncha limnoriae*	ostracod		■			
	Asteropella slatteryi	ostracod		■			
	Bathyleberis spp.	ostracod		■			
	Conchoecinae sp.	ostracod		■			
	Cylindroleberis mariae	ostracod		■			
	Cylindroleberis sp.	ostracod		■			
	Euphilomedes producta	ostracod		■			
	Euphilomedes carcharodonta	ostracod	■				
	Parasterope barnsei	ostracod	■	■			
	Philomedes spp.	ostracod		■			
	Podocopidae sp.	ostracod		■			
*	*Redekea californica*	ostracod		■			
	Rutiderma cf. *judayi*	ostracod		■			
	Rutiderma lomae	ostracod		■			
	Sarsiella spp.	ostracod		■			
	Soleroconcha spp.	ostracod		■			
	Cyclopoid spp.	cyclopoid		■			
	Harpacticoid spp.	harpacticoid		■			
	Parastephos esterlyi	copepod		■			
*	*Balanus amphitrite*	little striped barnacle			■	■	on rocks, pilings, and shells in bays and estuaries; from low tide line to 197 ft (60 m) deep.
*	*Balanus tintinnabulum*	red and white barnacle			■		
	Megabalanus californianus	red and white barnacle			■	■	on rocks, pilings, kelps, and other hard-shelled animals; from low tide line to 30 ft (9 m) deep.
	Chthamalus sp.	barnacle			■		
	Campylaspis rubromaculata	cumacean		■			
	Cumacea, unidentified	cumacean	■				
	Cyclaspis sp.	cumacean		■			
	Diastylis sp.	cumacean		■			
	Eudorella pacifica	cumacean		■			
	Oxyurolostylis pacifica	cumacean		■			
	Acanthomysis macropsis	mysid		■			in water just above unconsolidated sediment
	Archeomysis maculata	mysid		■			in water just above unconsolidated sediment
	Heteromysis odontops	mysid		■			in water just above unconsolidated sediment
	Holmesimysis sp.	mysid	■				
	Mysida, unidentified	mysid	■				
	Mysidopsis californica	mysid		■			in water just above unconsolidated sediment
	Mysidopsis intii	mysid		■			in water just above unconsolidated sediment

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Neomysis kadiakensis	mysid		X			in water just above unconsolidated sediment
	Neomysis sp.	mysid	X				
	Epinebalia spp.	nebalian		X			
	Nebalia daytoni	nebalian		X			
	Nebalia pugettensis	nebalian		X			
	Leptochelia cf. *dubia*	tanaid		X			
	Leptochelia sp.	tanaid		X			
*	Tanaid sp.	tanaid		X			
	Tanaidacea, unidentified	tanaid	X				
	Zeuxo narmani	tanaid		X			
	Schizobopyrina striata	bopyrid		X			
	Munna spp.	munnid		X			
	Cilicaea sculpta	sphaeromid		X			
*	*Sphaeroma quoyanum*	sphaeromid		X			
	Sphaeromatidae sp.	seriolid		X			
	Austrosignum tillerae	isopod		X			
	Cirolana harfordi	cirolanid		X			
	Paracerceis sculpta	isopod	X				
	Paranthura elegans	anthurid	X	X			
	Seriolis carinata	isopod		X			
	Ampelisca brevisimulata	ampeliscid		X			
	Ampelisca cristata	ampeliscid		X			
	Ampelisca hancocki	ampeliscid		X			
	Ampelisca sp.	ampeliscid		X			
	Ampeliscidae spp.	ampeliscid		X			
	Amphilochidae spp.	amphilochid		X			
	Amphithoe sp.	amphithoid		X			
	Ampithoidae spp.	amphithoid		X			
	Acuminodeutopus heteruropus	aorid		X			
	Amphideutopus oculatus	aorid		X			
	Lembos macromanus	aorid		X			
	Microdeutopus schmitti	aorid		X			
	Rudilembroides stenopropodus	aorid		X			
	Corophiidae spp.	corophiid		X			tube forming species
*	*Corophium acherusicum*	corophiid	X	X			
*	*Corophium uenoi*	corophiid		X			tube forming species
	Erichthonius brasiliensis	corophiid		X			
*	*Grandidierella cf. japonica*	corophiid	X	X			
	Dexaminidae spp.	desaminid		X			
	Eusiridae spp.	eusirid		X			
	Hyale frequens	hyalid		X			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Hyale spp.	hyalid		X			
	Hyalidae spp.	hyalid		X			
	Isaeidae spp.	isaeid		X			
	Leucothoe alata	leucothoid		X			
	Listriella goleta	liljeborgiid					
	Listrella spp.	liljeborgiid		X			
	Lysianassidae spp.	lysianassid		X			
	Orchomene pacifica	lysianassid		X			
	Orchomene pinguis	lysianassid	X				
	Orchomene sp.	lysianassid		X			
	Oedicerotidae spp.	oedicerotid		X			
	Synchelidium rectipalmum	oedicerotid		X			
	Synchelidium shoemakeri	oedicerotid	X				
	Photis sp.	gammarid		X			
	Paraphoxus spp.	phoxocephalid		X			
	Parapluestes spp.	pleustid		X			
	Pleustidae sp.	pleustid		X			
*	*Podocerus brasiliensis*	podocerid		X			
	Pontogeneia minuta	gammarid		X			
	Pontogeneia rostrata	gammarid		X			
*	*Stenothoe valida*	stenothoid	X	X			
	Elasmopus rapax	gammarid		X			
	Gammaridae spp.	gammarid	X				
	Gammaropsis thompsoni	gammarid		X			
	Heterophoxus oculatus	gammarid		X			
	Monoculodes hartmanae	gammarid		X			
	Synchelidium sp.	gammarid		X			
	Tiron biocellata	synophiid		X			
	Caprella californica	California skeleton shrimp	X	X			on vegetation/zoobotryon; usually above unconsolidated sediment
	Caprella equilbra	skeleton shrimp	X	X			on vegetation/zoobotryon; usually above unconsolidated sediment
	Caprella mendax	skeleton shrimp	X	X			on vegetation/zoobotryon; usually above unconsolidated sediment
	Caprella spp.	skeleton shrimp	X	X			on vegetation/zoobotryon; usually above unconsolidated sediment; eelgrass
	Caprelliidae spp.	skeleton shrimp	X	X			on vegetation/zoobotryon; usually above unconsolidated sediment
	Mayerella banksia	caprellid		X			
	Euphilomedes carcharodonta	seed shrimp		X			
	Alpheus californiensis	alpheid shrimp		X			
	Alpheus sp.A., sp. B	alpheid shrimp	X				
	Betaeus harrimani	alpheid shrimp	X				
	Betaeus longidactylus	alpheid shrimp	X				
	Betaeus sp.	alpheid shrimp	X				
	Atyidae spp.	decapod		X			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Callianassa californiensis	red ghost shrimp	X	X			
	Upogebia pugettensis	callianassid shrimp	X				
	Crangon franiscorum	crangonid shrimp	X				
	Crangon spp.	crangonid shrimp		X			
	Processa canaliculata	crangonid shrimp		X			
	Heptocarpus cf. *taylori*	hippolytid shrimp					
	Heptocarpus sp. A	hippolytid shrimp	X				
	Heptocarpus spp.	hippolytid shrimp		X			
	Hipployte californiensis	grass shrimp		X			
	Hippolyte california	hippolytid shrimp	X				
	Hippolyte spp.	hippolytid shrimp		X			
	Spriontocaris sp.	hippolytid shrimp		X			
	Pugettia producta	kelp crab			X	X	rocks and pilings from low tide line to 1,427 ft (435 m) deep
	Pyromaia tuberculata	decapod	X	X			
*	*Palaemon macrodactylus*	decapod	X				
	Panulirus interruptus	California spiny lobster			X	X	associated with rock riprap, buoy anchors and other man made objects; at low tide line to moderately deep water
	Hemigrapsus oregonensis	mudflat crab		X			intertidal and subtidal unconsolidated sediment; on mud flats and eelgrass beds between the high and low tide lines
	Pinnixa barnharti	pinnotherid crab		X			
	Scleroplax granulata	pinnotherid crab		X			intertidal mudflats
	Uca crenulata	fiddler crab		X			intertidal mud flats; in burrows in sandy mud bays near and estuaries near high tide line
	Portunus xantusi	swimming crab		X			swims just above mud, rests on bottom
	Cancer antennarius	common rock crab		X	X		gravel bottoms from between the low and high tide line to 131 ft (40 m) deep
	Cancer anthonyi	rock crab		X			
	Lophopanopeus bellus diegensis	xanthid mud crab	X	X			under rocks on mud or sand bottoms; from low tide line to 240 ft (73 m) deep
	Lophopanopeus sp.	xanthid crab		X			
	Brachyurs, unidentified	decapod	X				
	Caridea, unidentified	carideau shrimp	X				
	Hemisquilla ensigera	mantis shrimp		X			
	Malacoplax californiensis	mudflat crab		X			
	Nyeotrypaea californiensis	decapod		X			
	Pseudosquilla mamorata	mantis shrimp		X			
	Schmittius politus	mantis shrimp		X			
	Urocaris infraspinis	decapod		X			
PHYLUM MOLLUSCA							
	Acteocina culcitella	bubble shell	X				
	Acteocina inculta	bubble shell		X			
	Acteocina magdalenenis	glassy bubble		X			
	Cylichna alba	acteocinid	X				
	Cylichnella harpa	acteocinid tectibranch		X			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Cylichnella inculta	acteocinid tectibranch		■			
	Aelidae spp.	aelid		■			
	Aplysia californica	California sea hare	■	■			unconsolidated sediment; sheltered locations; from low tide line to 59 ft (18 m) deep; feed on red, brown, and green algae, and eelgrass
	Assiminea californica	assimineid snail		■			
	Caecum californicum	California caecum		■			
	Fartulum occidentale	caecid		■			
	Crepidula fornicata	gastropod		■	■		
	Crepidula onyx	onyx slipper shell		■	■		
	Crepipatela lingulata	half-slipper shell		■	■		
	Aglaja diomedia	tectibranch		■			
	Bulla gouldiana	Gould's bubble	■	■			
	Chelidonura inermis	large sea slug	■	■			
	Haminaea vesicula	blister paper bubble		■			
	Cerithidea californica	California horn shell		■			intertidal mudflat/saltmarsh habitat
	Cerithidea fuscata	horn shell snail		■			unconsolidated sediment on mudflats and in saltmarsh
	Columbellidae spp.	columbellid		■			
	Mitrella carinata	dove shell		■			
	Mitrella tuberosa	columbellid	■				
	Collisela depicta	fissurellid		■			
	Lacuna marmorata	chink shell		■			
	Nassarius perpinguis	gastropod					
	Nassarius tegula	mud-dog whelk	■	■			
	Neverita reclusiana	gastropod		■			
	Nudibranch spp.	nudibranch		■			
	Olivella baetica	olive shell		■			
	Olivella sp.	olive shell		■			
	Tricolia compta	banded pheasant		■			
	Odostomia sp.	odostome		■			
	Turbonilla sp.	pyramidellid					
	Alvinia spp.	rissoid snail		■			
	Barleeia californica	rissoid snail	■	■			
	Barleeia subtenuis	rissoid snail		■			
	Rissoella sp.	rissoid snail		■			
	Vitrinorbis diegensis	vitronorbis		■			
	Vitrinellidae spp.	vitrinella		■			
	Aclis tectibranch	gastropod	■	■			
	Acmira catherinae	gastropod		■			
	Acmira horikoshii	gastropod		■			
	Alabina spp.	gastropod		■			
	Crucibulum spinosum	cup and saucer limpet	■	■			

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	Scientific Name	Common Name	Eelgrass	Unconsolidated Sediment	Hard Substrate	Artificial Hard Substrate	Notes
	Ophiodermella ophioderma	penciled turret shell		X			
	Ophiodermella spp.	turret shell		X			
	Philine sp.	gastropod		X			
	Sulcoretusa xystrum	gastropod		X			
	Tachyhynchus sp.	turret shell		X			
	Mactra californica	California dish clam		X			
	Spisula catilliformis	narrow dish clam		X			
	Spisula spp.	dish clam		X			
	Platyodon cancellatus	checked borer		X			
*	*Geukensia (Ischadium) demissa*	ribbed mussel		X			
*	*Musculista senhousia*	Japanese muscle	X	X			
	Mytilus edulis	bay mussel			X		
*	*Mytilus galloprovincialis*	mytilid					
	Volsella flabellata (Modiolus modiolus)	giant horsemussel		X			
	Gari californica	sunset clam		X			
	Tagelus californianus	jackknife clam	X	X			
	Tagelus subteres	jackknife clam		X			
	Siliqua lucida	solenid clam		X			
	Solen rosaceus	rosy razor clam		X			
	Solen sicarius	razor clam		X			
	Macoma nasuta	bent-nosed clam	X	X			
	Macoma secta	sand-flat clam	X	X			
	Macoma yoldiformis	tellinid clam		X			
*	*Lyrodus pedicellatus*	southern shipworm		X		X	
*	*Teredo navalis*	shipworm		X		X	
*	*Tapes japonica (semidecussata)*	venerid clam		X			
	Tivela sp.	venus clam		X			
	Veneridae spp.	venerid clam		X			
	Asthenothaerus villiosior	clam		X			
	Laevicardium substriatum	eggshell clam		X			
*	*Theora fragilis*	clam		X			
	Octopus bimaculatus	two-spotted octopus		X			intertidal, subtidal, unconsolidated sediment, man-made
	Octopus bimaculoides			X		X	intertidal, subtidal, unconsolidated sediment, man-made
PHYLUM ECHINODERMATA							
	Dendraster excentricus	eccentric sand dollar		X			sand, silt, sediment; on sand bottoms of sheltered bays and open coasts; from low tide line to 131 ft (40 m) deep
	Holothuroidea sp.	sea cucumber	X				
	Leptosynapata albicans	Southern California sea cucumber	X	X			
	Amphiodia (nr) *occidentalis*	brittle star	X	X			in sand under rocks, algae, mudflats, and eelgrass roots; from low tide line to 1,214 ft (370 m) deep

Table E-2. San Diego Bay Invertebrate Species and Their Habitats. (Continued)

SPECIES			HABITAT				
Exotic	**Scientific Name**	**Common Name**	**Eelgrass**	**Unconsolidated Sediment**	**Hard Substrate**	**Artificial Hard Substrate**	**Notes**
	Amphipholis pugetana	brittle star		■			
	Axiognathus squamatus	brittle star	■	■	■		unconsolidated sediment; among gravel in tide pools, in crevices and algal holdfasts, on rocky shores; from between the high tide and low tide line to 2,625 ft (800 m) deep
	Ophiactis simplex	brittle star		■			
	Ophiuroidea sp.		■				
PHYLUM PHORONIDA							
	Phoronid spp.	phoronid		■			
PHYLUM ECTOPROCTA							
	Amathia spp.	bryzoan		■	■		
	Bowerbankia spp.	bryzoan		■	■		
	Bryzoan spp.	bryzoan		■	■		
	Bugula neritina	bryzoan		■	■		
	Cheilostomata sp.	bryzoan		■	■		
	Cryptosula pallasiana	bryzoan		■	■		
	Thalamoporella californica	bryzoan		■	■		
	Zoobotryon verticillatum	bryzoan		■			on surface of unconsolidated sediment, becomes very abundant during summer
PHYLUM CHORDATA							
*	*Botrylloides diegensis*	tunicate		■	■		
*	*Botryllus schlosseri*	tunicate		■	■		
*	*Ciona intestinalis*	tunicate		■		■	unconsolidated sediment and piling/float surface
*	*Ciona savignyi*	tunicate		■		■	unconsolidated sediment and piling/float surface
*	*Microcosmus squamiger*	tunicate		■		■	unconsolidated sediment and piling/float surface
*	*Polyandrocarpa zorritensis*	tunicate		■		■	unconsolidated sediment and piling/float surface
*	*Styela canopus*	tunicate		■		■	unconsolidated sediment and piling/float surface
*	*Styela clava* (formerly *barnharti*)	tunicate		■			
*	*Styela plicata*	tunicate	■	■			
	Branchiostoma californiense	lancelet		■			

Table E-3. San Diego Bay Fishes: Their Habitats and Feeding Strategies.

SPECIES			HABITAT							DIET			
				Relative Abundance[2]									
				Intertidal		Nearshore							
Exotic	Scientific Name	Common Name	Functional Group/Bay Region[1]	noveg	veg	noveg	veg	Channel	Notes on Habitat Use and Feeding	Fish	Aquatic Invertebrate	Aquatic Vegetation	Plankton
SHARKS AND RAYS													
	Carcharhinus remotus	narrowtooth shark							open water				
	Galeorhinus zyopterus	soupfin shark							open water; feed on fish and some squid				
	Mustelus californicus	gray smoothhound							open water; feed on crabs, fishes and shrimp				
	Mustelus henlei	brown smoothhound							open water; feed on crabs, shrimp and some fish				
	Mustelus lunulatus	sicklefin smoothhound							open water				
	Prionace glauca	blue shark							open water;shallow coastal waters over sand and mud; generally feed on small schooling fishes				
	Triakis semifasciata	leopard shark							demersal; over sand and mud in shallow bays and inshore waters to depths of 300 ft (91 m)				
	Gymnura marmorata	California butterfly ray							demersal on unconsolidated sediment				
	Heterodontus francisci	California hornshark							demersal on unconsolidated sediment				
	Myliobatis californica	bat ray							demersal on unconsolidated sediment; shallow, sandy areas in bays and on coasts to 150 ft (46 m); kelp beds.				
	Platyrhinoidis triseriata	thornback							demersal on unconsolidated sediment; over sand and mud to depths of 150 ft(46 m); feed on sand-dwelling worms, snails, clams, crabs, and shrimps; ovoviviparous				
	Urolophus halleri	round stingray	TOP10EI N, NC, SC, S						demersal on unconsolidated sediment; over sand or mud in shallow bays and off coast to 69 ft (21 m). Feed on shrimps, crabs, snails, and clams.				
	Zapteryx exasperatus	banded guitarfish							demersal on unconsolidated sediment				
	Sphyrna zygaena	smooth hammerhead shark							open water				
	Squalus acanthias	spiny dogfish							open water; soft bottoms; migratory				
	Squatina californica	pacific angel shark							demersal, sandy and muddy bottoms from shallow water to 600 ft (183 m); usually feed on prey such as the California halibut				
BONY FISH													
	Albula vulpes	bonefish	NC, S						openwater, shallow waters over soft bottoms; feed on clams, snails, shrimps, and small fishes				
	Atherinops affinis	topsmelt	TOP10EI N, NC, SC, S						open water; surface waters near shore, in basy, and around kelp beds; topsmelt mature in two to three years and spawn during the late winter and spring, often over estuaries and mudflats, attaching eggs to kelp and other algae, feed on plankton and algae				
	Atherinopsis californiensis	jacksmelt	N, NC, SC, S						open water				
	Leuresthes tenuis	California grunion	N, NC, SC						open water; off sandy beaches to depths of 59 ft (18 m); spawns on beaches at night during spring high tide; eggs are buried in sand and hatch when the next spring tide occurs				
	Porichthys myriaster	specklefin midshipman							demersal on unconsolidated sediment				
	Porichthys notatus	plainfin midshipman							demersal on unconsolidated sediment; over sand and mud to depths of 1,200 ft (366 m); occurs in shallow water during the late spring to spawn; male becomes emaciated while guarding the eggs and young; feeds at night on other fishes and crustaceans				
	Strongylura exilis	California needlefish	NC, SC, S						open water				
	Hypsoblennius gentilis	bay blenny	VEGSPP N, NC						on bottom				

Table E-3. San Diego Bay Fishes: Their Habitats and Feeding Strategies. (Continued)

SPECIES			HABITAT							DIET			
				Relative Abundance[2]									
			Functional Group/Bay Region[1]	Intertidal		Nearshore							
Exotic	Scientific Name	Common Name		noveg	veg	noveg	veg	Channel	Notes on Habitat Use and Feeding	Fish	Aquatic Invertebrate	Aquatic Vegetation	Plankton
	Hypsoblennius jenkensi	mussel blenny							on hard structure in association with mussels/barnacles				
	Citharichthys stigmaeus	speckled sand dab							demersal on unconsolidated sediment; over soft bottoms to 1,800 ft (549 m); spawns during the winter; some females spawn twice a season				
	Hippoglossina stomata	bigmouth sole							demersal on unconsolidated sediment				
	Xysteurys liolepis	fantail sole	N, NC						demersal on unconsolidated sediment				
	Caranx caballus	green jack							open water				
	Caranx hippos	crevalle jack							open water				
	Trachurus symmetricus	jack mackerel							open water; offshore on surface and at midwater; around reefs and kelp; feed on krill, squids, anchovies, and lanternfishes; major food source for seals, sea lions, porpoises, swordfishes, sea basses, and pelicans				
	Chanos chanos	milkfish							open water				
	Gibbonsia elegans	spotted kelpfish	VEGSPP N, NC						demersal on unconsolidated sediment				
	Gibbonsia montereyensis	crevice kelpfish							demersal on unconsolidated sediment				
	Heterostichus rostratus	giant kelpfish	TOP10EI, VEGSPP N, NC, SC, S						demersal on unconsolidated sediment; rocky areas with eelgrass, leafy red algae, jointed coralline algae, or kelp beds to depths of 132 ft (40 m); feed on small crustaceans, mollusks, and fishes				
	Parachinus integripinnis	reef finspot	VEGSPP										
	Scorpaenichthys marmoratus	cabezon							demersel on unconsolidated sediment and hard substrate; rocks and reefs in intertidal zone and below low tide level to 252 ft (77m)				
	Scorpaena guttata	spotted scorpionfish	N, NC										
	Symphurus atricauda	California tonguefish	N, NC						demersal on unconsolidated sediment				
	Fundulus parvipinnis	California killfish	BESPP NC, SC, S						open water near bottom				
	Amphistichus argenteus	barred surfperch							demersal				
	Cymatogaster aggregata	shiner surfperch	TOP10EI, VEGSPP N, NC, SC, S						demersal; in bays around piers				
	Damalichthys vacca	pile surfperch							demersal				
	Embiotoca jacksoni	black surfperch	VEGSPP NC						demersal; is this the same as the striped seaperch (*Embiotica lateralis*)				
	Hyperprosopon argenteum	walleye surfperch							demersal; surf, over snad, around piers, reefs, and kelp beds, bays up to depths of 59 ft (18 m); breeds October through December, giving birth to between five and twelve young in the spring; feeds on small crustaceans				
	Micrometrus minimus	dwarf surfperch	VEGSPP N						demersal				
	Phanerodon furcatus	white surfperch							demersal				
	Rhacochilus toxotes	rubberlip surfperch							demersal;reefs, piers, and kelp beds, from shallow bays to 150 ft (46 m); feeds on shrimp, amphipods, small crabs, and other crustaceans				
	Anchoa compressa	deepbody anchovy	BESPP NC, SC, S						open water				

Table E-3. San Diego Bay Fishes: Their Habitats and Feeding Strategies. (Continued)

SPECIES			HABITAT							DIET			
				Relative Abundance[2]									
				Intertidal		Nearshore							
Exotic	Scientific Name	Common Name	Functional Group/Bay Region[1]	noveg	veg	noveg	veg	Channel	Notes on Habitat Use and Feeding	Fish	Aquatic Invertebrate	Aquatic Vegetation	Plankton
	Anchoa delicatissima	slough anchovy	TOP10EI, BESPP N, NC, SC, S						open water				
	Cetengraulis mysticetus	anchoveta							open water				
	Engraulis mordax	northern anchovy	TOP10EI, RCSPP N, NC, SC, S						open water; spawns during winter and early spring, and the pelagic eggs take only 2–4 days to hatch; schools move large distances up and down the coast; important food source for other fishes, birds, and mammals				
	Sardinops sagax	Pacific sardine	TOP10EI, RCSPP N, NC, SC						open water				
	Girella nigricans	opaleye							demersal; unconsolidated sediment and hard substrate; shallow reefs and kelp beds to depths of 96 ft (29 m); spawn from April–May and area mature at two to three years; feed on algae and eelgrass, get nourishment from small animals living on the plants				
*	*Acanthogobius flavimanus*	yellowfin goby	SC, S						on/in unconsolidated sediment				
	Clevelandia ios	arrow goby	BESPP N, NC, SC, S						on/in unconsolidated sediment				
	Gillichthys mirabilis	longjaw mudsucker	BESPP						on/in unconsolidated sediment				
	Gobionellus longicaudus	longtail goby							on/in unconsolidated sediment				
	Ilypnus gilberti	cheekspot goby	BESPP N, NC, SC, S						on/in unconsolidated sediment				
	Lepidogobius lepidus	bay goby							on/in unconsolidated sediment				
	Quietula y-cauda	shadow goby	BESPP N, NC, SC, S						on/in unconsolidated sediment				
*	*Tridentiger trigonocephalus*	chameleon goby							on/in unconsolidated sediment				
	Haemulon flaviguttatum	Cortez grunt							demersal				
	Hyporhamphus rosae	California halfbeak	BESPP N, NC, SC, S						open water				
	Hermosilla azurea	zebra perch							open water				
	Halichoeres semicinctus	rock wrasse	N										
	Oxyjulis californica	senorita	N						Reefs and kelp beds to depths of 150 ft (46 m). Feed on small snails, crustaceans, worms, and larval fishes.				
	Mugil cephalus	striped mullet	BESPP S						demersal on unconsolidated sediment; this species supports the only commercial fishery in the Bay; coasts, estuaries, and fresh water; important food fish that travel up rivers but spawn in the sea				
	Leptocottus armatus	staghorn sculpin	N, NC, SC, S										
	Hypsopsetta guttulata	diamond turbot	BESPP N, NC, SC, S						demersal on unconsolidated sediment; over soft bottoms from6–150 ft (2–46 m)				
	Paralichthys californicus	California halibut	TOP10EI, RCSPP N, NC, SC, S						demersal on unconsolidated sediment; over soft bottoms to 600 ft (183 m); important commercial fish				

Table E-3. San Diego Bay Fishes: Their Habitats and Feeding Strategies. (Continued)

SPECIES			HABITAT							DIET			
				Relative Abundance[2]									
				Intertidal		Nearshore							
Exotic	Scientific Name	Common Name	Functional Group/Bay Region[1]	noveg	veg	noveg	veg	Channel	Notes on Habitat Use and Feeding	Fish	Aquatic Invertebrate	Aquatic Vegetation	Plankton
	Platichthys stellatus	starry flounder							demersal on unconsolidated sediment; in bays and estuaries over soft bottoms, and often open coast to 900 ft (274 m); feeds on crabs, shrimps, worms, clams, and small fishes; can tolerate low salininty				
	Pleuronectes vetulus	English sole							demersal on unconsolidated sediment; over soft bottoms to 1,800 ft (549 m); migratory fish that can travel up to 700 mi (1,127 km); among top three flat fish in terms of pounds caught by commercial trawlers				
	Pleuronichthys coenosus	CO turbot							demersal on unconsolidated sediment; over soft bottoms and rocks to depths of 1,140 ft (347 m); probably spawn during late winter and early spring; eggs float near surface				
	Pleuronichthys ritteri	spotted turbot	BESPP N, NC						demersal on unconsolidated sediment				
	Pleuronichthys verticalis	hornyhead turbot							demersal on unconsolidated sediment				
	Anisotremus davidsonii	sargo							open water				
	Xenistius californiensis	salema	N, NC, SC						open water				
	Atractoscion nobilis	white seabass							demersal on unconsolidated sediment and hard substrate				
	Cheilotrema saturnum	black croaker	N, NC, SC, S						demersal on unconsolidated sediment				
	Genyonemus lineatus	white croaker							demersal on unconsolidated sediment				
	Menticurrhus undulatus	California corbina							demersal on unconsolidated sediment				
	Roncador stearnsii	spotfin croaker							demersal on unconsolidated sediment				
	Seriphus politus	queenfish	N						demersal on unconsolidated sediment				
	Umbrina roncador	yellowfin croaker	N, NC, SC, S						demersal on unconsolidated sediment; over sand in surf zone, near rocks or kelp and to 26 ft (8 m) in bays; spawn during summer				
	Sarda chiliensis	pacific bonito							open water				
	Scomber japonicus	pacific mackerel	N, NC, SC						open water; warm coastal waters over continental shelf; schooling fish that feed on other schooling fish like anchovies and herrings, and also feed on invertebrates				
	Scomberomorus sierra	sierra							open water				
	Medialuna californiensis	halfmoon							demersal; reefs and kelp beds from near surface to depths of 132 ft (40 m); probably spawn during summer and fall; mature at about two years; feed on small invertebrates, especially those living amon algae"				
*	*Morone (Roccus) saxatilis*	striped bass							open water; inshore over various bottoms and freshwater inlets; spawns in freshwater.				
	Paralabrax clathratus	kelp bass	VEGSPP, RCSPP N, NC						demersal on unconsolidated sediment and hard substrate; reefs, wrecks and kelp beds to 150 ft (46 m); feeds on crustaceans, squids, octopuses, polychaete worms and fishes				
	Paralabrax maculatofasciatus	spotted sand bass	TOP10EI, BESPP, RCSPP N, NC, SC, S						demersal on unconsolidated sediment				
	Paralabrax nebulifer	barred sand bass	TOP10EI, RCSPP N, NC, SC, S						demersal on unconsolidated sediment				
	Sphyraena argentea	California barracuda	N, NC						open water				
	Peprilus simillimus	pacific butterfish											

Table E-3. San Diego Bay Fishes: Their Habitats and Feeding Strategies. (Continued)

SPECIES			HABITAT							DIET			
				Relative Abundance[2]									
				Intertidal		Nearshore							
Exotic	Scientific Name	Common Name	Functional Group/Bay Region[1]	noveg	veg	noveg	veg	Channel	Notes on Habitat Use and Feeding	Fish	Aquatic Invertebrate	Aquatic Vegetation	Plankton
	Bryx arctos	snubnose pipefish							demersal mostly associated with vegetation or zoobotryon				
	Hippocampus ingens	pacific seahorse	VEGSPP						demersal mostly associated with vegetation or zoobotryon				
	Syngnathus auliscus	barred pipefish	VEGSPP N, NC, SC, S						demersal mostly associated with vegetation or zoobotryon				
	Syngnathus californiensis	kelp pipefish	N, NC, SC, S						demersal mostly associated with vegetation or zoobotryon				
	Syngnathus exilis	barcheek pipefish	N, NC, SC, S						demersal mostly associated with vegetation or zoobotryon				
	Syngnathus griseolineatus	bay pipefish	VEGSPP N, NC, SC, S						demersal mostly associated with vegetation or zoobotryon; mate in early summer and female deposits eggs in brood pouch of male; feed on small crustaceans				
	Synodus lucioceps	California lizardfish	N						demersal on unconsolidated sediment				

1. Functional Groups: TOP10EI—Top 10 Species in Ecological Index; BESPP—Indigenous Bay Estuarine Species; VEGSPP—Species Closely Associated with Eelgrass; RCSPP—Recreational and Commercial Species. Bay Regions: N—North; NC—North-central; SC—South-central; S—South.
2. Shading of relative abundance in three categories (1-33%, 34-66%, and 67-100%, lightest to darkest respectively) is based on sampling by Allen (1998). Unfilled spaces indicate none or few of that species were captured in Allen's study.

Table E-4. San Diego Bay Birds: Their Diet, Status, and Habitat.

	SPECIES		DIET					STATUS[1]	HABITAT													
	Scientific Name	Common Name	Aquatic vegetation	Fish	Aquatic Inverts	Small Vertebrates	Scavenge		Open Water	Deep Subtidal	Medium Subtidal	Shallow Subtidal	Shallow Subtidal Vegetation	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Salt Works	Artificial Structures	Freshwater Marsh	Riparian	Upland Transition
WATERFOWL																						
Dabbling Ducks	*Anas acuta*	northern pintail	X		X			WO				X	X				X					X
Dabbling Ducks	*Anas americana*	American wigeon	X		X			W				X	X			X	X					X
Dabbling Ducks	*Anas crecca*	green-winged teal	X		X			WO				X	X			X	X					X
Dabbling Ducks	*Anas clypeata*	northern shoveler	X		X			WO				X	X			X	X					X
Dabbling Ducks	*Anas cyanoptera*	cinnamon teal	X		X			BR				X	X			X	X					X
Dabbling Ducks	*Anas platyrhynchos*	mallard	X		X			BR				X	X			X	X					X
Dabbling Ducks	*Anas strepera*	gadwall	X		X			BR				X	X				X					
Diving Ducks	*Aythya americana*	redhead	X		X			BR				X	X									
Diving Ducks	*Aythya collaris*	ring-necked duck	X		X			W	X	X	X		X			X	X					X
Diving Ducks	*Melanitta perspicillata*	surf scoter			X			W	X	X	X	X		X	X							
Diving Ducks	*Bucephala albeola*	bufflehead			X			W	X	X	X	X				X	X	X				
Diving Ducks	*Aythya affinis*	lesser scaup	X		X			W	X	X	X		X			X	X					
Diving Ducks	*Bucephala clangula*	common golden-eye			X			W	X	X	X							X				
Diving Ducks	*Clangula hyemalis*	oldsquaw			X			V	X	X	X							X				
Diving Ducks	*Melanitta fusca*	white-winged scoter			X			WV	X	X	X						X					
Diving Ducks	*Mergus serrator*	red-breasted merganser		X	X			W	X	X	X						X					
Diving Ducks	*Oxyura jamaicensis*	ruddy duck	X		X			BR	X	X	X		X			X	X					
Geese	*Branta canadensis parvipes*	lesser Canada goose	X		X			W		X	X		X									
Geese	*Branta bernicla*	black brant	X		X			W	X	X	X		X				X					
Grebes	*Aechmophorus clarkii*	Clark's grebe		X	X		X	BR	X	X	X	X					X					
Grebes	*Aechmophorus occidentalis*	western grebe		X	X		X	BRW	X	X	X	X					X					
Grebes	*Podiceps auritus*	horned grebe		X	X			W	X	X	X	X					X					
Grebes	*Podiceps grisegena*	red-necked grebe	X	X	X			WV	X	X	X	X	X				X					
Grebes	*Podiceps nigricollis*	eared grebe		X	X			WO	X	X	X	X					X					
Grebes	*Podilymbus podiceps*	pied-billed grebe		X	X		X	BR	X	X	X	X					X					
SHOREBIRDS																						
Plovers	*Charadrius alexandrinus nivosus*	western snowy plover			X			EBR							X	X	X	X				X
Plovers	*Charadrius semipalmatus*	semipalmated plover			X			W							X	X	X	X				
Plovers	*Charadrius vociferus*	killdeer			X			BR						X	X	X	X	X				X
Plovers	*Pluvialis squatarola*	black-bellied plover			X			W							X	X	X	X				X

Table E-4. San Diego Bay Birds: Their Diet, Status, and Habitat. (Continued)

SPECIES			DIET					STATUS[1]	HABITAT													
	Scientific Name	Common Name	Aquatic vegetation	Fish	Aquatic Inverts	Small Vertebrates	Scavenge		Open Water	Deep Subtidal	Medium Subtidal	Shallow Subtidal	Shallow Subtidal Vegetation	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Salt Works	Artificial Structures	Freshwater Marsh	Riparian	Upland Transition
Sandpipers	*Actitis macularia*	spotted sandpiper	■		■			WB										■				
	Aphriza virgata	surfbird	■		■			W						■	■			■				
	Arenaria interpres	ruddy turnstone	■		■			W								■	■	■				
	Arenaria melanocephala	black turnstone			■			W						■		■	■					
	Calidris canutus	red knot	■		■			W								■	■	■				
	Calidris pusilla	semipalmated sandpiper			■			M									■	■				
	Capella gallinayo	common snipe			■			W									■	■				
	Catoptrophorus semipalmatus	willet		■	■			W						■	■	■	■	■				
	Calidris alba	sanderling			■			W							■	■	■	■				
	Calidris mauri	western sandpiper			■			W							■	■	■	■				
	Calidris alpinia	dunlin			■			W							■	■	■	■				
	Calidris minutilla	least sandpiper	■		■			W							■	■	■	■				
	Heteroscelus incanus	wandering tattler			■			W						■								
	Limnodromus griseus	short-billed dowitcher			■			W								■	■	■				
	Limnodromus scolopaceus	long-billed dowitcher			■			W								■	■	■				
	Limosa fedoa	marbled godwit			■			W								■	■	■				
	Numenius americana	long-billed curlew			■			W								■	■	■				
	Numenius phaeopus	whimbrel			■			W								■	■	■				
	Phalaropus lobatus	red-necked phalarope	■		■			M				■				■	■	■				
	Phalaropus tricolor	Wilson's phalarope	■		■			M				■				■	■	■				
	Tringa flavipes	lesser yellowlegs		■	■			M								■	■	■				
	Tringa melanoleuca	greater yellowlegs		■	■			W								■	■	■				
Others	*Haematopus bachmani*	black oystercatcher			■			V							■							
	Himantopus mexicanus	black-necked stilt			■			BR								■	■	■				
	Recurvirostra americana	American avocet	■	■	■	■	■	BR								■	■	■				

Table E-4. San Diego Bay Birds: Their Diet, Status, and Habitat. (Continued)

Group	Scientific Name	Common Name	Aquatic vegetation	Fish	Aquatic Inverts	Small Vertebrates	Scavenge	STATUS[1]	Open Water	Deep Subtidal	Medium Subtidal	Shallow Subtidal	Shallow Subtidal Vegetation	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Salt Works	Artificial Structures	Freshwater Marsh	Riparian	Upland Transition
SEABIRDS																						
Gulls	*Larus argentatus*	herring gull		X	X		X	W		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus thayeri*	Thayer's gull	X	X	X	X	X	W		X	X	X	X	X	X	X	X	X	X			
Gulls	*Larus californicus*	California gull			X	X		W		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus canus*	mew gull	X	X	X	X	X	W		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus delawarensis*	ring-billed gull	X	X	X	X	X	W		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus glaucescens*	glaucous-winged gull		X	X		X	W		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus heermanni*	Heerman's gull		X	X		X	R		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus occidentalis*	western gull		X	X		X	BR		X	X	X	X	X	X	X	X	X	X			X
Gulls	*Larus philadelphia*	Bonaparte's gull		X	X			W		X	X	X	X	X	X	X	X	X	X			X
Terns and Skimmers	*Rynchops niger*	black skimmer		X	X			BR		X	X	X			X	X		X				
Terns and Skimmers	*Sterna antillarum browni*	California least tern		X	X			SB		X	X	X			X	X	X	X	X			
Terns and Skimmers	*Sterna caspia*	Caspian tern		X	X			BR		X	X	X			X	X	X	X				
Terns and Skimmers	*Sterna forsteri*	Forster's tern		X	X			BR		X	X	X			X	X	X	X				
Terns and Skimmers	*Sterna hirundo*	common tern		X	X			M		X	X	X			X	X	X	X				
Terns and Skimmers	*Sterna nilotica*	gull-billed tern			X			SB		X	X	X			X	X	X	X				
Terns and Skimmers	*Sterna elegans*	elegant tern		X	X			BR		X	X	X			X	X	X	X				
Terns and Skimmers	*Sterna maximus*	royal tern		X	X			RO		X	X	X			X	X	X	X				
Others	*Pelecanus erythrorhynchos*	American white pelican		X				W		X	X	X					X		X			
Others	*Pelecanus occidentalis*	California brown pelican		X				ER		X	X	X					X		X			
Others	*Phalacrocorax auritus*	double-crested cormorant		X	X			BR		X	X							X	X			
Others	*Phalacrocorax pelagicus*	pelagic cormorant	X	X	X			W		X	X											
Others	*Phalacrocorax penicillatus*	Brandt's cormorant		X	X			BR		X	X								X			
Others	*Gavia immer*	common loon		X	X			W		X	X	X					X					
Others	*Gavia pacifica*	pacific loon	X	X	X			W		X	X	X	X				X					
Others	*Gavia stellata*	red-throated loon		X	X			W		X	X	X					X					
MARSH BIRDS																						
Rails	*Fulica americana*	American coot	X	X	X	X		BR		X	X	X	X	X	X	X	X	X	X	X	X	X
Rails	*Gallinula chloropus*	common moorhen	X		X	X	X	BR									X			X		
Rails	*Porzana carolina*	sora	X		X			WO				X					X					
Rails	*Rallus limicola*	Virginia rail		X	X			BR				X					X					
Rails	*Rallus longirostris levipes*	light-footed clapper rail	X		X			EBR				X					X					

Table E-4. San Diego Bay Birds: Their Diet, Status, and Habitat. (Continued)

	SPECIES		DIET					STATUS[1]	HABITAT													
	Scientific Name	Common Name	Aquatic vegetation	Fish	Aquatic Inverts	Small Vertebrates	Scavenge		Open Water	Deep Subtidal	Medium Subtidal	Shallow Subtidal	Shallow Subtidal Vegetation	Intertidal Rocky	Intertidal Sandy	Intertidal Mudflat	Salt Marsh	Salt Works	Artificial Structures	Freshwater Marsh	Riparian	Upland Transition
Herons and Egrets	*Ardea albus*	common egret		■	■	■		BR				■		■	■	■	■	■				
	Ardea herodias	great blue heron		■	■	■		BR				■		■	■	■	■					
	Butorides virescens	green-backed heron		■	■	■		BR				■					■					
	Egretta caerulea	little blue heron		■	■	■		BR				■					■					
	Egretta thula	snowy egret		■	■	■		BR				■				■	■	■		■		
	Egretta reufenscens	reddish egret		■	■	■		W				■				■	■	■				
	Egretta tricolor	tricolored heron		■	■	■		W				■				■	■					
	Nyctansassa violaceus	yellow-crowned night heron		■	■	■		V				■					■					
	Nycticorax nycticorax	black-crowned night heron		■	■	■		BR				■				■	■					
UPLAND TRANSITIONAL BIRDS																						
Hawks, Kites, and Owls	*Circus cyaneus*	northern harrier				■	■	BR														■
	Accipter cooperii	Cooper's hawk				■		BR														■
	Accipter striatus	sharp-shinned hawk				■		W														■
	Elanus leucurus	white-tailed kite				■		BR														■
	Falco columbarius	merlin				■																■
	Falco peregrinus	peregrine falcon				■	■								■	■	■	■	■	■		■
	Pandion haliaetus	osprey		■				RO		■	■	■							■			■
	Falco sparverius	American kestrel				■	■	BR								■	■	■				■
	Asio flammeus	short-eared owl				■		W										■				■
	Athene cunicularia hypugaea	burrowing owl				■		BR														■
Passerines	*Ammodramus sandwichensis beldingi*	Belding's savannah sparrow	■		■			EBR									■					■
	Ammodramus sandwichensis rostratus	Large-billed savannah sparrow	■		■			W									■					■
	Cistothorus palustris	marsh wren			■												■					■
	Lanius ludovicianus	loggerhead shrike			■	■																■
	Eremophila alpestris	coast horned lark	■		■											■	■					■
	Ceryls alcyon	belted kingfisher		■	■	■		BR														■

1. Status Code: B=breeds in county regularly; E=designated as endangered or threatened; M=occurs in county mainly in migration; O=breeds in county occasionally; R=year-round resident; S=mainly a summer visitor; V=vagrant; W= mainly a winter visitor

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Appendix F: Narratives on Sensitive Species Not Listed Under Federal or State Endangered Species Acts

Large-billed savannah sparrow—*Passerculus sandwichensis rostratus*

The large-billed savannah sparrow is a federal and California Species of Concern and a winter visitor to the San Diego Bay area. It is found in salt marsh habitats, and from its breeding grounds along the Gulf of California it was known to range eastward from the coast to the Salton Basin, and as far north as the Channel Islands, Morro Bay, and Santa Cruz (Garrett and Dunn 1981; Unitt 1984). It was once fairly common along the coast of California, but depletion of its salt marsh breeding grounds within the Colorado River delta in Mexico led to a drastic reduction in its numbers (Small 1994). The large-billed savannah sparrow is now regularly found in south Bay, especially on Christmas bird counts (J. Coatsworth, San Diego Audubon Society, pers. comm.). It can also still be seen in the Salton Basin. Although its numbers have been on the rise, its range is still highly restricted, with California being at the extreme north of that range (Small 1994).

Black skimmer—*Rynchops niger niger*

The black skimmer is considered a California Species of Concern that has colonized southern California from western Mexico since the 1960s and is now considered native to the area (Kaufman 1996). In San Diego Bay, it nests on the levees at the Salt Works in midsummer (Unitt 1984), where at least 400 nests were established in 1999 (Patton 1999). They are also found at the Salton Sea and Batiquitos Lagoon. Recently a resident population at Mission Bay became established, centered around Kendall-Frost Marsh and the beaches of Crown Point (J. Coatsworth, pers. comm.). Skimmers forage for small fish in tidal channels, diked ponds, shallow subtidal water, and deep water by trawling the water surface with their lower beaks, which are elongated and extend beyond the upper beaks (Small 1994). Preferred prey are northern anchovy, Pacific sardine, and topsmelt (Horn *et al.* 1996).

Black skimmers are threatened by disturbance of their nesting colonies, predation, and bioaccumulation (Kaufman 1996). Skimmer eggs tested in 1997 from the Salt Works were found to have detectable levels of a few organochlorine compounds. The compound with the highest level, *p,p'DDE,* is believed to be the most biologically active of the breakdown products of the pesticide DDT (Carol Roberts, USFWS, *pers. comm.* 2000). Black skimmer eggs from the Imperial Valley have higher levels than those from the Salt Works. In addition, the silty soils present in some of the saltwork levees can become cement-like when dried, decreasing the value of these areas for nesting sites (D. Stadtlander, U.S. Fish and Wildlife Service, pers. comm.). The population at the Salt Works has been growing annually (Unitt 1984), and establishment of further colonies in the San Diego Bay area is possible as the range of the species expands in the west (Unitt 1984).

Burrowing owl, coastal population—*Athene cunicularia hypugaea*

The burrowing owl is a breeding resident of upland areas around San Diego Bay. It is a California Species of Concern that is declining throughout its range, and nearing extirpation in coastal San Diego County (Unitt 1984; E. Copper, pers. comm.). It is also a federal Species of Concern. Burrowing owls form loose colonies, with both resident and migratory components (E. Copper, pers. comm.). Eggs are produced from late March to mid-June, and fledglings are active through August (Unitt 1984).

Occasionally, wintering owls appear at Silver Strand. These come during the months of September and October, and leave in January or February (C. Winchell, U.S. Fish and Wildlife Service, pers. comm.).

The burrowing owls in the San Diego Bay area represent a large part of the population county-wide, with the largest nesting colony in San Diego County on North Island (Unitt 1984; E. Copper, pers. comm.). Throughout their range, burrowing owls are threatened by habitat loss, predation, vehicle impacts, and control programs for ground squirrels (Kaufman 1996). Owl burrows are strongly correlated with ground squirrel burrow complexes.

Double-crested cormorant—*Phalacrocorax auritus albociliatus*

The double-crested cormorant is a breeding resident of San Diego Bay, and a California Species of Concern. These cormorants nest and roost mainly on artificial structures, and have been observed avoiding water vessels (U.S. Fish and Wildlife Service 1995a). They forage for fish in areas of open water. Their nesting schedule in the San Diego Bay area remains undescribed (Unitt 1984).

This species suffered a population decline during the 1960s and early 1970s due to DDT residues in marine food chains, and though there was some recovery in the late 1970s and 1980s, original population levels have not been restored (Small 1994). However, in some parts of its range, the cormorant population has recovered to the point where in March of 1998 the U.S. Fish and Wildlife Service ruled to establish a depredation order to protect commercial freshwater aquaculture (see http://www.epa.gov for details).

There is only one breeding site currently known in San Diego County, on an old dredge in the Salt Works of south San Diego Bay (Unitt 1984; U.S. Fish and Wildlife Service 1993; U.S. Fish and Wildlife Service 1995b; E. Copper, pers. comm.), where at least 80 nests were found in 1999 (Patton 1999). It once occurred at Lake Henshaw, and could establish itself elsewhere over time (Unitt 1984). The double-crested cormorant is vulnerable to bioaccumulation in its prey and to human disturbance of nesting locales.

Elegant tern—*Sterna elegans*

The elegant tern is a federal and California Species of Concern and a breeding resident of San Diego Bay.

There were about 1,700 breeding pairs at the Salt Works in 1999, with approximately 3,100 nests at the height of the season (Patton 1999). They also roost on mudflats, sandy beaches, and salt flats. They will utilize subtidal and deepwater areas for foraging. Egg-laying begins in April, but duration of the breeding season is unknown (Unit 1984).

There is one large breeding colony at the Salt Works (Unitt 1984) that has been documented as utilizing much of the south and central Bay (U.S. Fish and Wildlife Service 1995b). One elegant tern nest was found at Zuniga Jetty at the mouth of the Bay, but the eggs were predated by June (R. Patton, pers. comm.). This species was nearly undocumented in San Diego Bay prior to 1950, and the San Diego breeding colony was established in 1959 (Gallup and Bailey 1960; Small 1994). This range expansion appears to have been triggered by an increase in anchovy abundance, which may in turn have been a result of the 1957–58 El Niño conditions (Schaffner 1986; Small 1994).

Gull-billed tern—*Sterna nilotica vanrossemi*

The gull-billed tern is both a federal and California Species of Concern, as well as a summer breeding species in San Diego Bay. It has only recently colonized the San Diego Bay, with eleven to 20 pairs at the Salt Works, where it nests on the levees in mid-to-late summer (Unitt 1984; Small 1994; Patton 1999). It forages in marshes and upland transition habitats.

Coastal records are extremely rare, and almost all are from San Diego County, commencing in summer 1985 (Small 1994). From April through August 1987 up to six were at south San Diego Bay, fledging two young. This represented the first US west coast breeding record. By summer 1993, this colony had increased to ten breeding pairs. In 1997, a year when there may have been a food shortage for fish foraging birds in San DIego Bay, gull-billed terns were documented predating on California least tern and western snowy plover chicks at the Naval Amphibious Base (M. Kenney, USFWS, *pers. comm.*). Gull-billed terns were recorded in California at the south end of the Salton Sea in 1927 with a nesting colony of 500 pairs. In 1993, only 120 nesting pairs were present there (Small 1994). Erosion and predation at the Salton Sea have been problems for the nesting colonies there.

Loggerhead shrike—*Lanius ludovicianus*

The loggerhead shrike is both a federal and California Species of Concern. It is a breeding resident of upland transition habitats of the Bay, and forages over the high salt marsh. The loggerhead shrike was considered a common breeding resident of the San Diego Bay area fifteen years ago, but it is now uncommon to rare with few known nesting locations in the area (E. Copper, pers. comm.), although it is widely distributed throughout much of the county and state (Unitt 1984; Small 1994). This species, along with other shrikes, has been on the decline for some time. Although the reasons for this decline are not clearly known, they may be related to the bioaccumulation of pesticides from its prey (Small 1994; Kaufman 1996). Changes in habitat may also be contributing to this decline (Kaufman 1996).

The shrike requires dense shrubs for concealing its nests, with ample open ground nearby (Unitt 1984). Eggs are laid from early March through mid-June, and chicks are fledged by late July (Unitt 1984). Loggerhead shrikes prey upon insects and vertebrate species, including some of the other sensitive species around San Diego Bay (E. Copper, pers. comm.).

Long-billed curlew—*Numenius americanus*

The long-billed curlew is a California Species of Concern. It is a winter visitor to the tidal mudflats, estuaries, and salt marshes with tidal channels, as well as grasslands and sandy beaches (Garrett and Dunn 1981; Small 1994; E. Copper, pers. comm.). Its preferred breeding grounds are grasslands with nearby lakes or marshes (Small 1994). This is one of the largest shorebirds, and its down-curved bill can be up to 8 in (20 cm) long. It can often be seen with marbled godwits probing in the mud and sand for small prey (E. Copper, pers. comm.). One of its favorite prey are ghost shrimp.

This species has decreased through much of its range as a result of loss of habitat at breeding grounds and bioaccumulation (Kaufman 1996; E. Copper, pers. comm.). Also, many populations were subject to heavy hunting pressures in the late 1800s and early 1900s (Schoolnet, web site).

Short-eared owl—*Asio flammeus flammeus*

The short-eared owl is a California Species of Concern. It is a rare to uncommon winter visitor in salt marshes, grasslands, and agricultural areas (E. Copper, pers. comm.).

The short-eared owl can still be found at the Sweetwater Marsh (J. Coatsworth, pers. comm.). This species once nested in many areas in California (Unitt 1984), but no longer does so along the southern coastal areas (Remsen 1978). Its numbers in general are declining, especially in coastal areas where it is now considered uncommon (Garrett and Dunn 1981; E. Copper, pers. comm.). Loss of grasslands and marsh habitats to agriculture, pastures, and development have contributed to the decline of this species. Short-eared owls and their chicks are also vulnerable to predation by skunks, feral cats, and dogs (Audubon Watch List).

San Diego coast horned lizard—*Phrynosoma coronatum blainvillei*

Both a California and federal Species of Concern (a former federal Category 2), this species is recorded from the San Diego Bay area. Details on extant populations are sketchy, at best, though some may still remain along the Silver Strand and Coronado coastal scrub habitats (Jennings and Hayes 1994). Specific habitat requirements are loose, fine, sandy soils with limited vegetation cover. They may also be found in areas of denser shrub cover where small pockets of open habitat occur, such as those created by fire or other disturbance (Jennings and Hayes 1994). Its range extends through much of southern California west of the deserts, and into Baja California, Mexico, from sea level to 6,500 ft (2,000 m) (Smith 1946; Stebbins 1985). Historically, it was most abundant in riparian and coastal sage habitats of the coastal plains of southern California, but has disappeared from about 45% of the areas it once inhabited (Jennings and Hayes 1994).

The San Diego coast horned lizard is threatened by habitat fragmentation, non-native ant species (causing a degradation of the food base for horned lizards), off road vehicle activity, predation by domestic pets, and especially by collectors, though commercial collecting was banned in 1981 (Schoenherr 1992; Jennings and Hayes 1994). Since horned lizards rely primarily on camouflage to avoid predators, they are very easy for humans to catch, but survival in captivity is poor and few are ever returned to the wild.

Silvery legless lizard—*Anniella pulchra pulchra*

The silvery legless lizard is a California and a federal Species of Concern. Historically, the silvery legless lizard was common in areas of suitable habitat, including the Silver Strand. It may still occur there, and at the neighboring Naval Radio Receiving Facility where coastal dune vegetation also occurs, but the species has not been noted at either locale in recent surveys (U.S. Department of Agriculture 1989). There are no other documented occurrences for the legless lizard elsewhere in the San Diego Bay area, and little suitable habitat occurs except along the beaches of the Silver Strand and the Pacific side of Coronado. Preferred habitat appears to be coastal dunes with native shrubs for cover (Jennings and Hayes 1994).

Legless lizards spend most of their time buried in the soil (usually 1–4 inches/3–10 cm deep), emerging onto the surface primarily in the mornings and at night (Stebbins 1985; Jennings and Hayes 1994; Germano and Morafka 1996). They can also be found under surface objects such as logs, rocks, etc. They feed upon insect larvae, small adult insects, and spiders either at the surface or just below it (Stebbins 1985). Primary predators include alligator lizards, snakes, birds, deer mice, and domestic cats (Zeiner *et al.* 1988; Jennings and Hayes 1994). Legless lizards bear one to four young per year between September and November (Jennings and Hayes 1994).

Activities that are likely to result in soil compaction can be expected to negatively impact legless lizards. Also of concern are alterations to the plant community, where removal of vegetation can result in a drying of the soils, or invasion of certain non-native plants (e.g. *Carpobrotus edulis*) can alter the soil structure. *Carpobrotus* and other invasive weeds also tend to support a much lower arthropod community (Nagano 1979; Snover 1992 and unpublished data), providing much less food for lizards and other animals.

Globose dune beetle—*Coelus globosus*

The globose dune beetle is a federal Species of Concern that inhabits coastal sand dunes and sand hummocks in scattered localities from Bodega Head, Sonoma County to Ensenada, Baja California, as well as the channel islands (except San Clemente) (Nagano 1979; Snover 1992). Throughout much of its range it co-occurs with the closely related *Coelus ciliatus*. Its population status has declined in recent years due to development of coastal areas and recreational use of remaining coastal dune habitats. Many of southern California's coastal dunes have also seen significant invasions by non-native plant species, which tend to be detrimental to native fauna, especially arthropods. *Coelus* spends the days burrowed into the sand beneath dune vegetation, and comes to the surface at night, leaving distinctive furrows in the sand around the perimeter of the vegetation. It feeds upon the leaves, twigs, seeds, and detritus of dune vegetation, both on the sand surface and below. It will also climb up into the plant canopies to feed. Overall it shows a marked preference for native plant species over invasive non-natives. One exception is sea rocket (*Cakile maritima*) which is actually preferred by adults over the native dune ragweed (*Ambrosia chamissonis*). However, in coastal areas sea rocket is an annual plant that dies off at the time of year when *Coelus* larvae are approaching the end of their development period. Particularly detrimental is the hottentot fig or sea fig (*Carpobrotus* spp.), which provides little or no food for dune beetles and most other dune arthropods. There are generally very few beetles and other dune arthropods found in the sands beneath *Carpobrotus* stands (Nagano 1979; Snover 1992 and unpublished data).

The globose dune beetle was proposed for listing as threatened in 1979, and was also a Category 2 species. In the San Diego Bay area, it has been found on the dunes at Silver Strand, as well as the coastal dune habitats near the Naval Radio Receiving Facility. *Carpobrotus* does occur in both areas and poses a direct threat to the continued persistence of the species.

Tiger beetles—*Cicindela* spp.

All tiger beetles are highly active, fast-moving predators, preying upon any small arthropods they can overpower, especially flies, moths, ants, and isopods. The adults can be seen on warm sunny days in the spring, summer, or fall on open mud or sand. The larvae inhabit burrows in the soils of the same regions, where they capture prey as its passes near the burrow entrance. Tiger beetles are generally considered beneficial insects, as they prey upon significant numbers of small flies, such as kelp flies, that can become quite numerous and bothersome to humans in the area.

Tiger beetles in general are severely threatened by urban expansion, insecticide use, and recreational use of the beaches and coastal habitats of southern California and elsewhere. Seven species of the genus *Cicindela* are known to inhabit the southern California coast, six of which have been recorded in the San Diego Bay area, though two of these have not been relocated in recent surveys (*C. oregona* and *C. hirticollis gravida*). Four of the six species are considered rare (see below for accounts on individual species). The species *C. haemorrhagica haemorrhagica*, which has been recorded at Sweetwater Marsh National Wildlife Refuge, is not considered rare. The sand dune tiger beetle was described earlier, since it has a federal threatened status. The three species described below have experienced declines in recent years and can now only be found at a handful of their former locales due to habitat loss.

Sandy beach tiger beetle—*Cicindela hirticollis gravida*

This beetle is a federal Species of Concern usually found on sandy areas subject to tidal flow. Historically it has been found in several locations adjacent to San Diego Bay, including Silver Strand and Coronado. It may still occur on the Silver Strand near the Naval Amphibious Base, but this area was not surveyed by Nagano in 1979.

Mudflat tiger beetle—C. *trifasciata sigmoidea*

This beetle is a California Species of Concern that inhabits mudflats and other areas with dark-colored, moist-to-wet sands. Adults can sometimes be seen running through sparse stands of *Salicornia*. The mudflat tiger beetle currently persists at various localities in Ventura, Los Angeles, Orange, and San Diego Counties, including the Sweetwater Marsh National Wildlife Refuge.

Gabb's tiger beetle—C. *gabbi*

Gabb's tiger beetle is a California Species of Concern that frequents the mudflats and salt flats of coastal marshes. Current populations are known from Sweetwater Marsh National Wildlife Refuge and Silver Strand, as well as Border Field and one location in Orange County. The population at Sweetwater Marsh National Wildlife Refuge was the largest of the populations surveyed in 1979.

Nuttal's lotus—*Lotus nuttalianus*

Nuttal's lotus, a California Native Plant Society List 1B species, is an annual herb in the family Fabaceae (Legumes). It occurs in coastal strand and coastal scrub habitats in San Diego County and Baja California, Mexico, below 98 ft (30 m) elevation (Hickman 1993; California Native Plant Society 1994). It produces small yellow flowers from March through June. It occurs in association with another rare plant, coast woolly heads (see below) (Reiser 1994).

In recent years Nuttal's lotus has been declining rapidly due to development and other human activities and the invasion of its habitat by non-native weedy species (California Native Plant Society 1994). It is now know to occur in less than ten locales in the state, including the following sites in the San Diego Bay area: Silver Strand beach, southwest of Emory Cove west of the freeway, north of Crown Cove, and the Naval Radio Receiving Facility (California Native Plant Society 1994; Reiser 1994). A historic site on North Island has been extirpated. Other known current locales are Border Field and Torrey Pines State Parks, and the mouths of both the San Luis Rey and Santa Margarita Rivers.

Coast woolly heads—*Nemacaulis denudata* var. *denudata*

Coast woolly heads, a California Native Plant Society List 2 species, is an annual herb in the family Polygonaceae (the Buckwheat family) that occurs on coastal strand habitats in southern California and Baja California, Mexico. Its flowers are small and clustered within heads of woolly fibers (Hickman 1993; California Native Plant Society 1994). Its distribution has been greatly reduced due to development, recreational activities, and invasive weeds. Extant populations in California include Silver Strand west of Emory Cove (Reiser 1994). It also occurs at the mouth of the Santa Margarita river, Penasquitos Lagoon, and Border Field State Park. Historical occurrences in the San Diego Bay area include a fill site in National City, Coronado, and Imperial Beach (Reiser 1994).

Palmer's frankenia—*Frankenia palmeri*

Palmer's frankenia, a California Native Plant Society List 2 species, is a perennial shrub of the family Frankenaceae (the genus *Frankenia* is the only genus in the family) that can be found on coastal dunes and salt marshes in southwestern San Diego County and northern Baja California, Mexico, below 1,476 ft (450 m) (Hickman 1993; California Native Plant Society 1994). Its flowers are white to pink, appearing from May to July. It grows on raised mounds in association with *Salicornia subterminalis* and *Suaeda* spp. (Reiser 1994).

Its status is seriously threatened by development (California Native Plant Society 1994). There is only one known native population in San Diego County, at Gunpowder Point. Two other transplanted populations may be found at the D Street Fill site and at Tijuana River National Wildlife Refuge (Reiser 1994). Historically it also occurred on the Bay portion of the Silver Strand (Reiser 1994).

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Appendix G: Ecological History of San Diego Bay

Table G-1. Ecological History of San Diego Bay.[1]

Natural Formation	Bay formation product of long term geologic process	12–2 million years ago	Bay margin is created in the Pliocene age, the result of subduction of tectonic plates and modified by glacial deposits, as the Ice Age warmed.
Pre-European Settlement	Prehistoric	48,000 years ago	Late in the Ice Age there was no Bay; Coronado, North Island and Point Loma were islands. Silt laden waters of the Tijuana River to the south were carried north by natural current action eventually building the Silver Strand and connecting Coronado and North Island. The Pacific shore was 20 miles farther west than today. Ice melt brought muddy San Diego River waters that built up a delta, tying Point Loma to the mainland and creating two Bays; Mission Bay on one side, and San Diego Bay on the other.
	San Diego Bay Estuary	10,000 years ago	The ocean had spread inland through a gap in the outer Coast Range, and seawater began to fill the bay. For thousands of years the waters rose at nearly an inch per year, which was enough to advance the shoreline nearly 100 feet each year along the imperceptibly sloping floor of the South Bay. Gradually, the rate of rise slowed. Beginning several thousand years ago, sediments accumulated in the shallows faster than the sea could cover them. These sediments sea level has risen about 400 feet since the last Ice Age supporting the expansion of tidal mudflats and marshes, and filling the Estuary to its current depth.
	Kumeyaay	1000 B.C.	Native American Indians hunted the land, fished the sea and harvested plants. They were attracted to the Bay for fish and shellfish resources. “Fish constitutes the principle food of the Indians who inhabit the shore of this port, and they consume much shellfish because of the greater ease they have in procuring them. They use rafts made of reeds, which they manage dexterously by means of a paddle or double-bladed oar. Their harpoons are several yards long, and the point is a very sharp bone inserted in the wood; they are so adroit in throwing this weapon that they very seldom miss their mark” (Captain Vicente Vila 1769, cited in Pourade 1960).
Spanish and Mexican Occupation	Juan Rodriguez Cabrillo discovers Bay	1542	Explorer Juan Cabrillo, of Portuguese birth, set foot at Point Loma laying claim to California lands for Spain. He had found the narrow natural channel opening to an embayment where seven river systems and tidal influences created a shore lined with deltas, mudflats and salt marshes. While sitting out a storm of six days in this well-sheltered bay and before moving north, Cabrillo logged reports of fishing with nets. Cabrillo named the Bay San Miguel. It was sixty years before Sebastian Vizcaino returned to rename it San Diego Bay. Vizcaino recorded good water and many fish, along with visits from the native Indian population, with whom he traded skins for beads. With the arrival of Fr. Serra and the establishment of the San Diego de Alcala Mission came a new era of occupation. Use of the Bay as an active harbor commenced for the Spanish fleet of wooden sailing vessels. Spanish maritime law forbade foreign traffic in their harbor. Traffic from the French, British, Americans, Dutch and Russian fleets increased with Mexican rule. By the time of settlement, Bay conditions were occasionally influenced by floodwater deposits of silt and clay. This natural process reshaped intertidal habitats and altered the depth of the Bay. Turbidity and salinity were changed for short periods of time with temporary loss of marine species. Early settlers noted that the Pacific gray whale used the Bay for calving (Scammon, 1968). Whaling in and outside of the Bay led to its recognition as a whaling center. Trade in hides also increased commerce. Use of the Bay as a harbor and center for whaling and hide trade, to this point, had little effect with a low level of waste from processing of whales and tanning of hides handled by tidal flushing. Whaling was most active from 1850–70 and declined by the 1890’s. Years of Spanish/Mexican rule ended in 1846, when San Diego (**population 500**) was claimed for America. The first Navy boat entered the Bay.
	Sebastian Vizcaino renames San Diego Bay	1602	
	Spanish Army constructs military post	1769	
	San Diego mission established by Father Junipero Serra	1769	
	Mexican rule begins	1821	
	Cattle hide export	1827	
	Whaling vessels operated out of San Diego Bay	1830	
	John Fremont claimed for America	1846	
	U.S.S. Cyane enters harbor	1846	

Table G-1. Ecological History of San Diego Bay.[1] *(Continued)*

Bay Front Development, Water Diversion, Dredging Begin	Mail boat arrives	1849	With statehood, came mandated US Mail delivery and the first steam-powered vessel to the Bay. The first pier was constructed in 1850 (end of Market St.) over mudflats and required little dredging or filling. In 1868, piers from the foot of 5th Street (Horton) and from F Street (Culverwell) were constructed, and in 1871 the National City Pier was completed. In 1888, construction began of a 15,000-ton capacity coal bunker wharf by Spreckles at the foot of G Street. Waterfront commerce was developing and changing in an attempt to handle the need for fuel to service a new breed of boat, incoming and outgoing cargo, and needs of the growing community.
	US Boundary Commission designates US/Mexico Border (officially declared 1856)	1849	
	"Oregon" first passenger liner to the bay, wooden paddlewheeler	1849	
	William Heath Davis builds first wharf	1850	The Bay charted in 1859 documented 2,674 acres of intertidal salt marsh and 4,057 acres of intertidal mud flats. The wooden piers did not change the shore configuration although water quality began to be impacted with coal dumped directly on wharfs.
	California statehood, City of San Diego incorporated, San Diego County established	1850	Waters of the San Diego River continued to flow over the delta to either Bay until the Derby Dike was built in 1853–54 (reconstructed in 1877). The river was forced to Mission Bay, and therefore, San Diego Bay kept from further siltation while the character of the mudflat and salt marsh habitats around the former mouth of the river was changed. By 1915, Mission Bay, or False Bay as it was know to early settlers, was prime habitat for California least tern. At the time, Sechrist described a typical least tern colony with "about 1000 pairs of birds breeding all the way from Pacific Beach down to False Bay with about 500 pairs nesting at the entrance to False Bay".
	Derby dike constructed	1853	
	Point Loma Light House constructed	1855	
	San Diego Bay charted	1859	
	Julian gold strike	1870	Diverting the San Diego River was the first reduction of freshwater input. Later, dams were built on the Sweetwater and Otay River affecting inflow of fresh water, as well as siltation. Fresh water for a growing population's needs became an issue and then an industry. Private companies developed mountain reservoirs and sold water to the City under contract. A well was drilled by the San Diego Water Company in Pound Canyon with two reservoirs, and in 1875, an additional well and reservoir at 8th and Hawthorne was drilled. A flood in 1891 was followed by an eleven year drought (1895–1905). Lack of water with infrequent floods had long been San Diego's pattern.
	San Diego Chamber Of Commerce formed	1870	
	Commercial oil production begins in California	1870–1880	
	San Diego Water Company established	1872	
	First tug boat	1881	San Diego's population continued to grow encouraged by a Chamber of Commerce that was anxious to promote the city's growth and prosperity. The men who ran the chamber had much to gain having invested in property and wharves, determined to develop the harbor's potential for commerce and industry while selling adjacent land.
	Transcontinental Santa Fe RR completed	1885	
	"Della" first Coronado ferry	1886	The 1880s experienced a land boom.
	Coronado Beach Company buys North Island	1886	Building of the Point Loma light house aided and encouraged traffic to the Bay. The lighthouse was deactivated in 1891 and replaced by Ballast Point Light House, which was low enough to provide light underneath the fog. The 1848 discovery of gold by James Marshall on the American River set off a huge migration to California, but this had little effect on San Diego until 1870, when gold was discovered in the Cuyamaca Mountains. This discovery brought prospectors, many from San Francisco where the gold rush boom was winding down. The Julian run lasted five years. The transcontinental railroad connection completed to San Diego in 1885, made the area accessible to many more people and increased opportunities for incoming and outgoing trade. San Diego became a fashionable winter resort, owing to the remarkable steadfastness of its climate and was advocated for its healthy climate at a time when tuberculosis was a common affliction.
	First sewage disposal system	1887	
	National City incorporated	1887	
	First trash barge	1888	
	First dredging	1888	
	Cuyamaca Dam diverts freshwater to Chollas Reservoir	1888	A survey by Eigenman in 1888 documented 56 species of fish; marine life was continuing to flourish.
	Sweetwater Reservoir built	1888	Problems related to a fast-growing community became evident. In an effort to keep up with accumulations of garbage, disposal at sea using a garbage scow hauled out past Pt. Loma began. Tidal currents returned garbage to the Bay waters making it necessary to travel further out to sea. Scows were unable to handle the volume of garbage which then piled up on docks, creating a terrible stench and eventually becoming a health hazard. When the Dixon Crematory was built to burn rubbish, the scows were discontinued. In 1889, the Harbor Commission wrote an ordinance prohibiting the dumping of garbage into the Bay in an effort to legislate control of waste.
	Rivers and Harbors Act	1889	
	City of Coronado sewage system	1890	
	Santa Fe Railroad washed out by flood	1891	
	Dixon Crematory built	1897	In 1887, a new San Diego City sewage disposal system dumped raw waste directly into the Bay. This was the beginning of a decline in water quality. Coinciding with the construction of Hotel del Coronado (more bathrooms per room of any building in the US in 1890) the City of Coronado added a sewage system dumping into the Bay. With funding from the Improvement Act of 1893, National City built a sewer system which also dumped raw sewage into Bay waters. The first dredging occurred in 1888 in Glorietta Bay, with the use of a steam suction dredge. In order to protect the narrow channel entrance to the Bay, the Zuniga jetty was constructed in the years 1893–1907. Construction of reservoirs on Bay watersheds reduced silt supply and natural filling, resulting in a tendency to stabilize some nearshore habitats.

Table G-1. Ecological History of San Diego Bay.[1] (Continued)

Increasing Commerce, Industry and Population	Pt. Loma Navy Coaling Station established	1901	At the turn of the century, San Diego was becoming a major west coast harbor with a **population of 30,000**. Charting by the U.S. Coast Guard indicated relatively undisturbed tide flats and salt marshes. Saltworks operations and development of Dutch Flats were offset by changes created when the San Diego River was diverted.
	Jetty built at Fort Pio Pico	1901	
	South Bay Saltworks operations	1902	Natural sloping conditions of the south bay were ideal for South Bay Saltworks system of dikes forming evaporation ponds to produce salt. The ponds replaced natural areas of salt marsh and mudflats. In the north bay, Campbell Machinery (later converted to a shipyard), Joe Fellows Boat Plant and Benson Lumber Company set up bayside. One to five 900 foot long log rafts/year were brought in by the lumber company from Oregon, until 1941. Industry had been slow to come to San Diego Bay; lack of water supply and shallow waters were problems.
	US Coast Guard and Geodetic Survey chart of San Diego Bay completed	1902	
	Benson Lumber Company set up bayside	1906	
	Campbells Machinery set up bayside	1906	
	Zuniga Jetty built	1893–1907	Military presence in the Bay dated back to 1850, when Davis offered the U.S. Government land near his wharf to build a barracks. Point Loma Naval Coaling Station was the first permanent installation. A Naval Radio Station had also been commission for Point Loma, and Fort Rosecrans protected the harbor. The first military reservation on North Island was built on Zuniga Shoal. Fort Pio Pico was a substation of Rosecrans, and from there work to build a jetty to protect the channel opening took place. In 1907, the channel was dredged to 28 feet. Additional dredging would be necessary for the harbor to be useful for the new, larger, steam-powered, propeller-driven ships.
	Navy Radio Station commissioned on Point Loma	1907	
	Bay channel dredged to 28´	1907	
	Great White Fleet anchored off Coronado	1908	Completion of the Panama Canal would make San Diego the first American port of call. San Diego's Chamber board of directors and more than 100 citizens wrote to the Secretary of the Navy stressing the strategic importance of their Bay encouraging a Naval Training Center, Naval Hospital, wireless telegraph station and additional dredging for a dry dock and repair station.
	Flying School on North Island initiated	1910	
	First wartime shipyard established	1911	In 1912, William Kettner became the first representative to Congress from San Diego and was able to secure funding to improve the harbor for Navy and commercial vessels. Good will between the Navy and San Diegans had been purposefully fostered by Kettner and other city fathers.
	First hydro-aeroplane takes off from North Island	1911	
	Legislative grants of tidal and submerged lands made to City and County of San Diego, Cities of Coronado, National City, Chula Vista and Imperial Beach (jurisdiction later transferred to Port District in 1962)	1911	California state relinquished control of tidelands to the City with terms tied to port improvements. In 1914, a gas powered suction dredge dug a thirty foot channel to the foot of Broadway to construct the first concrete pier. (Broadway Pier)
	Chula Vista incorporated	1911	The Panama California Exposition of 1915 celebrated the new route, and was an opportunity for San Diego to gain recognition.
	Army Signal Corps establishes aviation camp on North Island	1912	In 1916, reservoirs were dry and water supplies diminished. A rainmaker was hired in hopes that he could summon rains. Thirteen inches of rain fell, and floodwaters washed away the salt evaporation ponds. F. Stephens journalized, "The big flood of January, 1916, covered most of the salt marshes near San Diego and drowned most of the Little Black Rails (*Creciscus coturniculus*). I have not been able to find one since the flood."
	San Diego's first Congressman in office	1912	
	Mcguire incinerator built	1913	North Island property was offered to Glen Curtis, by the Coronado Beach Company, to set up a flying school and from there the first hydro-aeroplane departed. Aviation camps for the Navy and Army Signal Corps were established. North Island was the birthplace of Naval aviation, and the center of aviation activities in WWI.
	Panama Canal finished	1914	
	First Navy land purchase of Chollas Heights	1914	Open burning of trash and tideland dumping continued at least until 1935, possibly longer, despite building of an incinerator.
	Broadway Pier constructed	1914	Differences of opinion over what San Diego's future should be was characterized as "smokestacks vs geraniums." Military presence was perceived by some as a controlled, conservative industrialism.
	Panama/California Exposition	1915	
	Flooding, Otay Dam breaks	1916	
	U.S. enters WWI	1917	

Table G-1. Ecological History of San Diego Bay.[1] (Continued)

War, Water and Agriculture	Harbor Commission appointed	1919	In 1917, when the U.S. declared war on Germany, North Island became a permanent Army/Navy aviation school.
	Otay Reservoir built	1919	In 1919, the San Diego Chamber purchased tidelands at the foot of 32nd Street (“Dutch Flats”) for the Navy to dump dredge spoils gained from extending deep water areas. Later, major dredging deposits were used for filling in Spanish Bight on North Island increasing the island by 620 acres. McGrew reported “50,000 to 100,000” Brant in Spanish Bight in the 1880s, and contrasted this to the species’ rarity by the 1920s.
	Dutch Flat Salt Marsh covered with dredge spoil	1919	
	Salt Works rebuilt	1920–33	
	San Diego: headquarters for 11th Naval District	1922	The Bay was being reshaped to accommodate larger vessels and fill the demand for waterfront development. Shelter Island was created from dredge spoil on mudflats. Spoil was targeted for beaches eroding from the effect of damming the Tijuana River. Damming stopped transport of replacement sand to northern beaches. From 1940 to 1970, 28,300,000 cubic yards of dredge spoils was placed on beaches. South Bay Saltworks was rebuilt over time, eventually occupying 900 acres of diked ponds. Intertidal mudflats and salt marshes were decreased and the Bay floor modified, destroying large areas of eelgrass beds. There was some hope that increased depth would serve to lessen the effects of growing waste deposits; however, the added volume actually reduced the natural tidal flushing action.
	First Chula Vista sewer collector	1926	
	Spirit of St. Louis flight	1927	
	Lindbergh Field dedicated	1928	
	Construction of Hoover Dam initiated	1930	After the war, as expense money diminished, aviation and shipping activities suffered. In 1922, 450,000 tons of U.S. ships were destroyed and hundreds were put into ports and named “moth ball fleets”.(Rush 1958)
	Shelter Island created	1934	
	Rubbish Reduction plant in operation	1934	**Population was approaching 75,000** in 1919, and sewage was still a problem. At five sites: Olive Street, Market Street, Commercial Street, Beardsly and 32nd Street, raw sewage was dumped into the Bay from shoreline outfalls. Untreated wastes from the main industries: olive, pimento, citrus, and fish and meat packing, were entering the Bay through city sewers or industrial outfalls. The first Chula Vista collector was added in 1926, at the foot of G Street, dumping raw sewage. Primary treatment was added in 1943, and secondary treatment in 1948. By 1930, there were nine sites; two having partial treatment in settling tanks. Sludge was usually pumped directly into the Bay at high tide. Deterioration of water quality was becoming a serious problem, but a depressed economy of the 1930’s stalled efforts to upgrade the systems.
	Coast Guard Airstation accommodated at Lindbergh Field	1934	
	Consolidated Aircraft relocates to San Diego	1935	
	Naval Air Station North Island established	1935	
	California Pacific Exposition	1935	By 1941, there were more than 26 sewage outfalls serving the San Diego area, at least fifteen entering into the Bay. Between 1938–45 sixteen storm drains had been built discharging industrial waste directly into the Bay. Other wastes were discharged from military and commercial vessels in the Bay.
	Tijuana River dammed	1937	
	Controls placed on whaling	1937	The San Diego City Manager wrote to the Secretary of the Navy, soliciting others to do so as well, informing him of the degraded condition, and asked for federal assistance. A series of projects were funded including construction of a 14 million gallon/day sewage treatment plant completed in 1943. The new plant added clarification and chlorination, using oxidizers for sludge digestion.
	16 storm drains built	1938–45	
	Leading tuna port in the Pacific established	1941	With the buildup of military personnel as well as defense industries, the **population reached 250,000** in 1942, and the system was almost always overloaded. Many organisms apparently disappeared from the Bay due to poor water quality.
	North Island increased by 620 acres by the filling of Spanish Bight	1941	
	U.S. enters WWII	1941	Garbage continued to be a problem with the incinerator plant having failed. Garbage was dumped on tidelands and burned leaving widespread ash contamination. A new Rubbish Reduction Plant was built.
	“No eelgrass in the Bay” reported by Game Warden	1941	San Diego felt the depression less than most with funded projects banking a payroll. Aviation related industry flourished with Consolidated Aircraft (later General Dynamics) moving its entire plant to San Diego. Ryan Aeronautical and Solar Aircraft Co. manufactured aircraft parts, also a new industry. Charles Lindbergh started his historic transatlantic flight from North Island in the Spirit of St. Louis built by Curtis, out of San Diego. “Dutch Flats” had been converted to a municipal airport and was dedicated Lindbergh Field, later accommodating a Coast Guard Air Station.
	New sewage plants constructed	1943	
	San Diego Aqueduct Completed	1947	
	Dickey Act of California sets up state and 9 regional water quality control boards	1949	When war was declared, San Diego was home to six aircraft carriers while Pearl Harbor had ported battleships. The “mothball fleet” ships were re-activated and sent to do battle. Anti-submarine nets were placed across the entrances of San Diego harbor to prevent Japanese hit and run attacks. After the war, the nets were towed out to sea and dropped into deep water (Rush 1958).
	Korean War, work on Atlas missile	1950	
			In 1946, having endured another drought, San Diego bought annexation to the Metropolitan Water District with water rights to the Colorado River that had been granted in 1926. The City exceeded original rights within ten years, and by 1991 was using 562,000 acre-feet, five times the original allocation. Without the aqueduct feed, the San Diego area had no hopes of supporting their growing agricultural industry. Groves and nursery stock along with indoor decorative plants made the county one of the leading farm regions in California.

Table G-1. Ecological History of San Diego Bay.[1] (Continued)

Pollution Overload	Regional Water Quality Control Board formed	1950	Early in the 1950's, three Chula Vista shoreline outfalls were directly polluting the Bay; two with disinfected intermediate effluent from its sewage plants, and the other an adjacent aircraft manufacturing facility discharging untreated, highly toxic chemical waste.
	Sewage plant expanded	1950	Studies began after the San Diego Regional Water Pollution Control Board was established in 1950, to determine the extent of the Bay's degraded water. Distributions of dissolved oxygen concentrations and coliform densities from 1951–55 were lower than would support most fish and many invertebrates for all of the central Bay area and portions of the north and south Bay. Coliform bacteria counts were in excess of 10 mpn/ml. Planning had begun for a new Metropolitan Sewage System while the Bay continued to degrade. Additional studies found turbidity and discoloration due to blooms of phytoplankton stimulated by nutrients in the sewage effluent. Red tide blooms existed throughout most of the Bay. The Regional Board concluded that even secondary treatment with a high degree of disinfection were inadequate to prevent pollution. The Bay was no longer able to assimilate the accumulated pollution, and in 1955 quarantine signs were posted along the Coronado coastline.
	10th Avenue Marine Terminal approved	1955	
	Landfill site at Miramar	1959	
	Second pipeline for San Diego Aqueduct constructed	1960	
	Large-scale dredge and fill for National City and Chula Vista bayfronts, Harbor Island and Shelter islands	1960	
	First pipeline for second San Diego Aqueduct	1960	Chlorination programs in 1956 reduced coliform levels, however, by 1960 the Bay was again quarantined. Fifty-six million gallons per day of domestic waste were being discharged into San Diego Bay. Over 80% of dissolved oxygen levels were lower that 4mg/l, resulting in disappearance of bait and game fish. California Department of Fish and Game declared much of the Bay a virtual "marine desert". Sludge beds on the east shore had increased in thickness from 3 to 7.5 feet in the twelve years from 1951 to 1963.
	Nuclear submarines ported	1960	
	San Diego Gas & Electric operational	1960	
	$42.5 million bond approved for construction of Metropolitan Sewage System	1960	Pollution peaked in the Late 1950's and early 1960's. There was the putrid smell of algae, oil and sewage. If you had the misfortune of falling overboard, you didn't know whether to hurry home and take a shower, or go to the hospital for a tetanus shot. The health department had posted much of the shore, warning that the water was too contaminated for contact (San Diego Union 1971).
	Dredge ship channel and turning basin to 42 feet	1961	The State of California was first to address the Bay pollution problem, even before the Federal Clean Water Act was written.In August of 1963, the new San Diego Metropolitan Sewage System with ocean outfall went into operation, and by February of 1964, all domestic sewage was changed over to the new system.
	Second generating unit added to SDG&E	1962	
	San Diego Unified Port District established	1962	The San Diego Unified Port District was established in 1962 to manage the harbor, operate Lindbergh Field and administer public tidelands on San Diego Bay. Voters passed a bond issue to construct the 10th Avenue Marine Terminal. Large-scale dredging and filling for National City and Chula Vista Bay fronts and Harbor and Shelter islands was begun. The shipping channel was dredged with a turning basin to 42 feet. Coronado Cays was constructed over a previous city burn dump site adjacent to mudflats and salt marsh in 1968, requiring no environmental impact statement. San Diego Unified Port District funds an access channel and L shaped boat basin in the south Bay.
	Naval Ocean Systems Center established	1962	
	Metropolitan Sewage System begins operation	1963	
	San Diego Bay Master Plan adopted	1962	
	Third generating unit added to SDG&E	1964	San Diego Gas and Electric power generating plant was operational in the south Bay. Studies monitor effects of the plants operation on surrounding marine life, and the plant adds generating units.
	Coronado Cays construction begins	1968	
	First phase of L-shaped boat basin in South Bay	1968	Today it takes x-ray eyes to find the scars that were left by more than half a century of sewage disposal (San Diego Union 1971). "In a matter of months a difference in the clarity of water could be noticed, and within a year, fish were seen again breaking the surface and could be caught in the channels. Swimming in the bay could be safely permitted again. Sea lions and porpoises returned to the harbor, pelicans and terns plunged into shoals of anchovy, and San Diegans could congratulate themselves on their bay's salvation." (Herbert L. Mannishly)
	Coronado Bridge opens	1969	
	Last of major industrial process discharges diverted to sewer	1969	
	California Porter-Cologne Water Quality Control Act	1969	Nuclear submarines were stationed in the Bay, and the industry changed from aircraft to missile production.
	Naval discharges eliminated, including that from vessels	1970	The Navy installed a million dollar treatment plant to eliminate outflow. The Kelco Company's kelp-processing plant developed a clean-up program to end daily dumping of four million gallons of waste into the Bay.In 1971, the Westgate tuna packing plant, the only remaining cannery in the Bay, installed a filter system at its unloading docks. The Coast Guard kept an eye on oil spills from the Navy.
	Fourth generating unit added to SDG&E	1971	
	Federal Clean Water Act	1972	

Table G-1. Ecological History of San Diego Bay.[1] (Continued)

Bay Restoration	Coastal Zone Management Act	1972	In 1972, the Federal Clean Water Act prohibited discharge of pollutants to waters unless permitted. The act was written with the intent of limiting the impacts of increased development on water resources, and along with the Rivers and Harbors Act of 1899, drives regulation on a federal level with standards, prohibitions, permit review specifications and means of enforcement. Section 404 of the Act addresses discharges of dredge or fill material. Many other statutes and policies are written to protect the marine environment. Agencies responsible for implementation may be the U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (ACOE), the Natural Resources Conservation Service (NRCS), the National Marine Fisheries Service (NMFS) and the U.S.Fish and Wildlife Service (USFWS). From this point forward, the complex Bay system is being monitored and studied to build an understanding of the dynamics assuring success in restoring and maintaining a healthy state. A Plan written by the Unified Port District details efforts to prevent introduction of pollutants and to eliminate degradation of Bay waters, sediments and biological resources. The Navy agrees to install a million-dollar treatment plant to eliminate outflow, due to open in 1972 (San Diego Union 1971). Complete tidal flushing in the south Bay requires 7–14 days whereas the entrance of the Bay may only require 1–2 days. It has been estimated that over the last century, tidal flushing has been reduced by 30% due to dredging and landfill projects (Brown and Speth, 1973). Inadequate tidal flushing can result in the loss of both saltmarsh cordgrass habitat and the invertebrates upon which light-footed clapper rails feed; adequate tidal flow also prevents stagnation of the salt marsh and maintains salinity levels of the soil and water. From 1977 to 1985, documentation shows a distinct improvement in Bay condition. In 1980, when flooding caused an unusual spillover of the lower Otay and Sweetwater dams, monitoring data provided a baseline for determining the effects of the increased sediment load. Currently, Navy ships are no longer required to keep fuel while in Port. They fuel on departure. Also currently, the ships pump bilge into barges. Plans for a bilge only waste transportation system to be at every pier are being considered. Storm water runoff has become a big issue, with more than 200 storm drains emptying into the Bay. The Bay's response to storm water may be a temporary increase in levels of trash, turbidity, toxic and non toxic chemical counts and bacteria counts. Today, San Diego Bay is an agricultural trade center, a manufacturing trade center, a transportation hub, a base for fishing fleets, a base for military operations, a first port of call, a center of tourism and recreation, supports a diversity of marine life close to that originally noted in European settlement times, and home to over **three million people**.
	National Environmental Policy Act	1973	
	California Bays and Estuaries Policy	1974	
	California Coastal Act	1976	
	Eelgrass transplants begin in San Diego Bay	1976	
	Magnuson Fishery Conservation and Management Act	1976	
	Formation of Chula Vista Wildlife Reserve	1977	
	Copper ore spill	1979	
	Flood	1980	
	Tijuana Estuary designated National Estuarine Sanctuary	1982	
	Endangered Species Act	1987	
	Seal commando operations took place at Coronado	1987	
	Convention Center completed	1990	
	South San Diego Bay Enhancement Plan completed by Port District and Coastal Conservancy	1990	
	USFWS begins study of 5200-acre wildlife refuge proposal for South Bay	1990	
	NMFS Habitat Conservation Policy	1990	
	NMFS, USFWS, CDFG Southern California Eelgrass Policy	1991	
	Department of Defense downsizing	1990's	
	Unified Port District's Five-Year Action Plan	1992	
	Public Access controls to protect wildlands	1992	
	San Diego Area Contingency Plan	1993	
	Dredge for Nimitz CVN	1996	
	Friends of South Bay Wildlife develop an ecotourism proposal	1996	

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Appendix H: Habitat Protection Policies: Preliminary Concepts

H.1 Draft Policy for Protection of Intertidal Flats

H.2 Draft Policy for Protection of Unvegetated Shallows

H.3 Background Paper on Habitat Values of Unvegetated Shallows

H.4 Current Southern California Eelgrass Mitigation Policy

The following pages are intended to support the development of a formal, Baywide policy on habitat protection and mitigation for certain habitats that are considered most at risk. While the Technical Oversight Committee also considered salt marsh and upland transition habitats as also requiring a similar policy, drafts have only been developed for Intertidal Flats and Unvegetated Shallows.

Proposed Policy to Protect Southern California Intertidal Flat Habitat of Bays and Estuaries (Modeled After Existing Eelgrass Mitigation Policy)

I. BACKGROUND

A. FINDINGS: Past Losses of Habitat Area and Value

Intertidal habitat encompasses the area between the low end of the salt marsh (or the higher high tide if salt marsh vegetation does not occur) and lower low tide. Losses of intertidal habitat to fill and other conversion in bays and estuaries of southern California are between 60 and 90 percent. Most intertidal shorelines have been modified by steepening and by stabilization structures, and so no longer provide their full habitat value to fish, wildlife and plants that depend on them.

B. FINDINGS: Necessary Values to be Protected (see also Section 2.4.4)

Intertidal flats occur between the highest high and lowest low tide zones, or otherwise between the lowest cordgrass (beginning of the salt marsh) and highest eelgrass, approximately 3 to 0 ft (1 to 0 m) MLLW.

Mudflats contain abundant organic matter and microorganisms. Normally devoid of flowering plants, these areas may be covered with algae. Burrows and siphonholes of benthic invertebrates, tiny invertebrates that live among the grains of substrate (meiofauna), and algae and detritus fill the sediment with hidden activity, and are all necessary to support the food chain and mineral cycles of Southern California bays and estuaries. Snails, crabs and polychaete worms (deposit feeders) glean the surface for detrital bits and algae. Filter-feeders such as clams, mussels and small crustaceans collect plankton, algae and detritus as it washes by when the tide is in. The deposit and filter feeders together are extremely efficient processors of living and dead plankton.

When the tide recedes, a great diversity of shorebirds congregate sometimes by the thousands to consume the invertebrate prey. Foraging birds include the threatened western snowy plover and the endangered California least tern. Other terns and the black skimmer forage in the waters over submerged mudflats during high tide.

Also when the tide comes in, numerous fishes and rays move in to take advantage of the productivity, such as various flounders, skates and sharks, and deep-bodied forms such as surfperches. While most mudflat fishes are tidal visitors, and some remain at low tide in shallow drainage channels, a short list of species are full-time residents. These are commonly the ones that can live in the burrows of marine invertebrates. Other fishes are seasonal visitors during juvenile life stages: California halibut, California halfbeak, and striped mullet. Studies on tidal flats elsewhere have demonstrated that it is frequently only the juvenile decapod crustaceans such as shrimp and demersal fish that forage on tidal flats, while the adults and pelagic larvae stay offshore. Sub-adults migrate to the subtidal to avoid low tide conditions—the tidal flats function as nurseries for the resident juveniles and the sub-adults (which are flood tide visitors). These larvae drift onto tidal flats from open coastal waters so that the juvenile stages of these fishes may take advantage of high temperatures, abundant food, and the absence of large predators.

II. NEED FOR A STANDARD, CONSISTENT POLICY

Intertidal flats function as important habitat for a variety of invertebrates, birds, and fishes. In order to maintain a consistent policy regarding mitigating adverse impacts in intertidal flats, the following standards are proposed.

III. DEFINITIONS

For clarity, the following definitions apply. "Project" refers to work performed on-site to accomplish the applicant's purpose. "Mitigation" refers to work performed to compensate for any adverse impacts caused by the "project." "Resource agencies" refers to National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game.

IV. CRITERIA FOR MITIGATION NEED

A. Mitigation for intertidal flats shall be considered only after the normal provisions and policies regarding avoidance and minimization, as addressed in the Section 404 Mitigation Memorandum of Agreement between the Corps of Engineers and Environmental Protection Agency, have been pursued to the fullest extent possible prior to the development of any mitigation program.

B. When considering the need for avoiding impacts, minimizing impacts, and mitigating unavoidable impacts to intertidal habitat, at least some differences in site value and restoration potential should be recognized (see VIII below).

C. Coordinated environmental impact review should take place during the site selection and design stages, not after.

D. When new armoring or reconstruction of degraded armoring is unavoidable, incorporate maximum practical habitat value for native species, giving priority to solutions that use types of material indigenous to the bay or estuary.

E. Examination of shoreline modification alternatives is required. A project proponent should provide in their review an inventory of existing shoreline stabilization devices and unarmored areas that may be impacted adjacent to and near the project site; predicted impact upon area shore and hydraulic processes, adjacent properties, shoreline and water uses, and upland stability; and alternative measures (including non-structural) that will achieve the same purpose.

F. Technical peer review of hard structural solution applications is required. Hard shoreline modifications should be allowed only after it is demonstrated that non-structural solutions are not able to reduce the damage.

G. Riprapping and other bank stabilization measures should be located, designed, and constructed primarily to prevent damage to *existing* development.

V. PROTOCOL FOR MAPPING MITIGATION SITES

A. The project sponsor shall map thoroughly the area and relationship to depth contours of any site likely to be impacted by project construction. This includes areas immediately adjacent to the project site which have the potential to be indirectly or inadvertently impacted as well as areas having the proper depth and substrate requirements.

B. Protocol for mapping shall consist of the following format:

1. Coordinates

   Horizontal datum—Universal Transverse Mercator (UTM), NAD 83, Zone 11

   Vertical datum—Mean Lower Low Water (MLLW), depth in feet.

2. Units
3. Mapping shall be accomplished within ____ of the beginning of project construction. Mapping is expected to be valid for ___ months. Adjacent shorelines and habitats for a distance of ____ shall also be mapped for an adequate assessment of potential adverse effects.

C. Delineate areas based on a commonly agreed-upon definition and at a project-planning scale (1 in = 600 ft).

VI. PROTOCOL FOR SELECTING A MITIGATION SITE

A. The location of mitigation for adverse effects to intertidal flat habitats shall be in areas similar to those where the initial impact occurs. Factors such as distance from project, depth, sediment type, distance from ocean connection, water quality, and currents are among those that should be considered in evaluating potential sites.

B. Whenever feasible, mitigation siting should select broad, gently-sloping intertidal areas rather than small, narrow ones in order to maximize the benefit received from mitigation.

VII. MITIGATION SIZE / RATIO

In the case of mitigation activities that take place concurrent with the project that results in damage to the resource, a mitigation ratio of 1 to 1 shall apply.

Mitigation completed one year in advance of the impact (i.e., mitigation banks) will not incur the additional 10% requirement and, therefore, can be constructed on a one-for-one basis. However, all other monitoring requirements (outlined below) remain the same irrespective of when the mitigation is completed. Project proponents should consider increasing the size of the required mitigation area by 10–20% to provide greater assurance that the success criteria, as specified below, will be met.

VIII. MITIGATION TECHNIQUE

A. Intertidal flas shall be seeded with invertebrate fauna, especially those species that do not have swimming larval stages and are unlikely to disperse effectively to a site within a short time frame. Techniques to be employed at the mitigation site shall be consistent with the best available technology at the time of the project. Donor material shall be taken from area of direct impact whenever possible, but also should include a minimum of two additional distinct sites to better ensure genetic diversity of the donor. Written permission for collection of donor material shall be acquired from the appropriate landowner. It is understood that whatever techniques are employed, they must comply with the stated requirements and criteria.

B. Investigate and then consider the relative importance of the following as a basis for habitat valuation when planning or evaluating mitigation projects:

- Area affected.
- Patch size.
- Abundance/density of infauna.
- Diversity of infaunal lifestyles (dwelling modes and feeding modes). High density of one species or lifestyle (e.g. subsurface-deposit feeders) can indicated a fairly degraded system. Suspension feeders, burrowers, tube builders etc. all coexisting denote a fairly healthy system.
- Presence of larger infauna (ghost shrimp, clams, etc.).
- Sediment stability with wave action, flooding or migrating sand.
- Drainage/flushing at low tide.
- Use by foraging fishes/rays when the tide is in.
- Use as a nursery by juvenile fishes and decapod invertebrates.
- Limited habitation by exotic species (e.g. *Musculista senhousia*).
- Use by foraging shorebirds.
- Time since last disturbance by dredging or other disturbance.
- Natural vs. armored condition of shoreline.
- Position of shoreline armoring within the tidal prism.

C. Consider the following principles when determining mitigation techniques:

- Enhance the flow environment as affected by surrounding structures to ensure stability/persistence of intertidal sediments.
- Grade to appropriate tide levels—high intertidal supports few organisms.
- Improve drainage conditions.
- Place structures subtidally to stabilize.

D. Pursue exotic species control measures to prevent invasion of mudflats.

E. Set targets for use by western snowy plover, foraging California least tern, juvenile California halibut, and other declining birds or fishes, when baseline data are available.

F. Enhance the interchange of nutrients, organisms, and organic matter between mudflats and other habitats in the project design.

G. General guidelines to increase the habitat value of necessary stabilization structures to make them more like natural rocky shores are as follows:

1. Bank stabilization should be located, designed and constructed primarily to prevent damage to existing development.
2. New development should be located and designed to prevent or minimize the need for shoreline stabilization measures. New development requiring shoreline stabilization should be discouraged.
3. Consider confining bulkheading and filling to the upper one-third of the intertidal zone.
4. If important nursery or foraging areas are identified for fish of the intertidal zone, then restrict the extent to which bulkheads or riprap may encroach on these zones.
5. Encourage crenulation of the shoreline to create more shallow water niches and intertidal accretion in small inlets while maintaining the functionality of the stabilization structures.

H. There should be a preference for using natural materials similar to those indigenous to the bay or estuary.

1. Require the design and use of naturally regenerating systems for prevention and control of beach erosion over bulkheads or other structures where:
   a. the length and configuration of the beach will accommodate such systems;
   b. such solutions do not detrimentally interrupt littoral drift, or redirect waves, currents or sediments to other shorelines.
   c. beach enhancement may be permitted as a conditional use when the applicant has demonstrated that no significant change in littoral drift will result that will adversely affect properties or habitat.
   d. such protection is a reasonable solution to the needs of the site;
   e. it will reduce otherwise erosional conditions.
2. Supplementary beach nourishment to impacted beaches in a drift cell may be required where structural stabilization projects are necessary.
3. Proposals should demonstrate the use of natural materials and processes and that non-structural solutions to bank stabilization are unworkable in protecting existing development.
4. Bulkheads may be allowed only when evidence demonstrates that a) serious wave erosion threatens an established use or existing building(s) on upland property and/or b) bulkheads are necessary to the operation and location of water-dependent and water-related activities provided that all alternatives have proven infeasible.
5. Use of a bulkhead to protect a platted lot where no structure presently exists is discouraged.
6. Shoreline uses should be located in a manner so that bulkheading is not likely to become necessary in the future.

7. Affected property owners and public agencies should be encouraged to coordinate bulkhead development for an entire drift sector or homogenous reach in order to avoid exacerbating erosion on adjacent properties.
8. The cumulative effects of allowing bulkheads segments of shoreline should be evaluated prior to granting individual permits or exemptions.
9. Bulkheads should not be approved as a solution to geophysical problems caused by factors other than wave erosion.

IX. MITIGATION TIMING

For off-site mitigation, mitigation should be started prior to or concurrent with the initiation of shoreline construction resulting in the impact. Any off-site mitigation project which fails to initiate work within 135 days following the initiation of the shoreline construction resulting in impact will be subject to additional mitigation requirements as specified below. For on-site mitigation, on-site mitigation should be started no later than 135 days after initiation of shoreline construction activities. A construction schedule which includes specific starting and ending dates for all work including mitigation activities shall be provided to the resource agencies for approval at least 30 days prior to initiating shoreline construction.

X. MITIGATION DELAY PENALTY

If, according to the construction schedule or because of any delays, mitigation cannot be started within 135 days of initiating shoreline construction, the replacement ratio shall be increased above the 1.0:1 ratio specified in section 4 at a rate of three percent for each month of delay. This increase in mitigation obligation is necessary to ensure that all productivity losses incurred during this period are sufficiently offset within two years.

XI. MITIGATION MONITORING

Monitoring the success of mitigation shall be required for a period of one year for most projects. The monitoring of an adjacent or other acceptable control area (subject to the approval of the resource agencies) to account for any natural changes or fluctuations must be included as an element of the overall program.

A monitoring schedule that indicates when each of required monitoring events will be completed shall be provided to the resource agencies prior to or concurrent with the initiation of the mitigation.

Monitoring reports shall be provided to the resource agencies within 30 days after the completion of each required monitoring period.

XII. MITIGATION SUCCESS CRITERIA

Criteria for determination of success shall be based upon a comparison of coverage (area), depth and slope between the project and mitigation sites. Specific criteria are as follows:......

XIII. MITIGATION BANKING

XIV. EXCLUSIONS

Proposed Policy to Protect Unvegetated Shallows of Southern California Bays and Estuaries (Modeled After Existing Southern California Eelgrass Mitigation Policy)

I. BACKGROUND

A. FINDINGS: Past Losses of Habitat Area and Value

Historic losses of this habitat in Southern California due to dredging and other conversion are high, approaching 50 percent.

B. FINDINGS: Necessary Values to be Protected (see also Appendix G3)

Unvegetated areas of shallow soft bottom support species assemblages of benthic invertebrates and demersal fishes that are distinct from vegetated areas. Many of these invertebrate species serve as food sources for demersal fishes that are restricted to or occur primarily in these unvegetated shallow areas of soft sediment. The small juveniles of certain species such as the California halibut *(Paralichthys californicus)* are restricted primarily to unvegetated shallow areas of unconsolidated sediment in bays and estuaries, where they feed on the invertebrate fauna of those habitats. These habitats therefore provide an important nursery area for this species. Other species of demersal fishes which appear to depend primarily on invertebrates of unvegetated shallow habitats as their food source include the diamond turbot, the round stingray and several species of gobies. In addition, many fishes which also occur in eelgrass and other vegetated shallow habitats feed both there and in unvegetated areas.

II. NEED FOR A STANDARD, CONSISTENT POLICY

Unvegetated shallows function as important habitat for a variety of fish and other wildlife. In order to standardize and maintain a consistent policy regarding mitigating adverse impacts, the following standards are proposed.

III. DEFINITIONS

For clarity, the following definitions apply. “Unvegetated Shallows” refers to the area between the lower low tide -1.8 ft and about -12 ft in depth that does not grow eelgrass or other submerged aquatic vegetation. “Project” refers to work performed on-site to accomplish the applicant’s purpose. “Mitigation” refers to work performed to compensate for any adverse impacts caused by the “project.” “Resource agencies” refers to National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game.

IV. CRITERIA FOR MITIGATION NEED

A. Mitigation for impacts to unvegetated shallows shall be considered only after the normal provisions and policies regarding avoidance and minimization, as addressed in the Section 404 Mitigation Memorandum of Agreement between the Corps of Engineers and Environmental Protection Agency, have been pursued to the fullest extent possible prior to the development of any mitigation program.

B. Implement Best Management Practices (BMPs) during construction and dredging projects to keep temporary turbidity increases to a minimum, for the protection of foraging birds and fishes.

C. Alternative, innovative designs should be encouraged and considered early in the project planning stages that minimize impacts. Adjustments in project siting should also be considered to avoid or minimize impacts.

V. PROTOCOL FOR MITIGATION SITE MAPPING

The project sponsor shall map thoroughly the area to depth contours likely to be impacted by project construction. This includes areas immediately adjacent to the project site which have the potential to be indirectly or inadvertently impacted as well as areas having the proper depth and substrate requirements.

Protocol for mapping shall consist of the following format:

1) Coordinates

2) Units

3) Mapping, How long mapping is valid

VI. PROTOCOL FOR SELECTING A MITIGATION SITE

The location of mitigation shall be in areas similar to those where the initial impact occurs. Factors such as distance from project, depth, sediment type, distance from ocean connection, water quality, and currents are among those that should be considered in evaluating potential sites.

VII. MITIGATION SIZE / RATIO

A. In the case of mitigation activities that occur concurrent with the project that results in damage to the existing resource, a ratio of 1 to 1 shall apply. That is, for each square meter adversely impacted, 1 square meters of new suitable habitat must be created. The rationale for this ratio is based on, 1) the time (i.e., generally 6 months to 3 years) necessary for a mitigation site to reach full utilization by fishes and 2) the need to offset any productivity losses during this recovery period within 3 years. Recolonization rates vary depending on several factors which include degree of disturbance, proximity of propagules, and the life span of individual species.

B. Mitigation completed one year in advance of the impact (e.q. mitigation banks) will not incur the additional 10% requirement and, therefore, can be constructed on a one-for-one basis. However, all other monitoring requirements (outlined below) remain the same irrespective of when the transplant is completed. Project proponents should consider increasing the size of the required mitigation area by 10–20% to provide greater assurance that the success criteria, as specified below, will be met.

VIII. MITIGATION TECHNIQUE

A. Techniques for the construction of the mitigation site shall be consistent with the best available technology at the time of the project. Donor material shall be taken from area of direct impact whenever possible, but also should include a minimum of two additional distinct sites to better ensure genetic diversity of the donor plants. Written permission to acquire donor material shall be received from the appropriate landowner. Specific rates of seeding units shall be at the discretion of the project sponsor. However, it is understood that whatever techniques are employed, they must comply with the stated requirements and criteria.

B. Since project impacts are relatively infrequent and small-scale in unvegetated shallows, implement mitigation requirements on a case-by-case basis using the following as a guide:

1. Mitigate unavoidable impacts, recognizing and providing a means to define at least some differences in site value and restoration potential.
    - *a.* Differences in site value could be determined by:
        1. Area affected.
        2. Patch size/fragmentation.
        3. Abundance/density of infauna.
        4. Diversity of infaunal lifestyles (dwelling modes and feeding modes). High density of one species or lifestyle (e.g. subsurface-deposit feeders) can indicate a fairly degraded system. Suspension feeders, burrowers, tube builders, etc. all coexisting denote a fairly healthy system.
        5. Presence of larger infauna (ghost shrimp, clams etc.).
        6. Site maturity (time since last disturbance).
        7. Use as a nursery by halibut or other fishes.
2. Facilitate the local, beneficial use of dredge material for enhancement projects when the material has appropriate characteristics. When replacement shallow subtidal habitat sites are needed to mitigate for project-caused losses, convert from medium or deep subtidal habitats as a first choice.

IX. MITIGATION TIMING

Off-site mitigation should be started prior to or concurrent with the initiation of in-water construction resulting in the impact to the resource. Any off-site mitigation project which fails to initiate work within 135 days following the completion of the in-water construction resulting in impact will be subject to additional mitigation requirements as specified below. For on-site mitigation, on-site mitigation should be started no later than 135 days after completion of in-water construction activities. A construction schedule which includes specific starting and ending dates for all work including mitigation activities shall be provided to the resource agencies for approval at least 30 days prior to initiating in-water construction.

X. MITIGATION DELAY PENALTY

If, according to the construction schedule or because of any delays, mitigation cannot be started within 135 days of initiating in-water construction, replacement ratio shall be increased above the 1:1 ratio specified in section 4 at a rate of three percent for each month of delay. This increase in mitigation obligation is necessary to ensure that all productivity losses incurred during this period are sufficiently offset within 6 months–3 years.

XI. MITIGATION MONITORING

A. Monitoring the success of.......... mitigation shall be required for a period of one year for most projects. Monitoring activities shall determine the percent coverage and density invertebrates at the site and shall be conducted at 12 months after completion. All monitoring work must be conducted during the peak use period and shall avoid the winter months.

B. Sufficient flexibility in the scheduling of the 3 and 6 month surveys shall be allowed to ensure the work is completed during this period. Additional monitoring beyond the 12-month period may be required in those instances where stability of the proposed site is questionable.

C. A measure of the effectiveness of turbidity control BMPs shall be included in the monitoring report.

D. The monitoring of an adjacent or other acceptable control area (subject to the approval of the resource agencies) to account for any natural changes or fluctuations in fish use of an area must be included as an element of the overall program.

E. A monitoring schedule that indicates when each of required monitoring events will be completed shall be provided to the resource agencies prior to or concurrent with the initiation of the mitigation.

F. Monitoring reports shall be provided to the resource agencies within 30 days after the completion of each required monitoring period.

XII. MITIGATION SUCCESS CRITERIA

Criteria for determination of success shall be based upon a comparison of coverage (area) and density (per square meter) between the project and mitigation sites. Extent of coverage is defined as that area............. is present and where gaps in coverage are less than one meter between .... present in representative samples within the control .. Specific criteria are as follows:

XIII. MITIGATION BANKING

Any mitigation success that, after 3 years, exceeds the mitigation requirements, as defined above, may be considered as credit in a "mitigation bank." Establishment of any "mitigation bank" and use of any credits accrued from such a bank must be with the approval of the resource agencies and be consistent with the provisions stated in this policy. Monitoring of any approved mitigation bank shall be conducted on an annual basis until all credits are exhausted.

XIV. EXCLUSIONS

Background Paper on Soft-Bottom Shallow Subtidal Functions, Values, and Response to Disturbance: A Basis of Policy Development

Unvegetated habitats of shallow subtidal support distinct values. These habitats of unconsolidated sediment (0–10 ft below MLLW) which do not support eelgrass are of great importance to the ecological functioning of San Diego Bay. Together with eelgrass beds, these shallow, unvegetated areas of soft bottom represent the two primary subtidal habitats and their associated fauna and flora in San Diego Bay prior to its development for human activities. This in itself makes the conservation and rehabilitation of both eelgrass and shallow unvegetated habitats of considerable importance. The rate of loss of shallow subtidal habitat has abated with vigilant implementation and enhancement of the Clean Water Act and Southern California Eelgrass Mitigation Policy.

Both habitats merit equal attention in this management and conservation process.The shallow unvegetated habitats support distinct species assemblages of benthic invertebrates and demersal fishes (Takahashi 1992, Kramer 1990, Allen 1997) as shown in Tables 1–3. Takahashi (1992) compared the numbers of species of infaunal and epifaunal invertebrates which occurred at both shallow vegetated (eelgrass) and unvegetated study sites in central San Diego Bay. In doing so, she employed her data obtained from four eelgrass bed sampling sites with those from typical unvegetated, soft bottom sites of the same depth, located nearby, that were sampled by Kinnetic Laboratories (1988, 1989, 1990, 1991; KLI Station N2 and MacDonald *et. al.* 1990; SPUPD Station G1). As shown in Tables 1–3, overall there were very low numbers of invertebrate species occurring in both shallow subtidal vegetated and unvegetated habitats, ranging from only three to nine of the 19–33 species present at the unvegetated sites. Also shown in Table 4 are rank order of abundance data for invertebrates sampled at the KLI Station N2 site. This illustrates very clearly that shallow unvegetated habitats primarily support a distinct invertebrate fauna. This is significant because it means that these eelgrass and shallow unvegetated areas provide distinct habitat conditions for two almost completely separate species assemblages of invertebrates. Since both of these major subtidal habitats represent what mostly San Diego Bay was like before human intervention, both must be considered of equal and high ecological importance. Considering that most of the original shallow subtidal habitats have been lost, it is essential to protect and preserve what remains. This invertebrate fauna of shallow, unvegetated habitats in San Diego Bay is important to ecological functioning of the Bay, both because it serves as the main food source for a wide variety of demersal fishes that occur in this habitat, and because it is a major species assemblage in its own right.

An important example is the California halibut *(Paralichthys californicus)*, a flatfish species of commercial and recreational importance. The small juveniles of this species are restricted primarily to shallow unvegetated areas of unconsolidated sediment in bays and estuaries (Allen 1982, Kramer 1990), where they feed on the invertebrate fauna of those habitats (Drawbridge 1990). These habitats therefore provide an important nursery area for this species. The substantially greater abundance of juvenile California halibut in Mission Bay, as opposed to San Diego Bay (Kramer 1990), may be due in part to the reduced area of shallow unvegetated habitat that now remains available in San Diego Bay. Other species of demersal fishes which appear to depend primarily on invertebrates of shallow unvegetated habitats as their food source include the diamond turbot, the round stingray and several species of gobies. In addition, many species of fishes which also occur in eelgrass and other shallow vegetated habitats feed both there and in unvegetated habitats. This occurrence of many of the same species of demersal and open water fishes in both shallow unvegetated and vegetated habitats is illustrated in Table 4, based on recent work by Allen (1996). One of the things this indicates is that for fish species that occupy both of these habitats, both habitats probably also serve as important feeding areas.

The benthos provides other functional roles besides serving as a prey base for fish and birds. The less conspicuous mollusc, polychaete worms, small crustaceans, and other invertebrates living at the bottom of the bay mineralize organic wastes as it accumulates, consume macroalgae, and return essential chemicals and organic matter to the water column. Some invertebrate and fish species are harvested by humans for food or bait.

Eelgrass beds are considered to be biologically rich and productive compared to shallow unvegetated habitats. Clearly, basing management and mitigation decisions on these criteria alone is short-sighted. Shallow unvegetated soft bottom habitats in San Diego Bay have, by comparison, been called “biological deserts.” This is a false conception. On the basis of their role as a major feeding area for demersal fishes, a nursery area for juvenile California halibut, and other ecological functions, shallow unvegetated habitats in San Diego Bay merit equal consideration when it comes to their conservation and their qualification as sites for mitigation if disturbance of them is proposed.

Factors Affecting Invertebrates in Soft Bottom Habitats

Such unconsolidated sediment or soft bottom habitats in the intertidal and subtidal areas of San Diego Bay are fairly unstable. They can be disturbed easily by such factors as human activity, wind waves, tidal currents and feeding by bottom fishes and shore birds. Because of this, both plants and invertebrate animals living in soft bottom habitats normally do not have solid and stable attachment sites.

Because they lack solid places for attachment, a large majority of the invertebrates in soft bottom intertidal and subtidal habitats of San Diego Bay are part of the infauna, animals that burrow into the substrate for protection and to avoid being carried away by water movement. Relatively few species form part of the epifauna, invertebrates such as sponges, gastropod molluscs, and some larger crustaceans and tunicates that spend most of their time on the sediment surface.

Some soft bottom invertebrates are so small that they live and move around in the spaces between the sediment grains or attach to the grains. These are called the interstitial fauna. They include protozoans, nematodes, hydroids, polychaete and oligochaete worms, flatworms, and copepods, as well as five phyla or classes of invertebrates that are found primarily in this interstitial environment. These five groups are the gastrotrichs, kinorhynchs, rotifers, archiannelids, and gnathostomulids.

It is important to note that most of these interstitial species do not appear in the species list for San Diego Bay (Table 1) or are represented in that list only by notations such as unidentified oligochaete spp or nematode spp. The reason for this is that, because of their very small size, most interstitial pass through the 0.5 mm sieves normally used to process standard infauna samples. No special sampling has been conducted for the interstitial in San Diego Bay thus far. As a result, we know very little about its species composition.

The major physical and chemical factors which determine the structure of a soft bottom community and affect the population dynamics of its epifaunal and infaunal species involve a variety of characteristics of the sediment. They include grain size distribution, degree of grain compaction and porosity, water content, dissolved oxygen levels, levels of suspended and deposited organic material and the short-term and long-term stability of the sediment. These characteristics are affected by depth, slope of the bottom, wave action, currents, and other physical and chemical characteristics of the water above the bottom. Productivity of the overlying water, predation and other species interactions are the primary biological factors involved. Predation by fishes and larger invertebrates, particularly by larger, active predators such as the round stingray and flatfishes, may play a very important role in shaping the infauna and the dynamics of species which form the community.

Feeding Relationships of Invertebrates in Soft Bottom Habitats

Most infaunal species of intertidal and subtidal soft bottom communities in San Diego Bay and other estuaries feed on the abundant detritus suspended in the water and deposited in the sediments (Table I-2). This detritus consists of both dead organic matter and the bacteria and other decomposer organisms that live on it. Both these dead and living components are important in the diet of invertebrate detritus feeders.

Deposit feeding species tend to predominate in soft bottom sediment areas with large amounts of silt and clay (mud); this is the primary sediment type throughout most of San Diego Bay. The main reason for this relationship is that more detritus accumulates in the interstitial spaces between fine sediment particles than between those of larger grain size. In contrast, suspension feeders are more common in soft bottom areas where sandy sediments predominate, such as in some areas of north San Diego Bay.

Detritus is also considered to be the most important source of food for the meiofauna, as it is for larger infaunal invertebrates. However, many meiofauna species are predators or scavengers. Other meiofauna are grazing herbivores that feed on diatoms living in the upper few millimeters of the sediment.

Many of the species which occur in the intertidal habitats of south bay also occur subtidally as well (Ford & Chambers, 1973, 1974). This is not surprising, because the subtidal areas of south San Diego Bay are nearly all quite shallow and sediment characteristics at a given location are much the same both intertidally and subtidally. However, the number of intertidal species present generally appear to be much smaller than the number of subtidal species (Ford and Chambers 1973, 1974; Macdonald *et al.* 1989).

Some species of the common intertidal and subtidal bivalve molluscs of inner San Diego Bay are used as food by man, and the area has long been considered good for clam digging. These include the banded, smooth, and wavy cockle clams (*Chione californiensis, C. fluctifraga,* and *C. undatella*), the bent-nosed clam (*Macoma nasuta*), and the littleneck clam (*Protothaca staminea*). However, the size of most individuals of these species appears to be small compared with those in nearby clamming areas, such as the San Diego River mouth. The jackknife clams (*Tagelus californianus and T. subteres*), the rosy razor clam (*Solen rosaceus*) and other small bivalves are used commonly as bait for fishing. The ghost shrimp (*Callianassa californiensis*) is also caught and sold as bait.While the other invertebrates present are not of direct value to man, they are extremely important to the biological economy of estuarine areas. The feeding of nematode and polychaete worms, gastropod molluscs, brittlestars, crabs, isopods, and a wide variety of smaller crustaceans serves to transform detritus and small invertebrates into usable food for larger invertebrates and fishes; the latter, in turn, are eaten by other large fishes and aquatic birds, many of which are of sport fishing value or esthetic value to man. Bivalve molluscs and other suspension feeders serve a similar function in transforming plankton and suspended detrital material into food for fishes and birds.

Several species of marine algae associated with the shallow, soft bottom habitats of south San Diego Bay appear to be important habitat features for epifaunal invertebrates and fishes. At least during the summer months, shallow subtidal soft bottom areas throughout the south bay are covered by extensive mats of living marine algae, which are interspersed with areas of exposed sediment (Ford 1968, Ford and Chambers 1974). The dense, heavily branched red alga *Gracilaria verrucosa* forms the bulk of this mat, which also includes the red algae *Hypnea valentiae* and *Griffithsia pacifica*. Some of these plants are loosely anchored in the sediment, while others drift just above the bottom.

Underwater observations indicate that these algal mats are an important microhabitat feature, because they provide cover or refuge from predators for many species of motile invertebrates and fishes, much as marsh vegetation does for aquatic birds. The algae also appear to serve as a food source for some invertebrates.

An unusual colonial ectoproct or bryoaoan animal, *Zoobotryon verticillatum*, is present on the bottom sediment throughout much of inner San Diego Bay, where it forms large, flexible, tree-like masses during the warmer months of the year. Some clumps are attached to shell material embedded in the sediment or to algae, while much of it simply moves around freely on the bottom. Like the benthic plants discussed above, it serves as food for a variety of invertebrates and as refuge or cover for both motile invertebrates and small fishes.

Another unusual epifaunal species is a large purple and green basket sponge. These sponges are so large and abundant in some areas of inner San Diego Bay that they give the bottom of the bay the appearance of an underwater "cabbage patch." This sponge has been identified in previous studies of south San Diego Bay as *Tetilla mutabilis*, originally described from inner Newport Bay. However, recent examination by specialists indicates that it may be an undescribed species.

Invertebrate Fauna in Soft Bottom Habitats of Central and North San Diego Bay

There has been only one multi-season study of soft bottom communities in outer San Diego Bay, that conducted by Ford and Chambers (1973) in the downtown area adjacent to and offshore from the Broadway and Navy piers. All of the sampling stations employed were in relatively deep subtidal areas. In addition, the recent study by Fairey *et al.* (1996: Tables 7–11) provided important information about infaunal invertebrate assemblages at a large number of sites throughout central and outer San Diego Bay (Table I-1). Other environmental impact studies of limited scope have also provided useful information about the invertebrate fauna of soft bottom habitats in other areas of the central and outer bay.

Of the 218 invertebrates species in soft bottom habitats sampled during four seasons in 1972–1978 near and offshore of the Broadway and Navy piers, 81 (37%) were polychaete worms, 47 (22%) were crustaceans, and 24 (11%) were bivalve and gastropod molluscs (Ford and Chambers 1973). While the number of species in each category is smaller at the outer bay location, the percentages are very similar to those reported for inner San Diego Bay. This indicates that polychaetes, crustaceans and molluscs are the dominant invertebrates in both areas. Data on abundance and biomass also confirm the dominance of these three invertebrate groups at the north bay location.

Comparison of the data for infaunal invertebrates reported from north and central San Diego Bay by Ford and Chambers (1973) and Fairey *et al.* (1996) with those for the south bay (Macdonald *et al.* 1990) indicates that there is considerable overlap, with many of the same species occurring in all three areas.

The 22 species of multicellular algae present in the relatively deep bottom area near and offshore from the piers apparently do not form extensive mats, as they do in south San Diego Bay. This probably is the result of low light levels at greater depths and the relatively turbid water in this area of substantial vessel activity.

The colonial ectoproct, or bryozoan, *Zoobotryon verticillatum*, is also present in some areas near the downtown piers, where it forms large tree-like masses during the warmer months of the year. Most clumps are attached to the bases of pier pilings, while some are attached to shell material embedded in the unconsolidated sediment or simply drift above the bottom. In common with the benthic algae discussed above, this ectoproct serves as food for a variety of invertebrates and as a refuge for both invertebrates and small fishes near the pier pilings and on the soft bottom sediment.

Recolonization Rates after Disturbance

The environmental effects of dredging and disposal of dredged sediments on benthic invertebrates have been widely reviewed (O'Neal and Sceva 1971; Morton 1977; U.S. Army Corps of Engineers 1977; DiSalvo 1978, Hirsch *et al.* 1978). During the course of dredging, as well as the subsequent soil disposal, the water becomes turbid with resuspended silt and clay, and dissolved oxygen is consumed (JBF Scientific Corporation 1975; U.S. Army Corps of Engineers 1976). These effects are usually greater during disposal than during dredging (U.S. Army Corps of Engineers 1976). The formation of a thick suspension of dredged sediments called fluid mud smothers some infaunal species but not others (Diaz and Boesch 1977). The resulting turbidity is relatively short-lived and probably no worse than the natural turbidity caused by storm water discharge through rivers and smaller watercourses in winter, wind waves, and tidal currents. Laboratory studies concerning the effects of sediment suspensions on mussels, clams, polychaete worms, and crustaceans (Peddicord *et al.* 1975) showed that these mud-dwelling invertebrates would not be harmed by the levels of field suspensions measured during actual dredging operations (U.S. Army Corps of Engineers 1976). The depression of dissolved oxygen concentration was found to be small and brief, probably because of the bulk of the sediment rapidly sinks to the bottom before all the reduced substances can be oxidized. Advection and mixing quickly restore equilibrium conditions. *(Nichols and Pamatmat 1988)*

The Marine Board (1985) concluded that the potential for persistent environmental effects of benthic populations due to maintenance dredging is very small. The dredged bottom, as well as the areas where dredge spoil is deposited, are usually recolonized rapidly (McCauley *et al.* 1977). Soule and Oguri (1976) studied recolonization of infaunal species after dredging, compared to a reference site. They found that the re-colonizing species assemblages were less diverse than the established assemblages, and that two to three years were required for the community to stabilize. This time requirement was similar to the one Reish (1961) reported for the initial colonization of the benthos in newly established marinas. These studies lead to a conclusion that dredged areas gradually return to their previous population and community levels.

Moreover, the areas of dredging and disposition at any one time are small fractions of the total area of the estuary. Thus, the influx of organisms from the surrounding undisturbed areas can be rapid. In addition, benthic communities normally subject to wave scour, high turbidity, and sediment redeposition rapidly recover from dredging and sediment disposal. This appears to be because the residents are rapidly reproducing, opportunistic species with short life cycles (Oliver *et al.* 1977). Because many of the species in the benthos remain reproductively active for much of the year, they can quickly colonize a newly exposed sediment surface (Nichols and Pamatmat 1988), thereby facilitating the recovery process.

Southern California Eelgrass Mitigation Policy (Adopted July 31, 1991)

Eelgrass *Zostera marina* vegetated areas function as important habitat for a variety of fish and other wildlife. In order to standardize and maintain a consistent policy regarding mitigating adverse impacts to eelgrass resources, the following policy has been developed by the Federal and State resource agencies (National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game). This policy should be cited as the Southern California Eelgrass Mitigation Policy (revision 8).

For clarity, the following definitions apply. “Project” refers to work performed on-site to accomplish the applicant's purpose. “Mitigation” refers to work performed to compensate for any adverse impacts caused by the “project.” “Resource agencies” refers to National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the California Department of Fish and Game.

1. **Mitigation Need.** Eelgrass transplants shall be considered only after the normal provisions and policies regarding avoidance and minimization, as addressed in the Section 404 Mitigation Memorandum of Agreement between the Corps of Engineers and Environmental Protection Agency, have been pursued to the fullest extent possible prior to the development of any mitigation program.

2. **Mitigation Map.** The project applicant shall map thoroughly the area, distribution, density and relationship to depth contours of any eelgrass beds likely to be impacted by project construction. This includes areas immediately adjacent to the project site which have the potential to be indirectly or inadvertently impacted as well as areas having the proper depth and substrate requirements for eelgrass but which currently lack vegetation.

Protocol for mapping shall consist of the following format:

1) Coordinates

Horizontal datum—Universal Transverse Mercator (UTM), NAD 83, Zone 11

Vertical datum—Mean Lower Low Water (MLLW), depth in feet.

2) Units

Transects and grids in meters.

Area measurements in square meters/hectares.

All mapping efforts must be completed during the active growth phase for the vegetation (typically March through October) and shall be valid for a period of 120 days with the exception of surveys completed in August–October.

A survey completed in August–October shall be valid until the resumption of active growth (i.e., March 1). After project construction, a post-project survey shall be completed within 30 days. The actual area of impact shall be determined from this survey.

3. **Mitigation Site.** The location of eelgrass transplant mitigation shall be in areas similar to those where the initial impact occurs. Factors such as, distance from project, depth, sediment type, distance from ocean connection, water quality, and currents are among those that should be considered in evaluating potential sites.

4. **Mitigation Size.** In the case of transplant mitigation activities that occur concurrent to the project that results in damage to the existing eelgrass resource, a ratio of 1.2 to 1 shall apply. That is, for each square meter adversely impacted, 1.2 square meters of new suitable habitat, vegetated with eelgrass, must be created. The rationale for this ratio is based on, 1) the time (i.e., generally three

years) necessary for a mitigation site to reach full fishery utilization and 2) the need to offset any productivity losses during this recovery period within five years. An exception to the 1.2 to 1 requirement shall be allowed when the impact is temporary and the total area of impact is less than 100 square meters. Mitigation on a one-for-one basis shall be acceptable for projects that meet these requirements (see section 11 for projects impacting less than 10 square meters).

Transplant mitigation completed three years in advance of the impact (i.e., mitigation banks) will not incur the additional 20% requirement and, therefore, can be constructed on a one-for-one basis. However, all other annual monitoring requirements (see sections 8–9) remain the same irrespective of when the transplant is completed.

Project applicants should consider increasing the size of the required mitigation area by 20–30% to provide greater assurance that the success criteria, as specified in Section 9, will be met. In addition, alternative contingent mitigation must be specified, and included in any required permits, to address situation where performance standards (see section 9) are not met.

5. **Mitigation Technique.** Techniques for the construction and planting of the eelgrass mitigation site shall be consistent with the best available technology at the time of the project. Donor material shall be taken from the area of direct impact whenever possible, but also should include a minimum of two additional distinct sites to better ensure genetic diversity of the donor plants. No more than 10% of an existing bed shall be harvested for transplanting purposes. Plants harvested shall be taken in a manner to thin an existing bed without leaving any noticeable bare areas. Written permission to harvest donor plants must be obtained from the California Department of Fish and Game.

Plantings should consist of bare-root bundles consisting of 8–12 individual turions. Specific spacing of transplant units shall be at the discretion of the project applicant. However, it is understood that whatever techniques are employed, they must comply with the stated requirements and criteria.

6. **Mitigation Timing.** For off-site mitigation, transplanting should be started prior to or concurrent with the initiation of in-water construction resulting in the impact to the eelgrass bed. Any off-site mitigation project which fails to initiate transplanting work within 135 days following the initiation of the in-water construction resulting in impact to the eelgrass bed will be subject to additional mitigation requirements as specified in section 7. For on-site mitigation, transplanting should be postponed when construction work is likely to impact the mitigation. However, transplanting of on-site mitigation should be started no later than 135 days after initiation of in-water construction activities. A construction schedule which includes specific starting and ending dates for all work including mitigation activities shall be provided to the resource agencies for approval at least 30 days prior to initiating in-water construction.

7. **Mitigation Delay.** If, according to the construction schedule or because of any delays, mitigation cannot be started within 135 days of initiating in-water construction, the eelgrass replacement mitigation obligation shall increase at a rate of seven percent for each month of delay. This increase is necessary to ensure that all productivity losses incurred during this period are sufficiently offset within five years.

8. **Mitigation Monitoring.** Monitoring the success of eelgrass mitigation shall be required for a period of five years for most projects. Monitoring activities shall determine the area of eelgrass and density of plants at the transplant site and shall be conducted at 3, 6, 12, 24, 36, 48, and 60 months after completion of the trans-

plant. All monitoring work must be conducted during the active vegetative growth period and shall avoid the winter months of November through February. Sufficient flexibility in the scheduling of the 3 and 6 month surveys shall be allowed in order to ensure the work is completed during this active growth period. Additional monitoring beyond the 60 month period may be required in those instances where stability of the proposed transplant site is questionable or where other factors may influence the long-term success of transplant.

The monitoring of an adjacent or other acceptable control area (subject to the approval of the resource agencies) to account for any natural changes or fluctuations in bed width or density must be included as an element of the overall program.

A monitoring schedule that indicates when each of the required monitoring events will be completed shall be provided to the resource agencies prior to or concurrent with the initiation of the mitigation.

Monitoring reports shall be provided to the resource agencies within 30 days after the completion of each required monitoring period.

9. **Mitigation Success.** Criteria for determination of transplant success shall be based upon a comparison of vegetation coverage (area) and density (turions per square meter) between the project and mitigation sites. Extent of vegetated cover is defined as that area where eelgrass is present and where gaps in coverage are less than one meter between individual turion clusters. Density of shoots is defined by the number of turions per area present in representative samples within the control or transplant bed. Specific criteria are as follows:

a. a minimum of 70 percent area of eelgrass bed and 30 percent density after the first year.

b. a minimum of 85 percent area of eelgrass bed and 70 percent density after the second year.

c. a sustained 100 percent area of eelgrass bed and at least 85 percent density for the third, fourth and fifth years.

Should the required eelgrass transplant fail to meet the established criteria, then a Supplementary Transplant Area (STA) shall be constructed, if necessary, and planted. The size of this STA shall be determined by the following formula:

$$STA = MTA \times (|A_t + D_t| - |A_c + D_c|)$$

MTA = mitigation transplant area.

A_t = transplant deficiency or excess in area of coverage criterion (%).

D_t = transplant deficiency in density criterion (%).

A_c = natural decline in area of control (%).

D_c = natural decline in density of control (%).

Four conditions apply:

1) For years 2–5, an excess of only up to 30% in area of coverage over the stated criterion with a density of at least 60% as compared to the project area may be used to offset any deficiencies in the density criterion.

2) Only excesses in area criterion equal to or less than the deficiencies in density shall be entered into the STA formula.

3) Densities which exceed any of the stated criteria shall not be used to offset any deficiencies in area of coverage.

4) Any required STA must be initiated within 120 days following the monitoring event that identifies a deficiency in meeting the success criteria. Any delays beyond 120 days in the implementation of the STA shall be subject to the penalties as described in Section 7.

10. **Mitigation Bank.** Any mitigation transplant success that, after five years, exceeds the mitigation requirements, as defined in section 9, may be considered as credit in a "mitigation bank." Establishment of any "mitigation bank" and use of any credits accrued from such a bank must be with the approval of the resource agencies and be consistent with the provisions stated in this policy. Monitoring of any approved mitigation bank shall be conducted on an annual basis until all credits are exhausted.

11. **Exclusions.**

1) Placement of a single pipeline, cable, or other similar utility line across an existing eelgrass bed with an impact corridor of no more than 2 meter wide may be excluded from the provisions of this policy with concurrence of the resource agencies. After project construction, a post-project survey shall be completed within 30 days and the results shall be sent to the resource agencies. The actual area of impact shall be determined from this survey. An additional survey shall be completed after 12 months to insure that the project or impacts attributable to the project have not exceeded the allowed 2 meter corridor width. Should the post-project or 12 month survey demonstrate a loss of eelgrass greater than the 2 meter wide corridor, then mitigation pursuant to sections 1–11 of this policy shall be required.

2) Projects impacting less than 10 square meters. For these projects, an exemption may be requested by a project applicant from the mitigation requirements as stated in this policy, provided suitable out-of-kind mitigation is proposed. A case-by-case evaluation and determination regarding the applicability of the requested exemption shall be made by the resource agencies.

(last revised 2/2/99)

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Appendix I: Public Comments and Responses

Written comments received from the public on the Public Draft are presented in their entirety in this Appendix, and summarized in the Table below. Also presented following these comments is a summary of public comments from two public workshops.

Comment Location	Commenter	Comment	Response
General Comments			
	Save Our Bay Inc.	The massive plan of more than 590 pages, including Appendices A-H (excluding C, the six (?) oversize maps), is impressive and should forestall for the foreseeable future any similar planning efforts. It would seem nearly impossible to expand its 34 page bibliography.	Thanks.
	Save Our Bay Inc.	We could find no reference in the plan to the effects sea level rise caused by global warming. If that rise is three feet (3'), which is likely, and violent storms cause a breaching of the Silver Strand first at Emory Cove, also likely, all manner of adverse impacts will occur. The plan should address this problem and call for planning to deal with it.	We address sea level rise in Sections 2.7.4 "Disturbance Regimes and Time Scales of Change," and consider it as an issue and information gap in sections 4.2.1.6 "Salt Marsh," 4.2.1.9 "Upland Transitions," and 4.2.2 "Mitigation and Enhancement."
	Save Our Bay Inc.	It is now known that past major climate changes have occurred in a very short time, i.e., an abrupt (just a couple of decades) 16 degree warming at the end of what is considered the last ice age, 15,000 years ago, (Severinghaus of SIO in San Diego Union-Tribune 29 Oct. 1999). That was followed 8,200 years ago by a change "from warm back to ice age" that took just 70 years. (James Burke in "After the Warming 2050" by Ambrose Publishing 1990).	Acknowledged.
	San Diego Audubon Society	Organize, schedule and publicize shoreside tours in South Bay, especially in mid-winter and again in May-June. These might serve to get the attention of people who now have little or no awareness of what is there and why it is of interest.	We added this to Environmental Education section in Ch. 5.
	Environmental Health coalition	Please do an index. This is a great accumulation of information and would be made more usable with an index.	We could not find a way to do an index within our budget, but hope that the detailed Table of Contents helps.
	Environmental Health coalition	The framework of this report appears to be structured as a mechanism for enabling planning and to facilitate expanded (and, generally, environmentally destructive) military, industrial, and commercial use of the Bay by creating mechanisms whereby proposed projects can be facilitated through creation of habitat management plans, establishment of mitigation banks, etc. Without the specific project plan and areas to be protected, enhanced etc. and the mechanisms by which they will be protected and managed and the enforceable commitments by which that protection and enhancement will occur, one cannot know if this plan will protect the Bay's natural resources or not. The San Diego Bay Ecosystems plan would benefit by development of a specific Action Plan. The Action Plan would take the valuable elements out of the Ecosystem plan and identify a series of projects that could be implemented. This gives immediate focus and momentum for implementation. The Action Plan should consist of a significant number (20-30+) sanctioned projects grouped around Habitat Preservation (Creation, Restoration, Enhancement), Maintenance, Monitoring, Education, etc. Each project description should include: Purpose, Objectives, Approach, Monitoring and Remediation, and Costs.	A primary purpose of this Plan was always to make project planning more predictable for Bay users, as well as to facilitate commitment by project proponents to environmental protection and enhancement. A workshop was held after the Public Draft comments were received, and first-year priorities were identified that are presented in Chapter 7.

Comment Location	Commenter	Comment	Response
	San Diego Archeological Society	While making the document available on the Internet is a good idea, the size of this document effectively makes it inaccessible. I found that, even over a T-1 line, it took a significant period for the download to be completed.	Detail in the graphics is the reason the download is slow. We can provide a version of the document in which the graphics may remain fuzzy, but it will download quickly.
	San Diego Archeological Society	When I did a search in the document for references to archeological and historical sites, and archeological, historical and cultural resources, I found essentially no instances other than a high level overview. The potential for management for enhancement of biological resources cannot be discounted or ignored. It appears that no real effort has been made to identify cultural resources, on shore or underwater, which could be impacted by the project. Furthermore, to the extent that any federal government funds are expended or permits are required for any portions of this project, cultural resources must be addressed and the requirements of 36 CFR 79 will apply. As admirable as the intent of the plan is, it cannot be adopted without being modified to address cultural resources. We would like the opportunity to review these revisions.	Addressing cultural resources was out of scope for the contractor, since natural and cultural resources are routinely handled in separate planning documents by agencies. However, public review of the Environmental Assessment for this plan and later reviews of projects should allow for cultural review. Some additional strategies that incorporate cultural resource interpretation into educational activities have been added to Ch. 5.
Specific Comments			
Table of Contents	Save Our Bay Inc.	We suggest placing the word "Chapter" (or Chap.) ahead of the 1.0, 2.0, 3.0, etc.	Done.
Executive Summary pg. xxi	Save Our Bay Inc.	In the third paragraph (para) under habitats, we wonder if the emphasis on intertidal flats detracts from the importance of shallow subtidal, particularly for "juvenile California halibut." It is our belief that these juveniles require water habitat at all times which they would not have on intertidal when the tide is out. Or can juveniles lie buried until the tide returns?	California halibut use both intertidal and shallow subtidal areas. We think the plan emphasizes increased protection of both intertidal and shallow subtidal areas.
Pg. 2-104 (Sec. 2.5.5, Waterfowl)	Save Our Bay Inc.	We note margin comment: "Black brant depend upon eelgrass beds for food." The "Comprehensive Management Plan for San Diego Bay" says they may sometimes depend on sea lettuce.]	Statement amended.
Pg. 4-11 (Sec. 4.2.1.3, Proposed Mgmt. Strategy III)	Save Our Bay Inc.	It would be helpful to add the Section # after Chapter 6.	Done.
Ch. 5	Save Our Bay Inc.	We found no reference to use by the now Port District - owned South Bay Power Plant of bay waters for cooling purposes. This is extremely important if the shallow subtidal nursery habitat for California halibut is ever to produce any mature halibut. July/August water temperatures are increased by the power plant hot water outflow so that juvenile halibut cannot survive. If they retreat to the deeper cooler Chula Vista boat channel, they are probably eaten by the large halibut found there. They are cannabalistic. For your information, we have attached SAVE OUR BAY, INC (SOBI) Sept. 29, 1996 letter to the San Diego Regional Water Quality Control Board.	This concern is complicated by the impending closure of the South Bay Power Plant, and by the fact that the warm water emissions from the plant have apparently attracted and enhanced the growth rate of the endangered green sea turtle. The Power Plant area is proposed for enhancement in Section 4.2.2.
Pg. 5-70 Paragraph 2	San Diego Audubon Soc.	The Park and Rec Dept. of San Diego has set up some excellent story board displays/educational sites along the Flood Control Frontage Road on Sea World Drive, Mission Bay and also at the Observation platform at Kendall-Frost Marsh, Mission Bay. No idea what these cost, but they seem to work and do not seem subject to vandalism. Many more access points to the Bay, especially South Bay are needed, especially to include maps of hard to observe areas like the Salt Works ponds, and as per items E1,2,4,5 pg. 5-72, observation pts/board walks/short towers to provide exposure to these protected habitats. There is a very effective board walk at the Bolsa Chica wetland preserve near Seal Beach.	Comments added to Environmental Education section in Ch. 5.

Comment Location	Commenter	Comment	Response
Pg. 5-70 Paragraph 3	San Diego Audubon Soc.	How does "wind-blown trash" end up in the Sweetwater NWR? The prevailing wind is westerly. What's the source(s)? Some control of this would lessen the burden of volunteers forever cleaning up other people's messes. And all trash is not equal-plastic can loops, plastic bags, and items containing lead need particular attention.	We are not sure how trash ends up at the Refuge. Anything floating in the Bay seems to end up there, and the Sweetwater Channel brings down flood debris. Some of the larger items like dock parts, tires and couches are difficult to dispose of. This has been added as a concern.
Pg. 5-70 Paragraph 6	San Diego Audubon Soc.	Again, a message needs to be clearly sent to the Bay community that violating existing regulations and ignoring posted signage will result in substantial penalties and that enforcement is current. Negative things, which occur now are due in part at least to little or no enforcement and minimal penalties.	Acknowledged.
Pg. 6-6 Paragraph 2	San Diego Audubon Soc.	Bird Atlas grid blocks are 3mi x 3mi. Surveys are winter (Dec., Jan., Feb.) and summer (breeding), which can extend Feb/Mar. through July, but is concentrated in April, May and June. There is no Fall monitoring i.e., August through November, winter surveys of each block cover 3 years; breeding only one of all criteria are met. Hours per volunteer are minimum 25 hrs. winter plus 25 hrs. breeding season.	Incorporated.
Pg. 6-11 Paragraph 1	San Diego Audubon Soc.	San Diego Bay is certainly part of the Pacific Flyway for migratory birds, especially shore birds. Pt. Reyes Bird Observatory and San Francisco Bay Bird Observatory have been and are doing much work on SF Bay. So SF Bay has much in common with South SD Bay, just larger scale. There is even a salt extraction operation there, also being converted away from commercial salt production.	Thanks for the information.
Pg. 6-14, Table 6-4	San Diego Audubon Soc.	Some additional candidates for bird list:	
	San Diego Audubon Soc.	osprey: HI, SS, PS, maybe CI (open water)	Incorporated
	San Diego Audubon Soc.	Belding's savannah sparrow: C1, H1, SS, DS, PI, salt marsh	Incorporated
	San Diego Audubon Soc.	Large billed sparrow (now considered a separate species, but best to check status with Phil Unitt @ SDNHM): HI, SS. This bird was once widespread here in salt marsh, then essentially disappeared and is now present again.	Incorporated
P. 6-17 to 6-18	San Diego Audubon Soc.	Mitigation: From Joy Zedler research, tidal wetland restoration is marginal at best (Paradise Marsh and Connector marsh were particular sites).	Acknowledged. She also found it takes a very long time.
	San Diego Audubon Soc.	Populations: PRBO and SFBBO should have shorebird data, shorebird surveys of SD Bay, shoreline need to be facilitated by greatly improved ease of access-plenty of volunteers, but access is hard.	Thanks for the information. Access has been added as an issue to the Environmental Education and Long-term Monitoring sections. Information on PRBO and SFBBO added to Section 6.3 "Data Integration, Access and Reporting."
Pg. 6-25 to 6-26	San Diego Audubon Soc.	Should be flip-flopped, so text in 6-26 is contiguous with text on 6-24 instead of separated, as now.	Done.
D-28	San Diego Audubon Soc.	Phil Pride; name is spelled Pryde. He is a professor of geography at SDSU.	Corrected.
Pg. 2-20	Environmental Health Coalition	The discussion of contaminated site remediation is rosier than reality. Only Campbell's has a proper Cleanup and Abatement Order and the levels are not as protective as those cited in the earlier paragraph. There is no formal or enforceable cleanup agreement for NASSCO or SWM. These polluters refuse to cleanup to protective standard for the Bay and it is unclear how much of their polluted site will be remediated. The Navy's Naval Station sediment study has been apparently tabled for a few years and not shown to the public.	Comments noted. RWQCB is in process of developing cleanup agreements with NASSCO and SWM. The Naval Station's sediment study has been released as a Technical Document through SPAWAR.

Comment Location	Commenter	Comment	Response
	Environmental Health Coalition	Fish discussion should reflect that it has been reported to us that workers at NASSCO will fish from the piers during the lunch hour for fish for meals for their families	Comment noted. County of San Diego has posted fish advisory signs in several languages.
Pg. 3-32	Environmental Health Coalition	The assessment of the Navy future plans should include the Scheme 1A expansion plan for five carriers. A discussion of the concentration of carriers in San Diego waters for training grounds should be included.	Comment acknowledged. If the Navy brings in new carriers, they will be addressed in a separate EIS process.
Pg. 3-29	Environmental Health Coalition	The recreational boat survey seems designed to overestimate recreational boat traffic. Labor Day weekend has got to be one of the busiest weekends of the year.	Labor Day weekend data were extrapolated very conservatively to the rest of the year, due to the knowledge that it is an exceptionally busy weekend.
Pg. 4-4	Environmental Health Coalition	Evaluation of Current Management, again, paints a too-rosy picture of the current situation. It should rather read that unregulated oil spills and discharges from Navy vessels continue unregulated and Naval Facilities still have no discharge permit beyond the General Industrial Storm water permit. Toxic flows of runoff still enter the Bay from boatyards and shipyards and SDGE continues to discharge up to 600 mgd of hot water and wastes from chlorination into South Bay. The cooling discharges of carriers and submarine nuclear power plants are uncharacterized. In addition, dewatering discharges from Great American bldg and the Convention Center still discharge dewatering wastes into San Diego Bay. This is a more accurate picture of the current discharges currently entering San Diego Bay.	Comments acknowledged. It is widely agreed that once sewage was re-routed, the Bay's health improved dramatically. Monthly monitoring is conducted for metals, and quarterly monitoring for toxins in fish. The Navy and Port both report spills to the Marine Safety Office. Chlorinated discharges from the Power Plant are being addressed by examining the area of influence. SDG&E is in compliance with current requirements. Naval facilities are in a period of transition during which only a single permit is required. Dewatering discharges have not occurred since the Convention Center went on line.
	Environmental Health Coalition	The action items on this should include an immediate moratorium on any fill of any more deep water. This should begin with refusing to site the USS Midway in San Diego Bay as a de-facto permanent fill.	The Midway will need camels and dolphins to keep it in place away from the pier. We know of only tenuous justification for calling it a fill.
Pg. 4-7	Environmental Health Coalition	Restate to "Prohibit" new navigation channels in this habitat.	We have no authority to prohibit new navigation channels.
Pg. 4-8	Environmental Health Coalition	Under current management of shallow subtidal, current management has done little to protect this habitat. The net loss of this habitat type from the Stennis Homeporting project should be cited here.	It is not clear that shallow subtidal habitat was involved.
Pg. 4-91	Environmental Health Coalition	Please add Environmental Health Coalition as an organization that frequently comments on development projects in the Bay. EHC has been in San Diego for 20 years and the Clean Bay Campaign has been a dedicated San Diego Bay effort since 1987.	Done.
Section 5	Environmental Health Coalition	Needs a section on use of San Diego Bay as a cooling water system for multiple power plants. This should include the South Bay Power Plant, but also specifically the 6-14 nuclear submarines and the cooling systems of three nuclear powered aircraft carriers that will soon come to the Bay.	We have not been able to find any evidence that nuclear carriers, subs, or any vessel discharging cooling water have an adverse effect on Bay ecology.

Comment Location	Commenter	Comment	Response
	Environmental Health Coalition	There also needs to be a discussion of radiological impacts to the Bay. This must include the discovery of elevated levels of radiation in the fish in the 1990 health risk study and the elevated levels of Cesium at the Naval Station and the Sub Base noted in the most recent EPA study. Further, a plan to reduce or manage these risks should include a mention that the next CVX generation of carriers should be non-nuclear so that the radiological risks to the Bay are ultimately abated.	We are aware of these findings, but considered radiological impacts to be out of scope for this iteration of the Plan, perhaps to be taken up in updates. The planners never intended to deal in depth with water quality issues, since this was accomplished in the "Comprehensive Management Plan for San Diego Bay."
	Environmental Health Coalition	Compatible Use strategies should include development of ecotourism.	This has been added under Environmental Education in Ch. 5.
Pg.5-50	Environmental Health Coalition	There are additional runoff strategies that should be recommended and pursued. To effectively and positively reduce pollution in storm water runoff some or all of the following actions should be pursued.	The planners agree that non-point source pollution remains a problem in San Diego Bay, but not all of the specific recommendations mentioned. However, it was never intended that this Plan deal in depth with water quality issues, since this was a primary focus of the "Comprehensive Management Plan for San Diego Bay."
	Environmental Health Coalition	Ban use of certain problematic pesticides in the region such as has been done in San Francisco/Santa Barbara area. Legislative or ordinances. Bans of persistent chemicals is all that has ever worked to reduce load to the environment but will be unpopular with those that profit from their sale. If we want to see ecological improvement, we must be able to pursue this in spite of certain corporate opposition. Short of this, stiff "storm water pollution" taxes should be applied to all pesticides, fertilizers, etc. that are used outdoors with a label as to why the tax is needed and what the non-taxed alternatives to this product are.	Comment acknowledged. This is beyond the current scope of this Plan.
	Environmental Health Coalition	Required IPM for open space, park cemeteries, and gold courses. A low-cost or free contractor could be offered to support jurisdictions that wish to pursue IPM for their parks and open spaces. This could also be achieved legislatively.	The Port is implementing an Integrated Pest Management Program on its tidelands.
	Environmental Health Coalition	Support land acquisition to allow widening of rivers to support urban storm flow. This would avoid the continued highly detrimental activity of concreting and rip-rapping natural stream beds.	We agree that something needs to be done to correct the problem, but this was not an issue raised at our meetings, and perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Aggressive pursuit of E.V. and other non-polluting vehicles and fleets. Fund a subsidy program for purchase and lease of EVs. Initiate and support legislative efforts to strengthen EV mandate and development of EV and fuel cell technology.	The Port has an Electric Vehicle and propane "clean burning" vehicle program. However, this is beyond the current scope of this Plan.
	Environmental Health Coalition	Development of a structural UR element for the San Diego Bay watershed. Develop issue areas, Functional Assessment, Improvement Plan, Implementation. (Cost: existing FA plans for Otay and Penasquitos are $500,000 combined). This plan could find, identify areas that could be enhanced for filter strips, strategic locations for interceptors, marsh treatment sites, sediment/oil/grease etc...traps. Could be combined or separate from a non-structural plan.	We agree that something needs to be done to help, but this was not an issue raised at our meetings, and perhaps should be tackled in the next Plan iteration.

Comment Location	Commenter	Comment	Response
	Environmental Health Coalition	Full implementation of the SANDAG Regional Water Quality Element. This is a very important document and should be given the weight of law through requirements or ordinances. Permit for all new development should require structural and non-structural BMPs (for construction phase and the project) and to identify a perpetual funding source for said measures. BMPs should be required for all projects regardless of size (NPDES only required on 5 acres or more).	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Enforcement. On the ground enforcement within the watershed. Enforcement of construction runoff and erosion standards. Enforcement team for discharges to storm drain system.	Comment acknowledged. This is beyond the current scope of this Plan.
	Environmental Health Coalition	Major inclusion and coordination of SANDAG and CALTRANS regarding vehicle pollution. Water quality and vehicle pollution are very closely related. Issues regarding traffic methods, patterns, mass transit, must give increased consideration to vehicle impacts on water quality.	Comment acknowledged. This is beyond the current scope of this Plan.
	Environmental Health Coalition	Education program that emphasizes pollution prevention. (See discussion in the Water Quality Element, Cholla Creek Project).	This is ongoing. See Environmental Education section.
	Environmental Health Coalition	Development of integrated system of sinks, sediment traps, oil/water separators etc…within the watershed. Could be done with a pilot program first.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Development of a system of upland buffer strips and grassed water courses in lieu of pipes. Should also include major commitment to native, drought-tolerant vegetation for watershed.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Development of diversion and interceptor systems upstream of the Bay where they could be smaller.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Identify areas in the watershed where increases of infiltration rates can be accomplished. Identify areas where pavement could be removed and other surfaces be used. Also, methods in which to slow down storm water and increase infiltration time i.e. unpave bottoms of flood channels, widen them, and use cattails and other wetland species where possible to absorb pollutants and water.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Cover Navy gas stations under NPDES SW requirements and require BMP plans. Currently, we think they are only covered under CZARA.	Comment acknowledged. This was beyond the scope of our current Plan.
	Environmental Health Coalition	Cover Navy facilities under NPDES SW requirements comparable to those requirements covering shipyards.	Modifications to Navy NPDES permits are being considered.
	Environmental Health Coalition	Watershed BMP plan by regional hydro geographic unit focusing on specific plans and BMPs and plans for known uses i.e. gas stations, auto shops, painting and sanding, etc…	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Pollution Prevention Basin Plan amendment to encourage dischargers to become educated about their options for P2.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Develop and require an aggressive model for an industrial and commercial SWPP. These plans could/should include berming, structural BMPs, vacuuming of wastes, covering of waste areas, parking lot filter strips etc…	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.

Comment Location	Commenter	Comment	Response
	Environmental Health Coalition	Providing for adequate room for end of pipe treatments for new development projects. When projects such as the North Embarcadero are designed, adequate space and resources should be developed to allow for sediment traps, oil/grease/water separators, and filtration wetlands.	RWQCB prefers tougher source controls over end-of-pipe treatments. However, this is beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Support of existing pilot or demonstration programs. These are three projects that are underway, all of which will or are attempting to incorporate consideration of storm water in the design and management Paradise Creek Restoration Chollas Creek Linear Park (unsure of status) C.V. Bayfront Development Otay River Wetlands Working Group watershed management study	These are supported in the Environmental Education section of Ch. 5.
	Environmental Health Coalition	Requirement of watershed cities to pool funds for NPS programs within the watershed or through tax exercise ability of the Port.	Comment acknowledged. This was beyond the scope of our current Plan, but perhaps should be tackled in the next Plan iteration.
	Environmental Health Coalition	Replacement of rip-rap with wetlands, mudflats where possible. Consider in front of hotels, etc.	This is recommended in Ch. 4 and elsewhere in the document.
	Environmental Health Coalition	Interceptors systems around key areas of the bay to collect and divert dry weather flows. Mission Bay trap dry weather flows go into a tank in the ground and later gets pumped into the sewer system. There is also an interceptor at Famosa Slough.	There is an existing low-flow diversion system. Improvements may be discussed in a future iteration of the Plan.
	Environmental Health Coalition	End of Pipe Treatments. Oil and grease separator. Sediment traps are important because contaminants travel on sediments and can be removed and prevented from the Bay	RWQCB prefers tougher source controls to end-of-pipe treatment, which has not worked well.
	Environmental Health Coalition	Fund a storm water/BMP/whatever team to address and assist tenants with storm water compliance.	Added to Section 5.2.2 "Stormwater Management."
	Environmental Health Coalition	Fund and implement a Hazardous Materials Collection event/station for marinas.	Added to Section 5.2.2 "Stormwater Management."
	Environmental Health Coalition	Recommend strengthened Municipal and industrial storm water permits	These were strengthened January 2000.
	Environmental Health Coalition	Design a progressive and effective "blueprint" for Standardized Minimum Requirements to comply with the permit.	Comment acknowledged. This was beyond the scope of our current Plan.
	Environmental Health Coalition	Facilitate a staffed storm water hotline.	Co-permittees currently support this as part of the "Think Blue" campaign.
Pg. 7-20	Environmental Health Coalition	Revise third bullet to read that the NEP could be used to carry out..."developing and implementing corrective actions..."	Done.
Pg. 7-20	Environmental Health Coalition	NEP was not defeated by a generalized local distrust. It was defeated by local industry, specifically Industrial Environmental Association, Port Tenants Association, and the Mayor's Port Advisory Council comprised of Bayside industries and the Navy. This should be reflected accurately in the document.	Statement modified to say that NEP was defeated by local industry.
	Environmental Health Coalition	We are assuming that we will have a chance to comment on the actual recommendations for preservation, restoration and action.	A follow-up workshop was held and comments were received.
Pg. 7-20	Environmental Health Coalition	NEP could be used for funding if the nominations would open again and accept new estuary applications. This should not be discounted as a viable option.	This is kept as a viable option in the document.

SAN DIEGO COUNTY ARCHAEOLOGICAL SOCIETY

San Diego County Archaeological Society

Environmental Review Committee

15 November 1999

To: Ms. Melissa A. Mailander
Environmental Review Coordinator
Unified Port District
P.O. Box 488
San Diego, California 92112-0488

Subject: Draft Integrated Natural Resources Management Plan

Dear Ms. Mailander:

I have reviewed the subject document on behalf of this committee of the San Diego County Archaeological Society.

While making documents available on the Internet is a good idea, the size of this document effectively makes it inaccessible. I found that, even over a T-1 line, it took a significant period for the download to be completed.

When I did a search in the document for references to archaeological and historical sites, and archaeological, historical and cultural resources, I found essentially no instances other than a high level overview. The potential for management for enhancement of biological resources to adversely impact cultural resources cannot be discounted or ignored. It appears that no real effort has been made to identify cultural resources, on shore or underwater, which could be impacted by the project. Furthermore, to the extent that any federal government funds are expended or permits are required for any portions of this project, cultural resources must be addressed and the requirements of 36 CFR 79 will apply.

As admirable as the intent of the plan is, it cannot be adopted without being modified to address cultural resources. We would like the opportunity to review these revisions.

Thank you for notifying us of the public review period for the INRMP.

Sincerely,

RECEIVED NOV 17 1999 LAND USE & PLANNING

James W. Royle, Jr., Chairperson
Environmental Review Committee

P.O. Box 81106 . San Diego, CA 92138-1106 . (619) 538-0935

kno safe depository of the ultimate powers of
he s y but the people themselves; and
f we ..nk them not enlightened enough
o exercise their control with a
holesome discretion, the remedy is
ot to take it from them but to inform their
iscretion.
Thomas Jefferson
September 28, 1820

SAVE OUR BAY INC.

409 Palm Ave., Suite 100, Imperial Beach, CA 91932-1121 Tel: (619)429 7946

Nov. 3, 1999

Bay Ecosystem Plan Technical Oversight Committee
c/o Tierra Data Systems
Attn: Elizabeth Kellogg
10110 West Lilac Road
Escondido CA 92026

Dear Dr. Kellogg:

The massive plan of more than 590 pages, including Appendices A-H (excluding C, the six (?) oversize maps), is impressive and should forestall for the foreseeable future any similar planning efforts. It would seem nearly impossible to expand its 34 page bibliography.

We have several minor comments and several we consider of more consequence.

In the "Table of Contents" we suggest placing the word "Chapter" (or Chap.) ahead of the 1.0, 2.0, 3.0, etc.

In the Executive Summary, page (p) xxi, in the third paragraph (para) under habitats, we wonder if the emphasis on intertidal flats detracts from the importance of shallow subtidal, particularly for "juvenile California halibut". It is our belief that these juveniles require water habitat at all times which they would not have on intertidal when the tide is out. Or can juveniles lie buried until the tide returns?

On page 2-104 (Sec. 2.5.5 , Waterfowl) we note margin comment: "Black brant depend upon eelgrass beds for food."

For whatever it's worth, we cite the South San Diego Bay Enhancement Plan, Volume Two, page 7-2, last paragraph: "_ _ _ but in 1943 he noted that there was no eelgrass in San Diego Bay and presumed that the birds were feeding on sea lettuce (as they do in the bay to this day.)." So one ecosystem rule is that animals may have highly preferred foods but can survive on many others, just as wintering mule deer might prefer bitterbrush and mountain mahogany but can survive quite well on a mixture of sagebrush and juniper. Even humans might prefer beefsteak but can survive probably better on tofu and other vegetable proteins.

On page 4-11 (Sec. 4.2.1.3, Proposed Mgmt. Strategy III.), it would be helpful to add the Section # after Chapter 6.

In the "State of the Bay - Human Use" Chapter, we found no reference to use by the now Port District-owned South Bay Power Plant of bay waters for cooling purposes. This is extremely important if the shallow subtidal nursery habitat for California halibut is ever to produce any mature halibut. July/August water temperatures are increased by the power plant hot water outflow so that juvenile halibut cannot survive. If they retreat to the deeper cooler Chula Vista boat channel, they are probably eaten by the large halibut found there. They are cannibalistic. For your information we have attached SAVE OUR BAY, INC (SOBI) Sept. 29, 1996, letter to the San Diego Regional Water Quality Control Board.

We could find no reference in the plan to the effects sea level rise caused by global warming. If that rise is three feet (3'), which is likely, and violent storms cause a breaching of the Silver Strand first at Emory Cove, also likely, all manner of adverse impacts will occur. The plan should address this problem and call for planning to deal with it.

It is now known that past major climate changes have occurred in a very short time, i.e.,.an abrupt (just a couple of decades) 16 degree warming at the end of what is considered the last ice age, 15,000 years ago (Severinghaus of SIO in San Diego Union-Tribune 29 Oct. 1999). That was followed 8,200 years ago by a change "from warm back to ice age" that took just 70 years. (James Burke in "After the Warming 2050" by Ambrose Publishing 1990).

We hope this "Bay Ecosystem Plan" won't immediately go morbid as did the "Comprehensive Management Plan for San Diego Bay". On the other hand maybe, just maybe, the CMPSOB did help get the South Bay National Wildlife Refuge for whatever it may be worth after sea level rise.

Sincerely,

William E. Claycomb

William E. Claycomb, President

Attach.
SOBI 9-29-96 letter

For RWQCB
initialing
9-29-96
See note bottom
of letter
dated 9-11-96

SAVE OUR BAY INC.

457 Delaware St., Imperial Beach, CA 91932-1422 Tel: (619 429 7946

September 29, 1996

Chairman and Board Members AND
Mr. John Robertus, Executive Officer,
San Diego Region, Regional Water Quality Control Board
9771 Clairemont Mesa Blvd., Suite A
San Diego, CA 92124-1331

Dear Mr. Chairman and Executive Officer Robertus, et al:

Based upon information in our three previous letters to you dated Aug. 7, Sept. 11 and Sept. 26, 1996, we feel confident in preparing a billing for California halibut loss caused by SDG&E's SBPP.

We have a calculation, 13,759, the standing stock of California halibut (Paca) in San Diego Bay. Equating San Diego Bay with Mission Bay we calculate that it should be at least 110,410, an annual loss of 96,651. We say "annual" because during each year water temperature rises to the point of forcing juvenile Paca into deeper water where they are eaten as previously mentioned.

Rounding off, what the San Diego Bay standing stock loss ~~should~~ be, to 96,700 and multiplying by 7.502 pounds (#) per fish, we find an annual halibut fishery loss of 725,400 pounds. The 7.502 is the average weight of the four year catch (1993 - 3.49 Kg, 1994 - 3.4 Kg, 1995 - 3.11 Kg, 1996 - 3.63 Kg) according to the Marine Recreational Fisheries Statistics Survey of the Pacific States Marine Fisheries Commission. Multiplying 725,400 pounds by $2.50 per pound (the present dead fish price, according to California Fish and Game, Long Beach - live fish bring $4.50 to $6.00 to commercial fishermen unloading at the dock), we find the annual monetary value to be $1,813,500.00.

SDG&E got the SBPP four steam turbines in operation by 1971, so we assume they have been depleting halibut stocks, as calculated above, since that date, a period of 25 years. SDG&E should, therefore, be billed for $45,337,500. We would, of course, allow them to take inflation (or deflation) into account, but we would charge interest depending upon interest rates in effect each year.

A separate billing statement for loss of rosy razor and jackknife clams will be prepared in the future. It will not be so exact because of the limited distribution of only five (5) sampling stations near the power plant.

Sincerely,

William E. Claycomb
President

We Welcome Your Comments

San Diego Bay
Integrated Natural Resource Management Plan
"Bay Ecosystem Plan"

Your comments are important to us. Please use this sheet to tell us your comments on the Bay Ecosystem Plan. Please feel free to use additional comment sheets if more space is needed. To ensure that your comments are addressed in the INRMP, comments should be received no later than November 17, 1999.

(1) What follows are assorted comments, first from the 2 page Environmental Education handout for the Ed. workshop I was not able to attend.

page-2, ¶2: I could not find, in the preceding text, any explanation for what RCD refers to.

¶3: Imperial Beach Bird Fest either has or soon will have a name change. Check Mike Klein @ 619 563-6695 to check this.

page-3, ¶1 Children don't (or seldom) operate & own jet skis, power boats, & wind surfers — the major disruptive impactors in So. Bay of wildlife. They also don't dump trash, spill oils & dispose of hazardous chemicals in the Bay. Adults do all these. Children are also probably not going to heed boundary markers & posted notices re speed limits, trespass, etc. Adults can & probably will pay heed especially if regulations are enforced and penalties for not heeding become obvious. Much more educational exposure to So. Bay and its components, for adults, is needed.

page-4 item C-2 In the face of almost complete lack of basic natural history/environmental instruction in the schools, how much can you expect any child to get from discussion of ecosystem concepts? This item is a good idea, but my point is that it may be a very tough sell.

Your Name James Coatsworth
Address 941 B Avenue
City/St/Zip Coronado CA 92118-2605

This form can be mailed to: Tierra Data Systems Attention: Elizabeth Kellogg
10110 West Lilac Road, Escondido, CA 92026 or Fax to (760) 751-9707
To mail, please fold this form in half.

Additional Comments

San Diego Bay
Integrated Natural Resource Management Plan
"Bay Ecosystem Plan"

(2) These comments are from inspection of the INRMP at Coronado Library:

5-70 IP2 The Park & Rec Dept. of San Diego has set up some excellent story board displays/educational sites along the Flood Control Frontage Road on Sea World Drive, Mission Bay and also at the obs. platform at Kendall-Frost Marsh, Mission Bay. No idea what these cost but they seem to work & do NOT seem subject to vandalism.
Many more access points to the Bay especially South Bay are needed, espec. to include maps of hard to observe areas like the Salt Works ponds, and as per items E 1, 2, 4, 5 p. 5-72, observation pts/boardwalks/short towers to provide exposure to these protected habitats. There is a very effective board walk at the Bolsa Chica Wetland Preserve near Seal Beach.

IP3 How does "wind-blown trash" end up in the Sweetwater NWR. The prevailing wind is westerly, what's the source(s)? Some control of this would lessen the burden of volunteers forever cleaning up other peoples messes. And all trash is not equal — plastic can loops, plastic bags and items containing lead need particular attention.

IP6 Again a message needs to be clearly sent to the Bay community that violating existing regulations & ignoring posted signage will result in substantial penalties and that enforcement is current. Negative things which occur now are due in part at least to little or no enforcement & minimal penalties.

A suggestion: Organize, schedule & publicize shoreside tours in South Bay, especially in mid-winter & again in May-June. These might serve to get the attention of people who now have little or no awareness of what is there and why it is of interest.

Please fold in half and attach to "Comment Sheet" to mail

(3)

Additional Comments

San Diego Bay
Integrated Natural Resource Management Plan
"Bay Ecosystem Plan"

Monitoring

6-6 ¶2 Bird Atlas grid blocks are 3 mi x 3 mi. Surveys are winter (Dec, Jan, Feb) and Summer (breeding), which can extend Feb/Mar. through July, but is concentrated in April, May & June. There is no Fall monitoring, i.e., August through November. Winter surveys of each block cover 3 years; breeding only 1 if all criteria are met. Hours per volunteer are minimum 25 hrs. winter plus 25 hrs. breeding season

6-11 ¶1 San Diego Bay is certainly part of the Pacific Flyway for migratory birds, espec. Shore birds. Pt. Reyes Bird Observatory and San Francisco Bay Bird Observatory have been and are doing much work on SF Bay. So SF Bay has much in common w/ So. SD Bay, just larger scale. There is even a salt extraction operation there also being converted away from commercial salt production.

6-14, Table 6-4 Some additional candidates for bird list:

Osprey: HI, SS, PS, maybe CI (open water)

Salt marsh { Belding's Savannah Sparrow: CI, HI, SS, PS, PI
Large-billed Sparrow (now considered a sep. sp. but best to check status w/ Phil Unitt @ SDNHM); HI, SS. This bird was once widespread here in salt marsh, then essentially disappeared, & is now present again.

Mitigation: From Joy Zedler researches, tidal wetland restoration is marginal at best (Paradise Marsh & Connector marsh were particular sites).

Populations: PRBO & SFBBO should have shorebird data. Shorebird surveys of SD Bay shoreline need to be facilitated by greatly improved ease of access — plenty of volunteers but access is hard.

6-25 & 6-26 should be flip-flopped, so text on 6-26 is contiguous w/ text on 6-24 instead of separated, as now.

Please fold in half and attach to "Comment Sheet" to mail

Note, for D-28 Phil Pride's name is spelled Pryde — he is a Professor of Geography @ SDSU.

ENVIRONMENTAL HEALTH COALITION

1717 Kettner Boulevard, Suite 100 • San Diego, CA 92101 • (619) 235-0281 • Fax (619) 232-3670
ehc@environmentalhealth.org • www.environmentalhealth.org

November 17, 1999

Ms. Liz Kellog
Tierra Data Systems
10110 West Lilac
Escondido, CA 92026

Dear: Ms. Kellog:

Environmental Health Coalition (EHC) has the following comments on the Ecosystems Plan.

General Comments

Please do an index! This is a great accumulation of information and would be made more usable with and index.

The framework of this report appears to be structured as a mechanism for enabling planning and to facilitate expanded (and, generally, environmentally destructive) military, industrial, and commercial use of the bay by creating mechanisms whereby proposed projects can be facilitated through creation of habitat management plans, establishment of mitigation banks, etc. Without the specific project plan and areas to be protected, enhanced etc..and the mechanisms by which they will be protected and managed and the enforceable commitments by which that protection and enhancement will occur, one cannot know if this plan will protect the Bay's natural resources or not. The San Diego Bay Ecosystems plan would benefit by development of a specific Action Plan. The Action Plan would take the valuable elements out of the Ecosystem plan and identify a series of projects that could be implemented. This gives immediate focus and momentum for implementation. The Action Plan should consist of a significnat number (20 - 30+) sanctioned projects grouped around Habitat Preservation (Creation, Restoration, Enhancement), Maintenance, Monitoring, Education, etc. Each project description should include: Purpose, Objectives, Approach, Monitoring and Remediation, and Costs.

Lack of this specific action plan is a signficant failing.

Specific Comments
2-20
The discussion of contaminated site remediation is rosier than reality. Only

Campbell's has a proper Cleanup and Abatement Order and the levels are not as protective as those cited in the earlier paragraph. There is no formal or enforceable cleanup agreement for NASSCO or SWM. These polluters refuse to cleanup to a protective standard for the Bay and it is unclear how much of their polluted site will be remediated. The Navy's Naval Station sediment study has been apparently tabled for a few years and not shown to the public.

Fish consumption discussion should reflect that it has been reported to us that workers at NASSCO will fish from the piers during the lunch hour for fish for meals for their families.

3-32
The assessment of the Navy future plans should include the Scheme 1A expansion plan for five carriers. A discussion of the concentration of carriers in San Diego waters for training grounds should be included.

3-29
The recreational boat survey seems designed do overestimate recreational boat traffic. Labor Day weekend has got to be one of the busiest weekends of the year.

4-4
Evaluation of Current Management, again, paints a too-rosy picture of the current situation. It should rather read that unregulated oil spills and discharges from Navy vessels continue unregulated and Naval Facilities are still have no discharge permit beyond the General Industrial Storm water permit. Toxic flows of runoff still enter the Bay from boatyards and shipyards and SDGE continues to discharge up to 600 mgd of hot water and wastes from chlorination into South Bay. The cooling discharges of carriers and submarine nuclear power plants are uncharacterized.. In addition, dewatering discharges from Great American bldg and the Convention Center still discharge dewatering wastes into San Diego Bay.
This is a more accurate picture of the current discharges currently entering San Diego Bay.

The action items on this should include an immediate moratorium on any fill of any more deep water. This should begin with refusing to site the USS Midway in San Diego Bay as a de-facto permanent fill.

4-7
Restate to "Prohibit" new navigation channels in this habitat.

4-8
Under current management of shallow subtidal, current management has done little to protect this habitat. The net loss of this habitat type from the Stennis Homeporting project should be cited here.

4-91
Please add Environmental Health Coalition as an organization that frequently comments on development projects in the Bay. EHC has been in San Diego for 20 years and the Clean Bay Campaign has been a dedicated San Diego Bay effort since 1987.

Section 5 Compatible Use Strategies

Needs a section on use of San Diego Bay as a cooling water system for multiple power plants. This should include the South Bay Power Plant but also specifically the 6-14 nuclear submarines and the cooling systems of three nuclear powered aircraft carriers that will soon come to the Bay.

There also needs to be a discussion of radiological impacts to the Bay. This must include the discovery of elevated levels of radiation in the fish in the 1990 health risk study and the elevated levels of Cesium at the Naval Station and the Sub Base noted in the most recent EPA study. Further, a plan to reduce or manage these risks should include a mention that the next CVX generation of carriers should be non-nuclear so that the radiological risks to the Bay are ultimately abated.

Compatible Use strategies should include development of ecotourism.

5-50

There are additional runoff strategies that should be recommended and pursued. To effectively and positively reduce pollution in storm water runoff some or all of the following actions should be pursued.

- Ban use of certain problematic pesticides in the region such as has been done in San Francisco/Santa Barbara area. Legislative or ordinances. Bans of persistent chemicals is all that has ever worked to reduce load to the environment but will be unpopular with those that profit from their sale. If we want to see ecological improvement, we must be able to pursue this in spite of certain corporate opposition. Short of this, stiff "storm water pollution" taxes should be applied to all pesticides, fertilizers etc.. That are used outdoors with a label as to why the tax is needed and what the non-taxed alternatives to this product are.
- Required IPM for open space, park cemeteries, and golf courses. A low-cost or free contractor could be offered to support jurisdictions that wish to pursue IPM for their parks and open spaces. This could also be achieved legislatively.
- Support land acquisition to allow widening of rivers to support urban storm flow. This would avoid the continued highly detrimental activity of concreting and rip-rapping natural stream beds.
- Aggressive pursuit of E.V. and other non-polluting vehicles and fleets. Fund a subsidy program for purchase and lease of Evs. Initiate and support legislative efforts to strengthen EV mandate and development of EV and fuel cell technology.
- Development of an structural UR element for the San Diego Bay watershed. Develop issue areas, Functional Assessment, Improvement Plan, Implementation. (Cost: existing FA plans for Otay and Penasquitos are $500,000 combined.) This plan could find, identify areas that could be enhanced for filter strips, strategic locations for interceptors, marsh treatment sites, sediment/oil/grease etc... traps. Could be combined or separate from a non-structural plan.
- Full implementation of the SANDAG Regional Water Quality Element. This is a very important document and should be given the weight of law through requirements or ordinances. Permit for all new development should require structural and non-structural

BMPs (for construction phase and the project) and to identify an perpetual funding source for said measures. BMPs should be required for all projects regardless of size (NPDES only required on 5 acres or more).

- Enforcement. On the ground enforcement within the watershed Enforcement of construction runoff and erosion standards. Enforcement team for discharges to storm drain system.
- Major inclusion and coordination of SANDAG and CALTRANS regarding vehicle pollution. Water quality and vehicle pollution are very closely related. Issues regarding traffic methods, patterns, mass transit, must give increased consideration to vehicle impacts on water quality.
- Education program that emphasizes pollution prevention. (See discussion in the Water Quality Element, Cholla Creek Project).
- Development of integrated system of sinks, sediment traps, oil/water separators etc... within the watershed. Could be done with a pilot program first.
- Development of a system of upland buffer strips and grassed water courses in lieu of pipes. Should also include major commitment to native, drought-tolerant vegetation for watershed.
- Development of diversion and interceptor systems upstream of the Bay where they could be smaller.
- Identify areas in the watershed where increases of infiltration rates can be accomplished. Identify areas where pavement could be removed and other surfaces be used. Also, methods in which to slow down storm water and increase infiltration time i.e. unpave bottoms of flood channels, widen them, and use cattails and other wetland species where possible to absorb pollutants and water.
- Cover Navy gas stations under NPDES SW requirements and require BMP plans. Currently, we think they are only covered under CZARA.
- Cover Navy facilities under NPDES SW requirements comparable to those requirements covering shipyards.
- Watershed BMP plan by regional hydro geographic unit focusing on specific plans and BMPs and plans for known uses i.e. gas stations, auto shops, painting and sanding, etc...
- Pollution Prevention Basin Plan amendment to encourage dischargers to become educated about their options for P2.
- Develop and require an aggressive model for an industrial and commercial SWPP. These plans could/should include berming, structural BMPs, vacuuming of wastes, covering of waste areas, parking lot filter strips etc...
- Providing for adequate room for end of pipe treatments for new development projects. When projects such as the North Embarcadero are designed, adequate space a resources should be developed to allow for sediment traps, oil/grease/water separators, and filtration wetlands.
- Support of existing pilot or demonstration programs. These are three projects that are underway, all of which will or are attempting to incorporate consideration of storm water in the design and management.
- Paradise Creek Restoration
- Chollas Creek Linear Park (unsure of status)
- C.V. Bayfront Development

- Otay River Wetlands Working Group watershed management study
- Requirement of watershed cities to pool funds for NPS programs within the watershed or through tax exercise ability of the Port.
- Replacement of rip-rap with wetlands, mudflats where possible. Consider in front of hotels etc..
- Interceptors systems around key areas of the Bay to collect and divert dry weather flows. Mission Bay trap dry weather flows go into a tank in the ground and later gets pumped into the sewer system. There is also an interceptor at Famosa Slough.
- End of Pipe Treatments. Oil and grease separator. Sediment traps are important because contaminants travel on sediments and can be removed and prevented from the Bay
- Fund an storm water/BMP/whatever team to address and assist tenants with storm water compliance.
- Fund and implement a Hazardous Materials Collection event/station for marinas.
- Recommend strengthened Municiple and industrial storm water permits
- Design a progressive and effective "blueprint" for Standardized Minimum Requirements to comply with the permit.
- Facilitate a staffed storm water hotline

7-10

Revise third bullet to read that the NEP could be used to carry out.. "developing and implementing corrective actions...."

NEP was **not** defeated by a generalized local distrust. **It was defeated by local industry,** specifically Industrial Environmental Association, Port Tenants Association, and the Mayor's Port Advisory Council comprised of Bayside industries and the Navy. This should be reflected accurately in the document. ·

NEP could be used for funding if the nominations would open again and accept new estuary applications. This should not be discounted as a viable option.

Since my copy did not have an Appendix C, we are assuming that we will have a chance to comment on the actual recommendations for preservation, restoration and action. **Without these recommendations, this report is incomplete as an action or management plan.**

Thank you for the opportunity to comment on this Draft.

Sincerely,

Laura Hunter, Director
Clean Bay Campaign

7/31/97

Issues From 7/16/97 Public Workshop:

Mitigation Banking

- Preserving what we have should be the first priority.
- How does it relate to *preservation* of the wetlands?
- There is a mitigation deficit from historical impacts that has not yet been compensated. How do we deal with this?
- Mitigate to enhance existing wetlands *and* rehabilitate damaged areas, as opposed to making up for damage form new projects.
- Are shallow, sub-tidal & intertidal to be the only mitigation areas?
- There are conflicts with existing uses, i.e., airport, with seeking the historical condition. Have to come up with a new concept for the Bay.
- Please consider changing from in-kind, site-specific mitigation to a broader context.
- Mitigation is the most important thing for the Bay concept. This should be evolving.
- Mitigation Banking is one of the last things we should be doing.
- Terminology is inconsistent—there are too many different definitions; the lost area is not equal to the restored area.
- What does mitigation mean? Common language needed.
- "Enhance" is a better term, than mitigate.

Impacts of Human Use

- Historically it was a shallow bay, it is now deeper.
- Look at resource needs and not human needs.
- Consider what Bay ducks needs in the context of the Pacific Flyway.
- Include upper watershed areas as a type for banking/mitigation.

Tourism/Ecotourism

- Public outreach for ecotourism is not seen yet. Not Navy's job.
- Birdwatchers come to visit the Bay in an organized way. Small but increasing phenomenon. Could be encouraged by the Port.
- Chula Vista Nature Center is a good example.
- SANDAG may be getting involved in ecotourism/public outreach.
- Canoers, sailboaters, and kayakers are also users of the Bay that need to be acknowledged and planned for.
- What is the impact of jetskiiers on birds--chasing.
- Can we get a carrying capacity estimate for human water use? Can this be done?

Wildlife Refuge

- A National Wildlife Refuge is one way of bringing in federal monies, once designated.
- The "Coastal America Program" (ask Pete Seligman @NRaD) provides a potential federal matching program.
- Ecotourism, to make money, needs a long-term commitment such as a Refuge before the private sector would be willing to make an investment. Infrastructure is needed too.
- The Salt Works is integral to a Refuge. It needs to continue to operate as it is now, not be developed.
- The Planning Study Area for a refuge is mapped already; don't just wait for EA by USFWS; the South Bay is only one part of the FWS proposal.

Bay Values

- The west half of Central Bay and North Bay are also important. (See Navy studies on bird use.)
- Halibut, with less than three feet deep habitat, are important too.
- The Point Loma area with upper Coastal Sage Scrub, provides roosting sites and edge values.
- There are Fish Habitat Enhancement approaches that could be taken instead of eelgrass planting or traditional mitigation approaches, like halibut. Juvenile fish nursery areas--not as visible as birds.
- Look at what the Bay is about--the Big Picture.
- Make the Plan and description of Bay values something a politician can understand.
- Private sector covered by the Plan? The private sector is not well represented in planning process.
- The Salt Works is one of the first private businesses historically and is still the only private landowner.
- Using guilds of birds instead of individual species is one way to view it.
- Present comprehensive Ecosystem Picture.

Watershed Issue

- Protect the Bay from upland impacts, stormwater.
- Get the government involved with "Push-Pull" process between the Navy and Port and upland government entities and with regulatory agencies.
- SANDAG has the potential to help.
- There is not much left to enhance on the Bay; it is the watershed that is important.

Values and Priorities

- The Bay is not very big and there are lots of demands on it.
- Redevelopment of underutilized sites is a more efficient use than developing new sites.
- Consider priorities for water dependent users, such as sports fishermen and boaters.
- Criteria for priorities: Priority for those things that are irreplaceable and vulnerable.
- Water-dependent uses, such as shipyards, should receive higher priority.
- Monitoring of exotic organisms is important also.
- Single species management to-date is not right.
- A Remediation Plan to assist resources is already here.
- MSCP is getting away from in-kind mitigation.
- This should not be an Endangered Species Mgt. Plan—it must be visionary and include "all the species not lucky enough to be endangered."

Goals and Bay Health

- What *should* this resource be today, instead of what it is? Historic condition not attainable.
- Take a biological look of what it takes to be a healthy Bay.
- Get a handle on the healthy, representative species that should be there and whats ecologically healthy.
- Goal is to recover to what? 1859 vs. 1997?
- Example: Dredging impacts on tidal flushing--Navy.
- Some things, such as cleaning up old sediment, may not seem do-able in a ten to twenty year time frame? Timeframe is too short -- a century is better.
- Don't preclude anything.
- Need to take actions rather than planning.
- Public outreach and non-point source pollution--What public education of the citizens is needed to change their habits? What can the Plan do?
- The Speakers Bureau is a possibility for outreach. If the public "owns" the Bay, they will change their habits.
- Assist existing outreach efforts.
- The Navy should educate/train their own personnel on Bay resources.
- Comprehensive planning in the Bay include a big scope: north-south-east-west areas of Bay boundaries.
- Bay shoreline and multi-focus with local jurisdictions. Disclosure of information and dissemination.
- Take piers and bulkheads already developed and relate these areas to the more natural ecosystem.
- There have been lots of nifty plans in the past, but they were not implemented. Will this one be implemented?

San Diego Bay
Integrated Natural Resources Management Plan
Questions & Comments from **Public Workshop July 7, 1998**

1. What happened to the idea of the COC (Citizen Oversight Committee) for this plan? This is my second meeting!
2. Please elaborate on the current integration of the FWS's proposal for a South Bay National Wildlife Refuge and the INRMP.
3. It is not clear to me how the USFWS Refuge Plan is integrating with this plan. Can you explain the process? Are there joint meetings or sharing of data?
4. Please elaborate on interaction and agreements between this and the Bay Panel's plan.
5. Were City and County officials invited? Who? How? And When?
6. Why aren't there any handouts? There is so much information, how can we absorb it all? This is my second meeting!
7. Mitigation, is it possible?
8. Eelgrass, do we have too much?
9. Sea level rise, when will it be considered?
10. Does fueling predominantly occur during daylight hours or after dark when spills are less likely to be detected by operators?
11. I have been sorely disappointed in HCP's protection of specific rare species due to lack of adequate data. How does this process differ? How are needs of stationary or limited mobility species analyzed in this ecosystem approach?
12. Salt marsh habitat is dependent upon upland habitat for pollinator health. Does the plan area cover a broad enough range of habitats to accomplish its goal of healthy ecosystems?
13. The dredge and fill map is inaccurate. Particularly the CVN homeporting footprint.
14. #3 on map of planned capital improvements by Navy have been completed; #5 is incorrect.
15. Will there be specific timelines for removal of iceplant from dune systems with this plan? Will the effort involve volunteer labor or paid labor?
16. If this is supposed to be a comprehensive plan, you need to consider urban runoff and the fact that EPA will soon list the Bay as an impaired water body. This will effect total loading into the Bay, which affects stormwater runoff, etc.
17. Look at comparable studies in other Bays to help us with our gaps; don't reinvent the wheel if possible.
18. Pacific Brant is in many places but needs Bay too; widespread trends important to follow.
19. National Estuary Program for our Plan?
20. Scholarships to encourage studies of the Bay?
    a. Corporate?
    b. Educational opportunity with tourists that something needs to be done. (Headsets for bike riders along Bay?)
21. Public availability of plan?
22. Web page being considered? One way to get info exchange (consider seriously) Use Port's website or Bay Panel's.
23. Small size of Bay = puddle and that's why we can't afford to lose any more of it.
24. If so small, then why can't something get done?
25. Time perspective for "defining success" – 10 years too short for ecosystem, why not 100 years?
26. "Defining success" – if environmental groups feel like they have to sue or amend the law, then probably <u>not</u> successful.