11.0 FISH, WILDLIFE, AND PLANT SPECIES AND THEIR HABITATS

11.1 BACKGROUND AND SETTING

The Draft Humboldt Bay Management Plan includes a regional focus that encompasses a variety of habitat types and the species that occur in them. From the perspective of the Plan's potential effects, the possible effects on fish, wildlife, and plant species, and on the habitats that sustain these species, represent a set of criteria that inform the District's judgements about the environmental effects of the Plan. However, there are thousands of fish, wildlife, and plant species in the Humboldt Bay region, and the Plan cannot (and need not) address all of them, because most of these species are not sensitive to the effects of the Plan's policy recommendations. Conversely, there are some species, and some species groups, that are distinctly important in the District's consideration of the Plan's policy effects.

Because the Plan, and this EIR, cannot address all species in the bay's watershed, this chapter is focused on selected species groups that are "functionally related" to the Plan's recommendations. The chapter does address, generally, the "environmentally sensitive" species that are known to occur in the area. This chapter also addresses how the general ecological pattern in the Humboldt Bay watershed relates to fish, wildlife, and plant species that are biologically important in senses other than through a "listed" status. For fish species and fish habitats, in particular, Humboldt Bay is an essential habitat element, and this chapter considers the role of the Plan's policies in their overall management.

Some of the important considerations that arise in this context were included in Chapters 8.0, 9.0, and 10.0. Humboldt Bay, as a geographical feature, occurs within the functional context of a watershed with a functional connection to the adjacent Pacific Ocean. This context is best expressed in terms of "ecosystem-based management," an approach within which the policies of the Draft Plan are embedded.

11.1.1 "Heritage" Species and Community Types

Fish, wildlife, and plant species may be identified as "environmentally sensitive" in a variety of ways, as noted in subsection 4.4.2 in Chapter 4.0, Section II, of the Draft Plan.

> From an environmental resources planning perspective, one of the subjects that is normally addressed is the occurrence of "environmentally sensitive" species or their habitats. Environmentally sensitive species may be recognized in several ways, including appearing in the list of "element occurrences" maintained by the California Natural Diversity Data Base (CNDDB), an office in the Department of Fish and Game; occurrence in a separate list of "species of special concern" maintained by the Department of Fish and Game; appearance in one of the "lists" maintained by the California Native Plant Society (CNPS; plant species only); or appearance in the National Audubon Society's "watch list" (birds only).[1]

1 *N. B.* It should be noted that the approaches described in this subsection are all examples of "natural heritage program" approaches to conservation planning. Heritage programs have certain

The CNDDB provides a listing of all "elements" that have been reported to the CDFG that occur in a specified geographical region (typically a USGS 7.5-minute quadrangle). These "elements" have an important status within environmental review processes conducted pursuant to the California Environmental Quality Act (CEQA). Elements can be species that are listed under one or more federal or state laws, species considered sensitive by non-profit organizations like the CNPS, or community types that are judged by the Department of Fish and Game or other entities to be environmentally sensitive. Current conventions in heritage assessments use a "nine-quad" search, in order to assure that all potentially sensitive elements will be identified with respect to physical impacts from proposed projects. EIR Table 11-1 is the nine-quad search results for the Humboldt Bay region (centered on Woodley Island; it should be noted that two of the quads are "empty," with the quad locations falling in the Pacific Ocean).[2]

EIR Table 11-1. CNDDB RareFind3 element occurrences in the nine-quad area surrounding the Eureka 7.5-Minute USGS quadrangle. [A]

Taxonomic Name	Common Name	Status [B] Federal/State/ CDFG/CNPS
Plants		
Abronia umbellata ssp. *breviflora*	Pink sand-verbena	--/--/--/1B
Astragalus pycnostachyus var. *pycnostachyus*	Coastal marsh milk-vetch	--/--/--/1B
Carex arcta	Northern clustered sedge	--/--/--/2
Carex leptalea	Flaccid sedge	--/--/--/2
Carex lyngbyei	Lyngbye's sedge	--/--/--/2
Carex praticola	Meadow sedge	--/--/--/2
Castilleja affinis ssp. *litoralis*	Oregon coast Indian	--/--/--/2

inherent limitations for biodiversity planning. They are often focused on rarity and on small, mappable locations rather than large occurrence areas. This focus cannot adequately deal with elements that are not limited to small, mappable locations, such as habitat areas for large carnivores, or other elements that have large-area requirements or requirements for a mixture of habitats. As noted by Noss and Cooperrider (1994), such programs work through "successive approximations," which supposes that surveys are being conducted in various parts of the landscape over time, so that, eventually, the entire landscape will get adequate coverage.

An alternative to the heritage planning approach often advocated for extensive land areas is a "landscape ecology" conservation planning approach. Landscape ecology is concerned with the *spatial distribution of the ecological elements* that have conservation interest, as well as with the maintenance of *spatially based ecological processes* that support the elements of conservation interest. A consideration of the application of landscape ecology to conservation in the Humboldt Bay region is beyond the scope of this Plan.

2 The results in EIR Table 11-1 are derived from a software package, available from the Department of Fish & Game, called "RareFind3" (California Department of Fish and Game 2003). It should be clearly understood that the CNDDB list of "sensitive" species cannot remain static for long, and that the entries in EIR Table 11-1 are provided for illustrative purposes rather than as an attempt to list all of the "heritage species" that may be relevant for District consideration during the life of the Humboldt Bay Management Plan.

Taxonomic Name	Common Name	Status [B] Federal/State/ CDFG/CNPS
	paintbrush	
Castilleja ambigua ssp. *humboldtiensis*	Humboldt Bay owl's-clover	--/--/--/1B
Cordylanthus maritimus ssp. *palustris*	Point Reyes bird's-beak	--/--/--/1B
Erysimum menziesii ssp. *eurekense*	Humboldt Bay wallflower	FE/CE/--/1B
Erythronium revolutum	Coast fawn lily	--/--/--/2
Fissidens pauperculus	Minute pocket-moss	--/--/--/1B
Gilia capitata ssp. *pacifica*	Pacific gilia	--/--/--/1B
Gilia millefoliata	Dark-eyed gilia	--/--/--/1B
Hesperevax sparsiflora var. *brevifolia*	Short-leaved evax	--/--/--/2
Lathyrus japonicus	Sand pea	--/--/--/2
Lathyrus palustris	Marsh pea	--/--/--/2
Layia carnosa	Beach layia	FE/CE/--/1B
Lilium occidentale	Western lily	FE/CE/--/1B
Lycopodium clavatum	Running-pine	--/--/--/2
Mitella caulescens	Leafy-stemmed mitrewort	--/--/--/2
Monotropa uniflora	Indian-pipe	--/--/--/2
Montia howellii	Howell's montia	--/--/--/2
Puccinellia pumila	Dwarf alkali grass	--/--/--/2
Sidalcea malachroides	Maple-leaved checkerbloom	--/--/--/1B
Sidalcea malviflora ssp. *patula*	Siskiyou checkerbloom	--/--/--/1B
Sidalcea oregana ssp. *eximia*	Coast checkerbloom	--/--/--/1B
Spergularia canadensis var. *occidentalis*	Western sand-spurrey	--/--/--/2
Usnea longissima	Long-bearded lichen	--/--/--/--
Viola palustris	Marsh violet	--/--/--/2
Insects		
Cicindela hirticollis gravida	Sandy beach tiger beetle	FSC/--/--/--
Fish		
Eucyclogobius newberryi	Tidewater goby	FE/--/SC/--
Oncorhynchus clarkii clarkii	Coastal cutthroat trout	--/--/SC/--
Oncorhynchus kisutch	Coho salmon (SONCC ESU)	FT/CT/--/--
Reptiles and Amphibians		
Ascaphus truei	Tailed frog	--/--/SC/--
Emys (=*Clemmys*) *marmorata marmorata*	Northwestern pond turtle	--/--/SC/--

Taxonomic Name	Common Name	Status [B] Federal/State/ CDFG/CNPS
Rana aurora aurora	Northern red-legged frog	--/--/SC/--
Rhyacotriton variegatus	Southern torrent salamander	--/--/SC/--
Birds		
Ardea alba [C]	Great egret	--/--/--/--
Ardea herodias [C]	Great Blue heron	--/--/--/--
Charadrius alexandrinus nivosus	Western snowy plover	FT/--/SC/--
Egretta thula [C]	Snowy egret	--/--/--/--
Nycticorax nycticorax [C]	Black-crowned night heron	--/--/--/--
Pandion haliaetus	Osprey	--/--/SC/--
Phalacrocorax auritus [C]	Double-crested cormorant	--/--/SC/--
Rallus longirostris obsoletus	California clapper rail	FE/CE/--/--
Mammals		
Arborimus albipes	White-footed vole	--/--/SC/--
Arborimus pomo	Red tree vole	--/--/SC/--
Martes americana humboldtensis	Humboldt marten	--/--/SC/--
Myotis evotis	Long-eared myotis	--/--/--/--
Uncommon Community Types		
	Coastal Terrace Prairie	S2.1 [D]
	Northern Coastal Salt Marsh	S3.2 [D]
	Northern Foredune Grassland	S1.1 [D]
	Sitka Spruce Forest	S1.1 [D]

Notes:

A The entries in EIR Table 11-1 cover only seven quads; see text.

B FE "Endangered" under the federal Endangered Species Act.
FSC Federal "Special Concern" species lacking formal listing status.
FT "Threatened" under the federal Endangered Species Act.
CE "Endangered" under the California Endangered Species Act.
CT "Threatened" under the California Endangered Species Act.
SC "Special Concern" species for the California Department of Fish & Game under California law.
1B A species considered by the California Native Plant Society to be "Rare, Threatened, or Endangered in California and elsewhere."
2 A species considered by the California Native Plant Society to be "Rare, Threatened, or Endangered in California but more common elsewhere."

C Rookery sites only.

D State occurrence rankings for community types indicate two parameters.
Threat rankings:
SX.1 = "Very Threatened;" SX.2 = "Threatened."
Where "SX" has the following occurrence meanings:
S1 <6 element occurrences or <2000 acres
S2 6-20 element occurrences or 2000 to 10,000 acres
S3 21-80 element occurrences or 10,000 to 50,000 acres

The occurrences listed in EIR Table 11-1 do not represent a complete list of "heritage species" that are known to occur in the Humboldt Bay region, presumably because

some observers have not reported occurrences to the CNDDB of additional species that occur in the Humboldt Bay region.[3] The additional species reported in EIR Table 11-2 are identified in the most current CNDDB lists as being considered "sensitive" by state or federal government, or by one or more professional societies, or by one or more conservation organizations; these species, while known to occur in the Humboldt Bay region, lack element occurrence records in the Database listing.

EIR Table 11-2. Additional species known to occur in the Humboldt Bay region that are "sensitive" but which lack CNDDB occurrence records.

Taxonomic Name	Common Name	Status [A] Federal/State/ CDFG/CNPS
Fish Species		
Oncorhynchus mykiss	Steelhead (Northern California ESU)	FT/--/SC/--
Oncorhynchus tshawytscha	Chinook (California coast ESU)	FT/--/--/--
Spirinchus thaleichthys	Longfin smelt	--/--/SC/-- *
Thaleichthys pacificus	Eulachon	--/--/SC/-- *
Bird Species		
Pelecanus occidentalis	Brown pelican (roosts)	FE/SE/FP/--
Branta hutchinsii leucopareia	Aleutian Cackling Goose	--/FD/--/--
Circus cyaneus	Northern harrier (nest)	--/--/SC/--
Elanus leucurus	White-tailed kite	--/--/FP/--
Accipiter striatus	Sharp-shinned hawk (nest)	--/--/SC/--
Accipiter cooperi	Cooper's hawk (nest)	--/--/SC/--
Haliaetus leucocephalus	Bald eagle	FPD/SE/FP/--
Falco peregrinus anatum	Peregrine falcon (nest)	--/SE/FP/--
Sterna caspia	Caspian tern (nesting colony)	BCC/--/--/--
Brachyramphus marmoratus	Marbled Murrelet (nest)	FT/SE/--/-- #(1)
Chaetura vauxi	Vaux's Swift (nest)	--/--/SC/--
Selasphorus sasin	Allen's hummingbird (nest)	--/--/--/-- #(2)
Contopus cooperi	Olive-sided flycatcher (nest)	BCC/--/--/-- #(2)
Poecile atricapilla	Black-capped chickadee	--/--/SC/--
Mammal Species		
Eumatopias jubatus	Steller (=northern) sea lion	FT/--/--/-- @(T)

Notes:
A Status codes have the same meanings as in EIR Table 11-1. Additional codes used in this table have the following meanings:
BCC USFWS "Bird Species of Conservation Concern"
FD Federal "Delisted" species

3 The California Department of Fish and Game regularly posts updated lists of sensitive species, in PDF format, on a webpage in the Habitat Conservation and Planning Branch. The current lists may be viewed at URL: http://www.dfg.ca.gov/hcpb/species/lists.shtml (viewed December 2005).

FP California "Fully Protected" species
FPD Proposed by the U. S. Fish and Wildlife Service in 1999 for "Delisting"
* American Fisheries Society "Threatened"
#1 National Audubon Society WatchList
1 "Red" status
2 "Yellow" status

EIR Table 11-1 also identifies four community types that are considered to be "environmentally sensitive." The criteria under which these judgements were made are identified in the table footnotes. In general, the uncommon community types are characterized (or "ranked") the same way as other "elements" recorded by the CNDDB (CDFG 2005), on the basis of the number of occurrences for each community type and the area covered.

As noted in the Plan excerpt, plant species may be identified as sensitive if they are recognized as sensitive by the California Native Plant Society (CNPS); by an independent agency, such as a federal land management agency; or by one of a limited number of professional societies. Typically, for plant species, recognition by one of these sources will soon lead to the incorporation of the identification by the CNDDB, and this EIR does not separately report the status of plant species according to CNPS database.[4]

For wildlife species there are a number of independent organizations that may identify degrees of environmental sensitivity in addition to those that focus explicitly on the status of species pursuant to the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA). One example was identified in the Plan excerpt (the National Audubon Society, for birds); other sources of such identifications include the American Fisheries Society (fish); a few professional societies (in North America or the United States); and some international conservation organizations, such as the World Conservation Union (IUCN).[5] The "degree" of sensitivity reflected in some of these possible designations are well beyond the scope of a CEQA document; however, certain of the designations are germane for the Humboldt Bay Management Plan and for this EIR, and are covered below.

Additional "sensitive" classifications may be derived from other agency review processes. For example, the species identified in EIR Table 11-3 are have been identified by the National Marine Fisheries Service as concerns for Humboldt Bay.

EIR Table 11-3. Sensitive species listed by the National Marine Fisheries Service for Humboldt Bay

Taxonomic Name	Common Name	Status
Mollusk Species		
Haliotis cracherodii	Black abalone	Candidate

4 See URL: http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi (viewed December 2005).

5 See URL: http://www.iucn.org/themes/ssc/red_list_2004/main_EN.htm (viewed December 2005).

Taxonomic Name	Common Name	Status
Reptile Species		
Dermochelys coriacea	Leatherback turtle	Endangered
Lepidochelys olivacea	Olive (=Pacific) ridley sea turtle	Threatened
Chelonia mydas	Green turtle	Threatened
Caretta caretta	Loggerhead turtle	Threatened
Fish Species		
Sebastes paucispinus	Bocaccio	Candidate

11.1.2 Fishery Resources

11.1.2.1 General Patterns Among Humboldt Bay Fish

The general pattern in the fishery fauna in Humboldt Bay was summarized in Barnhart and others (1992), which indicated that at least 110 species of fish had been recorded in the Bay prior to the preparation of that report.[6] The description in Barnhart and others (1992, particularly Appendix C) incorporated a substantial amount of the information presented in the earlier report by Shapiro and Associates (1980, Volume II). The descriptions in these volumes are evidently sketchy and inexact descriptions of the ecological relationships of Humboldt Bay fish, but it appears that better or more complete characterizations have not been prepared.

From a perspective of bay management, the most important fact about the bay is that it cannot be considered independently of the nearshore Pacific Ocean, and for a few species neither the bay nor the ocean can be considered independently of the tributary watersheds. Humboldt Bay fishlife appears to be composed largely of species that are ecologically associated with the marine character of Humboldt Bay. For example, even the fish species that are most closely related to freshwater habitats in the bay and its watersheds are members of species groups that are typically marine (e.g., some gobies and smelts) or that spend substantial parts of their lives in the marine realm (e.g., salmon). Some fish species appear to be essentially permanent residents in Humboldt Bay, while others apparently enter Humboldt Bay for spawning purposes, or for rearing and growth as juveniles or subadults, or because conditions in the bay are strongly dominated by near-shore marine conditions and some marine species find suitable foraging conditions in the bay. In species that reside permanently in the bay an ability to tolerate periods of reduced salinity (that is, to be a "euryhaline" species) appears to be essential, and the identified common species in the bay [e.g., staghorn sculpins (*Leptocottus armatus*) and bay gobies (*Lepidogobius lepidus*)] are highly tolerant of varying salinity.

This EIR generally adopts the convention (incorporated in most management documents) that a given species cannot be present if its habitat is absent, although

6 Additional species have been recorded in the bay since 1992 (J. Robinson, pers. comm.). It seems highly probable that yet additional fish species will be "discovered" in Humboldt Bay in the future if globally changed climate results in more regular occurrences of warm waters in the region, whether associated with ENSO events or longer-term dynamics.

describing the variability in habitat usage among the fish species in Humboldt Bay clearly exceeds the scope of this programmatic environmental document. Many species appear to use a variety of bay habitats, while other species are much more selective. Among the habitat types that previously have been identified are creeks, tidal sloughs, and channels (including a differentiation into channels that are mostly freshwater-dominated or those mostly saltwater-dominated), tidal flats, shallow tidal channels, deep tidal channels, the open water column, and "structures" such as piers and rocky riprap. More recently it has become evident that tidal flats and shallow tidal channels with eelgrass are different from tidal flats and shallow tidal channels without eelgrass (see below; also see Chapter 10.0). For many species there may be requirements for different habitats in different life stages, and the absence of any one of the habitats may equate to an absence of those species from the bay.

Several generalizations about the life histories of Humboldt Bay's fish are germane for this document:

- The bay provides permanent habitat for a large number of fish species, including species associated with most of the habitat types noted above. Some species [e.g., herring (*Clupea harengus*)] use a variety of habitat areas but remain in schools in the water column rather than dispersing as individuals (a "semi-pelagic" life-history). Others, such as staghorn sculpin, occur in almost every habitat in the bay but typically do not school.
- Several commercially important demersal[7] fish species, such as English sole (*Parophrys vetulus*) and Dover sole (*Microstomus pacificus*), find important habitat values in the tidal channels and tidal flats in Humboldt Bay, but leave the bay and spawn in the Pacific Ocean.
- A number of rockfish species (see below) also utilize Humboldt Bay's tidal channels and tidal flats (including eelgrass beds) as juveniles, which then leave the bay to spend most of what may be fairly long lives, and to spawn, in the Pacific Ocean.
- The bay serves as a transitional habitat for a number of species (salmonids, smelts, lampreys, possibly shad) that spend their adult lives in the Pacific Ocean before entering the bay's tributaries to spawn (see below; also see Chapter 10).

The ecological roles played by many of the fish species in Humboldt Bay (see Chapter 8.0) involve the level of "secondary consumer." Organic energy created by plant photosynthesis is introduced to the consumer food web through consumption by invertebrates (either by direct consumption or through the detritus pathway). Most of the fish species in the bay "make a living" by eating the invertebrates, although quite a few of the larger fish also eat smaller fish, an energy pathway that is not shown in EIR Figure 8-1.

EIR Chapter 8.0 identified, in a general way, some of the trophic and ecological interrelationships among Humboldt Bay and the nearshore Pacific Ocean, including the importance of the bay for fish that spend much of their lives in the Pacific Ocean. It is a truism that depleted fish stocks cannot support commercial or significant recreational fisheries. In the past half-century the fish stocks that supported a formerly abundant salmon fishery and a highly productive groundfish fishery have

7 "Demersal" refers to fish that are associated with the sea-bottom.

been depleted. Some of the effect clearly arose because of heavy fishing pressure (e.g., for rockfish). Some of the effect arose because of land use practices in areas far from Humboldt Bay that adversely affected the reproductive success of commercially important species (e.g., salmon). Considerations of this kind are the primary focus of the Pacific Fishery Management Council (PFMC), which is charged with establishing management programs for species that are utilized commercially (see below). This subject is considered a significant element in the management of Humboldt Bay, because the ecological vibrancy and resiliency of fish stocks that support fishing and related commercial and recreational activities are generally regarded as among the more important elements in the environment of many residents in the Humboldt Bay region.

11.1.2.2 Listed Species and Habitat Relationships

Tables 11-1 and 11-2 identify seven fish species that are considered as "environmentally sensitive" under criteria that are generally recognized in CEQA documents. Three of these species [coastal cutthroat trout (*Oncorhynchus clarkii clarkii*), longfin smelt (*Spirinchus thaleichthys*), and eulachon (*Thaleichthys pacificus*)] are identified as "special concern" species by the Department of Fish and Game under California law.[8] The other four species [tidewater goby (*Eucyclogobius newberryi*), coho salmon (*O. kisutch*), Chinook salmon (*O. tshawytscha*), and steelhead (*O. mykiss*)] are formally listed under the ESA or the CESA or both (two of these four are also "commercial species" that are addressed by Fishery Management Plans adopted by the PFMC; see below).

The two smelt species represent uncommon fish in California that were formerly more abundant, and their status is partly a result of the apparent subsequent declines in abundance, the reasons for which are uncertain. Longfin smelt are "anadromous" in a general sense, although it appears that adults characteristically do not move to offshore oceanic waters. Spawning occurs in low-salinity waters in estuary tributaries, apparently including those in the Humboldt Bay watershed. Eulachon are fully anadromous, with adults moving offshore as a schooling pelagic species, then returning to spawn in coastal rivers, apparently including the Mad River; this species is not known to spawn in Humboldt Bay tributaries, although it has been encountered in the bay previously. Both species appear to be more common at the present time farther north along the Pacific coast than in California waters.

The tidewater goby is federally listed as "endangered." A recovery plan was adopted in January, 2006;[9] designated critical habitat does not include waters in northern California. The U. S. Fish and Wildlife Service published a Federal Register notice in 1999 proposing to delist the northern California occurrences of the species; the proposal was withdrawn in 2002. This resident species is a California endemic, and typically is not found outside of the brackish water in coastal lagoons and tidal tributaries; consequently the species occurs in a series of currently disjunct local populations. Tidewater gobies are small (ca. 5 cm long), and occur in at least one of

8 Longfin smelt and eulachon are also considered to be "threatened" under criteria developed by the American Fisheries Society.

9 See URL: http://ecos.fws.gov/docs/recovery_plans/2006/060123.pdf (viewed April 2006).

the significant tributaries to Humboldt Bay, preferring water with brackish characteristics (i.e., salinity in the 5-10 ‰ range).

All four of the salmonids identified in Tables 11-1 and 11-2 occur in Humboldt Bay and its tributaries. All four species are at least facultatively anadromous, with adults entering the Pacific and then returning to spawn in bay tributaries. Coastal cutthroat trout are relatively small salmonids that typically spend long periods in fresh water, but may also undergo smoltification and enter the Pacific Ocean, later re-entering freshwater streams to spawn (in fact, it appears that some individual trout may do this more than once). This species is not particularly common where it occurs, it has a relatively limited range in California (in coastal streams north of Cape Mendocino), and it is a "special concern" species in California.

Steelhead are, in effect, a seagoing form of rainbow trout, are relatively closely related to cutthroat trout, and may re-enter the ocean after spawning.[10] The major tributary streams to Humboldt Bay are spawning streams for steelhead, which rear in the streams as well. In 2005 young steelhead were captured in the Freshwater Creek, Elk River, and Salmon Creek basins (Wallace *in lit.*)[11] The Northern California steelhead ESU is a state "special concern" taxon, and is federally listed as "threatened" and a critical habitat designation for the ESU was published in 2005; critical habitat was designated in Jacoby Creek, the Freshwater Creek basin, the Elk River Basin, and Salmon Creek.

Coho (also known as silver) salmon are a group of ESUs that spawn in smaller river basins that generally drain directly to the Pacific Ocean (that is, these ESUs generally do not occur in basins far inland from the Pacific Ocean). The "southern Oregon – northern California coast" (SONC) ESU is designated as "threatened" under both the federal and state Endangered Species Acts. Critical habitat was designated in 1999 that includes "all river reaches accessible to coho" between Shelter Cove and Cape Blanco, Oregon. Coho occur in all of the significant Humboldt Bay tributary streams (Wallace *in lit.*). Coho generally remain within their natal watersheds for some period of time before entering the marine environment, rearing in streams or other favorable locations.

Chinook (or king) salmon are a group of ESUs that spawn in most of the major river basins that enter the Pacific Ocean, sometimes at great distances from the ocean. The ESU that occurs in the Humboldt County region is the "California coast ESU," which is designated as "threatened" under the federal ESA. Critical habitat was designated for this ESU in 2005 that includes Jacoby Creek, the Freshwater Creek basin, the Elk River Basin, and Salmon Creek. During the 2005 sampling in bay tributaries, chinook

10 That steelhead may re-enter the ocean and return to spawn more than once suggests to some biologists that steelhead or a similar ancestor form the "basal branch" of the evolutionary tree of Pacific Coast salmonids.

11 Mike Wallace, an Associate Biologist with the Department of Fish and Game, trapped and identified salmonids and other fish in major Humboldt Bay tributaries throughout 2005. References to "Wallace *in lit.*" in this section refer to summaries published by email distribution to interested parties.

salmon were found in the Freshwater Creek and Elk River basins, but not in Salmon Creek (Wallace *in lit.*).

The relationships of the four salmonid species/ESUs with the physical environment in the region differ, in terms of seasonal timing or desired water characteristics that are needed for use by fry, yearlings, smolts, and migratory adults. In general the scientific understanding of the evolutionary and ecological relationships among salmonid ESUs in the river basins of the Pacific coast continues to change to accommodate both differences among the ESUs and differences among the river basins [see Fresh and others (2005), Bottom and others (2005)].[12] As a general summary, the evolutionary selection pressures to which each ESU is exposed will favor specific traits of each ESU's life history. Sometimes the selection pressures will favor remaining longer in the fish's natal stream, sometimes selection will favor a lengthy residence in estuarine conditions, and sometimes selection may favor an early migration to the ocean. The overall pattern exhibited by the collection of salmonid ESUs in a particular region likely will resemble patterns in other regions, but the species that exhibit particular adaptive traits (e.g., long-term freshwater residency as juveniles) may differ among the regions.

In the Humboldt Bay area it is inaccurate to conclude that the life histories of salmonid species are well understood. Fragmentary local data provide a sketchy profile of some fish remaining in the major tributaries to Humboldt Bay, but relatively extensive sampling within the bay itself has found no evidence of salmonids (Pinnix and others 2005). Partly on the basis of these neutral findings the National Marine Fisheries Service did not find that the mariculture activities carried out in Humboldt Bay constituted an adverse effect on salmonids in the bay (see Chapter 10.0). This EIR concludes that the usage patterns of the salmonids in the Humboldt Bay watershed are not known well enough to allow an adequate characterization of impacts that could result from many of the Draft Plan's policies.

11.1.2.3 Essential Fish Habitat

Subsection 4.4.3 in Chapter 4.0, Section II, of the Draft HBMP includes the following synopsis of the setting of discussions of "essential fish habitat:"

> In 1996 the Magnuson Act, a law that provided for federal involvement in fishery management, was revised and readopted as the Magnuson-Stevens Fishery Conservation and Management Act (generally, the Magnuson-Stevens Act). One primary element added to the Act was the requirement that federal agencies consider the potential effects of proposed actions on "Essential Fish Habitat" (EFH).[13] The Act requires NOAA fisheries, in consultation with the Management Councils that oversee adopted Fishery Management Plans, to identify EFH for all species listed in each of the Management Plans. EFH is defined

12 The EIR's authors note that the portrayal in the cited reports represents a fundamental reassessment of the ecological and evolutionary patterns represented by the numerous ESUs in the Columbia River basin. To the extent that the "model" underlying the assessment in the Columbia basin is valid, then it is likely that a similar reassessment of the relationships among ESUs and the biophysical river dynamics in northern California is also warranted.

13 See URL: http://swr.nmfs.noaa.gov/efh.htm (viewed July 2005) for additional information about EFH.

as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NOAA Fisheries and the management Councils are directed, for each Plan, to:

- Describe EFH and identify EFH in each fishery management plan,
- Minimize to the extent practicable the adverse effects of fishing on EFH, and
- Identify other actions to encourage the conservation and enhancement of EFH

Essentially, the EFH mandate in the Magnuson-Stevens Act requires that decision-making within Humboldt Bay consider the potential effects of Bay management on the "spawning, breeding, feeding, or growth" of any species listed in an adopted Fishery Management Plan. The species that occur in Humboldt Bay that are listed in a Fishery Management Plant are enumerated in EIR Table 11-4.

EIR Table 11-4. Fish species in Humboldt Bay affected by Essential Fish Habitat designations.[14]

Taxonomic Name	Common Name	Adults	Spawning / Mating	Juveniles	Larvae	Eggs / Parturition
Coastal Pelagics Fishery Management Plan						
Engraulis mordax	Northern anchovy	X		X	X	X
Sardinops sagax caeruleus	Pacific sardine	X		X	X	X
Pacific Groundfish Fishery Management Plan						
Triakis semifasciata	Leopard shark	X	X	X	NA	X
Galeorhinus zyopterus	Soupfin shark	X	X	X	NA	X
Squalis acanthius	Spiny dogfish	X		X	NA	X
Raja binoculata	Big skate	X	X	X	NA	X
Raja inornata	California skate [4]	X	X	X	NA	X
Ophiodon elongatus	Lingcod	X	X	X	X	X
Scorpaenichthys marmoratus	Cabezon	X	X	X	X	X
Hexagrammos decagrammus	Kelp Greenling	X	X	X	X	X
Gadus macrocephalus	Pacific cod [4]				X	
Merluccius productus	Pacific whiting (hake) [4]			X		
Sebastes melanops	Black rockfish	X		X		
Sebastes chrysomelas	Black-and-yellow rockfish [4]	X	X	X		X
Sebastes mystinus	Blue rockfish	X	X			
Sebastes paucispinus	Bocaccio		X	X	X	
Sebastes auriculatus	Brown rockfish	X	X	X		X

14 EIR Table 11-4 has been modified, with respect to Table 4-7 in the Draft Plan, to reflect the species and life stages identified by NMFS in the EFH consultation for the Coast Seafoods application to the Army Corps of Engineers, dated November 10, 2005.

Taxonomic Name	Common Name	Adults	Spawning / Mating	Juveniles	Larvae	Eggs / Parturition
Sebastes pinniger	Canary rockfish [4]			X		
Sebastes goodei	Chilipepper [4]			X	X	X
Sebastes nebulosus	China rockfish [4]	X		X	X	X
Sebastes caurinus	Copper rockfish	X		X		X
Sebastes carnatus	Gopher rockfish [4]	X	X	X		X
Sebastes rastrelliger	Grass rockfish	X		X		X
Sebastes maliger	Quillback rockfish [4]	X		X	X	X
Sebastes saxicola	Stripetail rockfish [4]	X				X
Sebastes miniatus	Vermillion rockfish	X		X		
Sebastes flavidus	Yellowtail rockfish			X		
Isopsetta isolepis	Butter sole	X	X	NA	X	X
Microstomus pacificus	Dover sole	X			X	X
Parophrys vetulus	English sole	X	X	X	X	X
Citharichthys sordidus	Pacific sanddab	X	X	X	X	X
Psettichthys melanostictus	Sand sole	X	X	X		
Platichthys stellatus	Starry flounder	X	X	X	X	X
Pacific Salmon Fishery Management Plan						
Oncorhynchus kisutch	Coho salmon	X		X		
Oncorhynchus tshawytscha	Chinook salmon	X		X		

Notes: X EFH occurs for the species and life stage.
NA Not Applicable.
4 Species added on the basis of the 2005 NMFS consultation letter, Table 1.

The District has consulted with NOAA Fisheries regarding the EFH designation and management process that applies for Humboldt Bay. At the present time, EFH determinations are made by NOAA Fisheries on a project-by-project review basis; specific habitat designations have not been developed for habitats within Humboldt Bay.

The role that Humboldt Bay plays as essential habitat for the identified species is not well understood, in part because the designation is so recent that neither adequate research attention nor adequate regulatory attention has been paid to this question. Research results from recent studies in Humboldt Bay (Schlosser pers. comm.; also see the letter to the District in Appendix A, emphasizing the importance of eelgrass as a habitat element for young-of-the-year fishes throughout the bay) indicate that "structures" (pilings and rocks) and eelgrass beds in the bay play important roles for differing life stages of juvenile rockfish of several species. Rockfish are demersal fish, highly important commercially, that are covered by the Pacific Groundfish

Management Plan (most recently updated 2004).[15] Overfishing, other anthropogenic effects, and possibly other environmental changes have significantly reduced rockfish abundances during recent decades, and rebuilding rockfish stocks requires that all of the habitats that sustain the covered species be managed appropriately.

While it can be argued fairly that within Humboldt Bay all of the habitats are important, the habitat that may be most important for species covered by all of the Fishery Management Plans is eelgrass. As just noted, eelgrass is one of the structural elements that is important for juvenile rockfishes. Eelgrass is well established as an egg-deposition substrate for spawning herring in Humboldt Bay. While existing evidence from Humboldt Bay is mixed about the importance of eelgrass for salmonids, there is abundant evidence (not summarized here, but see Chapter 10.0) that eelgrass is an important habitat element for salmonids in other locations. The National Marine Fisheries Service concluded, in a 2005 letter to the Army Cops of Engineers, that operations associated with oyster mariculture in Arcata Bay (which were concluded not to produce significant effects on listed salmonids pursuant to the federal ESA) did in fact constitute a significant impact to essential fish habitat because of the effects of those activities on eelgrass. This regulatory finding is not determinative with respect to the conclusions reached in this EIR, but the rationale presented and the data summarized in the NMFS assessment support the conclusion reached in the letter. Generally, this EIR considers the existing evidence to indicate that Humboldt Bay habitats play critical roles in the lives of a number of regulated fish species; the bay does provide "essential fish habitat" for at least some of the covered species.

The EIR cautions that the life histories and habitat requirements of the covered species are not well understood, and it is inadvisable to conclude too firmly that various possible effects of activities in the bay would or would not affect the necessary habitat for many of the covered species. As with the salmonids discussed in the previous section, all of the covered fish species exist as biological populations that are constantly interacting with the biophysical environment, and the interactions must be presumed to be altered over time with changing environmental conditions in the bay and the ocean. The EIR finds that knowledge about habitat requirements for the covered species is inadequate for assessing the possible effects of the variety of bay uses on fish habitat elements. For the several commercially important fish species it is important that the Draft Management Plan incorporate a policy focus that directs additional research and assessment through time in order to identify and address the roles that the bay ecosystem plays in the life cycles of these species.

11.1.3 Plant Species and Community Types

11.1.3.1 Listed Plant Species

EIR Table 11-1 includes 30 plant species that have occurrence records for the Humboldt Bay region in the Natural Diversity Database. Three species have formal listed status under both the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA), as well as a CNPS List 1B status. Two species, beach layia (*Layia carnosa*) and Eureka wallflower (*Erysimum menziesii* ssp. *eurekense*), are

15 See URL: http://www.pcouncil.org/ (viewed February 2006) for copies of the Pacific Groundfish Management Plan, the March 1999 Pacific Salmon Management Plan, and the 1998 Coastal Pelagic Species Management Plan.

duneland plant species, and occur in areas that are not subject to District jurisdiction. The third species, western lily (*Lilium occidentale*), has been detected primarily in nontidal seasonal wetlands in the bay's vicinity and in uplands, also areas that are not subject to District jurisdiction.

Twenty-six of the remaining species are included in California Native Plant Society lists 1B or 2 (see Table 11-1 footnotes for definitions), and all 29 species are included in the CNDDB listing of "Special Vascular Plants, Bryophytes, and Lichens List." Under the conventions used in the CEQA process, all of these species are considered to be "sensitive."

Because the Draft Plan is not a proposal to physically modify the environment, this EIR need not identify all of the current locations of these species; that is, the Plan does not represent an immediate threat to any of the occurrences. However, the EIR notes for reviewers the identities of species that occur in habitats that are directly subject to the District's jurisdiction, because the District must consider possible direct and indirect adverse effects on these species when implementing the Plan.

Three plant species occur in wetland habitats that are subject to tidal action and which are subject to District jurisdiction: (1) Lyngbye's sedge (*Carex lyngbyei*) occurs in the upper reaches of Fay Slough, and probably occurs in other areas such as along Eureka Slough and Elk River; (2) Humboldt Bay Owl's-clover (*Castilleja ambigua* ssp. *humboldtiensis*) occurs in many high saltmarsh habitats outside levees around the bay, including the marshlands in Mad River Slough, those near Eureka Slough, and in the Elk River area, among other locations; and (3) Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*) occurs in tidal saltmarsh areas in some locations around the bay.[16]

The element occurrence data included in the CNDDB records indicate that three additional species in EIR Table 11-1 were detected a number of decades ago in tidal marsh habitat areas: (1) sand pea (*Lathyrus japonicus*), originally identified in tidal marsh areas near Elk River, (2) dwarf alkali grass (*Puccinellia pumila*), identified in tidal marsh areas near Cannibal Island in the Eel River delta; and (3) western sand-spurrey (*Spergularia canadensis* var. *occidentalis*), also identified near tidal marshes on Cannibal Island. These species currently do not occur in the Humboldt Bay area.

The other plant species listed in EIR Table 11-1 are species of upland habitats, and would not expected to occur in tidal marshlands or the open waters of the bay (or in diked former tidelands), and therefore would be expected not to be affected by the policies in the Draft Plan.

11.1.3.2 Community Types

Four community types are identified as environmentally sensitive in EIR Table 11-1. The rankings included in EIR Table 11-1 are based on a classification process

16 The latter two species are annuals, and the plants do not necessarily occur in the same locations from year to year, although their general occurrences remain the same (i.e., the bay's remnant saltmarshes).

developed for heritage species that assigns a "state element occurrence ranking" according to the criteria identified in footnote D at the bottom of EIR Table 11-1.

Three of the community types (Coastal Terrace Prairie, Northern Foredune Grassland, and Sitka Spruce Forest) have state element occurrence rankings of "very threatened." The rankings identify Northern Foredune Grassland and Sitka Spruce Forest as existing in fewer than six occurrences or fewer than 2000 total acres.[17] Coastal Terrace Prairie is identified as occurring in between six and 20 occurrences, or between 2000 and 10,000 acres. The fourth sensitive community type (Northern Coastal Salt Marsh) is identified as occurring in between 21 and 80 occurrences, or as occurring in between 10,000 total acres and 50,000 total acres. This community type is classified with a state element occurrence ranking as "threatened."

One of the four community types, Sitka Spruce Forest, roughly corresponds to a plant "alliance" [the term "series" was applied to a vegetation formation dominated by a given species in the Manual of California Vegetation (Sawyer and Keeler-Wolf 1995); in the soon-to-be-published second edition the term "series" will be changed to "alliance" in order to maintain consistency with vegetation naming conventions used in other locations].[18] The other three community types appear to maintain a residual status in the CNDDB by virtue of the Holland (1986) listing, since they are not based on dominance by particular plant species.

The community type named Northern Coastal Salt Marsh is a tidewater wetland community type that occurs, in part, in areas that are under the direct jurisdiction of the Harbor District (see EIR Figure 9-1); saltmarsh wetlands also occur behind levees, in areas that are not subject to the District's direct jurisdiction. A second community type, Sitka Spruce Forest, sometimes includes wetland areas, but these spruce-dominated wetlands typically are not subject to tidal influence in the Humboldt Bay watershed,[19] and do not fall under the District's direct jurisdiction.

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17 In the opinions of the EIR's authors, this attribution clearly understates the occurrence frequency of Sitka spruce forests in California, and likely underestimates the extent of forestlands dominated by this species. Nonetheless, the total area of Sitka spruce forest in California may well be less than 50,000 acres, and the association may warrant a threat classification at a lower level.

18 An additional "alliance" type that is not included in the CNDDB listing in EIR Table 11-1, but which is generally considered environmentally sensitive in California, is Beach Pine Forest (MCV code 87.060.01). Coastal woodlands or forestlands dominated by "shore pines" occur in three locations in California, in coastal Del Norte, Humboldt, and Mendocino counties; the total area of these occurrences is less than 2000 acres (Critchfield 1978).

19 Sitka spruce (*Picea sitchensis*) is, however, generally known as "tidewater spruce" in coastal regions farther north along the Pacific coast, and this species often dominates, or co-dominates with black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and willows, riparian forest stands in estuaries and in tidal reaches of rivers [see, for example, Figure 213 in Franklin and Dyrness (1973) and Plate 50 in Cowardin and others (1979)]. Evidence is available to document the former dominance of riparian forests in the Eel River delta in the middle 1800s by Sitka spruce (Roberts 1992). A young riparian forest stand co-dominated by Sitka spruce and willows currently occurs adjacent to tidewater in the Redwood Creek estuary of Redwood National Park.

11.1.4 Wildlife Resources

11.1.4.1 Ecological Patterns in Wildlife Habitats in the Humboldt Bay Watershed

A description of the myriad ways that wildlife species are functionally tied to their habitats is beyond the scope of this document. There are many generalizations that reflect the value of various habitat types to wildlife, such as the widespread recognition that riparian habitats are among the most valuable for terrestrial wildlife (e.g., Thomas 1979), or the long-standing recognition that the number of bird species in a forested habitat is related to the vertical structural diversity in the habitat (e.g., Morrison and others 1992). In general, professional wildlife managers and most ecologists have concluded that the abundance of a wildlife species in a given habitat type is a function of the degree to which the habitat provides food, cover, water, and reproductive opportunities for members of the species.[20]

The value of specific habitats to wildlife can be related, functionally, to structural characteristics of the habitats and to the trophic energy available to species in the habitats. Terrestrial habitats (particularly forested habitats) in the Humboldt Bay watershed provide significant opportunities for use by wildlife, and (as summarized in Chapter 8.0) also provide substantial energy flows that sustain wildlife populations. The Draft Management Plan does not cover most of these terrestrial habitats, and the terrestrial habitats that the Plan does cover mostly have less structural diversity and therefore fewer opportunities for use by wildlife.

The Draft Plan explicitly covers the following general habitat categories:

- Open bay waters, including the subsurface water column and the bottom, as these areas are used by swimming or diving birds, marine mammals, and fish
- Intertidal and shallow subtidal flats, providing habitat for infaunal and epifaunal invertebrates, and foraging areas for shorebirds, herons, waterfowl, and some raptors
- Seagrass/eelgrass beds (see Chapter 10.0)
- Emergent marshes and marsh channels, which may be variously intertidal, shallow subtidal, or supra-tidal, and which provide foraging areas for fish, invertebrates, herons, and some raptors
- Structures located within the bay, including pilings, docks, rocks, and similar constructed or natural features that provide settling locations for invertebrates and shelter for a variety of other species
- Tidal riverine bottoms and shorelines, providing habitat values like those found in intertidal flats and emergent marshes

20 This basic approach, for example, underlies the Habitat Evaluation Procedure (HEP) process developed by the U. S. Fish & Wildlife Service in the late 1970s, but the basic approach transcends specific application to the HEP process. The basic theory underlying the overall approach is explained in USFWS policy documents which may be reviewed at the following USFWS website: http://policy.fws.gov/870fw1.html (viewed February 2006). The historical and biological rational for the HEP methodology is summarized in part 101 of the USFWS' Ecological Services Manual, "Habitat as a Basis for Environmental Assessment" (101 ESM; this is available for download at http://policy.fws.gov/hbindex.html#HEP; viewed February 2006).

In addition, the Draft Plan indicates District interest in formerly tidal areas currently behind levees, which provide additional habitat types:

- Seasonal emergent marshes, including seasonally inundated or saturated pasturelands and freshwater marshes
- Seasonal ponds, including cutoff sloughs
- Riparian scrub-shrub and forested wetlands associated with streams passing through low-gradient bottomlands near the bay

All of the above habitat regions in the bay's watershed are used by wildlife. In a general sense, the lack of a significant three-dimensional "permanent" physical structure minimizes the ability of wildlife species to segregate their use of the bay by selecting differing elements of structural complexity (as species in many upland communities do), and requires a separation of the two-dimensional environment among species by time of use, tidal stage, depth of substrate, and similar kinds of ecological differentiation. These modes of ecological separation tend to be found in ecological communities in which "scramble competition" occurs, in which similar species secure energy and nutrients by increasing individual intake rates or efficiencies of similar prey gathered from the common habitat, rather than through spatial separation or behavioral exclusion of potential competitors. These circumstances tend, ecologically, to produce ecosystems in which the overall "carrying capacity" of higher trophic groups (like fish or birds) are directly related to the abundances of the invertebrate prey species and thus to the productivity of the basal layer of the food web, the photosynthesizers.

In the relationships among wildlife species within the variety of habitats in the bay watershed, it should be recalled that wildlife need not find value in only one habitat type, and many species or species groups do find important habitat values in more than one habitat. As noted in Chapter 4.0 of Volume III of the Draft Plan:

> In the rainy season, large areas of these diked former tidelands are often saturated, or even inundated, for prolonged periods. "Cutoff" sloughs are frequently converted to broad, shallow ponds. During these periods these former tidelands function as shallow freshwater wetlands, and are important habitat areas for waterfowl and shorebirds (see Colwell and Dodd 1997). The diked former tidelands are increasingly being used during the period between February and April by Aleutian geese (*Branta hutchinsii leucopareia*).

The functional relationships among uses of both the tidelands and the diked former tidelands by important wildlife species groups reinforce important conclusions about the Humboldt Bay ecosystem. The productivity of the communities within the bay's waters and tidal flat communities is linked to nutrients and productivity from the watershed. The wildlife species groups that are functionally related to the tidal flat habitats also make use of the wetland habitats within the diked former tidelands.

11.1.4.2 Listed Species and Habitat Relationships

Birds. Eight bird species are identified in EIR Table 11-1, and 14 additional species are listed in Table 11-2. All eight species in Table 11-1, and three additional species in Table 11-2, occur regularly in habitat types that are subject to the District's jurisdiction, and the Draft Plan's policies may affect the well-being of these species in

the Humboldt Bay region. Three of the species in Table 11-1, and two in Table 11-2, have a formal listed status under the federal ESA or the CESA.

Four heron species [great egret (*Ardea alba*), great blue heron (*Ardea herodias*), snowy egret (*Egretta thula*), and black-crowned night heron (*Nycticorax nycticorax*)] are considered sensitive only in terms of nesting colonies (that is, these species are not otherwise considered "sensitive" under any of the criteria normally used for such determinations). One of the described nesting colonies for all of these species is the cypress grove on Indian Island, at a location that is surrounded by areas that are subject to the District's jurisdiction.[21] The other identified nesting colonies for all four species are not located close to tidelands subject to District jurisdiction (according to the CNDDB element occurrence records), and it appears unlikely that these locations would be affected by the Plan's policies.

The Double-crested Cormorant (*Phalacrocorax auritus*), a state "special concern" species, is also considered "sensitive" in terms of nesting colony sites. One of three known nesting colonies for this species in California occurs on the ruins of the old wharf in Arcata Bay, and the status of this colony clearly could be affected by policies in the Draft Plan.[22]

The Database includes, for the Humboldt Bay region, 76 known nesting locations for osprey (*Pandion haliaetus*), a state "special concern" species, almost all of which occur far from the baylands, in locations not sensitive to the policies in the Draft Plan. However, there are nesting records for this species at the District's Redwood Dock facility, a site that the District will continue to protect. The foraging habitat for this species is primarily the waters of Humboldt Bay, however, and the well-being of this species is partly a function of the success of the Plan's policies.

The western snowy plover (*Charadrius alexandrinus nivosus*) is federally listed as "threatened," and is a state "special concern" species. This species currently occurs in the Humboldt Bay region, typically in the high intertidal and beach zones of areas around Humboldt Bay and on the sand spits along the Pacific Ocean shoreline. The Plan's policies could affect this species only to the extent that the Plan addresses the sandy shorelines of the bay to an elevation of Mean Higher High Water; the EIR concludes that there is some potential for coverage by Plan policies for the Elk River Spit, but other known use areas for this species (outer beach areas from Little River to Centerville) appear to be outside of the District's area of jurisdiction.

The final bird species listed in EIR Table 11-1 is the California clapper rail (*Rallus longirostris obsoletus*); this species is listed as "endangered" under both the ESA and the CESA. The Database records indicate occurrences of this species in saltmarshes

21 Section 5.5 (b) of the legislation that created the District stated that only the "portion" of Indian Island "bayward of the mean high tide line shall be under the jurisdiction of the district." The saltmarsh areas of Indian Island are under the District's jurisdiction, but the cypress grove appears not to be included in areas subject to District jurisdiction.

22 This site is included as partial "habitat restoration" in the Department of Fish and Game's Office of Spill Prevention and Response (OSPR) planning with respect to the *M/V Kure* spill. Formal action has not yet been taken.

in Humboldt Bay (Indian Island and the Mad River Slough) as late as 1932, but the species has not been recorded since then and is now considered "extirpated" in the Humboldt Bay region.

Table 11-2 identifies the Caspian tern (*Sterna caspia*) as a federal "bird species of conservation concern." Caspian terns nest in a small colony in Arcata Bay (Shuford and Craig 2002). This species could be affected during the implementation of policies in the Draft Plan.

Brown pelicans (*Pelecanus occidentalis*), identified in Table 11-2 as listed under both the federal ESA and the CESA in addition to being a "fully protected" species under state law, occur in Humboldt Bay each year after the birds complete their nesting season south of the Humboldt Bay region. Brown pelican roosts are a protected or sensitive biological feature that could be affected by the Draft Plan.

The northern harrier (*Circus cyaneus*) is a "special concern" species that nests in seasonal wetlands and diked former tidelands in the Humboldt Bay region, and is only indirectly a potentially affected bird species under the Draft Plan.

Similarly, the white-tailed kite (*Elanus leucurus*), a "fully protected" species that nests in some seasonally wet areas and diked former tidelands near the bay, could be affected indirectly by the policies in the Draft Plan.

Bald eagles (*Haliaetus leucocephalus*) are becoming increasingly widespread, although remaining numerically few, in northern California after having been virtually extirpated from the state by the effects of DDE in the mid-20th Century. This species is listed under the CESA as "endangered," and eagles are also "fully protected" under the Fish and Game Code. The bald eagle has been proposed by the federal government for delisting pursuant to the federal Endangered Species Act. Eagles have been seen irregularly in winter along the coast near Humboldt Bay in the past. Until recently there were no known nesting records of this species in the Humboldt Bay vicinity, but this species has now been observed nesting in the Humboldt Bay region (K. Kovacs, pers. comm.).

The final bird species listed in Table 11-2 that utilizes habitats near Humboldt Bay that could be affected by the Plan's policies is the CESA-listed (and "fully protected") American peregrine falcon (*Falco peregrinus anatum*). This species is present in winter in the Humboldt Bay area, and hunts broadly for waterfowl and shorebirds over tidal flats and diked former tidelands (as well as in open areas within the limits of the cities adjacent to the bay).

The other bird species identified in Table 11-2 appear unlikely to be experience adverse effects because of Plan policies, since they are typically found in scrubby or forested habitats that are only slightly affected by plan policies or not affected at all.

Other Wildlife. Among the species listed in EIR Table 11-1 are four mammals, three amphibians, and one reptile species. The four mammals are characteristically species of forested upland habitats and would not be expected to occur in open baylands that are subject to the District's jurisdiction. All three amphibian species and the reptile are associated with freshwater habitats, and do not appear likely to occur in areas

subject to current District jurisdiction. The amphibian species would not long survive in high-salinity tidewater, should any be washed downstream and into the bay. The western pond turtle (*Emys marmorata marmorata*) is generally associated with freshwater streams and nearby grasslands, and is unlikely to occur in or near saltwater-dominated habitats. The EIR concludes that these species are unlikely to be affected significantly by the policies in the Draft Plan.

Table 11-1 identifies one insect species, the sandy beach tiger beetle (*Cicindela hirticollis gravida*), a species that could occur, if present in the region, on beach habitats that would potentially be subject to District jurisdiction. The sole occurrence record for this species in the CNDDB was an observation made in 1905, and the Database indicates that the species is "extirpated" locally; this EIR concludes that the species is unlikely to be found again.

11.1.4.3 Shorebirds Species as a Measure of Ecosystem Sensitivity

Table 11-2 identifies two species [Allen's hummingbird (*Selasphorus sasin*) and olive-sided flycatcher (*Contopus cooperi*)] as sensitive species because the National Audubon Society had included them as species of concern in the Audubon WatchList. These species are unlikely to be affected significantly by the policies in the Draft Plan, but the identification demonstrates that species may be identified as "sensitive" by methods other than by listing under federal or state law. EIR Table 11-5 identifies bird species that are incorporated into the Audubon "WatchList" that appear likely to use the open waters or tidal flats within the bay, and these species could be affected by the policies in the Draft Plan.

The National Audubon Society is a conservation organization whose members are interested in birds and which has effective working relationships with professional ornithologists. The Society maintains a list of bird species that are considered to be sensitive to extinction pressures because of small population sizes, restricted ranges, habitat losses, and similar factors. The Audubon "WatchList"[23] includes a total of 160 continental species or subspecies at the present time (67 red-listed species or subspecies and 97 yellow-listed species or subspecies). EIR Table 11-5 includes the WatchList species that occur in Humboldt Bay that are associated with the primary habitat types under the District's jurisdiction and which are worthy of conservation consideration.

EIR Table 11-5. Audubon WatchList Species for Humboldt Bay's waters and tidal flats (excluding rocky rip-rap).

List Code	Taxonomic Name	Common Name
Seabirds		
Red	*Brachyramphus marmoratus*	Marbled Murrelet
Waterfowl		
Yellow	*Branta bernicla*	Brant

23 See URL: http://www.audubon.org/bird/watchlist/. Viewed February 2005.

List Code	Taxonomic Name	Common Name
Gulls, Terns, and Shorebirds		
Red	*Sterna elegans*	Elegant Tern
Red	*Larus heermanni*	Heermann's Gull
Red	*Numenius americanus*	Long-billed Curlew
Red	*Charadrius alexandrinus*	Snowy Plover
Yellow	*Arenaria melanocephala*	Black Turnstone
Yellow	*Limosa fedoa*	Marbled Godwit
Yellow	*Calidris canutus*	Red Knot
Yellow	*Limnodromus griseus*	Short-billed Dowitcher
Yellow	*Numenius phaeopus*	Whimbrel
Yellow	*Phalaropus tricolor*	Wilson's Phalarope

Red: Species in this category are declining rapidly, have very small populations or limited ranges, and face major conservation threats; these typically are species of global conservation concern. Species in the *Red* category that have been identified by BirdLife International as "Threatened" or "Near-threatened" at the global level, and all species identified by Partners In Flight (PIF) as "Extremely High Priority" at the national level.

Yellow: this category includes those species that are also declining but at a slower rate than those in the red category; these typically are species of national conservation concern. Species in the Y*ellow* category include the remaining species identified by Partners In Flight at the national level as of "Moderately High Priority" or "Moderate Priority."

The dominance of the species in the Audubon WatchList group by shorebirds is also reflected in the considerations in the Southern Pacific Shorebird Conservation Plan (Hickey and others 2003), an additional example of species sensitivity arrived at by criteria other than a government listing program. Humboldt Bay as been identified by the Western Hemisphere Shorebird Reserve Network as a site with "International" significance for shorebirds (sites with >100,000 shorebirds per year, or with >10 percent of a biogeographic population of one or more shorebird species (Harrington and Perry 1995; available online at URL: http://www.manomet.org/WHSRN/). Thus the importance of the bay for shorebirds is well established under criteria accepted by shorebird conservationists around the planet. All of the species listed in EIR Table 11-6 for which Humboldt Bay has "primary importance" occur in the bay and use habitats affected by the policies in the Draft Plan.

EIR Table 11-6. Species for which Humboldt Bay is important according to the criteria in the Southern Pacific Shorebird Conservation Plan.

Species	Shorebird Plan Commentary
Shorebird Species for Which Humboldt Bay has Primary Importance	
Black-bellied Plover (*Pluvialis squatarola)*	At least 28,500 birds winter and 42,500 migrate along the coast.
Snowy Plover (*Charadrius*	Over 90 percent of the listed population along the U.S. Pacific Coast breeds in the region and most of it also winters here.

Species	Shorebird Plan Commentary
alexandrinus)	Snowy Plovers from the Central Valley and western Great Basin also winter along the region's coastline.
Semipalmated Plover *(Charadrius semipalmatus)*	Coastal wetlands are important for this species during fall and spring migration, with low thousands migrating through the region.
Black Oystercatcher (*Haematopus bachmani)*	This species is limited in distribution to the west coast of North America and, hence, the region is one of three U.S. shorebird planning regions in which the species is found. Its primary habitat is outer coast rocky shoreline. Carter et al. recorded 888 Black Oystercatchers on the California coast during a state-wide survey of nesting seabirds from 1989 to1991. Although comparable data are lacking, similar numbers appear to occur year round.
Willet (*Catoptrophorus semipalmatus)*	Over 20,000 Willets winter along the California coast and over 50,000 may migrate through the coastal region.
Marbled Godwit (*Limosa fedoa)*	An estimated 37,000 occur along the California coast in winter, and up to 138,000 may pass through during migration, assuming the majority of birds wintering in Baja California, Mexico, migrate through California. Wintering numbers on the California coast are unmatched elsewhere in the United States.
Black Turnstone (*Arenaria melanocephala)*	This species is restricted to the three shorebird planning regions on the west coast of the United States. Black Turnstones forage on rocky outer coast shoreline and estuarine tidal flats.
Short-billed Dowitcher *(Limnodromus griseus)*	As many as 150,000 Short-billed Dowitchers migrate along the California coast in spring.
Red-necked Phalarope *(Phalaropus lobatus)*	Over 80,000 migrate along the U.S. Pacific Coast in fall, with almost 20,000 found in San Francisco Bay alone.
Red Phalarope (*Phalaropus fulicaria)*	Abundant offshore migrant in the California Current. Accurate counts are lacking.
Long-billed Curlew (*Numenius americanus)*	The region holds a large percentage of this species' wintering population. Pacific Flyway Project surveys found at least 7,000 curlews in the region in winter, but this is a minimum estimate because of a lack of surveys in upland habitats of the Central Valley.
Western Sandpiper (*Calidris mauri)*	Over one million Western Sandpipers migrate through the Central Valley and along the coast during spring. The entire world population of this species is approximately 2.5 to 4.0 million birds. Single day counts at San Francisco Bay in the spring have approached one million birds.
Dunlin (*Calidris alpina)*	The minimum estimate of 250,000 individuals of the race *Calidris alpina pacifica* that winters along the coast and in the Central Valley represents about one half of that subspecies' entire population.
American Avocet (*Recurvirostra americana)*	Avocet numbers in this region in winter may be greater than those in any other planning region and in fall may be surpassed only by numbers in the Intermountain West Region. Eighty-eight percent of the U.S. Pacific coast avocets counted in winter (median count = 26,177 birds) are found in San Francisco Bay.

Species	Shorebird Plan Commentary
Shorebird Species for Which Humboldt Bay has Secondary Importance	
Black-necked Stilt (*Himantopus mexicanus*)	On coast year round.
Wandering Tattler (*Heteroscelus incanus*)	On coast during migration.
Spotted Sandpiper (*Actitis macularia*)	On coast during migration and winter.
Red Knot (*Calidris canutus*)	On coast during migration and winter.
Sanderling (*Calidris alba*)	On coast during migration and winter.
Least Sandpiper (*Calidris minutilla*)	On coast and inland during migration and winter.
Wilson's Phalarope (*Phalaropus tricolor*)	On coast during migration.

The identification of Humboldt Bay's importance in EIR Table 11-6 is based on properties of the Humboldt Bay ecosystem within the context of similar ecosystems on the west coast of North America and in the western hemisphere (similarly to the identification of the bay's importance for brant in Chapter 10.0). This identification is particularly germane with respect to identifying criteria for managing the Humboldt Bay ecosystem as a whole.

11.1.5 Nonindigenous Species

The subject of nonindigenous species management was considered briefly in Chapter 6.0. The biological environment in Humboldt Bay may be less modified by the introduction or colonization of "exotic" or "nonindigenous" or "non-native" species than are most other west coast estuaries. The Draft Management Plan includes the following text regarding exotic species (section 4.5.2, Chapter 4.0. Section II):

> The effect of exotic (better described as "nonindigenous") species on ecosystem functions is a substantive environmental concern throughout the world. Nonindigenous species may have a variety of potential adverse impacts, including:
>
> - Direct physical impacts on human infrastructure, such as boring into and weakening wooden pilings or clogging water intake pipelines.
> - Adversely affecting the productivity of biological populations directly used by humans, such as the effects of non-native parasites or predators on fish or shellfish.
> - Reducing the capability of natural populations or ecosystems to resist stress-related changes in composition or structure, such as a loss of native plant species because of the effects of non-native plant species invading the natural communities.
>
> The introduction of nonindigenous species into estuaries such as Humboldt Bay is the subject of a Presidential Executive Order (EO 13112), issued in 1999. Nonindigenous species are also the subject of the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, last amended in 2000. Both the EO and the legislative act direct federal agencies to avoid or prevent the introduction of nonindigenous aquatic species into

American waters. The primary focus in the case of these federal agency programs is the potential delivery of harmful or nuisance species in ballast waters. The release of exotic organisms into California waters is also regulated under state law (e.g., Fish and Game Code section 6950). Nonetheless, introductions of additional nonindigenous species still occur in major California ports (see, e.g., Cohen 1998).

Humboldt Bay, as a natural estuarine ecosystem, appears to be less-affected by non-indigenous species than are many other bodies of water that are commonly exposed to shipping, primarily as a consequence of historically lower levels of shipping in Humboldt Bay. However, there appear to be at least 95 species of organisms, in a variety of taxonomic groups, in Humboldt Bay that most likely did not evolve there (Boyd and others 2002). Some of these species appear to have been present in Humboldt Bay for a considerable period of time, and to have already resulted in substantial alterations in the native ecosystems in the Bay (e.g., dense-flowered cordgrass). Other nonindigenous species have been introduced intentionally (e.g., the commercially grown oyster in Humboldt Bay, *Crassostrea gigas*).

The District has been cognizant of the threat represented by nonindigenous species for more than a decade, and addressed the potential effects of nonindigenous organisms on Humboldt Bay for the first time in adopting Resolution 96-9, in 1996.[24] As part of the development of the Management Plan, the District will re-examine the potential need for proactive management of ballast water in commercial vessel traffic, working in collaboration with relevant state and federal agencies (particularly the Department of Fish and Game and the U. S. Coast Guard).

This excerpt largely identifies the circumstances in which the Humboldt Bay Management Plan currently exists. There are multiple sources for nonindigenous species that are periodically introduced to west coast estuaries, including ship deballasting, introductions within mariculture seeding operations, and natural colonizations (Wonham and Carlton 2005). Recent studies (Boyd and others 2002, Wonham and Carlton 2005) indicate that Humboldt Bay has a lower proportion of nonindigenous species than other West Coast estuaries, but that the observed rate of increase for nonindigenous species in Humboldt Bay is comparable to the rates in other West Coast estuaries with ports.

Regulatory authority for exotic species management is vested in federal and state agencies. At the present time it appears that the California State Lands Commission has embarked on an aggressive program to protect California waters (Falkner and others 2005), and the District will continue to cooperate with the SLC and the Coast Guard to identify suitable nonindigenous organism control measures for Humboldt Bay.

11.1.6 An Ecosystem-Based Perspective on Species Protection

Humboldt Bay plays an important role in the life cycles of many fish, wildlife, and plant species. For practical purposes, the District cannot adopt specific policy

24 The District's action was the first action taken by any port facility on the West Coast to address this issue, and one of the first programs enacted in the United States.

elements that address all of the species individually, and the Draft Plan must accommodate a management approach that allows the District to "focus" its management effort effectively in order to promote the welfare of all of the species collectively, to the extent possible, with respect to the District's operational constraints of time and staff availability.

As noted throughout this EIR, the District has adopted an ecosystem-based perspective for the bay's management. This approach is based on recommendations for coastal zone and ocean management that are included in the 2003 Pew Oceans Commission Report and the 2004 Final U. S. Ocean Commission Report. An ecosystem-based approach is essentially embedded in coastal and ocean-resource management initiatives in California, the United States, and the rest of the planet.

The District has concluded that an ecosystem-based approach, focused on maintaining important ecosystem elements and ecosystem functions, represents the District's most effective means for protecting and managing the habitats of the species that depend on the ecosystem elements and functions for which the District is responsible. The District has further concluded that protecting the habitats of the species (the approach adopted by trustee agencies like the California Department of Fish and Game and the Coastal Commission) will functionally assure the continued "health" of those species, meeting the District's "trust" responsibilities for managing the bay's tidelands and other public trust resources.

11.2 Issues to be Addressed and Thresholds of Significance

The Initial Study prepared for the Management Plan EIR identified potential effects on a number of biological elements of the Humboldt Bay region in the queries about "biological resources," including: item IV (a) – sensitive species, item IV (b) – riparian areas and other sensitive community types, item IV (c) – wetlands, and item IV (d) – nursery areas and migratory corridors. These Environmental Checklist categories reflect a project-specific focus in typical CEQA contexts, but it is unclear that the categories serve the planning context of this EIR well. Many specific elements that are the subjects of the Checklist questions are covered in this EIR in chapters 8.0, 9.0, and 10.0. The specific subjects described in this chapter thus form part of an analytical framework within which the Plan's potential effects on ecosystem elements can be assessed.

Comments received by the District encompassed a variety of variations on these ecosystem-based concerns. Some comments requested that the EIR evaluate possible effects of the Draft Plan with respect to exotic species management. Other commenters requested that the EIR consider possible relationships among bay management and species that are important for commercial and recreational fisheries. A comment from the National Marine Fisheries Services requested that the EIR identify a number of specific relationships among plan elements and potential impacts to listed fish species and habitats. One commenter asked that the EIR discuss the relationship between the Management Plan and other agency and nongovernmental fishery plans for the watershed. Other commenters asked that the EIR assess the relationships among the Management Plan and the Fishery Management Plans developed by the Pacific Fisheries Management Council, including any relationships to Essential Fish Habitat.

As in other chapters, the thresholds of significance convention used in this chapter is that a potential environmental effect of the Plan is judged to be significant if the proposed policies increase the potential for occurrence of possible environmental impacts beyond the degree that would exist if the policies were not carried out. This assessment requires a judgement regarding the likelihood that the Plan will lead to actions that will create or exacerbate adverse conditions that would not occur without the policies. If a reasonable argument is possible that the Plan's policies would exacerbate a possible adverse condition, or create a new adverse condition that does not occur at the present time, then the effect is judged to be significant.

11.3 ENVIRONMENTAL EFFECTS OF PLAN ALTERNATIVES

11.3.1 "No Project" (Existing Master Plan)

The existing Humboldt Bay Master Plan provides direction to the District that "The natural environment shall be protected and enhanced" (Master Plan page IV-4). The Master Plan also includes, in the description of the use "Conservation – Water," the statement that "(t)his use … provides for conservation of natural resources, habitat and wildlife." The Master Plan also includes (pages IV-13 and -14) some generalized policy guidance for areas having that designation regarding the need to evaluate "reclamation" practices (that is, dredge spoil disposal) for their potential adverse effects on natural values, the need to support scientific research and public access, and a general support for mariculture activities.

In implementing the Master Plan the District adopted Ordinance No. 7 in 1976. Ordinance No. 7 includes the following general policy direction in Section 9:

> "(a) Maintenance and improvement of environmental quality shall be primary objectives for the use and development of all areas of Humboldt Bay and not just those designated as 'Conservation Water' and 'Public Open Space Lands.' "

This policy appears to provide direction to District staff and decision-makers that can be interpreted as a policy to protect sensitive species and habitats, fish and wildlife resources, and the bay ecosystem. However, this is essentially the extent of policy guidance that Ordinance No. 7 provides for these environmental concerns. This EIR finds that the "No Project" alternative is far less explicit for the subject areas discussed in this chapter than is the Draft Plan, and on this basis the EIR finds that the Draft Management Plan is superior to existing policy guidance for these concerns.

11.3.2 Proposed Management Plan

The Draft Management Plan may have either direct or indirect adverse effects on the bay ecosystem elements, including fish and wildlife resources and habitats (it should be noted that a number of other policies in the Plan would have positive or beneficial effects on these species or their habitats). The following policies appear to have a potential for producing adverse effects on fish, plant, and wildlife species considered in this chapter, or on their habitats.

Harbor Policies:

- HSM-2: Develop standards for new and existing Humboldt Bay shoreline protection

- HSM-3: Develop appropriate, consistent shoreline protection guidelines for commercial, industrial, and residential development around Humboldt Bay
- HWM-2: Dredging may be authorized to meet Plan purposes
- HWM-3: Re-deposition of dredged materials within Humboldt Bay may be authorized to meet Plan purposes
- HWM-4: Placement of fill within Humboldt Bay may be authorized to meet Plan purposes
- HFA-1: Support the improvement of existing fish landing, buying, and processing facilities in the Humboldt Bay area
- HFA-3: Assist in developing agency approval strategies and funding for commercial fishing and aquaculture marketing and outreach activities in Humboldt Bay
- HFA-4: Identify additional aquaculture opportunities in Humboldt Bay
- HFA-5: Designate a Preferred Aquaculture Use Area in Arcata Bay, and require Best Management Practices to meet environmental constraints

Recreation Policies:

- ROP-3: Identification of designated recreational use areas
- RFA-2: Project approvals shall incorporate public access and associated services and amenities where appropriate
- RFA-3: Water-oriented recreation facilities; access for fishing and shellfish harvesting
- RFA-5: Environmentally sensitive areas
- RFA-8: Minor amounts of fill authorized
- RSA-1: Improvement and provision of boat launch sites
- RSA-2: Assistance to, maintenance of, and consideration of marinas
- RSA-5: Support opportunities for recreational fishing
- RSA-9: Support for a water trails program for Humboldt Bay

Conservation Policies:

- CAE-3: Work cooperatively to develop and implement a restoration and enhancement plan for Humboldt Bay's aquatic ecosystems
- CAS-5 Fill placement may be used for habitat enhancement purposes
- CEP-2 Dredging may be approved under specified conditions
- CEP-3 Revetments, breakwaters, and other shoreline structures may be approved under specified conditions

The Draft Management Plan is intended to provide a "self-mitigating" programmatic management program for Humboldt Bay. The goal in that approach is to assure that policies that could result in adverse effects are accompanied by other policies that moderate or prevent possible adverse effects. For example, while the policies listed above could be associated with activities having adverse effect on the bay's aquatic ecosystem elements and functions, policies CEP-4 through CEP-11 in the Management Plan explicitly assure that the District will identify and adopt appropriate measures to assure that no adverse long-term impacts remain as a consequence of

Plan implementation. However, as noted throughout this EIR, the Plan's success in avoiding impacts depends entirely on the full implementation of all of the Plan's policies.

11.3.2.1 Fishery Resources

The setting description in this chapter identified a variety of fish species and habitat use patterns within the bay. Because these fish and their habitats occur within the waters that are the subject of the Draft Plan, the potential for the Plan to affect the species and their habitats is inherently the most important potential biological effect of the Plan. The same consideration, viewed from another perspective, is the basis for the widely recognized need for an ecosystem-based approach to managing fishery resources: appropriate management for important fishery resources requires an approach that incorporates all of the ecosystem elements that affect the fish and their habitats. In the context of Humboldt Bay, that ecosystem incorporates the bay itself, its tributaries and the watersheds that produce runoff flows, and the Pacific Ocean with which the bay exchanges water each day.

As summarized previously, potentially affected fishery resources within this aquatic ecosystem are ecologically varied, and are not easily categorized in the EIR context. From a regulatory and environmental assessment context, an approach may be appropriate that considers fish in a pseudo-regulatory context. In this context, relevant topics include: (a) species (and habitats) listed pursuant to the federal or state Endangered Species Act, or under other federal or state regulation, as "sensitive;" (b) species and (particularly) habitat elements that are covered by the Magnuson-Stevens Act; and (c) many other species, and their habitats, which constitute the pisciform diversity of the bay ecosystem.

Tidewater Goby and Smelts. As noted above (subsection 11.1.2.2), the tidewater goby and two species of smelts are, or are potentially, associated with the Humboldt Bay ecosystem. Tidewater gobies (*Eucyclogobius newberryi*) generally are associated with tidal waterways in areas that are subject to District jurisdiction. Longfin smelt (*Spirinchus thaleichthys*), to the extent that they occur in the bay watershed, are also associated with tidal streams and with bay waters, and may also use major streams above the limit of District jurisdiction. Eulachon (*Thaleichthys pacificus*) apparently don't spawn in the bay's tributaries, but may occur within the bay. Thus, all three of these species have a potential to be affected by the Draft Plan's policies.

This EIR finds that the existing policy focus in the Draft Plan addresses the necessary policy framework for protecting these species and their habitats. In particular, policies CAE-1 and CAS-3 provide guidance that assures that District decision-makers identify and consider possible effects on these species and their habitats. Additional policy elements are not required.

Salmonids. Humboldt Bay ecosystem elements provide habitat for four salmonids, coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*), and coastal cutthroat trout (*O. clarkii clarkii*). Three of these species are listed under the provisions of the federal and/or the state Endangered Species Act(s), and the ecosystem has been included in critical habitat designations for them (see subsection 11.1.2.2). The potential effects of the Management Plan's policies on

salmonid ecology, and on the individual fish themselves, cannot be separated easily from a number of regulatory processes that are not the focus of this EIR; however, the EIR draws two generalized conclusions about the role of Humboldt Bay in the life histories of these salmonids.

The first general conclusion is that the role(s) that Humboldt Bay aquatic ecosystem elements play in the life histories of these salmonid species is not well described or understood. While the fact that one or more of the species spawn and/or rear in one or more of the bay's major tributaries is well established, precise life history facts surrounding the uses of these habitats are not well known. As a general summary, this EIR offers the following statement regarding salmonid use and habitat in the bay:

> *Humboldt Bay functions as a migration corridor for adults and young of several salmonid species that depend jointly on the bay and the bay's tributary watershed. Adult fish spawn in the tributary watershed. Juvenile fish rear within the Humboldt Bay tributary watershed, but detailed knowledge about specific rearing locations and habitat utilization patterns in the tributaries is intermittent. It is understood that juvenile salmonids also use habitats with the bay for rearing purposes, but actual habitat utilization patterns of juvenile salmonids are essentially undocumented within Humboldt Bay. It is not possible, given current knowledge about the habitat use patterns of these fish, to assess the relative importance of various habitat elements within Humboldt Bay to salmonids.*

The use of the bay's tributaries by the salmonid species has been documented in the recent past by the unpublished but widely circulated results of studies being conducted by CDFG biologist Michael Wallace (generally summarized in subsection 11.1.2.2, above). With respect to salmonid use of the habitat conditions within the bay itself, Pinnix and others (2005) captured no salmonids among the more than 20,000 individual fish captured in their recent study, using several sampling procedures and sampling several habitat types within the bay's shallows. Definitive (or even well-informed) judgements about the importance of habitat elements for these species must wait until substantially increased sampling results are available from studies within the variety of bay ecosystem elements that could provide habitat for these species.

This EIR concludes that the existing policy framework included in the Draft Management Plan adequately addresses the protection of important salmonid habitat elements in general. Policies CAS-2 and HFA-6 direct the District to maintain and enhance habitat for commercially important species (relevant for the salmonid species that are covered by the PFMC Salmon Plan), and Policy CAS-3 directs the District to maintain and enhance habitat for sensitive species (relevant for species listed under state or federal Endangered Species regulations). Additional policies to address these concerns are unnecessary.

Notwithstanding the above conclusion, this EIR also draws a second general conclusion that salmonid habitat use considerations in the bay ecosystem should be broadened to address habitat elements that do not appear to be much considered at the present time. Current interpretations of Humboldt Bay salmonid ecology suggest that salmonid juveniles rearing in or migrating through the bay use eelgrass beds and channel-margin habitats, areas that were evaluated extensively as part of the Pinnix et

al. (2005) study with largely negative results. However, current interpretations of salmonid ecology from other parts of the Pacific Northwest suggest that juvenile salmonids use intertidal marshes and shallow tidal flat habitats extensively, and that these juveniles might benefit from enhancement actions that increase the extent of intertidal marshland and shallow vegetated and unvegetated habitats [Bottom and others (2005) provide an excellent summary of the scientific rationale and data that support this conclusion].

How such discussions would be focused within the Humboldt Bay watershed is unclear. The "restoration" or enhancement of diked former tidelands to intertidal condition appears likely to be the primary means of increasing the area of intertidal marshlands and shallow sub-tidal flats in the bay region. This approach is not without possible adverse effects and resource conflicts or "trade-offs" (see Chapter 9.0 and subsection 11.3.2.3 below). Wetland "restoration" projects that *might* benefit salmonids appear likely to be associated with adverse impacts for a variety of other protected or valued resources.[25] For example, a conversion of diked former tidelands to intertidal vegetated wetlands appears likely to produce effects within the grazing and dairying economic sectors in the regional economy, although these potential effects are apparently largely unstudied at the present time. In addition, it is highly probable that the "restoration" of diked former tidelands to intertidal marshes would result in the elimination of important secondary foraging areas for shorebirds, egrets, some raptors, and other wildlife.

From a policy perspective, the Draft Plan already includes a policy focus (Policy CAE-3) that directs the District to collaboratively develop and implement a restoration plan for Humboldt Bay's aquatic ecosystem. The potential restoration of former tidelands that would benefit the covered salmonid species is already included under that policy, and the potential benefits to salmonids are a factor that will be considered in the evaluations that result from that policy. Additional policies are unnecessary.

Essential Fish Habitat. The relative importance of Humboldt Bay as habitat for the commercially important fish species covered by the three Fishery Management Plans (Coastal Pelagics, Groundfish, and Salmonids) is uncertain, owing to a lack of information about the life histories and habitat requirements of most of the 35 species covered by the plans. However, current specific study results for Humboldt Bay already confirm the importance of the bay's "essential fish habitat" for a few of the commercially important groundfish species (Schlosser, pers. comm.; see subsection 11.1.2.2); important habitat elements that have been identified include eelgrass beds and other structural elements in the bay. Further explication of the habitat relationships of the covered species must await a substantial increase in applied research addressing these relationships. (It should be noted that the conclusion that the bay's habitats function as important elements for species that spend much of their lives in the near-shore Pacific Ocean confirms the importance of an ecosystem-based focus for managing these species.)

The Draft Plan generally already includes a policy framework (in Policy HFA-7 and Policy CAS-2) that directs the District to protect, enhance, and manage needed habitat

25 Identifying and characterizing these potential impacts will be the CEQA/NEPA obligation of the proponents of the projects.

for commercially important species. However, as noted in Chapter 10.0, an assessment of potential impacts to eelgrass (*Zostera marina*), a singularly important and essential habitat element in Humboldt Bay for commercially important species, indicated that this habitat may be adversely affected by the implementation of some of the Plan's policies. This chapter echoes that finding. In Chapter 10.0 an additional policy was identified that would reduce the potential effect of the Plan on eelgrass to less-than-significant levels. That policy suggestion is also incorporated into this chapter to mitigate the potential impact (see Section 11.4.1), and would reduce the potential policy concern for EFH to a less-than-significant level.

Other Aquatic Species Groups. This EIR concludes that policies in the Draft Management Plan include a high degree of "internal" mitigation for possible adverse effects on the aquatic ecosystem elements in Humboldt Bay (see Chapter 8.0). This concern for the general aquatic ecosystem elements in the bay is closely associated with the ecosystem-based focus of the Plan, addressed below in subsection 11.3.2.5.

11.3.2.2 Sensitive Plant Species and Community Types

The policies in the Draft Plan do not appear to be associated with substantial direct impacts on existing sensitive plant species in the Humboldt Bay region. The policy framework includes a direction to the District (in Policy CAS-3) to maintain and enhance habitat for sensitive species. Additional policy elements to address this concern are unnecessary. It should be noted, in addition, that these species form a central feature in the regulatory programs of a number of state and federal regulatory and trustee agencies that must approve many proposed actions within the bay; this environmental concern is well-covered.

The policy framework in the Draft Plan may be associated with potential indirect effects on some sensitive community types, through changes in the species composition of saltmarshes or benthic invertebrate communities because of the introductions of exotic species (see below). These possible effects appear to be adequately addressed in the Plan's approach to bay management, however, and additional policies do not appear to be needed for these concerns.

An additional concern for the bay's management results from potential direct and indirect impacts to the ecosystem, and to sensitive species and community types, from activities that are not "managed" by the District. For example, possible sea level changes, changes in climate, or major oceanographic changes in the Pacific Ocean could be associated with changes in the Humboldt Bay ecosystem complex. These effects would not result from Plan policy elements, but it is appropriate that the Management Plan anticipate that such effects could occur and provide guidance to the District regarding the District's responses to these changes.

As summarized in EIR Chapter 4.0, there are a number of predictions that sea level will increase during (and after) the effective life of the Management Plan. The increased sea level may be associated with changes in storminess that further change tidal dynamics in the bay. As a consequence of these externally forced changes, there is a potential that the existing saltmarshes within the bay could be adversely affected, or even that the existing marshlands, which are mostly external to the perimeter levees, could be obliterated. Dynamically, following the re-establishment of tidal flats

at higher elevations it is likely that saltmarshes would be re-established, but the composition of these future saltmarshes might differ from that of the saltmarshes present in the bay today.

The Draft Plan includes both a number of specific policies and an overall policy focus that provide direction to District staff and decision-makers to maintain wetlands and wetland-associated habitat values. Policy CAS-1, for example, is focused on maintaining the functional integrity of habitats throughout the bay for the range of species that compose the bay ecosystem. This EIR concludes that the policy framework included in the Draft Plan does not require additional policies in order to protect sensitive species and habitats.

11.3.2.3 Wildlife Resources

Wildlife species (not including, in the context of this discussion, fish and plants) in the Humboldt Bay region utilize a variety of habitat types (see subsection 11.1.4.1 above). As noted above, the potentially affected "sensitive" wildlife species are mostly water-related birds (see subsection 11.1.4.2). Functionally, potential Plan-related effects on these wildlife groups can be assessed by considering the Plan's implications for bird species included within the following groups: waterfowl, shorebirds, gulls and terns, piscivorous "divers" (e.g., loons, cormorants, and pelicans), herons and egrets, and some raptors. Species in these groups forage for a wide variety of prey types within the bay, and most of the non-avian species that would be affected by bay management are ecologically similar to one or more of these ecological surrogates.

The functional bay ecosystem elements that the vast majority of these species require, within the tidal part of the bay, are adequately protected by the policy framework in the Draft Plan. Policy CAE-1, for example, directs District decision-makers to protect the integrity of the bay ecosystem, which explicitly requires the protection of the prey bases for these aquatic bird species. Policy CAS-1 directs that viable populations of all species, including these wildlife species, be protected; this also directs a protection of the ecological elements (i.e., habitat and prey base) that sustain these species. Thus this EIR concludes that the existing Draft Plan includes a policy focus that adequately protects the majority of the wildlife species that occur in the bay, and additional policies are unnecessary.

In two contexts, however, this EIR finds that the Draft Plan does not include policies that fully protect "sensitive" wildlife species (and, therefore, the Plan does not fully protect all other wildlife species): (a) species that are functionally dependent on habitats outside of the District's direct jurisdiction, particularly the diked former tidelands; and (b) species that are functionally related to eelgrass.

Species using diked former tidelands. During the preceding four decades, and particularly since 1990, the ecological importance of agricultural lands (also known as "diked former tidelands") adjacent to Humboldt Bay for shorebirds has been well documented (see, e.g., Gerstenberg 1972; Colwell and Dodd 1995, 1997; Long and Ralph 2001; Hickey and others 2003). As noted earlier in this chapter, the importance of coastal wetland complexes for shorebirds, including the Humboldt Bay complex, has resulted in the identification of the Humboldt Bay region as having "international" significance for shorebirds.

In addition to the importance of the former intertidal wetlands for shorebirds, these pasturelands also function as a significant habitat for herons/egrets (Schlorff 1978) and a variety of other water-related birds (Hoff 1979), including waterfowl and several raptor species. Pasturelands are the habitat type that is most commonly used by Aleutian geese (*Branta hutchinsii leucopareia*), a waterfowl species that is still under the aegis of the federal Endangered Species Act.

As noted a number of times in this EIR, the District lacks jurisdiction over these diked former tidelands (see Chapter 9.0), although these former tidelands are an area of significant interest for the District. Consequently the policy coverage in the Draft Plan does not reach the diked former tidelands. The Draft Plan incorporates an ecosystem-based focus that directs the District to collaborate with agencies that regulate land use in the diked former tidelands (i.e., policies CAE-1, CAE-2, and CAE-3), but it is unclear that this focus adequately protects the functionally important diked former tidelands from impacts. By the same token, however, it is unclear that the current policy focus will be inadequate to protect these important habitat areas.

Because these habitat areas are not within the region covered by the District's direct jurisdiction, the EIR does not identify a need for additional planning policies.

Species using eelgrass. The tidelands within the bay are within the District's direct jurisdiction, and the likely effects of Plan policies on eelgrass were identified in Chapter 10.0. Eelgrass meadows have been identified as the most important habitat element for Pacific brant (*Branta bernicla nigricans*), and the abundance of this sensitive species is directly correlated with the abundance of eelgrass (Ward and others 2005).

The effects of the Plan's policy focus on eelgrass was discussed extensively in Chapter 10.0, which identified a need for additional policy elements in order to offset potentially significant effects that could result from the Draft Plan's lack of eelgrass protection. The mitigation measures identified in Chapter 10.0 are incorporated below in Section 11.4, and have the effect of reducing the potentially significant effects to less-than-significant levels.

11.3.2.4 Nonindigenous Species

Policies included in the Draft Management Plan that may be associated with an increased use of the bay for coastal and international shipping purposes (e.g., Policy HLU-1 and Policy HLU-5) encourage an increase in vessel traffic into the bay. Increased vessel traffic into Humboldt Bay originating in or having called at most major harbors along the Pacific coast or elsewhere in the world has a potential for increasing the introduction rate of nonindigenous marine and/or estuarine organisms into Humboldt Bay. An increased rate of introduction of nonindigenous species, particularly estuarine-adapted invertebrates, would be expected to be associated with adverse effects on the existing bay ecosystem, including the possible loss of existing species and the increased use of one or more substances or compounds for control purposes (e.g., tributyltin; see Section 6.1.5).

The ecological effects of nonindigenous species (particularly plant species and invertebrates from other estuaries) on native estuarine species and existing estuarine communities are not are uniform (Falkner and others 2005). However, the general ecological effects of invasions of coastal estuaries have been documented adequately to conclude that many invasions have ecologically significant consequences, and this effect is undoubtedly a concern for Humboldt Bay's management.

As an example of this phenomenon, the introduction of smooth cordgrass (*Spartina alterniflora*) into San Francisco Bay in the 1970s for erosion-control purposes has had, and will have in the future, significant effects on both the dynamics of saltmarsh plant associations and the dynamics of sediment deposition and erosion in that bay.[26] Research carried out with "drifter cards" has demonstrated that viable seeds that drifted out of that bay on ebb tides could be carried by oceanic currents to the Humboldt Bay region. It seems possible (if not likely) that the occurrence of "*S. alterniflora*" that was eliminated from Humboldt Bay in the 1980s was a natural colonization, and it seems likely that there will be additional colonizations in the future. Should the hybrid cordgrasses become established in Humboldt Bay, the likely effects would include: (a) a loss of several thousand acres of open tidal flats, including a loss of all of the associated habitat values for shorebirds, brant, and other wildlife; (b) significant reductions in the extent of the bay available for mariculture opportunities; and (c) a significant reduction in the tidal prism in the bay, with possible increases in shoaling in the central parts of the bay.

It is not possible to predict the full nature or extent of the possible effects that might result from the introductions of nonindigenous species, but the cordgrass example demonstrates that the effects can be significant in many contexts. In addition, the introductions of nonindigenous or "exotic" species and the losses of some native species have a potential (which cannot be quantified but which is nonetheless nontrivial) to adversely affect the integrity of the ecological communities in Humboldt Bay.

The circumstances concerning nonindigenous species management in California estuaries are summarized in the setting description above. Both the state and federal governments have existing nonindigenous species programs in place that carry out the requirements of federal and state laws. These programs appear to pre-empt local programs for managing nonindigenous species that significantly exceed the approaches and requirements in the existing federal and/or state program(s).

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26 Smooth cordgrass is a species native to the Atlantic coast of the United States. This species is much taller, and also grows at substantially lower tidal elevations, than any native species in west coast saltmarshes, and forms very dense stands (which are largely rhizomally clones of one "parent" individual). Research in the past decade has shown that most of the non-native cordgrass in San Francisco Bay is now a hybrid swarm involving various genetic mixtures of smooth cordgrass and the native Pacific cordgrass (*S. foliosa*). There are also three other non-native cordgrass species in San Francisco Bay, including a population of S. densiflora that resulted from a transplant of material from Humboldt Bay. See the website of the Invasive Spartina Project (http://www.spartina.org/index.htm; viewed March 2006) for additional information.

The Draft Management Plan includes a proposed policy (Policy CAS-4) directing the District to assist the federal and state governments, local governments in the Humboldt Bay region, and other interested parties in identifying and implementing appropriate management of nonindigenous species, including species that are already present in the bay and species that could be introduced into the bay as a consequence of future commercial activity. This EIR finds that the Plan's existing policy framework is adequate to address the environmental concern, and that policy additions are unnecessary.

The EIR also notes that the success of the proposed policies will be dependent on their collaborative implementation, because the known effects of exotic species on estuarine ecosystems are pervasive and important. It appears that the Humboldt Bay ecosystem has been fortunate in avoiding the significant ecological disruptions that have occurred in other west coast estuaries as a consequence of intentional introductions associated with erosion-control projects, or of inadvertent introductions resulting from national and international shipping [e.g., the effects of zebra mussels (*Dreissena polymorpha*), or the more recently introduced quagga mussels (*D. bugensis*), in freshwater ecosystems in the central U.S.].

11.3.2.5 Ecosystem-Based Management

The proposed Management Plan specifically enfolds an ecosystem-based approach to bay management, and many of the proposed policies in the Draft Plan are focused on creating an ecosystem-based framework for District decision-making. That is, the implementation of the Draft Plan would be largely beneficial for the bay ecosystem. The Plan would not, however, be without some potential, or even likely, adverse effects on the bay ecosystem. As noted above, for example, the Plan includes policies that would be expected to lead to losses in eelgrass coverage, which would have an effect on the net primary productivity in the bay in addition to affecting habitat for fishery resources.

The Draft Plan omitted a policy reference that explicitly incorporates the Pacific Ocean into the Plan framework (see Chapter 8.0), and an additional policy should be incorporated into the Plan to rectify the inadvertent omission, specifically focusing the Plan on the interrelationships among the bay, the ocean, and the watershed. A similar concern exists with respect to the living elements of the ecosystem that are the subject of this chapter, and the policy recommendation from Chapter 8.0 is incorporated into this chapter.

11.4 Policy Considerations for Mitigating Potentially Significant Effects

The existing policy framework in the Draft Management Plan already includes policies that assure that District and other decision-makers and interested parties will identify most possible adverse effects that might arise because of the Plan's policies. The Draft Plan lacks a specific policy focus that fully captures potential adverse effects on eelgrass habitat, which is mitigated to a less-than-significant level with the incorporation of the first and second measures (these are the same as the measures identified in Sections 10.4.1 and 10.4.2). The Draft Plan inadvertently failed to incorporate a policy direction to include the nearshore Pacific Ocean into the Plan's

ecosystem-based approach; this omission is corrected with the incorporation of the third measure (this is the same measure identified in Section 8.4.1).

11.4.1 Eelgrass Maintenance as Essential Fish Habitat

This EIR recommends that Policy CAS-2 be amended to read as follows (deleted text in ~~strikethrough~~; added text underlined):

CAS-2: Maintain and enhance conditions required by commercially important fish, invertebrate, and plant species

Policy: The District shall, to the extent possible, maintain viable populations of commercially important fish species and invertebrate species, and the habitats for these species. The District shall develop a plan, in consultation with local, state, and federal agencies, non-profit conservation organizations, and other interested parties, which is focused on maintaining the diversity of native and desired non-native fish and invertebrate species present in Humboldt Bay and its watershed. The plan shall identify strategies for District adoption that will assist the District in managing or protecting native and desirable non-native fish, invertebrate, and plant species while carrying out District operations. The District ~~may~~ shall also incorporate considerations that could result from actions proposed to the District by applicants for District approvals. The plan shall identify District responsibilities with respect to managing the population levels and habitat for commercially important native fish species and their habitats, including eelgrass, and the plan shall identify the District's responsibilities for implementing the Essential Fish Habitat recommendations of NOAA Fisheries. The plan shall also address District responsibilities with respect to managing population levels and habitat for commercially important invertebrate or plant species. The District shall adopt findings with respect to the requirements of this plan when approving District operational programs or when approving any applications for approvals submitted to the District.

11.4.2 Eelgrass Maintenance as Important Wildlife Habitat

This EIR recommends that Policy CAS-1 be amended to read as follows (deleted text in ~~strikethrough~~; added text underlined):

CAS-1: Maintain biological diversity and important habitats throughout Humboldt Bay

Policy: The District shall, to the extent possible, maintain viable populations of native species in Humboldt Bay, distributed in appropriate habitats within the Bay, in a state that will maintain the ecological functions of the Humboldt Bay ecosystem. The District shall develop a plan, in consultation with local, state, and federal agencies, non-profit conservation organizations, and other interested parties, which is focused on maintaining the native biological diversity and important habitats that are present in Humboldt Bay and its watershed. The plan shall expressly address eelgrass and other habitats that are closely linked to environmentally sensitive species. The plan shall identify strategies for District adoption that will assist the District in managing or protecting native biological diversity while carrying out District operations. The District ~~may~~ shall also incorporate considerations that could result from actions proposed to the District by applicants for District approvals. The District shall adopt findings with respect to the requirements of this plan when

approving District operational programs or when approving any applications for approvals submitted to the District.

11.4.3 Ecosystem-Based Management

The Draft Management Plan lacks a policy element that explicitly directs management attention to possible effects of management actions on the Pacific Ocean, even though it is generally known that activities within the bay may affect ocean resources. To address this effect, the following new policy should be added to the Plan.

The new policy is designated as CAE-1. The policy should be inserted at the beginning of Subsection 5.2.2, Chapter 5.0, Section III, of the Management Plan, and existing policies numbered CAE-1 through CAE-4 should be renumbered as CAE-2 through CAE-5 (added text underlined):

CAE-1: Base management decisions on maintaining the Humboldt Bay ecosystem, including the bay, the watershed, and the nearby ocean

Policy: The District shall actively focus its implementation of the Management Plan on protecting, maintaining, and enhancing the biological, physical, hydrological, and cultural characteristics of the Humboldt Bay ecosystem. The bay's ecosystem includes the bay's watershed and the nearby Pacific Ocean, and management actions that affect any part of this aquatic ecosystem complex may affect all parts of the ecosystem. Many bay uses only affect ecosystem processes and structural elements indirectly, but the Management Plan recognizes that effects on ecosystem processes and structural elements may be significant even if indirect or attenuated. Decisions regarding the bay's management shall incorporate the understanding that the integrity of the bay's ecosystem elements determines many of the values that are important to the bay's users.

The incorporation of this additional policy into the Plan fully incorporates the intended ecosystem-based management focus into the Management Plan.