

# Central and Northern California Coastal Marine Habitats: Oil Residence and Biological Sensitivity Indices

## 1:24,000 Map Series Legend Sheet: Biology

### Biological Sensitivity Index

The Biological Sensitivity Index (BSI) is applied to the major biological resources on the central and northern California coast. Estimation of the level of concern is necessarily subjective due to the large amount of uncertainty about the physical and biological conditions at the time of an actual spill and about the characteristics of the oil spill itself. The Biological Sensitivity Index does not include an estimate of the likelihood of an oil spill occurring. The estimated levels of concern presented on the accompanying maps are based on the experience and professional judgement of the biologists conducting this (or any similar) study and pertinent literature on the short and long-term effects of spilled oil upon the biotic components. The index presented on the maps and in the tabular format with the maps must only be used as a guideline in assessing the potential effects of an oil spill. More accurate estimates of the level of concern of a particular resource to an oil spill can only be made at the time of the spill when the numerous variables affecting the level of impact can be evaluated.

The biological sensitivity is developed from data obtained in the aerial and field surveys plus the considerable amount of pertinent biological information contained in several literature sources such as the California Department of Fish and Game coastal wetland series report, California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Reports, Winzler and Kelly, Consulting Engineers (1977), Jones and Stokes (1980), University of California, Santa Cruz (1981) and Sows et al. (1980). The Biological Sensitivity Index identifies those resources which are of primary or secondary concern during some part of the year along the coast. These resources include sea otters, seabirds, and major marine mammal rookeries, as well as those resources such as marshes, waterfowl, and eelgrass beds associated with bays and estuaries.

The spatial variation of the biologically sensitive features are identified on the map by the Biological Sensitivity Index (see sample map to far right) and the temporal variation of the resources is identified in a separate temporal variation graph, (an example of which is shown to the right). The two components of the index are cross-referenced by an identifier that appears on both the map and on the graph (e.g., identifier B-1).

Where there are two or more levels of concern indicated for the same section of shoreline in the matrix the highest level of concern is the one shown on the map itself. Because the map only shows the spatial distribution of the features of concern and does not include the temporal component shown on the temporal variation graph the level of concern shown on the map for a specific section of coastline will be primary (i.e., solid black line) even though the information in the graph shows it to be of primary concern for only a few months.

The biotic resources that are included in the development and implementation of the BSI are as follows:

- nesting seabird populations
- pinnipeds (elephant seal, harbor seal, California sea lion, Steller sea lion)
- southern sea otter
- threatened/endangered species
- kelp beds
- intertidal macrobiota
- bays, estuaries and lagoons

These populations/communities are fairly well fixed in time and space within the study area and represent the major biotic resources of concern occurring within the study area. They also represent those resources for which a sufficient body of literature for the study area exists so that their potential BSI level of concern could be determined. Other species that could be negatively affected by an oil spill do occur adjacent to or occasionally within the defined study area but the data to adequately describe the temporal and spatial occurrence of these species for use in development of the BSI are poorly developed. These include most importantly the nearshore occurrence of non-breeding marine birds such as the western grebe, scoters, and the brown pelican.

**Vulnerability and sensitivity** are key components in defining the level of concern for the biotic resources. The relationship between the level of concern (e.g., the BSI) and the vulnerability and sensitivity levels of specific biotic resources is illustrated below (bottom left table). For the purposes of this report, the terms are defined as follows:

**Vulnerability** is the likelihood that some portion of the biotic resource of concern will come into contact with oil.

Assessing the vulnerability of a resource involves a qualitative assessment of the proportion of the population or community of biotic resource that could potentially come into contact with oil. The levels of vulnerability (low, moderate, high) represent the possibility that a substantial portion of the population/community will come into contact with oil within the study area and that the loss of this portion of the population/community could potentially affect overall population numbers of the species in the study area.

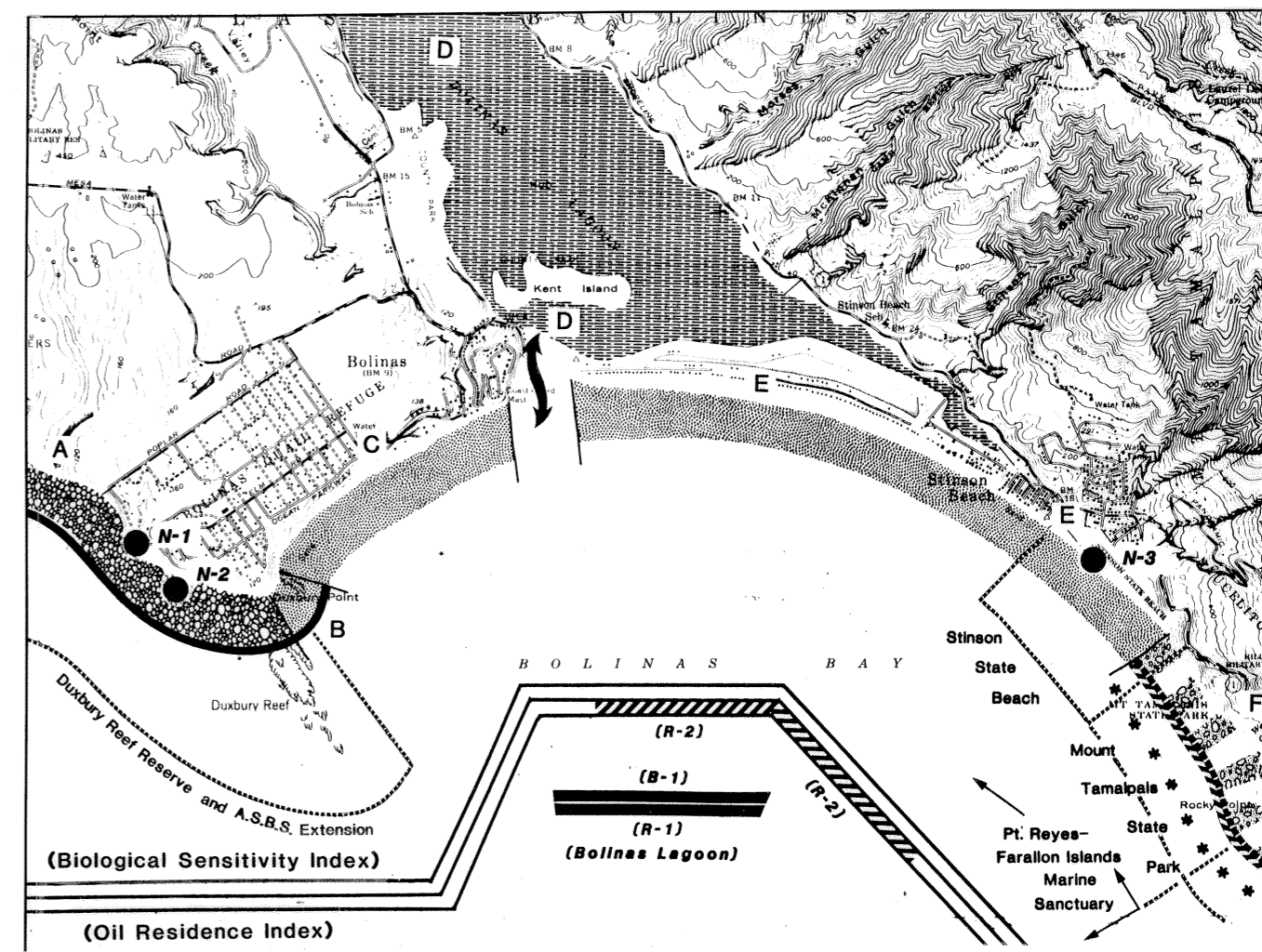
### Vulnerability, Sensitivity and Levels of Concern of the Biological Sensitivity Index:

BIOTIC RESOURCE	VULNERABILITY	SENSITIVITY	LEVEL OF CONCERN
<b>SEABIRD NESTING COLONIES</b>			
Fork-tailed storm-petrel	Low	High	3
Leach's storm-petrel	Low	High	3
Ashy storm-petrel	Moderate	High	2
Brandt's cormorant	Moderate	High	2
Double-crested cormorant	Moderate	High	2
Pelagic cormorant	Low	High	3
Western gull	Low	High	3
Common murre	High	High	1
Pigeon guillemot	Low	High	3
Cassin's auklet	High	High	1
Rhinoceros auklet	High	High	1
Tufted puffin	High	High	1
<b>MARINE MAMMALS</b>			
Southern sea otter	High	High	1
Pinnipeds	High	Moderate	2
Major Rookeries	High	Low	3
Hauling Grounds	High	Low	3
<b>THREATENED/ENDANGERED SPECIES</b>			
Intertidal Macrobiota & Kelp ( <i>Macrocystis</i> , <i>Nereocystis</i> )	High	Low	3
<b>ESTUARIES</b>			
	High	High	1

### Temporal Variation of the Biological Sensitivity Index:

IDENTIFIER	FEATURE	MONTH											
		J	F	M	A	M	J	J	A	S	O	N	D
B-1	Marsh												
	Glam beds												
	Waterfowl												
	Shorebirds/water-assoc. birds												
	California clapper rail												

CONCERN LEVEL	SYMBOL	DESCRIPTION
PRIMARY CONCERN	Solid black line	Major change expected in distribution, size, structure and/or function of affected biotic resource (population, community or habitat) throughout central and northern California. Recovery from these changes expected to require several years to decades.
SECONDARY CONCERN	Hatched line	Moderate change expected in distribution, size, structure and/or function of affected biotic resource (population, community or habitat) throughout central and northern California. Recovery from these changes expected to require several years.
TERTIARY CONCERN	Thin solid line	No to minor change expected in distribution, size, structure and/or function of affected biotic resource (population, community or habitat) throughout central and northern California. Recovery from these changes expected to require several months to years.



The final vulnerability level represents a composite of several factors which will identify the proportion of the population/community which may come into contact with the oil including distribution within the study area and behavior. Clumped resources such as some of nesting seabirds (e.g., common murre, Cassin's auklet) are considered more vulnerable than those with non-clumped widespread distributions such as pelagic cormorant and Brandt's cormorants. Seabirds, such as the common murre, which form large social flocks on the water in the vicinity of their nesting colonies are considered more vulnerable than species such as the fork-tailed storm-petrel which do not. Birds that dive for their food (alciids) are considered more vulnerable than those that do not (gulls). The vulnerability level for seabirds nesting in the study area are presented below (see bottom center table).

### Sensitivity is the response of the biotic resource to contact with oil.

The sensitivity of a resource is determined by the response of that resource to contact with oil. Response is evaluated in terms of potential mortality or diminished reproductive capacity. Sensitivity at the population/community level can be viewed as an indication of the resilience of the potentially affected population/community.

### Level of Concern is a combination of the vulnerability and sensitivity levels of a particular biotic resource.

The level of concern of the BSI reflects the combination of vulnerability and sensitivity of the particular population/community being assessed.

Determination of a level of concern for a particular biotic resource at any selected location is dependent upon the status of that resource in the region; region being defined as the study area. It is important to keep in mind that even though there might be a substantial portion of a local population/community potentially adversely affected by an oil spill, the levels of concern looks at the potential effects to the total population/community in the region (study area). The status of the potentially affected biotic resource in the region is important in determining the recoverability of that biotic resource at the local level.

Whereas major estuarine areas (>10,000 m<sup>2</sup>) are considered primary levels of concern, the mouth of small ephemeral creeks in the study area are tertiary levels of concern. The opening of these creeks is seasonal and the mouth may not open in some years. The small areal extent makes these areas less important as wildlife habitat on a regional basis than major estuarine areas. The lack of regular communication with the ocean coupled with their small areal extent (often being seasonally dry) results in reduced importance as a nursery or habitat area for coastal fishes.

### Vulnerability - Seabirds:

SPECIES	BREEDING DISTRIBUTION		VULNERABILITY DUE TO BREEDING DISTRIBUTION	VULNERABILITY DUE TO BEHAVIOR	OVERALL VULNERABILITY TO OIL
	California <sup>1</sup>	World <sup>2</sup>			
Fork-tailed storm-petrel	Concentrated (Castle Rock)	Circum N. Pacific	High	Low	Low
Leach's storm-petrel	Concentrated (Castle Rock)	Circum N. Pacific & N. Atlantic	High	Low	Low
Ashy storm-petrel	Concentrated (Farallon Isl.)	California	High	Low	Moderate
Brandt's cormorant	Regional (Farallon Isl.)	West Coast N. America	Moderate	Moderate	Moderate
Double-crested cormorant	Regional (Primarily N. California)	N. America	Moderate	Moderate	Moderate
Pelagic cormorant	Widespread	Circum N. Pacific	Low	Moderate	Low
Western gull	Concentrated (Farallon Isl.)	West Coast U.S. & Mexico	High	Low	Low
Common murre	Concentrated (Castle Rock)	Pacific & Atlantic N. latitudes	High	High	High
Pigeon guillemot	Widespread	Circum N. Pacific	Low	High	Low
Cassin's auklet	Concentrated (Farallon Isl.)	N. America	High	High	High
Rhinoceros auklet	Concentrated (Farallon Isl.)	West Coast N. America	High	High	High
Tufted puffin	Concentrated (Castle Rock & Farallon Isl.)	Circum N. Pacific	High	High	High

<sup>1</sup> From Sows et al. (1980).

<sup>2</sup> California breeding distribution considered concentrated if over 50 percent of the nesting birds of a species are found at one site or at a few sites along a short section of the coast (1° latitude). Population considered regional if over 50 percent of the species nesting birds occur along a 2° latitude section of coast. Species with widespread distribution occur along most of the coastline within the study area with no specific area of concentration.

<sup>3</sup> From Sows et al. (1980), King and Sanger (1979), Ohlendorf et al. (1978), Wahl et al. (1981).

<sup>4</sup> Vulnerability is a function of the birds behavior (feeding, nesting, flocking, resting) and breeding distribution. The levels of vulnerability represent the possibility that a substantial number of birds will come into contact with oil within the study area potentially affecting the breeding population in the region. Levels assigned are independent of sensitivity to oil and include consideration of the species vulnerability to oil due to its breeding distribution and behavior.

### Sources of Information

**Intertidal macrobiota:**

- Direct observation during aerial and ground-truth surveys

**Kelp beds:**

- Direct observation during aerial and ground-truth surveys

**Marine mammals:**

- University of California, Santa Cruz. 1980-1981 survey results. Marine mammal and seabird study. Central and northern California. Study funded by MMS (BLM). Contract No. AASSI-CT 9-33

**Seabird nesting colonies:**

- Sows, A.L., De Gange, A.R., Nelson, J.W., and Lester, G.S., 1980. Catalog of California seabird colonies. Prep. for U.S. Fish and Wildlife Service, FWS/OBS-80/37. Study funded by MMS (BLM)-AASSI-MU9-13

**Threatened/endangered species:**

- Jones and Stokes Associates, Inc. 1980. The ecological characterization of the central and northern California coastal region. Prepared for U.S. Fish and Wildlife Service., Office of Biological Services Region 1. Contract No. 14-16-0009-79-043. Funded by MMS (BLM)-AASSI-MU9-12.

**Legislated areas of special concern:**

- USGS Topographic Maps
- Jones and Stokes (1980)
- California State Water Resources Control Board. California Marine Waters Areas of Special Biological Significance Reconnaissance Survey Report, Water Quality Monitoring Report No.
  - 79-9. Point Lobos Ecological Reserve
  - 79-10. Carmel Bay
  - 79-11. Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life Refuge
  - 79-12. James V. Fitzgeralds Marine Reserve
  - 79-13. Farallon Islands
  - 79-14. Duxbury Reef Reserve and Extension
  - 79-15. Double Point
  - 79-16. Bodega Marine Life Refuge
  - 79-17. Gerstle Cove
  - 79-18. King Range National Conservation Area
  - 79-19. Kelp Beds at Trinidad Head
  - 80-1. Point Reyes Headland Reserve and Extension
  - 80-2. Bird Rock
  - 80-3. Kelp Beds at Saunders Reef
  - 80-4. Julia Pfeiffer Burns Underwater Park

**Bays and Estuaries:**

- USGS Topographic Maps
- Jones and Stokes (1980)
- State of California, Department of Fish and Game. Coastal Wetland Report Series
  - No. 3. 1970. The Natural Resources of Bolinas Lagoon
  - No. 4. 1972. The Natural Resources of Elkhorn Slough
  - No. 6. 1973. The Natural Resources of Humboldt Bay
  - No. 8. 1974. The Natural Resources of Morro Bay
  - No. 10. 1975. The Natural Resources of Lake Earl and the Smith River Delta
  - No. 11. 1975. The Natural Resources of Bodega Harbor
  - No. 14. 1976. The Natural Resources of Coastal Wetlands in Northern Santa Barbara County.
  - No. 15. 1976. The Natural Resources of the Nepomo Dunes and Wetlands
  - No. 20. 1977. The Natural Resources of Estero Americano and de Santa Antonio

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**M.M.S. Map Legend**  
Sheet 3 of 3