ENVIRONMENTAL SENSITIVITY INDEX
GEORGIA

SHORELINE TYPES

The shorelines of the study area were classified during a low-altitude, fixed-wing aerial survey undertaken in fall 1984. Based on previous investigations of numerous oil spills, shoreline types are ranked in order of increasing sensitivity (as appears below). Environments 8, 9, and 10 are most sensitive and deserve priority protection.

Sensitivity ↓

1. Exposed vertical seawalls
2. Marsh outcrops on sand beaches
3. Fine-grained sand beaches
4. Medium- to coarse-grained sand beaches (not present)
5. Exposed tidal flats (low biomass)
5A. Sheltered erosional scarps
6. Shell beaches/exposed riprap
7. Exposed tidal flats (high biomass)/erosional scarps in marsh
8. Sheltered coastal structures
9. Sheltered tidal flats (high biomass)
10. Exposed marshes
10A. Sheltered marshes

BIOLOGICAL FEATURES

Information pertaining to the biological resources of the study area was collected from the literature and from regional experts. Areas having important biological populations should be given high response priority. Symbols used on the enclosed map series are:

MARINE MAMMALS	
Bottlenose dolphins	Feeding area
Manatees	Feeding and migratory area
BIRDS	
Gulls or terns	Rookeries and feeding areas
Wading birds	Rookeries and feeding areas
Shorebirds	Nesting, wintering and feeding areas
Waterfowl	Wintering grounds and feeding areas
Diving birds	Rookeries and feeding areas
Raptors	Nesting and feeding areas
REPTILES	
Sea turtles	Nesting beaches
Alligators	Habitats and ranges
FINFISH	
Anadromous fish	Spawning areas
Marine fish	Habitats and fishing areas
Flatfish	Habitats and fishing areas
SHELLFISH	
Oysters	Beds and concentrations
Clams	
Crabs	Habitats and crabbing areas
Shrimp	Habitats and shrimping areas

SOCIOECONOMIC FEATURES

The following sites are indicated on the map series to aid or direct the spill-response effort.

Marinas Boat Slips Parks

SPILL-RESPONSE INFORMATION

Booms and skimmers are the primary spill-response tools indicated on the maps. The positions of each are meant to be only approximate depending highly on the particular spill and weather conditions. Generally, they are placed to prevent oil from entering into the highly sensitive, interior, marsh-dominated areas.

Skimmer Locations Boom Locations

KEY TO SPECIES

BIRDS

B. Shorebirds - Any of the following species: 56, 58, 62, 63, 66, 67, 69, 70, 73, 152, 154, 155.
C. Waterfowl - Any of the following species: 1, 3, 5, 12, 16, 17, 18, 20, 21, 22, 23, 30, 33, 34, 179, 180, 186, 191, 197, 198.
D. Diving birds - Species listed below symbol.
E. Wading birds - Any of the following species: 54, 87, 88, 89, 90, 91, 93, 94, 97, 115, 120, 184, 187, 192.
F. Seabirds - Any of the following species: 38, 40, 42, 45, 86, 98, 133, 134, 135, 136, 137, 138, 193.
G. Raptors - Species listed below symbol.

1. Common loon	*Gavia immer*
3. Red-throated loon	*Gavia stellata*
5. Horned grebe	*Podiceps auritus*
8. Double-crested cormorant	*Phalacrocorax auritus*
12. Canada goose	*Branta canadensis*
16. Mallard	*Anas platyrhynchos*
17. Pintail	*Anas acuta*
18. Green-winged teal	*Anas crecca*
20. Northern shoveler	*Anas clypeata*
21. Canvasback	*Aythya valisineria*
22. Greater scaup	*Aythya marila*
23. Lesser scaup	*Aythya affinis*
30. Surf scoter	*Melanitta perspicillata*
33. Red-breasted merganser	*Mergus serrator*
34. American coot	*Fulica americana*
38. Herring gull	*Larus argentatus*
40. Ring-billed gull	*Larus delawarensis*
42. Bonaparte's gull	*Larus philadelphia*
45. Common tern	*Sterna hirundo*
54. Great blue heron	*Ardea herodias*
56. Spotted sandpiper	*Actitis macularia*
58. Greater yellowlegs	*Tringa melanaleuca*
62. Least sandpiper	*Calidris minutilla*
63. Dunlin	*Calidris alpina*
66. Western sandpiper	*Calidris mauri*
67. Sanderling	*Calidris alba*
69. Semipalmated plover	*Charadrius semipalmatus*
70. Killdeer	*Charadrius vociferus*
73. Ruddy turnstone	*Arenaria interpres*
* 76. Bald eagle	*Haliaeetus leucocephalus*
* 77. Osprey	*Pandion haliaetus*
86. Least tern	*Sterna albifrons*
87. Little blue heron	*Egretta caerulea*
88. Great egret	*Casmerodius albus*
89. Snowy egret	*Egretta thula*
90. Black-crowned night heron	*Nycticorax nycticorax*
91. Glossy ibis	*Plegadis falcinellus*
93. Cattle egret	*Bubulcus ibis*
94. Louisiana heron	*Egretta tricolor*
97. Green heron	*Butorides striatus*
98. Laughing gull	*Larus atricilla*
*107. Peregrine falcon	*Falco peregrinus*
115. White ibis	*Eudocimus albus*
*118. Brown pelican	*Pelecanus occidentalis*
120. Yellow-crowned night heron	*Nyctanassa violacea*
121. Anhinga	*Anhinga anhinga*
125. Clapper rail	*Rallus longirostris*
132. Wood stork	*Mycteria americana*
133. Black skimmer	*Rynchops niger*
134. Gull-billed tern	*Gelochilidon nilotica*
135. Sandwich tern	*Sterna sandvicensis*
136. Caspian tern	*Sterna caspia*
137. Royal tern	*Sterna maxima*
138. Forster's tern	*Sterna fosteri*
142. Black-necked stilt	*Himantopus maxicanus*
152. American oystercatcher	*Haematopus palliatus*
154. Wilson's plover	*Charadrius wilsonia*
155. Willet	*Catoptrophorus semipalmatus*
179. Pied-billed grebe	*Podilymbus podiceps*
180. Ring-necked duck	*Aythya collaris*
184. King rail	*Rallus elegans*
186. Black duck	*Anas rubripes*
187. Virginia rail	*Rallus limicola*
190. Blue-winged teal	*Anas discors*
191. Wood duck	*Aix sponsa*
192. Common gallinule	*Gallinula chloropus*
193. Black tern	*Chilidonias niger*
197. Black scoter	*Melanitta nigra*
198. Hooded merganser	*Lophodytes cucullatus*

FINFISH

65. Bluefish	*Pomatomus saltatrix*
86. Blueback herring	*Alosa aestivalis*
87. American shad	*Alosa sapidissima*
98. American eel	*Anguilla rostrata*
*101. Shortnose sturgeon	*Acipenser brevirostrum*
102. Atlantic sturgeon	*Acipenser sturio*
104. Striped bass	*Morone saxatilis*
105. Hickory shad	*Alosa mediocris*
107. Spotted sea trout	*Cynoscion nebulosus*
108. Summer flounder	*Paralichthys dentatus*
109. Red drum	*Sciaenops ocellata*
110. Black sea bass	*Centropristis striata*
111. Southern flounder	*Paralichthys lethostigma*
114. Florida pompano	*Trachinotus carolinus*
115. Atlantic menhaden	*Brevoortia tyrannus*
116. Striped mullet	*Mugil cephalus*
119. Silver perch	*Bairdiella chrysoura*
121. Spot	*Leiostomus xanthurus*
122. Black drum	*Pogonias cromis*
123. Atlantic croaker	*Micropogonias undulatus*
124. Southern kingfish (whiting)	*Menticirrhus americanus*
127. Spanish mackerel	*Scomberomorus maculatus*
134. Cobia	*Rachycentron canadum*
137. Sheepshead	*Archosargus probatocephalus*
138. Seatrout (weakfish)	*Cynoscion regalis*
173. White mullet	*Mugil curema*

SHELLFISH

42. Hard clam (Quahog)	*Mercenaria mercenaria*
43. American oyster	*Crassostrea virginica*
49. Blue crab	*Callinectes sapidus*
50. White shrimp	*Penaeus setiferus*
51. Brown shrimp	*Penaeus aztecus*

MAMMALS

*10. Manatee	*Trichechus manatus*
17. Bottlenose dolphin	*Tursiops truncatus*

REPTILES

* 3. American alligator	*Alligator mississippiensis*
* 6. Atlantic loggerhead turtle	*Caretta caretta*

*Threatened or endangered (state or federal list)

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Description of Shoreline Types

EXPOSED VERTICAL SEAWALLS — ESI = 1

- Exposed vertical seawalls are uncommon
- They are found along developed areas on erosional barrier islands and meander bends on rivers and creeks

Predicted Oil Impact

- On more exposed shores:
  - -Oil would be held offshore by reflected waves
  - -Deposited light oils would be removed rapidly by wave action; heavier, sticky oils are likely to remain longer
- On less exposed shores:
  - -Oil removal would depend upon storm frequency

Recommended Response Activity

- On very exposed shores, no cleanup is necessary
- On less exposed shores:
  - -High-pressure spraying may be effective while oil is still liquid
  - -Manual scraping of seawalls may be necessary for removal of tarry deposits
- Cleanup is recommended only for aesthetic rather than environmental reasons
- Cleanup should not remove attached algae if possible

MARSH OUTCROPS ON SAND BEACHES — ESI = 2

- These outcrops are found along erosional ocean beaches and inland waterways
- Marsh substrate will be very soft
- Marsh outcrops on sand beaches are uncommon in study area

Predicted Oil Impact

- Penetration will be minimal unless there are numerous burrows
- Organisms livng in the burrows may be killed by smothering
- Shorebird use may be high, and they may be oiled
- Waves and currents should remove most accumulations

Recommended Response Activity

- Exposed nature of shoreline makes protection difficult
- Cleanup is not recommended because of soft sediments
- If deemed necessary, cleanup could be attempted with low-pressure flushing and in recovery

FINE-GRAINED SAND BEACHES — ESI = 3

- Fine-grained sand beaches are common along the outer beaches throughout the state
- These areas have hard, flat beach profiles
- Dunes in natural areas or seawalls in developed islands back the beaches
- Upper beach fauna are scarce

Predicted Oil Impact

- Heavy oil accumulations will cover the entire beach face
- Light oil accumulations will be deposited as oily swashes along the upper intertidal zone
- Oil penetration into the beach will be approximately 15 cm
- Organisms living in the beach sands may be killed either by smothering or by lethal oil concentrations in the water
- Shorebirds may be killed if oiled

Recommended Response Activity

- Fine-grained sand beaches are among the easiest beach types to clean
- Cleanup should concentrate on the removal of oil from the upper swash zone after all oil has come ashore
- Removal of sand from the beach should be minimal to avoid erosion problems; special caution is necessary in areas backed by seawalls
- Activity through both oiled and dune areas should be severely limited
- Manual cleanup rather than use of road graders and front-end loaders is advised except for very heavy accumulations

MEDIUM- TO COARSE-GRAINED SAND BEACHES ESI = 4

Not present

EXPOSED TIDAL FLATS (LOW BIOMASS) ESI = 5

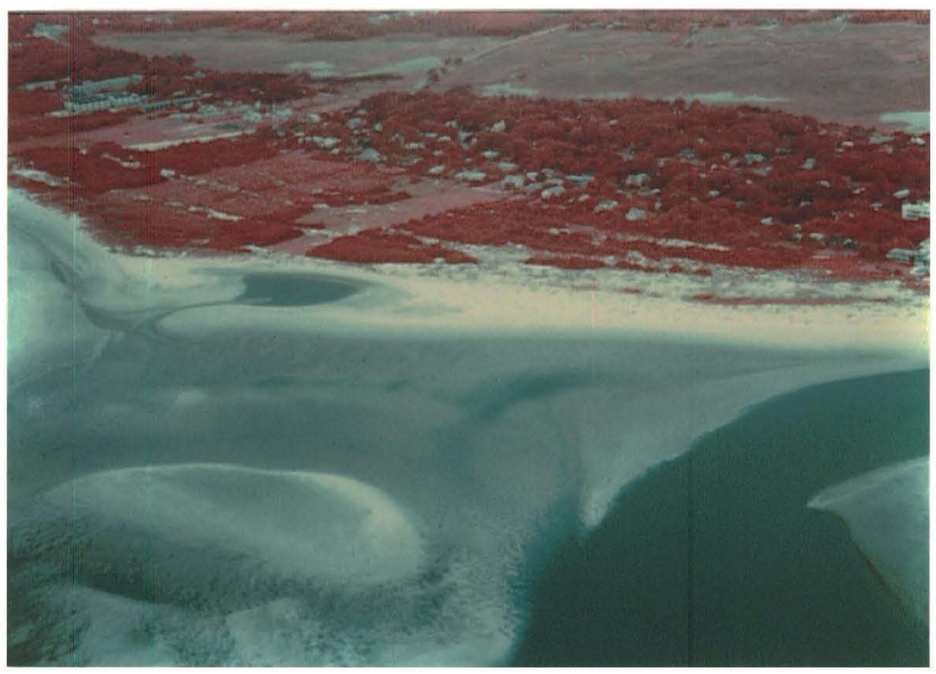
- Exposed tidal flats are most common at mouths of major inlets and in river channels that have high wave and/or current energy
- Well-sorted sand with some shell material composes the tidal flats
- These flats are visible only at low tide

Predicted Oil Impact

- Any oil deposited at low tide will be removed by waves and currents with the rising tide
- Water-soluble fractions of the oil can contaminate/kill infauna

Recommended Response Activity

- Cleanup is generally neither possible nor recommended
- Emphasis should be placed on recovery of oil from adjacent beaches



SHELTERED EROSIONAL SCARPS ESI = 5A

- Sheltered erosional scarps occur where creek and river meanders cut into sandy bluffs
- Erosional, vertical scarps have very narrow, sandy beaches

Predicted Oil Impact

- Oil can cover entire beach area but generally is thickest along high-tide line
- Tidal currents will rapidly remove surficial oil; burial is unlikely
- Oil may penetrate up to 30 cm into beach sediments

Recommended Response Activity

- Remove oil deposited along highest tide lines
- Cleanup should use manual methods to minimize sediment removal which might increase bluff erosion

SHELL BEACHES/EXPOSED RIPRAP — ESI = 6

- Shell beaches are very common as washovers on the surface of marsh and peat along the intracoastal waterway and are composed of shell fragments
- Riprap structures are common in populated areas for shoreline protection and are composed of cobble- to boulder-sized rocks

Predicted Oil Impact

- Oil will readily penetrate deeply into the shell beaches and between the riprap
- Natural removal is likely along shorelines frequently washed by boat wakes or waves
- If oil is not removed, especially from the riprap, it could become asphalt-like
- Resident fauna may be killed by the oil

Recommended Response Activity

- Removal of sediment should be restricted to prevent erosion
- High-pressure water spraying is effective at removing oil while it is still fresh and may be necessary for removing oil between crevices
- Sorbent booms or pads should be used to capture oil released during cleaning

EXPOSED TIDAL FLATS (HIGH BIOMASS)/ EROSIONAL SCARPS IN MARSH — ESI = 7

- Tidal flats are very common throughout the extensive marsh/tidal creek system and are composed of sand and silt
- They are exposed to moderate tidal currents, even in relatively small creeks, and can have abundant fauna, such as oysters, clams, and worms
- Scarps in marsh are uncommon and occur as steep banks in consolidated marsh clays along exposed shorelines
- Scarps can be heavily burrowed with numerous organisms living in the sediments

Predicted Oil Impact

- On tidal flats, most of the oil will be pushed across the flat as the tide rises and will accumulate along the high-tide line
- Water-soluble fractions can contaminate/kill infauna
- Long-term contamination of fine-grained sediments is possible
- On marsh scarps, oil can adhere onto the clay sediments but should be naturally removed by waves or tidal currents
- Biological damages can be severe and of moderate duration

Recommended Response Activity

- Cleanup of tidal flats is not possible because of soft, water-saturated sediments and inaccessibility
- Cleanup should concentrate on removal of oil accumulated along the high-tide line
- On marsh scarps, cleanup is difficult and not recommended; if deemed necessary, low-pressure flushing may be attempted

SHELTERED COASTAL STRUCTURES — ESI = 8

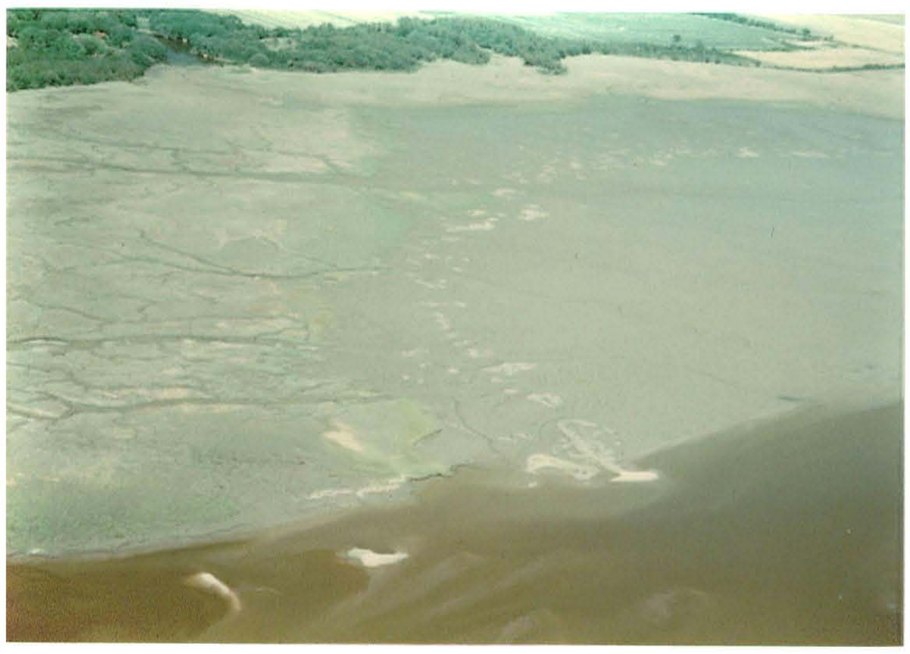
- Such structures are uncommon but scattered along populated shorelines in the marsh/creek systems
- They occur as short segments of various man-made structures (seawalls, groins, docks, bulkheads, etc.) where meanders intersect with high grounds that are developed

Predicted Oil Impact

- Oil will percolate between the joints and voids of the structures
- Oil will coat the intertidal areas of solid structures
- Biota living on the structures (barnacles, oysters, snails) would be impacted

Recommended Response Activity

- May require high-pressure spraying of the structures:
  - -To remove oil
  - -To prepare substrate for recolonization of barnacles, oysters, etc.
  - -For aesthetic reasons
  - -To prevent the chronic leaching of oil from the structure



SHELTERED TIDAL FLATS (HIGH BIOMASS) ESI = 9

- Sheltered tidal flats are common throughout the marsh system behind Georgia's barrier islands
- They range in size from very small to extensive flats filling the heads of bays
- The flats/beds occur in calm-water settings, sheltered from high wave and tidal current activities
- They are composed of muddy sediments and usually contain large populations of mollusks and polychaetes
- Bird populations are seasonally abundant

Predicted Oil Impact

- Oil deposition will commonly occur along the upper fringes of the flat
- Very heavy accumulations will cover much of the flat surface
- Oil may persist for many years; natural removal is very slow
- Long-term contamination of muddy tidal-flat sediments is common
- Organisms living in the sediments will be impacted

Recommended Response Activity

- These environments are high-priority areas necessitating the use of spill-protection devices such as booms to prevent or minimize oil impact
- Cleanup of the tidal flat is nearly impossible and not recommended because of the soft, water-saturated sediments; cleanup can sometimes cause severe damage
- Sorbent booms can be deployed along the low-tide line to absorb oil as it is slowly released, but they must be changed frequently to be effective
- Under very heavy accumulations, manual operations from shallow-draft boats may be attempted under close technical supervision

EXPOSED MARSHES ESI = 10

- Marshes are the dominant shoreline type in Georgia
- Exposed marshes occur along rivers and creeks that are flushed by strong tidal currents or exposed to waves
- The marsh vegetation is flooded daily by normal tides
- These areas provide nursery grounds for numerous fish and invertebrate species and birds

Predicted Oil Impact

- Small quantities of oil will be deposited along the outer fringe of the marsh and naturally removed over time by waves and currents
- Oil in heavy accumulations at the upper tidal area may persist for years
- Oiled marsh grass will die back but will recover within a short time unless roots have been disturbed
- Greatest impacts to wildlife will be to wading birds and waterfowl which move between the waterline and the marsh

Recommended Response Activity

- Under most conditions, the best practice is to allow natural recovery, especially where high natural cleansing can occur
- Replanting should be considered where extensive diebacks have occurred
- Cleanup activities should be carefully supervised to avoid excessive traffic and disturbance in the marsh
- Low-pressure spraying may be effective, but it will also release large volumes of oiled debris from the marsh, and plants are not usually cleaned well by this process

SHELTERED MARSHES ESI = 10A

- Most of the wetland area in Georgia is composed of sheltered marshes
- These areas are sheltered from wave action and have low tidal flushing
- They include the high marsh which is only flooded during spring tides
- These marshes are important as habitat for wildlife and nursery areas for fish and invertebrates

Predicted Oil Impact

- Even small quantities of oil will persist for years; physical removal will be very slow
- Oil in heavy accumulations may persist for decades
- Long-term contamination of marsh sediments is likely, resulting in damage to the roots, particularly from lighter oils
- Heavy oils remaining in the marsh will harden into asphalt-like deposits

Recommended Response Activity

- Under all conditions, the best practice is to allow natural recovery
- Replanting should be considered where extensive diebacks have occurred
- Cleanup activities should be carefully supervised to avoid excessive traffic and disturbance in the marsh
- Low-pressure spraying may be effective, but it will also release large volumes of oiled debris from the marsh, and plants are not usually cleaned well by this process