ENVIRONMENTAL SENSITIVITY INDEX - NEW YORK

SHORELINE TYPES

The majority of the shoreline of the study area was mapped during low-altitude aerial surveys using a fixed-wing aircraft. The dates of the surveys vary from 1981 to July 1984. The areas adjacent to the three major New York airports were classified using aerial photographs and then verified by ground survey. Most of the area was also field checked by visiting certain sites on the ground. Based on previous oil spill studies, shoreline types were ranked (below) in order of increasing sensitivity to spilled oil. Environments 8, 9, and 10 are most sensitive and deserve priority protection.

Sensitivity

1. Exposed rocky shores
2. Exposed bluffs or rocky ledges
3. Fine-sand beaches
4. Medium- to coarse-sand beaches
5A. Mixed sand and gravel beaches
5B. Artificial sand and gravel beaches (Hudson R. maps only)
6A. Gravel beaches
6B. Artificial gravel beaches (Hudson R. maps only)
6C. Riprap structures (Hudson R. maps only)
7. Exposed tidal flats
8. Sheltered rocky shores
9. Sheltered tidal flats
10. Marshes

Unranked: Man-made structures

BIOLOGICAL RESOURCES

Information pertaining to the biological resources of the study area were 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 BIRDS
- Gulls and terns — Rookeries and critical forage areas
- Shorebirds
- Wading birds
- Waterfowl

FISHES
- Marine — Nearshore species
- Riverine and anadromous — Spawning areas or runs
- Flatfish — Population concentrations

SHELLFISH
- Clams — Abundant beds
- Oysters
- Crabs — Population concentrations
- Lobsters

SOCIOECONOMIC INFORMATION

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

- Parks and recreational areas, refuges and wildlife areas.
- Marinas.
- Boat ramps.

SPILL-RESPONSE INFORMATION

Booms and skimmers are the primary spill-response tools indicated on the maps. The positions of each are meant only to be 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.

Booms Skimmers

KEY TO SPECIES

BIRDS

A.	Numerous species	△ 1-9, ○ 10-100, □ 101-1000, ● 1001-5000, ■ 5000
B.	Numerous shorebirds	
C.	Numerous waterfowl	
E.	Numerous wading birds	

38.	Herring gull	*(Larus argentatus)*
45.	Common tern	*(Sterna hirundo)*
54.	Great blue heron	*(Ardea herodias)*
■76.	Bald eagle	*(Haliaeetus leucocephalus)*
77.	Osprey	*(Pandion haliaetus)*
80.	Arctic tern	*(Sterna paradisaea)*
86.	Least tern	*(Sterna albifrons)*
87.	Little blue heron	*(Egretta caerulea)*
88.	Great egret	*(Casmerodias albus)*
89.	Snowy egret	*(Egretta thula)*
90.	Black-crowned night heron	*(Nycticorax nycticorax)*
91.	Glossy ibis	*(Plegadis falcinellus)*
92.	Great black-backed gull	*(Larus marinus)*
93.	Cattle egret	*(Bubulcus ibis)*
94.	Louisiana heron	*(Egretta tricolor)*
■95.	Roseate tern	*(Sterna dougallii)*
97.	Green heron	*(Butorides striatus)*
98.	Laughing gull	*(Larus atricilla)*
■107.	Peregrine falcon	*(Falco peregrinus)*
■120.	Yellow-crowned night heron	*(Nycticorax violacea)*
■133.	Black skimmer	*(Rynchops niger)*
134.	Gull-billed tern	*(Gelochelidon nilotica)*
138.	Forster's gull	*(Sterna fosteri)*
■181.	Marsh hawk	*(Circus cyaneus)*

FISH

65.	Bluefish	*(Pomatomus saltatrix)*
84.	Rainbow smelt	*(Osmerus mordax)*
85.	Alewife	*(Alosa pseudoharengus)*
86.	Blueback herring	*(Alosa aestivalis)*
■87.	American shad	*(Alosa sapidissima)*
88.	Winter flounder	*(Pseudopleuronectes americanus)*
89.	Cunner	*(Tautogolabrus adspersus)*
94.	Atlantic silverside	*(Menidia menidia)*
95.	Mummichog	*(Fundulous heteroclitus)*
97.	Tautog	*(Tautoga onitis)*
98.	American eel	*(Anguilla rostrata)*
99.	Atlantic tomcod	*(Microgadus tomcod)*
■101.	Shortnose sturgeon	*(Acipenser brevirostrum)*
■102.	Atlantic sturgeon	*(Acipenser oxyrhynchus)*
104.	Striped bass	*(Morone saxatilis)*
108.	Summer flounder	*(Paralichthys dentatus)*
110.	Black sea bass	*(Centropristis striata)*
115.	Atlantic menhaden	*(Brevoortia tyrannus)*
121.	Spot	*(Leiostomus xanthurus)*
123.	Atlantic croaker	*(Micropogonias undulatus)*
138.	Weakfish (sea trout)	*(Cynoscion regalis)*
145.	White perch	*(Morone americana)*
146.	Atlantic herring	*(Clupea harengus harengus)*
150.	Scup (porgy)	*(Stenotomus chrysops)*
152.	Yellow perch	*(Perca flavescens)*
153.	Northern kingfish	*(Menticirrhus saxatilis)*
156.	Sand lance	*(Ammodytes americanus)*
158.	Butterfish	*(Peprilus triacanthus)*

SHELLFISH

25.	Soft-shell clam	*(Mya arenaria)*
41.	Bay scallop	*(Argopecten irradians)*
42.	Hard clam (Quahog)	*(Mercenaria mercenaria)*
43.	American oyster	*(Crassostrea virginica)*
45.	American lobster	*(Homarus americanus)*
48.	Surf clam	*(Spisula solidissima)*
49.	Blue crab	*(Callinectes sapidus)*

■ Threatened or endangered (state or federal list).

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Description of Shoreline Types

EXPOSED ROCKY SHORES — ESI = 1

- Found along the middle portions of the Hudson River and along the north shore of Long Island near Connecticut
- Composed of steeply-dipping to vertical bedrock
- Exposed to strong currents and moderate waves
- May contain attached algae

Predicted Oil Impact

- Most commonly, oil will be washed along the base of the cliffs by strong currents
- Oil persistence is short-term due to current and wave activity
- Most oil will be naturally removed within weeks
- The damage to the intertidal community is expected to be relatively light with fairly rapid recovery
- Diving birds utilizing these rocky sites may be killed if oiled

Recommended Response Activity

- On most shores, no cleanup is necessary (and may be dangerous)
- Access is usually difficult
- Cleanup of recreational areas may be necessary; high-pressure water spraying is effective while oil is still fresh

EXPOSED BLUFFS OR ROCKY LEDGES — ESI = 2

- Found along the coastal areas exposed to moderate-to-high waves
- Consist of low-lying bedrock or glacial bluffs
- Along bluff shorelines; as along eastern Long Island
  - -composed of eroding till having a steep, exposed scarp
  - -usually contains a narrow platform and beach
  - -contains a steep beach composed of mixed sand and gravel/cobbles
  - -beach sediment may be highly mobile
  - -few organisms are present
- Along bedrock shorelines; only along the north shore of Long Island Sound by Connecticut
  - -ledges are low-lying
  - -the lower intertidal cove is likely to contain extensive algal growth and attached organisms

Predicted Oil Impact

- Incoming oil will commonly form a band along the high-tide swash line
- Tide-pool organisms may be killed
- Lower intertidal algae may escape damage depending on tidal stage and oil type and quantity
- Oil persistence is limited (days to weeks) in most high-energy areas

Recommended Response Activity

- In most wave-exposed areas, cleanup is not necessary
- High recreational-use areas may be effectively cleaned using high-pressure water sraying if oil is still fresh. Removal of organisms should be avoided.

FINE-SAND BEACHES — ESI = 3

- Present along the Atlantic Coast of Long Island as long, recreational beaches
- Usually contain a broad, gently sloping profile
- Commonly backed by dunes or seawalls
- May be mixed with shells or shell fragments
- Upper beach fauna are scarce
- Along the upper Hudson River, sediments may be muddy and the beach may have trees in or close to the water

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 sediment may be killed either by smothering or by lethal oil concentrations in the water
- Shorebirds may be killed if oiled

Recommended Response Activity

- Fine-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 for light-to-moderate oil quantities

MEDIUM- TO COARSE-SAND BEACHES — ESI = 4

- Common within the study area, particularly along the outer south shore of Long Island
- Usually have a moderate-to-steep slope
- Contain low species density and diversity

Predicted Oil Impact

- Commonly, oil will be deposited on and become mixed into the sand along the high-tide swash zone
- Oil may become deeply buried (30-50 cm) into the beach sands
- Oil may also penetrate (or seep) deeply into the beach
- Organisms resident in the beach are likely to be killed under moderate oil concentrations

Recommended Response Activity

- Cleanup may be difficult because of relatively soft sediments
- Cleanup should concentrate on oil removal from the upper swash zone
- Sand removal should be minimal to avoid erosion problems
- Activity through the oiled sand should be limited to prevent grinding oil deeper into the beach
- Use of heavy equipment for oil/sand removal may result in the removal of excessive amounts of sand; manual cleanup may be more efficient

MIXED SAND AND GRAVEL BEACHES (MS&G) — ESI = 5A

ARTIFICIAL MS&G—HUDSON R. ONLY 5B

- Very common throughout the study site
- Present in both sheltered and exposed areas
- Along the Hudson River (5B), material was placed during the construction of the railroads which hug both banks
- Most commonly composed of coarse sand and gravels of varying sizes
- In New York Harbor, beaches may contain various construction debris
- In active beaches, organisms are scarce due to the harshness of the environment
- In stable habitats, algae may be attached to the larger gravel or boulder components
- The larger rocks may also provide habitat for mussels, crabs, and snails

Predicted Oil Impact

- Oil will be deposited primarily along the high-tide swash zone
- Under very heavy accumulations, oil may spread across the entire beach face
- Oil percolation into the beach may be up to 15 to 25 cm
- Biota present may be killed by the oil, either by smothering or by lethal concentrations in the water column

Recommended Response Activity

- Remove oil primarily from the upper swash lines
- Removal of sediment should be limited
- Mechanical reworking of the sediment into the wave zone and/or high-pressure water spraying can effectively remove the oil; sorbent boom may be necessary to capture oil outflow

GRAVEL BEACHES — ESI = 6A

ARTIFICIAL GRAVEL BEACHES—HUDSON R. ONLY 6B
RIPRAP STRUCTURES—HUDSON R. ONLY 6C

- Consists of finer- to medium-sized gravels
- Common throughout the study area
- Along Hudson River, gravels placed during railroad construction are separately indicated
- Riprap structures, commonly boulder-sized, are also marked on Hudson River maps (on other maps, riprap is included as a man-made structure)
- In New York Harbor, gravel beaches may contain extensive consruction material
- In calm areas, the population of fauna and attached algae may be fairly great; crabs, snails, mussels, barnacles, and attached algae are most common

Predicted Oil Impact

- Under light-to-moderate concentrations, oil will be deposited primarily along the last high-tide swash zone
- With heavy oil quantities, the entire beach face may be covered
- Oil may percolate rapidly and deeply into the beach face
- If oil is left to harden, an asphalt/gravel pavement may result
- Resident fauna and flora may be killed by the oil

Recommended Response Activity

- Removal of sediment should be restricted
- Pushing gravel into the active surf zone and use of high-pressure water spraying are effective at removing oil while it is still fresh
- Sorbent booms should be used to capture oil outflowing during the above cleansing

EXPOSED TIDAL FLATS — ESI = 7

- Common in the upper Hudson River and within the bays of the south shore of Long Island
- Visible only at low tide
- Exposed to low-to-moderate wave energy and/or tidal currents
- Composition is most commonly sand or finer
- Species density and diversity may be high; clams and worms are most important

Predicted Oil Impact

- Most oil will be pushed across the flat as the tide rises
- Deposition of oil on the flat may occur on a falling tide if oil concentrations are heavy
- Biological damage may be severe

Recommended Response Activity

- Cleanup is very difficult (and possible only during low tides)
- The use of heavy machinery should be restricted to prevent mixing oil into the sediments
- On sand flats, oil will be removed naturally from the flat and deposited on the adjacent beaches where cleanup is more feasible

SHELTERED ROCKY SHORES — ESI = 8

- Very uncommon within the study area
- Only present in a few quiescent areas of the mid-Hudson River
- Biota may be limited due to salinity variations

Predicted Oil Impact

- Oil will persist for several years especially between rocks

Recommended Response Activity

- Areas needing protection using deflection booms, sorbent booms, and offshore skimmers
- High- and low-pressure water spraying is effective while oil is still fresh

SHELTERED TIDAL FLATS — ESI = 9

- Common throughout the study area within calm-water habitats sheltered from major wave activity
- Composed of muds, commonly fronting marshes
- Usually contain large populations of clams, worms, and snails
- Bird life is seasonally abundant

Predicted Oil Impact

- Oil may persist for many years
- Long-term oil incorporation into tidal-flat sediments is common
- Oil deposition will commonly occur along the upper fringes of the flat
- Very heavy oil accumulations will cover much of the flat surface
- Biological damage may be severe

Recommended Response Activity

- This is a high-priority area necessitating the use of spill protection devices to prevent or limit oil spill impact; open-water, deflection, and sorbent booms and open-water skimmers should be used
- Cleanup of the flat surface after oiling is very difficult because of the soft substrate
- Manual operations from shallow-draft boats may be helpful

MARSHES — ESI = 10

- Very common as narrow, fringing marshes in most areas, or as broad marshes within major bays
- Very sheltered from waves and tidal activity
- Composed primarily of *Spartina* grasses on an organic-rich mud base
- Crabs are common and bird life may be abundant
- Marshes provide a nursery ground for numerous fish species

Predicted Oil Impact

- Oil in heavy accumulations may persist for decades
- Small quantities of oil will be deposited primarily along the outer marsh fringe or along the upper wrack (debris) swash line
- Resident biota, including bird life, are likely to be oiled and possibly killed

Recommended Response Activity

- Under light oiling, the best practice is to let the marsh recover naturally
- During winter months, surface ice commonly offers shoreline protection
- Cutting of oiled grasses and low-pressure water spraying are effective, especially during the early part of the spring growing season
- Heavy oil accumulations on the marsh surface should be removed manually; access across the marsh should be greatly restricted
- Cleanup activities should be carefully supervised to avoid excessive damage to the marsh

MAN-MADE STRUCTURES — (NOT RANKED)

- Very common throughout the study area
- Composed of riprap, concrete and stone, wooden or metal bulkheads, and wooden pilings (except on Hudson R. maps which denote riprap separately)
- Concrete and stone are most common along the outer coast (behind the beach) and along the sheltered residential areas
- Organisms and algae may be common in riprap structures and on pilings
- Biota on concrete structures along the upper intertidal or supratidal zones is sparse

Predicted Oil Impact

- Oil would percolate easily between the gravel and boulders of riprap structures
- Oil would coat the intertidal areas of solid structures
- Biota would be damaged or killed under heavy accumulations

Recommended Cleanup Activity

- May require high-pressure spraying:
  - -to remove oil
  - -to prepare substrate for recolonization of barnacle and oyster communities
  - -for aesthetic reasons
- Since riprap is often associated with developed, recreational beaches, cleanup would be advisable to minimize chronic leaching of oil trapped in the rocks