

**ENVIRONMENTAL QUALITY MATRIX
FOR THE QUODDY REGION, SOUTHWESTERN BAY OF FUNDY
(EXCLUDING ST. CROIX ESTUARY and COBSCOOK BAY)**

Prepared by Conservation Council of New Brunswick
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The Quoddy Region is in the southwestern Bay of Fundy, inside a line drawn south from Point Lepreau to the outer boundaries of the Grand Manan archipelago including Machias Seal Island, and west to the coast of downeast Maine. The sub-zones are defined as a) Passamaquoddy Bay and its drainage basin, b) the West Isles archipelago (islands and waters around Campobello and Deer Island), c) L'Etang Estuary zone from L'Etete to Black's Harbour, d) Maces Bay from Point Lepreau to Beaver Harbour, e) Grand Manan archipelago, f) open waters including The Wolves Islands and Machias Seal Island. This assessment excludes the St. Croix watershed (completed by SCEP) and the area within the State of Maine.

| | Indicator | Quoddy Summary | Pass. Bay Subregion | L'Etang Subregion | West Isles Subregion | Maces Bay Subregion | Grand Manan | Open/Wolves |
|---|-------------------------------|----------------|---------------------|-------------------|----------------------|---------------------|-------------|-------------|
| water quality | bacteria | Yellow | Red | Red | Yellow | Yellow | Yellow | Green |
| | nutrients | Yellow | Red | Red | Yellow | Green | Yellow | Green |
| | sediments | Yellow | Red | Red | Yellow | Green | Yellow | Green |
| | toxic contaminants | Yellow | Red | Red | Yellow | Yellow | Yellow | Yellow |
| | dissolved oxygen | Yellow | Red | Red | Yellow | Green | Yellow | Green |
| presence and quality of critical habitats | benthic habitat | Yellow | Red | Red | Yellow | Yellow | Yellow | Yellow |
| | wetlands | Yellow | Yellow | Yellow | Yellow | Yellow | Yellow | N/A |
| | seagrass beds | Yellow | Yellow | Red | Red | Yellow | Yellow | Green |
| | nesting and foraging areas | Green | Yellow | Yellow | Green | Green | Green | Green |
| | spawning and nursery areas | Yellow | Red | Red | Yellow | Yellow | Yellow | Green |
| | legally prot. areas protected | Yellow | Yellow | Yellow | Yellow | Green | Yellow | Yellow |
| | marine mammals habit. | Yellow | Yellow | Red | Yellow | Green | Yellow | Green |

| | Indicator | Quoddy Region | Passam. Bay | L'Etang Estuary | West Isles | Maces Bay | Grand Manan | Open water |
|--|---------------------------------|---------------|-------------|-----------------|------------|-----------|-------------|------------|
| | populations | Yellow | Red | Red | Yellow | Yellow | Yellow | Yellow |
| | diversity | Yellow | Red | Red | Yellow | Yellow | Yellow | Yellow |
| | dominance | Red | Red | Red | Red | Red | Red | Red |
| | changes in species invaders | Yellow | Yellow | Light Red | Green | Green | Green | Green |
| | other | | | | | | | |
| changes in use and integrity of riparian and water zones | clearing, dev. natural areas | Red | Red | Light Red | Red | Red | Red | Green |
| | replacement of traditional uses | Yellow | Red | Red | Yellow | Green | Yellow | Green |
| | erosion and deposition changes | Yellow | Red | Red | Yellow | Green | Green | Green |
| | tidal barriers on streams and | Yellow | Yellow | Light Red | Green | Yellow | Green | N/A |
| changes in resource use | shift in targeted species | Red | Red | Red | Red | Red | Red | Red |
| | species introductions | Green | Green | Green | Green | Green | Green | Green |
| | shift from harvesting to | Yellow | Yellow | Yellow | Yellow | Green | Yellow | Yellow |
| | shift from harvesting | Yellow | Light Red | Red | Yellow | Green | Yellow | Green |
| other | other: | | | | | | | |

Notes to the Matrix

Colour Interpretation

Colours are allocated to the matrix boxes on a comparative basis rather than an absolute basis. That is, high to low impact designations are made relative to other subregions within the Quoddy Region. While this may also translate into absolute measures relative to the entire Gulf of Maine (e.g. marine mammal habitat), it may not mean that a “red” designation for water quality in the Quoddy Region is comparable to a “red” designation for Boston Harbour. Similarly, development of coastal areas in the Quoddy Region is qualitatively and quantitatively different than in the southern Gulf of Maine, but within the Quoddy Region can be rated a high, moderate and low impact.

Within each category on the matrix, the colour designations have particular meaning. These are described as follows:

Category: Water Quality

Red - serious water quality problems

Yellow - moderate water quality problems

Green - generally good water quality

Category: Presence and quality of critical habitats

Red - critical habitats seriously impaired or significant losses

Yellow – critical habitats moderately impaired, moderate losses, or significant threats

Green – critical habitats largely undiminished and in relatively good shape

Category: Changes in Species

Red - dramatic declines in populations, loss of diversity, dramatic shifts in dominance within trophic levels, and high incursions of invaders over past 50 years

Yellow - moderate declines in populations and diversity, shifts in dominance and moderate incursions of invaders

Green - overall population stability or increase, maintenance of diversity, maintenance of historic trophic relationships, and low impacts by invaders.

Category: Changes in use and integrity of riparian and water zones

Red - dramatic changes in use of land or water zones and / or impairment of ecological integrity over past 50 years

Yellow - moderate changes and/or impairment

Green - general maintenance of traditional uses and low impacts on ecological integrity

Category: Changes in resource use

Red - dramatic changes in resource use over past 50 years (no judgement as to the desirability of those changes intended)

Yellow – moderate changes in resource use

Green – general maintenance of traditional resource use

Explanations of Indicators in the Quoddy Region

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| | <i>Category: Water Quality</i> |
| Bacteria | We interpreted this as the extent and frequency of shellfish bed closures as well as the presence of raw sewage or wastewater flowing into waterways and onto beaches (Lotze and Milewski, 2002; Environment Canada). |
| Nutrients. | Designations are based on the presence of large sources of nutrients, especially finfish aquaculture and fish plants, as well as the probable dilution factors of the subregions (Lotze and Milewski 2002; observations; Chopin pers. com). |
| Sediments. | Designations are based on the presence of sediment loads, particularly finfish aquaculture, and land-based activities contributing to erosion and run-off. Sediments still present from historic sources are also considered, ie. pulp and saw mills (Lotze and Milewski 2002). |
| Toxic contaminants and radionuclides. | Designations are based on current and past monitoring of persistent organic pollutants and heavy metals, the influence of the Saint John River plume carrying contaminants from industry, and the presence of local sources such as the Point Lepreau Nuclear Generating Station, the Domtar pulp mill in Woodland, the Irving mill in Lake Utopia, the aquaculture industry, the shipping industry. (Lotze and Milewski 2002, Sunderland, pers. com; Harvey 1994, Harvey et al 1998). |
| Dissolved oxygen. | This is generally based on monitoring of the finfish aquaculture industry (Lotze and Milewski 2002). |
| | <i>Category: Presence and Quality of Critical Habitats</i> |
| Benthic habitat. | We considered current and past fish and scallop dragging in the area, the ability of the bottom to recover from this, and the presence of aquaculture operations (Lotze and Milewski 2002; observations). |
| Wetlands. | There are no large wetlands in the area. Allocations were based on threats to the several small wetlands from infilling and adjacent development (observations). |
| Seagrass beds. | Designations based on the presence and intensity of commercial-scale rockweed harvesting, degree of colonization by annual algae, and possible disruption from fish or scallop dragging (Harvey et al 1998; Lotze and Milewski 2002), observations.) |
| Nesting and foraging areas. | We considered the extent of intact habitat as well as disturbances due to noise and light from adjacent development, particularly aquaculture (Lotze and Milewski 2002; observations). |
| Spawning and nursery areas. | This is based on a recent report on the loss of spawning grounds in the Bay of Fundy, the presence of aquaculture operations in embayments, other habitat disturbance such as rockweed harvesting and coastal development (Coon 1999; Lotze and Milewski 2002; Graham et al 2002). |
| Legally protected areas, private and public | Designations based on the extent of coastline and/or number of areas protected in each subregion (Harvey, 1994; observations). |

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| Marine mammal habitat | Designations based on the quality of habitat relative to disturbances such as boat traffic, noise and food supply (Lotze and Milewski 2002). |
| | <i>Category: Changes in species</i> |
| Populations | Designations based on the relative abundance of populations of fish, marine mammal and bird species over 100 years. Note the numbers of seabirds have increased overall from historic lows but shorebirds are generally declining. All commercial and anadromous fish populations have dramatically declined (Lotze and Milewski 2002). |
| Diversity | Loss of biodiversity throughout the food web is associated with loss of fish populations (ie. Atlantic salmon, large groundfish, spawning populations of fish) due to overfishing and with aquaculture operations affecting the benthos (Lotze and Milewski 2002; aquaculture monitoring by Pohle (L'Etang) and Milewski (Crow Harbour). |
| Dominance | This is indicated by shifts in dominant species in all trophic levels (Lotze and Milewski 2002). |
| Invaders | Considered were green crab (populations appear lower and thus less impact - anecdotal) and the presence of aquaculture escapees, particularly Atlantic Salmon, in estuaries and rivers. This may or may not be considered an invader by others but we wanted to include it for information purposes. We did not consider plants (Lotze and Milewski 2002; observations). |
| | <i>Category: Changes in use and integrity of riparian and water zones</i> |
| Clearing and development of natural areas | We considered natural areas to be those areas of coastline which are dark and quiet at night and with no significant disturbance either on land or water. We consider aquaculture operations on water to be development of an area, regardless of whether the adjacent land is cleared or developed, due to the intensity of noise, activity, movement and light (even underwater lights are used) (Lotze and Milewski 2002; Harvey et al 1998; present threats). |
| Replacement of traditional uses. | This is the extent to which activity on land or water has changed over the past 50-100 years (observation). |
| Erosion and depositional changes | We considered the presence or absence of human activity that generate deposition of sediments or exacerbate erosion, such as wood and fish processing facilities, aquaculture, and shoreline development (Lotze and Milewski 2002). |
| Tidal barriers on streams, marshes or estuaries | We considered the number of tidal crossings in each area and the percentage of these that restrict tidal flow to some degree (Thomas 2003 unpublished). |
| | <i>Category: Changes in resource use</i> |
| Shift in targeted species | We considered the degree to which new species harvesting (ie. sea urchins, rockweed, sea cucumbers, crab, dogfish) is replacing traditional harvesting (ie. groundfish, inshore herring, Atlantic salmon, clams), and the change in intensity of harvest of lobster and scallops (increasing) (Lotze and Milewski 2002). |

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| Species introductions | We did not consider freshwater introductions in the region because any such introductions are longstanding and appear to be relatively benign (note that the St. Croix watershed is not included in this matrix) (anecdotal). We did not consider plants. Green indicates the absence of introductions (as opposed to invaders) in the coastal waters (observation). |
| Shift from harvesting to recreation/tourism | Colours indicate the degree to which resource harvesting activity is declining while tourism is increasing, ie, fewer fishing boats and more sightseeing. It does not consider just growth in tourism while harvesting activity remains the same (observation). |
| Shift from harvesting to aquaculture | Colours indicate the degree to which harvesting is declining in an area while aquaculture is increasing, including the displacement of fishing, spawning and nursery grounds (Lotze and Milewski 2002; fishermen pers. com., observation). |

References

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