Ecosystem-Based Fishery Management

Habitat Suitability:

I.Thermal regime

II.Hypoxia

III.Flow

IV.Structured Habitat

Effects

Reference Points for the Sustainable Fisheries GIT

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Thermal Stress: Effects

(1) growth rate, reproductive output, and the seasonal duration of growth and reproduction,

(2) stress and lethal responses to temperature,

(3) mismatches in the seasonal timing of reproduction and feeding,

(4) shifts in distribution of prey, predators, parasites and disease, and

(5) changes in the abundance or distribution of critical habitats.

Thermal Stress: Reference Points

(1) seagrass areal cover in the bay,

(2) blue crab survival and abundance derived from the winter dredge survey,

(3) native oyster abundance in different tributaries,

(4) benthic clam abundance (soft-shell, hard, Baltic and razor clams),

(5) spawning frequency and distribution of blue crab females, derived from trawl surveys, and

(6) spawning run surveys, and egg presence/absence surveys (striped bass and Alosines).

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Hypoxia: Effects

(1) loss of potential habitat through active avoidance of hypoxic regions or direct degradation of the habitat,

(2) reduced growth, reproduction, and survival, and

(3) altered food web interactions.

Hypoxia: Reference Points

Given that hypoxia reduces overall carrying capacity and fisheries production in the Bay, fisheries management should strive to eliminate hypoxia from the Bay.

Consequently, fisheries managers should promote and support water quality regulations that are aimed at reductions in nutrient inputs, such as the recent EPA mandates.

Furthermore, there should be further modeling to determine the relative influence of hypoxia upon fisheries production relative to other environmental and biotic variables.

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Flow: Effects

(1) climate effects, where regional climatology (linked seasonal patterns of precipitation and temperature) and storms influence recruitment of all five focal species, albeit in different ways, and

(2) dams, which principally influence Alosines.

High flow can reduce oyster recruitment by precluding the retention of larvae in subestuaries,
lower the incidence of disease in oysters, and
enhance stratification of the water column, which promotes hypoxia.

Low flow enhances oyster recruitment,
raises disease incidence in oysters, and
reduces stratification.

Additionally, summer and fall storm events can influence recruitment of blue crabs.

Flow: Reference Points

(1) Monitoring to determine the effectiveness of dam removal on restoration of Alosine reproductive and spawning habitats.

(2) Minimum flow requirements for successful spawning and nursery conditions for Alosines should be scientifically corroborated and enforced.

(3) Removal of stored sediments accumulated behind dams.

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Structured Habitat: Effects

The types of structured habitat important for the blue crab, oyster and striped bass include submerged aquatic vegetation (SAV), salt marsh (SM), macroalgae (MA), coarse woody debris (CWD), oyster reef (OR), and various artificial substrates such as riprap and artificial reefs (AR).

These habitats serve as nurseries for blue crab (SAV, MA, CWD),
foraging grounds for blue crab (SAV, SM, MA, OR, AR) and
striped bass (SAV, OR, AR), and
as a lifetime resource for oyster (OR, AR).

The classes of effects stemming from degradation, fragmentation and loss of structured habitat include reductions in:

(1) nursery habitat and consequently, juvenile survival and abundance, and

(2) growth rates and production due to decreased foraging areas.

Structured Habitat: Reference Points

Fisheries management should support attempts to preserve or restore these habitat types.

Indicators for these habitats can be based on areal cover (SAV), length of shoreline (SM), and abundance (OR).

Shoreline development should not be permitted, but when necessary, riprap or salt marsh mitigation should be encouraged as reasonable solutions.

The rapid expansion of some macroalgae, such as the red alga *Gracilaria vermicullophyla*, over the past two decades may have compensated for the decline in SAV to some degree.

Hence, monitoring of macroalgae may be a useful indicator of nursery habitat.

A final metric includes the amount of hardened shoreline.
Fisheries managers should promote the conversion of bulkhead to riprap or to salt marsh where feasible. In this regard, coastline inventories will be useful.