Conserving aquatic systems

Soggy issues

Why aquatic systems?

- Humans are terrestrial
- Depths are hidden from easy view
- Gravity

Major issues in aquatic conservation

- Habitat alteration
- Invasive species
- Overharvesting
- Eutrophication
- Other pollutants

Adventure Falls, Surfside Beach

Habitat alteration

- Degradation of benthic habitats due to dredging and trawling
- Shoreline development and riparian zone alteration
- Dams

Trawling (1)

Gulf of Alaska

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean density (no. 100m$^{-2}$)</th>
<th>p</th>
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<tbody>
<tr>
<td>Sponge groups</td>
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<tr>
<td>Proper sponges</td>
<td>71.4</td>
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<td>Amphiesma</td>
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<td>Mixed sponges</td>
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<td>View sponges</td>
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<td>Nettle groups</td>
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<td>Asteroidea and ophiurida</td>
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<td>Hydrozoa</td>
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<tr>
<td>Sponges</td>
<td>1.6</td>
<td>0.9947</td>
</tr>
</tbody>
</table>

Freese et al. (1999)

Bottom trawling scrapes

Trawling (2)

Global analysis of depletion and recovery of seabed biota after bottom trawling disturbance


Towed dredge

Beam trawl

Otter trawl

Freese et al. (1999)

Figure 1: The relationship between the proportion depth f and depletion of macrofauna biomass between sediments at a single level for different trawl designs, with 50%.
Shoreline alteration

Walters et al. (2010)

Riparian zone degradation

Semlitsch & Bodie (2003)

Dams

- Breaking upstream-downstream linkages

Espiritu Santo River, Puerto Rico

Xiphocaris elongata

Dam-Nation?

- Only 42 free-flowing streams >200 km long remaining in lower 48

Only 2% of US river miles of high enough quality to be protected federally

Benke (1990)

Destruction to the rescue?

Science, 18 Nov 2011

Data source: American Rivers

Boom + 1 year

1,086 and counting

O’Connor et al. (2015)

Major issues in aquatic conservation

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- Overharvesting
- Eutrophication
- Other pollutants

US invasives
**Invasive species**

Shoreline Development Drives Invasion of Phragmites australis and the Loss of Plant Diversity on New England Salt Marshes

BRIAN R. NELDORP AND MARK D. BEITNESS
Department of Biology and Biochemistry, Biology, Brown University, Providence, RI 02912, U.S.A.

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**Invader insights from Moyle & Marchetti (2006)**

- 110 spp.; 43%

- **No** one set of characteristics always predict “success” of invaders, but 5 significant factors for CA fishes are:
  - Successful invasion elsewhere
  - Invading a habitat similar to native one
  - Invading species-rich areas
  - >100 individuals introduced repeatedly
  - Species-specific characteristics that aid success at multiple steps required for successful invasion

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**Major issues in aquatic conservation**

- Habitat alteration
- Invasive species
- **Harvesting**
- Eutrophication
- Other pollutants

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**Harvesting**

- Over-harvesting
- By-catch

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**Another invader**

Invader insights from Moyle & Marchetti (2006)

- 110 spp.; 43%

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  - Successful invasion elsewhere
  - Invading a habitat similar to native one
  - Invading species-rich areas
  - >100 individuals introduced repeatedly
  - Species-specific characteristics that aid success at multiple steps required for successful invasion

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**Adventure Falls, Surfside Beach**
Over-harvesting of ocean fishes

Worm et al. (2009)

Uses all available data

“one-third for the birds”

Cury et al. (2011)

Bycatch

- 39 of 49 commercial fisheries along East Coast had bycatch (Zollett, 2009)

Major issues in aquatic conservation

- Habitat alteration
- Invasive species
- Overharvesting
- Eutrophication
- Other pollutants

Adventure Falls, Surfside Beach

Eutrophication

- HABs, too

Dead zones on the rise

- Exponential spread since the 1960s

Breitburg et al. (2018)
Major issues in aquatic conservation

- Habitat alteration
- Invasive species
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- Other pollutants

Adventure Falls, Surfside Beach

Some other pollutants

- Sedimentation
- Microplastics
- Pesticides
- Endocrine disruptors

Tributary to the Chattahoochee River, GA

Microplastics

Gray et al. (2018)
Marine Pollution Bulletin

Pesticides

Stone et al. (2014)

Endocrine disruptors (1)

Bergman et al. (2013)
Environmental Health Perspectives

Some tools

- Marine sanctuaries
- Wild and Scenic Rivers+
- Index of Biotic Integrity (IBI)

What does an MPA need?

- No take
- Law enforcement
- >10-years old
- > 100 km²
- Isolated

Edgar et al. (2014)

IBI vs. Impervious for Fairfax Co, VA

Fairfax County Stream Protection Strategy: Baseline Study (2001)