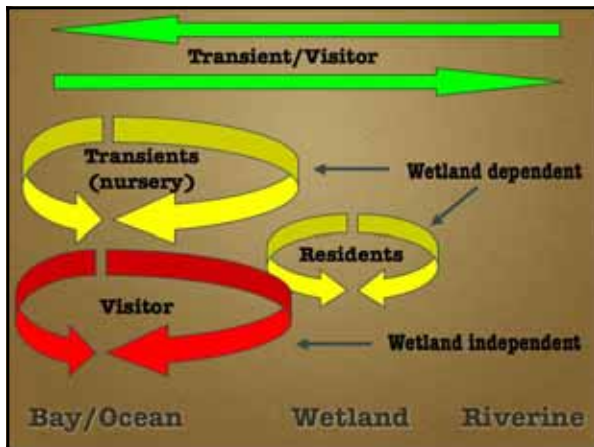
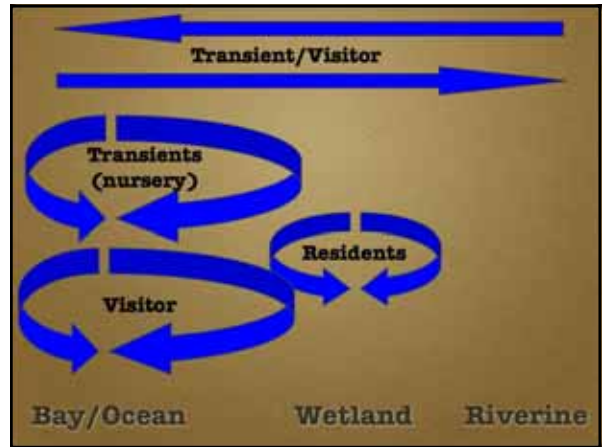
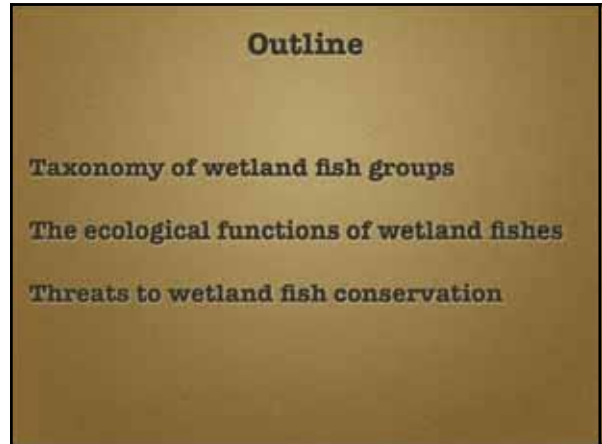
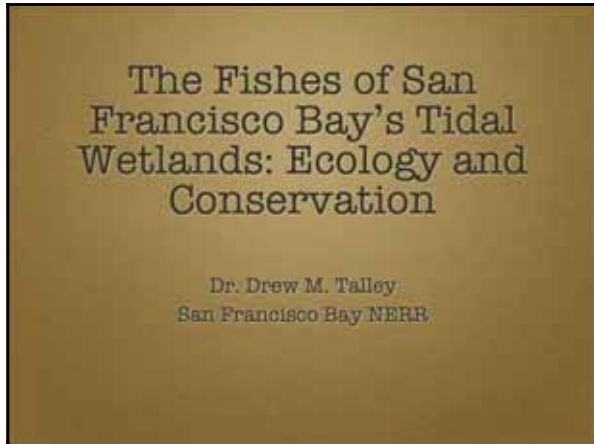


Introducion to Ecology and Regulation of
Tidal Wetlands in Central California and the San Francisco Bay
August 17, 2005



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Functional Roles of Wetland Fishes

Trophic:

1. Prey
2. Predators:
 - a. Direct
 - b. Indirect

Indicators
Vectors
Ecosystem engineers

Functional Roles of Wetland Fishes

Trophic:

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2. Predators:
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 - b. Indirect

Indicators
Vectors
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Wetland Fishes as Prey



Numerous taxa feed on fishes
Includes many listed species
Commercially important

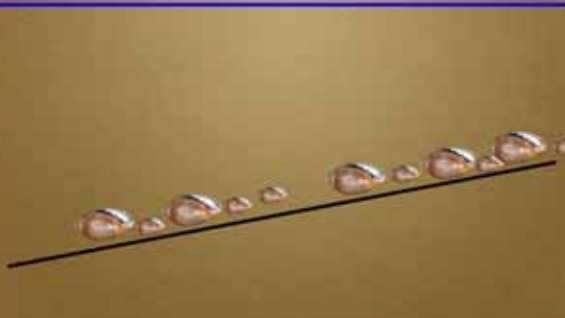
Functional Roles of Wetland Fishes

Trophic:

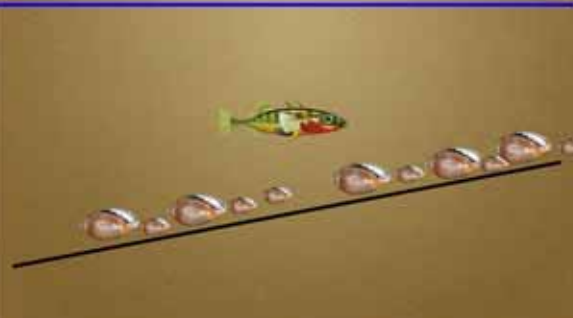
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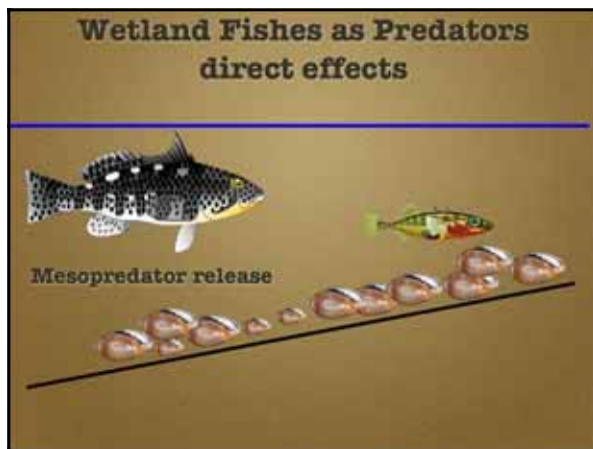
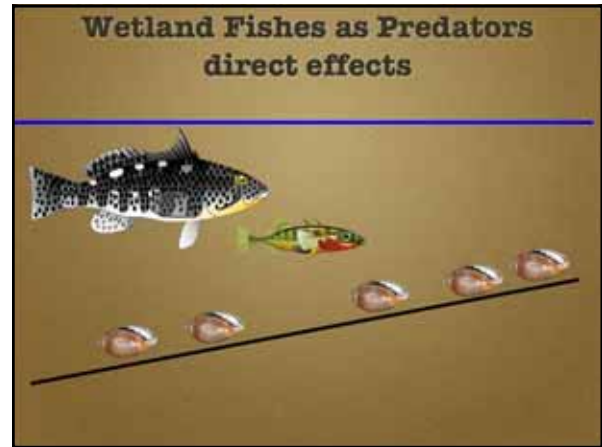
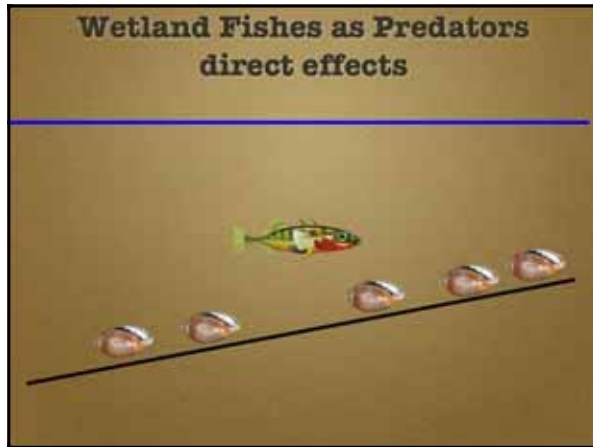
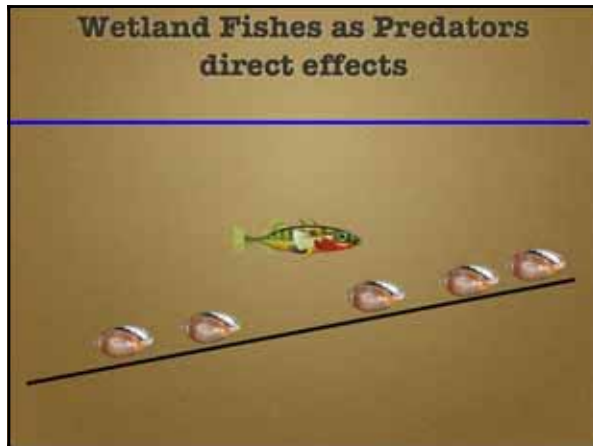
Wetland Fishes as Predators
direct effects



Wetland Fishes as Predators
direct effects



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Wetland Fishes as Indicators



Delta smelt
Hypomesus transpacificus

Requires:
Multiple intact and connected habitats
Appropriate flow conditions
Moderate turbidity
Low toxic concentrations
Abundant zooplankton
"normal" competition

"Sentinel" or "indicator" species


Functional Roles of Wetland Fishes

Trophic:

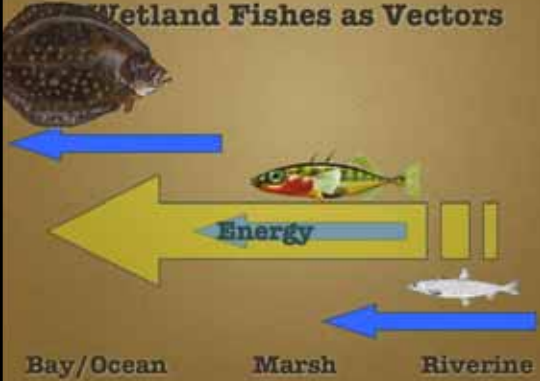
1. Prey
2. Predators:
 - a. Direct
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Indicators
Vectors
Ecosystem engineers

Wetland Fishes as Vectors



Wetland Fishes as Vectors



Bay/Ocean Marsh Riverine


Functional Roles of Wetland Fishes

Trophic:

1. Prey
2. Predators:
 - a. Direct
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Indicators
Vectors
Ecosystem engineers

Wetland Fishes as Ecosystem Engineers



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Wetland Fishes as Ecosystem Engineers



Conservation of Wetland Fishes

Major Conservation Threats:

- Habitat Loss/Degradation
- Invasive (Exotic) Species

Habitat Loss and Degradation




90% of historic wetlands lost

Exotic Species Introductions

- Both intentional and accidental introductions
- Since 1870's, "successfully" established 29 spp
- Also baitfish, aquarium, and ballast water

Exotic Species Introductions

Both intentional and accidental introductions



Inland silverside
Menidia beryllina

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Exotic Species Introductions

Both intentional and accidental introductions



Striped Bass
Morone saxatilis

Exotic Species Introductions

Both intentional and accidental introductions



Sailfin Molly
Poecilia latipinna


Aquarium



Yellowfin Goby
Acanthogobius flavimanus

Ballast Water

Tidal Marsh Fishes



Critical ecosystem functions
Critical management functions
Urgent conservation threats

