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**Delaware River Basin Commission**

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## Evaluation of “Existing Use” for the Delaware Estuary

Erik L. Sillardorff (WQAC meeting – November 13, 2014)



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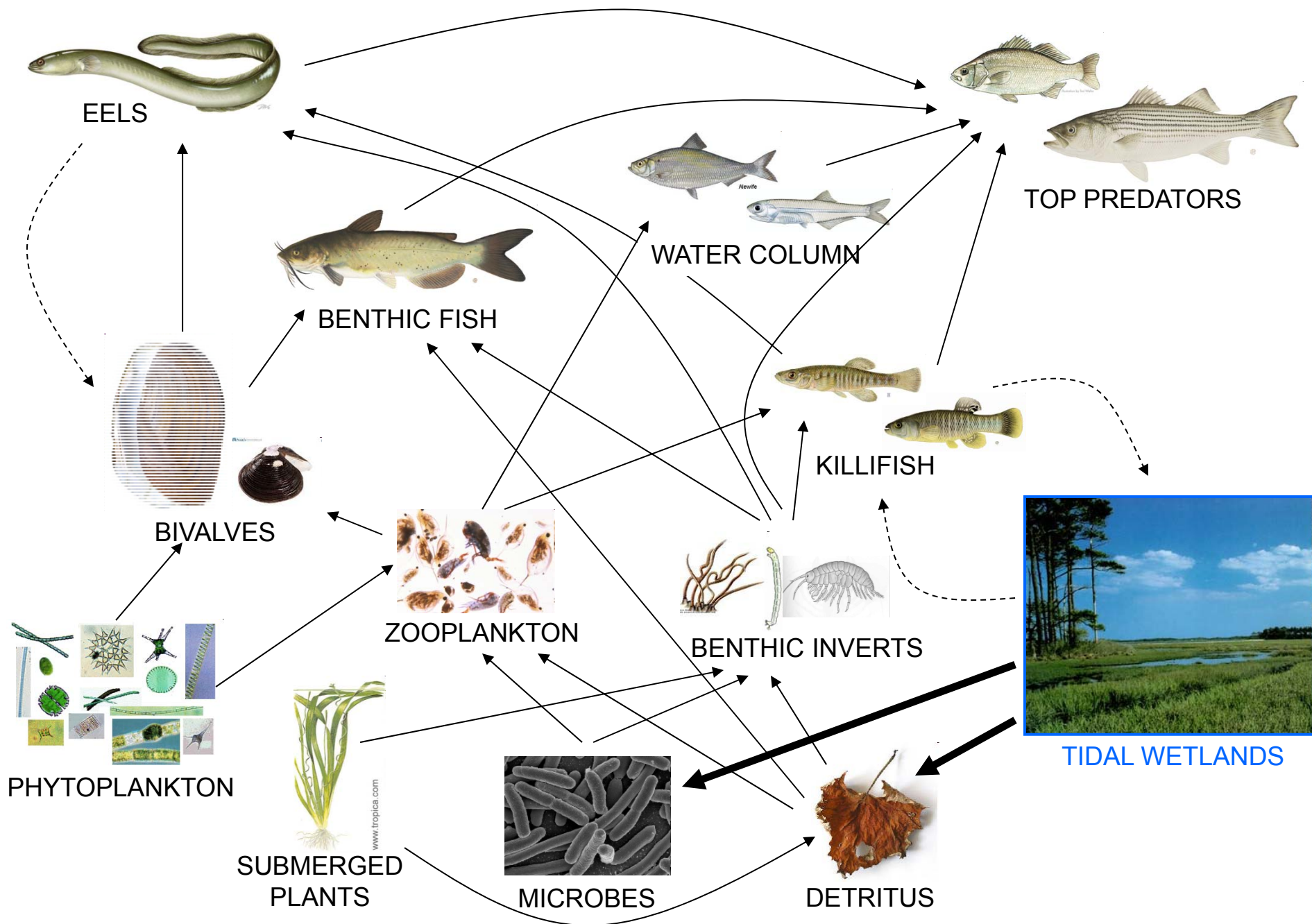
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# Outline of Presentation

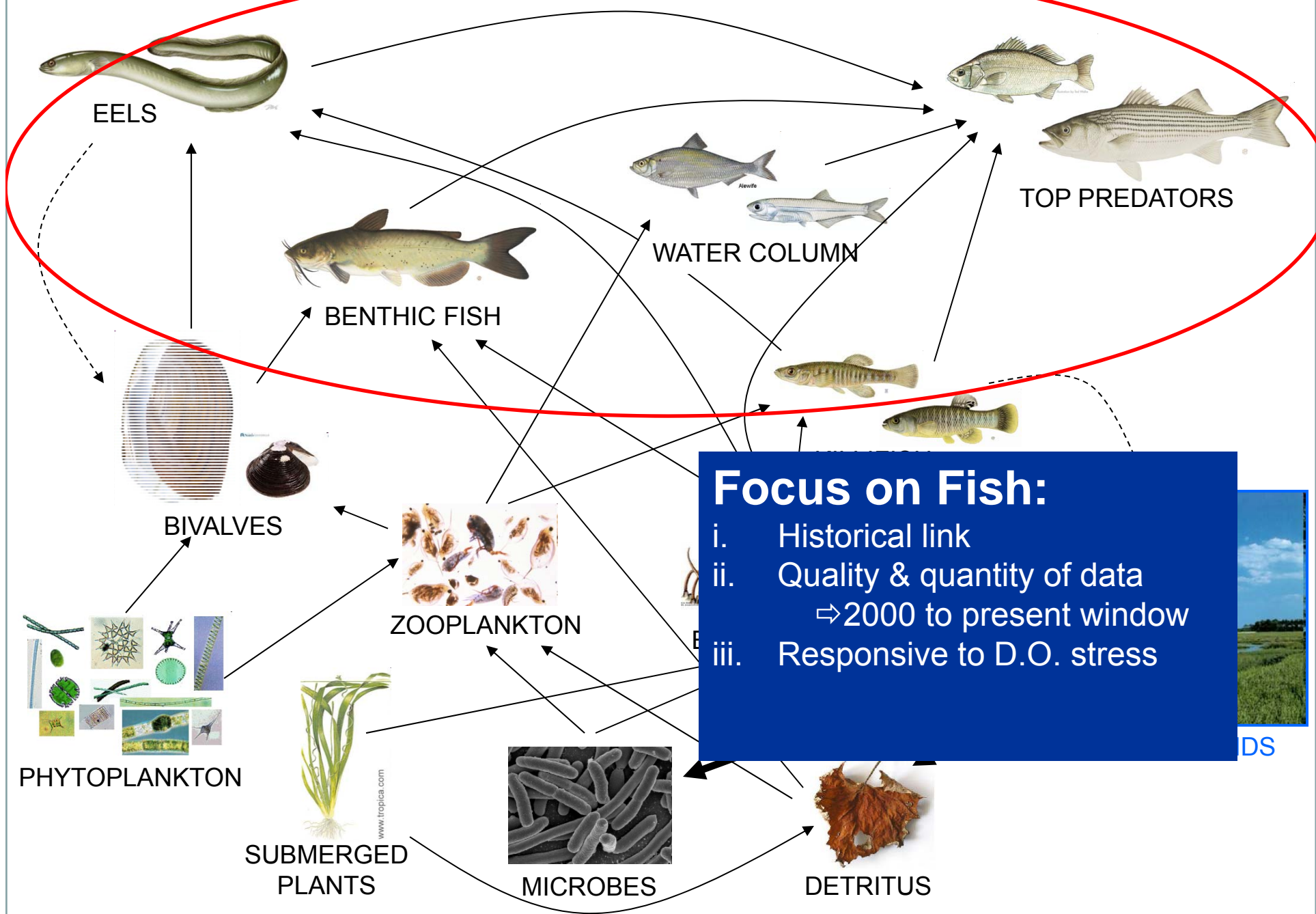
- Data Review
  - data & methods
  - examples
  - summary
- Discussion of “Uses”
- Placing Current Data in “Use” Context
- Next Steps



# Food Web: freshwater tidal Delaware River



# Food Web: freshwater tidal Delaware River



**Focus on Fish:**

- i. Historical link
- ii. Quality & quantity of data  
⇒ 2000 to present window
- iii. Responsive to D.O. stress



DS



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# Sources of Fishery Data

## Primary Sources

- PSEG Ichthyoplankton Surveys (2002-2004)
- Atlantic Sturgeon reports & summaries (2011-2014)
- NJDEP Tidal Seining surveys (1980-2013)

## Additional Potential Sources

- DNREC 17 ft. Trawl Survey
- Impingement & Entrainment Reports
  - Trainer Refinery
  - Deepwater Refinery
  - Eddystone Power Plant
  - Delaware City Refinery
  - others...





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# Data Review Template

Zone 3 (RM 95.0 to RM108.4)								
1979 Task Force	PSEG target (12 spp)	NJ: 10 K/yr and 10/yr groups	Common name	Scientific name	Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
<b>Fishes</b>								
m			Fish X	<i>Genus species</i>	Y	Y	?	Y
m			Fish Y	<i>Genus species</i>	?	?	N	Y
			Fish Z	<i>Genus species</i>	Y	Y	Y	Y

Zone-Specific: data evaluated for a DRBC Zone



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<b>Fishes</b>								
m	■	■	Fish X	<i>Genus species</i>	Y	Y	?	Y
m	■	■	Fish Y	<i>Genus species</i>	?	?	N	Y
			Fish Z	<i>Genus species</i>	Y	Y	Y	Y

- 1979 Task Force: f (freshwater), m (marine/migratory), e (endangered)
- PSEG target: 12 species selected for monitoring
- NJ Seine surveys: blue for highest abundance, green for moderate





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<b>Fishes</b>							
m		Fish X	<i>Genus species</i>	Y	Y	?	Y
m		Fish Y	<i>Genus species</i>	?	?	N	Y
		Fish Z	<i>Genus species</i>	Y	Y	Y	Y

Level of Reproduction: recognize 3 distinctions in the spectrum

- (1) "any" – weak indications that it is occurring
- (2) "regular" – somewhat consistent
- (3) "strong" – large numbers, consistent year-on-year



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			<b>Fishes</b>					
m			Fish X	<i>Genus species</i>	Y	Y	?	Y
m			Fish Y	<i>Genus species</i>	?	?	N	Y
			Fish Z	<i>Genus species</i>	Y	Y	Y	Y

3 answers possible for each cell

**Y** yes = clear indication that qualifies

**N** no = clear indication that does not qualify

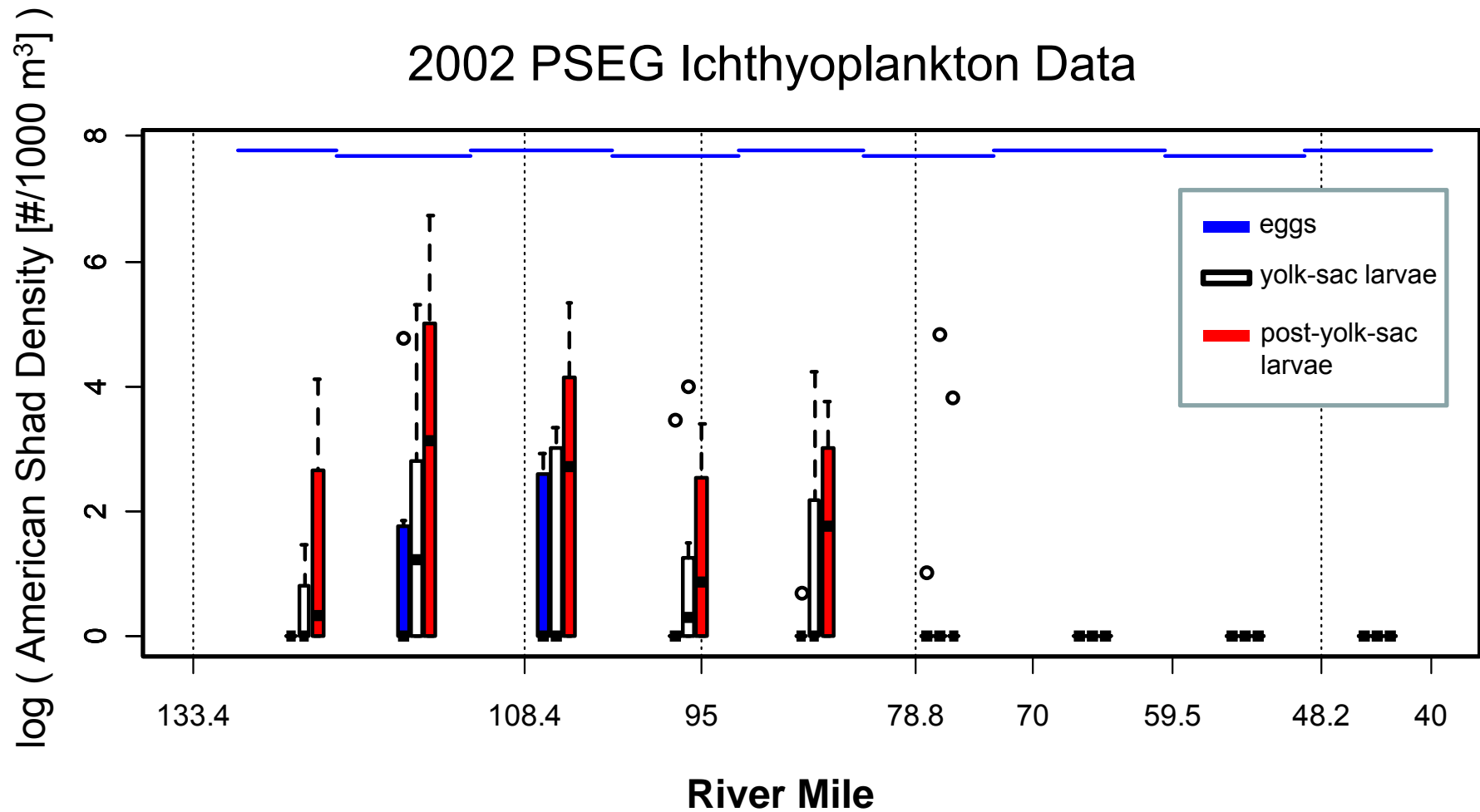
**?** ? = weak or equivocal evidence that qualifies

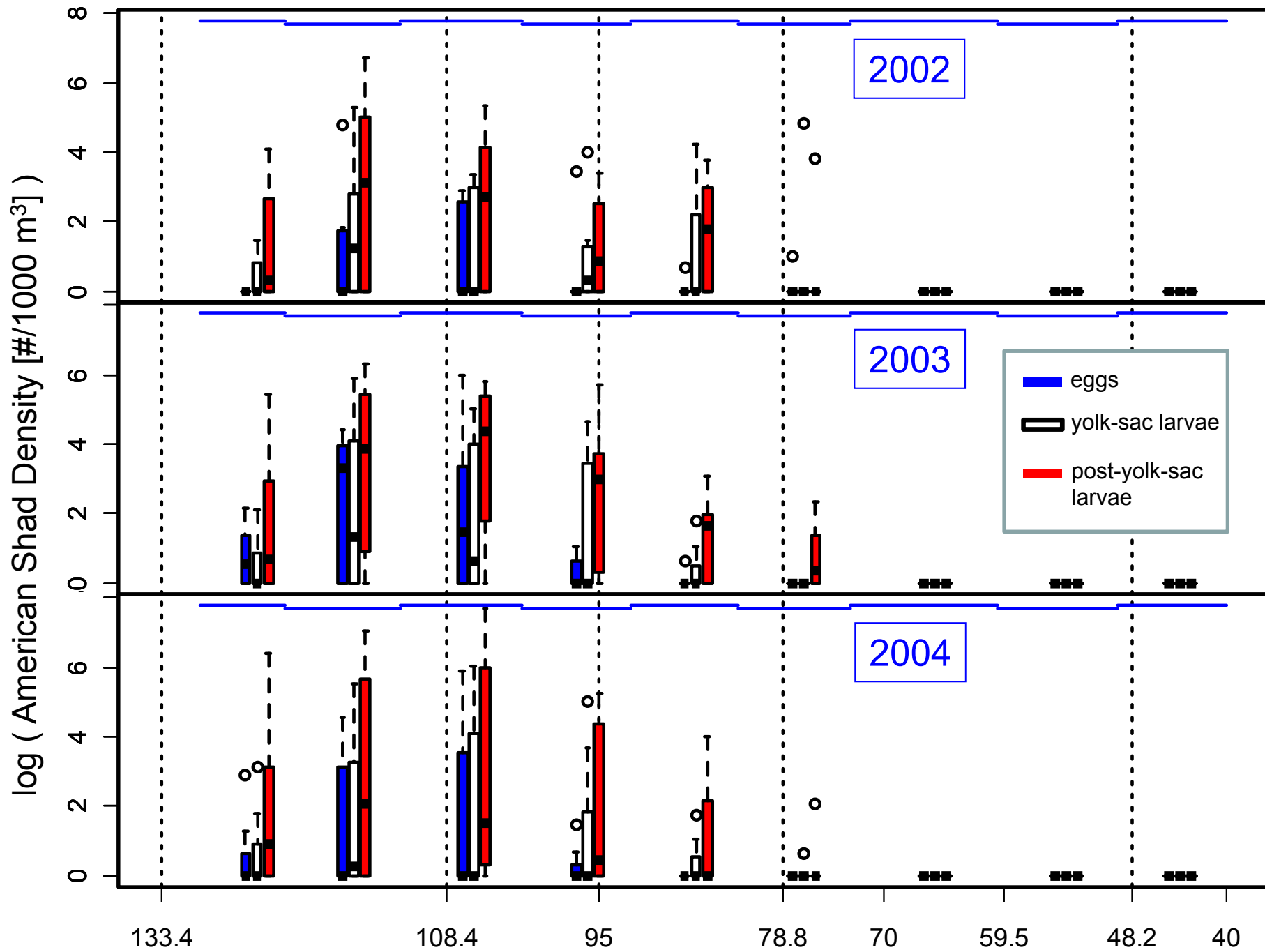


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# Review Example: Ichthyoplankton









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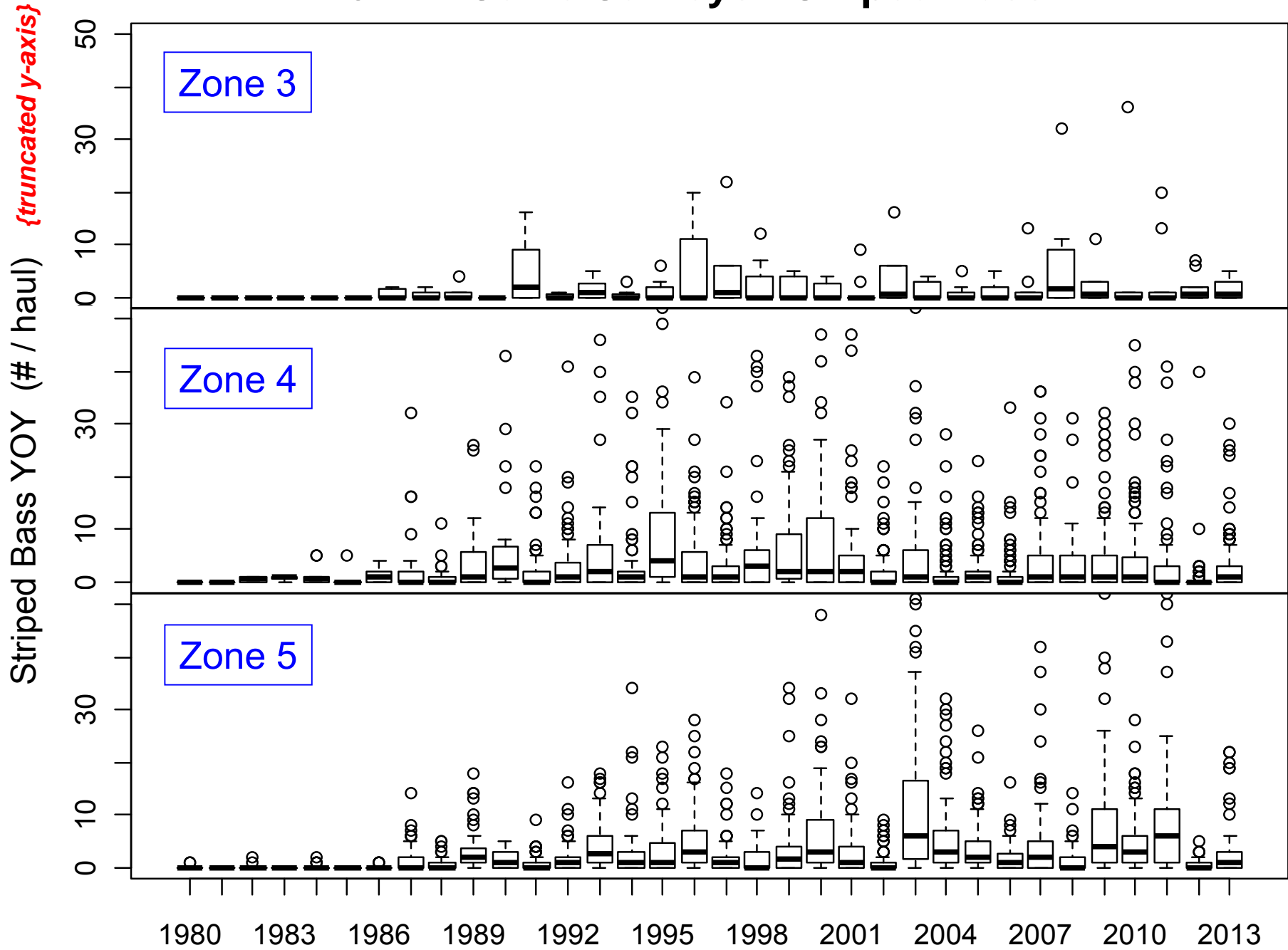
# American Shad Results

## American Shad

1979 Task Force  
PSEG target (12 spp)  
NJ: 10 K/yr and 10/yr groups

				Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
	Common name	Scientific name					
m	American Shad	<i>Alosa sapidissima</i>					
			Zone 3	Y	Y	?	Y
			Zone 4	Y	?	N	Y
			Zone 5 (upper)	Y	N	N	Y
			Zone 5 (lower)	N	N	N	?

# NJDEP Seine Surveys: Striped Bass





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# Striped Bass Results

## Striped Bass

1979 Task Force  
PSEG target (12 spp)  
NJ: 10 K/yr and 10/yr groups

Common name

Scientific name

Any evidence of successful reproduction?

Regular evidence of successful reproduction?

Strong spawning numbers every year?

"Nursery" with juveniles

m			Striped Bass	<i>Morone saxatilis</i>				
					Zone 3	Y	?	N
					Zone 4	Y	Y	?
					Zone 5 (upper)	Y	Y	Y
					Zone 5 (lower)	Y	Y	Y



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# Zone 3 Summary

## Zone 3 (RM 95.0 to RM108.4)

1979 Task Force PSEG target (12 spp) NJ: 10 K/yr and 10/yr groups		Common name	Scientific name	Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
<b>Fishes</b>							
		Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	?	N	N	Y
m		Striped Bass	<i>Morone saxatilis</i>	Y	?	N	Y
f		White Perch	<i>Morone americana</i>	Y	Y	Y	Y
m		Alewife	<i>Alosa pseudoharengus</i>	Y	Y	?	Y
m		Blueback Herring	<i>Alosa aestivalis</i>	Y	?	N	Y
m		American Shad	<i>Alosa sapidissima</i>	Y	Y	?	Y
m		Atlantic Menhaden	<i>Brevoortia tyrannus</i>	?	N	N	?
m		Bay Anchovy	<i>Anchoa mitchilli</i>	?	N	N	Y
m		Atlantic Silverside	<i>Menidia menidia</i>	N	N	N	N
		Hogchoker	<i>Trinectes maculatus</i>	?	?	?	Y
m		Atlantic Croaker	<i>Micropogonias undulatus</i>	?	N	N	N
m		Spot	<i>Leiostomus xanthurus</i>	?	?	?	N
m		Weakfish	<i>Cynoscion regalis</i>	N	N	N	N





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# Zone 4 Summary

## Zone 4 (RM 78.8 to RM95)

1979 Task Force PSEG target (12 spp) NJ: 10 K/yr and 10/yr groups			Common name	Scientific name	Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
			<b>Fishes</b>					
			Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	Y	N	N	Y
m			Striped Bass	<i>Morone saxatilis</i>	Y	Y	?	Y
f			White Perch	<i>Morone americana</i>	Y	Y	Y	Y
m			Alewife	<i>Alosa pseudoharengus</i>	Y	Y	N	Y
m			Blueback Herring	<i>Alosa aestivalis</i>	Y	?	N	Y
m			American Shad	<i>Alosa sapidissima</i>	Y	?	N	Y
m			Atlantic Menhaden	<i>Brevoortia tyrannus</i>	?	N	N	?
m			Bay Anchovy	<i>Anchoa mitchilli</i>	Y	Y	N	Y
m			Atlantic Silverside	<i>Menidia menidia</i>	?	N	N	?
			Hogchoker	<i>Trinectes maculatus</i>	?	?	?	Y
m			Atlantic Croaker	<i>Micropogonias undulatus</i>	?	N	N	Y
m			Spot	<i>Leiostomus xanthurus</i>	?	?	?	?
m			Weakfish	<i>Cynoscion regalis</i>	N	N	N	N



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# Zone 5 (upper) Summary

## Zone 5 upper (RM 70 to RM78.8)

1979 Task Force PSEG target (12 spp) NJ: 10 K/yr and 10/yr groups		Common name	Scientific name	Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
<b>Fishes</b>							
		Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	Y	N	N	Y
m		Striped Bass	<i>Morone saxatilis</i>	Y	Y	Y	Y
f		White Perch	<i>Morone americana</i>	Y	Y	?	Y
m		Alewife	<i>Alosa pseudoharengus</i>	Y	?	N	Y
m		Blueback Herring	<i>Alosa aestivalis</i>	Y	?	N	Y
m		American Shad	<i>Alosa sapidissima</i>	Y	N	N	Y
m		Atlantic Menhaden	<i>Brevoortia tyrannus</i>	Y	N	N	Y
m		Bay Anchovy	<i>Anchoa mitchilli</i>	Y	Y	N	Y
m		Atlantic Silverside	<i>Menidia menidia</i>	?	N	N	?
		Hogchoker	<i>Trinectes maculatus</i>	?	?	?	Y
m		Atlantic Croaker	<i>Micropogonias undulatus</i>	?	N	N	Y
m		Spot	<i>Leiostomus xanthurus</i>	?	?	?	?
m		Weakfish	<i>Cynoscion regalis</i>	?	N	N	N



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# Zone 5 (lower) Summary

## Zone 5 lower (RM 48.2 to RM70)

1979 Task Force PSEG target (12 spp) NJ: 10 K/yr and 10/yr groups			Common name	Scientific name	Any evidence of successful reproduction?	Regular evidence of successful reproduction?	Strong spawning numbers every year?	"Nursery" with juveniles
<b>Fishes</b>								
			Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	?	N	N	Y
m			Striped Bass	<i>Morone saxatilis</i>	Y	Y	Y	Y
f			White Perch	<i>Morone americana</i>	Y	?	N	Y
m			Alewife	<i>Alosa pseudoharengus</i>	N	N	N	Y
m			Blueback Herring	<i>Alosa aestivalis</i>	N	N	N	Y
m			American Shad	<i>Alosa sapidissima</i>	N	N	N	?
m			Atlantic Menhaden	<i>Brevoortia tyrannus</i>	Y	?	N	Y
m			Bay Anchovy	<i>Anchoa mitchilli</i>	Y	Y	N	Y
m			Atlantic Silverside	<i>Menidia menidia</i>	Y	?	N	Y
			Hogchoker	<i>Trinectes maculatus</i>	?	?	?	Y
m			Atlantic Croaker	<i>Micropogonias undulatus</i>	?	N	N	Y
m			Spot	<i>Leiostomus xanthurus</i>	?	?	?	Y
m			Weakfish	<i>Cynoscion regalis</i>	Y	?	N	?



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# Summary of Data Review

- Fish species each have natural spatial distribution for **Spawning** (salinity, habitat) & **Nursery**
- Some strong evidence for successful reproduction in each Zone  
White Perch (3, 4) - Striped Bass (5)
- Some moderate evidence for successful reproduction in each Zone  
American Shad (3) - Alewife (3, 4) - Bay Anchovy (4, 5)
- Evidence for weak reproductive success in each zone  
Atlantic Sturgeon (4) - American Shad (4) - Blueback Herring (3, 4)
- Evidence for **Nursery** in each Zone across most species evaluated





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  - examples
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- Discussion of “Uses”
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- Next Steps



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## Existing Use & Designated Use

- “Existing Use” is the use attained on or after 1975
- “Designated Use” is the goal for the waterbody
- Seek “Existing Use” = “Designated Use”
- “Highest Attainable Use” is proposed (2013) as the use closest to 101(a) that is attainable



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# Designated Aquatic Life Uses

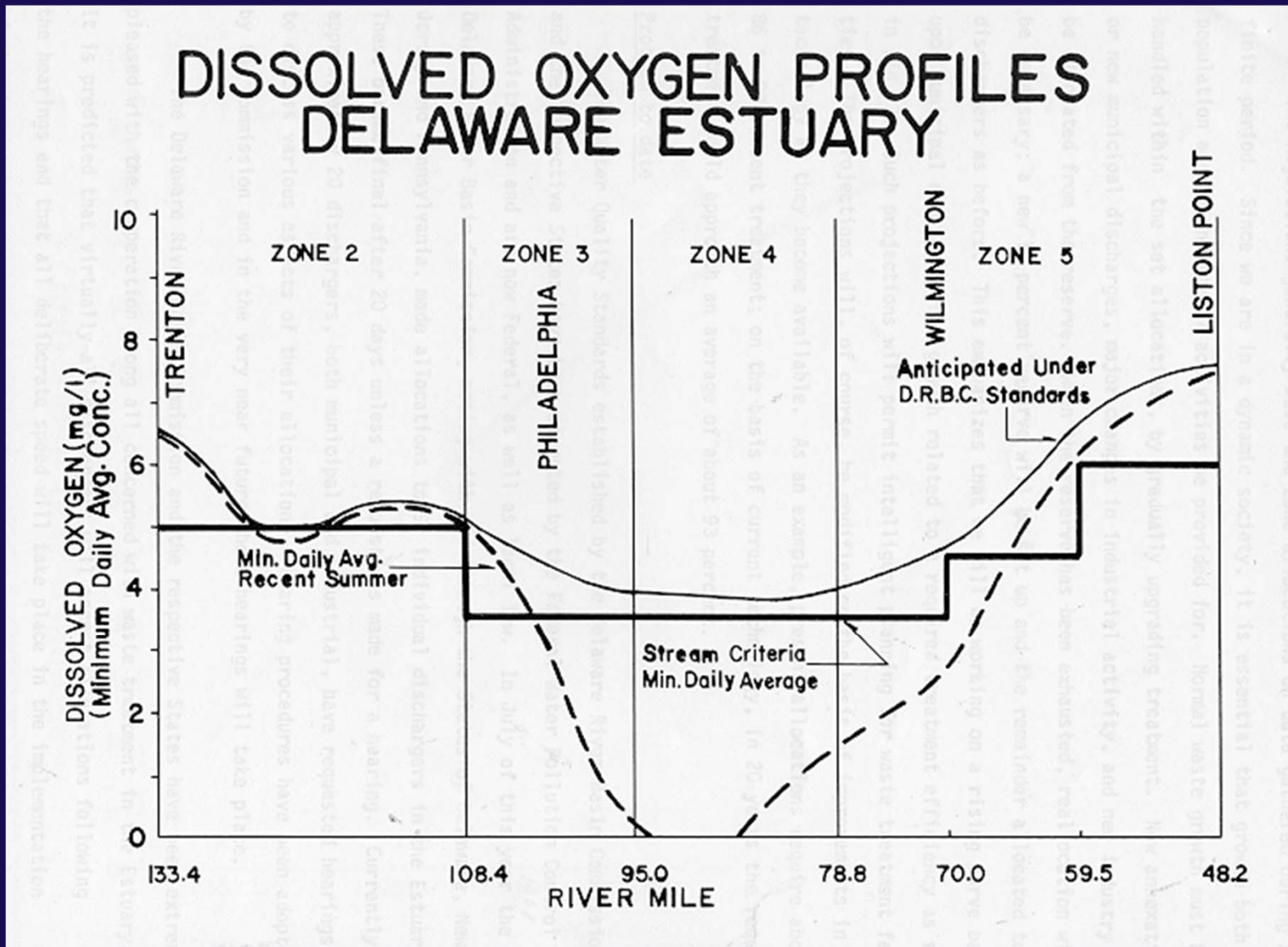
Zone	RM	Aquatic Life	Diadromous Fishes	Wildlife
2	108.4 – 133.4	<b>maintenance</b> and <b>propagation</b> of resident fish and other aquatic life	<b>passage</b> of anadromous fish	wildlife
3	95 – 108.4	<b>maintenance</b> of resident fish and other aquatic life	<b>passage</b> of anadromous fish	wildlife
4	78.8 – 95	<b>maintenance</b> of resident fish and other aquatic life	<b>passage</b> of anadromous fish	wildlife
5	70 – 78.8	<b>maintenance</b> of resident fish and other aquatic life	<b>passage</b> of anadromous fish	wildlife
	48.2 – 70	<b>maintenance</b> and <b>propagation</b> of resident fish and other aquatic life	<b>passage</b> of anadromous fish	wildlife
6	0 – 48.2	<b>maintenance</b> and <b>propagation</b> of resident fish and other aquatic life <b>maintenance</b> and <b>propagation</b> of shellfish	<b>passage</b> of anadromous fish	wildlife



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# Uses & Historical Context

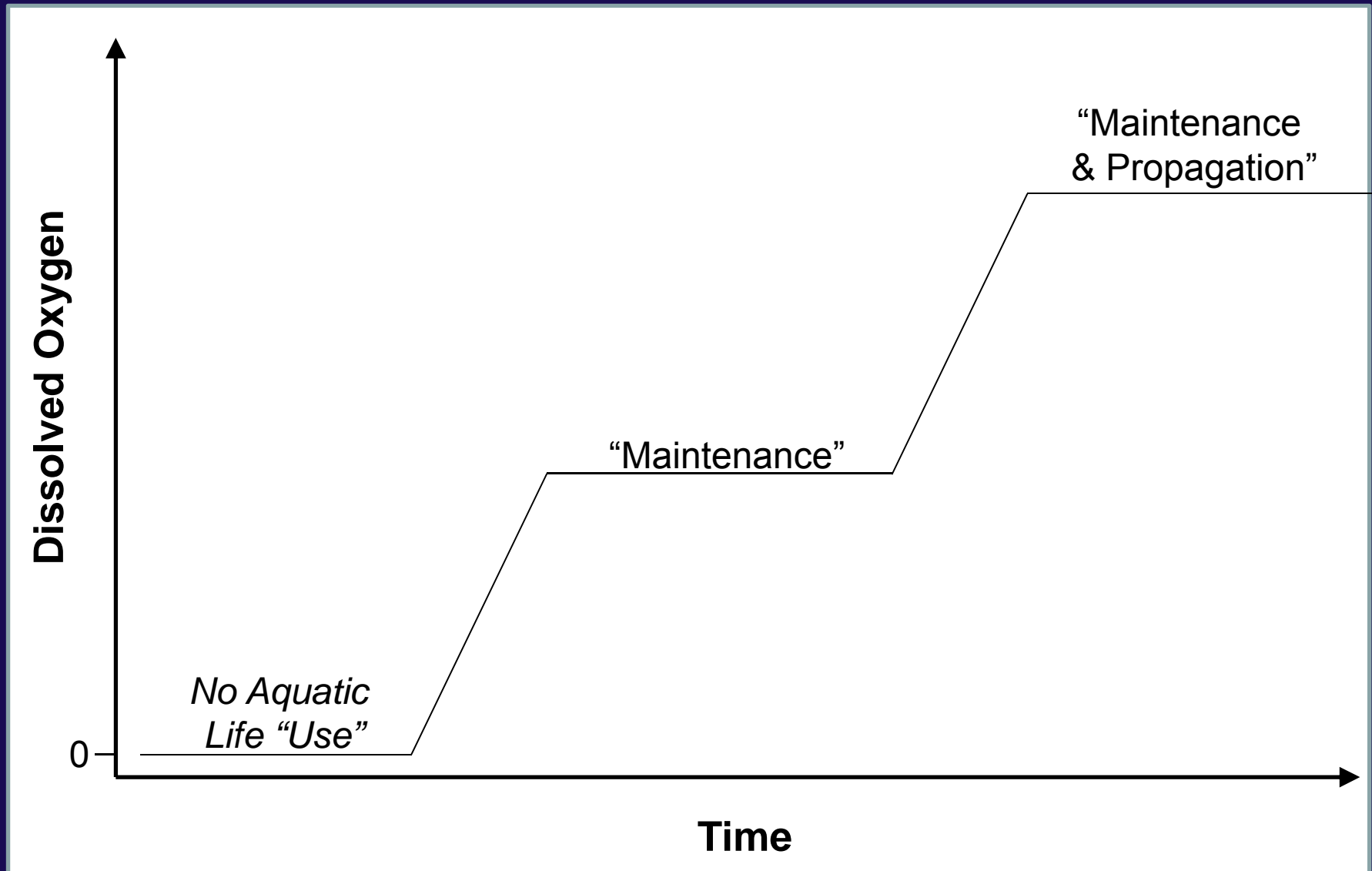




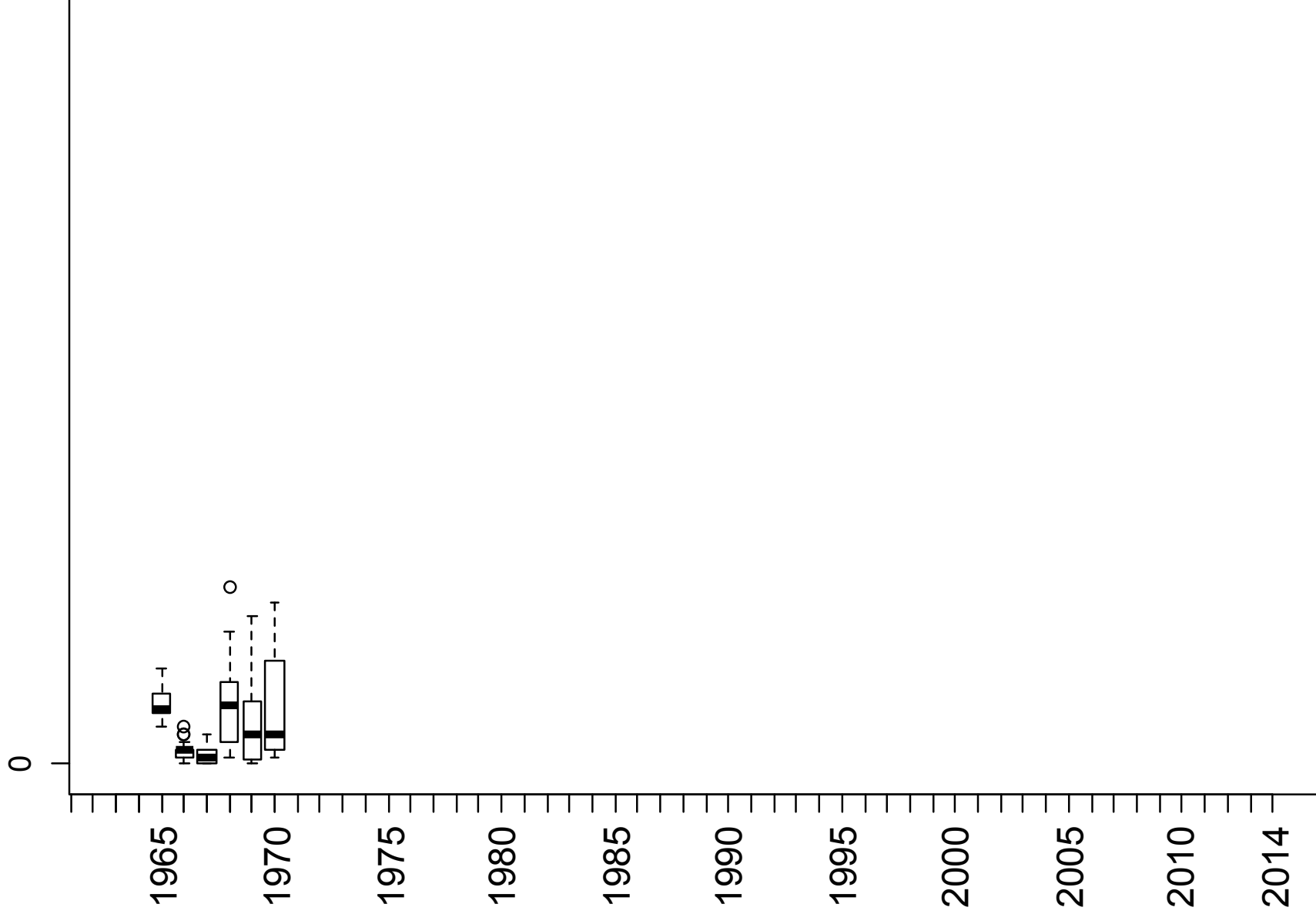
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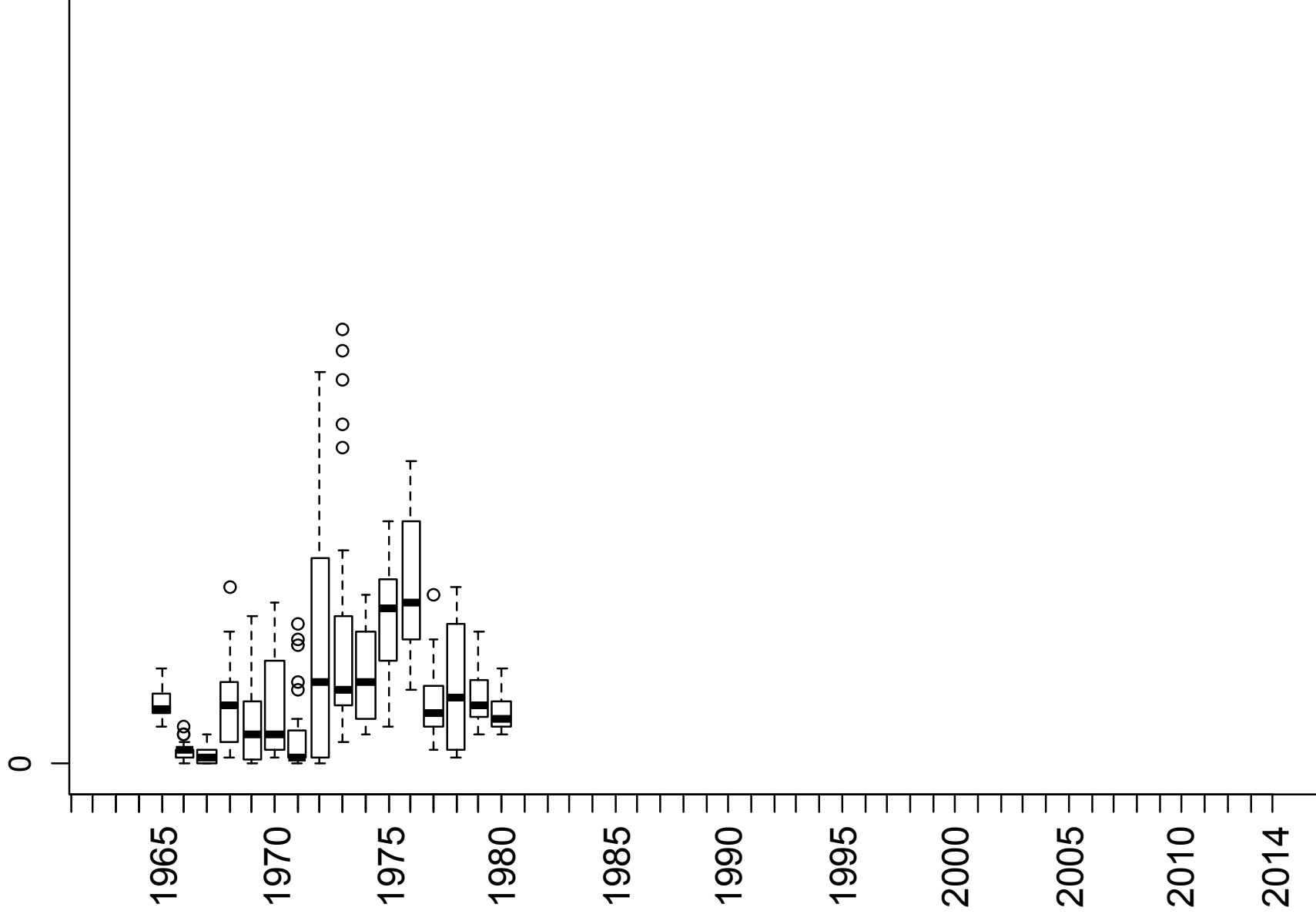
# Delaware Estuary Use Trajectory



# Dissolved Oxygen

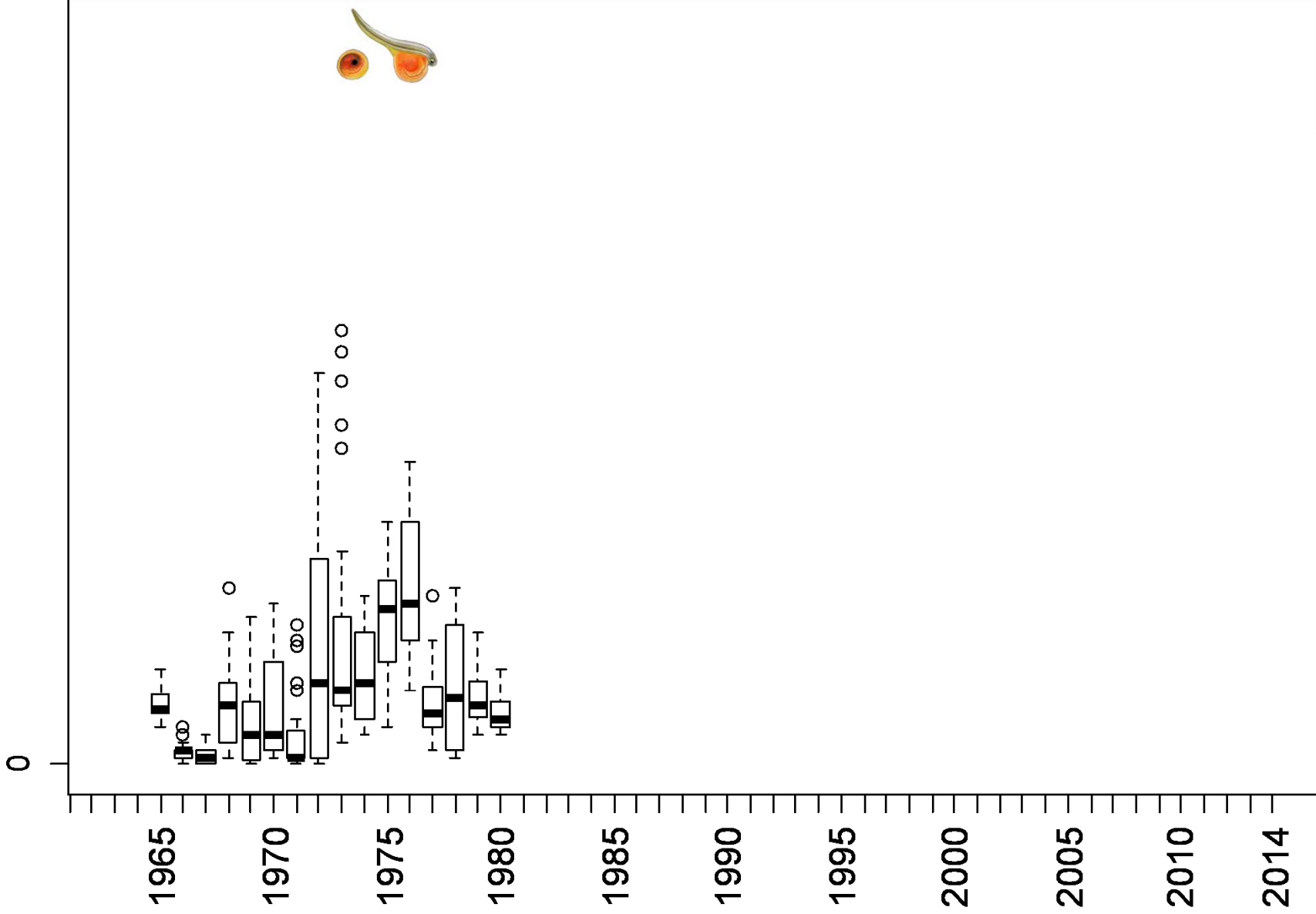


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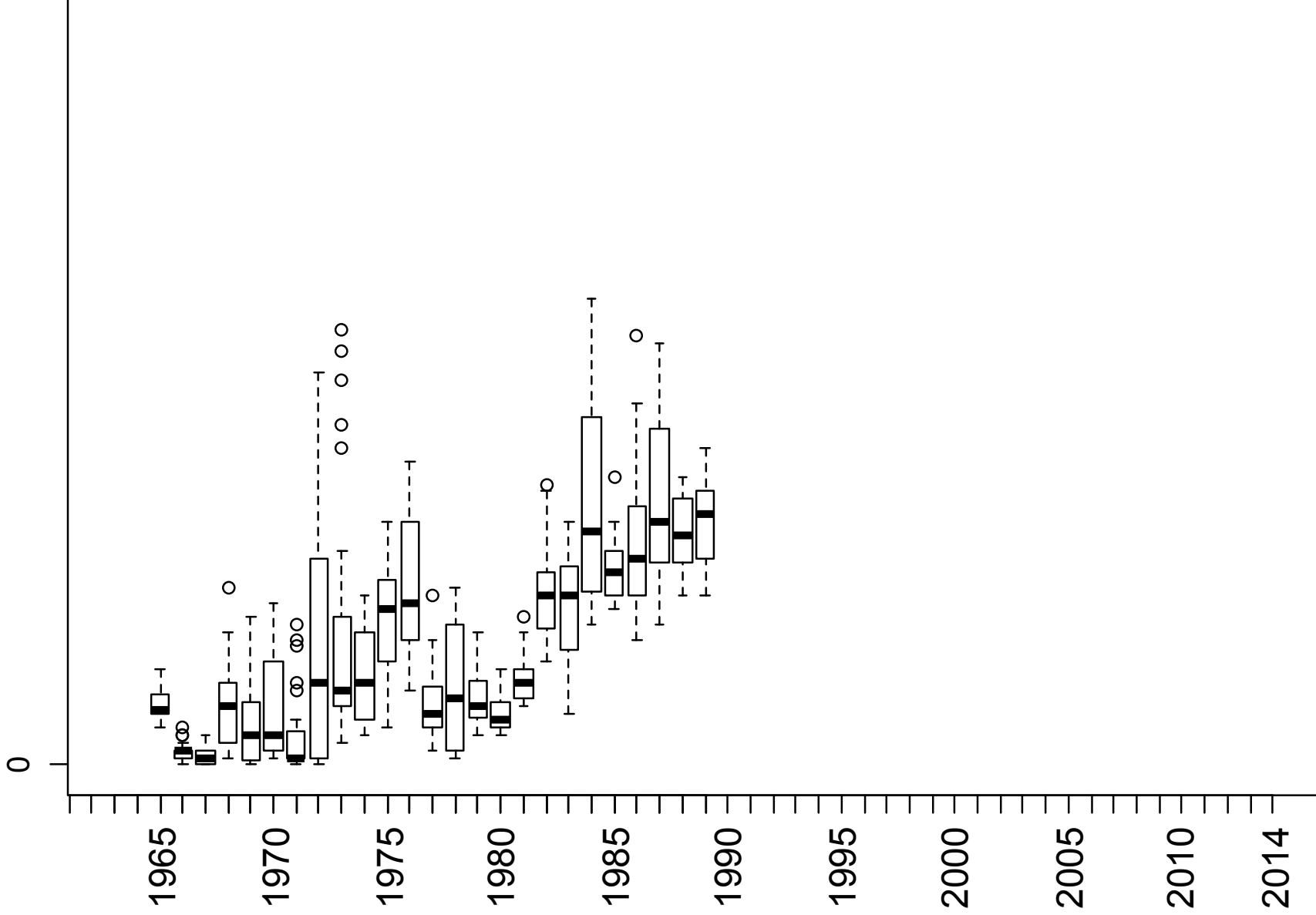




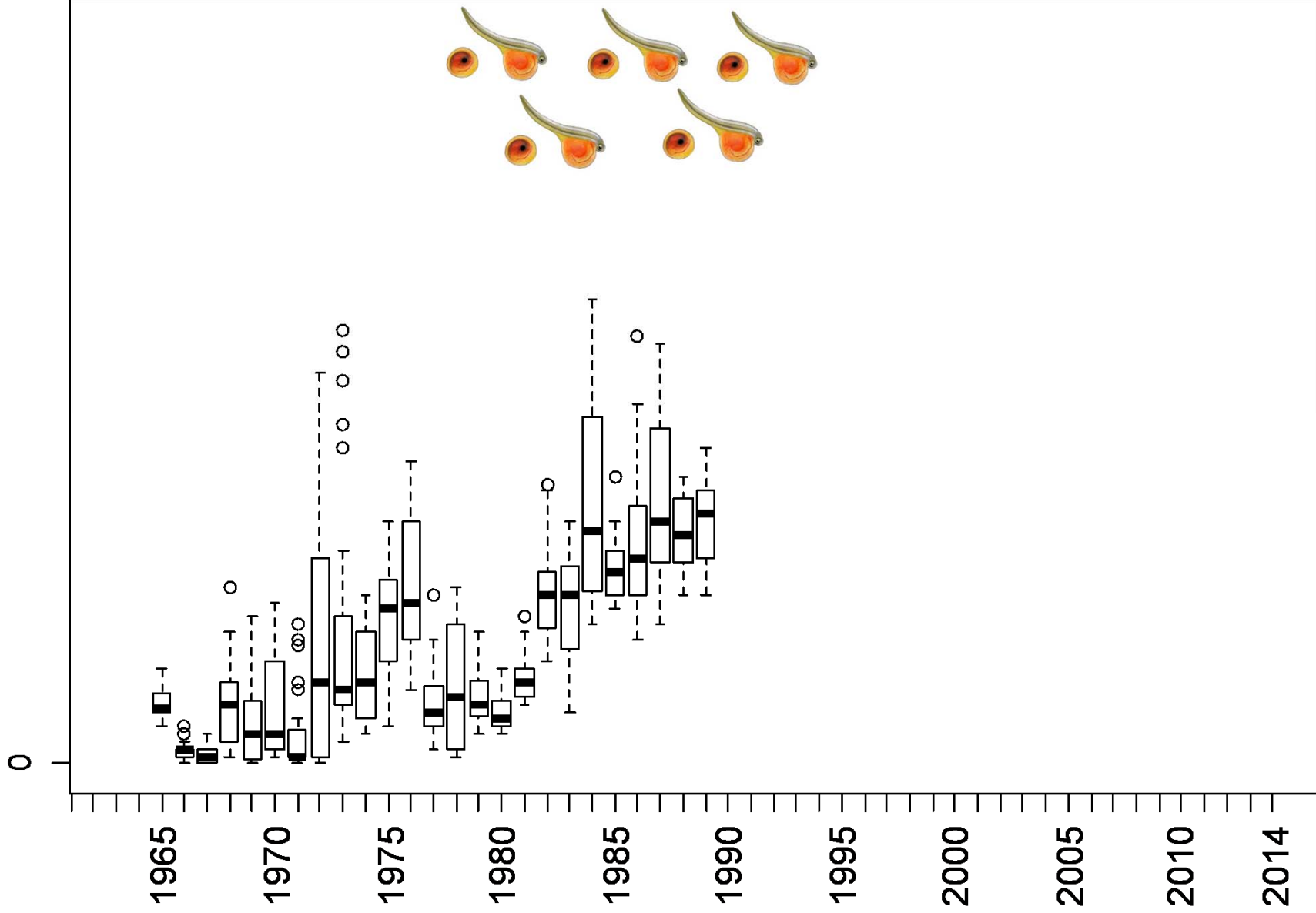
# Dissolved Oxygen



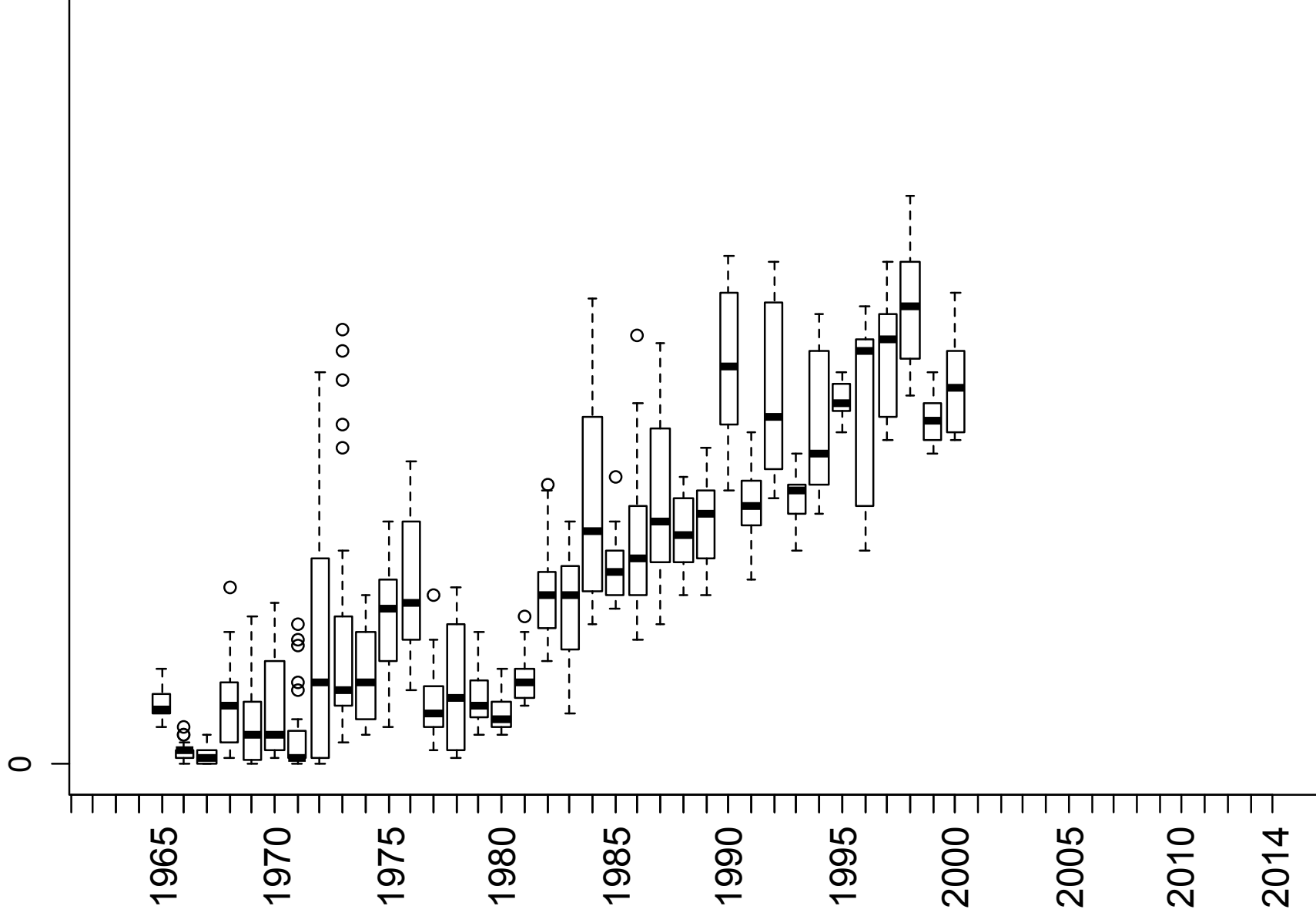
# Dissolved Oxygen



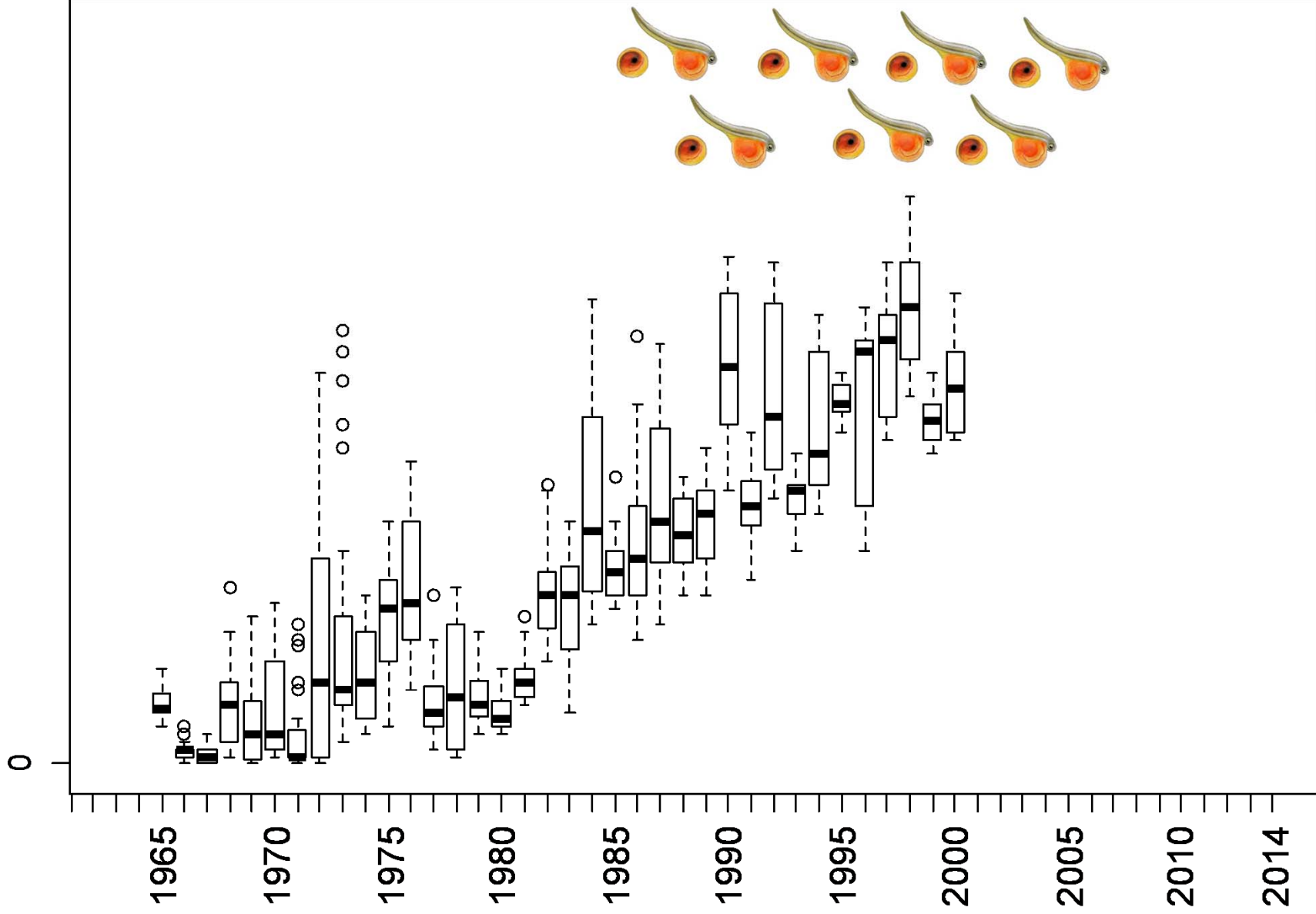
# Dissolved Oxygen



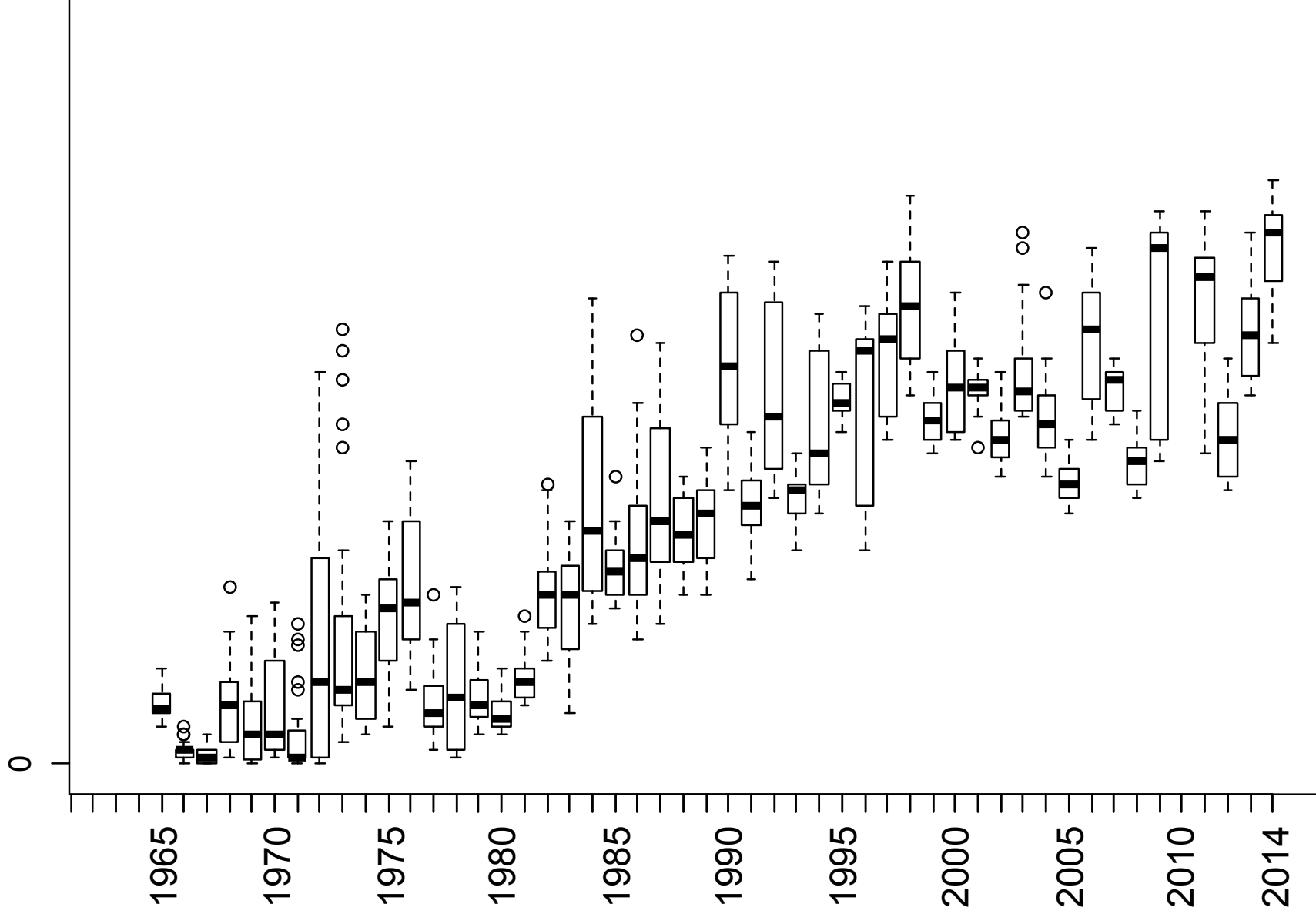
# Dissolved Oxygen



# Dissolved Oxygen



# Dissolved Oxygen

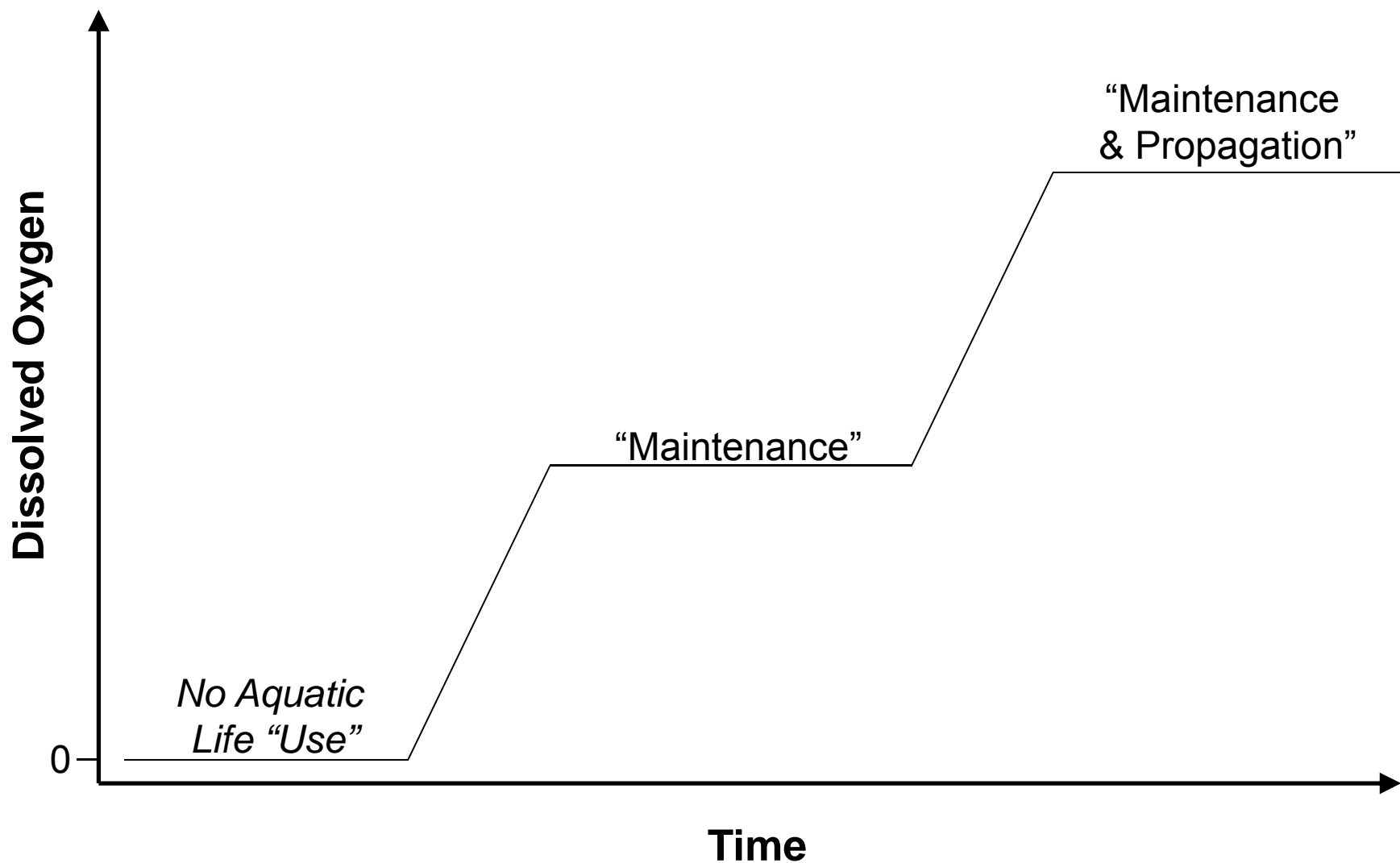




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# Recognize Gradient & Continuum



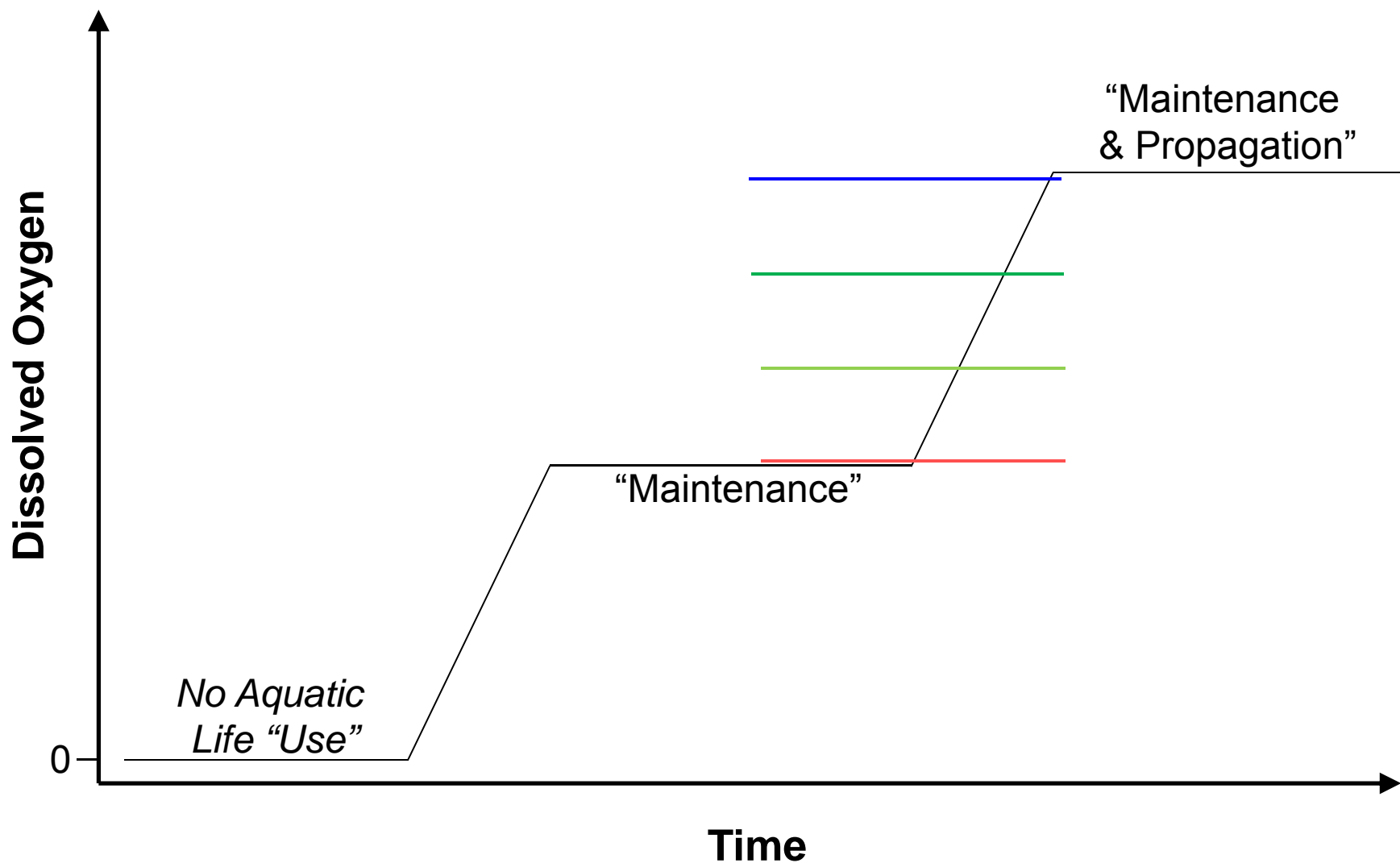




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# Recognize Gradient & Continuum

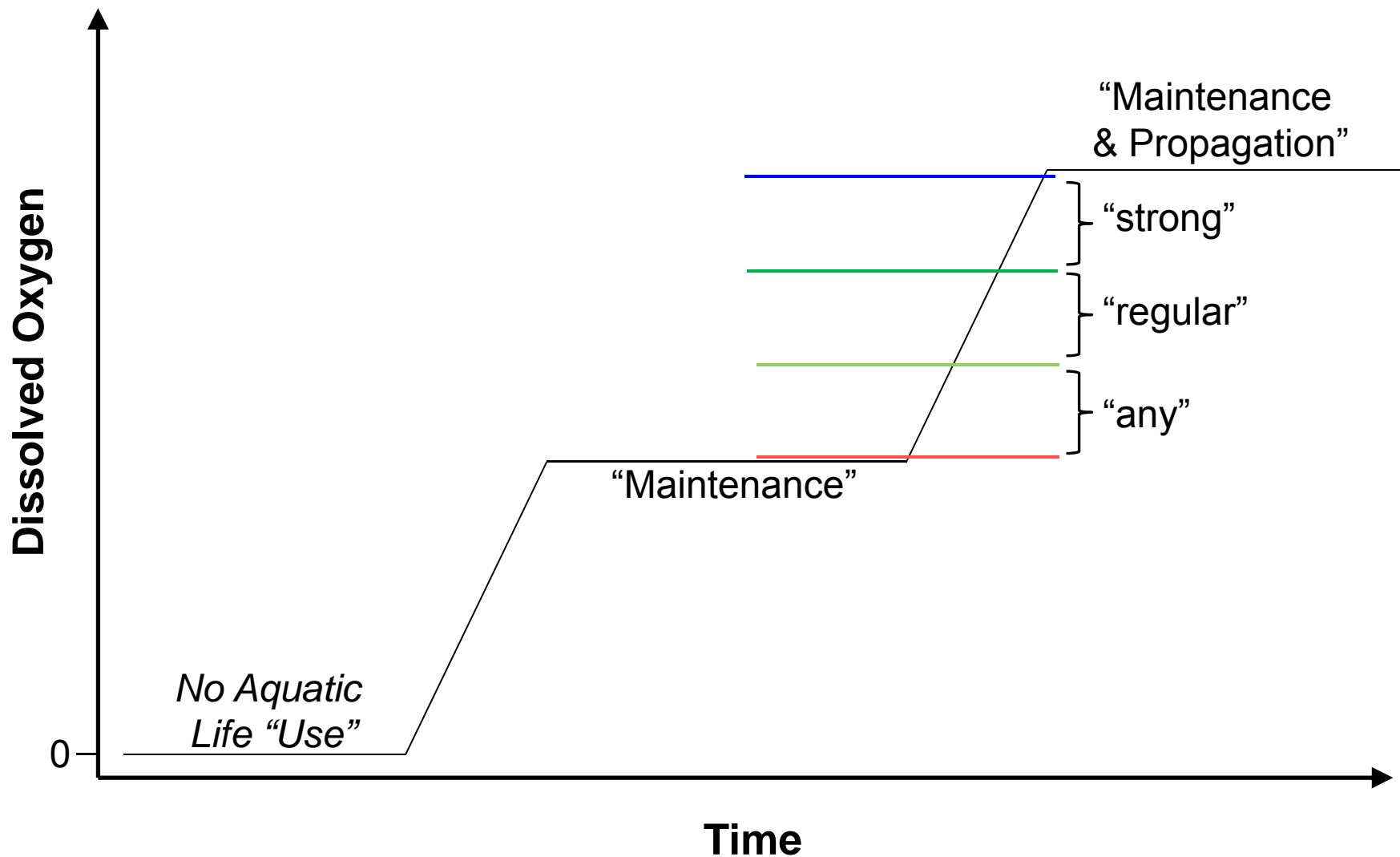




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# Map Gradient to Fish Summary

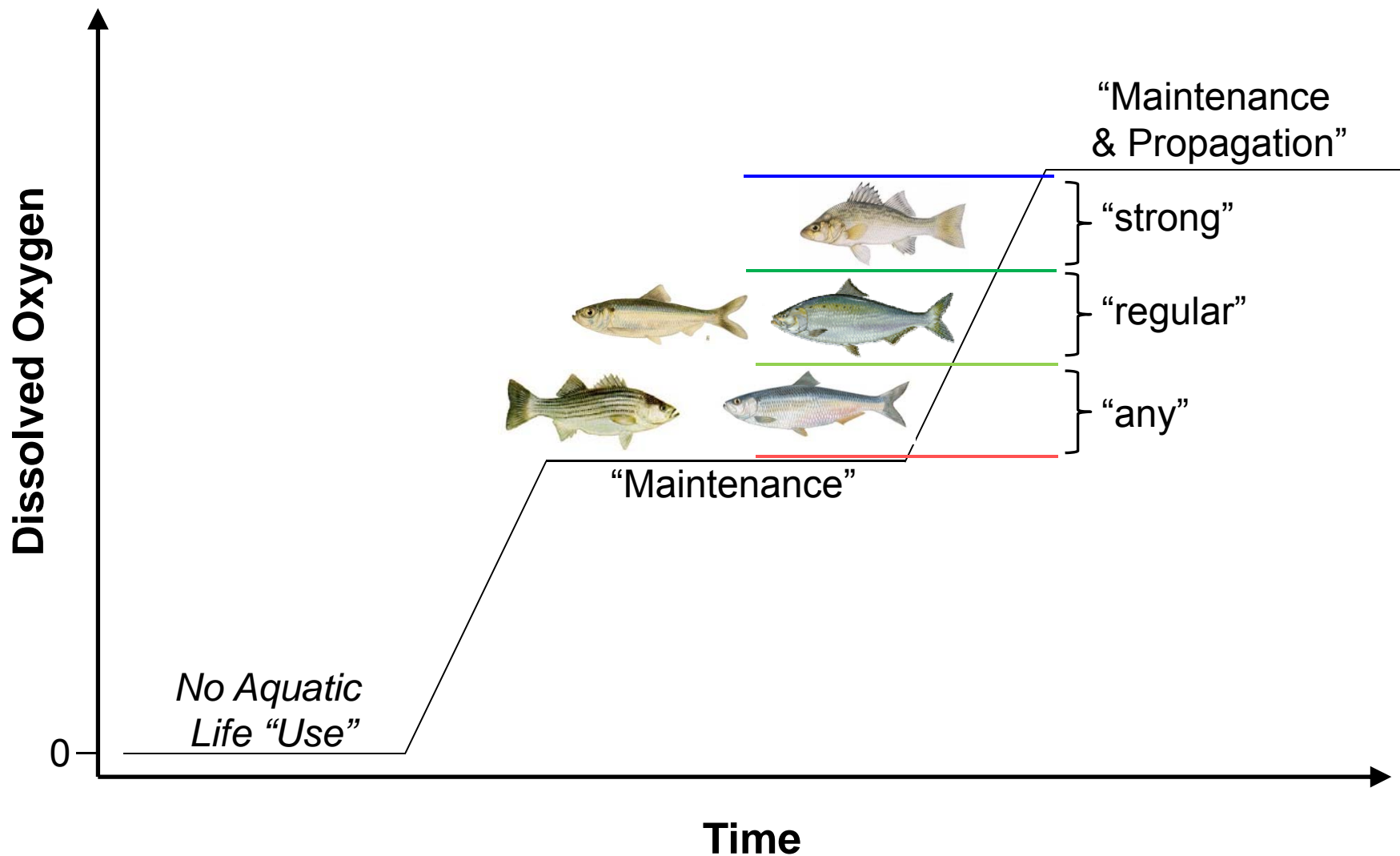




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# Map Gradient: Zone 3

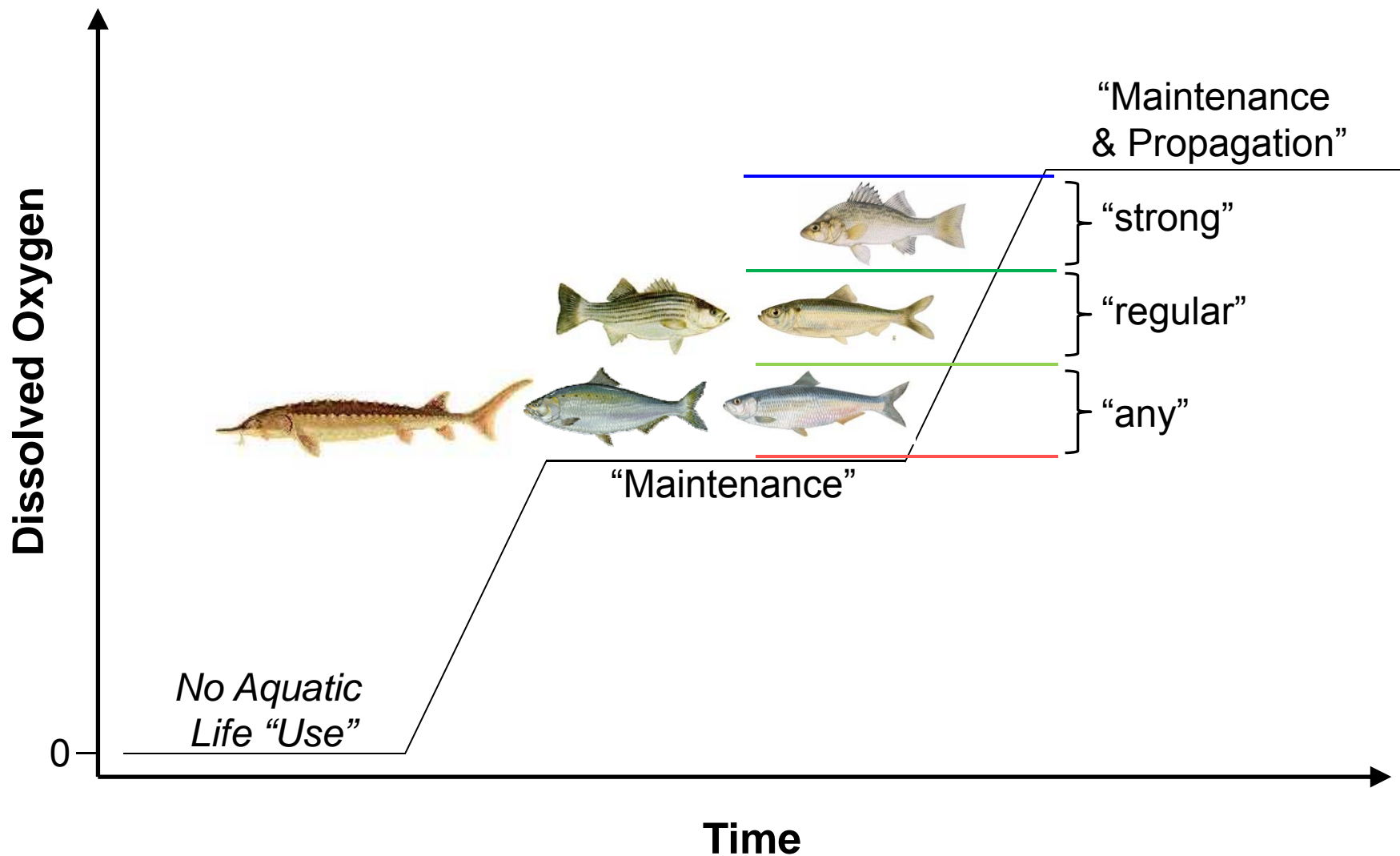




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# Map Gradient: Zone 4

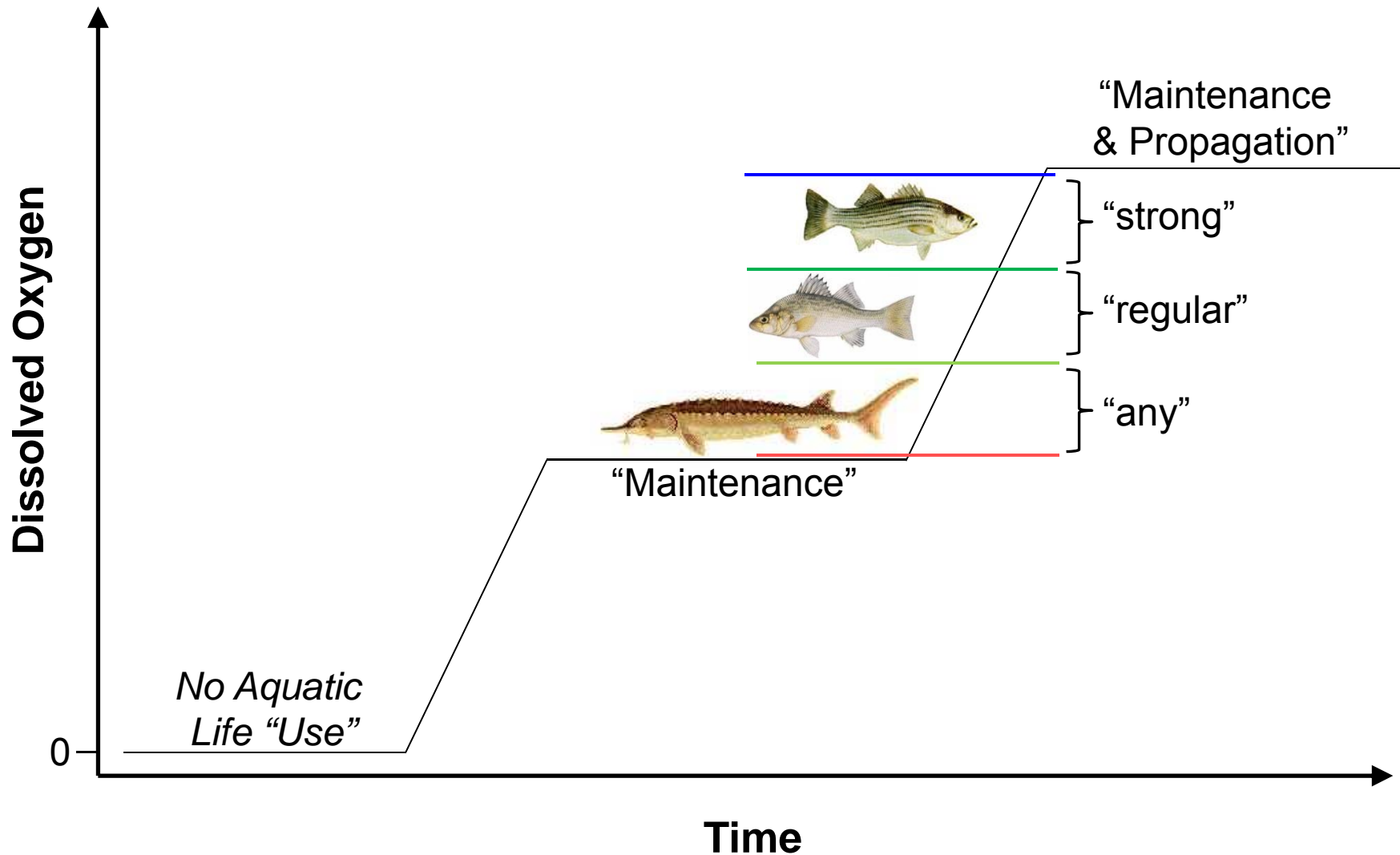




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# Map Gradient: Zone 5 (upper)

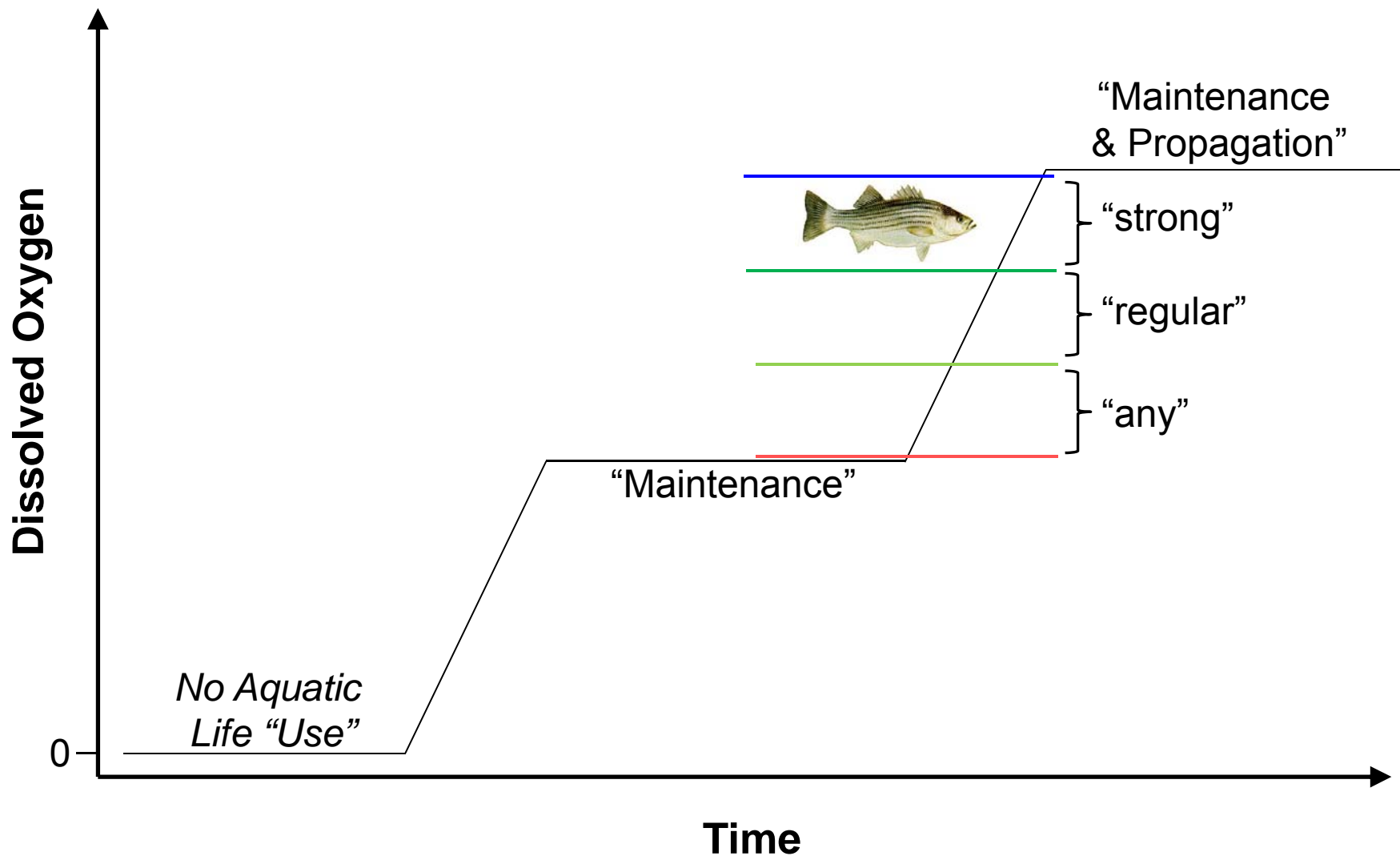




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# Map Gradient: Zone 5 (lower)

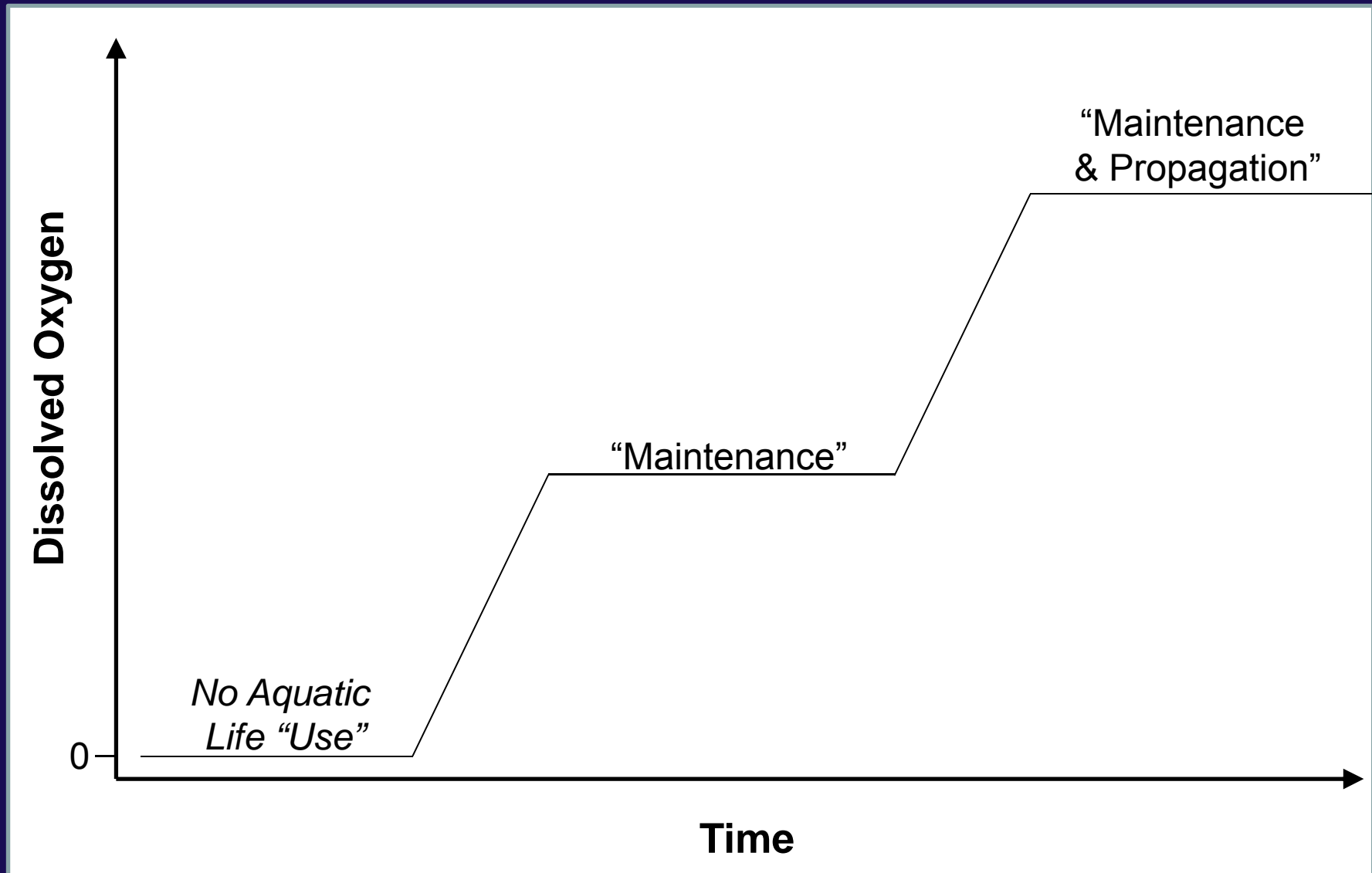




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# Delaware Estuary Use Trajectory







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## Existing Use & Designated Use

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- Seek “Existing Use” = “Designated Use”
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Complex & Subtle



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## Recommended Next Steps

1. DRBC consult with Fish Coop on data review
2. Committee members review internally
3. Schedule WQAC meeting ~ 4 months from now to discuss data review and “Existing Use”