Delaware River Basin Commission

Analysis of Attainability Part 2
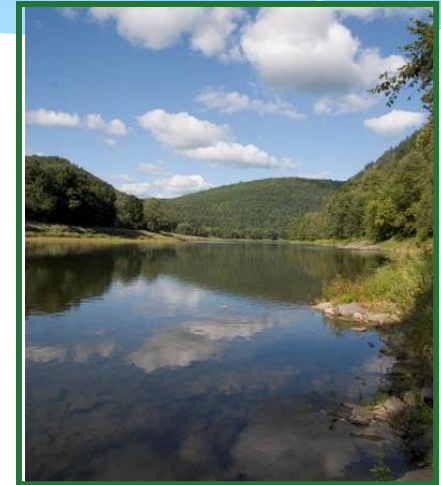
Linking Aquatic Life Uses With Dissolved Oxygen Condition in the Delaware River Estuary

Jake Bransky

Aquatic Biologist

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Delaware Estuary Science and Environmental Summit

60 years
1961–2021

Delaware River Basin Commission
DELAWARE • NEW JERSEY
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Objective

- Discuss our approach for comparing dissolved oxygen (DO) conditions to various degrees of propagation for sensitive species by season and zone throughout the estuary

- Introduce a tool that will allow us to evaluate various DO scenarios associated with model output

- *This is a work in progress*
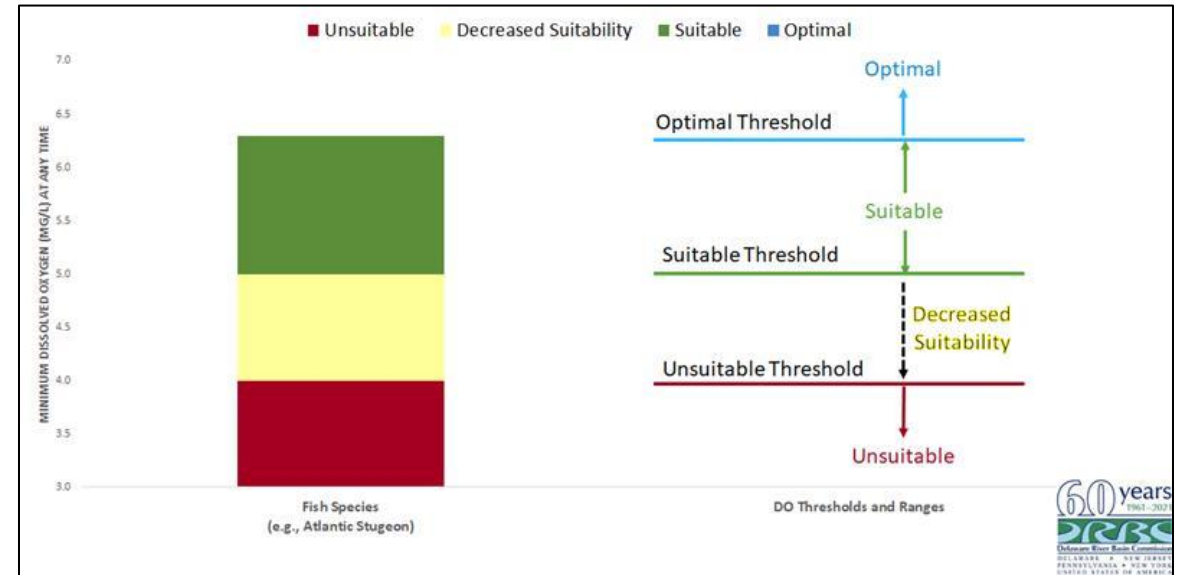
Steps

- Compile dissolved oxygen requirements of sensitive species
- Determine sensitive species distribution
- Characterize the dissolved oxygen conditions

_____

- Develop a graphical tool to help evaluate use attainability

Literature Review

A Review of Dissolved Oxygen Requirements
for Key Sensitive Species in the Delaware Estuary

Final Report

Submitted to

The Delaware River Basin Commission

By

Allison M. Stoklosa, David H. Keller, Raffaela Marano, and
Richard J. Horwitz

The Patrick Center for Environmental Research
Academy of Natural Sciences of Drexel University

November 2018

- Performed by the Academy of Natural Sciences in 2018
- Highlighted species that exhibit negative effects when exposed to DO conditions above the current criteria
  - Atlantic sturgeon, shortnose sturgeon, American shad, channel catfish, striped bass, yellow perch, white perch, summer flounder, and bluefish
- Includes information on both lethal and non-lethal dissolved oxygen levels

Translation of Literature Review Values

- DO values from the literature take a variety of forms
- DRBC needed to:
  - 1) Review the sources to make sure they are of consistent integrity
  - 2) Bin the values into meaningful categories
    - Optimal
    - Suitable
    - Non-suitable
- Input from fisheries professionals

Species	Lifestage	DO	Threshold	Source	Notes
Atlantic sturgeon	Juvenile	6.3	Optimal	Niklitschek and Secor 2009	optimal for survival, low mortality, and growth
Atlantic sturgeon	Juvenile	5	Suitable	Secor and Niklitschek 2001	a 60% saturation level, or 5 mg/L @ 25 C was determined to protect sturgeon from nonlethal effects
Atlantic sturgeon	Juvenile	4	Non-suitable	Secor and Niklitschek 2001	mortality occurred at 3.3 mg/l under summer temps

Sensitive Species Distribution

**Delaware Estuary Water Quality Zones**
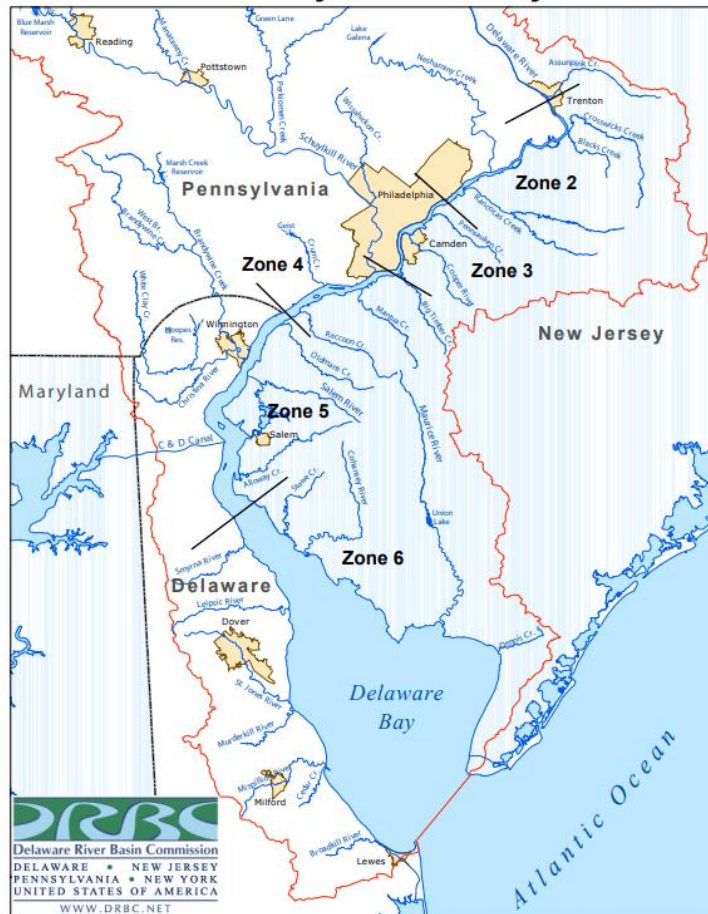
- DRBC has compiled distribution data for sensitive species
- Sources include:
  - Academy report
  - PSEG ichthyoplankton study
  - Other literature review
  - Input from fisheries professionals
- Presence/absence determined for various lifestages of sensitive species in each DRBC estuary water quality zone

Summertime Sensitive Species Distribution

	Atlantic sturgeon	Striped bass	White perch	American shad	Channel catfish	Largemouth bass	Shortnose sturgeon	Yellow perch
Zone 2								
Zone 3			All Lifestages Present					
Zone 4								
Zone 5			Juveniles and Adults Present					
Zone 6					Not Present			

Evaluation Tool

Degree of Suitability for Fish Propagation
Zone 2 Fall
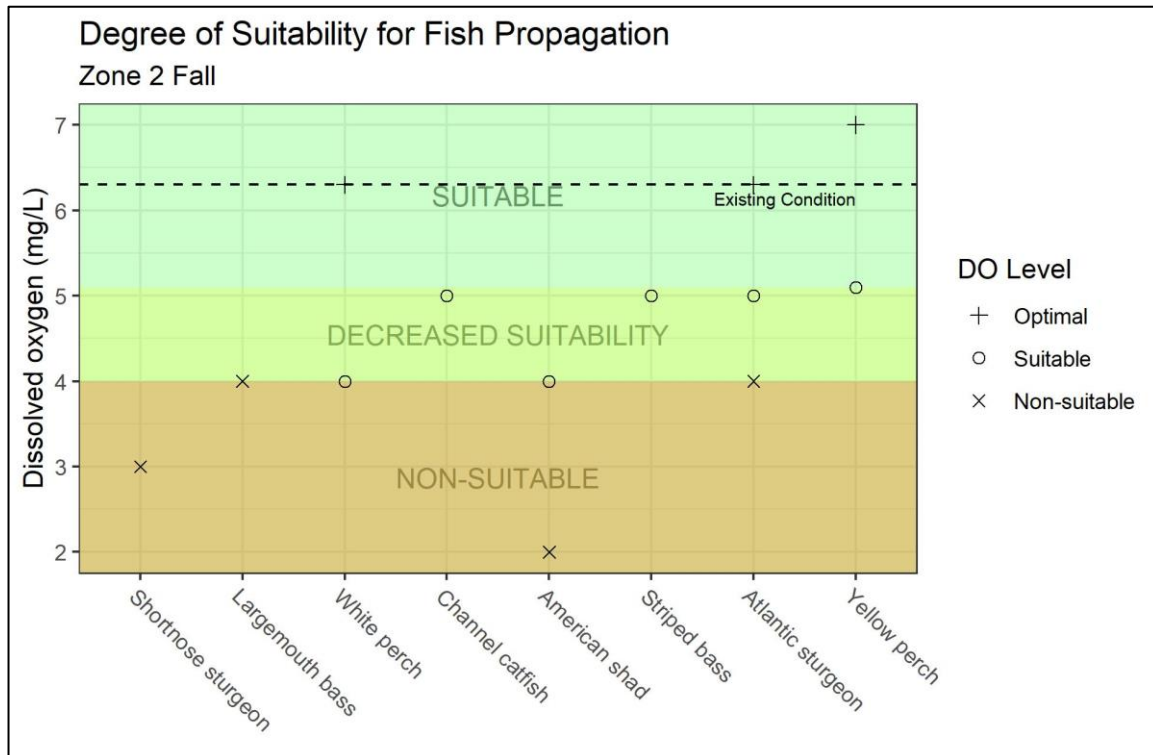
- Combine DO requirements and species distribution data to evaluate dissolved oxygen condition produced by model runs
- Points represent literature DO values
- Colored by suitability
  - Green is suitable for all species
  - Yellow is some level of decreased suitability
  - Orange is non suitable for at least one species
- Charts produced for unique species/lifestage/season/zone combos
- Existing condition
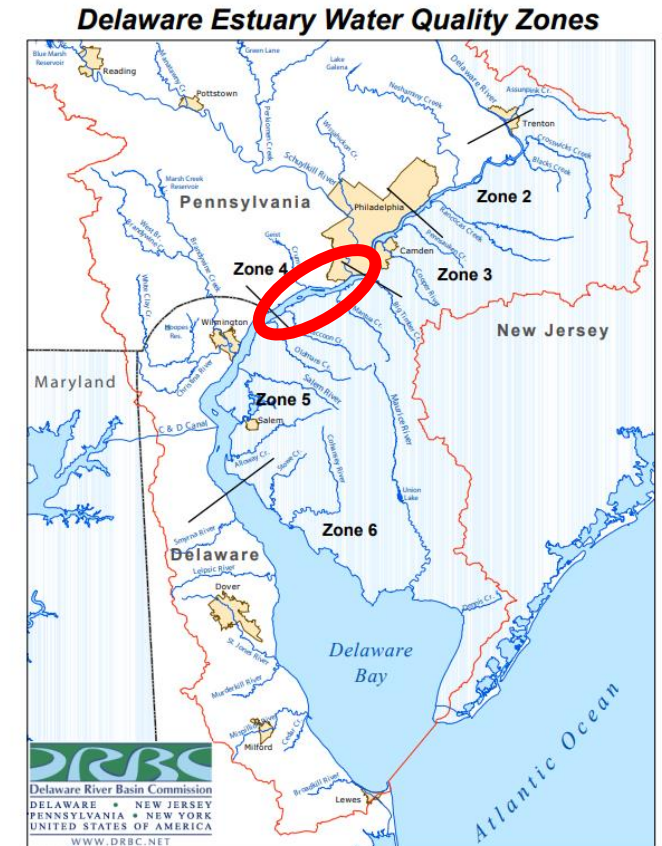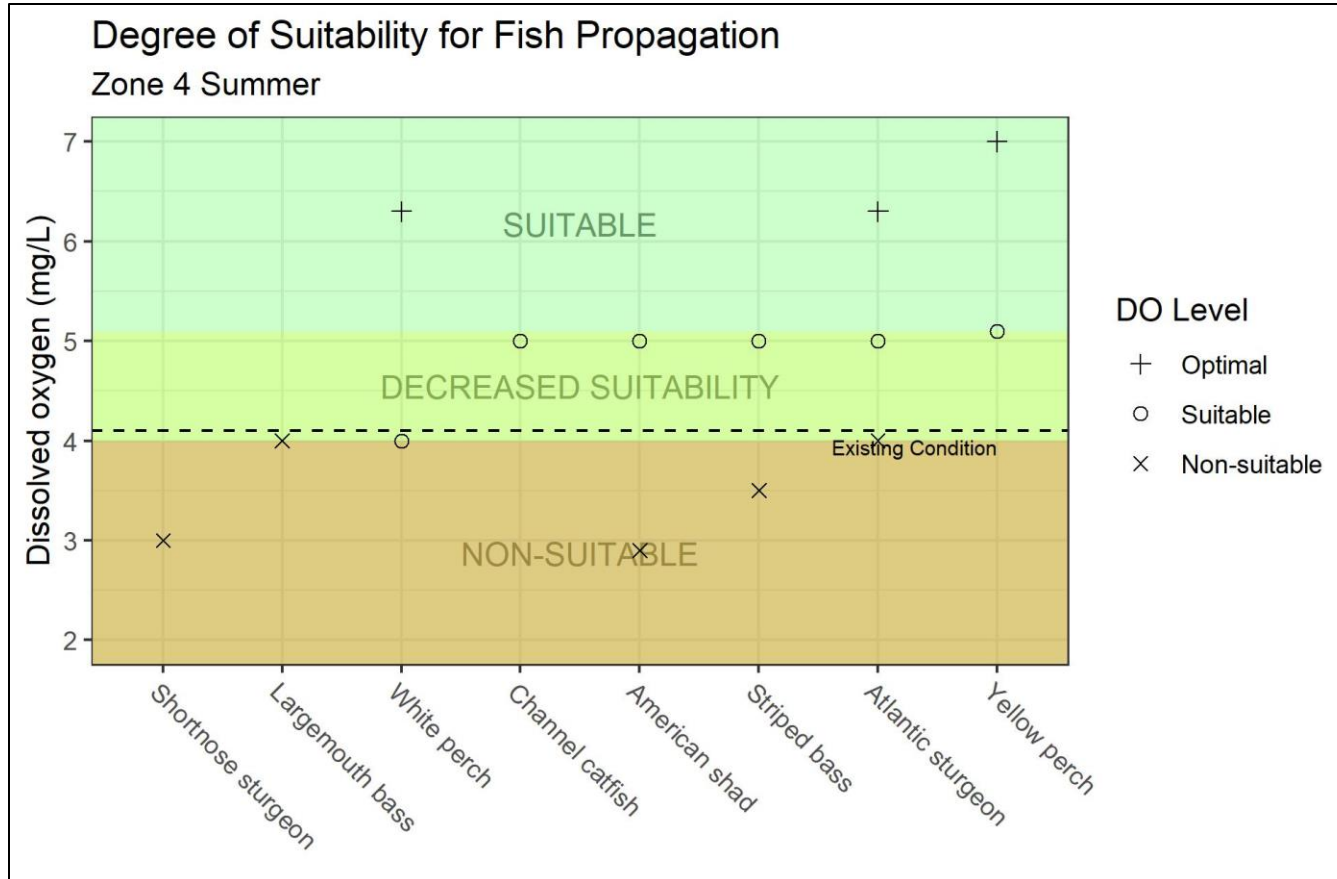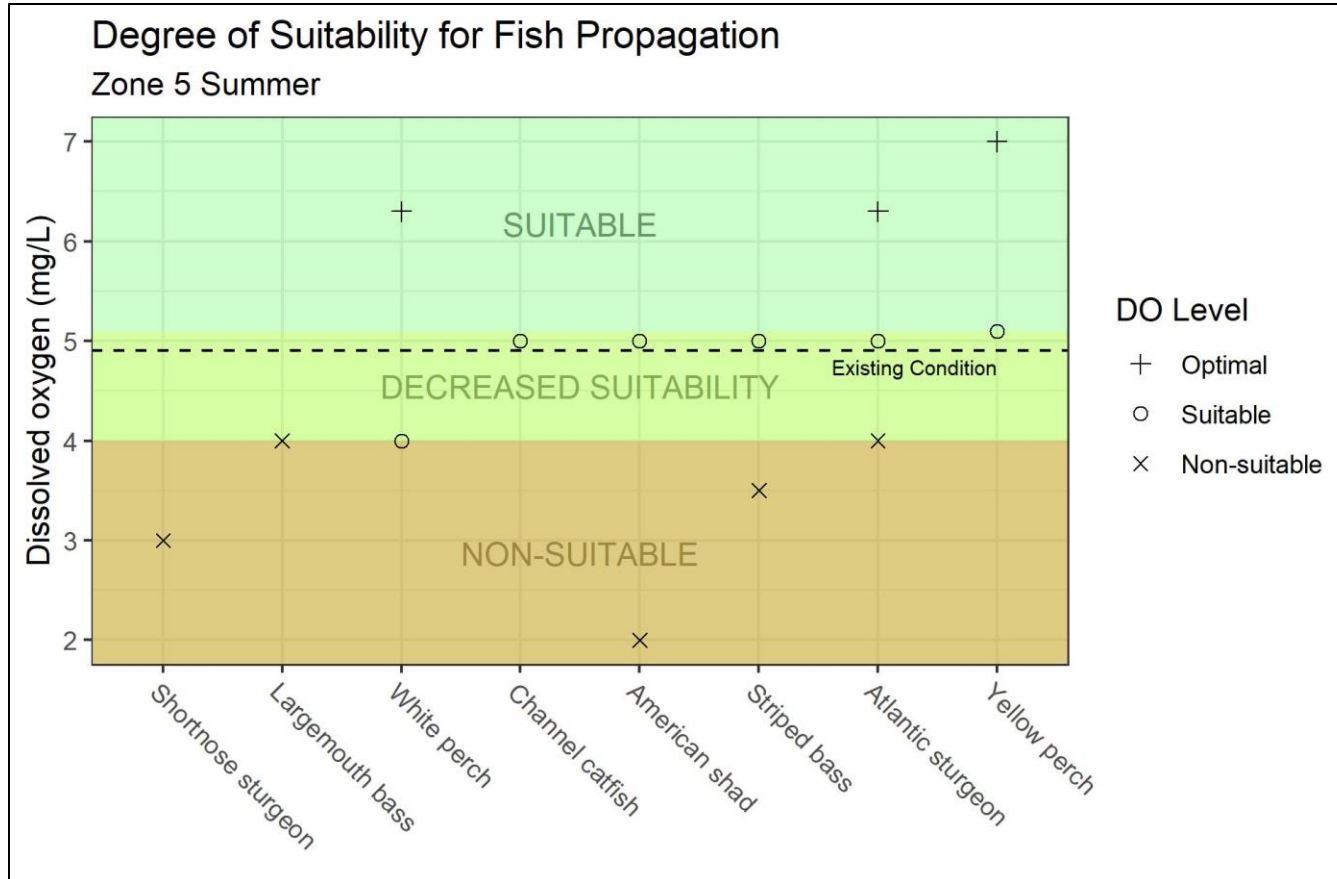 - Determined from 1st percentile DO value and USGS gages in each zone

Summer– Zone 2

Degree of Suitability for Fish Propagation — Zone 2 Summer

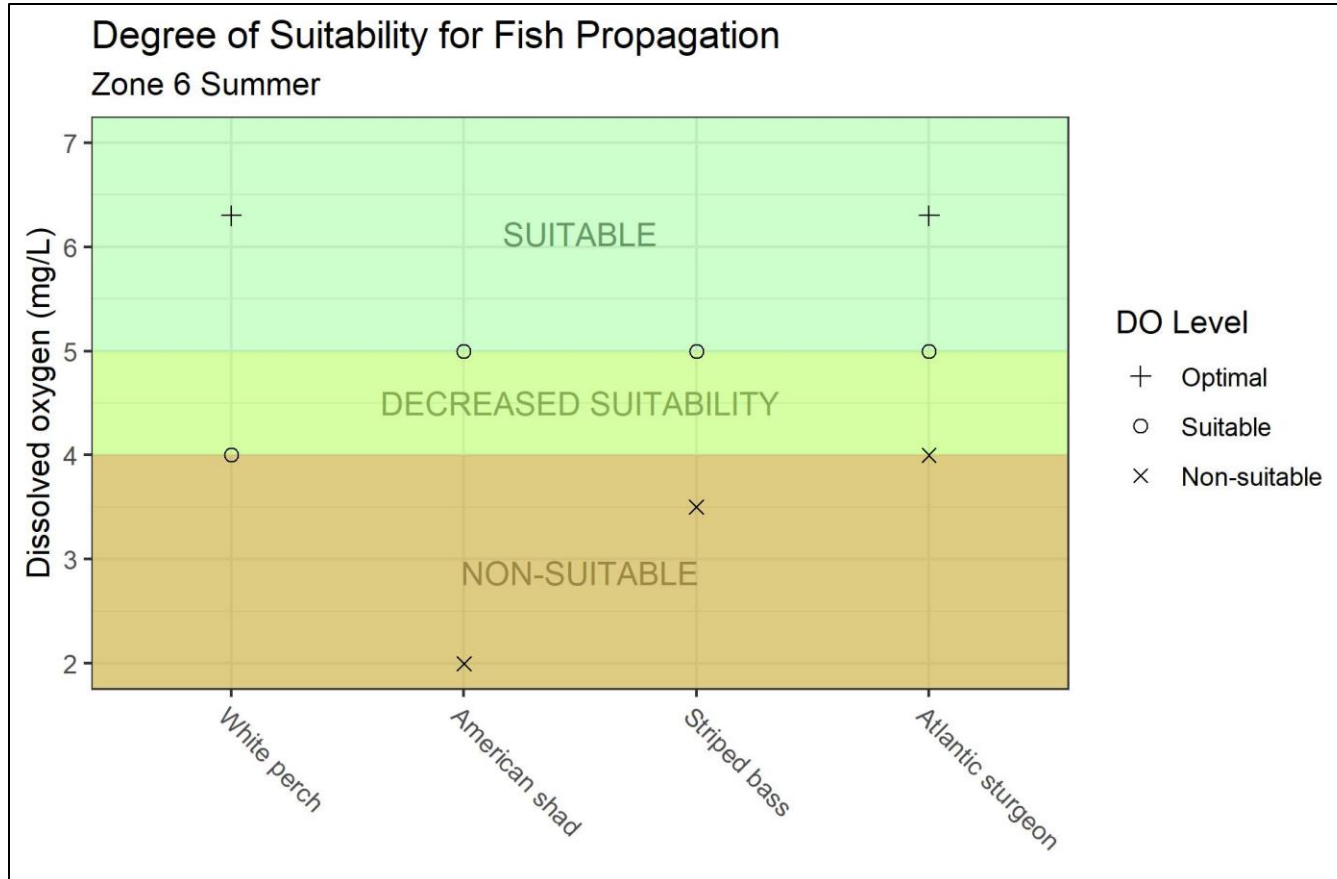Delaware Estuary Water Quality Zones
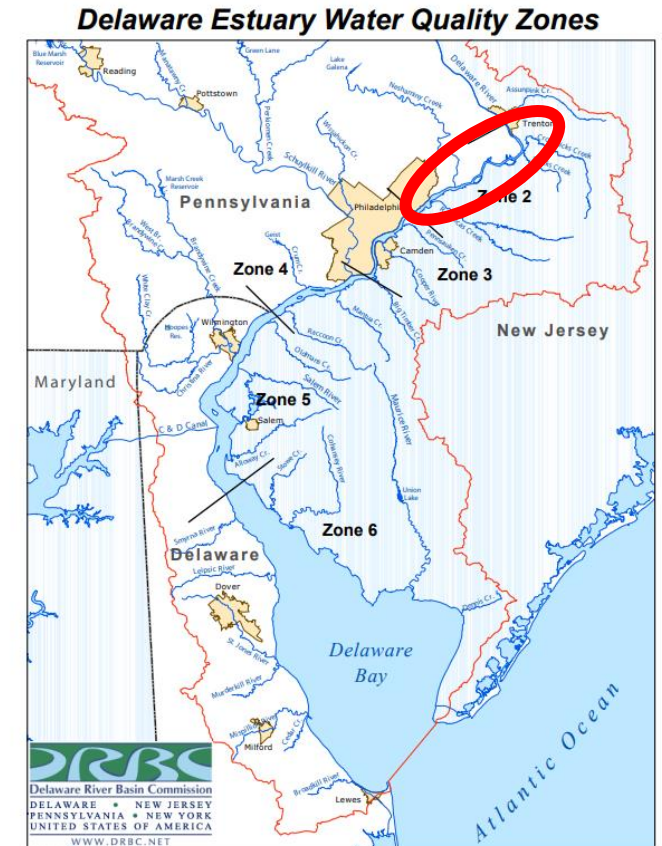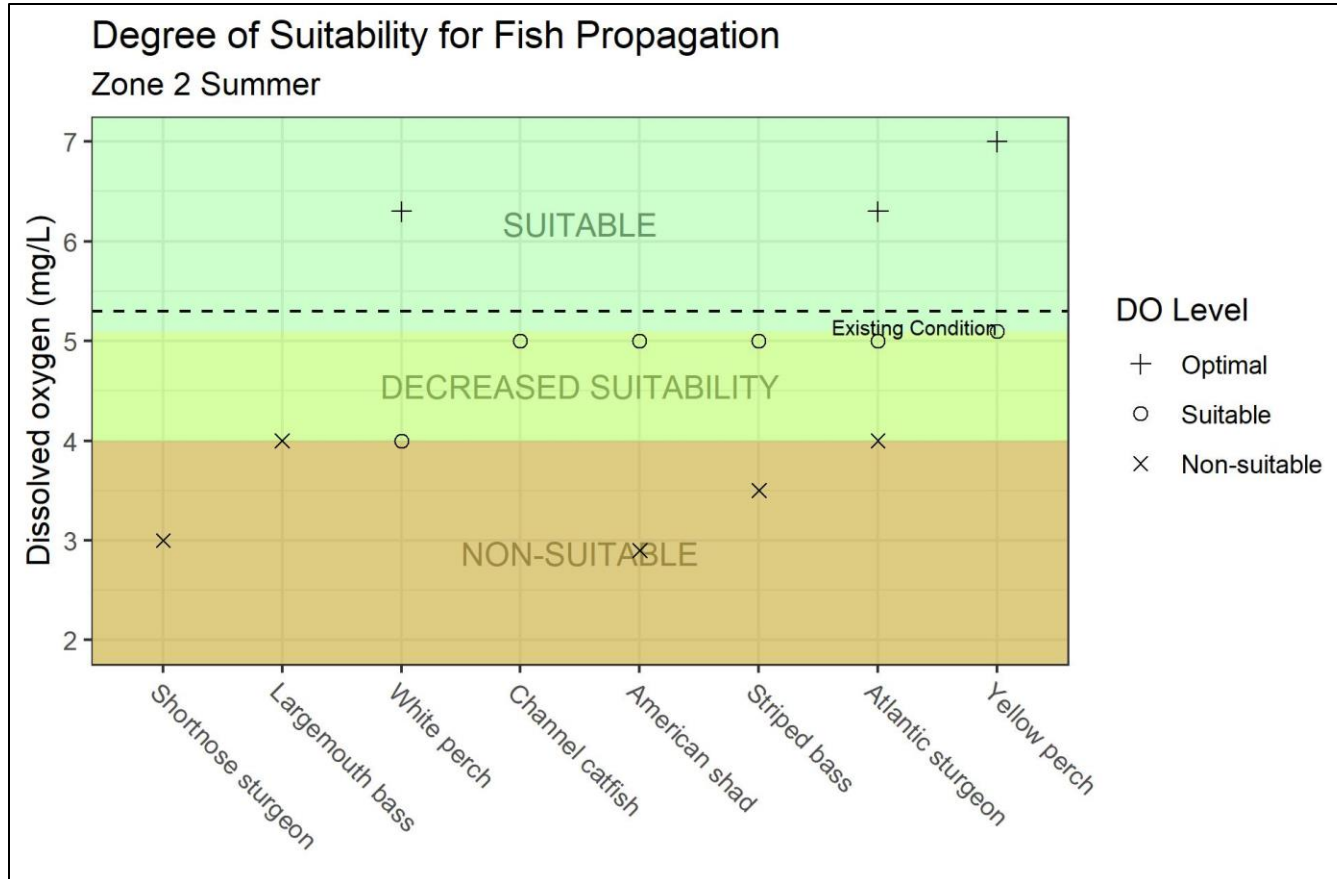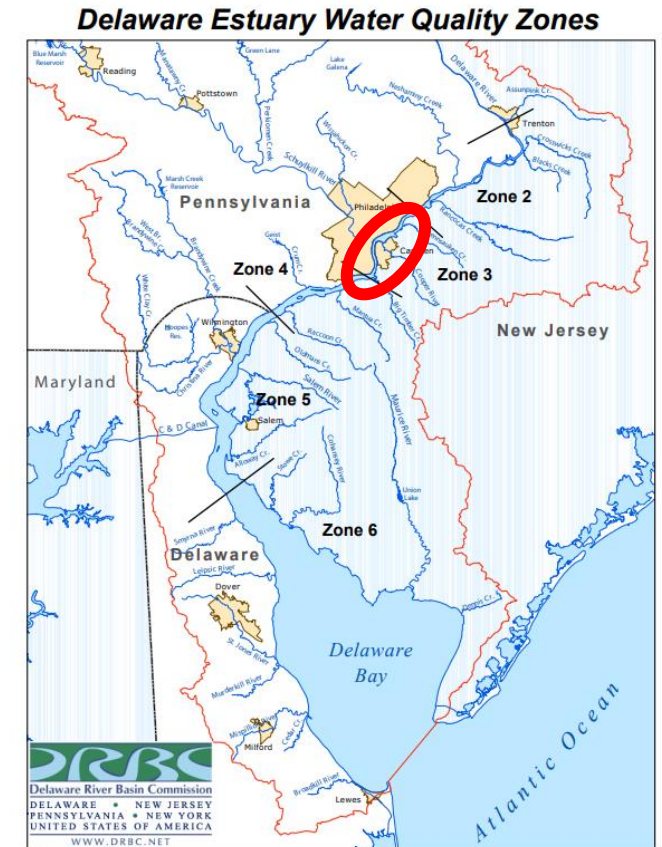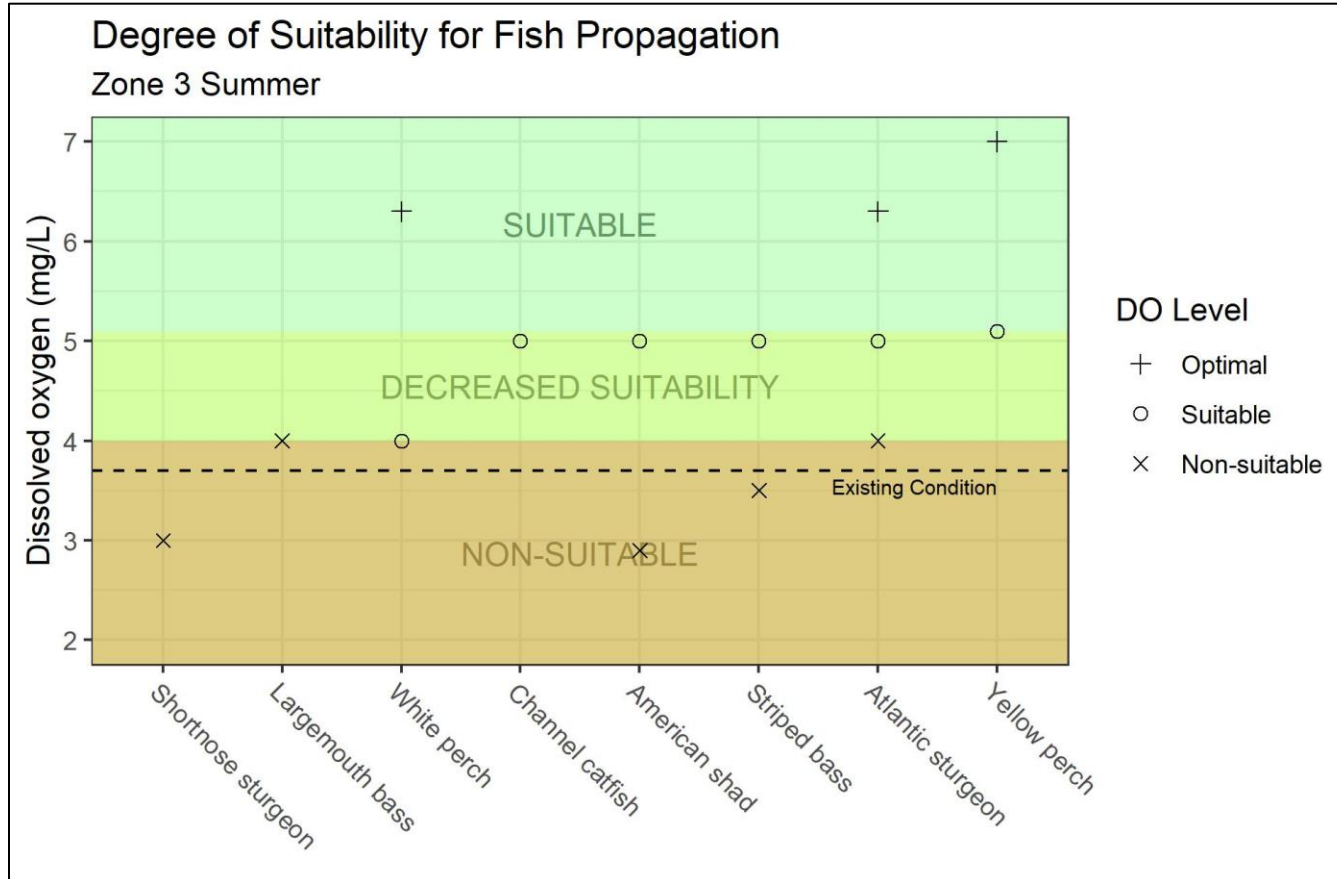
Summer– Zone 3

Summer– Zone 4

Summer– Zone 5

Summer– Zone 6

Summary

- Introduce a graphical tool to compare dissolved oxygen needs of sensitive fish species to existing and potential future conditions
- *This is a work in progress*
  - Thresholds and values will be tweaked
    - Internal review
    - Input from fisheries professionals

Atlantic sturgeon (sampling activity was conducted pursuant to a NMFS ESA Permit No. 19255-01)

American shad

60 years 1961–2021

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Jake Bransky, Aquatic Biologist

Jake.Bransky@drbc.gov

www.drbc.gov

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