When Do Pallid Sturgeon Spawn?

Information Sources:

Herb Bollig USFWS
Aaron Delonay USGS-CERC
Wyatt Doyle, USFWS
Dave Herzog, MDC
Diana Papoulias, USGS-CERC
Kerry Reeves, U of MO
Darrel Snyder, CSU

Photo: David Ostendorf

Presenter:

David Galat
USGS, Cooperative Research Units
Department of Fisheries & Wildlife Sciences
University of Missouri, Columbia, MO
galatd@missouri.edu

INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

When & Where do Pallid Sturgeon Spawn?

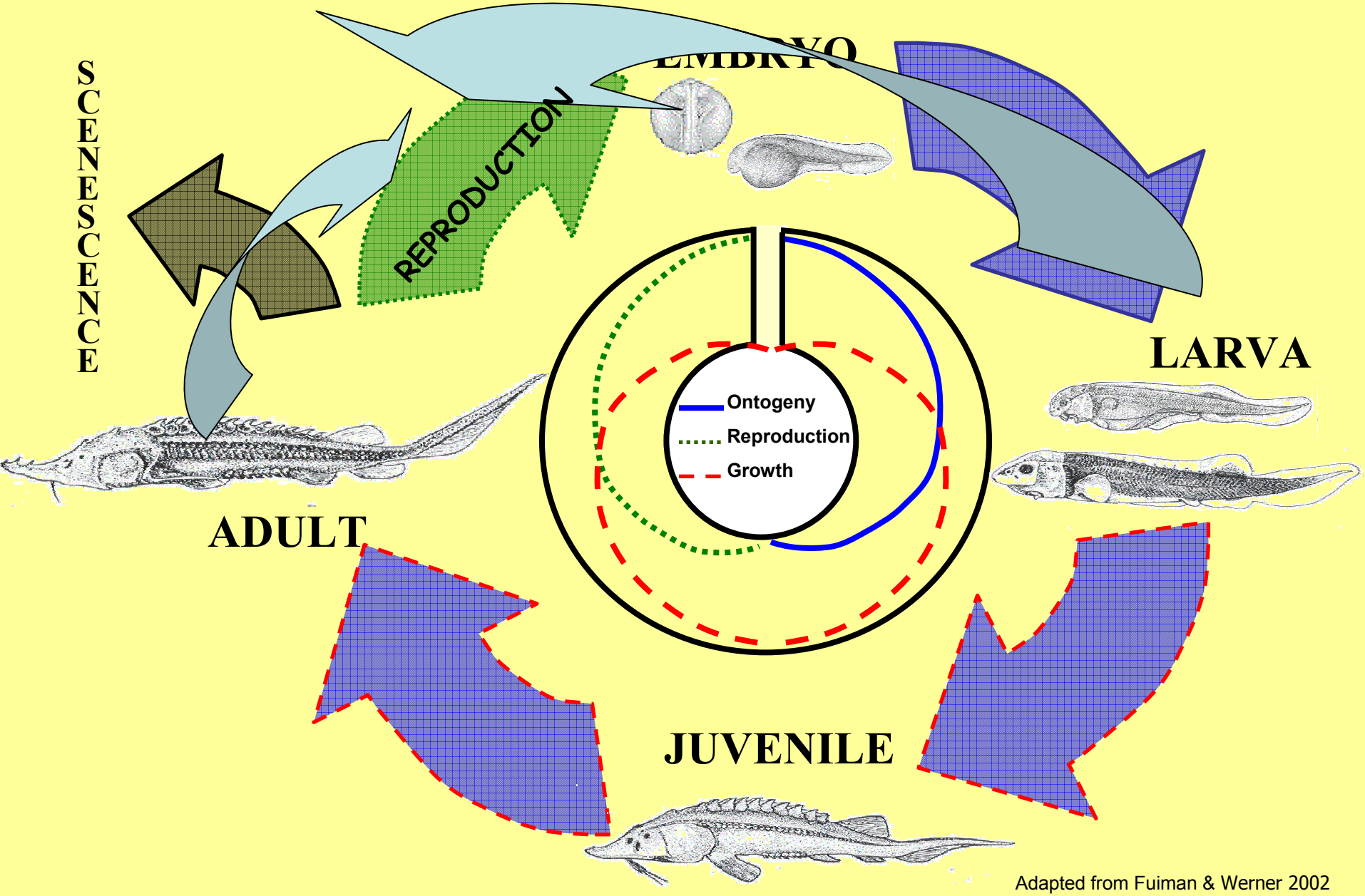
When do *Scaphirhynchus* Sturgeon Spawn?

INFORMATION NEEDS TO DESIGN GPD FLOW RELEASE

What Environmental Conditions Control *Scaphirhyncus* Spawning?

What GP Dam Flow Releases will Most Benefit Pallid Sturgeon Reproduction & Meet Other System Needs?

GENERALIZED *SCAPHIRHYNCHUS* LIFE STAGES



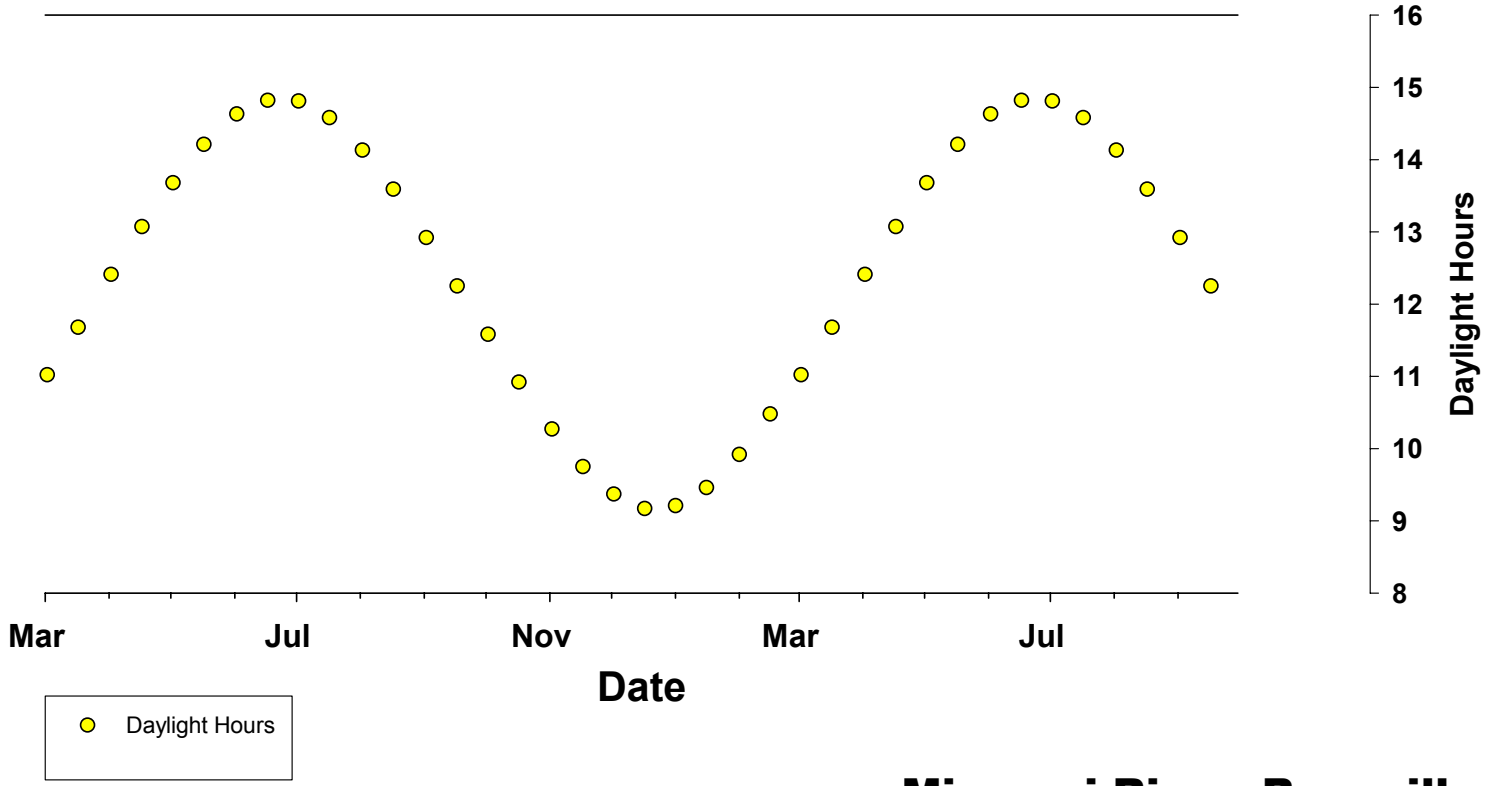
Adapted from Fuiman & Werner 2002

Environmental Factors Affecting Successful Sturgeon Spawning

- **Photoperiod**
- **Lunar Cycle**
- **Temperature**
- **River Flow**

Environmental Factors Affecting Successful Sturgeon Reproduction

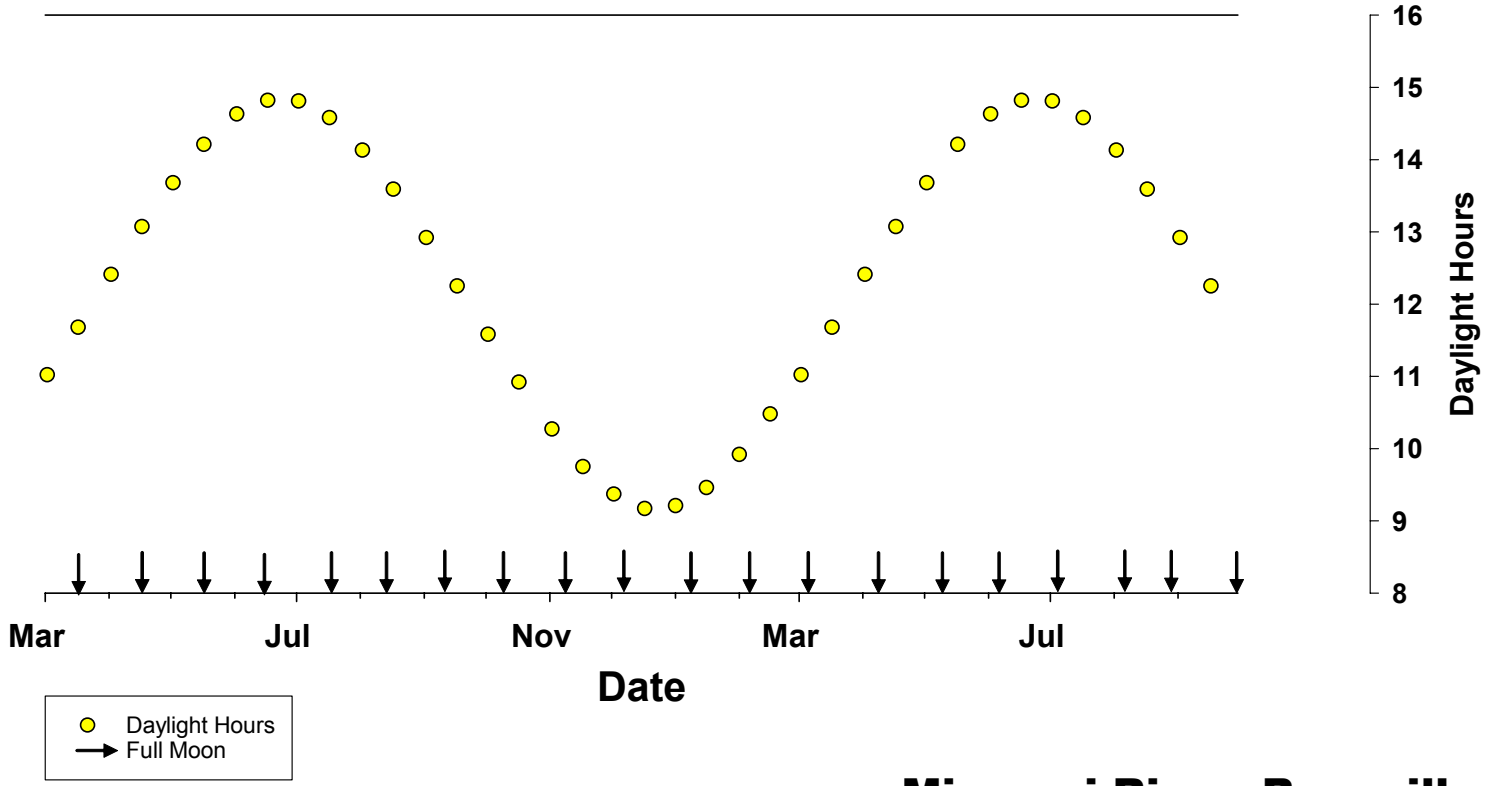
PHOTOPERIOD



Missouri River, Boonville
2003-2004

Environmental Factors Affecting Successful Sturgeon Reproduction

PHOTOPERIOD + LUNAR CYCLE



Missouri River, Boonville
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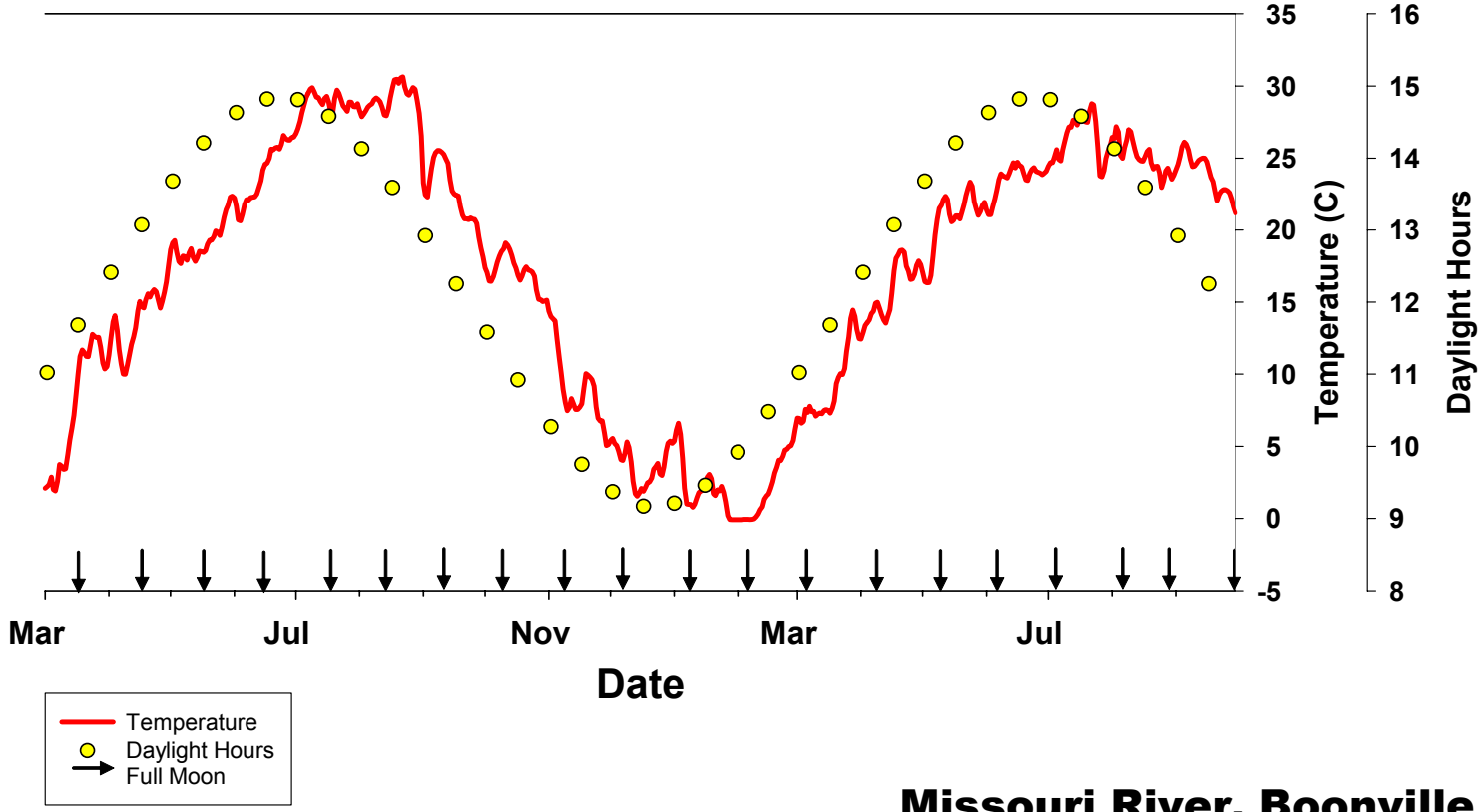
Environmental Factors Affecting Successful Sturgeon Reproduction

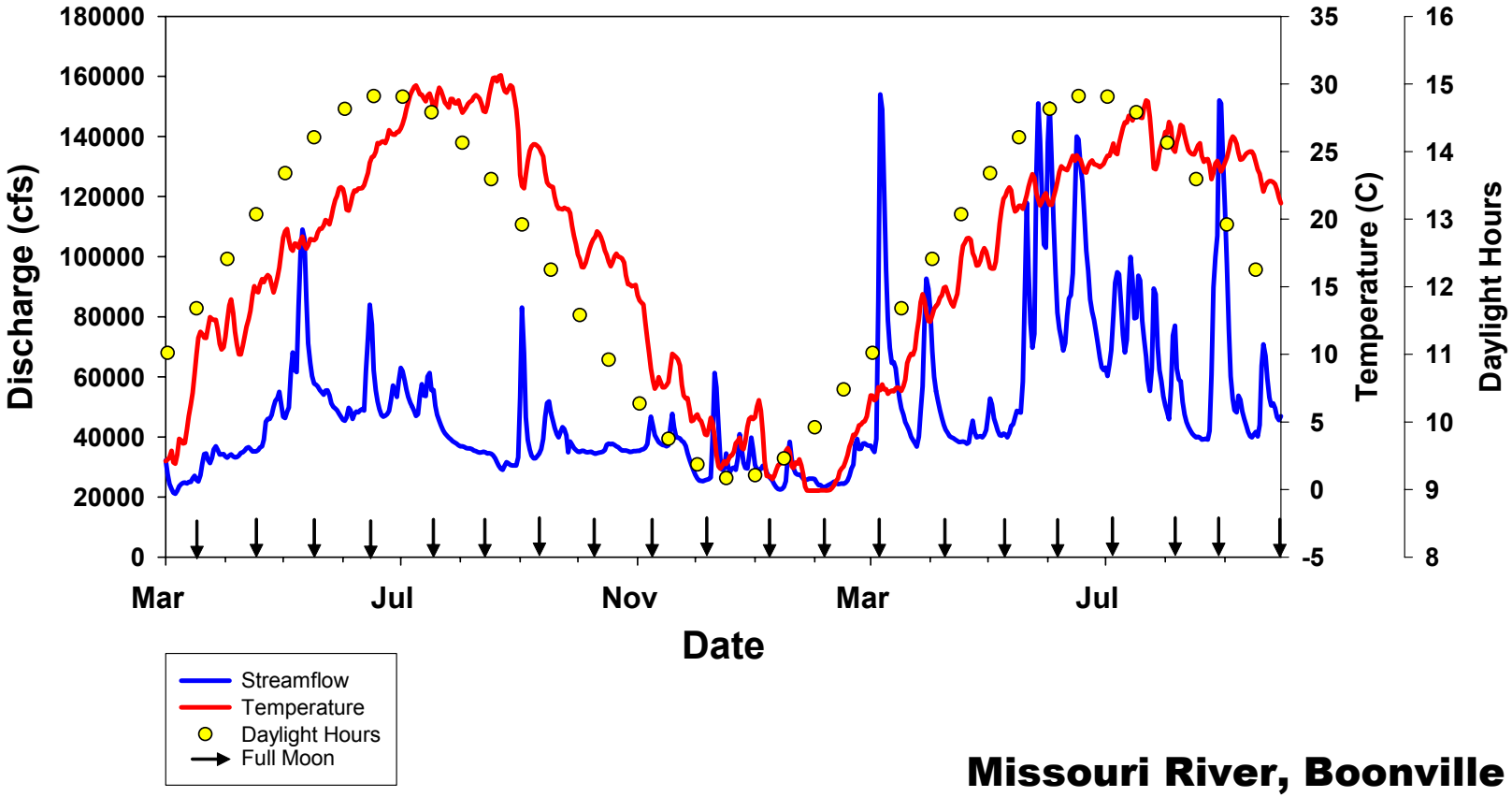
PHOTOPERIOD + LUNAR CYCLE + TEMPERATURE



Missouri River, Boonville
2003-2004

Environmental Factors Affecting Successful Sturgeon Reproduction

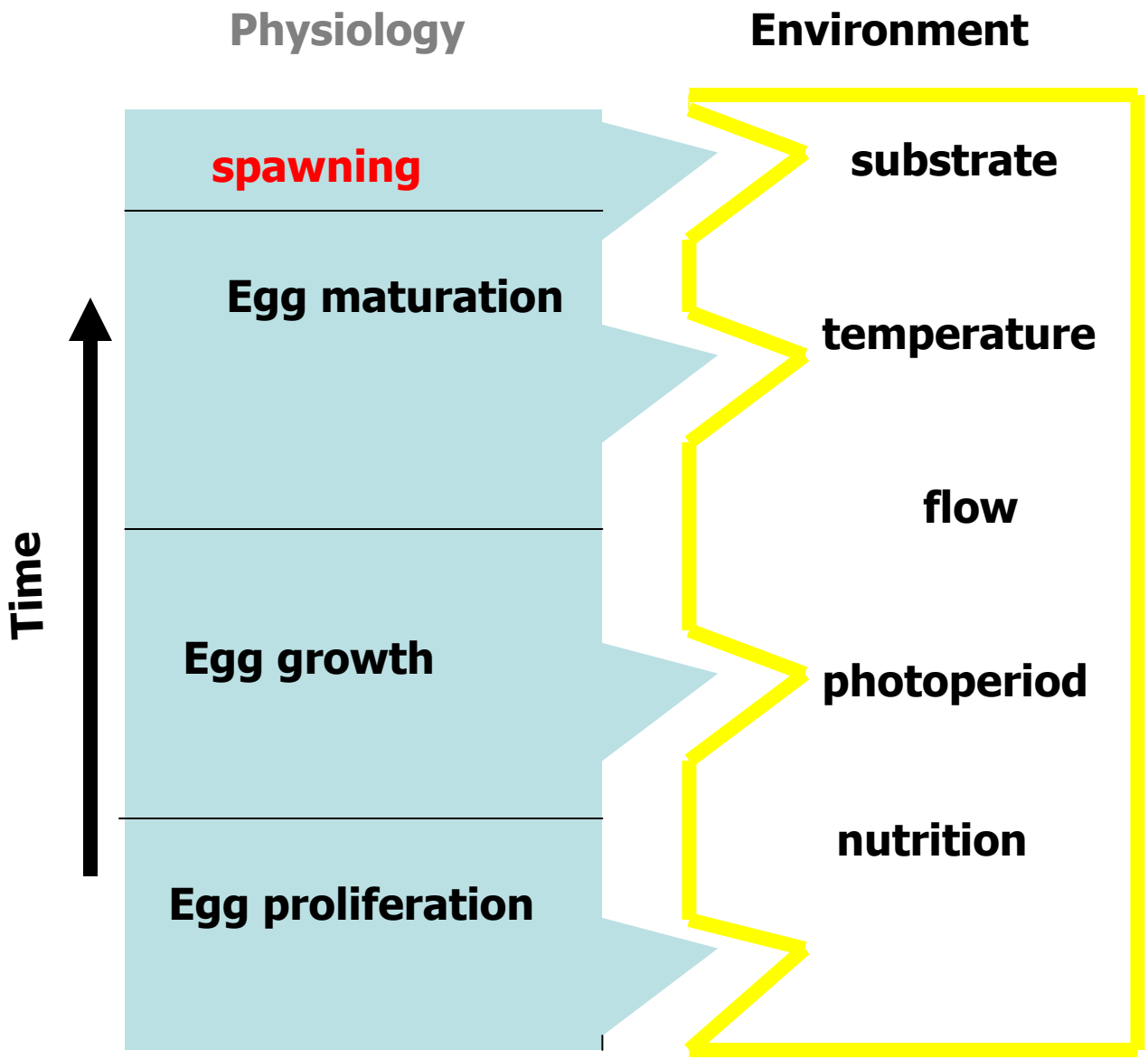
PHOTOPERIOD + LUNAR CYCLE + TEMPERATURE + RIVER FLOW



Missouri River, Boonville
2003-2004

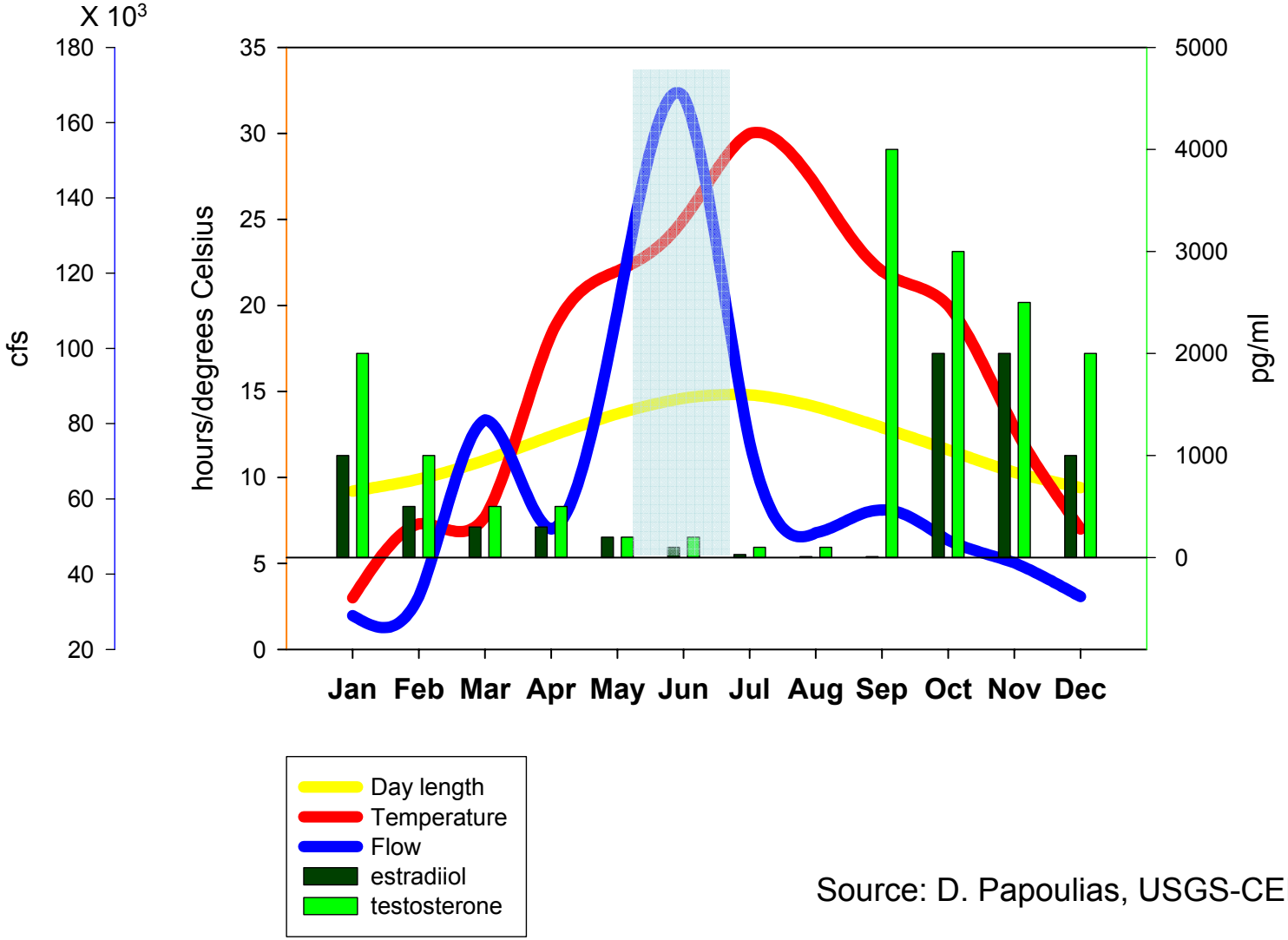
Biotic Factors Affecting Successful Sturgeon Spawning

- Age
- Condition
- Physiological State
- Behavioral (Social) Cues



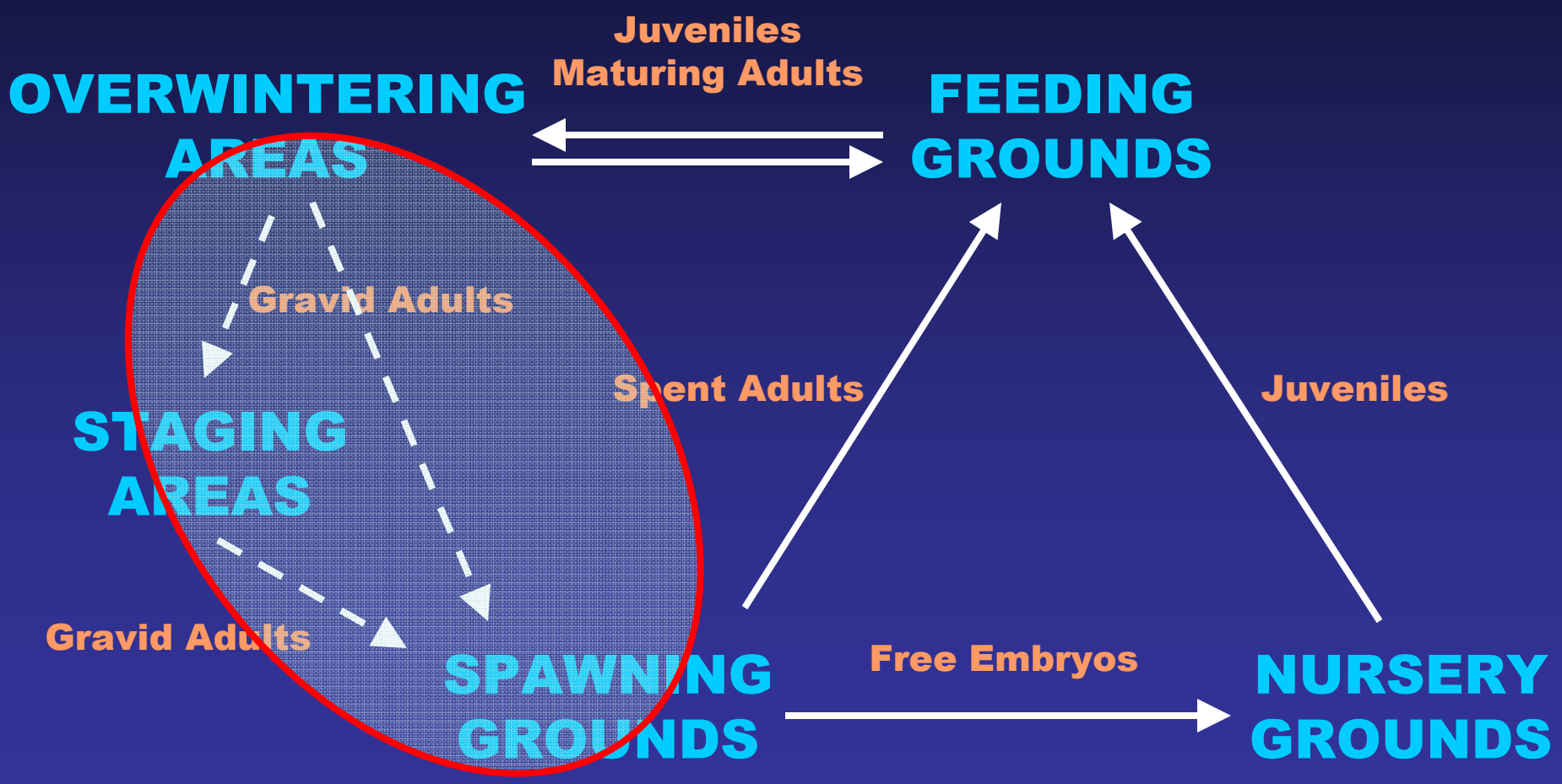
Source: D. Papoulias, USGS-CERC

Environmental Variables Relative to Reproductive Indicators



Source: D. Papoulias, USGS-CERC

Dynamic Model of Possible *Scaphirhynchus* Habitat Use by Life Stage & Associated Migration Cycles



How do we know when sturgeon spawn?

- Observe spawning
- Track reproductively mature instrumented fish
- Ovarian development
- Collect larvae

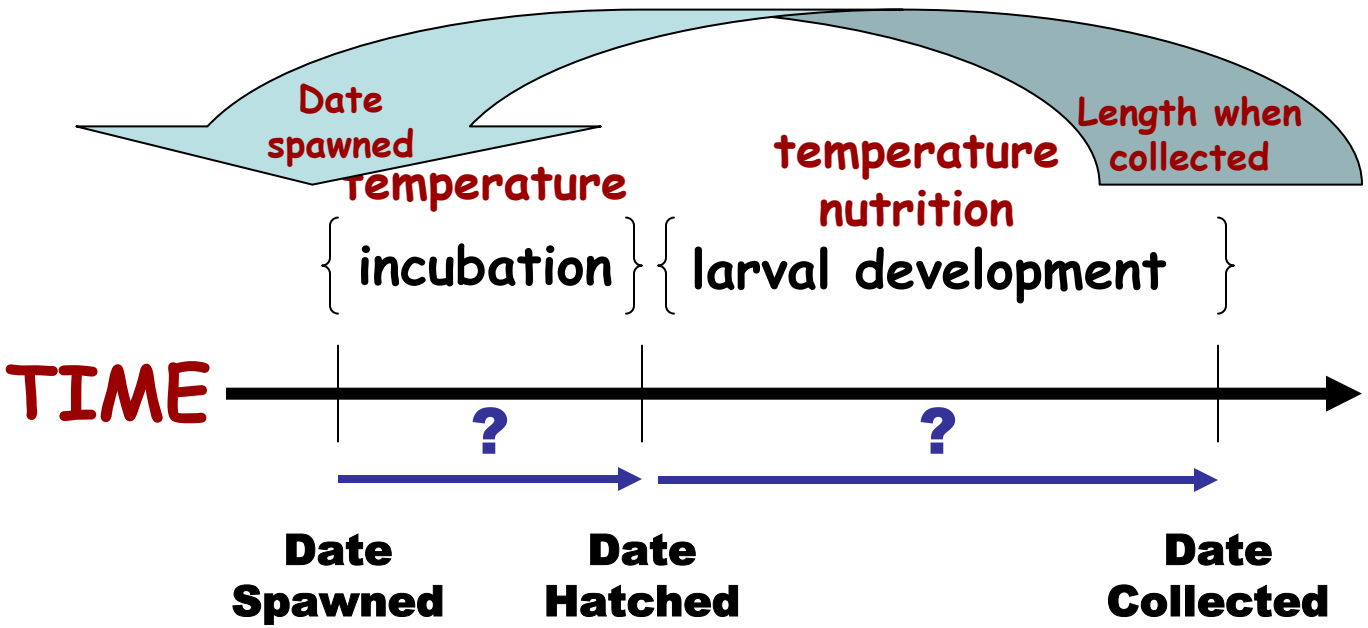
Ovarian Development

Ripe Female – black eggs

Recently Spawned Female – spent

Source: D. Papoulias, USGS-CERC

When a larval sturgeon is collected versus when its mom spawned

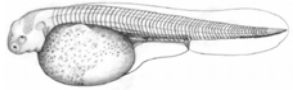


~7 days @ 16 °C

Important Developmental Events for Larval Pallid Sturgeon

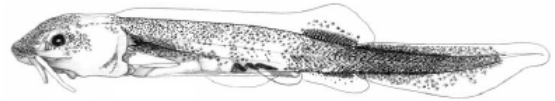
Source: Snyder J. Appl. Ichthyol. 2002

Free Embryo 8-9 mm TL, 0 D

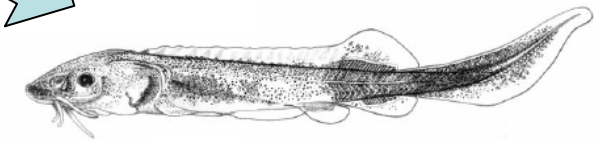


Protolarvae

Yolk Absorbed 18-19 mm TL, ~12 D

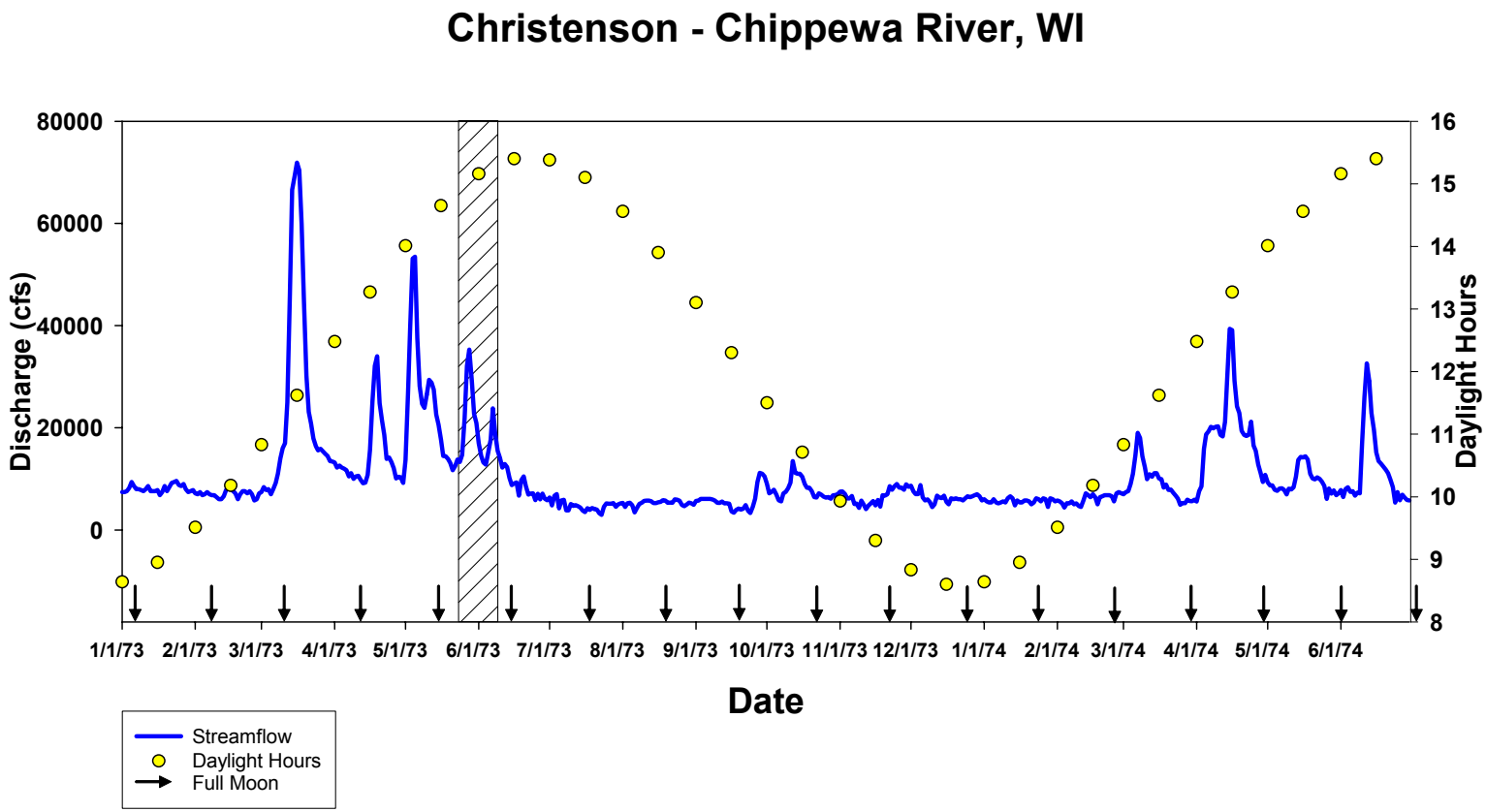


Mesolarva ~25 mm TL, ~21 D

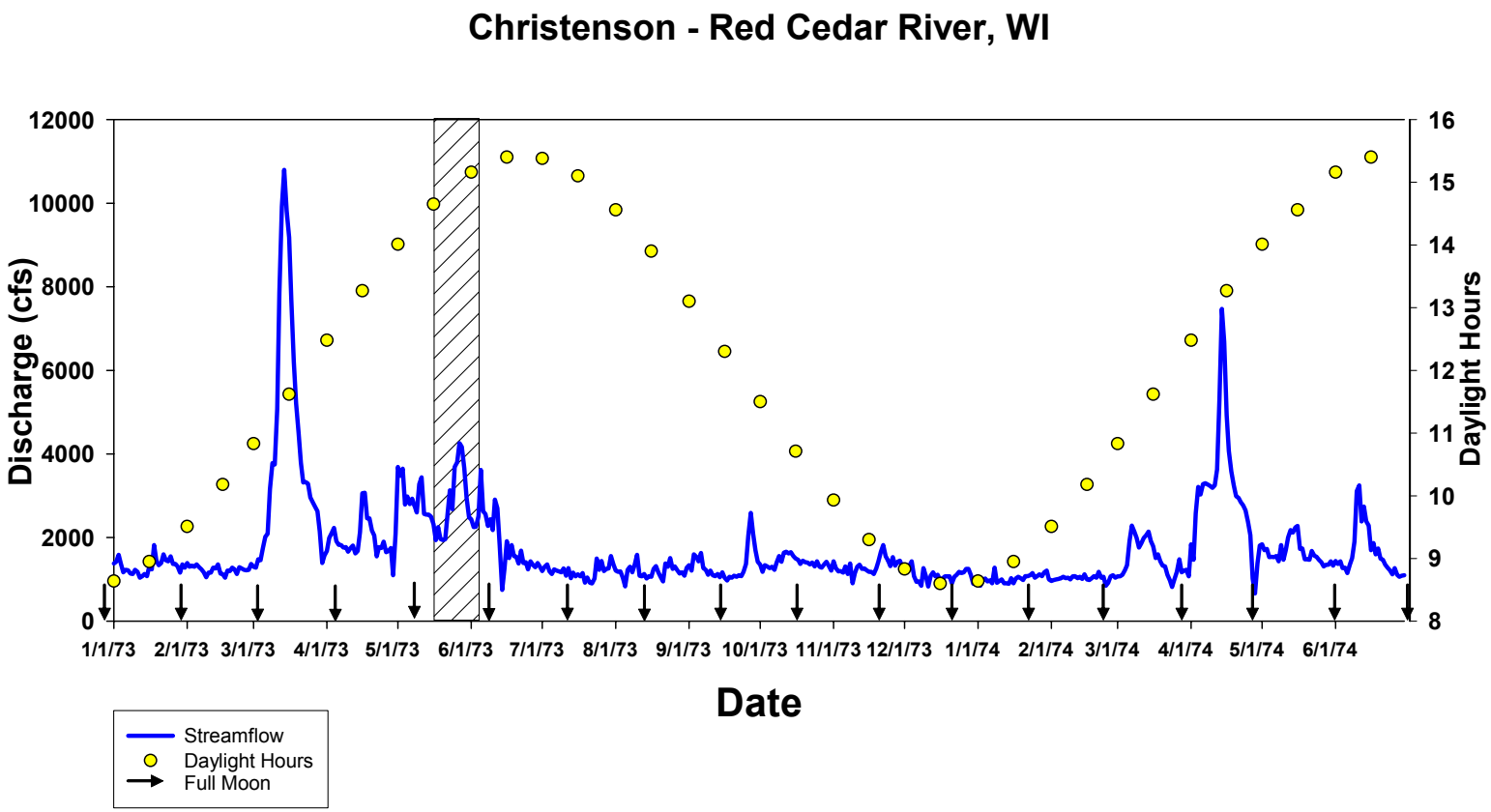


Metalarvae 82-138 mm, 54-92 D

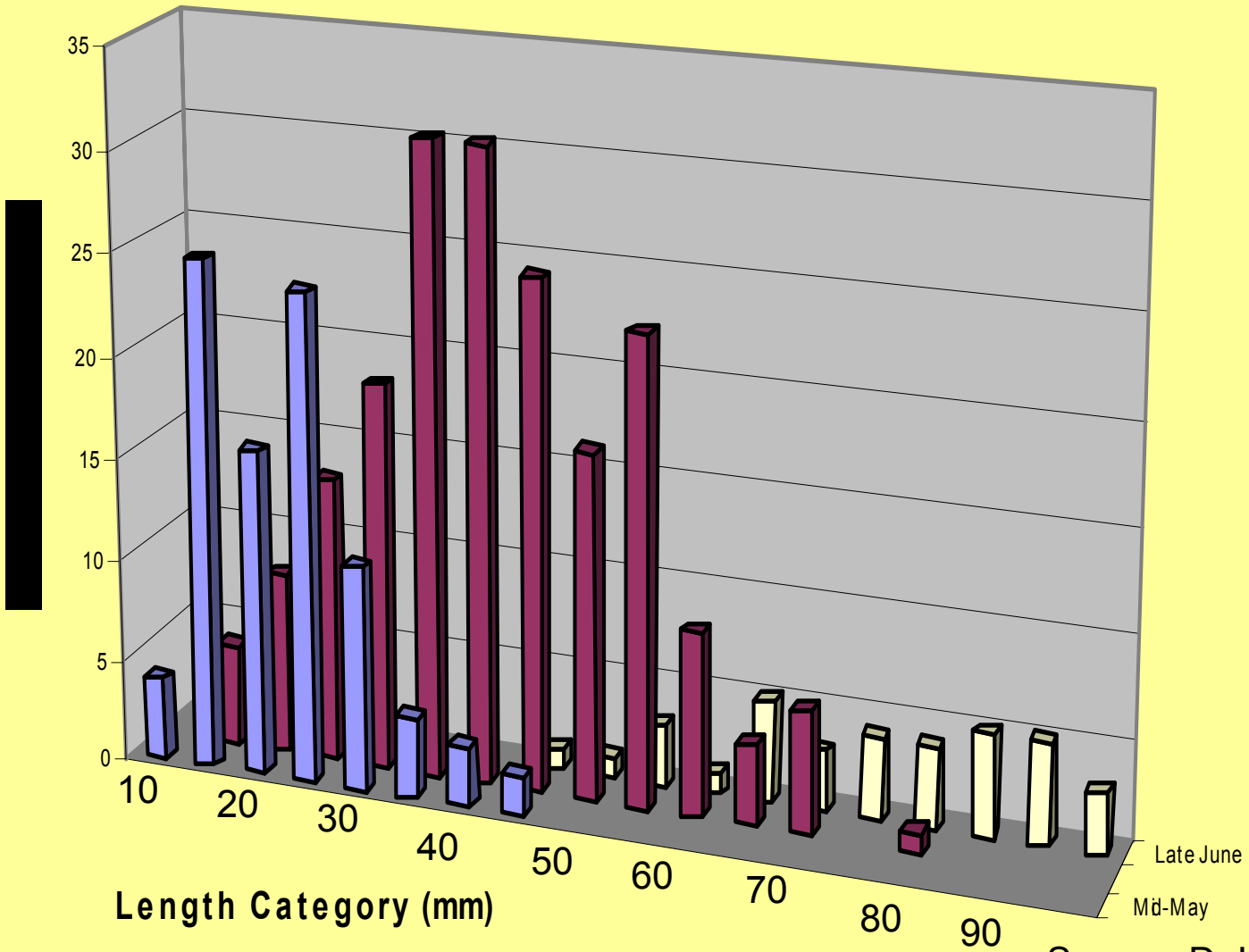
Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River



Estimated Spawning Period for Shovelnose Sturgeon in a Non-flow Regulated River

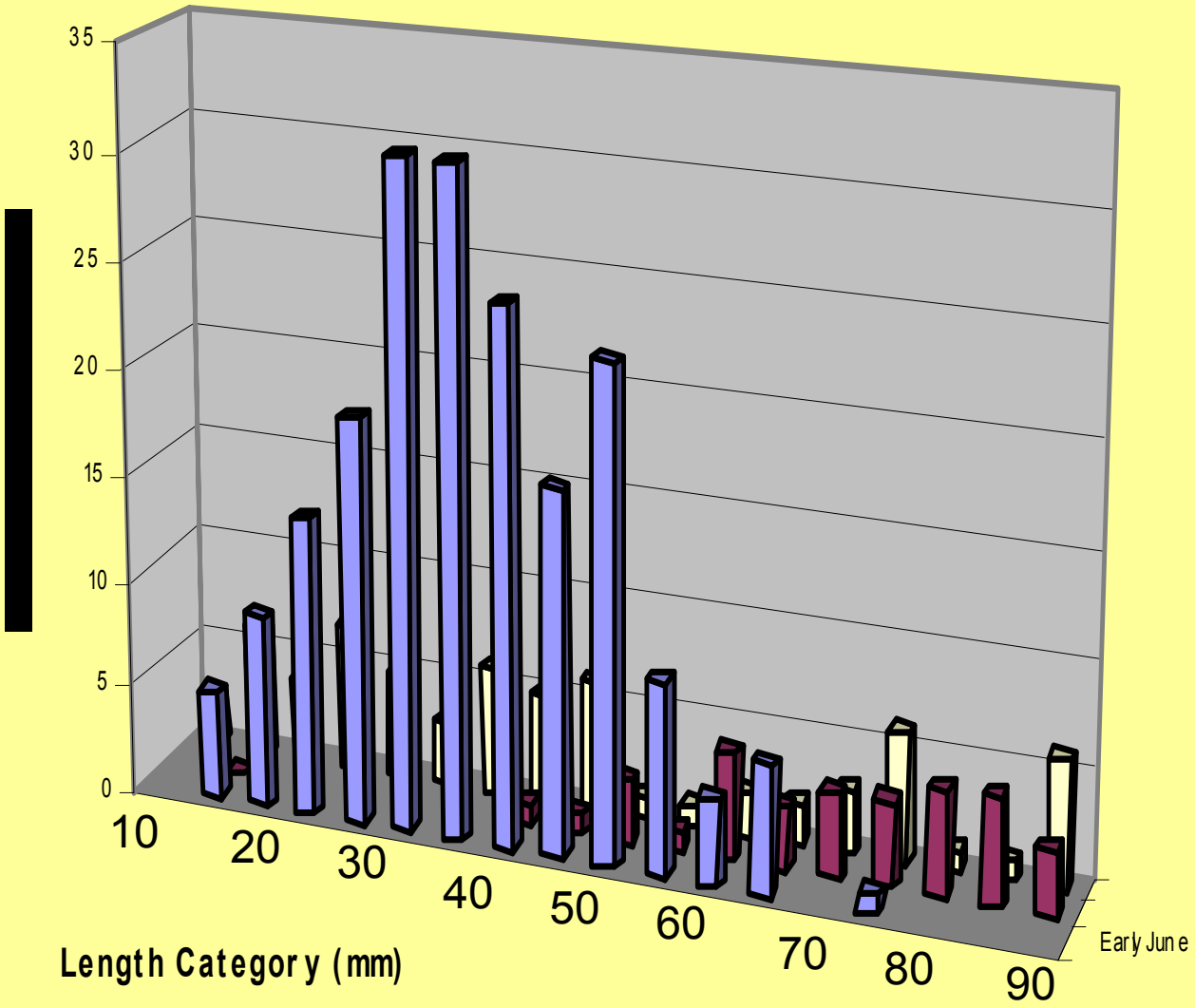


Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Mid-May through Late-June



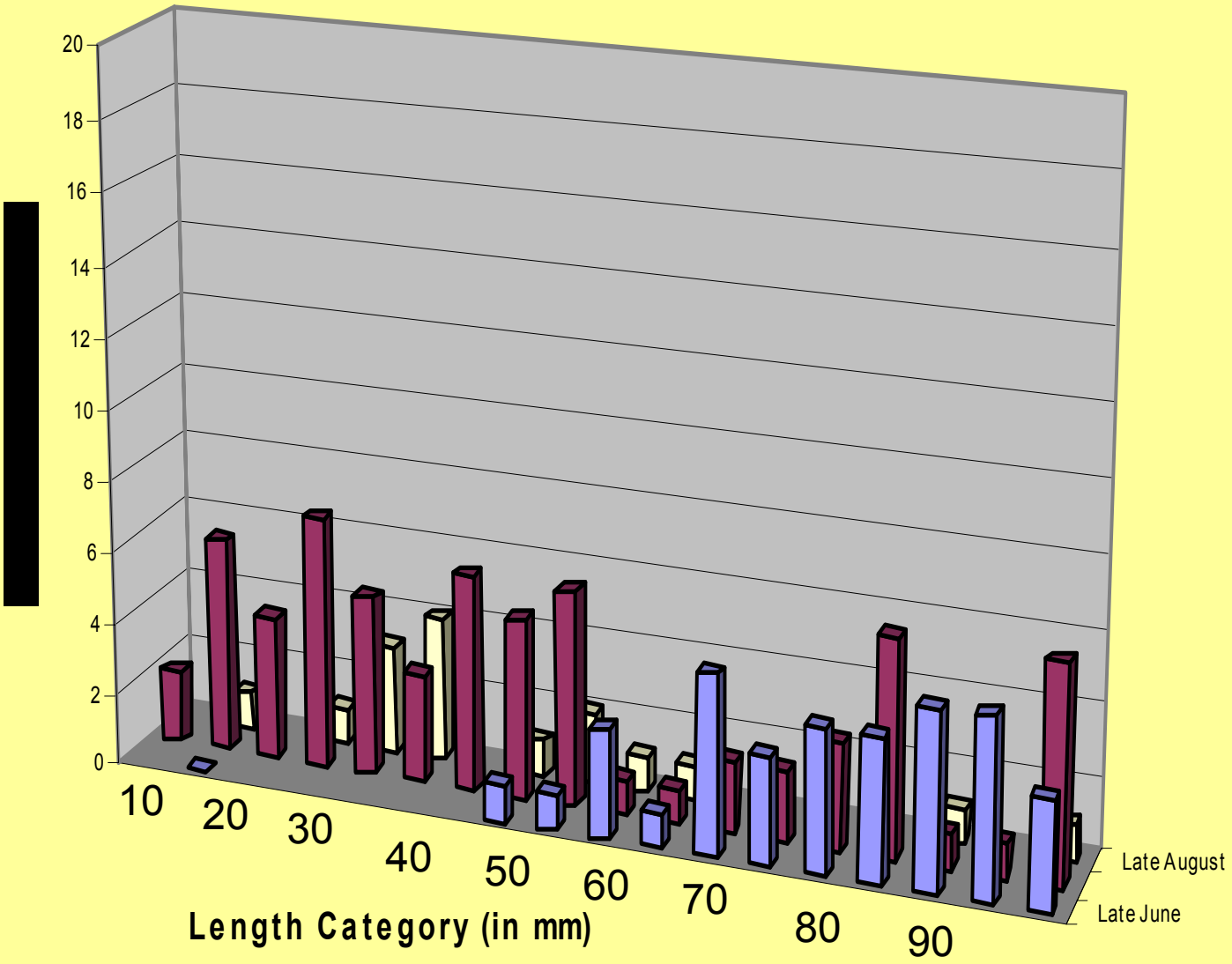
Source: D. Herzog, MDC

Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Early June through Late July



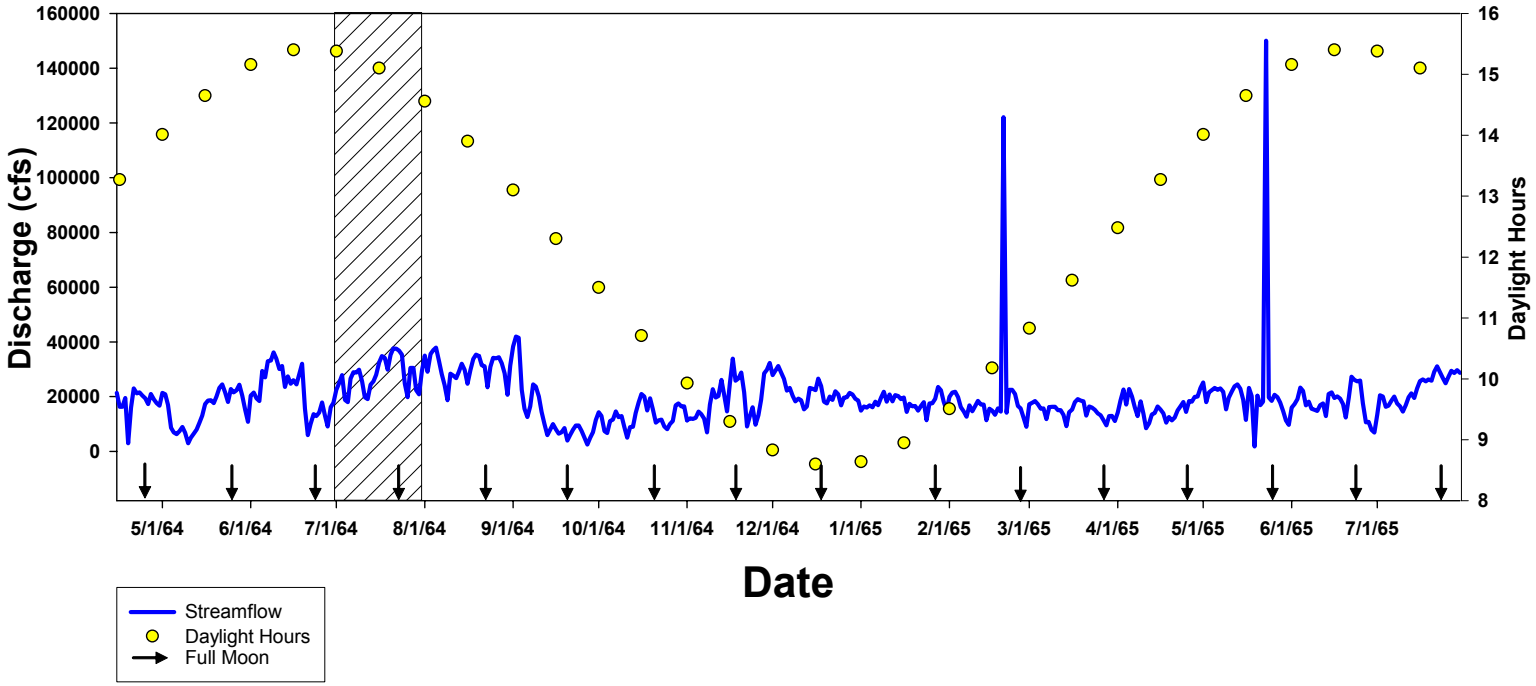
Source: D. Herzog, MDC

Length-Frequency Distributions for Young-of-the-Year Sturgeons Collected from the Middle Mississippi River from Late June through Late August



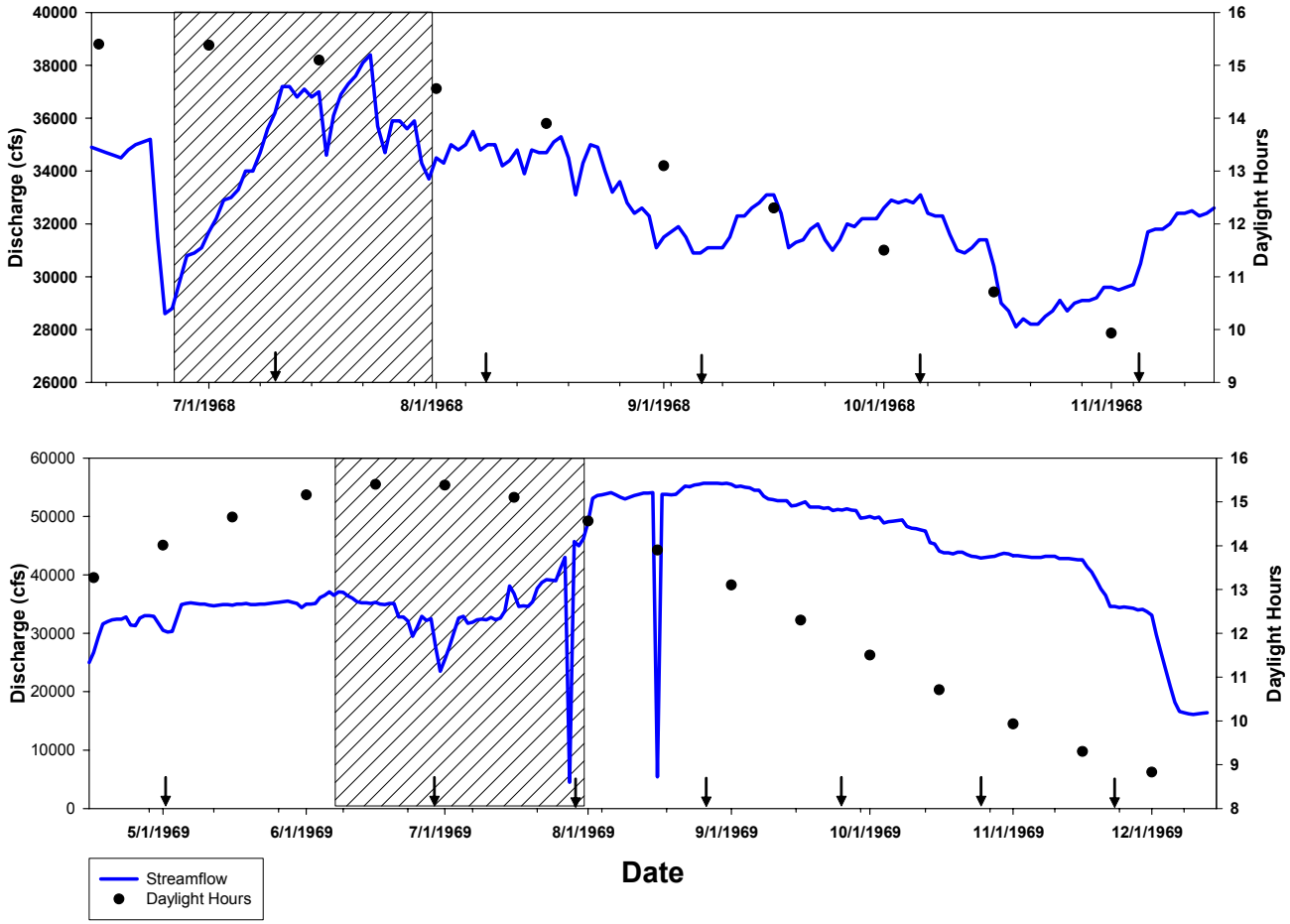
Source: D. Herzog, MDC

June – MOR, Pierre, SD, 15 April 1964 – 30 July 1965



June, F. C. Env. Biol. Fish. 2: 285-296, 1977

Moos – MOR, Yankton, SD, 1968 – 1969

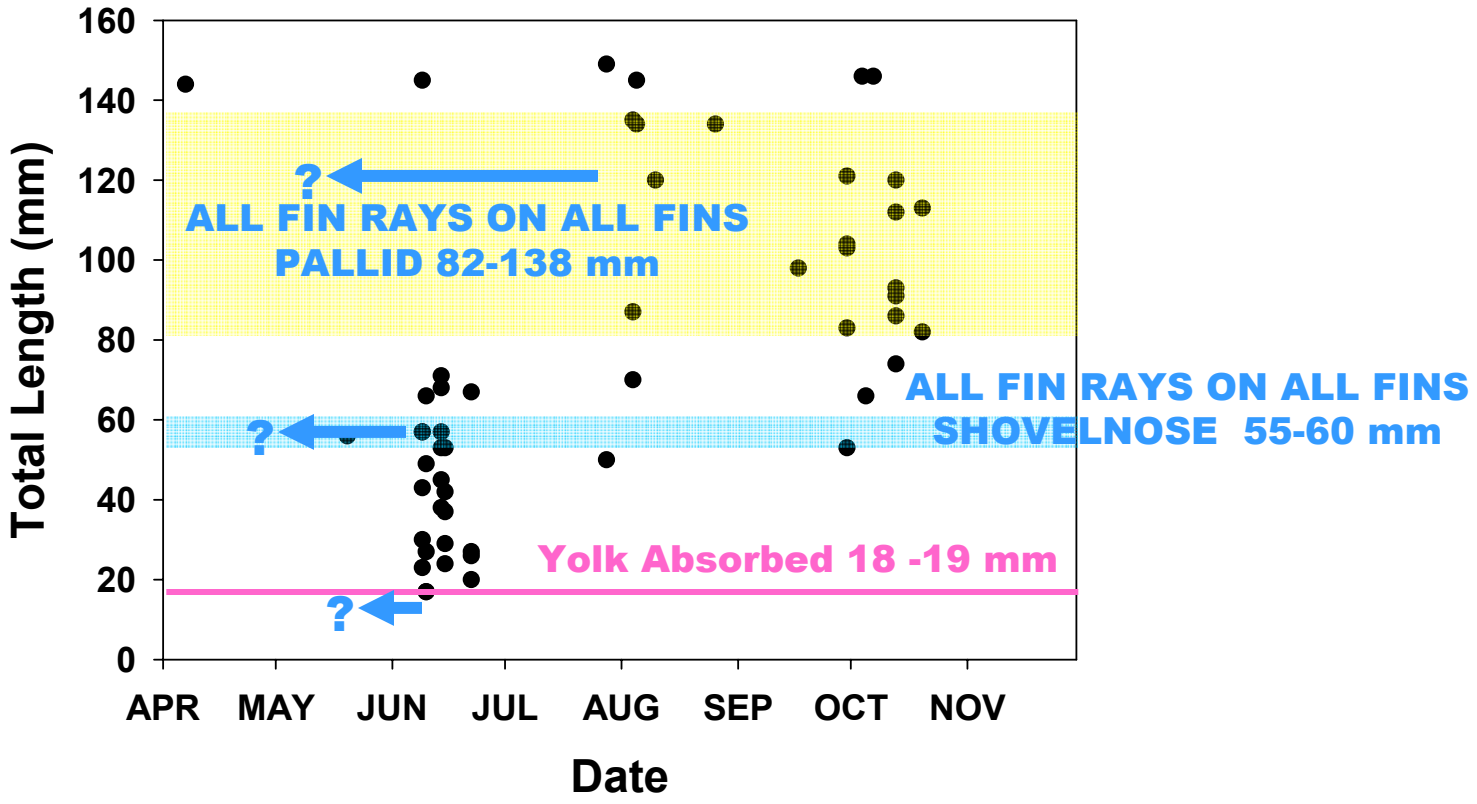


Moos, R. E. PhD Dissertation, U. of SD, 1978

Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO

USFWS Columbia Fisheries

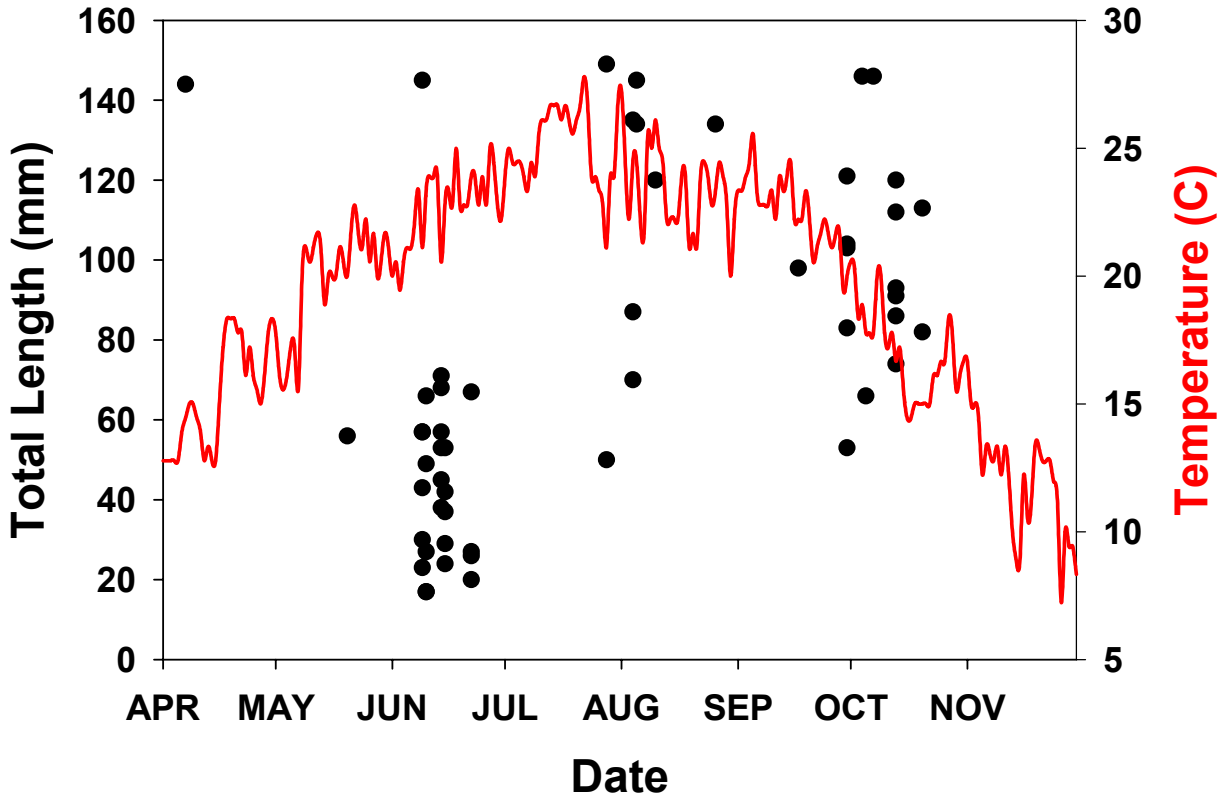
2004



Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO

USFWS Columbia Fisheries

2004



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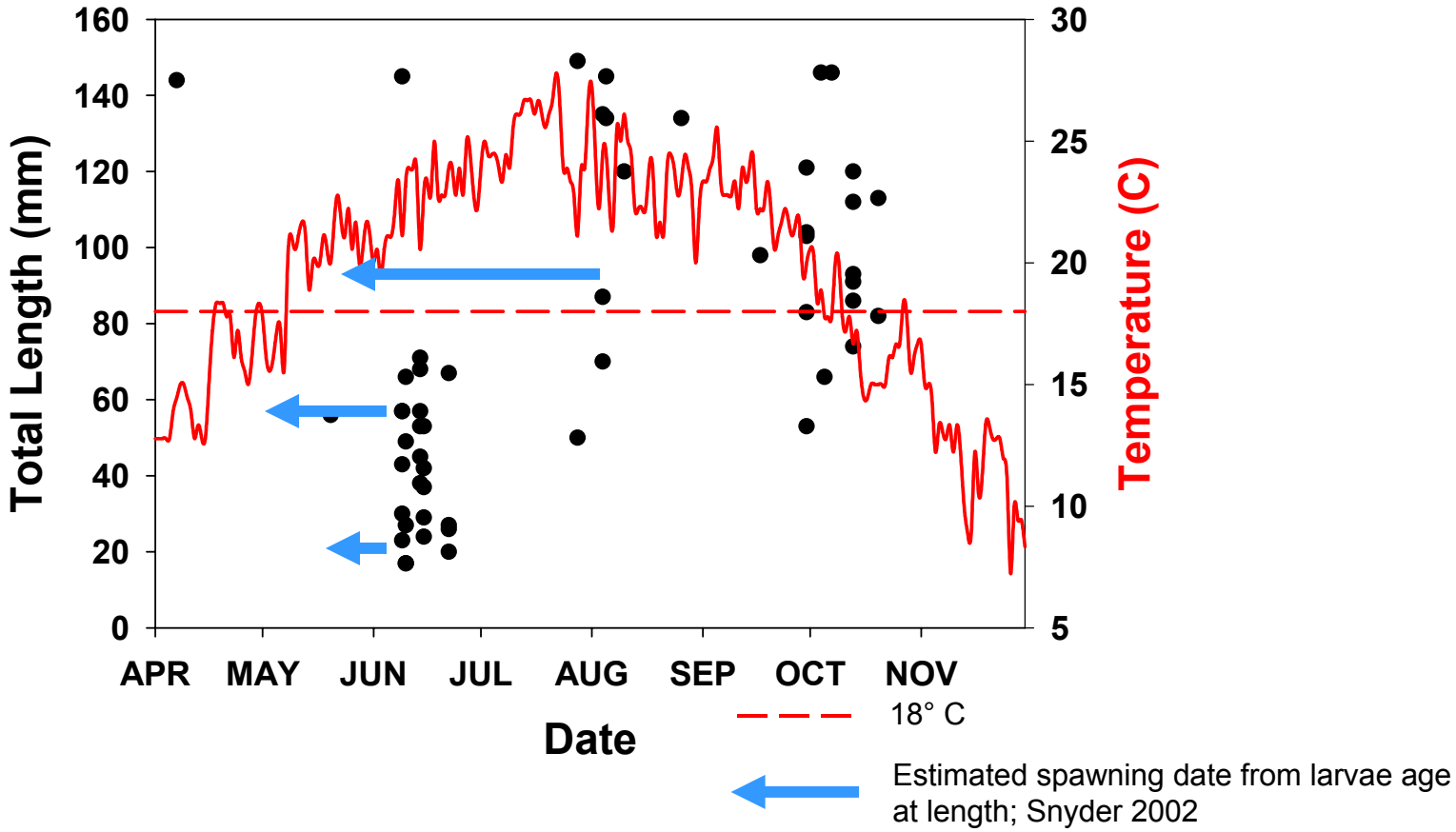

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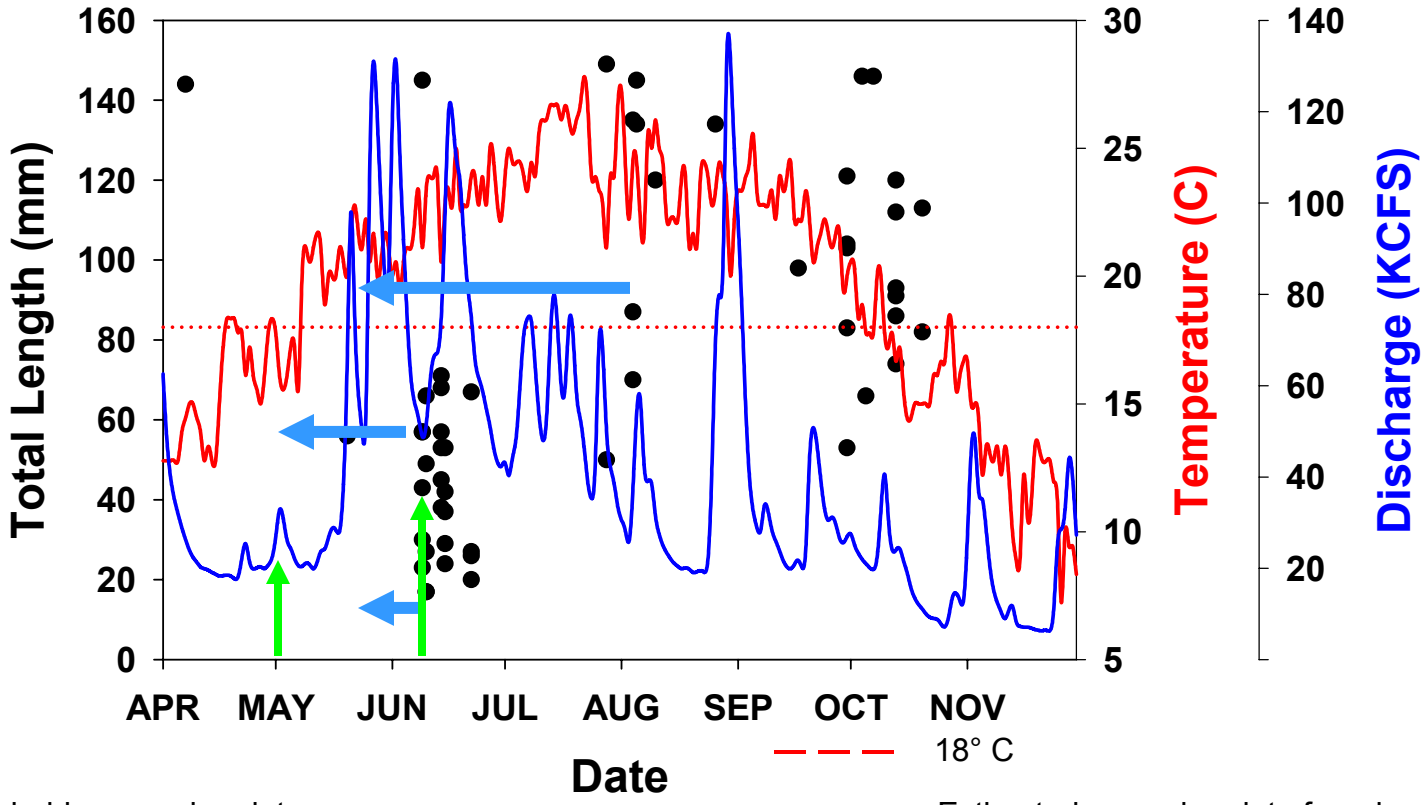


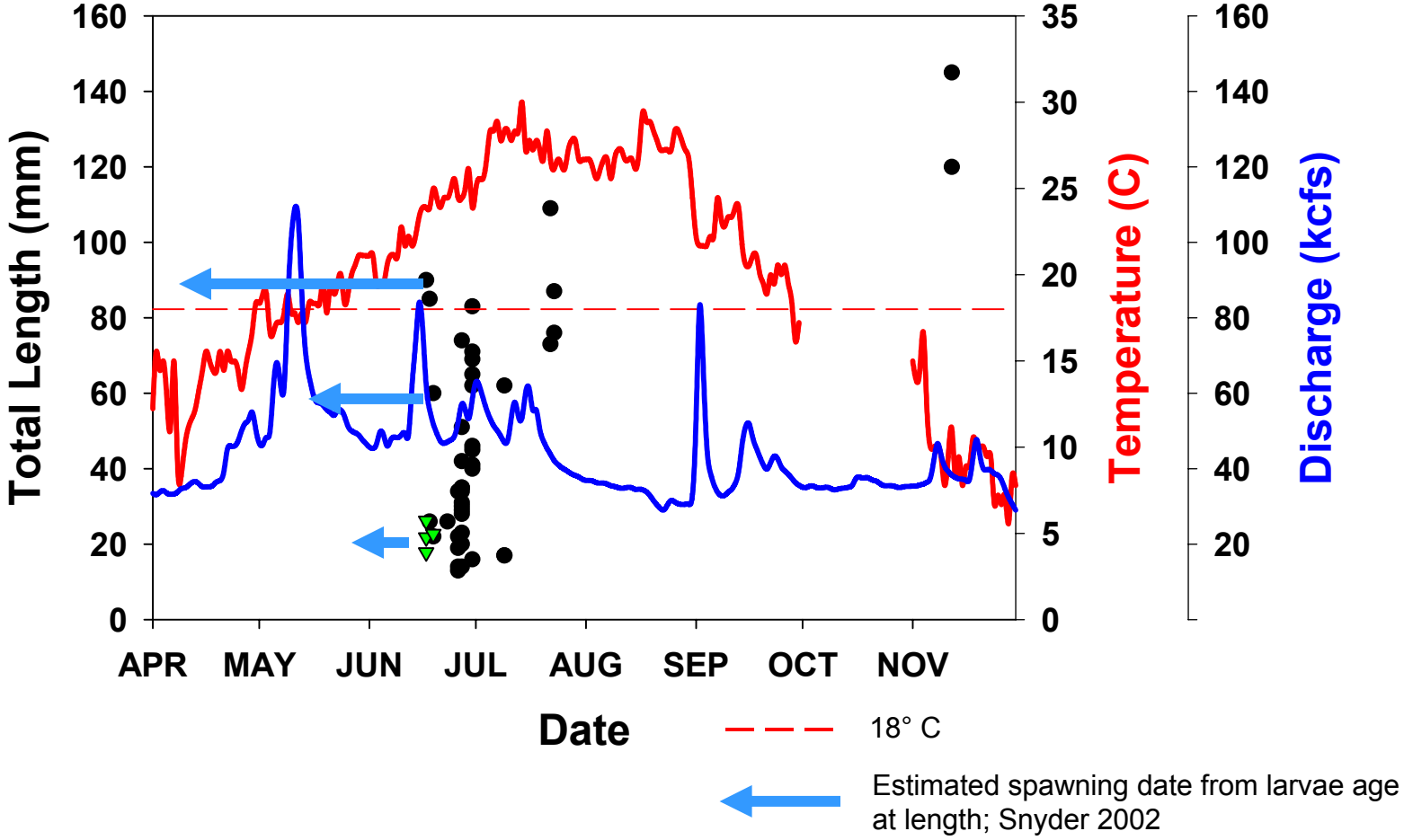
Probable spawning date; Delonay USGS-CERC

Estimated spawning date from larvae age at length; Snyder 2002

Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO

USFWS Columbia Fisheries – K. Reeves UMC

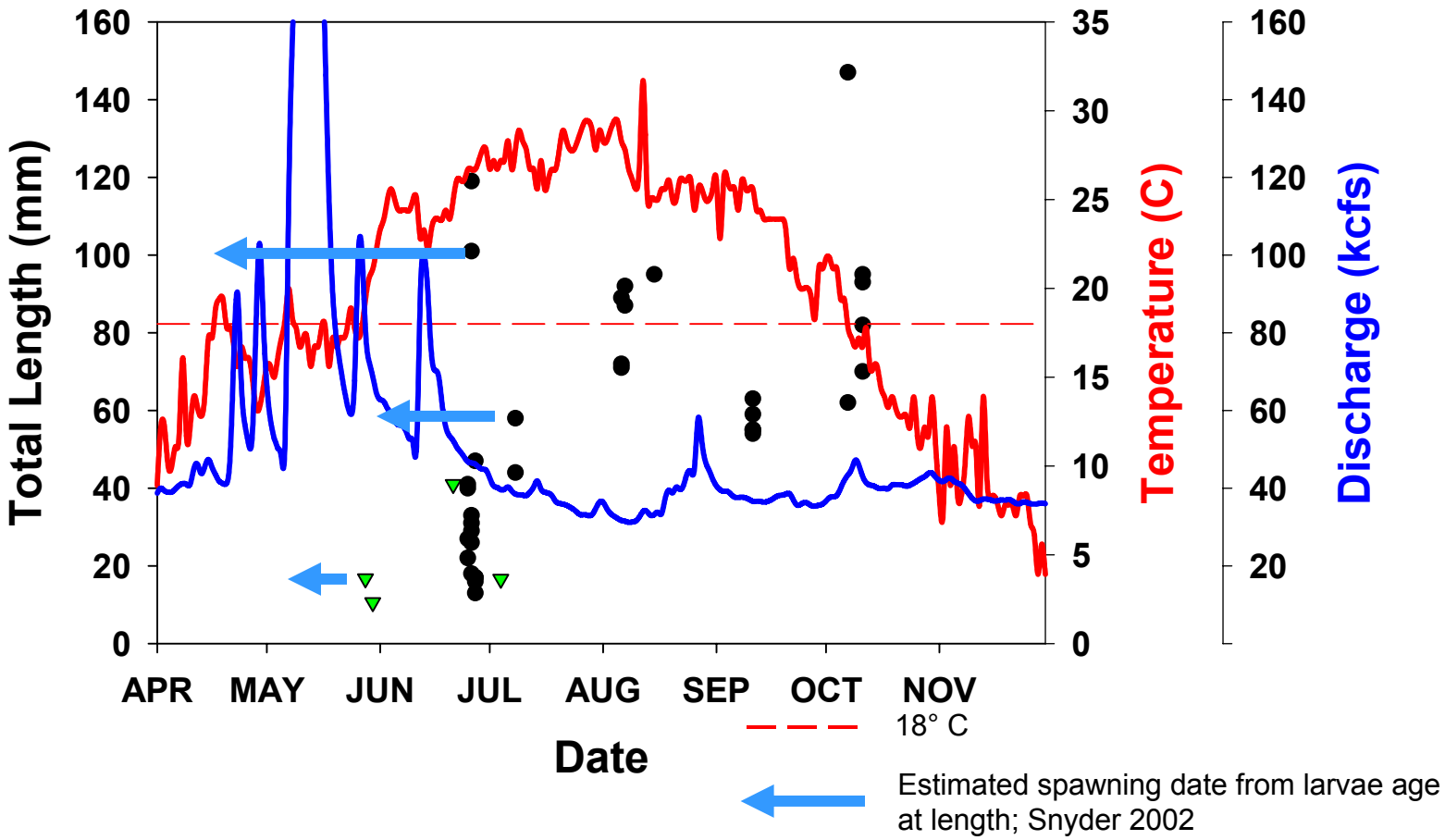
2003



Length-Frequency Distributions for YOY Scaphirhynchus Sturgeons, Lower Missouri River, MO

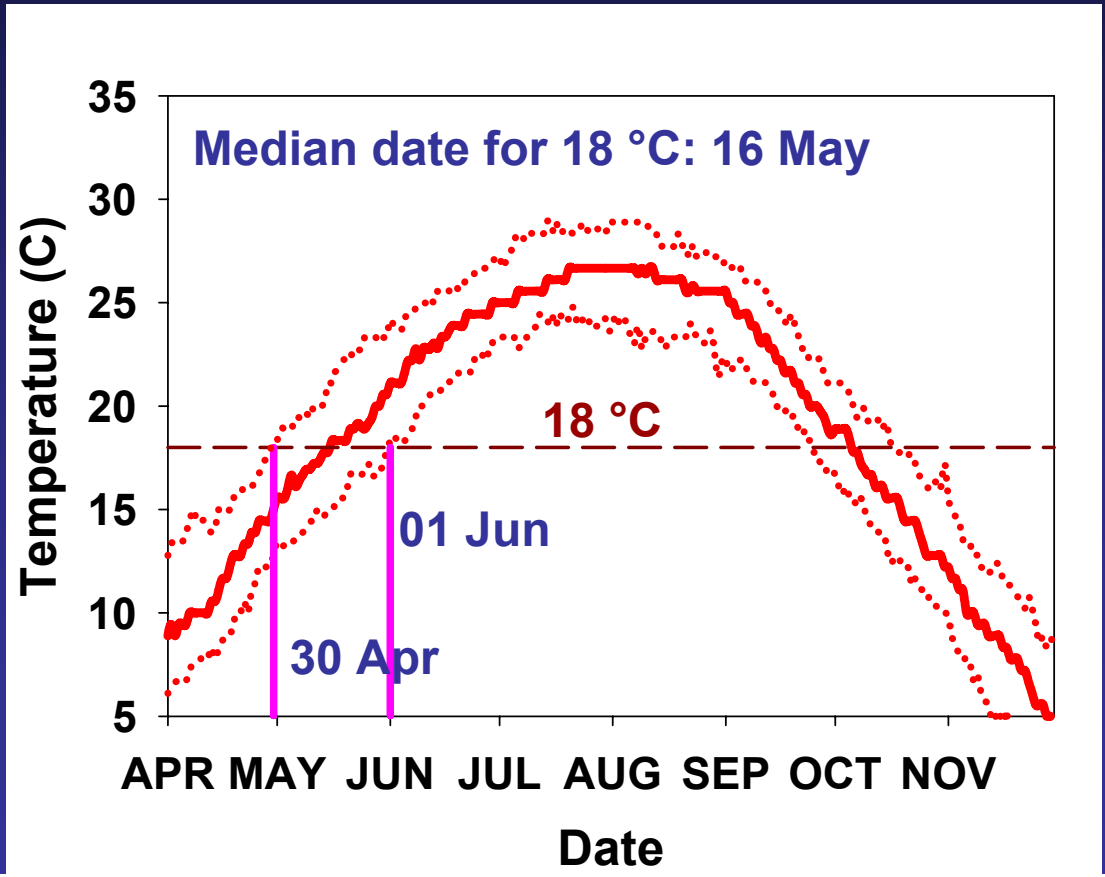
USFWS Columbia Fisheries – K. Reeves UMC

2002



What we know about Scaphirhynchus spawning

- ~18 °C when spawning begins in lower Missouri River Missouri



10th , 50th, 90th Percentiles of 1937- 2005 Water Temperature Boonville, MO

What we know about Scaphirhynchus spawning in LMOR

Observations:

- Mature females, black eggs, high GSI occur from March – August
- Duration of larvae <60 mm TL Apr – Oct
- No larvae collected at water temperature <18°C

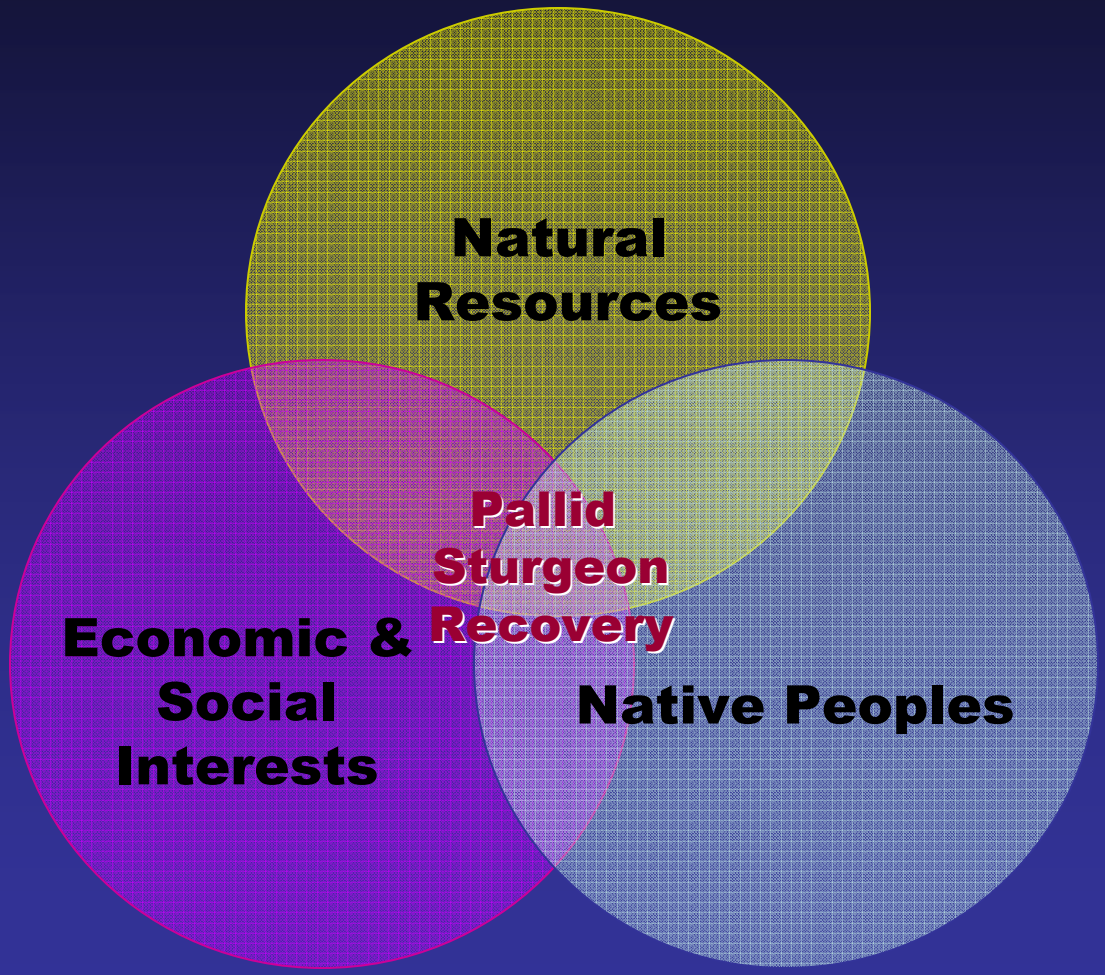
Conclusions:

- Spawning generally begins before June rise
- Spawning may not be flow dependent, but successful reproduction might be
- Scaphirhyncus population has a protracted spawning period

Uncertainties
When do pallid sturgeon spawn?

- No empirical evidence as of today of when or where pallid or shovelnose sturgeon actually spawn
- Sturgeon responses observed in highly altered Missouri River many not be normative or adaptive
- Information here is largely for lower Missouri River in MO, does it apply elsewhere?
- We cannot accurately separate shovelnose & pallid sturgeon larvae to refine role of flow & temperature in spawning by each species
- Is the shovelnose sturgeon an accurate surrogate for pallid sturgeon reproduction?

Uncertainties
When do pallid sturgeon spawn?

- How do flow & temperature & interact spatially to affect spawning? - longitudinal, lateral w/in main channel, main channel vs. tributaries
- How do flow & temperature & interact temporally to affect spawning? - w/in season, w/in year, among years
- How long does it take from spawn to hatch for sturgeon eggs at various river temperatures?
- What is the growth (Δ in TL) per day for sturgeon larvae from hatch to juvenile over a range of temperatures and food rations?

Adaptive Problem Solving