How does streamflow regulation affect fish population dynamics?

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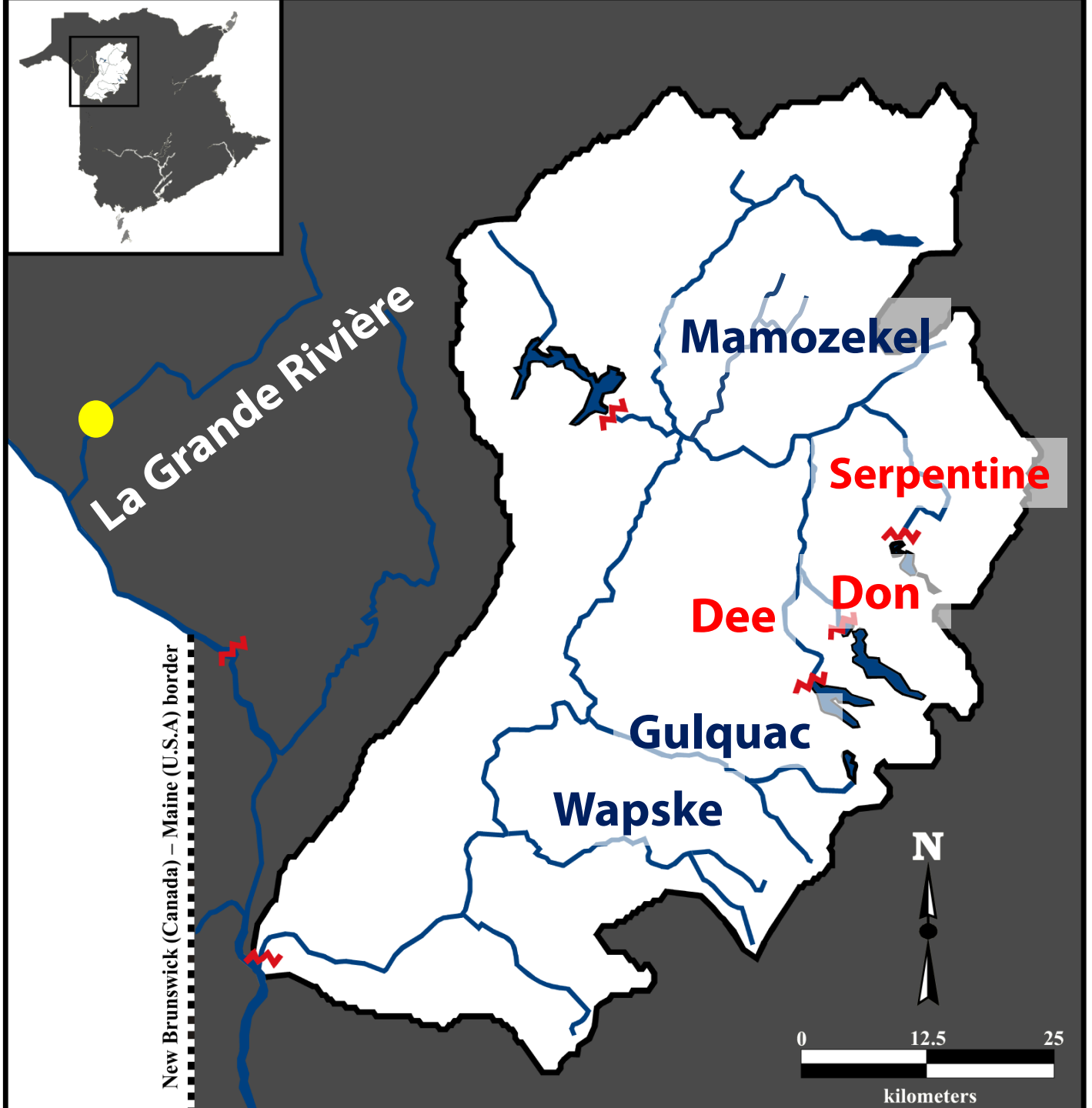
Murchie *et al.* (2008)

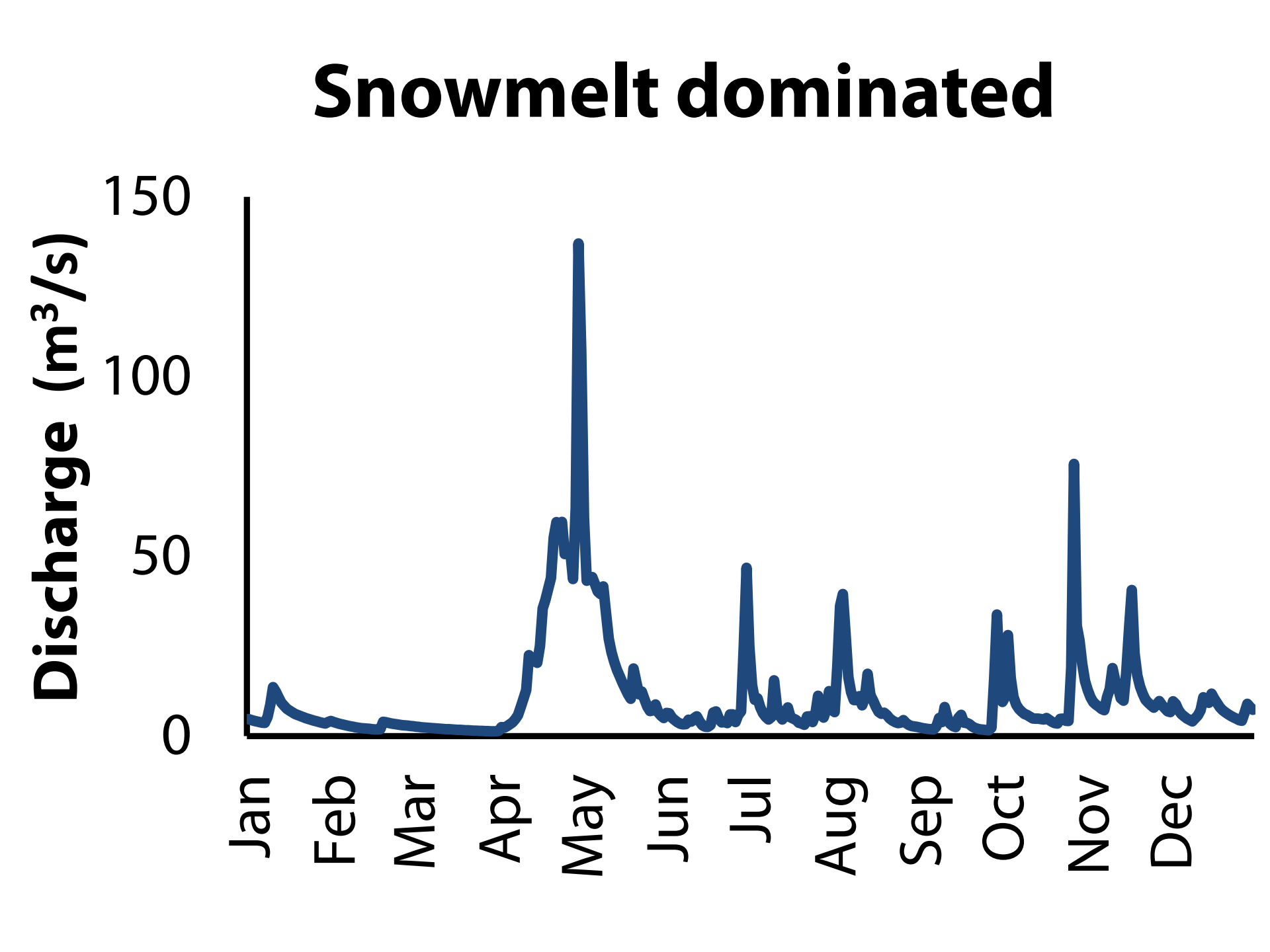
- Multiple species and life-history stages
- Multiple covariates
- Temporal and spatial variability
- Morphological responses
- Linking multiple biological endpoints

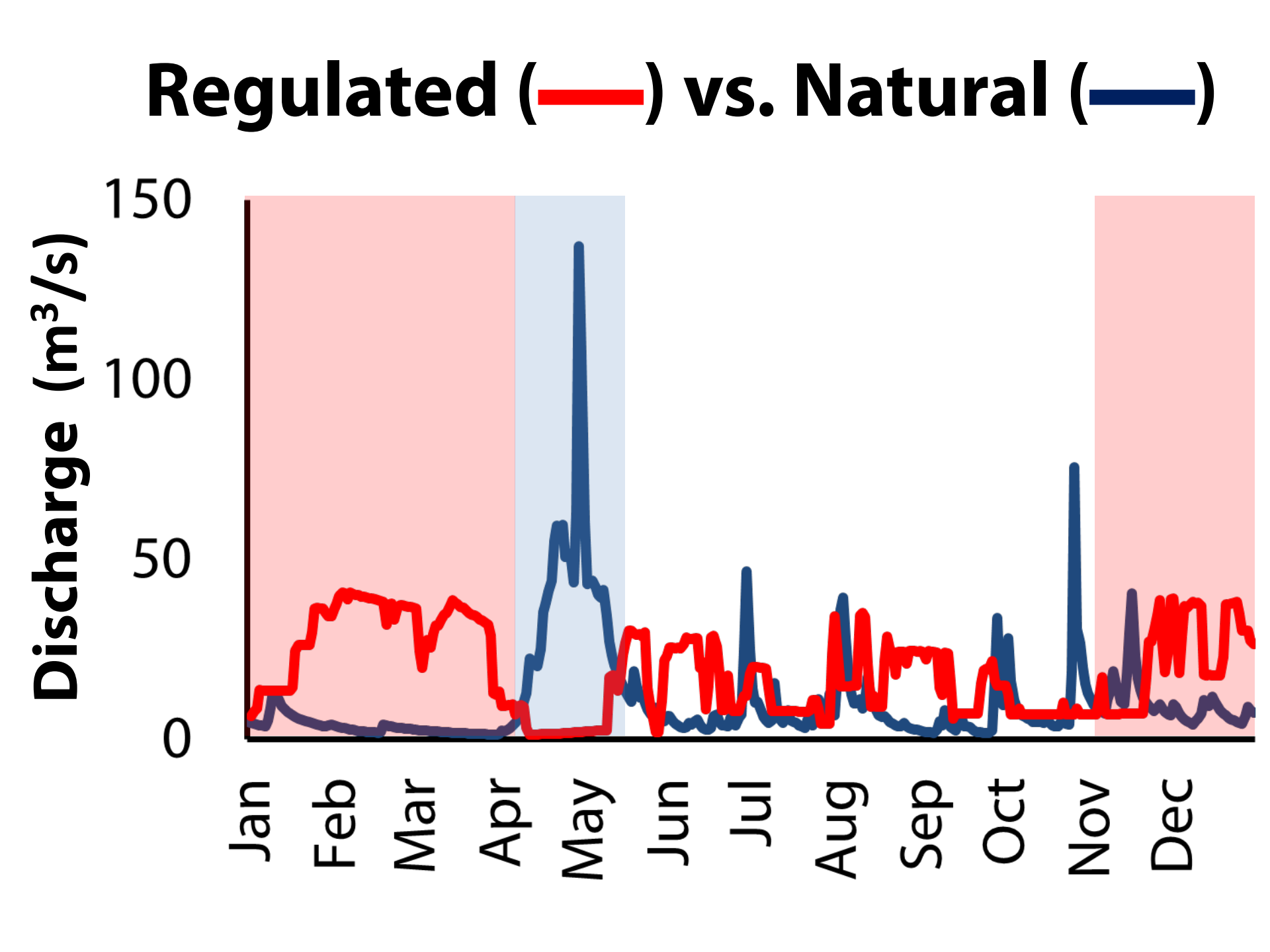
Objectives

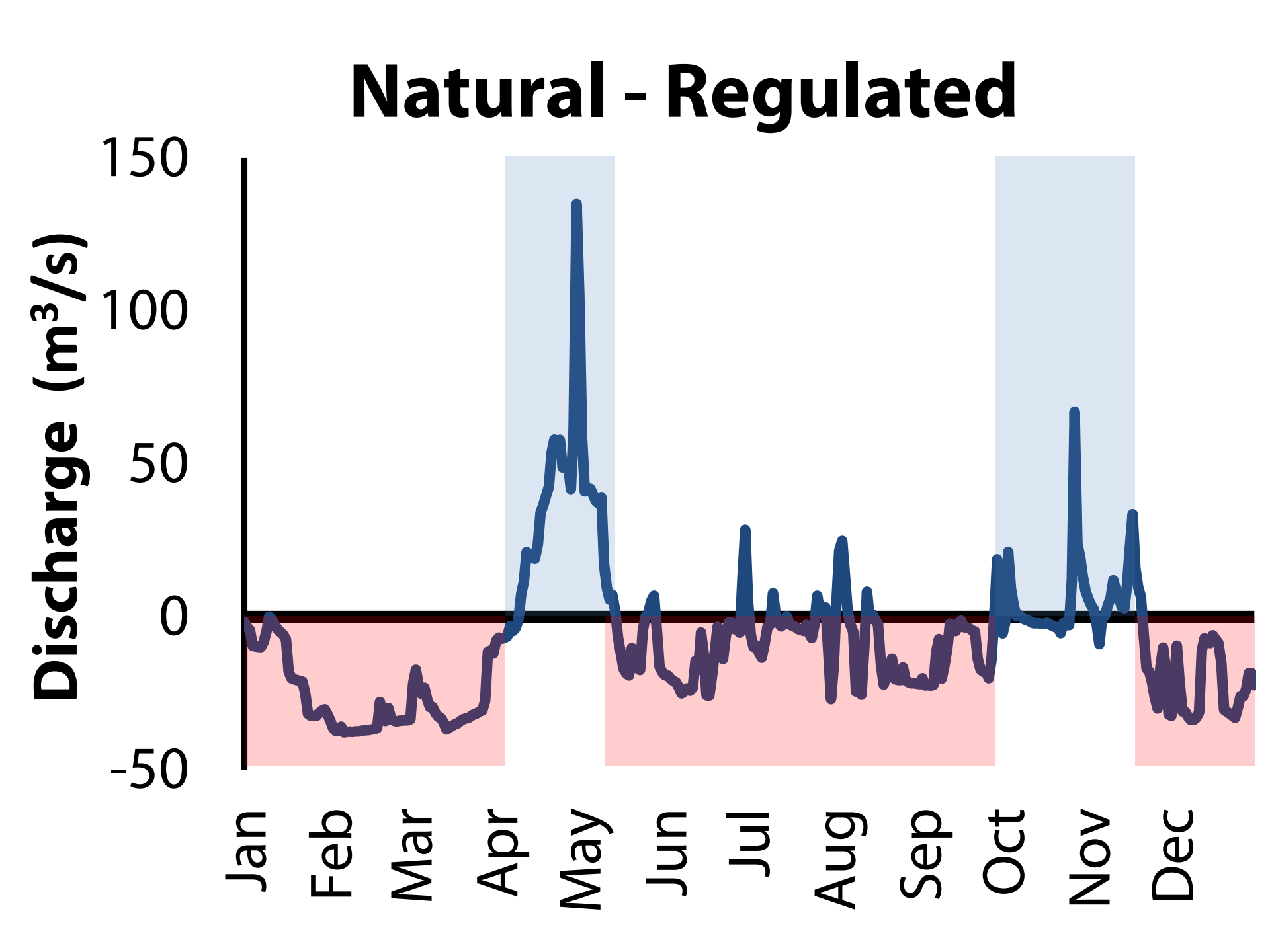
To determine:

- The physiological, behavioural and morphological consequences of regulation
- How these affect population dynamics
- Whether these effects vary spatially and temporally


La Grande Rivière
Mamozekel
Serpentine
Don
Dee
Gulquac
Wapske
New Brunswick (Canada) – Maine (U.S.A) border
N
0
12.5
25
kilometers


Snowmelt dominated
Discharge (m³/s)
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Regulated (—) vs. Natural (—)
Discharge (m³/s)
150
100
50
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec


Natural - Regulated
Discharge (m³/s)
150
100
50
0
-50
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Preliminary study

Water temperature (°C)

	Spawning	Optimum	Upper
	Spring 8	10	25
	Summer 21		29.3
	Fall 4.5 to 10	14	25

MacCrimmon & Campbell, 1969; Gray (2005); Hart (1952); Noble (1965);

Hypothesis

Regulated rivers are cooler in the summer and warmer in the winter than nearby natural rivers

Physiological predictions

In regulated rivers:

- The somatic growth of fish the same age will be faster in the summer
- Gonadal development in spring spawning fish will occur earlier in the spring

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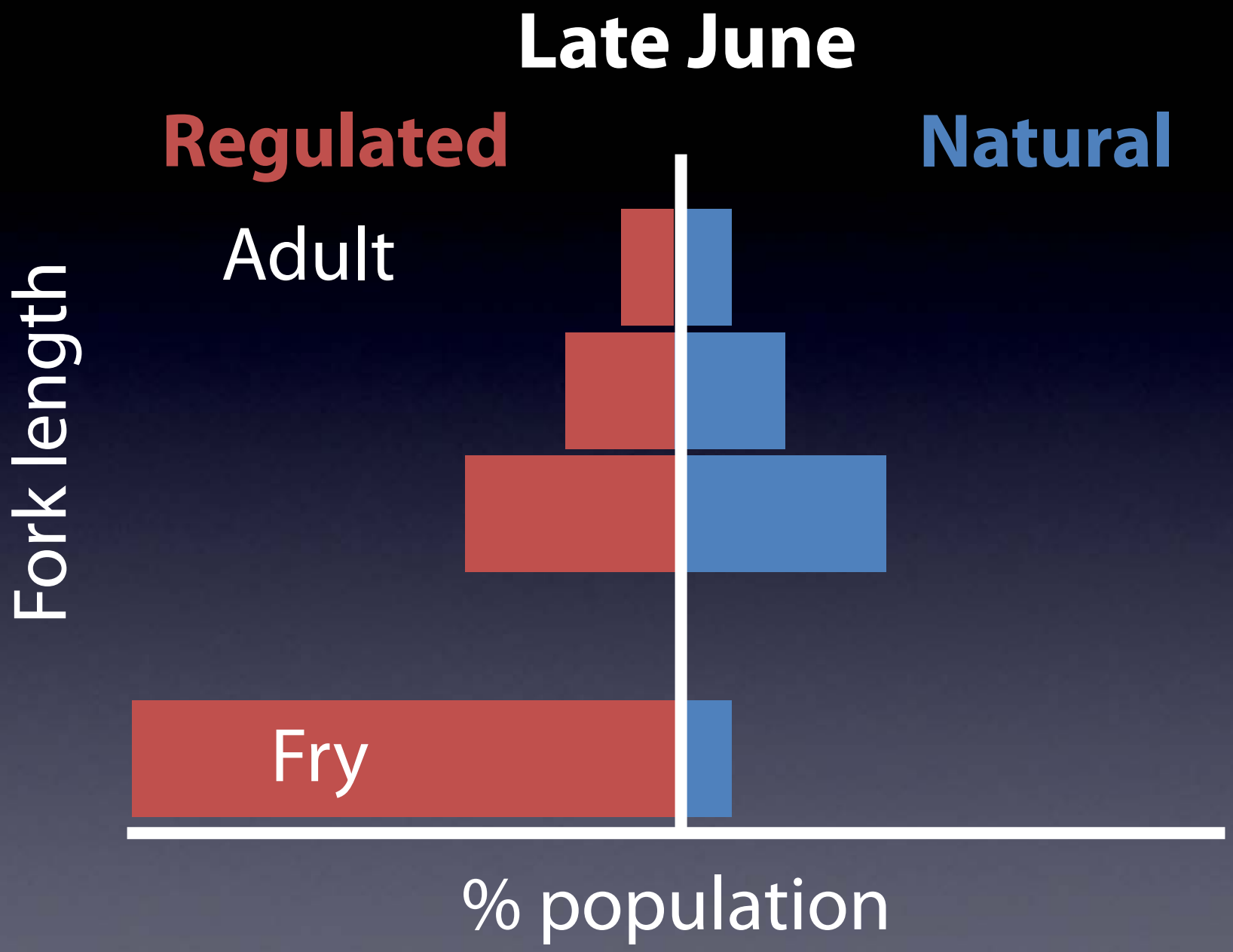
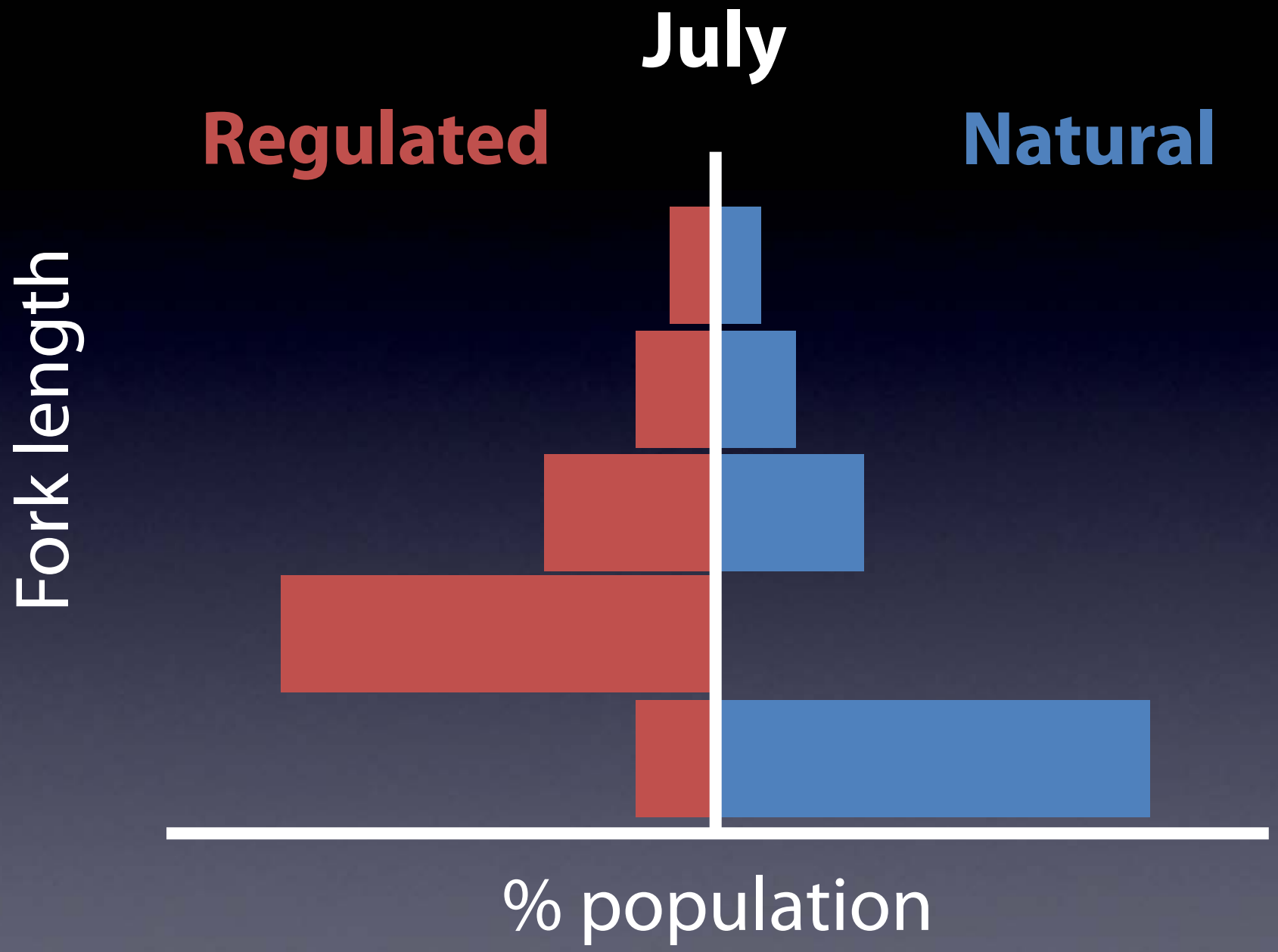
Population predictions

In regulated rivers:

- Greater number of fry earlier in the spring


Late June
Regulated
Natural
Adult
Fork length
Fry
% population


July
Regulated
Natural
Fork length
% population

Population predictions

In regulated rivers:

- Greater number of fry earlier in the spring
- Greater number of cold-water species in the summer

Objectives

To determine:

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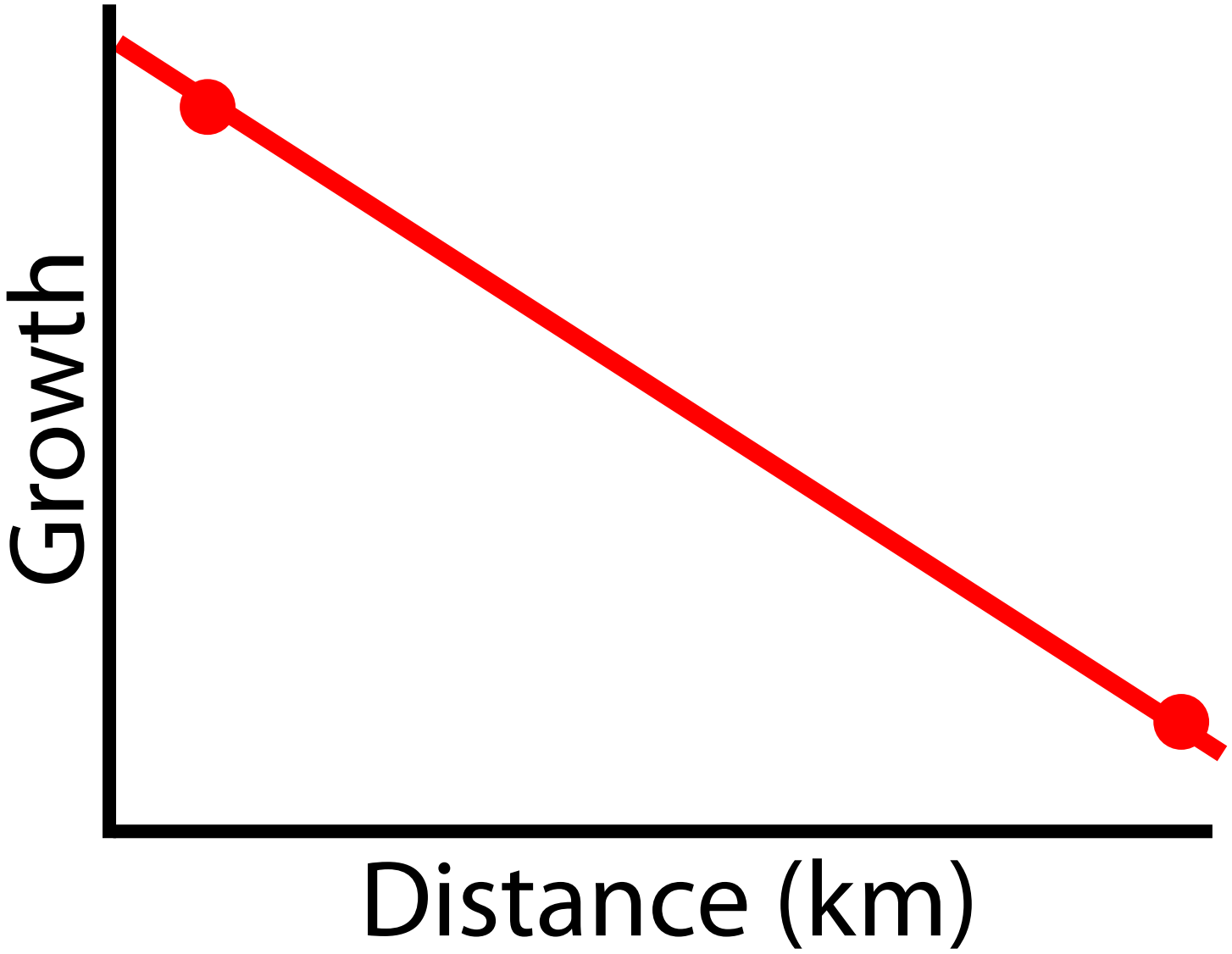
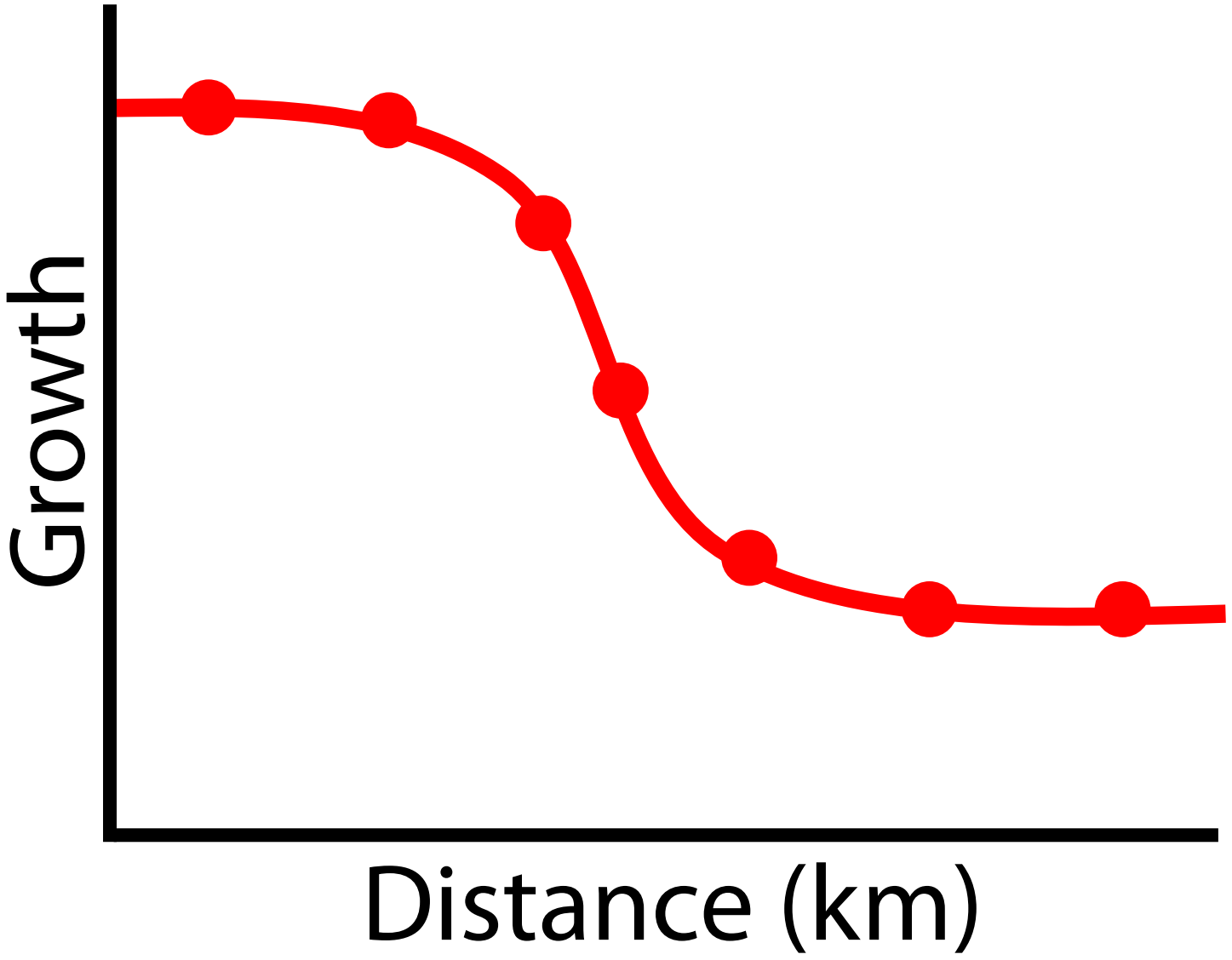
- Whether these effects vary spatially and temporally

Summer – regulated river



Summer – regulated river



Contributions

How hydropower affects:

- Energy partitioning
- Age structure
- Species composition and abundance
- Temporal and spatial variation

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