

# Habitat Conceptual Models



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# POD Conceptual Model

TOP-DOWN

**"Drivers"**

*Water Quality  
Diversions*

PHYSICAL  
&  
CHEMICAL  
FISH  
HABITAT

*Temperature  
Turbidity  
Salinity*

*Contaminants*

*Disease*

*Toxic algae*

**POD Fish**

**Abundance, Distribution, Health**

*Prior Fish  
Abundance*

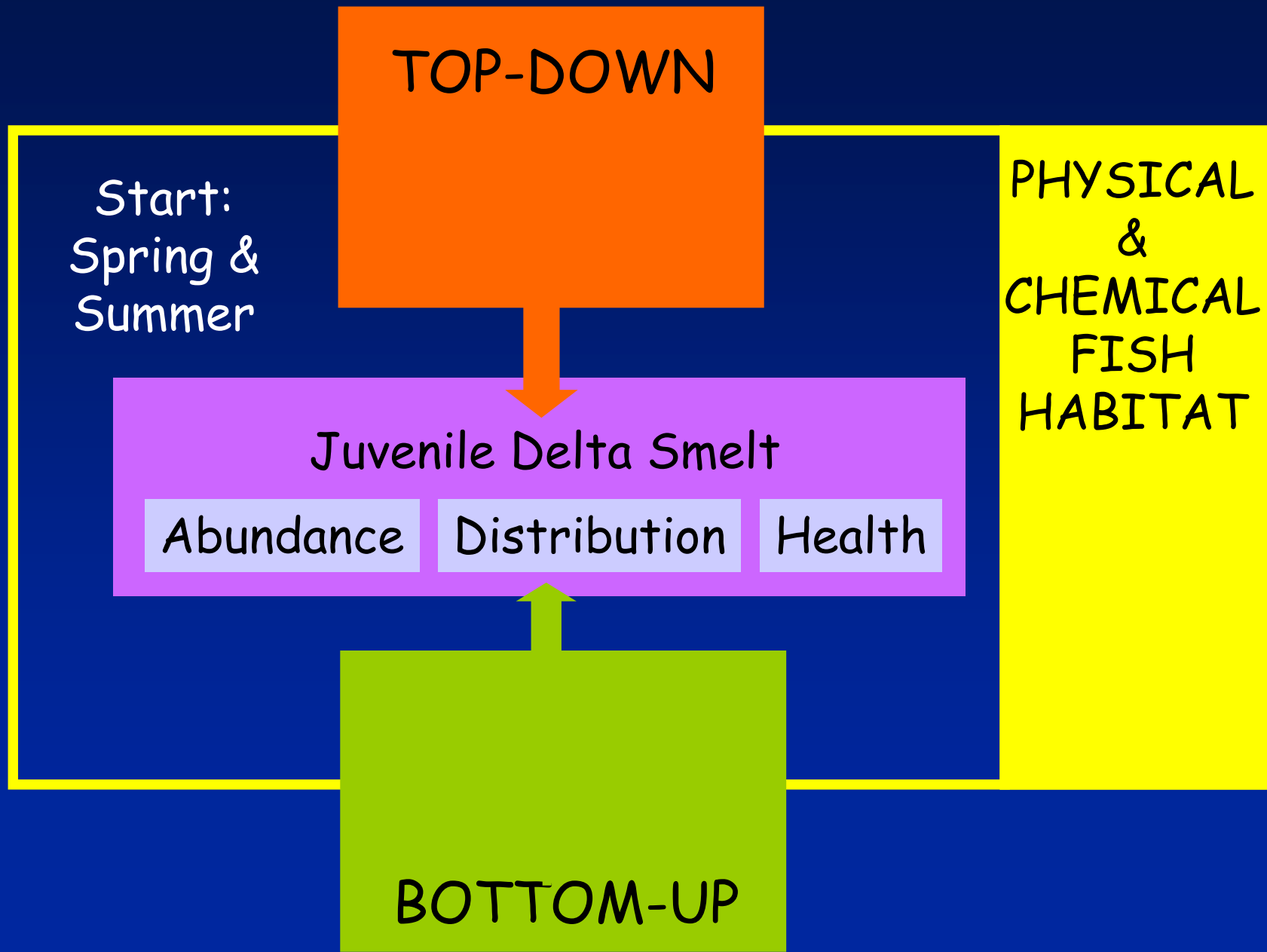
ABUNDANCE

*Food  
availability*

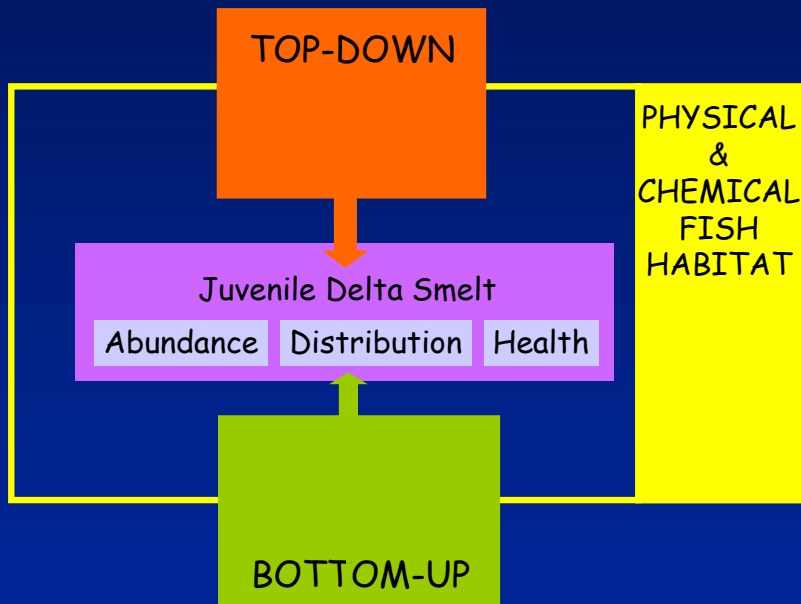
*Food quality*

BOTTOM-UP

# Delta Smelt Life Cycle & Fall X2 in the POD CM



Spring & Summer → Fall



Spring & Summer



Fall

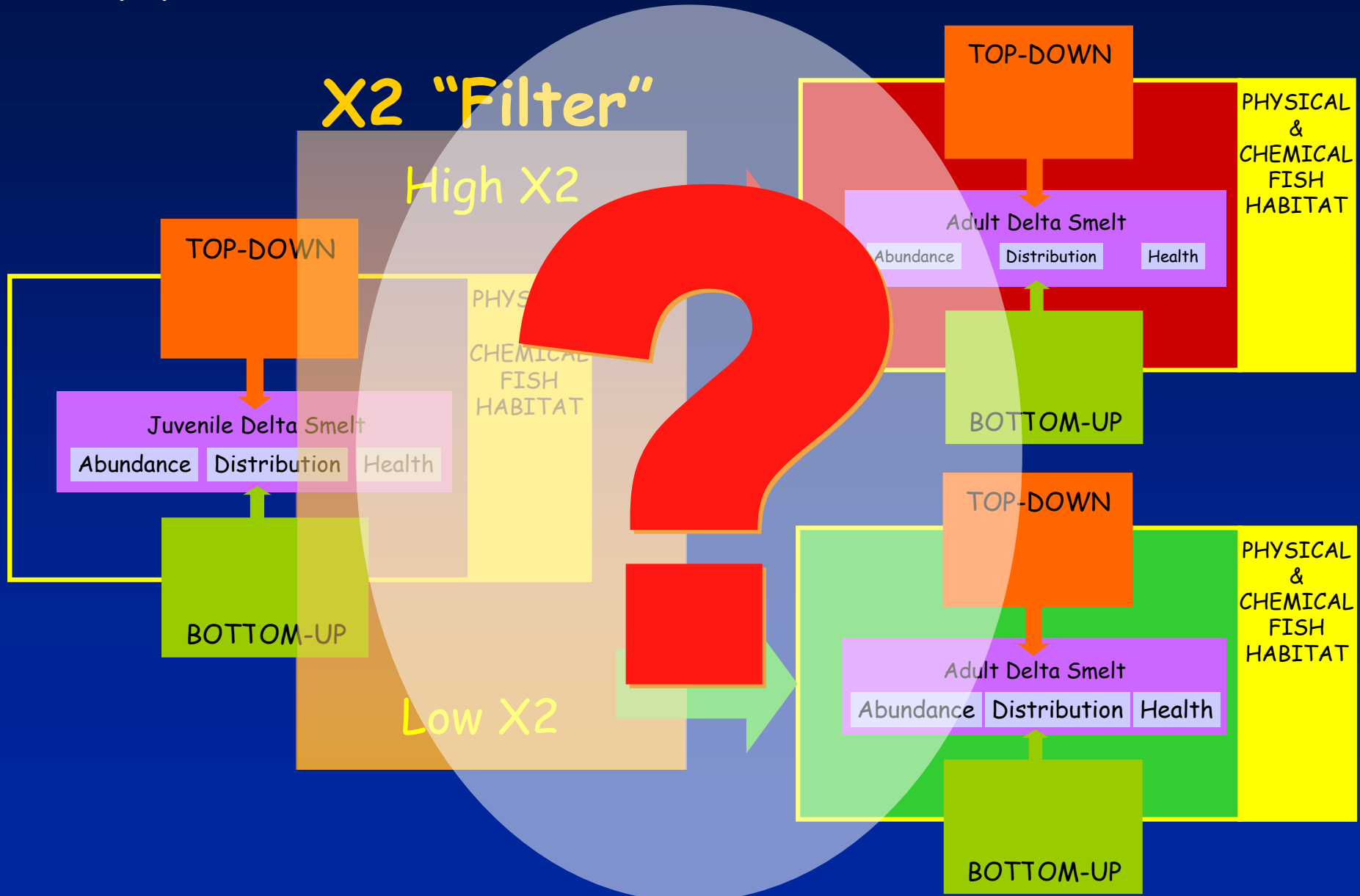


Winter & Spring

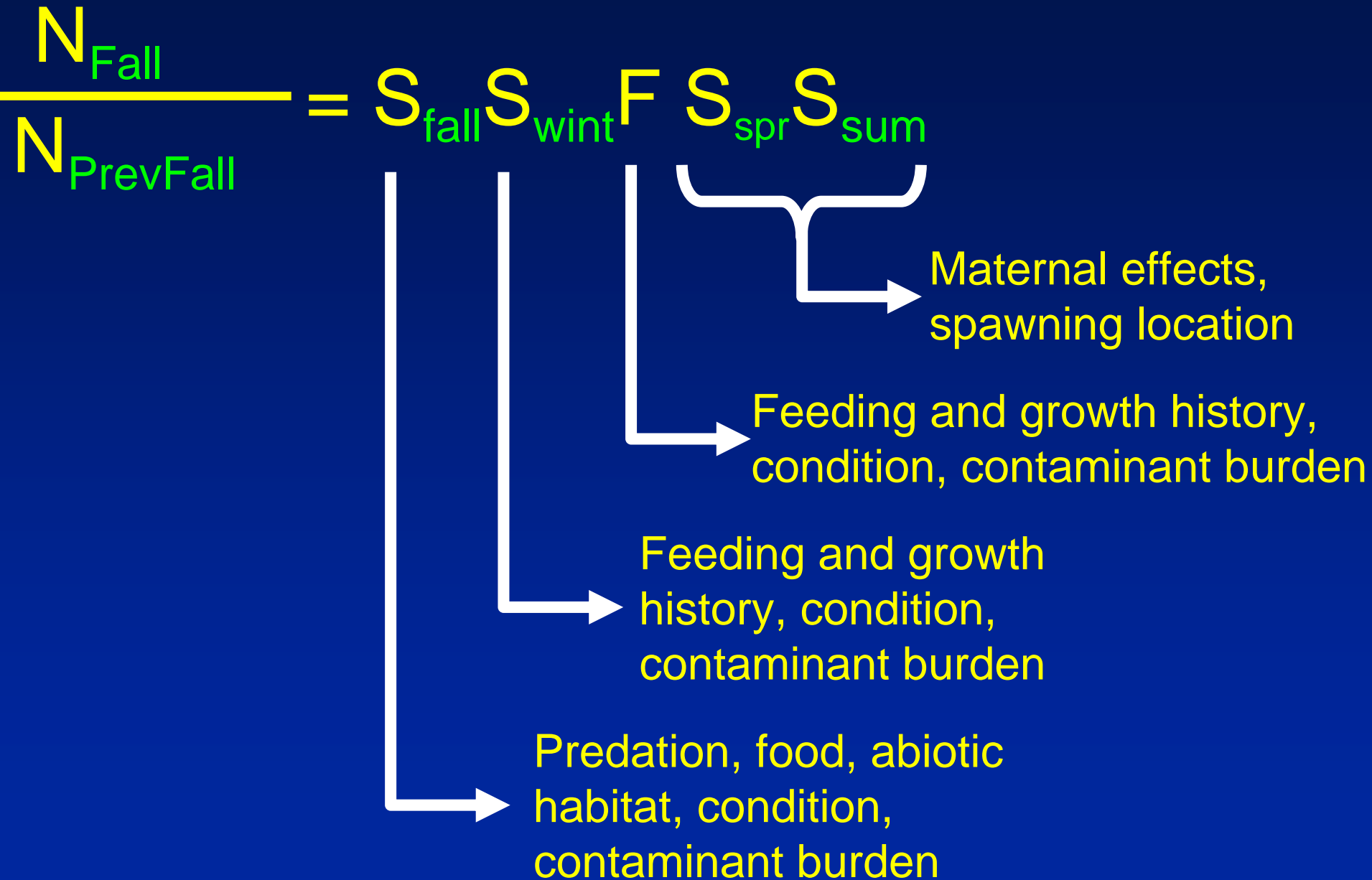
X2 "Filter"

High X2

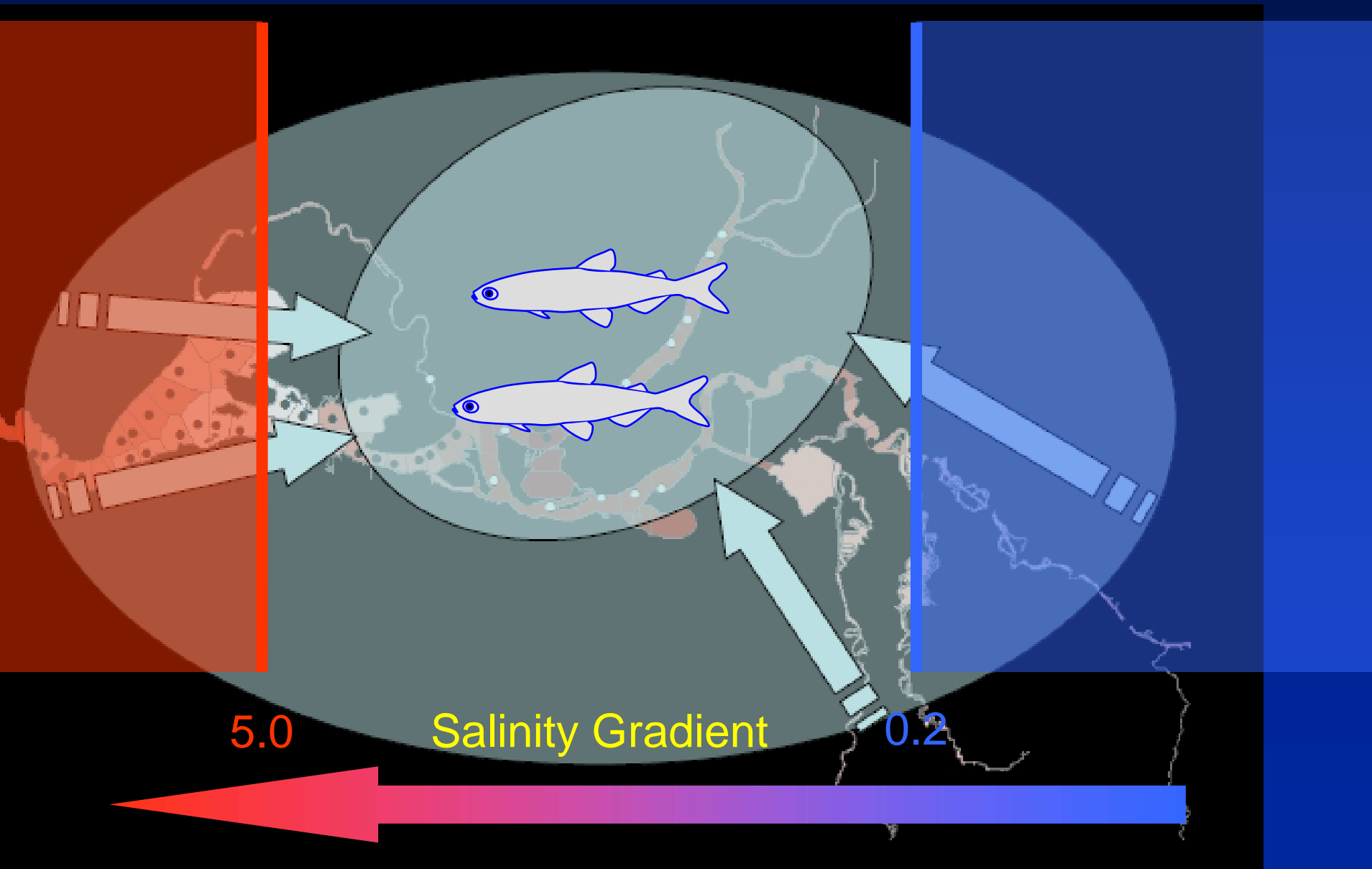
Low X2



# Life-cycle effects attributable to fall conditions

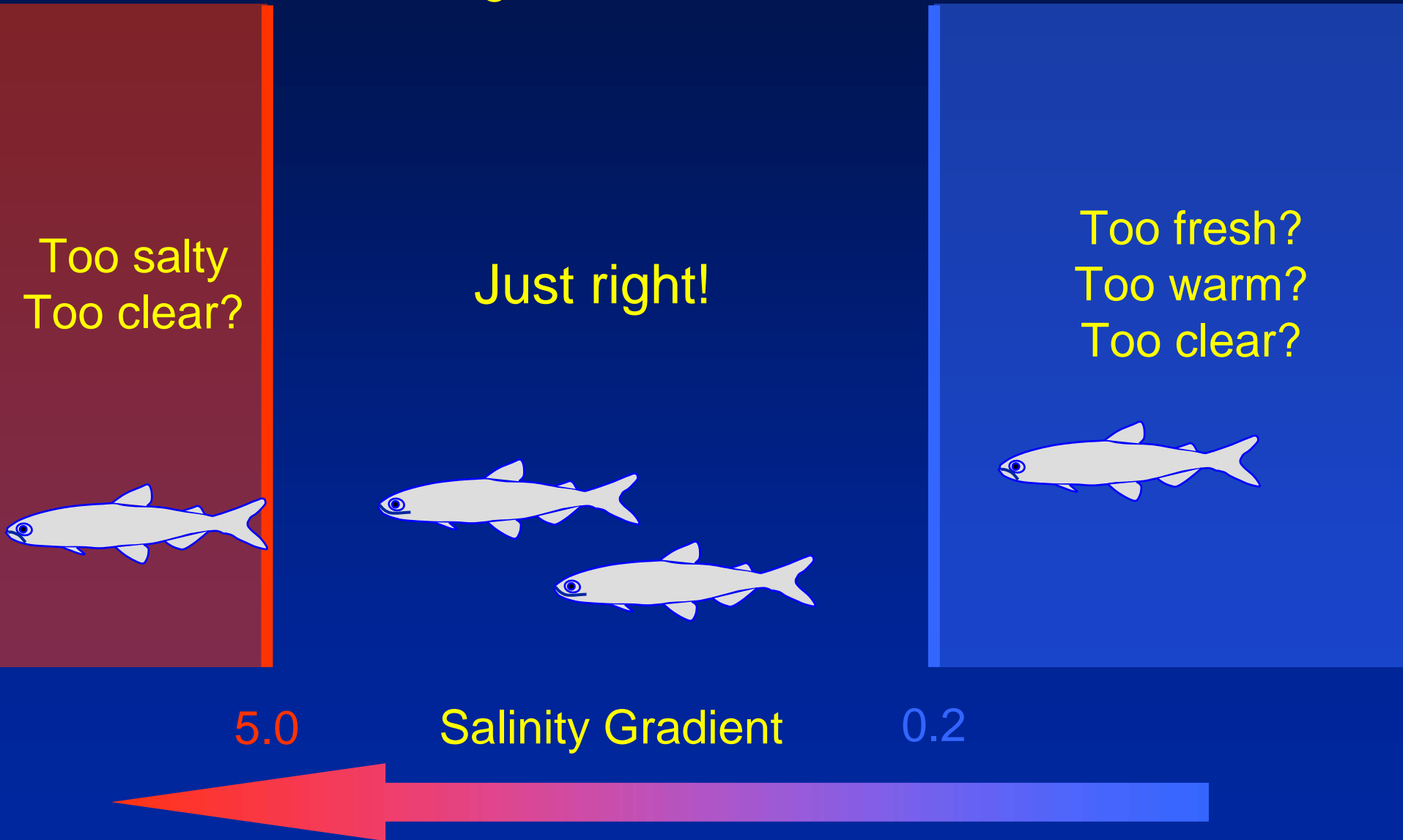


# Fall Habitat $\approx$ Low-Salinity Zone



# Fall Habitat $\approx$ Low-Salinity Zone

Moving frame of reference





# Classes of Mechanism

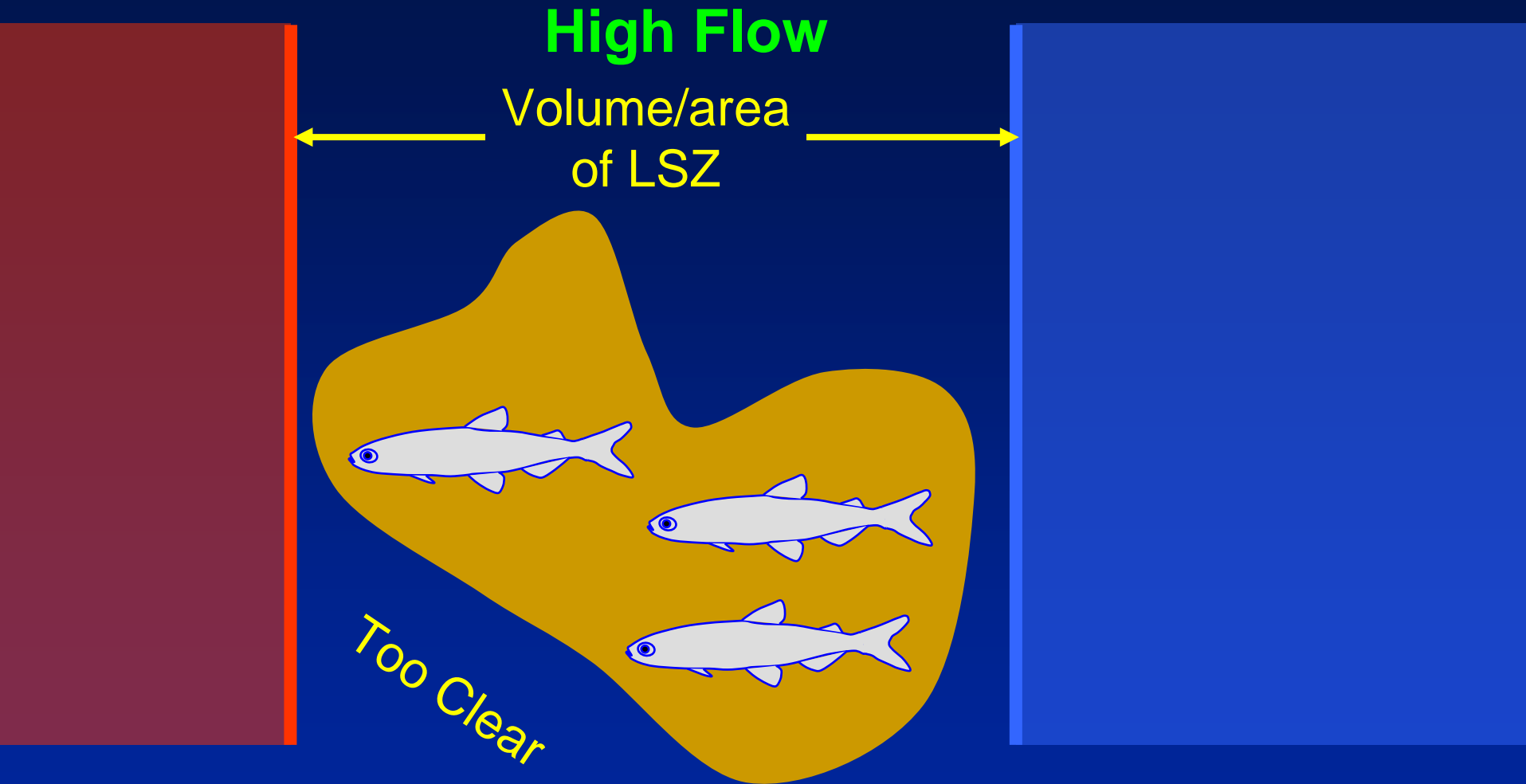
- “Abiotic” habitat including contaminants
- “Top-down” effects: predation and diversions
- “Bottom-up” effects: food supply
- Interactions



# Classes of Mechanism (drivers)

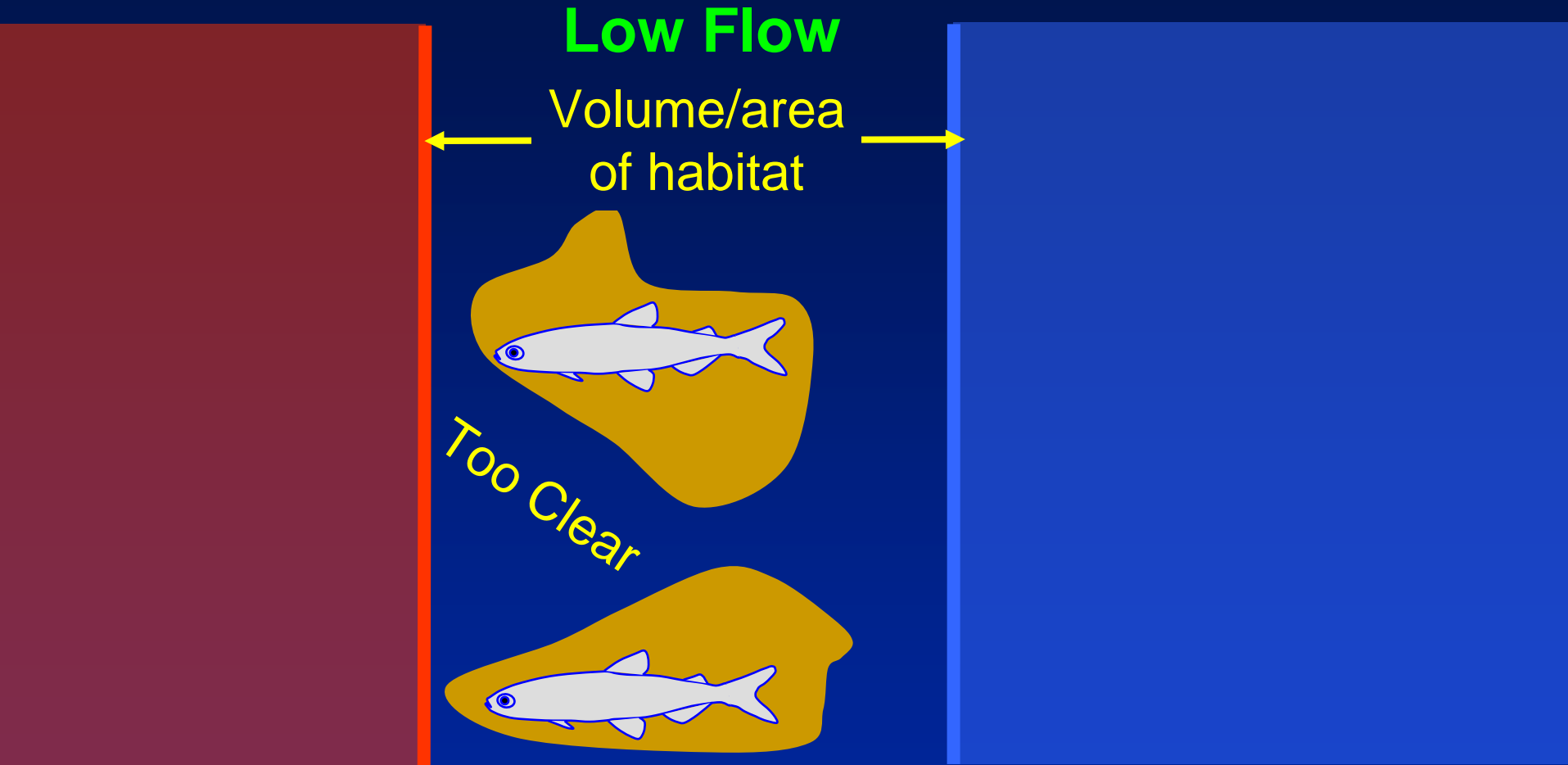
- “Abiotic” habitat
  - Salinity
  - Turbidity
  - Contaminants
  - Temperature
- “Top-down” effects: predation and diversions
- “Bottom-up” effects: food supply
- Interactions

# Potential changes in abiotic habitat I



How does the amount of physical habitat vary with  $X^2$ ?

# Potential changes in abiotic habitat I



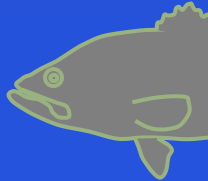
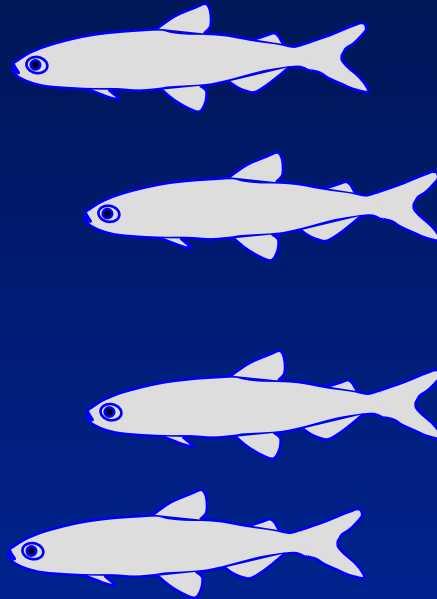
How does the amount of physical habitat vary with  $X^2$ ?

# Classes of Mechanism (drivers)

- “Abiotic” habitat
- “Top-down” effects: predation and diversions
  - Predation by striped bass, largemouth bass
  - Diversions (all)
- “Bottom-up” effects: food supply
- Interactions

# Potential changes in predation I

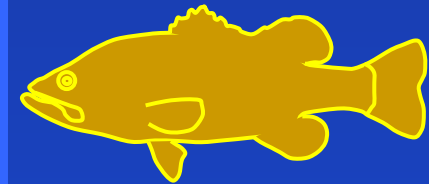
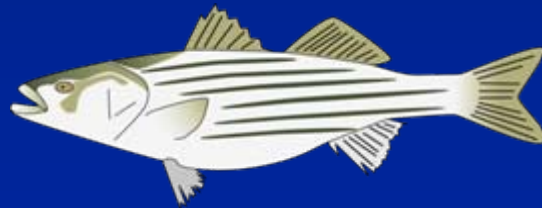
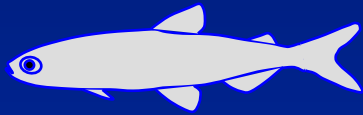
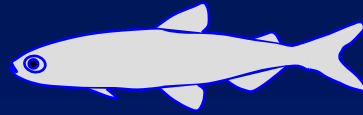
## High Flow



How does predation by striped bass and largemouth bass vary?

# Potential changes in predation I

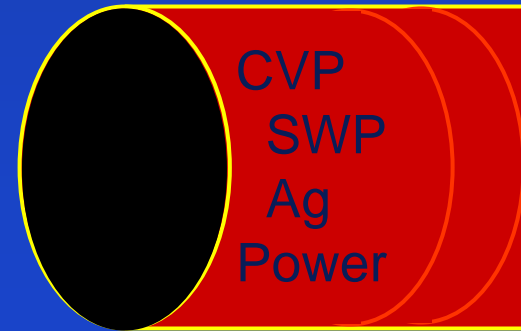
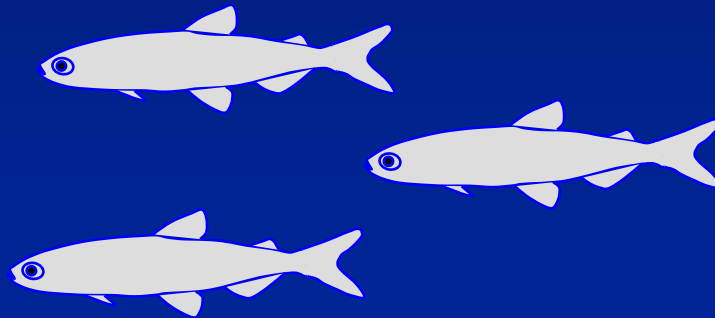
Low Flow



How does predation by striped bass and largemouth bass vary?

# Potential changes in predation II

High Flow

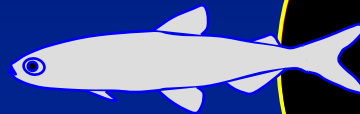
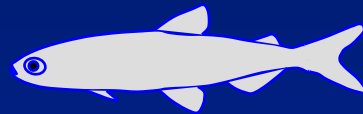


How does exposure to diversions vary with  $X_2$ ?



# Potential changes in predation II

Low Flow



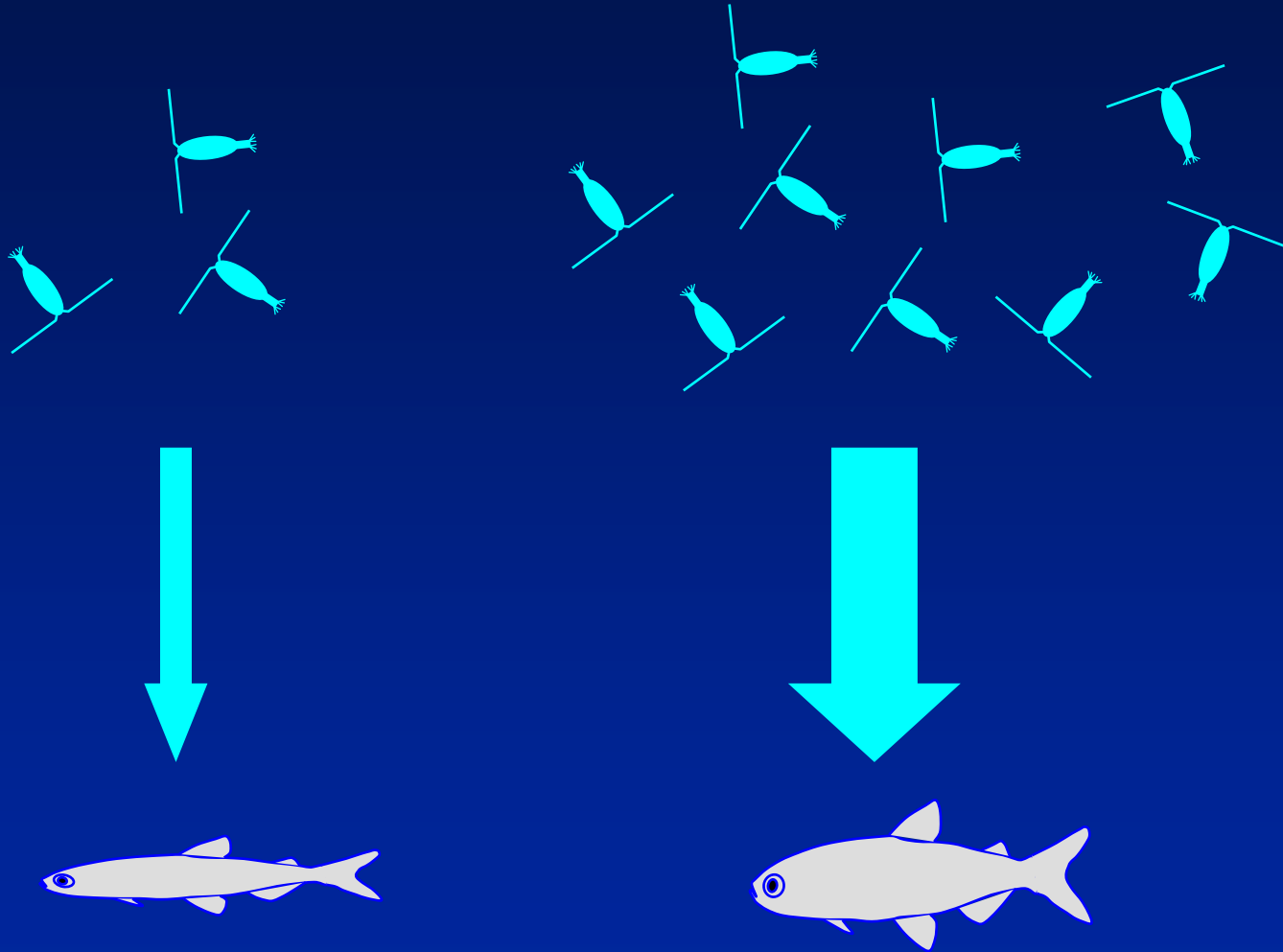
CVP  
SWP  
Ag  
Power

How does exposure to diversions vary with  $X^2$ ?

# Classes of Mechanism (drivers)

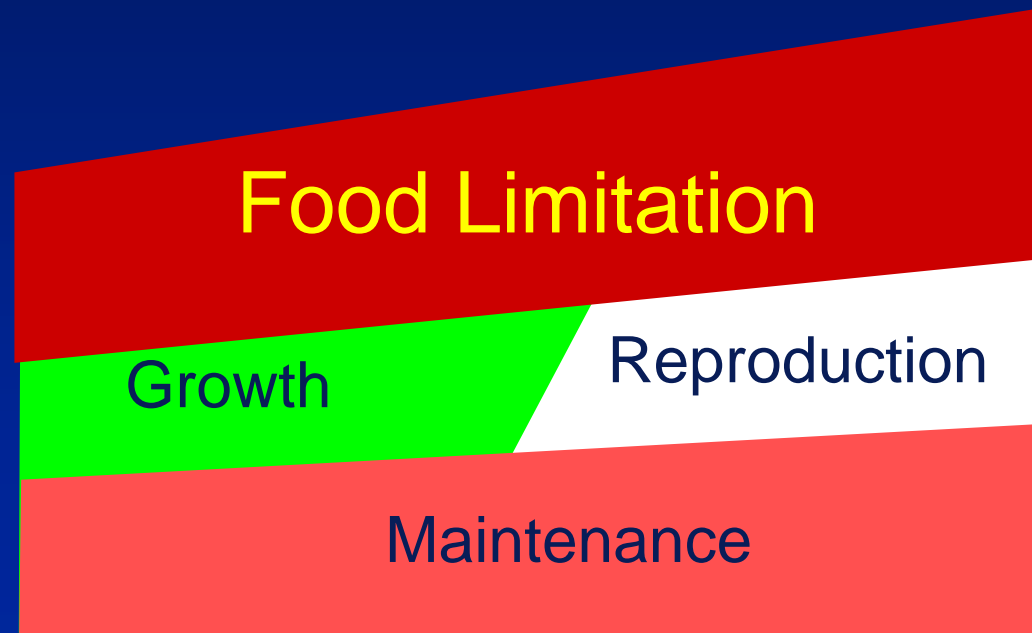
- “Abiotic” habitat
- “Top-down” effects: predation and diversions
- “Bottom-up” effects: food supply
  - Transport effects
  - Physical habitat effects
  - Predation and competition
  - Production of undesirables
  - Contaminant effects
- Interactions

# Importance of food limitation



# Energy Allocation (greatly simplified)

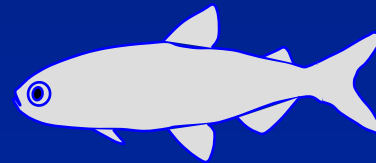
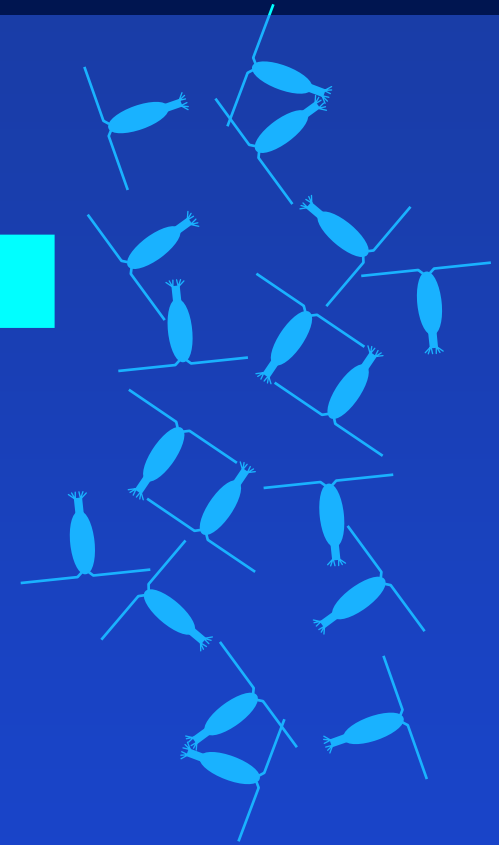
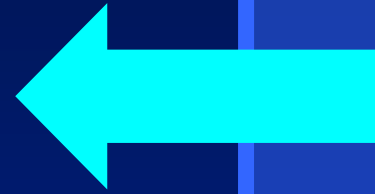
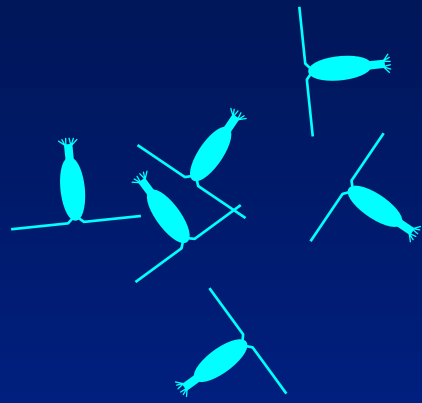
Fraction of  
Assimilated  
Energy



Age

# Potential changes in foodweb I

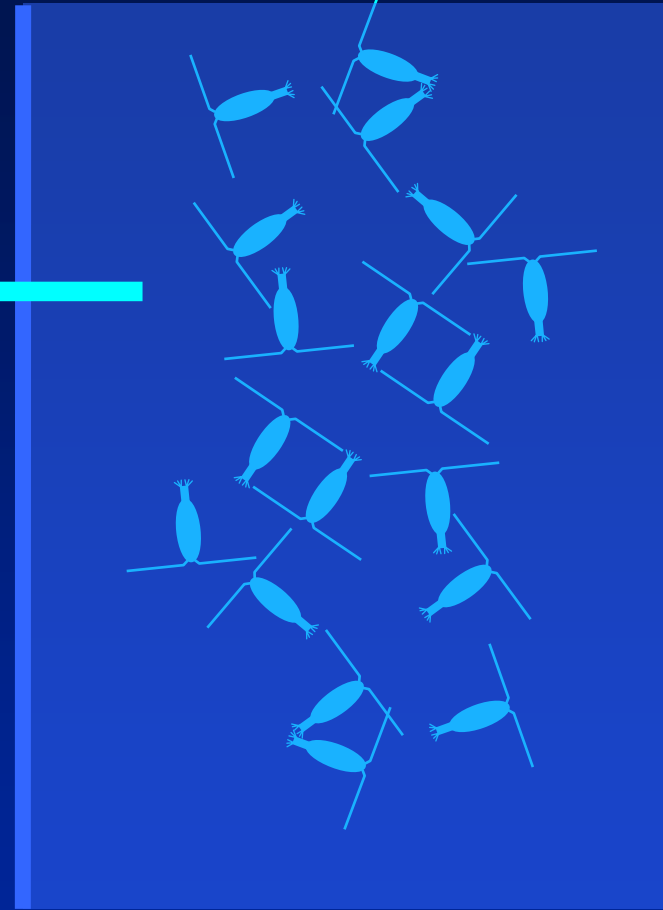
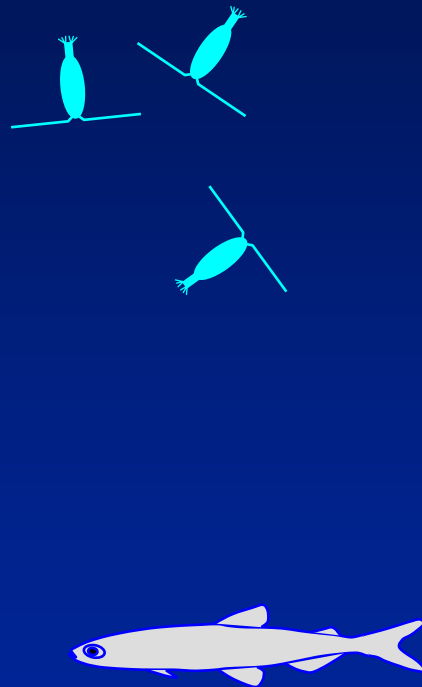
High Flow



How does the transport of *Pseudodiaptomus* vary?

# Potential changes in foodweb I

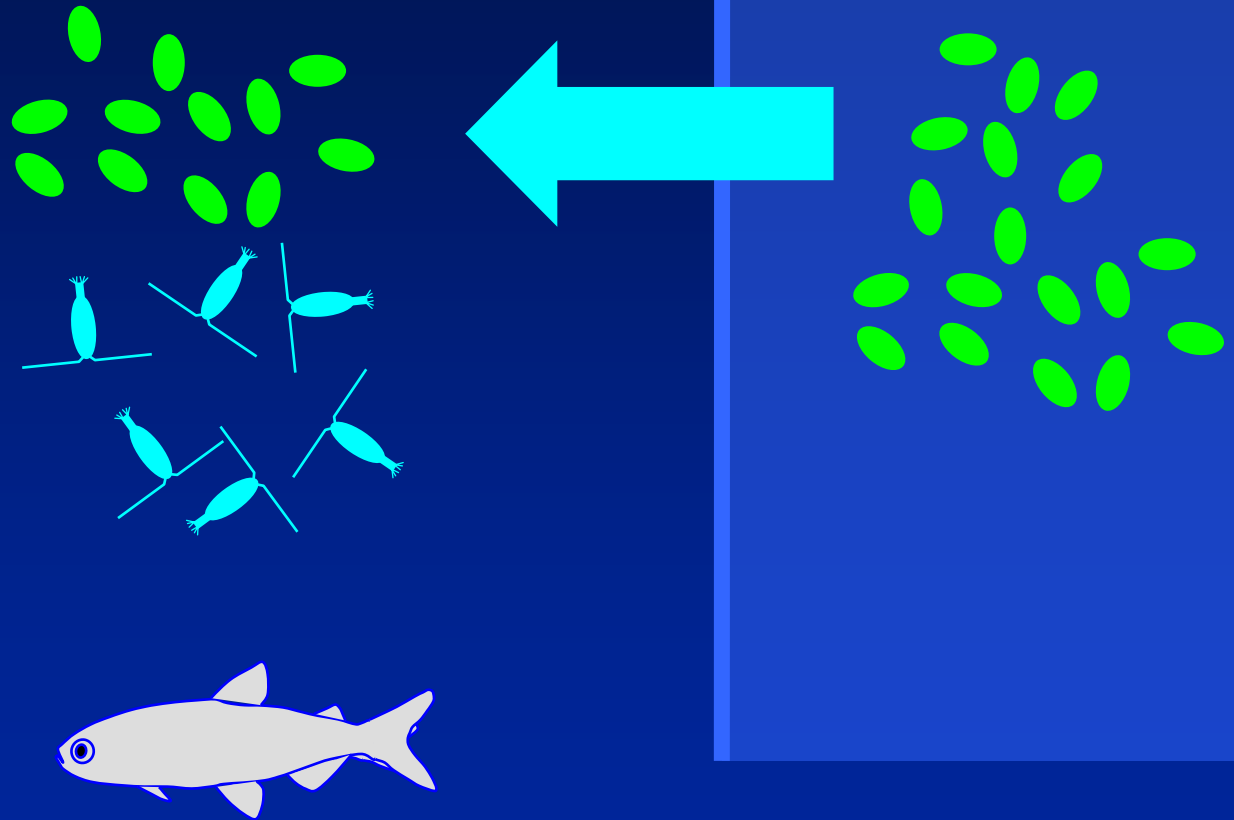
Low Flow



How does the transport of *Pseudodiaptomus* vary?

# Potential changes in foodweb II

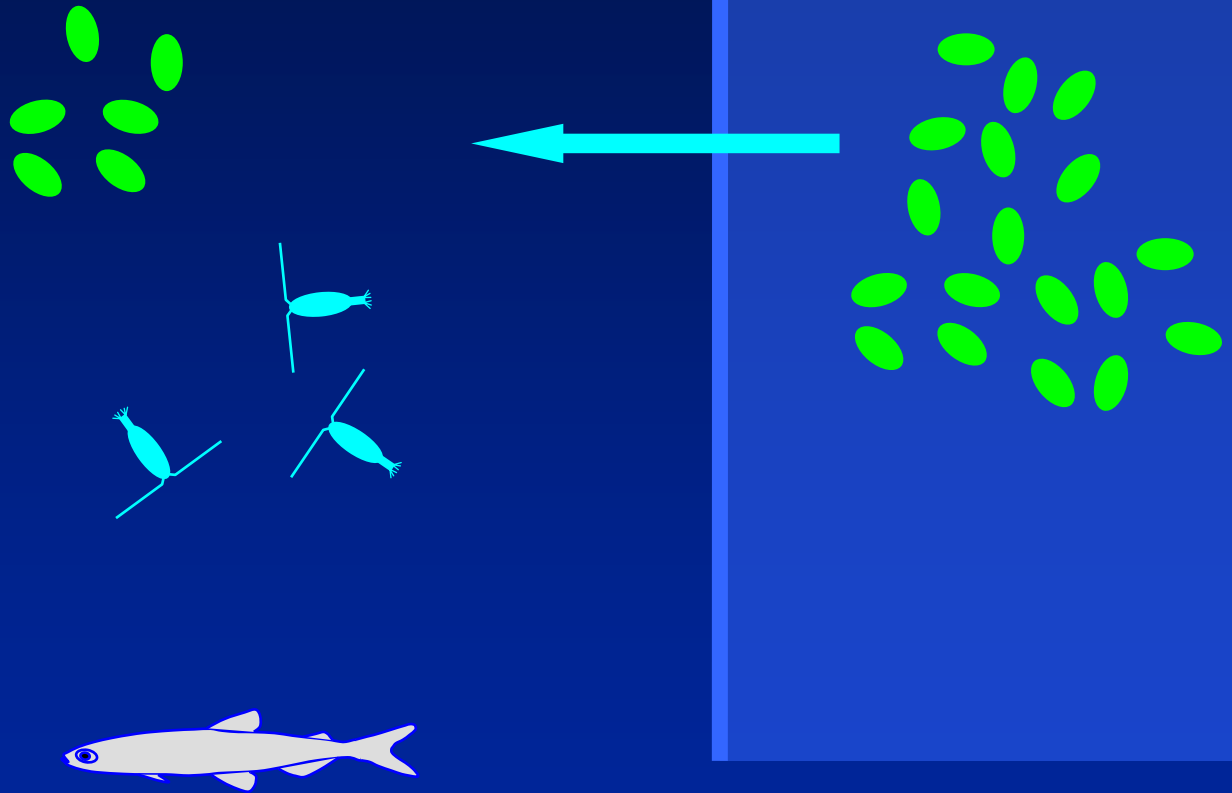
High Flow



How does the transport of phytoplankton and organic matter vary?

# Potential changes in foodweb II

Low Flow

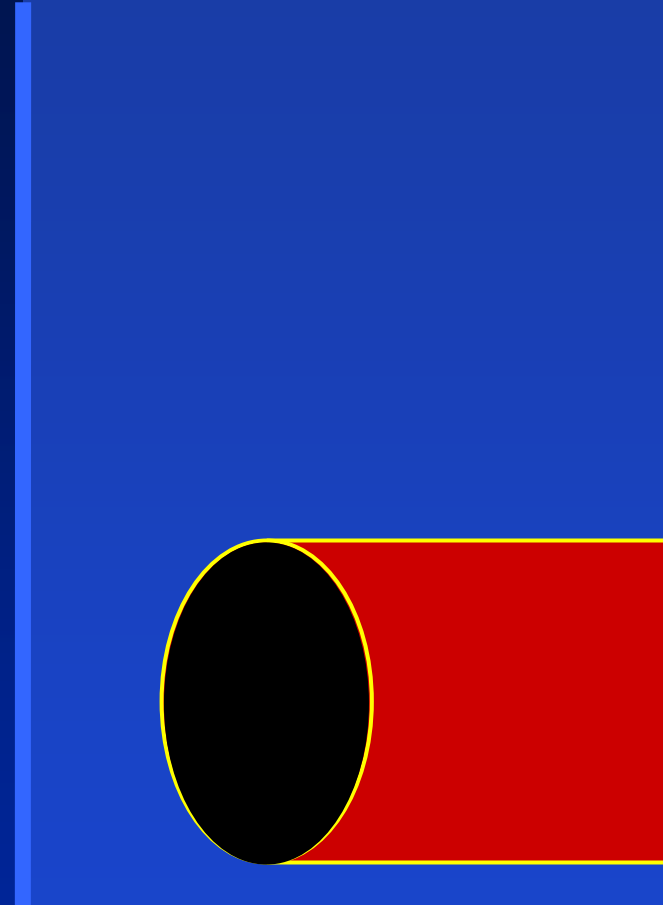
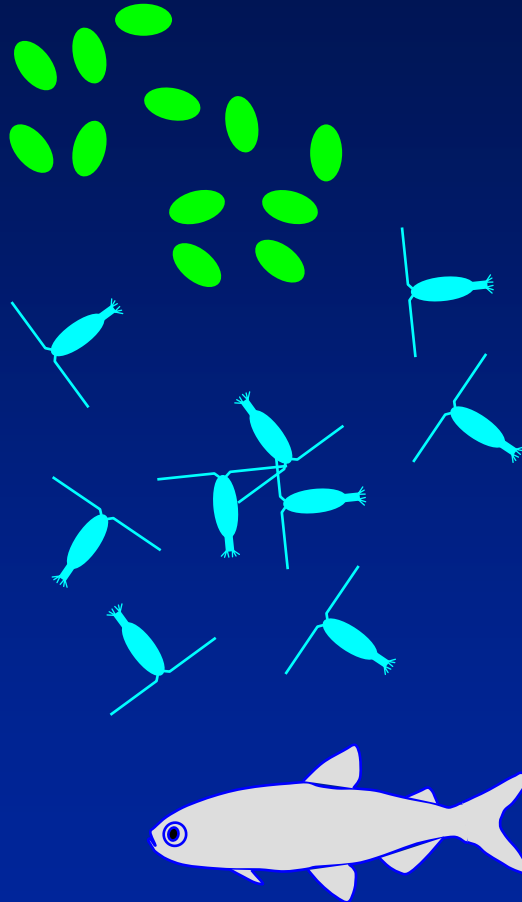


How does the transport of phytoplankton and organic matter vary?



# Potential changes in foodweb III

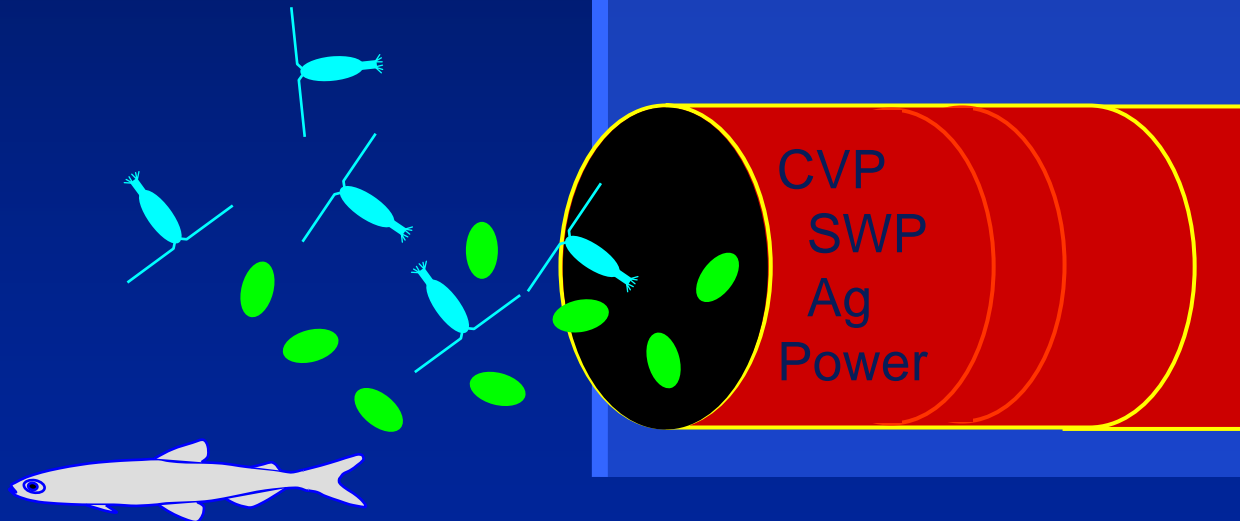
High Flow



How does exposure of food organisms to diversions vary with  $X_2$ ?

# Potential changes in foodweb III

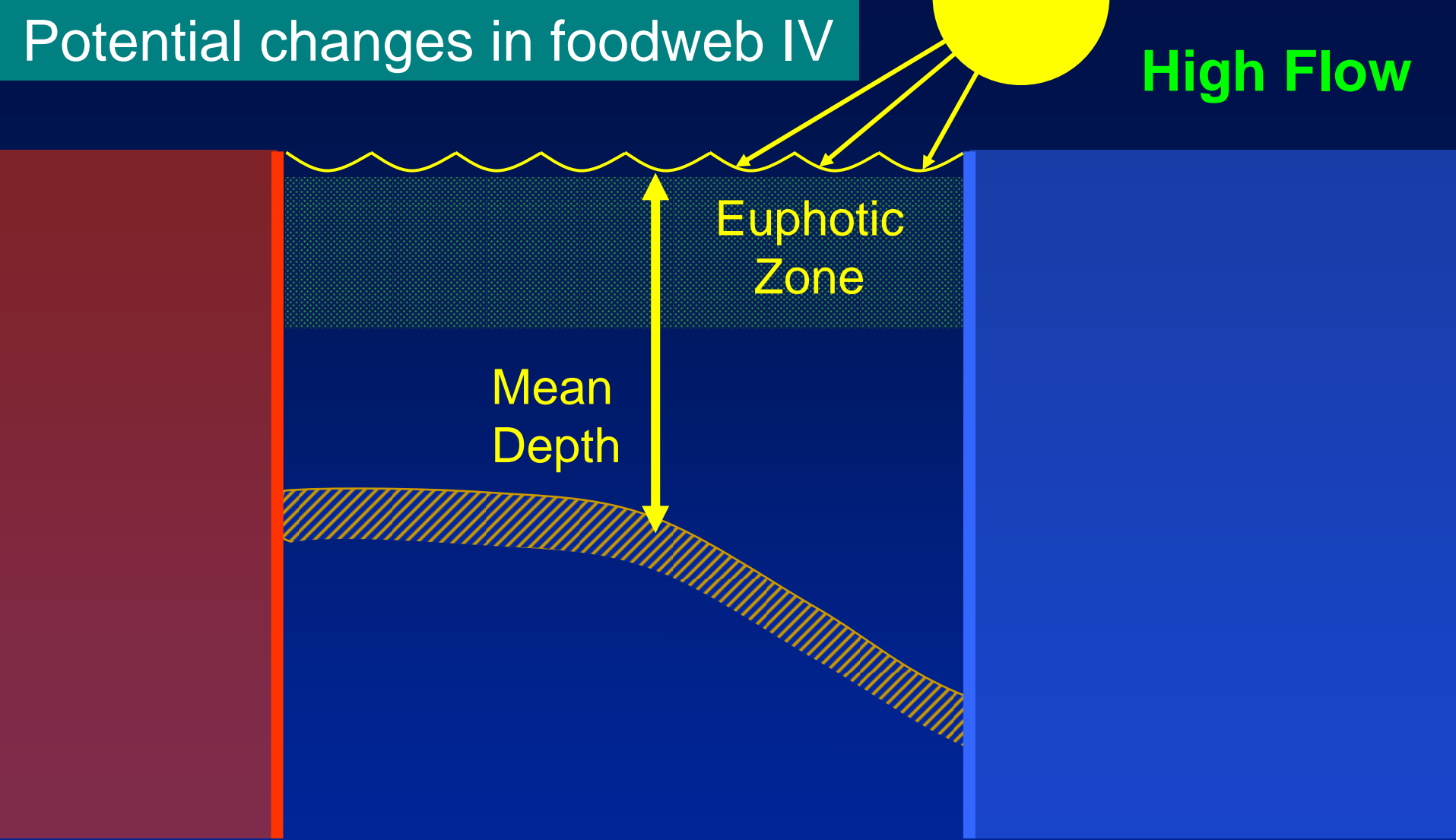
## Low Flow



How does exposure of food organisms to diversions vary with X2?

# Potential changes in foodweb IV

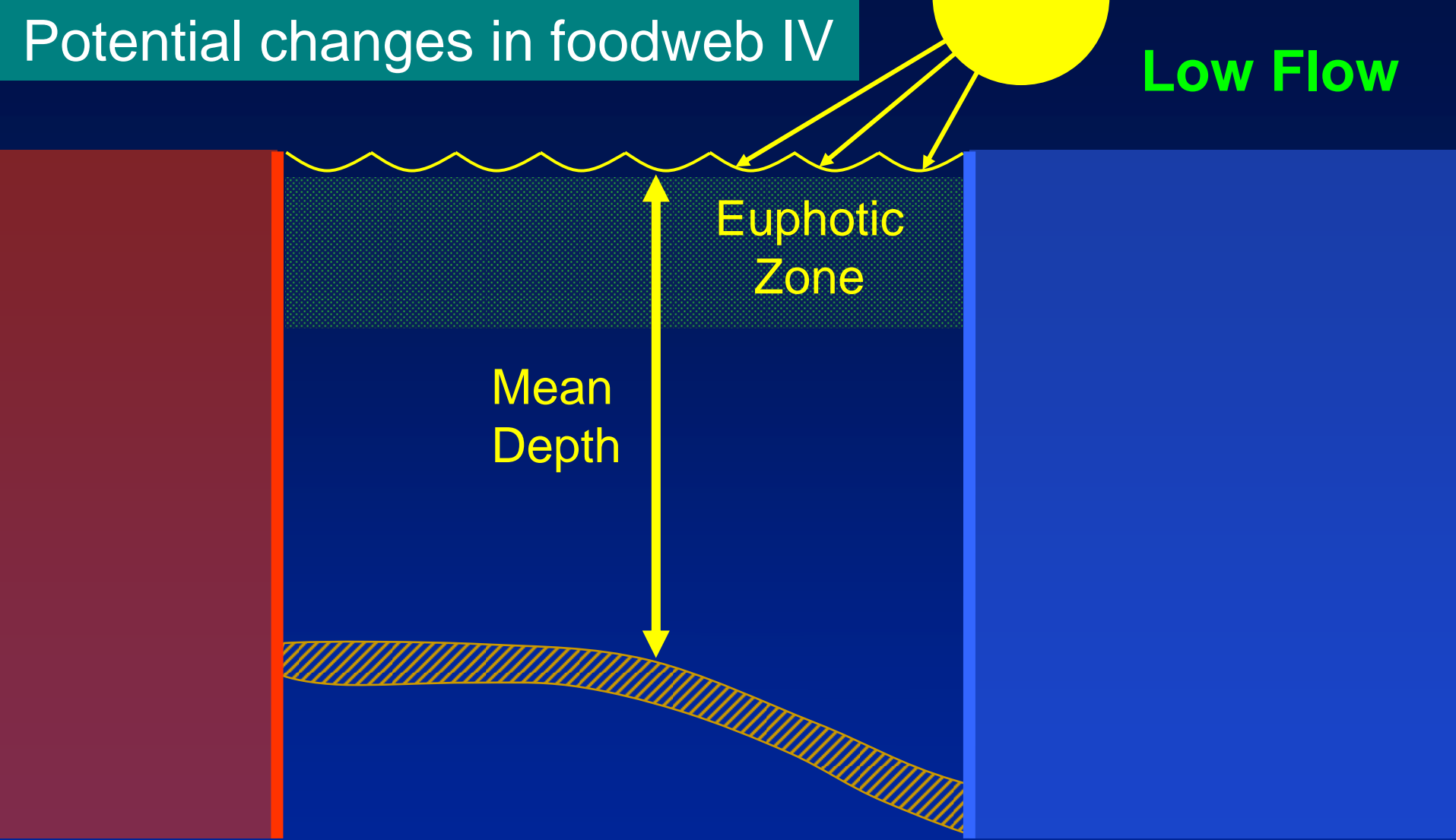
High Flow



How do mean depth and light-limited primary production vary?

# Potential changes in foodweb IV

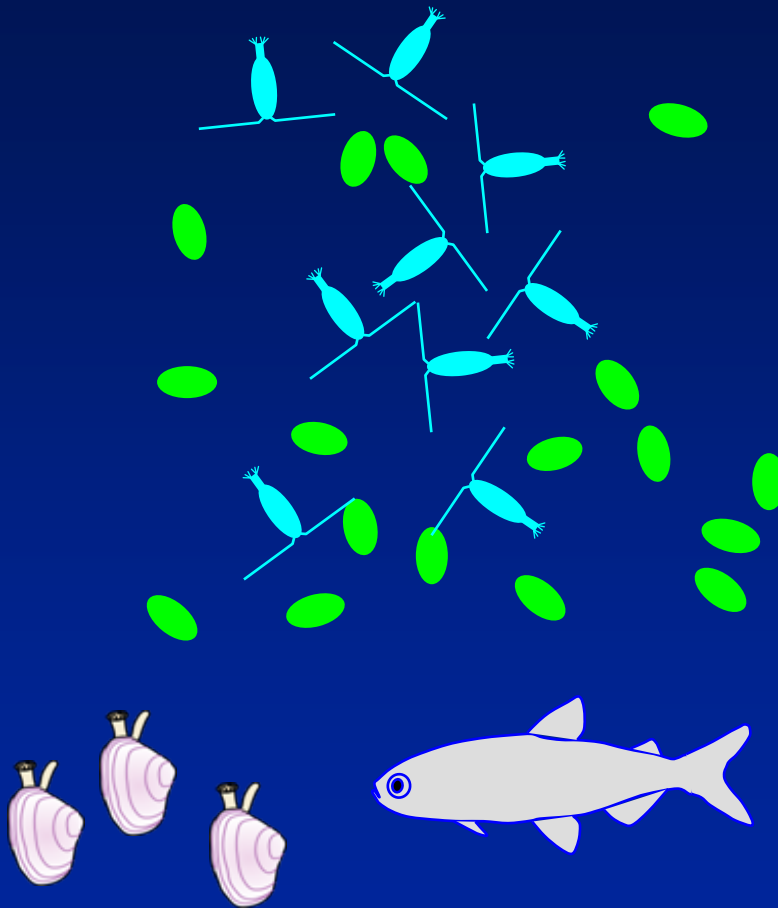
Low Flow



How do mean depth and light-limited primary production vary?

# Potential changes in foodweb V

## Low Flow

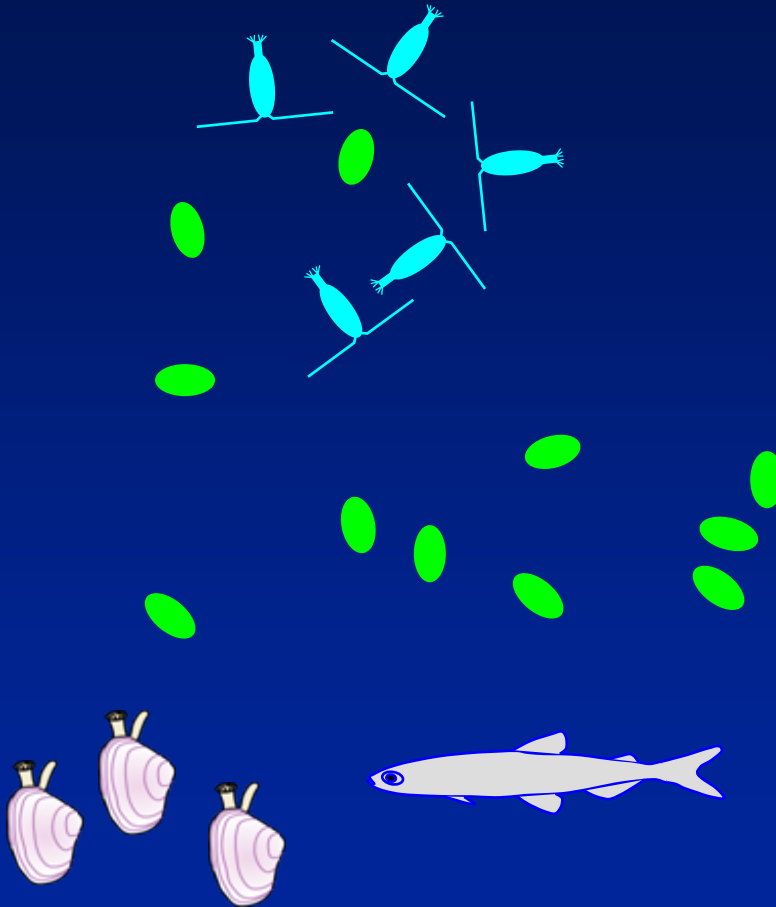


How does recruitment of *Corbula* vary?

How does overlap of *Corbula* with the LSZ vary?

# Potential changes in foodweb V

## Low Flow

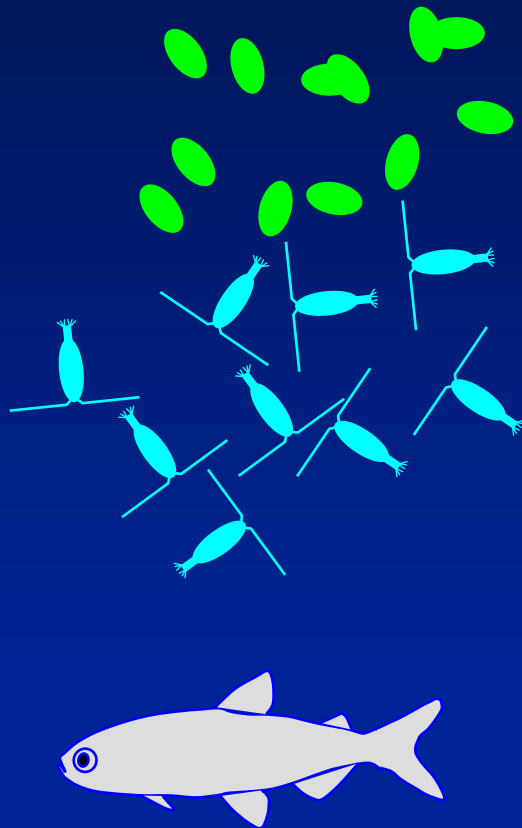


How does recruitment of *Corbula* vary?

How does overlap of *Corbula* with the LSZ vary?

# Potential changes in foodweb VI

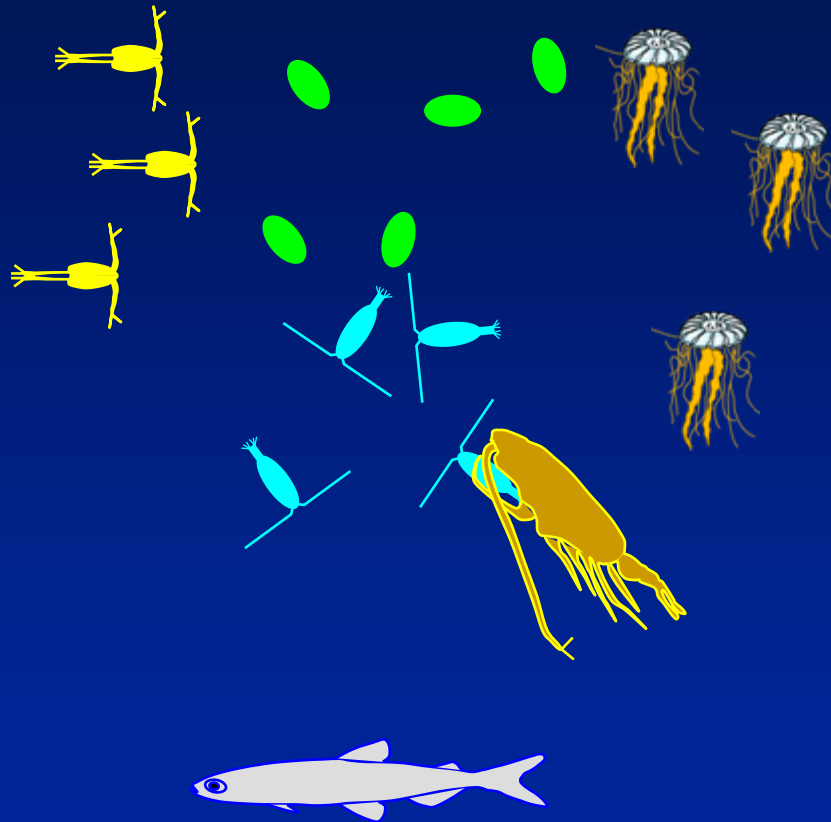
## High Flow



How do competition and predation vary?

# Potential changes in foodweb VI

## Low Flow

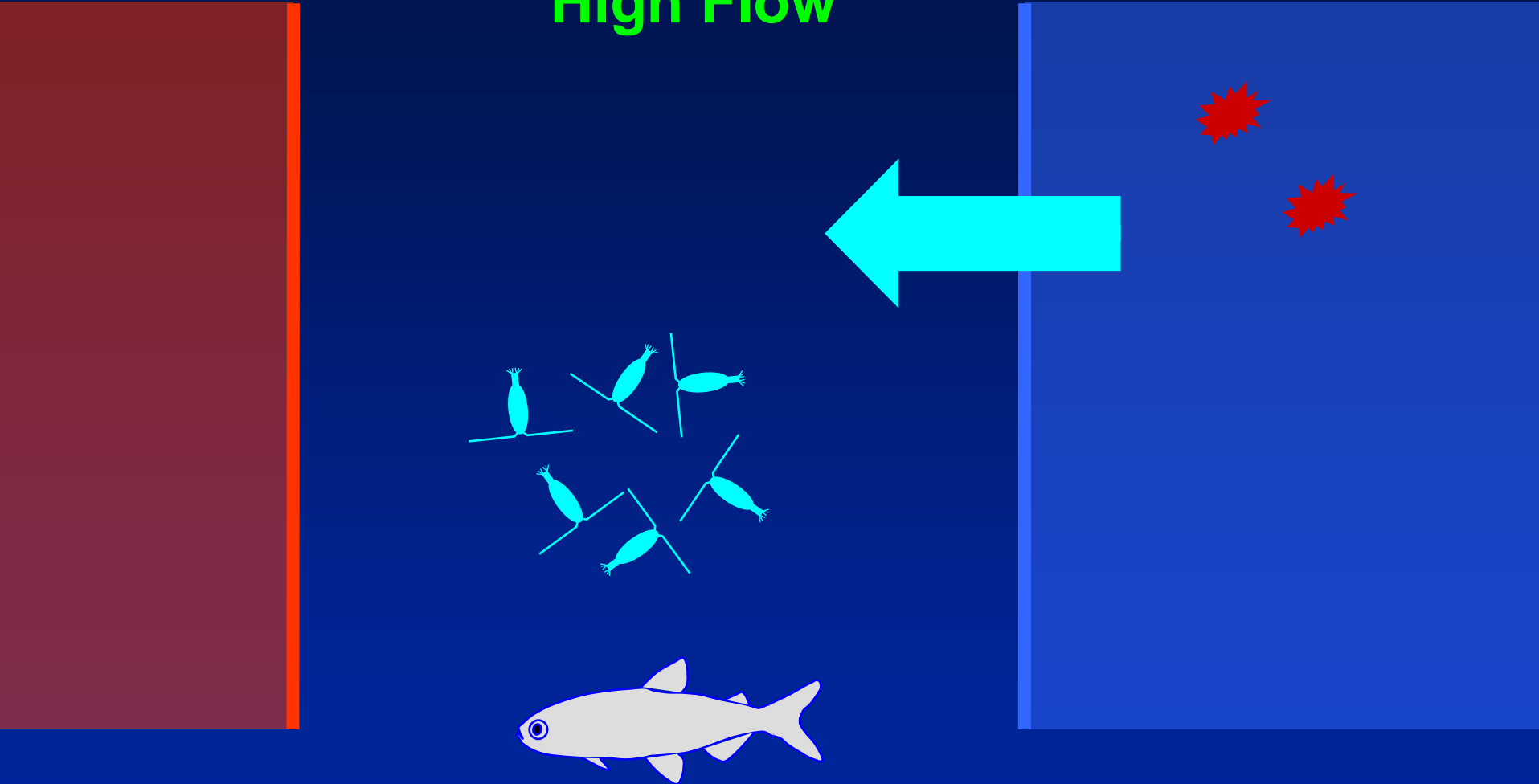


How do competition and predation vary?



# Potential changes in foodweb VIII

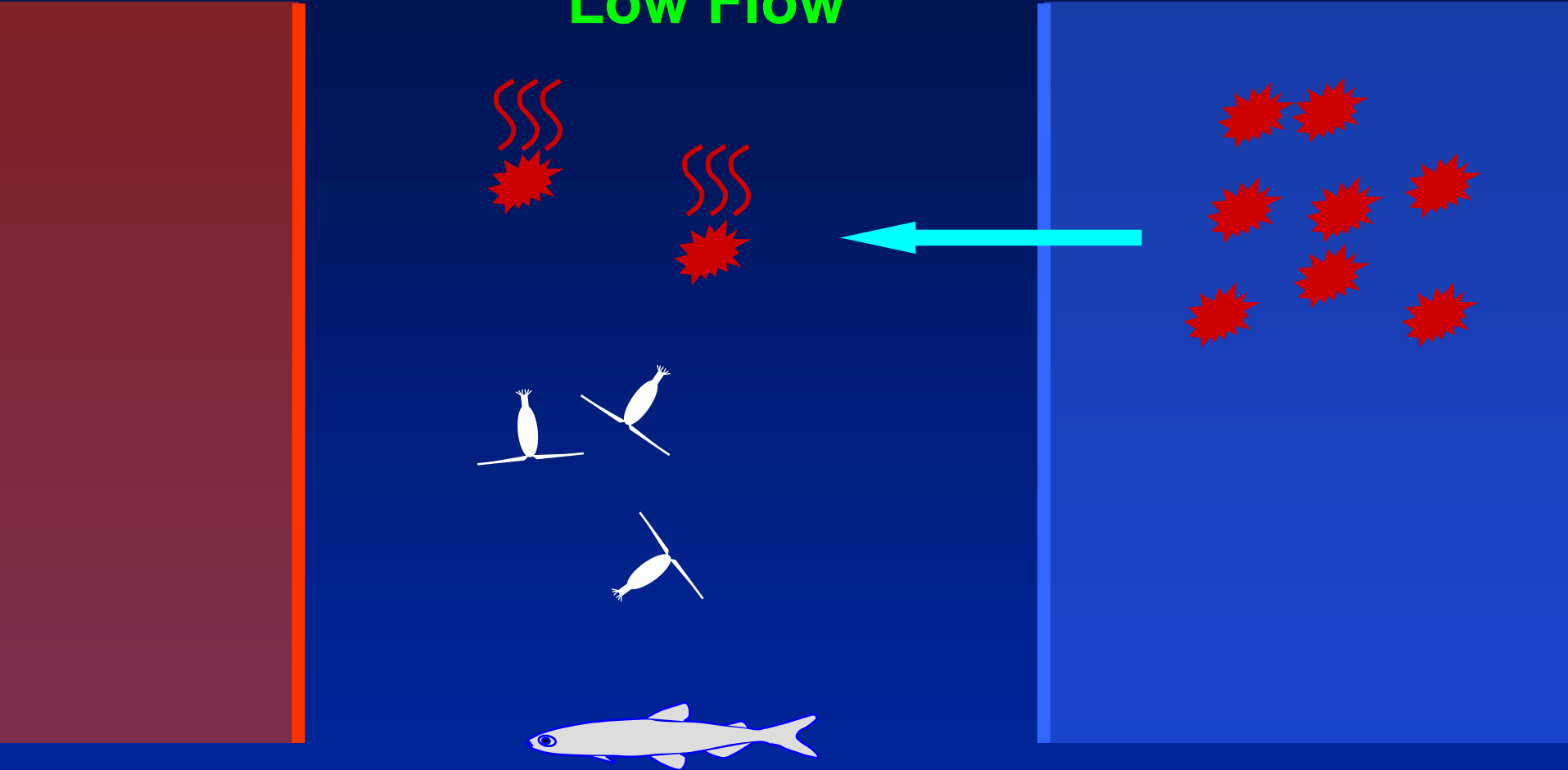
High Flow



How do effects of *Microcystis* vary?

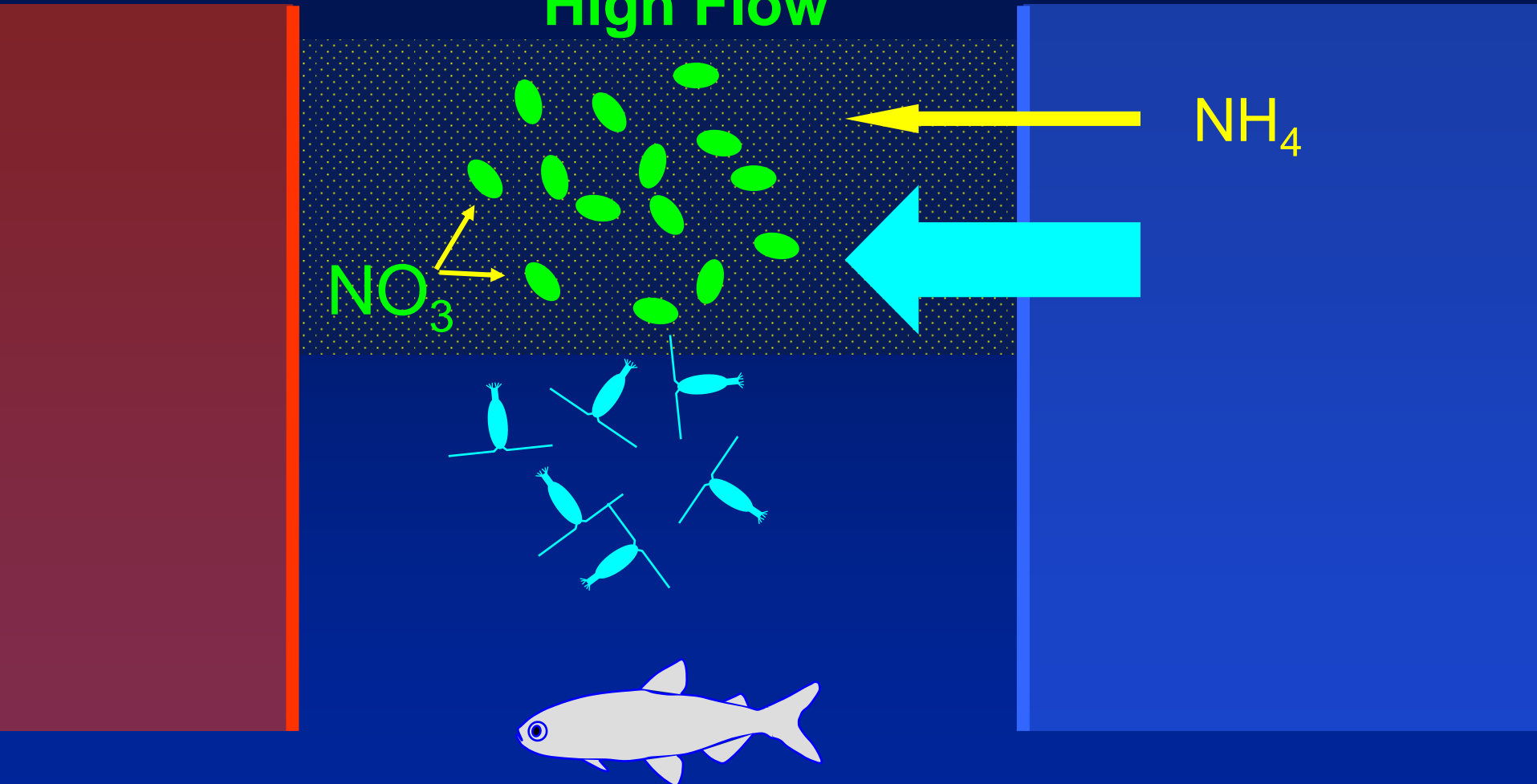
# Potential changes in foodweb VIII

Low Flow



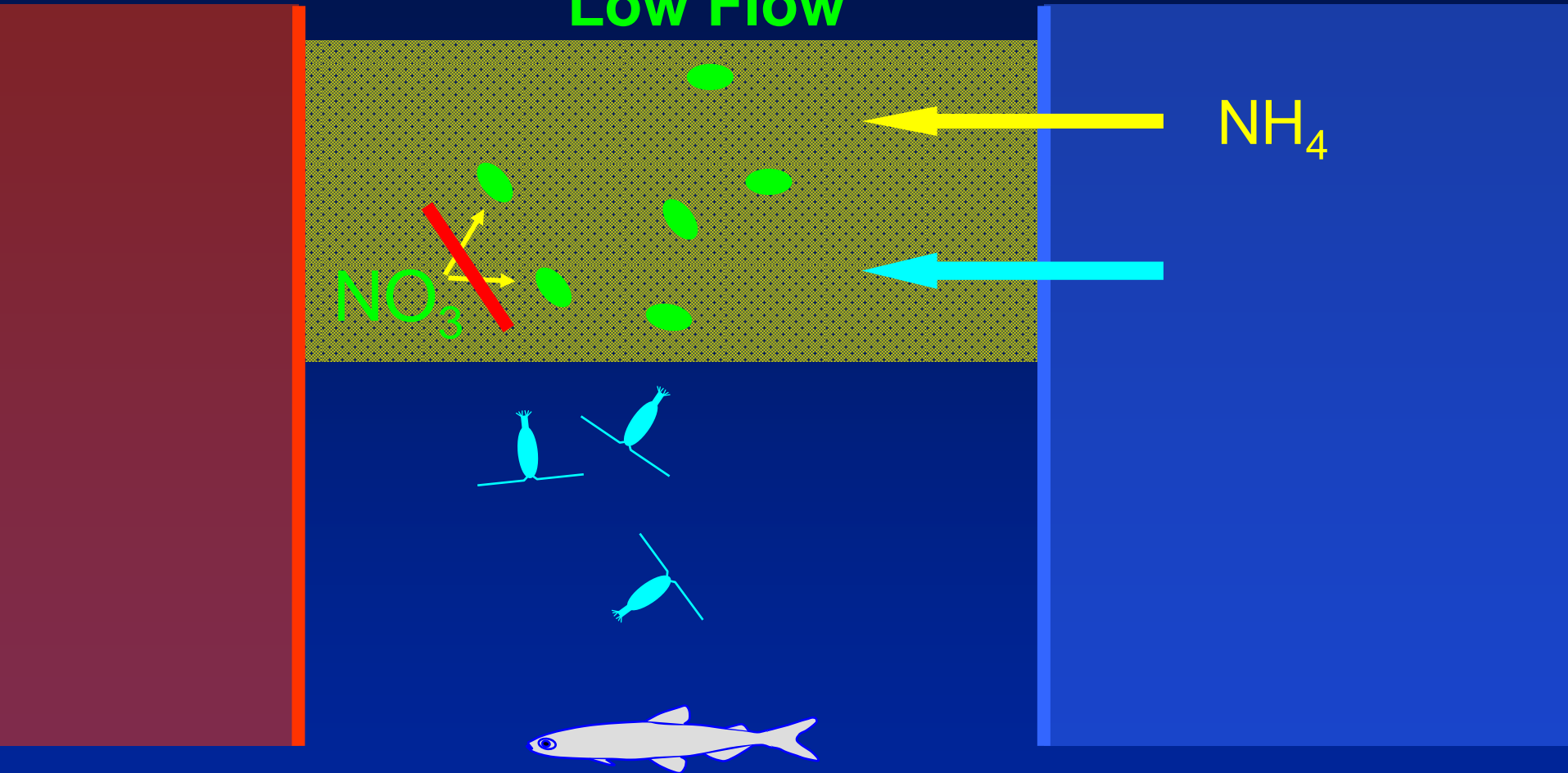
How do effects of *Microcystis* vary?

# Potential changes in foodweb IX



How do effects of ammonium vary?

# Potential changes in foodweb IX



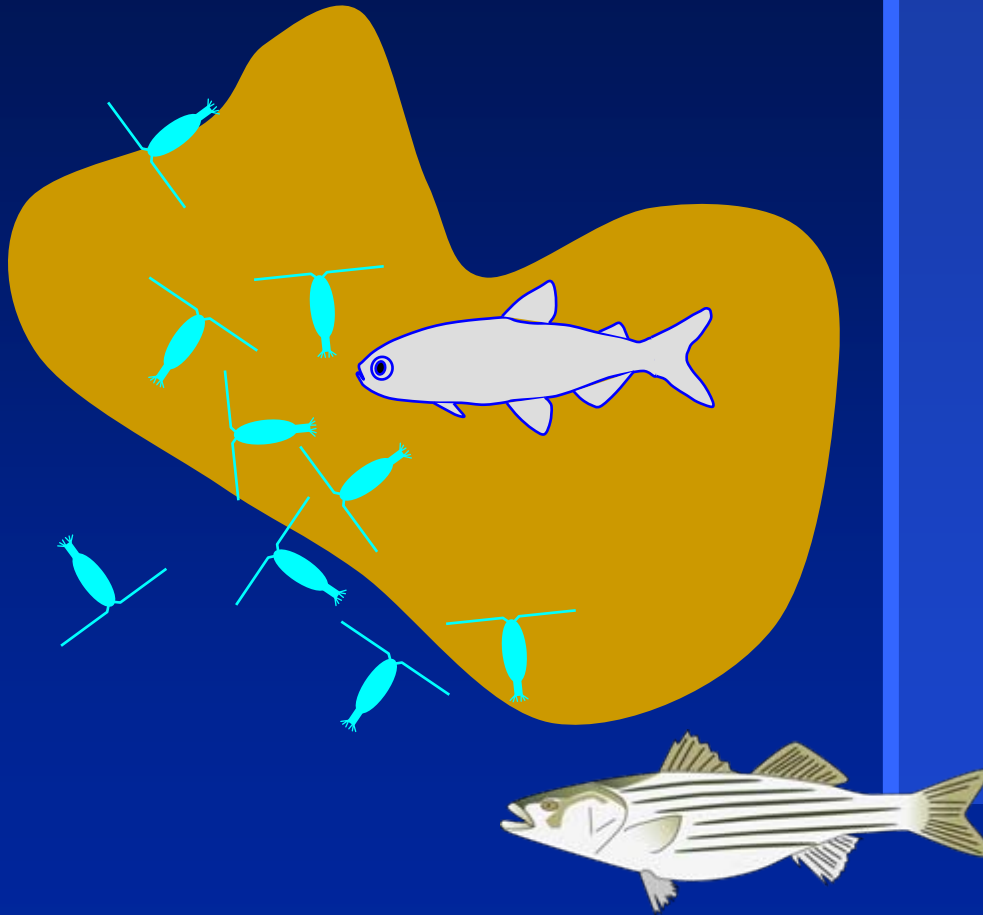
How do effects of ammonium vary?

# Classes of Mechanism (drivers)

- “Abiotic” habitat
- “Top-down” effects: predation and diversions
- “Bottom-up” effects: food supply
- Interactions
  - Turbidity – food - predation
  - Contaminants - food

# Interactions I

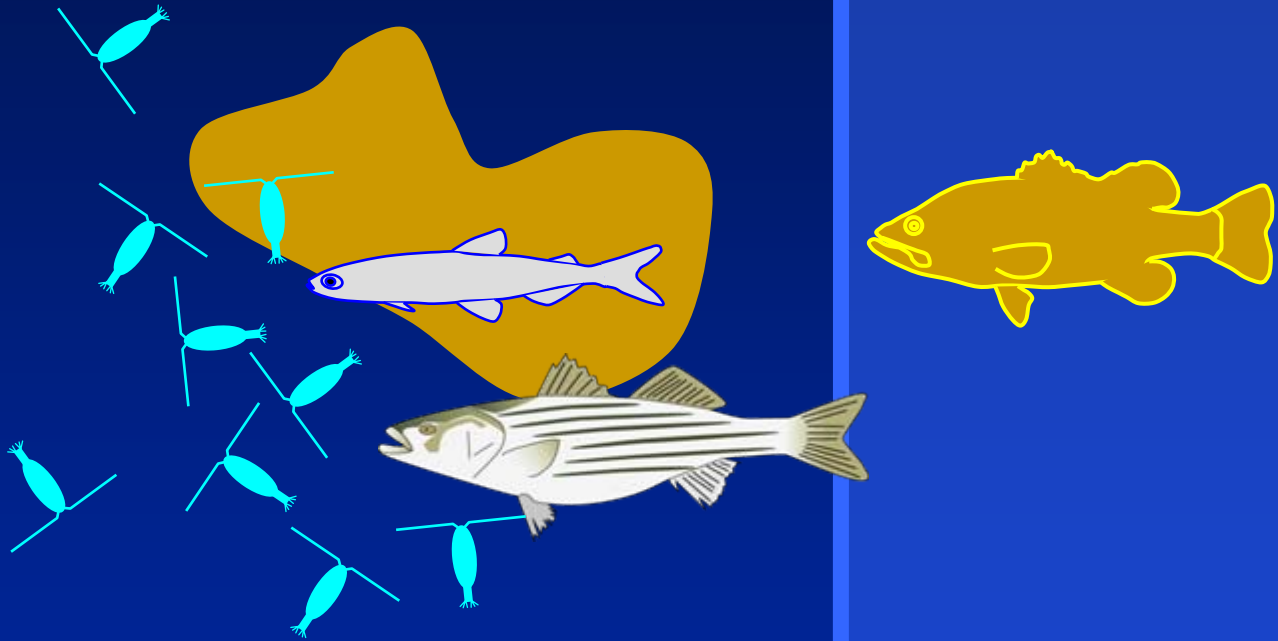
## High Flow



How does turbidity influence feeding and predator avoidance?

# Interactions I

## Low Flow

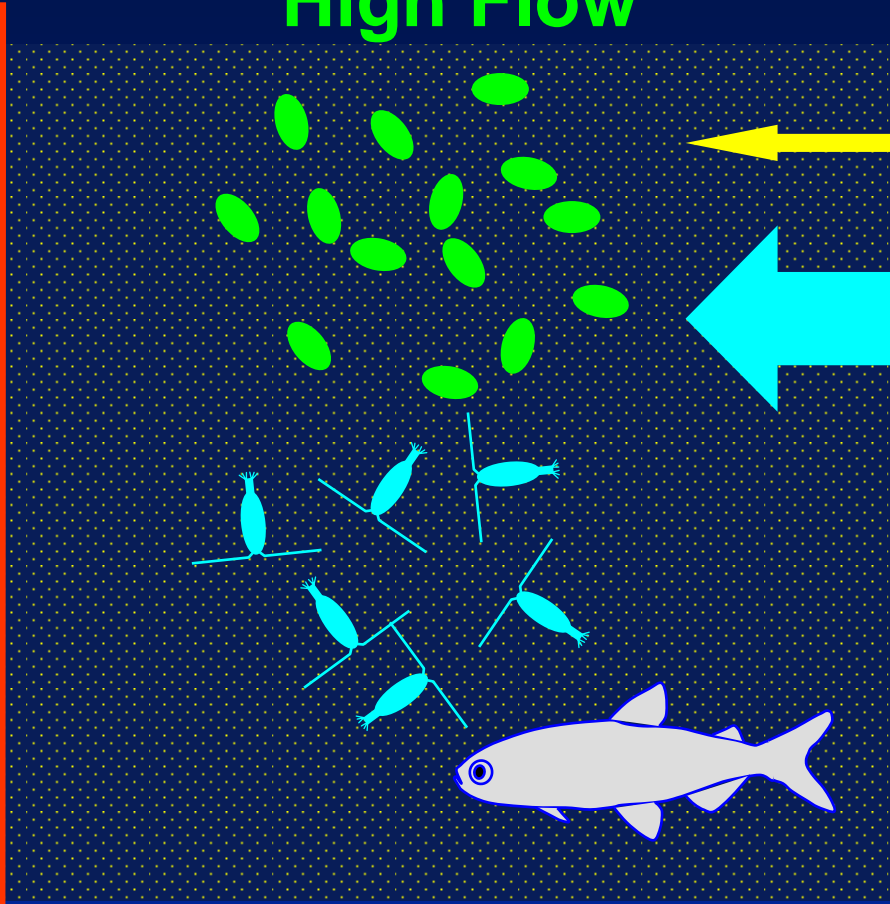


How does turbidity influence feeding and predator avoidance?

# Interactions II

High Flow

Contaminants

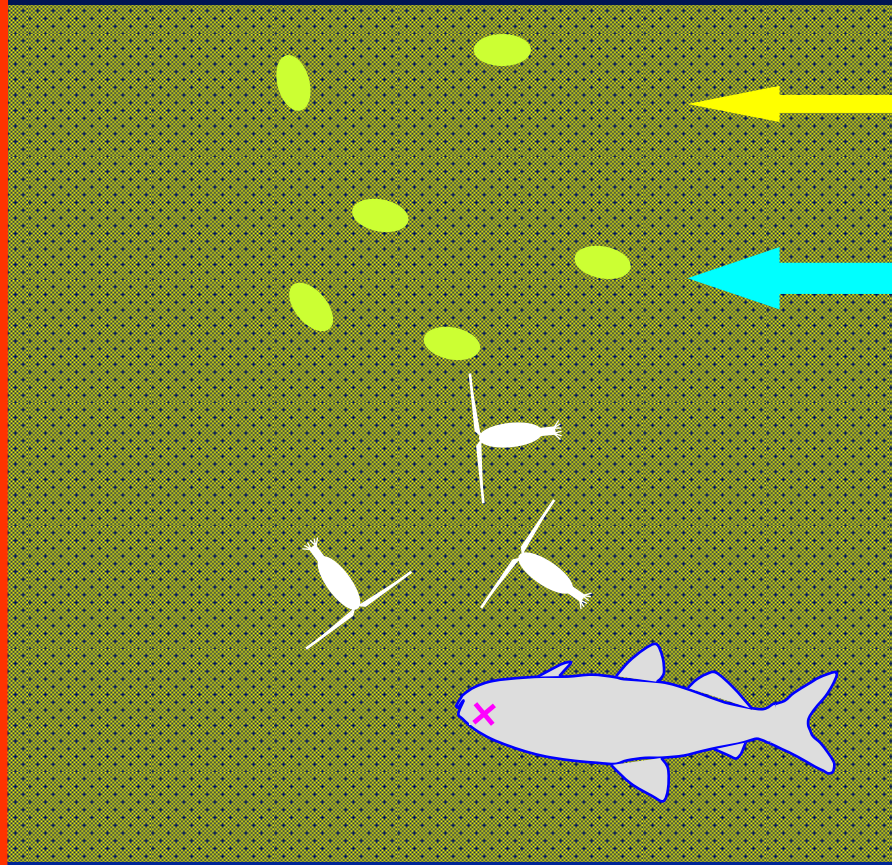


How do effects of contaminants vary?



# Interactions II

Low Flow



Contaminants

How do effects of contaminants vary?

Questions\*?  
Comments\*?  
Suggestions\*?

\*(Relevant to our conceptual models  
and study questions)