Campaspe Flow Manipulation Project: the highs and lows

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Department of the Environment and Heritage

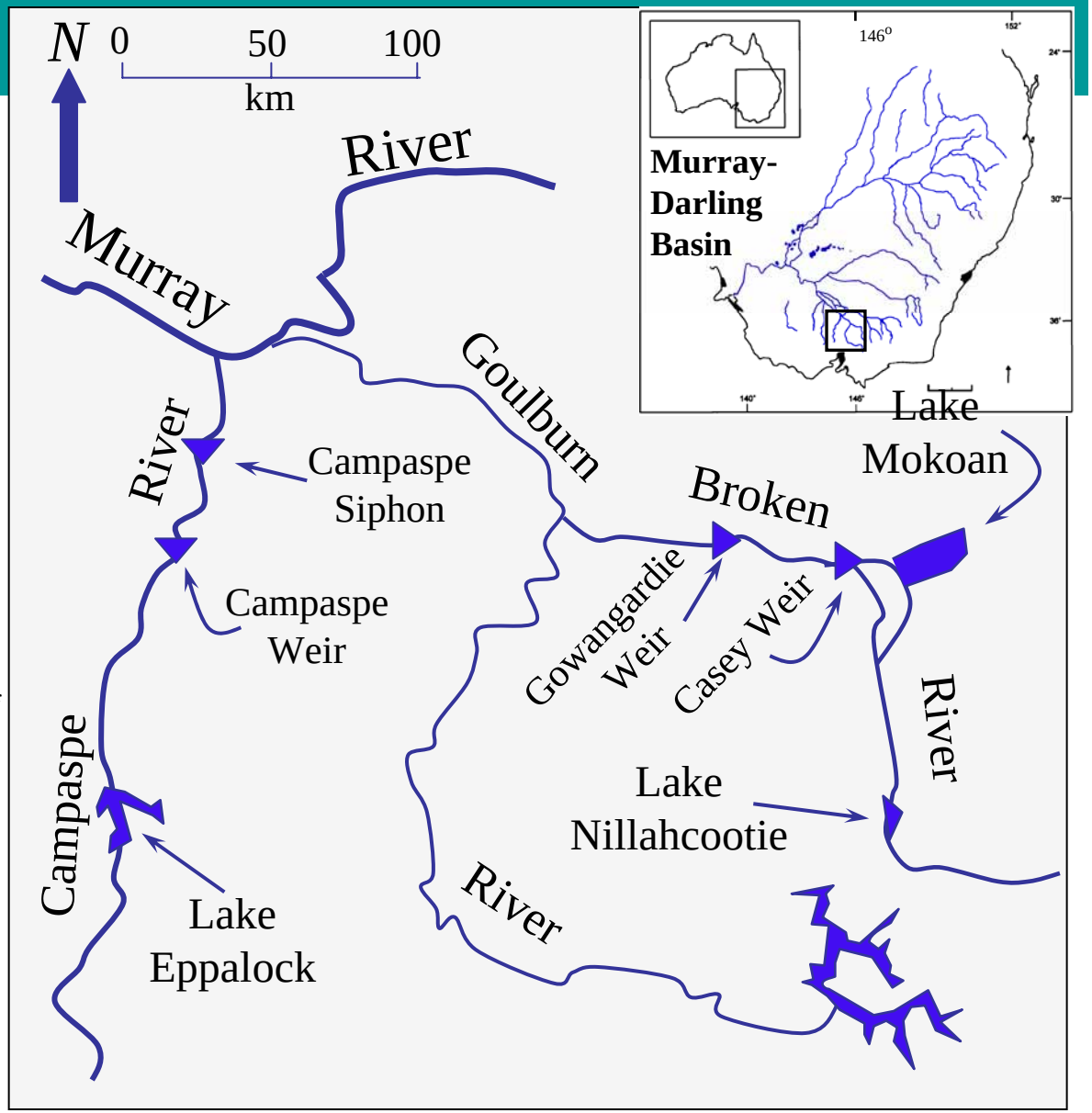
The Murray-Darling Freshwater Research Centre

Campaspe Flow Manipulation Project

- Regulated rivers in SE Australia - aseasonal flows
- CFMP: ecologists and water managers cooperating to manage flow to improve conditions for the flora and fauna
- Attempt to provide water for the environment and for offstream users
- Test the effectiveness of environmental water allocation using an experimental, before/after approach – Broken River as ‘reference’

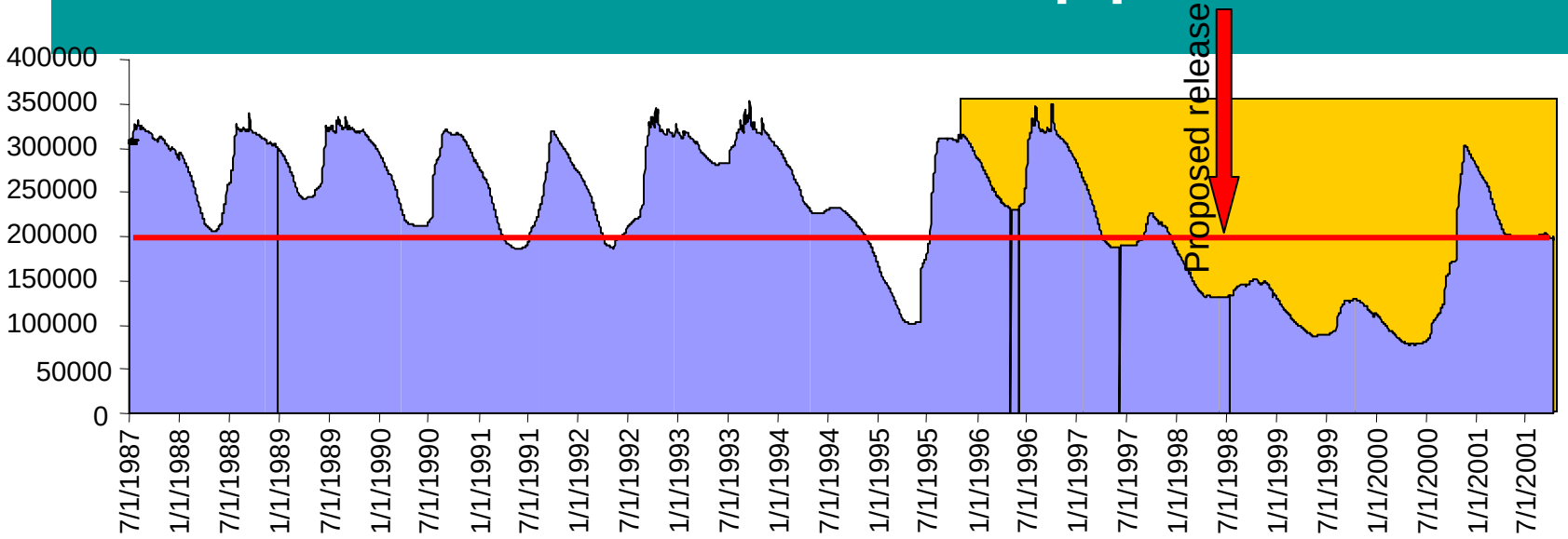
Records of fish in the Campaspe and Broken Rivers

- Murray cod*
- Trout cod*
- Macquarie perch*
- Golden perch
- River blackfish*
- Freshwater catfish*
- Silver perch
- Mountain galaxias*
- Spotted galaxias*
- Flathead galaxias*
- Australian smelt*
- Freshwater hardyhead*
- Crimson-spotted rainbowfish*
- Western carp gudgeon*
- Lake's carp gudgeon*
- Midgley's carp gudgeon*
- Flathead gudgeon*
- Southern pygmy perch*
- Bony herring
- Short-finned eel

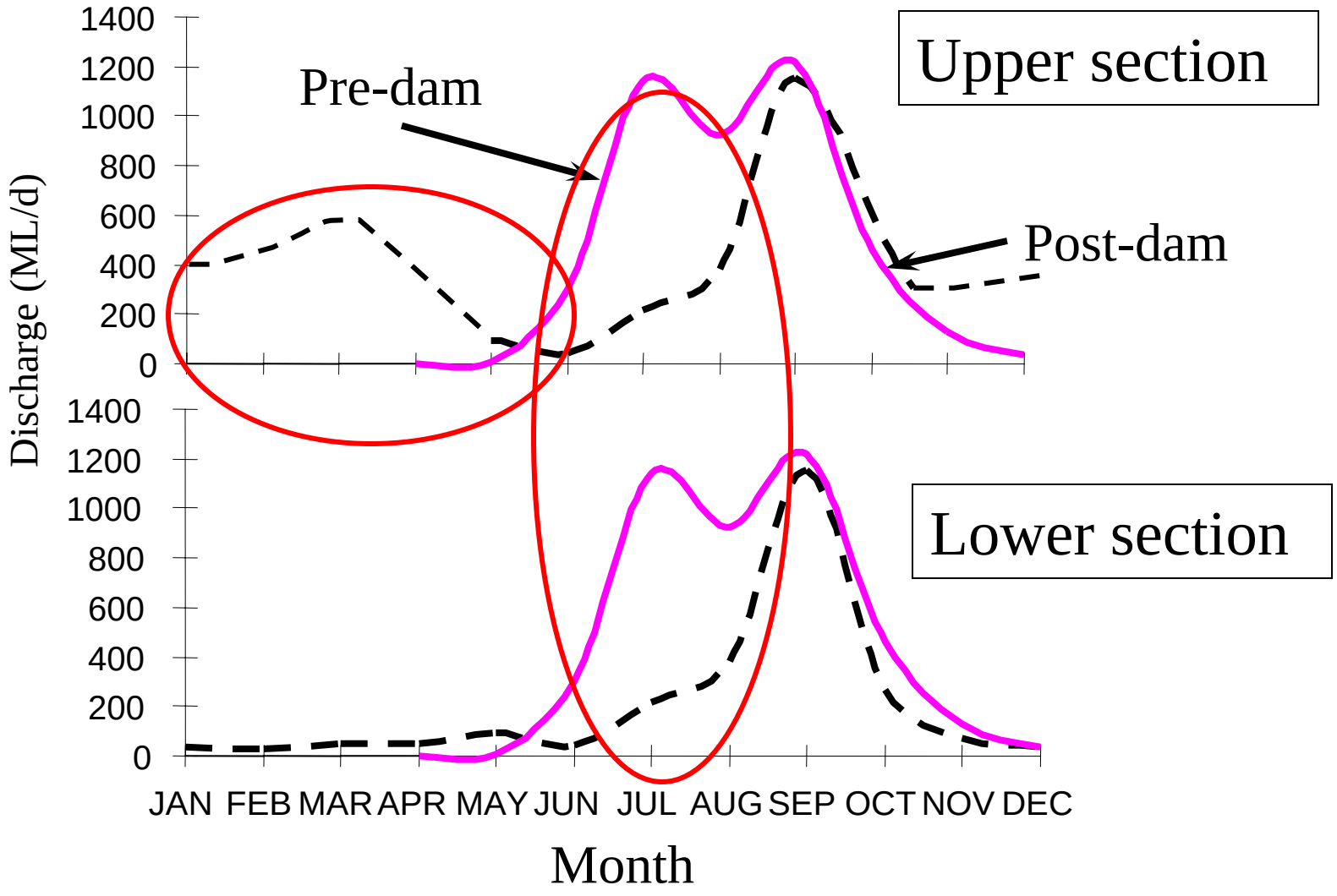


* Species which would have lived and bred in the Campaspe River

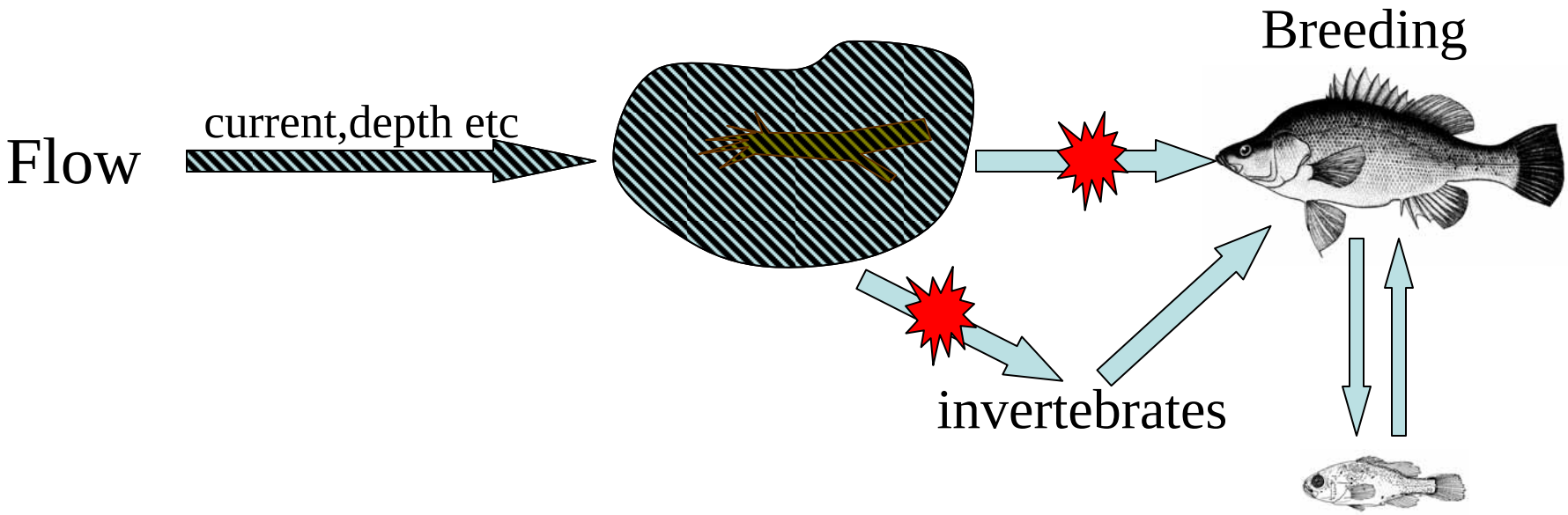
But it didn't happen!



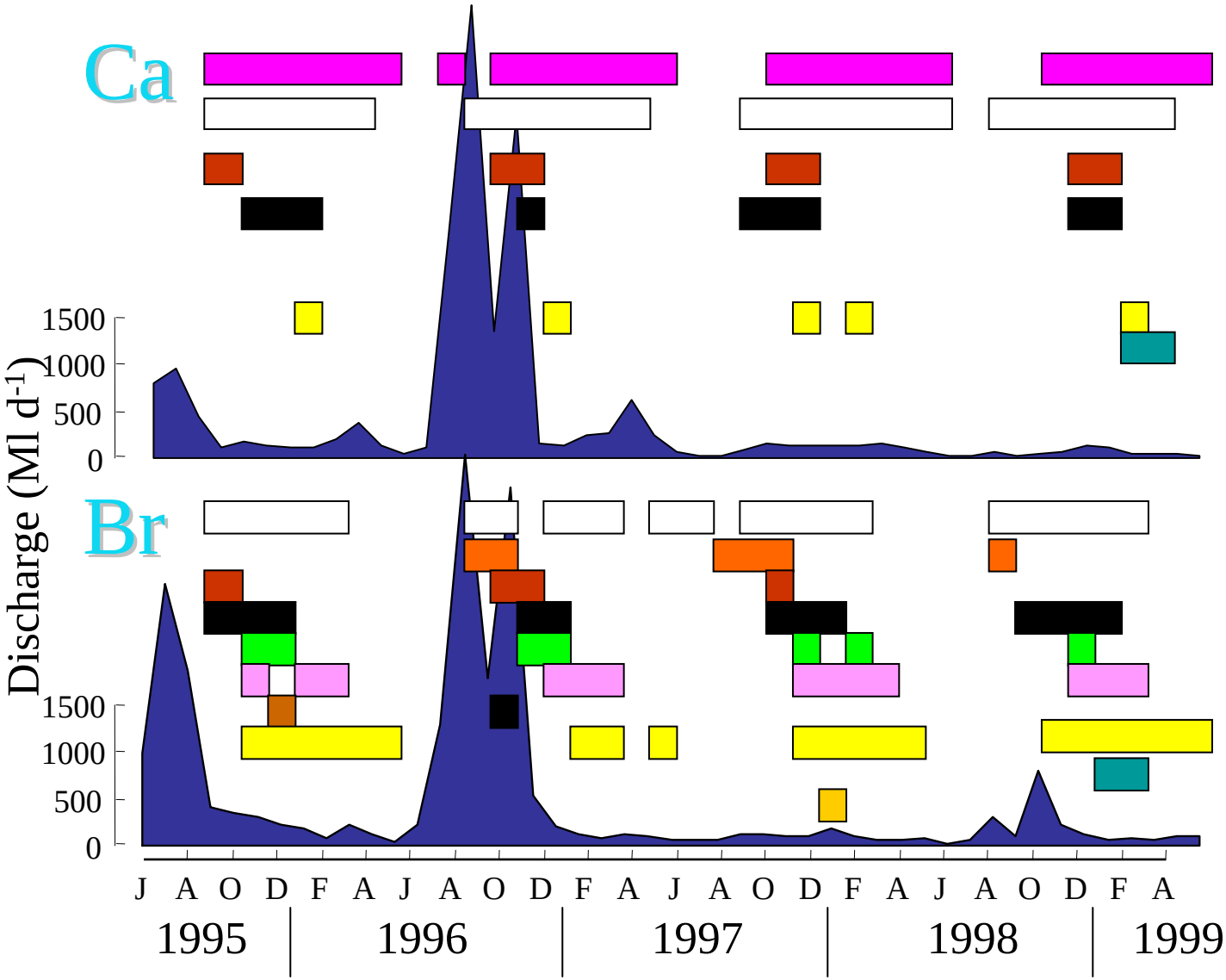
Changes to the flow regime in the Campaspe River



Hypothesis #1

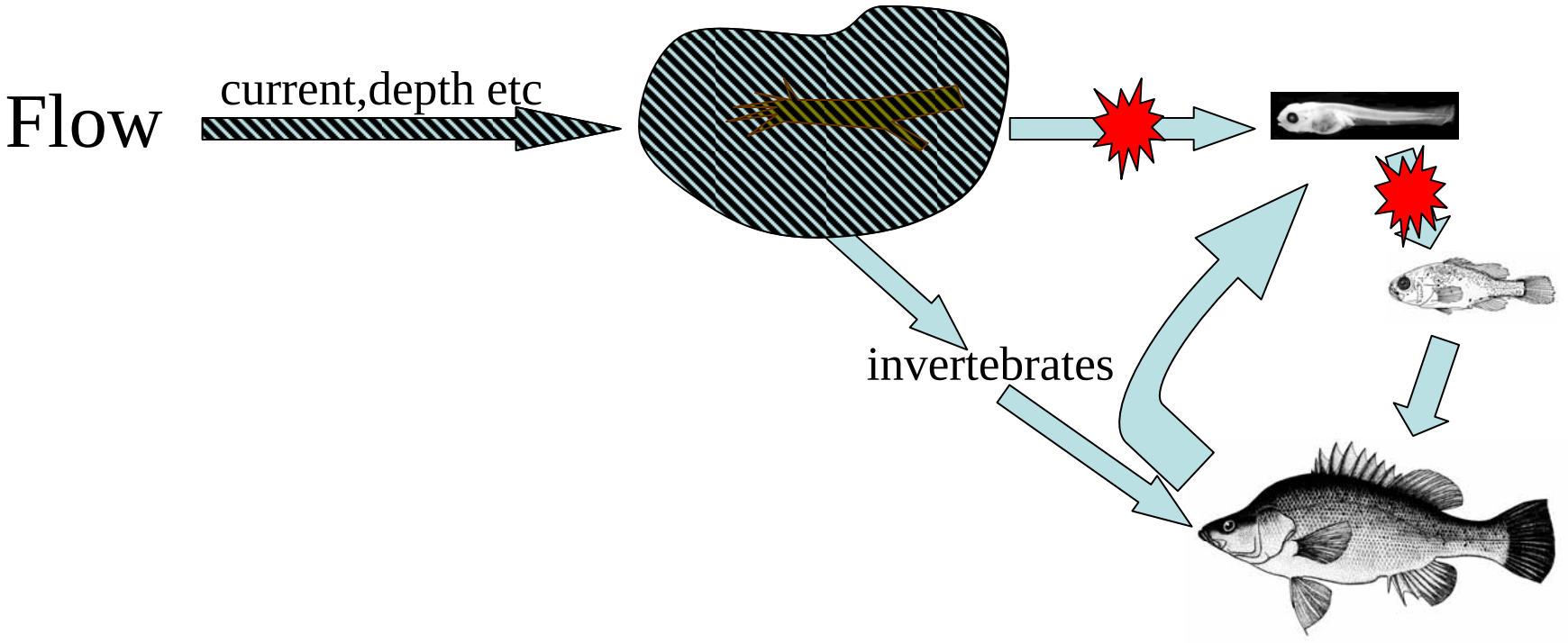


Flow and spawning

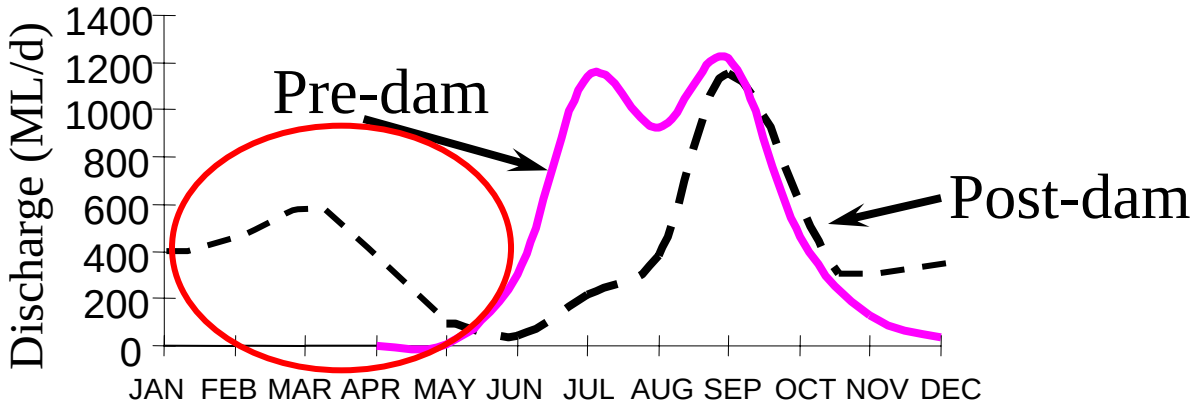


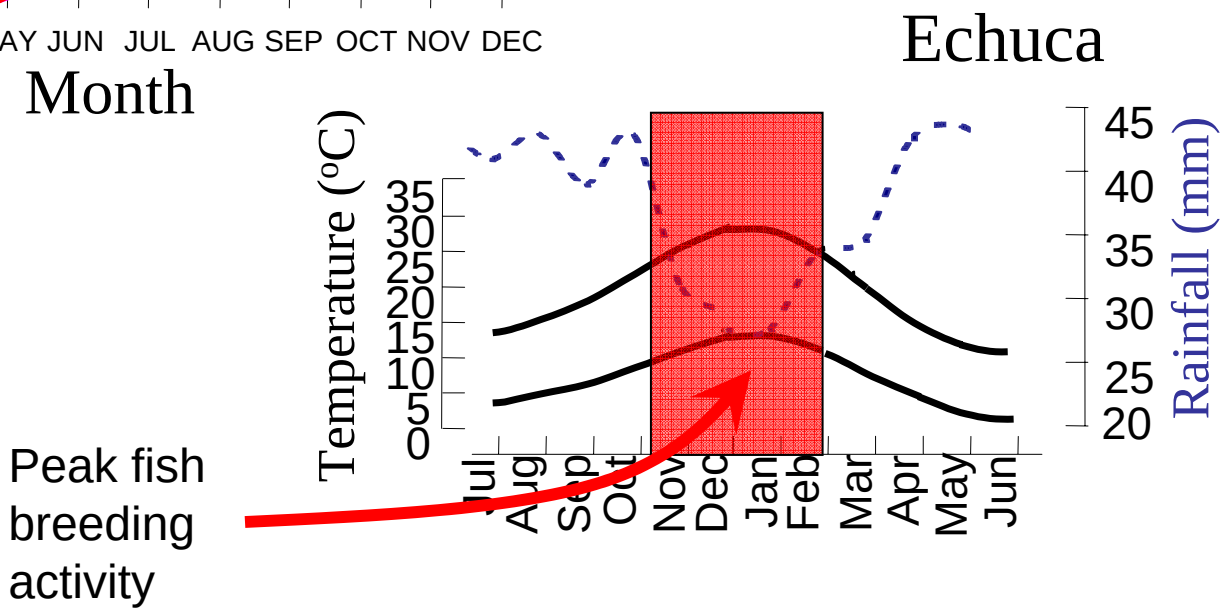
Flathead gudgeon
Galaxiids
Australian smelt
Redfin
Common carp
Murray cod
Rainbowfish
Blackfish
Carp gudgeon
Gambusia
Golden perch

Hypothesis #2



Flow and breeding of fish: summer releases





Crimson-spotted rainbowfish

Alison King, PhD

Australian smelt

Alison King, PhD

Murray cod

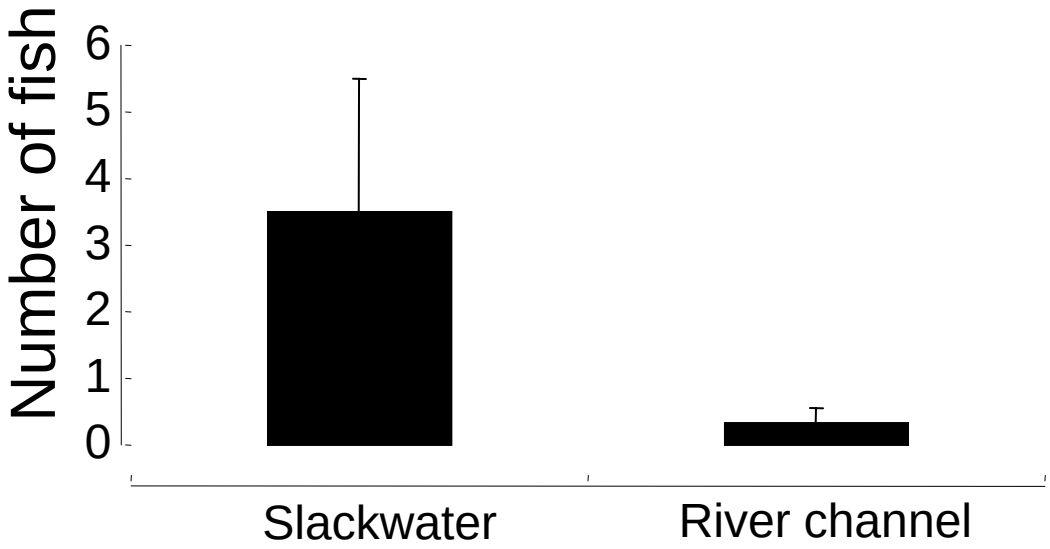
Alison King, PhD

Low flow recruitment hypothesis

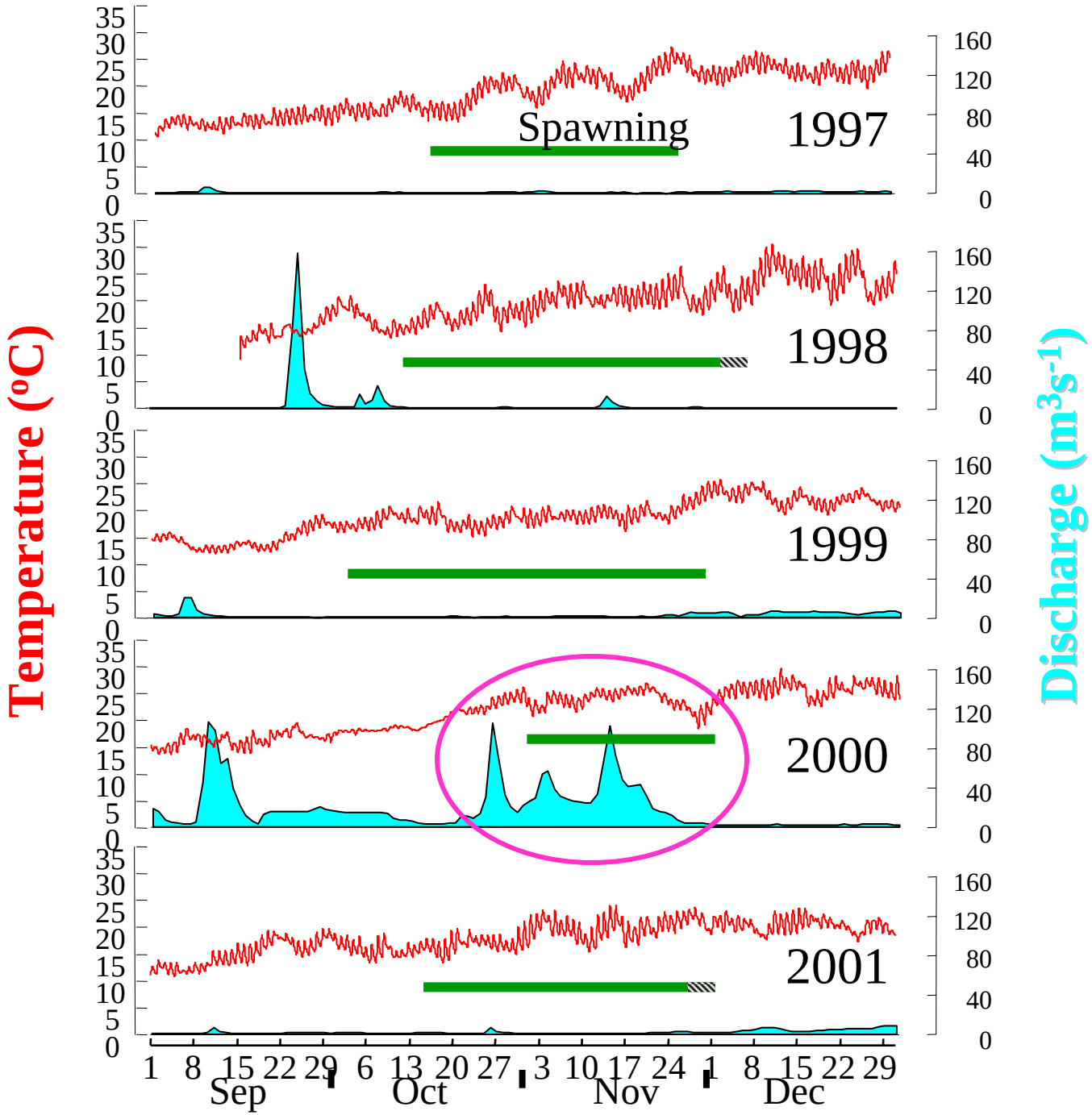
- Some fish breed and recruit during warm, low flow period
- In slackwater habitats
- Low flow period may enable development of rich source of prey

When summer irrigation releases occur...

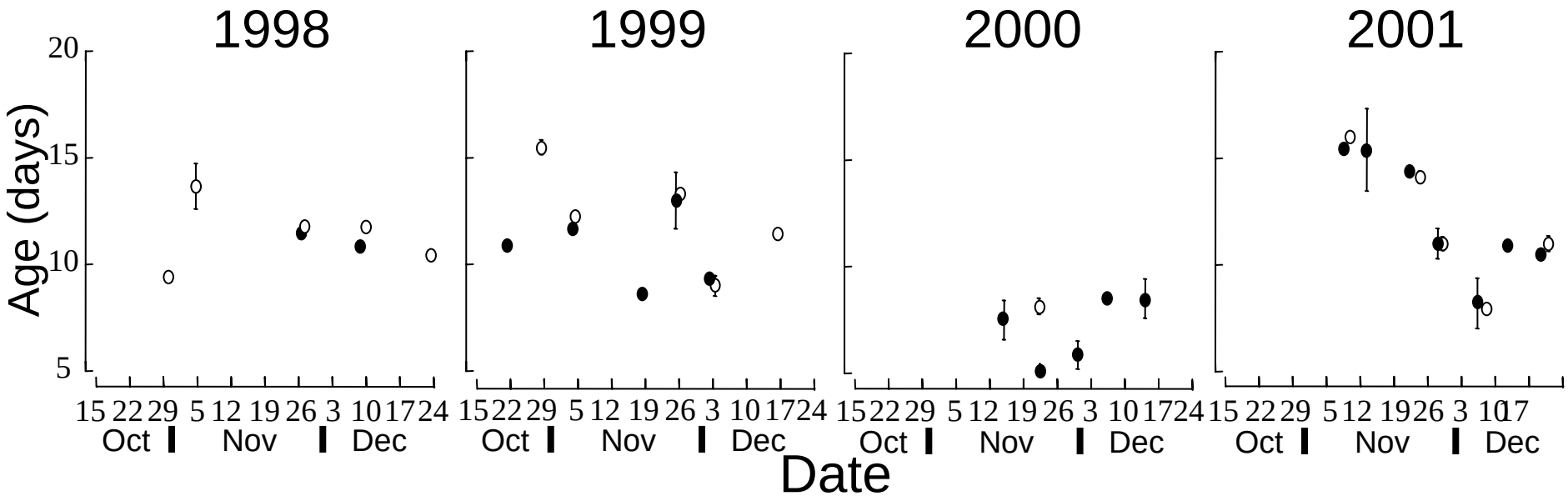
……are fish larvae flushed from slackwaters?



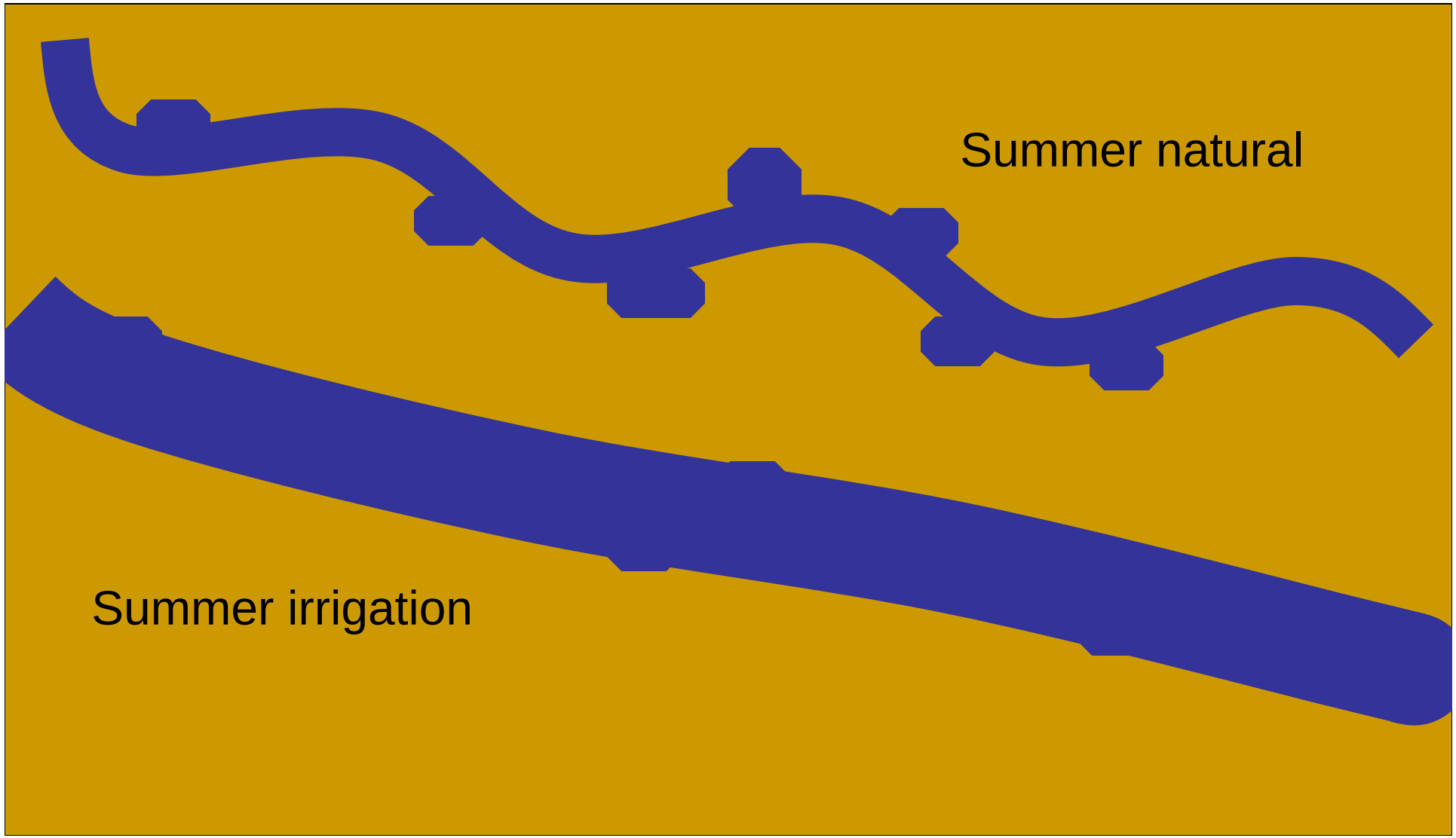
Spawning of Murray cod



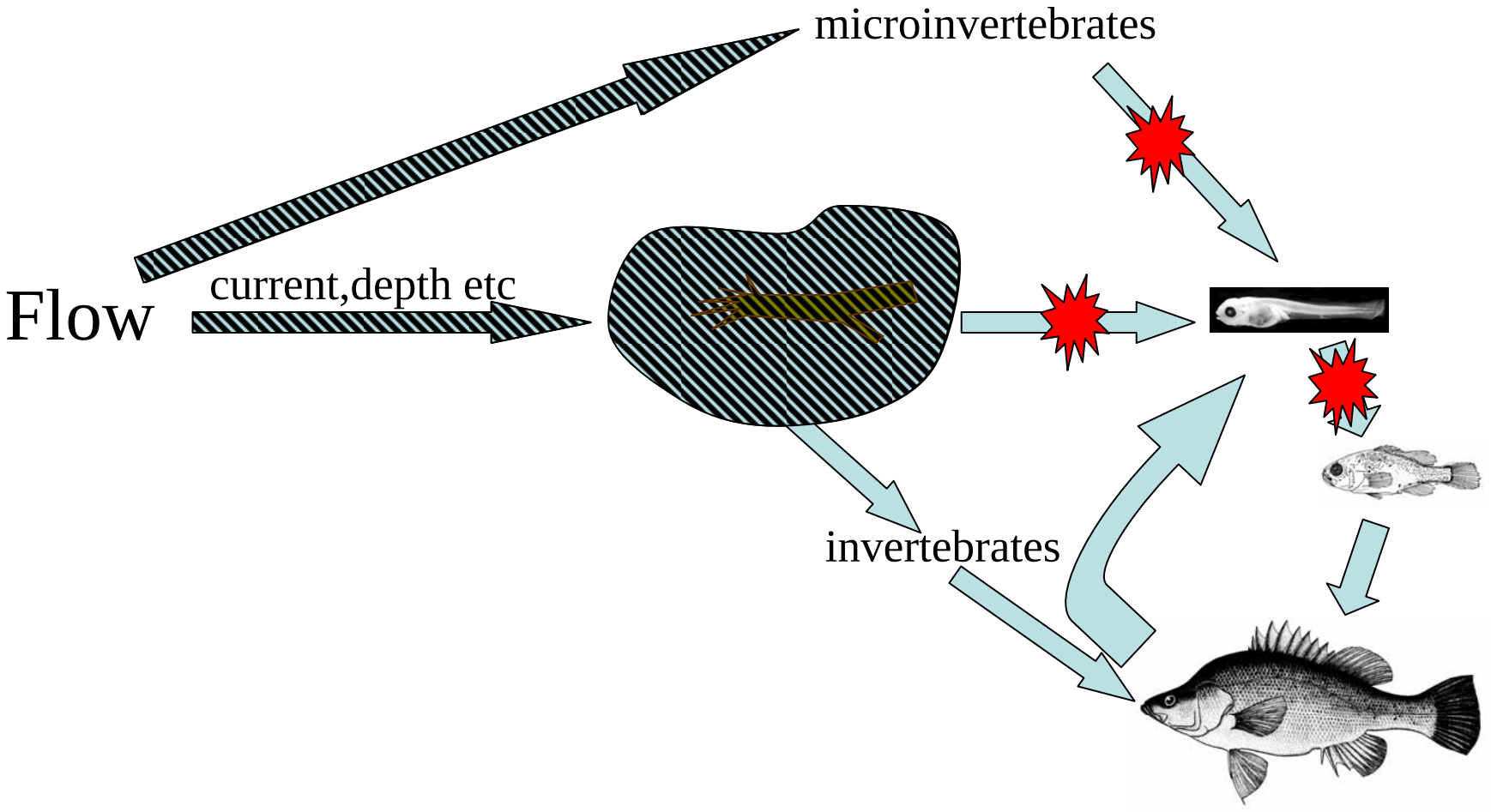
Age of drifting Murray cod larvae



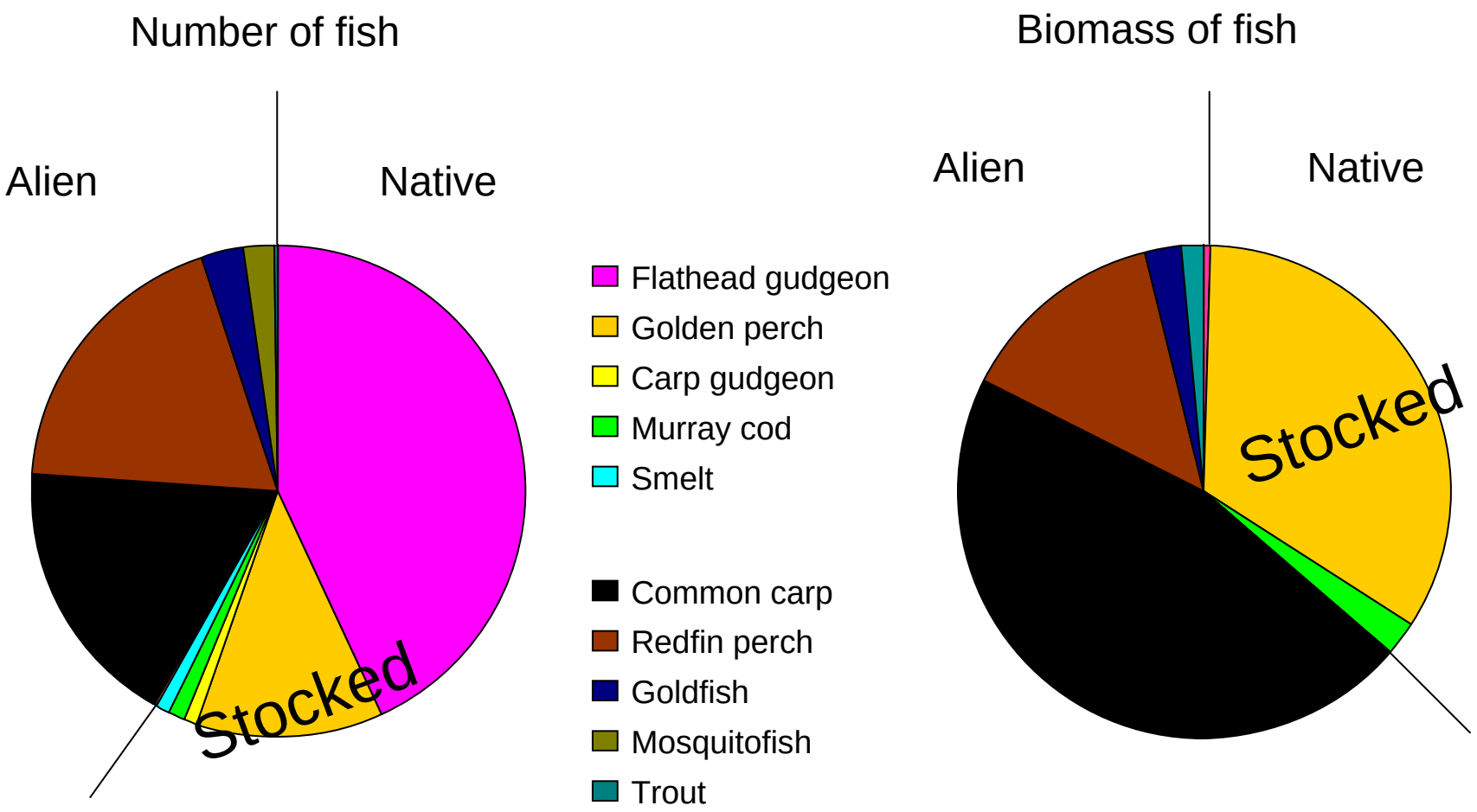
Irrigation flows and slackwaters



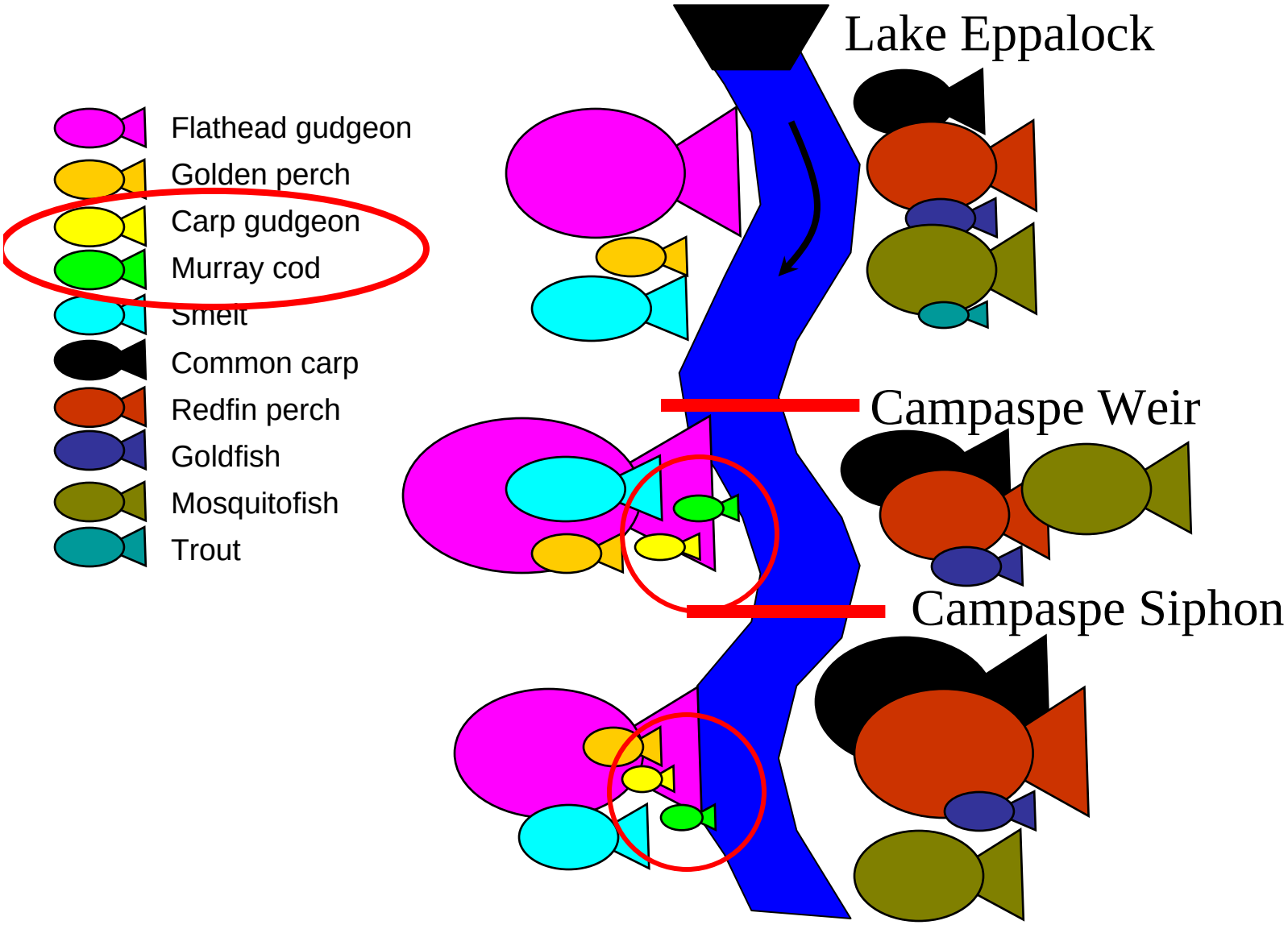
Flow change and recruitment



Fish in the Campaspe River 1995-2003



Distribution of fish in the Campaspe

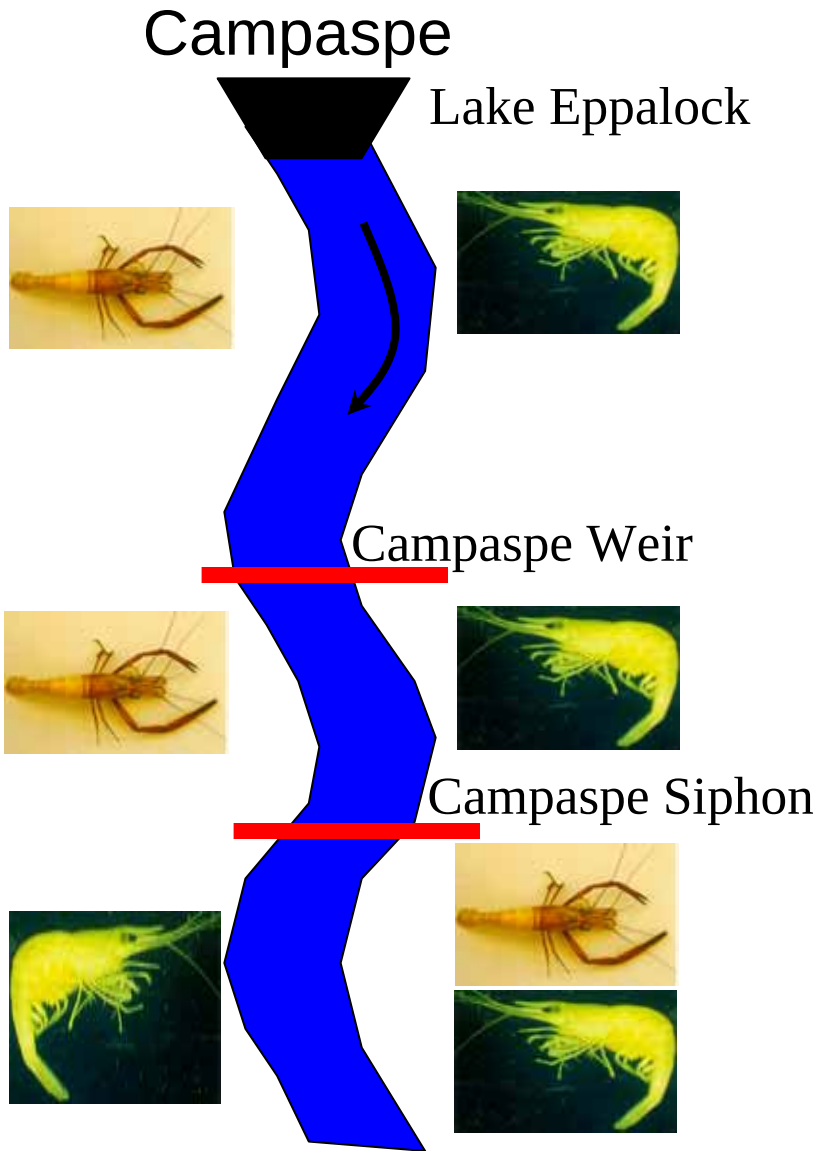


Distribution of shrimp in the Campaspe

Macrobrachium

Paratya

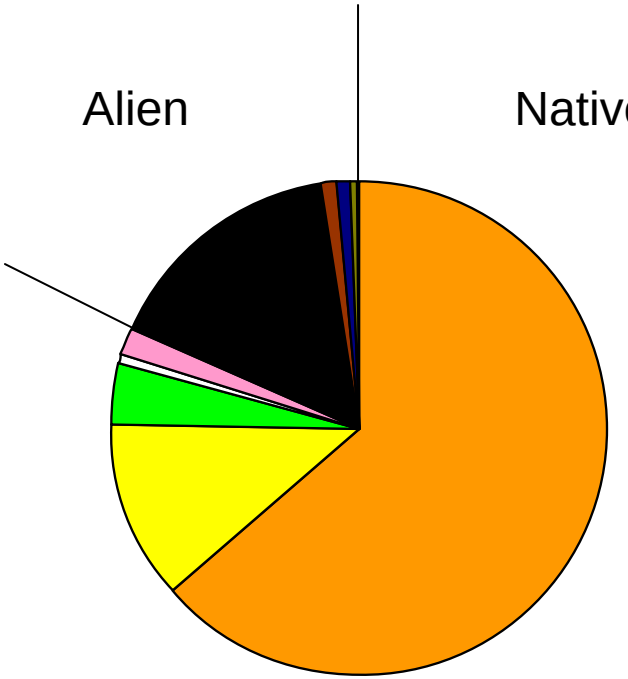
Caridina



But in the Broken River…….

Fish in the Broken River 2000-2003

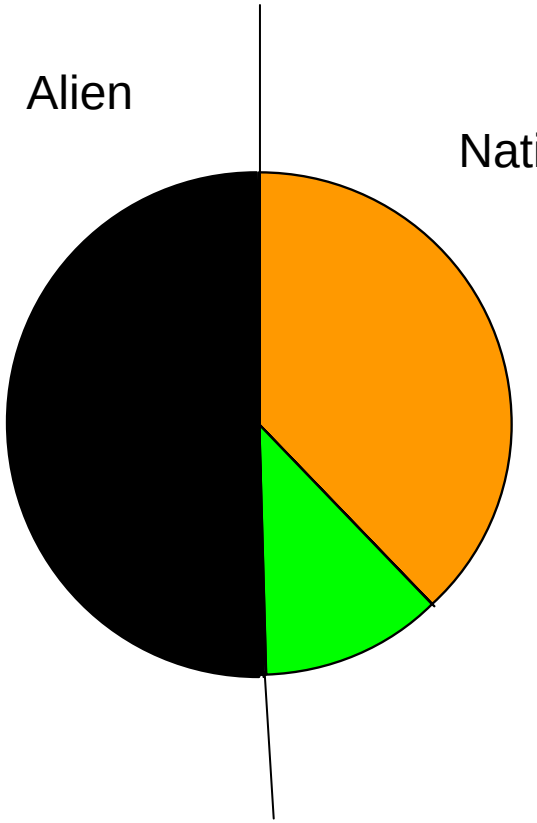
Number of fish

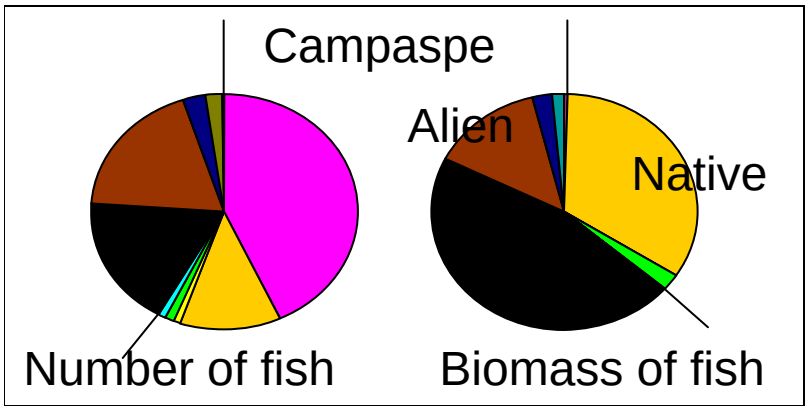


Golden perch
Carp gudgeon
Murray cod
Smelt
Blackfish
Rainbowfish

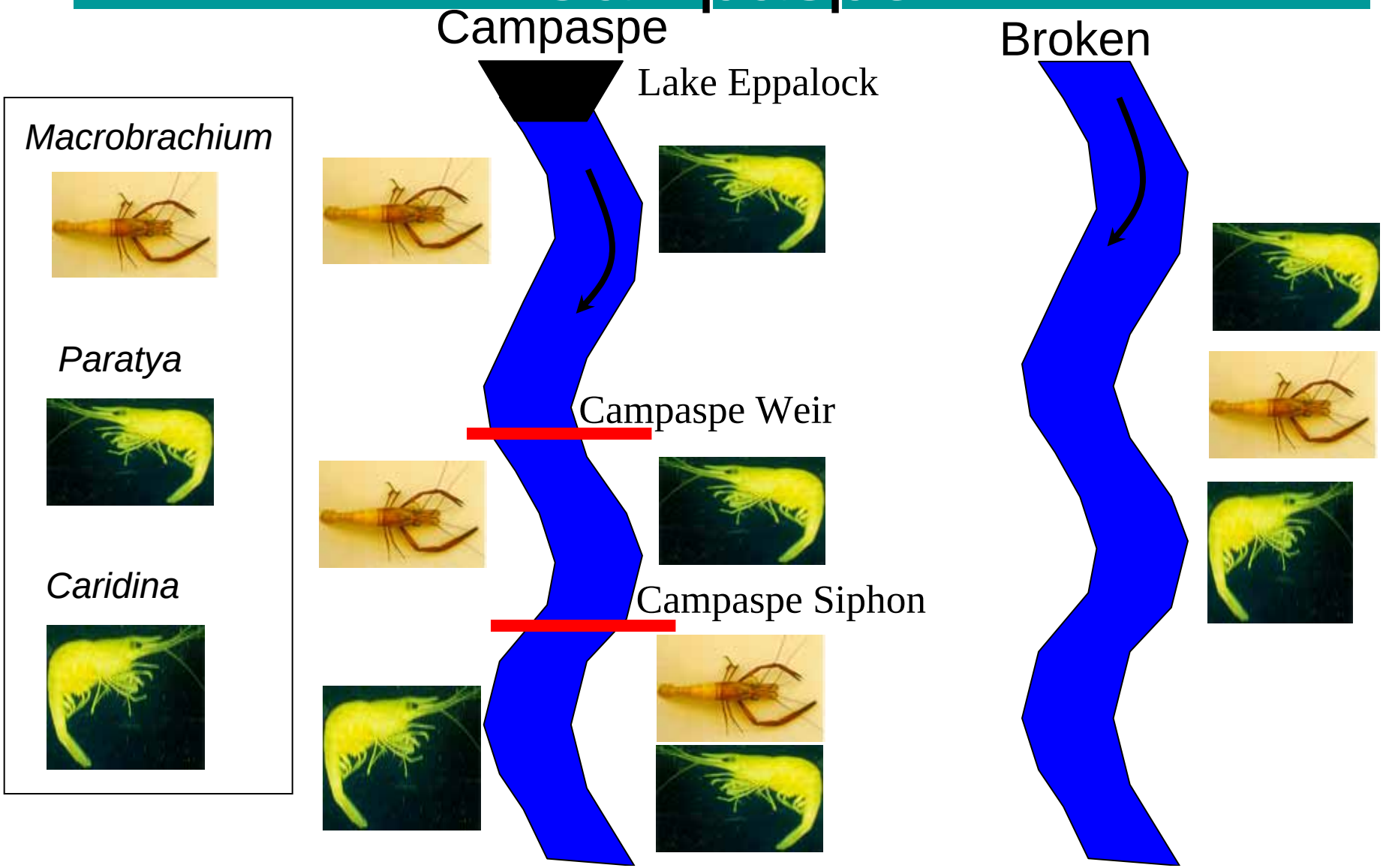
Common carp
Redfin perch
Goldfish
Mosquitofish

Biomass of fish

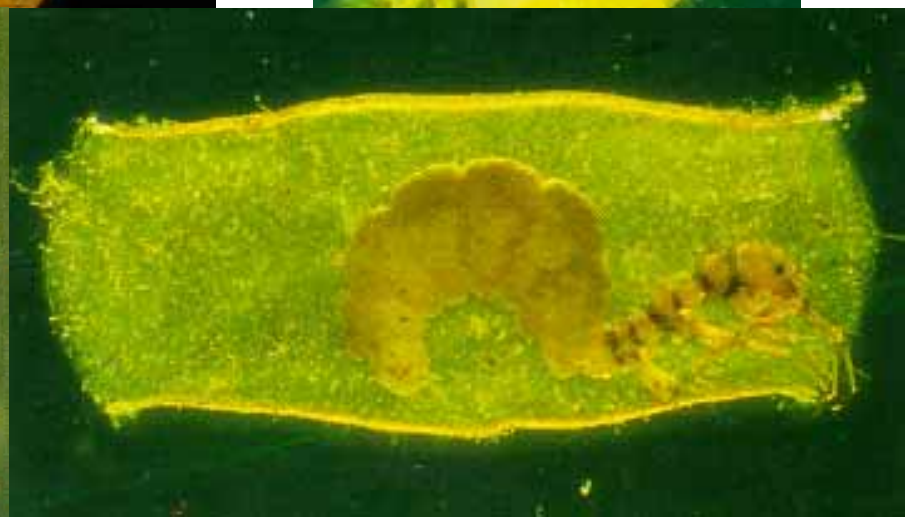




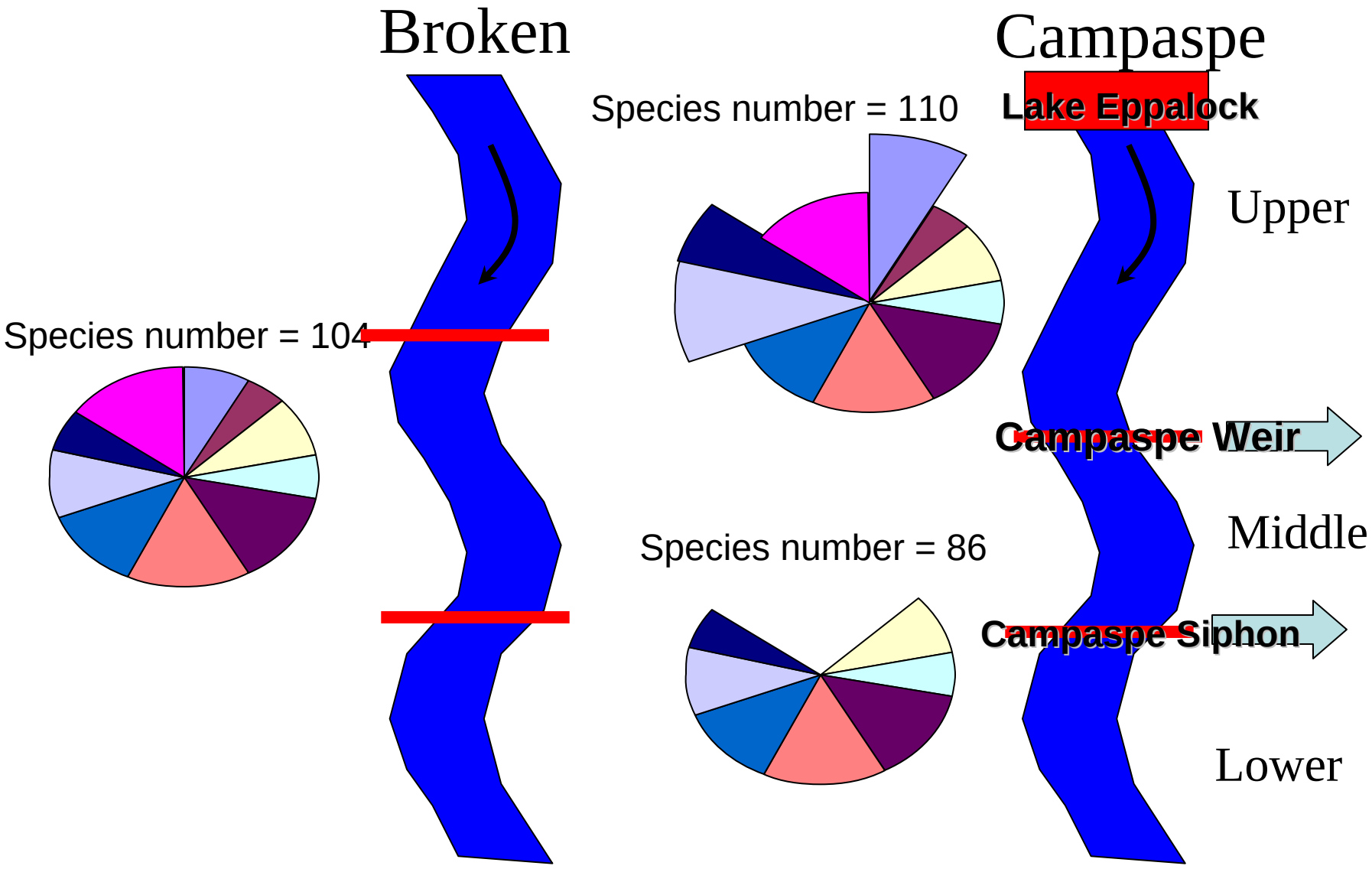
Distribution of shrimp in the Campaspe



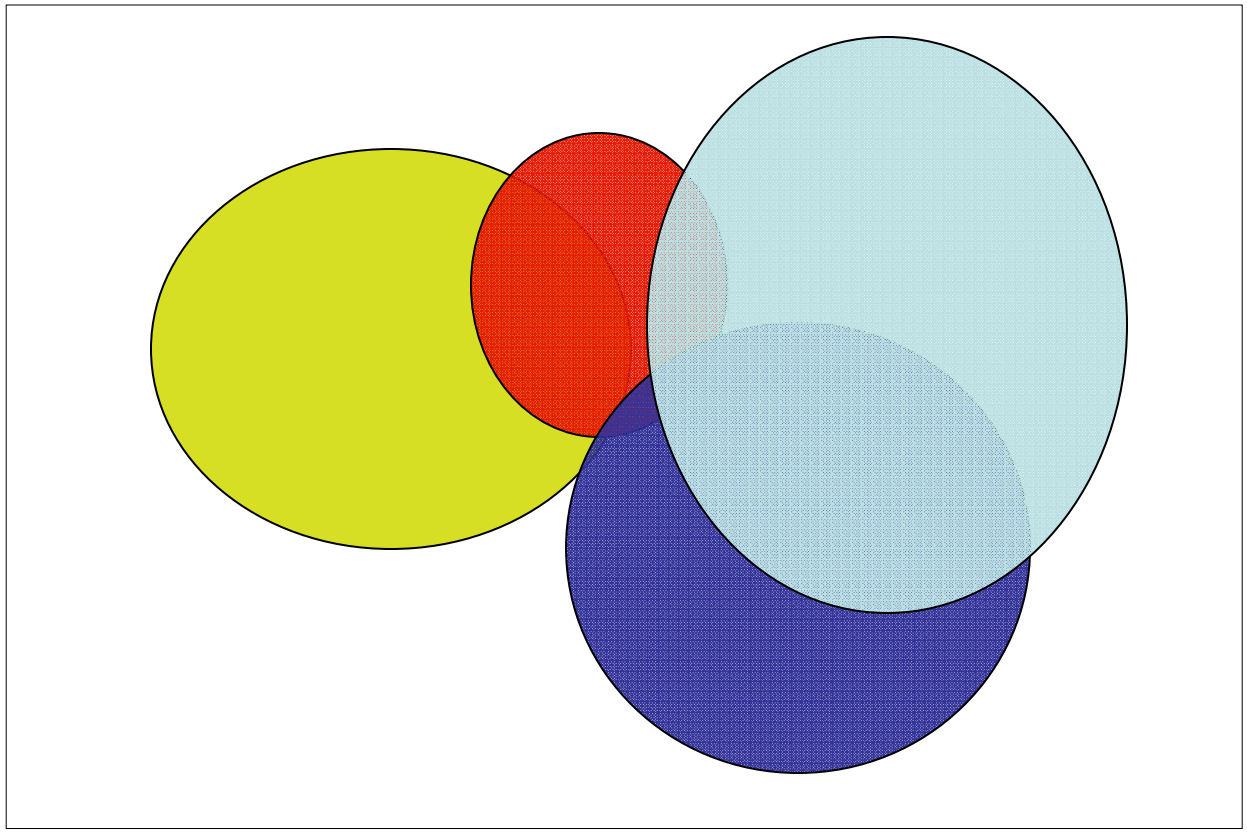
What has summer releases done to macroinvertebrates?



Species richness



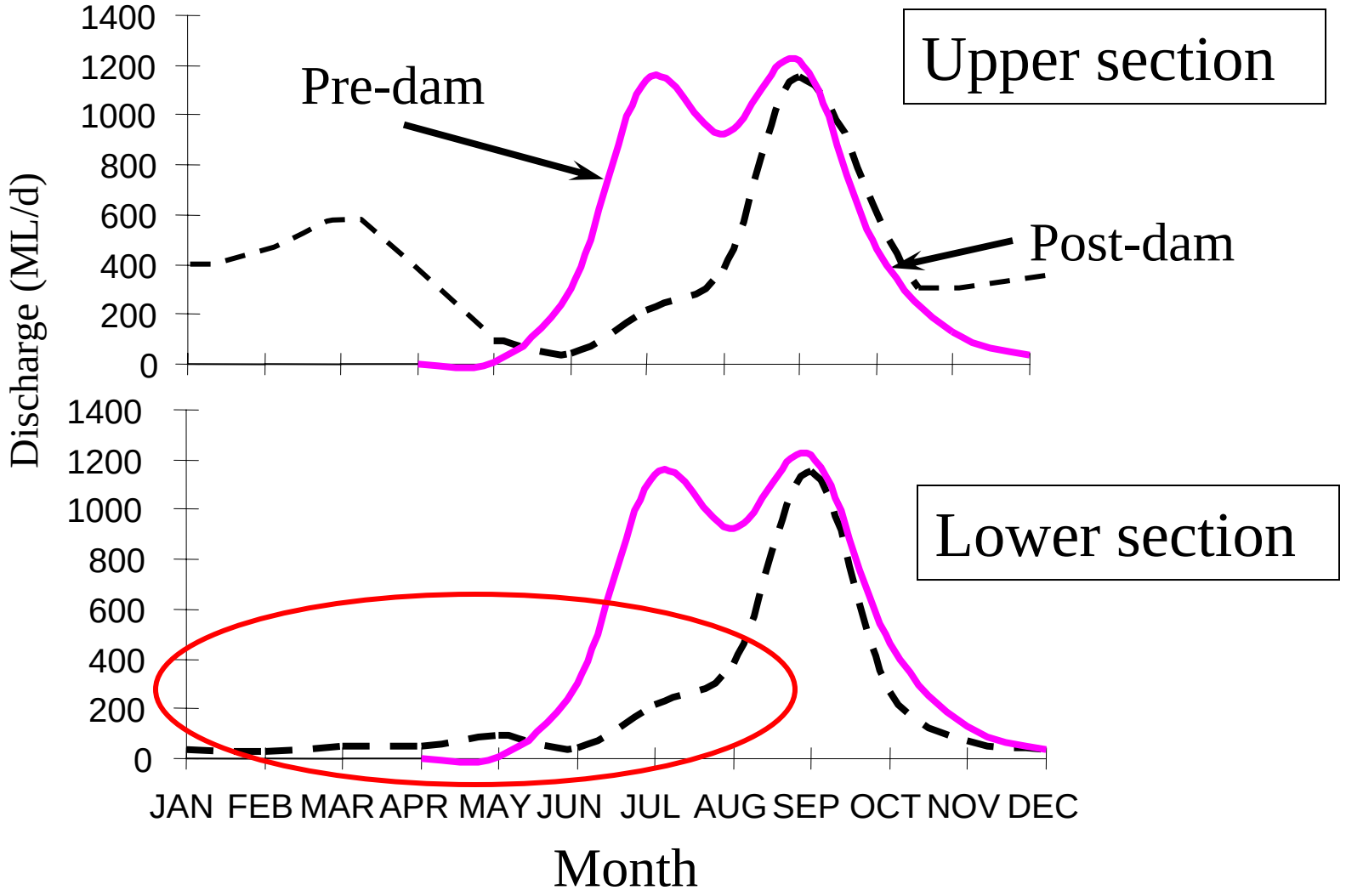
Macroinvertebrate assemblages



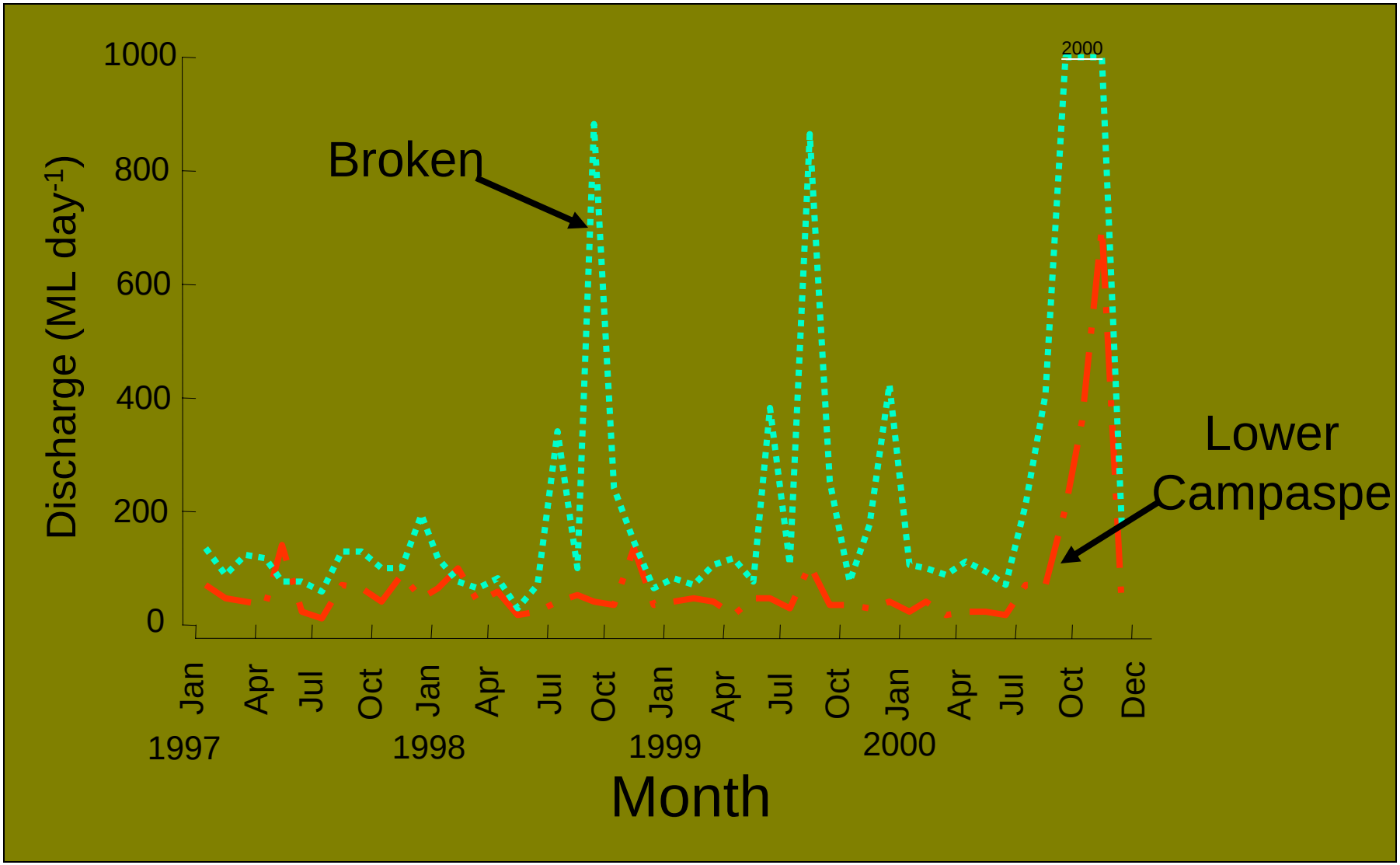
Environmental variables influencing macroinvertebrates assemblages

- Flow components
  - Current velocity ✓
  - Minimum discharge ✓
  - Median discharge ✓
- Other
  - Conductivity ✓

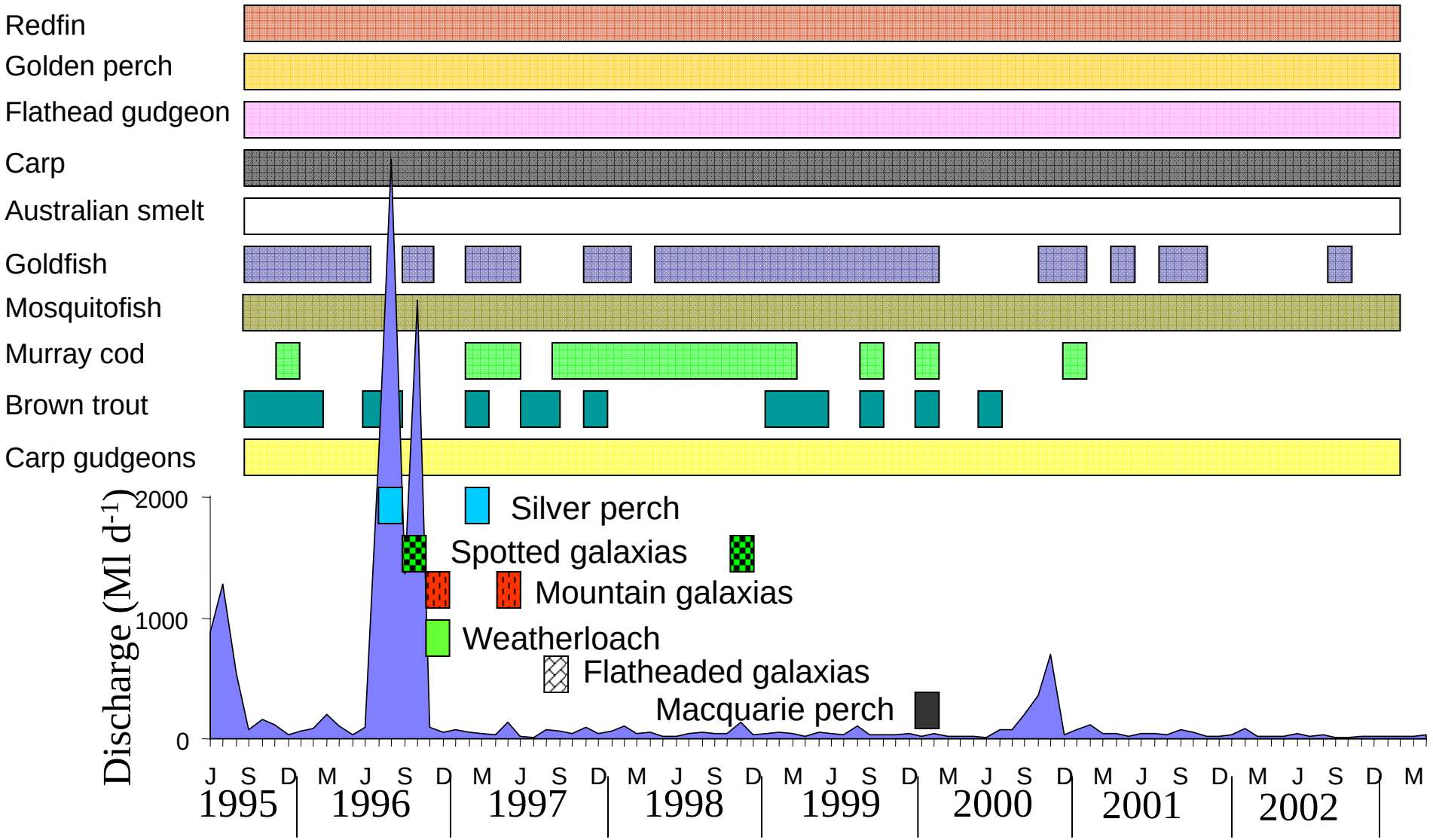
Extended low flows in the Campaspe River



Flows in lower Campaspe & Broken Rivers

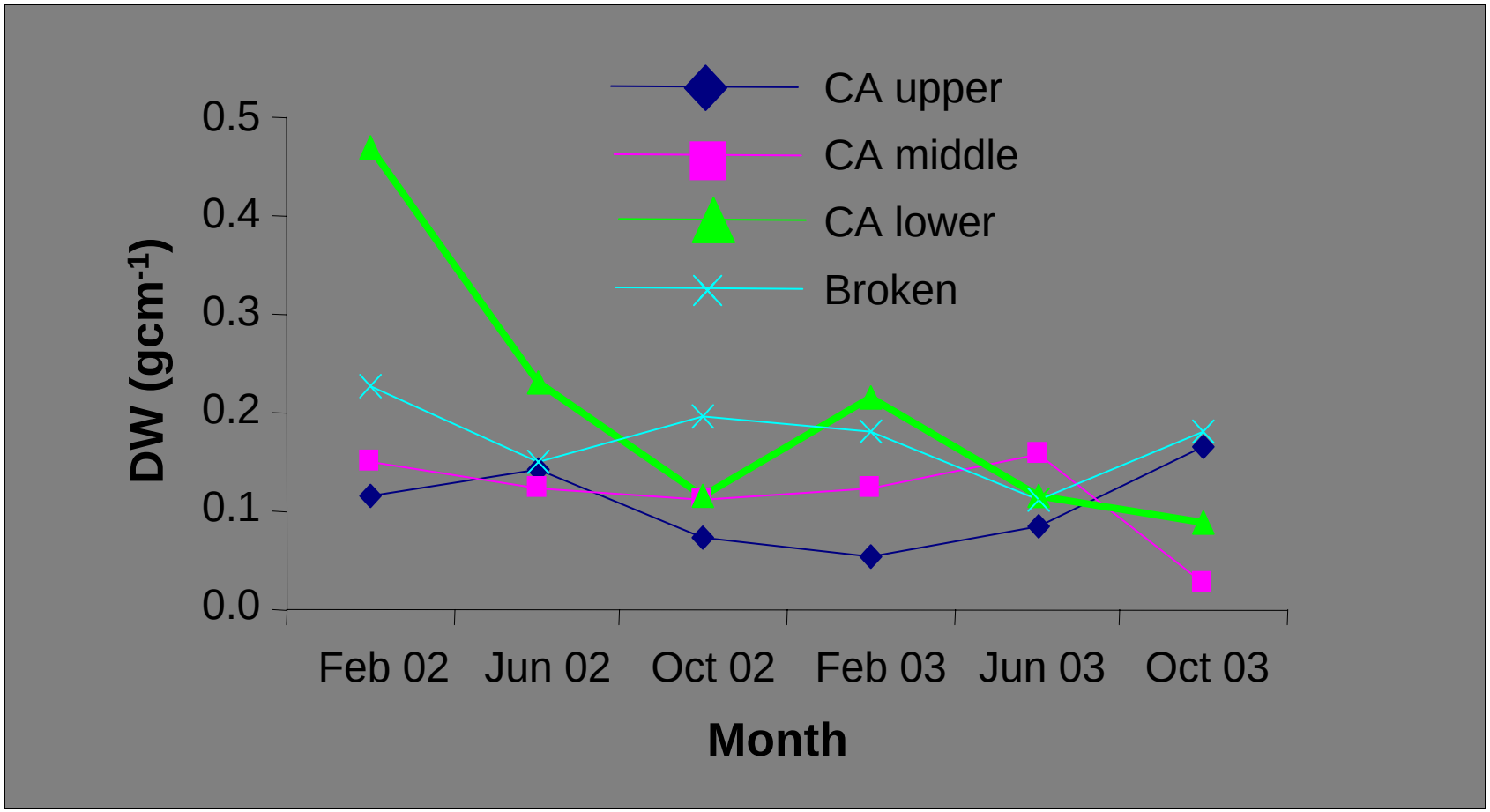


Occurrence of species in the Campaspe River

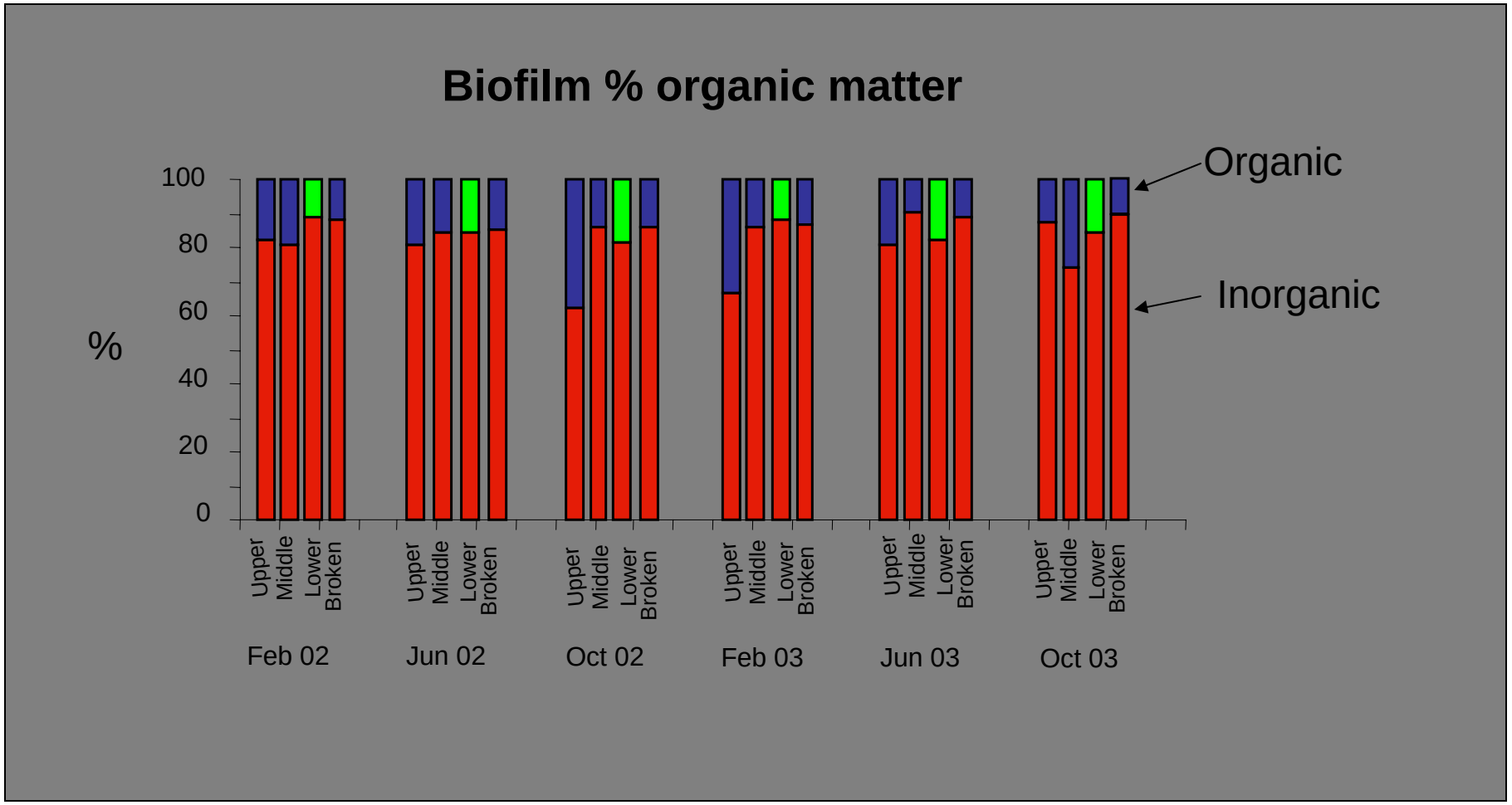


Biofilm

Biofilm biomass



Biofilm composition



Flow recommendations

- Summer irrigation releases
  - ❖Avoid constant moderate/high releases over summer
  - ❖Some other means of supplying off stream demand
  - ❖Reinstate a low flow period in rivers to enable fish and shrimp recruitment
  - ❖Provide in-stream structures in rivers to create slackwater areas?
  - ❖restoration experiment
- Constant low flows
  - ❖Provide flushing/scouring flows along the length of river system coinciding with natural rain events
  - ❖At least two

Flow recommendations

- Above trigger level – ‘Translucent dam approach’
  - Release % of incoming flows at all times
  - Allow low flows, unless natural rain event (but water quality needs to be good)
  - High flows need to be sufficient to scour and provide cue for fish movement (bank full for x days?)
- Below trigger level – ‘Managed flows’
  - Low flows between November and April, unless natural rain event (contribution by tribs?)
  - Flushing/scouring flows x 2 - July and September, coinciding with rain events (bank full for x days?)