Fish and Habitat Surveys and Modelling   **Statewide**

Identifying the key flow and habitat needs of early life stages of native fish and decapods and how environmental flows can be managed to benefit them.

Aims

1. Quantify the physical habitat attributes that are used by the early life stages of native fish and their key prey (decapods including shrimp, prawns, yabbies and crayfish) within a waterway: mesohabitats (i.e. slackwaters and glides); and whole of site (i.e. 500-1000m stream length).

2. Assess how flow events, such as freshes, influence these habitat attributes and the composition of larval and juvenile fish and decapods.

3. Assess how different flows influence the availability of key physical habitat attributes, over time and space.

Background

River regulation and the alteration of flow regimes are a major cause of declines of riverine fish populations globally. River regulation can result in reductions in the availability of critical habitats needed by native fish to complete their life cycle. In particular, alterations to the availability of habitats critical for spawning and early life stages (eggs, larvae and juveniles) and important prey of native fish (i.e. decapods) is thought to be a major impact pathway given their importance in governing population dynamics.

To address the impacts of river regulation on habitat availability to early life stages of native fish and their key prey, stream-flow management plans include recommendations which seek to provide or maintain specific habitat features for early life stages of native fish and all life stages of their prey. Achieving such objectives will ultimately enhance recruitment and populations. Of course, achieving these outcomes require knowledge of the key habitat requirements of the target biota (species, life stage and their association with key habitat features such as temperature, structure and hydraulics); their required timing and scale of these habitat features; and finally, how flows can be managed in specific river reaches to influence these key habitat features.

Victorian Environmental Flows Monitoring and Assessment Program

Research questions

a) Will sites (500-1000m stream length) with a greater mosaic of physical habitats such as instream wood, fringing and instream vegetation, depth and hydraulic diversity exhibit the greatest abundance and diversity of native fish recruits and decapods within a waterway and how do these recruitment zones vary through space and time?

b) How do changes in discharge associated with managed freshes [environmental flows or IVT (Inter-valley Trade) delivery] influence velocity, depth, temperature and structural habitat availability during core reproductive periods for native fish and decapods?

c) Do changes in discharge associated with managed freshes result in fewer fish and decapod recruits at mesohabitat and reach scales, by reducing their retention or increasing their mortality?

d) How can flows be managed to maximise key habitat requirements of early life stages of native fish species at the appropriate time of year and spatial scales in a particular river reach?

Approach

Aim 1

• Assess early life stages of native fish and decapods and their key habitat needs at mesohabitat and site scales using existing literature and analysis of recruitment data sets. Additional field survey data will be collected for species where such information is lacking. Additional field collections will involve sampling early life stages from priority river systems along with measures of structural habitat (e.g. presence of snags, vegetation), depth, temperature and flow velocity to determine ecohydraulic characteristics of habitat used by larval and juvenile fish.

Aim 2

• Collate nursery habitat attributes before, during and after summer flow events in the Goulburn and Campaspe rivers, to assess how these events influence key habitat attributes and the composition of larval and juvenile fish and decapods.

o Deploy depth and temperature sensors across key mesohabitat groups at three sites in each of two rivers.

o Undertake sampling of habitat characteristics three times (immediately before, during and after a flow event).

o Sample fish and decapods before and after flow events at three sites in each of two rivers.

Aim 3

• Use hydraulic habitat models to quantify the amount of each key physical habitat attributes for the early life stages of native fish species and decapods (identified in Research Question a) in the Goulburn and Campaspe rivers and assess how the existing flow recommendations influence these habitats at different scales.

Timeline   July 2022 - June 2024

Murray Cod larvae collected from the Goulburn River

Outputs

• **Annual Updates** outlining progress towards achieving the objectives.

• A **Final Report** which:

o Collates key habitat requirements, including hydraulic metrics of early life stages of native fish and decapod species (or groups where appropriate).

o Quantifies how flow events (e.g. freshes and IVT delivery) influence these habitats, and their larval and juvenile fish and decapod composition.

o Assesses how varying discharge levels influence the availability of key habitats metrics through time and space using hydraulic habitat models in two Victorian rivers, including mapping changes in habitat types relative to discharge.

o Provides preliminary recommendations to update and refine existing environmental flow recommendations for native fish recruitment for two regulated rivers.

• **Hydraulic models** for the Goulburn and Campaspe rivers.

• **Data** which can be used in an associated VEFMAP project relating to population modelling for fish.

Outcomes

• An evaluation of the role of flow management in maintaining or restoring habitats for early life stages of native fish and decapods, and ultimately enhancing recruitment and populations.

• Advice to refine seasonal watering plans in the Goulburn and Campaspe rivers.

• Improved understanding of physical habitat attributes used by early life stages of fish and decapods and how their availability is influenced by flows over time and space across Victoria.

• A blueprint to test and refine flow recommendations aimed at enhancing key habitat features for native fish recruitment in other rivers across Victoria.

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