FRDC Project 2021-114

Water abstraction impacts on flow dependent fisheries species of the Northern Territory, Australia

A synthesis of current knowledge and future research needs

Project objective and methods

Natural river flows support healthy rivers and associated fisheries. Water resource development that alters natural flows poses a threat that needs to be understood so that actions can be put in place to minimise harm. This project aimed to increase understanding of the impacts of water abstraction on flow dependent fisheries species of the Northern Territory, Australia.

This was achieved by:

1. Meeting with stakeholders to establish a list of focal species for the review.
2. Conducting a global review on the impacts of water abstraction on these species to understand impacts on tropical aquatic species in general and determine how research conducted in Australia compares to other continents.
3. Reviewing and synthesising literature pertinent to flow for Northern Territory fisheries species, most of which are found across northern Australia.
4. Identifying key knowledge gaps and providing expert opinion on the likely impacts for species with little data available.

Key findings - global review of water abstraction impacts on tropical aquatic species

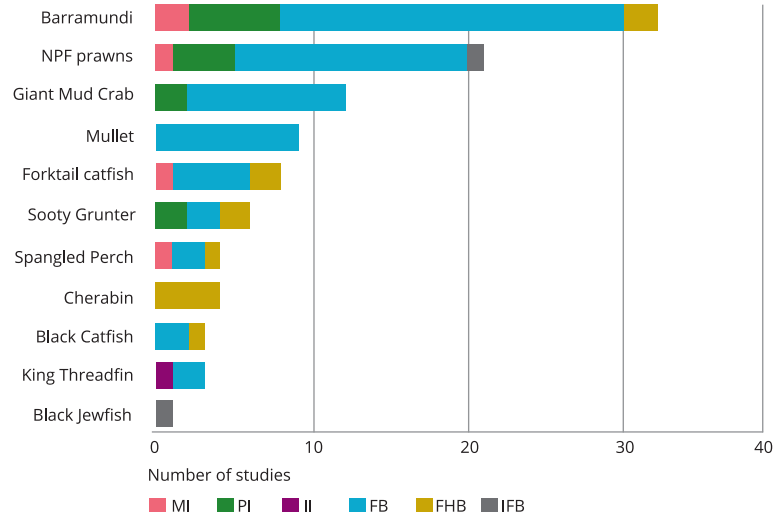
- The number of studies examining relationships between river flows and aquatic biota, or measuring or predicting impacts of water abstraction on aquatic biota, have been increasing over time.
- Fish species, fish communities, crustaceans and macroinvertebrate communities were the most frequently studied organisms.
- Australia (along with South America) leads the research effort for tropical flow-ecology studies.
- Most studies that have measured, or predicted, the impacts of water abstraction have been carried out in river or stream environments, with wetland, groundwater and coastal environments rarely studied.
- Few studies have been conducted in northern Australia that have actually measured the impacts of existing water developments. This is consistent with the lower number of developments in northern Australia compared to many other tropical regions.

Key findings - NT fisheries species

Focal species were chosen to be reviewed if they were flow dependent species commonly harvested by Indigenous, recreational or commercial fishers.

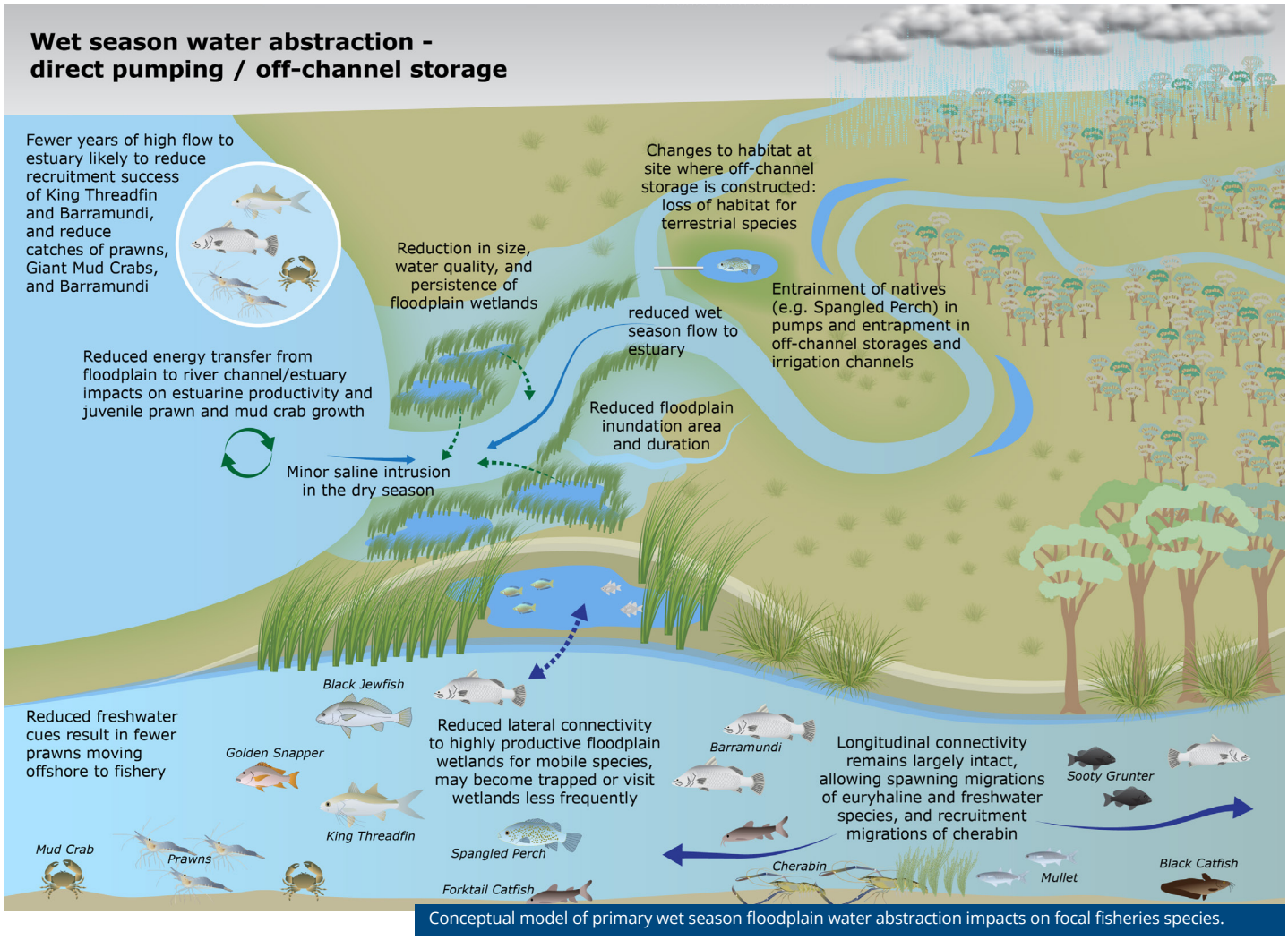
Research effort was skewed towards Barramundi, Banana Prawns and Giant Mud Crabs.

MI = measured impact,
PI = predicted (modelled) impact
II = inferred impact (from known biology or observed pattern)
FB = direct flow-biota relationships studied
FHB = flow-habitat-biota (indirect flow) relationships studied
IFB = inferred flow-biota relationship from an observation
NPF = Northern Prawn Fishery



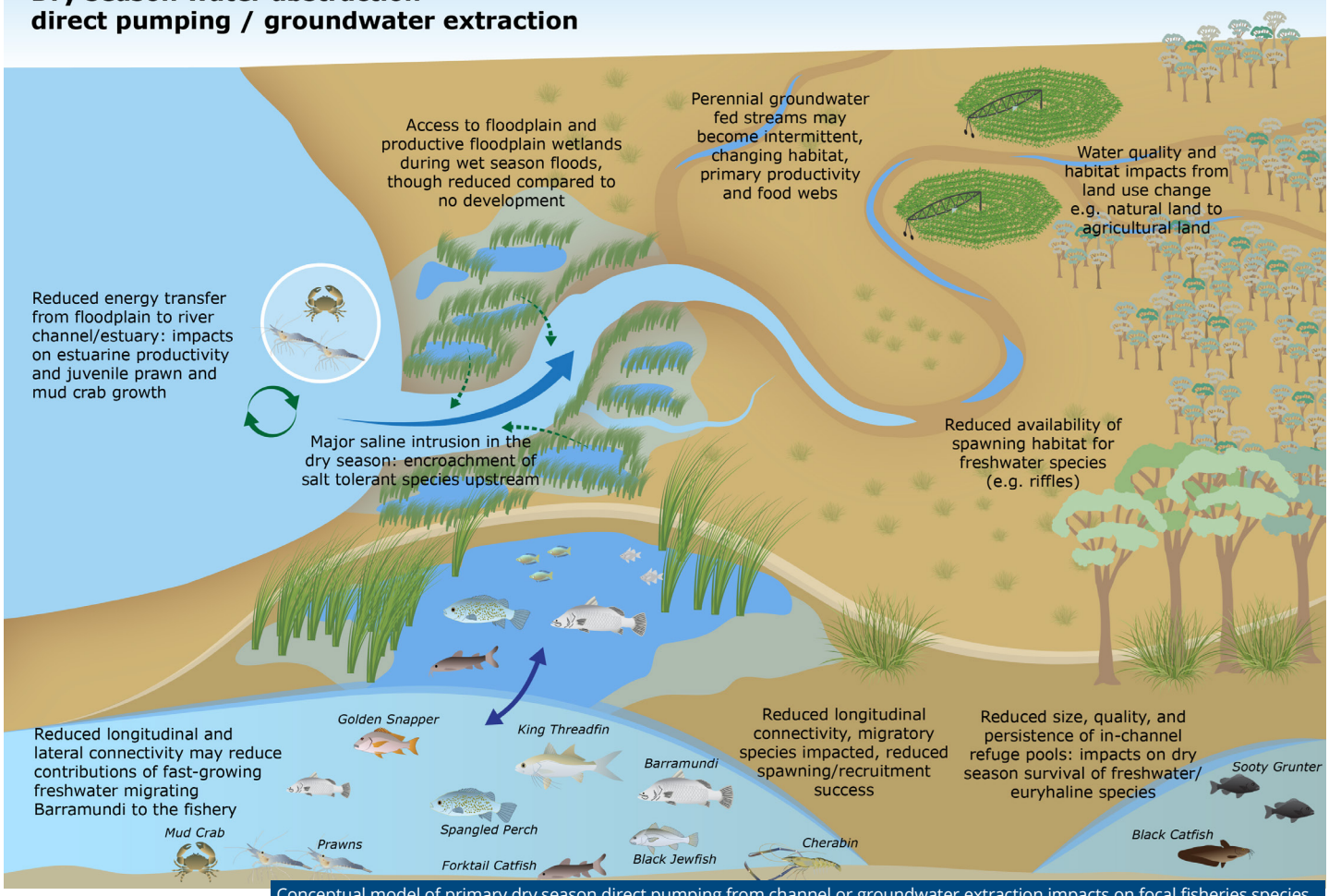
Evidence suggests the timing and magnitude of river flows are important for spawning and recruitment migrations for some freshwater (Black Catfish, Sooty Grunter and Spangled Perch), euryhaline (Barramundi, Mullet, Cherabin) and coastal species (Giant Mud Crabs, Northern Prawn Fishery [NPF] prawn species).

Wet season flood flows were found to be important for lateral connectivity, facilitating the transfer of energy across habitats. Wet season water abstraction would reduce lateral connectivity via reduced floodplain inundation. Decreased floodplain inundation would also reduce wetland flushing, impacting water quality in wetlands which serve as dry season aquatic refugia and productivity hotspots.



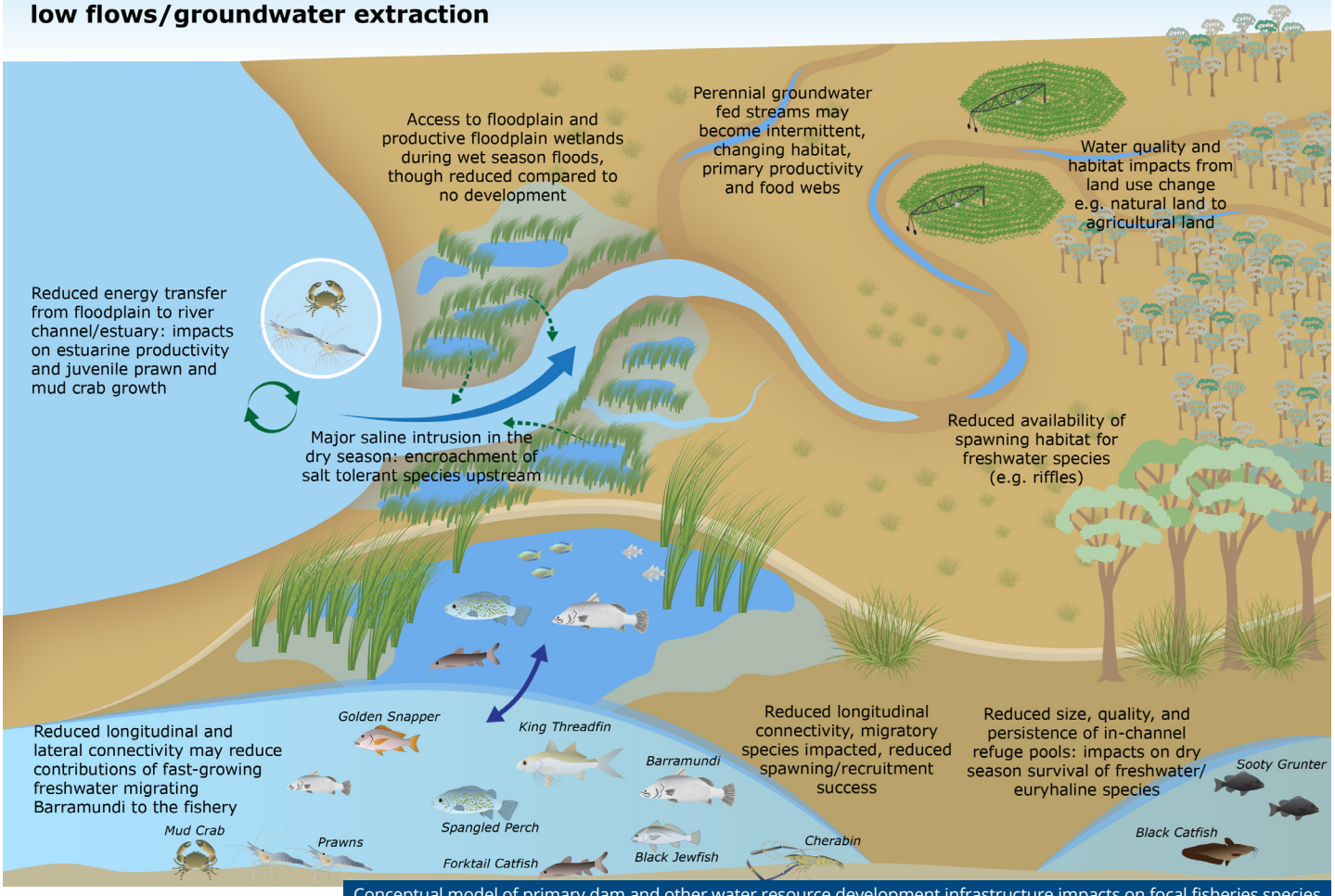
Conceptual model of primary wet season floodplain water abstraction impacts on focal fisheries species.

Dry season water abstraction - direct pumping / groundwater extraction



Conceptual model of primary dry season direct pumping from channel or groundwater extraction impacts on focal fisheries species.

Dry season harvesting – direct pumping low flows/groundwater extraction



Conceptual model of primary dam and other water resource development infrastructure impacts on focal fisheries species.

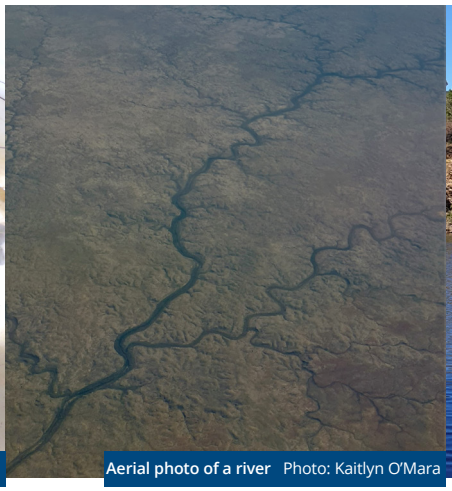
Key findings continued - NT fisheries species

- In-channel flows maintain longitudinal connectivity, facilitating movement between the estuary and freshwater for euryhaline species, ensuring fast-growing Barramundi contribute to the fishery.
- River flow, rainfall, and climate drivers are important predictors of catch and recruitment for Giant Mud Crabs and NPF prawns, as well as predictors of catch, recruitment, and growth for Barramundi.
- In-channel flows maintain critical habitat for fish (e.g. riffles used by juvenile Sooty Grunter). Studies modelling changes to these habitats under water development scenarios have found even low levels of water abstraction could have severe impacts on habitat availability and persistence.
- Coastal species will be impacted by reduced sediment and nutrient transport to the coast. Flow releases from dams in the dry season will reduce salinity in the estuary and impact available habitat and prey, as well as spawning and recruitment cues.
- Infrastructure impacts are likely for freshwater species (e.g. Spangled Perch).
- Studies using models to predict impacts of water abstraction on these fisheries species have showed that impacts are likely to vary between river systems and between different modes of water abstraction, as well as with different timing, magnitude, and thresholds of water take. Impacts are also predicted to vary between low, moderate, and high flow years.

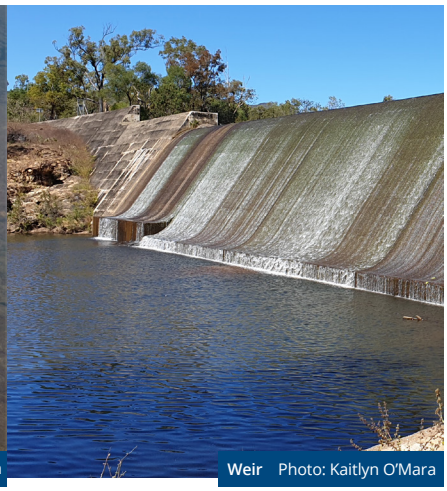
Knowledge gaps and future research needs

- There is a lack of research on the importance of flow to the life cycle of less well studied species including Black Jewfish, Golden Snapper and forktail catfish species. This warrants further study and a precautionary approach to water take, with particular emphasis on ensuring the continuation of high flow years as they disproportionately support fishery biomass.
- Very few studies have directly measured the impacts of existing water developments. Quantifying impacts (including cumulative impacts of multiple developments) is of high importance for minimising harm to fisheries. Infrastructure impacts should be mitigated through effective design measures (e.g. pump screens, fishways) tested for effectiveness in each system.
- There is a need for studies that quantify the relationships between flow and critical components of survival for fisheries species with flow dependency knowledge gaps, including studies on growth, condition, reproduction, and movement. These studies are useful to managers because scenarios can then be modelled and trialed to determine the lowest impact solutions.

Cherabin Photo: Mark Kennard



Aerial photo of a river Photo: Kaitlyn O'Mara



Weir Photo: Kaitlyn O'Mara

Additional outputs

More information about this project can be found at www.frdc.com.au/project/2021-114 or follow the QR code.

O'Mara, K., Beesley, L.S., Kopf, R.K., Burford, M.A., Douglas, M.M., Stewart-Koster, B., Kennard, M.J., (2023) Synthesis of research on water abstraction impacts on flow dependent fisheries species of the Northern Territory, Australia. FRDC Project No. 2021-114 Research findings factsheet.

Contact: Kaitlyn O'Mara - kaitlyn.omara@griffith.edu.au

FRDC FISHERIES RESEARCH AND DEVELOPMENT CORPORATION
CHARLES DARWIN UNIVERSITY AUSTRALIA
GRIFFITH UNIVERSITY
THE UNIVERSITY OF WESTERN AUSTRALIA