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Maintaining Native Fishes in Urban Landscapes

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Introduction

The future for native fish in many urban waterways seems insecure, as they are susceptible to cumulative impacts of modified stream hydrology, poor water quality, waterway barriers, aquatic habitat degradation and introduced species. While this makes them reliable indicators of ecosystem health[1], it can also make them locally imperilled. Many urban waterways have low habitat quality and are dominated by pest fishes, and often the native fish populations that do persist are under stress and vulnerable to local extirpation.

Native fish management requires an amalgamation of policies and actions towards conservation and biosecurity outcomes, that together increase the 'resilience' of urban waterways.

Encouragingly, a recent expert workshop[2] considered ways to 'stack the odds in favour of native fish', through:

- enhanced governance
- habitat management
- surveillance, and
- community engagement.

Governance

Local government corporate plans can help stack the odds in favour of native fish by:

- having healthy waterways with healthy fish communities as a key corporate goal

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1 Kennard, M.J., Harch, B.D., Arthington, A.H., Mackay, S.J. and Pusey, B.J. (2001) Freshwater Fish as Indicators of Ecosystem Health. In Smith, M.J. and Storey, A.W. (Eds.) Design and Implementation of Baseline Monitoring (DIBM3): Developing Ecosystem Health Monitoring Program for Rivers and Stream in Southeast Queensland. SEQRWQMS, Brisbane.

2 Expert elicitation workshop, facilitated by frc environmental, included fish ecology experts from Griffith University, Department of Agriculture and Fisheries, Department of Environment and Science, Seqwater, several Local Governments, Quandamooka Yoolooburrabee Aboriginal Corporation, and ANGFA. The contribution of all workshop participants is greatly appreciated and duly acknowledged.

Governance

Local government corporate plans can help stack the odds in favour of native fish by:

- having healthy waterways with healthy fish communities as a key corporate goal
- funding allocations in annual budgets to water health initiatives that comprise both on-ground habitat restoration, monitoring and management (i.e. not *just* monitoring)
- having appropriate conservation and biosecurity strategies pursuant to the corporate plan that adequately deal with aquatic and riparian ecosystems, including:
  - identifying conservation significant fish at the local level[3], and requiring protection of water quality, habitat and fish passage for these species (ex situ conservation a last resort)
  - identifying and protecting key aquatic habitats (e.g. streams with minimal existing disturbances; permanent waterholes in ephemeral systems)
  - identifying key threatening process (e.g. waterway barriers, point source pollution sources, biosecurity hazards) and mitigate impacts.

Local government planning schemes must have cohesive and aligned overlays to support achievement of the corporate plan, and can help stack the odds in favour of native fish by:

- ensuring riparian vegetation widths and longitudinal continuity along waterways are adequate for:
  - buffering overland flows to protect water quality
  - providing habitat structure and shade for fish, and
  - providing stream bank stability
- capping building and road density to reduce the proportion of impervious surfaces within catchment areas, so that runoff patterns and resultant stream flows are less flashy
- requiring water sensitive urban design and storm water management to protect water quality and reduce flashiness of stream flows in developed catchments, whilst also requiring water sensitive designs (e.g. retention basins) to either be ephemeral or drainable so that they do not become 'havens' for pest fish[4].

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[3] Our survey work has shown that some native species are now rare within some local government areas, or their distribution is restricted to one or two waterways within a local government area; such species could be given priority conservation status at the local scale.

[4] Our survey work has shown that permanent artificial waterbodies tend to be dominated by pest fish (e.g. eastern Gambusia, tilapia); thus, they may function as biosecurity hazards. Regular complete drying of such waterbodies is an effective, cost-sensitive and environmentally-friendly approach for preventing proliferation of pest fish in these types of system, noting that drainable options would need to ensure that pest fish are not spread during dewatering.

Coordination is critical for governance of environmental assets:

- internal coordination to:
  - improve planning schemes where there are inadequacies
  - mitigate adverse impacts to waterways from future development
  - ensure the corporate plan and planning scheme comply with the General Biosecurity Obligation of the *Biosecurity Act 2014*
- regional coordination (between local government authorities, and between local and state government):
  - reciprocal reporting of biosecurity surveillance results (i.e. are pest fish expanding their range locally and regionally)

Habitat Management

Aquatic habitat restoration is likely to be a key management action in urban environments:

- ideally restoration would follow a staged approach, although the need to adopt a multi-criteria decision making (prioritisation) approach to progress multiple strategic objectives is likely to necessary. Consequently, waterway health needs to be a corporate priority.
- habitat restoration should be guided by broad-based restoration and catchment management principles, tailored to suit local conditions, including:
  - conversion of concrete-lined or piped sections of waterway back to natural channel design, with earthen / natural bed and banks, and vegetated banks
  - creation of greenspace corridors along waterways, with vegetated stream banks, grassy recreational areas and pedestrian / bike trails that cross waterways designed so as to not create waterway barriers
  - waterway barrier removal (see below)
  - riparian vegetation rehabilitation
  - storm water management (treatment) and treatment of point-source discharges
- multiple restoration actions in a single catchment will likely result in superior outcomes; thus, identifying priority areas is critical to focusing effort.

Waterway barrier removal is a key aquatic habitat management action:

- prioritised on the basis of drown-out frequency, quality of upstream habitat and cumulative effects of barriers (i.e. considered on a case-by-case basis, rather than investing in systematic barrier removal, because other actions might have greater benefit)

- in some cases it is possible that an existing barrier prevents the upstream range expansion of pest fish within a waterway; such barriers may have biosecurity and conservation benefits if there are conservation significant fish species that are not diadromous upstream[5].

Artificial waterbodies are common features of urban areas, and some water-sensitive urban designs incorporate artificial waterbodies for water quality improvement and sediment detention. However, as noted above, permanent waterbodies may become havens for pest fish, and where surveillance indicates that an artificial waterbody is indeed dominated by pest fish, then such waterbodies could be:

- in-filled
- modified to become ephemeral
- modified so they can be regularly drained, or
- left as is, if water retention and nutrient / contaminant processing functions are deemed to be of greater importance than risk of a pest fish.

Surveillance (monitoring)

Surveillance is a key management activity that can be used to:

- assess the integrity of native fish communities / map location of remnant native fish populations / monitor the establishment of new pest fish populations
- analyse responses to any trial pest fish control measures[6]
- assess the cyclical (natural) fluctuations in native fish populations, and
- assess potential for co-existence of native and pest fish in waterways with fewer catchment-scale and site-specific impacts.

Community Engagement

Community awareness is a further important and potentially cost-effective management tool, both to promote the values of native fish to the public, and educate the public on the adverse impacts of pest fish on native fish communities. There is a need to focus on the positives not just the negatives, and develop skills such as fish identification (to discriminate invasive species) within the community.

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5 A particular barrier believed to be preventing upstream movement of tilapia into ornate rainbowfish habitat on a particular waterway was discussed at the workshop.

6 Workshop discussion was that eradication was not feasible in most cases, with chemical control or total drying of a waterbody the most likely methods to have any level of success, noting that colonisation pathways would still exist in most cases and thus pest fish would likely re-establish.

A range of communication and awareness programs could be considered, including:

- fact sheets, social media (e.g. biosecurity Qld have a facebook page)
- aquarium trade (perhaps supplying facts sheets, inviting to special events)
- special events, e.g. pest fish removal days; fish identification workshops
- awareness programs for planners, design engineers, politicians, developers and other decision-makers:
  - land / property surrounded by functioning ecosystems has higher value than those surrounded by degraded ecosystems
  - educate about regulations and environmental standards that are sometimes not well understood by decision makers
- discourage food value of tilapia, and
- school-based education programs.

Case Study 1 – Brisbane City Council's Hanlon Park Project

Norman Creek is an inner-city waterway that connects to the Brisbane River a small distance downstream of the Brisbane CBD and has a highly urbanised catchment. The lower reach of Norman Creek traverses Hanlon Park in the suburb of Stones Corner, with this reach being highly channelised (straightened and concrete-lined) with riparian zones cleared of native vegetation.

The Hanlon Park Project will convert this reach of Norman Creek into a more natural state by:

- removing existing concrete lining, and replacing it with more natural bed and bank material
- introducing naturalised channel pattern (i.e. sinuous rather than straight channel pattern)
- planting native tree species along the top bank to increase shade cover of the creek, and
- increasing habitat complexity, including a wetland island.

The project will include improved recreational facilities, stepping stone crossings of the creek and an education trial that together will provide the community with up-close access to stream ecology and interpretative signage to enhance understanding and awareness of urban stream ecology.

The Hanlon Park Project progresses a number of objectives of Brisbane City Council's Corporate Plan, with multiple criteria driving the development of the restoration design,

which include flood management, water quality and ecology, recreation and leisure, and community identify.

Case Study 2 – Redland City Council's 'Pest Fish in the Redlands Website'

The Redland City Council's Pest Fish in the Redlands promotes awareness of, and presents management actions for reducing, the impacts of pest fish on native fish in urban waterways of Redland City.

The key pest fish in the Redlands are tilapia, eastern Gambusia and carp, although swordtails, platys and guppies also comprise the exotic fish fauna of Redland City's waterways.

Actions listed on the website are aimed at community awareness and action, and include:

- stop the spread of pest fish: do not use pest fish as bait, no not release aquarium fish, do not release pest fish once caught
- improve water quality to favour native species, e.g. through water sensitive urban design
- improve aquatic habitat quality for native fish: via riparian vegetation and waterway restoration
- line-fishing to remove and destroy pest fish, such as tilapia.

Case Study 3 – Richmond Valley Council Key Fish Habitat Map

- Richmond City Council has developed a key fish habitat map, focusing on habitats preferred by the endangered oxleyan pygmy perch. The mapping layer supports strategic and operational management of known threats of oxleyan pygmy perch, including coastal and urban development, water pollution, habitat degradation and competition with the pest fish eastern Gambusia.

Conclusion

Urban waterways will never be returned to pristine, and unfortunately pest fish are here to stay. However, using a range of management approaches, such as those discussed in this paper, it can be possible to 'stack the odds in favour of native fish' in many urban waterways. The continued existence of native freshwater fish in our local waterways will increase the value of our natural assets closest to where we live.