

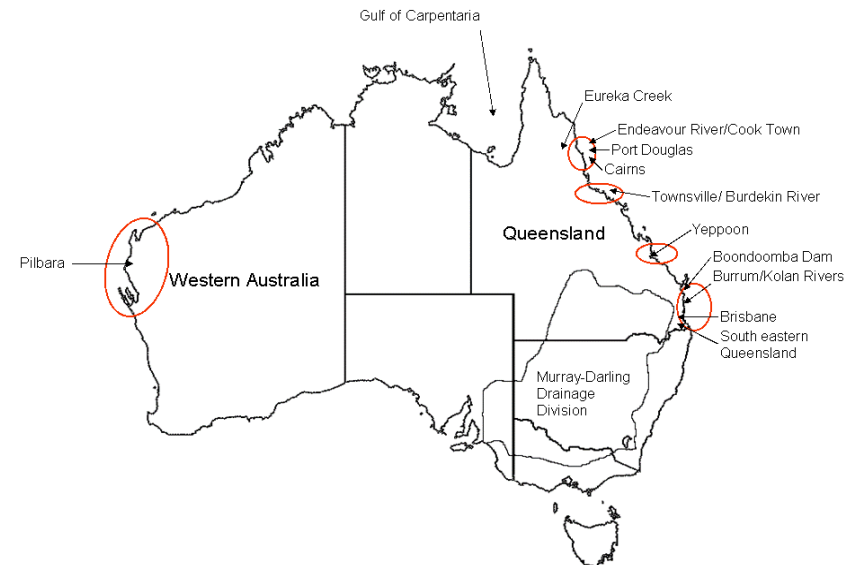
Preventing tilapia establishing in the Murray-Darling Basin: Surveys and Science

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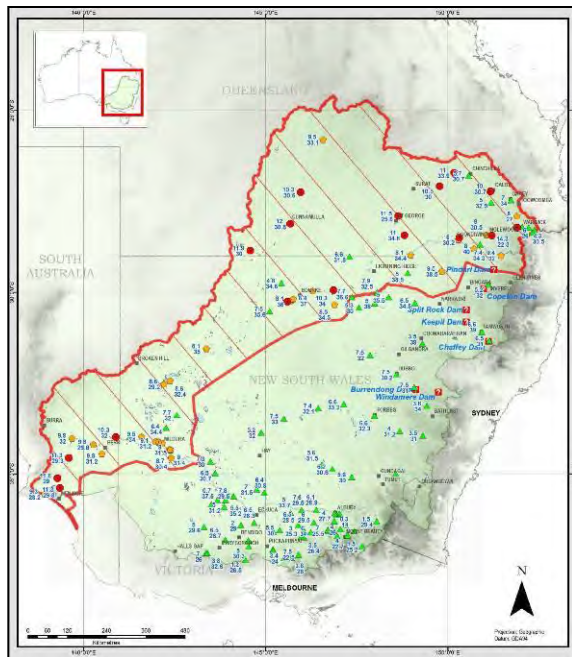
Overview

- The Mozambique tilapia (*Oreochromis mossambicus*) occurs in both northern and southern Queensland
- One of the World's top 100 pest fish (IUCN)
- Detrimental impacts through
 - competition for habitat and food
 - aggressive behaviour
 - nest building
 - disturbing native plant beds.



Threat to the Murray-Darling Basin

- Not currently found in the Murray-Darling Basin (MDB)
- Thriving populations in at least 8 SEQ catchments near the MDB
- Pose a serious threat to the MDB



- Tropical to warm-temperate species
- Survival and potential distribution governed by low water temperatures
- Climate mapping
=> inhabit up to 50% of the MDB
- Prevention is far more cost effective than treatment



Main Objectives

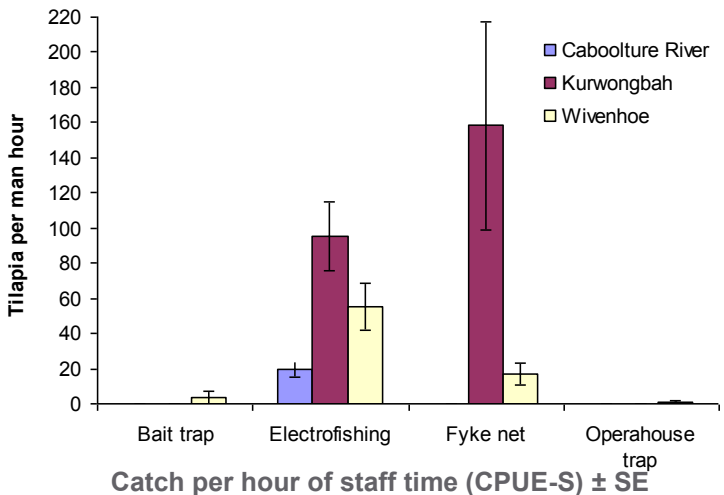
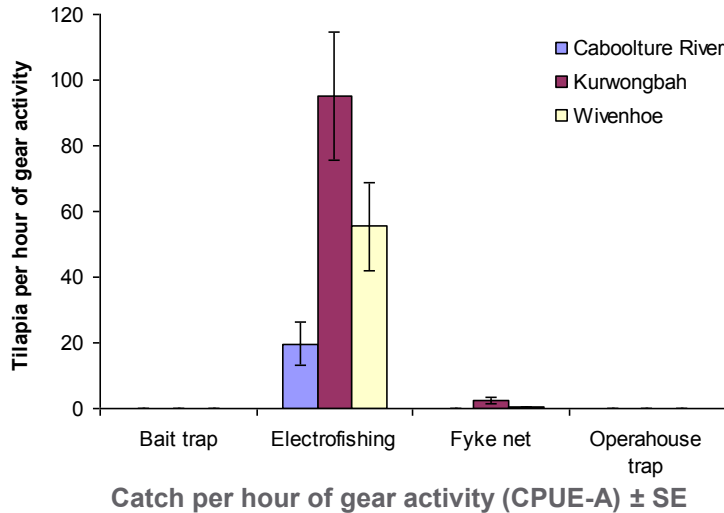
- Assess the effectiveness of current management tools
- Survey for tilapia populations in the northern MDB
- Identify key habitat preferences
- Investigate over winter behavioural thermoregulation
- Improve monitoring and control methodologies.

Technique Assessment

- Common community oriented techniques
- Conducted in tilapia infested sites outside the MDB
- Compared:
 - Bait traps
 - Opera-house traps
 - Fyke nets
 - Electrofishing
- Sites
 - Wivenhoe Dam
 - Kurwongbah Dam
 - Caboolture River
- Seasonal – Summer vs Winter



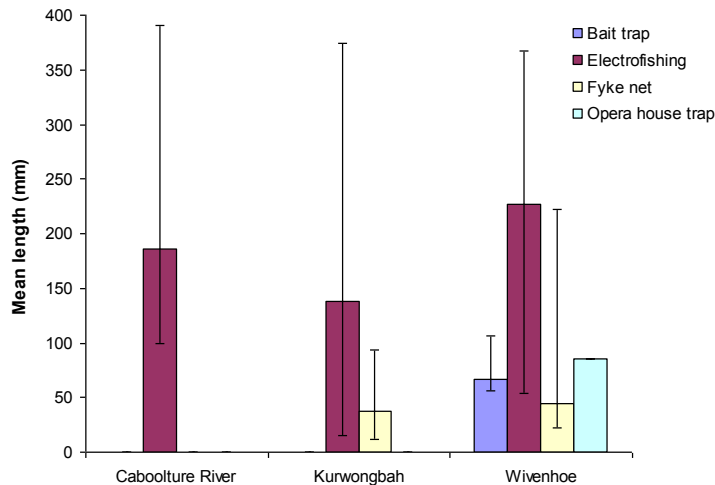
Catch per unit effort (CPUE)



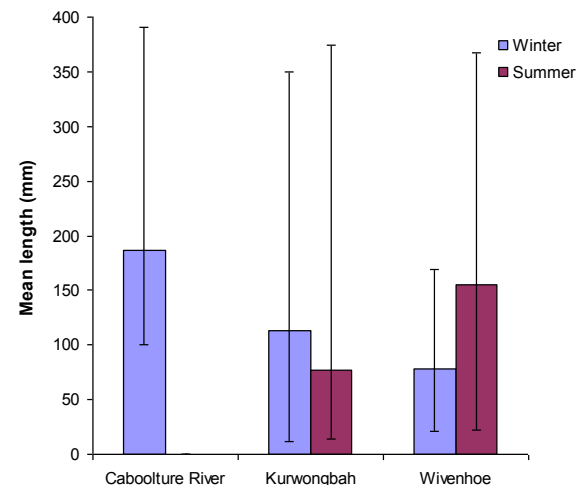
- CPUE-S = Tilapia per man hour i.e. \$\$\$\$
- CPUE-A = Tilapia per hour gear activity
- Significant differences ($P < 0.026$) between techniques and sites
- Electrofishing and fyke nets were by far the most effective techniques
- Electrofishing CPUE-A was significantly ($P < 0.001$) higher
- Fyke nets had greatest CPUE-S at Kurwongbah
 - Many summer juveniles in areas where nets could be set
- However, mean electrofishing CPUE-S across all sites was highest
- Fyke nets can be readily deployed by community groups.

Gear specificity

- Site, season and technique were all significant factors ($P < 0.001$)
- Summer recruitment resulted in a reduction of the mean fish size
- Electrofishing caught the largest size range, but mostly large fish
- Fyke nets only caught small fish (< 222 mm)



Significant differences in the size of tilapia caught between techniques



Seasonal differences in the size of tilapia caught

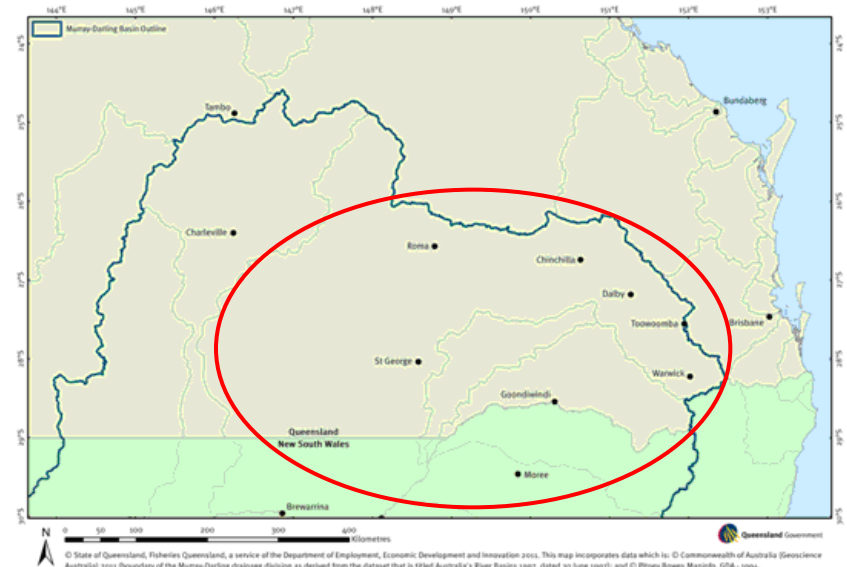
Habitat preferences

- Data still being analysed
- Initial observations suggest a strong preference for areas with aquatic macrophytes, particularly broken paragrass and lilies



Surveys

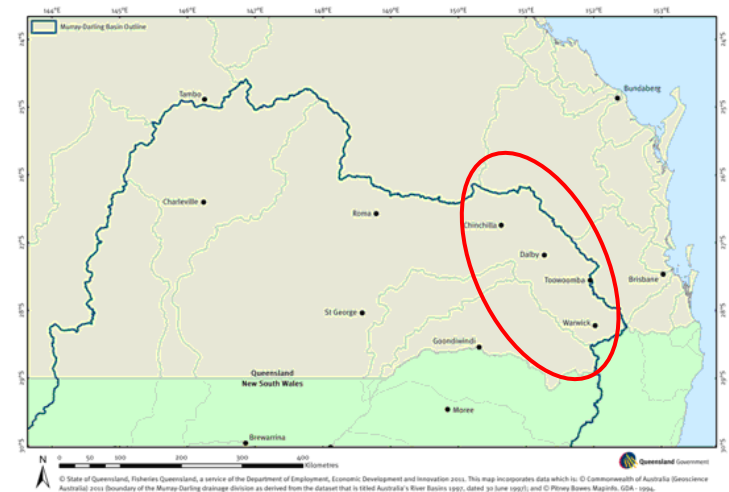
- Surveys looking for tilapia in MDB
- Used electrofishing and fine-mesh fyke nets
- Sites were prioritised by:
 - Habitat
 - Socio-economic; and
 - Geographic characteristics
- Initial surveys winter 2010
 - 11 sites in MDB
 - 5 sites adjacent to MDB
 - No tilapia in MDB; but
 - Tilapia confirmed <50 km from MDB



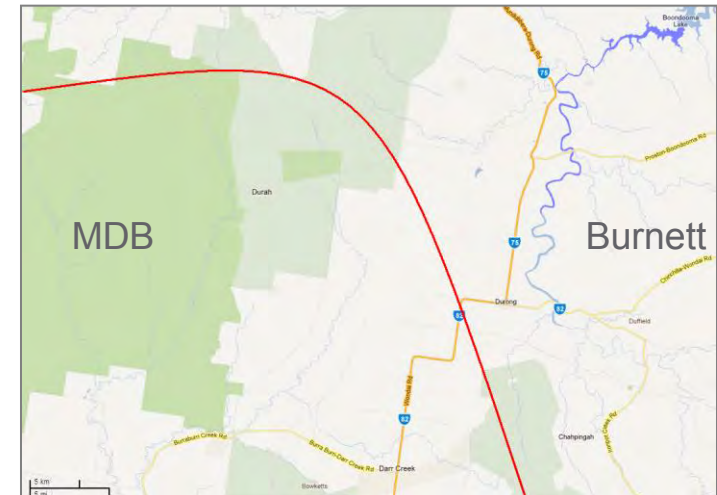
Winter 2010 survey area

Surveys

- Second survey winter 2011
 - 18 additional sites
 - Looking at post-flood pest fish distributions
 - Sites prioritised by:
 - Degree of inundation during 2011 floods
 - Risk of incursion
 - Socio-geographic characteristics
 - No tilapia or non-native ornamentals
 - Tilapia reported <10km from MDB
 - Potential inter-catchment connection during floods near Durong
 - Carp reported to move from Nudley Creek into the upper Boyne River via road drainages and inundated melon holes
 - Intensive surveys could not confirm this
- Third survey spring 2011 – currently underway



Winter 2011 survey area



Durong area where unconfirmed overland connection occurred

Thermal preference experiments

- Determine the temperature difference required to attract tilapia under winter conditions
- Experimental protocols
 - 3 chambered choice experiment
 - Ambient water 17°C
 - Acclimate for 60 min
 - Start thermal gradient of 1,2 or 3°C
 - Record positions during acclimation and for 90 min in thermal gradient
 - 32 replicates for each temp
 - Compare pre and post gradient behaviour
- Data is currently being analysed
 - GLM of binomial proportions
 - Covariates - Size and sex
- Initial observations suggest 1°C may lure fish to the warm end
- About to trial thermal attractants in 10 tonne tank using large heaters (control/treatment)



During acclimation at ambient water temp (17°C)



45 min after 3 °C thermal gradient introduced

Acoustic telemetry

- Array of acoustic receivers in one arm of Kurwongbah Dam
- Co-located Temperature loggers
- Range testing to design array
- Surgically implanted acoustic transmitters into 32 tilapia late July 2011
- Monitored fish for 6 weeks to assess overwintering behaviour
- Mapped habitat characteristics of the arm
 - Margins dominated by heavy macrophytic growth
 - Lilies (*Nymphaea spp.*)
 - Cabomba (*Cabomba caroliniana*) – invasive weed
 - Deep clear open water in middle



Surgical implantation on acoustic tags



Acoustic receiver array in Kurwongbah Dam

Acoustic tracking



Acoustic telemetry site at Kurwongbah Dam

During the first 10 days:

- Red** = most time spent
- Green** = movement pathways
- Blue** = shallow water forays

Fish sizes

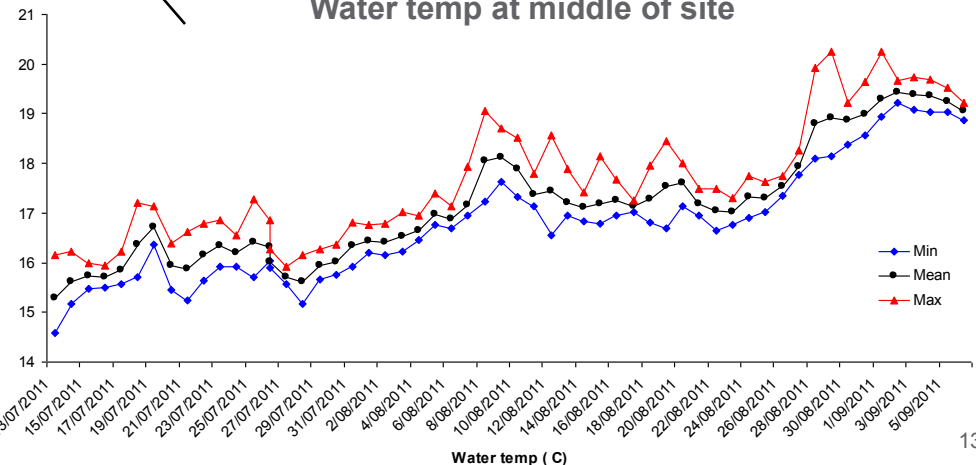
- Mean length 306 mm (244-385)
- Mean weight 604 g (298-958)

Habitat has been mapped

Will analyse:

- Swimming speed
- Movement distances
- Site fidelity/Home range
- Habitat preference
- Water temp correlation

Water temp at middle of site





Key messages

- A combination of electrofishing and fyke-nets was the most effective at capturing the entire size range of tilapia
- No tilapia have been found within the MDB, but confirmed reports place them <10 km from the northern headwaters
- Tilapia are attracted to warmer water when ambient water temperatures are low and a difference of 1 °C may be enough to elicit a behavioural response
- Tilapia appear to exhibit several diel movement patterns in winter that could be exploited for management.



Recommendations

- Ongoing monitoring is required to detect incursions before they become well established
- Particular attention should be paid to the area around Durong as well as other key areas of highest risk to incursion
- Monitoring programs should integrate fine-mesh fyke-nets and electrofishing to target all fish sizes.



Knowledge gaps for further research

- Field trials are needed to ascertain if thermal attractants can lure tilapia into traps
- Acoustic telemetry in summer when tilapia are likely to exhibit different behaviour could identify additional opportunities to exploit.
- Surveillance and monitoring sites should be prioritised. The use of GIS to map waterway characteristics for use in surveillance planning warrants further attention.
- Food attractants could assist management, especially in summer. Several food types have potential to be relatively tilapia specific attractants and merit further investigation.



Acknowledgements

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Life wasn't always meant to be easy.....

