

# A life of ups and downs: Dam levels and the littoral fish communities of Lake Wivenhoe, Southeast Queensland



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**ABSTRACT** Fishes dwelling in the margins (< 1.5 m) of Wivenhoe Lake were sampled by seine net to assess changes in community and trophic structure during a filling event. The community is dominated by barred grunter *Amniataba percoides* and bony bream *Nematalosa erebi*. The contributions of these littoral fishes to the ecology of the dam are considered in relation to those of the pelagic communities. Biomass and trophic models will be developed that reflect the dynamics of this relationship under changing reservoir levels.

**BACKGROUND.** Wivenhoe Dam is the major water storage and flood mitigation facility for Brisbane. Drought and diminishing water levels led to concern about ecosystem functionality and its relationship to water quality and water treatment costs. A systematic study was initiated incorporating all abiotic and biotic ecosystem components from catchment to water grid output. Of considerable interest is the trophic cascade between fishes, zooplankton and phytoplankton. This study assesses the biomass of littoral fish assemblages at four sites in the reservoir for use in ecological models of system function.

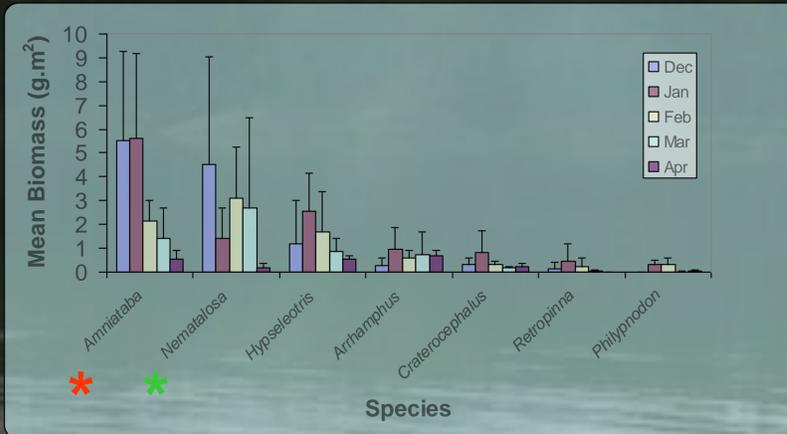
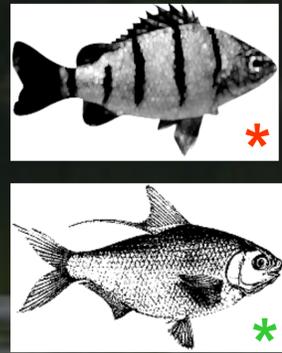


Figure 2. Mean biomass (SD) of littoral fishes pooled for four sites in Lake Wivenhoe over monthly seine net sampling events from December to April. Biomass is dominated by the invasive terapontid, *Amniataba* and the native clupeid *Nematalosa*. With the exception of the epipelagic snub-nosed halfbeak, *Arrhamphus* most species showed a marked decline with the onset of Autumn.

## RESULTS & DISCUSSION.

- The littoral fish community of Wivenhoe Dam is dominated by *Amniataba percoides* (Terapontidae), an invasive species thought to have been introduced during sport fish stocking, and *Nematalosa erebi* (Clupeidae) (Fig. 2).
- Differences in community structure are driven chiefly by these species, both occurring in higher biomass densities in the lower dam (Fig. 3).
- Diet analysis indicated that *A. percoides* is omnivorous and *N. erebi* detritivorous, consequently nocturnal migrations of these species may lead to advection of nutrients of littoral origin into the lake's pelagic zone, thereby influencing pelagic productivity.
- Nocturnal migrations of planktivores such as juvenile gudgeon (*Hypseleotris* spp.) (Meredith, 2005) hardyheads (*Craterocephalus* spp.) and smelt (*Retropinna semoni*) will potentially influence zooplankton abundance (Metveev pers. comm).
- The role of this mobile littoral fish community as a driver of lake trophic relations is likely to be greater at lower dam levels (Fig. 4) and in the shallower upper reaches of the dam (Fig. 1) where the ratio of littoral to pelagic waters is greater.

There was a marked decline in the biomass of the two dominant species that coincided with rising dam levels and the approach of winter.

Lake filling following extended drought coincided with the late spring and summer recruitment pulse supported by progressively inundated riparian grasses.



Figure 1. A topographic map of Lake Wivenhoe showing sampling sites: HQ = Headquarters, CB = Cormorant Bay, HL = Hay's Landing, LI = Logan's Inlet. The lower lake is deeper than the mid lake.

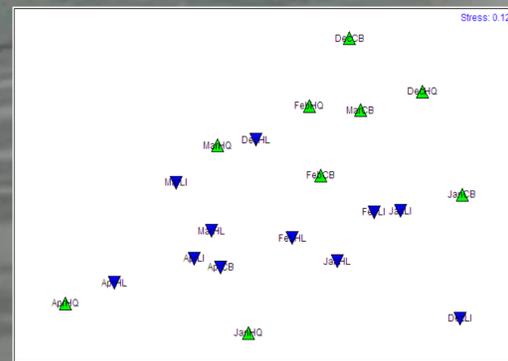


Figure 3. An MDS plot of Bray-Curtis similarity of square root transformed fish biomass density for littoral habitats of Lake Wivenhoe. ANOSIM indicated a significant effect ( $R=0.197$ ,  $p=1.5\%$ ) of lake zone (Lower = green, Mid = blue) which SIMPER indicated was driven largely by a higher biomass density of *A. percoides* and *N. erebi* in the steeper littoral of the lower lake.

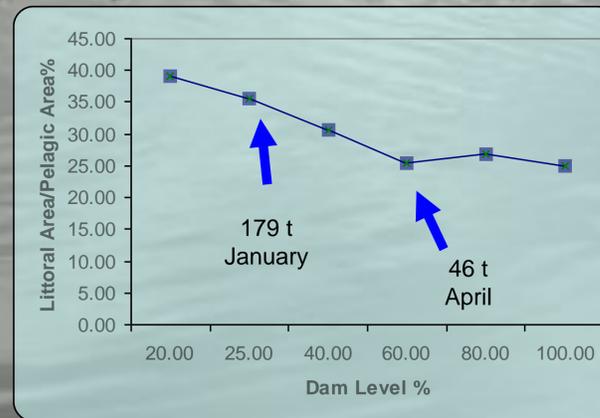


Figure 4. Model of the ratio of littoral area vs pelagic area of Wivenhoe Dam at a range of fill scenarios. Arrows indicate estimated biomass (tonnes) of littoral fishes in summer and autumn. The contribution of littoral fish to trophic relationships in Wivenhoe is likely to diminish rapidly as Dam level rises and winter approaches.

**METHODS.** Monthly samples commencing December 2008 comprising three replicate seine net (10 x 2 m x 3 mm mesh) hauls at four sites (Head Quarters Ramp and Cormorant Bay near the dam wall and Logan's Inlet and Hay's Landing in the mid lake) (Fig.1) were used to determine the diurnal community structure of littoral fish assemblages. Subsamples of fish were identified, counted and standard length measured (1 mm) from which biomass was estimated. Gut contents ( $n=20$ , monthly) were examined to provide a snapshot of trophic level. One way ANOSIM (Primer) was used to compare community biomass between mid lake and lower lake, and species driving differences were identified using SIMPER.

**REFERENCE.** Meredith S. 2005 Ecology and bioenergetics of gudgeon (*Hypseleotris* spp) in Maroon Dam: A zooplanktivorous fish in a whole-lake manipulation. QUT, School of Natural Resource Sciences

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