

# The environmental management of prawn farming in Queensland – worlds best practice

Research Summary

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The emergence of prawn farming as an economically successful industry in coastal regions of Queensland over the past two decades prompted a comprehensive, multi-disciplinary study of intensive prawn pond ecosystems, their ecological impacts on downstream environments and the development of cost-effective effluent treatment systems.

The seven year study (1995-2002) focussed on the largest prawn farms in Queensland and New South Wales throughout the production cycle for several successive years. The study encompassed a range of latitudes, discharge environments (e.g. tidal creeks and estuaries) and both flow through and recirculating water management systems.

The study integrated the research skills of 30 scientists from several institutions including CSIRO, Australian Institute of Marine Science, University of Queensland, Queensland Department of Environment and Heritage, New South Wales Environment Protection Authority, Griffith University, University of Sydney, University of Technology, Marine and Freshwater Resources Institute, Victoria and the University of Maryland, U.S.A.

The multidisciplinary study was the most comprehensive analysis of the environmental management of prawn farming ever conducted. The team developed rigorous techniques for sampling eutrophic pond ecosystems including sediment and water column nutrients and microorganisms, pond biota and abiotic variables. The application of enriched isotope nutrient labeling techniques, pioneered by the team, permitted the first accurate quantification



of the fate of feed nutrients in an intensive prawn farming system and downstream from the farm. The integrated approach adopted throughout the study also permitted the team to produce a multi-author synthesis of the dominant ecological processes in intensive shrimp ponds and adjacent coastal environments. Beyond developing a quantitative understanding of these processes the team analysed pond effluent composition and designed a cost-effective effluent treatment system based on sedimentation processes. The introduction of settlement ponds has also provided industry the opportunity to recapture water nutrients using natural biological filters.

The results of the project have been communicated via 42 refereed scientific publications and four final reports (see references).

### The key elements of the study were:

- prawn pond sediment and nutrient processes (*references 1-22*)
- composition of prawn pond discharges (23)
- discharge treatment systems and environmental management (23-29)
- receiving waters - assimilation and monitoring (30-40)
- synthesis of pond processes and environmental management (41-45)
- aquaculture land use planning (46).

### The key outputs of these studies were:

- Prawn pond sediment and nutrient processes rigorously quantified and modelled (1, 18)
- Pond discharge composition rigorously quantified (22, 23)
- Published the first synthesis of the dominant ecological processes in ponds and adjacent coastal environments (30)
- In collaboration with industry, designed and implemented cost-effective treatment system based on sedimentation processes (24, 25, 27).

### Outcomes and implications:

- All Australian prawn farms use environmental management practices, including discharge treatment systems, which enable them to meet world best practice discharge water quality.
- Progressive advances in treatment systems and practices have enabled some farms to increase their total production area with no net increase in sediment and nutrient loads discharged into receiving waters.
- Increasing production area without increasing sediment and nutrient outputs has been achieved by increasing the area of treatment ponds (in some cases up to 35% of the total pond area). There is a major opportunity to develop the next generation of discharge treatment technology to reduce the required area of treatment ponds.
- The prawn farming industry has achieved an effective balance between economic gains and conserving ecosystems, including the world heritage listed Great Barrier Reef.

- With these operating practices and regulations in place, there is significant opportunity for the industry to expand without compromising the economic and environmental sustainability of the industry.
- Broad scale desktop analysis identified 594,000 hectares of potentially optimal pond aquaculture land along the Queensland coast that would not compromise the environmental standards for the region (46).
- A fine scale land use modelling case study that enabled the expansion of an existing prawn farm adjacent to the Logan River, optimising the economic benefits of land use in the regions with no increase in nutrient or sediment discharges to the Logan River (commercial in confidence).
- For example an increase from the current 717 hectares of prawn ponds, producing 2,940 tonnes valued at \$40 million to 5,000 hectares of ponds producing 30,000 tonnes valued at \$400 million - would correspond to less than 1.4% of the existing sugar cane production area. The 5,000 hectares could be located within any of the 594,000 hectares of potentially suitable land between the border of New South Wales and Northern Territory border (a total distance of 13,347 km).



# Scientific publications and reports - Prawn pond nutrient process, downstream impacts and environmental management options

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