



THE NATIONAL RESEARCH AND DEVELOPMENT PLAN FOR COMMERCIAL INLAND SALINE AQUACULTURE: A VIEW FROM AFAR

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ABSTRACT

Increasing dryland salinity is among Australia's most pressing environmental problems, and a recent two-volume publication—Developing Commercial Inland Saline Aquaculture in Australia (Allan, Dignam & Fielder 2002; Allan, Banens & Fielder 2002) has identified inland aquaculture as an alternative productive use for salinised land and water resources. Part 1 of the report (the R & D Plan) has sought to determine a strategic plan for commercial inland saline aquaculture development that is based on the authors' evaluation of which land and water resources are suitable for fish culture (provided in Part 2, the Resource Inventory and Assessment). The report established a number of screening criteria to determine the saline water resources that had most potential for the establishment of an aquaculture industry, and despite the Western Australian wheatbelt adequately satisfying most selection criteria for commercial aquaculture development, it was mostly ignored. Here, we seek to clarify the potential for an inland saline aquaculture industry in the wheatbelt of Western Australia.

KEYWORDS

Salinity management, inland saline aquaculture, Western Australia

INTRODUCTION

The wheatbelt region of southern Western Australia covers approximately 18 million hectares, and accounts for over 70% of Australia's salt-affected lands. One productive use for these salinised land and water resources is inland aquaculture (Allan, Dignam & Fielder 2002a; Allan, Banens & Fielder 2002b).

The considerable amount of hydrogeological information readily available for the southern Western Australian region (e.g. George 1990, 1992; Salama 1997; Clarke et al. 2000) shows that this region represents a major saline groundwater resource that presents a range of aquaculture development options

(Doupé et al. 1999). Applying aquaculture assessment criteria to the information on the Western Australian wheatbelt, shows that the area falls in the top 5% of opportunities for grow-out production of diadromous fish using ponds, and in

the top 10% of opportunities for grow-out production of diadromous fish using recirculation facilities. The potential for an inland saline aquaculture industry in the wheatbelt of Western Australia should therefore be recognised.

AQUACULTURE RESOURCES

Criteria determining the saline water resources that have most potential for the establishment of an aquaculture industry include:

- water availability (yield or permanence);
- water salinity (waters should exceed 2 000 mg/L TDS);
- soil suitability; and
- ability for existing infrastructure to service markets;

Water and soils

Archaean rocks (mainly granite and gneiss) underlie most of the wheatbelt, with a deeply weathered mantle of saprolite and sediments. Three dominant types of aquifers are recognised (George 1992):

- a sandplain perched aquifer;
- a saprolite grit aquifer; and
- a valley sedimentary aquifer.

A number of studies have documented the characteristics of groundwater stored in saprolite aquifers of the Western Australian wheatbelt (e.g. George [1990] drilled random bores at depths from 10–60 m across 13 catchments of the wheatbelt, and found that, on average, farms had from one to three bores yielding between 10 and 28×10^3 L/d of water, mostly between 10 000 and 100 000 mg/L TDS). More detailed study of the

hydraulic properties of aquifers in valley floors suggests that, although bore yields are variable throughout the region, proper placement of bores could achieve realistic discharge rates of 250×10^3 L/d (George 1992). The groundwater chemistry of wheatbelt aquifers is dominated by sodium and chloride, and maintains the same basic ionic composition as seawater (Mazor & George 1992).

Large areas of cheap, environmentally insensitive land are available. Soil characteristics are suitable for infrastructure and pond construction. Freshwater may be limiting in some areas over summer, but is readily available from surface storage in large parts of the wheatbelt (Anon 1974, George 1990).

Infrastructure

Groundwater resources in the Western Australian wheatbelt are sufficient to support a significant inland aquaculture industry. But could the existing infrastructure support it?

The wheatbelt of Western Australia is serviced by a number of regional centres, arterial road and air networks, and several coastal ports. Yabby (*Cherax albidus*) culture is well-established in farm dams, and there has been considerable interest in finfish culture using both saline lakes and ponds, and groundwater pumped from aquifers.

DEVELOPMENT STATUS OF INLAND SALINE AQUACULTURE IN WESTERN AUSTRALIA'S WHEATBELT

Research and development of inland saline aquaculture in southern Western Australia is ongoing.

- A number of studies over many years have detailed the range of potential aquaculture species that could be farmed using the region's groundwater (e.g. Lawrence 1996, Trendall & Pitman 1998, Actis 1999, George & Coleman 2001).

- A delegation of Western Australian researchers has obtained AusIndustry funding to undertake a study tour of arid land saline aquaculture in the United States to identify fish production technologies that could be practically transferred to the Western Australian wheatbelt.
- Thirty shires in the wheatbelt have begun to investigate the risk from salinisation to rural towns and all are developing urban water

management options, incorporating aquaculture for infrastructure cost recovery (Pridham 2001, George & Coleman 2001).

- A comprehensive study of the commercial opportunities (including aquaculture) from the groundwater interception scheme at Lake Toolibin, near Narrogin (Actis 1999) has been undertaken.
- Research and development has largely concentrated on finfish species (e.g. rainbow trout [*Oncorhynchus mykiss*] have been grown-out over winter by farmers throughout the region since 1997 and in 2000, almost 20 000 rainbow trout fingerlings were stocked [Starcevic 2000]).
- A producer cooperative and an alliance of producers, processors and retailers, have been formed to progress fisheries industry development with several independent reports being commissioned to assess the viability of the industry (e.g. Robinson 2000, Anon 2002). Preliminary estimates of production economics suggest that semi-intensive fish farming where trout stocked in ponds consume a combination of manufactured and naturally occurring feeds is the most cost-effective method (Lever 2000). A collaborative study to determine appropriate environmental management systems for trout production in the Western Australian wheatbelt has just begun (RIRDC, Project UMU-27A).
- Since 1997, a long-running series of studies have been undertaken to determine the optimum conditions required for the inland

saline aquaculture of black bream (*Acanthopagrus butcheri*) for recreational fishing (FRDC, Projects 97/309, 99/320). This work demonstrates that the species is ideally suited to a wide range of water bodies in the Western Australian wheatbelt. Optimum culture conditions have been determined through extensive field-based pond research trials (see Sarre et al. 1999) and results have been adopted by a number of farmers for private and commercial recreational fishing ventures. The commercial aquaculture potential of black bream is mainly limited by slow growth rates, however a genetic improvement program for hatchery-reared black bream has been instigated (RIRDC, Project UMU-26A, Doupe & Lymbery 2002).

- Snapper (*Pagrus auratus*) have been grown for recreational purposes on several Western Australian wheatbelt properties since 1997. Trials at Springfield Waters Aquaculture Research Facility in Northam have achieved high survival rates and rapid growth over summer in both floating cages and in-ground ponds. Snapper have also been grown successfully in saline groundwater from the Dumbleyung catchment under a collaborative project between Challenger TAFE and the Western Australian Department of Agriculture. Following these preliminary trials, Challenger and CY O'Connor TAFE colleges and the Western Australian Department of Agriculture will be undertaking a detailed evaluation of groundwater sources throughout the wheatbelt to determine suitable sites for commercial culture of marine and estuarine fish species.

CONCLUSION

The development of inland saline aquaculture industries is a concept worthy of endeavour in salt-affected areas right across Australia. The recent inventory and proposal of a strategic plan for commercial inland saline aquaculture development (Allan, Dignam & Fielder 2002; Allan, Banens & Fielder 2002) concentrates mainly on the suitability

of land along Australia's eastern seaboard virtually ignoring potential and existing developments in Western Australia. The potential of the Western Australian wheatbelt for inland saline aquaculture should not be ignored, for without its inclusion, the proposed research and development plan and resource inventory, could hardly be considered national, and a skewed research effort would appear to be an inevitable outcome.

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