

Redclaw crayfish

Clive M. Jones

Introduction

Redclaw, *Cherax quadricarinatus*, is a species of freshwater crayfish native to the rivers of north-west Queensland and the Northern Territory. Although well known to the locals of this isolated region of tropical Australia, it remained effectively unknown to the rest of Australia until the late 1980s.

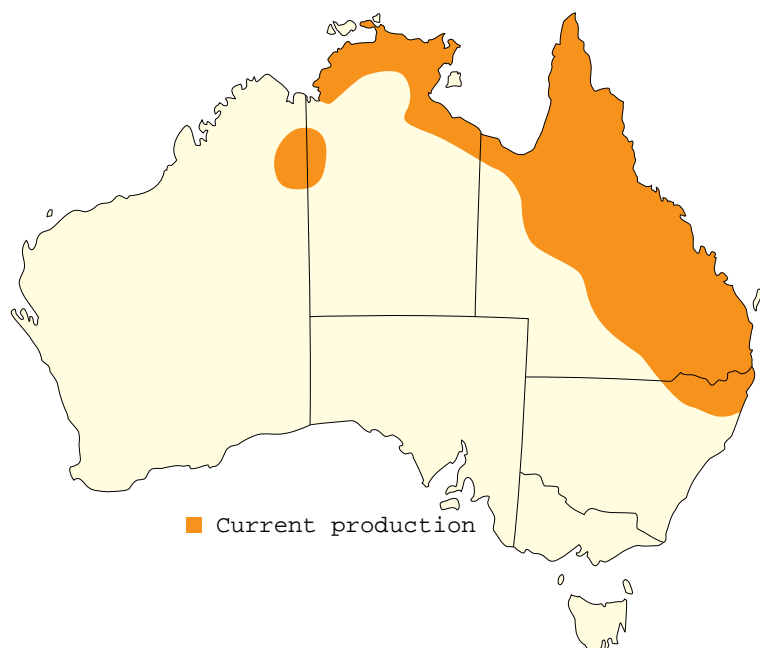
Redclaw is advantaged by a host of physical, biological and commercial attributes which make it an excellent candidate for aquaculture. It is a robust species with broad geographic potential, has a simple life-cycle and straight-forward production technology, requires simple foods and is economic to produce. The texture and flavour of the flesh compares very favourably with other commonly eaten marine crustaceans, and because it looks like a lobster, it is positioned at the premium end of the crustacean market spectrum.

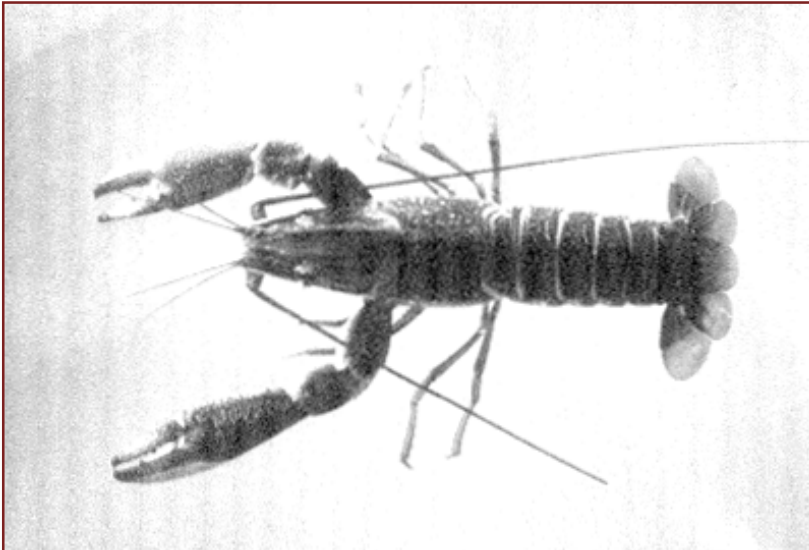
While current production at around 60 t/year is primarily marketed domestically, the growth potential for the industry lies with the substantial export demand for this product.

Although a native Australian, redclaw's excellent aquaculture attributes have seen it transplanted to several other countries where commercial production has been established. In the short-term this will be to Australia's advantage in increasing the market profile of this new product. Longer term, Australia will maintain a production advantage based on access to the broad genetic pool of native stocks, sustainability due to thorough environmental regulations, and isolation from recognised diseases which have decimated off-shore industries.

Redclaw aquaculture in Australia is poised for significant expansion. The basic resources of

suitable land and water are readily available throughout northern Australia, and could potentially support production of several thousands of tonnes. The challenge for the industry is to increase production, through expansion and new investment, so as to lift production volumes to a point where the substantial quantities required by identified export markets can be consistently supplied. Production technologies, while still being developed, are at a stage where 'best practice' methods have been identified. These technologies are relatively straight-forward and the skill levels required of practitioners are not onerous. Supporting documentation and training are readily available.





Mature male redclaw crayfish have distinctive red patches on their claws.

Markets and marketing issues

The redclaw industry is faced with several marketing challenges. Typical of most fledgling industries, very little promotion has been done, thus consumer awareness both domestically and overseas is relatively low. The industry is composed of many small enterprises making the marketing quite fragmented. Recently, localised marketing groups have emerged, consisting of several cooperative growers with common purpose. They have established quality standards, brand names and promotional material to more effectively market their collective production in a coordinated manner.

In Australia, redclaw are commonly marketed in 20 g size grades ranging from 30–50 g (at approximately \$11.50/kg) to greater than 120 g (at approximately \$19.00/kg). The smaller grades are commonly used in buffet style presentations, with the larger animals featuring in à la

carte restaurants, both as entree and main course dishes. Export opportunities have been identified through considerable market research. However, sales to date have been limited by the small production volume and therefore the risk of inconsistent supply. At present 60% of redclaw are sold within Queensland, 10% interstate and 30% are exported.

There are three steps in the marketing chain; producer, wholesaler and restaurateur. There is effectively no retail sale of the raw product. While selling direct to restaurants may result in slightly higher prices paid, the practice can have a limiting effect on market growth. A good wholesaler can increase the market penetration of redclaw by cross-selling while servicing customers from their existing product lists. Farm-gate sales are substantial, but the volumes are likely to decrease as more coordinated marketing through wholesalers develops.

Wholesalers have tended to position redclaw on the price scale lower than marine lobsters but higher than prawns. They

are generally marketed alongside Moreton Bay bugs and small champagne lobsters or scampi.

A clear marketing attribute for redclaw is its reputation as a product from clean water, free of medical or chemical additives. Product is purged before sale and is often held in salt water which improves the flavour and its attractiveness to Asian markets.

About the author



Clive Jones (BSc PhD) is a Principal Biologist Aquaculture at the Freshwater Fisheries and Aquaculture Centre Walkamin (see Key contacts for address) and has been involved with redclaw crayfish since 1988. His work has proved to be a stimulus to wide interest and commercial development in redclaw aquaculture. He spent two years in industry and has studied crayfish farming techniques in the United States and Europe. Since 1992 he has supervised a research program developing production technologies for redclaw. He is widely recognised in Australia and throughout the world as the leading expert in redclaw aquaculture.

Redclaw are largely sold as a live product, although some processing is done, particularly cooking and freezing. Fresh redclaw have a smooth, lustrous, deep blue to green shell, with males exhibiting a bright red colouring on the margins of their large claws. Cooked, they present as bright red, typical of premium crustaceans.

Production requirements

Redclaw is a tropical species endemic to north-west Queensland and the north-east of the Northern Territory. The harsh physical extremes of this region mean that redclaw has evolved as a robust animal with broad climatic tolerances. Its preferred water temperature range for >70% of maximum growth rate is 23–31°C. Redclaw will die at temperatures below 10°C or above 36°C. Reproduction will occur only while water temperature remains above 23°C. While suitable temperatures prevail throughout Queensland during summer, the shorter and less extreme winter period in more northern areas confers a significant advantage. Most industry growth is expected to occur north of Bundaberg, including parts of western Queensland, the north of the Northern Territory and the Kununurra region of Western Australia. The accompanying map broadly indicates the regions suitable for redclaw production.

Redclaw aquaculture needs earthen ponds which will hold water. Consequently, the soil must have a reasonable clay content and be free of rock. Ponds are typically 1000 m² in surface area, with a depth of between 1.0 and 2.5 m. Their

Key statistics

Redclaw crayfish production in Queensland. Figures for 1996/97 represent projections as estimated by industry sources.

Sales of Queensland redclaw by destination, 1992–1994.

specification and design can have an important bearing on productivity, so professional advice should be sought before construction. Productive topsoil can be beneficial when applied across the clay-base of a pond, but it must be free of pesticides which may be highly toxic to crayfish. Some practitioners recommend lining of ponds with coarse river gravel to enhance productivity, but the benefit–cost of this practice has not been assessed.

Water may be sourced from surface supplies or underground. Generally, water suitable for watering livestock is suitable.

Some of the characteristics which should be identified include: pH of between 6.5 and 8.0, hardness of > 40 ppm, low salt content and low metals content. Once water has been introduced to the production ponds there is a host of management issues which must be addressed to ensure optimal water quality for redclaw production. Further information on water quality management should be sought. Water usage is dependent on local evaporation rates, but will range from 15 to 20 ML/ha of ponds. This is on the basis that all effluent from harvested ponds is recycled through appropriate settlement and supply dams.



North Queensland redclaw farm

Varieties/breeds

Research has demonstrated that distinct strains of redclaw occur throughout the species' natural range. The differences between strains are generally slight, but variability of biological characteristics, as borne out in production statistics, suggests that some strains may be superior for aquaculture. Although the full range of strains has not been assessed, it is clear that the Gilbert and Flinders River strains have advantageous characteristics in regard to high fecundity (no. of young per brood) and fast growth rates at high densities.

Some long-standing redclaw farmers have selectively bred their perceived 'best' crayfish and cross-bred strains to improve their stock. There are clear indications that these improved stocks are superior to wild, undomesticated stock, and to stock from farms where managed reproduction has not occurred.

A managed selection program for increased growth rate of redclaw was established by the

Queensland Department of Primary Industries in 1993, and so far has successfully increased growth rate by about 9.5%. This program is continuing and will likely generate a significantly improved stock for distribution to industry by 1999.

Animal husbandry

Once all government approvals have been sought and an aquaculture licence has been issued, the farmer may acquire crayfish from established growers. It is recommended that a small number of broodstock be purchased and used to generate juveniles for stocking to the new operation.

The husbandry involved is best explained in terms of the key elements of recognised 'best practice'. Site selection is the first step, and should involve assessment of several criteria which will maximise the suitability of the chosen site. A designed and systematic farm layout is important to minimise establishment and operational costs by utilising gravity to fill

and drain ponds, and to centralise facilities. Optimal pond specifications are 1000m², 1.2–2.5 m deep and a V-shape that allows rapid and complete drainage.

Artificial shelters for the crayfish are essential. They should be abundant, and their shape, specification and positioning should permit water to drain out freely and completely as the pond is drained. Thick bundles of synthetic mesh have been found to be the most effective.

Aeration is also essential. For redclaw aquaculture it is most often provided through airlift pumps, although other forms of aeration such as paddle-wheels and aspirators may be used. The aeration system should provide both oxygen input to the water and circulation of water from bottom to top and around the pond.

Key messages

- E Established and proven production technology
- E Attractive economics
- E Excellent markets with high export demand
- E Significant growth potential

Juvenile production and grow-out of stock to market size are managed as separate processes. A managed juvenile production program is essential to provide the advanced juveniles required for grow-out, and to make effective use of the superior broodstock selected. Depending

on temperature and whether berried females or mature broodstock are used, a culture period of 3–4 months is necessary to achieve a mean size of juveniles of 5–15g. The two most critical factors in juvenile production are shelter and food.

Grow-out also involves an active stock management approach. Because redclaw breed so readily and profusely, the pond populations must be managed intensively. This includes stocking with known numbers of advanced juveniles of at least 5 g mean weight. Uniformity of size is very important. Maximum size range at stocking should be 10 g. A stocking density of between 5 and 15 per m² is recommended.

The food used will have an important bearing on production. Several commercial crayfish pellets are available, and they have proven to be effective. Chicken layer pellets are not recommended. The most effective diets have a protein content of approximately 20% and are composed primarily of grains. A feeding frequency of 3–5 times/week is adequate, but daily feeding is recommended, preferably at dusk when crayfish are active. Use of a feeding schedule is critical.

Active management of the pond environment is integral to commercial yields. There should be weekly monitoring of pH, dissolved oxygen and turbidity; and monthly monitoring of hardness, alkalinity and ammonia. All measurements must be made at the water/soil interface on the bottom, and some contingency plan must be developed to counter water quality which falls outside of preferred ranges. This may

involve applications of lime or fertiliser, or flushing of the pond with fresh water.

Drying of ponds between crops is essential to sterilise and revitalise the bottom. There is often a considerable build-up of organic waste after a culture period. The most effective management of this is to dry the pond for 1–2 weeks until cracks appear. Toxic compounds are broken down and useful nutrients are released.

Protection against birds, rats, and eels, and any other potential predators must be provided. Complete enclosure by netting and fencing is essential. A recent economic analysis indicated that the cost of netting (including materials and installation) is equivalent to 15% of one optimal crop. As losses to predators may be well above this, netting is very cost-effective.

Provided good husbandry practices are applied, juvenile production and grow-out can be completed within 12 months.

Disease control

Several potentially serious disease-causing organisms including protozoans and viruses have been identified in redclaw. To date none has caused any significant commercial loss, and the industry is aware that careful quarantining and good health monitoring and management will minimise the risk of a disease outbreak.

A virulent disease of crayfish which has decimated production throughout Europe is known as 'crayfish plague'. Australia is free of this disease, and authorities are conscious of the importance of preventing its entry into the country.

By maintaining good culture conditions which maximise survival and growth, stress of crayfish is minimised and the threat of disease is relatively small. Because production of juveniles and grow-out are contained on each farm, there is little requirement to introduce



Newly harvested juveniles are graded before stocking into growout ponds.

new, potentially disease-carrying stock to the farm. This factor also diminishes the risk of disease.

Harvest, processing and packaging

Harvesting is generally quite straightforward, but if it is not managed carefully, the previous several months of production management can be wasted. Some form of sampling before harvest is important to gauge the size and number of crayfish expected. Harvesting may involve a number of methods, although the most effective is the application of a flow-trap. This trap exploits redclaw's strong response to flowing water. A slow but steady flow of water into the pond via a box and ramp will illicit movement of crayfish against the flow and into the box.

Flow-trapping should involve 95% drainage of the pond over 24 hours from dawn to dawn. There should be several thousand litres of water remaining in the deepest part of the pond at dawn, when stock are removed. The slow drainage enables the crayfish to move out of shelters and with the main body of water, so they concentrate and respond most effectively to the flow trap. Both the flow trap and the last remaining water must be well aerated. The entire harvest can be easily lost if the flow trap or remaining pond water are not aerated. The stock should be quickly removed and transported to clean water in a tank system. Care should be taken to minimise crushing by not exceeding 15 kg of stock per transport container.

Other harvesting methods include bait trapping and drain harvesting with manual collection of stock.

Most redclaw are sold live, and so after harvesting stock are held in tanks with flow-through water supply or a recirculating system involving biological filtration. A stay of at least 24 hours in the tank to permit purging of the gut is recommended before packing for transport. Redclaw can survive extended periods out of water provided they are kept cool and moist. Packing therefore involves insulated containers containing some moist packing material (foam rubber or wood shavings) and cooling packs.

Road transport is used to reach local markets, but air transport is necessary to supply the large seafood markets in Sydney, Melbourne and for export.

Economics of production

The profitability of redclaw aquaculture has been assessed using a model or hypothetical farm, with data gathered from two, pilot-scale commercial farms established jointly by the participating farmer and QDPI. The model involves a farm size of 40 ∞ 1000 m² grow-out ponds and 7 ∞ 1000 m² juvenile production ponds, representing a total pond area of 4.7 ha. Previous analysis suggested that a production area of approximately 4 ha was the minimum for commercial viability.

The financial evaluation was undertaken using a discounted cash flow technique.

Discounting was used to allow for the timing of the costs and benefits for the life of the enterprise, which was assumed to be 20 years.

The model farm was assumed to harvest 394 kg/year of redclaw per grow-out pond from year two onwards. Redclaw were estimated to take nine months to reach the acceptable market size of 65 g mean weight. At this weight the farm-gate price was estimated to be \$13.50/kg.

Initial establishment of the model farm was estimated to cost \$347,900. Included in this cost were land, hired labour, machinery and all farm infrastructure costs. Specifications for the farm layout and pond characteristics were based on 'best practice' recommendations.

Redclaw aquaculture was profitable based on the model farm. Using the model farm yield and price, the farm profit was \$5.25/kg/year. The total costs of production were estimated to be \$8.25/kg/year. Included in this cost were all operating costs, capital costs and allowance for the owner's labour and management. The discounted payback period, which represents the time to recover the initial outlay, was 4 years.

Sensitivity analyses for prices and yield showed that, at the annual yield of 394 kg/ grow-out pond, the minimum price for the investment to be profitable was \$8.25/kg. Similarly, at the assumed price of \$13.50/kg, the minimum annual yield required to be profitable was 232 kg/ grow-out pond.

Grow-out periods may vary between 6 and 15 months depending on the redclaw

market weight the grower intends selling. Redclaw market weights and price were assumed to increase with longer turn-off periods. Based on a sensitivity analysis which compared various grow-out periods, the most profitable option was 9 months. The least profitable turn-off period was 12 months. The results from this analysis were very sensitive to prices, survival rates and market weights. Survival rates and market weights are strongly correlated to farm management expertise.

Results from established farms applying best practice techniques confirm that the economics of the model are a true and accurate representation of commercial redclaw aquaculture.

Key contacts

For further information on redclaw aquaculture contact the extension officers at the following QDPI centres:

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