Aquaculture and Pearl Production

General Overview

The State's commercial aquaculture industry continued to be dominated by South Sea pearl production in the north, algae production for beta carotene on the west coast and freshwater crayfish and mussels in the south. Development increased for species such as non-maxima pearl oysters, edible oysters and abalone.

Pearling Activities

The culture of pearl oysters of the species *Pinctada maxima* has been a major success. Centred on Broome, the pearling industry has operated since the 1880s, initially as a source of mother-of-pearl and more recently as Australia's largest and most successful aquaculture sector, producing quality South Sea pearls. The industry has continued to develop with a sound management base, with farms operating from Exmouth Gulf through to the Northern Territory border. Live shell is also traditionally used to stock farms in the Northern Territory.

Other Aquaculture Activities

The level of activity and interest in aquaculture continued, with a diverse range of aquaculture enterprises operating throughout Western Australia. These included the production of algae for beta carotene, mussels, yabbies, marron and trout. Development work and commercial production continued for marine finfish, abalone, edible oysters, pearl oysters of the species *Pinctada albina* and *Pinctada margaritifera,* barramundi and trochus. The State's first prawn farm was licensed at a site in Exmouth Gulf. Following health and quarantine clearances, a large number of juvenile redclaw of a superior genetic strain were brought into Western Australia for aquaculture purposes.

Aquaculture Development Initiative

During 1994, the Minister for Fisheries announced an aquaculture development initiative, supported by funding of $4.5 million over three years. Financial support for the initiative was subsequently extended with a further $8 million for the years 1997/98 to 2000/01.

During 1998/99, the agency continued to implement this initiative. Key activities included the completion of aquaculture infrastructure in Albany and Pemberton and the preparation of draft aquaculture plans for key regions such as Exmouth Gulf, Shark Bay, the Abrolhos Islands and the Recherche Archipelago. There were also significant resources committed to the assessment of licence applications in accordance with Ministerial Policy Guideline No. 8, 'Assessment of applications for authorisations for Aquaculture and Pearling in coastal waters of Western Australia', and the development of policy for species such as non-maxima pearl oysters and abalone and matters relating to translocation, performance criteria and access to broodstock. Marron farming regulations were also reviewed with the aim of simplifying the licensing framework.

A major strategy for aquaculture development in the Kimberley was released during the year. The strategy included development of an investment attraction package and preparation of environmental assessment documentation for development at Lake Argyle.

The agency maintained strong linkages with peak industry bodies and the relevant management advisory committees. Twelve aquaculture development projects were funded through the Aquaculture Development Fund during 1998/99, worth in excess of $150,000.

Major Achievements

- Continued implementation of the Government aquaculture development strategy.
- Completion of the Great Southern Aquaculture Park in Albany.
- Completion of the South West Freshwater Research and Aquaculture Centre in Pemberton.
- Approximately 50 pearling and aquaculture applications assessed to date in accordance with Ministerial Policy Guideline No. 8, 'Assessment of applications for authorisations for Aquaculture and Pearling in coastal waters in Western Australia'.
- Release of a major strategy for aquaculture development in the Kimberley.
- Marron farming regulations reviewed.
- Commencement of drafting for a new Pearling Act.
- Participation in the review of pearling legislation under National Competition Policy agreements.

Pearl Oyster Fishery

Management Overview

The pearl oyster fishery in Western Australia is based on the species *Pinctada maxima* for the subsequent production of pearls. Activities within the industry range from the hatchery production of oysters suitable for the seeding of round pearls to the fishing of wild-stock oysters for the culturing of pearls on a large number of pearl leases situated in the waters of the State.

Pearl oyster farms are predominantly situated in sheltered waters and range from Exmouth Gulf to the northern waters of the Kimberley. One company generally transports its wild-stock quota to the Northern Territory for the culturing process, however this company has begun to develop the necessary pearl farm infrastructure in the north Kimberley area to allow farming in Western Australia. Pearl farm lease applications are assessed through a pubic consultation process in accordance with Ministerial Policy Guideline No. 8, 'Assessment of applications for authorisations for Aquaculture and Pearling in coastal waters of Western Australia'. The assessment of pearl farm lease applications was a major activity during 1998/99.

The wild-stock pearl oyster fishery is managed on a system of individual quotas with a total allowable catch (TAC). The status of stocks is reviewed each year by Fisheries WA in liaison with the Pearling Industry Advisory Committee (PIAC). During 1998/99, the TAC for the 1999 fishing season for Zone 2/3 was 457,000 shells (one quota unit equals 1000 shells).

The status of stocks in Zone 1 was also reviewed. A total allowable catch of 40,000 shells for the Exmouth Gulf component of the Zone 1 fishery was set for the 1999 season. A maximum size limit of 140 mm was also placed on shell taken in Exmouth Gulf to ensure that any residual animals following fishing in a season were not open to future exploitation and flowed through to the breeding stock. These arrangements were similar to those in 1998.

The seeding of hatchery-produced oysters was continued by some companies through licensees utilising hatchery options available to industry.

The annual production for pearls for 1997/98 was estimated at about $190 million. This is expected to rise for 1998/99, however production figures are not yet available.

The agency, with the Pearl Producers' Association and PIAC, dealt with a number of other management issues during 1998/99, including the consideration of guidelines for pearl divers' licences and planning for pearl farm leases. PIAC met on two occasions. The drafting of a series of Regulation amendments was finalised and drafting commenced for a new Pearling Act. Current and proposed new pearling legislation is currently being reviewed in accordance with National Competition Policy agreements.

Compliance and Community Education Overview

During 1998/99, a staff commitment equivalent to 4.6 officers was involved in compliance monitoring across all zones of this fishery. With the increased involvement of all companies in the production of hatchery-reared shell, emphasis has been placed on the monitoring and control of this product. Major compliance issues are the verification of shell numbers and size prior to seeding operations, and the movement of hatchery shell within and also between farms. Approvals to allow the use of hatchery shell for technician training and for mantle tissue in seeding operations have also increased compliance requirements in this area.

Quotas continued to be monitored through a combination of quota tags and a paper audit trail using catch, dump, transport and seeding operations logbooks submitted by licensees to the agency.

The production and translocation of hatchery-produced pearl oysters is monitored by the system of hatchery and transport logbooks combined with a system for disease testing, quarantine and health certificate clearances. Conversion of hatchery options to hatchery quota is monitored by a combination of operations logbooks, nursery and operations audits, and at-sea compliance presence during operations.

The move to a Vessel Monitoring System for this fishery which could enable real-time quota logbook data transfer has been postponed, with industry examining various system options.

Field officers based in Karratha and Broome patrolled from Exmouth Gulf (Zone 1) to the Kimberley Development Zone (Zone 4). Patrols to verify compliance with tagging and associated logbook systems, utilised diving inspections, aircraft, both large and small agency patrol vessels and industry boats. The majority of at-sea inspections and patrols were carried out using the joint agency (Fisheries WA and Department of Transport) ocean-going patrol vessel *Walcott,* with small agency vessels being used as dive platforms.

Officers continued to receive training to ensure ongoing compliance with the agency Occupational Health and Safety Policy for diving inspection duties. The purchase of a diving communications unit has improved the efficiency of dive inspections, simplifying the methods used to conduct dump site and nursery audits.

The focus will continue to shift towards monitoring compliance of hatchery shell regulations, with an increasing number of patrols targeting this area of the pearling industry. With some companies moving towards operating hatchery-reared shell in lieu of wild stock, the emphasis will be shifted to rigid monitoring of the number of shell operated, which will require a compliance presence on board operations vessels.

Research Overview

Research for managing the pearl oyster stocks across the North-West Shelf utilises detailed diver logbook records, at-sea sampling of catches and biological research information. This information is used annually to monitor the status of the stocks and to review and set catch quotas.

FRDC-funded research completed during the 1997/98 year provided detailed information on regional growth rates of oysters to complement previous studies on the biology and the exploitation levels applied to the stock. In addition to this core research, the Fisheries Research Division has received a major new FRDC grant to undertake research into the breeding (mother-of-pearl) component of the pearl oyster stocks. The Division's fish pathology group also provides a comprehensive disease testing program to ensure translocation protocols are met.

Data from the research program have been used to compile the following status report.

Fishery Status Report

Main Features

Stock assessment complete:
Yes

Exploitation status:
Fully exploited (within management parameters of diver safety and maximisation of value of pearl crop)

Breeding stock levels:
Increasing

Previous catch and effort projections for year 1998:
572,000 shell (quota all zones), with 15,000-19,000 dive hours in Zone 2

Catch and effort current season (1998):
565,322 shell taken over 20,593 dive hours (13,035 dive hours in Zone 2)

Estimated annual value (to fishers) for year 1998:
Total fishery and cultured pearl valued at $185 million

continued over

Catch and effort projection next year (1999):
572,000 shell (quota all zones) taken over an estimated 18,000-25,000 dive hours (all zones) (based on the effort range over the past five years)

Recreational component (1997):
Nil

Boundaries and Access

The four management zones (Pearl Figure 1) of the pearl oyster fishery are listed below.

Pearl Oyster Zone 1: NW Cape (including Exmouth Gulf) to longitude 119° 30′ E - 5 licensees.

Pearl Oyster Zone 2: East of Cape Thouin (118°10′ E) and south of latitude 18°14′ S - 11 licensees.

Pearl Oyster Zone 3: West of longitude 125°20′ E and north of latitude 18°14′ S - 2 licensees (plus 11 Zone 2 licensees).

Pearl Oyster Zone 4: East of longitude 125°20′ E to WA/NT border (all licensees have access).

Annual Production

Main fishing method
Diving.

Landings
The total catch is controlled by a quota system, with a 1998 total allowable catch for Zones 2/3 of 457,000 shell. The 1998 season represented the first year of the TAC returning to pre-1995 quota levels. During the seasons 1995-1997 the quota was raised by 55,000 shell due to the indication of an increased stock abundance suggested by significant increases in catch rate. The quota increase was initially proposed for a two-year period; however, this was extended to include a third year in 1997 due to continued high catch rates. The reported Zone 2/3 catch for 1998 was 457,266 shell (Pearl Table 1).

The Zone 1 quota for 1998 was 115,000 shell. The reported catch of 108,056 shell (Pearl Table 2) was below this due to the fact that one licensee did not take their full quota during 1998.

Fishing effort
Total effort for 1998 in Zone 2/3 was 14,499 dive hours, which represented a 14% decrease on the 1997 total effort of 16,893 dive hours (Pearl Table 1). However, there was also an 11% reduction in quota for the 1998 season. The Zone 2 effort was 13,035 hours, which was below the forecast range for Zone 2 of 15,000-19,000 hours. (Note that, as the result of a typographical error, this figure appeared in the *State of the Fisheries Report 1997/98* as the effort prediction for all zones, whereas in fact it was for Zone 2 only.) The total effort in Zone 1 was 6,094 dive hours, representing a 36% decrease on the 1997 total effort of 9,494 dive hours (Pearl Table 2).

Catch rate

Catch per unit effort in Zone 2/3 in 1998 was 31.5 shells/dive hour (shells/hr), which represented a small increase on the 1997 catch rate of 30.3 shells/hr, and a 10% increase on the 10-year (1987-1996) average of 28.5 shells/hr. This increase on the 10-year average is somewhat understated due to more stringent shell grading methods applied to a large sector of the industry in recent years, which has resulted in operators reducing the maximum size of shell taken (Pearl Table 1).

The Zone 1 catch per unit effort was 17.7 shells/hr in 1998, which represented a 52% increase from the 1997 figure of 11.6 shells/hr (Pearl Table 2). This was partly due to the effort being shifted from the Exmouth Gulf area, where low catch rates have been experienced in recent years, into a previously under-utilised area in the buffer zone between Zones 1 and 2.

Stock Assessment

The primary measure of stock availability in Zone 2/3 is catch per unit effort. The high level of catch rate recorded in recent years (1994-1996) had previously only been experienced during the late 1970s and early 1980s when the pearling fleet was fishing both culture and mother-of-pearl (MOP) shell. The reasons for the increase in catch rates during this period are believed to be a combination of high levels of recruitment and/or increased fishing efficiency from the introduction of global positioning system (GPS) navigation. The causes of the apparent increase in recruitment are probably favourable environmental conditions, and/or increased fertilisation success due to an increase in breeding stock at the time of breeding.

The 1998 Zone 2/3 catch rate remained similar to the 1997 level, and to those recorded prior to 1994, and reflects a more 'traditional' level of recruitment. The return to the 'normal' catch rates of the past two years follows the three-year period (1994-1996) during which the pulse of recruitment responsible for higher catch rates passed through the size range targeted by the fishery. Overall, the catch-rate data indicate that recruitment to the Zone 2/3 pearl oyster stock is at a level sufficient to maintain stock levels permitting safe and economic fishing operations.

The distribution of catch and effort in Zone 1 changed considerably during 1998 as a result of management decisions designed to reduce fishing pressure in Exmouth Gulf. These decisions involved setting a TAC of 40,000 shell for Exmouth Gulf, and extending the Zone 1 buffer zone 30 miles east to allow operators access to previously under-utilised grounds in the southern areas of Zone 2. As a result total shell caught in the Port Hedland region increased significantly (from 23,473 shell in 1997 to 70,465 shell in 1998), with the vast majority of shell caught in the buffer zone extension. Catch rates also improved from 14.4 shells/hr in 1997 to 26.4 shells/hr in 1998. There was a corresponding decline in total catch from Exmouth Gulf (72,244 shell in 1997 to 33,804 shell in 1998), obviously due to the 40,000 shell TAC and good catch rates from the Port Hedland region (buffer zone). Catch rates in Exmouth Gulf fell slightly in 1998 to 11.01 shells/hr, and remain an area of concern. However, the effects of management changes are unlikely to be apparent until at least the 1999 season. Very little fishing took place in the Onslow/Dampier area of Zone 1 during 1998, with catch rates similar to those recorded in 1997.

The steady decline in catch rates from Exmouth Gulf since 1993 (when the Zone 1 quota was increased from 55,000 to 115,000 shell) indicates that exploitation levels in this area may have been excessive. The 1998 management changes in Zone 1, which have been successful in reducing heavy fishing pressure in Exmouth Gulf, will be retained during the 1999 season to limit effort and encourage the rebuilding of pearl oyster stocks in this area. A maximum legal shell size limit of 160 mm will also remain in Exmouth Gulf to allow for increased recruitment into the broodstock. Catch rates will continue to be monitored closely, with factors such as searching/fishing patterns and diving conditions taken into account.

The Port Hedland region (particularly the buffer zone extension) is expected to again produce the majority of the 1999 Zone 1 quota.

Breeding Stock Levels

The greater proportion of pearl oysters do not become breeding females until they reach a size that is too large for pearling operations. Consequently, an animal is not subject to fishing mortality once it grows through the 'gauntlet' size targeted by industry. As the current quota set for the fishery is thought to be in balance with, and most likely less than, the production of the stock, breeding stock is most likely being maintained, if not increased, given the longevity of the species. This is especially true for Zone 2/3 in recent years with the good recruitment occurring in the mid-1990s. In contrast, heavy fishing pressure in some sectors of Zone 1, particularly Exmouth Gulf, is considered to have reduced flow-through of recruits to broodstock sizes. Current management arrangements in Exmouth Gulf are designed to ensure that breeding stocks in that sector are maintained in the longer term. A new FRDC-funded project to assess the status of mother-of-pearl stocks will provide more detailed information on breeding stock level.

Catch Projection for Year 1998

It is expected that the pearl oyster fishery will achieve its historical quota of 572,000 shell within the range of 18,000-25,000 dive hours experienced over the past five years (1994-1998).

Product Value for Year 1998

The value of cultured pearls and by-products is considered to be approximately $185 million for the 1998 year. A precise estimate of the value of product is, however, difficult to achieve due to the variable time lags between time of harvest and sale to offshore buyers and the costs incurred in marketing before sales occur.

General Comments

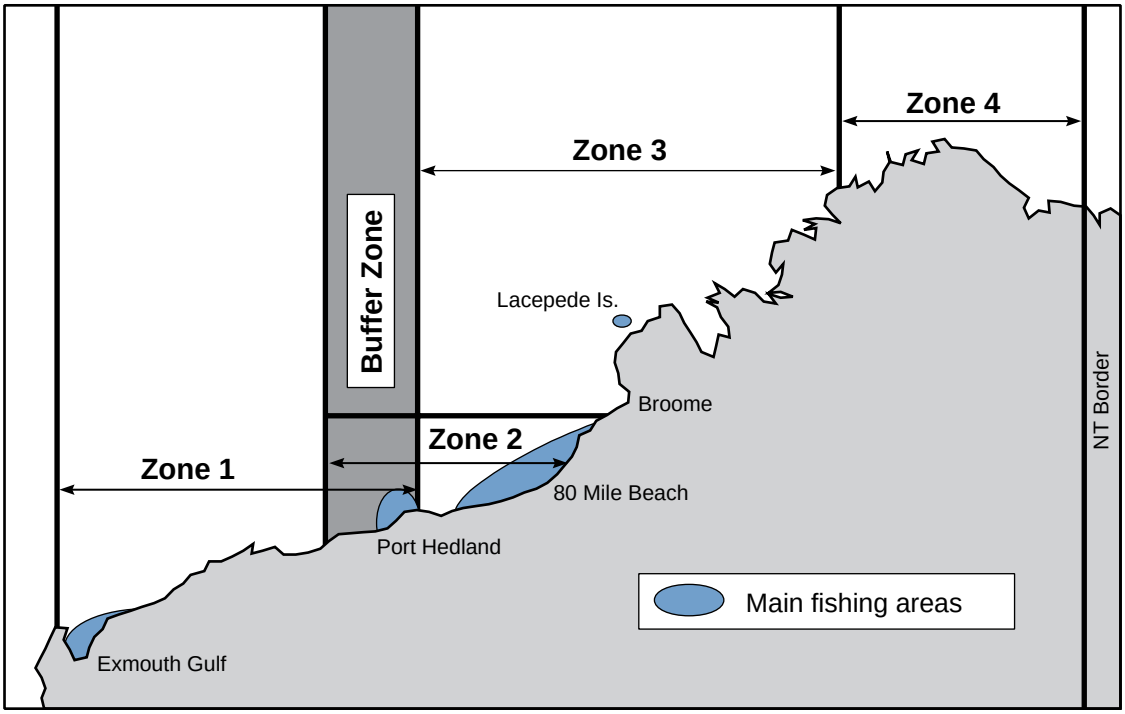
The pearl oyster stocks underpinning the fishery in Zone 2, although having returned to 'normal' recruitment levels, continue to provide a reliable level of production to support this major Western Australian industry. The provision to Zone 1 operators of access to previously unexploited areas in the Port Hedland sector has provided improved catches, however the reliability of recruitment in the area will only be known when fishing has occurred for a number of years. If catches cannot be maintained, this zone will possibly need to rely on hatchery-produced shell from the facilities established for that purpose, and work on a reduced wild-stock catch quota.

Pearl Table 1 Historical changes in pearl shell catch and effort - Broome area (Zones 2 & 3).

Year	Quota	No. of culture shells	No. of MOP shells	Total shells	Dive hours	Culture shells/hr	MOP shells/hr	Total shells/hr
1978		404,952	146,692	551,644	10,583	38.3	13.9	52.1
1979		371,806	355,599	727,405	16,068	23.1	22.1	45.3
1980		364,502	260,714	625,216	18,568	19.6	14.0	33.7
1981		481,193	210,649	691,842	23,320	20.6	9.0	29.7
1982	460,000	439,092	132,931	572,023	15,710	27.9	8.5	36.4
1983	520,000	365,381	87,049	452,430	19,019	19.2	4.6	23.8
1984	375,000	242,828	47,230	290,058	11,615	20.9	4.1	25.0
1985	342,000	272,869	53,831	326,700	12,423	21.0	4.3	26.3
1986	360,000	337,566	10,929	348,495	16,478	20.5	0.7	21.2
1987	380,000	365,397	0	365,397	17,476	20.9	0.0	20.9
1988	445,000	379,657	0	379,657	14,600	26.0	0.0	26.0
1989	445,000	445,364	0	445,364	18,625	23.9	0.0	23.9
1990	457,000	453,705	0	453,705	23,263	19.5	0.0	19.5
1991	457,000	460,608	0	460,608	21,657	21.3	0.0	21.3
1992	457,000	461,599	0	461,599	19,455	23.7	0.0	23.7
1993	457,000	457,186	0	457,186	14,733	31.0	0.0	31.0
1994	457,000	456,832	0	456,832	12,384	36.9	0.0	36.9
1995	512,000	511,633	0	511,633	12,217	41.9	0.0	41.9
1996	512,000	511,756	0	511,756	12,774	40.1	0.0	40.1
1997	512,000	512,314	0	512,314	16,893	30.3	0.0	30.3
1998	457,000	457,266	0	457,266	14,499	31.5	0.0	31.5

Pearl Table 2 Historical changes in pearl shell catch and effort in Zone 1 since the 1993 quota increase.

Year	Quota	No. of culture shells	No. of MOP shells	Total shells	Dive hours	Culture shells/hr	MOP shells/hr	Total shells/hr
1993	115,000	79,465	0	79,465	2,395	33.2	0	33.2
1994	115,000	132,316	0	132,316	6,291	21.0	0	21.0
1995	115,000	121,312	0	121,312	6,247	19.4	0	19.4
1996	115,000	80,163	0	80,163	5,013	16.0	0	16.0
1997	115,000	110,348	0	110,348	9,494	11.6	0	11.6
1998	115,000	108,056	0	108,056	6,094	17.7	0	17.7



Pearl Figure 1 Map showing the boundaries of the management zones of the pearl oyster fishery.

Mussel Aquaculture

Management Overview

Fisheries WA manages mussel farming in Cockburn Sound following an agreement reached between the Minister for Fisheries and the Fremantle Port Authority in 1997/98. Tenure for the existing farming sites at the Kwinana Grain Terminal is due to expire in December 1999. As a result, Fisheries WA in liaison with industry has identified an alternative site at Southern Flats within Cockburn Sound. The suitability of the site has been assessed through a comprehensive consultation process involving a wide range of stakeholders. Subject to final approvals, relocation of mussel farming activities is expected to be completed by the end of 1999.

During 1998/99, the Australian Quarantine and Inspection Service (AQIS) approved the export status of three shellfish-growing areas in Western Australia in accordance with the procedures outlined in the Western Australian Shellfish Quality Assurance Program.

Industry Status Report

Main Features

Production current season (1997/98):
659 tonnes

Number of producers for year 1997/98:
14

Estimated annual value (to producers) for year 1997/98:
$1,750,000

Production projection next year (1998/99):
800 tonnes

Production areas

Mussel farms are found in Cockburn Sound, Warnbro Sound, Oyster Harbour, Princess Royal Harbour and King George Sound. Resource-sharing issues are a major constraint to access to lease sites in protected and productive areas. Additional lease area is being negotiated in the Southern Flats area of Cockburn Sound to give the Cockburn Sound mussel farmers more access to productive areas.

Annual Production

Production method(s)
Vertical rope and bag culture on longlines.

Production trends for year 1998/99
Increasing.

General Comments

Production levels for this species are related to dissolved nutrient levels which provide the basis for phytoplankton, the main food of mussels. Productive areas are therefore generally protected waters where nutrients from terrestrial sources raise the food levels above those in coastal waters dominated by the low-nutrient, tropical Leeuwin Current. A study reviewing the data on phytoplankton levels around the WA coastline, completed in 1997/98 by CSIRO and Curtin University in collaboration with Fisheries WA, will facilitate better planning for bivalve culture.

Marron Aquaculture

Management Overview

Changes made in 1995 to the regulations governing marron cultivation have resulted in more small farmers contributing to industry production. There have also been improvements in the production reporting system, which has resulted in a more realistic production report. During 1998/99, the marron regulations were further reviewed with the aim of simplifying the licensing framework.

Compliance and Community Education Overview

Aquaculture Development Officers and Fisheries Research Division staff continue to provide technical and development advice to the industry, as well as providing displays and information at field days, country shows and workshops. A number of new industry entrants were given in-field and administrative assistance during the year to obtain commercial licences.

Compliance service level to the industry from a Fisheries perspective was low in this period, however officers were associated with a number of investigations related to stealing of marron from farm dams. These investigations were carried out in conjunction with police.

Research Overview

Fisheries Research Division activities for marron farming during 1998/99 focused on providing expert technical advice to marron farmers on pond construction, pond management, broodstock management procedures and grow-out processes based on previous research findings. There has been a rapid expansion in the number of marron farms in the state and this is likely to continue.

In addition, basic research was completed to compare growth rates of blue and black marron and to assess the effect of replacing a commercial freshwater crayfish

feed with a more expensive trout feed. Attempts to maintain the captive breeding population of the depleted Margaret River sub-species have been hindered by poor reproductive output.

Information from the various research and extension activities has been compiled into the following status report.

Industry Status Report

Main Features

Production current season (1997/98):
42 tonnes

Number of producers for year 1997/98:
197

Estimated annual value (to producers) for year 1997/98:
$1,027,000

Production projection next year (1998/99):
40-50 tonnes

Production areas

Licensed purpose-built farms extend from east of Albany to Hutt River north of Geraldton, though the bulk of farms are concentrated in the higher-rainfall south-west coastal area. Legal-sized marron produced in farm dams can be sold through a licensed farmer or processor. Under-size farm marron can be sold by holding an unrestricted licence, which can only be obtained for a substantial area of pond development or on the performance criterion of a higher level of production per unit area.

Annual Production

Production method(s)
Semi-intensive farming in purpose-built earthen ponds; extensive farming in gully dams.

Production
The average industry annual yield of 600 kg/ha compares with 1,500-2,300 kg/ha/year from well constructed and managed semi-intensive ponds. For farm dams, the annual yield is about 100 kg/ha.

Extension and Information Transfer

Considerable effort has been made to ensure that information on aquaculture of marron is readily available to the public. Methods of communication included extension publications, seminars, workshops and field days. During 1998/99, a program of attendance at and detailed documentation of harvests and farming procedures was initiated to help evaluate the commercial applicability of agency extension advice. This will also indicate which site and management variables have the most influence on production.

General Comments

A significant number of new purpose-built marron farms have been developed during 1998/99 and should progressively contribute to expansion in State production. Development of a new farm to full production usually requires around three years. Many of these new farms will utilise the increased processing capacity now available through the Pemberton Aquaculture Producers (operating from a facility at the South West Freshwater Research and Aquaculture Centre). This processing group is now providing a coordinated marketing arrangement for many of the new producers.

Yabby Aquaculture

Management Overview

Yabby production has continued on an extensive basis by trapping from existing farm dams. Management and licensing arrangements have not changed significantly over the past year. Aquaculture Development Officers stationed in Geraldton, Narrogin and Albany are assisting industry development through the provision of information on production techniques and the results of FRDC-funded research.

In March 1999, the presence of the protozoan *Thelohania* was detected in Western Australian yabbies. Following investigation of the outbreak, it was determined that the disease had become widespread in Western Australia and was likely to have been within the State for a number of years. There is no public health issue associated with the disease, and arrangements for ongoing management are currently being developed.

Compliance and Community Education Overview

South-west freshwater aquaculture fisheries are serviced by Fisheries Officers based in Esperance, Albany, Bunbury, Mandurah, Fremantle and Geraldton to ensure continuation of a high level of awareness of, and compliance with, management rules.

Aquaculture Development Officers stationed at Geraldton, Narrogin and Albany provide extension services to farmers producing yabbies, as well as providing displays and information at country shows and workshops.

Low levels of compliance are directed at this industry group, however compliance officers were involved in disease control and monitoring during the recent *Thelohania* outbreak.

Research Overview

A major national research project to develop methods to enhance yabby production has been conducted over the past five years. This research, conducted at the Avondale experimental pond complex and at the joint Fisheries WA/University of Western Australia freshwater crayfish genetics facility, has enabled the development of a variety of methods to significantly enhance the production of marketable quality yabbies from farm dams, including evaluation of an all-male hybrid yabby. During 1998/99, these findings were promoted by research staff and Regional Services Aquaculture Development Officers through field days and seminars held in association with yabby processors and farmers' groups.

Data from this research, conducted in collaboration with industry organisations and individual farms, have provided the basis for the following industry status report.

Industry Status Report

Main Features

Production current season (1997/98):
231 tonnes

Number of producers for year 1997/98:
32 (licensed farmers or processors - most farmers do not require licences)

Estimated annual value (to producers) for year 1997/98:
$2,252,573

Production projection next year (1998/99):
250-300 tonnes

Production areas

Yabbies are an introduced species and so for translocation reasons, the licensed commercial yabby farming industry is restricted to the drier inland developed agricultural area of the south-west, to the north of Perth and to the east of Albany. Unlicensed agricultural farmers may sell yabbies to licensed farmers/processors or permit licensed harvesters access.

Annual Production

Production method(s)
Harvesting of farm dams by baited traps.

Production
Extensive farming; self-sustaining farm dam populations; annual farm dam yields average 400-500 kg/ha.

Production trends
Increasing, subject to annual rainfall, to 500 tonnes by year 2000/01.

Extension and Information Transfer

Considerable effort has been made to ensure that research and development information for aquaculture of yabbies is readily available to the agricultural sector. In addition to responding to numerous inquiries, methods of communication included extension publications, seminars, workshops and field days.

General Comments

The annual production was approaching 300 tonnes in 1993/94, but then declined in 1994 and 1995 due to poor winter rainfall to refill farm dams. Stocks recovered after the above-average rainfall of 1996. The strategic plan for development aims at increasing farmer participation and increasing the low or inconsistent production of many dams.

Commercial production of 231 tonnes recorded for the last full financial year, 1997/98, represents a substantial increase over the revised figure of 150 tonnes for 1996/97. This increase may be ascribed to a number of factors including improved winter rainfall, increased participation rates, improved management techniques based on Fisheries WA research (monosex growout, higher feed rates, improved feeding regimes and regular trapping), and an improved data returns process.

The discovery of two significant diseases in a variety of farms was a major setback in 1998/99 although these pose no threat to consumers. Concern in some overseas markets over potential damage through burrowing activities of WA yabbies has been shown not to be well founded as a major survey revealed that most burrows were relatively shallow and would not impact on dam walls.

Trout Aquaculture

Industry Status Report

Main Features

Production current season (1997/98):
24.2 tonnes

Number of producers for year 1997/98:
8 (includes major pay-fishing dam operations)

Estimated annual value (to producers) for year 1997/98:
$196,038

Production projection next year (1998/99):
25-30 tonnes

Production areas

Intensive trout culture is confined to the lower south-west by summer water temperatures and limited by the need for a large through-put volume of water. Potential exists to expand production by the utilisation of irrigation dam water in transit to agricultural farms on the south-west coastal plain. In addition, farmers with saline underground water are evaluating the performance of rainbow trout, stocked as yearlings and grown out in dams during cooler months.

Annual Production

Production method(s)
Highly intensive pond culture for food, and extensive farming in large gully dams stocked for pay fishing.

Production
Up to 200,000 kg/ha/year in dedicated ponds; up to 1,500 kg/ha/year in nutrient-rich dams can be achieved.

General Comments

The Fisheries WA Pemberton trout hatchery provides support for the commercial trout farming industry as a by-product of producing trout fry for recreational stocking programs. Fry are also supplied to private buyers who stock private dams within tourist complexes. Trout sold via tourist fishing ventures do not appear within the commercial production records, although they add significant commercial benefits to that sector and the regional economy. There is a trend for major trout producers to move towards tourist fishing ventures, effectively 'adding value' to the trout grown in these systems. While there is no reliable method of estimating the value of this sector, its tourism value within the south-west may be similar to that of the trout grown for the general fish market trade.

Ornamental Fish Aquaculture

Management Overview

The production of a wide range of freshwater and marine ornamental fish species is a small but rapidly growing sector of the aquaculture industry in Western Australia. As at June 1999, 23 licences are on issue for the production of these species. During 1998/99, the agency published information on the opportunities for ornamental fish production in Western Australia, and also convened a session on ornamental fish aquaculture at the World Aquaculture Society Conference held in Sydney in April 1999.

Industry Status Report

Main Features

Production current season (1997/98):
183,480 fish

Number of producers for year 1997/98:
15

Estimated annual value (to producers) for year 1997/98:
$67,666

Production projection next year (1998/99):
Approximately 200,000 fish

Production Areas

State-wide.

Annual Production

Production method(s)
Dedicated small ponds and aquaria; breeding and rearing of juveniles for live sales.

Extension and Information Transfer

As with other aquaculture species, the Fisheries Research Division provides considerable advice on ornamental fish aquaculture and proactively promotes native fish as ornamentals and for mosquito control; however, most of this culture is for internationally well known exotic species (e.g. Cichlidae) associated with the aquarium trade. A major advisory publication on production of aquarium fish was released in 1998/99.

General Comments

Commercial production recorded for 1998/99 indicated considerable volatility in production for major aquarium fish groups.