SHARK BAY PRAWN AND SCALLOP FISHERIES

Final Review Report

FISHERIES MANAGEMENT PAPER NO. 235

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Government of **Western Australia**
Department of **Fisheries**

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FOREWORD

The Shark Bay Prawn and Scallop Review Report (Fisheries Management Paper No. 235) has been finalised. Five written submissions were received after the initial draft report (Fisheries Management Paper No. 222) was released in April 2006. These submissions, along with those received prior to the draft review paper being published, are attached to this document as annexes. The contents of the submissions have been published verbatim in this report.

The report will provide for consideration future management arrangements and research directions.

The Department would like to thank all industry members for their contribution to the Review process.

1.0 INTRODUCTION

1.1 Reasons for Review

The Shark Bay Prawn Fishery and Shark Bay Scallop Fishery operate in the same general areas of Shark Bay (although there are some differences in their areas of operation). The inter-relationship between trawling activities for the two target species (prawns and scallops) has raised both management challenges and industry conflicts over time.

Harvest level settings for each fishery (in the form of effort levels and the timing and/or location of fishing) are independently set, on the basis of recruitment and abundance surveys of each target species. However, each industry sector strongly believes that the interactions between the fisheries arise because of the physical effect of the other fishery's trawl gear on their particular fishery.

Industry conflict has increased to the point where further management innovations have been difficult to achieve in the absence of either an industry consensus position and/or research data, which could shed some light on the real impacts of fishing gear in each fishery.

In recent times, the Department of Fisheries has received representations from both sectors about the ongoing interaction of the fisheries and their respective management settings. As a result, a decision was made to comprehensively review the fisheries, taking into account matters of fishery sustainability and gear interactions, together with industry economics and market considerations.

The review has also addressed research requirements to ensure an appropriate scientific basis for decision-making into the future.

1.2 Terms of Reference

The terms of reference for the review, as approved by the Minister, are:

1. To review management arrangements for the Shark Bay Prawn and Shark Bay Scallop Fisheries ("the fisheries").
2. Based on (1), to provide advice on emerging issues and future directions for management of the fisheries, taking into account, but not limited to:
    - Sustainability issues;
    - Gear interactions and fishery interrelationships;
    - Environmental and conservation issues;
    - Industry economics; and
    - Market considerations.
3. To report on future research directions and information needs for the fisheries

1.3 Review Process

The Strategic Planning and Policy Branch of the Department of Fisheries has undertaken the review. The review has been assisted by a steering committee, comprising of:

Heather Brayford	Chair (Manager Strategic Planning and Policy, Department of Fisheries)
Neil Sarti	Chair (from 2009) [Department of Fisheries]
Graeme Stewart	(Shark Bay Prawn Trawler Operators' Association)
Hamish Ch'ng	(West Coast Trawl Association)
Lindsay Joll	(Manager, Commercial Fisheries Program, Department of Fisheries)
Nick Caputi	(Supervising Scientist, Research Division, Department of Fisheries)

Following initial scoping of the review process in liaison with the steering committee, written submissions were sought from the two trawl associations and licence holders in the respective fisheries. Details of the review were also provided to other interested parties.

Submissions prior to the Draft review were received from Elmwood Holdings Pty Ltd, the West Coast Trawl Association and the Shark Bay Prawn Trawler Operators' Association. The Department of Fisheries also provided submissions – one from its Research Division and one from its (then) Commercial Fisheries Program. These submissions have been annexed.

Submission were received and feed back provided on this report (Fisheries Management Paper No. 222) from West Coast Trawl Association, Shark Bay Prawn Operators Association and Correia Fishing Co. These submissions have been annexed.

2.0 HISTORICAL BACKGROUND

The early history of the prawn trawl fishery (up to 1976) is recorded in Penn and Stalker (1979), while the early history of the scallop trawl fishery is set out in Joll (1987). The submission to this review from the Commercial Fisheries Program of the Department of Fisheries also provided a comprehensive overview of the history and background to development of both fisheries and is repeated here.

The history of the prawn fishery to date can be summarised as encompassing a period of development (up to the mid-1970s); a period of stabilisation but with a steady creep in fishing power (when effort began to reach undesirable levels and tiger prawn catches declined [probably through recruitment over fishing]); followed by a short, sharp re-structure (through an internally-funded buy-back scheme in 1990).

Following the re-structure, effort levels returned to about 80 per cent of pre buy-back levels and tiger prawn catches again began to climb to that seen in the 1970s. Since the late 1990s, effort (or at least *nominal* effort) has declined as the fishery has moved into tighter, real-time management and the catch of tiger prawns has moved to a slightly lower (but probably more sustainable) level.

Over the last 20 years or so of the fishery's 40-year history, prawn prices have remained relatively static (and therefore have declined in real terms), while fuel prices have climbed steadily, causing a slow but steady economic squeeze. Industry has responded to this by operational changes (e.g. moon closures, targeting larger [higher value] prawns) and more fuel-efficient fishing gear (bison boards, computerised engine management systems), but the economic margins have become thinner and thinner. The recent very steep increases in fuel prices have exacerbated this economic position.

Despite the 'ups and downs' in the fishery over its 40-year history, the prawn fishery operates in what could be considered a relatively stable prawn recruitment environment compared to the scallop fishery.

The scallop trawl fishery began in the late 1960s and developed in the landscape provided by its relatively stable prawn trawl fishery 'cousin'. Variability of scallop recruitment has been a key aspect of the development of the scallop fishery. While the presence of scallops (and prawns) was known from survey work in Shark Bay in the 1950s and 1960s, the development of a trawl fishery in Shark Bay in the mid 1960s was focussed on prawns (although there are commercial scallop catch data from as early as 1966).

The first serious commercial catches of scallops were not until 1969, when a number of non-prawn trawlers specifically fished for scallops, while some vessels in the prawn fishery either took them as by-product or target fished for them. Scallop catches at the time were landed whole, as shucking at-sea was not the practice at the time.

It is likely that the increase in catch at this time was the result of an increase in the recruitment levels of scallops. However, it seems likely that the increased recruitment was short-lived, as the scallop catch dropped to zero in 1971.

It is also understood that the scallops fished in 1969/70 were fairly old (one+ and two+ year classes) as the scallop meats taken in the fishery were heavily infested with nematode worms (which typically only develop in older scallops).

Scallop abundance (or at least landings) declined, following the 'showing' in the late 1960s/ early 1970s, with the bulk of landings being by prawn trawlers. It is not clear if this low catch

period represents a real reduction in abundance or simply a lack of interest in catching or landing scallops.

However, by the late 1970s scallops again began to be landed, suggesting an increase in abundance, although there was also a change in on-board handling methods evolving at this time (i.e. hand shucking on-board) which improved the economics of fishing and encouraged scallop trawlers into the fishery.

Increases in the level of fishing also moved the fishery into a state where fishing effort was sufficiently high to effectively crop-off all or most of the incoming 0+ recruit group, with the result that the symptoms of nematode infestation declined, which improved the marketability of scallops.

Over the next few years the number of boats fishing for scallops increased, with 26 scallop trawlers operating in 1983.

In December 1982, the Minister for Fisheries and Wildlife announced the appointment of the Scallop Fishery Management Working Group. The Working Group was required to inquire into the commercial exploitation of the scallop fisheries in Shark Bay and at the Abrolhos Islands.

With respect to Shark Bay, the Working Group's recommendations included a temporary [three-year] freeze on boat numbers, together with strict selection criteria for determining those who could operate in the fishery and a ban on vessel transfers during the period of the freeze. A number of other management measures were recommended, including gear controls and a closed season aimed at stabilising the fishery given low recruitment, which had been recorded in the fishery from time-to-time.

Recommendations were also made with respect to the prawn fleet's continuing ability to take scallops using prawn nets. One of the key recommendations was the need for a biological study [research] to better understand the scallop fishery and assist in determining future management arrangements. A report on this research was to be submitted to the then Minister by 1 November 1986.

Subsequently, a freeze on scallop trawlers operating in Shark Bay was announced in June 1983 and the 1983 season (which opened on 1 March) was closed on 31 August.

The research program commenced in September 1983. It was established with a four-year term, with a field component of three years and a further year for analysis and report writing. Consequently, the interim [freeze] arrangements for the scallop fishery were extended through 1987, at which time the research results would be known and further management arrangements considered. Joll (1987) summarised the results of the research program and discussed a management strategy, including the option of moving to limited entry with controls on total effort.

As a result of the Joll report, and following discussions with both the prawn and scallop sectors on future scallop management arrangements, the scallop fishery was declared limited entry in 1987 (it had essentially been limited entry since 1983). Access to the fishery was restricted to 14 dedicated scallop boats operating alongside the then 35 boats endorsed to fish the limited entry prawn fishery under a catch-sharing arrangement.

Since that time the original number of dedicated scallop boats (14) has continued to operate in the fishery. The fishery has been through a number of recruitment 'spikes' (of varying degrees) and quite a few years of 'average' recruitment (i.e. producing around 300 – 500 tonnes [meat weight] of catch) as well as a significant number of years of 'below-average' recruitment (i.e. 100 – 300 tonnes meat weight). Over time the fleet has gradually re-configured itself to cope with these recruitment variations, mostly by ensuring it has 'fall-back' options in other scallop

fisheries - particularly the Abrolhos Islands and Mid-West Trawl fishery and the South Coast (Esperance) Scallop fishery, but also in some prawn fisheries.

Like the prawn fleet, the scallop fleet is now feeling the effects of high fuel prices, although the impact of the fuel price is not quite so great in the scallop fishery. This is primarily because when the scallop fisheries are in 'hyper abundance' (as has happened in two recent years at the Abrolhos) their costs of catching are significantly lower than in prawn fisheries (with their more stable recruitment/steady catch mode of operation due to prawn migration to the trawl grounds) and when scallops are in low abundance the scallop fleet just stops fishing. Nevertheless, in most years there has been overcapacity in the scallop fleet.

3.0 DESCRIPTION OF THE SHARK BAY PRAWN FISHERY

The Shark Bay Prawn Fishery exists within the waters of Shark Bay off the mid-west coast of WA. The fishery is an otter-trawl fishery, with prawn trawling occurring in a much smaller area than the overall boundary of the fishery.

The fishery targets two main species – western king prawns (*Penaeus latisulcatus*) and brown tiger prawns (*Penaeus esculentus*). King prawns are the dominant species, comprising approximately 70 per cent of the catch. Tiger prawns make up most of the remaining 30 per cent.

The fishery is a Managed Fishery under the *Fish Resources Management Act 1994*, with 27 boats currently licensed for prawn trawling.

The total landings of major prawn species (penaeids) during the 2004 season were 1,748 tonnes - comprising 1,164 tonnes of king prawns, 576 tonnes of tiger prawns and eight tonnes of endeavour prawns. Sixty five tonnes of minor penaeid prawns (coral prawns) were also landed.

The multi-species nature of the fishery requires the levels of harvest for both king and tiger prawns stocks to be carefully monitored.

Current stock and recruitment studies for king prawns indicate that, at current exploitation levels, the stock remains above the level where recruitment is affected by spawning stock levels. Thus, at the current level of exploitation, most fluctuations in the annual king prawn harvest are likely to have resulted from varying effort levels and environmental effects on recruitment, not from the abundance of the spawning stock.

In contrast, the recruitment levels of tiger prawns were, during the 1980s, significantly impacted by reduced spawning stock biomass. Management practices have subsequently been improved to increase the level of these spawning stocks. Such measures have included spatial and temporal closures, as well as a reduction in fishing effort.

Historical catch and effort data for the fishery is provided in Figure 1 below.

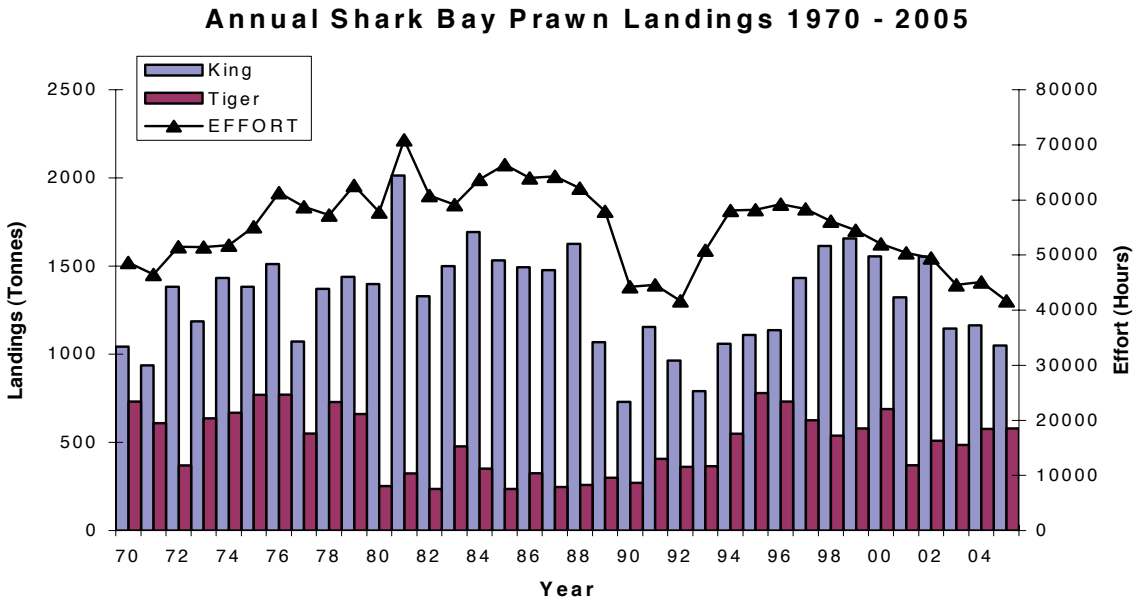


Figure 1. Annual prawn landings and effort (adjusted to twin-rig vessels) 1970 – 2005

4.0 DESCRIPTION OF THE SHARK BAY SCALLOP FISHERY

The Shark Bay Scallop Fishery exists within the same overall boundary as the Shark Bay Prawn Fishery. Within this overall area, scallop trawling only occurs in waters east of the outer islands of Shark Bay, in depths between 16 metres and 40 metres. The fishery targets the western saucer scallop *Amusium balloti*.

The catch is taken using otter trawl by boats licensed to take only scallops (14 A-Class licences) and boats that also fish for prawns in the Shark Bay Prawn Managed Fishery (27 B-Class licences).

The fishery is a Managed Fishery under the *Fish Resources Management Act 1994*.

The total scallop landings for the fishery in 2004 were 1,665 tonnes whole weight, of which 916 tonnes was taken from the grounds known as Red Cliff and North West Peron and the remaining 749 tonnes from Denham Sound. A Class licence holders caught 1,185 tonnes or 71 per cent of the total catch, with B Class licence holders taking 480 tonnes.

Scallop landings have varied dramatically over the last 15 years, depending primarily on the strength of recruitment. To date, recruitment strength has been thought to be mainly independent of spawning stock size and largely environmentally driven. This particular issue is discussed in more detail in section 9.1.

Historical catch and effort data is provided in Figure 2 below.

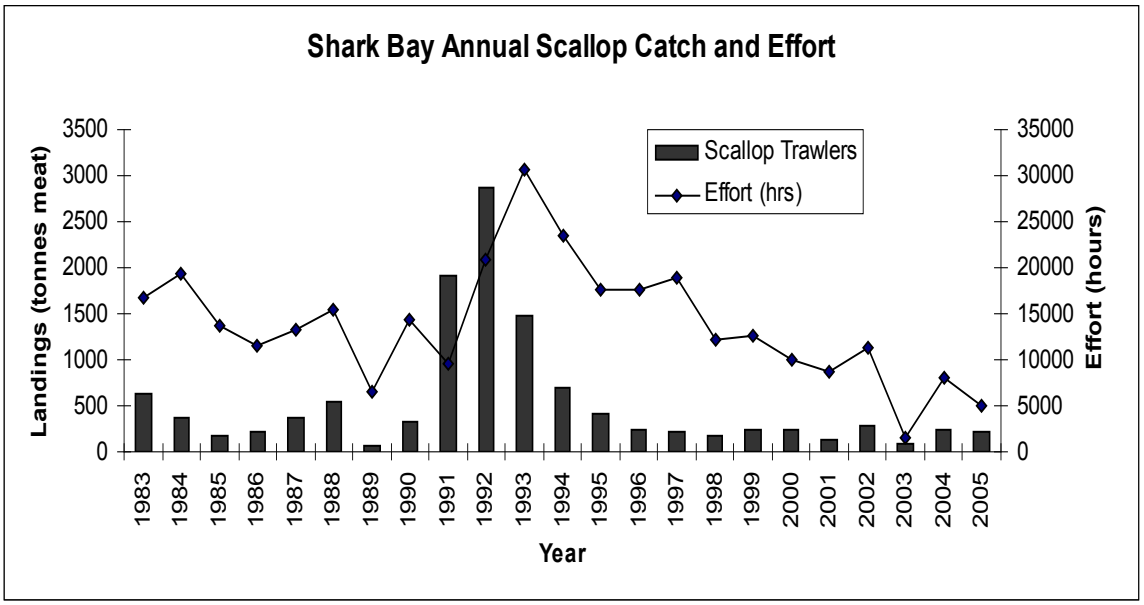


Figure 2. Shark Bay annual scallop catch and effort for scallop boats for the past 23 years

5.0 CURRENT MANAGEMENT FRAMEWORK

5.1 Shark Bay Prawn

Aside from limited entry (27 licensed fishing boats), management of the Shark Bay prawn fishery is based on a series of sophisticated input controls including gear controls, spatial and temporal closures, together with Vessel Monitoring System (VMS) monitoring of the fleet.

Fishing effort in the fishery is monitored with the aim of reducing ineffective trawl hours (e.g. around full moon phases) while maintaining high catch rate levels, thus reducing overall effort to improve economic and energy efficiency within the fleet.

The yearly cycle of operation for the fishery is dynamic and multi-faceted. Opening and closing dates vary each year, depending on environmental conditions, moon phase and the results of surveys, which predict recruitment dynamics.

The timing of the opening of the season allows the harvesting of the current season's recruits and the large residual prawns not caught in the previous season. Permanently closed nursery areas within the fishery prevent the fishing of small-size prawns and provide habitat preservation, while spatial and temporal closures serve to protect tiger prawn breeding stocks at a threshold catch level and small-size king prawns in the Extended Nursery Area from August onwards.

Within the main fishing period, there are various subsidiary openings and closings designed to increase size, quality and market value, while protecting stocks from recruitment overfishing. Moon closures (no fishing) around each full moon also operate to increase economic efficiency by shifting fishing effort away from these times of reduced catch rate.

The fishery is also subject to a range of gear controls, including restrictions on mesh size of nets, length of head rope, number of trawl nets that can be towed, size of the ground chain and dimensions of otter boards. There is also a requirement for a VMS to be installed and used on all boats. Bycatch reduction devices are also mandatory within the fishery.

5.2 Shark Bay Scallop

As with the prawn fishery, management of the scallop fishery is based on input controls, including limited entry [14 A-Class (scallops only) and 27 B-Class (scallops and prawns) fishing boats], season and area closures, gear controls and crew limits.

Management is currently aimed at catching scallops at the best size and condition for the market, thereby maximising economic return whilst maintaining appropriate levels of the breeding stock to ensure sustainability. Management settings have been refined through time with an adaptive management approach based on pre-season surveys that measure the strength of scallop recruitment into Shark Bay.

The scallop stock commences spawning in mid-April (continuing through until the end of November) and meat condition declines as spawning continues. Therefore, the opening date of the season is a compromise between breeding stock levels (measured by a pre-season survey of stock abundance and commercial catch rates during the fishing season) and the seasonal decline in meat condition associated with spawning.

The fishery is generally closed between November and April [this has changed in recent years to take advantage of the optimum meat size earlier in the season, so the opening has been occurring in February/March and closing when a threshold catch level is achieved].

The closure is generally aligned with the Shark Bay prawn closure times, but the A-Class fleet (scallops only) usually ceases fishing before the declared scallop closure date, as scallop catch rates are often reduced to non-economic ones for scallop boats. This usually occurs prior to the closing date for the prawn fishery.

The Shark Bay scallop fishery is also subject to a number of area closures. Only the more marine (i.e. western) areas of Shark Bay are open for scallop trawling. As with the prawn fishery, permanent area closures are in place. During the scallop season, trawling by A-Class boats can take place 24-hours a day, with B-Class vessels restricted to specified prawn trawling hours (1700 – 0800 hours) or 15-hours per day.

There is also a range of gear controls, including mesh size, number of nets, the length of trawl net head rope, and the size of trawl otter boards and ground chains. There is also a requirement for VMS to be installed on all A and B-Class licensed fishing boats.

Bycatch reduction devices, in the form of grids, and secondary fish escape devices are required to be fitted in the nets in this fishery.

6.0 CURRENT RESEARCH PROGRAM

The Research Division of the Department of Fisheries has a strong and well-established relationship with the prawn and the scallop fishing sectors. With continued low scallop stock levels in Shark Bay (and the reasons for this being unclear), resource sharing and gear interaction issues between the scallop and prawn fleets have increased in prominence over the last few years, placing a stronger focus on research outcomes and future requirements.

The thrust of the current trawl research program is focussed on monitoring the status of stocks through daily research logbooks providing location, catch and effort, size grades, recruitment, spawning stock, size management surveys and real-time monitoring. Information on general fleet dynamics, processor ‘unloads’ and prawn and scallop prices is also collected, which assists in providing an overall view of the fisheries’ performance.

Over the last five years, significant improvements in real-time management, assisted by timely surveys, have allowed better optimisation of the prawn and scallop resource. Significant changes in harvesting strategies have been implemented since the late 1990s, in liaison with industry, to optimise the value of the available resource.

A collaborative three-year project with industry to review the impact of trawling on non-target species, funded by the Fisheries Research and Development Corporation (FRDC), was completed in 2004. A further FRDC-funded project is examining the biodiversity of bycatch in trawled and untrawled areas of Shark Bay and is shortly due for completion.

An FRDC project with Edith Cowan University has been examining the spatial distribution of abundance of the scallop recruitment and the spatial distribution of catch during the fishing season to improve catch forecasting. In addition, analysis of prawn daily logbooks for king and tiger prawn size categories and abundance may assist in refinement of current prawn fishing closures.

7.0 COMPLIANCE

Significant resources are put into ensuring compliance within the fisheries. Over time, compliance activities have included at-sea and aerial patrols to ensure closed seasons, closed areas, and operational rules are being adhered to.

Since 2000 [for prawns] and 2002/03 [for scallops], the use of the Vessel Monitoring System (VMS) in the fisheries has assisted in monitoring vessel location and speed, thus increasing compliance with fishing closures and decreasing the need for untargeted patrol activities. Licence and gear checks are also undertaken, both at-sea and in-port.

In more recent times, compliance activities in the fisheries have been based on a risk-based approach. This has assisted in the allocation of compliance resources to appropriate areas and enhances cost efficiency. As a result of the risk assessments, key compliance strategies now include pre-season briefings of skippers, pre-season inspection of the trawl fleet, and at-sea inspections.

The implementation of VMS in the fisheries, in particular, expands the scope for real-time and adaptive management within them and may be an important element of the management solution to the Shark Bay 'problem'. Although VMS is used to check on legislative lines, the presence of VMS has also enabled short-term area closures to be implemented by industry agreement.

8.0 OVERVIEW OF SUBMISSIONS

Submissions on the review were received from the West Coast Trawl Association (representing Shark Bay scallop licensees) and from the Shark Bay Prawn Trawler Operators Association (representing Shark Bay prawn licensees). A submission was also received from Elmwood Holdings Pty Ltd, a scallop licensee. The Department of Fisheries also provided submissions. An overview of the submissions is provided below.

The West Coast Trawl Association (WCTA) provided two submissions. The first comprehensive submission described the decline of the scallop fishery in Shark Bay and suggested, given industry economics, that restoring the productivity of the scallop resource was critical to the future prosperity of both prawn and scallop industries. The importance of maximising the combined value of the prawn and scallop catch was also highlighted.

The submission rejected the proposition that a decade of recruitment failure was the product of a sustained period of unfavorable environmental conditions [noting that even in periods of presumably favorable environmental conditions, recruitment has failed]. Rather, its decline was attributed primarily to a process of evolutionary change in the management arrangements for the prawn fishery.

It was argued that these changes have resulted in a high level of effort in targeting prawns on the main scallop grounds; altered the historical distribution of the prawn fleet's effort; and had a devastating impact on the recruitment to, and productivity of, the scallop fishery.

The submission argued for a more robust management system and further investigation into other, possibly non-environmental factors, these having a far more important role in scallop recruitment than previously considered. Further research on the extent of trawl-induced mortality upon juvenile scallop stocks was suggested.

Accordingly, the submission called for the introduction of a significant fishing closure area on the main scallop grounds of Shark Bay. The submission also concluded that so long as the Department's strategy for the recovery of the scallop fishery amounted to little more than waiting for the return of 'favorable environmental conditions', the pattern of poor recruitment on the main scallop grounds would persist.

The submission also suggested that the prawn and scallop fisheries are confronted by two quite distinct problems. For the scallop industry, the problem in Shark Bay is essentially biological in nature. While the industry will inevitably have to come to terms with the economic problem of excess capacity, it is a problem that is presently subservient to the more pressing problem of ongoing recruitment failure. When the catches of the last decade compare so unfavorably to the catches that were achieved in the eight years before the redistribution of the prawn fleet's effort[1], it is clear that the scallop fishery in Shark Bay is not operating at its full potential.

The supplementary submission from the WCTA explored in more detail the potential benefits of introducing a closure on the main scallop grounds in Shark Bay. The submission reviewed the successful implementation of closure areas in the United State's sea scallop (*Placopecten magellanicus*) fishery and assessed whether some of the management initiatives undertaken in that particular fishery might also be applied in Shark Bay.

The submission then explored the potential for further, largely economic, management reforms, which could follow the successful implementation of a fishing closure area. A key reform suggested was the introduction of industry-based quotas to formally allocate future scallop catch on the basis of the historical catch ratio between the prawn and scallop fleets[2].

It was argued that a formal catch share allocation would eliminate the resource sharing conflict between the two fleets and allow a stronger focus on management initiatives to rebuild the scallop resource. Such a system would also allow for a market-driven process of fleet rationalisation over time.

The submission from Elmwood Holdings Pty Ltd was along similar lines to the submissions from the WCTA. Elmwood Holdings Pty Ltd argued strongly that the reason for the decline in Shark Bay scallop yield was due to the constant trawling by prawn vessels over sensitive known scallop grounds.

[1] A comparison of the catches from 1983 to 1990 to the catches from 1996 to 2005 illustrates the extent of the fishery's decline. The catch data shows that the total average annual catch between the two periods has fallen by 133 tons of meat weight.

[2] A scallop catch share ratio of 72 per cent to A-Class and 28 per cent to B-Class licensees is recommended by the WCTA, based on historical catch records.

The submission also discussed at length the equity issues associated with the scallop catch by both A-Class and B-Class licensees. Elmwood Holdings pointed to erosion over time of the historical catch 'share' of 80 per cent of the catch to the scallop fleet and 20 per cent of the catch to the prawn fleet. The submission also argued for standardisation of gear.

The Shark Bay Prawn Trawler Operators' Association (SBPTOA) also provided a detailed submission. The SBPTOA argues that dissatisfaction with management of the Shark Bay prawn and scallop fisheries has arisen, in part, from the high expectations that scallop fishers have of the returns expected from the fishery.

The submission points to the many past warnings to the scallop fleet about the ability of the Shark Bay scallop resource to provide a regular or profitable income. The submission also draws attention to the enormous inter-annual variability of scallop abundance and the resultant management difficulties and potential sustainability issues, as a result of the low level of residual scallop stock left after fishing and prior to spawning.

The submission dismisses the proposition that there is a connection between prawn management boundaries and scallop catch rates. It suggests that while total scallop catches have fallen, catch rates have not.

The submission also argues that efforts by prawn licensees to introduce real-time management and profit maximisation in the prawn fishery have been frustrated by prawn mortalities caused by the operation of scallop trawlers on grounds that have been closed to prawn trawling. It points to the continued sustainability of the prawn fishery as a result of continual management adjustment, including the buy-back in the early 1990s.

The submission also describes concessions of the prawn fleet in the past that have been made to assist the scallop fishery (such as providing access to scallopers to Denham Sound early in the season, with prawners not operating) resulting in shifts in equity arrangements between the A-Class and B-Class fleets. The submission recommends a rationalisation of the A-Class scallop fleet via a scallop industry funded buy-back.

With respect to research, the Shark Bay Prawn Trawler Operators' Association (SBPTOA) suggests the need to determine whether or not a stock recruitment relationship exists in the scallop fishery. If a stock recruitment relationship can be established, research is required to determine the appropriate level of scallop abundance (catch rate per hour) to ensure that only the environment (not stock abundance) is influencing scallop recruitment in the following year. If a stock recruitment relationship cannot be determined, then research is required to identify the major determinants of Shark Bay scallop abundance.

The submission also suggests research should determine more accurately the extent of damage caused to prawn stocks and habitat from scallop trawling.

The Department of Fisheries provided two submissions – one from the Research Division and one from the Commercial Fisheries Program. The Research Division submission has largely been reflected in sections 6 and 11 of this report.

The Commercial Fisheries Program submission provided a detailed historical background to development and operations of the prawn and scallop fisheries, which is incorporated in section 2 of this review report. It also addresses a number of biological and gear interaction issues, and fisheries management issues and possible solutions, which are reflected in the following sections.

9.0 MANAGEMENT ISSUES

9.1 Scallop Recruitment

A key focus of this review is the cause of the low recruitment that has persisted in the scallop fishery since the mid 1990s.

There are three key factors that warrant further investigation that separately, or in combination, may have contributed to low recruitment. These are environmental conditions (e.g. water temperatures, hydrology of Shark Bay and various other Leeuwin Current influences), inadequate spawning stock and trawling negatively impacting on scallop recruitment.

With respect to environmental conditions, the available data does not indicate a strong stock-recruitment relationship in the scallop fishery, although there is (or at least, was) evidence of a stock-recruitment-environment relationship. Previous research identified a relationship between years of weak Leeuwin Current (which are associated with El Nino-Southern Oscillation (ENSO) years) and good recruitment. However, recent ENSO years in 1997 and 2002 have not been associated with good recruitment.

A closer look at the Fremantle Sea Level (FSL) - an indicator of the strength of the Leeuwin Current - over the last 30 years shows an interesting trend that may be affecting scallop recruitment. From 1977 to 1994 the annual mean FSL was below 70 cm in 11 of the 18 years, and these low FSL years were usually associated with ENSO years.

Since 1995, none of the 12 years have a mean FSL below 70 cm. The lowest annual FSL have been in the ENSO years, 1997 (70.4 cm) and 2002 (71.5 cm). This is probably due to an increasing trend in FSL of about 1.5 mm per year identified by CSIRO oceanographers (Feng *et al.* 2004).

The effect of the Leeuwin Current on water temperature may also be a critical factor, as the good recruitment measured in November 2006 appears to be associated with cooler water temperatures during the spawning season. The implications of these to the environment in Shark Bay and its effect on scallop recruitment will be further investigated as part of a proposed Fisheries Research and Development Corporation (FRDC) project for commencement in 2007/08.

The second factor relates to spawning stock. The spawning stock has varied significantly in Shark Bay due to variations in recruitment. Previous assessments have indicated that, in the range of spawning stocks experienced, spawning stock has not had a significant impact on recruitment and that environmental conditions were the main cause of recruitment variation.

An assessment of the spawning stock indicators in recent years should be undertaken to determine if the current levels are still within the range that have previously produced good recruitment. The decision rule framework (i.e. catch rate thresholds) associated with the change in the pattern of fishing also needs to be re-assessed to ensure adequate breeding stock protection.

In years of very low recruitment, as identified in the November research survey, consideration should be given to not fishing the stock if it is going to reduce spawning stock to very low levels.

The third factor that needs to be assessed is whether changes in the spatial closures associated with the prawn fishery have contributed to increased trawling on the scallop grounds, and whether the 'disturbance' of the scallop recruits has affected their survival. This issue is discussed in more detail in section 10.2.2 of this document.

The first part of the issue can be assessed by examining the changes in the prawn fishing closures relative to the timing and location of scallop recruitment. The second part may be assessed by

an adaptive management approach using 'research' closures to assess the relative survival of the scallops settling in the closed areas, compared to the areas open to trawling.

This assessment may take a number of years, as it will require a reasonable level of recruitment to evaluate the effects of the closure. The Research Division suggests these closures should have minimal impact on prawn fishing, as the prawns will migrate through these areas and are available for capture before or after they enter the areas.

9.2 Gear Interactions and Fishery Interrelationships

This is a complex and pressing issue facing the Shark Bay fisheries and is a key driver for this review. It is also inextricably linked to the scallop recruitment issue discussed in section 9.1 above.

The issues include:

- impact of scallop gear on prawns; and
- impact of trawl gear on scallops.

9.2.1 Impact of Scallop Gear on Prawns

It is argued in the submission from the Shark Bay Prawn Trawler Operators' Association (SBPTOA) that the operations of scallop trawlers cause prawn mortalities and impede real-time management and profit maximisation in the prawn fishery.

The Department of Fisheries, in its Commercial Fisheries Program submission, explain that newly settled and juvenile prawns (both kings and tigers) in Shark Bay are not located on the main trawl grounds but migrate there at larger (fishable) sizes from the inshore nursery areas in the south and the shallows on the eastern banks. Because of this, the Department considers that there is low risk of incidental fishing mortality on juvenile prawns from either prawn or scallop trawling in the main grounds of the fishery in the autumn months (i.e. February to March).

If scallop trawling does damage prawns, any incidental fishing mortality risk to newly recruited stocks increases sharply from around May/June, as higher abundances of recruiting prawns move onto the more central areas of the trawl grounds where scallop trawlers typically operate.

Scallop trawling in the early part of the year potentially poses some risk to residual adult prawns and early recruiting prawns, as they occur in some of the areas where scallops typically occur - although under the current prawn fishing arrangements, the numbers of adult prawns available at this time (March to May) is relatively low due to their stocks having been fished down in the previous season.

The notable exception to this is the deep-water fishery for tiger prawns in the Quobba area in the early part of the prawn fishing season (March). However, the Quobba area is not known for scallop recruitment (and, therefore, scallop trawling), which precludes any potential gear interaction issues in this area.

The other issue is that scallop gear (currently 100mm mesh) does catch some prawns - despite earlier studies which showed that the prawn catch in 100mm mesh was nil to minimal. The degree to which 100mm mesh retains prawns depends on the size of the prawns (larger prawns are more readily retained) and the degree of clogging of the 100mm mesh by scallops or other catch.

It is also likely that there is some mortality of prawns that pass through the 100mm mesh or are damaged in the net's cod end. The fate of prawns that enter scallop nets is one of the major unanswered questions in the gear interaction issue (but one which could be answered by a targeted research program, such as the proposed FRDC project mentioned in section 9.1 above).

The other gear issue is whether or not the ground chains of scallop gear have any effect on prawns buried in the seabed. Given the diurnal behaviour of prawns (i.e. burying themselves during the daylight hours), it is unclear whether scallop trawl gear (which is currently the only trawl gear permitted to be operated between 8am and 5pm) has any effect on buried prawns.

The ground chain is meant to be set to 'skim' across the surface of the seabed's substrate, but depending on exactly how the gear is rigged, or how heavy the trawl gear has become as catch accumulates, some 'digging' of the substrate can occur. Again, how this impacts on the fate of buried prawns in the path of the net is unclear (but potentially also answerable [or at least inferable] by a targeted research program)[3].

9.2.2 Impact of Trawl Gear on Scallops

Unlike prawns, juvenile scallops recruit directly onto the fishing grounds and are vulnerable to gear impacts from the time they settle. This vulnerability arises from the fact that, as far as is known, juvenile scallops settle onto the sand substrates that are the habitat of adult scallops and reside in the top few millimetres or the first centimetre of the sandy seabed.

Given the fragility of their shells, juvenile scallops are (or at least appear to be) vulnerable to crushing or fatal shell fractures from trawl ground chains or dragging cod-ends (which might be either prawn or scallop gear) passing over them.

Whether or not there are any impacts on juvenile scallops can be a function of where they settle, given the patchiness of scallop recruitment. However, given that scallop recruits are potentially present on the trawl grounds from around mid-May (arising from spawnings in mid-April), they may be vulnerable to gear impacts from trawlers (prawn or scallop) operating in their recruitment areas.

Whether or not this is happening, and is the (or a) cause contributing to low scallop catches in recent years, may be interpretable from a research study to examine the spatial relationships between scallop recruitment, fishing effort in the area of the recruitment and subsequent catches (as is currently being undertaken by Edith Cowan University). The other option would be for a laboratory-based research study using hatchery-reared juvenile scallops and 'dummy' trawl gear, in order to carry out experiments on gear impacts.

9.3 Scallop Catch Share

Historically, catching scallops has been an important component of the viability of the prawn fleet, with the prawn fleet enjoying total access to the scallop fishery until the introduction of formal management arrangements for the latter in the 1980s.

As part of the management package, the then Minister introduced a catch guideline, directing the Fisheries Department to implement a management strategy to effect a catch distribution of 80 per cent to dedicated scallop vessels and 20 per cent to the prawn fleet. The prawn fleet did not accept the catch share arrangement, arguing that it was based on an inappropriate period of fishing history and questioning its legal basis. This catch guideline was removed in 1991.

[3] Any proposal to move trawling for scallops by A-Class vessels to a daylight-only to 'capitalise' on this aspect of prawn behaviour will need to consider the maritime safety issues of having A-Class scallop trawlers at anchor during the night when prawn trawlers will, at some times of the year, be operating over the same ground. There may also be issues of diurnal differences in catchability (with scallops possibly being less catchable during the day), which would need to be considered more closely if a time-split between the fleets was actively considered as an element of any solution.

Irrespective of the above, there has continued to be ongoing 'tension' over scallop catch share between the A-Class and B-Class licence holders.

The West Coast Trawl Association (WCTA) argues in its submission for a formalised catch share allocation within the scallop fishery to eliminate the resource sharing conflict between the respective fleets and allow a greater focus on management initiatives to rebuild the scallop resource. This position was supported in the submission from Elmwood Holdings Pty Ltd.

9.4 Prawn Fishery Sustainability

An assessment of the Department of Fisheries ESD and *State of the Fisheries* reports do not indicate any overriding stock sustainability concerns within the prawn fishery, given the current management settings. Assessments indicate that target species are currently being maintained above levels necessary to maintain ecologically viable stock levels. They do however point to the need to remain vigilant with respect to catch and effort monitoring, particularly in relation to tiger prawns, given their susceptibility to overfishing.

Aside from the interaction issues with the scallop fleet, the submissions from the Shark Bay Prawn Trawler Operators' Association (SBPTOA) and the Department of Fisheries similarly do not indicate any specific stock sustainability concerns with the prawn fishery.

However, this position of stock sustainability has not come about without costly and specific research/management over a long period of time aimed at protecting prawn stocks. Notable management interventions to ensure long-term sustainability have included an industry-funded buy-back in the early 1990s; the introduction of nursery area closures; and a range of other input controls including spatial and temporal closures.

There are, of course, a number of issues related to industry economics and the impact of the cost-price squeeze on the prawn fleet and on licence holders. These issues are discussed in section 9.5 below.

9.5 Economic Issues

The profitability of the Shark Bay Prawn and Scallop fleets has suffered considerably over the last few years, with declining prices and rising costs. This section focuses on factors affecting the profitability of fishing (including the trends in those factors).

9.5.1 Prawn Trawling

9.5.1.1 Revenue Factors

The Shark Bay Prawn fishery is the third largest in Western Australia, (after the western rock lobster fishery and white South Sea pearl industry's), with an annual Gross Value of Production (GVP) of between $25 million and $30 million.

Production is usually spread over eight months of the year, with the season starting in mid March. The seasonal pattern of production is a significant factor in determining the economics of fishing, with production peaking early in the season and being interspersed with fishery closures over the period of the full moon when catch rates are relatively low.

The average catch rates through the year have shifted somewhat to later in the year, due to research/management efforts, with production peaking more obviously in the third moon cycle than is indicated by Figure 3. These management measures have been designed in order to encourage later harvesting of prawns in order to improve their size and quality.

The variations in allowable trawled areas and opening and closing times of the season appears to be an important contributor to the economics of fishing (within seasons) because these have the potential to limit the efficiency of fishing effort throughout the season and can also spread the catch more evenly from month to month. The primary role of such closures, in protecting the breeding stock, is unquestionably important for the long-term economic sustainability of the fishery.

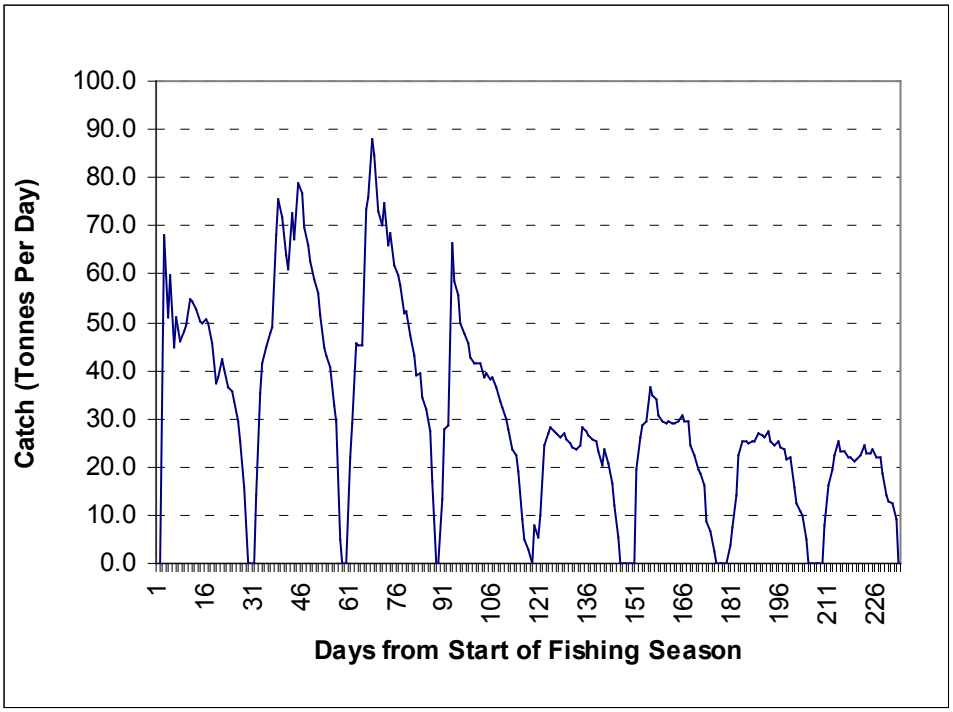


Figure 3. Average daily prawn catch (synchronised with moon cycles and season opening) 1998 – 2004

Generally, prawn production patterns are relatively stable from one season to the next. The GVP of the Shark Bay prawn trawl fleet is made up of two major species of prawns and between 20 per cent and 40 per cent of scallops caught within Shark Bay, noting that the dedicated scallop trawl fleet catches the balance of scallops in Shark Bay. There are two parameters to GVP - volume caught and the prices received.

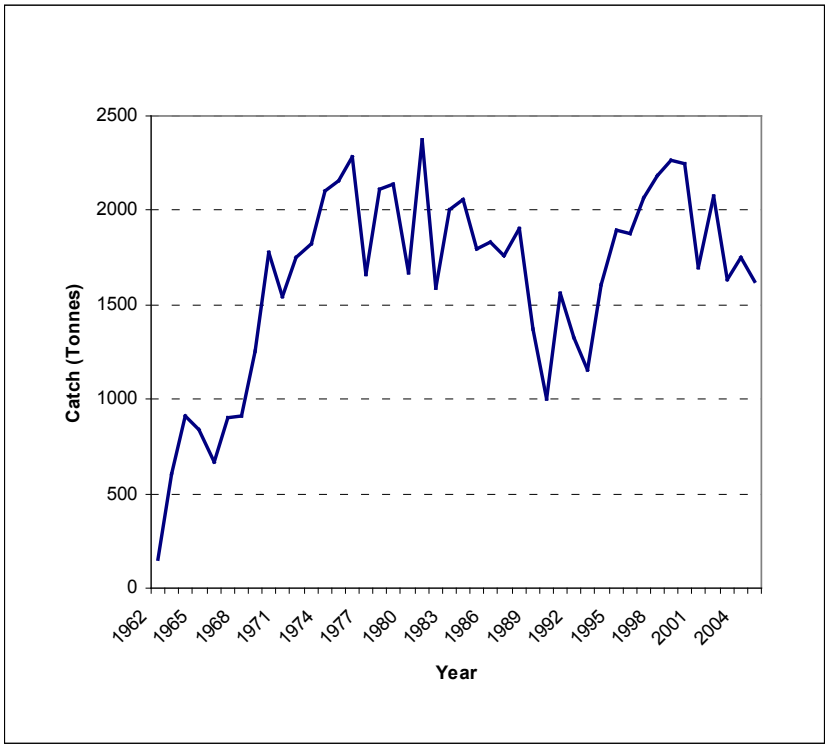


Figure 4. Shark Bay prawn catch over the last 40 years

Prawn catches are determined as a function of:

- seasonal factors, such as recruitment, previous fishing effort; and
- trawling effort, being the number of vessels, hours trawled per vessel and fathoms of headrope used in trawling nets.

There were some sustainability concerns in the late 1980s that were addressed by an effort reduction (and prawn fishing boat licence buy-back) in 1990. This was followed by a reduction in catch and then an increase in catch, as stock improved and fishing activity adjusted to the new total allowable effort (refer to Figure 4).

The other component of GVP is price. Beach prices in Australia are mainly determined by the world price of prawns (and shrimps) including those fished from the wild and those grown in aquaculture, (noting that research has shown a link between the price of cultured Thai shrimp and wild shrimp *Penaeus subtilis* fished in the Caribbean) and changes in the exchange rate.

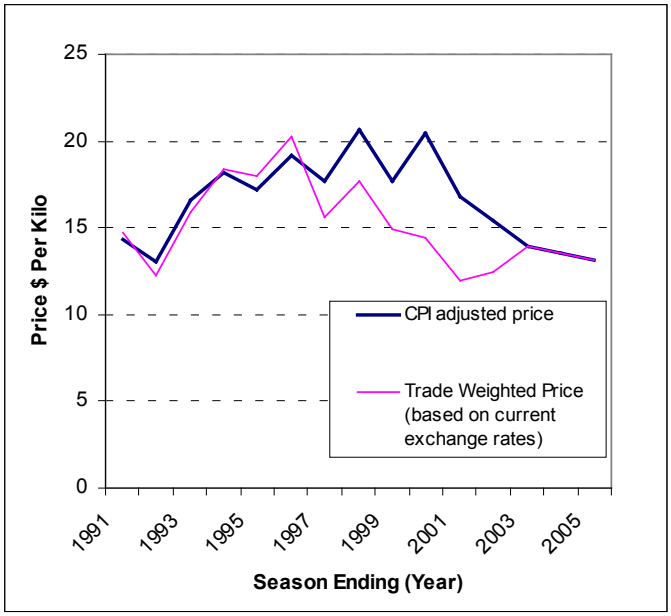


Figure 5. The average beach price of prawns caught in Shark Bay

Figure 5 shows that inflation adjusted prices have risen steadily until about 2000, since when they have undergone a steady decline. The reduction in beach price since 2000 can be attributed to two main factors:

1. The rapid increases in the production of aquaculture-reared prawns over the same period. While the local market represents a small proportion of the total sales from Shark Bay, this market has contracted in recent years as it has been swamped by cheaper imports. This is particularly relevant in the period 2002 – 2004 when imports increased rapidly. In November and December of 2004 alone, imports of *Penaeus vannamei* averaged (for the first time) 2,500 tonnes per month[4], which is equivalent to the total annual prawn production of Shark Bay in a good year.
2. The increase in the Australian Dollar against the US Dollar. The Trade Weighted Price is the price that prawners would have received if the value of the Australian dollar had remained fixed at 74 US cents over the period 1991 – 2005. The trend in the Trade Weighted Price indicates that world prices of prawns began declining from a peak of $20 per kg in 1996. The fall in the Australian dollar buffered producers from falls in world prices for a period of time from 1997 to 2003.

An issue of concern for the prawn industry is that future trends in prices are likely to be, at best, levelled out around $13 per kilogram, down from a (inflation adjusted) peak of $20 per kilogram, given the ongoing development of aquaculture around the world.

This poses a problem for the economics of fishing over the longer term, given the likelihood that fuel costs could increase at a rate above inflation if some of the more pessimistic predictions around oil demand and supply prove to be correct in the next ten years.

The Australian Bureau of Resource Economics paints a more optimistic outlook for prawn trawling in its 2006 Commodities Outlook document, suggesting that fuel prices will decline over the short term and that the Australian dollar could weaken. Such predictions would appear, on face value, to be fraught with risks.

[4] Reported in the Sydney Morning Herald, 22 May 2004

Trends in declining beach prices and catches in Shark Bay in the last five years have had a considerable impact on the profitability of fishing over the same period.

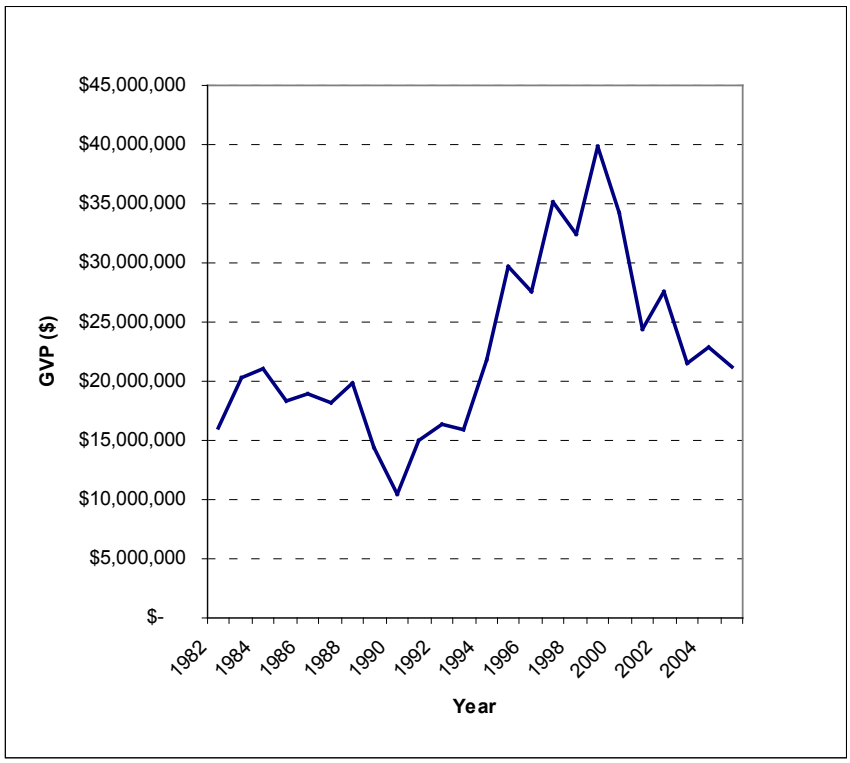


Figure 6. The gross value of production of Shark Bay prawns

Prawn trawlers also supplement their income by fishing scallops through the season. However, this only represents about six per cent[5] of the total gross value of production of the prawn trawlers, so it forms a relatively small part of the economic equation in the prawn fishery.

Nevertheless, there is considerable concern by prawn fishers to maintain their share of the Shark Bay scallop fishery, which from 1984-2006 ranged between 9 and 45 per cent; with an average of 29%.

King prawns are the main species caught (in terms of kilograms and total value). Figure 7 demonstrates the catch and value pattern typical of recent times. Nevertheless, tiger prawns usually have a higher value per kilogram than king prawns. On average this is about 20 per cent higher and in 2002 this differential was 39 per cent.

The inter-temporal pattern of catch and the differences in value of king prawns and tiger prawns could have a bearing on the economics of fishing within a season, although this difference is smaller than the difference in total catch rates and the change in value of prawns as they mature into different size grades.

[5] Over the last eight years, there has been very little variation in this figure (between two per cent and seven per cent), although in 1992, during a hyper-abundant year for scallops, scallops were 52 per cent of the value of prawn trawlers' catch.

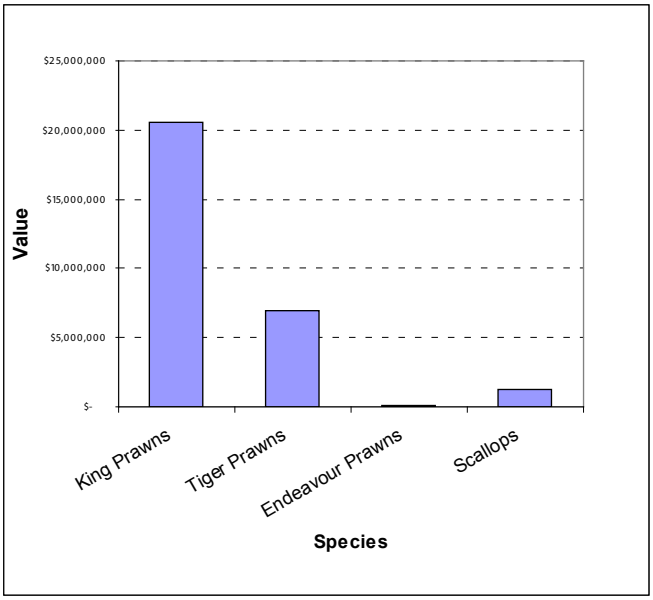


Figure 7. The composition of catch value by species (in 2002)

9.5.1.2 Cost Factors

The costs of trawling can be broken into three broad categories that are:

- fuel and other variable costs associated with running vessels while trawling;
- labour costs which are usually set as a percentage of the catch (often around 25 per cent); and
- fixed costs of maintaining vessels (including the cost of depreciation).

The hourly rate of trawling can vary depending on the vessel size, engine power, the size of the nets towed and the speed at which the boats trawls for prawns. However, net sizes have been fixed, at two nets of eight fathoms head rope length, so all vessels are currently operating with the same net drag.

It is estimated that an average vessel uses about 150 litres of fuel per hour of trawling, which currently costs around $170 per hour (ex-fuel tax rebate).

Trawling efficiency has been increased over the years, as a result of three main management measures:

- The industry financed fleet reduction of 1990 (from 35 boats to the current 27) saw a considerable reduction in hours trawled, although this trend was reversed as vessels increased their individual trawling rates (see Figure 8).
- Introduction of moon closures, which suspend fishing for periods of up to 10 days (and now up to 12 days) over the low catch periods of the full moon.
- Inter-temporal spatial closures which encouraged greater effort later in the season concentrating in areas where catches are higher.

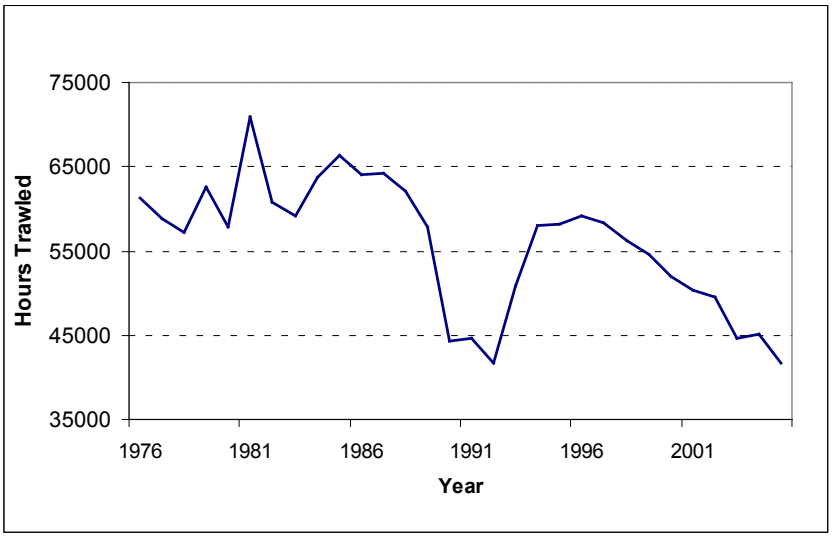


Figure 8. Trends in hours trawled by prawn trawlers

The ongoing efforts to improve trawling efficiency have underpinned the fleet's profitability over the last 16 years by ensuring that the revenue generated per hour trawled has stayed above $500 (see Figure 9). Certainly, without the fleet reduction of 1990 and the subsequent management changes (such as moon closures), trawling returns would be much less than they are today.

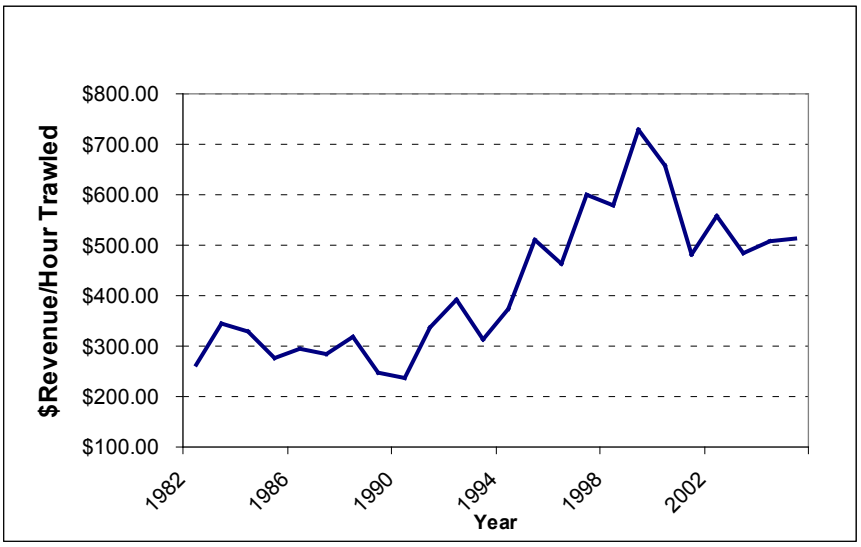


Figure 9. Revenue generated from prawn trawling per hour trawled

The problem for the fleet is that attempts to manage trawling efficiency have not kept pace with rising costs.

If it is assumed that the average prawn trawler uses 130 litres per hour while trawling, then in the 2006 season, this equated to diesel costs of about $143 per hour[6]. Fuel costs have risen markedly in recent years and the long-term outlook is for continuing high prices, although some short-term relief may have been felt in the 2007 fishing season (refer Figure 10).

[6] Based on a cost of $1.10 per litre ex-tax. Source: Fuel Watch at www.fuelwatch.wa.gov.au .

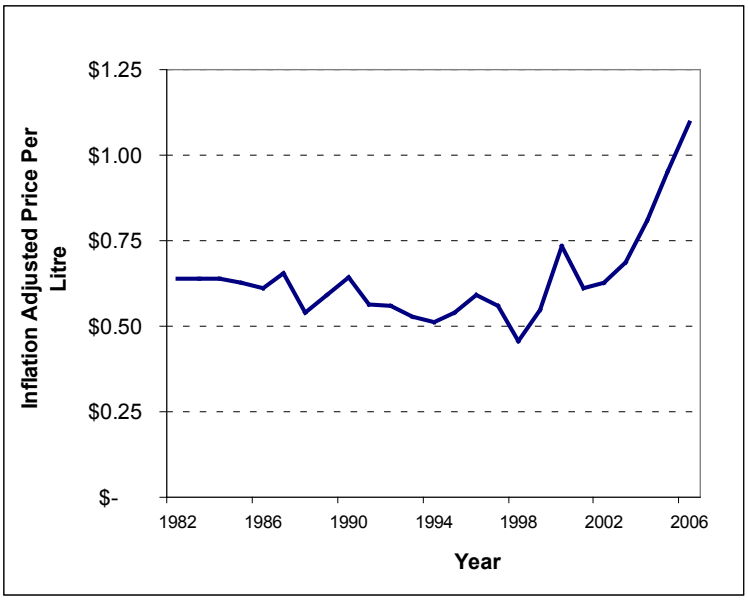


Figure 10. The estimated (inflation adjusted) price of diesel fuel (ex-tax)[7]

Given that a major component of trawling is the fuel cost, the index provided in Figure 11, which estimates the ratio of the value of catch over the cost of fuel, is a telling barometer of the industry's economic health.

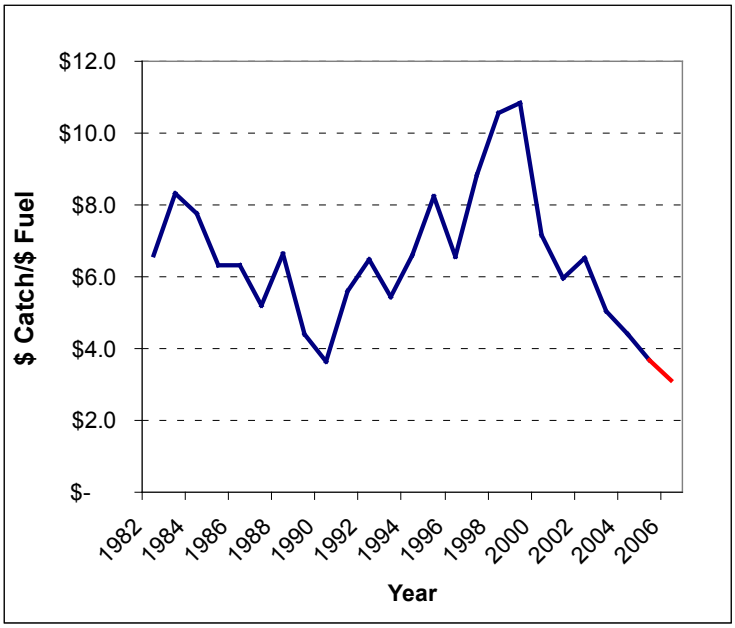


Figure 11. Ratio of catch value/fuel costs over time– prawn fishers

Figure 9 shows that the industry is in a similarly precarious position to that prior to the 1990 fleet restructure where one-third of revenues were consumed by fuel costs.

Clearly, the industry is at a crossroads again, requiring either major amendment to the management controls or a complete change to the system of management, in order to reduce catching costs.

7 Based on the world price of oil and an assumed relationship between that and the price of diesel.

9.5.2 Scallop Trawling

9.5.2.2 Revenue Factors

The Shark Bay Scallop industry has an annual Gross Value of Production (GVP) of about $3 million to $6 million per annum, with one exceptional period in the early 1990s when its value was over $50 million in one year (Figure 13). A-Class licensees (who are only authorised to catch scallops) catch about 70 per cent of the total harvest, while B-Class licensees (who also fish for prawns) catch the remainder.

For the dedicated scallop fishers, production in low abundance years is usually confined to a very short season at the beginning of March (only in recent years) extending for about a month in duration, whereas prawn fishers catch scallops throughout the much longer prawning season. However, the scallop season can be extended if there is a high abundance of scallops.

Usually, after fishing at Shark Bay, the dedicated scallop fishers move to the Abrolhos Islands, where they can catch up to $1.5 million in product per vessel in a good year. The same boats occasionally fish in the State's northern waters or on the south coast at Esperance, depending on the season. However, these options typically form a very small part of the majority of revenue earned by holders of Shark Bay scallop authorisations.

The major feature of the catch in the Shark Bay area is the production 'spike' around 1991, which extended over a period of about three years. This spike has never been repeated, although similar variation has occurred in the Abrolhos Islands in subsequent years.

The prices of scallops have trended in a similar pattern to the prices of prawns, with a peak in 1995 – 1998 and declines in real (inflation adjusted) prices over the last five years (Figure 12).

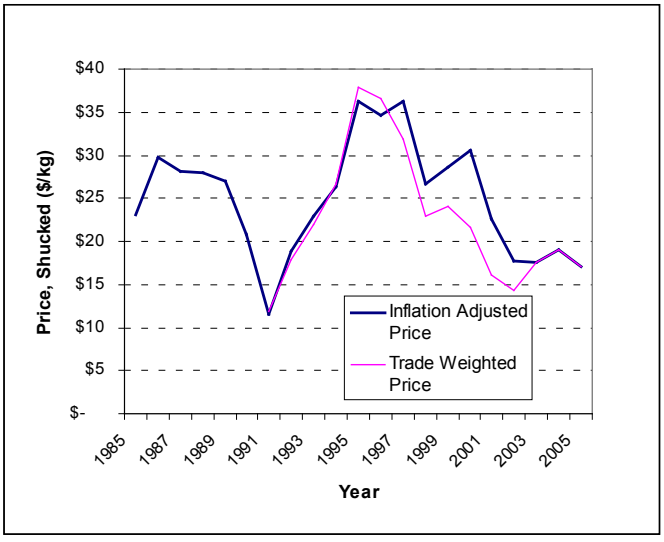


Figure 12. Scallop prices[8]

The variation in scallop prices has been around 120 per cent, compared with a 50 per cent variation in prawn prices over the same period. Combined with the extreme variation in catch over the same period, it is apparent that the scallop industry is subject to much greater economic variability than the prawn industry.

[8] The Trade Weighted Price demonstrates the trend in underlying world prices, with Australian producers being buffered by exchange rate variations in the period 1998 to 2002.

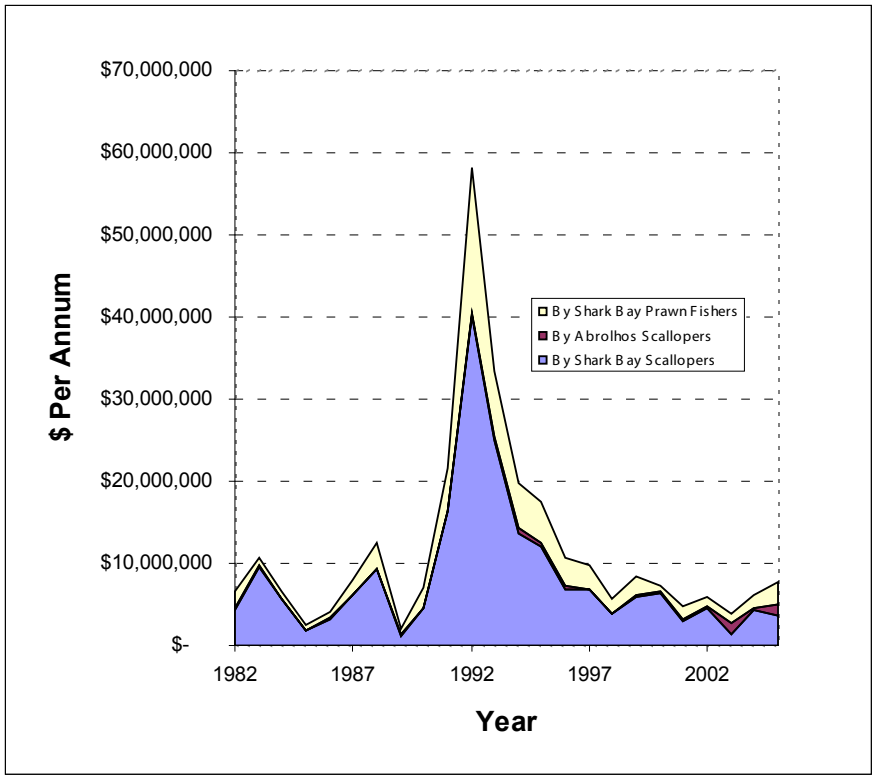


Figure 13. The gross value of production from scallops caught at Shark Bay and the Abrolhos Islands

A-Class and B-Class licensees differ in their behaviour (with the former targeting scallops, while the latter target prawns) and their allowable mesh sizes. Over the longer term, prawn fishers have taken 28 per cent of the total scallops caught, but this percentage has been higher in recent years as overall scallop catches have been lower in Shark Bay (see Figure 14).

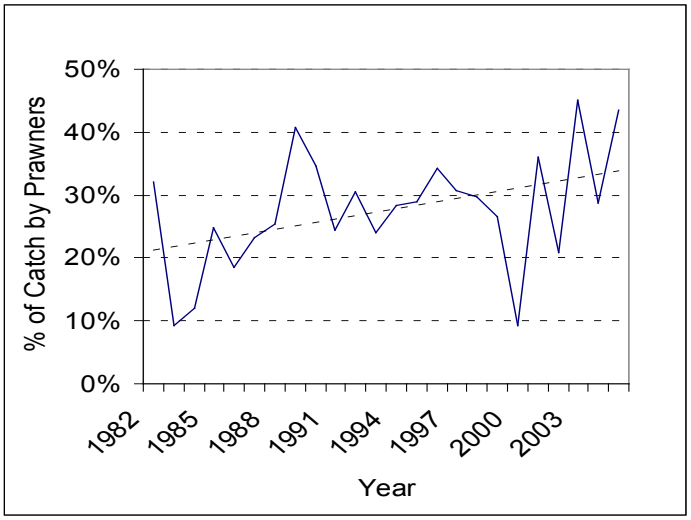


Figure 14. Trend in scallop catch by B-Class licensees

9.5.2.3 Cost Factors

Under the current fisheries management regime, there are two key effort variables in a given season, which fishers can adjust in order to adjust to market and seasonal fishing conditions. These are:

- the hours trawled each day; and
- the number of days trawled in a season.

Other parameters such as net size, spatial allocation of trawled areas and trawling speed can be regarded as 'givens'; that is to say they are either set under management plans or determined by economic fundamentals and therefore not able to be varied much at all.

As is the case with prawn trawling, the cost of scallop fishing is highly dependent on the time spent trawling. However, unlike prawns, the seasonal variability can be considerable and this leads to problems around overcapacity (in poor seasons).

In high abundance years, fishing is limited by the processing capacity of trawlers, so the hours trawled in any given day are reduced as the fishers stop trawling to shuck their catch before moving on for another trawling run. The result in those years of high abundance is a longer fishing season, so more of the available catch can be harvested.

The rate at which shucking can occur depends on the processing infrastructure (including cold storage capacity on the vessel) and the number of deck hands that can be kept on the boat. It is noted that in Shark Bay, there have been no high abundance years since the early 1990s, which means, over the period of the analysis (undertaken to demonstrate the profitability of options), the median year is similar to the average year. However, this is not true for catches from the Abrolhos Islands, with the median year being significantly lower than the average year, over a nine-year period.

Figure 15 is a hypothetical relationship between the maximum fishing capacity of a vessel and the hours trawled in any given day (a 24-hour period).

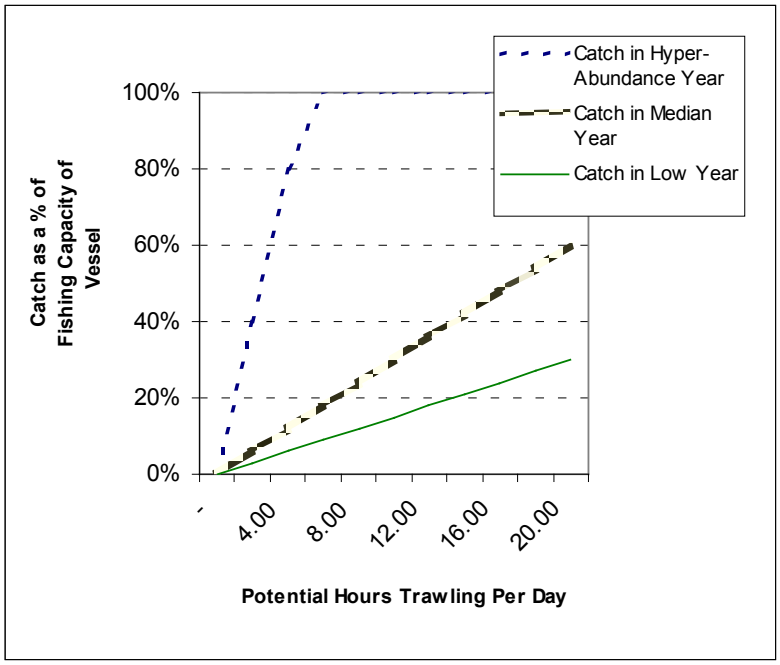


Figure 15. The relationship between fishing capacity and hours trawled

However, hyper-abundance years are the exception rather that the norm and need to be set aside when considering the relationship between catch and hours trawled. Figure 16 shows the linear relationship between the area swept and catch (demonstrated by plotting logbook data that exclude hyper-abundance years).

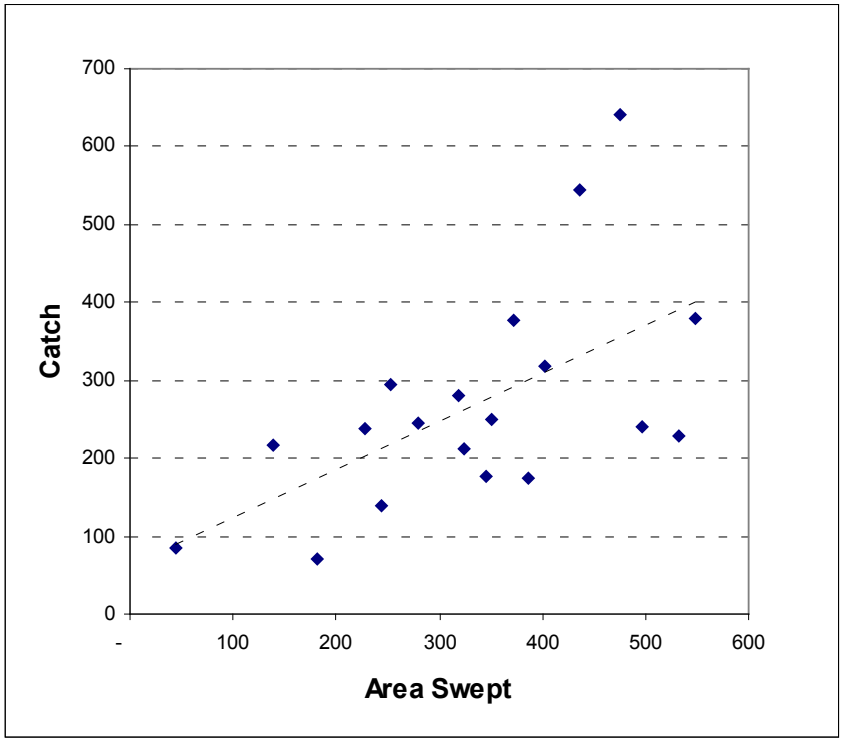


Figure 16. The relationship between catch and area swept

Comparatively, scallop fishers have lower fuel consumption rates than prawn fishers for three main reasons:

1. Scallop fishers use seven-fathom nets (2 by 7) compared to the eight-fathom nets used by prawn fishers.
2. They trawl at lower speeds because there is no risk of scallops escaping nets at speeds of about 2.5 knots, as opposed to prawn fishers who travel at approximately four knots in order to ensure they capture mobile prawns.
3. The mesh size of 100 mm used by scallop fishers imposes less drag compared to the mesh size of 50mm used by prawn fishers.

As a result, scallop trawlers estimate their fuel consumption to be about 60 litres per hour, compared to the 130 litres per hour used by prawn trawlers. In other respects, the fishing activity is the same as prawn trawling.

On the basis of the above, the following index[9] of catch to fuel consumption can be calculated. A logarithmic scale has been used to remove the emphasis the few hyper-abundance years have on the visual representation, so that the more recent trend (which is a downwards one), can be observed more clearly (Figure 17).

[9] Only includes data for A-Class licensees and assumes catches from the Abrolhos Islands are also incorporated on a pro-rata basis to the numbers of vessels operating in that fishery.

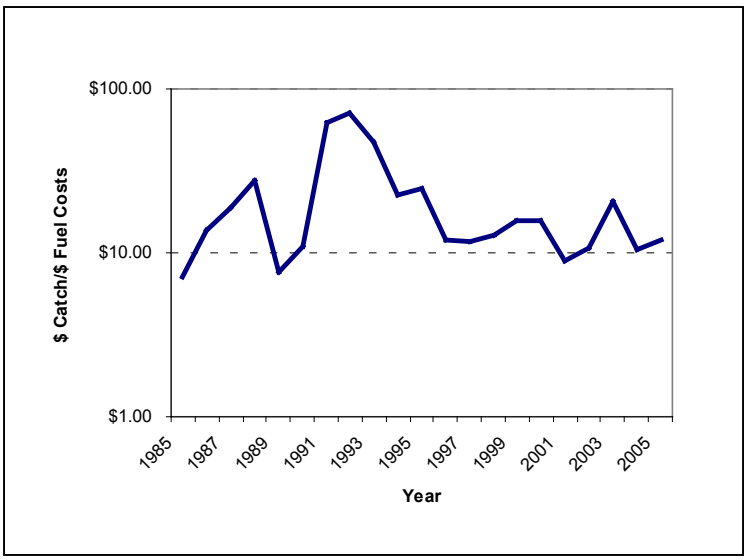


Figure 17 Ratio of catch value/fuel costs over time– scallop fishers

In summary, scallop trawlers are facing similar cost price pressures as the prawn trawling fleet, although their cost and revenue structures are different in some important ways. The important differences are:

- The variability of fishing revenue and costs are much greater in the scallop fleet.
- There is a heavily skewed distribution of catching rates with few good years and many poor years for scallops, whereas the prawn fishery tends to operate more predictably around the mean/median year.
- The Abrolhos Islands fishery provides another source of scallops for the Shark Bay scallop fleet.

In conclusion, there are a number of factors that impact on profitability of prawns and scallop trawling in Shark Bay. However, what is clear is the increased economic pressure being placed on the fleet as costs rise and revenues remain static or even decline. It is important that the fisheries be reformed in order to ensure long-term economic sustainability as well as long-term biological sustainability.

9.6 Scallop Growth-Meat Condition-Reproductive Cycle

The meat condition issues with scallops are closely linked to their reproductive cycle. Scallop meat 'condition' (a term which covers both the weight of the meat as well as its dry tissue content [which varies from around 17 per cent to 25 per cent of the wet weight]) deteriorates as the reproductive season (April to November) progresses.

This is because the tissues of the adductor muscle are used as a store of nutrients to 'power' the production of gametes and the long period of gamete production during the April to November spawning period 'drains' the adductor muscle.

Shell growth also slows over this period (typically from around 90mm shell height). While there is a broad relationship between shell size and meat weight, the outcome of the slowing in shell growth and the fairly rapid changes in meat weight, as tissues are 'drawn off' to power reproduction, is that meat weights can decline even if the shell is getting larger.

The texture and integrity of scallop meat also deteriorates as tissue matter is drawn off to power reproduction, which can impact on product quality (and result in more broken meats).

There are also some local variations in meat condition that modulate the broader scallop meat condition/reproductive cycle relationships. The reasons for this variation are not entirely clear and it is also not clear if it is a consistent pattern from year-to-year.

Denham Sound in particular is often reported to be 'out of phase' with other areas of the fishery (and some of this shows up in the studies reported by Joll and Caputi 1995). An improved understanding of this phenomenon could aid in the 'micro-management' of the scallop fleet and improve yields from the fishery.

9.7 Environmental and Conservation Issues

Under Commonwealth environmental legislation (*Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]), all export fisheries are required to have an assessment of their environmental sustainability.

The Department of Fisheries has published Ecologically Sustainable Development (ESD) reports for both the Shark Bay Prawn and Shark Bay Scallop Fisheries (Kangas *et al.* 2006a and b). These documents form part of the Department of Fisheries' ESD reporting processes and were used as the basis of submissions to Environment Australia (now the Department of Environment and Heritage) to meet the requirements of the Australian Government's guidelines for the *Ecologically Sustainable Management of Fisheries* and to obtain export approval for both fisheries.

The ESD reports relate to performance of the fisheries from an ecological perspective and include reference to the operational objectives, performance measures and indicators that will be used to assess the performance of the fisheries.

The fisheries were awarded export status in 2003 by way of an exemption to Part 13A of the EPBC Act for a five-year period. The Australian Government in relation to these exemptions made a number of recommendations.

The recommendations cover a range of operational matters around consultative and decision-making processes, and recommendations related to byproduct and bycatch. For the Shark Bay Scallop Fishery, it was also recommended that a 'decision rule' to close the fishery or prevent commencement of the fishing season, when recruitment of scallops is sufficiently low, should be pursued as a priority.

This work is essentially complete by virtue of current management processes and decision rules used in the fishery on a season-to-season basis.

The fisheries operate within the Shark Bay Marine Park and World Heritage areas. There is a need to ensure that sustainable fishing practices – which have been demonstrated over the last 40 years - continue to be an important value of the World Heritage Area.

10.0 FUTURE MANAGEMENT DIRECTIONS

10.1 Introductory Comments

The interaction between the prawn and scallop fleets within Shark Bay is a classic example of the complexities and difficulties that face those who operate in and manage fisheries.

A series of previous management decisions and iterations has resulted in two separate fleets under separate management arrangements 'sharing' the same fishing ground and, at times, the same resource. Finding solutions to these types of issues has preoccupied fisheries managers, governments and fishing industries for many years and 'win-win' outcomes are difficult to achieve.

In the situation of the Shark Bay prawn and scallop fisheries, each sector blames, to some extent, the other. The scallopers argue that recruitment failure can be attributed, in part, to the operations of prawn trawlers on historical scallop grounds. In contrast, the prawners argue that there are too many scallop trawlers for economic viability and that scallop fishing impacts on the prawn fishery.

There are few, if any, points of agreement in the industry submissions. It can also be said that these issues are not new and have been around since the formal commencement of the scallop fishery.

The overriding objective of this review is to ensure sustainability long-term and to maximise the overall return to the community from the prawn and scallop resource. For this to be achieved, a new approach is required.

In considering future management directions, it needs to be clearly recognised that the prawn and scallop fisheries operate under separate legal instruments (Management Plans). In this respect, the scallop fishery is of no less legal standing than the prawn fishery and *vice versa.*

It should also be recognised that prawn trawlers are also scallop trawlers with B-Class scallopers (prawners) operating under the same Management Plan as A-Class scallop licensees.

The Department of Fisheries has a responsibility to manage both fisheries for long-term sustainability and community return. There are significant issues in the scallop fishery, in particular such as "priority of access" between A-Class and B-Class licensees and catch sharing arrangements.

There are also historical elements that have resulted in considerable tension within the fleets, related principally to government decision-making associated with the establishment of the scallop fishery.

While history is important and provides valuable lessons, it is perhaps more important to focus on the future to the mutual benefit of (hopefully) both fleets. Without a spirit of co-operation and compromise in resolving inter-fishery conflicts, there is a significant risk that one or both of these fisheries may face serious economic decline.

10.2 Management Options

There is a range of management options available in relation to the Shark Bay prawn and scallop fisheries to address issues associated with the long-term biological and economic sustainability of both fisheries and to deal specifically with the issue of scallop recruitment. Some options are of a lower order and essentially 'tweak' existing arrangements or assist in more micro or real-time management.

Others, however, are more fundamental and represent a real shift in management measures. The majority of the options are focussed on the scallop fishery, given the scallop recruitment issue, and the interrelationship between A-Class and B-Class scallop licensees.

The options need to be considered on their merit, given the knowledge of factors affecting prawn and scallop recruitment and/or fishing mortality or their ability to contribute to that knowledge, their practicality of introduction (including compliance costs), their capacity to achieve or support management objectives, and their economic consequences.

Before considering future management options, there is merit in identifying the underlying principles of current management arrangements, particularly with respect to the scallop fishery.

These are:

- Sustainability of the scallop stock (i.e. ensuring there is adequate breeding stock through development of a catch rate decision rule [or rules], particularly if fishing is allowed before scallops reach maturity);
- Providing access to scallop stocks to both the A-Class and B-Class fleet at an optimum time for meat yield and condition;
- Providing protection to stocks during periods where the size of the scallops and/or meat yield and/or condition are not optimum, through use of closures based on, or a, meat size/ condition decision rule (or rules);
- Providing some certainty and stability around scallop catch sharing arrangements;
- Providing arrangements that will maximise the economic benefits to licence holders, crew and the community.

Minimising the impact of fishing-induced mortality on both prawn and scallop stocks.

The key alternatives for managing the fisheries are set out below with a summary provided at Appendix 1. At this stage, there has been no attempt to determine the 'best' option (or combination of options). This will be a matter to be determined by all parties (the Minister, industry and the Department of Fisheries) once they have had the opportunity to consider and evaluate the options.

10.2.1 Scallop Fishing Season

Since 1994, the timing of scallop fishing in Shark Bay has historically been 'tied' to the prawn fishery. However, in the development of the Shark Bay fishery (i.e. pre-1984) there was no set fishing season, although scallop boats tended to fish in the months when the weather was more benign (March to October).

Prawn trawlers had only been able to take scallops in conjunction with their prawning activities during the prawn season (typically March to November at that time). While they could have fished outside that period for scallops using 100mm mesh nets, they had generally had enough of fishing by the end of the prawn season and were either laid-up or in re-fit immediately prior to the normal opening of the prawn fishery. As a result, the prawn trawlers did not engage in scallop fishing outside the normal parameters of the prawn fishery season (i.e. March to October/November).

Since 1984 the timing of the scallop fishery has been set within the constraints of the prawn season, so that prawn boats were able to continue to take scallops as by-product in their prawning operations (and subsequently as B-class licensees in the scallop fishery). However, this practice

has brought with it the mind-set that the scallop season can only run during the overarching framework of the prawn fishing season.

Given the nature and timing of the scallop reproductive cycle in Shark Bay, and the level of fishing which has occurred in most years, the available 0+ year-class scallop stock has generally been fished down to the point where scallop fishing is no longer economic (for A-class scallop boats) by around July to September.

This economic 'bottom-out' is around 150 – 250 kg (meat) per day –depending on the economic parameters of the boat (crew numbers, fuel usage), although it has tended towards the higher value in recent years as fuel prices have increased. Thus the scallop catch in most years has largely depended on the strength of the incoming recruit group to provide the fishable stock.

In only a few of the last 20 or so years (1984 and 1992 [and maybe 1987]) - when the recruitment to the fishable stock in the previous year was of such a magnitude that it overwhelmed the capacity of the prawn and scallop fleets to fish it down - has the scallop fishery had a significant level of older (1+ age class) scallops present in the fishery.

The reproductive (and to some extent the growth and recruitment) problem is that recruiting scallops (i.e. 0+ age class) do not commence spawning until around mid-April (Joll and Caputi 1995). Therefore, with a scallop fishery that is tied to the prawn fishery season (March to October/November), there is a risk that scallop fishing could commence before the spawning season has begun.

In years of low recruitment, this would severely reduce the overall abundance of scallops (or their density – thereby possibly limiting effectiveness of fertilization) before the scallop stock has had an opportunity to spawn.

It is this scenario which is behind the development of a 'matrix' which, among other things, attempted to deal with the interacting issues of total abundance and the relative abundances of the 0+ and 1+ year classes to determine a start date for the scallop fishery (but only within the mind-set of a March to October/November season framework).

Consideration should be given (at least in 'normal' seasons) to scallops being fished as 1+ age-class animals in the period January to March/April, which would put them into the biologically equivalent phase of scallops at the Abrolhos Islands.

At this time the scallops would be post-spawning, so there would be no issue of scallops being fished before or during their spawning period, the meat condition would be at a premium and moved into their post-spawning and the shells would all be large (which, in combination with the meat condition parameters, would mean a large meat size).

This fishing arrangement could be considered to be a development of the 'matrix', which was not 'constrained' by the timing of the prawn season.

However, there are some problems with such a proposal including-

- The prawn fleet would be cut out from taking scallops, unless they also fished at that time or, alternatively, just took any remaining scallops as by-product to their prawning operations. (Note that, if appropriate catch cut-offs were applied to scallop fishing early in the year, it would be possible to pass some of the 1+ scallop through to the prawn fleet).
- Late 0+/early 1+ scallops would be present on the trawl grounds during the prawn trawling season and, depending on the degree of overlap in prawn and scallop distributions, may be caught by prawn trawlers, who would then have to discard them. (Note also that if this fishing was adopted, then it may be necessary to apply some sort of size limit or other

control to scallops taken by prawn fleet to stop the latter from fishing down the 0+ year-class, which would be the following year's fishery for scallop trawlers).

- In years of hyper-abundance the presence of large amounts of scallops on the trawl grounds could be a real nuisance to prawn trawlers - particularly if they couldn't take them while prawn trawling, although this situation could be resolved by allowing prawn trawlers to retain scallops.
- In years of hyper-abundance, unless scallop stocks were fished down before the scallops got much past April - May in their 1+ year (i.e. moving to become 2+ year class), there could be a return of the problem of nematode blemishes in the meats. The problem occurs with older scallops, as the development of the nematodes is a function of time and the blemishes are not usually overtly expressed until scallops are nearing the end of their 1+ year.
- There is currently nothing in the management plan that allows for A-Class and B-Class licensees to be treated separately when it comes to the areas or times when scallops may be fished in Shark Bay.
- A scallop fishery operating in January to April would probably need to use larger mesh to avoid significant capture of incoming 0+ recruits (which would typically be around 70 – 80mm shell height (SH) at that time).

Despite some of these difficulties, moving the scallop fleet to fish in January – March/April would mean that the scallop fleet was, in general, not trawling during the prawning season or at least when recruiting prawns had moved onto the main fishing grounds).

This would alleviate some of the scallop trawling/prawn interaction issues, although it might create a new issue of scallopers trawling in January – March/April in areas where large prawns occur at low abundance – which are the residual stock from the previous year and form part of the early season fishery for the prawn boats.

One possibility may be to have a much more dynamic approach to setting the parameters for the scallop season (effectively a modified "matrix"), which takes into account low-to-medium recruitment years (when fishing would be in the period January - March) and hyper–abundance years (when fishing could be timed to operate in a balance between a pest-removal mode and a meat size and condition mode).

This approach would also need to be teamed with catch-rate thresholds for the cessation of fishing, rather than just allowing the fishery to effectively close by reaching its economic 'bottom-out, in order to ensure that adequate breeding stock levels and/or densities remained - and, in the case of the A-Class fleet, to leave scallops for the prawn fleet (B-Class fleet) to catch.

10.2.2 Trawl Closure

The submission from the West Coast Trawl Association (WCTA) argues strongly for the implementation of a trawl closure on the main scallop grounds to determine if trawl-induced mortality is the primary cause of recruitment failure in Shark Bay. Indeed, the WCTA considers a closure to be its highest priority.

The WCTA argues that while the impact of intensive trawling on juvenile or emerging scallop populations is difficult to measure, they consider that, given the fragile nature of juvenile scallops, it is highly likely to have an effect. Previous research on this issue has been inconclusive and the extent of trawl-induced mortality on juvenile scallop stocks has not been properly quantified.

The closure would need to be meaningful and attempt to determine, with a degree of confidence,

the impact of trawling on emerging or juvenile scallop stocks. As a result, it would need to be located on historically important or key scallop grounds, of a sufficient size (the WCTA suggests no smaller than 10 nautical miles by three nautical miles), and in place for a sufficient period (the WCTA suggests at least five years). This scenario would provide a reasonable likelihood of a closure being in operation when there was sufficient recruitment to provide a 'signal'.

To support the case for a closure, the WCTA points to the recovery of the USA's sea scallop fishery for the long-lived scallop species *Placopecten magellanicus.*

The Research Division of the Department of Fisheries, to assist this review process, has examined this particular closure. The Research Division has advised that, in this fishery, there was a significant stock decline in the Georges Bank area.

Year-round closed areas were implemented in 1994, as part of a suite of management strategies. The biomass increased in the Georges Bank area by 18-fold and the increase was attributed to the area closures (Hart 2003, Hart and Rago 2006).

However, assessment of a recruitment increase was inconclusive and the long-term mean scallop recruitment in the closed and open areas was similar. The physical effects of trawling and dredging on juvenile scallops were also tested, but no area effect on recruitment was found.

Hart (2003) considers rotational fishing as part of a precautionary strategy rather than a solution to all woes. Rotational closures are only effective in a fishery when size at capture is below optimal and other fishery management measures are not able to manage this issue.

In the Western Australian context, this optimal size of capture may also be attained through other mechanisms; such as a larger mesh size that allows smaller scallops to escape.

Another long-term closure experiment with scallops has been conducted in the Isle of Man (Beukers-Stewart *et al*. 2005). In this case, a closed area and an adjacent fished area have been monitored for a period of 14 years for the long-lived scallop species *Pecten maximus*.

When the scallop closure was implemented in 1989 the overall scallop densities were very low. Once the closure was in place, the abundance increased significantly, in both the open and closed area. By 2003, there was seven times the amount of scallops in the closed area than there had been at the start of the closure.

As would be expected, there was a shift in size and type to a much larger and older stock in the closed area than before. This resulted in both the biomass and reproductive biomass being significantly higher in the closed area. This reproductive output should result in some larvae being exported out of the closure area as well.

It was also demonstrated that juvenile scallops had higher survival and individual growth rates in the closed area than in other places. It was hypothesised that this was due to less fishing disturbance in the former.

There are substantial differences in the life history traits of the two species discussed above compared to *Amusium balloti* – the scallop species that occurs in Shark Bay - which must be recognised. Both *Placopecten magellanicus* and *Pecten* maximus are long-lived species; living up to 20 years of age, and therefore biomass accumulation can be highly positive in closed areas.

For *Amusium balloti* – which generally only live up to two years - very little benefit would occur in biomass increase for closures longer than two years, unless the closure area also results in increased recruitment in closed and/or adjacent areas. Also, in *Amusium balloti*, a high incidence of nematode infestation occurs in older, larger animals and this detracts from their market value.

In Queensland, the introduction of a rotational harvest strategy for *Amusium balloti* commenced in 2001. The effectiveness of seasonal and rotational protected area (SRA) management strategies in stabilising recruitment and maximising yields in the fishery is still being assessed.

The current rotational strategy allows for a nine-month fishing period, followed by a 15-month closure. To date, a highly significant relationship has been found between the proportional increase in scallop catch rate within SRAs in relation to closure duration in years. Queensland authorities currently consider the rotational harvest strategy areas to be a suitable management strategy to ensure the sustainability of scallop stocks (DPI Annual Status Report, 2006).

Given the above, advice from the Department of Fisheries' Research Division suggests that closures may be beneficial if the displacement of effort is not counterproductive in the areas that remain open to fishing. Physical damage to small recruiting scallops may also be an issue, but no study has yet conclusively demonstrated this.

It is likely that repeat recapture and release increases mortality rates and the level of physical damage to juvenile scallops. This means that areas with high recruitment could be closed-off to optimise the good recruitment and enhance the survival of those recruits.

The closure of a reasonable abundance of scallops may also increase egg production if the closure is maintained during the spawning period. However, there is no easy way to measure the success of this strategy, as it is unlikely that the resultant offspring will end up in the closure area due to the length of larval life (two to three weeks) and advection of larvae.

Confounding effects will make it difficult to deduce whether an improvement in recruitment could be attributed to the protection of the spawners in the closed area or due to purely natural environmental factors.

No studies to date categorically state that area closures have resulted in higher recruitment success, even though the biomass has increased in areas closed to fishing in comparison to those generally open to fishing.

In the USA's Atlantic sea scallop fishery, it was indicated that there may have been some evidence of downstream effects of increased recruitment in one part of the fishery, but this was not an overall observation. The 'hit-and-miss' nature of larval settlement may preclude the ability to demonstrate benefits of increased recruitment.

Murawski *et al.* (2000) suggest the incorporation of critical source areas for larval production in any closure scenario. Studies of scallop larval production in relation to hydrographic circulation on Georges Bank (Tremblay *et al.* 1994) have emphasised that some areas may be self-seeding, whereas others are net exporters of larvae widely across the bank and to scallop grounds south and west.

Permanent or long-term closures for spawning protection may increase overall recruitment to the stocks. Additional modelling work incorporating historical circulation patterns and distributions of adult and juveniles scallops is needed to verify the predictive capabilities of these models.

This type of research is part of the Department of Fisheries' Research Division's proposed Fisheries Research and Development Corporation (FRDC) project for Shark Bay, i.e. spatial closures and oceanographic modelling.

No one advocates permanent closures for the primary aim of increasing yield, as increases in recruitment outside the areas must increase sufficiently to make up for the loss of yield in the closed areas. However, permanently closed areas may be appropriate for other reasons, such

as habitat protection, and the reasons for closures or specific closures need to be explicit and understood by all stakeholders.

Although no spawning stock recruitment relationship is evident at current stock levels in Shark Bay, there must be a level to which a stock can be driven that would result in poor recruitment. However, the large variation in recruitment due to environmental conditions makes it difficult to determine the minimum spawning stock level required.

The scallop and prawn fleet in Shark Bay have high fishing efficiency and the capacity to fish down the scallop stocks rapidly. During the Shark Bay survey in November 2006, the amount of residual scallops was minimal, indicating the capacity of the fleet to take the available stock in one fishing season. This indicates that some protection of the spawning stock during the peak spawning period is critical to ensure some spawning success.

Traditionally the prawn boats commenced prawn fishing prior to the opening of the scallop season and the operational areas of prawn and scallop boats have some overlap. When the scallop season opened, both prawn and scallop boats retain scallops.

The scallop boats leave the fishery when catches are economically unviable to continue fishing. The prawn fleet then continue to take scallops until the end of their prawn season (usually November).

As early fishing has been an option in recent years (fishing pre spawning) to take advantage of the better quality meat at this time of year, other mechanisms to protect some portion of the spawning stock (including area closures) may be required as a precautionary measure. There is little protection afforded to the spawning stock of scallops if fishing commences much earlier than the spawning season (i.e. February/March) and then continues all-year.

As a result, catch rate thresholds and/or closures are required to protect the breeding stock. Modelling of larval transport mechanisms may allow for a more strategic placement of a closure area in the future, which may give the best chance of optimising spawning potential.

In summary, the options for closed areas include:

- Protection of 0+ scallops identified in the November surveys - noting there are two parts to the Shark Bay scallop fishing area - Denham Sound and Shark Bay north.
- Denham Sound - this appears to be resolved with early fishing (February/March) by scallop boats only during daylight hours (to minimise prawn interaction) and then complete cessation of fishing at a catch rate threshold, leaving adequate spawning stock and scallops for prawn boats to catch later in the season (but noting that later in the year, scallops tend to be of poor meat quality).
- Northern Shark Bay - this would appear to be at least partly resolved with scallop fishing commencing for both prawn and scallop boats at the same time, until a catch rate threshold level is reached and with a cessation of retention of scallops for the period May – June, although fishing for prawns continues over these grounds. Scallop fishing could then re-commence until the end of the prawn season or cessation of scallop retention could continue to avoid taking sub-optimal scallop meat weights (and with the result that most of the scallops would be available in optimal meat condition in the early part of the following year). However, there is no specific area closure in the northern part of Shark Bay to protect scallops.
- Protection of spawning stock - if used, this would require a large area to offset early fishing (much prior to the spawning season) in all of Denham Sound and Shark Bay. This assumes that spawning is limited or disturbed by fishing.

- Protection of settling recruits after spawning period (i.e. after April/May). This closure would be based on areas where good recruitment has been traditionally observed.

This can be tested with research closures to compare 0+ survival inside and outside closed areas. This should be done for at least two years and, ideally, several replicate areas chosen. There are several scenarios that could arise from the experiment – see the table below.

Age group	Open	Closed	Result
0+	poor abundance	poor abundance	No result can be determined.
0+	good abundance	poor abundance	Closure is not adding any benefit.
0+	good abundance	good abundance	No result can be determined.
0+	poor abundance	good abundance	Closure is likely to be positive.

10.2.3 Formalised Scallop Catch Share Arrangement

Notwithstanding, the highly variable nature of scallop recruitment, management that is based on the control of catch, either overall or proportionally between the A-Class and B-Class fleet, is worthy of consideration.

While not addressing the fundamental problem of poor scallop recruitment, a formalisation of catch share arrangements would resolve one current management 'tension' between the A-Class and B-Class scallop fleets. Subject to the relevant management tool (e.g. catch cut-offs, competitive Total Allowable Catch, etc) this would deliver a sustainability benefit by ensuring that adequate breeding stock remain for spawning.

It should also be noted that even with other management reforms such as fleet or gear adjustment, the issue of 'catch share' would remain between the A-Class and B-Class fleet. There is considerable merit in resolving this issue.

In considering this matter, it is acknowledged that the prawn sector will point to the history of development of the scallop fishery and discussions at the time the scallop fishery was declared limited entry. However, the benefit of providing some certainty to the fleets, with respect to catch allocation and removing the ongoing tension with respect to catch share, has considerable merit and is strongly recommended for consideration.

10.2.4 Quotas

The alternative of output controls (namely individual transferable quotas) could be considered for the scallop fishery, given the potential of output management tools to improve the incentives to cut fishing costs. If other obstacles concerning the management of the fishery and the assessment of compliance could be overcome, output controls (combined with appropriate input controls governing for example spatial and temporal fishing restrictions) might overcome the inefficiencies in gear and lack of flexibility around the unitisation of gear.

On the positive side, quotas could:

- allow fishers to target the most appropriate time to fish, e.g. when prices were highest or catch efficiency was higher;
- allow fishers to use a range of fishing gear and thereby trial fishing innovations more readily (noting the need to ensure data consistency for research purposes);
- possibly reduce some aspects of the compliance effort (although other aspects may be increased);
- potentially provide more direct control to managers over the sustainability of stocks through the setting of a realistic TAC; and

- increase the incentive of fishers to reduce fishing costs, by eliminating (or at least reducing) the incentive to 'rush to fish'.

On the negative side, quotas could:

- be difficult to operate because of difficulties in predicting the catch from one year to the next in order to establish a realistic TAC[10]; and
- potentially add compliance costs in order to more effectively monitor catch and/or provide better stock level predictions.

In the case of the scallop fishery, there is a fairly well developed catch prediction system, which could be adapted to a quota or catch sharing management arrangement.

Further consideration of a quota system could be advantageous, given the potential benefits in increasing fishing efficiency.

10.2.5 Unitisation of Head Rope Entitlement

Under the current management settings, there is considerable inflexibility around the specification of gear (input) controls. Long-term sustainability concerns have obviously been a major factor in the development of restrictive gear options, but inflexibility around how those gear options are unitised, transferred and rearranged on vessels (e.g. combining net entitlements on one vessel) would appear to limit the economic performance of the fleet.

Similarly, changes in the future that prescribe certain configurations of gear and create incentives for fishers to fish hard and as quickly as possible could work against the long-term economic condition of the fishery. This is particularly true in a fishery where the catch-to-effort ratio varies markedly through the season.

More flexible arrangements, such as the unitisation of head rope entitlement, would allow fishers to decide which gear they use at a particular time, provide greater efficiency within the sector and lead to more active trading of headrope entitlement (either in fathoms or as a full complement of nets), as fishers adjusted their operations to suit different economic conditions.

One of the major issues related to this option is the difficulty in calibrating the effort across a range of different gear configurations. Therefore, the calibration of the performance of various gear options would need to be acceptable if greater flexibility was allowed. A number of approved combinations could be developed that provide industry with some flexibility, while still providing the Research Division with meaningful research data.

An illustrative scenario for each sector in relation to gear changes is provided in Appendix 2.

10.2.6 Buy-Back

Given economics and over-capacity issues, consideration could be given to a restructure of one or both fleets, with a view to reducing the number of boats and associated gear entitlement within the fisheries.

A buy-back scheme would allow vessels to leave the industry with compensation, paid for by industry through a Government facilitated buy-back scheme. The economics of such a scheme are supported by the lower interest rate provided through Government guaranteed funds, although these sorts of schemes do impose their own risks on Government.

[10] It would appear that quotas in the Golden Bay Scallop Fishery of New Zealand are rarely met by the actual catch, effectively meaning the TAC has no impact on fishing effort.

Separate discussions are underway by Shark Bay Prawn licensees and A-Class scallop licensees, (in the case of Shark Bay Prawn, discussions are well advanced) with respect to the options for a buy-back scheme in the respective fisheries. It is likely that in one or both fisheries, buy-back arrangements will progress ahead of the final outcomes of this review.

10.2.7 Gear Controls

As a means of improving economic efficiency and minimising gear interactions across the prawn and scallop fisheries, there would be merit in reconsidering scallop mesh size to more closely align mesh size with the target size class. This is related to the timing of the scallop season discussed in 10.2.1 above.

In addition, consideration could be given to the introduction of square-mesh cod ends for the scallop fleet to limit/reduce any impacts on prawns caused by 'filtering' them through the current 'diamond'-mesh scallop nets.

Quad gear or increased headrope of twin gear could also be a mechanism to facilitate "get-in or get-out quickly"-style fishing for scallops (particularly in years of lower stock levels). Given that the prawn fleet is targeting larger size prawns than it did in the 1970s and 1980s, there may be merit in reviewing the mesh size used for prawns.

10.2.8 Single Trawl Fleet

At various times the notion of a single trawl fleet, targeting prawns and scallops, has been informally suggested.

In essence, this would result in an amalgamation of the prawn and scallop fleets, with both having the capacity to take prawns and scallops under one trawl management plan. Whilst this may sound straightforward, in practical terms it is not easy to see how this could realistically be achieved.

While solving some issues, the formation of single trawl fleet would create a range of other very serious and complex management and equity issues, with the benefits unlikely to outweigh the costs. That is not to say that in the long-term, a single fleet is not a desirable outcome and may, in fact, be possible through industry and market-facilitated re-structuring. It is not proposed at this stage as a viable management option.

10.2.9 Integrated Scallop Management

There may be merit in considering management of the State's scallop fisheries on an integrated basis, aligned under a single scallop management plan.

Under this scenario, the WA scallop fishery would be broken into zones, with greater capacity and flexibility for the Department of Fisheries in decision-making (e.g. openings and closings of zones, based on the best overall outcome). Such an approach would also focus management on optimising value across the WA scallop fishery.

10.2.10 Other Measures

There are a number of other, less substantive, changes that could be considered to help improve overall management of the fisheries. These include:

- changes to the Prawn and Scallop Fishery Management Plans to provide greater flexibility for the implementation of spatial and temporal closures, and provision for differing management arrangements for A-Class and B-Class licensee in the scallop fishery; and

- the possibility of daylight fishing only for A-Class scallop licensees to assist in minimising any gear impacts on prawns.

As a final comment, once a future management framework is settled, there is a need to ensure clear understanding of the mode of implementation of the various management options (e.g. legislation, determinations, 'gentlemen's agreements', etc).

There is also likely to be a need for Management Plan amendments and, potentially, for development of an underpinning Ministerial Policy Guideline, particularly in relation to matters such as decision rules.

It is important that licensees within the Shark Bay prawn and scallop fisheries and the Department of Fisheries (including its research and aquatic management divisions) are clear on their respective roles and responsibilities and the overall governance arrangements for management of the fisheries. This will provide for greater certainty and understanding into the future.

11.0 FUTURE RESEARCH DIRECTIONS

As noted earlier, the Department of Fisheries' Research Division has a very strong relationship with industry. Indeed, much of the real-time management within the fisheries occurs as a result of direct communication between operators and Research Division staff.

There have been a number of targeted research programs in the Shark Bay prawn and scallop fisheries over the years, although the results of some have not proved conclusive. The current management settings - including adaptive, real-time management - have also provided a degree of experimentation in relation to questions surrounding scallop recruitment and gear interaction[11].

This review provides an opportunity to identify research work, which may 'put to bed', a number of issues, such as those around gear interaction and the benefit of a closure(s) in the scallop fishery.

An important point in relation to research is that the data derived from the fishery has had a very high degree of comparability and useability because of the high level of standardisation of fishing gear. Fishery-dependent data is one of the key data sources used to manage the fisheries. It is critical that changes in management settings do not result in the loss of comparability of fishery-dependent datasets.

Notwithstanding the above, and as part of the review process, a number of future research needs have been identified which are relevant to both the prawn and scallop fisheries, but with the main focus on scallops.

There is an urgent need to develop an understanding of the level of gear interaction between the prawn and scallop sectors and whether this may be a cause for the recent low scallop recruitment and subsequent catches in the fishery, and if scallop fishing negatively impacts on prawns.

This urgency was noted at a recent workshop that reviewed the research and management needs in the Shark Bay trawl fisheries. Both prawn and scallop sectors support the need to fully and rigorously address the issue of gear interactions in those areas of the fishery where distribution of the target species overlaps.

Several research gaps in relation to gear interactions will be addressed as part of the proposed

[11] However, as noted by the Department of Fisheries in its submission, the uncontrolled nature of these experiments, in the scientific sense, have not been able to demonstrate anything particularly useful.

Fisheries Research and Development Corporation (FRDC) funding application to be submitted for commencement in 2007/08.

The use of adaptive management techniques, such as trialling spatial closures within specific areas of the scallop fishery, will provide key information about the usefulness of such a management approach for the short-lived and sedentary scallop species *Amusium balloti* and to assess the impact of the closures on the capture of migrating prawns.

The proposed FRDC project will be used as a pilot study to assess whether closures can assist to increase scallop recruitment, mitigate the impact of continued release and recapture on mortality, and whether or not area closures could be used as a possible management strategy in the future. Completion of this project should result in information that is required to help optimise the use of these resources and assist to resolve the resource sharing conflicts between sectors within the region.

A further objective of the proposed FRDC project is to develop an understanding of the oceanographic effect on recruitment within Shark Bay, which may assist in determining the reasons for the persistent low scallop stock levels in the bay.

In addition, prawn larval behaviour could also be incorporated to investigate annual variations in prawn recruitment. Developing specific models of water and scallop larval movements within Shark Bay, along with an assessment of relevant environmental variables (e.g. sea surface temperature), would also provide insights into the potential causes of the relatively low level of scallop recruitment in areas that were traditionally reliable scallop grounds.

Analyses of environmental factors such as the Leeuwin Current and sea surface temperatures on recruitment and scallop catches, combined with trends in relation to climate change, will need to be conducted. These analyses can be incorporated with updated analyses of spawning stock-recruitment-environment relationships.

An analysis of improved fishing power is required to ensure that catch rate thresholds used for management purposes remain appropriate. Vessel gear configurations and impact of other boat changes to fishing power also need to be monitored, particularly given the need, as outlined above, to ensure fishery-dependent data remains useable.

A range of other research needs have been highlighted by the Department of Fisheries, including a review of the logbook data and improved Geographical Information System (GIS) analyses, and an analysis of existing data (logbooks and surveys) including assessment of day-night catch patterns for scallops.

In regard to scallops specifically, and in addition to the above, the Research Division suggests that earlier biological studies may need to be supplemented by more recent scallop biological information, particularly meat weight and reproductive cycles in relation to spatial and temporal changes recently observed in Denham Sound, North West Peron and Red Cliff. This could be achieved establishing a commercial sampling program using selected scallop and prawns boats (when scallop boats have left Shark Bay).

13.0 REFERENCES

Beukers-Stewart B.D., Vause, B.J., Mosley, M.W.J., Rosetti, H.L. and Brand, A.R. (2005). Benefits of closed area protection for a population of scallops. *Marine Ecology Progress Series* 298: 189-204.

Hart, D.R. (2003). Yield- and biomass-per-recruit analysis for rotational fisheries, with an application to the Atlantic sea scallop *(Placopecten magellanicus)*. *Fisheries Bulletin* 101: 44-57.

Hart, D.R. and Rago, P.J. (2006). Long-term dynamics of U.S. Atlantic sea scallop *Placopecten magellanicus* populations. *North American Journal of Fisheries Management* 26: 490-501.

Joll, L.M. 1987, The Shark Bay Scallop Fishery Discussion Paper, Fisheries Management Paper No. 11, Fisheries Department, Perth, Western Australia.

Joll, L.M. and Caputi, N. (1995). Geographic variation in the reproductive cycle of the saucer scallop, Amusium balloti (Bernardi 1861) (Mollusca Pectinidae) along the Western Australian coast. Marine and Freshwater Research, vol 46; pp 779-92.

Kangas, M., McCrea, J., Fletcher, W., Sporer, E. and Weir, V. (2006a). Application to Environment Australia for the Shark Bay Prawn Fishery. Department of Fisheries ESD Report Series 3: 128 pp.

Kangas, M., Weir, V., Fletcher, W. and Sporer, E. (2006b). Application to Environment Australia for the Shark Bay Scallop Fishery. Department of Fisheries ESD Report Series 2: 104 pp.

Feng, M., Li, Y. and Meyers, G. (2004), Multidecal variations of Fremantle sea level: Footprint of climate variability in the tropical Pacific. Geophysical Research Letters, 31, L16302, doi:10.1029/2004GLO19947.

Murawski, S.A., Brown, R., Lai, H.-L., Rago, P.J. and Hendrickson L. (2000). Large-scaled closed areas as a fishery-management tool in temperate marine systems: The Georges Bank experience. *Bulletin of Marine Science* 66: 775-798.

Penn, J.W. and Stalker, R. (1979), The Shark Bay prawn fishery (1970-1976). Report (Western Australian Department of Fisheries and Wildlife): no. 38: 38p

Queensland Department of Primary Industry. 2006, Annual Status Report.

Tremblay, M.J., Loder, J.W., Werner, F.E., Naimie, C.E., Page, F.H. and Sinclair, M.M. (1994). Drift of seas scallop larvae, *Placopecten magellanicus* on Georges Bank: a model study of the roles of mean advection, larval behaviour and larval drift. *Deep-Sea Research* 41:7-49.

Appendix 1 Shark Bay Prawn and Scallop Fisheries Management Options

Option	Description	Reason/Basis	Comments
1. Adjustment to scallop season (early start with explicit season finish).	• Early fishing (i.e. in February/March) of 0+ and residuals from previous season (1+), subject to survey results. • Explicit (and fairly high) catch rate thresholds (or total catch taken) for cessation of fishing (season closure). (Refer to Attachment 1 for more detail)	• Maintenance of spawning stock. • Optimise meat yield and condition. • Catch share management tool [refer (3) below)].	• Could incorporate spatial micro management (e.g. Denham Sound versus main grounds). Such micro management is already undertaken. • Needs formalised decision rules for opening/closings. • Note impacts on existing survey/catch prediction model (based on March/April opening). May need season adjustment or re-working. • If leaving higher level of residual stocks, would need to be matched with a increase in catch cut-off. • Would require explicit catch level controls for Catch Per Unit Effort (CPUE) trigger limits in the prawn fleet and the return of scallops to the water by the prawn fleet during the prawn season once those triggers had been reached.
2. Trawl closure.	• Implementation of a trawl closure [prawns and scallops] for at least three years. Could be open in February/ March/April period for early prawn and scallop fishing but then closed.	• Assist in resolving research question around scallop recruitment and impact of trawl gear.	• Current Fisheries Research and Development Corporation (FRDC) project proposal. • Closure area and timeframe needs to be meaningful. Permanent area needs to be positioned in area of high likelihood of scallop recruitment, but there also needs to be scope to include any areas of high scallop abundance on an adaptive basis from year-to-year. • Prawns will migrate through closure area and hence still be available to prawners, provided areas into which prawns migrate are open for the purpose of catching those prawns. • Longer term closure (need and area) subject to research results.

Option	Description	Reason/Basis	Comments
3. Catch Share.	• Introduction of a formalised catch share arrangement based on competitive Total Allowable Catch (TAC) (in-season) or catch cut-offs (established pre-season).	• Will deliver sustainability benefit by leaving spawning stock and resolve catch share issue. • Note that catch share outcome is dependent on having the threshold level correct to provide the catch level. Initially, the survey data may not provide accurate catch share amount(s).	• Could be based on average catch share over history of scallop limited entry fishery. • Would need to be on an annual basis. • Some compliance issues, although less with a competitive TAC than with Individual Transferable Quotas (ITQs). Need daily reporting and total landing reconciliation. • Competitive TAC would need to be set on a precautionary basis in the initial years, due to uncertainty in the accuracy of prediction. • Could be incorporated with Option 1 as the control on catch levels by the two fleets.
4. Quotas (scallops).	Individual transferable quotas	Economic efficiency	Various pros and cons
5. Unitisation of head rope entitlement.	• More flexible gear arrangements, which could be considered across both fleets. • For prawn fishery, consider progressing unitisation as a matter of priority (noting flow-on to B-Class scallop licensees) together with rationalisation of gear configurations across the fleet. • For scallop fishery, consider unitisation including possible capacity for fleet contraction in 'poor' years and expansion in 'good' years. Need to couple unitisation with rationalisation of gear configurations across the fleet.	• Primarily economic efficiency. • May get some fleet reduction by way of gear amalgamation. • Some catch share implications if there are changes in relative ratios of headrope between fleets. • May allow for flexibility in fleet size within the current limited entry parameters.	• Need level of standardisation for research purposes. • May need to include a gear 'discount' or net reduction as part of unitisation process. • Should be matched with gear unitisation in the Abrolhos Islands. • Requires that Catch Per Unit Effort (CPUE) thresholds be recalibrated to the new gear.

Option	Description	Reason/Basis	Comments
6. Buy-Back.	• Industry-driven re-structure through industry funded buy-back (direct buy-out of licenses and net allocation).	• Fleet rationalisation. Reduction in capacity. • Economic efficiency. • Reduction in real fishing effort with sustainability benefits.	
7. Gear Controls.	• Reconsider scallop mesh size (i.e. need appropriate mesh size to take target size class). Note linkage to Option 1 above. • Consider square mesh cod end for scallop fleet (size?). • Consider quad gear (as part of the unitisation process). Linked to Option 5 above. • Review prawn mesh size.	• Minimise any scallop gear impacts on prawns. • Improve economic efficiency and/or size selectivity.	• Proposed FRDC proposal will address much of this. • Could consider trials initially of 100mm mesh. • Needs to be examined in the context of any season shifts and for changes in target sizes.
8. Single trawl fleet.	• A formal merger of the two Management Plans to establish one Shark Bay trawl fishery.	• Minimise gear interactions. • Economic efficiency.	• Not considered a practical, realistic option. • Could be a long-term possibility, particularly with internal re-structuring within and between the fleets.
9. Integrated scallop management.	• A formal merger of all the existing scallop fisheries to create one Scallop Management Plan, with a number of zones within the fishery (alternatively, focus on a formal integration of Shark Bay and Abrolhos Islands fisheries).	• Benefit would be greater capacity and flexibility of the Chief Executive Officer of the Department of Fisheries in his decision-making (e.g. openings and closings of zones based on best overall outcome). • Would focus management on optimising value across WA scallop fishery.	• May have implications for those licensees who do not hold other scallop authorisations. • Would formalise what we try to do presently.

Option	Description	Reason/Basis	Comments
10. Management Plan adjustments.	• Need greater flexibility in Management Plan for spatial/temporal closures and for ability to implement different management arrangements for A-Class and B-Class licensees.	• Management flexibility. • Can be used as one tool for catch-sharing outcomes.	
11. A-Class daylight fishing only.	• A-Class daylight fishing only.	• Minimise any gear impacts on prawns.	• Possible option to consider in the absence of more substantive measures such as unitisation and catch share arrangements. Could be used while gear interaction issue is worked through. • Probably more of a tool to be used on occasions. • Currently in place in Denham Sound. • May have efficiency impacts and therefore may need to increase gear size to offset these efficiency changes. • Possible marine safety issues with anchored scallop vessels at night and mobile prawn vessels. • Could cause nasty fleet interactions.
12. Governance issues.	• Once management framework settled, need: - Clear understanding and processes for legislative gazettal's, determinations and gentlemen's agreements. - Need Management Plan amendments. - May need underpinning Ministerial Policy Guideline.	• Clear understanding by both fleets and Department of Fisheries of processes and decision rules.	• Need an agreed and robust process for industry consultation.

Management Option – Adjustment To Scallop Season (Early Start)

NB: This is indicative only. If considered worthwhile as a management option, then full details would need to be mapped out with industry.

- Overriding philosophy for the timing of the opening [and closing] of the scallop season is:
  - maintenance of scallop spawning stock (i.e. to ensure an adequate level of spawning stock is present during the spawning season);
  - optimisation of meat yield and condition; and
  - equitable catch share outcomes.
- Subject to annual survey results in November, the opening date would be determined taking into account the abundance of pre-recruits (0+) and residuals (1+). Note that Denham Sound and the rest of Shark Bay could be treated separately.
- Following the November survey, the 'decision steps' would include:
  1. If *good* (i.e. high abundance) survey result for 0+ (or residual 1+) [need decision rule here], then look at modal/mean size classes within the 0+ population. If *large* (i.e. 60+mm mode) and abundant 0+ then move to an early opening in February/March. If *smaller* (i.e. 50 - 60mm mode) open in March/April (to allow for some more growth). Fishery should then be closed at a certain point to retain spawning stock, based on a decision rule (e.g. kg per hour or catch share taken) adjusted by the headrope used (if unitised) or the different mesh size used.

     Under this scenario, the option is open for differing arrangements for the A-Class and B-Class fleets. A decision could be taken to close the fishery to A-Class licensees but leave it open to B-Class licensees to take their share later, as they commence prawn fishing. A decision rule for closure of the fishery to B-Class and, consequently the fishery overall, would also be required. This approach would require formalisation of the catch sharing arrangement between the two fleets. If no formal catch share arrangement is in place, then it is suggested any opening or closing dates for the fishery should apply to both the A- and B-Class licensees.
  2. If *medium* or *low* abundance of 0+ survey result (i.e. low recruitment or smaller size classes), the fishery should not be opened at all - a decision rule is needed - or only opened for a limited period - possibly April (with smaller 0+ size classes in the November survey) or March (with larger 0+ size classes in November survey). The use of larger mesh nets could also be required to shift catch towards taking only residual 1+. A separate decision rule would also be required overall for a seasonal closure of the fishery.
- The above decision steps are summarised in the table below (noting further issues of details would need to be considered, in liaison with industry).

Estimated catch/survey result (tonnes)	Abundance/condition of recruits (0+)	Abundance/ condition of residuals (1+)	Indicative opening – A Class	Indicative opening – B Class
High >500t	High >300t (abundant and/or large 0+)	>200t	February/March	Early/late March, but dependent on moon phase
Medium <200t	Medium <100t (less abundant and/or smaller 0+)	<100t	Limited opening – March/April	Limited opening – March/April
Low <100t	Low <50t (low abundance)	< 50t	Close	Close

Appendix 2 Unitisation Of Head Rope Entitlement – For Illustrative Purposes

Possible Gear Changes - Prawns

Gear configurations could be amended in the prawn fleet such that trawling capacity is increased, thereby allowing for the structural adjustment of the fleet from 27 vessels to, say, 18 vessels.

In this scenario, options would include amending the specifications of gear from two nets of eight fathoms in length to four nets of 5.5 fathoms in length. It is assumed that this configuration would result in a 50 per cent increase in the catch per vessel, partially resulting from the increase in headrope and partially from an increase in the overall share of available prawn stocks.

In order to reflect this, it is assumed there would be a 20 per cent increase in the hours trawled.

Under this new scenario, in a median year, the average vessel would earn around $1.34 million in revenue (including scallop catch). In average years, this figure would be around $1.49 million.

These revenues result in an estimated median net profit of about $688,000, which is an improvement of $244,000 per vessel, based on the following assumption:

Vessel cost	$550,000 (depreciated at 13 per cent per annum)
Annual refit cost	$100,000
Administration	$30,000
Insurance	$30,000
Annual licensing costs	$35,000

Labour at 25 per cent of catch value

Fuel at $150 per hour

This corresponds to a 12 per cent return on investment in median years and a 13 per cent return on investment in average years if it is assumed that gear entitlements are worth $5.2 million[12] after the consolidation of entitlement value (on a ratio of 27:18). While the reform does not significantly alter the return on investment (from 11 per cent to 12 per cent), it importantly increases net profit per vessel.

The driving factor behind increases in profitability is the reduction in fixed costs required per kg of prawns caught.

Possible Gear Changes: Scallops

Similar to the prawn proposal, scallop gear configurations could be amended to increase trawling capacity, thereby allowing for the structural adjustment of the fleet from 14 vessels to, say, and nine vessels.

In this scenario, an option could include amending scallop gear specifications from two nets of seven fathoms in length to four nets of 4.5 fathoms in length. The analysis below has been undertaken on the assumption that trawling hours would need to be increased by 56 per cent, which is the ratio at which the fleet is reduced and a higher ratio compared to that assumed in the prawn industry (20 per cent increase in trawling hours).

It is assumed also that this configuration would result in a 50 per cent increase in the catch per

[12] Indicative only. Figures will depend on the capital value of entitlements.

vessel, partially resulting from an improvement in the average catch and availability of scallops as more vessels leave the fishery.

Under this scenario, in a median year, the average vessel earns around $510,000 in revenue. In average years, this figure is around $736,000.

These revenues result in an estimated median net profit of about $110,000 (and average profit of $264,000), which is an improvement of $76,000 in median profit, based on the following assumptions:

Vessel cost	$250,000 (depreciated at 13 per cent per annum)
Annual refit cost	$60,000
Administration	$30,000
Insurance	$30,000
Annual licensing costs	$20,000

Labour at 25 per cent of catch value

Fuel at $75 per hour

This corresponds to a four per cent return on investment in median years and a eight per cent return on investment in average years, if it is assumed that gear entitlements are worth $3.1 million13 after the consolidation of entitlement value (on a ratio of 14:9). While the reform does not significantly alter the return on investment (from two per cent to four per cent in median years), like prawns, it importantly increases net profit per vessel.

[13] Indicative only. Figures will depend on the capital value of entitlements.

Appendix 3 Submission on draft review of Shark Bay and Scallop Fisheries prepared by the West Coast Trawl Assocation, 13 July 2006

REVIEW OF SHARK BAY PRAWN AND SCALLOP FISHERIES

Submission prepared by: West Coast Trawl Association
13th July 2006

Introduction

All stakeholders should welcome the opportunity to participate in a review of the two trawl fisheries in Shark Bay. Licensees in both the prawn and scallop fisheries acknowledge that today's fisheries operate in a difficult business climate. While the price of our products remains constant or falls, the cost of our key inputs such as fuel, insurance, labour and vessel maintenance continue to rise. If these trends continue, this cost-price squeeze will further erode the profit margins of all operators and inevitably the future prospects of the entire industry will have dimmed.

It is against this broader backdrop that the Department's Review of the Shark Bay Trawl Fishery must be an uncompromising and independent assessment of the prospects and long term profitability of the respective prawn and scallop industries. For the sake of both industries, the Department needs to establish a regulatory environment and develop management arrangements which allow operators to maximize the combined value of the prawn and scallop catch and minimize the costs of harvesting that catch within a framework of sustainability.

The West Coast Trawl Association (WCTA) maintains that securing the future of the scallop fishery in Shark Bay is pivotal to the long term viability of both prawn and scallop industries. This submission considers that past and present management strategies have failed to unlock the potential of the scallop resource in Shark Bay. Whilst acknowledging that environmental conditions are the primary driver of recruitment success, central to this submission is an assumption that considered management intervention is crucial to the recovery of the scallop fishery. In this context, the development and implementation of specific strategies to enhance the scallop resource is the single most important issue for Shark Bay. Whilst there are certainly other claims, the potential gains from a more productive scallop fishery offer significantly greater returns to the prawn and scallop industries in the medium to long term. By restoring some balance in the management arrangements for the two fisheries and working towards an objective of developing the scallop resource, the Department can take an active role in establishing a sound foundation for the sustained profitability of the Shark Bay Fishery.

The Decline of the Scallop Fishery

In 2006 Shark Bay's 14 Class A vessels fished for a total of 32 days. 20 of these days were spent daylight trawling in Denham (historically the least productive area in the fishery), leaving a total of 12 fishing days on the main scallop grounds in the northern areas of the fishery. The total catch for the Class A fleet in 2006 is estimated to be in the order of 140 tons, with only 40 tons being sourced from the main grounds in Red Cliff and Nor West Peron. By any measure it was an extremely poor result from one of the State's major commercial fisheries.

Whilst the experience of a poor season is always disappointing for licensees and the skippers and crew who operate their vessels, it should not necessarily be cause for major concern. Scallop fisheries throughout the world are known to experience highly variable recruitment as a result of environmental factors (Joll and Caputi 1995: 47). In this regard, a poor season can be viewed as a natural down turn in the cycle of rising and falling catches which are, in turn, caused by fluctuations in environmental conditions.

Any honest assessment of the Shark Bay Scallop fishery will acknowledge that the fishery's problems are deeper than "the occasional poor season". The fishery has performed poorly for

over a decade, it being 11 years since the total annual catch exceeded 400 tons. If highly variable recruitment is considered a key characteristic of commercial scallop fisheries, then the catches of the last 11 years indicates that the Shark Bay Fishery is now devoid of this core and defining feature.

The WCTA's dismay with the performance of the Shark Bay Scallop Fishery should not be confused with disappointment that the spectacular scallop recruitment seen in the early 1990's has not been repeated. The period from 1991 to 1995 is regarded as the 'golden era' for the Shark Bay Scallop Fishery. During this period scallop vessels operated in Shark Bay for periods of up 6 to 7 months and in 1992 landed catches in excess of 200 ton per vessel. This period revealed the maximum potential of Shark Bay as a commercial scallop fishery when all of the environmental conditions are favourable. While the scallop industry would be delighted with a return to such times, it is certainly not the source of its consternation.

A rigorous analysis of the Shark Bay Fishery would begin by comparing the catch data from two distinct periods of time. By comparing the catch from the last 11 years (the period between 1996 and 2005) with the catches that were achieved in the 8 years between 1983 and 1990, the WCTA believes it is possible to fathom the full extent of the fishery's decline.

Comparison of Average Shark Bay Catches: 1983 to 1990 and 1996 to 2005[1].

Catch Period	Prawn Catch				Scallop Catch				
	King	Tiger	End	Total	Class B	Class A	Total	Min	Max
1983 to 1990 Average Annual Catch	1,390	312	14	1,716	93	340	433	121	731
1996 to 2005 Average Annual Catch	1,363	568	11	1,942	90	210	300	155	384

The above table shows that the prawn fishery is performing exceedingly well. The catch of king prawns is relatively constant between the two periods and the catch of tiger prawns has improved significantly. The catch of scallops, on the other hand, has declined quite dramatically. Importantly, the table reveals that the minimum and maximum catch range for scallops has also narrowed. For example, the catch range from the period between 1983 and 1990 is more than 2.5 times greater the range we have seen in the last 11 years. Clearly, Shark Bay no longer exhibits the key characteristic of highly variable recruitment that is the hallmark of a vibrant scallop fishery. With the scallop resource so obviously in decline, it is imperative that we seek an explanation for this condition.

Environmental Conditions and Scallop Recruitment in Western Australia

Prior to 1991 the relationship between recruitment success in the Shark Bay Scallop Fishery and episodes of weak Leeuwin Current was shown to be very strong. The years of good recruitment in 1982, 1987 and 1990 all corresponded with the onset of El Niño Southern Oscillation (ENSO) events which, in turn, are considered to be associated with years of weak Leeuwin Current (Caputi et al 1995: 43). A number of studies have identified the strength of the Leeuwin Current as the primary factor in determining the level of scallop recruitment in Shark Bay. Although

[1] Historical catch data supplied by Department of Fisheries Trawl Research.

these studies could not determine the precise mechanism by which the Leeuwin Current influenced recruitment success in Shark Bay, it was possible to strongly suggest that in years of weak Leeuwin Current, scallop recruitment would be typically strong and the following season's catch would be very high (Lenanton et al 1991: 111). Further studies indicated that episodes of weak Leeuwin Current were also an important factor in recruitment success in the Abrolhos Islands scallop fishery (Caputi et al 1998: 43). Importantly, the relationship between these two variables was shown to be weaker in the Abrolhos than in Shark Bay.

Having identified the Leeuwin Current as the environmental factor responsible for driving scallop recruitment success in Shark Bay, is it possible to conclude that a decade of poor catches is simply the outcome of a persistent climate of unfavourable environmental conditions? Since 1991 a total of four ENSO events and episodes of weak Leeuwin Current have been recorded, with ENSO events being observed in 1993, 1997, 2002 and 2004 respectively. While there was clearly some positive impact on recruitment in the Abrolhos, most notably in the record breaking 2003 and 2005 seasons, there were no discernible impacts on recruitment in Shark Bay. In these circumstances, why has Shark Bay failed to experience good scallop recruitment when environmental conditions have clearly been favourable?

Environmental systems are complex by nature and the strength of the Leeuwin Current is only one of a number of factors to consider. While the relative importance of micro-environmental conditions, such as wind strength and water temperature, on recruitment success needs to be considered (Caputi et al 1998: 43), it is ultimately difficult to ignore the claims of Leeuwin Current strength as the main environmental driver. Irrespective of the potential role of micro-level impacts, in circumstances where prior to 1991 three ENSO events delivered three very high recruitments, it seems highly improbable that four ENSO events over an eleven year period should prove incapable of producing even one year of strong recruitment.

In the 2003/04 edition of its *State of the Fisheries Report*, the Department boldly predicted that:

"*The recovery of the [Shark Bay Scallop] fishery to average catch levels (similar to those before the peak years of 1991-1993) is expected if environmental conditions (including the El Niño /Southern Oscillation index) become favourable*"[2]

Despite the Department's optimism the anticipated recovery of the scallop fishery has not materialized. As managers of the Shark Bay Fishery, the persistence of recruitment failure presents a real conundrum for the Department.

The WCTA believes that it is time to move beyond a management framework that is based exclusively on the hope or expectation that favourable environmental conditions alone will deliver good scallop recruitment to Shark Bay. In these circumstances it is time to investigate the possibility that a more robust management system is needed and that other, possibly non-environmental, factors have a far more important role in determining scallop recruitment than has previously been considered.

[2] 'Shark Bay Scallop Managed Fishery Status Report', State of the Fisheries Report 2003/04, Department of Fisheries (p 85-87): page 87.

Recruitment Failure and the Class A Fleet

An investigation into other, non-environmental, causes of recruitment failure should begin with an assessment of the operations of the scallop industry. The 14 Class A vessels trawl almost exclusively for scallops. These vessels catch very few by-products (mainly blue swimmer crabs and bugs) and, on average, take in the order of 72% of the total scallop catch in any given year. However, in poor catch years, the Class A fleet generally takes a smaller proportion of the available catch and conversely the Class B, or prawn, fleet a larger share.

It has been suggested that overfishing by the Class A fleet is chiefly responsible for the ongoing recruitment problems in Shark Bay. Advocates of this view believe that the scallop industry starts each season with the aim of "taking every last scallop" and subsequently not enough scallops are left in the waters for spawning purposes. An assessment of the historical catch data and a clear understanding of the operations of Class A vessels will reveal that this proposition does not withstand close scrutiny.

The Class A fleet's operations is based broadly on a "get in and get out quick" principle. The tendency for scallops to settle in concentrated patches allows the resource to be fished with reasonable efficiency and 14 modern trawlers, with a capacity to carry up to 13 crew, are capable of harvesting an available resource in relatively quick time. With up to 27 prawn vessels also being authorized to take scallops, the bulk of the catch can be harvested over a very short period. Even in big catch years the scallop fleet will leave Shark Bay well before the formal close of the fishery and scallop vessels historically continue to fish to a catch level of 150 kg per 24 hour period. When the catch falls below this mark the licensee, skipper and crew generally lack any financial incentive to continue fishing and vessels subsequently opt to leave the fishery.

While fishing effort will vary with differing circumstances, the historical catch data suggests that the impact on total scallop stocks is not related solely to the efforts of the Class A fleet. By comparing the outcomes of the 1997 season with the outcomes of the 2003 and 2005 seasons, it is possible to assess the impact of contrasting fishing strategies employed by the Class A fleet on total scallop stocks.

In 1997 good market conditions (strong demand and high prices) coincided with the worst season ever recorded at the Abrolhos Islands. In this environment the scallop industry showed a willingness to apply significantly more fishing pressure in Shark Bay. Most Class A vessels averaged close to 75 operating days in the fishery (a reasonably high number considering the annual catch for the year was only 328 tons) and operated at a catch rate of 12.1 kg per hour. With the offer of higher prices there was financial incentive for Class A vessels to continue fishing beyond the general 150 kg 'rule of thumb' and stocks were clearly fished down to a lower than usual level[3]. While it is possible to see this as an example of the Class A fleet's propensity to overfish the resource, a closer look at the data reveals a wider problem. It is important to note that the prawn fleet also took 100 tons or 30.7% of the total scallop catch in the 1997 season. Thus despite a noticeable increase in effort from Class A vessels, the prawn fleet still maintained its historical share of the scallop catch. Indeed, the breakdown in catch suggests that both prawn and scallop fleets – no doubt equally motivated by the prospect of higher scallop prices – were equally determined in their efforts to catch their share of the limited scallop

[3] Shark Bay Scallop Historical Catches supplied by Department of Fisheries.

resource. In these circumstances, the 'problem' of overfishing[4] is not strictly limited to the Class A fleet, but applies to both prawn and scallop industries.

The 2003 and 2005 seasons saw the Class A fleet take the concept of getting in and out of the fishery quickly to absurd new levels. With the landing of record catches in the Abrolhos Islands, Class A vessels applied considerably less fishing effort in the Shark Bay Fishery in the 2003 and 2005 seasons. During these years the catch rate for Class A vessels was an exceptionally high 53.5 kg and 44.4 kg per hour respectively and stemmed from the decision of the Class A fleet to leave the fishery and focus on the better catches that were available at the Abrolhos. Yet despite the fact that the Class A fleet left more scallops in the water during these years, the residual index in the following year's pre-season survey was not noticeably higher. The fact that the Class A fleet left more scallops in the water simply resulted in the prawn fleet taking a greater share of the catch. The scallops were still harvested, but by prawn and not scallop vessels. Thus in the light of the 2003 and 2005 seasons it would appear that an argument for the Class A fleet to leave more scallops in the water is a measure which simply enables the prawn fleet to increase its share of the scallop resource.

Whilst history suggests that the fishing impact of the Class A fleet is somewhat overstated, an assessment of the actual operations of the scallop fleet reveals that its potential to impact heavily on scallop stocks is limited by the relative inefficiency of the gear it employs. With smaller boards, nets and larger mesh size, scallop vessels are far less efficient than prawn vessels in terms of their capacity to catch scallops[5]. Scallop vessels take only a very small quantity and range of by-products and importantly do not catch prawns. Put simply, the productivity of Class A vessels is driven almost entirely by the ability to catch scallops. When these factors are combined, it is clear that prawn vessels have a far greater capacity to fish scallop stocks to low levels than the scallop fleet possesses. Prawn vessels use gear that is more efficient at catching scallops, is more able to catch smaller scallops by virtue of the smaller mesh used in their nets, and is capable of fishing for extended periods due to the mix of products (prawns, scallops and by-products) that they are able to catch. Indeed, with the prospect of additional prawn vessels converting to the use of quad gear, the ability of prawn vessels to operate at lower catch levels is further enhanced and the potential threat to scallop stocks is increased.

The importance of retaining adequate stock levels for recruitment success in Western Australia's scallop fisheries remains a contentious issue. Whilst it is obvious that some level of stock abundance is needed for breeding to occur, how many scallops are actually required to replenish stocks to a high level? In a situation where the Abrolhos Islands has demonstrated a capacity to generate very high catches from very small residual populations[6], it is understandable that researchers from the Department struggle to observe any statistically significant relationship between stock levels and recruitment[7]. Notwithstanding the actual validity of these claims, if overfishing scallop stocks is a serious problem in Shark Bay, it is clear that the operations of the prawn, and not the scallop fleet, pose the gravest threat. However, irrespective as to which sector should carry a greater portion of the blame, it is abundantly clear that there needs to be a

[4] To accept that 'overfishing' is a problem, it is first necessary to reject the view that there is no relationship between stock and recruitment in this Fishery.
[5] Class A vessels have greater processing power than prawn vessels by virtue of their ability to carry additional crew. This is a different concept to fishing or catching ability.
[6] In the record breaking 2003 and 2005 Abrolhos seasons catches exceeding 1,100 tons were generated from small populations. In the seasons prior to these boom catch years, the fishery yielded catches less than 30 and 40 tons respectively. Of course, in the Abrolhos Islands a fleet of vessels do not trawl continuously on the scallop grounds during the key spawning and settlement periods.
[7] 'Application to Environment Australia for the Shark Bay Scallop Fishery', Department of Fisheries. Page 52.

focus on the total catch from both scallop and prawn industries. Clearly both fleets combined are capable of exerting greater fishing effort on the scallop resource and that past and existing management arrangements have demonstrated no capacity to address this issue. It is an obvious conclusion, but without the establishment of specific closure areas for the scallop fishery, the scallop resource will continue to remain vulnerable to overfishing by both prawn and scallop fleets.

Changes to the Management Arrangements of the Prawn Fishery

On face value, asserting that the prawn fleet is responsible for the malaise of the scallop fishery would appear way off the mark. The last 15 years has seen an enormous reduction in total fishing effort. A buy-back in 1990 saw 8 vessels taken out of the fishery, reducing the prawn fleet from 35 to 27 vessels. While the implementation of extended moon closures in recent seasons has also played a role in reducing total effort, particularly towards the end of the season. It can be rightly claimed that the prawn fleet today trawls fewer hours than ever before. Given this environment of total effort reductions, how is it possible to speculate that the prawn fleet is possibly the root cause of recruitment failure in the scallop fishery?

A reduction in total effort is, however, only part of the story of management change in the prawn fishery. Over the course of a 15 year period the Department has overseen the introduction of a series of spatial and temporal closures which have sought to maximize prawn size and value at capture while also securing appropriate spawning stock levels in order to maximize the recruitment of prawns in the following year (Kangas et al 2006: 15). The introduction of the Carnarvon-Peron Line in 1991, the decision to establish Tiger Prawn Spawning Areas in 1996 and the northward drift of the closure areas which are applied to Denham Sound at the start of the season are the main reforms to have been initiated by the Department. These changes have effectively evolved over a 15 year period and have radically altered the distribution of fishing effort by the prawn fleet.

The accumulative impact of these changes has seen a significant transfer of trawl effort onto the western grounds of the Bay – that is, onto areas which are regarded as the historical scallop grounds. It is not suggested that prawn trawlers today operate in an area that they had never previously fished. The prawn fleet has, to a limited extent, always worked these grounds. However, the manner in which they fish today bears little or no resemblance to the fishing patterns that were followed in the past.

At the start of a new season, prawn vessels can operate in either the northern area of Shark Bay or on the western grounds (i.e. the area containing the main grounds for the scallop fishery) (Kangas et al 2006: 16). This management strategy aims to achieve two goals. First, it aims to focus the fleet's efforts on targeting last year's recruits (which have now migrated onto the western grounds) and have now grown into large and commercially valuable prawns. Second, it aims to impose discipline on the fleet, to eliminate the capture of small prawns and to delay the start of fishing in the areas east of the Carnarvon-Peron Line and within the Extended Nursery Area until such a time as the prawns within these respective areas become a more marketable (i.e. larger) size (Kangas et al 2006: 17).

A comparison of the prawn fishery's catch results from the period between 1983 and 1990 with the period from 1996 to the present day shows that the adoption of this management regime has delivered enormous benefits to the Shark Bay prawn industry. Tiger prawn stocks have

recovered, while the catch volume of king prawns has been maintained, but with the benefit of a reduction in effort and thus costs. Whilst these management changes have clearly enhanced the productivity and profitability of the prawn fishery, it cannot be denied that the transfer of more intensive trawl effort onto the main scallop grounds at the early stages of the season has coincided with poor scallop recruitment in this part of the fishery.

Recruitment Failure and the Prawn Fleet

The WCTA maintains that the recruitment crisis of the last decade is linked very strongly to the transfer of the prawn fleet's fishing effort onto the historical scallop grounds. Central to this view is a belief that scallop stocks have been exposed to unprecedented levels of trawl effort in the early stages of the season and that through the mechanism of gear-induced mortality there has been a devastating impact on both the adult and emerging or juvenile scallop populations.

The Department's support for the trial of an 'Experimental Scallop Closure' in the Nor-West Peron area during the 2004 season was an opportunity to test these claims. In the years leading up to the 2004 season, the scallop industry had expressed its concern that significant scallop stocks were being lost as a result of prawn vessels catching scallops in their nets, bringing the animals to the surface and then returning them to the water. With the start of the scallop season being typically delayed until early or mid-May, scallop settlements on the main trawl grounds were subjected to relentless gear interaction for a period of four to six weeks. Over this period any scallop patches which had been identified in the November pre-season survey or whose location had since been uncovered by the prawn fleet were effectively destroyed. By the time the scallop season formally opened, most of the scallops that had settled on these grounds had effectively 'disappeared'. This outcome constituted a needless waste of the resource and represented lost catch and income for both prawn and scallop fleets.

The Experimental Scallop Closure encompassed a discrete area of relatively significant scallop abundance and sought to protect these scallops from all trawling until the formal opening of the scallop season. History shows that the closure proved to be effective. Whereas scallop populations, identified in the survey but outside of the closure area, were no longer to be seen, the scallops in the closure area were still in the waters when the scallop season eventually opened and the entire fleet of 41 prawn and scallop vessels descended on the closed waters of the trial area. The trial demonstrated conclusively that preventing the prawn fleet from dragging their collective nets through areas of known scallop abundance would ensure that those scallops were still available for harvesting when the season formally opened. Prawn vessels simply worked and caught prawns around the closure. Unfortunately there have been no further opportunities to repeat the trial due the general failure of recruitment on the historical scallop grounds. Subsequent surveys have failed to discover any scallop patches of a significant size and, in any case, the Department initiated a new fishing strategy for the area which rendered obsolete the need for closure areas.

The new management strategy side-steps these gear-interaction issues by instigating an early start to the scallop season. By allowing both scallop and prawn fleets to process the scallops which are captured on the main grounds, the Department ensures that the known scallop resource is not wasted. Similarly, by implementing a catch rate threshold of 180 kg to 200 kg[8] at which the take of scallops is suspended, the Department believes it has ensured that sufficient stocks

[8] The catch rate expressed as the average catch of Class A vessels over a 24 hour period.

are left in the water during the key spawning period. The WCTA disagrees with this assessment and considers the new strategy to be shortsighted insofar as it merely attempts to make the best of a bad situation. The new strategy does nothing to address the main issue of recruitment failure and does nothing to limit the impact on juvenile or emerging scallop populations. With the entire fleet (both prawn and scallop vessels) now encouraged to operate on the main scallop grounds at the start of each season the fishing has become more intense and it is conceivable that these new arrangements have potentially only made the situation worse. Furthermore, the lessons of the 2004 trial scallop closure appear to have been forgotten in the development of this strategy. A policy which allows prawn vessels to catch and return scallops offers no protection to adult scallop populations. Thus as a strategy to ensure the survival of sufficient breeding stocks, it is subsequently doomed to failure.

The impact of intensive trawling on juvenile or emerging scallop populations is difficult to measure. Previous research has been inconclusive and the extent of trawl-induced mortality upon juvenile scallops has not been fully quantified and should certainly be the subject of further research (Dredge 1988: 110). Notwithstanding these reservations, it is difficult to believe that vulnerable and fragile emerging scallop populations are not harmed by intensive trawling on the grounds in which they have settled. Joll (1988: 67) describes the impact of gear interaction on scallop populations as a process whereby:

> *"physical damage inflicted by ground chains, otter boards and heavy cod-ends may lead to mortality of the new recruits, which are interspersed among the adult stock. In years of high scallop abundance there are also high levels of fishing effort and the mortality of recruits resulting from this effort may lead to a low survival rate of the recruits into the fishery in the following year."*

While Joll might have been speculating on the cause of poor catches in the Abrolhos Islands following from high catches in the previous year, the logic applies equally to the situation that presently exists on the main scallop grounds in Shark Bay. In effect, a vicious cycle of stock depletion has been allowed to develop. On the one hand, as mature stocks are killed-off[9] and their numbers reduced, the chances of recruitment success are diminished. On the other hand, the habitat in which juvenile, post-larval stage, scallop populations are attempting to settle in is kept in a constant state of disturbance at this critical time. The combined effect: fewer mature scallops are left in the water for spawning and intensive trawling produces an environment which severely impedes successful settlement.

Management Changes to the Scallop Fishery

Ensuring the sustainability of the resource has always been paramount to the management of the Shark Bay Scallop Fishery. While a relationship between stock and recruitment has never been evident, a precautionary approach dictated that adequate stock abundance should always be maintained for breeding purposes. Prior to the 2005 Season, the (opening) matrix played a crucial role in achieving these objectives. With the scallops in Shark Bay spawning from mid-April to November, the matrix established some firm parameters which would ensure that overfishing did not jeopardize the fishery's ability to replenish its stocks. In real terms, this translated into a policy that saw the scallop season open late when the estimated catch was low,

[9] Although these scallops are now harvested and processed under the new management arrangements.

but also allowed the flexibility to bring the opening date forward with the prospect of better catches and the right mix of new recruits and residual stocks.

The matrix was employed for the last time in the 2004 season and in 2005 the main grounds were opened to fishing on the 10th of March despite the fact that poor catches were forecast for this area. The decision to abandon the matrix should not be seen as a fundamental shift in the management approach to the fishery as the importance of retaining adequate spawning stocks remains integral to the management strategy. However, rather than seeking to leave the entire adult population in the waters of the fishery for spawning purposes, the Department believed that spawning success was just as likely if only a 'sufficient number' of animals were retained in the waters during the key spawning period. In reworking this spawning stock equation, the Department believed that it could achieve better economic returns for the resource without compromising the fishery's sustainability requirements. Thus by opening the season early and allowing the catch of scallops in pre-spawning condition, the Department not only sought to allow scallops to be harvested at a time when the meat size and condition was best, but it also hoped to avoid the waste of lost catch from gear-induced mortality.

Establishing a set of management arrangements which are specific to the fishing grounds in Denham Sound is another recent initiative. It is generally recognized that the scallop resource in Denham is quite different from the resource that is typically found in the rest of Shark Bay. Recruitment in Denham is more fickle and it is historically the least productive area of the fishery. Furthermore, while the scallop meat from Denham is whiter in appearance, a tendency for the meat to be soft and watery has limited its market value and appeal. To its credit, the Department has refined the management arrangements for Denham since 2003 and has sought to address these marketing issues whilst balancing the resource sharing conflict between prawn and scallop industries. The new arrangements grants the scallop industry exclusive access to these fishing grounds early in the season and allows the harvest of its share of the resource in pre-spawning condition when the meat is both large and firm. However, the arrangements also ensure that sufficient stocks are left in the waters for both spawning purposes and for the prawn fleet to harvest when Denham opens for prawn fishing later in the season. To date, the new strategy appears to have been a success and can be seen as a precursor for the decision to abandon the use of the matrix in the rest of the fishery.

It is important to remember that poor recruitment in Shark Bay pre-dates the decision to abandon the matrix. In many respects the decision to dispense with the matrix was made easier by its comprehensive failure to deliver any improvement in recruitment. Since 1996 the matrix had more-or-less delivered a 'lose/lose situation' to industry. On the one hand, low stocks required a late start to the season and the late start ensured small, poor quality meat and thus a lower economic return from the available catch. When the late starts to the season continually failed to deliver any tangible improvements in recruitment, the matrix appeared to have lost any credibility as a useful management tool.

An assessment of the recent initiatives undertaken by the Department needs to be considered in the context of the fishery's performance. In a situation where the last 4 years has seen the Class-A fleet average fewer than 9 fishing days on the main grounds of the fishery, the short term prospects of the fishery are bleak and the long term outlook is decidedly grim. Set in this context, the Department's response has been manifestly inadequate. It is only now, with the establishment of this review, that the issue of recruitment failure is coming under serious consideration. Up until this time the Department has focused its efforts on resolving trawl issues in the Denham and South Denham areas; adjusting the boundaries of the Red Cliff Closure Area;

and has had an unhealthy obsession with improving the accuracy of the catch forecast from the pre-season survey! While all of these issues are important, they are peripheral when compared with the problem of ongoing recruitment failure on the fishery's main scallop grounds. To some extent, the debate about the respective merits of the matrix or fishing the resource early in the year can be added to this list.

This Paper has already questioned the merits of the new management system. While the (minimal) stocks of adult scallops on the main trawl grounds are now being harvested and are no longer left to perish on the sea floor, the recruitment problems in the north of the fishery appears to have only deteriorated further. In this context, the question of whether the scallop season opens early or is opened in accordance with a matrix that specifically considers breeding stock numbers is a moot point. Under both of these management responses the problem of recruitment failure has remained constant. In these circumstances, has management actually addressed the core problem with the scallop resource? And is the question of when scallops should be harvested critically important when there are in fact very few scallops available for harvest in the first instance? The WCTA maintains that the management of the scallop resource has lacked a critical focus. Whilst the Department is finally starting to re-assess the management arrangements for the scallop fishery, it has shown no appetite to address the core issue of recruitment failure. Until there is a fundamental change in this approach the fishery will continue its recent record of poor performance.

Prawn Fishery and the Class A Fleet

An assessment of the impact of 23 years of dedicated scallop fishing on the catch and viability of the prawn fleet should commence with a look at the historical catches of both king and tiger prawns. On face value, the prawn fishery would appear to be performing quite well. The current catch of king prawns is comparable with the catches achieved in previous times. Importantly, the stock and catch of tiger prawns has also recovered and the implementation of management reforms has seen catches return to the levels that were achieved in the 1970s. If the operations of the scallop fleet are having an adverse impact on the prawn fishery, they do not appear to be supported by the catch data.

Of course, it could be argued that the prawn fishery's potential has not been fully realized and that the present day catches would be better were it not for the impact of the scallop fleet. Such claims have been around since the establishment of a scallop fishery in Shark Bay and generally stem from the belief that:

a) scallop vessels catch significant numbers of prawns and;
b) those prawns that are not captured, but pass through the 100mm mesh of scallop nets are damaged, killed and thus constitute lost catch and income for prawn vessels.

Two independent trials – one conducted in the mid-1980s and the other in 2004 – both cast serious doubts as to the validity of these claims.

On the 29th and 30th of April 2004 the *F V Takari* conducted gear trials in the 'Experimental scallop closure area' to, in part, test mesh selectivity and to compare the catches from scallop and prawn nets. The 3 night shots conducted on this trial yielded from the scallop net a combined catch of 5.3 kg of king prawns and 1.4 kg of tiger prawns. The trial also sought to provide an insight into the fate of those prawns which pass through 100mm scallop mesh. This

involved placing the scallop net inside a prawn net in such a way that the prawn net would then act as an outer liner. A total of 49.8 kg of king prawns and 10.3 kg of tiger prawns were captured in the outer liner during the 3 night shots, with 86.3% and 94.8% of those prawns being found to have been undamaged by the experience. On the evidence of this trial, the number of prawns captured or damaged by the scallop net would appear to be remarkably small. It should, however, be noted that the gear set-up used in this trial (i.e. placing a scallop net inside a prawn net) would have inflated even these small numbers. The presence of the outer liner would have resulted in a cross-over of net mesh, effectively narrowing the 100mm spacing between the mesh and thus contributing to a higher catch of prawns than would have been achieved with the use of a standard scallop net. Additionally, the proportion of damaged prawns (10.2% and 4.4% respectively) would also have been higher as a result of the methodology employed in the trial. As the draft report noted "some scallops also passed into the outer liner and may have caused some of the damage recorded in these prawns and results should be seen as a 'worse case' scenario"[10].

This is not the only trial which has tested the claims that 100mm scallop mesh causes significant loss of product to the prawn industry. In November 1985 and March 1986 the *R V Flinders* conducted trials comparing the catches of paired trawls by scallop and prawn nets. A total of 15 trawls were carried out over these two periods and while both nets proved adept at catching scallops, the scallop net caught no prawns, except for a few coral prawns in one shot (Joll 1987: 53). Clearly, the claims that scallop vessels have a significant impact on the catch or loss of prawns are exaggerated and are not supported by any of the gear trials that have been conducted to date or the fishery's historical catch data. Indeed, with the low level of effort from Class A vessels on the main grounds of the fishery, it would be reasonable to suggest that in recent seasons there has been almost no impact at all.

Setting aside the question of the actual impacts caused by the interaction of scallop gear and prawn stocks, it is also important that the Department consider both the specific nature of the prawn industry's claims and understand the historical basis for the emergence of this issue. Prior to 1991 there existed a physical separation of the respective prawn and scallop fleets. Joll (1987: 69-70) noted that in the early years of the scallop fishery, the scallop fleet operated mainly in areas which were not previously fished to any great extent by the prawn fleet and that the effort of the prawn fleet was largely concentrated near the nursery lines. Thus while prawn vessels certainly worked the western grounds of the fishery, it was not an area of strong interest. With the introduction of the Carnarvon-Peron Line in 1991 the fishing patterns of the prawn fleet changed radically. By transferring the prawn fleet's effort onto traditional scallop grounds, the Carnarvon-Peron Line successfully reduced the prawn fleet's effort on tiger prawn stocks early in the season. In effect, the imposition of the Carnarvon-Peron Line allowed the prawn fleet to systematically target the catch of large king prawns on the scallop grounds at the start of the season.

Quite clearly, any subsequent interaction between scallop vessels and prawn stocks is a direct consequence of changes to the fishing strategies of the prawn fleet and is not the product of any changes to the operations of the scallop fleet. Of course, scallop populations are not strictly limited to these traditional western grounds. At times significant scallop settlements do occur east of the Carnarvon-Peron Line and the scallop industry certainly does not waive its right to operate vessels in this part of the fishery. However, while scallop vessels will, on occasions, operate east of the Carnarvon-Peron Line, such incursions are rare and generally brief. In recent

[10] Draft Shark Bay 'Experimental scallop closure area' Survey April 2004, page 4.

years Class A vessels have not applied any effort to the area east of the Line. In these circumstances the prawn industry has not lost a single prawn as a result of scallop fleet activity east of the Carnarvon-Peron Line.

Given the fact that scallops are a sedentary species and are predominantly found on the main grounds in the areas to the west of the Carnarvon-Peron Line, it is difficult to argue that the scallop fleet has any scope to adjust its fishing practices. When the prawn industry's complaints stem directly from the decision to choose the scallop grounds as its preferred site for the harvesting of prawns at the start of the season, it is inconceivable that the scallop industry should be held responsible for any perceived impacts on the catch of large prawns in this area. To suggest that the scallop fleet should now have to adopt larger net mesh to accommodate these unsubstantiated claims from sections of the prawn industry is completely unreasonable. It is particularly harsh when it is clear that the gear interaction 'problem' is fundamentally a problem of the prawn industry's making.

In the final analysis, the WCTA does not oppose and, in fact, would encourage the Department to conduct further gear trials to establish the legitimacy of the prawn industry's claims. However, in light of the scale of this 'problem', the importance of resolving this issue needs to be kept in perspective and its priority weighted accordingly. Indeed, when the Department is ready to tackle this matter it might also consider trialing the use of smaller 90mm mesh for the scallop industry as a means of addressing the relative inefficiency of the gear used by Class A vessels.

The Case for a Scallop Closure Area.

Most successful fisheries protect their nursery areas. The introduction of a meaningful closure area for the scallop fishery should be awarded the highest priority and its implementation is crucial to an investigation of the cause of recruitment failure in Shark Bay. If recruitment failure is, in fact, a product of gear-induced mortality then the only means of testing this theory is to limit the extent of trawling by means of a closure. If the value of a closure is to be truly tested it will need to have the following characteristics:

1. The closure area needs to be located on the historical scallop grounds of the fishery and must incorporate key or historically important ground.
2. The closure area needs to be reasonably large. The minimum size for such an area must be no smaller than 10 nm x 3nm.
3. The closure area can remain open for fishing to both scallop and prawn vessels, but should close, and remain closed, once the catch of scallops falls to a catch threshold of 400 kg per 24 hour period for Class A vessels. It is important to recognize that commercial operations still need to be maintained. Continued, albeit limited, access to the area would allow vessels to harvest a portion of the available stock, if recruitment to the area is successful, but would ensure that significant numbers of animals remain in the water for further monitoring and for spawning purposes.
4. The trial closure area should remain in place for at least a 5 year period and would ideally be in force during a year when there is a strong ENSO event.

Although it is impossible to predict exactly where scallops will settle, this does not justify abandoning the trial of a scallop closure. It is possible to argue that there are a myriad of factors that can determine the overall success of recruitment and location of any settlement. The

movement of water flow within the Bay and its impact on where larvae settles, the effect of water temperature on spawning or fertilization, the importance of the density of scallops for the success of spawning are all questions for which there are no readily available answers. However, rather than speculating on the relevance of these unknown factors, it is perhaps more important to focus on what we do know. The historical patterns of settlement in seasons of strong recruitment can certainly be assessed. The annual recruitment survey gives some insight into broad settlement patterns in the Bay. An assessment of the pre-season recruitment surveys carried out in 1987 and 1990 (that is, the surveys leading into the big catch years in 1988 and 1991), is a good method of selecting the site of a trial closure which incorporates a good portion of the productive ground from these high catch seasons. There is, of course, no steadfast guarantee that scallops will necessarily recruit to this area in the future. Indeed, the uncertainty about the location of settlement to some extent explains the need for a larger, rather than smaller closure area. Appendix one shows the location of the WCTA's proposed trial scallop closure area.

The introduction of a closure on Shark Bay's traditional scallop grounds will clearly require some adjustments to the management arrangements currently employed in the prawn fishery. If intensive trawl effort on scallop grounds at the start of the season is the cause of recruitment failure, it is clearly unacceptable that the scallop resource should be sacrificed in a bid to maximize the yield and profitability of the prawn fishery. With the implementation of the scallop closure the capture of (large) king prawns will still continue. However, rather than harvesting the catch on the scallop grounds, the prawn industry will have to target the catch either before prawns enter the closure or when they exit. Additionally, prawns will also be available for capture when the closure is opened to trawling for both prawn and scallop fleets. In other words, the prawn resource will not be lost to the prawn industry, but will simply require that prawns are harvested in different locations. If king prawns already migrate to areas beyond the Carnarvon-Peron Line why wouldn't they continue to migrate beyond the western boundary of a scallop closure? Of course, it is possible that the yield of prawns may decrease. It is conceivable that increasing the catch of king prawns east of the Carnarvon-Peron Line may result in the catch of a higher proportion of smaller prawns. It is also conceivable that targeting the areas to the west of the closure area will produce a higher catch of larger prawns. We can only speculate as to the possible outcomes that will arise from the introduction of a scallop closure. However, it is clear that both prawn and scallop industries would benefit from an increase in the recruitment and subsequent catch of scallops.

If the Department is seeking a template on how to introduce a closure into a commercial managed fishery, it needs to look no further than the Shark Bay Prawn Fishery. When the concept of Tiger Prawn Spawning Areas was first introduced in 1996, the Department made a conscious decision to establish a large closure area. This decision was a response to concerns that excessive fishing pressure was being imposed on tiger prawn stocks and that without tough new measures the stocks and future catch of tiger prawns would be adversely affected. The closure has proved to be an effective and successful management response. Of course, the closure's size and the mechanism employed for closing the area have both been adjusted with the passing of time. The area closed today is significantly smaller than the area that was first introduced in 1996. As an example in how a trial closure can be implemented in a fully operational commercial fishery, the Tiger Prawn Spawning Area offers a number of valuable lessons. First, do not compromise the ability to achieve the stated outcomes by securing too small a closure. If the threat to the stock is considered serious enough to warrant implementing a trial closure make sure that the closure is of an appropriate size. Second, observe and measure the impact of the closure. Third, adjust or fine tune the closure accordingly. The WCTA

believes that the philosophy which underpinned the decision to implement a tiger prawn closure should apply equally to the scallop fishery. The recruitment problems on the main grounds of the scallop fishery are even more desperate than those which applied to tiger prawn stocks in the mid-1980s. In these circumstances, the scallop fishery requires the same urgent management response.

It could, of course, be argued that a closure area for scallops is already being trialed. In July 2003 the Department brokered an agreement between the scallop and prawn industries to establish the Red Cliff Closure Area (RCCA). This closure encompasses a large area along the western boundary of the fishery adjacent to the Bernier Dorre Islands Closure. Although the RCCA has been in place for 3 years it is yet to demonstrate any positive benefits in terms of improved recruitment and catch. The WCTA maintains that the apparent failure of the RCCA should not be regarded as evidence that there is no merit in introducing a scallop closure area on the main trawl grounds in Shark Bay.

A number of reasons can help explain why the measures to limit trawling in this area have failed to produce any positive outcomes. It can be firstly argued that this trial has not been given time to prove its true worth and has not been conducted in a controlled manner. The RCCA operates on a catch rate threshold of 400 kg per 24 hour period for Class A vessels and this has applied in both the 2005 and 2006 seasons. In 2004 the RCCA operated under a catch threshold of 200 kg, while in 2003 a catch threshold did not apply at all. Clearly, there has been no continuity or uniformity to the conduct of the trial and, in effect, the fully fledged trial is only now in its second year.

The fact that the RCCA is only marginal scallop ground is a more compelling explanation for its failure to deliver any positive benefits for recruitment and catch. Put simply, the RCCA is not considered traditionally good scallop ground. While scallops have always been found in this area and there has always been some effort on these grounds by Class A vessels, it needs to be recognized that recruitment in this area of the Bay is historically haphazard. This area tends to only produce a few 'runs' of scallops and possesses only one area of sand habitat capable of supporting a patch of any real significance. In the December 2005 Survey a total of 9 shots were carried out in the RCCA from a total of 30 shots in the wider Red Cliff area. Whilst such a number is certainly significant, only 1 of the 9 is a traditional survey shot, the other 8 having been added to the survey in 2003. This clearly indicates that the RCCA has no real standing as traditional scallop ground and it is unrealistic to expect that scallops will ever recruit to this area in any significant numbers. Appendix two highlights the fact that the RCCA is excluded from the main grounds of the scallop fishery.

It should also be recognized that the RCCA was not the preferred site of a scallop closure by the WCTA. The criteria used for the selection of this particular site could be described as "what the prawn industry would agree to". The WCTA initially requested that consideration be given to a proposal to shift the Carnarvon-Peron Line eastwards in an effort to shift some of the prawn fleet's trawl effort off the traditional scallop grounds. It was only when it was clear that the prawn industry would not consider such a change that alternative arrangements were sought. Furthermore, prior to the 2005 season the WCTA sought, and won, the prawn industry's agreement to extend the eastern boundary of the RCCA as an alternative means of incorporating at least some elements of the traditional scallop ground within the closure area. During the course of the season, the prawn industry wished to renege on its commitment and successfully lobbied the Department to restore the original boundaries of the RCCA.

In 2006 the WCTA considers the existing RCCA to be an unnecessary distraction. The closure is poorly positioned and fails to incorporate any of the important scallop ground in the fishery. It is therefore incapable of making a significant contribution towards turning around the fishery's fortunes. It is also a poor choice as a proxy for the wider fishery in which to test and measure the success of the closure concept. In these circumstances, the WCTA believes that the RCCA might as well be abandoned. In its place a more substantial and meaningful closure, such as the 10 nm x 3nm proposed area closure, must be considered.

The Future of a Western Australian Scallop Industry

The long term viability of the Western Australian scallop industry extends beyond the question of future management arrangements for Shark Bay. For operators in the scallop industry long term profitability depends upon access to fishing grounds which are capable of supporting significant scallop populations. At a macro-level this equates to being able to operate a vessel in as many fisheries as possible. At a micro-level it equates to your vessel being able to access all of the historically important ground within those fisheries. For once an area has demonstrated a capacity to support big numbers of scallops, it is capable of doing so again when the environmental conditions become favourable.

The scallop industry understands that scallop fishing is a fickle business. Recruitment is highly variable, but there remains an understanding that, over time, each fishery and each area will contribute to the total catch. Over the course of the last decade Shark Bay, as the State's primary source of scallops, has failed to exhibit this defining characteristic of high variability and it has failed to contribute its expected share of the industry catch.

This submission has already addressed, at length, the specific issues relating to the management of Shark Bay as a wild scallop fishery and how the Department can seek to resolve the problem of persistent recruitment failure. Whilst this clearly remains the core problem with the scallop resource, there are also other questions relating to the future viability of the industry that ought to be considered in the context of a review of Shark Bay.

In the same way that achieving cost savings through fleet reductions has emerged as an important issue for the prawn fisheries of Exmouth and Shark Bay, the ability to manage future fleet reductions will also become an important consideration for the scallop industry. In the 2006 season, 14 vessels were deployed in the Shark Bay and Abrolhos fisheries to catch a combined total of 175 tons of scallop meat. Clearly, this resource could have been harvested with fewer vessels and to some extent it stands as a good example of the poor utilization of resources. From an industry perspective, fewer vessels offers the prospect of cost savings in vessel maintenance, insurance and would also result in longer seasons with greater security and incomes for the skippers and crew who work in the industry. Fleet reductions for Class A vessels in Shark Bay will, however, be difficult to achieve until such a time as there is some formal recognition as to the equitable division of the scallop resource between the respective prawn and scallop industries. Under current management arrangements the Class A fleet's equity in the fishery is controlled largely by the 14 licenses to operate in the fishery, the 13 crew permitted on each vessel and 24 hour trawling. If the fleet is reduced the scallop industry's capacity to retain its equity in the fishery will diminish unless some other mechanisms are employed to ensure that traditional catch shares are retained.

The ability to supplement the wild stocks of scallops by enhancement via the deployment of hatchery produced spat would undoubtedly provide enormous benefits to the Shark Bay Fishery. However, at this point in time, the prospects of achieving a commercial scale enhancement program for *amusium balloti* remain a pipedream. Whilst the scallop enhancement project recently concluded in Geraldton achieved some important breakthroughs, fundamental technical issues relating to the ability to achieve reliable spawning in a hatchery and the ability to culture juvenile scallops prior to deployment remain unresolved (Scoones and McGowan 2006: 40-41). Whilst it may be premature to dismiss entirely the future prospects of enhancement in Western Australia's scallop fisheries, the introduction of innovative new management strategies for the scallop resource in Shark Bay should not be deferred by the promise of an aquaculture sponsored solution to the problems of recruitment failure.

A Brighter Future for the Shark Bay Fishery

A productive scallop fishery in Shark Bay is critical for the future viability of both prawn and scallop industries. A recovery of the fishery would reduce the scallop industry's reliance on the supposedly lesser fisheries in the Abrolhos Islands and Esperance and the prawn industry would clearly enjoy the benefits of a valuable supplement to its prawn catch. In this context, the continued squabbling between the prawn and scallop sectors over the distribution of the diminishing scallop resource is totally counterproductive. As long as the total annual catch of scallops remains low neither sector stands to win. A larger share of the resource in small catch years adds very little to the profitability of the individual operators in either industry. Quite clearly the two industries need to decide whether they wish to keep fighting over the issue of how to share the resource or move the management focus away from the distribution of the resource and onto the more productive goal of expanding the resource so that there are more scallops for both industries. The WCTA is convinced that by imposing a large closure area on the main trawl grounds this objective can be achieved.

The failure of some operators to comprehend the gravity of the situation can be explained, in part, by the fact that for the prawn fleet very little has changed in terms of scallop productivity. In the period from1996 to 2005 the prawn fleet managed to catch an average of 90 tons of scallops. This is only 3 tons less than the catches that were being achieved between 1983 and 1990. Thus from a prawn operators perspective the landings of scallops have hardly changed. However, if the present pattern of recruitment continues this situation will not last. The total catch in the fishery has only been held at its present level because of unusually good catches from the Denham area. If history is any guide it is highly unlikely that the catch from Denham will continue at these levels. Thus without reasonable recruitment from Denham the fishery is confronted with imminent disaster and the prawn industry will be unable to sustain its total scallop output when recruitment throughout the Bay is poor. Additionally, the prawn industry has also been assisted by the scallop fleet's reduced presence in Shark Bay due to the pursuit of outstanding catches in the Abrolhos Islands in 2003 and 2005. Clearly, if the prawn sector values its share of the scallop resource it should prepare to confront the reality that it will need to continue its operations with a reduced scallop catch.

There is no doubt that fleet reductions and gear amalgamations can deliver important cost savings to industry and thus contribute significantly to its long term profitability. However, when confronted with the reality of spiraling fuel costs, falling prawn prices and an acknowledgement that the prawn fishery has already reached its maximum level of sustainable catch; will these cost savings and improved efficiencies be enough? To suggest that there is

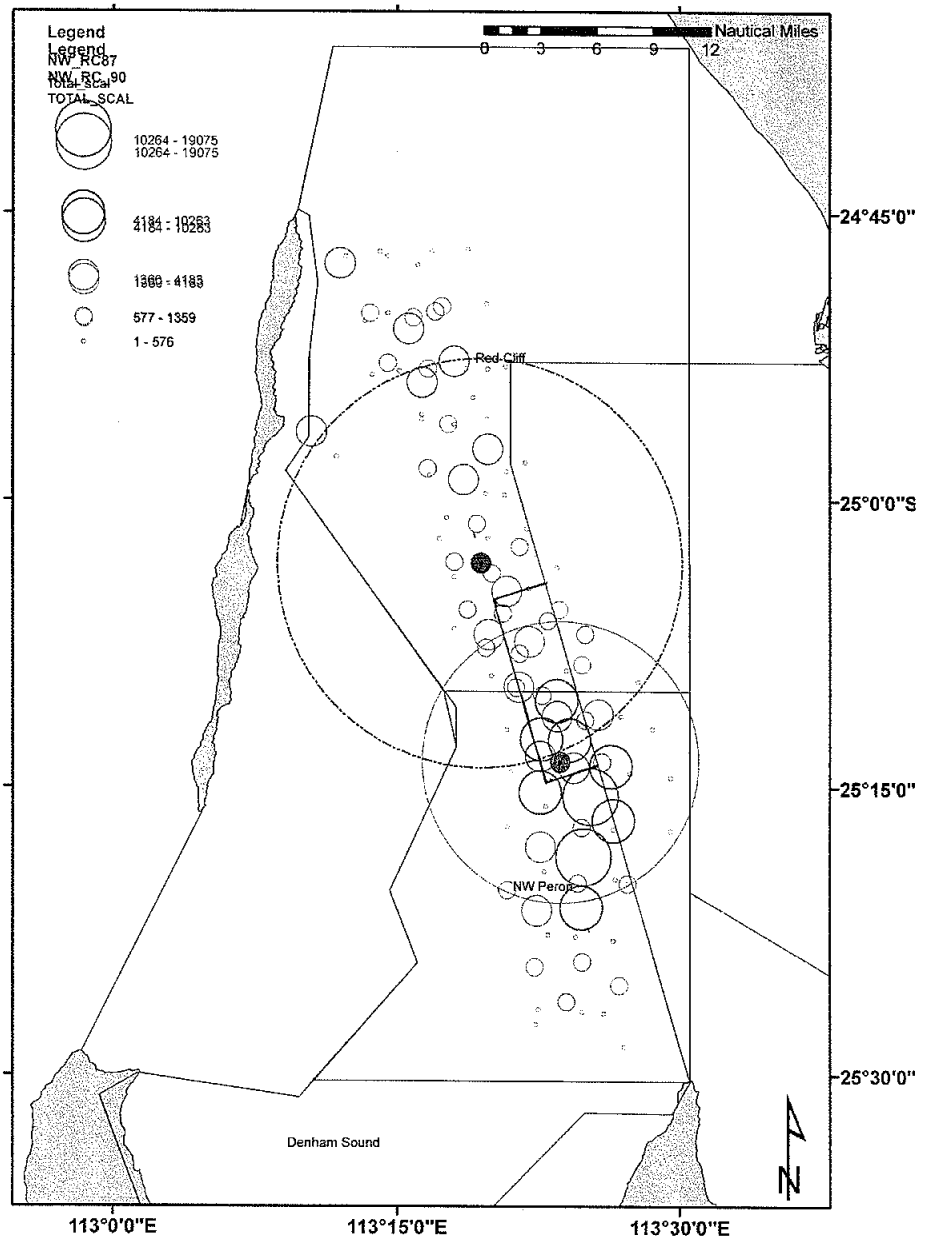
scope to access an untapped prawn resource – i.e. the prawns lost via the impact of scallop fishing – is plainly delusional. With almost no presence in the fishery, the scope for the scallop fleet to have impacted on prawn stocks has not even existed in recent years. How many tons of prawns could possibly have been lost in the 46 days that the Class A fleet has spent on the main grounds in the last 4 years? It is in this environment that it is possible to see that a productive scallop fishery in Shark Bay is critical for the future viability of both prawn and scallop industries.

Throughout the 1980's prawn vessels fished intensively along nursery lines and freely targeted the catch of tiger prawns. In the absence of firm management controls, too many small king prawns were being caught and excessive fishing effort on tiger prawn stocks had adversely affected recruitment levels. Clearly the commercial potential of the prawn resource was not being realized and the Department responded by forcing changes to existing fishing practices through management intervention. This submission has argued that a decade of persistent recruitment failure in the scallop fishery signals that a new era of reform is now needed in Shark Bay. For 15 years the management of Shark Bay has focused almost exclusively on the goal of maximizing the total yield of king and tiger prawns and promoting the profitability of the prawn industry. In contrast to the Department's dynamic and pro-active approach to managing the prawn resource, management of the scallop resource has been largely passive and ineffective. The consequences of this approach are now self-evident and after 11 years of poor recruitment and having apparently lost the defining characteristic of high variability it should now be obvious that the scallop resource will not simply revive on its accord. The management intervention that the Department has so successfully applied to the prawn resource must now be extended to incorporate the scallop resource too.

In the late 1980's the scallop industry was warned that: "*The future prospects of these [scallop] fisheries are continued wide variation in annual catch and fishermen must adapt fishing strategies which will cope with this variability*" (Joll 1988: 40). In 2006, scallop fishermen might ask the Department when it will act and implement strategies to promote the return of abundant scallop recruitment in Shark Bay. Until the Department accepts this challenge and implements a meaningful closure area on the main scallop grounds, the commercial potential of this fishery will remain unfulfilled and both prawn and scallop industries will lose out in the long term.

Appendix One:

The proposed closure is a 10nm x 3nm rectangular area located on the historical scallop grounds to the west of the Carnarvon-Peron Line. The area incorporates the centre of main scallop abundance indicated in the 1987 and 1990 pre-season surveys. These were the surveys leading into the big catch seasons of 1988 and 1991. The closure effectively straddles the central zone of the Nor-West Peron and Red Cliff areas and thus offers improved prospects of successful recruitment and settlement in the fishery.



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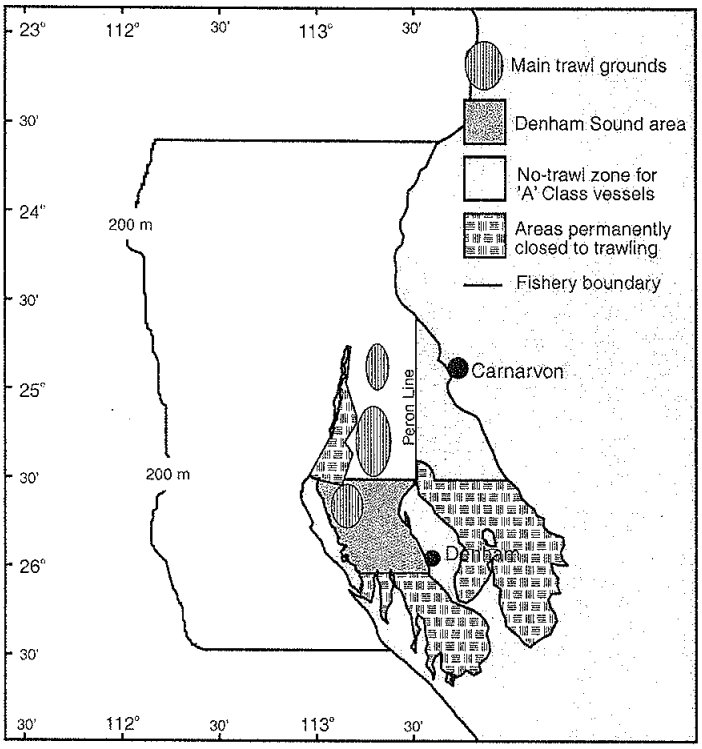
Appendix Two:

Map Showing Main Trawl Grounds of Shark Bay Scallop Fishery as featured in Fisheries Report No. 114 'The Western Australian Scallop Industry' (1999). It is important to note that the Red Cliff Closure Area (RCCA) is excluded from the areas considered to be the main trawl grounds for the scallop fishery.



Map showing the general boundaries of the Shark Bay Scallop Managed Fishery.

References

Caputi N, Watson R, Joll, L and Pearce A
1998 'Scallops', Effects of seasonal and interannual variability of the ocean environment on recruitment to the fisheries of Western Australia (Pearce, Caputi and Suber).

Dredge M
1988 'Trawl-induced Mortality of Juvenile Saucer Scallops, *Amusium Japonicum Balloti Bernardi*, Measured from Video Recordings and Tag Recoveries', Proceedings of the Australasian Scallop Workshop: 103-110.

Harris DC, Joll LM and Watson RA
1999 'The Western Australian Scallop Industry', Fisheries Report No. 114, Fisheries Western Australia.

Joll LM
1987 'The Shark Bay Scallop Fishery', Department of Fisheries Western Australia Fisheries Management Paper No. 11'.

Joll LM
1988 'Recruitment variation in Stocks of the Saucer Scallop *Amusium balloti* in the Abrolhos Islands Area', Proceedings of the Australasian Scallop Workshop: 61-67.

Joll LM
1988 'History, biology and management of Western Australian stocks of the Saucer Scallop *Amusium balloti*', Proceedings of the Australasian Scallop Workshop: 30-41.

Joll LM and Caputi N
1995 'Environmental influences on recruitment in the saucer scallop (*Amusium balloti*) fishery of Shark Bay, Western Australia', ICES mar. Sci Symp., 199: 47-53.

Kangas M. et al
2006 'Shark Bay Prawn Fishery', Department of Fisheries ESD Report, Department of Fisheries Western Australia

Lenanton, Joll, Penn and Jones
1991 'The influence of the Leeuwin Current on coastal fisheries of Western Australia', Journal of the Royal Society of Western Australia, 74: 101-114.

Pattiaratchi CB and Buchan SJ
1991 'Implications of long-term climate change for the Leeuwin Current', Journal of the Royal Society of Western Australia, 74: 133-140.

Penn JW
25 October 2005 Memorandum regarding Scallop Fishing in Southern Denham Sound (Shark Bay).

Scoones RJS and McGowan P
2006 'Enhancement of Saucer Scallops (*Amusium balloti*) (Bernardi) in Western Australia', FRDC Project No. 2002/048.

Appendix 4 Supplementary submission on draft review of Shark Bay and Scallop Fisheries prepared by the West Coast Trawl Assocation, 22 August 2006

REVIEW OF SHARK BAY PRAWN & SCALLOP FISHERIES (2)

Supplementary submission prepared by: West Coast Trawl Association
22nd August 2006

Introduction

In its first submission, the West Coast Trawl Association (WCTA) described the decline of the scallop fishery in Shark Bay and suggested that restoring the productivity of the scallop resource was critical to the future prosperity of both prawn and scallop industries. The submission rejected the proposition that a decade of recruitment failure was the product of a sustained period of unfavourable environmental conditions. Rather, its decline was attributed primarily to a process of evolutionary change to the management arrangements for the prawn fishery. These changes, which place a strong focus on the targeting of prawns on the main scallop grounds, have radically altered the distribution of the prawn fleet's effort and have had a devastating impact on the recruitment and productivity of the scallop fishery. The submission called for the introduction of a significant closure area on the main scallop grounds of the Bay and concluded that so long as the Department's strategy for the recovery of the scallop fishery amounted to little more than waiting for the return of 'favourable environmental conditions', the pattern of poor recruitment on the main scallop grounds would persist.

The WCTA's first submission suggests that the prawn and scallop fisheries are confronted by two quite distinct problems. For the scallop industry, the problem in Shark Bay is essentially biological in nature. While the industry will inevitably have to come to terms with the economic problem of excess capacity[1], it is a problem that is presently subservient to the more pressing problem of ongoing recruitment failure. When the catches of the last decade compare so unfavourably to the catches that were achieved in the 8 years before the redistribution of the prawn fleet's effort[2], it is clear that the scallop fishery in Shark Bay is not operating at its full potential.

For the prawn fishery, the problems in Shark Bay are fundamentally economic in nature. At a biological level, the fishery is operating at near-maximum capacity. While the catch will continue to exhibit some variation in accordance with fluctuating environmental conditions, the productivity of the fishery, measured by the catch of king and tiger prawns, is likely to remain relatively stable. Essentially, there is a fundamental problem of excess capacity, there being too many vessels for the amount of prawns that Shark Bay is typically able to produce. With the rapid increase in fuel and maintenance costs, coupled with falling prawn prices, caused by the high value of the Australian dollar and the influx of cheap imported prawns, the problem of excess capacity has been brought into sharper focus.

The purpose of this supplementary submission is to further explore the potential benefits of introducing a closure on the main scallop grounds in Shark Bay. The submission specifically reviews the successful implementation of closure areas in the U.S. Sea Scallop (*Placopecten magellanicus*) Fishery and assesses if some of the management initiatives undertaken in this Fishery might also be applied in Shark Bay. The submission then explores the potential for further, largely economic, management reforms which could follow the successful implementation of a closure area.

The Benefit of Closure Areas: The U.S. Experience

The introduction of closure areas has been central to the recovery of the U.S. Sea Scallop (*Placopecten magellanicus*) Fishery. The spectacular success of the closure areas indicates that properly implemented closures are not just good ideas in theory, but also have a practical use as a

[1] The expression "excess capacity" refers to a situation where a fleet's capacity to catch fish exceeds the quantity of fish that the fishery is able to produce fish.

[2] A comparison of the catches from 1983 to 1990 to the catches from 1996 to 2005 illustrates the extent of the fishery's decline. The catch data shows that the total average annual catch between the 2 periods has fallen by 133 tons of meat weight.

management tool for improving the productivity of sedentary species such as scallops (Kaiser: 2005: 1198).

In 1994 closures covering a total area of 17,000 km² were introduced to protect the depleted groundfish resources on Georges Bank and southern New England (Murawski et al 2000: 779-780). The three closure areas incorporated some of the most important and productive scallop grounds in the Fishery[3] (Hart and Rago 2006: 494) and whilst the closures were part of a wider suite of fishery reforms[4], it was the closures which were deemed to have had the most significant impact for the recovery of the Fishery (Hart and Rago 2006: 498-99).

The transformation of the Fishery which has followed from the introduction of the closures has been quite breathtaking. Hart and Rago (2006: 494) claim that the biomass of sea scallops increased rapidly after the introduction of the closures and by 2005 it was about 18 times the 1994 value and more than 4 times the maximum seen during the 1982 to 1994 pre-closure period. Furthermore, in the period between 2000 and 2004, the combined annual U.S. and Canadian landings of sea scallops was 30,000 metric tons (meat weight), more than double the mean long-term annual landings (Hart and Rago 2006: 500). The success of the initial closures in the Georges Bank region provided impetus for further experimentation and reform in the Fishery. Additional closures were implemented in the Mid-Atlantic Bight and a strategy of rotational harvesting is being considered to reduce fishing-induced mortality and improve meat yields (Hart and Rago 2006: 496).

Whilst the recovery of the U.S. Sea Scallop (*Placopecten magellanicus*) Fishery is undeniable, establishing the precise mechanism through which the closures have brought about its renewed productivity is a matter for debate. In essence, a number of factors are believed to have contributed to the recovery of the Fishery. The closures firstly prevented the incidence of high indirect (non-catch) fishing mortality (Myers et al 2000: 2357). Secondly, the closures allowed scallop populations to form dense aggregations which, in turn could have significantly improved the chances of fertilization success (Hart 2003: 53). And thirdly, the closures prevented the problem of growth overfishing which resulted in improved yields per recruit (i.e. larger meat sizes leading to increased yields) once the closure areas were reopened to fishing (Hart 2003: 53).

The Potential Application of Scallop Closure Areas in Shark Bay

When closures have clearly made a significant contribution to doubling the productive capacity of the U.S. Sea Scallop Fishery the economic incentives of introducing a closure in Shark Bay are certainly alluring. Indeed, given the reality of continued recruitment failure despite the occurrence of the environmental factors[5] which are believed to drive recruitment success, the establishment of a significant closure area on the main scallop grounds of Shark Bay is critical.

The existing management arrangements in Shark Bay make no provision to: a) limit the impact of indirect (gear-induced) fishing mortality on juvenile scallop populations; b) sponsor and protect the formation of high density scallop populations; c) systematically maximize yield[6]. In these

[3] About 52% of the total sea scallop landings from the U.S. portions of Georges Bank during the period 1982 to 1993 were obtained from the closed areas.
[4] Restrictions on new entrants to the Fishery, crew numbers and gear restrictions aimed at improving catch selectivity were also introduced in addition to the closures.
[5] El Niño Southern Oscillation (ENSO) Events and the onset of weak Leeuwin Current.
[6] There have, of course, been some initiatives to enhance yield via the catch of bigger meats, particularly in Denham Sound. However, the strategy to improve yields in the northern areas of Shark Bay by simply allowing both fleets to freely target pre-spawning scallop populations may be counterproductive. The safeguard of catch rate thresholds as a means of ensuring sufficient spawning stocks appears to be totally ineffective. When *Amusium balotti* scallops are

circumstances it is plausible that a number of the factors identified as problems for the U.S. Sea Scallop Fishery could also be contributing factors in the ongoing recruitment crisis in Shark Bay. Spatial management, in the form of a closure area, certainly offers a viable solution to each of these issues. Regardless as to the underlying cause of recruitment failure – be it high mortality on juvenile scallop populations or impairment to successful fertilization due to the absence of suitable population density – implementing a closure area on the main scallop grounds is clearly a pre-requisite to test and develop experimental fishing strategies and to monitor stock in a controlled environment (Smith and Rago 2004: 1353).

When it is clear that the implementation of a 10nm x 3nm closure on the main scallop grounds in Shark Bay offers the best means of directly increasing the productivity of the fishery, it defies logic that the prawn industry is actively encouraged to fish for prawns on these grounds early in the season in order to maximize prawn yield. As the managers of the fishery, the Department should question if this is the most productive use of these grounds.

Industry-Based Quotas: Securing Equity and Future Prosperity in the Fishery.

Whilst the introduction of a closure area on the main scallop grounds is the key to resolving the biological issue of recruitment failure, broader management reforms must also be considered in order to secure the long term prosperity of both prawn and scallop industries.

Critics have suggested that the real challenge for modern fisheries management is to find a solution to the problem of the 'race for fish' and the ensuing overcapitalization that generally follows (Hillborn et al 2004, Parma et al 2006, and Wilen 2006). By adopting governance systems, such as property rights, it is possible to limit the race for fish and nurture the development of more sustainable and profitable fisheries (Parma et al 2006, and Wilen 2006). The WCTA believes that applying these principles to the management of the Shark Bay Fishery could enhance the long term profitability of both prawn and scallop industries and significantly ease the growing conflict between the 2 sectors.

Appendix One shows that since 1983 the catch of Shark Bay's scallop resource has been split 72% and 28% between the respective scallop and prawn industries. The WCTA proposes the introduction of an industry-based quota for the scallop resource in Shark Bay. This system would formally allocate the future scallop catch on the basis of the historical catch ratio between the prawn and scallop industries. The equity of such a system could not be questioned[7] and it would eliminate one of the central causes of the senseless bickering between the 2 industries. In turn, it would allow the management of the fishery to focus on more productive initiatives that promote rebuilding the scallop resource for the mutual benefit of both sectors.

Under the proposed industry based quotas, the catch share of each sector is allocated on a 72% and 28% basis. There are no individual quotas in this system and the competition for catch between vessels within the respective prawn and scallop fleets will continue. For any given season, the

clearly extremely vulnerable to air exposure (Heald 1978: 845), forcing the return of all scallops back to the water once the threshold limit is reached, does not prevent indirect mortality and thus does not offer any protection of spawning stocks.

[7] A debate on the issue of an 'equitable' catch share for each sector often begins with the scallop industry citing the 80/20 rule and the prawn industry countering that a dedicated scallop fishery should never have been created in the first instance. However, after more than 23 years of a dedicated scallop fishery it is time that both 'claims' were put to rest. Plainly the scallop fleet is not going to disappear and the prawn fleet will continue to take more than a 20% share of the catch. There must therefore be some acceptance that enough time has passed and enough fishing has occurred to establish a formal split based on the actual historical catch share between the 2 sectors.

fishery will aim to achieve the agreed 72-28 split in the take of scallops. Pre-season surveys indicating both the total and distribution of stock abundance will naturally assist in the planning of harvest strategies. Even so, the successful implementation of industry-based quotas will clearly present a number of challenges. However, with the application of some imaginative solutions, these difficulties are not insurmountable. Some measures that could support the implementation of such a system could include:

- Close monitoring of industry catches to ensure that catch shares do not greatly exceed the quota limits set for each sector. Vessels could send twice-weekly catch reports to the Department via VMS. Alternatively, if the fishery adopted an electronic log book system, the Department would have a ready-made, real-time catch monitoring tool.
- A system of 'Overs and Unders' could function as a mechanism to redress any imbalance in a sector's annual scallop quota. It is possible that correcting an imbalance may have to be achieved over a number of seasons. It is also possible that imbalances could be corrected via exclusive or priority access to closure areas or areas of known scallop abundance.
- Adequate penalties for misreporting catches might need to be investigated to ensure the integrity of the system.
- Each industry would be responsible for managing or overseeing the distribution of its allocated share of the scallop resource among its own members.

By establishing an industry-based quota which permanently settles the issue of how the scallop resource is to be distributed between the 2 industries, the prawn and scallop sectors can conduct their respective fishing operations in the knowledge that they will each secure their allocated share of the scallop resource. Operators within each sector will then have a guaranteed opportunity to secure a share of the resource, with the actual share to be determined by the fishing and organisational skills of the skipper and the capacity of the vessel. With each sector having a pre-determined share of the resource, there are no incentives for either industry to pursue initiatives designed to maximise catch share and the Department could get on with the task of managing the resource, rather than settling disputes.

In the event that either sector's catch is excessive or over-quota, then that sector will have to forgo catch in subsequent years in order to restore balance to the total catch share. Importantly, both industries will have a shared incentive to focus a collective effort on developing or growing the scallop resource for this is the sole means through which either sector can increase its total catch of scallops. Thus in the context of the successful implementation of a closure area on the main scallop grounds, both sectors are guaranteed to reap the benefits of increased recruitment to the fishery.

Under current management arrangements the allocation of Shark Bay's scallop resource between the scallop and prawn sectors is determined by indirect instruments. In this sense, equity in the fishery is determined by the total number of licenses to operate in the fishery, crew limits, hours of trawling and various other gear controls. Rather than using these indirect instruments to allocate the annual scallop catch, an explicit division of each sector's catch share would appear to be a more transparent and more manageable system.

For the scallop industry there are many benefits in adopting industry-based quotas. It would allow the industry to negotiate changes in fishing strategies to better fit the circumstances of each season. For example, in a poor catch season licensees could negotiate season-only, vessel reductions. Similarly, crew numbers could also be capped to ensure improved incomes for skippers and crew. Product quality may also be improved by reducing the reliance on inexperienced crew. It would also improve the prospects of integrating the operations between the scallop fisheries in the Abrolhos and Shark Bay.

The possibility of permanent fleet reductions in the scallop industry is, of course, the major benefit of introducing a system of industry-based quotas for the Shark Bay scallop resource. If the scallop industry's equitable share of the resource is guaranteed into the future, then participants in the industry have the opportunity to look rationally at the economics of the fleet that is required to harvest any available resource. Under current management arrangements the scallop industry is locked into a fleet of 14-16 vessels[8]. Given the fishing and processing power of the existing fleet, the industry and the Department ought to consider the possibility that the number of vessels used by the industry is excessive regardless of the potential size of the scallop harvest. While it is obvious that there are presently too many vessels in seasons where the catch of scallops is poor, it is reasonable to suggest that a reduced fleet has sufficient capacity to harvest even very large scallop populations. For example, in 2005 16 vessels[9] were able to harvest almost 1,300 tons of scallop meat in the Abrolhos Islands in an 85 day period. If the issue of recruitment failure could only be addressed, the combined capacity of the prawn and scallop fleets would have ample fishing power to harvest even very large scallop catches in Shark Bay.

Given the quality of vessels which comprise the existing fleet, the number of vessels deployed to catch the State's scallop resource is wasteful and is not economically sustainable in the long- term. Whilst it would be useful to have the option of reducing vessel numbers in poor catch seasons, permanent fleet reductions offer permanent and lasting savings. Management strategies which only canvass the possibility of temporary fleet adjustments (both reductions and increases) in accordance with changing scallop abundance (FMP No. 199 2005: 33) do not fully address the issue of excess capacity. Under a policy of only temporary reductions, licensees must still keep additional vessels in survey, maintain them in good working condition and keep them insured. Additional vessels also represent tied up capital that a licensee could otherwise put to far better use. If the Department wishes to support a viable scallop industry it must find a means of promoting permanent fleet reductions. The WCTA maintains that an industry-based quota for the scallop resource in Shark Bay would be an important first step in achieving this goal.

Conclusion

A successful fishery must ultimately rest on sound biological management. If stocks are consistently plentiful or recruitment follows a pattern that is appropriate for that species, then there is at least a foundation on which to build a profitable and vibrant industry. Smith and Rago (2004: 1339) list declining catches, declining catch rates, absence of recruitment in general or in particular areas and declining survey indices as key indicators of an unsustainable fishery. After a decade-long period of recruitment failure and diminishing recruitment on the main scallop grounds, there is a compelling body of evidence to support the WCTA's claims that the current management arrangements have failed to secure the biological sustainability of Shark Bay's scallop resource. Given the extent and apparent seriousness of the fishery's decline, the Department's response to date has been manifestly inadequate.

Walters and Collie (1988: 1853) observed that:

"*There is a fundamental difference between deliberate, experimental management and conservative management that waits hoping for natural events to create the contrasting circumstances needed to distinguish environmental and stock-size effects. Waiting and hoping could require decades or even centuries to resolve long-term climactic effects...*"

[8] There are currently 14 Class A licenses in Shark Bay and 16 Abrolhos Islands and Mid-West Managed Trawl Fishery licences.
[9] 17 vessels if the *F.V. Atlantic Ocean* (fishing under Ministerial Exemption) is included in the fleet.

The WCTA is hopeful that it won't take quite so long for the Department to reconsider its passive approach to managing the scallop resource in Shark Bay. Indeed, in light of the encouraging success of management reforms in the U.S. Sea Scallop Fishery, the Department must seriously consider that Shark Bay will not realise its full potential as a trawl fishery until the practice of unrestricted trawling on the main scallop grounds is stopped. With the introduction of a significant closure area on these grounds, the Department can ensure the recovery of the scallop resource and take a vital first step in securing the future prosperity of the prawn and scallop industries.

If the review of this fishery is an exercise in long-term planning and aims to develop a management framework which will underpin the next 20 years of Shark Bay's development, then the Department and industry need to jointly ask some fundamental questions as to what sort of industry structure it wishes to develop? This process must inevitably consider the question of optimal harvest strategies for the available prawn and scallop resource in light of the rising cost of inputs. Given the existing industry structures, it is also important to consider what is realistically achievable in terms of reform. Whilst the idea of establishing a single, homogenous trawl fleet in Shark Bay has some merit, how such a major transformation could be logistically achieved is difficult to see. A reform of this nature would also need to consider how a stand-alone scallop fishery in the Abrolhos would be managed in the context of these changes.

Since the Minister's announcement of this Review, the WCTA has consistently advocated that a review of Shark Bay could not be conducted without considering the position of other fisheries, notably the Abrolhos Islands and Mid-West Trawl Managed Fishery[10]. Since the creation of a dedicated scallop fishery in Shark Bay, a model for the scallop industry has gradually evolved, where one fleet now targets the catch of scallops in two different regions (the Abrolhos Islands and Shark Bay). The WCTA's proposal seeks to contain industry reform within the constraints of the existing dynamic of 2 distinct fleets. That is, a mobile fleet of scallop trawlers and a geographically-based fleet which catches scallops as a supplement to its primary take of king and tiger prawns. By proposing the introduction of industry-based quotas for the scallop resource in Shark Bay, the WCTA believes that the Department has the opportunity to extinguish the resource sharing issue between the prawn and scallop industries. Furthermore, establishing such a system creates an environment which, over time, will allow a market-driven process of fleet rationalization to evolve in both industries. If the Department can achieve these changes, coupled with the introduction of a significant closure area to assist the recovery of the scallop resource in Shark Bay, it will have significantly enhanced the future prospects of the State's prawn and scallop industries.

[10] The official title of what is generally recognised as the Abrolhos Islands Scallop Fishery.

Appendix One:

The table below shows the 23 year catch history of scallops in Shark Bay between 1983 and 2005. Over the duration of this period, the proportion of total catch between the respective prawn and scallop fleets is split 72% (scallop fleet) and 28% (prawn fleet).

Shark Bay Scallop Fishery Catch History: 1983 to 2005.					
Year	Total Catch (t)	Class A Catch (t)	Class B Catch (t)	Class A Catch (%)	Class B Catch (%)
1983	705.3	640.4	64.9	90.8%	9.2%
1984	431.2	379.0	52.2	87.9%	12.1%
1985	232.8	175.0	57.8	75.2%	24.8%
1986	259.5	211.1	48.4	81.3%	18.7%
1987	490.9	377.3	113.6	76.9%	23.1%
1988	731.2	544.9	186.3	74.5%	25.5%
1989	121.0	71.2	49.8	58.8%	41.2%
1990	486.7	318.2	168.5	65.4%	34.6%
1991	2,532.0	1,916.2	615.8	75.7%	24.3%
1992	4,414.0	2,876.2	1,537.8	65.2%	34.8%
1993	1,934.6	1,469.6	465.0	76.0%	24.0%
1994	957.1	685.5	271.6	71.6%	28.4%
1995	596.0	423.4	172.6	71.0%	29.0%
1996	364.0	239.3	124.7	65.7%	34.3%
1997	328.5	227.6	100.9	69.3%	30.7%
1998	252.2	177.4	74.8	70.3%	29.7%
1999	339.9	249.8	90.1	73.5%	26.5%
2000	269.0	244.1	24.9	90.7%	9.3%
2001	216.3	138.7	77.6	64.1%	35.9%
2002	354.0	279.8	74.2	79.0%	21.0%
2003	155.2	85.50	69.70	55.1%	44.9%
2004	332.9	237.10	95.90	71.2%	28.8%
2005	384.6	217.50	167.10	56.6%	43.4%
Total Catch (t)	**16,888.9**	**12,184.8**	**4,704.2**		
		72.1%	**27.9%**		

8

References

Fisheries Management Paper No. 199
2005 'Management of the Proposed South Coast Trawl Fishery', Department of Fisheries.

Hart, D
2003 'Yield and biomass-per-recruit analysis for rotational fisheries, with an application to the Atlantic sea scallop (*Placopecten magellanicus*)', Fishery Bulletin, 101 (1): 44-57.

Hart, D
2006 'When do marine reserves increase fishery yield?', Canadian Journal of Fisheries and Aquatic Sciences, 63: 1445-1449.

Hart, D and Rago, P
2006 'Long-Term Dynamics of U.S. Atlantic Sea Scallop *Placopecten magellanicus* Populations', North American Journal of Fisheries Management, 26: 490-501.

Heald, D
1978 'A Successful Marking Method for the Saucer Scallop *Amusium balloti* (Bernardi)', Australian Journal of Marine and Freshwater Research, 29: 845-851.

Hillborn, R et al
2004 'Beyond Band-Aids in Fisheries Management: Fixing World Fisheries', Bulletin of Marine Science, 74 (3): 493-507.

Kaiser, M
2005 'Are marine protected areas a red herring or fisheries panacea?', Canadian Journal of Fisheries and Aquatic Sciences, 62: 1194-1199.

Murawski, S et al
2000 'Large-Scale Closed Areas as a Fishery-Management Tool in Temperate Marine Systems: The Georges Bank Experience', Bulletin of Marine Science, 66 (3): 775-798.

Parma, A et al
2006 'The Good, The Bad and the Ugly: Learning From Experience to Achieve Sustainable Fisheries', Bulletin of Marine Science, 78 (3): 411-428.

Smith, S and Rago, P
2004 'Biological reference points for sea scallops (*Placopecten magellanicus*): the benefits and costs of being nearly sessile', Canadian Journal of Fisheries and Aquatic Sciences, 61: 1338-1354.

Walters, C and Collie, J
1988 'Is Research on Environmental Factors Useful to Fisheries Management', Canadian Journal of Fisheries and Aquatic Sciences, 45: 1848-1854.

Wilen, J
2006 'Why Fisheries Management Fails: Treating Symptoms Rather Than the Cause, Bulletin of Marine Science, 78 (3): 529-546.

Appendix 5 Submission on draft review of Shark Bay and Scallop Fisheries prepared by Elmwood Holdings Pty Ltd (trading as McBoats [Geraldton])

Review of the Shark Bay Prawn (SBPF) and the Shark Bay Scallop Fishery (SBSF)

This paper is prepared by Elmwood Holdings Pty Ltd T/as McBoats (Geraldton)

Introduction

McBoats has two SBSF licences and has fished for scallops in the Shark Bay region since 1982.

It is the Company's belief that the SBSF is on the verge of near collapse due to the fishing pressure on the scallops and, as a result, the lack of scallops available.

The Company believes that the cause of the diminishing numbers available to the fleet is due to factors other than environmental.

It is the Company's contention that the increased trawling by the prawn fleet along the Carnarvon Peron Line has increased scallop and scallop spat mortality – thus effecting scallop catches for both fleets.

It is also evident that the SB Prawn Fleet needs to catch scallops to maintain its economic position as a viable fishery. This deliberate targeting of scallops, rather than the taking of them as a by-catch, has caused the SB Scallop fleet extra hardship as it is obtaining a reduced percentage of the total scallop catch when compared to previous years.

It is the interest of both the prawn and scallop fleets to increase the number of marketable scallops on the grounds.

Management

Under present management practices involving meeting between prawn licence holders and scallop licence holders, one sees the meetings dominated by the strong prawn lobby group.

These strong "orators" working for the B Class prawn licensees leave little decision making for the A Class owners who are supposed to be entitled to the major portion of the scallop resource.

Over the years, since the Prawn / Scallop relationship was established in 1982, the prawn group has initiated many subtle changes which effect the catch ratio between prawn and scallop vessels. (see appendix 1)

McBoats believes that this review should address two area of concern:

1. How both groups can catch more marketable scallops and
2. How adjustments can be made so that the scallop fleet can obtain their fair historical share of the resource.

Sustainability issues

McBoats believes that the Department of Fisheries needs to include the SB Scallop Fishery as well as the SB Prawn Fishery in the planning to make trawling sustainable in Shark Bay.

To-date, emphasis has been mainly on the efficiency and sustainability of the prawn fleet as the attitude is that scallop recruitment fluctuations are based totally on environmental factors and this attitude is still maintained.

After 10 years of waiting for an environmental "happening" it is obvious that some other factors must be contributing other that the Leeuwin Current.

When one compares the catches from the Shark Bay trawl grounds with the Abrolhos Islands trawl grounds (massive returns in some years) it appears that the only difference is that the Shark Bay grounds are constantly trawled by the SB Prawn Fleet vessels. During the past 10 years, the Abrolhos has had major productions of scallops whilst Shark Bay has had less and less.

McBoats believes that the reason for the decline in Shark Bay scallop yields is due to the constant trawling by prawn vessels over and over sensitive known scallop recruitment grounds. We believe that this practice must be addressed for both fleets to survive into the future.

With the current world trend of lower and lower prawn prices, it is obvious that the SB Prawn vessels are trying to catch as many scallops as possible to supplement their required income.

Subtle pressure by the prawn lobby for the Scallop Fleet to have to use larger mesh, fish daylight hours, have less crew and cease fishing the grounds at high daily catch levels and hence leave more scallops for the prawn fleet have not gone unnoticed by the scallop licensees.

Constant accusations by prawn owners that the scallop fleet are catching and harming prawns are also a feature of most meetings. The fact that prawn vessels pay no attention to the millions of juvenile scallops that they destroy in their quest for prawns is never an issue.

When one observes that the prawn fleet goes up and down the same area many times during the season shows what little chance small scallops have of survival after being entangled in the smaller prawn mesh.

It may even be a time for smaller scallop mesh and larger prawn mesh to enable the scallop fleet to be more competitive.

If both groups are to benefit from scallop catches (which unlike prawns have been able to hold their price) small scallops must be allowed to grow-out to harvestable and marketable size. It should be a very simple exercise to have nursery grow-out areas similar to those of prawns – these areas can be opened and closed ensuring the best value product is caught. The advent of VMS technology allows relatively easy control of such practices.

These zones can be placed in known historic scallop grounds around the Bay. The Prawn Fleet can still catch their prawns as they pass through these areas. The prawns may also be larger as they have had time to mature.

McBoats believes that sensible conservation issues pertaining to delicate juvenile scallops which entail structured opening and closing times will help the prawn and scallop fleets catch more marketable scallops.

Again, McBoats believe that scallops left undisturbed until the following year will be the basis for better spat production – probably regardless of environmental conditions.

With more scallops available, and considering all the historical crew and hour ratios between both fleets, there should be a return to the original percentage proportion of 80% of the yield being taken by the Scallop Fleet and 20% by the Prawn Fleet as set up in 1982. (See Appendix 2)

Gear interaction issues

Due to the "creep" increase in the percentage of scallop catch by the Prawn Fleet over the years, it is time to standardize the gear of both fleets in regard to head-rope length and board size.

With the obvious introduction of unitization for the prawn fleet to allow more economic fishing using "double gear" it is time for the same possibilities to be allowed for the scallop fishery. We would like to be able to have the choice in regard to how we utilized our licences – by nets or units.

It would be of advantage to owners to have the flexibility of choosing single vessels in large seasons.

We wish to draw attention to the obvious benefits to the prawn fleet in using "double gear" to catch scallops. Such new efficiency may allow prawn vessels to fish scallops to a much lower density and daily catch rate but still allow daily fishing activities to remain economic.

McBoats also believe that the practice of using scallop mesh inside prawn nets (under the guise of crab protectors) is only a method of allowing prawn vessels to catch more scallops without damage to their nets. We believe that this is an advantage to the prawn group not considered or evident in 1982.

Environmental and conservation issues

McBoats wishes to bring to the attention of this review the waste of sea creatures which occurs with prawn fishing activities in Shark Bay. These creatures are caught up in the smaller prawn mesh size. We advocate the use of flume type tanks of seawater to keep the creatures alive during the sorting process. As scallops are one of the last animals sorted there is an increased chance of mortality whilst left on the vessel tables. Use of the tanks may increase the survival chances of the scallops and other creatures so that they can be returned to the sea.

As previously stated, McBoats believes that constant trawling by the prawn fleet using small mesh over sensitive nursery areas is having a negative effect on the numbers of scallops available for harvest.

McBoats would urge that known scallop recruitment grounds be closed until the stock reach optimum marketable levels, sampled for proof of quality and then fished. Once reaching an agreed daily catch level, the area would be closed until the next year and sampling.

Such a conservation practice should create the environment whereby the best marketable scallops are always available for catch – by both fleets.

Industry economics

McBoats believes that the present system where one group is trying to lift its economic gain to the detriment of another is unfair.

It costs approximately the same to maintain a scallop trawler as a prawn trawler.

Economic savings should concern fuel saving and gear – not targeting the other group's entitlement to a natural resource.

As prawns tend to become less and less valuable due to the importation of product from aquaculture ventures in Asia, the prawn fleet is being pushed into finding other catch areas and methods to support its income and remain economic.

Double gear vessels will help in this regard and this option must be extended to scallop vessels as well.

It is the responsibility of the Department of Fisheries to ensure that equity within the trawl industry remains and its research officers must make greater effort to implement strategies that will improve the abundance of scallops so that the scallop and prawn fisheries are to survive.

Department of Fisheries may need to take control of the Shark Bay fisheries and even use affirmative action to see that justice is done for the scallop fleet. This may encompass taking of scallops by only the A Class scallop fleet for a period during the season.

Scallop vessel owners are being faced with increasing costs in the areas of fuel, licences and subsidized crew payments. Unless drastic changes are made from 2007 we may not just see the demise of the fishery but also the owners.

Market considerations

It is an unfortunate fact that prawns are bringing less return due to price decreases while scallops have been able to hold their value. Meanwhile, other operational costs have increased.

Market outlets for both prawns and scallops are adequate and should remain the same. The trend is to look for large scallops and prawns.

The excessive prices paid for prawn and scallop licences does not justify either party for a greater share of the resource. Department of Fisheries should not be trying to help either party because of these licence prices.

However, Department of Fisheries does have a duty to ensure that optimum quantity and quality of prawns and scallops can be achieved via fishing activities.

McBoats believes that while this is happening for the prawn fishery in Shark Bay, little if anything is being done to maximise the scallop fishery.

Summary and Conclusion by McBoats

- It is obvious that there must be management changes in the fishery if all parties are to survive.
- The increased effort by the prawn group to maintain its economic position at the expense of another party entitled to the resource – the scallop group – is unfair and must be addressed immediately.
- The encroachment of the prawn group via trawling on sensitive scallop breeding and fishing grounds must stop now.
- The dual fishery must address itself to the historical scallop percentage catch which was initially allocated. This was 80% of the scallop catch to the scallop fleet and the remaining 20% to the prawn fleet. The scallop group has the right to maintain its historical catch in Shark Bay.
- Fisheries must be diligent and ensure that the new double gear used by the prawn fleet does not reduce the scallop grounds to a position where they can never recover.
- Areas must be closed to both fleets for the season once the minimum daily catch level has been reached.
- The new practice of leaving scallops on the grounds for "breeding purposes" only to see them targeted and harvested later in the year by the prawn fleet is unfair.
- The scallop fleet should be allowed to fish Shark Bay until the catch becomes uneconomic. At this stage, all fishing for scallops by any vessel should cease until the next year. Both fleets will benefit from this practice as some residual catch should be available.
- It is time for both groups to respect the other's position and to return to the basic rules and regulations introduced in 1982.

Appendix I – Changes encroaching on 1982 Agreement

Some changes to the 1982 Agreement where the SB Prawn Fleet have been improving their position in a subtle manner mainly at the expense of the SB Scallop Industry.

1. The change from taking scallops as a by-catch to B Class licences.
2. Non observance of the 80 / 20 % agreement.
3. Deliberate targeting of scallops via their B Class licences.
4. Scallops, once a by-product, now part of the planned fishing programme.
5. Net protection devices placed inside prawn mesh which in fact allow greater scallop catch.
6. Changes to the fishing grounds especially the over fishing of the Carnarvon Peron Line.
7. The advent of sorting machines on prawn vessels leaving more time for crew to shuck scallops.
8. Advocating that scallops be left on the grounds by scallop vessels once a minimum level has been activated under the guise of "breeding stock" – only to see prawn vessels continue to harvest this product.
9. Over domination of inter-industry meetings by the prawn lobby to the stage whereby Department of Fisheries and scallop representatives are manipulated and even intimidated.
10. Allowing rumour to be a factor in trying to change the original catch arrangements ratio.

Appendix II – Catch sharing arrangement

When the Shark Bay scallop fishery was established, the following catch sharing arrangements were to be implemented as law.

The parameters have eroded in favour of the prawn fleet and it is time to return to the original rules.

Crews	Scallop vessels	13	
	Prawn vessels	6	
Hours	Scallop vessels	24	
	Prawn vessels	15	
Nets	Scallop vessels	2 x 7 fath	100mm mesh
	Prawn vessels	2 x 8 fath	prawn mesh
only			
Catch	Scallop vessels	Scallops only	
	Prawn vessels	Prawns & scallop by-catch	
Targeting	Scallop vessels	Scallops only	
	Prawn vessels	No pure targeting of scallops	
Resource sharing	Scallop vessels	80% Scallops	
	Prawn vessels	20% Scallops	

McBoats believes that by subtle manipulation over the years that the original agreement has becomes blurred and the prawn group has eroded the original set of parameters to the current stage where the situation is strongly in favour of the prawn fleet to the detriment and economic livelihood of the scallop industry.

Appendix 6 Submission on draft review of Shark Bay and Scallop Fisheries prepared by the Shark Bay Prawn Trawlers Assocation Inc.

Review of the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop Managed Fishery

Submission by the -
Shark Bay Prawn Trawler Operators' Association Inc.

Introduction

This review is the result of continuing dissatisfaction with the management arrangements in the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop Managed Fishery by the authorisation holders in each fishery. The general dissatisfaction arises partly from the high expectations that scallop fishers have of the returns they expect from each fishery.

For the Shark Bay Prawn Managed Fishery authorisation holders, efforts to introduce real-time micromanagement and profit maximization in their fishery are being frustrated by prawn mortalities caused by the operation of scallop trawlers on grounds that have been closed to prawn trawling. Shark Bay Prawn Managed Fishery authorisation holders also feel that there inequities occurring in the access to scallop resources. A further frustration for Shark Bay Prawn Managed Fishery authorisation holders is the apparent readiness of the Department of Fisheries to close areas of Shark Bay to trawling the test hypothesis that have already been tested elsewhere.

The Shark Bay Scallop Managed Fishery authorisation holders believe that the continuing series of years of low to medium scallop catch is the result of the environmental factors and perhaps to decisions made in the mid-1990s to introduce boundaries within the Shark Bay Prawn Managed Fishery that have concentrated prawn trawling effort in an area that the Shark Bay Scallop Managed Fishery authorisation holders believe are critical to the recruitment of scallops in shark Bay.

Sustainability issues

The Shark Bay Prawn Managed Fishery has been sustainable since its inception in the early 1960s – albeit as a result of continual management adjustment; the most important of which was and industry funded buy-back instituted in early1990. More detail of the buy-back is given below.

The sustainability of the Shark Bay Prawn Managed Fishery has been maintained for the capture of prawns but prior to the declaration of the Shark Bay Scallop Limited Entry Fishery in 1987 it was not known if the capture of scallops was sustainable because scallops demonstrated large inter-annual abundance. Prior to the mid 1980s there was no attempt to explain the wide inter-annual variability of scallop abundance. Even to this day there is no demonstrably robust explanation for the phenomena. It is postulated that good scallop recruitment follows a year of weak Leeuwin Current but the causative relationship is extremely weak. The relationship appears to be stronger for two consecutive years of weak Leeuwin Current.

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In the early 1970s the collective wisdom of the Department of Fisheries was that Shark Bay scallop stocks were a long-lived species (at least five years old at maturity) of low fecundity – but both these assertions were later proved to incorrect. During those years, the Department of Fisheries asked prawn trawl operators not to target scallops because of the potential for over-exploitation of scallop stocks –and the prawn fleet obliged. Scallop catches averaged in the period 1968 –1982 averaged 484 tonnes with peak catches of 1364 tonnes and 2173 tonnes occurring in 1969 and 1982 respectively.

Prior to 1979 all scallops were landed "in shell" but in 1979 the "Eva Rae' and the "Kingfisher" commenced processing scallops at sea. This change allowed profitability at much lower levels of catch and encouraged many non-prawn trawlers to commence trawling for scallops (and snapper) in Shark Bay. The Department of Fisheries did not discourage the practice until boat numbers grew to exceed 30.

The Department of Fisheries appeared to have a curiously schizoid attitude to Shark Bay scallops; the scallops could be over-exploited if prawn trawlers caught them (which is unavoidable because they inhabit some of the same fishing grounds as prawns) but scallops could not be over-exploited if other trawlers caught them.

Regardless of the forgoing, the fact that a separate scallop fishing trawlers could be introduced into Shark Bay in the early 1980s and that a Shark Bay Scallop Limited Entry Fishery could be declared in 1987 is evidence that the 35 prawn trawlers operating in Shark Bay since 1962 must have taken scallops on a sustainable basis. If not, the Department of Fisheries would not have allowed other trawlers to catch Shark Bay scallops nor could have it ultimately declared a separate Shark Bay Limited Entry Scallop Fishery in 1987 to allow 14 more trawlers exploit Shark Bay scallop stocks.

It is also curious to note that prior to the introduction of 14 scallop trawlers into Shark Bay by the declaration of the Shark Bay Scallop Limited Entry Fishery in 1987, there had been little indication of, or discussion about, of over-exploitation of prawn stocks by the Shark Bay prawn fleet, other than observations about the tiger prawn stock reduction in Exmouth Gulf. However, simultaneous with the declaration of a Shark Bay Scallop Limited Entry Fishery, the Department of Fisheries advised the prawn fishing fleet that it must reduce prawn trawling to approximately 40,000 trawled hours per year to protect the sustainability of prawn resources. The data supporting the Department of Fisheries change of view was that immediately following the arrival of a substantial number of non-prawn trawlers into Shark Bay in 1980, tiger prawn catches reduced from more than 600 tonne plus per annum experienced for most of the previous decade to around 300 tonnes per annum in the 1980s.

The prawn trawl reduction required by the Department of Fisheries was achieved by reducing the length of the prawn season and by a prawn industry funded buy-back prior to the 1990 prawn season that reduced the number of prawn trawlers from 35 to 27 – at a cost of $19,500,000 to the remaining prawn fleet. There was an immediate reduction in prawn trawl hours from approximately 58,000 hours per annum to approximately 44,000 hours per annum. The number of prawn trawl hours increased again to approximately 59,000 hours in 1996 but has since fallen to approximately 39,000 in 2005.

The Shark Bay Prawn Managed Fishery is now managed for maximum economic yield not maximum sustainable yield. Maximum economic yield is achieved at a much lower level of fishing effort than maximum sustainable yield.

Between 1993 and 2004 the Shark Bay Scallop Managed Fishery was managed on the basis of a "matrix". Since almost all Shark Bay Scallop Managed Fishery licence holders also hold licences in the Abrolhos Islands and Mid-west Trawl Fishery, the matrix consisted of commencing the Shark Bay Scallop Managed Fishery after the Abrolhos Islands and Mid-west Trawl Fishery finished; usually in April. Denham At the same time the Shark Bay Prawn Managed Fishery moved towards a co-management model operating on an increasingly small scale and closer to real time action; subject always to the limitations of changes to legislative restrictions that were running about five years behind the agreed management arrangements.

As more was learnt about Shark Bay prawn behaviour various management options were trialled. Department of Fisheries Research Officers advised that productivity and profitability could be improved if Denham Sound prawns were not trawled prior to July each year. The prawn industry agreed to this approach in late 2003. However, at the start of 2004, the Department of Fisheries advised that the November 2003 scallop survey indicated that the scallop fleet should operate in Denham Sound in May 2004.

It is well known among prawn trawler operators that scallop trawling causes prawn mortality. (Prawn trawler operators also operate, or have operated, scallop trawlers and there is constant movement of crew between the fleets so the operations on each type fleet is well understood by the other.) In fact, the capture of prawns by scallop trawlers was noted in the *Report of the Scallop Fishery Management Working Group March 1983*. Prawn trawler operators only agreed to scallop trawlers operating in the Denham Sound if prawn trawlers (that are also scallop trawlers) also operated so that prawn trawlers could catch some prawns before scallop trawling destroyed prawns.

So despite their misgivings, the prawn fleet operated in Denham Sound, with the scallop fleet, prior to July in 2004.

Following the 2004 experience, the prawn fleet sought an alternative management process for Denham Sound so that prawn mortalities caused by scallop trawling could be minimised. Based upon Department of Fisheries advice that prawn recruits are not on the Denham Sound scallop grounds until March each year and that scallop meat quality is superior in February, the prawn fleet agreed that in any year that the prior November scallop survey indicated that there would be a good Denham Sound scallop abundance, the scallop fleet could operate in Denham Sound in February and the prawn fleet would not operate.

This was a considerable concession by the prawn fleet because it changed the basic equity arrangements between the two fleets giving the scallop fleet exclusive access to a resource that the prawn fleet has a prior right of access. The prawn trawler operators made the concession only on the basis that although the scallop fleet would have exclusive access to Denham Sound scallops in February, the scallop fleets' early departure from Denham Sound would stop the waste of prawns. It was agreed that the scallop fleet would only fish the resource to a cut-off level of catch, then fish other

parts of Shark Bay when the prawn season started and when a certain cut-off catch rate was reached stop fishing and leave Shark Bay completely. Prawn trawlers operators agreed not keep scallops caught during the critical scallop pre-spawning season.

The agreed change of arrangements also has sustainability implications.

A consequence of the major changes that were made to be Shark Bay Scallop Managed Fishery in 2005 was a shift of fishing effort from approximately May each year to February or March. The majority of scallops are now being taken prior to spawning with the inherent risk of that there may not be sufficient spawning scallop left for successful recruitment in the following year.

The method of measuring the point at which scallop fishing is terminated relies entirely upon accurate real-time catch data collection from the scallop fleet. The inherent weakness of this system is that there is an in economic incentive for a scallop trawlers to over-report their catch so that the reported catch rate is above the threshold level at which scallop fishing is terminated. No observers are on board scallop trawlers to monitor the accuracy of the reporting.

The agreed catch cut off rates suggest that the cut off catch level has been set at a level where it is no longer viable to continue fishing rather than at a level that has some scientific basis, for example, a catch level that leaves sufficient breeding stock to provide future recruitment. The Department of Fisheries has not provided any data that the cut off level of scallop catch leaves a level of scallop density that is sufficient to provide successful scallop recruitment. It seems to this Association that the low level of residual stock that is now left by fishing prior to spawning could be a major threat to scallop sustainability.

There are various theories regarding the determinants of scallop density in Shark Bay. It has been postulated that in years of very weak Leeuwin Current, gyres and eddies concentrate spawning stock into aggregations in Shark Bay that promote successful spawning resulting in higher levels of recruitment in the following year. The relationship between a weak Leeuwin Current in one year and scallop recruitment in the following year is poor.

We note however, that there appears to be a stronger relationship between two successive years of weak Leeuwin Current and a high level of scallop recruitment the following year.

Environment and conservation issues

In November 2001, the Department of Fisheries submitted applications for the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop Managed Fishery to Environment Australia for assessment against the guidelines for ecologically sustainable management of fisheries for continued listing on Section 303DB of the *Environmental Protection and Biodiversity Conservation Act 1999.*

Environment Australia assessed the submissions in accordance with the wildlife trade provisions of part 13A of the *Environmental Protection and Biodiversity Conservation Act 1999* and on 11th February 2003 and the Minister for the Environment and Heritage granted a conditional five year approval for both the Shark Bay Prawn and Shark Bay Managed Fisheries.

As noted above, the Shark Bay Prawn Managed Fishery is managed with an objective of maximising economic yield. Maximum economic yield is achieved at a level of catch that is substantially less than maximum sustainable yield. The Shark Bay Prawn Managed Fishery is co-managed on a real-time basis by agreement between industry and the Department fisheries based on data collected by the fleet and by independent surveys. Fishing is almost always confined to an area less than the area allowed by legislation and if small prawns are encountered then that area is closed by industry agreement almost over night.

The current situation in the Shark bay Scallop Managed Fishery is less clear. Between 1993 and 2004 the Shark Bay Scallop Managed Fishery was managed on the basis on a "matrix". Since almost all Shark Bay Scallop Managed Fishery licence holders also hold licences in the Abrolhos Islands and Mid-west Trawl Fishery, the matrix consisted of commencing the Shark Bay Scallop Managed Fishery after the Abrolhos Islands and Mid-west Trawl Fishery finished; usually in April. Denham Sound was closed to all trawling between either 1 May or 15 May and 1 August each year to protect small prawns. A November survey of Shark Bay was used to predict scallop catch in the following year.

By scallop trawling in Shark Bay in late April and May each year it appears that scallop trawling has been occurring at about the time that scallops were entering their spawning phase – although spawning appears to vary from year to year. Spent roes are generally observed in December, January or February each year.

As indicated above the trawling cut off rates do not appear to be based upon any measure of the scallop density necessary to ensure successful recruitment - nor is there independent verification of reported scallop catch rates. The strategy has inherent scallop stock conservation dangers.

Industry economics

The prawn industry has previously supplied the Department of Fisheries economist with details of the current budget for an "average" trawler operating in the Shark Bay Prawn Managed Fishery.

It is well known that since the SARS epidemic in Asia, there have been a series of events that have subdued international travel and economic activity in major export markets. International demand has never recovered to pre-SARS levels.

International aquaculture production of prawns has increased substantially over the past decade. The Shark Bay Prawn Managed Fishery has been spared the full force of the aquaculture over-supply situation because the main specie of prawn caught in

Shark Bay (western king prawn) is not produced by aquaculture. The price of tiger prawns caught in Shark Bay has been reduced although that price is now rising again (albeit from a low base) as the international supplies of aquaculture tiger prawns are reducing as farms change their production to *Penaeus vanomei* - a white prawn that is not in direct competition with either major Shark Bay species.

The value of the Australian dollar in US dollar terms rose considerably and quickly in 2003. Most international sales of prawns are written in US dollars. Australian dollar returns have been negatively impacted by the strength of the Australia dollar. The Australian dollar is a "commodity currency" and given Australia's role as a commodity exporter to the emerging China economy, it is unlikely the Australian dollar will exhibit a substantial reduction in value in the foreseeable future.

The gross value of production of the Shark Bay Prawn Managed Fishery for the seasons 2000 – 2004 (not adjusted for inflation) as reported in *State of the Fisheries* is:

2000 $42.7M
2001 $25.2M
2002 $30.0M
2003 $22.3M
2004 $24.4M

The net price of fuel paid in Carnarvon has risen considerably over the past eight years. The following are the average diesel net price (after diesel fuel rebate and not adjusted for inflation) per litre for fuel delivered to prawn trawlers at the Carnarvon T Jetty from 1999 – 2006:

1999 31c / lt (34.9c custom fuel rebate)
2000 49c
2001 57c
2002 52c
2003 59c
2004 59c
2005 83c
2006 99c ... thus far (+38.143c custom fuel rebate)

The June 2006 price Carnarvon T Jetty diesel is $1.142 / lt inclusive of GST and net of excise duty.

Each Shark Bay prawn trawler uses between 1300lts and 1700lts of diesel each night.

The prawn industry response has been to adjust management and operations to minimise fuel usage. Industry/government co-management is eliminating times of low catch efficiency. The management regime is being reshaped to provide short periods of high catch rates. It is hoped that Department of Fisheries Legislative drafting will eventually catch up with its work load so that net unitization can be introduced to reduce the number of prawn trawlers and therefore decrease fuel input costs per kilogram of catch.

Scallop industry expectations – realistic or not?

From as early as 1983, the then Minister for Fisheries warned those investing in the Shark Bay scallop industry that they should not consider Shark Bay scallops as a fishery that they could rely upon to form a major part of their income. There were similar regular warnings prior to, and after, the declaration of the Shark Bay scallop Limited Entry Fishery in 1987.

The Director of the Fisheries Department wrote to the president of the Shark Bay Scallop Association on 31 July 1989. That the letter stated in response to the Associations decision to cease fishing in July:

"I am pleased to be informed of this action. The decision is in line with my original view that the fourteen boats approved to take scallops in Shark Bay would need to consider the resource is part of their total fishing strategy rather than identify Shark Bay scallops as a fishery occupying a major portion of the year."

Similarly, the Minister for Fisheries in a letter to the same Association and dated 4 September of 1989 stated:

"In some years the scallop stocks will be higher but in others they will be very low. The scallop fishermen must regard the Shark Bay scallop fishery as part of their fishing strategy which will provide a variable percentage of their annual income. They should not regard scallop as providing their total income."

There are many other letters from both the Minister for Fisheries and the Director of Fisheries that contain the same advice. Members of the scallop industry have been put on notice right from the outset that scallop catches will be variable and investments cannot be made in the expectation that scallop catches will provide major or regular or indeed any income.

All of the scientific assessments emphasise that Shark Bay scallop concentrations irregular, occur in localised areas and that scallops are essentially immobile - there is little or no migration.

Since 1995 large parts of Shark Bay have been closed to all forms of trawling. In 1993 a small triangular area to the east of Bernier and Dorre Islands was closed to all trawling. By 1996 the area had in increased considerably so that a large area to the east or Bernier and Dorre Islands and extending south to Cape Inscription was no longer available for trawling. This area had been a good provider of scallop catches. Annual scallop catch data shows a significant drop that coincides with the closure of these waters.

Other areas of Shark Bay including the majority of Denham Sound, the area around Quobba, Withnell Point and the Shark Bay Marine Park have all been closed since the mid 1990s.

Since scallops are localised and immobile they could be occurring but in areas that are no longer available for trawling. It may be unrealistic for the scallop industry to

expect that the area of Shark Bay that that is now open to trawling will ever return the levels of catch that were experienced prior to 1995 when a much larger part of Shark Bay was open to trawling. As the next paragraph shows scallop catch rates have not fallen – only the total scallop catch.

Shark Bay Scallop Managed Fishery authorization holders often make the claim that prawn management boundaries introduced in the 1990s have had the effect of reducing scallop catches. Data showing targeted scallop trawling hours and catch (as opposed to scallops taken by prawn trawlers that are not targeting scallops) is available from 1982. The catch rate for scallops is less than 30kg/hour for two years in every three. There is no downward trend to the catch rate. The scallop catch rate per hour in the 1980s (excepting 1988) is very similar to the catch rate per hour from 1994 to 2002. Scallop catch rates have remained at a consistent at long-term average catch rates from 1994 to 2002 inclusive. The scallop catch rate in 2003 (53.5kg/hour), after the prawn management boundaries changes, was higher than any year in the 1980s. The scallop catch rate increased in 2003, 2004, 2005 and 2006 when Levillian Shoal (north of Denham Sound) was opened for scallop trawling.

Quite clearly prawn management boundary changes have not decreased scallop catch rates. This Association contends that there is no connection between prawn management boundaries and scallop catch rates. If Shark Bay Scallop Managed Fishery authorization holders insist that there is a connection then the data shows that prawn management boundary changes have <u>increased</u> scallop catch rates.

Perhaps a look at the wise words of the *Report of the Scallop Fishery Managing Working Group March 1983* may be useful. On page 15 it stated that:

"The more experienced scallop fishermen within Shark Bay in most instances supported a policy of sharply reducing fishing effort to 6 to 8 scallop trawlers and accepted the historical right of prawn trawlers being able to take scallops."

and

"The Working Group whilst not having the data to precisely determined desirable levels of fishing effort, accepted that for biological and economic reasons it may be necessary to reduce at some time in the future the number of scallop boats to significantly lower levels than the number which operated in the Shark Bay Scallop Fishery in 1982. Average catches would support a figure in the order of 4 to 6 scallop boats by ratio of 1982 catches."

If catch rates have not reduced, but the area of Shark Bay that is available for trawling has reduced so that the total scallop catch has reduced then the logical course of action for the Shark Bay scallop fleet is to consider reducing the size of the scallop fleet - perhaps to the number suggested by the Working Group twenty three years ago.

It should be noted that the 1990 reduction in the Shark Bay prawn fleet, also resulted in a reduction in the number of trawlers taking scallops in Shark Bay. The major beneficiary was the Shark Bay scallop fleet. The reduction was paid entirely by the Shark Bay prawn fleet. In essence, there was a transfer payment from the Shark Bay prawn fleet to the Shark Bay scallop fleet in 1990.

Equity Issues

Catch ratios

Following the declaration of the Shark Bay Scallop Limited Entry Fishery in 1987 the then Minister for Fisheries issued a directive that the scallop catch of Shark Bay should be caught on a ratio of 80% to Shark Bay Scallop Limited Entry Fishery authorisation holders and 20% by Shark Bay Prawn Limited Entry Fishery authorisation holders. The directive was never accepted by this Association because it is it was ultra vires as to the powers of the Fisheries Act 1905 and the Minister, and because it was an absurdity since it was not possible or any party to know ex ante what the ex post catch for the year would be nor what any other boat within a fleet has caught therefore it was impossible for any individual authorization holder to take any action that could comply with the directive.

The 80% to 20% catch ratio directive was based upon the capture ratio of scallops during the period 1984 to 1987 when the research was undertaken in the Shark Bay scallop fishery. Shark Bay Prawn Limited Entry Fishery authorisation holders were asked not to catch scallops during at a time so that correct scientific studies could be made. As a result of the Shark Bay Limited Entry Prawn Fishery authorisation holders complying with the request the ratio of scallop catch during that period was 80% by scallop only trawlers and 20% by prawn trawlers. The Minister for Fisheries used this artificial catch ratio as a basis for allocating catch after the research period. Either the reasons given to Shark Bay Prawn Limited Entry Fishery authorisation holders not to target gallops during the research period were misleading or the only circumstances under which the ratios could ever be justified is if the Shark Bay Scallop Limited Entry Fishery authorization is revoked and research into the Shark Bay scallop resource is recommenced.

The 80to 20% ratio directive was superseded by regulations restricting Shark Bay Prawn Limited Entry Fishery authorisation holders to six crew and while Shark Bay Scallop Managed Fishery authorisation holders could use up to 13 crew. The reason for the difference as stated by the Fisheries Department is to allocate catch between the Shark Bay Prawn Managed Fishery authorisation holders and Shark Bay Scallop Managed Fishery authorisation holders. Given the reasons for the varying crew sizes, the regulation of crew sizes contravenes the National Competition Policy that has been signed by the Western Australian Government.

Fleet restructure – payers and beneficiaries

As noted above, the 1990 Shark Bay prawn fleet buy back, also resulted in a reduction in the number of trawlers taking scallops in Shark Bay. A beneficiary was the Shark Bay scallop fleet because the number of trawlers taking scallops was reduced. The reduction was paid entirely by the Shark Bay prawn fleet. There was a transfer payment from the Shark Bay prawn fleet to the Shark Bay scallop fleet in 1990. The cost to the Shark Bay Prawn Managed Fishery authorisation holders was $19,500,000.

Exclusive access

As also noted above, in 2004 the prawn fleet sought an alternative management process for Denham Sound so that scallop trawling caused prawn mortalities could be minimised. Based upon Department of Fisheries recommendations that prawn recruits are not on the Denham Sound scallop grounds until March each year and that the meat quality of the scallops in Denham Sound is superior in February, the prawn fleet agreed that in any year that the prior November scallop survey indicated that there would be a good scallop abundance, the scallop fleet could operate in Denham Sound in February and the prawn fleet would not operate.

This was a considerable concession by the prawn fleet because it changed the basic equity arrangements between the two fleets allowing the scallop fleet exclusive access to a resource that the prawn fleet has a prior right of access. The prawn trawler operators felt that the concession was worthwhile because although the scallop fleet would have exclusive access to Denham Sound scallops, the scallop fleet's early departure from Denham Sound would stop the waste of prawns. It was agreed that the scallop fleet would only fish the resource to a cut-off level of catch, then fish other parts of Shark Bay when the prawn season started and then leave Shark Bay and not return to Shark Bay in that season when another cut off level of scallop catch was reached. This would have the benefit of saving more prawns from scallop nets. Prawn trawler operators agreed not keep scallops during the critical scallop pre-spawning season.

The November 2004 survey indicated a good 2005 Denham Sound scallop season and the prawn fleet agreed to a scallop fleet only operation in Denham Sound for February 2005. The indications were that the February Denham Sound scallop trawling would last 10 days. In the event the trawling lasted well into March causing considerable angst for the prawn fleet because of the concern that prawn recruits would be destroyed by the scallop trawling and because far more scallops were available for the exclusive access of scallop trawlers.

Regardless of the angst in the prawn fleet, 2005 provided a better quality scallop meat for the scallop fleet and the 2005 Denham Sound prawn catch (commencing in August) was good quality and quantity.

When the November 2005 scallop survey indicated reasonable catches in Denham Sound in 2006, the prawn industry agreed to similar arrangements as 2005 with the proviso that the scallop fleet would leave Denham Sound on 18 March when the prawn season started north of Denham Sound. The notes to the "Shark Bay 2006 Season Fishing Arrangements" reflected the agreement and stated that *"the scallop fleet can continue fishing in the "northern area" outside of the closed portion of red cliff until the catch rate of 180 to 200kg/24hr is reached. The prawn fleet should cease taking scallops when the scallop fleet catch rate reaches 180 to 200kg/24hr. This leaves some scallop breeding stock during the spawning season period. The prawn fleet can re-commence fishing scallops directly after the June moon closure..."*

This was understood to mean that there would be no more trawling by scallop trawling by the scallop fleet after the catch rate fell below 180 to 200kg/24hrs whereas the prawn fleet could re-commence retaining scallops after the June moon

closure. It is difficult to understand how the statement could be interpreted in any other way.

This agreement was an attempt by the prawn industry to create a "win-win" situation; scallop trawlers would get exclusive access to big meat scallops, in return Denham Sound prawns would not be unnecessarily damaged prior to prawn trawlers entering Denham Sound and prawn trawlers would get exclusive access to any scallops remaining after spawning season. There were major equity issues involved in the trade offs. In the event, one scallop trawler (of 14) did return to Shark Bay and commenced fishing after the June moon closure on the basis that – "There is no legislation to stop me trawling." The Department of Fisheries did nothing.

The experience of 2005 and 2006 has left the Shark Bay Prawn Managed fishery authorisation holders very wary of the equity shifts that result from assisting the Shark Bay Scallop Managed Fishery licence holders because one Shark Bay Scallop Managed Fishery licence holder did not display reciprocity or responsibility

Areas set aside for scallop only access

Since 2004 an area known as the "Redcliff Closure" has been closed to prawn fishing, by industry agreement, to allow exclusive access to scallop trawlers. This arrangement was proposed by the Department of Fisheries to see if scallops would become more abundant in an area not subject to prawn trawling and the prawn industry agreed.

We have been advised that Shark Bay scallops are highly fecund and have a life span of 3 years. The Redcliff Closure has now been in place for 3 years and there is no indication of scallop population increase in the Redcliff Closure – indeed we have been told that scallop abundance in the Redcliff Closure is decreasing.

The south east corner of the Redcliff Closure is an important area for the capture of large king prawns. Whilst it is impossible to calculate the value of large king prawns that have been foregone over the last three years as a result of the Redcliff Closure it is likely that the value of the scallops that have been taken from the Redcliff Closure area does not exceed the value of the large king prawns that have been foregone – and, not surprisingly, there has been no increase in scallop abundance in the Redcliff Closure area.

Gear interactions and fishery interrelationships

Prawn nets catch scallops. They have done since the early 1960s when scallops were first caught in Shark Bay. This is understood by the prawn industry and there are rules in place so that if scallops are caught when the scallop season is closed, prawn trawlers return the scallops to the sea. The Shark Bay Prawn Trawler Operators' Association Inc. is not aware of any study that has shown to the extent of mortality on scallops that had been trawled and returned to the sea. It is assumed that factors such as physical damage, the time out of the water and any contact with toxic organisms we will affect mortality on scallops returned to the sea. However, it is noted that

scallops and are very robust animals and it is likely that survival is good in when scallops have been held in hoppers before being returned to the sea.

As stated above the action of trawling scallops and then returning them to the sea has the effect of creating small aggregations of scallops rather than having them sparsely separated in the seafloor.

Conversely it is also know that prawns, particularly large prawns, are caught in scallop nets. This fact was noted in the *Report of the Scallop Fishery Management Working Group March 1983.* It was confirmed again during a study done in April 2004 when it was demonstrated that a standard scallop net caught 9-10% by weight of the prawn catch of a prawn net when used for the same period of time.

Given that the 14 scallop were trawlers introduced into Shark Bay in the 1980s to operate on the 24 hour the operating cycle as opposed to the 15 hour operating cycle allowed for prawn trawlers, it can be deduced that the introduction of 14 scallop trawlers into Shark Bay had a prawn mortality effect approximately equal to prawn catch of 2.24 prawn trawlers. The introduction of the equivalent of 2.24 extra prawn trawlers in 1987 preceded the requirement for the prawn industry to reduce its fleet by 8 eight in 1990. It could be argued that 2.24 of the 8 trawlers bought out by the prawn fleet were merely removing the extra prawn mortality caused by introducing 14 scallop trawlers into Shark Bay in 1987. We note that the *Report of the Scallop Fishery Management Working Group March 1983* states at page (ii) that

"Any action to promote the scallop fishery should be in no way prejudicial to the viability of the prawn fishery."

It is clear that the very creation of the Shark Bay Scallop Limited Entry Fishery was prejudicial to the prawn fishery.

More scallops and less red herrings

A recurring complaint from the scallop industry is that prawn trawlers that catch scallops and then return them to the water when the scallop season is closed are dispersing scallops. An examination of the facts suggests that the reverse is true.

Most prawn trawlers operating in Shark Bay are fitted with hoppers that keep scallops alive while prawns are sorted from the catch. By trawling up scallops that a spread as thinly as one scallop per area of sea floor equivalent to the size of a standard tennis court, prawn trawlers gather scallops together in one place, the hopper. At the end of sorting, the scallops are then returned to the water all in the one place. Rather than dispersing scallops, prawn trawl operations actually concentrate scallops into small aggregations that should have a higher potential for successful spawning,

Future Research Directions

The Shark Bay Prawn Managed Fishery authorisation holders believe that the priorities for future research in the Shark Bay trawl fisheries are:

- First, there must be research to determine if there is any stock/recruitment relationship in the Shark Bay Scallop Managed Fishery. If there is not relationship, that is equally important to know.

- Second, if there is a stock/recruitment relationship in the Shark Bay Scallop Managed Fishery, there needs to be a study undertaken to determine if the level of scallop abundance required to guarantee scallop recruitment in the following year. The required level of scallop abundance should be expressed in terms of a catch rate per hour.

- Third, if no stock recruitment relationship can be determined for the Shark Bay Scallop Managed Fishery then research needs to be undertaken to the identify the major determinants for Shark Bay scallop abundance.

- Finally, there needs to be research undertaken to determine more accurately the extent of damage caused to prawn stocks and habitat from scallop trawling.

Conclusions and Recommendations

It has been clear from the history of the Shark Bay Scallop Managed Fishery that since its creation with at least twice as many boats as originally recommended by the report of the *Scallop Fishery Management Working Group March 1983,* it very existence has prejudiced the viability of the Shark Bay Prawn Managed Fishery.

The declaration of a species defined fishery (using competing gear) within a method defined a fishery is always certain to create conflict. Undertakings given to each fishery at the outset have been lost through political processes, changing economic circumstances and the loss of corporate memory. The challenge for administrators, having created the problem, is to honour the guarantees given to each party, have the strength to remind each party of the warnings and limitations that they have been given and to act in an equitable and unbiased manner. There has been little evidence of this in the past nineteen years.

The enormous inter-annual variability of scallop abundance makes it an extremely difficult resource to manage. The many of failed attempts to manage scallop fisheries throughout the world are testament to that fact.

The original Working Group's recommendations recognised the severe limitations of fisheries management tools in coping with a species subject to such large inter-annual changes in abundance and recommended a low level of exploitation on an opportunistic basis. The Working Group and all subsequent Fisheries Department advice warned that there should be no expectation that the Shark Bay scallop resource could provide either a regular or a profitable income.

Many other Western Australian trawl fisheries operate under the same circumstances - most notably the Abrolhos Islands and Mid-West Trawl Fishery (scallops), the South Coast Trawl Fishery (scallops), the Onslow Prawn Fishery, the Broome Prawn Fishery and the Nickol Bay Prawn Fishery.

The difference between these fisheries and the Shark Bay Scallop Managed Fishery is that none of them are operating on over-lapping trawl grounds with another trawl fishery. None of the other fisheries can blame another fishery for their circumstances or seek access to another fishery's resource to resolve their problems. They resolve their own problems using their own resources. Usually that is accepting that they are operating in a fishery with high inter-annual stock abundance and making their business plans accordingly.

The Shark Bay Scallop Managed Fishery has demonstrated a total inability to confront or resolve its own problems – if there are any. Its actions so far have impinged upon the viability of the Shark Bay Prawn Managed Fishery either by way of direct costs (the 1990 Shark Bay Prawn managed Fishery Buy-back) or by damage to prawn stocks (as proved by the April 2004 trawl study) or by the closure of productive prawn fishing grounds (such as the Redcliff Closure).

If there are problems in the Shark Bay Scallop Managed Fishery then that fishery appears to be in denial. The obvious solution to problems in the Shark Bay Scallop Managed Fishery, if there are any, is a scallop industry funded buy-back.

Graeme Stewart
Executive Officer
Shark Bay Prawn Trawler Operators Association Inc. 26 July 2006

Appendix 7 Submission on draft review of Shark Bay and Scallop Fisheries prepared by the Norwest Fishing Co Pty Ltd (trading as Correia Fishing Co)

Norwest Fishing Co Pty Ltd
ACN 008 907 104
Trading as

Correia Fishing Co

2 July 2007

Lindsay Joll
Executive Officer
Shark Bay Prawn and Scallop Fisheries Review
Locked Bag 39 Cloisters Square Post Office
Perth WA 6850

Dear Lindsay,

Re Shark Bay Prawn and Scallop Fisheries Review; Fisheries Management Paper No. 222

Introduction
Correia Fishing Co ("CFC") currently owns and operates 2 licences in both the Shark Bay Prawn and Scallop Fisheries.

Before commenting on the contents of the Shark Bay Prawn and Scallops Fisheries Review ("Review Report") CFC would like its comments viewed in terms of the future management direction overriding objectives stated in the review report, namely

"Ensure sustainability long-term and to maximise the overall return to the community from prawn and scallop resource"

The Shark Bay prawn fishery is the third largest Fishery in the state. In terms of assessing overall returns to the community it is critical that all parties not lose sight of the fact as stated in the review that the Gross Value of Production ("GVP")of the Prawn Fishery is $25 to $30 million verses $3 to $6 million for the Scallop Fishery. Accordingly any future management recommendations and research must ensure that we do not jeopardise a $30 million dollar fishery over a $6 million fishery. This would be contrary to the overriding objective of the review report and ultimately not be of any benefit to the community.

When the Shark Bay Scallop fishery was created with both A Class and B Class licences a natural basis for conflict was also created with both classes of licences effectively via for the same resource in an area where the resource itself is not the main resource in terms of GVP. With A Class licence holders having little or no regard to the overall dynamics of the fishery as a whole and B Class licence holders having to relinquish its ability to share in the Scallop resource in order to protect and benefit other resources in the fishery.

While the regime of different licence categories exists there will always be some level of conflict and due to the annual fluctuations of available resource both in terms of scallops and prawns the best approach for dealing with these conflicts will also vary from year to year.

In essence there must firstly be the acknowledgement that there is no one size fits all solution to the conflicts that exist between the two fisheries and two licence classes. While frustrating the need for annual dialogue and consensus between licence categories is an integral and necessary process in managing a dynamic fishery.

Future Management Directions

1. **Scallop Fishing Season**

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Email: correiafishing@ccigroup.com.au

The ability to vary the timing for commencement of the scallop season for A Class holders as apposed to B Class holders is a management practice that has worked with good results in recent years with the opening of Denham Sound to A Class holders for daylight fishing only. This is an example of both licence holders looking at an area both in terms of timing to take scallop and more importantly for B Class holders limiting the damage to prawning stocks to via daylight fishing only. The result of this arrangement has lead to A Class holders being able to harvest Scallops when the meat is at an optimum size and for B Class holders has resulted in Denham Sound providing arguably the highest quality prawn in Shark Bay from August onwards with the benefit of selectively harvesting good quality post spawning scallop meat. It should be noted that this arrangement was arrived to not via the introduction of new management initiatives or catch share arrangements but a mutual acknowledgement for what is best for both fisheries. It continues to work as both A class and B class licence holders know that for the arrangement to work both licence classes must benefit.

2. Trawl Closure

CFC notes that the WCTA argued strongly for the implementation of a trawl closure on the main scallop grounds to determine if trawl induced mortality is the primary cause of recruitment failure in Shark Bay. The WCTA recommends a closure of at least 30 square nautical miles for five years. Firstly the main Scallop grounds also happen to be on the main prawn grounds. Despite the migratory nature of prawns any closure will result in a net loss as migration occurs into a closure as it does out of a closure with the net effect in such an important area being extremely material. Previous attempts at area closures ie Red Cliff and NW Peron provided no evidence in relation to trawl impacts and the recruitment during the summer of 2006/2007 onto an area that was the main trawl ground for both fisheries indicates that the trawling activity that has taken place in this area for in excess of 40 years has had no effect on recruitment patterns. Furthermore a trawl closure on the main scallop and prawn grounds goes against the overriding direction for future management initiatives as previously stated as it will effectively cost the prawn industry and jeopardises a $30million fishery over a $6million fishery which in no way benefits the community. Lastly as noted in the review report the anecdotal evidence with respects to closures implemented in other fisheries do not provide any clear indication that such a closure will provide any meaningful data. In short the risks simply do not outweigh the benefits.

3. Formalised Scallop Catch Share Arrangement

CFC notes that the review report is strongly in favour of a formalised catch arrangement between fleets. It was noted that historically the catch share ration has been 72/28 A Class B Class but in recent years the B Class holders have had as much as 40% of the resource. This highlights that in years of low abundance or when the Abrolhos Islands is having a high abundance year the A Class fleet is not capable of fully utilising the resource to 72% and given the nature of scallop and the risk of nematode infestation may result in the scallop not being harvested at its optimum time. The increasing catch share by the B Class fleet also highlights efficiencies created by the B Class fleet in terms of quality of vessels, use of hoppers, expertise of crew and industry restructures whereas the A Class fleet has ignored the need to restructure and as a result have become more and more inefficient over time. The move to a formalised catch share arrangement would be a disincentive for the B Class fleet to continue investing in Worlds best practice and an incentive for the A Class fleet to continue to operative as an inefficient fleet.

4. Quotas

The difficulty in predicting allowable harvest from year to year makes the use of quotas extremely difficult. One of the most important characteristics of the scallop fishery is the equality given to each licence holder in terms of there ability to catch scallops. The use of quotos will eventually lead to transfers of allowable catch between vessels and possibly across licence classes which from a research, management and compliance point of view would make management of the fishery more cumbersome and costly. Furthermore the allowing of different vessels to harvest varying set quantities adds to the possibility of further conflict between licence holders as evidenced between current tensions between A and B Class licence holders. The need for standardisation is an important tool in the need for minimising licence holder conflicts.

5. Unitisation of Head Rope Entitlement

Unitisation of Head Rope to allow more efficient gear configurations is a logical move forward. However this should again be done on a standardised basis to minimise conflicts between licence holders. The current example of the prawn fleet moving to 4 by 5.5 fathom nets is a good example of how gear reconfigurations can improve the economics of the fishery while still maintaining a standardised fleet and as a result minimising conflict between licence holders.

6. Single Trawl Fleet

The concept of a single trawl fleet is the only way conflicts will be completely resolved. While it is difficult to imagine how this could occur it should not be ruled out as an ultimate goal.

7. Integrated Scallop Management

Shark Bay as a multi resource, multi fishery area must be managed based on its own merits. If the Scallop Fishery was the highest value fishery in the area this may have some merit but as a predominant prawn fishery, the scallop fishery within Shark Bay must be managed in accordance with the Prawn Fishery. This has and foreseeable will continue to deliver the highest return to the community.

8. Other Measures

CFC is dismayed that the possibility of day light trawling only for A Class licence holders has not been given serious consideration and has been described as a "less substantive" measure. The only area within Shark Bay where conflict has been minimised to the point of non existence is in Denham. The fact that the A Class licence holders only day trawl in this area has resulted in the quality of prawn improve in this area and has provided clear benefits to both fisheries and importantly to the community through an increase in the total GVP from Denham. CFC cannot understand why DOF research has not been pushing for the A Class licence holders to move to daylight trawling only, in other areas of the fishery. Given what has transcribed in Denham is the only real positive to come out of the fishery since the creation of the Scallop fishery why hasn't this model been implemented in other areas? If the purpose of the review report is to minimise conflict between A and B Class licence holders surely the implementation of what has happen in Denham must be fully examined and trailed.

Future Research Directions

CFC stresses that any future research must be done with a common sense approach. While it is clear that our understanding of the factors affecting scallop recruitment are limited all parties must not lose sight of the fact that Shark Bay has and will foreseeable remain predominantly a prawn fishery and that research needs to be measured in terms of protecting the community interests in relation to maximising Total Gross Realisable Values for Shark Bay Fisheries. Research that threatens the economic return from the largest component of Shark Bay GVP does not serve the community interest nor does managing individual lower economic value fisheries over higher economic value fisheries.

Summary

The creation of two classes of licences in the Scallop Fishery has created a natural conflict between licence classes which is further compounded by the Prawn fleet attempting to protect prawn stocks from damage.

CFC welcomes the ability to create meaningful dialogue between A and B class licence holders and looks forward to creating new outcomes for the Scallop fishery such as the Denham arrangements but will appose any move to formalise a catch share arrangement and any form of research that impacts on the viability of the Prawn Fishery.

Regards,

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Appendix 8 Submission on draft review of Shark Bay and Scallop Fisheries prepared by the Shark Bay Prawn Operators Assocation

SUBMISSION IN RESPONSE

TO

FISHERIES MANAGEMENT PAPER NO. 222

SHARK BAY PRAWN AND SCALLOP FISHERIES DRAFT REVIEW REPORT

SUBMITTED
BY

THE SHARK BAY PRAWN OPERATORS ASSOCIATION
17TH AUGUST 2007

Introduction

The creation of the dedicated “A” class 14 vessel scallop fleet in 1987 resulted from a difficult birthing process which saw the Minister of Fisheries of the day discount the advice of 1983 Scallop Fishery Working Group, which recommended a limit of 6 to 8 vessels. The working group report stated that “*average catches* (of scallop) *would support a figure in the order of 4 to 6 scallop boats by ratio of 1982 catches “ (average total catch for the period 1972-1982 was 576 tonnes)* (ref appendix 1)

The creation of over capacity within the dedicated Shark Bay Scallop fleet has unfortunately created a management environment that relies on “gold rush” splurges of catch in the Shark Bay , Abrolhos and Esperance Scallop Fisheries to ensure economic survival of the fleet. Given the fortunate spread of Scallop “hype abundance “ events between the various WA scallop fisheries the Scallop fleet has not been forced into the economic rationalizations seen within the sister fleets of the Shark Bay and Exmouth Prawn Fleets. It can be noted that nearly all major Australian trawl fisheries have seen rationalization over the past five years.

At the time the scallop “A” class fleet was gazetted into existence there were 35 prawn \ scallop licences fishing an approximated 59,000 hours in Shark Bay. Today the prawn fleet has been voluntarily reduced to 18 vessels fishing approximately 35,000 hours. The aim of the “prawn” fleet has been to work with WA Fisheries department to reduce overall effort and increase catch per unit of effort whilst targeting a larger more valuable size mix of catch. The Shark Bay prawn fleet has also self managed numerous area and time closures to increase viability and ensure sustainability.

Unfortunately there has been no move by the scallop fleet to make the same hull reductions as other fisheries to ensure their own economic sustainability. Today we find the scallop fleet unable to sustain their economic viability based on average historical levels of recruitment and hence are now seeking to somehow augment recruitment and increase their access by pushing management and research directions to their advantage.

At the time of its inception the then Minister for Fisheries, Mr. Gordon Hill, warned the commercial scallop fishery :

> *In some years the scallop stock will be high but in others they will be very low. The scallop fishermen must regard the Shark Bay Scallop fishery as part of their fishing strategy which will provide a variable percentage of their annual income. They should not regard the scallop as providing their total income.* (appendix ref 2)

When issues of interaction, enhancement or scallop catch equity are raised a concerning bias towards the “A” class licence holders is evident. It must be remembered that it is the “B” class licensees that have the historical predominance within the fishery. Making either management decisions or setting research directions that detract in any way from the AUD25 -30million dollar GVP prawn fishery to subsidize the AUD3-6 million dollar scallop fishery cannot be seen as being in the public interest. Given the importance of the prawn fishery to the community both directly to licence holders and indirectly to the hundreds of people and support businesses that rely on the health of the prawn sector for their survival, any directions that inversely impact on the capture of prawns or the sustainability of the prawn fleet, should be clearly enunciated in management objectives of both fisheries.

This is not to say that the “B” class licensees have been unsympathetic to the plight of the “A” class licencees. The move in recent years to allow the Scallop fleet “preseason”, exclusive access to valuable large, prespawn scallop meats in the area of Denham Sound, in return for the agreement that the scallop fleet operates in daylight hours only (reducing damage to prawns) and that it leaves the grounds prior to the main migration of prawns into Denham Sound, is an example of one of the many initiatives proposed by the prawn fleet to protect prawn stocks and enhance scallop returns.

Sustainability

For many years, the main driving biological factor governing the management of the Shark Bay Fishery was the need to maintain healthy levels of spawning scallop stock. It has long been recognized that *Amusium balloti* (saucer scallop) enjoys very high fecundity and is able to be fished to relatively low levels of abundance and still maintain a viable spawning index. Given the need to maintain a healthy level of spawning stock as the driving management goal a “matrix” based on abundance of recruits (newly settled scallop) and residuals (one year olds left from the previous years settlement) was developed to initiate the opening time for the season.

The matrix (ref appendix 3) saw the opening of the scallop season vary from mid March for high abundance years (1500mt meat weight) to mid May for low abundance years (less than 300mt). Thus on a year of average abundance (300-600mt meat weight) the opening was from mid April to

early May with both “A” and “B” licencees commencing fishing at the same time.

Whilst the matrix offered a sound biological safeguard to protect the spawning biomass, it meant that both fleets were targeting smaller less profitable meats and more importantly were in conflict as scallop trawlers worked grounds with high abundance of prawn stock. Subsequently the move to allow “A” class licencees to fish daylight hours, and enter the fishery much earlier than the “B” class licencees, broke away from the dictates of the “matrix”. The new management arrangements have allowed early opening of the season to A class licencees and allows direct targeting of the pre-spawning scallop biomass even on years of low abundance. It must be remembered that “*a spawning stock and recruitment relationship has not been experienced in this fishery*” and “*recruitment strength is mainly independent of spawning stock size being largely environmentally driven*” (ref appendix 4)

Hence in trying to move A Class licencees in and out of the fishery early (before April) to prevent damage to prawn stocks, the B class licencees have seen a dramatic reduction in the economic value of their relative catch due to taking poorer quality spawning or post spawned meat of lower value. Early access to Scallop stocks granted to A Class licencees has also created a position especially in years of low abundance, where the A class licencees fish the scallop down to biological cut off levels before the B class licencees have time to catch a reasonable quantity of scallop meat, hence creating a “biological risk” for the “B” class fleet.

Research knowledge gaps relating to the viable spawning index of scallop needs more research. SBPOA believe that as scallop fertilization takes place in the water column, examination of fertilization success from “Hot spots” (areas of high abundance) or post fishing low spatial abundance needs to take place. As it is likely that future management will stay removed from the principles of the “Matrix” all licencees need a better understanding of scallop recruitment to assist in the sustainable management of the scallop resource.

Management Issues

One of the major sources of conflict since the creation of the scallop fleet has been gear interaction, in particular the damage done to King prawn (*Penaeus latisulcatus*) during night fishing by the scallop fleet. Traditionally scallop vessels work their gear hard to the bottom in order to effectively catch scallop shell and in doing so disturb and damage prawn. As the King Prawn is mainly nocturnal the rate of damage inflicted by scallop trawls is much higher at night than during the day.

In Denham Sound the prawn fleet self regulated to stop prawn trawling in March and April to preserve juvenile prawn stocks. This stock is now fished from August onward when the size and value of the prawn is much increased. In allowing the scallop fleet access to Denham Sound in February and March, to take large valuable scallop, the primary concern of the Prawn fleet was to ensure that daylight fishing was maintained, to preserve residual prawn stock, and that the Scallop fleet had left the grounds prior to the new seasons recruitment prawns moving into the fishery from early April.

Whilst nefarious arguments have been put forward by A class licencees that daylight fishing only seems to work in Denham Sound, SBPOA insist that daylight fishing for scallop be extended to all areas of Shark Bay. It is conceded that there may well be some efficiency drop in scallop capture if daylight only trawling is implemented however preliminary Fishery Research Department trials indicate the reduction in efficency to be no more than 10-20% which could easily be addressed via gear reconfigurations. Furthermore in moving A class licencees to daylight fishing one of the largest conflicts between the two scallop fleets is solved with additional benefits to the scallop fleet such as Occupational Heath and Safety concerns that currently exist with 24 hour trawling.

Any review of scallop management plans must take into account that with time the scallop fleet will seek hull reduction as it learns to accept that average recruitments of 300-500 mt are the norm and " hyper abundance " events are unique and rare occurences. A fleet of 14 vessels simply cannot survive on average scallop catches let alone when coupled with high fuel and labor costs.

A reduction in vessel numbers of A class licencees from 14 to say 7 will require a revision of gear capacity and manning levels to ensure that the equivalent time to extract the equivalent levels of scallop to the current 14 vessel fleet.

Greater trawling duration is not in the interest of the prawn fishery and hence any move to reduce vessel numbers should be met with defined limits of time boundaries to exit sensitive prawn grounds such as Denham Sound.

For the 2007 and 2008 scallop seasons the “B” class scallop fleet agreed, after little consultation, to a trial of a catch share agreement. Fishery Research Department had advised both A and B Class licencees that the 2007 catch estimate was to be 1000 to 1100 mt meat weight and as such, not too much significance was placed in the trial share arrangement. In effect the trial has served its purpose well in that it has made licensees remember why the 80\20 concept of catch share was thrown out in the early 1990s.

The 2007 scallop season has seen catch levels of about one third the of Fisheries Department survey predictions and catch for both “A” and “B”class licencees has been dramatically lower than expected. The impact however has been hardest felt by the B class licensees who will have their catch of scallop stopped due to reaching a notional 28% catch share based on volume while actually sharing far less in terms of realizable value of catch. It is now with the benefit of hindsight the B class licencees are realizing that any catch share arrangements must be carefully considered in the context of a dynamic fishery prior to any formal acceptance.

The B Class Licencees are not supportive of the current catch share arrangement and any future resource sharing agreements must take into account the following:

- Value of catch and not quantity of catch needs to be assessed as “A” class vessels access large meats in February and March which are worth 25-35% more that the poor quality meats accessed by the “B” class holders in August.

- Pre-spawning catch taken by the “A” class vessels creates “biological risk” for the “B” class fleet. On years of low abundance or Fisheries miscalculation of stock the “B” class fleet will run the risk of being shut down to preserve scallop spawning stock at cutoff levels

- On years of high scallop abundance in other scallop fisheries, like the Abrolhos Islands, the “B” class fleet should not be tied to a catch share if the “A” class holders leave the fishery. Nor should the “A” class vessels be able to return to the Shark Bay fishery once they have left as this would create serious interaction issues with the prawn fleet.

Any move toward catch share arrangements must be balanced and fair and the risks inherent not weighted towards any one party. It is suggested the

discrepancy in value of catch between the fleets can easily be examined for the 2007 season and a “weighted” differential generated for discussion.

With A class licencees assessing vessel reduction possibilities, examination of the implementation of any catch share arrangement, quota or prescribed time units of effort as a potential management option will need careful consideration. There are a number of pros and cons for the implementation of quota. Issues such as a decline of catch value over time with meat weight and quality degradation, excessive targeting of the prespawn biomass and the potential for quota to move between the “A” and “B” fleets all need to be addressed together with Items listed under secton 10.2.4 of the draft review. Given the serious and complex nature of any catch share arrangement, a separate level of consideration outside of the current review, must be established.

It must be made unequivocally clear that both the right and the necessity to catch scallop is an inalienable part of the Prawn fleet operations. The Prawn fleet has “taken the pain” in self adjusting its fleet down form 35 to 18 vessels (in effect also removing 17 “B” class licences). It is not reasonable to suggest the pre-eminent fishery in Shark bay should subsidise in any socialistic way the fleet reduction amongst A class licencees in a fishery that has had over capacity from its inception. Scallop catch represents a vital part of prawn vessel income, crew pay, debt servicing and at times profit for “B” class licensees.

Research Directions

The SBPOA has sought the assistance of Dr. Jeremy Prince to examine research issues in a separate paper to be read in conjunction with this submission. In particular Dr Prince addresses the idea, promoted actively by the West Coast Trawl Association (“WCTA”) (representing “A” class scallop licence holders) of a significant spatial closure to “augment “ scallop settlement.

The SBPOA **in no way endorses or agrees to the concept** of a spatial closure to assess gear impacts from trawling.

The facts are as follows :

- Given the lack of relationship between standing stock and recruitment an input as small as trawling impact has no way of being

discreetly observed to the point of drawing meaningful scientific conclusion.

- Previous scallop area closures in the Red Cliff area have proved worthless and Fisheries Research has been disinclined to document the failure of this closure even though at the time of inception they were of supreme importance to the WCTA representing the “A” class fleet.

- Survey of scallop and extrapolation to stock levels is often inaccurate (in 2007 error was over 100%)

- Areas suggested for closures are significant trawl grounds for prawn fishers.

- The dedicated scallop fishery was created overlapping an existing prawn fishery and the historical fishing over juvenile scallops has taken place for 30 years. If any change has been made over the last decade, it has been to reduce prawn fleet effort over the scallop grounds.

- The WCTA suggestion that the Carnarvon- Peron lines inception in 1991 has caused consistent failure in scallop recruitment lacks any credibility and represents a “clutching at straws “ mentality. The WCTA, it would appear, cannot accept the reality that the endemic inconsistence of scallop settlement patterns are predominantly driven by environmental factors.

- Any suggestion that prawn fishing impacts scallop mortality is transparent in management terms as it has always occurred and the value of the prawn fishery activity in areas of issue far outweighs that of any marginal augmentation to the scallop catch.

With regard to the general principles of filling in research gaps within the stock of knowledge of the scallop biology, SBPOA is in complete support with the overriding proviso that research should be both constructive and in line with the overriding objective of “ensuring sustainability long-term and to maximize the overall return to the community from the prawn and scallop resource” For example, there is little point spending valuable time and money researching scallop gear impact on prawn mortality if the scallop fishery is moved to a daylight trawling, thus preserving and enhancing prawn stocks while allowing the sustainable take of scallop, ensuring long term sustainability and increased returns to the community.

Conclusions

The SBPOA seeks that the outcome of this review process goes some way to addressing the nub of the problem facing the Shark Bay Scallop Fishery – overcapacity of the A class licencees. SBPOA strongly recommends :

- That the A class Licencees adopt daylight fishing in all areas of Shark Bay. Any consequential loss of efficiency in moving to daylight trawl that is quantified be compensated with gear or manning increases for the "A" class Fleet.

- An examination of catch dollar value benefits and values ascribed to the notion of "Biological Risk" need to be incorporated to create an index of the overall relative value of scallop catch to each fleet, given they now no longer access that stock at the same time. This index can then be used as a tool to assess the possibility of a relative catch share between the fleets.

- Economic and management modeling takes place on assisting the "A" class fleet to adjust and models for catch share and management tools such as ITQ s or time units be examined as a priority.

- That no spatial closures over post spawned or new recruitment scallops be gazetted within prawn trawl managed fishery boundaries in Shark Bay. **The SBPOA advises that any attempt at closures in sensitive high economic return areas will be refuted and defended at all costs.**

- That management priorities continue to focus on ensuring A class licencees, fishing activity is targeted early in the season with the objective of having the scallop fleet leave the fishing grounds in sensitive areas like Denham Sound prior to prawn recruitment.

- That fisheries research be conducted with a view to meeting management aims and not creating division and conflict between the licence holders.

- That the primacy of the Shark Bay Prawn Fishery (and their associated status as "B" class scallop fishers) be clearly enunciated in management plans as being of primary importance to the public good and that consequent management directions reflect this primacy.

Appendix 9 Submission on draft review of Shark Bay and Scallop Fisheries prepared by Biospherics Pty Ltd

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20 August 2008

Comment To: **Review of Shark Bay Prawn and Scallop Fisheries**

By: **Dr Jeremy Prince**, **Biospherics P/L**

Introduction

This comment has been prepared at the request of the **Shark Bay Prawn Operators Association Inc.** who, on the basis of my national and international experience with fisheries science, assessment and management, provided me with a range of background documents (see Appendix 1) and requested that I develop an opinion about the core R&D issue confronting them in the Draft Review Report on Shark Bay Prawn and Scallop Fisheries.

Overview

The strongest and most immediate concern the Shark Bay Prawn Operators Association ("SBPOA") have with the proposals contained within the Draft Review Report on Shark Bay Prawn and Scallop Fisheries focuses on the proposed Future Research Directions, and in particular the recently funded FRDC project: FRDC MK013.

While generally supportive of that project's intentions the SBPOA has major and legitimate concerns about the experimental spatial closure proposed as a part of FRDC MK013, primarily with its location, but also its size and shape which will maximize its socio-economic impacts on the Shark Bay Prawn fishery.

The Draft Review states that the Shark Bay Prawn Industry is the third largest fishery in WA (after WA Rock Lobster and South Sea Pearls), with an annual Gross Value of Production (GVP) of between $25 million and $30 million, while the Shark Bay Scallop Industry has an annual GVP of about $3 million to $6 million per annum.

Project FRDC MK013 has the aim of conducting blue sky research into whether it is possible to enhance scallop recruitment and future catches by reducing trawl impacts and to determine the impact of prawn trawling on scallop survival. The relatively low value of the industry it is hoped to enhance through this research must be borne in mind against the larger more stable value of the prawn fishery being impacted by this proposal.

As stated in the Needs Section of FRDC MK013:

1

> "This project will be used as a pilot study to assess whether closures can assist increase scallop recruitment and if area closures could be used as a possible management strategy in the future."

It makes no policy sense to propose doing this experiment at the economic heart of the prawn fishery. Pilot Studies are used to test basic principals on small sub-sets or areas of minor importance, so that the actual impacts of the study can be minimized until the principal is proven, and the costs and benefits of possible commercial scale implementation evaluated.

This 'pilot study' should not be located in a place of commercial and logistical sensitivity to the prawn fishery. An alternative area of lower value should be found with enough shared prawn and scallop stocks to conduct scientific studies on the impacts of trawling upon prawns and scallops. Likewise the potential for enhancing scallop recruitment with breeding stock closures should be trialed and experimented with on scallop grounds of low, or no, value to the prawn fishery. Only after the relative merits of closures have been proven, the appropriate cost benefit analyses performed, and cross-sector compensation agreed, should such costly and logistically impractical closures be considered.

The Position, Size and Shape of the proposed Research Closure:

The 3 x 10 nm proposed research area to be closed to trawling as a part of FRDC MK013 is planned to be located at the economic core of the main fishing ground and encapsulates an area that is readily accessible to port and currently provides some 5-10% of annual income for the prawn fleet. The accessibility of these trawl grounds at the heart of the stock and to the immediate southwest of Carnarvon means that these grounds have lower costs of fishing and with normal catch rates generate the best fishing returns. Closure of these grounds will deny the fleet easily accessible catches and disperse fishing effort to more marginal areas where catch rates will be lower and costs proportionately higher pre kilogram of prawns produced. The loss of this core economically efficient fishing ground will impose additional costs on the prawn industry that is already battling rising costs and static prices.

The proposed shape and precise situation maximizes the logistical hazard of the proposal. The closure is proposed at a point where the commercially valuable trawl grounds north-south through Shark Bay are constricted by regulated and industry agreed closures to both the east and the west, to a width of just 12 nm for a length of some 20nm. The long rectangular shape of the closure proposed to run from NNW to SSE within this constricted corridor of trawl ground further narrows the available area so that there will be only two passes around the proposed research area, one of about 3nm width around the northwest corner, and a second of about 4nm width around the southwest corner.

These narrows will:

1. Place major restrictions on normal fishing practices; and
2. Create a dangerous hazard at sea by forcing all skippers to trawl through two narrow corridors around the points of the closure;

3. Concentrate heavy levels of trawling within them.

Serving the Public Good

This issue of placing a research area in an extremely costly and logistically problematic location needs to be analyzed in terms of its service to the public good; its costs and benefits to the broader public good, as distinct to narrower benefits accruing to just one sector or another.

What is the likely gain through recruitment and catches to the scallop fishery, offset against the likely costs to the prawn fishery?

If costs accrue mainly to one sector and all the gains flow to another sector then issues of equity are triggered and policy dictates that at some level compensation becomes necessary to preserve the relative equity positions of the different sectors.

The Shark Bay Prawn Industry is the third largest fishery in WA (after WA Rock Lobster and South Sea Pearls), with an annual Gross Value of Production (GVP) of between $25 million and $30 million, while the Shark Bay Scallop Industry has an annual GVP of about $3 million to $6 million per annum.

The SBPOA does not hold that prawns foregone in a closed area will inevitably be caught for equal returns from other grounds. Rather it expects some levels of prawns to be lost permanently to the fishery while some further part of the catch will only be made up through fishing less profitable grounds more intensively, so increasing costs of operations. The SBPOA expects these factors to cost the prawn sector some $2-3 million per annum in increased costs and decreased income an amount that represents almost 50% of the annual value of the scallop fishery.

What are the prospects of this research increasing long term scallop yields by >50% and how long is it likely to take to achieve these benefits? The answer to these questions needs to be placed against the equivalent cost placed upon the prawn sector for many years to undertake this research.

If the public good is served by doing research for the benefit of the scallop sector, at great cost to the prawn sector the proposal should also include mechanisms by which the scallop sector compensates for the negative impact on the prawn sector's relative equity position.

Before going this far let us instead stop and ask the question; what is wrong with the scallop fishery anyway, that requires this level of immediate action? What is the pressing and urgent need that requires research areas to be implemented at great cost and inconvenience to the prawn sector.

What is wrong with the Scallop Fishery?

As with many other temperate and sub-tropical Australian marine species pulses of recruitment to the stocks of *Amusium* and *Pecten* scallops tend to coincide with La Nina events. In Western Australia these conditions are thought to foster the retention or return of larvae to the coastal shallows, in Eastern Australia the mechanism is assumed to be plumes of cold deep nutrient rich water pulsing into shallower shelf environments enriching and enhancing planktonic communities and the larval survival of a wide range of commercial species.

Management of the Shark Bay Scallop resource has been developed over some time to ensure that conservative levels of breeding stock are maintained on the grounds to sustain stocks, and to allow for a relatively ephemeral fishery that subsists on other incomes between sporadic major pulses of recruitment.

As stated by the Department of Fisheries' Application to Environment Australia for the Shark Bay Scallop Fishery. (Dept. Fisheries WA July 2002 Page 16)

> "Management arrangements utilized since the mid-1990s have ensured adequate spawning stock levels are maintained such that there is an adequate level of spawning stock present when spawning commences. While the approach has been generally successful in maintaining stocks, annual variations in recruitment seem to be dominated by environmental factors that are inversely correlated with the strength of the Leeuwin Current."

Repeated warnings have been given to industry by government on the sporadic nature of this resource.

However, since the peak catches of 1991-93 around 1,500-3,000t per annum more normal <500t per annum catches have been considered disappointing. The La Nina events in 1996 and 2001/02 did not produce the pulses of recruitment hoped for, and it is this that seems to have spurred discussion of the potential ways of enhancing scallop recruitment. However plausible alternative explanations exist. The available scientific evidence suggests that despite the La Nina conditions of 1996 and 2001, the nutrient rich waters that normally flush into the shallow coastal lagoons of Shark Bay remained at depth through the region and did not foster the high larval survival normally expected of La Nina conditions.

Most recently it appears scallop recruitment levels for the next couple of years is trending back upwards. So is there really something wrong with scallop recruitment in Shark Bay, or is this normal variability?

There is no evidence to suggest that recent recruitment to the Shark Bay scallop has been anything other than normally sporadic, there is less evidence that it is being adversely affected by prawn trawling. It is most likely that scallop numbers are almost entirely driven by environmental conditions which enhance larval survival and retention and that this effect completely swamps the impact of low levels of mortality inflicted by fishing.

Despite this position the members of the SBPOA have long had concerns about the interaction of the two sectors on resources, first recording their concern about the incidental mortality of prawns from scallop trawling in the Report of the Scallop Management Working Group (Fisheries Department WA, March 1983). For this reason the SBPOA wishes to support further research about the mutual impacts the two sectors are having on each other with the aim to minimizing them for the long term. In this context, and while noting this proposals single species focus on scallops, the SBPOA is broadly supportive of the type of research embodied by FRDC MK013, provided the immediate socio-economic impact to the prawn sector is not disproportionate to the scale of the issue, or to either sector.

Cost Benefit Analysis

The SBPOA does not hold that prawns foregone in a closed area will inevitably be caught for equal returns from other grounds. Rather it expects some levels of prawns to be lost permanently to the fishery while some further part of the catch will only be made up through fishing less profitably grounds more intensively, so increasing costs of operations. The SBPOA expects these factors to cost the prawn sector some $2-3 million per annum in increased costs and decreased income, representing almost 50% of the annual value of scallop fishery. This socio-economic impact will be felt directly by the prawn sector with the loss of one of its primary and most profitable fishing grounds. This will force the prawn sector to expend more hours of fishing less profitably on margin grounds. Whereas, the long term benefit of this research, should it prove successful, is the enhancement of the scallop fishery.

It is clear that a rare confluence of environmental conditions is needed to produce the spectacularly valuable recruitment pulses like 1991-93 (>1,500t). Under normal circumstances enhancement of the stock by reducing gear interactions can only seek to enhance the survival of a normal cohort (<500t) as it grows through both fisheries for several years. Thus by the enhancement of the scallop fishery through fishery closures, we are talking about saving some proportion of a normal cohort. In real terms a successful program of this sort might optimistically hope to boost the annual production of scallops by saving 10-30% of a cohort, if achieved, a saving worth something like $0.5 – 2 million per annum to the scallop industry. In contrast if the same level of improvement could be achieved by minimizing the interaction of scallop trawling on prawn survival a potential saving of $5-10 million might be achieved for the broader community. From the broader perspective of serving the public good it makes no sense to incur annual costs of $2-3 million on the prawn sector so that this blue sky research can be conducted with the hope of one day possibly saving the scallop sector $0.5-2 million per annum.

Such an exercise is simply a transfer of wealth by stealth between sectors and serves no greater public good. If it is to occur for some higher reason of public good, not currently obvious here, there should be some form of compensation for the economic impact of the proposal on the members of the Shark Bay Prawn Operators Association.

Comment on Research

The broader context for the propose research program is given by Dr Kangas et al. in the opening statements of the Needs Section of FRDC MK013;

> "Both sectors (prawn and scallop) support the need to fully and rigorously address the issue of gear interactions in those areas of the fishery where the distribution of the target species overlap."
>
> "There is an urgent need to develop an understanding of the level of gear interaction between the prawn and scallop sectors and whether this may be a cause for the recent low scallop recruitment (and subsequent catches)."

The SBPOA supports the need to fully and rigorously address the issue of gear interactions between the two fisheries, but given the relatively stable status of the larger prawn fishery, and the known variability of the much smaller scallop fishery the SBPOA rightly disputes the "urgent" nature of this research objective, especially if it necessitates causing major economic loss and logistical disruption to more valuable sector of the fishery.

There are other highly plausible explanations for the current variations being observed in scallop catches and recruitment. We know enough to understand the system is driven by environmental forces. In this context it should be noted that the most recent surveys suggest scallop recruitment is already rising ahead of any research taking place. The priority for research in Shark Bay should continue to be on the broader range of potential drivers for the prawn and scallop resources, rather than too narrowly focusing on the single issue of enhancing scallop recruitment through trawl closure.

For example, given the relative value of the two fisheries and the benefits observed by SBPOA from the introduction of Daylight Fishing Only for A-class Licenses it would be more cost effective to be conducting research documenting the impact of Daylight Fishing Only. Such Research would derive some certain return back to the community, in the form of enhanced prawn yield. In contrast research on enhancing scallop production through trawl closures is highly speculative, as other known drivers of scallop production are likely to be at work, and the value of the scallop industry is about 15% of the larger prawn fishery.

Within these caveats the SBPOA supports the narrower aims of this research project but retains concern about the location of the proposed closed area. Noting specifically the context for the project given amongst the concluding statements in the Needs Section of FRDC MK013:

> "This project will be used as a pilot study to assess whether closures can assist increase scallop recruitment and if area closures could be used as a possible management strategy in the future."

It makes no policy sense to then propose undertaking a 'pilot study' at the economic heart of the fishery. In the spirit of 'pilot studies' basic principals are tested in practice on small sub-sets or areas of minor importance, not at the core of the fishery being impacted by these measures. This 'pilot study' should not be located in a place of commercial and logistical sensitivity, rather an alternative area of lower value should be found with enough shared prawn and scallop stocks to conduct scientific studies of the impacts of trawling upon prawns and scallops. Historic scallop beds of lesser importance to the prawn fishery can be used to experiment with enhancing recruitment levels.

There needs to be a process involving research and consultation to identify agreed closed experimental areas to be imposed on the fishery. In this process Objective 4 of FRDC MK013 should be undertaken first so that the information from "existing hydrodynamic models can guide the selection of spatial closures". An essential part of this process which I note received no priority in FRDC MK013, and is not covered by any Objective, but which I consider essential to such a process is the socio-economic mapping of the trawl grounds to show the distribution and value of the various prawn and scallop grounds that could be closed for experimentation. These maps will be useful in locating areas that are optimal from the point of view of conducting the experiments, and of minimizing costs and impacts to both sectors.

These Issues can be Addressed without Significant Costs to the Prawn Sector

There are easily available alternative strategies for addressing these issues without a disproportionate impact on one or the other sectors.

1. Closures in a different location. There are alternative grounds containing scallops and prawns which could be closed to achieve the objectives of this research with minimal impact on the prawn sector. A process involving all stakeholders should be undertaken to select an area of the fishery for this purpose. Hydrodynamic models and socio-economic maps of the fishing grounds should be used to select mutually agreeable areas which satisfy the scientific needs of a pilot study with Shark Bay. Alternatively the potential for stabilizing scallop recruitment through closures could be trialed without invoking these cross-sector issues by conducting the research in the Abrolhos Islands scallop fishery.

2. Make greater use of parallel research elsewhere. A similar project has been underway in Hervey Bay with the aim of studying this same issue of breed stock reserves for *Amusium* scallops. An alternative approach for WA would be to not undertake this aspect of the research program but to endeavor to learn from the experience of that project. What is the absolute necessity of undertaking this research in this way at this time, while there are researchers who will provide us information on the same topic without the negative socio-economic impact on the WA fisheries? It is reported that results from the Queensland study to date are inconclusive, as if this is reason to push ahead with this study. On the contrary the inconclusive nature of that result should suggest greater caution, before foisting at great cost to the prawn industry, a similar project also likely to produce inconclusive results.

3. Because of the greater value of the Shark Bay Prawn resource four to five times the level of public good could be achieved by reducing the impact of scallop trawling on prawn survival and enhancing long term yields from the prawn fishery. Over the last three years daylight only trawling has been trialed as a condition of earlier access by A Class licences to Denham Sound. During this period prawn quality has improved significantly to the point where the highest quality of prawn is now from Denham. Rather than embarking on speculative research about possible trawl impact on scallop recruitment with the aim of possibly enhancing a fishery of minor value. Research to document the proven positive impact of daylight only trawling and extend it to the rest of the fishery would return a guaranteed dividend to the broader community by enhancing the value of Shark Bay's more valuable prawn resource.

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Appendix 1

This opinion has been developed on the basis of an in-depth briefing provided by the members of the Shark Bay Prawn Operators Association listed below, and analysis of the historical data and background papers also listed below.

Members of the Shark Bay Prawn Operators Association
Mr Rod Johnson (Nor-West Seafoods Pty Ltd),
Mr Ian Ricciardi (Ricciardi Seafoods & Coldstores) and
Daniel Correia (Correia Fishing Co.)

Background Papers Provided

March 1983	Report of the Scallop Fishery Management Working Group
June 1987	The future of the Shark Bay Scallop fishery. A SBPOA submission to the Minister Fisheries
July 1989	Letter BK Bowen to K Brown SB Scallop Association
July 1989	Fax PD Rich SBPOA Chairman to BK Bowen
September 1989	Letter Minister Fisheries to K Brown SB Scallop Association
May 1990	Fax RW Hoffman Nor-West Seafood P/L to BK Bowen
June 1990	Aide-memoire PD Rich SBPOA Chairman to Minister Fisheries
December 1990	SBPOA submission to Minister Fisheries
January 1991	Letter SBPOA to P. Rogers Re: changes to SB scallop fishery
March 1991	Letter BK Bowen to G Stewart Re: changes to SB scallop fishery
December 1992	Letter Minister of Fisheries to G Stewart Re SBPOA concern about buy-back
January 1993	Letter Exec. Dir. Fisheries to G Stewart Re: Fisheries concern for viability of SB prawn fishery.
March 1993	SBPOA submission to Minister of Fisheries
July 2002	Dept Fisheries Application to Environment Australia for the Shark Bay Scallop Fishery
April 2004	Brief report on' Shark Bay Experimental scallop closure area' Survey April 2004
July 2006	SBPOA Submission to the Review of the Shark Bay Prawn Managed Fishery and the Shark Bay Scallop Managed Fishery
November 2006	FRDC MK013 Project proposal – minimizing gear conflict and resource sharing issues in the Shark Bay trawl fisheries and promotion of scallop recruitment.
Undated 2007	Printout of Powerpoint display Re: FRDC MK013
April 2007	Shark Bay Prawn and Scallop Fisheries Draft Review Report
May 2007	FRDC letter to M Kangas advising funding has been approved for FRDC MK013
Undated 2007	Summary figures for scallop and prawn catch and effort 1966-2007

Appendix 10 Submission on draft review of Shark Bay and Scallop Fisheries prepared by the West Coast Trawl Assocation, 29 May 2007

Shark Bay Prawn and Scallop Fisheries
Draft Review Report

Submission prepared by: West Coast Trawl Association
29th May 2007

1

The West Coast Trawl Association (WCTA) welcomes the opportunity to respond to the Department's Draft Review Report for the Shark Bay Prawn and Scallop Fisheries. In July and August 2006 the WCTA made submissions to the Department that described the decline of the Shark Bay Scallop Fishery, listed the factors it believed were responsible for the current crisis in the Fishery and offered a program of management reforms that could revive the Fishery's fortunes. In the 9 months since lodging these submissions, the pattern of poor scallop recruitment/catch persists and the management of the Fishery continues without a strategic focus while the Review of the Fishery remains unresolved. In these circumstances, the WCTA re-affirms the views and proposals presented in the earlier submissions. By actively pursuing strategies that seek to improve the productivity of Shark Bay's under performing scallop resource, the WCTA believes it is possible to enhance the long-term prospects of Shark Bay's Prawn and Scallop Industries. While its earlier submissions continue to reflect the WCTA's position, a number of issues raised in the Draft Review Report require direct comment and some of the proposals presented in the WCTA's earlier submissions require further clarification.

1. The WCTA welcomes the Report's acknowledgement that the Shark Bay Prawn and Scallop Fisheries have equal legal standing and that the Department has a responsibility to manage both Fisheries.

2. 2007 will mark the 12th consecutive year where the scallop catch in Shark Bay has fallen below 400 tons. The passing of another disappointing catch season indicates the failure of a passive management strategy that simply hopes that the onset of 'favourable environmental conditions' will, on their own, deliver improved catches. The WCTA contends that a strategic shift in management policy is required if the Fishery is to regain its defining characteristic of highly variable catch and have the opportunity to realise its potential.

3. The WCTA supports the formal implementation of catch share arrangements for Shark Bay (72% - scallop industry and 28% prawn industry). Considering the progress of the trials during the 2007 season, it is clear that a system of industry-based catch share arrangements are a workable initiative that promotes better management of the Fishery. While a system to manage the process of catch shares requires some additional refinement, the WCTA considers that industry-based catch share arrangements have worked well in its initial trial and fully supports its formal adoption.

4. The WCTA believes that pro-active management must include the introduction of a scallop closure and that a robust trial of the closure concept should be awarded the highest priority. The area nominated in its first submission remains the WCTA's preferred site of a trial closure. The positioning of any closure is absolutely critical. The closure must incorporate meaningful historical scallop ground (i.e. areas that are known to have produced significant scallop settlement **before** the shift in effort that resulted from the introduction of both the Carnarvon-Peron Line and Tiger Prawn Spawning Area), be of a reasonable size (at least 3nm x 10nm), and be given time to demonstrate the value of closures as an effective management tool in this Fishery. Any research that seeks to scientifically assess the potential value of closures cannot be compromised. Science cannot be conducted by consensus and the location of a

closure cannot be determined or unduly influenced by the wishes of the prawn industry. The continued pattern of persistent recruitment failure/poor catches in the Scallop Fishery is the single-most important issue in Shark Bay. The Trawl Research Division must therefore have a mandate to conduct this important research in the most scientifically appropriate manner.

5. The role of a scallop closure, as proposed by the WCTA, requires clarification. The WCTA contends that the persistence of low scallop catches in the Red Cliff / Nor-West Peron area of Shark Bay over a 12 year period (i.e. the absence of highly variable recruitment over this lengthy period) is the direct result of major changes to the distribution of fishing effort by the Shark Bay Prawn fleet. With the introduction of the Carnarvon-Peron Line in 1991, the introduction of the Tiger Prawn Spawning Area in 1996 and the gradual northward drift and eventual cessation of fishing effort in Denham at the start of the season, there has unquestionably been an important shift in the distribution of fishing effort by the prawn fleet that has resulted in a direct increase in fishing effort on traditional scallop ground. The WCTA is convinced that this shift in effort has had a twofold effect - a continual disturbance of spawning adult populations and, **most importantly**, a total lack of protection for new recruits. The combined impact has produced a scallop fishery now devoid of the defining characteristic of highly variable recruitment.

   To test the validity of the WCTA's hypothesis it is important to recognise the key aims of any trial closure. The closure should not only be about assessing the impact of trawling on known (i.e. adult) scallop populations. It should, more importantly, be about protecting juvenile scallops from the time they settle through to the time when their existence is "officially" confirmed in the November survey. It is in this early period of their lifecycle that scallops are most susceptible to fishing induced mortality and in most need of protection. Most successful trawl fisheries have closures over spawning/settling grounds. In Shark Bay, the most productive known scallop grounds have none.

6. The potential to enhance the productivity of the Scallop Fishery by limiting the amount of trawling on traditional scallop ground can be gauged by assessing the improved productivity of Denham over a number of years and, to a lesser extent, the improved catch in Nor-West Peron during the 2007 season.

   a) <u>Denham</u>

   Historically, Denham is the least productive area of the Shark Bay Scallop Managed Fishery. In the 8 years between 1994 and 2001 a total of only 60 tons of scallops were harvested from the Denham area. Since 2003 the Prawn fleet has sought to limit the amount of fishing effort in Denham at the start of the season (i.e. during the key spawning and settling time for scallops) in order to reduce the catch of small prawns at this time and to harvest larger, more valuable prawns post-August. This strategy has evolved over time and the prawn fleet no longer operates in Denham at the start of the season and has not done so since 2005. Interestingly, there has been a corresponding improvement in the catch of scallops from the Denham area over the same period. Since 2003, the annual catch of scallops from Denham has exceeded 100 tons. It is an interesting observation that a strategy that has limited the amount of trawling on traditional scallop ground

during **and after** the spawning/settlement period has resulted in a significant improvement in the productivity of this area.

b) Nor-West Peron

In recent seasons the amount of scallops caught in Nor-West Peron has been particularly poor. While the predicted bumper harvest in 2007 did not materialise, the catch of scallops in 2007 from the Nor-West Peron area was still significantly better than the catches achieved in the area for many years. Interestingly again, there was a corresponding reduction in the amount of trawl effort from both the prawn and scallop fleets in the Nor-West Peron area during the 2006 season. The decision to impose a catch rate cut off of 200kg after which the take of scallops would cease until after the mid-June moon break, limited the amount of trawling on key scallop ground at a time when scallops are likely to have been settling after spawning. Once again, this increase in scallop productivity suggests that a properly conducted and monitored closure in the area nominated by the WCTA could significantly enhance the productivity of the Fishery. A closure that only seeks to protect adult populations is, in the WCTA's opinion, doomed to fail or will, at best, provide only inconclusive results. A closure must aim to protect the most likely areas of settlement and these areas can only be deduced by analysing the data provided by pre-1992 surveys.

7. Any reform of the Shark Bay Scallop Managed Fishery must also consider the management arrangements for the Abrolhos Islands Mid West Trawl Fishery. There is a significant overlap of vessels operating in both fisheries, with 13 of the 14 Class A Shark Bay Scallop vessels also having licenses to operate in the Abrolhos Islands. Any reforms undertaken in Shark Bay (fleet restructure, buy-back or changes in gear control) must also consider the Abrolhos Islands and reforms in general should aim to further promote efficiencies and streamlining the management arrangements between the two scallop fisheries.

8. The WCTA notes that any restructure of the scallop industry (and any restructure would need to look at both Shark Bay and the Abrolhos Islands) hinges on the formal adoption of 72% and 28% catch share arrangements in Shark Bay and would require the support of the State Government via a Government facilitated buy-back scheme (i.e. a scheme funded by the State Government, but repaid over time by those remaining in the Fishery).

9. The WCTA notes that the Review process itself is well behind schedule. The Minister for Fisheries indicated that the Review document would be completed by October 2006 and that the implementation of the Review outcomes would most likely commence from the 2008 season. Whilst the WCTA understands that it is important that the Review be thorough and that Heather Brayford's move to the Northern Territory has disrupted the Review process, it is important to consider the original timeframes and to press on with the Review with both purpose and urgency.

Appendix 11 Supplementary submission on draft review of Shark Bay and Scallop Fisheries prepared by the West Coast Trawl Assocation, 20 August 2007

Shark Bay Prawn and Scallop Fisheries
Draft Review Report (2)

Supplementary submission prepared by: West Coast Trawl Association
20th August 2007

1

In its previous submissions to the Review and in its earlier response to the Draft Review Report, the West Coast Trawl Association (WCTA) expressed strong support for a trial closure and stressed the pivotal role that a closure may have in remedying the trend of persistent recruitment failure in the Shark Bay scallop fishery. In circumstances where the fate of the Research Division's FRDC-funded research proposal is seemingly in the balance, the WCTA believes that it is important to examine, in more detail, the case for the trial of a 10 nm x 3 nm closure on the main scallop grounds of Shark Bay.

The prawn industry's reluctance to support this trial is difficult to comprehend. While it is rare for operators in the prawn and scallop industries to share a point of view, one of the few points of agreement in the submissions to the Review is that a wild catch scallop fishery should exhibit highly variable catch and recruitment. Indeed, "high variability" is considered a defining characteristic of a scallop fishery and it is a quality that is no longer evident in Shark Bay[1]. If we accept the validity of this premise, the prolonged absence of this quality inevitably suggests a problem with recruitment in the Fishery. When the environmental conditions (the onset of El Nino Southern Oscillation events) that had previously triggered recruitment spikes now fail to produce the same effect, denying the existence of a problem with scallop recruitment in Shark Bay seems implausible.

It is important to reiterate that the proposed trial of a closure is not an attempt to undermine the viability of the prawn industry or to in some way enhance the prospects of the scallop industry at the prawn industry's expense. The WCTA is not advocating the establishment of a closure that effectively sets aside an area of the Fishery for the exclusive use or benefit of the Class-A scallop fleet. In this sense, it is important that any scallop closure be viewed in the context of the broader Fishery reforms proposed the WCTA. The proposal to use industry-based quotas to allocate Shark Bay's scallop resource in accordance with the historical catch shares for the two sectors (72% scallop industry and 28% prawn industry) guarantees that any increase in the productivity of the Bay's scallop resource is shared equitably between the two industry groups. Thus a win for the scallop industry through improved scallop recruitment and catch would likewise be a win for the prawn industry.

An assessment of the potential value of introducing a scallop closure, must also consider its impact on the harvesting strategies employed in the Shark Bay Prawn Fishery. The management of the prawn fishery aims to maximise the yield and value of prawns and is premised on the migration of prawns from inshore nursery areas out to the open waters of the Bay. By delaying the catch until the prawns make their way onto the trawl grounds, operators effectively target the catch of larger prawns thereby achieving better prices and enhancing the profitability of the Fishery. The WCTA proposal for a 10 nm x 3 nm trial closure on traditional scallop grounds does not in any way undermine or contradict the basic tenets of this harvesting strategy. Indeed, in the Draft Review Report it was noted that:

"*The Research Division suggests that these closures should have minimal impact on prawn fishing, as the prawns will migrate through these areas and are available for capture before or after they enter the* [closure] *areas*"

(Shark Bay Prawn and Scallop Fisheries Draft Review Report 2007: 17).

[1] See Appendix One which compares the variability of the annual catch of scallops in Shark Bay in the last 12 years with the variability of the catch that persists in the Abrolhos and was previously evident in Shark Bay.

In these circumstances, there does not appear to be a compelling reason why a closure on traditional scallop grounds could not co-exist with the fishing strategies presently employed by the prawn fleet.

With its recent implementation of another industry funded buy-back and the adoption of quad-gear on the 18 vessels that remain in the fleet, it is difficult to see how the prawn fishery can achieve further efficiency gains or better exploit the prawn resource. The fishery is clearly operating at near-full capacity. Nevertheless, the prawn industry is still confronted with problems, but ones that are external and outside of the control of both operators and the Department of Fisheries. If the Minister for Fisheries could do something about the strength of the Australian dollar, the influx of imported prawns, rising fuel and maintenance costs and the impact of labour shortages resulting from Western Australia's resources boom, he would have addressed the major factors impacting on the profitability and viability of the Shark Bay prawn industry. By contrast, the scallop fishery in Shark Bay does not appear to be operating any where near full capacity. With the recruitment and catch of scallops being flat for an extended 12-year period, the fishery no longer has the defining characteristic of highly variable catch and the anticipated "spikes" in recruitment have failed to materialise. From this perspective, the Department can at least investigate the causes of the anomaly in recruitment through the 5-year trial of a closure on the main scallop grounds in Shark Bay. As this submission has argued, such a trial would not impact greatly, if at all, on the operations of the prawn fleet and, if successful, would also provide a boost to the viability of both scallop and prawn industries.

It is also important to consider that, at this point in time, there is no proposal for the introduction of a permanent scallop closure in Shark Bay. The WCTA's first submission to the Review stated that a five-year trial was an appropriate period of time to test the effectiveness of closures as a means of enhancing the productivity of the Bay's scallop resource. Similarly, the Department's Research Division only considers the introduction of a closure on a trial basis. For operators in the prawn industry to claim that the viability of the prawn fishery will be jeopardised by the **trial** of a closure area on the traditional scallop grounds of Shark Bay would appear to be a gross exaggeration of the plausible impact on the fishing operations of the prawn fleet.

Irrespective of the legitimacy of the prawn industry's claims, the viability of the scallop fleet should not be considered any less important than the aim of securing the viability of the prawn industry. The Draft Review Report noted that:

"*the scallop fishery is of no less legal standing than the prawn fishery and…. the Department of Fisheries has a responsibility to manage both fisheries for long term sustainability and community return*".

(Shark Bay Prawn and Scallop Fisheries Draft Review Report 2007: 33).

From the WCTA's perspective, the failure to conduct an appropriate trial of a closure on Shark Bay's traditional scallop grounds threatens the viability of the scallop industry. The WCTA is realistic in its assessment of the capacities of the Shark Bay Scallop Fishery. The WCTA does not hope to establish a Fishery with steady recruitment that delivers the security of regular catch and incomes for operators in the Fishery. Rather, the WCTA simply wishes to see Shark Bay regain the characteristics and productivity of a healthy wild catch scallop fishery. In such a fishery the catch will fluctuate according to the presence of favourable environmental conditions and, importantly, when the conditions are right recruitment "spikes" will occur. Recruitment "spikes" which produce the big catch seasons are pivotal to the viability of the scallop industry. It is these bumper seasons that deliver value in the Fishery

and are ultimately the foundation of value to the licences. The trial of closures is clearly a legitimate research inquiry investigating the reasons for the absence of the recruitment and catch spikes in Shark Bay. To abandon a meaningful trial of closures in Shark Bay condemns the scallop industry to relying on the recruitment "spikes" that still occur in the State's other scallop fisheries and ultimately to an uncertain future.

The decision to review the Shark Bay Prawn and Scallop Fisheries is recognition that the existing management strategies employed in Shark Bay are not working and that a new management direction is desperately required. The WCTA has welcomed this Review and has embraced the opportunity to have some input into the management of the Shark Bay Fishery. The WCTA believes that the management of Shark Bay has lacked a strategic focus and attempts to reform the Fishery through a consensus approach have proved fruitless. Importantly, decisions about the future management directions in Shark Bay must be based on a realistic assessment of the position of the prawn and scallop fisheries and on the strength of the arguments presented to the Review. The WCTA believes that it has submitted a package of reforms that can establish a foundation for the future prosperity of the Fishery for the benefit of both prawn and scallop industries. At a time when the profitability of the Fishery is declining, and "where there is a significant risk that one or both of the fisheries may face serious economic decline" Shark Bay Prawn and Scallop Fisheries Draft Review Report 2007: 33), the WCTA urges the Department to adopt its reform agenda.

Appendix One:

The four graphs in Figures 1 to 4 below illustrate the extent to which the defining feature of a wild catch scallop fishery - highly variable recruitment and catch - is no longer evident in Shark Bay. The pattern of highly variable recruitment and catch, highlighted by the catch spikes that still occur in the Abrolhos and which were once a feature of Shark Bay prior to the shift in the distribution of fishing effort by the prawn fleet (see Figures 2 and 3) have clearly failed to materialise in recent seasons. Figure 4 which shows the extent to which the catch on the main scallop grounds has declined in recent years.

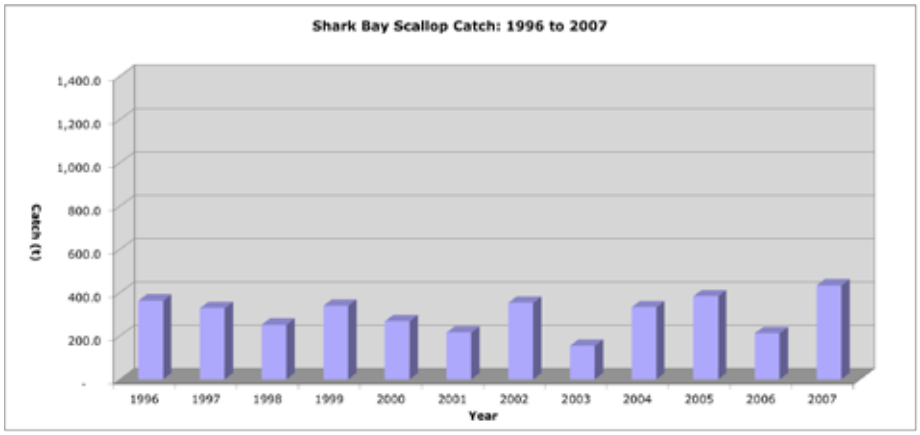

Figure 1: A graph depicting the catch of scallops in Shark Bay between 1996 and 2007. The productivity of Shark Bay over this period does not accord with the behaviour of a healthy wild catch scallop fishery. Recruitment and catch are relatively flat and the productivity "spikes" that accompany the onset of favourable environmental conditions are absent.

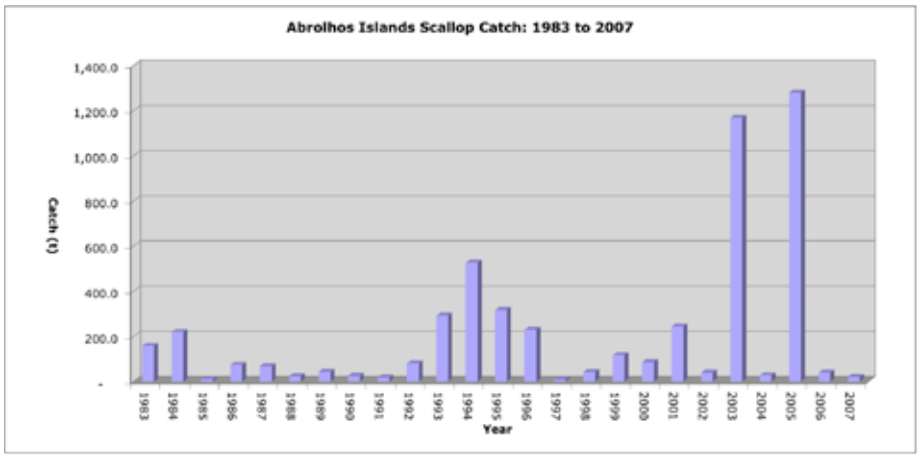

Figure 2: A graph depicting the annual catch of scallops in the Abrolhos Islands between 1983 and 2007. The productivity of the Abrolhos over this period is typical for a wild catch scallop fishery with "highly variable" recruitment and catch.

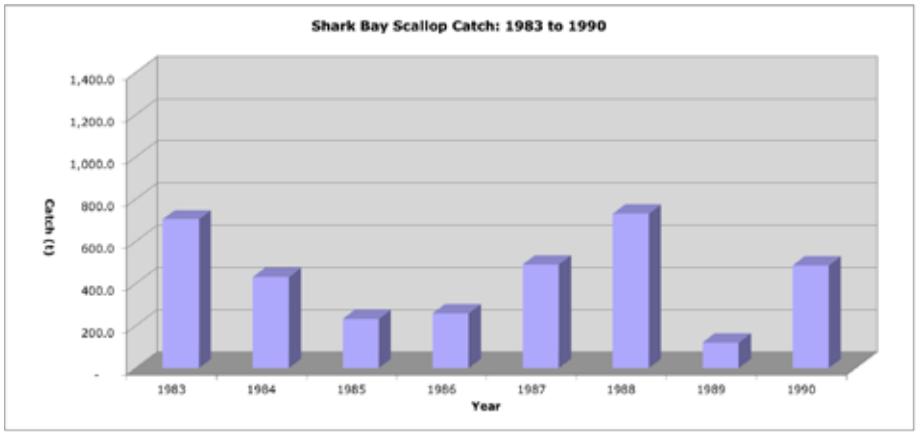

Figure 3: A graph depicting the annual catch of scallops in Shark Bay between 1983 and 1990. The productivity of Shark Bay over this period is typical for a wild catch scallop fishery with "highly variable" recruitment and catch.

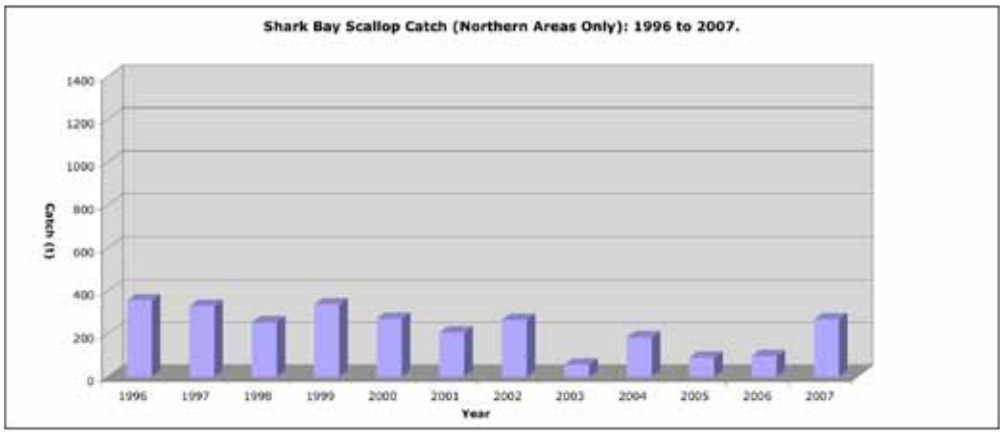

Figure 4: A graph depicting the annual catch of scallops on the northern grounds of Shark Bay between 1996 and 2007. The northern grounds of the fishery are the most historically important scallop grounds in Shark Bay. There is very little variability in catch and not a hint of "high variability".

Appendix 12 'Equitable Reform in the Shark Bay Scallop and Prawn Managed Fisheries'. A proposal submitted by the West Coast Trawl Association, 12 May 2009

"Equitable Reform in the Shark Bay Scallop and Prawn Managed Fisheries"

Proposal submitted by the: West Coast Trawl Association
12th May 2009

Executive Summary

The continued absence of leadership poses a significant threat to the future viability of Shark Bay's scallop and prawn industries. The Department's inability to commit to reform and its failure to make decisions has created uncertainty, undermined industry confidence and has only served to exacerbate problems in the Fishery rather than help to resolve them. The issues and problems confronting Shark Bay's scallop and prawn fisheries have been canvassed and are well understood. A comprehensive Review Report completed over 2-years ago now gathers dust and the results of a 2-year trial of alternative management arrangements for the Scallop Fishery have been largely ignored. Thus, while the groundwork for decisions has been laid, actual decisions are deferred in the futile search for consensus between the scallop and prawn sectors where plainly none exists.

In circumstances where reform by consensus cannot be achieved, the Department should strive for reform that is achievable, equitable and will ultimately deliver long-term outcomes that will benefit both industries and the broader community. To this end, the scallop industry maintains that the objective of profitable and economically sustainable scallop and prawn industries can be secured at no cost to Government and without the need to radically overhaul the existing management structures in Shark Bay.

The process of reform must start by resolving the issue of equity in the Shark Bay Scallop Managed Fishery. The failure to legislatively determine and manage to an equitable allocation of the scallop resource between the competing scallop and prawn sectors is the root cause of management deadlock in Shark Bay. Until this requirement is finally met the outlook for the Fishery will remain uncertain and its full potential will never be realised.

The existing management arrangements in Shark Bay fails to confer upon licensees a true sense of ownership of the resource and defies almost every principle of good fisheries management. The current system is based on archaic regulation that employs indirect input controls to determine the allocation of the annual scallop harvest between the respective scallop and prawn fleets. Under these arrangements the capacity of each sector to achieve its share of the scallop catch is driven by the number of vessels in each fleet, crew numbers, available fishing time and various other gear controls.

A management system that is based on input controls has no capacity to deliver reforms that address the twin objectives of increasing the productivity or value of the Fishery and reducing production costs. The innovative pre-spawn harvesting strategy, developed by the Department's Research Division, aims to enhance the overall productivity of the Fishery by ensuring that fishing occurs at a time where scallops are best in terms of quality, yield and market value. The ability to implement the strategy hinges upon operators accepting the need to modify traditional and ingrained fishing practices. Convincing operators to stop taking scallops when catch levels are still profitable in order to preserve stocks that replenish the fishery is clearly a major shift from the pursuit of as many as scallops as possible before they are caught, shucked and stored in the freezers of rivals. Without a guarantee or promise of catch allocation, no operator will willingly cease or adjust their fishing practices in circumstances where they stand to derive no or only minimal benefits from the decision to do so. Without the

underpinning of catch allocation, the ability to utilise the flexible management arrangements that allows pre-spawn harvesting unravels.

Similarly, the continued use of input controls denies the scallop industry the opportunity to enhance operational efficiency and minimise the overall costs of production. Without the fishing capacity of 14-vessels the scallop industry cannot achieve its 72% historical share of Shark Bay's scallop resource. In these circumstances, management by input controls effectively locks the scallop industry into a fleet of 14-vessels within a competitive fishing regime.

Since the establishment of an independent scallop fishery in 1983 the scallop resource in Shark Bay has been split on a 72:28 ratio between the scallop and prawn industries. Removing the use of indirect input controls and giving legal effect to this acknowledged historical equity and directly allocating the catch on this basis is the critical first step towards establishing management arrangements that will secure the foundations for the future prosperity of the scallop and prawn industries based in Shark Bay. A system of direct allocation will effectively remove the barriers to rationalisation in the scallop industry and establish firm principles of equity that will force operators in both the scallop and prawn industries to accept the requirement of living within the level of resource access provided by their respective fisheries. For the scallop industry this equates to accepting an entitlement to 72% of the annual scallop harvest in Shark Bay and the catch provided by the Abrolhos. For the prawn industry this means accepting that it is entitled to the combined catch of king and tiger prawns and its 28% allocation of the Shark Bay scallop catch. A system of direct allocation guarantees that both sectors continue to receive their "fair share" of the scallop resource and prevents the possibility of one sector taking a greater share thereby achieving an advantage at the other sector's direct expense.

The Exmouth Gulf Prawn Fishery's ability to couple strategies that maximise both yield and value with an ability to drastically cut the costs of production offers some important insights on how to transform Shark Bay into a more profitable fishery. Exmouth Gulf now operates with a fleet of 9 vessels, a reduction of 60% from the 23 vessels that originally operated in the Fishery. Fleet rationalisation on this scale has slashed fixed costs in the Fishery and has been a key factor in enhancing the long-term prospects of the Fishery.

The Exmouth Gulf example clearly shows that a combined fleet of 32 trawlers in Shark Bay is unsustainable in the long-term. The prawn industry will argue that it has already undertaken significant measures to restructure its fleet. While 18 vessels now operate in the Prawn Fishery, this represents a 48% reduction from the 35 vessels that originally operated in the Fishery. If the reform undertaken in Exmouth Gulf is any guide, further rationalisation in Shark Bay's Prawn Fishery will be required if the long-term viability of the industry is to be secured.

The scallop industry deserves the opportunity afforded to the prawn industries in both Exmouth and Shark Bay to address its own issues of overcapacity and rising production costs. Removing the barriers to rationalisation imposed by management via indirect input controls would provide operators in the scallop industry with the opportunity to negotiate the means of restructuring. While operators can consider options such as

consolidation through industry-funded buy-back or the implementation of I.T.Q.'s, the scallop industry itself should be given the chance to resolve these issues.

The framework of independent scallop and prawn fisheries has existed since 1983 when the Government of Western Australia permitted 14 vessels to fish exclusively for scallops in Shark Bay. This decision, taken over twenty-six years ago, has sponsored the development of two distinct industries: a prawn industry based in Shark Bay that catches scallops as a supplement to its principal catch of king and tiger prawns and a scallop industry relying almost exclusively on the catch of scallops in both Shark Bay and the Abrolhos Islands. While the prospect of the formation of a single trawl fishery may have some allure for the prawn industry, the time to consider it a realistic management option has long since passed. In assessing the future management options for Shark Bay, the consequences of decisions made 26 years ago cannot be disregarded. In 2009 Western Australia has a well-established and independent scallop industry that does not seek and will not support the introduction of a single trawl fishery in Shark Bay. Substantial investments have been outlaid over this time. Vessels have been upgraded and consolidation has resulted in every scallop licence in Shark Bay now being paired with an Abrolhos licence. When consideration is given to the processing facilities that have been constructed and the markets and brands that have been nurtured over 20+ years, the question of dismantling the foundations of an independent and specialised scallop industry is simply unacceptable. Operators' equity in the scallop industry will not be surrendered and efforts to erode established equity will be strongly opposed.

The pathway to profitable and economically sustainable scallop and prawn industries begins with the Department accepting that there is no silver bullet that will resolve the conflict and ongoing tensions between Shark Bay's scallop and prawn industries. Efforts that strive to achieve a pre-determined outcome (i.e. a single trawl fishery) are doomed to fail and will simply prolong uncertainty in both industries. If the Department is serious about breaking the management deadlock in Shark Bay, it must lower its sights and aim to create the regulatory environment that will allow the market to determine the extent and mechanism of rationalisation in Shark Bay. Formalising the system of industry-based quotas or catch share arrangements that was successfully trialled in 2007/'08 would impose a cap on the resource available to the respective scallop and prawn industries thereby creating the pre-conditions for reform. Direct allocation of the scallop resource confers 'ownership' to both sectors and will encourage them to rationally assess the most efficient, economically viable means of harvesting that resource. Reform along these lines is achievable, is founded on the explicit allocation of catch shares based on the existing equity in the Fishery and does not require Government funding. This action will facilitate the opportunity for industry to continue to evolve the reform required in the Shark Bay trawl industry and, within each of the respective sectors, the opportunity to adopt new fleet rationalisation strategies with certainty. All that is required is the political will to implement these reforms.

Introduction

In 1983 the Government of Western Australia permitted 14 vessels to fish exclusively for scallops in Shark Bay, thereby creating independent scallop and prawn fisheries. The decision sponsored the development of two distinct industries: a prawn industry based in Shark Bay that catches scallops as a supplement to its principal catch of king and tiger prawns and a scallop industry relying almost exclusively on the catch of scallops in both Shark Bay and the Abrolhos Islands. Twenty-six years after this decision the core issue of determining equity in the Shark Bay Scallop Fishery remains unresolved.

While the management arrangements for the scallop and prawn fisheries are matters under consideration by the Shark Bay Review, the overriding issue for government is to maintain and promote scallop and prawn industries that are economically viable in the long term. This is a subtle, yet important distinction. For the scallop industry Shark Bay is only one part of the two sided viability equation. Over the twenty-six year period since the creation of an independent scallop fishery in Shark Bay, the scallop industry has evolved to the stage where a single fleet now operates in the State's two major scallop fisheries. To achieve economies of scale and thus ensure the viability of their business, operators in the scallop industry require dual licensed vessels. Indeed, every Shark Bay licence is now paired with an Abrolhos licence. In these circumstances, management reform has to consider the Abrolhos and a strategy to secure the future viability of the scallop industry must extend beyond the boundaries of the Shark Bay Fishery.

There are clearly compelling arguments for reform in the Shark Bay Scallop Managed Fishery. With management grid locked by the competing claims of the scallop and prawn industries and operator profits being squeezed by the combined impact of rising production costs and static prices, the future of the Fishery and the scallop industry is uncertain. This paper maintains that a system employing the use of indirect input controls[1] to allocate catch is incapable of addressing the future management needs of the Fishery. An overhaul of the management arrangements for the Fishery is therefore critical to securing the long-term viability of the industry. For the Fishery to thrive and reach its enormous potential it is clear that a new management system is required. This paper will argue that the most effective means to ensure sustainability, equity and maximum economic return for the scallop resource in Shark Bay is to replace input controls as the mechanism that indirectly determines equity in the Fishery with a system that formally acknowledges the equity in the Fishery and directly allocates the catch on this basis.

Maximising Catch Value

The introduction of pre-spawn harvesting strategies in 2005 has made an important contribution to increasing productivity and thus maximising economic returns in the Shark Bay Scallop Fishery. The decision to allow pre-spawn fishing marked an important departure from earlier management strategies. Prior to 2005 the scallop harvesting strategy in Shark Bay was based on the application of a (opening) matrix[2] that was passive in nature,

[1] Input controls that are used to allocate catch in the Fishery between the scallop and prawn industries include: the number of vessels in each fleet; crew numbers; available fishing time and various fishing gear controls.

[2] The opening matrix dictated the season fishing arrangements. When the estimated catch and scallop abundance was low the season would open late thus ensuring the maximum number of animals during the key spawning period. Conversely, when higher scallop numbers were forecast

where the primary strategic purpose was the prevention of spawning failure. While product quality and meat yields were factors to consider, these objectives were subservient to the principal goal of maximising the chances of spawning success.

In 2005 the Department effectively abandoned the use of the matrix as a management tool in the Fishery and sought to implement a more pro-active harvesting strategy that aimed to produce better returns without jeopardising the sustainability of the resource. The new system allowed the catch of pre-spawn scallops and was based on a reworking of the spawning stock equation. Rather than seeking to leave the entire scallop population in the waters of the fishery for spawning purposes, the Research Division considered spawning success to be just as likely with only an adequate number of animals retained in the waters during the key spawning period.

The pre-spawn harvesting strategy thus permits the take of scallops at a time when scallop quality and meat size is optimum. However, spawning stocks and sustainability requirements are secured by measures that stop the take of scallops when stocks reach a pre-determined level[3] and additionally suspends the take of scallops over the key spawning time (May to July). The take of scallops then resumes after July. Importantly, an additional limit on the total take of scallops is imposed to ensure the preservation of spawning stock in the following season in the event of recruitment failure. These residual scallops also make an important contribution to improving yields and value in the Fishery, as they will be taken as larger more valuable scallops at the start of the following season.

The impressive catch results from Denham in the last 7-years indicates the benefits of pre-spawn harvesting strategies for the productivity of the scallop fishery. In assessing the impact of the changes to harvesting and broader management strategies in the Denham area, it is important to note that Denham is historically the least productive area of the Shark Bay Scallop Managed Fishery. In the 8 years between 1994 and 2001 a total of 60 tons of scallops were harvested from the Denham area. In contrast, over the 7-year period between 2002 and 2008, a total of 1,195 tons of scallops has been harvested and Denham has become a consistently productive area of the Fishery.

During the last 7-years there have been two important changes to the fishing strategy applied in Denham:

1. There has been significantly less trawling on the Denham grounds by the prawn fleet at the start of the season (i.e. during the key spawning and settling time for scallops). In fact, the prawn fleet no longer operates in Denham at the start of the season and has not done so since 2005[4].

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and the mix of new recruits and residual stocks was right the opening of the season could be brought forward.

[3] Scallop fishing ceases when catches reach a threshold of 400kg per 24-hour period for Class-A scallop vessels.

[4] This indicates that there is a strong case for investigating the potential benefit of implementing trawl closures on important scallop grounds as a means of improving the productivity of the scallop fishery.

2. A new fishing strategy that incorporates both pre-spawn fishing to maximise scallop yield and value and the retention of significant scallop numbers on the grounds for the following season has been applied since 2005.

The phenomenal increase in the productivity of the Denham grounds suggests that the combination of these two initiatives has had a very positive impact on the economic returns being generated in the Fishery. Given the profound change in the productivity of the Denham area over this period there is certainly merit in persisting with these new fishing strategies and perhaps assessing the prospects of their broader application.

While the pre-spawn harvesting strategy successfully combines the twin objectives of ensuring sustainability and maximising economic returns in the Fishery via increased meat yield and product quality, its practical application is seriously undermined by a management system that employs input controls to determine equity in the Fishery.

In circumstances where the scallop fleet ceases fishing with relatively high stock levels remaining on the trawl grounds[5], the prawn fleet would be free to target the significant scallop abundance from August onwards. Thus in the absence of any limits being imposed on the catch to be taken by each sector, the pre-spawn harvesting strategy will potentially deliver an outright transfer of equity in the Fishery. Such an outcome is clearly unacceptable to the scallop industry.

It is clearly difficult to engender a spirit of conservation in the Fishery without a mechanism that directly allocates shares of the scallop resource. In this environment, conservation of the resource becomes secondary to operators' resolute pursuit of as many scallops as possible before they are caught, shucked and stored in the freezers of rivals. No operators will willingly cease fishing in circumstances where they derive no or only minimal benefits from the decision to do so. Without a guaranteed share of the catch both scallop and prawn fleets will continue to take scallops to the point where very few animals will survive into the following season. In these circumstances, a management system that determines equity in the Fishery by input controls can be seen to threaten the sustainability of the Fishery[6]. It is clear that management by input controls is completely incompatible with the pre-spawn harvesting strategy that seeks to maximise economic returns in the Fishery through improved meat yields and value. Without the supporting framework of a management system that directly allocates catch shares the pre-spawn harvesting strategy is simply unworkable and innovative, proactive management that increases productivity and adds value to the Fishery would not be implemented to the eventual detriment of all.

[5] The success of the pre-spawn harvesting strategy relies on the ability to apply and enforce relatively high catch rate thresholds on the scallop fleet. Only through the application of a conservatively set catch threshold is it possible to maintain adequate scallop numbers to meet the combined requirements of spawning stock in the current season; the prawn fleet having an opportunity to obtain its "fair share" of the resource; and retaining residual spawning stock for the following season.

[6] Indeed it is possible to argue that the extended period of low catches in the Fishery may ultimately be an outcome of the failure to address the issue of allocating the scallop resource.

Minimising Production Costs

In a management system that employs input controls to allocate catch in the Fishery, the scallop industry's capacity to respond to changing economic pressures is severely limited. In circumstances where the scallop industry's share of the resource is determined largely by the collective catching and processing power of 14 vessels and their 13 crew, there is no prospect of rationalisation by fleet restructure and the scallop industry is effectively denied the opportunity to reduce fixed costs in the Fishery.

The fishing and processing power of the vessels used in Shark Bay have advanced considerably since the effective establishment of the Fishery in 1983. While the problem of over-capacity is obvious in small catch years, the productive potential of the scallop fleet should not be underestimated and there is a strong case to suggest that a reduced fleet has sufficient productive capacity to harvest even very large scallop populations[7]. In 2009 there are plainly too many vessels operating in the Fishery and there is clearly over-capacity in the scallop industry that is not economically sustainable in the long-term.

In the absence of a management system that directly allocates shares of the resource, a decision to reduce the number of scallop vessels will simply transfer equity in the Fishery. A reduction in the number of scallop vessels will constrain the productive capacity of the fleet and enhance the prawn fleet's potential to increase its share of the catch. In these circumstances the scallop industry is forever condemned to a 14-vessel fleet and offers further confirmation that the system of managing the Fishery by input controls sustains and promotes inefficiencies in the industry and ultimately reduces economic returns.

A Framework for New Management: A Historical Basis for the Direct Allocation of Catch in the Fishery.

When a Fishery lacks structure, certainty and regularly calls upon intervention from the Minister or CEO, it is clear that the management system has broken down and new management options must be explored. While input controls no longer provide a basis for effective management in the Fishery, their use for twenty-six years does provide a sound and irrefutable basis for an equitable allocation of Shark Bay's scallop resource. Over the course of this time, the scallop resource has been split on a 72:28 ratio between the scallop and prawn industries. While the legitimacy of other methods of determining allocation can be debated, the validity of a system that determines the allocation of future catch in the Fishery on the basis of historical data is difficult to contest.

The 2007/'08 trial of catch share arrangements demonstrates the existence of a tested and working model of how direct allocation can be successfully applied in Shark Bay. The two-year trial sought to replicate the historical 72:28 allocation of the scallop resource through the application of industry-based quotas for the scallop and prawn fleets. There were no individual quotas in this system and the competition for catch between vessels within the respective scallop and prawn fleets continued. Although administering the catch share arrangement was initially onerous, the experience of the trial indicates that the task will be easier in the future. From a practical point of view, achieving the equitable 72:28 allocation

[7] For example, in 2005, 16 scallop vessels were able to harvest nearly 1,300 tons of scallop meat in the Abrolhos Islands over an 85-day period.

of the scallop resource simply requires that the scallop fleet stops fishing at the point where there are enough scallops left on the fishing grounds to:

a) Allow the prawn fleet the opportunity to achieve its 28% allocation[8]; and

b) Satisfy the requirements for residual stocks carrying over into the following season.

For this to occur it is vital that the Fisheries Department receives accurate and timely feedback from industry on the progress of catch. The collaboration of industry and Fisheries Research facilitates real time management that subsequently allows catch rates to be monitored and catch allocation to be successfully managed.

The capacity to achieve the 72:28 allocation of the scallop resource between scallop and prawn fleets was convincingly demonstrated by the catch arrangement trial. With a total of 1,189 tons of scallop meat caught in Shark Bay over the two-year period there was a net imbalance of only 23.3 tons from successfully achieving the target 72:28 ratio - an amount representing less than 2% of the total catch. While the prawn industry was left short of achieving its allocation at the end of the trial, it should be noted that the scallop industry was down 20 tons after the first year. Given the capacity to address any shortfall in the following season by means of applying an appropriate mechanism of priority access[9], the trial conclusively showed that the allocation of catch could be reliably achieved.

The capacity of catch share arrangements to lift productivity and economic returns in the Fishery must also be acknowledged. An assessment of the residual scallop index detailed in Table 1 shows the extent to which the number of residual scallops (i.e. older, 1+ scallops) available for harvesting has risen to unprecedented levels during the trial period.

Table 1: Comparison of Residual (Scallop) Index -2007/'08 & 1994 to 2006.

Nor-West Peron	Residual Index
2007	177
2008	240
2007/'08 Average	208
1996 to 2006 Average	39

Red Cliff	Residual Index
2007	55
2008	280
2007/'08 Average	167.5
1996 to 2006 Average	45.9

In the 2007/'08 trial the average residual index in Red Cliff was 3.5 times greater than the average achieved over the preceding 11 years. The Nor-West Peron area produced an even more impressive five-fold increase. Putting aside the potential recruitment benefits of retaining increased spawning stock into the following season, the availability of significantly more residual scallops produces better yields, a higher proportion of larger and more valuable meat and adds considerably to the value of the Fishery.

[8] It is important to note that the prawn fleet's failure to achieve the full allotment of its 28% share of the resource was not due to a shortage of scallops. The scallops were available, but were not taken.

[9] The shortfall in scallop allocation to the prawn industry over the trial represents less than 1.3 tons per vessel and could easily be addressed through measures that might involve starting the season a few days before the scallop fleet or a requirement that the scallop fleet leave the fishery at a higher catch threshold in the following season to ensure that additional scallops remain for the prawn fleet. It is important to note that the catch share system maintains a record of catch between the two fleets so that any imbalances are restored.

basis and to a much greater degree of accuracy[10]. Furthermore, quotas might need to be set conservatively, but allow scope for in-season adjustments if assessment of the catch rates warranted the resetting of the TAC (Total Allowable Catch) and thus the quotas upon which they are based. To some extent, this would create management inefficiencies and uncertainty. Thus while ITQs may deliver the same productivity gains offered by catch share arrangements, the profitability of the Fishery by direct comparison might be less due to additional management costs.

An assessment of the merits of ITQs must look beyond a straightforward cost/benefit analysis. It should be recognised that ITQs offer considerable benefits in terms of the capacity to facilitate structural reform in the industry through a process of market-driven rationalisation. With the flexibility of free movement of quota, prices are easy to measure and transactions that can potentially transform the ownership structure in the fishery require only 2 participants (a buyer and seller or leasor and leasee). In this arrangement, the market will determine the optimal fleet size or arrangement on how best to fish the scallop resource. For example, scallop quota could be transferred from prawn vessels to scallop vessels, scallop vessels could consolidate quota, prawn vessels wishing to take a greater share of the scallop catch could opt to purchase additional quota. There are a myriad of combinations that would, in the end, produce the optimal result.

A system of industry-based quotas, on the other hand, does not offer the same level of flexibility to further progress rationalisation. The system is limited insofar as it requires collective decision-making and industry-wide agreement. The system does not establish comprehensive entitlement or property rights. A system of industry-based quotas provides an entitlement to access the fishery as 1 of 14 scallop vessels entitled to take (for the sake of the argument) 72% of the scallop annual harvest. This is clearly an improvement on the existing system of management via input controls that simply entitles access to the Fishery and an opportunity as 1 of 32 boats that all have a capacity to take scallops. However, the catch share model is still limited and not as extensive or flexible as the system offered by ITQs.

In terms of a process for reform in the Shark Bay Scallop Fishery, the role of ITQs needs to be considered a longer-term prospect. Clearly the obstacle of establishing and mandating an equitable system of catch allocation between the scallop and prawn industries must first be addressed. It needs to be noted that catch share arrangements may, in its own right, establish sufficient incentive for industry reform and rationalisation. In circumstances where ITQs offer the prospect of more vigilant and demanding management and thus the promise of higher costs for managing the Fishery, there is considerable merit in first assessing the capacity of catch share arrangements to initiate reform. There also exists the very difficult issue of quota allocation within each of the industry sectors that will require significant discussion and debate. Rushing to embrace ITQs as a new management system for the Fishery would appear to be premature.

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[10] The accuracy of catch predictions extrapolated from the pre-season surveys is an issue for producing a realistic or meaningful TAC. The accuracy of catch predictions for the Shark Bay Scallop Fishery has a checkered history, with the actual catch typically being substantially less than the estimate. In circumstances where the TAC cannot be set with any degree of certainty the system of ITQs will not work. Some vessels catch significantly better and operate with greater efficiency than others. If the TAC cannot be set with any confidence there is scope for some operators to achieve their quota by the time the TAC is recalibrated due to inaccurate catch prediction. In these circumstances, ITQs are rendered ineffective.

Single Trawl Fishery

The formation of a single trawl fleet in Shark Bay offers an alternative management option considered in the *Draft Review Report*. The single fleet option is based on the premise that the productive capacity of Shark Bay cannot support a fleet of 32 vessels (18 prawn and 14 scallop) and proposes an amalgamation of the two fleets or a straight buy-out of the scallop industry, as a solution to the problem of over-capacity. For the prawn industry the prospect of a single Shark Bay Trawl Fishery has considerable appeal. When the prawn fishery operates at a high level of efficiency, is already fully exploited and prawn prices continue to decline with the expansion of global prawn aquaculture production the pressure for additional sources of income will intensify. In these circumstances, the ability to take more scallops becomes an increasingly important factor in sustaining the business of operators in the prawn industry.

While it may appeal to the prawn industry, the single trawl fleet option fails to address the issue of equity in the Fishery and conveniently ignores the history of the past 26 years. The single fleet option offers no assistance to the scallop industry, but threatens to systematically dismantle the industry at every stage of production. Without the supporting catch from Shark Bay and a newly found dependence on the catch from the Abrolhos, the opportunities for achieving economies of scale for scallop vessels and land-based processing facilities would be seriously diminished. Similarly, markets that have been developed over a twenty-year period could not be satisfied. And, in the event of scallop operators becoming a participant in a new single trawl fishery, they would also contend with the problem of marketing prawns for which they have no immediate expertise. Rather than solving the scallop industry's problems, the prospect of a single trawl fleet promises to cripple the business of operators who specialise in the catching, processing and marketing of scallops. If management by input controls threatens to undermine equity in the scallop fishery, the imposition of a single trawl fleet simply sweeps it away. The scallop industry clearly has no interest in a single trawl fishery in Shark Bay.

Conclusion

There is an obvious and unquestionable need to change the existing management arrangements in Shark Bay. While there are calls to radically overhaul the fundamental structure of Shark Bay through the creation of a single trawl fishery, the scallop industry challenges the motives for such a move and questions the value of the anticipated benefits. Casting aside the question of how such a major transformation of ownership in the Fishery might be achieved, the benefits of a single trawl fishery weigh heavily in the prawn industry's favour. With the prospect of unfettered access to Shark Bay's scallop resource, a single trawl fishery offers a solution to the prawn industry's need for additional income streams, but at the direct expense of the future viability of the scallop industry. Such an outcome is clearly unacceptable and, in the absence of willing buyers and sellers for such a proposal, the prospects of delivering on the promise of a single trawl fishery appears doomed from the outset.

In contrast, the scallop industry supports the formal application of industry-based quotas, modelled on the recent catch share arrangements trial. This position represents reform within the existing management framework of distinct and independent scallop and prawn industries that simply gives legal effect to the acknowledged historical equity in the Fishery.

With these reforms, neither industry stands to receive an advantage at the direct expense of the other. But through the direct allocation of catch shares to prawn and scallop fleets, both industries have a guarantee that they will continue to receive their "fair share" of the Shark Bay scallop resource. Furthermore, management initiatives that enhance the productivity and value of the Fishery through better meat yields and more consistent recruitment are benefits that both industries would share. By working co-operatively to enhance the total scallop resource, scallop and prawn licensees have an opportunity to secure the future viability of their businesses.

The prawn industry's rejection of catch share arrangements suggests a desire for a greater share of the scallop resource. When the prawn industry contributes only 20% of the costs of managing the Fishery[11] in accordance with cost recovery principles, it is difficult to accept the prawn industry's view that a 28% limit on the annual take of scallops is somehow unreasonable. The prawn industry clearly has no entitlement to the scallop resource beyond its historic 28% share. To allow the prawn fleet the capacity to take a greater share of the scallop resource undermines the established equity in the Fishery and is therefore totally unacceptable.

The scallop industry has approached the Shark Bay Review in a spirit of co-operation, but with a resolve to defend its right to self-determination. Although frustrated by the lack of progress with the Review, it is confident and remains positive about the future outlook for the industry. After many dormant years there are clear signs that management initiatives in Shark Bay are restoring productivity to the Scallop Fishery. Similarly, approval for a limited adjustment scheme in the Abrolhos Islands scallop fishery continues the process of rationalisation in the industry and is cause for further optimism. In its efforts to promote reform in Shark Bay, the scallop industry is not seeking government handouts or positioning itself to take away the access or historical property rights of others. The scallop industry simply seeks the opportunity to help itself and to stand on its own feet. By adopting the system of industry-based quotas, modelled on the 72:28 trial of catch share arrangements, the Department will deliver effective and achievable reform that provides a management system that gives the scallop industry the best opportunity to prosper facilitated through certainty and potential fleet adjustment. With experience and time, it may also lead to future confidence with the prospect of ITQ management reform.

[11] It should be noted that the decision to adopt an 80:20 split of cost recovery payments between the scallop (Class A) and prawn (Class B) fleets was based on the original principle that the catch between both sectors would be split on a 80:20 basis.

The model of industry-based quotas that was applied during the catch share arrangement trials of 2007/'08 offers an equitable means for independent scallop and prawn industries to resolve the issue of their future viability. With each sector certain of its allocated share of the resource, there are opportunities for both industries to look rationally at the economics of the fleet required to harvest their share of the available resource. In these circumstances, a framework for adjustment or future rationalisation is created. Over time, market forces – possibly through the means of industry-funded buy-back, adjustment after further industry consolidation or possibly via industry agreement to apply quotas - will determine the most efficient fleet configuration. In this way, the scallop industry will - like the prawn industries in Exmouth and Shark Bay - have the capacity to combat rising production costs through rationalisation and fleet restructure.

It would therefore appear that catch share arrangements that allocate the scallop resource between scallop and prawn industries on the basis of a historically equitable 72:28 split is certainly achievable; promotes better long-term returns in the Fishery and provides a framework that facilitates restructuring in the industry that will ultimately restrain production costs. None of these benefits are achievable in a Fishery that employs input controls to manage equity.

Quotas.

The potential for applying ITQ's (Individual Transferable Quotas) as a management option in the Shark Bay Scallop Fishery is canvassed in the Draft Review Report. However, before ITQs can be seriously considered as a management option the issue of equity – the allocation of the annual scallop harvest between scallop and prawn fleets - must be resolved. This action alone will assist each of the sectors to further address rationalisation strategies within their own fleets with certainty. Clearly, addressing the catch share issue is a pre-requisite for any management system that seeks to directly allocate catch.

ITQs can only proceed if the more difficult issue of catch allocation within each of the respective sectors is adequately addressed. This is not an easy issue for Government or Industry. In the absence of a ready and easy answer acceptable to all parties, the issue of ITQs needs to be carefully considered by Industry.

ITQs can be considered an extension of the catch share proposal. However, rather than establishing a system that collectively pools individual vessel catches into respective scallop and prawn sectors, ITQ's promise a specific allocation to individual licence holders. The benefits of direct allocation offered through industry-based catch share arrangements would apply equally to a system based on ITQs. In this sense, the ability to maximise catch value and retain scallops in the waters of the Fishery for spawning stock purposes would also be key achievements of a Fishery managed with ITQs. However, the benefits in terms of establishing a more productive fishery biologically would only equal, but not surpass the achievements delivered by catch share arrangements.

The management demands of ITQs will be considerably more taxing than those that would apply to catch share arrangements. The costs of administration, compliance and research would all be significantly higher. Catch predictions from pre-season surveys would need to be more comprehensive in scope and/or analysis if quotas were to be set with a reasonable level of accuracy. The requirements for monitoring the catch and verification of catch would additionally be more stringent as catch would need to be tracked on an individual