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Department of Fisheries
Government of Western Australia



Fish for the future

FISHERIES

OCCASIONAL PUBLICATION

**Proceedings of the Western Australian Dhufish Workshop
2004**

**Murdoch University, Western Australia
June 12, 2004**

Edited by Mark Pagano and Terry Fuller

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The Western Australian Dhufish Workshop 2004

Edited by Mark Pagano and Terry Fuller

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EXECUTIVE SUMMARY

The Western Australian Dhufish Workshop 2004 was a joint project between Recfishwest and the Western Australian Department of Fisheries.

The workshop incorporated presentations from the Department of Fisheries, Recfishwest, the Western Australian Fishing Industry Council, Murdoch University and Challenger TAFE to showcase current knowledge relating to the iconic dhufish in Western Australia. The perspectives of a recreational fisher, a commercial wetline operator and a metropolitan charter boat operator were also presented.

Through information sharing and discussion the workshop provided a platform to better understand the fundamental issues that underpin current and future management arrangements for this valuable resource. Both commercial and recreational fishers were provided the opportunity to discuss their concerns and have meaningful input into potential future management of dhufish in Western Australia.

The Workshop was separated into three distinct sessions to examine the current knowledge base, the issues as seen by those involved in the fishery, and present and future management scenarios as we head toward an integrated approach to fisheries management.

The current knowledge session explored what we know to date about dhufish. The session included presentations regarding the biology, physiology, stock assessment and current research on dhufish in Western Australia.

The issues session provided insight into a commercial, recreational and charter fishing perspective from individual fishers that have extensive experience fishing for dhufish in Western Australia.

The management session provided a useful depiction of historic and current management of the commercial and recreational dhufish take. Potential future management scenarios were explained from a sustainability and efficiency perspective. The session ended with a presentation on the challenges that lay ahead through the Integrated Fishery Management process.

Discussion panels were run at the end of each session to provide an opportunity for all present to engage the presenters of the session with questions and comments.

The result was a very informative workshop that exposed a broader perspective of what is really happening and what needs to happen regarding management of this iconic species. Management of the demersal commercial finfish fishery is essential and it needs to be introduced as quickly and practically as possible.

A clear outcome from the workshop was the unanimous concern among all presenters that dhufish management must change and change soon if we are to protect this iconic species for future generations.

INTRODUCTION

The Western Australian Dhufish Workshop 2004 was held on June 12, 2004 at Murdoch University in Western Australia. The Workshop was a Fishcare WA-funded joint project between Recfishwest, the peak body representing recreational fishing interests in Western Australia and the Western Australian Department of Fisheries.

Recfishwest proposed the dhufish workshop following a combination of concerns raised by Recfishwest members, fisheries researchers and managers and many recreational fishers regarding the sustainability of dhufish stocks in Western Australia.

There was a resounding call for people with in-depth knowledge of dhufish, both formal through research and management and practical through many years of targeting dhufish, to collectively discuss what they believe are the risks to this iconic species. Through information sharing and discussion the workshop presented an opportunity to better understand the fundamental issues that underpin current and future management arrangements for dhufish in Western Australia.

The Workshop was separated into three sessions to examine; the current knowledge base, the issues as seen by those involved in the fishery and future management scenarios as we head toward an integrated approach to fisheries management.

Over one hundred people attended the workshop and were provided the opportunity to discuss their concerns and have meaningful input into potential future management of dhufish through a discussion period at the end of each session.

The first session provided current knowledge of dhufish biology and physiology crucial to the management of dhufish and included presentations from Challenger TAFE and Murdoch University. The current stock assessment and research in progress was presented by the Department of Fisheries.

The second session gave an opportunity for individuals, whose livelihood and or passion has provided them with a unique understanding of dhufish, to provide their personal perspectives. A commercial wetline operator that targets dhufish was sourced through the Western Australian Fishing Industry Council, a metropolitan charter boat operator was found through the Charter Boat Association and the Board of Recfishwest were asked to source an experienced recreational dhufish fisher willing to present his/her views at the workshop. The point of view presented by the three individual fishers during the issues session of the workshop do not necessarily reflect representative views, but represent the concerns they as individuals have about the future of dhufish in Western Australia.

The final management session provided information regarding historic and current management of the commercial and recreational dhufish take and an opportunity for future management scenarios to be presented. The session included a presentation on the challenges that lay ahead through the Integrated Fishery Management process.

Mark Pagano

Coordinator

The Western Australian Dhufish Workshop 2004

SECTION 1 CURRENT KNOWLEDGE

1.1 **Biology of the West Australian dhufish *Glaucosoma hebraicum*, by A. Hesp, I. Potter and N. Hall**

*Presentation by Dr Alex Hesp
Centre for Fish and Fisheries Research
Murdoch University
Western Australia*

Summary of presentation

The West Australian dhufish *Glaucosoma hebraicum* is endemic to Western Australia and is one of the most commercially important and recreationally sought after finfish species in Western Australia. Our study has provided the first detailed biological information of the type that is required by managers to enable them to develop appropriate management plans for this species. Many commercial and recreational fishers report that they now need to travel further offshore and north or south of the main metropolitan area to obtain the same size and quantity of dhufish as had been previously possible. This indicates strongly that there has been localized depletion in some areas, and particularly in the metropolitan region.

Widespread concern that the abundance of dhufish in our coastal waters were declining led the Australian Fisheries Research and Development Corporation (FRDC) in 1996 to fund a three year project aimed at determining the types of habitat occupied by dhufish during the sequential stages of its life cycle, and the size and age compositions, growth rates and reproductive biology of this species.

Dhufish occur between Shark Bay and the Recherche Archipelago (Esperance). Our sampling, which included trawling, line fishing and spearfishing, demonstrated that as dhufish increase in size, they move from flat hard-bottom areas where sponges are often abundant (fish < 150mm total body length, TL) to low-lying reefs (fish 150-300mm TL) and then to prominent reefs (fish > 300mm TL). Dhufish become vulnerable to line fishing when they reach about 300mm TL and have moved onto prominent reefs.

Each dhufish collected during our study was aged by counting the number of yearly-formed growth zones (annuli) in their otoliths (ear bones). A number of individuals obtained during our study were more than 20 years old and a small number were over 35 years. The oldest female and male dhufish collected during our study were 39 and 41 years, respectively. Males grow slightly faster than females. Thus, on average, after 2, 5 and 20 years of life, male dhufish reach total lengths of about 210, 440 and 910mm, respectively, compared with 200, 400 and 830mm, respectively, by the females. The largest dhufish we collected in our study was 23.2kg and measured 1100mm in total body length. Dhufish spawn predominantly between December and March and individual fish spawn on many occasions during a spawning season.

Management implications for subsequent consideration

From a fisheries management perspective, it is desirable that the minimum legal length (MLL) for a species should exceed the length at which the individuals of that species typically first reproduce. Our data demonstrate that female and male dhufish typically first breed at about three years of age, when they have reached total lengths of about 320-340mm, which is thus below the current MLL of 500mm. After reaching maturity, dhufish can breed for about two or three years before they can be caught and legally retained.

The MLL might be of limited value for dhufish, as many of the small individuals caught in deeper waters do not survive release. This topic is being investigated by Dr Jill St John at the Department of Fisheries, Western Australia. Furthermore, female dhufish which are slightly above the minimum legal length for capture, breed over a relatively short period and produce far fewer eggs than larger individuals relative to their body size. Thus, it is important to ensure that some larger fish survive in order to optimize egg production. When considered in conjunction with apparent declines in abundance, the above data on the biology of dhufish emphasize the need to constantly monitor the fishery to ensure that the stocks of this very sought-after species are conserved.

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1.2 Dhufish Aquaculture by G. Jenkins

*Presentation by Greg Jenkins
Aquaculture Development Unit
Western Australian Maritime Training Centre
Challenger TAFE*

Summary of presentation

One of the tasks carried out by the Aquaculture Development Unit (ADU) of Challenger TAFE is to investigate the potential for culture of a number of marine aquaculture species of interest to the pre-emergent industry in Western Australia (WA). As this industry struggles to emerge in WA, a number of small companies have attempted to culture a range of marine fish species, including the WA dhufish, generally with poor results. Numerous other companies and individuals constantly enquire about 'the best fish to grow' and the WA dhufish has historically always been number one on this list in Western Australia.

As a result of the previous unsuccessful culture attempts for this species by industry, and the numerous and on-going further enquiries, the ADU undertook, in collaboration with the Department of Fisheries, a preliminary, one year investigation with the support of the Fisheries Research and Development Corporation (FRDC) (Project 95-095). Within this preliminary, 12 month project, ADU staff captured and maintained broodstock in the Fremantle hatchery, successfully obtained 31,000 fertilised eggs of the captive fish through hormonal inducement and stripping, and cultured 24 fish to 6 months of age (See Fisheries Research and Development Corporation Final Report 95-095). This initial encouraging result led to the two further FRDC supported programs reported here.

One of the first obstacles encountered in this project was in the capture and handling of the broodstock. It was quickly determined that fish caught from depths of greater than 20 metres did not survive for long in the hatchery. It was thought that this was due to barotrauma and Recfishwest commissioned the ADU in 1996 (through Recreational Fishing Advisory Committee funding) to conduct a preliminary study on this issue. The results of this work (conducted by Mr Damien Ashby for the ADU) were that: *'All WA dhufish sustain damage from decompression sickness upon capture and that the effects were greater in fish caught from deeper water.'* It should be noted that this barotrauma was associated with fish caught in the ocean and then confined to shallow tanks.

Many of the objectives of the dhufish culture projects were achieved and the project was responsible for many 'firsts' in WA, for example:

- first to investigate dhufish within any scientific study;
- first to identify barotrauma as an issue in relation to the return of dhufish to the ocean following capture;
- first to secure, identify eggs, embryos, larvae and juveniles of dhufish; and
- first to culture dhufish successfully.

The project also identified that male dhufish had very low gonadosomatic indices (i.e. low volumes of sperm) in the spawning season leading to the conclusion that it is likely that spawning occurs in pairs rather than in a group. However, it was also noted that 'bull' male dhufish dominated a number of females held in tanks, and suppressed gonad development in smaller males.

However, there were no easy methods for the culture of the fish and every step of the way was difficult. The broodstock, including first generation fish, would not spawn naturally in captivity and continued hormonal inducement and stripping of eggs were required. The larvae were difficult to grow and required feeding with copepods in addition to the standard live feeds for marine fish species of rotifers and *Artemia*. Fish health concerns were always evident, with the species susceptible to exophthalmia (pop-eye), nutritional deficiencies and a range of other ailments. Growth rates were variable, suspected to be due to the health concerns.

In 1997, as a result of the ongoing concerns for the health problems with the WA dhufish, the ADU approached Dr Shane Raidal of the Murdoch University Division of Veterinary and Biomedical Sciences for fish health assistance. Murdoch University was subsequently funded by the FRDC in 1998 to investigate the health problems of the WA dhufish (FRDC Project 98-328). Dr Fran Stephens of Murdoch University undertook this work.

The WA dhufish health project identified numerous parasites and disease causing organisms for the species and also identified treatments (See FRDC Final Report 98-328). However, during the course of the Murdoch University investigations, it was determined that the WA dhufish has but a single type of haemoglobin in their blood, whereas most fish tested have four or five different types of haemoglobin. Multiple haemoglobin types are believed to allow fish species to be flexible in their adaptation to their environment, accommodating various environmental conditions such as temperatures and low oxygen concentrations.

The WA dhufish lives in a region where the environment is relatively constant, and so is not required to be environmentally 'flexible'. Aquaculture species however, do require flexibility, as they are required to be cultured at high densities and under varying conditions. The single haemoglobin of the WA dhufish may be part of the reason why the culture of this species is so difficult.

The ADU consider that the WA dhufish is not currently, or will be in the short to medium future, a viable species for commercial aquaculture due to the wide range of difficulties in their culture. Despite this result, we believe that the results of this project are of great benefit to the emerging WA industry. In addition to the documentation of a range of procedures and trials of great interest to the marine aquaculturist, this project will save the industry considerable time and funds as they seek 'the right fish to grow'.

The results of FRDC Projects 96-302 and 1999-322 are set out in the ADU 'Hatchery Manual' style for easy reading and comprehension. The combined reports are available from the libraries of the WA Maritime Training Centre, Department of Fisheries WA and the Alexander Library. The report can also be purchased on CD from the ADU.

1.3 Stock Assessment of Dhufish (*Glaucosoma herbraicum*) by R. Lenanton and J. St John

*Presentation by Dr Dan Gaughan for Dr Rod Lenanton
Research Division
Department of Fisheries
Western Australia*

The aim of this talk was to present the types of data that are currently available to the Department of Fisheries and that can be used to assist in assessing the status of the dhufish stock. This information was presented to give workshop participants the background to the current level of knowledge for dhufish. This presentation does not purport to provide a detailed review of the status of the dhufish stock but concludes with a summary of current status.

A brief history of assessment of status of dhufish stock(s).

- Concerns from all sectors led, in August 1995, to first assessment (N. Hall).
- Study of biology of dhufish by Murdoch University (FRDC 96/97-98/99).
- Estimate of natural mortality of dhufish by Hesp, Potter and Hall (2001).
- Annual status of dhufish first reported in the Department of Fisheries State of the Fisheries Report 00/01.
- Department of Fisheries Research (FRDC 00/01- 06/07) (see list of research projects below).
- First detailed formal age-based assessment of dhufish is intended to be complete by end of 2006.

FRDC funded projects undertaken by the Department of Fisheries that include a focus on dhufish include:

- *Maximising survival of released undersize west coast reef fish.* 2000-2006. (Principal Investigator: Jill St. John);
- *Spatial scales of exploitation among populations of demersal scalefish: implications for wetline management.* 2003-2006. (Principal Investigator: Jill St. John); and
- *Management and monitoring of fish spawning aggregations within the west coast bio-region of Western Australia.* 2004-2007. (Principal Investigator: Michael Mackie).

These are described in more detail in a companion presentation by Gaughan and St. John.

Catch and effort data

Data required for a better understanding of dhufish catches are available from three fishing sectors; commercial, recreational and charter. The key trends in catch history for each of these will be described below.

Commercial data

The Department of Fisheries collects monthly catch and effort data from all commercial fishers. The fishers report, amongst other things, the type and amount of gear used, the time spent fishing, the species of fish caught and the locations of catches in one degree latitude by one degree longitude blocks.

The numbers of commercial vessels that reported catching dhufish since 1976 has fluctuated between about 160 and 320. The total reported dhufish catch for this same period has been between 130 and 295 tonnes per year. The effort in 2002/03 was within historical bounds, with approximately 280 vessels landing 253 tonnes of dhufish. Data are available for all types of commercial fishing; these indicate that most of the dhufish is caught by handline and dropline.

Catch records indicate that commercial catches of dhufish have been increasing steadily since 1999/00. However, for various reasons (e.g. changes in efficiency or reporting accuracy of the fleet) the reported catch does not necessarily reflect changes in abundance of the stock. However, the catch rate data (kg caught per day of fishing) can provide a broad index of abundance, albeit noting there are still biases to consider. Several sources of catch rate data are examined when assessing the status of the dhufish stocks. Besides the handline and dropline catch rates (i.e. from the “wetline” fleet) the Department can also use catch rates from the demersal gillnet and longline fisheries which do not specifically target dhufish. Thus, catch rates from this source are thought to more accurately reflect real changes in abundance. Nevertheless, comparing the behaviour of trends from different fisheries will help elucidate some of the potential biases that can exist when attempting to use catch rate as an index of abundance. For example, there has been considerable interannual variability in handline and dropline catches, whereas catches by gillnet have been steady, and considerably lower, than for these other two methods.

Spatial and temporal variability in catches and catch rates of dhufish are evident. These reflect changes in fishing practises and possibly also regional differences in the biology of dhufish. These differences need to be further investigated so that any potential implication for managing the fishery can be clearly understood.

In summary, the Department has a long-standing system in place to collect commercial catch and effort data. These data currently provide the basis for assessing the status of the stock. In addition, the biological data that provide the fundamental understanding of the species are being collected as part of the FRDC project *Spatial scales of exploitation among populations of demersal scalefish: implications for wetline management*. These data will greatly enhance the stock assessment methods, allowing more sophisticated analyses which can include, for example, provisions for variable recruitment.

Recreational data

There have been two recreational fishing surveys that have included the region of the coast occupied by (a) dhufish and (b) boat fishers. The first was a Department of Fisheries creel survey undertaken in 1997. This study estimated that the annual recreational catch at that time was approximately 170 tonnes. In 2001 a national phone survey estimated that the recreational dhufish catch in WA was over 500 tonnes, but concern that there was considerable recall bias (over-estimation of catches) strongly suggests that the catch was not >500 tonnes. Nonetheless, in consideration of the increase in participation in fishing and increase in efficiency for all fishers through GPS and acoustic technology indicates that the 2003 recreational catch of dhufish was probably close to 250 tonnes. Although the estimate is not precise, it clearly shows that the recreational sector can catch similar quantities of dhufish as the commercial sector. A more precise estimate of current recreational catch is urgently required so another creel survey will be undertaken in the near future (2005/06). Data collected in the previously surveys, such as the spatial and seasonal distribution of recreational boat fishing, will be used to ensure the impending survey is appropriately designed.

Besides estimating catch and effort, creel surveys also allow some biological data (sex, lengths) to be collected. Such data can make a substantial contribution to the data sets collected as part of the biological studies.

Charter data

All charter boats are now licensed and must fill out detailed catch returns. These returns allow catch and effort for this sector to be estimated. Annual reported catch in 2002/03 for Charter sector was about 24 tonnes, only one tenth of the annual catches for each of the commercial (253 tonnes) and recreational (~250 tonnes) sectors.

Summary of status

Research by Murdoch University has estimated:

- natural mortality (1996-98) of exploited stock is approximately 10 per cent per year, and.
- fishing mortality (1996-98) of exploited stock is at least 11 per cent per year.

A general principle of fisheries management is that fishing mortality should be less than natural mortality. The above estimates therefore indicate that the dhufish stock is fully exploited. While natural mortality is relatively constant for a stock of fish, and the 1996-98 estimate for dhufish likely remains the same now, the increased catch since that time indicates that fishing mortality has increased. Also, the 1996-98 estimate of fishing mortality did not include post-release mortality, which research has now shown to be significant at depths >40m. Given that 25-35 per cent of dhufish caught are returned to the water, it is likely that fishing mortality is somewhat higher than natural mortality. Dhufish are thus possibly overexploited.

However, while commercial catch rates remain relatively steady, they are declining slightly. However, catches are within historical bounds. Thus, catch level for dhufish

should be set below the 2002/03 level and managed adaptively until both the stock assessment project is complete and formal management arrangements have been put in place.

1.4 Dhufish (*Glaucosoma herbraicum*) Research by the Department of Fisheries by D. Gaughan and J. St John

Presentation by Dr Dan Gaughan
Research Division
Department of Fisheries
Western Australia

Several projects are currently investigating aspects of the biology and exploitation of dhufish. Following concerns raised by the fishing sectors in 1995, the first assessment of the status of dhufish stock was undertaken by the Department of Fisheries. This was subsequently followed by a dedicated project, funded by the Fisheries Research and Development Corporation, on the biology of dhufish along the west coast of Western Australia (FRDC Final Report 2000, and Hesp's presentation). The key aspects of this work were published in an international fisheries journal (Hesp et al., 2002); this paper showed that the Perth metropolitan dhufish were overexploited. Because dhufish are an iconic fishing species, and endemic to south Western Australia, there was a clear need for further research on this species. This presentation provides an overview of the current research being undertaken on dhufish.

FRDC funded projects undertaken by Department of Fisheries that include a focus on dhufish:

There is currently three projects lead by the Department of Fisheries that have a focus on dhufish and snapper (*Pagrus auratus*). The importance of dhufish (and demersal reef fishing) to the fishing community and the broader WA community is highlighted by the fact that each of these projects has received substantial external funding. The projects and their timelines are as follows

- *Maximising survival of released undersize west coast reef fish*. 2000-2006. (Principal Investigator: Jill St. John).
- *Spatial scales of exploitation among populations of demersal scalefish: implications for wetline management*. 2003-2006. (Principal Investigator: Jill St. John).
- *Management and monitoring of fish spawning aggregations within the west coast bio-region of Western Australia*. 2004-2007. (Principal Investigator: Michael Mackie).

An overview for each of these projects, including an examination of some preliminary result (where available) are provided below.

Project 1: Maximising survival of released undersize west coast reef fish.

A primary objective of this project was to estimate the survival rate of dhufish that are returned to the water. This is an important management consideration because of the large numbers of dhufish that are released following capture. Two different experimental approaches were used to assess both short term (days) and long-term mortality (weeks – years).

Both methods were designed to test the influence of:

- depth
- hook type (J-hooks and circle hooks)
- on-board handling techniques (venting or no venting)
- position of hooking (mouth or deeper, foul hooking)

Short term mortality was assessed by capturing dhufish from a range of depths (up to 75m) using a rod and line with a two-hook rig. Captured dhufish were placed in a cage and lowered back down to the depth of capture. These fish were left for 1-5 days before the cages were retrieved. The size and numbers of live and dead dhufish recorded. Preliminary examination of dhufish in the cages by SCUBA divers indicated that the fish had sufficient room to move around. The cage size was therefore appropriate for this study.

Longer-term mortality will be assessed by tagging dhufish and then releasing them. In addition to the factors included for the cage experiment, some tagged fish were returned to their depth of capture using a lead weight (shotlining) while others were simply placed back in the water (i.e. at the surface).

The several factors that may influence survival rate of released dhufish were tested statistically (Table 1). The test showed that mortality of released dhufish increased with time. For those dhufish that died, most succumbed on the first day, but there was a clear trend for mortality to continue up to five days after initial release. Fifty one percent of all dhufish captured died; of these, depth-of-capture was the greatest contributing factor, accounting for 75 per cent of all mortalities. The remaining 25 per cent of mortalities was attributed to the hook location; specifically, all dhufish hooked in the gills or deeper down the throat died. Importantly, foul hooking of the gills from the second hook on the rig was responsible for many of the hook related deaths.

A significant finding of this study was that mortality of dhufish increased with depth of capture from 21 per cent at 0-14m to 86 per cent at 45-59m (note that insufficient fish were caught at >60m to provide a reliable estimate).

Table 1.1 Factors that were tested to determine which contributed to mortality of released dhufish.

FACTOR	SIGNIFICANT
Size of fish	no
Depth of capture	yes
Days in cage	yes
Vented/not vented	no
Hook location	yes
Hook type	no

The long-term tagging study still has another year to run (two years at the time of the workshop). In contrast to the cage method, survival rate of dhufish will be estimated from the numbers of tagged dhufish re-caught. Preliminary results of the tagging experiment are similar to those of the short-term cage experiment, indicating that fewer dhufish survive when captured in deeper water. Nonetheless, there have been a few notable exceptions, with some dhufish able to survive capture from depths up to 90 m. The shotlining method of release (which can only be tested within the tagging experiment) appears to improve survival of dhufish.

In summary, the project on post-release survival of dhufish has shown that:

- 20 per cent mortality occurs for fish captured from >20 m;
- 80 per cent mortality occurs for fish captured from >45 m;
- deep hooking is fatal; and
- shotline decreases mortality of released dhufish.

A full analysis of release methods and factors affecting survival of dhufish will be conducted when the study is completed.

Project 2: Spatial scales of exploitation among populations of demersal scalefish: implications for wetline management.

This project does not yet have any data sets that would be worthwhile to present. Rather, the project will be introduced here by highlighting what the project aims to achieve.

The key questions or goals for this project are:

- Level of intermixing along the coast - what geographical scales are appropriate for management?
- Regional differences in the biology – do growth and reproductive biology (e.g. timing of /size at maturity) vary? A populations model will be developed for dhufish using the biological and fisheries data collected in the project. This model will be used as the basis for management strategy evaluation (MSE). MSE will essentially assess how the stock will respond to alternative management possibilities.
- Evaluate the spatial variation in the exploitation status within the west coast bio-region.
- Communicate with fishing sectors to develop a suite of alternative management scenarios to assist with selecting and adopting an optimal management strategy.

Project 3: Management and monitoring of fish spawning aggregations within the west coast bio-region of Western Australia.

This is just starting – there is a need to determine if schooling behaviour at time of spawning exposes dhufish to unacceptable levels of exploitation during the spawning season, as has been documented for several species elsewhere in Australia and overseas. The project will develop techniques to determine if dhufish typically aggregate to spawn and how many fish make up a typical spawning aggregation.

Conclusion

As these studies progress, and our knowledge of dhufish increases, we will be better able to assess how well the management strategies are working. There will be more information about:

- levels of mixing
- finer scale movements
- exploitation patterns
- recruitment variations
- mortality rates
- resilience to fishing pressure

References

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1.5 Discussion Panel #1

Panel Members: Dr Dan Gaughan, Dr Alex Hesp and Greg Jenkins

Question 1: Are there differences in timing of spawning in different locations, for example between Geraldton and Busselton?

Response 1: (Dr Alex Hesp) No specific spawning areas were identified. Every fish caught of breeding size was mature when caught on reefs. There appears to be some slight differences in timing of spawning over the years. More southern fish had higher gonadosomatic indices (GSIs) which could be a result of environmental influences such as water temperature. We require a larger sample size to investigate this further.

Question 2: What effect does the Leeuwin Current have on dhufish spawning?

Response 2: (Dr Alex Hesp) We have limited data to indicate a relationship between dhufish spawning and the Leeuwin Current. (Dr Daniel Gaughan) But, yes, it is possible that the Leeuwin Current could well influence dhufish spawning success.

Question 3: Are dhufish partial spawners?

Response 3: (Dr Alex Hesp) Dhufish are multiple (serial) spawners, that is, they spawn many times over the breeding period. However, we do not know the frequency of spawning.

Question 4: At what size are dhufish recruiting out onto reefs?

Response 4: (Dr Alex Hesp) Dhufish start recruiting onto reefs at 270mm to 280mm, and generally by 300mm.

Question 5: Are dhufish day or night spawners?

Response 5: (Dr Alex Hesp) Dhufish most probably spawn at dusk.

Question 6: Do larger dhufish survive being released?

Response 6: (Dr Daniel Gaughan) Current collaborative ANSA (WA), Department of Fisheries and Recfishwest research results should give us this information.

Question 7: Is there heavy pressure on dhufish stocks in the Jurien/Lancelin area?

Response 7: (Dr Daniel Gaughan) Catches are still at historical levels.

Question 8: Is there scope for sanctuary zones in lightly fished areas?

Response 8: (Dr Daniel Gaughan) I do not know, I cannot say.

Question 9: Is there a significant difference between depths of capture and is there a seasonal variation?

Response 9: (Dr Daniel Gaughan) Yes, there appears to be seasonal variation, the depth variation of catches occurs seasonally, but we don't know if there is localised depletion inshore.

Question 10: Mortality rates in cages seemed high, were there different sized cages?

Answer 10: (Dr Daniel Gaughan) No, all cages were a standard size. We also undertook diver observation of the cages and the cages held quite well.

Question 11: You mentioned that dhufish produce only small amounts of sperm. Are dhufish territorial and are males dominant?

Response 11: (Greg Jenkins) Yes, they are possibly territorial and males are definitely dominant. In aquaculture we usually put three to four females with one male.

Question 12: Are there issues regarding restocking dhufish?

Response 12: (Greg Jenkins) Restocking is problematic for many species. There is a struggle to get 10 per cent survival for dhufish compared with up to 80 per cent survival for black bream. Dhufish aquaculture would require large amounts of money to pursue restocking and there would be no guarantee of success.

SECTION 2 THE ISSUES

2.1 Commercial Fisher Perspective by W. Aitchison

Presentation by Warren Aitchison
Commercial Wetline Operator
Western Australia

I started fishing in Bass Strait and then moved to Port Phillip Bay, where there were a huge number of recreational fishers and very few commercial fishers, yet it was the commercial fishers who were demonized for all the problems, such as lack of fish. I was advised to leave by a friend in the Fisheries Department before I was starved out by legislation.

I then moved to Western Australia and started wetline fishing from Geraldton for a short while before moving to Dongara where I have been fishing for about 14 years. I made a decision about three years ago to leave spawning dhufish alone and started fishing in water 350 metres deep and deeper from Perth. It was a vain hope as three other boats moved in and took up the slack.

The efficiency of fishers has increased so much and not just the commercial sector. For example, when I went to Dongara we would just steam out and start gridding, three miles out, one mile down, three miles out, one mile down and so on, until we found a lump to fish. In a three to four day trip we would find between three to five lumps and of these, we would catch 200 to 500kg of dhufish. Now with Global Positioning Systems (GPS) and computers I can now do 20 lumps in a day with far less fish being caught.

Catch and effort returns are very deceptive for researchers, I am a classic example. The efficiency of GPS and computers means I go from spot to spot and spend very little time looking with very little time wasted. I used to employ one crewmember, but I purchased two DNG (Icelandic) fishing machines, which can do everything I can do, only better. They don't get tired or grumpy, they just keep working (most wetliners have similar hydraulic reels now).

My fishing trips are now usually three days long where once they were five days long. On a side note, when we used to hand crank, the first day we were keen and usually did well, day two not so keen and usually did well and day three not keen at all and a bit slow, day four, grumpy, tired and very slow and by day five, not worth the effort! Now the machines do most of the work so I don't get as tired yet when the researchers look at my catch returns they say the catch is staying the same, but they don't see the huge increase in efficiency and effort.

All fishers have access to such electronics. I'm not saying that recreational fishers will be buying fishing machines but GPS and top of the line echo sounders are now being installed on most recreational fishing boats. The electronic guys are now targeting their sales at the recreational sector, not the commercial sector.

The illusion that there are places where the recreational fishers can't get to is false. My 38 foot boat does eight knots (downhill) and distance is a problem where as some recreational fishers' boats can do 30 knots. I am now seeing them 50 miles out to sea, very mobile indeed.

The price I get for my fish has not increased in the last 10 years but our running costs have gone up a huge amount and the poor fish picks up the slack. The price of crayfish has been very low and some crayfishers are now doing five-day trips. Day one, they pull their pots then go wetlining, day two, they go wetlining, day three, they pull their pots then go wetlining, day four, just wetlining and day five, pull their pots and go home.

On some boats the money from the fish is used to pay the crew's wages. Whether this is right or wrong is not the point, they are only doing what they are allowed and the Department of Fisheries send out very mixed signals. They say conserve the stocks but when it comes to access it is the bigger catchers that are rewarded by gaining greater access. This only encourages people to invest more, catch heaps of fish and get the rewards.

With modern electronics a simple card is put into a plotter, up comes in some cases 20 years of knowledge in an instant. Modern technology 'deskills' us, once some good ground is known it is not long until it is known and targeted by a lot of fishers. Both commercial and recreational fishers are too efficient and it is the fish that suffer as a consequence.

The way that the Department of Fisheries researchers determine catch history and stock exploitation is via commercial fishing returns. However, some people 'pad' their return by recording more fish than they really catch to make their history look better than it is. The problem with this is it can give a false view of the stock. It worries me and other commercial fishers that the Department of Fisheries admit they do not check the accuracy of our catch returns in any way yet very important decisions i.e. stock status and catch history, are made on inaccurate catch figures.

As a commercial fisherman it distresses me greatly when I am fishing and small (undersized) dhufish come up. I make every effort to return them but have had little success. The best method I have found is to move to another spot. If you don't know what is down there you can't regret not catching it but I do believe the 'release weight' seems to be a great idea and I will be trying it out.

These are just my views, thank you for your time.

2.2 Recreational Fisher Perspective by P. Shinnick

Presentation by Pat Shinnick

Member of the Lancelin Angling and Aquatic Club

Chairperson - Australian Anglers Association (W.A. Branch) Boating Sub Committee
Western Australia

As a recreational angler I thank you for the opportunity to address my thoughts on this great species. I have been fortunate to have fished with what most club members perceive as some of the better club anglers in Western Australia, and have developed to the stage I am today.

I have been boat fishing for approximately thirty years now, fishing mainly for our prized species, from shallow waters through to 400m plus, I have been fortunate to have caught a great range of fish.

I also assist the fishing fraternity, through fishing, clinics advising on the use of our latest technological gadgetry. Due to this, I can say that I do have a reasonable amount of knowledge in the capture of this iconic fish we are discussing here today.

I guess most of us fish for the relaxation and the hunter-gatherer feelings that the human race has instincts for, camaraderie with a few mates, or that competitiveness we have in club competitions. So if I can, I would like to address a few issues that I consider are worthwhile, as do the majority of recreational fishers and commercial fishers that I have contacted regarding this workshop.

The comments I am making in this workshop are not being made to get any persons offside nor agitated. They are all comments that I have made, to different people with some queries and concerns back to me. My feelings are that we all want to make everything work for us all, not just a few.

Releasing fish

In the past we have tried numerous ways of releasing the fish so they can return back to the depths to which they dwell in, with very limited success, due to poorly advised release practices, such as piercing the cavity behind the stomach, popping the stomach with a knife etc. We all thought these were the right things to do, but most of the time it just led to a slow death for the released fish.

However, the fish release method developed by Australian National Sportfishing Association (ANSA) and promoted by Recfishwest and the Australian Anglers Association (AAA), appears to be the least traumatic method. I can vouch that it does appear to work, but release devices and tags need to be given to each boat fisher that wishes to help the release not only of this most prized specie, but all the fish caught that are either too small or too many caught in the one fishing drift.

Fishing methods

The recreational angler can not overfish using the methods of catching by hand. Why? We only use two lines at most, two flights of hooks per line, (all clubs) per angler. Also

those that do fish reasonably well know that if we hook and drop a fish then the majority of the time that fish and the school with them do not continue to bite. This I can say is true the majority of the time.

Areas fished are not always productive with the gear we use, drop lines do work in these areas as proved by professionals. Technology has improved over the last 20 years, and those that are able to read their sounders, or their GPSs have a much higher catch rate than the average fisherperson. But to say that we fish, as the fisheries reports state, the amount of time and days is absurd. Costs are also becoming so great for little return that these days most people tend to fish on charters or on boats that can take multiple rather than single crews, to help with fuel and bait etc.

Size limits

I do consider that the size limits on some species of fish are too small, and this is only my personal belief not scientific data, dhufish is one of them. Of course you will get those that don't release fish well, who will say that this is a waste of time, but persevere with the methods and you will reap the rewards.

Fin fishing by minority of commercial rock lobster fishers

I am not targeting all commercial crayfishers just those few who go overboard, so to speak. The habit of overfishing must cease and the only real way is to stop commercial crayfishers from finfishing with the methods they do. Don't let it be said that this does not happen. I have seen the catches, it is something that needs to be addressed soon or else the industry will suffer dramatically. I consider that the commercial crayfishers who do fish for finfish are happy with the decision to lower the limits of us the recreational fisher, this way when the fish are schooling in certain areas, they will be more abundant. The animosity that goes with this will create difficult situations that could have been easily controlled, with commonsense.

Wetliners

Wetliners will not decimate the fish as this industry is difficult and the gear used at times is expensive to maintain, however as I will mention later they will need to be managed, which is being looked at as we all know through the Wetline Review.

The wetline industry needs to be as viable as possible so that the local community can purchase fish at a reasonable cost. Most that do have a wetlining licence have to diversify to make ends meet as well.

Charter fishing

Charter boats need to enforce their self-imposed and regulated code of practice. They need to ensure that overfishing does not occur as it does now. Numbers may need to be looked at to ensure that this can be regulated.

Fishing Rules

I consider that the Wetline Review should have been implemented at the same time as the recent changes brought about by the west coast and Gascoyne recreational fishing reviews, as indicated by the *Toohey Report*. The antagonism and discontent caused by the rules implemented by the Department of Fisheries with the non-equitable situation between recreational fishers and the commercial sector has hit an all-time high. We must move on and try to fix up the mistakes of the past.

Changes required

I have contacted many commercial crayfishers and finfishers up and down our coast. I have had mainly positive comments on my proposals, controversial to some they may be. The majority of commercial and recreational fishers suggest and accept that:

- We should be limited to two dhufish, as we are now, but only for the same period as the opening of the rock lobster season to the change in gauge size from November 15 to January 30 season. This is when the majority of fishing is done by recreational fishers, and this is also when the fish are full of roe and raises some concern about the taking of spawning fish. We should then revert back to a daily bag limit of four dhufish for the rest of the year.
- Commercial crayfishers who do not have a logged finfish catch lose the license to catch finfish, using a buyback system which would be at a minimum cost since they have no history of earning from finfish.
- Commercial crayfishers, who do have a logged finfish catch, forego the license to catch finfish, using a buyback system. This would be at the current accepted value of the finfish license based on recorded earnings. Commercial crayfishers can however catch fish, as a recreational fisher in future. At present, crayfishers can catch crayfish and finfish for sale but cannot catch other types of fish stocks such as abalone, marron etc for their own personal use, so:
 - allow them to catch finfish for their own use, as a recreational angler and comply with the recreational fishing regulations;
 - allow them to catch abalone for their own use, as per recreational anglers (paid license) and comply with the regulations;
 - allow them to catch marron, as a recreational angler (paid license) and comply with the regulations; and
 - allow them all the benefits that recreational anglers may have with the fees as applicable and comply with the regulations.

Commercial finfish fishers can also have similar benefits.

- Allow the commercial finfisher to fish for crayfish as a recreational angler (paid license and comply with the regulations), at the moment they are unable to have this benefit.

- Allow the commercial finfisher to fish for other species for their own use, the same as recreational anglers and comply with the regulations similar to the rules proposed for the professional crayfisher.

However, having put these suggestions forward, what then needs to be implemented would be:

- Commercial fishers must have quotas.
- Commercial fishers must have areas that cannot be fished, due to over fishing of localised areas (as has been the case with “other” areas e.g. Shark Bay and Cockburn Sound).
- Stop fishing areas known to be the breeding areas of susceptible species.
- Establish areas that are used extensively by recreational fishers, for example, areas of a nominated distance from the coast near boat ramps, or a radius from known frequented areas.

With these small but worthwhile changes to the recreational and commercial industry, I consider that the dhufish and other targeted species will be easily sustained and grow in numbers by their breeding.

I know the majority of recreational fishers understand that changes need to be made to allow the effective management of our fisheries, but all changes need to be over the whole industry not just one at a time.

Unfortunately what happens with some unworkable rules is that there are the few people that do the wrong thing and taint the rest with that bad image. We all need to be aware of this and offer assistance and advice to that minority. Consultation does work, confrontation does not and emotion can also cloud our judgment.

I once again appreciate the opportunity to offer some of my thoughts on fixing our fishing industry both recreational and commercial, and if I am able to assist further by being on your committee or by way of advise please contact me through the AAA and we will be only too pleased to assist.

Once again I thank you all for the opportunity to address most of our feelings to you the people, who can make a difference.

2.3 Charter Operator Perspective by A. Bevan

Presentation by Allan Bevan,
Charter Boat Owner/Operator
Fremantle, Western Australia

Introduction

Fishing for me started at a young age when my grandfather would take me to a jetty to fish for herring. These days the humble herring is more likely to be caught by me for live bait or strip bait, for some of the prime eating fish that we can fish for off the West Australian coast, especially dhufish. I have evolved from a jetty rat, through small boats, trailer boats, and the Royal Australian Navy to the present time where I own and operate Shikari Charters, a charter vessel based out of Fremantle.

In my first years of operation I had my vessel working from Rockingham and had good fish captures, with the West Australian dhufish making up a good percentage of my catch rate. When starting out in business, during the mid-1990s, it was not out of the question to capture a lot of dhufish, often upwards of eight to ten dhufish per trip. This was due, in my opinion, to the fact that I had the boat working out of Rockingham and then fished the grounds to the south. This worked well, as I was getting away from the fishing pressure of the metropolitan area.

In 1998 I shifted the business to Fremantle. While the crew and boat achieved good catches, I found that the grounds that I had been fishing at that time steadily succumbed to fishing pressure. On average I have been moving out at a rate of approximately one nautical mile each year to maintain the boat's catch rate. The area that I bring to your attention is the metropolitan, from Rockingham through to Hillarys.

So, for my part in today's workshop I hope to bring to your attention the importance of dhufish to the recreational fishers, who are my customers, and its impact on charter operators.

Impact of technology

In the *Fisheries Management Paper 139*, Ken Pech wrote:

"With a growing population and advances in technology, fishing pressure will continue to increase and anglers will become more efficient at targeting fish, particularly offshore demersal species such as dhufish and baldchin groper. Already, the signs of a fishery under pressure are showing. Catch rates of dhufish around inshore reef systems such as three-mile are a far cry from the 1950s and 60s when people launched wooden dinghies to fish inshore for these highly prized fish."

As we have moved from wooden dinghies, today's improvements in technology, new braided fishing lines and improved fishing methods and equipment is forcing operators working out of the metropolitan area to travel further. To travel farther and fish deeper water, with pink snapper now targeted as the prize fish to be caught from a metropolitan charter boat.

Most of the so-called ‘secret spots’ are well known, with the use of Global Positioning Systems (GPS) and commercial quality sounders. No longer does a fisherman need to hit and miss fishing locations using landmarks but can now go back again and again to the same spot/area.

I have been informed that a recent customer had a wristwatch GPS and he would no longer need a charter operator to take him to the spots as he already had them!

The trend over the last five years has seen charter boats working deeper water. Some of the larger vessels are now fishing water deeper than 120m on a regular basis, with the emphasis more on pink snapper than dhufish. Most charter operators feel that the inshore water inside 60m is no longer worth fishing, as the lack of fish will be to the detriment of their business. No fish on deck equals nil return of customers.

This situation is not confined to just charter boats. Many well-equipped trailer boats are heading further a field searching for greener pastures. One of the first comments made to me from an average customer on what they hope to catch during the day is “*a big dhufish*”.

Going through my catch returns for the past years, the majority of species caught were pink snapper, breaksea cod, Samson fish and queen snapper. This is not to say that we don’t catch dhufish, it’s just that these days we treat a big dhufish as more of a holy grail than a regular catch.

While most customers are happy with the fact that they have caught a fish, the elusive dhufish still remains the target fish that they have in mind. This adds pressure to the charter operator to continually revisit productive grounds to ensure his customers value for money i.e. fillet return for dollar. This may soon be the same situation in other areas like Mandurah and Jurien Bay, as the main target species, dhufish, is still sort in numbers as was done in the good old days. These areas I believe will soon, if not already, start to feel the pressure as stocks become depleted.

The decline of the fishery has seen charter operators diversify into other areas such as ecotourism i.e. diving, whale watching and sport fishing, with the emphasis on releasing the fish.

The responsibility of the charter industry

Charter boats, the licensed fishing tour operators, I feel are at the front line when it comes to educating the public. For too long we have just pushed out into deeper water with little to no thought of fishing for the future. In this area I feel that we can make a huge difference by providing assistance to the researchers with the passing on of, not just log book returns, but the opportunity to pass on observations, sample collections and assistance in the field.

My business has set goals in this area with research assistance that includes:

- tagging and data collection for Westag;
- sample collection for the Department of Fisheries; and
- assistance to Murdoch University, with sample collection.

This may come as a surprise to you but I have found that a good percentage of my customers are quite interested in this area. Many customers are also happy to help out with sample collections.

Onboard Shikari Charters we make a point of educating customers about barotrauma, a pressure equalisation problem. With a size fish this is not such a problem, as the fish will end up in the ice box and then onto the table as an eating fish.

The problem is with the undersized fish that need to be returned to the water for release. So the methods that I use are:

- getting the customers to bring in the fish slowly. This I believe is one of the most important things a fisherman can do to increase the chance of returning undersize fish to the water in good condition. This is especially true with dhufish.
- the use of the release weight. With this release weight I feel that the fish will, if handled correctly on the surface, stand a good chance of survival on being released.
- other things like not putting fingers in eyes or gills, and having wet hands to avoid removing the fishes protective slime coating during handling are important things to remember for successful release.
- keeping the time on deck to a minimum.

This is just a brief description of how we handle fish that we release. This is one area that needs to be addressed for the education of fishermen and the survivability of undersize and or unwanted fish.

Release Weight

Too many fish are being returned just to float away with little to no chance of survival! Place the release weight hook through the top or bottom jaw membrane of the fish. Place reel in free spool or open bail arm, place fish on the surface of the water and release fish. For best results, make sure leader knots and swivels are clear of the top guide of fishing rod. When the release weight is close to the bottom, stop the descent and wind up the release weight. The barbless hook will pull out of the fish with ease, leaving it at optimum depth for the best chances of survival.

On a side note, the release weight has sparked interest in various parts of the world, Japan, USA, and Singapore to name a few. Enquiries have also been made from other Australian States and the release weight has received positive write ups in fishing magazines and electronic media.

While the results with different release methods are still being investigated, I feel that the release weight is more than a feel good measure and does make a difference to fish, especially dhufish, that need to be released.

Conclusion

- Demand for dhufish remains high.
- The boats have to work further afield; this must show that inshore stocks are depleted.
- Charter operators can and should play a key role in the education of fishers, assistance in research and ensuring the substantiality of our catches.
- Do we need a new metropolitan zoning and limits due to the fishing pressure. Slot limits? Closures? All questions for our managers.

We, the charter industry, are there for the long term and I hope to still catch dhufish in the years to come.

2.4 Discussion Panel #2

Panel Members; Warren Aitchison, Allan Bevan, Guy Leyland, Frank Prokop, Peter Rogers, Andrew Cribb and Pat Shinnick.

Question 1: Do you have any suggestions for strategies for obtaining better data from the recreational sector?

Response 1: (Pat Shinnick) Data can be collected on a fishing competition day, for example, entrants can be asked to provide carcasses for biological samples. There is some fear amongst some recreational fishers that information that is collected will be used against them at a later date. Therefore there is a need to educate recreational fishers.
(Norman Hall) We at Murdoch University are very grateful to recreational fishers for the biological information provided in the past.

Question 2: Pat what release technique do you think is best?

Response 2: (Pat Shinnick) I believe the shotline (release weight) is the best method.
(Warren Aitchison) If I am catching undersized fish in a particular spot I believe that the best technique is to move.
(Pat Shinnick) Fishing clubs also suggest to their members to move after catching one or two undersized fish in the same spot.

Question 3: Western rock lobster fishers are allowed to catch dhufish. I can't believe they get away with it. Do you have any comment?

Response 3: (Warren Aitchison) Rock lobster fishers drop craypots then go fishing for finfish to pay deckies wages, they're allowed to do that, it's legal.

Question 4: We rarely see fisheries officers on the water. Don't you think that researchers could benefit from more fisheries officers at boat ramps to collect data?

Response 4: (Allan Bevan) As a charter operator, I have only seen Fisheries Officers twice in seven years.

Question 5: During the 1980s there was a rumour that the wetline entitlement for Licensed Fishing Boats would be removed to reduce the wetline catch. Do commercial fishers need to have a history in wetfish catch to meet criteria for future allocation?

Response 5: (Peter Rogers) The Bowen Paper was rejected and replaced with a paper for management on a range of fisheries. In 1986 another focus was pushed to manage Fisheries. The Wetline Review Report will go to the Minister for Fisheries by August this year dealing with allocation and future access rights for wetliners and Western Rock Lobster fleet. There is still a question of benchmark date (1997). The Minister is committed to proceeding but must look at the overall catch.

Question 6: Four dhufish per recreational fisher is too many. How can you justify this limit?

Response 6: (Pat Shinnick) This is not my personal view.
(Frank Prokop) There is a huge spectrum of views, beliefs and expectations from the recreational fishery, so it is not the only view. There are different perspectives.

Question 7: Is there discussion about introducing maximum size limits as per barramundi?

Response 7: (Andrew Cribb) We must take into consideration release mortality, for example post-release mortality for barramundi is not really as much an issue as it is with dhufish.

Question 8: What does the Western Rock Lobster Fishing Industry think of the proposal to take away their entitlement to wetline?

Response 8: (Guy Leyland) Broad spectrum, some don't care, others guard their right to wetline.

Question 9: Is there an increase in commercial pressure on dhufish?

Response 9: (Frank Prokop) That will be covered during the next session.

Question 10: During the issues session we were advised that pressure is increasing on dhufish stocks due to increases in technology etc., but that didn't appear to be reflected in data presented during the first session. So what is the state of dhufish in Western Australia?

Response 10: (Peter Rogers) Fishing efficiency by both sectors has increased enormously. Both recreational and commercial participation has expanded resulting in increased exploitation and increased depletion. As pressure increases there is a shift offshore and further from populated areas. It appears growth overfishing is occurring in inshore areas and this would indicate that the biomass is shrinking. So have we got to a point of recruitment failure? Most probably not. My experience is that by the time we get data it may be too far progressed and this is a concern. It would have been better to address all this earlier and we need to address it now as one, commercial and recreational.

Question 11: Is the speed of retrieval at capture an issue with post-release survival of juvenile dhufish?

Response 11: (Frank Prokop) Yes, we believe so, however whether retrieving slowly or fast the impact of retrieval speed needs to be studied further.

Question 12: With reference to commercial fishing and the use of the dropline method, how fast are your lines coming up?

Response 12: (Warren Aitchison) Commercial fishers generally retrieve their drop lines slowly to avoid losing fish.

SECTION 3 CURRENT AND FUTURE MANAGEMENT

3.1 Managing the Recreational Catch by A. Cribb

Presentation by Andrew Cribb
Program Manager – Recreational Fisheries
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What is fisheries management?

Management of the recreational catch in Western Australia needs to be considered in the context of how fisheries management has developed, and the current philosophy at both Federal and State levels that directs policy on ecological sustainability.

The management of human harvesting of wild fish species based upon scientific assessment of the abundance of fish populations, their reproductive capacity and identified sustainable harvest levels are a relatively recent phenomenon that emerged after World War II and is still mainly confined to the Western industrialised nations.

It is also a truism to say that it has, until very recently, only been applied in a rigorous sense to major commercial fisheries. In most countries and in other Australian States this is still the case.

The justification for this approach is largely pragmatic. Unconstrained commercial fishing, and the fishing power and technology that can be mobilised in short periods of time is demonstrably capable of collapsing, or at least significantly reducing, entire populations of a given marine species, and in some cases a spectrum of associated species vulnerable to the fishing methods employed.

In the case of fishing methods that affect habitat, there is also a wider concern that change to the ecosystem induced by methods such as trawling or dredging may also affect the whole food chain and the fundamental health and productivity of marine ecosystems.

In Western Australia, with its low-nutrient, highly diverse marine systems, major commercial fisheries have mainly developed around species of greatest abundance that thrive largely on a benthic food chain effectively driven by rotting seaweed and seagrasses (macroalgae), other algae and low level flows of nutrients from estuary systems e.g. spiny rock lobsters, prawns, abalone, and crabs.

Recreational fishing by contrast has developed most rapidly and intensively around population centres, driven in part by the philosophical and cultural tenets of angling as a sport (as espoused by the leading writers in the genre from Isaac Walton to Ross Cusack), and generally focused on a suite of between 50 and 100 finfish species, which are generally high-order predators, both demersal and pelagic.

However, there is also a strong cultural element of communal food gathering and sharing in Western Australia, with many recreational fishers specifically seeking fish for the consumption, rather than for non-consumptive sport.

The need to manage recreational fishing (and in particular angling) has historically not been regarded by most governments as a critical issue, except where localised high levels of harvest on vulnerable and often sedentary species are clearly significant threats, or cause social ruckus e.g. abalone, or where recreational fishing activity has the potential to seriously deplete a species at a critical life-history stage and affect recruitment e.g. spiny rock lobster.

It is also important to note that fisheries management philosophy in Western Australia in particular has also shifted significantly from the initial focus developed between about 1967 and 1985 on managing a sustainable commercial catch of generally single species/single stock fisheries, and the habitat effects of fishing operations, to a broader concept of ecological sustainability known as “ecosystem-based management”.

These principles and the principle of biodiversity conservation are now embraced in government fisheries policy under the label of Integrated Fisheries Management (IFM) as is the concept of managing the total harvest by all sectors, either from a given ecosystem or at a specific fish population level.

There is a wealth of literature available on the internet or through libraries, which I will not attempt to formally cite in this paper that explores and reviews these concepts. For further information the management documents on the Western Australian Department of Fisheries website, and the National Fisheries Ecological Sustainable Development (ESD) website are good places to start.

Fisheries management as a philosophy is a subset of “ecologically sustainable development” and seeks to achieve a number of potentially conflicting outcomes, and to maintain a balance between human benefits and ecological benefits. These outcomes need to be measured or assessed in some meaningful way. They include:

- ecological sustainability i.e. ensuring fishing activities or catch does not disrupt in any irreparable way either habitat, ecological processes or biological processes;
- biological sustainability i.e. ensuring individual species and stocks remain productive;
- social outcomes i.e. what society wants from its fisheries including the aspirations of sectoral groups such indigenous, recreational and commercial fishers, tourism etc. Goals for recreational fisheries may also include better fishing quality, fair catch sharing etc.; and
- economic outcomes i.e. a better return to Western Australia or regional economies in tourism dollars, employment or industry value.

In a simplistic sense the management process is a cycle based around research and adaptation. Scientific investigation establishes knowledge of the fish population and harvesting practices (fishery), management creates a regulatory framework to control

the harvest, compliance and education activities implement the framework, scientific investigation reviews the condition of the fishery, the regulatory management framework is adapted to adjust harvest levels to suit the stock condition and compliance and education strategies are revised.

However, in practice, a considerable amount of management is developed on a precautionary basis prior to the availability of any substantial fishery data. This is particularly true of many of the rules that apply to recreational fishing such as minimum legal sizes and individual daily bag limits. Once economic and social factors are added into this mix the picture also becomes more complicated, particularly when the aspirations of various sectors are in conflict.

An important point to make is that the spatial scale (size) at which a fishery is managed needs to be determined by a biological understanding of the ecosystem, size and distribution of target fish stocks and most importantly the reproduction and recruitment dynamics i.e. where do all the little fish come from? The smaller the spatial scale at which a species functions, the more vulnerable it is to depletion, and the more detailed and complex the research, regulatory systems, compliance and education needed to achieve sustainability or protection. Hence the more they will cost the community i.e. the taxpayer.

In a big oceanic environment, even though local populations of adult fish may seem to be quite specific to an area or type of habitat, the juveniles that recruit into this population may be derived from adults of the species spawning across enormous areas of ocean, often at locations many hundreds of kilometres from where the juveniles eventually settle.

Spawning locations are also not necessarily static, finfish in particular appear to seek out optimum oceanic conditions which act as spawning triggers.

Another important point to make is that the vast majority of marine finfish, crustacean and many mollusc species have a fundamental life-history reproductive strategy that relies on producing enormous quantities of eggs, which develop into larvae then juveniles after being carried long distances by wind, wave, weather and ocean currents.

The natural mortality is very high, but in benign environmental conditions the survival rates can also be very high, which accounts for the differences in abundance among cohorts (age classes) that fishers observe from year to year or decade to decade.

Another point to make is that the statistical methods and assumptions and hence results made in the process of stock assessment are not precise or absolute in the conventional sense of the word, they estimate catches, fishing activity and stock sizes within a statistical range.

A short history of recreational finfish management in Western Australia

It is probably fair comment to say that Western Australia, and the Department of Fisheries, through a unique combination of political and social circumstance, personalities, commitment and relationships has, since the early 1970s, pioneered many of the most successful commercial fisheries management strategies in Australia.

However, the management of recreational fishing has not generally focused on managing total catch from the sector. Western Australia, and the rest of Australia, is on an evolving path, which if it succeeds should ensure quality sustainable recreational fishing for generations to come. If it fails we will have what they have in Europe, much of the United States of America and elsewhere - a shadow of the fishery we have now. To get to the end point, however, we have to be very clear about the outcomes we are seeking and not confuse resource-sharing arguments with sustainability arguments.

In Western Australia, before about 1990, there was little or no data on the recreational component of the catch, activity levels and the distribution of fishing effort, at least for finfish fisheries, and no explicit biological or fishery outcomes for the recreational sector. A few regulations existed mainly for the sake of social equity and to control high catch rate or extreme fishing methods i.e. dynamite, set netting etc.

An underlying assumption appeared to be that if the commercial sector of the fishery was managed the recreational component alone was unlikely to be a significant threat to sustainability.

The history of the dhufish minimum legal size and bag limit regulations provides an interesting illustration of how values-based regulation can evolve through social forces when there is little science, and non-explicit outcomes.

- 1958 – Dhufish minimum legal size of 13 inches (33cm). No biological study to support this, no bag limit.
- 1975 – Bag limit of three. Introduced after a small number of fishers expressed concern over dhufish to the Minister of the day.
- 1977 – 50cm size limit. Size limit increased, again with no specific biological work to support the decision and little consideration of issues such as ancillary mortality through barotrauma, hook injuries etc.
- 1985 – Bag limit of five introduced. Bag limit adjusted upward after recreational fishing lobby groups approached the Minister. No reason is recorded. Included in a mixed bag limit of 10 reef fish.
- 1991 to 1996 – The first Recreational Fishing Advisory Committee (RFAC) review of recreational fisheries introduced a comprehensive suite of regulations on social and precautionary lines placing dhufish in prize fish category with a bag limit of four, same size limit (50cm), part of mixed bag of eight.

Whether these regulatory changes to largely social controls had a significant effect on either the total recreational catch, the reproductive capacity of the dhufish stock, or

stocks, or any other biological parameter, remains a moot point. Certainly there was no pre- and post- assessment in any rigorous way of the effectiveness of regulatory changes and this is an issue that has dogged the management of recreational fishing throughout the world.

However, among the key features the 1991 review identified and built on was a growing awareness among recreational fishers themselves and government that recreational fishing could and would have an impact.

At the time this was comfortably far off for the government of the day to ignore any calls for wider licensing of finfish fisheries and for the original review committee to consider bag limits in the context of “what’s a fair day’s catch for a feed”, rather than go through any form of risk assessment against known biological and exploitation parameters.

Consequently the review also created a number of inherent contradictions. For example:

- The structure of the bag limit tables implied that single species management was the best approach, which is clearly debateable in the context of eco-system based management, and the limitations on data.
- The fishing ethic of catching a feed, widely promoted through the review process and later education programs, related to the social and cultural values of anglers at the time, not the biological and ecological sustainability needs of the fisheries.
- The reliance on individual daily bag limits as the primary management tool and the absence of pre and post implementation surveys begged the question about their effectiveness in managing the total recreational catch.
- While the final report of the first RFAC review acknowledged the need for comprehensive data collection, the specific research projects needed to quantify the level of fishing activity, the level of catch, and identify long-term trends went begging for adequate funding. Instead the emphasis was placed on research into the biological features of species of interest to anglers.

Lack of data and stock assessment for many finfish species and hence the omission of any risk assessment meant that more explicit input or total catch controls, including a licensing regime were not even on the agenda for discussion. It also meant that outcome-based management was not possible, and any regulatory changes had to be viewed as social or precautionary in nature.

Finally, the regulations that a committee, largely comprised of recreational anglers, were prepared to recommend, were flawed and largely unenforceable for finfish. To clarify, anglers retained the ability/right to land fish cut into any configuration of fillets and pieces. This meant identification and measurement was largely impossible and that to all intents and purposes, bag and size limits could not be enforced at the point of landing for those that wished to evade the regulations. In other words the law only applied to the law-abiding.

In combination those recommendations that were accepted strongly implied that government at the time considered the recreational catch was not a significant factor in sustainability and that the likely social and political reaction to more rigorous management outweighed the need for a more precautionary approach.

How the recreational component of finfish fisheries currently operates

By 1996 recreational fishing across Australia was starting to be recognised by State governments, at least, as an activity worthy of closer management attention. A notable exception was the Commonwealth (or as it now calls itself, the Australian Government), which steadfastly refused to accept any responsibility for, or make any concessions to, one of Australia's largest national passions and pastimes.

In WA, the establishment of a Recreational Fisheries Program within the Department of Fisheries in 1996 led to a number of key surveys and planning exercises by the Department of Fisheries and the Minister for Fisheries' central RFAC and Regional Recreational Fishing Advisory Committees (RRFAC). These identified a number of emerging key threats to continued recreational fishing quality – and potentially sustainability.

These included:

- rapid population growth;
- an increase from 27 to 34 per cent of the population in participation in recreational fishing since the baseline survey by the Australian Bureau of Statistics in 1987;
- an apparent 200 per cent or more increase in fishing effort (angler/days) over the same period;
- spreading urban centres;
- new and better roads, boat ramps and other infrastructure;
- quantum leaps in the accuracy and ease of use of digital fish finding and navigation technology, coupled with a decreasing costs; and
- significant improvements in angling gear – including low-stretch gel-spun and braid lines which improve gear sensitivity and consequently hook-up rates in particularly deep water.

The survey program clearly showed that the economic impact and social value of recreational fishing activity was high and sustained and worth upwards of \$600 million per year to Western Australian and regional economies.

These factors in combination were driving increased access and increased recreational fishing activity and efficiency over a growing area of near-shore waters and the continental shelf.

Boat catch and fishing activity surveys by the Department of Fisheries in every major marine region of the State since 1996/97 also showed very high levels of recreational

boat fishing activity clustered within 15 nautical miles of major coastal centres and boat ramps. They also show significant levels of activity even in quite remote locations – both offshore and onshore.

For the first time in Western Australia these surveys also estimated the total recreational catch for finfish by species, area and season in a way that could at least be contrasted, if not directly compared, with commercial catch data provided through fishers logbooks.

Perhaps contrary to popular belief, the data from these surveys also indicated that the annual recreational share of the total catch for many finfish species was between 30 per cent and 95 per cent of total take, depending on the species.

In the case of dhufish the initial 1995/96 west coast survey estimated the recreational catch at 132 tonnes, with about 50 tonnes returned to the water. The reported commercial catch for that year was in the order of 230 tonnes. By 2000/01 a national survey had estimated the total recreational catch at 578 tonnes, while the commercial catch remained relatively steady at 224 tonnes.

A key lesson from these surveys is that the strategies for data collection and analysis, and consequently the comparability of the results, were all different. As a consequence there is considerable debate about the precision/accuracy of the methods used for the 2000/01 national survey for providing information useful for stock assessment and management at a fishery level.

There is also considerable debate about the validity and precision of comparing census type data (i.e. commercial fishing logbooks), which in principle at least, records actual catch with survey type results which provide estimates within a statistical range.

However, data from a number of sources, including commercial fishing logbooks, also indicated that catch shares between sectors were not necessarily static from year, and the overall annual catch was also variable.

Surveys also showed that at least 73 per cent of recreational fishing boats were equipped with echo sounders, and 49 per cent with GPS.

The advent of digital positioning data, a boom in recreational fishing information via the press, and e-media including the internet, and the portability and accuracy of location information also lead to an explosion in information sharing between anglers. This effectively gave even inexperienced and ineffective anglers a significant boost in fishing effectiveness and making once closely guarded fishing locations common knowledge.

Between 1996 and 1998 both anecdotal reports and extensive structured fisheries research indicated a serious depletion of confined pink snapper populations in Shark Bay's inner gulfs, with the finger clearly pointed at recreational boat angling on spawning aggregations as the prime cause.

The subsequent recovery of these stocks is still underway after the implementation, by current Australian standards, of a series of relatively rigorous adaptive management

measures, which not only defined targets for stock estimates and total catch levels, but also established effective regulations that contained the catch.

As a consequence the management of recreational fishing and the recreational component of the catch are now widely acknowledged both within and outside government as a critical element in ensuring ecological sustainability. The debate is now about the goals, degree and style of management required and the cost.

Other developments relevant to management of recreational fishing during this period included a massive expansion in the marine conservation agenda, primarily through Commonwealth and State policy on the establishment of marine parks, and a wide recognition that ecologically sustainable development was a key plank in government policy for all political parties.

These factors were also primary drivers in the move to put recreational fisheries management on a more biologically, ecologically and scientifically meaningful scale and triggered a series of major reviews that resulted in the development of four major bioregional management strategies.

These reviews explicitly recognised the need for more and better data, but also incorporated a review of all the available data, and introduced a structured approach to risk assessment in the re-setting of recreational fishing rules including possession, bag and size limit regulations.

They also recognised the complexity of managing multi-species fisheries and promoted recognition of the place, and impacts, that recreational fishing has in the context of managing marine ecosystems.

In parallel a separate management regime and licensing arrangement was also introduced for the fishing tour (charter) sector, which clearly established the role of the industry as service providers to the recreational and tourism sectors – rather than direct beneficiaries of their catch.

In summary, the program planning process and four regional fishery management reviews introduced a number of largely precautionary adjustments to fishing rules, but they also served to further highlight the growing competition and conflict between recreational and commercial fishers, and the need for a significantly enhanced research and recreational fishing sector monitoring program.

Perhaps as importantly as anything, the regional reviews and experience with the Shark Bay inner gulf pink snapper also emphasised that there was no magic recipe, or even tried and true formula, for the management of recreational fisheries. The models of effort or catch management based on limiting fishing inputs or creating individual transferable quotas that applied to commercial fishing could not be simply ported across the sectors, due in part to social acceptance, and in part to the fundamental characteristics of recreational fishing.

There was also an emerging, but limited, body of international scientific literature highlighted at the 2002 World Recreational Fishing Conference in Darwin that indicated that, despite regular adjustments to conventional management rules such as bag limits

and fishing seasons, many freshwater recreational-only fisheries in the United States and Canada appeared to have effectively collapsed over a long period of time, but no-one had noticed.

The prime evidence cited included significantly diminished catch rates over a 30 to 50 year period, greatly increased levels of fishing effort near major population centres, reduced angler expectations of fishing quality, and restocking programs that had effectively replaced wildstock recruitment, without actually improving the fishery, either qualitatively or quantitatively.

How the recreational catch and recreational sector responds to management change

In Western Australia there are a number of case studies with sufficient data to illustrate how fisheries, recreational fishers and the recreational sector adapt and respond to changes to management, and some of the complexities that arise in the ocean.

While the marron, abalone and rock lobster fisheries all have interesting long-term data sets, the most relevant example with lessons for dhufish management is how Shark Bay's inner gulf pink snapper (*Pagrus auratus*) fisheries collapsed and recovered between about 1991 and 2005 respectively.

The first point to make is that inner gulf pink snapper, unlike oceanic stocks, are in some way constrained by salinity barriers, oceanic current systems or behavioural tropes to a limited and well-defined area.

Studies into their genetic make-up, ear-bone chemistry and movement patterns all point to the same thing. Snapper inside Shark Bay don't swim far, don't mix with other populations of snapper, and appear to rely on breeding populations of fish within the inner bays for recruitment.

The populations are also very small by Western Australia and international standards, perhaps a total stock in each gulf in the order of several hundred tonnes, with a sustainable harvest in the tens of tonnes.

Pink snapper are long-lived (30 years +), slow-growing (four to five years to reach maturity) and very easy to catch when they are aggregating to spawn in the winter months, at the peak of the local tourist season.

Two major streams of research contributed to the assessment of snapper stocks. One provided fishery-independent estimates of the total adult spawning population using plankton tows as the primary data collection method, and sophisticated statistical modelling. The results from this method gave an indication of the condition of the snapper population and the first clear evidence that there was significant depletion in all three inner gulf areas.

The second stream of research used statistically randomised boat ramp interviews to collect catch and activity information, as well as the length and weights of fish landed. These figures could then be aggregated into estimates of total catch and effort.

Importantly this data was collected with sufficient frequency to provide monthly estimates by area and in effect track real time changes in catch and fishing activity levels as the fishery responded to regulation adjustments. A highly unusual and, as far as I am aware, unique situation for any recreational fishery anywhere in Australia.

During this period extensive (and intensive) dialogue between the Department of Fisheries, the local community and interested angling groups resulted in a level of acceptance of the need for tighter management and the need for clear management goals.

These included a target adult stock level in each area, which then translated back to the creation of rules intended to lead to a rebuild in the adult snapper populations.

The management solutions covered almost the entire spectrum of regulatory and educational tools available and were introduced in stages over a six-year period, as the community became prepared to support them.

The elapsed time between the identification of overfishing and the acceptance of both the need for management and new regulations makes a clear statement about the rapidity with which community and government support for significant management change can be realistically obtained, and highlights the need for a precautionary approach to management well in advance of the problem becoming evident.

This is, however, a chicken-and-egg conundrum, without the research the problem is not defined, with research only starting when the problem is identified so the lag time for the results means a delay in action.

These issues can only be resolved by a significant change to the approach we take to the management of recreational fishing for finfish. A change that has to be accepted and supported by not only recreational fishers themselves, but also the government at all political levels.

Eventually the management solutions in Shark Bay included a complete closure to fishing in the eastern inner gulf of the bay, reduced bag limits, increased minimum sizes, a slot limit aimed at protecting larger adult fish, angler education programs and the introduction of an explicit total allowable catch for both commercial and recreational sectors, with a defined allocation of catch share to each sector.

In the Freycinet Estuary this was administered by the sale of quota tags to both anglers and commercial fishers. In the eastern gulf the fishery was effectively closed for the duration of the peak winter aggregation season. Total catches were contained due to the limited fishing time and, most importantly, the fact that the snapper were much harder to find and catch outside their spawning season.

The following figures (Figs.1 and 2) are derived from a series of boat surveys over a three-year period during the time of greatest management change in the inner gulf pink snapper fishery.

The changes to management are indicated when they came into effect. An immediate point to note is that there is a lag of at least one year and often longer before any

response in the fishery becomes evident. The other key point is that variations in cohort sizes and hence abundance and available catch driven by natural mortality can mask apparent responses to management change.

The other key point is that each fishery is quite different and that a one-size-fits-all approach (sometimes misnamed equitable), while it may be simple from an angler's point of view, is unlikely to provide the biological benefits needed for fishery management. In other words, the solution needs to be tailored to the nature of the fishery.

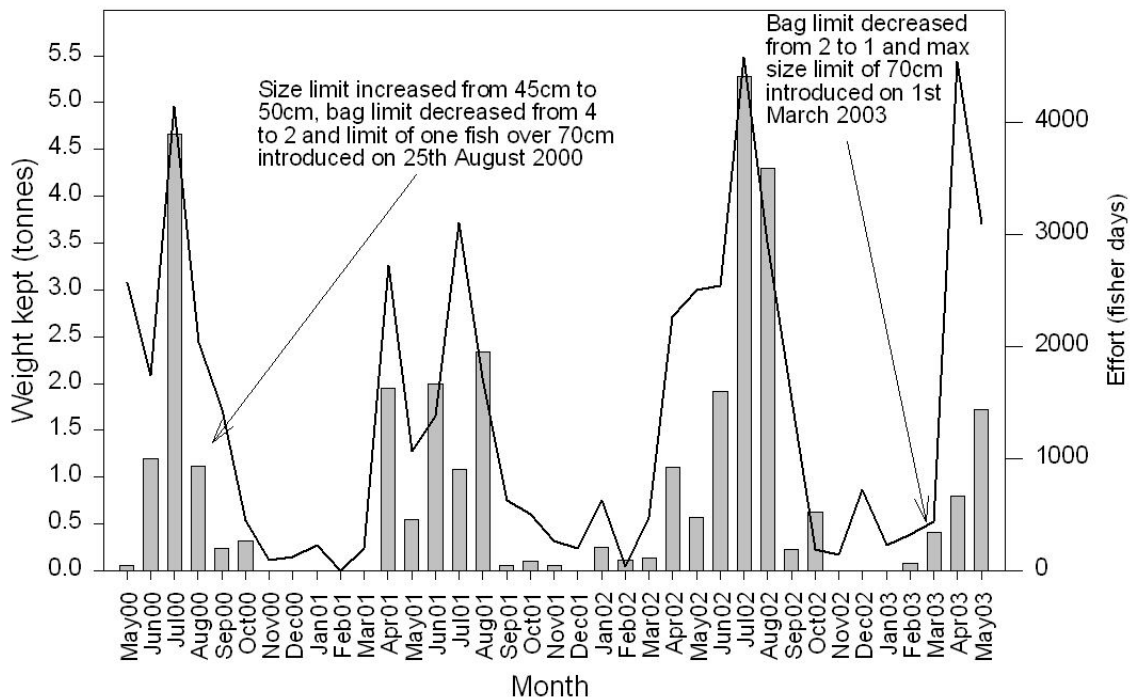


Figure 3.1 Estimated weight of pink snapper kept per month from Freycinet Reach (Denham) May 2000 to May 2003.

The solid line shows the level of fishing activity, while the histograms show the level of catch by month.

In Denham Sound (Fig 3.1) the increased legal size, and reduced individual bag limit (from four to two per angler) appeared to have an effect in 2001. The overall monthly catch is lower, is more spread out and starts earlier in the year. Fishing activity levels have also dropped away significantly. This is typical of a number of (albeit anecdotal) observations I have made over the years.

When changes to regulations adjust potential individual catches downwards, many anglers often temporarily stop fishing in that fishery. A good point to make here is that individual daily bag limits are often erroneously equated by recreational fishers to actual catch, this is seldom if ever the case.

One way of viewing this is that angler confidence in the fishery i.e. the expectation of a quality fishing experience that meets past expectations declines as an immediate reaction and people go elsewhere to try their luck. In other words adjustments to regulations tend to deconstruct the image of the fishery held in the popular

consciousness of the angling community (myth), and reset cultural expectations of the fishery as well as their more practical biological effects.

This also has an immediate social and political impact as tourism businesses start to fear loss of trade driven by changes to fisheries management. Again these are often more a fear than a reality and certainly the Shark Bay experience indicates that in the longer term tourism numbers didn't fall one iota.

A further point in relation to Shark Bay is that the low fishing activity year of 2001 also coincided with a general downturn in tourism to the region, reportedly driven by a hike in petrol prices. So the attribution of the social and behavioural impacts on tourism solely to fisheries management adjustments is dubious logic at best.

However anglers' memories are short, enthusiasm for fishing (angler confidence) is elastic, and the lag never lasts very long. In 2002 the catch and fishing activity zoomed up beyond their former levels. The bag limit was then dropped to one and a maximum size introduced – activity remained high, but catches dropped significantly. What the graph doesn't show is that anglers were also returning thousands of undersize snapper to the water, indicating a scarcity of fish over 50cm, and raising questions of incidental post-release mortality.

At this stage it looked like the penultimate bag limit of one and a lag effect from the increased minimum legal size had finally pulled the total catch back. A critical point is that the overall fishing effort didn't increase during this period and in fact showed some signs of decreasing. Hence a very low bag limit and size limit regulations designed on the basis of about 40,000 angler days per year in the fishery, with an understanding of the size structure of the stock, to produce a defined catch level were effective for a while.

The story in Freycinet Estuary (Fig 3.2.) also had some interesting lessons in practical recreational fisheries management. The first was that the bag limit of two, slot limit of 70cm, increased minimum size to 45cm and six-week closed season introduced in 2000 made little difference to the overall catch and fishing activity in this area.

Why? The fish were on average much bigger than in Denham Sound, the small number of high-catch anglers shifted the time they went fishing to later in the year, and the catches peaked just before and after the short closed season, showing that the fish were still aggregating and easy to catch in quantity.

However the setting of a very low total allowable catch and the introduction of tags at \$10 per fish and one per angler per year achieved what no previous management had come close to – an absolute containment of the catch to allow rebuild of the seriously depleted adult snapper population which could not be stretched by changes in the behaviour of recreational fishers.

The angler reaction was also predictable – a significant drop in fishing activity as snapper fishers went elsewhere to fill their ice boxes.

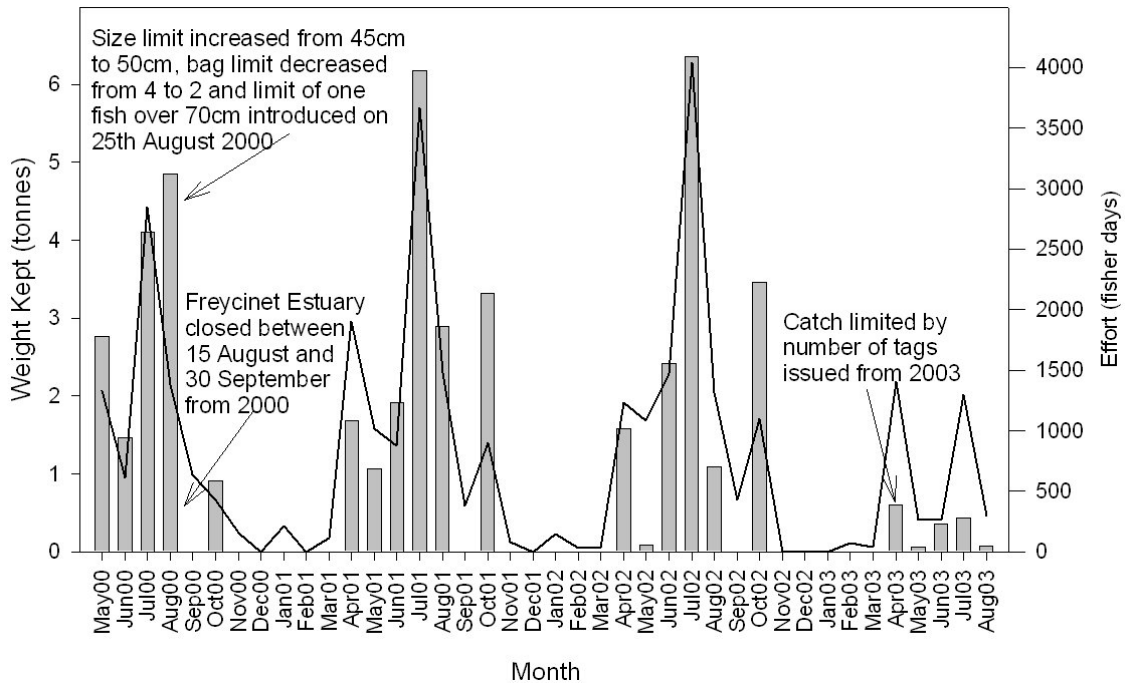


Figure 3.2 *Estimated weight of pink snapper per month from Freycinet Estuary (Nanga) May 2000 to August 2003.*

In summary, what management achieved was a good stock recovery in both Denham Sound and the eastern gulf using quite different strategies, and reduced the Freycinet Estuary catch to the sustainability rebuild target.

Some observations from this experience to consider in the context of dhufish management are:

- Total closures are always good for fish, but not always for “fisheries”.
- Size limits, if set high enough, protect some spawning stock, provided post-release mortality is low.
- Any changes to individual catch regulations will create an increase in the return of undersize/unwanted fish.
- Short seasonal closures don’t work very well unless they extend several weeks on either side of the “peak” catching period, assuming this is static from year to year. Anglers simply shift their fishing patterns in response, while feeling a warm inner glow.
- Bag limits without total effort constraint have minimal impact on total catch - until they get to one and fishing effort is also contained in some way, or drops in response to management change. Quite often they appear to redistribute catch, rather than contain it.
- Effort plus “potential catch” almost always exceeds sustainable yield under a “bag limit” scenario, so real catch data is critical.

So, the best conventional tools are:

- Size limits – they work if mortality is low.
- Gear constraints – are essential.
- Closed seasons – need to be designed with care.
- Possession limits and bag limits – work only if participation is known and below a level that suits the productivity of the fishery, or fishing effort is constrained to a known level.
- Closed areas – depends on mobility of fish and larvae.
- Angler education and catch handling – is critical.

Are the tools we have adequate?

The key to understanding how United States and Canadian freshwater recreational fisheries could almost collapse, or certainly decline significantly, without a major public outcry is to understand the limitations of the simple, one could say simplistic, tools for management conventionally adopted for recreational fishing, the limited availability of time-series data and the often long (in human terms) timeframes involved.

It is also important to recognise the phenomena of angler confidence and the popular image of the fishery, and how this is highly elastic and immediately responsive to regulatory change.

The other factor is the significant lack of emphasis and funding usually given to properly understanding the reproductive or production capacity of recreationally fished stocks of fish, and the absence of clear objectives for management.

In a nutshell the recreational fishing sector has, in the vast majority of cases, been managed by seven simple regulatory tools, for example:

- daily personal bag limits
- gear constraints
- minimum legal size limits
- personal possession limits
- closed seasons
- closed areas
- licences

In the case of marine finfish fisheries in Western Australia, only the first three have been widely accepted by anglers and governments and applied. The first four types of regulatory controls listed above act primarily on individual anglers but not directly on the whole fishery or total catch of fish. In other words, they are a means of managing human behaviour at an individual level.

If fishing activity and participation were unvarying, and low in proportion to the overall productivity and size of a stock of fish, then they might possibly represent a reasonable means of management, but the reality in the early 21st Century is different.

A close look at the data from Western Australia that is available shows in nearly every instance that only the last three strategies have been demonstrably effective at containing either total catch or total effort.

Recreational fishers, of course, know this intuitively and some will often strongly oppose the last three measures while supporting more cosmetic measures even at risk of collapsing a fishery. In other words the interests of the individual often drive the political debate rather than the interests of the fish, or the longer term interests of the fishery.

The odd-man-out in the pack is licensing, which in Australia has been used to identify participants in a fishery, establish a database and grant access but has yet to be linked in any way to constraints on total catch.

The inner Shark Bay experience also showed that a relatively small number of anglers (less than 5,000) can generate large pulses in effort and catch if the opportunity is there and the fish are easy to catch.

The current state of play for recreational participation in most Western Australian finfish fisheries means that anyone can fish, at any time, as often as they like, wherever they like, with generally no entry fee.

The total level of fishing activity is also unconstrained by regulation in most fisheries although arguably it may be constrained by physical access, remoteness, weather and other physical factors. Growth in participation and fishing effort is also unconstrained by regulation irrespective of the size of the fish stock or its productivity.

In reality participation and activity levels (angler behaviour) is driven by angler confidence, which in itself is a combination of a number of factors: These include:

- the popular image of the fishery promoted through the recreational fishing and other media, including the internet;
- the fishing grapevine; and
- recent successful catch or fishing experiences.

In WA overall fishing effort and participation in recreational fishing is at least twice 1990 levels and appears to be growing steadily in nearly every area of the State.

Recreational fishers are also highly mobile; they migrate in large numbers to regional areas of the State to pursue their chosen activity.

A simple illustration is that the resident population of the Gascoyne Region is around 10,000 people. This has been static for well over a decade. In the winter season tourists visiting the region boost the number of residents fourfold. Tourism and related fishing activity is significant with over 270,000 visitor nights estimated each year – and 240,000 fisher days.

When they get to their destination, improved boating and fishing gear, better access to fishing grounds via either roads or boat ramps and marinas, and the growth in use of portable freezers over the past few decades all contribute to increased rates of exploitation.

Some other features of recreational fishing of relevance to managing the total catch have also become clear in the course of the Department's survey programs. The first is that, despite the high participation rates, the fishing effort and catch are highly skewed. In other words some people fish a lot more often than others, and some catch a lot more fish, more consistently.

This is obvious to even the least successful angler. Everyone has good days and bad days, and angling knowledge is all about increasing success rates.

What surveys show is that around 30 per cent of the fishermen account for 70 per cent of the activity and take 80 per cent of the total catch. Again about 80 per cent of what is caught is taken in 30 per cent of the available fishing time.

So a major challenge for management is working out which segment of the fishery contain the most active and successful fishers, and deciding when and how to create effective controls.

All of this says that despite the high reported numbers of participants in recreational fisheries, or would-be participants, the number of people that effectively fish and catch is lower and that management needs to be targeted at areas of greatest effect – in time, in space, or in segmenting the fishing population.

Issues for dhufish management

If the west coast dhufish fishery is to be managed there are a number of critical questions that need to be answered and decisions made on how the management will operate. The biological questions apply to both the commercial and recreational sectors, but the management questions are quite discrete and need to be designed to suit the manner in which each sector operates.

Key biological questions are:

- What is the best spatial and biological scale of management? Is it species, stock, ecosystem or bioregion or smaller scale?
- What are the biological objectives? What are the trigger points for action?
- Is this to be managed as part of a demersal multi-species fishery? What about snapper, Samson fish etc?
- What are the post release mortality issues, in particular at depth?
- Is there adequate data for stock assessment including catch estimates?

For the recreational sector the overwhelming question remains 'How best can we manage the total recreational catch?'

The critical lessons from Shark Bay form the sketch of a recipe for successful management of the recreational component of the catch. They are:

- Define the participants in a fishery. For example, registration of all participants by licence or other means. Without this management is uncertain at best.
- Get good data at the spatial and temporal resolution that suits the fishery. Understand seasonal and spatial issues.
- Set concrete management targets and triggers for the sector as well as the fishery.
- Ensure good education and compliance.
- Make sure tools constrain the total sector catch, not just individuals on singular occasions.
- Make sure effort is known and if necessary limited by licensing, seasons or other means.

The answers, of course, are simple to conceptualise but much harder to put into practice than the questions, but anglers who are seriously committed to a future for dhufish fishing as we now have it will need to put aside self-interest and support what is best for the fish.

3.2 Managing the Commercial Catch by I. Curnow

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Introduction

Dhufish are taken commercially by both wetliners (not currently subject to specific management arrangements) and by fishers operating in the Demersal Gillnet and Longline Managed Fishery (DGLMF).

The DGLMF accounts for about eight per cent of the overall scalefish catch on the west coast and seven per cent of the dhufish catch. This fishery is subject to a formal management plan that restricts participation to licence holders in the fishery and controls fishing effort by regulating both time and gear.

The major commercial take of demersal scalefish on the west coast, including dhufish, is taken by wetlining that accounts for about 1000 tonnes of scalefish per year, including 230 tonnes of dhufish. Specific information on dhufish catches and trends in fishing effort were presented in an earlier presentation and will not be repeated in this paper. The development of management arrangements for the wetline fishery will be the focus of this presentation.

Background

Before September 1983, there was no constraint on the issue of a commercial Fishing Boat Licence (FBL) in Western Australia. Any person submitting a competent application was granted a new FBL. It gave the holder an authorisation to use a boat for commercial fishing. Provided that person also held a Commercial Fishing Licence (CFL), the licensed boat could be used in fishing operations to take any fish for commercial sale. This general provision applies unless there is an existing constraint under fisheries legislation to prevent the licence holder from operating within a managed fishery, operating in a specific area or taking a specific fish species.

On 5 September 1983 the then Minister for Fisheries announced an immediate freeze on all new applications to enter the fishing industry via an FBL, noting that '*the government and industry are increasingly being faced with the consequences of excess fishing capacity in areas such as ... the inshore fisheries on shark, dhufish and other reef fish species ...*'.

Ultimately this led to the *Ministerial Policy Guidelines for Entry into the Western Australian Fishing Fleet* being adopted in 1984. The main thrust of the guidelines was a permanent cap on the total number of registered fishing boats in the Western Australian fishing industry. Thus from 1984 onwards, people wishing to enter into the commercial fishing industry could only do so by purchasing an existing FBL. At this time there were only five managed fisheries but progressively the majority of Western Australia's fisheries have been brought under management and now there are over 30

managed fisheries and a variety of fishing prohibitions. This has reduced the range of activities available to the holder of an unrestricted FBL, to the extent that wetlining is the last major commercial activity available to an FBL holder who does not hold a Managed Fishery Licence (MFL).

On 3 November 1997 Fisheries WA announced that a study would be undertaken into the activities associated with the ‘unrestricted’ Western Australian FBL (i.e. an FBL with no restrictive conditions in addition to the standard conditions), commonly known as ‘wetline’ or ‘open access’ fishing and its associated wetline fishery. The then Minister for Fisheries set a benchmark date of 3 November 1997 for fishing history within the wetline fishery.

This benchmark date was announced following concerns that large numbers of operators who did not normally participate in the wetline fishery were gearing up to gain history following the commencement of negotiations between Fisheries and the Western Australian Fishing Industry Council (WAFIC) over future management of wetline fishing. The media release noted: *‘No wetline fishing history after this date would be considered in the development of any new arrangements for the fishery’*. At the same time it was announced that 3 November 1997 would be a benchmark date for all open access fisheries where benchmark dates had not previously been announced. At the time, a letter was also sent to all FBL holders which noted that *‘.... fishing history after 3 November may not be taken into account’*.

In July 2002, the current Minister for Fisheries announced that a review of wetline fishing would be undertaken. Two panels, a Management Planning Panel and a Commercial Access Panel, were appointed to undertake the review.

What is wetlining?

The term ‘wetlining’ is generally applied to fishing activities undertaken under the authority of a CFL used in conjunction with an FBL. Permitted fishing activities are any activity (which may include fishing for certain species, using certain gear, or operating in certain areas), which is not otherwise prohibited by other legislation (such as a management plan, regulations, or Section 43 Order). Typically, wetlining involves the catching of scalefish using handline or dropline, but may also involve the use of nets in inshore areas to target species such as mullet or whiting.

The nature of wetlining, in terms of the species targeted and gear that can be used, can therefore vary between regions depending upon the existing managed fisheries in that region. For example in the Gascoyne, a wetliner may target reef and demersal scalefish species by handline or dropline but cannot take pink snapper in most areas of the Gascoyne due to the operation of the Shark Bay Snapper Managed Fishery (SBSMF) which restricts the take of snapper within the bounds of the fishery to persons who hold an SBSMF licence.

An FBL is sometimes referred to by commercial fishers as an ‘open west coast licence’ or ‘wetline licence’ which has promoted a perception that wetline fishing is a separately managed (and licensed) activity. It is likely boat brokers initially coined these terms, however they are now widely used. Indeed some fishers believe that an FBL carries

some form of endorsement, or confers some form of right, to take scalefish rather than just being the residual permissible activities arising from holding an FBL.

As noted earlier in this paper, an FBL is a licence granted under the *Fish Resource Management Regulations 1995* that authorises a person to use a boat for commercial fishing. While it is the CFL that actually authorises a person to engage in commercial fishing (that is, to take fish for sale), any holder of a CFL who uses a boat as part of their fishing operation is required to also hold an FBL. For example, a commercial fisher who uses a hand-hauled net from shore does not require an FBL. If however he uses a dinghy as part of that operation, an FBL is required (that is, the dinghy must be licensed).

In practice, the majority of commercial fishing operations require the use of a boat and consequently the holding of an FBL. Therefore, even in the event that commercial fishers did not gain access to the future managed wetline fishery, fisheries legislation still requires an FBL to be held in order to use a boat in their other managed fishing operations.

This is an important point to note, as a number of fishers have indicated they believe they may lose their FBL if they do not gain access to a future wetline fishery. This is not the case and FBL holders who may not initially gain access to the wetline fishery will retain the ability to lease/buy wetline access off other fishers in the future so that catching scalefish (within the framework of the management arrangements) becomes part of their fishing package.

Types of wetlining

While the majority of wetline activity along the west coast is based around dropline and handline fishing for demersal scalefish species, the use of gillnet, haul net and beach seine fishing (for mullet, herring, whiting etc.) is also still carried out by some fishermen. Although some operators engage in both types of fishing, they are two distinctly different fishing operations.

Profile of demersal line fishing activity in the west coast bioregion

In recent years on the west coast, some 220-260 boats have reported wetlining in any given year. A total of 506 FBLs reported a wetline catch of demersal species in the west coast region over the period 1991-2003 (Table 3.1).

Table 3.1 Demersal wetline scalefish catch and the number of boats reporting wetline catch in the west coast bioregion from 1990/91 to 2002/03.

Year	Catch (tonnes)	No. of Boats
1990-91	569	192
1991-92	567	174
1992-93	515	156
1993-94	565	147
1994-95	656	165
1995-96	735	178
1996-97	678	194
1997-98	783	237
1998-99	722	237
1999-00	717	227
2000-01	834	219
2001-02	942	256
2002-03	1002	261

Over the past decade there have been increased rates of exploitation of scalefish stocks, particularly dhufish, through increased fishing efficiency (technology) and increased effort in both numbers of boats and days fished. Recent changes on some boats to using hydraulic and electric winches with automated triggers for reeling-in has enabled them to increase the number of lines and hooks used on their boats.

Key issues for management

Status of west coast demersal scalefish stocks

Stocks of key demersal scalefish species, according to State of the Fisheries 2002/03, are already fully exploited in the west coast bioregion. In recent years there has been an 18 per cent increase in the number of boats wetlining and a 30 per cent increase in effort.

Current effort levels are considered unsustainable in the long term and most stakeholders now agree that intensive management of scalefish stocks is a matter of urgent and growing importance. Anecdotal reports suggest localised depletion is also becoming an increasing concern for key scalefish species such as dhufish and pink snapper, particularly in areas highly utilised by both the recreational and commercial fishing sectors.

The Department of Fisheries Research Division has estimated an acceptable (i.e. a sustainable) catch range for the commercial sector of 558-798 tonnes (based on the mean from catches for the period 1990/91 to 1999/2000 using 80 per cent confidence limits). A detailed analysis of the status of demersal scalefish stocks is summarised in the Department of Fisheries *State of the Fisheries Report 2002/03*.

Highly variable levels of wetlining activity

Around half of the FBLs that reported wetlining in the west coast bioregion from 1990 to 2001 reported less than one tonne of demersal wetline catch (Table 3.2) and around half of these FBLs in fact took less than 300kg of demersal wetline catch (Table 3.3). 376 of the 443 FBLs (or 85 per cent of the FBLs) represented in the '<1 tonne' category (between 1990 and 2001) were packaged with at least one MFL or exemption (to participate in a developing new fishery) in May 2003.

The majority of FBLs that recorded greater than 20 tonnes of demersal wetline catch in the west coast bioregion in any one year caught between 20 and 30 tonnes. Very few operators took more than 30 tonnes. In 2001, catch returns indicate that five of the 13 operators who took more than 20 tonnes were fishing near Kalbarri.

Table 3.2 The number of boats that reported demersal wetline catch in the west coast bioregion from 1990/91 to 2002/03 in categories.

Year	< 1 tonne	1-5 tonnes	5-10 tonnes	10-20 tonnes	> 20 tonnes	Total No. of Boats
1990-91	87	66	16	18	5	192
1991-92	81	53	22	13	5	174
1992-93	72	50	19	10	5	156
1993-94	68	43	17	13	6	147
1994-95	72	58	13	13	9	165
1995-96	82	56	19	8	13	178
1996-97	99	56	16	14	9	194
1997-98	103	85	22	17	10	237
1998-99	120	76	16	14	11	237
1999-00	118	62	22	16	9	227
2000-01	102	64	24	16	13	219
2001-02	122	80	18	24	12	256
2002-03	121	85	23	18	14	261

Table 3.3 The number of the boats that reported less than one tonne of demersal wetline catch in the west coast bioregion from 1990/91 to 2002/03 in categories.

Year	< 100kg	100 - 200kg	200 - 300kg	300 - 400kg	400 - 500kg	500 - 600kg	600 - 700kg	700 - 800kg	800 - 900kg	900 - 1000kg	Total
1990-91	21	14	19	6	6	4	5	5	3	4	87
1991-92	20	12	10	13	7	6	1	5	3	4	81
1992-93	16	13	15	4	5	2	3	4	7	3	72
1993-94	15	14	12	5	6	3	5	4	2	2	68
1994-95	16	11	15	9	3	7	3	3	2	3	72
1995-96	16	13	8	7	9	9	7	4	3	6	82
1996-97	18	17	14	5	5	14	6	7	8	5	99
1997-98	19	26	13	5	9	7	11	1	7	5	103
1998-99	16	18	18	12	11	14	11	8	10	2	120
1999-00	21	20	24	13	9	10	8	5	6	2	118
2000-01	22	20	12	5	15	6	7	8	5	2	102
2001-02	31	16	22	12	8	10	7	2	6	8	122
2002-03	18	22	16	18	12	13	6	4	4	8	121

*Differences in species abundance and catch rates on west coast**Kalbarri area*

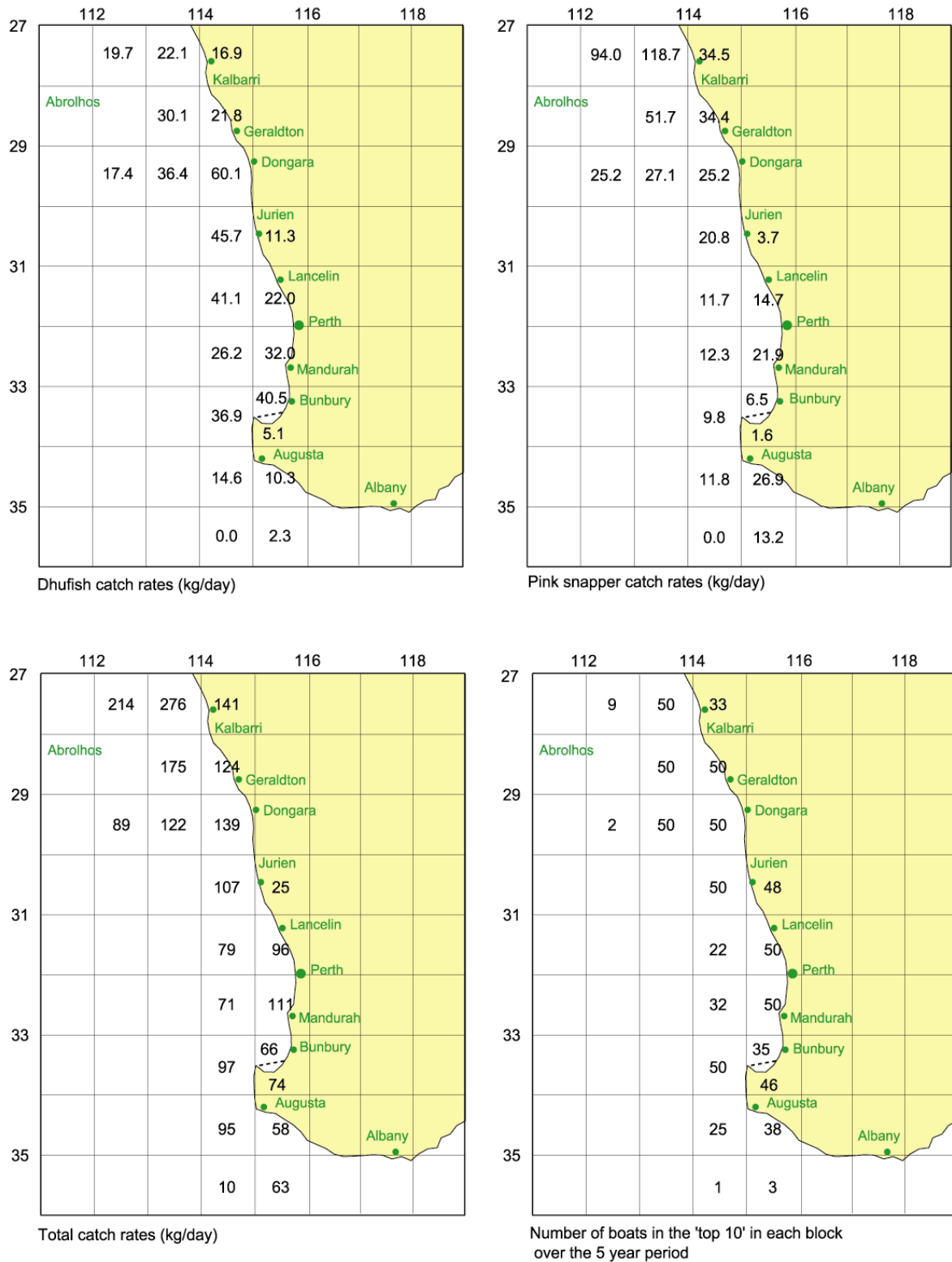
The zone around Kalbarri has a distinctly high catch rate of pink snapper which raises the total catch rate of this area to well above any other area within the west coast bioregion (Figure 3.3). The catch composition in this zone is predominantly pink snapper and Lethrinids and catches and catch rates of these species are much higher in this area compared to any other area within the west coast bioregion.

Mid-west area

Geraldton, Dongara and Jurien have relatively similar catch per unit of effort (CPUE) figures for dhufish, pink snapper and total catches across all species. The total CPUE for this sub-region is higher than the southern blocks and lower than the Kalbarri blocks. The catch composition in this sub-region is primarily pink snapper, dhufish and baldchin groper.

Metropolitan area

The metro sub-region has a relatively consistent pink snapper CPUE across the Lancelin, Perth and Mandurah Catch and Effort Statistics System (CAESS) blocks. As a subregion the CPUE is lower than both the northern and southern bounding blocks. The catch composition in this sub-region is primarily pink snapper, dhufish and Samson fish. These blocks are also the focus of high recreational fishing pressure.



Catch rates for main species and total catch over the 1997-98 to 2001-02 seasons for the top 10 vessels.

Figure 3.3 Catch Per Unit Effort (CPUE) by CAESS blocks of dhufish; pink snapper; and all scalefish of the ten highest catching wetline boats; and the number of boats operating in each CAESS block.

South west area

The CPUE of all species from Bunbury through to Augusta is higher than the adjacent metro sub-region. This sub-region also has high commercial catches of skipjack trevally, hapuka and Bight redfish in addition to the pink snapper, dhufish and Samson fish also found in the metro sub-region. Skippy, hapuka and Bight redfish dominate two blocks in this area and have shown a rapid increase in recent years.

Table 3.4 Total annual demersal wetline catch (tonnes) by sub-zone in the west coast bioregion.

Financial Year	Kalbarri	Metro	Mid West	South West	TOTAL
1990-91	109.1	101.1	374.1	56.9	641.2
1991-92	137.5	63.4	407.1	51.5	659.5
1992-93	131.0	76.8	308.6	41.5	557.9
1993-94	177.7	77.6	292.9	42.8	591
1994-95	173.7	97.4	338.4	61.7	671.2
1995-96	225.1	75.1	387.5	70.7	758.4
1996-97	196.9	69.2	356.6	86.5	709.2
1997-98	207.6	133.4	364.8	96.1	801.9
1998-99	162.8	127.0	338.9	96.6	725.3
1999-00	180.2	132.6	312.7	91.3	716.8
2000-01	219.8	117.1	379.2	117.4	833.5
2001-02	281.4	128.0	410.7	122.9	943
2002-03	317.6	152.2	398.7	137.9	1006.4

High latent effort

Many boats with the potential to wetline currently do not do so, or only catch very small amounts. There has been a mobilisation of effort in the past two years that has resulted in an increase in catch. This high latent effort therefore represents a key potential threat to the sustainability of fishery.

There are currently about 1350 unrestricted FBLs in Western Australia (not including registered dinghies) that have the ability to go wetlining. Of these FBLs, only 156 do not have access to a managed fishery in some part of the State (i.e. they are wetline-only boats). Although about 250 boats go wetlining on the west coast each year, potentially any one of 1350 FBLs in Western Australia could choose to go wetlining in this region.

Potential mobility of commercial fleet

The potential for effort to be focussed on specific areas also requires consideration in this review. Concerns have been raised over 'transient' boats, particularly larger vessels, moving into localised areas, fishing intensively for a few weeks and then moving on when catch rates decline. This has the potential to become a bigger issue once management arrangements are put into place for the wetline fishery. Fishers will seek

to maximise returns which may involve boats seeking to fish areas with the best catch rates. If excessive effort can be focussed in these areas it may result in localised depletion, and possibly the serial depletion, of stocks.

Accuracy of catch returns

A total of 506 boats reported a wetline catch at least once over the period 1991 to 2001. A number of anecdotal comments suggest that many small catches of scalefish are not recorded. In particular, it was noted this might have been the case prior to the announcement of the 1997 benchmark date.

While some operators have started recording these catches since 1997, concerns were also raised that some operators may now be over-recording catches in an attempt to compensate for not recording catches earlier. This is a key issue that must be addressed during this review as accurate information on catch and effort is essential for fisheries research purposes.

Outcomes required from review

Ultimately, the Wetline Review is aimed at developing a formal management framework for the wetline fishery that:

- sets a target commercial catch for demersal scalefish;
- can constrain the commercial catch within this target;
- contains mechanisms to avoid the focus of effort;
- provides a ‘toolbox’ for refined management of species as biological knowledge improves (e.g. distribution, spawning times); and
- removes latent effort from the fishery.

The introduction of formal management around the commercial take of demersal scalefish will provide the necessary framework for containing the commercial catch within a prescribed catch ceiling while providing greater certainty for those commercial fishers authorised to operate in the wetline fishery.

This review is therefore an essential first step in the introduction of Integrated Fisheries Management for the demersal scalefish fishery on the west coast.

3.3 Sustainability and Effective Management- Available Tools by G. Leyland

Presentation by Guy Leyland
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I would like to thank Recfishwest and the Department of Fisheries for putting on this workshop. From the earlier presentations I have gained considerable knowledge on dhufish which I was not aware of before.

Dhufish, or *Glaucosoma hebraicum* to give its correct scientific name, was first described by J. Richardson in 1845 from specimens collected from the voyage of His Majesty's ships *Erebus & Terror* during 1839 to 1843.

It is endemic to waters of Western Australia and is distributed from the Recherche Archipelago off Esperance to Shark Bay. It is an icon species for Western Australians and its use therefore is a matter of interest to all Western Australians and one that we should always be conscious of.

Dhufish live in shallow inshore waters and depths to over 200m. They are present over hard, flat sea beds and in reefs, wrecks and underwater caverns and gutters. Adult fish move into shallower waters in the cooler months between April and June. Juveniles tend to remain in shallower water than adults and are rarely found in waters more than 100m deep. Adults feed mainly on fish, also rock lobsters, crabs, squid, octopus and cuttlefish.

The take of dhufish is by three sectors operating in what is called the wetline fishery or West Coast Demersal Scalefish Fishery. The three sectors are commercial line, recreational and charter sectors. The fishery is not a dhufish fishery as such but a multi species fishery which also takes snapper, baldchin grouper and off Geraldton also includes several Lethrinid species and coral trout as the bulk of the catch. It is worth noting that smaller components of the catch include around 75 other scalefish species plus 17 species of sharks and rays.

To make the management of the fishery even more complex many of this suite of species is also accessed by the West Coast Demersal Gill and Demersal Longline fishery. But catches from this sector have remained stable and this fishery has the potential to provide a good source of independent data in regard to the state of stocks. Recent scientific advice (*State of the Fisheries* report 2002/2003) in regard to the sustainability of the scalefish fishery is that:

"...for the entire fishery the acceptable catch range is 558-798 tonnes. Acceptable catch ranges for individual species are 125-179 tonnes for dhufish, 153-254 tonnes for pink snapper and 27.5-35.5 tonnes for baldchin groper.

For the second consecutive year, the catch of the entire fishery at 1,094 tonnes is well above the acceptable range. although catches of pink snapper and baldchin groper in 2001/2002 were both within the acceptable range based on 1990s catches, the record

catch of dhufish at 219 tonnes was well above the acceptable range for the second consecutive year.”

Without going into specific detail, it is true to say that both the commercial and recreational (including charter boat) sectors have increased their catch levels of dhufish compared to previous years. Both sectors need to share the burden of addressing over harvesting of dhufish.

It needs to be recognised that managing the take of dhufish cannot be done in isolation. That is given that dhufish stocks form a component of other species stocks that collectively comprise the west coast demersal fin fishery. Any management action aimed at conserving dhufish will also impact on the take of these other species.

In other words it is unlikely that there is a single magic bullet that will be effective in the management of Dhufish and these other species.

So how do we get to effective management? What is the tool that will allow us to effectively manage this multi species fishery including dhufish and ensure that we do not overfish? I suggest to you that the principle tool is employing what is termed ‘adaptive fisheries management’.

What is adaptive management?

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs. Its most effective form -“active” adaptive management- employs management programs that are designed to experimentally compare selected policies or practices, by evaluating alternative hypotheses about the system being managed.

In short, adaptive management is essentially a process that permits continuous improvement or learning to manage by managing to learn. Its components are:

- acknowledgment of uncertainty about what policy or practice is “best” for the particular management issue, which in this case is a sustainable demersal scale fishery including dhufish;
- selection of policies or practices to be applied, in this case for the recreational and charter boat sectors bag limits, possession limits and size limits. For the commercial sector it is limited entry (the 1983 freeze on the commercial fleet size) and size limits.
- implementation of these policies and practices, which in this case is the rules applying to the fishing sectors;
- monitoring of key response indicators, which in this case are through catch returns from the commercial fleet and various surveys of recreational catches;
- analysis of the management outcomes in consideration of the original objective, which in this case shows that the fishery is being fished unsustainably; and

- incorporation of the results into future decisions, which in this case is the government's initiatives for formal management arrangements for the commercial wetline fishery and integrated fisheries management.

I note that Peter Rogers is speaking about these initiatives later today.

We are now back at the top of the adaptive management process with the aim of a sustainable demersal scale fishery while acknowledging uncertainty about which policy or practice is best to achieve this.

The results of the commercial wetline fishery review and Integrated Fisheries Management will be incorporated into the policies or practices to be applied. Without prejudging the outcomes of these initiatives these are likely to result in the substantial shrinking of the size of the commercial fleet permitted to access the demersal scale fishery. That is, the creation of a dedicated wetline fishery with the realisation amongst licence holders of the economic benefits that might be realised from a sustainable and well-managed fishery that is responsive to the market. The incentive of gaining these benefits is likely to drive management arrangements. In addition, with the application of market mechanisms in regard to licence transferability it is likely that the fleet size will further self-rationalise in response to efficiency and viability considerations

For the recreational and charter boat sectors, the outcome of Integrated Fisheries Management is likely to spark considerable debate about the best use of share of fish stocks available to these sectors. It is likely that some means of internal allocation of rights of access within these sectors will be implemented. In this regard I note the employment of tags at Shark Bay for allocation of access to snapper stocks.

The successful implementation of these initiatives should diminish the tensions between the commercial, recreational and charter boat sectors and redirect the considerable energy that has been expended on debate about the legitimacy of the activities of each of the sectors towards debate about best management practices for the fishery, which will achieve sustainable stocks and allow each sector to access the resource for their best use. That is all sectors can realise their aspirations over access to the resource without interference with each other.

In regard to the management tools that might be employed there are a number that might be used. These include:

- individual transferable quota
- individual transferable effort units
- tags
- time and space closures
- minimum sizes
- maximum sizes
- bag limits
- possession limits

As I said earlier, there is unlikely to be one magic management bullet which will achieve management objectives for the fishery given that it is multi species fishery and given that these objectives will include social and economic considerations as well as

measures designed to ensure sustainable use of the stocks. Thus management arrangements trialled in an adaptive management context are likely to be a mix of a number of measures. These mixes of measures are likely to change as their effectiveness is evaluated.

In conclusion, it is likely that it will take a number of years before the dust settles following implementation of the Wetline Review and Integrated Fisheries Management. The challenge for all sectors is to create institutional arrangements that will allow the sectors to work positively and cooperatively together towards realising their desires in regard to use of dhufish and other demersal scalefishes.

In this regard I note from the presentations mid morning by the three sector groups that there are common themes. These are:

- shared concerns over current practices and uses;
- shared understanding of impacts;
- shared objectives; and
- shared desire for use of these stocks, including dhufish, to be sustainable.

Once the issues around allocation (that is fairness and equity) are resolved it is these sectors collectively who will drive effective research and use in an adaptive management framework.

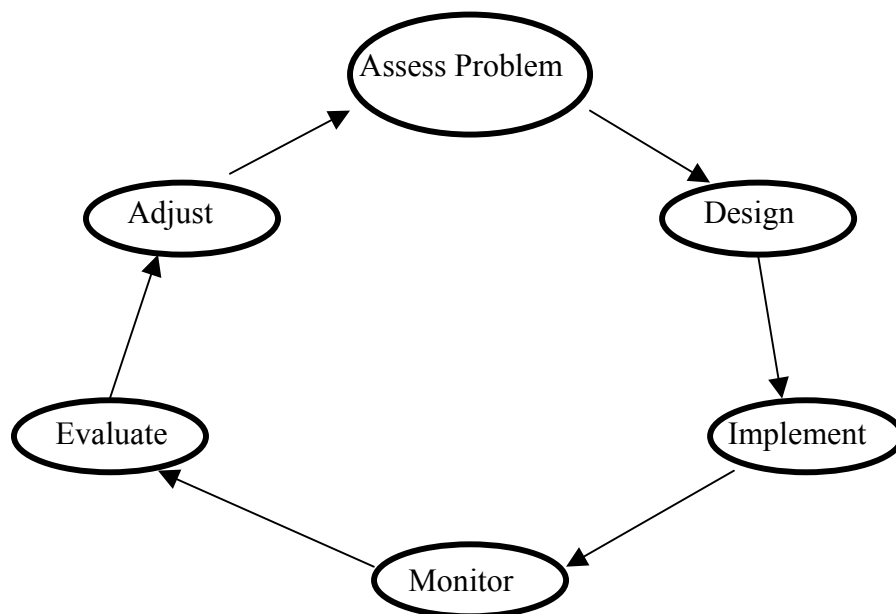


Figure 3.4 *Adaptive management.*

3.4 Future Management Scenarios for WA Dhufish by F. Prokop

Presentation by Frank Prokop
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What dhu we know?

Dhufish – everyone wants them

Looking at management scenarios is particularly difficult for Western Australian dhufish. Everyone wants them. Even when fishing for herring, there is always that secret desire to see a big dhufish swim up the berley trail and inhale your bait, making your day and hopefully getting your picture in one of the major fishing newspapers.

Commercial catches are increasing; 219 tonnes were taken in 2001/2002 and more recent figures show catches in the order of 250 tonnes and 230 tonnes, well above the acceptable range for the second consecutive year.

The recreational catch is much more interesting and much more problematical. The national survey said the recreational catch is 577 tonnes with an additional 35.6 per cent returned, mostly undersize. The Western Australian Department of Fisheries report from 1996/97 says this is a gross over-estimate and estimates the catch at 130 tonnes. This will become extremely important later on when I talk about making management and allocation decisions and how catch shares might be managed. There are some really scary figures due to the huge diversity in numbers being attributed to recreational fishing and how you might manage it and the overall catch.

Curiously, before today no one ever mentioned undersize dhufish taken by the commercial fishing industry. I found Warren Aitcheson's talk about his experiences as a commercial wetliner fascinating; particularly about ways we might get undersize dhufish caught by the commercial fishers back down in an effective manner that increases survival, because all participants want future access to the same fish.

Barotrauma is a big issue

I have some updated information on what Department of Fisheries researcher Dr Dan Gaughan had presented earlier. We can see quite clearly that in depths of up to about 50m the catch and tag returns are pretty good. What is extremely important however is there is still a very low number of dhufish being tagged in depths of 50 to 90m.

The low recapture rates could mean that the mortality is significantly higher or could just mean that the in those depths dhufish are significantly less targeted in the identical areas and that is one of the reasons for the lower catch rate. Even if you think you are fishing on the same lump in 70m of water, you might be drifting a little bit and that might mean you are actually fishing 30m away. I think that is important, because I think there are fine scale issues for dhufish that do not exist for most other species.

It is really important to mention that each species is really different with respect to impact of barotrauma. Information here about Western Australian dhufish should not be taken and applied across all species and should not be used to indicate that, for example, groper are identical to pink snapper, which has occurred in the past.

What is shown is that pink snapper are much more robust, as most people who have handled them know, and information here shows that simple release works extremely well for pink snapper. Snapper released in waters up to 100m in depth survive extremely well. One of the reasons we invited Greg Jenkins from Challenger TAFE to speak here today was so he could explain the information regarding the single haemoglobin type that may be one of the factors which significantly affect dhufish's capacity to survive handling and barotrauma.

Table 3.5 Dhufish tagged and recaptured.

Depth	Tagged	Recaptured	% Recaptured
10-19m	54	8	14.81
20-29	156	24	17.14
30-39	291	24	9.20
40-49	436	23	5.27
50-59	68	0	0.00
60-69	48	1	2.50
70-79	6	0	0
80-89	15	1	6.66
Total	1074	81	7.54

But species are different.

Table 3.6 Pink snapper tagged and recaptured (outside Shark Bay).

Depth (metres)	Tagged	Recaptured	% Recaptured
0-10m	57	3	5.26
10-19m	213	18	8.45
20-29m	123	11	8.94
30-39m	150	9	6.00
40-49m	163	16	9.81
50-59m	54	2	3.70
60-69m	10	1	10.00
70-79m	12	2	16.67
80-89m	65	7	10.77
90-99m	15	1	6.67
100-109m	62	1	1.61
110-119m	14	0	0
Total	938	71	7.57

It's about equity mate.

The biggest single issue is about equity. It is all very well to talk about fisheries management but the recreational sector is saying, okay it is the same stock, so when is the equity going to come in terms of management?

Two previous speakers have talked about the unfettered and uncontrolled recreational catch. I think that is a furphy. I think that the capacity of the recreational sector to destroy the resource is something that is rolled out as alarmist to avoid taking an objective look at management of a resource.

There is very little evidence to suggest that recreational fishers will crash a fishery. The Shark Bay pink snapper are an exception but they are very specific in terms of their location and very vulnerable by reason of spawning aggregations which are targeted. Reefishwest, for example, wrote back in 1997 when the eastern gulf was in severe trouble that we should be assessing the western gulf and Freycinet Inlet in the same way and looking at recovery through closed seasons. The fact that did not happen has led to some of the problems.

Please do not tell me the commercial sector fishes for the entire community. We do need to get some research about the needs and drivers of fish consumers and what the real impact on our society would be if tailor, for example, were no longer available for sale. The commercial supply of fish is very important but theirs is a money-making exercise and the consumer needs and wants are very poorly understood and politicised to meet a commercial fishing objective.

Please do not tell me it is all too hard. When I first started in recreational fisheries management some 20 years ago, no one released fish that they were legally permitted to keep from salt water. If you arrived back at a boat ramp and said you caught a fish and let it go, people would have taken you away in the little rubber ambulance and locked you away. The changes in attitude have been phenomenal, public attitude changes have been revolutionary and if we move together as partners it can continue to grow in that same way. Recreational fishers also need to improve the partnership with other users.

Fisheries management is really about getting the best return for Western Australia and from each dhufish. One of the objects of the *Fisheries Resources Management Act 1994* is to maximise the economic and social return from the resource.

While it is very important to talk about the potential impact of recreational fishers, we also need to recognise the economic benefit which accrues from recreational fisheries. The two go together. You cannot have people say the recreational fishers are killing all the fish without recognising the economic benefit, and you cannot recognise the economic benefit without recognising that we also catch fish and kill them.

We are concerned about the lack of commercial controls. Recreational controls in recent times have been quite significant although it is fascinating to see the bag limits were lower at one time in history, when the bag limit was three. Current management proposals and information raising such as through this workshop have been driven by the recreational sector to a large extent.

At Recfishwest we are continually being lobbied for greater controls on recreational take, from people who are worried about the long-term future of a quality recreational fishing experience. Things like the Cockburn Sound pink snapper spawning closure, for example, were driven entirely by the recreational fishing sector.

The recent introduction of state-wide possession limits have had a significant impact, particularly in the north and this is not being recognised very much in the assessment of overall impact of recreational fishing on stocks.

When the Shark Bay snapper inner gulf fishery had problems it was closed. It was done so controversially, but it was done with the support of the peak recreational fishing body Recfishwest and most of the regional Recreational Fishing Advisory Committees (RFAC), although there were a few political issues. The fishery has recovered remarkably well to the extent that 4100 pink snapper were tagged in the eastern gulf recently in a research project for the Department of Fisheries, and 100 of those fish were recaptured during the 10-day time frame for the project.

Ironically, when the Shark Bay outer gulf snapper stocks had problems, largely due to commercial exploitation, the management proposal was to reduce the size limit to accommodate the mortality of fish which were taken at depth. Tagging figures that we have here show that if you handle the fish well, mortality in less than 100 metres is not a significant problem. What we would ask is “why are recreational fishers being asked to close the inner gulf snapper fishery when the commercial sector is saying that management for the oceanic stocks has to change to suit their practices rather than having the fishermen change their practices?”

The community spent a million dollars buying out commercial fishers from south coast estuaries and bringing in management. The scheme was specifically designed to shift catch from commercial to recreational fishers. The commercials had a bit of a whinge about the impact of the management plan that was developed in consultation with the community and they got 10 extra concessions. The concerns of Recfishwest were totally ignored. Overall we basically had a three percent reduction in catch in the south coast estuaries for a million dollars and that impact will be less with the liberalisation of the rules for commercial fishers. In addition, we have been buying back herring traps on the one hand and giving them back with the other. In reality, we are being patronised from an equity perspective.

What we are saying is “if we are fair dinkum about Integrated Fisheries Management we have to treat both sides equally. We have got to recognise that the recreational sector is a legitimate stakeholder, and while we do have an impact, we also have an economic benefit.” This is the reason why recreational fishers consistently raise the fact that they do not have any problem with taking significant extra management but we want it to be consistent with our economic benefit and our overall impact.

The Wetline Review is coming, and to be fair, the bits that we have heard about will be powerful. It should address many of the concerns about the commercial fishing industry by the recreational fishing industry, but the development process is very slow and the implementation processes are also very slow. We have been promised shark management for three years because two of the species are way, way, way below sustainable levels.

Recreational fishers, because you can manage them and they have a legitimate role, do not have objections to a small profitable commercial wetline fishery.. In most cases the commercial fishermen in dedicated wetline fisheries do care about the fish as much as recreational fishers. This concern for the resource is an important fact we have to acknowledge and it makes negotiation with those people much easier. Warren Aitcheson's livelihood does depend on having a sustainable resource and he is not out there to cut his nose off to spite his face by destroying the fish stocks.

Spatial and temporal management is extremely important when it comes to scalefish. For most recreational fishers, Integrated Fisheries Management is about scalefish. We know what the results are most likely to give us on rock lobster; we know pretty well what it is likely to give us on abalone; we do not really care much about prawns or scallops or pearls. IFM is really about scalefish, and also the interactions from things like shark fishing and Commonwealth managed fisheries.

There are two very important parts to spatial management. One of them relates to prime recreational fishing areas such as the Perth metropolitan area as alluded to by Pat Shinnick. Recreational fishing effort is concentrated significantly around access points. Those are the places where the recreational fishers fish much more heavily, and in terms of spatial allocation there is a strong case for having priority access going to the recreational sector in the areas where it is most accessible to them. There are some issues with the commercial fishermen having to travel further which will increase their on-costs, but if you look at the overall economic benefit in the area from Mandurah to Two Rocks, it is the most important recreational area for scalefish in Western Australia.

The second problem is the barotrauma problem and spatial management. It has been frequently put to me that if all or most dhufish are dying when caught in depths greater than 60m, and it looks like it is a major problem, can you solve it with spatial management? The answer is yes, but you have to be extremely dedicated in doing it. How do you keep commercial and recreational effort out of the deeper water, especially given that it is a multiple-species fishery?

Guy Leyland gave you a list of just some of the species which are caught in waters deeper than 60m. So how do you stop someone from going out to fish for pink snapper in deeper waters and catching undersized dhufish which they are killing? In order to do it you need to have things like Global Positioning Systems or Vessel Monitoring Systems capability on recreational boats, and the compliance costs would be horrendous.

This type of management is a potential solution if the barotrauma is that big a problem, and early indications show there is a really, really big problem. But the solutions are extremely difficult.

Are there times when the dhufish are particularly vulnerable such as when spawning as we already know with snapper? We have heard that to a certain extent they may be seasonally vulnerable. Many people have said well perhaps you can just have spatial and temporal closures just during certain periods of the year.

One thing you have to remember is that dhufish are spawning from about December to March. If you catch a dhufish from about July onwards they will almost certainly not

spawn that year anyway, even if they survive. The post-capture trauma will be such that they will reabsorb their eggs and will not be able to spawn during the coming season.

So if you want to protect dhufish while they are spawning, that is one thing. Do they aggregate, as Greg Jenkins has said? I would be amazed given the small size of the mature testes and other information that they do anything other than pair spawn in very local areas. This is extremely important but it has not come up yet and has not been assessed.

Not one dhufish which has been recaptured has moved, within the quite sophisticated measurements of differential GPS. The good news is that if you catch a dhufish and release it, the person who is most likely to catch it again is you because you know where it came from. The little fish is not going to move from where you released it. The bad news is that they do not move, and that means they are vulnerable to other people fishing the same areas. Interestingly, the legends of them following the rock lobster “whites run” and spawning cuttlefish has not held true.

We got a really interesting recapture of a fish that Gary Shugg caught that was out for nearly three years in 10m of water up Lancelin way. It was recaptured in 12m of water which in that country could be as little as five metres from where it was originally captured. It had grown and done really well but had not moved.

So the belief that they recruit into very specific reef areas at about 30cm in length might be an extremely important factor in terms of distribution of fish. It might well be that dhufish do not move from an area much larger than this lecture theatre over most of the rest of their lives. That is pretty unusual. The dominant male theory that Warren Aitcheson put forward and I have had put to me by many recreational fishermen, may have a lot of validity in the real world out there.

Bag limits can make a difference in some circumstances and one of the reasons is although they only affect small number of people it can be a much larger proportion of the total catch because of the highly skewed nature of the catch. Although it only impacts on two percent of anglers, the actual number of the fish which are benefiting can be much greater.

The other very important thing is that bag limits represent a very important social constraint that people use as a measure against what they consider to be a reasonable catch. Peer pressure is, and probably will be for the foreseeable future, more important in recreational fisheries management than ‘big stick’ compliance.

One of the reasons that the management of fisheries in Western Australia is so highly regarded around the world is exactly what you see when you look around here: a partnership between Fisheries Officers and Volunteer Fisheries Liaison Officers, each undertaking a role extremely well and both helping the community reinforce the fact that the majority of people try to do the right thing.

Is a tagging system like that used in Shark Bay a viable option for dhufish? This scares a lot of people because they are worried about having to pay \$10 per tag. But if you are going to be limiting total catches, it is something that may have to have to be considered

both recreationally and perhaps ultimately, commercially. Let us not forget the icon status of the fishery.

I need to point out the number of people who have said they hate the new bag limits, because it forces people to 'high-grade'- that is returning small dead fish to keep a larger fish caught later. Someone said they had to kill 40 dhufish to take eight. Some people say this because they want to get up the nose of the Department of Fisheries.

I can assure you the Department of Fisheries do not care that you are high-grading; they do not care in the slightest. What they do care about is that you are killing fish. They care about the total mortality, so if you are telling them that you are killing 40 fish to keep eight, they will be undertaking the management and stock assessment based on killing 40 dhufish.

That means ultimately the overall recreational catch will be reduced. If you are high grading, please stop, because you are cutting your own throat and you are cutting our throat and you are affecting our future fish stocks. I know it is really difficult to release a 10kg dhufish when you have a 52cm one in the ice bucket, but as I have said before the good news about them not moving is that the person most like to catch it later if you release it using a release device is you!

I have had 10 recent phone calls from parliamentarians about removing the size limit because of the barotrauma issue. They are saying if all of the dhufish are dying, then if we remove the size limit that will not be a problem.

I oppose that line of thinking for two reasons. One of them is it just puts the high grading problem back to a different level. If you are currently high grading with fish at the current size limit of 50cm you are still going to be high grading with no size limit but you are going to have little fish in your possession. The other problem is that particularly in the central west coast, such as the Jurien, Cervantes and Lancelin area, on the inshore reefs there are lots of small dhufish 30 to 35cm. Many of these would be killed because the fish are so highly prized, people would keep them. The mortality rate in areas shallower than 40m is pretty low.

If you do want to remove the size limit, then we have to consider carefully what the consequences might be. Again it will be the total mortality that will be used to determine the allocation to the recreational sector which would include the charter sector.

Maximum size limits have a bit of benefit and based on the biomagnification of large animals in terms of egg production it may have more use in the case of dhufish than in other species. It is a great concern that you do not see very many large female dhufish any more. If you look at all the pictures that are in the newspapers or club newsletters, they are all large male dhufish. I see very few female dhufish that are over 80cm anymore and if you have anecdotal evidence that is not the case then I would be very happy to hear it.

You can tell the difference between the sexes of dhufish via external characteristics. The creative use of maximum size limits has some benefits, noting however that we have this barotrauma problem. Also a maximum size limit can be imposed in

conjunction with slot limits, or you can have a combination of maximum size limits for some time.

Another option might be that you are only allowed dhufish above a certain size during the months of October through to March, so you might have a slot limit of 50 to 80cm during those months. Or you might conversely apply the maximum size limit during winter when people are less likely to be venturing 30 miles offshore and less likely to be catching fish in 60, 70, or 100m of water.

One thing that is becoming increasingly apparent and will be more so with dhufish, is that each individual fish is important. What I am hoping will come out of today is that Warren Aitchison and other commercial fishermen will increasingly recognise the importance of each fish and specifically the large females and will work on returning undersize dhufish taken in the commercial catch in the best possible condition.

The recreational fishers are doing fairly well, but we need each of you to tell 10 to 20 other people about the way to release dhufish because we need to get an attitudinal change throughout the entire industry. Survival definitely improves with good handling. I need to point out clearly that the depth release device that many people are using was designed by Gary Lilley, a keen recreational fishermen who got tired of seeing dhufish float away with the current and came up with this design which is now commercially available. I have had contacts from three continents with respect to the use of this device, not just for dhufish but for other demersal fish which are particularly prone to the impact of barotrauma.

The release weight is working very well. It is not the complete solution for saving the dhufish, but it has gone a fair way towards addressing some of the problems. It is not difficult to use, once you have spent a bit of time with it. The other thing which is interesting is that fish which looked badly damaged are being recaptured. We originally thought that any fish which had exophthalmia (popped-out eyes) was dead, but we are starting to get tags returned where the comments quite clearly say "badly bulging eyes, stomach protruding from mouth, fish floated away on the surface". The survival rate is probably pretty low, but a fish that is released, or released in good condition, has an infinitely better chance of survival than one that sits on the bottom of your boat or, heaven forbid, you chop it up for bait because it's small and it is in pretty poor shape.

Integrated Fisheries Management will decide the proportion of total catch, and it is the critical thing that both the commercial and recreational sectors are waiting for. It will flow from the Wetfish Review when they bring in commercial management. Somebody somewhere is going to have to say the recreational sector gets 40, or 50, or 90 per cent or some figure of the dhufish catch and the associated finfish which are part of the catch taken in association with WA dhufish.

Obviously Recfishwest will be working for as large a share as possible but everyone needs to be aware that the commercial sector will also be arguing for as large a share as possible. This is the critical decision in the next 8 to 10 years with respect to future fisheries management.

The Department of Fisheries are looking to move towards IFM for rock lobster and abalone before they get onto scalefish. Recfishwest is keen that they do rock lobster

and then scalefish, because this group of fish is of most importance to us. Abalone is going to be an interesting debate but it is not the one which is of most interest to recreational fishers. Rock lobster is a good fishery to start with because the catches are pretty well understood, movement and mortality are pretty well understood and we can get some of the ground rules for IFM worked out.

The proportional share for each IFM assessment will ultimately be converted to tonnes, given the best available research. There is no doubt that in the allocation and final management discussions we will be talking about the need to get good quality and more research.

It takes time to get quality research and we better start now because when we are starting to allocate these things like dhufish shares we are going to have problems. The recreational sector will be largely responsible for managing our share and to determine the management responses if the catches exceed the quota which will be expressed in tonnes. Trading between the sectors needs an awful lot of work.

One of the future management scenarios is that the recreational sector gets allocated a share and underutilises it. What happens to the fish which are underutilised? Do they go to the commercial sector? Does the commercial sector lease it from us? Do they buy it from us? These are the things which cause the Recfishwest Board to work late into the night. They also need careful consideration by the Government.

In terms of the survival of dhufish, you can see that depth release devices are working extremely well. If you think about the presentation that Greg Jenkins of Challenger TAFE gave about the capacity for capillary collapse in swim bladders, maybe it is not surprising that venting does not work that well with dhufish. They have a lot of blood vessels on the upper surface of their swim bladder which are susceptible to trauma. Sticking a venting needle into it might cause them to bleed and reduce their survival. So we do not know at this stage, but the survival using the range of release types is definitely different.

The way forward is that we definitely need more research about the recreational catch. We cannot go into management with an assessment of the recreational catch of somewhere between 130 and 570 tonnes. We need to know what sustainable catch levels are and we need to know how sensitive those levels are when being set. So we need to know whether the sustainable catch share for the recreational sector ultimately translates into 250 or 400 tonnes plus or minus 10 tonnes; plus or minus 50 tonnes; or plus or minus 100 tonnes.

On species like herring or salmon we know the variability probably does not matter very much, as they are quite robust. With rock lobster we will probably be worried about the second decimal place in terms of recreational percentage allocation because they are high value. We need to know how the various fisheries management tools might be applied to ensure the recreational catch share is managed once it is allocated.

The worst-case scenario in terms of allocation and management for the recreational sector is this one, and this unfortunately is typical of management around the world. We start out:

Table 3.7 Future allocation scenarios for dhufish.

Year After Allocation	Target Catch	Actual Catch	Fishery Management Response
1	500 t	510 t	Not too bad
2	500 t	525 t	Could be a worry
3	500 t	530 t	Better do something soon
4	500 t	500 t	See we told you it was temporary
5	500 t	540 t	Oh oh
6	0 t	0 t	Close the fishery

At a recreational catch level of 540 tonnes in year five, research starts to come through that the stock assessment was much more vulnerable than we first assumed. Fishing mortality is higher, natural mortality is higher, natural recruitment is low and the managers need to close the fishery. Under this scenario the people who lose the most are the recreational fishers and also the commercial fishers. This is not an unusual situation.

During all this the people who have the most to lose are saying “I have never seen so many small fish in my whole life and the Leeuwin current was really strong this year, there will be plenty coming through, we do not need to do anything,” until the fishery is closed. If you really want to be scared, read about the Canadian ground fish fisheries.

The best-case scenario is one where you have a little bit of pre-planning. At 525 tonnes in year two you automatically reduce the bag limit or bring in spatial closures for a month or increase the size limit or bring in a maximum size limit or a combination of these management measures previously agreed to. The recreational sector reacts quickly to a catch which is above the level of their allocation. The catch drops back down and sustainable fishing can continue. If you drop the catch to say 475 tonnes the stock might come back to what it was originally if, and this is a highly idealistic scenario, you might also get a bonus in terms of the target which is set because the overall sustainable catch to be set might ultimately be considered to be higher. However, the do-nothing option must be discouraged or the longer term consequences could result in total closure.

There are no quick fixes. If anyone thinks they can solve the dhufish problem here today or even in the next two years, I do not think it's possible. Dhufish mean a lot to many people, including the commercial fishers, and I think one thing we can take away from Warren Aitcheson's talk is that commercial fishers do care about the stocks and the resource.

Dhufish must be managed for the future. There must be better research and management solutions are not going to be easy. In order to manage dhufish sustainably there is going to have to be some pain. What Guy Leyland talked about though is that we need to share the pain; we have to ensure that everybody understands the part that they play will have some benefit in the longer term in the improved fishing quality in the recreational case and improved profitability and sustainability for the commercial fishers. We do need to work together.

We actually agree on many more things than we disagree. It is important in forums such as this to recognise that. The other thing we have to ask is there are a number of people here I have not met yet. We are going to need more bodies than we currently have to carry the load. There are people sitting in some of these rows that I know very well because I see them more often than I see my wife, because we go to the same meetings together all the time, but we get tired.

Sometimes it is a thankless task and many recreational fishers are very good at remembering the things you do that they do not like and not very good at all at remembering the things that you do that they do like, because they say it is obvious you should have done it in first place.

It does not work that way because there are a variety of opinions about what is important in recreational fishing.

Thank you.

3.5 Integrated Fisheries Management - Challenges by P. Rogers

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Integrated Fisheries Management: an essential step for sustainable fisheries management

Solomon was a very wise man because he knew if he was going to cut the baby in two the mother would cry out and he would know who to give the baby to, but in this case everyone wants to fish so I don't think Solomon would have had a chance. We have to think about different ways of managing our business.

Where are we now in Western Australia?

Much of where we have been is a consequence of our history and where we need to go is also a consequence of our history in terms of shaping the future. Most of our stocks in Western Australia are fully exploited, and there are a few that could be considered over exploited and clearly corrective action needs to be taken.

We have heard at today's workshop that competition between sectors has intensified. As the population increases that pressure will continue, real prices will fall and commercial fishers will have to work harder to maintain an income unless adjustment measures are available of sufficient scale, you will not be able to deal with the growth pressures.

Most stocks are fully exploited

Over the past decade there has been a significant shift in focus from commercial to recreational fisheries and other sectors. With sectoral management, you have to integrate exploitation of all stakeholders in terms of its impact on fish populations and deal with the issues which flow from increased exploitation.

We are increasingly subject to environmental scrutiny by the Australian Government. *The Environmental Protection and Biodiversity Conservation Act (EPBC Act)* is live and well. All of our export fisheries are subject to accreditation in terms of Ecological Sustainable Development and compliance with ecosystems based management approaches. We are living through this reality, dealing with 26 fisheries all of which must be completed by December 1, 2004. We are well down the track.

There are two things in the world of fisheries management that seem to be making a difference in the world's successful fisheries. One is a rights-based framework for all sectors not just one. There are a number of countries or jurisdictions that are starting to grapple with a total rights based management approach. The second is the use of environmental accreditation in terms of performance of fisheries management, using market incentive to get better management of fish stocks.

Many of you are probably heard of Toohey and the work that he has done trying to establish an allocation framework commonly called Integrated Fisheries Management (IFM) in the Western Australian context. That has now come to pass, but it has taken some years to achieve public and Government acceptance; and funding for the approach to proceed. A funding allocation for future years, to deal with IFM management implementation, was announced as part of this Government's budget.

Guiding principles for allocation

Fish resources are a common property resource managed by Government for the benefit of present and future generations. Who are the beneficiary sectors? In broad terms they are the commercial fishing sector, recreational fishing sector and customary fishing (indigenous sector).

Sustainability is paramount and ecological requirements must be considered prior to any allocation to user groups. Through the *EPBC Act* fisheries managers increasingly recognise the importance of sustainable yields in the context of all competing pressures and constraints on interfering with wildlife, including the influence of increasing marine reservation around Australia. All of you would be aware there is a push for at least a 20-30 per cent increase in closed areas by elements of the conservation movement. In terms of fisheries, that is not necessarily being driven by an Australian context but by an international context as a consequence of fisheries management failures in other jurisdictions.

A sustainable target catch level must be set for all fisheries and explicit allocations designated to user groups. Allocations should account for the total fishing mortality. We heard Frank Prokop say earlier that *"if you kill too many juveniles that's got to be taken into account in terms of the allocation"*.

Allocation decisions should aim to maximise the overall benefit to the Western Australian community and take account of economic, social, cultural and environmental factors. The methodology has been developed over the past three years to some extent.

Allocations should generally be made on a proportional basis because one can't always allocate on an outputs basis because output management may be too difficult or inappropriate. We can focus on inputs and deal with notional allocation in terms of catch, recognising that there are natural yield variations in fisheries. This is particularly true for fish such as snapper. We are starting to learn that there are peaks and troughs in recruitment which effect year to year production over long periods.

Allocations are notional and they depend on what sector you are talking about. If you are dealing with the commercial sector you can take the next step of actually allocating to individuals within the sector and allow market forces to work.

It is more difficult in respect to recreational fishing in the sense that you are dealing with a notional 'community' allocation. Someone has to take stewardship of the allocation, perhaps Government or some other body. Arrangements must provide users with opportunity to access that allocation.

Integrated Fisheries Management - framework

In terms of the IFM process, the Minister is proceeding with the appointment of a Ministerial Allocation Advisory Committee with three members. The committee will be expert based

The Terms of Reference will include:

- allocation of harvest level between sectors;
- allocations within a sector; and
- strategies to overcome spatial and temporal competition between groups/sectors at a local level.

We may not be able to manage all demersal finfish on a species by species or stock by stock basis, as it will be just be too expensive, especially in the initial phases.

Due to the breadth of diversity and arising complications one might assign a specific allocation for key species like dhufish or snapper (for example) and deal with the broader group of demersal fishes as an aggregate proportional share to cover 'other species' for allocations between sectors. No one is experienced in this process and we will have to go through a learning cycle as we progressively gain expertise in this new direction.

Data requirements

The process requires establishing baseline data. Baseline data needs are problematic. We need consistent year to year data. To achieve this we may have to re-engineer our business, and from a Department of Fisheries perspective, we may have to more strongly engage both volunteers and the recreational sector to work with us, to make sure we have better data sets.

Obviously, there will be a submission phase, as all sectors have an interest.

Allocation issues will need to be investigated and to assess where possible the costs and benefits of alternative allocation models.

There will need to be a draft report released that assesses submissions and a final report will go to the Minister for Fisheries. A determination by the Minister will result in allocations that will be set for five to ten years. These processes can't be managed on an annual basis. We will have to take five- or ten-year views of how fisheries are to be managed in the future.

Priorities and timeframes

The first fisheries for IFM review will be rock lobster and abalone. They will commence almost immediately because the data sets at least for the metropolitan abalone and rock lobster are fairly well established.

The west coast finfish sector, which is probably the most problematic sector to deal with, will have to go next and I believe it is a priority to go next. Some of the elements of getting there are progressing. We have the Wetline Review which is planned to be finalised by August 2005. We are planning to do a recreational creel survey for the west coast from the end of 2005 into 2006.

There will be focused research on demersal finfish species:

- mortality research (2006)
- spatial scales of exploitation (2006)
- spawning aggregations (2007)
- assessment of status of key demersal stocks (dhufish, snapper) in 2007

There has been a fair bit planned and there is a fair bit progressing. If we can do it earlier, fine, but the earlier it commences the more it will be based on less quality information. Noting that not having all the data in itself is not a reason not to make a decision. I believe it is much more important to make a decision and move on and use adaptive management to improve performance in the management of each sector as we progress.

Future challenges

Meeting data requirements is the greatest challenge. The most essential focus is having consistent year-to-year data sets, collecting the right data and validating that data. We do not have a regular data system that allows integration of recreational fishers in recreational year-to-year catches. We have to address this need and re-engineer the way we collect information.

The compliance needs are about data validation and as the actual form of management changes, there is nothing surer than as management complexities increase, the cost of management goes up and the risks around non compliance increase.

Evaluation opens up new doors. How are you going to address the question of allocation? What are the net economic benefits? How can you best improve those net economic benefits over time? It may not just be between sectors but it can also be within sectors as to how you maximise economic performance over time.

The last thing I want to talk about is the 'vision' for future allocations. One could start setting goals for future marine resource use. In Canada, one approach for dealing with allocation between sectors was to simply identify two species of salmon, and decide that one should go to the recreational sector and the other one should go to the commercial sector. You might wonder about the wisdom of that, but that is one tool for actually dealing with allocation.

If you are trying to deal with the complexities of thirty-six fisheries or more it may be better to take a leap forward when we consider the west coast and look at the total bioregion and make judgements about current and future management for our fisheries. That may actually help policy makers and sectors plan for future change without it

being sprung on them. So you could end up with a mixture of future directions and allocation between sectors, and spatial and temporal separations as part of a total mixed package. All of this is technically feasible. There are many ways to deal with the issues of allocation.

So the structure and form will matter. We will need to change our management consultative processes. Potentially that could also lead to much greater control by sectors as this proves successful. The two sectors making their own management decisions within the bounds and limits of allocation and sustainability.

I must comment on the question of marine resource management in terms of marine resource use planning. This is the most critical issue I believe facing all of us over the next decade or two. We have in fact a number of processes in place. One dealing with marine parks and marine park planning. The difficulties of allocation will be recognised as the proposed Capes to Capes Marine Park plan comes into the public forum and people carry out the debate. The debate will swing between the desires of larger community of Perth and Western Australian and those of the local community, in terms of what are the best usage outcomes for fish stocks. I can see that debate looming large.

Also looming large is the broader issue of bioregional planning. That is planned to unfold in November this year as a joint venture exercise between the Western Australian Government and the Commonwealth Government via the National Oceans Office. The area of interest, to give you an idea of the magnitude, will extend from roughly Kalbarri to the South Australian and Western Australian border in the first instance. This is yet to be fully clarified. That process will unfold over the next two or three years.

Conclusions

ESD is leading to a total resource management framework for fisheries.

The determination of sustainable harvest levels and the allocation of explicit harvest shares is essential. Unless we address that in the face of growing population and improving technology we will lose more and more fish stocks – guaranteed.

There will be new demands for data collection, research, assessment methodology and public policy platforms supporting the process. This will be an evolving process and I can guarantee you the first time we do it, we won't do it that well, the second time we'll do it better, and by the time we have gone through a decade of this, we won't sufficiently recognise where we have been in the last ten years in shaping that process.

We will have to set up mechanisms to deal with allocation and reallocation between sectors. Whether these are administrative or market based, is yet to be determined. Preferably market-based, because then you don't get a bureaucrat telling you what to do. You can actually allow the market to do that for you. For that to work for the recreational sector, you have to somehow improve your own financial powerbase so you become an influential partner in the market place. This is a very important issue.

The new management framework will require knowledge based decisions supported by appropriate legal frameworks and processes. There will need to be new law, new policy

guidelines and so on, and these will develop as we go. It will need better stakeholder and community participation, both in terms of management of the sectors and allocation processes.

I have already covered the question of structural adjustment mechanisms and the issue of compensation as you change allocations from one sector to another over time. If it is market driven it will be driven by price, if it is administratively driven then you will have to have allocation adjustment mechanisms for specific sectors. If you move down the rights-based framework, people tend to think that they have commercial value and in reality they do. We have a rights-based framework for the commercial fishing sector which is worth about 2.6 billion dollars. As for the total framework, I don't know what the recreational sector collective value is worth but it is likely to be substantial.

This overall policy development is evolutionary and will take considerable resources and time to fully implement.

The final objective is ecologically sustainable fish resource use, which is enduring and meets the requirements of the community as the use of fish continues to shift with new knowledge, attitudes and values over time.

That's the challenge, ladies and gentlemen.

3.6 Discussion Panel #3

Panel Members; Andrew Cribb, Ian Curnow, Dr Dan Gaughan, Guy Leyland, Frank Prokop and Peter Rogers.

Question 1: Do you recognise that recreational fishers have the moral high ground regarding limits imposed on them? When will commercial fishers come under wetfish management, 2005? And will the Department of Fisheries have the clout to deal with commercial western rock lobster fishers?

Response 1: (Peter Rogers) Yes, yes and yes.

Question 2: (Question to Andrew Cribb) I would like to point out that your presentation had some incorrect data. For example, there was a 10 dhufish bag limit at some stage in history of recreational bag limits.

Response 2: (Andrew Cribb) Thanks, I'll take that on board.

Question 3: Will the 1997 cut off date be adhered to?

Response 3: (Peter Rogers) There is no question in my mind that it will be used; otherwise it will be grossly unfair. Considerable weighting must be given to the pre-1997 cut off date advised by the Minister of the day. (Norman Halse) The 1997 commitment was given for the situation at that time; it is now a complicated issue.

(Peter Rogers) We need to give weight to different circumstances. Someone that was in the wetline industry in 1998 who has not fished since is an issue that will need to be addressed.

(Guy Leyland) Advice from the Minister was that the 1997 cut-off may not be taken into account for allocation purposes.

(Ian Curnow) It is important to note that the total catch will not have anything to do with the pre-1997 cut-off date.

Question 4: There appears to be a problem with increased effort of charter boat fleet via increased boat size, allowing upgrading from 12 to 20 pax. Is there a chance of this happening in the commercial wetline?

Response 4: (Ian Curnow) No.

Question 5: Can the information from fishing diaries as part of licence requirements be used to collect information for policy decisions?

Response 5: (Andrew Cribb) Yes, we looked at that information to give a trend of catch rates ten years ago but it wasn't a good spread of information, however it will be revisited.

(Peter Rogers) We need to go down various paths to gather and validate data, diaries, creel surveys and data validation via inspectors. The Department needs to better integrate the data from all sectors.

(Frank Prokop) We require good real-time data from the recreational sector. We must know what recreational fishers are catching. This will be an expensive and difficult problem to overcome.

Question 6: How will the allocation proportion be decided?

Response 6: (Peter Rogers) There have not been any decisions yet. The Economic Regulation Authority are studying this from net economic value: cost/benefit, value of next fish caught, but this is just one element to take into account, there is a historical context, the decision will need to be one of fairness, one of judgement.

(Frank Prokop) Three models that have been put forward by the different sectors. The historical model by the commercial sector, the soft landing model by the recreational sector and the green fields model by the conservatives.

(Frank Prokop) the Western Australian Fishing Industry Council and Recfishwest will need resources to argue their points to ensure a quality community decision.

Question 7: What process do you use to scrutinize padded returns by commercial fishers?

Response 7: (Peter Rogers) Data validation is important. The returns are a statutory declaration; they are committing fraud if they are reporting in a padded way.

(Warren Aitchison) The Australian Tax Office does not have access to our returns.

Question 8: Restrictions have been placed on recreational fishers but they don't seem to have flowed onto commercial fishers.

Response 8: (Andrew Cribb) Yes, that is true, it started in 1997, recreational fishers did go first but commercial fishers are now facing the Wetfish Review.

Question 9: Will the wetline review take another 10 years?

Response 9: (Peter Rogers) No, the wetfish review was given to Government in August then released for comment; we then need to deal with adjustments, etc. Equity issues are being dealt with; Government will make a decision hopefully before the end of the year.

Question 10: Western Rock Lobster fishers have to have logs. Why don't recreational fishers have to fill out compulsory diaries?

Response 10: (Andrew Cribb) We will not get accurate records, better to get more accurate information from those willing to do them voluntarily. For example a Fisheries Officer that manages a group of recreational fishing volunteers.

Question 11: What of the cost?

Response 11: (Frank Prokop) The cost of fine scale management? It depends how much are you willing to pay for this type of management?

Question 12: I think this is leading to a saltwater recreational fishing licence to fund this?

Response 12: (Peter Rogers) I have advocated recreational fishing licences for 10 years and have drafted these to government four times and each time it was discarded. It is a political issue. We need to convince the people of the need for licensing to fund recreational fishing research for future

allocation/reallocation. The Government has been allocated four million dollars towards the IFM process. That is a start, although not enough. Momentum is increasing over time and leading to significant progress and change in the future. Other States are going the same way with other allocation methods, for example, in New South Wales they closed estuaries to commercial fishing, and in the Northern Territory mackerel fishing allocation was determined in terms of recreational, commercial and aboriginal allocation.

Question 13: What are the legal ramifications for removal of rights for commercial fishing?

Response 13: (Peter Rogers) Provided it is done fairly there should be none if dealing within a sector. If there is reallocation between sectors it may be considered. I prefer a market situation and while we have a recreational sector with no political power it will be difficult.

(Frank Prokop) The recreational sector is penalised by the market for example, over- and under-harvest.

(Warren Aitchison) The problem with market pressure on commercial fishing is if they need to pay for extra allocation then they are putting more pressure on commercial fishers to catch more.

(Peter Rogers) Conversely, if you have one million tied up in a licence and the fishing collapses then the licence is worth nothing.

CONCLUDING REMARKS

Peter Rogers

I found this to be a very constructive day with a lot of lucid comments; first coming from research by Alex Hesp, Greg Jenkins and Dan Gaughan presenting an array of data which I think improved all of our knowledge about dhufish.

In terms of the stakeholder representation, clearly the commercial perspective was interesting and enjoyable and was well presented and it certainly gave some insights to aspects of a commercial dhufish operation.

Some of the ideas that came from the recreational perspective were interesting and certainly some of those ideas haven't been lost and I'm sure they will re-emerge somewhere down the track.

The charter perspective again was valuable, and I thank you for that. Certainly all three presentations suggest that there is continuing depletion in near-shore areas and in the light of all those experiences I don't think that message was lost, it was clearly understood.

In terms of the Government and industry representatives, clearly they have painted a picture in terms of where we are today. There is probably a lot more going on and there is a lot more that needs to be done, there is no question about that.

Where are we with dhufish? Clearly the management of the demersal commercial finfish fishery is critical and it needs to be brought into place as quickly and practically as possible. We know the time lines on that and we have to deliver on those timelines as fast as possible.

The allocation question is a world first as to how we are going to go forward. It poses considerable challenges and I have no doubt that those challenges will take time to evolve but in the end it needs to be effective to ensure our resource sustainability. As I often say that's *Fishing for the Future*.

I congratulate the organisers, particularly Recfishwest for putting this day together. What it does point to is the opportunity of doing this at least once a year, particularly over the next two years. The rate of change on the west coast is going to increase and increase considerably, not only for the Department of Fisheries and better managing this resource, but also for a whole array of other stakeholders affecting access to the west coast.

Frank Prokop

Thank you everyone for coming out on a Saturday. We are glad that many of the key players are here. It is important that the key players are actually the participants in the development of management in fisheries.

I think this is a wonderful day because it was done under a spirit of cooperation and common vision. We have had the Department of Fisheries, we had WAFIC and the commercial fishing industry coming together with recreational fishers to share concerns about a common problem, which is the sustainability of a resource and a stock that we all value and prize.

When you cut to the quick, sustainability of dhufish is an integral part of being a Western Australian, because dhufish are an iconic species. If we have to face the rest of the world and say that the one fish that we have that is unique and highly valued we would feel shame if it were not looked after and we couldn't tell everybody about the fishing experience.

There's a lot to be done. The path will be difficult, but the challenge is to raise the awareness of some of the pathways. Recfishwest ran this workshop because we are continually being told that we know hardly anything at all about dhufish. Well, some of these talks today showed we actually do know a reasonable amount about dhufish. However, there is much more that needs to be done in order to manage these stocks sustainably so that we can pass the legacy on to our children of the quality fishing we have come to expect.

A special thank you to Heather Brayford for facilitating today's proceedings, thanks to the Department of Fisheries and Peter Rogers, thanks to WAFIC, Guy Leyland and all presenters, thanks to the Recfishwest Board and staff, RFAC and Volunteer Fisheries Liaison Officers (VFLO's) that helped out here today.

Now go home and think of ways to develop management strategies for the mighty dhufish.

APPENDIX

Abbreviations

AAA - Australian Anglers Association

ADU – Aquaculture Development Unit (Challenger TAFE)

ANSA – Australian National Sportfishing Association

CFL – Commercial Fishing license

CPUE – Catch Per Unit Effort

CAESS - Catch and Effort Statistics System

DGLMF – Demersal Gillnet and Longline Managed Fishery

EPBC Act - Biodiversity Conservation Act 1999

ESD – Ecological Sustainable Development

FBL – Fishing Boat License

FRDC – Fisheries Research and Development Corporation

GPS – Global Positioning Systems

IFM – Integrated Fisheries Management

LFB – Licensed Fishing Boat

MFL - Managed Fishery Licence

MLL – Minimum Legal Length

MSE – Management Strategy Evaluation

RFAC - Recreational Fishing Advisory Committee

RRFAC- Regional Recreational Fishing Advisory Committee

SBSMF – Shark Bay Snapper Managed Fishery

VFLO – Volunteer Fisheries Liaison Officers

WAFIC – Western Australian Fishing Industry Council

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