The Northern Demersal Scalefish Fishery

A review and recommendations

by

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for

Kimberley Professional Fishermen's Association

SEPTEMBER 2008

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Executive Summary

The Northern Demersal Scalefish Fishery (NDSF) is a small but valuable demersal trap fishery based primarily on species of snappers (Lutjanidae), emperors (Lethrinidae) and groupers (Serranidae). The existing fishery is restricted to an area of about 220,000 km². The fishing zone covers an irregular shaped area extending about 1000 Km in length off the Kimberley region of Western Australia from S.W. of Broome to the Northern Territory border and lying between about 40 and 300 km offshore. Bottom depths are mostly between 50 and 200 m

The existing fishery is limited to 11 licences permitting the equivalent of 20 traps per day for an allocated number of days for each license each year. A larger number of traps may be used with proportionate reduction in the number of fishing days permitted. The fishery began in 1990 and in recent years has consisted of 5 - 6 boats each fishing more than one license for economic viability. The total allowable catch (TAC) deemed sustainable is 800 t annually. Fishing effort is regulated by an allowable number of fishing days set each year by the WA Fisheries Department. It amounts to about 100 days per year. The gross value of the fishery at point of first sale is currently about $5-6 million.

Like virtually all Australian fisheries, the NDSF faces an uncertain future, not from a decline in the resource but because of ever increasing costs, requirements and restrictions imposed by management. Although catches remain excellent, two quite different pictures of the sustainability of the fishery appear in the literature regarding it. One depicts it as well managed and certifiably sustainable. The other expresses ongoing concern that it is being quite heavily overfished. The well managed view has been presented to state, national and international agencies where recognition for good management would be desirable. The negative view in which overfishing is emphasized has appeared in a context where this would be in accord with environmentalist sentiments, regulatory aims and funding needs.

From consideration of the number of traps used and fishing days permitted it can be estimated that only about 0.2 of 1% of the primary fishing zone is actually fished each year. In other words, at the currently mandated level of effort it would take 500 years to fish this entire zone just once. From the total annual catch and size of the fishing area one may also estimate the annual harvest rate to be 9 kg/km² or 90 g/ha. This is less than 1% of the global average for fisheries and less than half of !% of the sustainable yield for beef on moderately good grazing land. The claims of overfishing seem unlikely.

The estimate of virgin biomass used to determine the TAC was based on experimental trawling by the CSIRO between 1978 and 1980. The total catch of the principle species in the fishery was only a fraction of a single day's catch in the current fishery. A similar estimate based on the catches of the fishery itself results in a biomass and TAC some 20 times larger than that derived from the CSIRO trawl figures. Even then, this would still only amount to a harvest rate of just over 2 kg/ha. Trawling is simply an inappropriate method to determine the abundance of these fishes.

Additional methodologies used in ongoing assessment of the stocks in this fishery include a half-century old population model of questionable applicability and age determinations for limited samples of the catch with no analysis of variance between

samples from different locations and over time to indicate whether the observed age structure may be the result of the fishery or is only natural variability.

To explain the continuing good catches despite over a decade of ongoing claims of overfishing the hypothetical possibility of "hyperstability”. has been suggested. The idea is that these fish form aggregations which the fishermen target so that catches will remain good right up until the last fish enter a trap. This, however, is only unsubstantiated speculation and it is refuted by two important facts. One is that excellent catches have been made in hundreds of different widely scattered locations throughout the fishing zone, not just in a few locations. The other is that similarly good catches have resulted on research trips when fisheries personnel, not the fishermen, have chosen where to fish.

In this fishery, as in many others, the precautionary principle has been improperly applied. Although its proper application has been clearly determined to be when there is a threat of irreversible or significant damage. It has been widely invoked where the threat is not apparent but only a hypothetical possibility and the putative harm neither irreversible nor significant but easily reversed should it actually develop.

The management issues raised here are unfortunately not unique to the NDSF. Around the nation Australian fisheries are in widespread decline in terms of production, profitability and participation. Our fishing industry is in decline in every important respect save the resource itself. With the largest *per capita* fishing zone in the world, Australia has the lowest harvest at only 1/30 of the global average. We also have the world's most restrictive and costly management. The AFMA budget alone amounts to over $100,000 per vessel each year. Huge increases in expenditure on management have delivered only declining production and profits.

Australia has the largest remaining underexploited potential for fisheries and aquaculture in the world. Properly developed it could be a major drought-proof food producing sector, a significant contributor to the health and wealth of the nation and a wholly renewable resource. This is a matter of national importance and government is being badly misadvised by office based agenda driven management claims bearing little resemblance to the actual resource. Genuine science is based on evidence not opinions. Our marine resource management has come to be dominated by claims of scientific authority based on unverified theories and models plus a generous misapplication of the precautionary principle with scant empirical evidence.

There is clearly a much more substantial resource in the NDSF than has been estimated. Implementation of a more experimental, empirical and less restrictive approach to management with improved data collecting and monitoring could be undertaken with no risk of any significant damage. Management that reverses the downward trajectory in Australian fisheries and results in increased production and productivity would be a major achievement well deserving of all due recognition for those who might achieve it. Effecting this would require good co-operation between management and fishermen with some degree of compromise on both sides but it is eminently doable. It is an approach worth serious consideration.

Overview

The Northern Demersal Scalefish Fishery (NDSF) is a small but valuable demersal fishery based primarily on species of .snappers (Lutjanidae), emperors (Lethrinidae) and groupers (Serranidae). Goldband snappers (*Pristipomoides multiden)* and red emperor* (*Lutjanus sebae*) comprise over half of the catch. Fishing is done by heavy steel mesh traps that are near square in length and width of about 1.5 m by about 0.9 m high.

Fig. 1. NDSF fish trap

The regional fisheries area comprises the coastal waters out to the EEZ limit between 120°E longitude and the Northern Territory border near 129°E longitude. The total regional fisheries area is 483,600 km². For management purposes it has been divided into two areas. Area 1 comprises the inshore waters up to about 25 Km offshore and Area 2 comprises the remaining offshore waters out to the limit of the EEZ Area 2 is further subdivided into A, B and C Zones (See map p. 54). The existing NDSF is restricted to Zones A and B of Area 2 which comprises about 220,000 km² lying mostly between the 50 and 200 m isobaths. Approximately 90% of the NDSF catch and effort comes from the B zone which covers an irregular area of about 90,000 km² extending 1000 km in length between 40 and 300 km offshore.

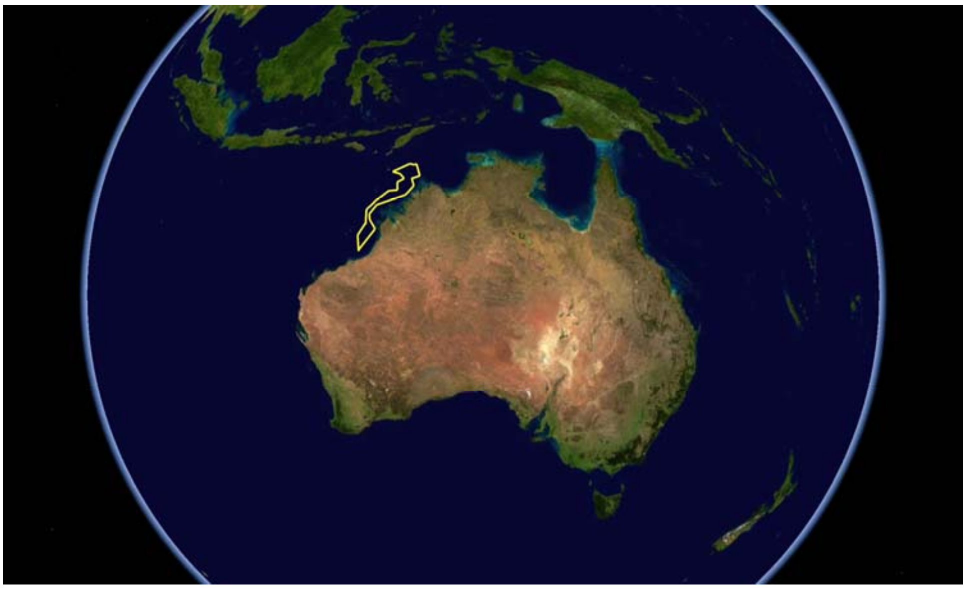

Fig.2. NDSF B zone area outlined in yellow

Licences to fish the NDSF have been limited to 11 since 1997. In recent years 5 to 7 boats have fished the 11 licences. Each licence permits use of the equivalent of 20 traps per day for an allocated number of days each. A larger number of traps may be used with proportionate reduction in the number of fishing days permitted. Additional management restrictions are imposed on trap size and number of fishing days allowed annually. Management has been aimed at adherence to a total allowable catch (TAC) of 800 t.

Anon. 2004b reported that the total catch in the fishery steadily increased during early development of the fishery from 1990 to 1992. A peak of 949 t was reached in 1996. A decrease in catch after 1996 followed introduction of management controls in that year. From 1998 to 2002 catches stabilised at 500-600 t and effort at 900-1100 fishing days at which level the catch was considered sustainable. This report also stated that the catch decrease from 2001 to 2002 was a result of a reduction in the total amount of effort utilised in the fishery (a large amount of effort remained unutilised at the end of the year). The catch in 2002 was 434 t. More recent catches have been: 922 t in 2005, 796 t in 2006 and 907 t in 1195 fishing days in 2007. The gross value of the fishery at point of first sale is currently about $5-6 million.

History

As early as 1935 Japanese trawlers carried out experimental fishing in northern and north-western Australia. Between 1959 and 1963 they conducted commercial operations west of 119° E. and from 1962 to 1966 additional research surveys were carried out as well. From 1962-1973 Russian research trawling was also conducted in northern waters. From 1971 to 1990 Taiwanese pair-trawlers then fished the region and Chinese pair-trawlers worked it in 1989 as well.

In the Kimberley region most of this early fishing was by Taiwanese pair-trawlers of around 40 m length and 300 gross tonns. They used trawl nets with a head rope width of about 100 m with a mouth height of 6-12 m (Ramm, 1994). Their catch and effort in this region peaked in 1985 at 4, 394 t in 14,896 hours. From 1981-88 45-60 pairs of these trawlers fished in the Kimberley region with catch quotas of 15,000 t to 27,500 t from 1981 to 1987.

From 1978 to 1980 CSIRO also conducted some 151 hours of experimental trawling in the region. This yielded a total catch of 25.1 t. (Nowra and Newman 2001)

The domestic trap and line fishery began in the Pilbara region in 1984 and spread to Broome in 1989-90. In 1988, the Offshore Constitutional Settlement (OCS), transferred management of most of the offshore fisheries off the WA coast from the Commonwealth to State responsibility. In that year a limit of 20 licences was set for fish trapping off the Kimberley coast east of 120° E. In 1992 theoretical concerns about the possibility of overfishing lead to the number of trap fishermen being further restricted to 11 with a limit of 20 traps per boat. In January 1998 the Northern Demersal Scalefish Interim Managed Fishery Management Plan 1997 went into effect. It divided the Kimberley fishery into two zones. The inshore zone provided for handline activity but has remained effectively unused. The offshore zone is fished only by the trap fishery.

Individual license rights are transferable and may be bought, sold or leased as their owners see fit. The number of fishing days per license is set for each year by the Executive Director of Fisheries with advice from the Fisheries Research Division, the area fishery management and the license holders. Effectively this has resulted in an ongoing trend of declining fishing days. If catches have been good they must then be reduced to prevent overfishing, however, if they are not so good it's also seen as evidence of overfishing so a cutback is still required. No matter what happens with catches it's still seen as evidence of overfishing and regardless of multi-fold improvement in the goldband snapper catch per unit of effort from 1990 through 2007 it's dismissed as due to increasing efficiency not a healthy resource.

Current Status

At present good catches and good prices make this a still profitable fishery but costs are high and increasing. These include long distances to both fishing grounds and to markets, high living costs in Broome along with high costs for crew, license fees, fuel, unloading, and maintenance as well as a requirement for substantial vessels. With ongoing reductions in the fishing days permitted for a license a single license is not economically viable thus most boats must also lease another license at considerable expense in order to operate profitably. With further reductions in permitted fishing days being mooted by management the industry believes the future economic sustainability of the fishery is seriously threatened.

Management

(Resource Issues)

Like virtually all Australian fisheries the NDSF faces an uncertain future, not from a decline in the resource but because of ever increasing costs, requirements and restrictions imposed by management. The following are some key management issues which bear on the ongoing viability of this fishery.

Sustainability – This concern is repeated like a manta throughout the substantial management literature regarding the NDSF. Always however, the expressed concern is solely for the resource, never for the industry. Strangely though, two quite different pictures are presented. The following is an ongoing series of examples over the past decade in first the positive and then the negative mode.

The NDSF in Positive Perspective

" An examination of management of the small Northern Demersal Scalefish Fishery found that Western Australia's Fisheries Department and major permit holders consider the interim management of the fishery to be sustainable, flexible and economically viable." - *Public Sector Performance Report by the Office of the Auditor General (Anon. 1998)*

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"The spawning biomass of *L. sebae* and *P. multidens* in 1980 are assumed to represent the virgin stock levels. Spawning biomass levels of less than 40percent are considered to be exposed to a significant risk of recruitment overfishing. The current stock assessment analyses indicate that the optimum yield of the two target species can be obtained at current effort levels."

"In 2002, the total spawning biomass of the two indicator species, red emperor and goldband snapper, in the NDSF were estimated to be at 54 percent and 41 percent of the estimated virgin levels. These levels were both above the recommended target level of 40 percent of the virgin spawning biomass and their breeding stocks were considered adequate at the current levels of catch." - *FAO conference on the governance and management of deep-sea fisheries in 2003 (Newman, 2006).*

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"The fishery has been operating under a detailed and sophisticated management regime since 1997 using a comprehensive set of regulations that include input controls such as individually transferable effort allocations, gear restrictions and area closures. Each of these has been refined through time, and is subject to regular reviews to achieve the overall aim of successful management."

"The combination of having a large amount of relevant and accurate information on the biology of the main finfish species, the sophisticated suite of management arrangements in place and the proactive management used in the fishery has resulted in the maintenance of stocks as well as the successful continuation of the fishery.

The NDSMF, being a relatively small-scale trap and line fishery has minimal impacts on the broader ecosystem."

"Using the indicators as described above in 1.1.2, 1.1.3 and 1.1.6, both of the primary species have been within the acceptable performance limits from 1999 to 2002 (see below – no indicators have triggered a review). Catch and catch rate indicators were consistent with spawning biomass assessments of each species.

The trap catch rate of red emperor was relatively stable from 1998 to 2002, suggesting adequate spawning biomass levels. This suggestion was consistent with spawning biomass estimates. In 2002, the age-structured stock assessment model suggested that the spawning biomass of red emperor was approximately 54%. This level of spawning biomass is above the recommended level of 40% of the virgin spawning biomass and therefore the current breeding stock and catch levels were considered adequate."

The trap catch rate of goldband snapper increased after 1998 and also became more variable. These variations were assumed to reflect changes in efficiency by trap fishers as they attempted to maximise their return from each day spent in the fishery (as fishing days are limited). In 2002, the total spawning biomass of goldband snapper was estimated at approximately 41% of the virgin (1980) level. The estimated lower limit of the 95% confidence interval for the level of spawning stock biomass for goldband snapper was below the target level of 40% of the virgin spawning biomass, but was above the limit level of 30% of the virgin spawning biomass. Therefore, the current breeding stock and catch levels were considered adequate."

"If the collection of age structure data for each of the key species was available it would provide a more robust indicator of stock status than is provided by catch data alone. Age structure data, used in combination with catch and catch rate data within age-structured models provides highly robust indicators of stock status. Consequently, even without the age structure data for each key species the level of robustness of current indicators is considered adequate to manage red emperor and goldband snapper stocks at a sustainable level. "

"The take of demersal scalefish in the NDSMF is fully regulated. The current breeding stock and catch levels of red emperor and goldband snapper are considered adequate and the management system is flexible to allow for both increases and decreases in fishing effort should they be required."

"Evidence from other fisheries suggests that a limit of 30%, with a target of 40%, of the virgin biomass is appropriate to ensure sustainability of the fishery...."

(*and under the heading* "**Robustness High**") "...even without the age structure data for each key species the level of robustness of current indicators is considered adequate to manage red emperor and goldband snapper stocks at a sustainable level. "
- *Final application to the Australian government Department of the Environment and Heritage on the Northern Demersal scalefish managed fishery against the guidelines for the ecologically sustainable management of fisheries (Anon. 2004b).*

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(*DEH then made an assessment*) "DEH considers that the NDSMF is a well managed fishery that is unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term."
"DEH considers that the NDSMF management regime is documented, publicly available and transparent, and is developed through a consultative process that could be further improved. The current fishery management arrangements are adaptable and have been used effectively to maintain target stocks at a sustainable level." - *Assessment of the NDSF by the Department of the Environment and Heritage, Commonwealth of Australia (Anon. 2004c).*

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(*and the minister decided*) "A preliminary age structured stock assessment model for red emperor and goldband snapper has been developed using age, growth and other biological data from the above mentioned 1997-2000 FRDC research project survey data. This model is also informed by time series of catch data from 1980 and effort data from 1995 to provide annual spawning biomass estimates for the target species. For the 2002 review, red emperor was assessed at 54% of virgin spawning biomass, and goldband snapper 41%, both achieving the performance target point of maintaining the proportion of virgin spawning biomass above40%."
"...neither target species has been outside the acceptable performance limits for the respective catch and catch rate performance measures since 1999. DFWA concludes that the range of performance information confirms that the current breeding stock and catch levels are adequate for the target species."
"DEH considers that the management regime in the NDSMF is appropriately precautionary and has provided for the fishery to be conducted in a manner that has not led to over-fishing and is unlikely to do so in the short term. DEH considers that the quality of information being collected, the information collection systems and the stock assessment approach are generally sufficient in the short term, under the current scale of operations, to ensure that the fishery is conducted at catch levels that maintain ecologically viable stock levels with acceptable levels of probability
DEH considers that the NDSMF target stocks are not below defined reference points
DEH accepts that the risks to the physical environment posed by the equivalent of 5 to 7 full time vessels in a fishing area of 483,600 sq kilometres are negligible.'
"The management arrangements for the fishery meet the Australian Government's Guidelines for the Ecologically Sustainable Management of Fisheries. The fishery is well managed under a comprehensive, adaptable, precautionary and ecologically based regime capable of controlling, monitoring and enforcing the level of take from the fishery." - *Ministerial decision. Department of the Environment, Water, Heritage and the Arts. Commonwealth of Australia (Cresswell, 2004).*

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From the above comments one would certainly get a positive impression of a well managed fishery harvested within sustainable limits. However, at the same time there is another quite different impression also being presented.

The NDSF in Negative Perspective

"...these results (age determination from otoliths) indicate that the NDSF population of goldband snapper is currently exploited above optimum levels. The protracted longevity, moderately slow growth, large size and age at maturity and low natural mortality rates of goldband snapper imply that this species is particularly vulnerable to overfishing."

"...only approximately 5-6% of the available stock of *P. multidens* can be harvested on an annual basis in a sustainable manner, and that in order to prevent stock declines annual harvest rates should not exceed 7-9% of the stock size."

"Estimates of the rate of fishing mortality, F, were 0.20-0.22 for 1997/98 and 0.15-0.17 for 1998/99, representing an annual harvest rate of approximately 17-19% and 13-15%.by the fishery in each year."

"...only approximately 5-6% of the available stock of *L. sebae* can be harvested on an annual basis in a sustainable manner, and that in order to prevent stock declines annual harvest rates should not exceed 7-8% of the stock size." - *stock assessment of the outer-shelf species in the Kimberley region (Newman et al. 2001)*

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"...the NDSF population of *L. sebae* is exploited above optimum levels. Given their low production potential, populations of L. sebae in north-western Australia and elsewhere in the Indo-Pacific region require prudent management. Furthermore, fishery managers need to consider as part of any harvest strategy for these fish to preserve significant levels of the spawning stock." - *Growth, age validation, mortality, and other population characteristics of the red emperor snapper (Newman and Dunk,2002)*

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":Estimates of the annual instantaneous rate of natural mortality (M) were 0.10-0.14. The NDSF population of *P. multidens* is considered to be exploited above optimum levels on the basis of these mortality estimates. The protracted longevity, moderately slow growth and low natural mortality rates of *P. multidens* predisposes this species as one vulnerable to overfishing, thus cautious management strategies will be required."

"These results indicate that only approximately 6% of the available stock of P. multidens can be harvested on an annual basis in a sustainable manner and that annual harvest rates should not exceed 10% of the average stock size." - *Age validation, growth, mortality, and additional population parameters of the goldband snapper off the Kimberley coast (Newman and Dunk, 2003)*

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"The current stock assessment analyses indicate that the harvest of the two target species at current effort levels is above the sustainable yield estimates. Therefore, there is a need to restrict effort within the fishery. "

"Based on current catch levels, the harvest rate of goldband snapper and red emperor are now above the optimal level...." - *Fishery status, stock assessment and effort allocation options for the NDSF (Anon. 2005a)*

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"An annual catch of 164 tonnes per year (for goldband snapper) is recommended as this is expected maintain the stock at a constant and healthy level. " *Assessment of the status of goldband snapper (Pristimoides multidens) in the NDSF (Anon. 2005b).*

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"The model indicates the red emperor stock experienced a steep decline after 1992 with a constant level from 1998-2004 and a subsequent decline with recent larger catches. "

"The model indicates that the stock is still in slight decline but not too serious, with the fishing mortality at an appropriate level. Slight effort reduction is recommended to offset the efficiency increases and to arrest the spawning stock decline expected in the future."

"In 2007, 1065 SFDs were used in Zone B resulting in the red emperor catch of 155 tonnes. To arrest the spawning stock decline, catches of red emperor should be in the order of 135 tonnes or less per year, at an effort allocation of less than 1000 SFDs."

- *Assessment of the status of red emperor in the NDSF (Anon. 2007a).*

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"Concerns exist about the status of red emperor and goldband snapper stocks in Zone B of the the NDSF. " (2006 catch was reported as: Red emperor 164 tonnes, Goldband snapper 336 tonnes) - *NDSF Research overview 2007 (Newman and Skepper, 2007).*

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From this second series of quotes one would clearly receive the impression of an ongoing over exploitation of the two most important species in the fishery. Note also that the goldband snapper catch reported for 2006 immediately above is a bit over double the 164 t recommended to "maintain the stock at a constant and healthy level. " *in (Anon. 2005b).* This certainly sounds like serious over exploitation and the next year (2007) it gets even worse with a goldband catch of 393 t (Newman 2008). So, what is going on; is the fishery well managed or is it being over fished?

To understand this apparent conflict of opinion it is important to realise that this is not a matter of different parties in disagreement; but, it all stems from the same source, the managers of the NDSF in WA Fisheries. What then might be the purpose in putting forth two such different perspectives? In this regard it may be worth noting that the well managed view has been presented to state, national and international agencies where recognition for good management would be desirable. The negative view where overfishing is emphasized has been in a context where this would be in accord with prevailing environmentalist sentiments, regulatory aims and funding needs.

For present purposes we will note, but not digress into, the vexing matter of misleading parliament.

Fishing pressure - Before getting into the distractions of sundry management details let us first recognise one overwhelmingly important fact that cannot be credibly dismissed. This is the 800 pound gorilla in the room which strangely never seems to be noticed. It is simply that with the existing level of fishing and the size of the fishing grounds, any notion of overfishing is not just improbable but truly astounding.

The Kimberley fishing zone out to the 200 m isobath comprises an area of about 300,000 km^2 and the primary species being fished occur widely over most of this area. Fishing is restricted to Zone 2 which comprises about 220,000 km^2. Almost 90 percent of the catch and effort comes from the B zone of Area 2. This comprises some 90,000 km^2. Large areas of totally unfished stocks thus exist both inshore and offshore of the fishing area.

Even in the most heavily fished B Zone actual fishing pressure is extremely low. The entire fishery is limited to 11 licenses for 20 traps each or 220 in total. Five boats fish all the licenses. A single licence is only marginally economic at current levels of access. In 2007 the number of Standard Fishing Days effort in the B Zone was 1065. A Standard Fishing Day (SFD) is 20 traps for one day. Traps are normally pulled and reset about 3 times per day. They are usually reset each time in a different location at least a few hundred meters away from their previous position. 1065 SFD x 20 traps x 3 sets per day = 63,900 trap sets per year.

A study of reef fish trapping in the Caribbean found that the effective area fished ranged from 135-348 m^2/trap (Miller and Hunte, 1987). This amounts to a radius of about 10 m. The NDSF comprises similar types of fish but larger individuals and a larger effective fishing area would be expected. Let's assume a fishing radius of 30 m which would amount to an effective fishing area of about 3000 m^2. 63,900 trap sets per year x 3000 m^2 effective fishing area = 191,700,000 m^2 or 192 km^2 actually fished each year. This amounts to 0.2 % of the B Zone area that is actually fished each year. At this rate it would take 500 years to fish the entire zone once. We also know from echo sounder and video observations that a trap at best only catches a small portion of the fish immediately around it.

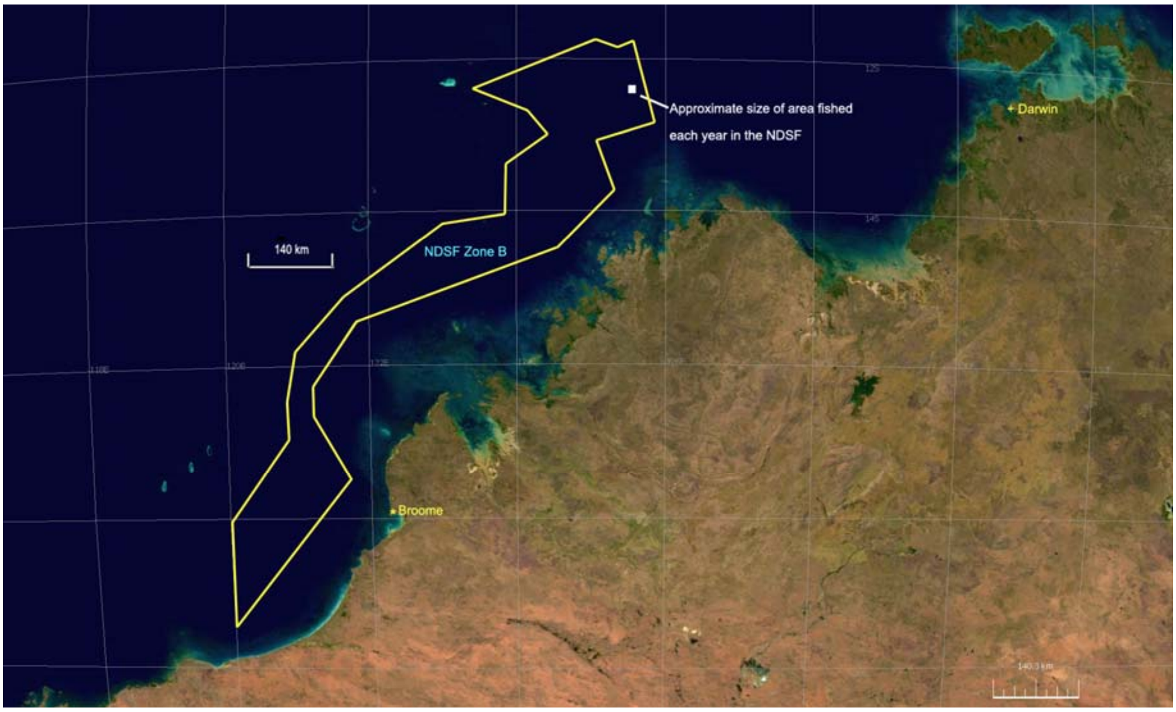
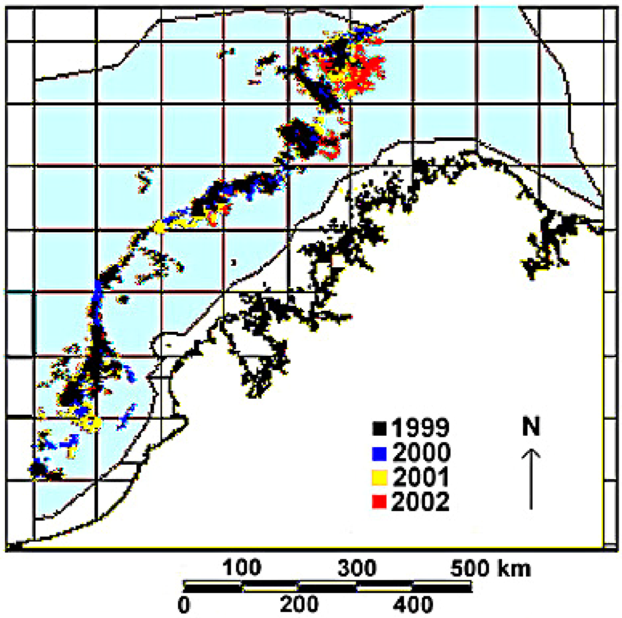


Fig.3. NDSF B zone area with size of area fished annually shown as white square for comparison

Now, consider the fishing pressure from another perspective. We know from widespread fishing effort that good catches are found throughout the B zone, not just a few specific locations (Fig. 4). That this is not just a matter of fishermen targeting a few concentrations is also verified by equally good catches when fisheries researchers have chosen where to fish when sampling in cooperation with the fishermen.



Spatial distribution of effort obtained from the VMS database for all vessels from 1999 to 2002. (area of the NDSMF fishery in light blue).

Fig.4. Spatial distribution of fishing effort in the NDSF is widespread (from Anon., 2004)

Although the 800 t Total Allowable Catch used for this fishery was estimated by CSIRO for the entire region it is effectively being applied to just the B Zone. Let's consider it both ways. For the B zone alone this would mean a harvest rate of 800,000 kg/90,000 km^2 = 8.89 kg/km^2 or 89 g/Ha. For the region as a whole it would be about 3 kg/km^2 (30 g/ha). How does this compare to other harvest rates?

Area	Harvest Rate (kg/ km^2/year)
Kimberley offshore to 200 m.	3
NDSF Zone B	9
Australian average	30
World average	1200
Conservative sustainable reef	4000
Pacific reefs widespread average	7000
Thailand	9000
Moderately good beef grazing land	2000

Table 1. Comparative harvest rates

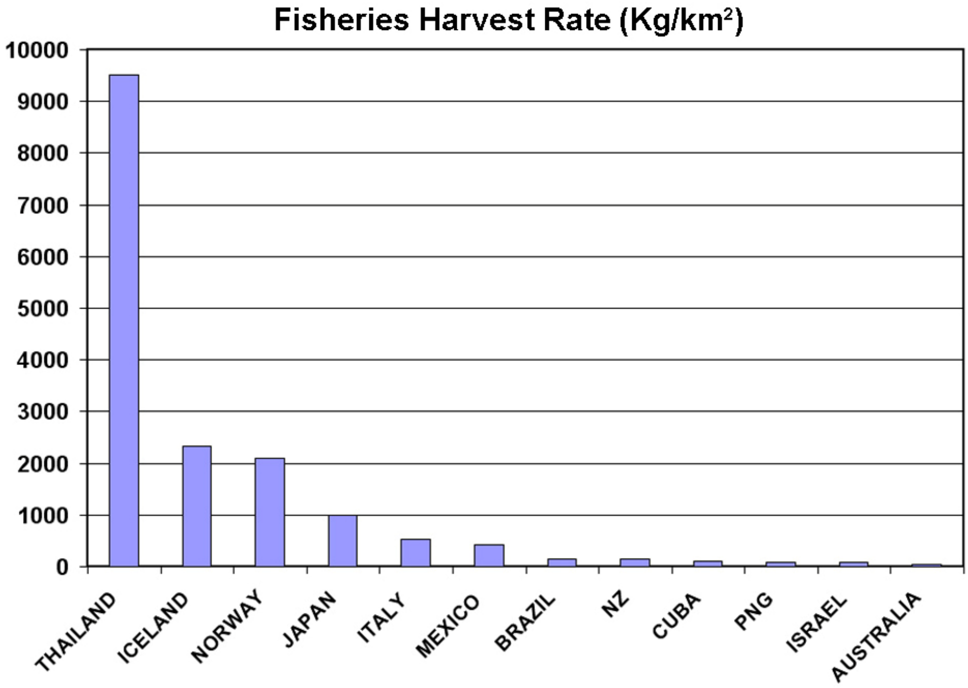


Fig.6. Australian fishery harvest rates in comparison

Considering that the NDSF is in the midst of one of the most naturally productive marine areas in Australia the idea that the current level of harvest is the highest that is sustainable would require some exceptional circumstance to explain. None has been offered and the fact that such an extraordinarily low level of sustainable catch should require scientific explanation never seems to have been even recognized.

Comparisons with adjacent areas - Even in comparison to the immediately adjacent fishing areas (Fig. 7) the NDSF's purported sustainable limit is very low.

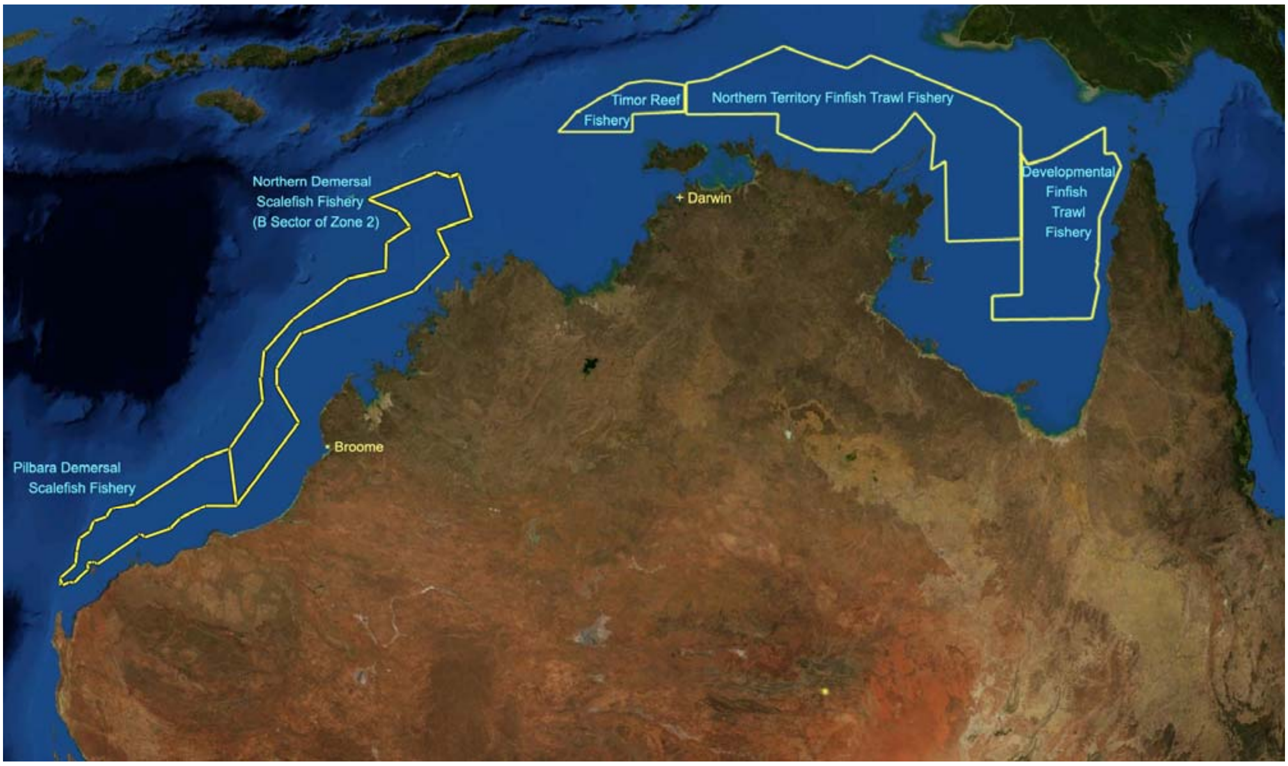


Fig.7. NDSF and adjacent fishing areas

To the west the Pilbara supports a mixed line, trap and trawler fishery exploiting a similar mix of species. The fishing area is about 2/3 that of the NDSF and the acceptable catch range is 2,000–2,800 t for the trawl. 160–360 t for the trap, and 50–115 t for the line fisheries. The 2005 combined catch for goldband snapper was 213 t and 194 t for red emperor (Stephenson *et al*. 2006). The acceptable harvest range would thus be 36 to 56 kg/km^2.

To the east in the Northern Territory a single trawler has in recent years harvested around 900 t of snappers each year (Lloyd and McKey, 2004c). Farther east in the Gulf of Carpentaria Queensland fisheries has established an annual offshore trawlfish quota of 1500 t. The total harvest of quota species for 2006 was reported as 444 t. (Roelofs, 2007)(Fig. 8).

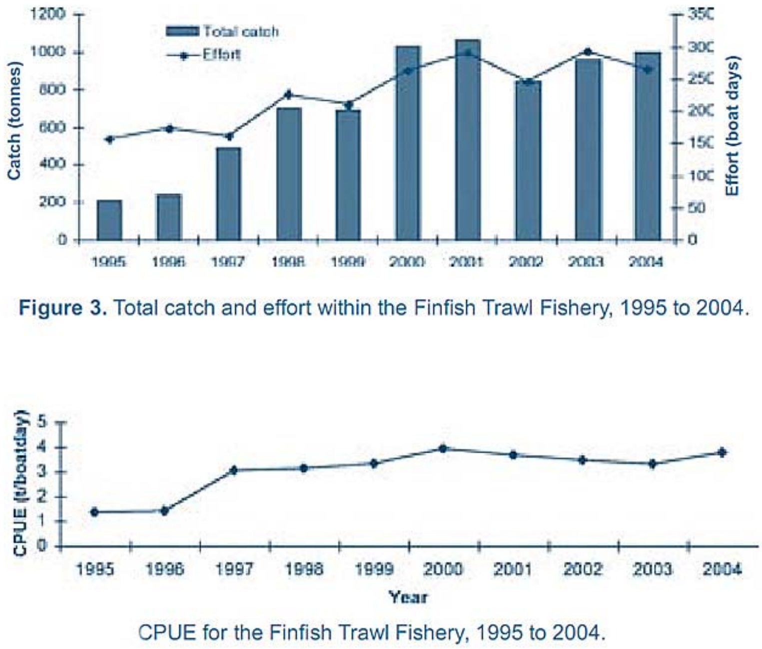
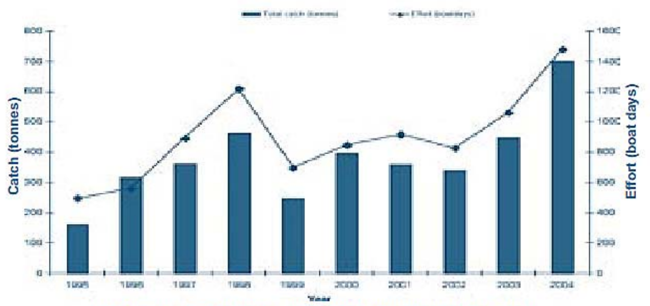
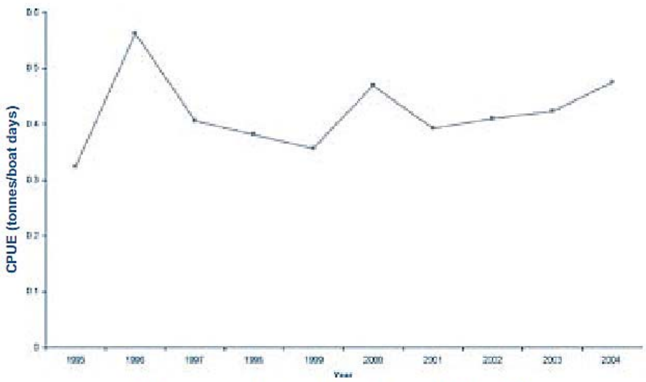


Fig.8. Northern Territory snapper trawl fishery statistics (from Roelofs, 2007)

To the north the Timor Reef fishery has an acceptable annual catch limit of 900 t for goldband and an annual combined catch of 1300 tonnes for red snappers. (McKey, 2008)(Lloyd and McKey, 2004c) (Fig. 9). The area of this fishery is about 30,000 km^2 or about 1/3 the size of the NDSF Zone B. The average catch in recent years has been about 300 t and the highest was 574 t. This corresponds to a harvest rate of 10 and 19 kg/km^2 respectively). All of the above fisheries have received Commonwealth approval as being managed in an ecologically sustainable manner.



Catch and Effort for the Timor Reef Fishery 1995 to 2004.



Catch rates for the Timor Reef Fishery, 1995 to 2004.

Fig. 9. Timor Reef fishery statistics (from Lloyd and McKey, 2004c)

The idea that the present catch level of the NDSF is anywhere near sustainable limits is clearly not based on declining catches, any quantitative consideration of the area size and level of fishing activity or what similar fisheries anywhere else sustain.

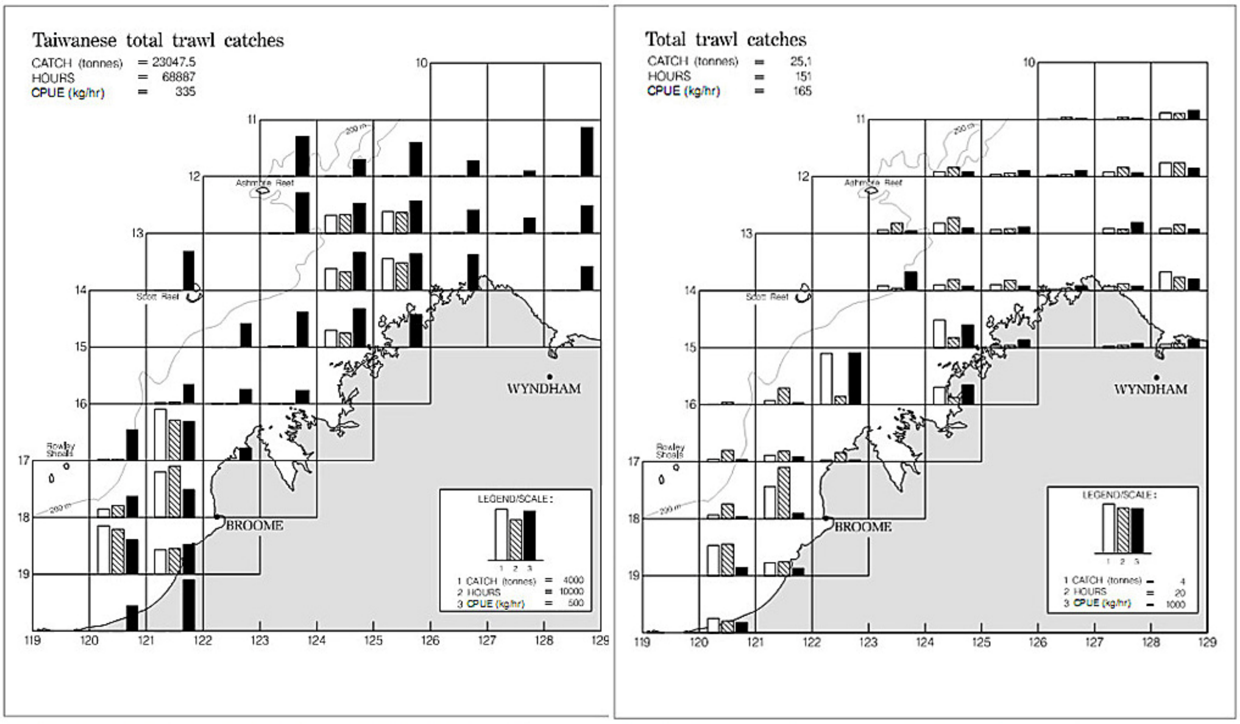
Total Allowable Catch (TAC) and Virgin Biomass – The TAC of 800 t for all species in the fishery appears to have been established from an estimate of 1980 biomass based on experimental trawling by CSIRO between 1978 and 1980 (Fig. 10). This biomass estimate for 1980 has been deemed to be the virgin biomass (i.e. biomass before fishing began). The total CSIRO catch was 25.1 t in 151 hours or 166 kg/hour. The principal NDSF species (lutjanids, lethrinids and serranids) totalled only 2.7 t or 15% of the catch (Fig. 11). This is only a fraction of a single day's catch in the current fishery.

Although the virgin biomass is frequently referred to in NDSF literature the actual quantitative figure and how it was derived has proven difficult to discover. No one in the industry knows nor could it be found in the voluminous references listed at the end of the present review. Presumably it is based on Jernakoff & Sainsbury, 1990 but I have as yet been unable to obtain a copy. Anon., 2000a states that: "For the whole north coast (that is, north of North West Cape), the only yield estimates available for the large Lutjanids are the TACs provided by CSIRO. The most recent recommended TAC was calculated in 1991 at 840 tonnes for the NW Shelf as a conservative yield estimate." They then go on to say that: "the sustainable yield of demersal scalefish in the Kimberley region of WA is unlikely to exceed 800 tonnes per year."

Newman *et al.*, 2001 and various other references state that for long lived species such as goldband and red emperor only about 5 to 6% of the available stock can be harvested on an annual basis in a sustainable manner. One can thus presume that an allowable harvest of 800 t must thus equal a virgin biomass of 13,000 to 16,000 t.

From 1980 to 1990 the much larger Taiwanese pair trawlers operated in the same area (Nowara and Newman, 2001) (Fig. 10). If their much more voluminous data is considered a quite different picture emerges. Their total catch was 23,047 t in 68,887 hours or 335 kg/hour with lutjanids, lethrinids and serranids making up 9534 t or 41% of the catch. It is worth noting that the total trawling area covered by the entire 11 year effort amounts to about 50,000 km^2 or around 10% of the total area over which they operated. In the peak year of fishing activity they trawled 6959 hours (Ramm. 1994) and covered about 5150 km^2 or about 2% of the area.

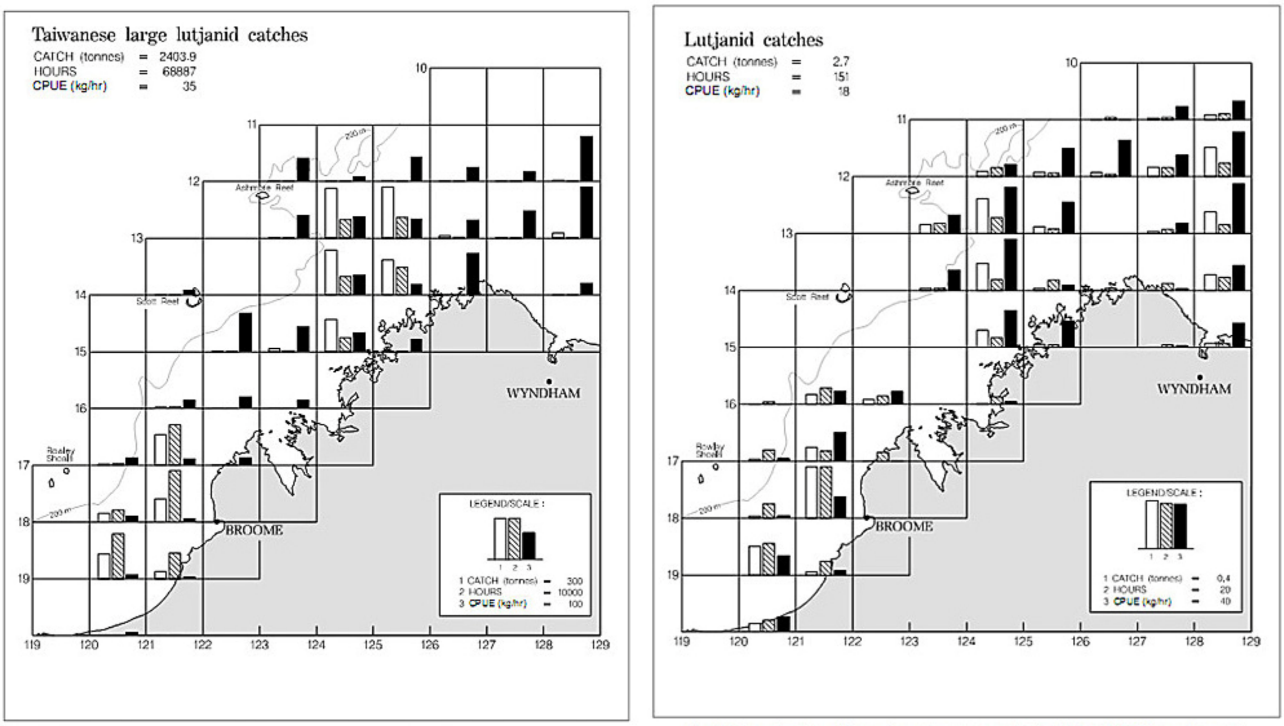
The Nowara and Newman (2001) study presents only the 1980 to 1990 data for the Taiwanese trawl fishing and may give the impression that before 1980 there was little or no fishing off the Kimberley coast. One might therefore assume that the estimate of biomass in 1980 used for management would indeed be indicative of the virgin or unfished condition. However they include a map captioned: "Major trawling grounds between 120° E and 129° E used by the foreign pair-trawl fleets from 1975-1978 as recorded by Fisheries WA (Source: C. Ostle)". This map (Fig. 12) shows differently shaded areas delimiting major and minor trawl areas of the fishery. About 90% of these appear to be in the current B Zone of the NDSF. This would indicate that these large trawlers were fishing the NDSF area intensely enough immediately before 1980 to be able to distinguish major and minor fishing areas. It also raises serious doubts about the estimation of 1980 biomass as representing the virgin condition. Nowhere in the management literature does any consideration appear to be given this situation. 1980 biomass being the virgin condition is simply presented as unquestioned fact.



Distribution of total catch, effort and catch per hour for Taiwanese pair-trawlers 1980-1990.

Distribution of total catch, effort and catch per hour by CSIRO experimental trawling 1978-1980.

Fig.10. Taiwanese (L. and CSIRO (R.) total trawling catch (from Nowara and Newman, 2001)



Distribution of catch, effort and catch per hour of large lutjanids by Taiwanese pair-trawlers 1980-1990.

Distribution of catch, effort and catch per hour of lutjanids by CSIRO experimental trawling 1978-1980.

Fig.11. Taiwanese (L. and CSIRO (R.) lutjanid catches (from Nowara and Newman, 2001)

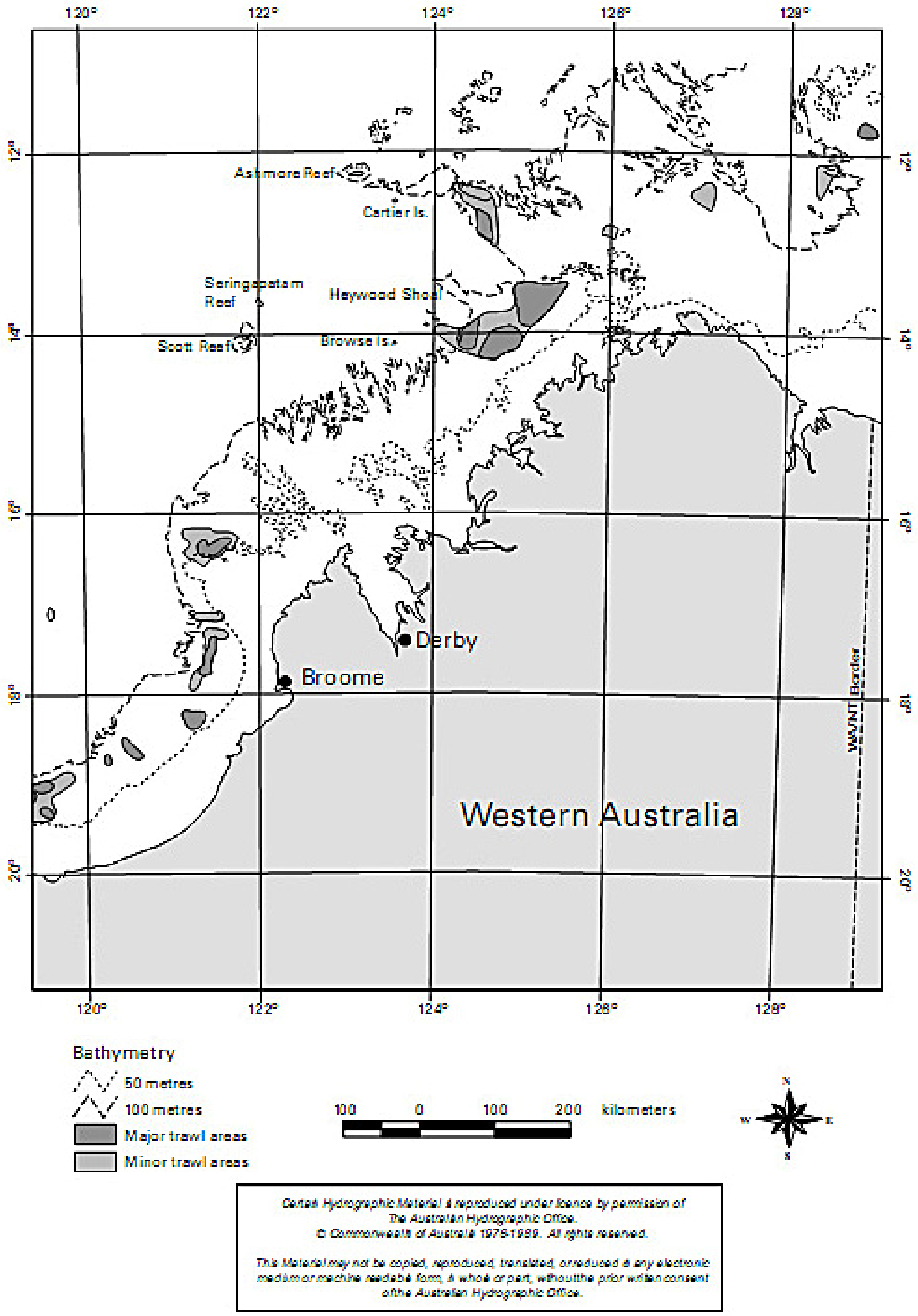


Figure 2 Major trawling grounds between 120° E and 129° E used by the foreign pair-trawl fleets from 1975-1978 as recorded by Fisheries WA (Source: C. Ostle).

Fig.12. Map from Nowara and Newman (2001) indicating major foreign trawling immediately before CSIRO sampling used for determination of “virgin” biomass

If adjustment is made for the smaller CSIRO trawl net as being half the size of the Taiwanese nets and figuring a trawl speed of 4 knots the CSIRO catch rate if applied to the 220,000 km² of the NDSF Zone 2 would indicate a total biomass for lutjanids, lethrinids and serranids of about 15,000 t. An 800 t TAC would thus represent an annual harvest of about 5% of this biomass. However. applying this same calculation to the Taiwanese catch would result in a biomass of 41,000 t and a 5% annual harvest would then be just over 2000 t.

So, which is correct? Actually neither is. Much if not most of both the CSIRO and Taiwanese trawling was done outside the NDSF fishing area on open bottom areas suited for trawling but where lutjanids and serranids in particular are generally much less abundant than in the areas fished by the NDSF trap fishery. Large lutjanids and lethrinids are also fast swimming fishes and many will run away from an approaching trawl. In addition the lutjanids often form large schools well above the bottom where a demersal trawl would pass beneath them. Serranids on the other hand, normally live around rocky outcrops or other cover into which they retreat if threatened. Relatively few can be caught by trawling. The differences between the percent abundance in the catch from the CSIRO survey data (1978-1980), Taiwanese fishing data (1980 only) and the NDSF (2007) is marked.

FA MILY	CSIRO %	TAIWANESE %	NDSF %
Lutjanidae	10.4	18.4	73.3
Lethrinidae	2.9	14.1	1.5
Serranidae	1.8	3.5	13.3
Totals	15.1	36.0	88.1

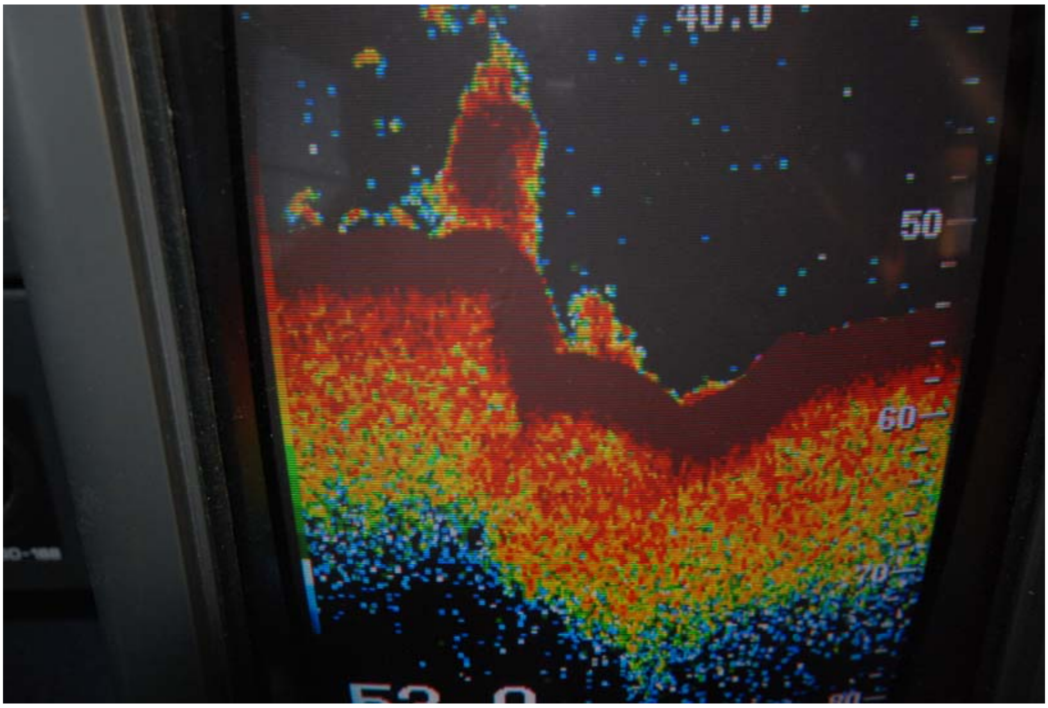
Table 2. Percent abundance in the catch from CSIRO survey, Taiwanese trawling and the NDSF

Any estimates of biomass for these fishes based on trawl data will almost certainly be well below the actual biomass and so uncertain as to be virtually useless. It is simply the wrong method in the wrong place.

A fishery based TAC - A more realistic estimate may be derived from the catch of the NDSF itself. If the 192 km² fished each year yields a catch of about 800 t then the total biomass for the 90,000 km² of the B Zone can be estimated to be 90,000/190 x 800 or about 380,000 t and we know traps leave more fish than they catch. Could this possibly be right? Well, it actually amounts to just over 4 t/km² or 40 kg/ha, which is not at all unreasonable. This would also not be inconsistent with a 4000 kg/km² harvest level for reef fisheries considered sustainable by the World Resource Institute. It would also be in accord with the ongoing excellent level of catch per unit of effort in the NDSF fishery. Five percent of 380,000 t would be 19,000 t or an annual sustainable harvest rate of 211 kg /km² or 2.1 kg/ha.

While a TAC of 19,000 t may seem absurdly high compared to the 800 t now deemed the limit of sustainability when reduced to a more readily comprehensible scale of hectares, 2.1 kg begins to look eminently more plausible than the 90 g now being imposed.

That such quantities of fish may actually be present is also evidenced by echo sounder indications of large schools of fish up to 5 to 10 fathoms above the bottom being common and widespread in the NDSF B zone (Fig. 13). While their identity has not been confirmed, snappers are the commonest large schooling fish known to inhabit the area and video proof should not be difficult to obtain.



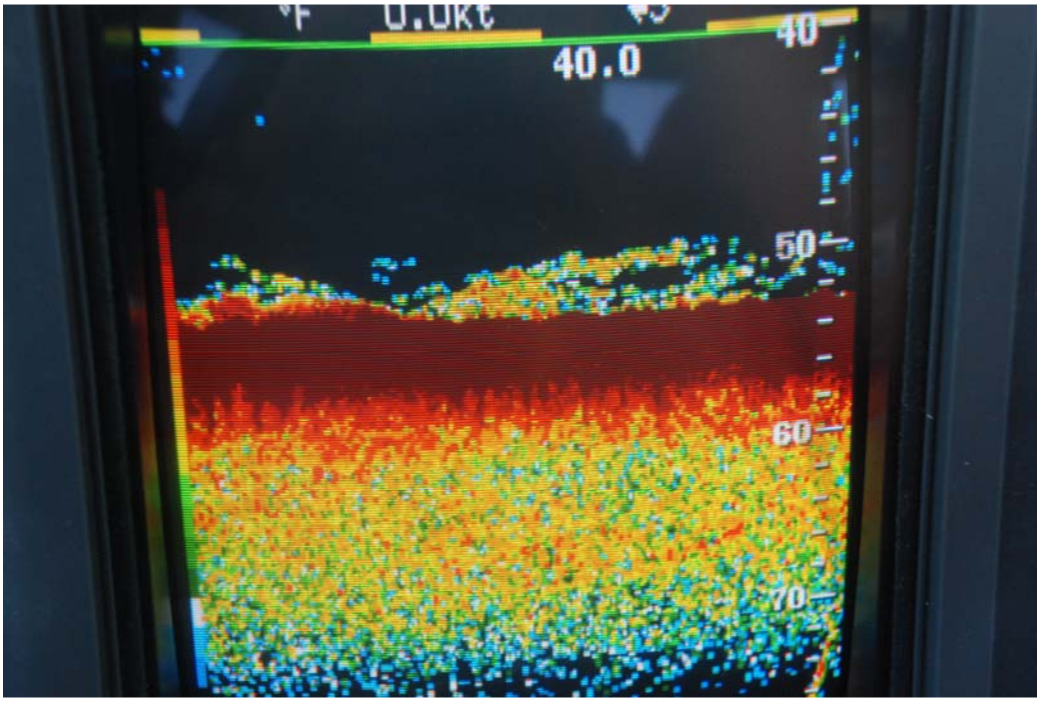


Fig.13. Echo sounder images of large schools of fish up to 5 to 10 fathoms above the bottom are common and widespread in the NDSF B zone.

Ongoing overfishing concerns – In a circumstance where only a fraction of 1% of the prime fishing area is being even partially harvested in a year and catches are better than ever, maintaining a concern for overfishing requires sophisticated argument. In this case a population model has been combined with an analysis of the age structure of the populations of the two key species plus the Hoenig (1983) equation to estimate mortality. Unfortunately for credibility all these methodologies suffer from critical shortcomings.

Beverton-Holt Model – Scientific models bring to mind complex computer programs involving thousands of lines of code and requiring high level computing resources to run them. However, the Beverton-Holt Model used here is decidedly less impressive. In essence it is just a short one line formula which expresses the number of individuals in a given generation as a function of the number in the previous generation . The proliferation rate and carrying capacity of the environment for the species are key variables. This model has been employed in fisheries for some 50 years. It is a simple mathematical relationship that will hold true in nature only if several important assumptions are met. One is that new recruitment is dependent on the size of the spawning population. Another is that the age structure remains constant (*i.e.* the mortality rate is constant over age classes).

Any model, no matter how simple or sophisticated, is only as good as the thoroughness with which it represents all important relationships, the accuracy of input variables and validity of assumptions. In this instance, use of the Beverton-Holt Model entails three critical uncertainties that have not been addressed and are likely to invalidate its appropriateness. These are the assumptions about recruitment and mortality as well as determination of carrying capacity.

Recruitment in demersal marine species that produce large numbers of planktonic larvae tend to be highly variable. Successful settlement of early juveniles may differ greatly from year to year and place to place. New recruitment often has little relation to the size of the spawning population. As Dixon *et al.* (1997) state: "The lack of a clear relationship between spawning output and recruitment success continues to confound attempts to understand and manage temporally variable fish populations. .... Non-linear responses of larval fish to their noisy physical environment may offer a general explanation for the erratic, often episodic, replenishment of open marine populations."

Likewise, mortality rates are likely to vary with both age and location. In snappers, juveniles and adults have quite different biologies entailing dissimilar habitats, food, predators and behaviour. The relative carrying capacities for juveniles and adults may differ markedly between different areas with consequent differences in mortality rate at different sizes. In goldbands and red emperors the largest adults are also large enough to enjoy freedom from all but a few of the largest predators. Then too, different locations may afford quite different levels of both shelter and predator abundance. Altogether, a constant rate of mortality across all age classes and locations is extremely unlikely. In addition to this, mortality from the fishery may also be reduced for the largest fish as they are less likely to enter traps with a trap entrance size optimised for smaller fish.

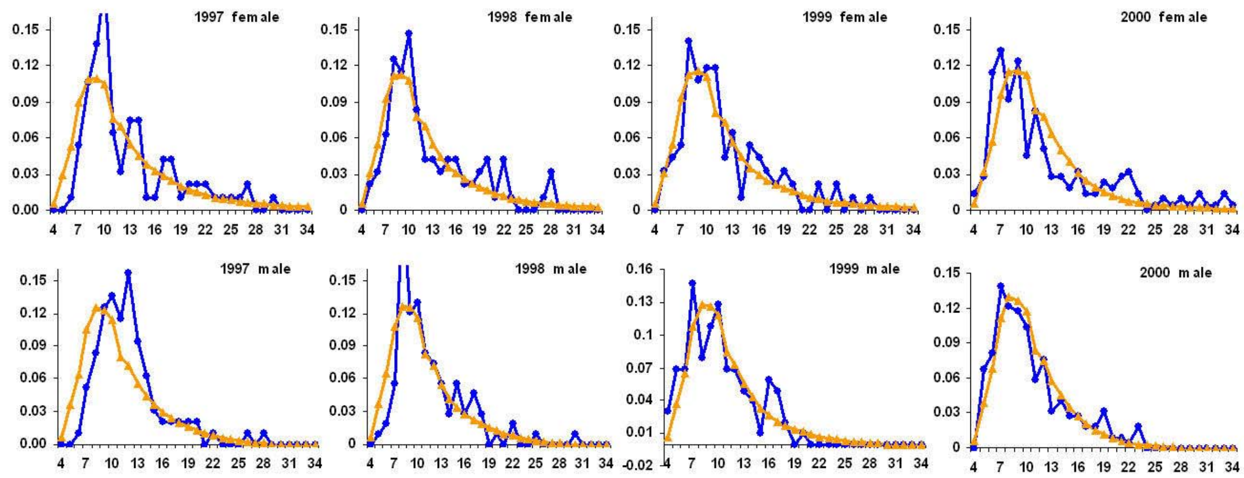
Carrying capacity is another vexed issue. The estimated overall carrying capacity of the fishery must be presumed to be the often mentioned but rarely or never revealed virgin biomass that one can presume to be the 16,000 to 18,000 t implied from the 800 t TAC set for the fishery. The portion attributable to goldband snappers and red emperors must then be roughly proportional to their respective proportions of the total catch. As this estimate of virgin biomass is probably far too low so too must then be any carrying capacity estimate based on it that could be used in the model.

If distributed over the 90,000 km^2 of the B Zone, a biomass of 16,000 to 18,000 t would result in an average of 200 kg or less per km^2. If every fish present in the 192 km^2 fished each year was caught, the total catch would only be 38 t or less than 1/20 of the actual catch.

Age Structured Stock Analysis – In essence this is just an impressive sounding way of referring to counting the different ages of fish in a sample of the catch. In this case age has been determined by counting annual growth rings in the otoliths (ear bones) from the fish. While the method used for determining the age of individuals cannot be faulted the sampling treatment fails to provide any assessment of the all important question of how representative the sample may be of the actual population. There are several possible sources of sample bias. One is the variability in annual recruitment in different areas, another is an observed tendency of snappers to often aggregate in schools of similar sized individuals in different locations and still another is any selectivity of the fishing method.

It seems curious in this regard that no analysis of variance for year, location or fishing method appears to have been presented for any of the age structure assessment studies. In contrast Nowara and Newman (2001) provided detailed analysis of variance for 11 different effects and interactions in the catch of the Taiwanese trawl fishery which was already defunct for a decade when they published. Although no implications for the current fishery were suggested from this data one would presume it must have been considered significant enough to justify the expenditure of limited management resources to prepare and publish it.

A proper analysis of sample variability is important to any assessment of how adequately the age structure sampled may represent the structure of the actual population. There is good reason to expect that a high degree of spatial and temporal variability may exist and thus require a much larger, wider and longer term sample for valid results. Certainly the year to year differences in age composition found in the catch of both goldband and red emperor (Anon. 2005b and 2007a) is indicative of high sample variability not fishing mortality (Fig. 14).



Age composition of red emperor 1997 to 1999 and 2006 (blue) with model estimates (orange).

Fig.14. Significant inter-annual variability in age composition is evident but not commented upon in this Department of Fisheries (WA) assessment of the status of red emperor (*Lutjanus sebae*) in the NDSF(Anon., 2007).

Although age structure stock assessment is repeatedly referred to in NDSF management as providing evidence of overfishing, no clear statement ever seems to be made of specifically what such evidence is or why it indicates overfishing and not some other variable. Like virgin biomass, this fundamental element is often referred to but never specified.

Hoenig (1983) method of natural mortality rate estimation – This method depends upon an estimation of maximum age and the assumption of a constant rate of mortality. Several other methods for estimation of natural mortality exist and may produce differing estimates. All depend on various assumptions. None are certain. They are only estimates. In the NDSF fishery the estimate of natural mortality derived by the Hoenig method has been combined with total mortality estimates from age structured analysis of successive years catch to derive an estimate of mortality from the fishery. This concatenation of estimates and assumptions is at best highly uncertain.

The von Bertalanffy growth equation – This 90 year old mathematical model is another tool that appears to have been used by the NDSF management for determination of age structure in NDSF fish populations. It employs an equation that relates age to length. It is particularly applicable with fast growing short lived species living in uniform environments such as midwater or level bottoms where nutrition, energy demands and growth are similar throughout the population and where small individual differences in growth rate do not have decades to manifest in significant size differences at a given age in later life. Long lived demersal species living over a broad depth/habitat range such as the NDSF lutjanids, lethrinids and serranids can be expected to exhibit considerable size variability at a given age depending on location. Again, this likely possibility has not been addressed in the age structured assessment of the fishery and adds further uncertainty to estimates of mortality due to fishing.

Newman and Dunk, 2002 indicate (without caveat) that the von Bertalanffy equation was used in their study of growth, age, mortality, and other population characteristics of the red emperor. However, Newman and Dunk, 2003 in their similar study of the goldband snapper published the next year, they state: ”Considerable variation in length was observed within most age groups for both sexes. The large variation in length at a given age makes it difficult to accurately determine the age of *P. multidens* from length data alone. For example, fish ranging in length from 450 to 550 mm FL may vary in age from 5 to 30 years.”
That the same situation would not exist for both species seems unlikely yet no further investigation of this matter or re-evaluation of its implications for modelling assumptions appears to have been conducted.

In view of the circumstances, conclusions regarding overfishing based on indirect theoretical estimates should be considered with great caution. These circumstances include:

- An extremely low level of total fishing effort
- Ongoing high CPUE
- A poorly based estimate of virgin biomass
- The unassessed inclusion of three different species in goldband catch data
- Likely high variability in recruitment and natural mortality
- Some degree of size/age segregation
- Serious doubts about modelling assumptions
- Limited sampling with no analysis of variance
- Good evidence for an order of magnitude greater existing biomass than is being used by management.

Imposition of restrictions to address overfishing concerns based on such doubtful evidence should be regarded as indicating need for a review of management performance.

Hyperstability - To explain the continuing high catches and CPUE in the NDSF despite over a decade of ongoing claims of overfishing still another hypothetical has been invoked by management. This one has been termed “hyperstability”. The idea is that these fish form a relatively limited number of aggregations which the fishermen then target so that catches will remain good right up until the last fish enter the trap. This however is only speculation with no evidence to support it. There are however two overwhelmingly facts that refute it:

1. Excellent catches have been made in hundreds of different widely scattered locations throughout the B Zone not just in a few locations.
2. Similar catches have resulted on research trips when fisheries personnel, not the fishermen, have chosen where to fish.

Although snappers do often school and their abundance varies with both time and place it is clear from catches that they are abundant at myriad locations throughout the B Zone area. As the fishermen clearly do not fish just a few selected locations the purported hyperstability effect could only occur if the aggregations were moving and by some preternatural ability either the fishermen could always go straight to them or by some equally unexplainable ability the fish themselves could always locate the traps and get to them before they are pulled. Hyperstability as an explanation for ongoing high catches in this fishery is obviously more hype than stability.

(Miscellaneous Management Issues)

In addition to the primary concerns pertaining to the condition of the resource there are several other concerns of the industry regarding management. These include.

Precaution – The precautionary principle has become a blank cheque for regulatory restriction no matter how uncertain or poorly demonstrated the purported threat. It is repeatedly referred to in NDSF management documents. As pointed out in the Ernst & Young review of Australia's Marine Protected Areas (Anon. 2006) this principle has been widely misapplied in environmental management.

The legislation and treaties under which the precautionary principle is prescribed make clear that it is to be invoked where there is a threat of significant or irreversible environmental damage not simply when any hypothetical possibility of damage exists. A threat must be clearly perceptible. As in the right of self defence, a threat must be apparent not just something that might be possible. That the threatened damage must also be of an irreversible or significant nature is particularly important in the context of fisheries management.

In fisheries the real possibility of irreversible damage is remote. No where, ever, has any species of marine fish or invertebrate known to have been exterminated by fishing and in the case of trap and line fisheries even overfishing is rare. These methods require the active cooperation of the fish to be caught. With intense fishing the hardest to catch individuals survive and the population becomes much more wary. It is not uncommon to find abundant but difficult to catch fish in heavily fished locations.

Recovery from overfishing is usually rapid when fishing pressure is sufficiently curtailed. Virtually all of the widely cited instances of poor recovery have turned out to involve a longer term shift in oceanic conditions and recovery, though delayed, has been sudden once favourable conditions eventually returned.

In the present instance there is no credible threat of any irreversible damage from overfishing. At worst it might be expected to result in an eventual decline in catches that would soon recover if catch was restricted. Under the strict interpretation of precaution now commonly misapplied in resource management, restrictions have become an arbitrary prerogative of management. No evidence of any problem is needed and indeed, management's own lack of evidence can itself become a basis for precaution. Remarkably, this utterly unscientific approach has become an integral part of what is deemed to be management based on "best scientific evidence".

Recommending precautionary reductions in catch as being needed to assure future sustainability as has been done in the NDSF is a moronically simple approach to sustainability.
If catch is restricted to a small fraction of MSY then it will assuredly be sustainable, just as a 5 Km speed limit would virtually eliminate road accidents. After all, you can't be too careful when you are being precautionary. However, this approach to sustainability totally fails to recognize that competent fishery management involves the sustainability of the industry as well as the resource and ignores the fact that a fundamental aim such management is not just sustainability but *maximum* sustainability.

Zoning – There are at least four and perhaps 5 different sets of waypoints that define the boundaries of the B Zone and there is uncertainty in the industry as to which the current legally declared one to which they must adhere under threat of substantial penalty. Two such differing boundaries are shown in Figs. 15 & 16 below. Also, compare these to Fisheries WA map of the NDSF dated November 2006 (Fig. 37, p. 54). No explanation appears to be available as to any reason for so many changes and it is hard to imagine any. Greater transparency and better communication on this issue is badly needed.

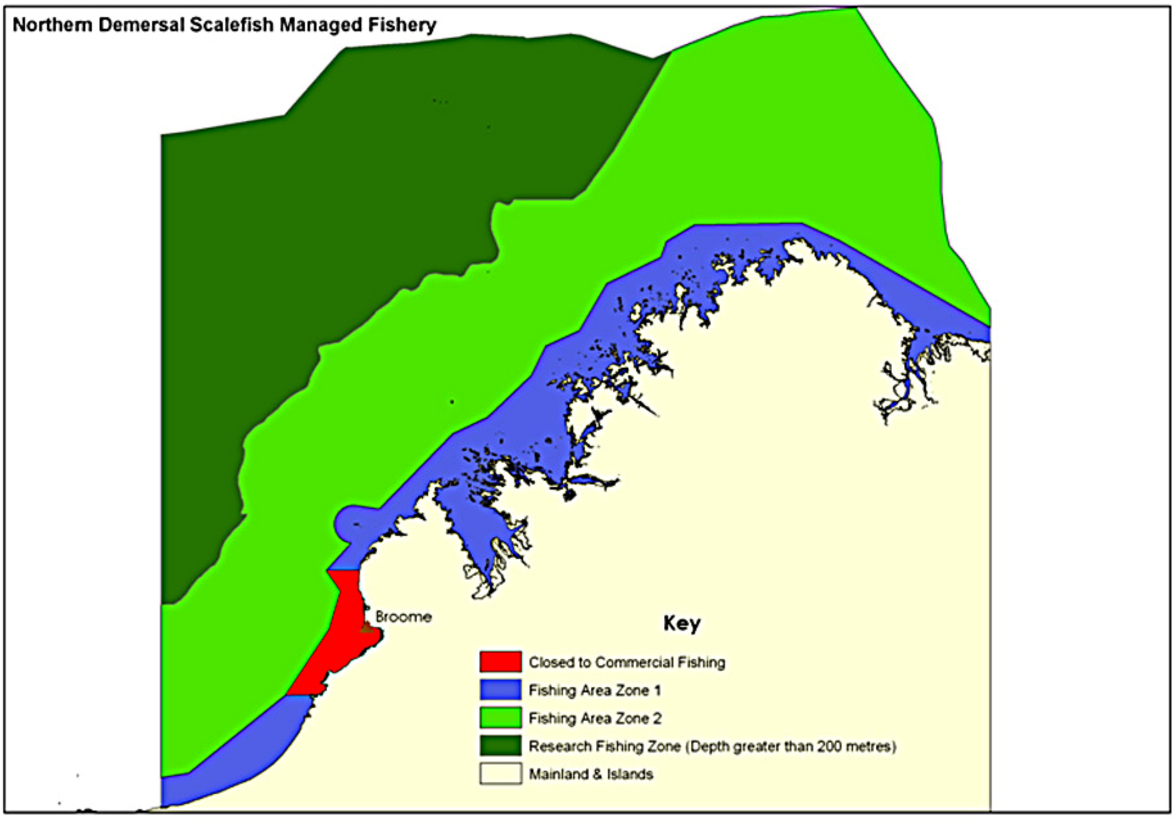


Fig.15. Power point slide used by W.A. Fisheries in presentation to 2007 NDSF industry meeting. (from Newman and Skepper, 2007a)

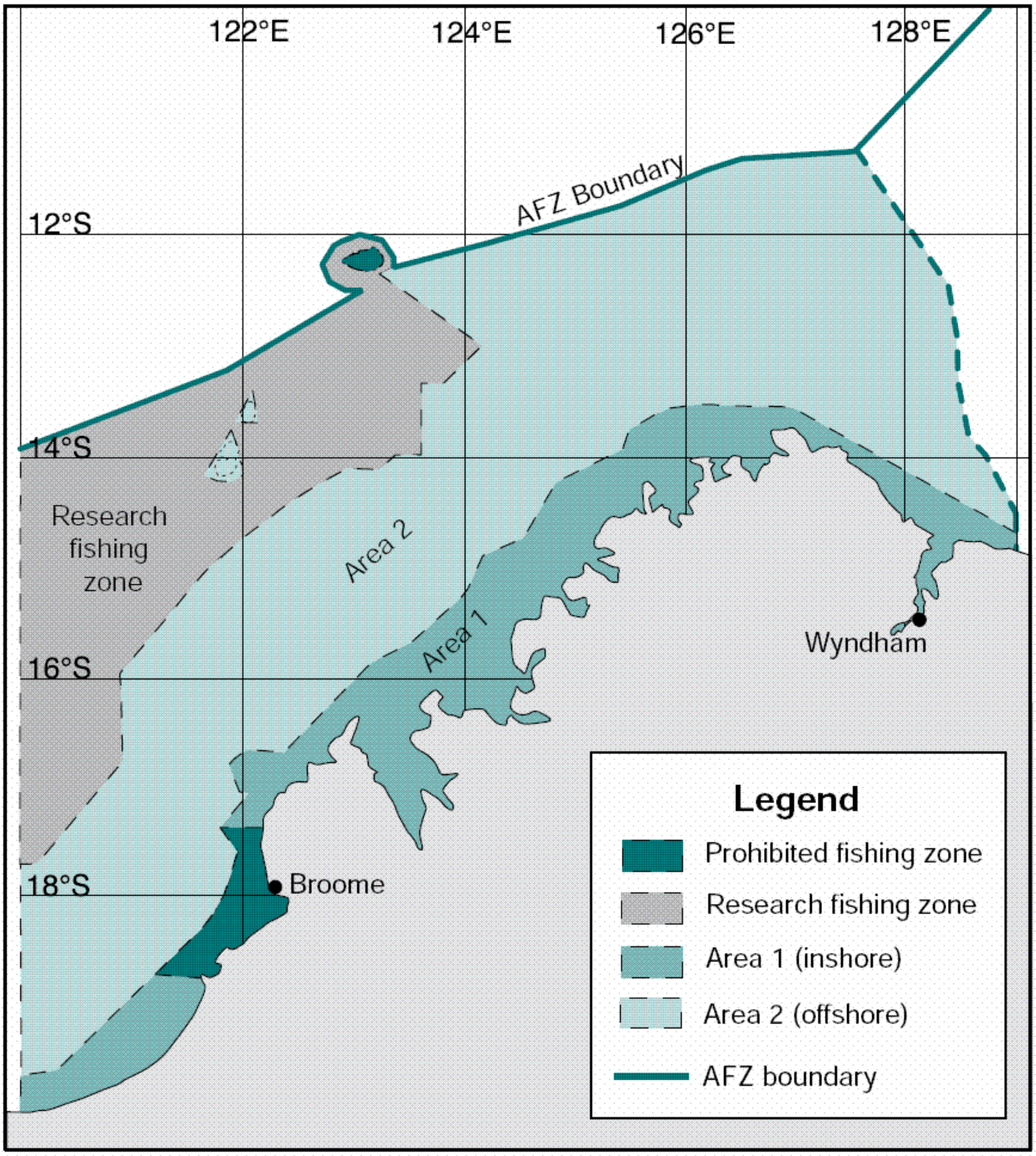


Fig. 16. NDSF boundaries from 2007 Fisheries Status Report. Note significant difference in shape of upper part of Area 2 from map immediately above (from Newman and Skepper, 2007b).

EBFM – the Kimberley Professional Fishermen's Association recently received notice that: “'The WA Department of Fisheries (DoF) is moving away from management based solely on single-species stock assessments towards ecosystem-based fisheries management (EBFM).” And, that ”By managing fisheries on an ecosystem basis the DoF will also include the social and economic impacts of changes to ensure fishing communities and the fishing industry remain sustainable.”

While EBFM may surely be desirable if it were possible to effect, any real application would require vastly greater knowledge of marine ecosystems and their thousands of component species than now exists. Knowledge of even the relative handful of commercial species is still only sketchy despite decades and hundreds of millions of dollars in research effort. In practice this initiative appears likely to only result in a huge expansion of hypothetical concerns calling for commensurate increases in precautionary measures.

The aim for consideration of social and economic impacts is long overdue and can only be commended. Implementation, however, will be crucial if the result is to be genuine and not just a public pretence ignored in actual decision making.

Cost recovery – Cost recovery has become another repeated bureaucratic mantra. The NDSF Overview 2000 (Anon., 2000a) states: "The NDSF is not classified as a major fishery, and therefore it is not a cost recovered fishery. As previously stated, the NDSF is classified as a 'major Minor Commercial Fishery.' It is the long-term objective of the agency to move the 'major Minor Commercial Fisheries' into cost recovery mode as well. ..... The NDSF currently contributes to the management of the fishery through the payment of licensing fees. However, these charges are nominal and do not meet the entire costs of administration, management and research." These "nominal" fees now amount to some $8000 per license each year.

While cost recovery may be desirable it must also be equitable and reasonable under the law. Fishermen are not the sole beneficiaries of fisheries. Wholesalers, retailers and consumers also benefit as does government from tax revenue at every step in the chain. Aiming to make fishermen solely liable for management costs seems decidedly inequitable. Reasonableness would also seem to dictate a necessity for transparency, accountability and cost effectiveness. Most importantly it should entail a place for direct industry representation in management decision making.

At present there is a decided lack of transparency, accountability and cost effectiveness in management of the NDSF. The industry has little knowledge of what management is doing and finds their own inputs ignored and inquiries unanswered. Management that is unaccountable to stakeholders who are nevertheless expected to be responsible for the cost is not just poor practice but fundamentally undemocratic. It is also difficult to reconcile "…the long-term objective of the agency to move the 'major Minor Commercial Fisheries' into cost recovery mode…." with management that precludes any possibility of an increase in production or efficiency that could support it.

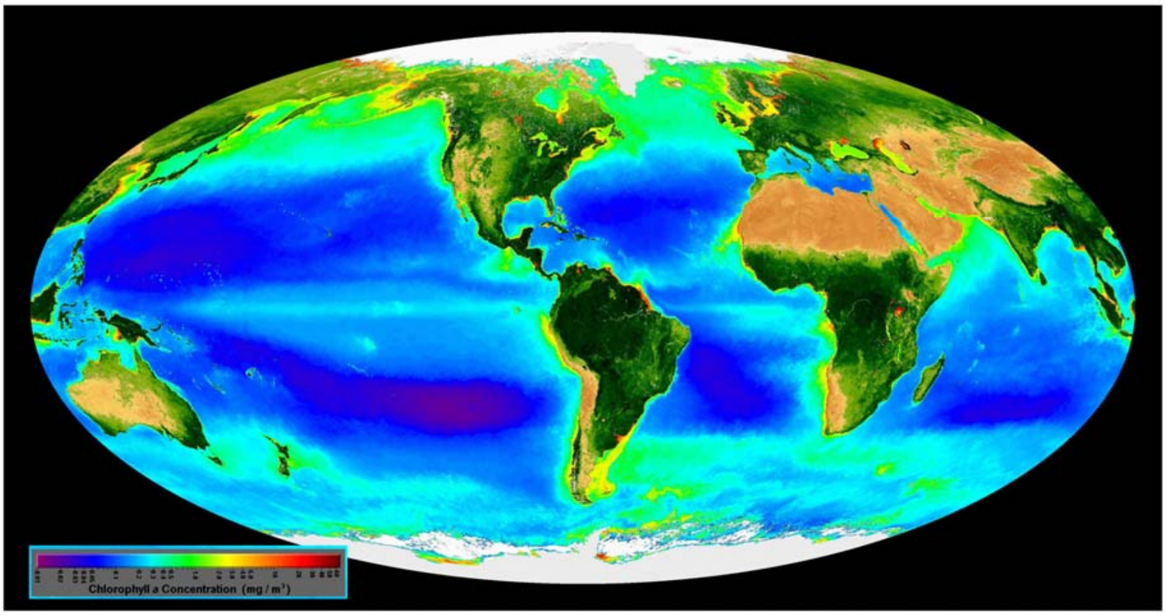
Oil & Gas Development- Recent consultations with "stakeholders" regarding offshore oil and gas development appears to have invited input from every group in the region save the one most likely to be directly affected, the NDSF. Hopefully, this omission may reflect the fact that there is no reason why fishery and oil/gas operations should not coexist with minimal conflict of interest as it does in many other parts of the world. Unfortunately material regarding offshore oil/gas development received by the Kimberley Professional Fishermen's Association has raised concerns that large exclusion areas may be imposed on the fishery. This matter needs clarification and extensive experience elsewhere deserves consideration.

NDSF Issues in Context

The management issues raised here are unfortunately not unique to the NDSF. Across the nation Australian fisheries are in widespread decline in terms of production, profitability and participation. Our fishing industry is in decay in every important respect save the resource itself. This is easily verified. Just go to a few fishing ports and see for yourself the empty berths and inactive deteriorating vessels. Take a few flights over coastal waters and see how few and far between are any fishing vessels. Talk to fishermen. Look at the ads in *Ausmarine* and *Trade-a-Boat* magazines offering fishing vessels, licences and quotas for a fraction of their market value only a few years ago. Look around any supermarket and see how pathetically little Australian seafood is on offer.

Although increased operating costs and import competition are contributing factors these are global conditions being faced by fisheries everywhere. The overwhelming reason our fishermen can't cope is increasingly stifling regulation which have now reached a level that profitable operation is no longer possible.

While there might be a credible argument over whether our sustainable harvest rate might be 20 or 30% or even 50% less than the global average the claim that the current harvest at only about 3% of the global average is near the sustainable limit for our waters is simply absurd. It wasn't until claims of widespread overfishing were challenged by pointing to our tiny harvest rate that low natural productivity was even mentioned. Now that this convenient excuse has been refuted with the oceanic productivity data from satellite monitoring (Figs. 17 a & b and Fig. 18) the good news that our waters might not be so impoverished after all has still been denied by a further claim that the productivity figures are only averages and seasonal and area differences mean that much of our region is still relatively impoverished.



Oceanic Chlorophyll concentration (satellite measurement)

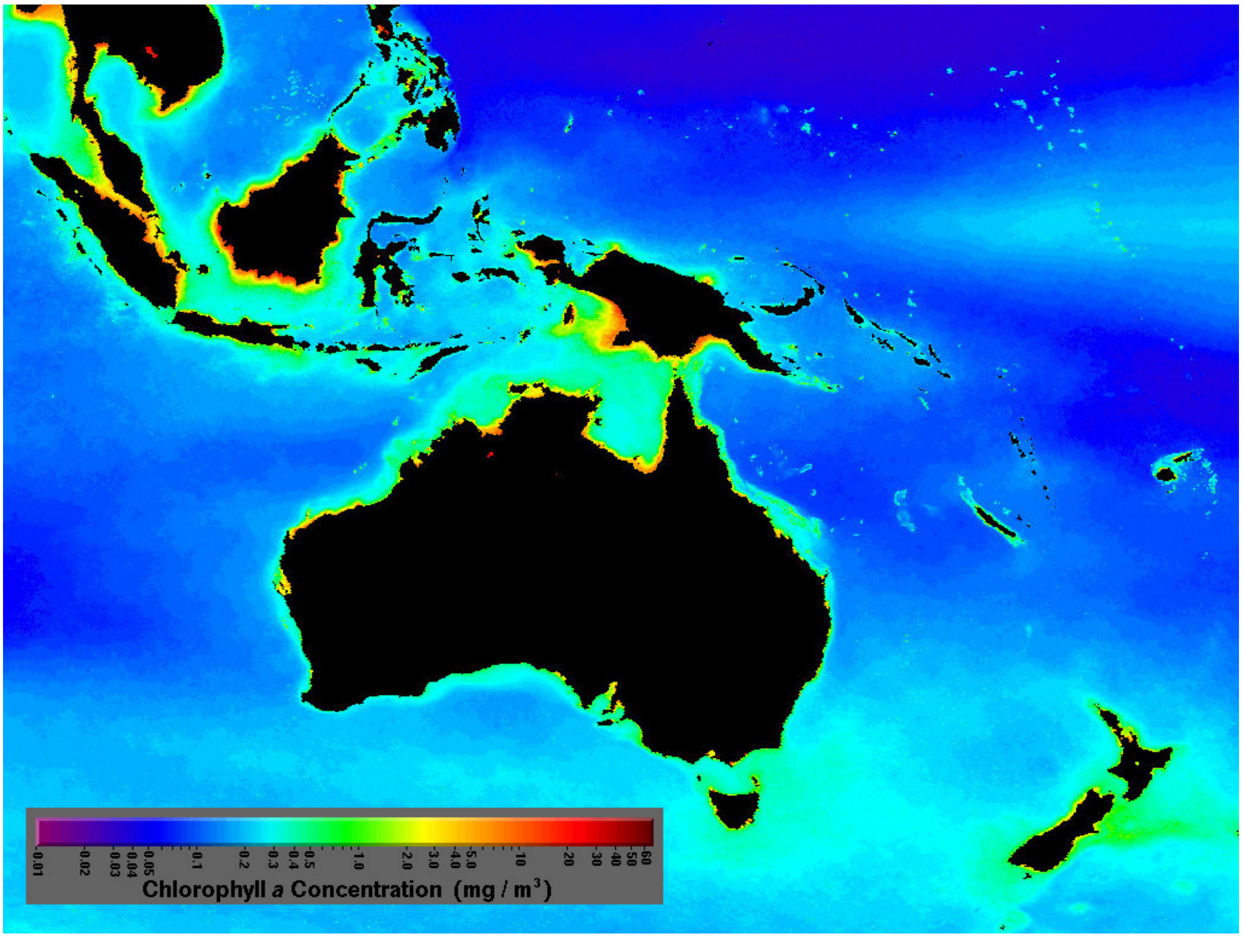


Fig. 17a & b. Satellite monitoring of oceanic primary productivity shows no unusually low productivity in Australian waters. NDSF area is in fact unusually high. (NASA Seawif images).

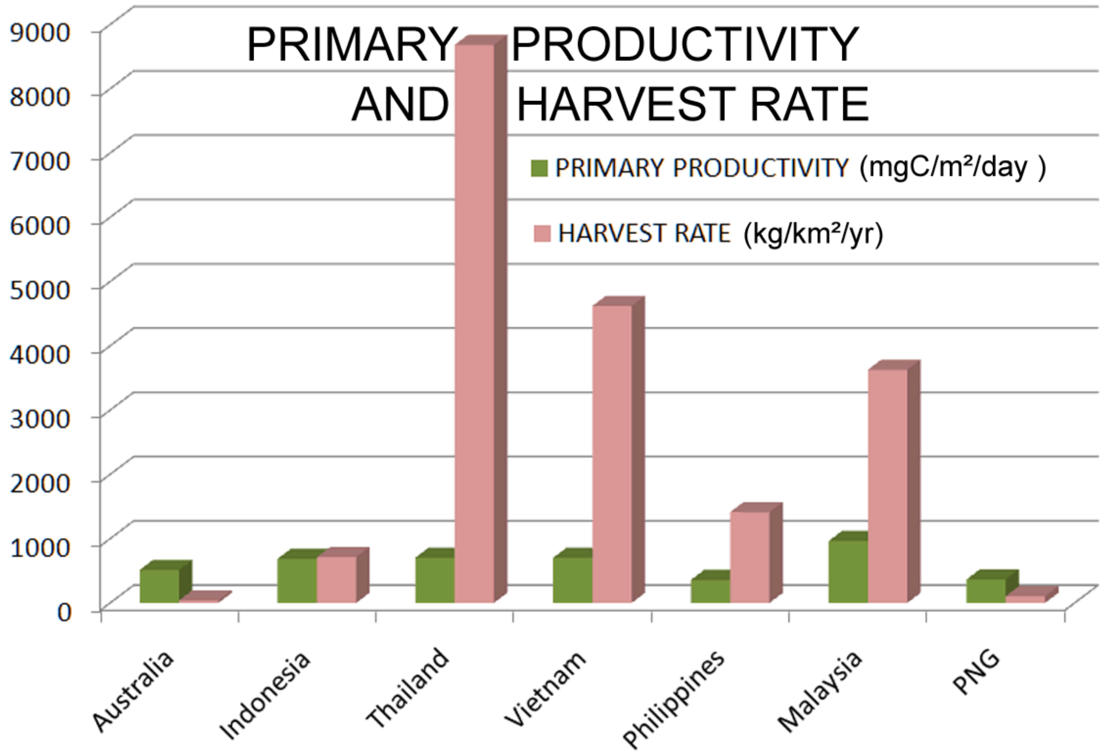


Fig. 18. Oceanic primary productivity and fisheries harvest rate for Australia and selected Southeast Asian nations.

Such argument reveals more a commitment to an agenda than to genuine scientific understanding. Large seasonal variations and area differences are common everywhere. Also, if much of our average productivity is due to an unusually high area in the north, where are the important fisheries associated with it? A major resource does indeed exist and the NDSF is right in the heart of it. The primary reason for its meagre utilization is entirely due to regulatory restrictions.

To accept the simplistic excuse of such low productivity one must be willing to believe that Australia sits in the middle of some amazing black hole in oceanic productivity in which the level of sustainable harvest is only 1/30 that of the average for the rest of the world. One must also accept that somehow such a remarkable phenomenon has attracted no scientific investigation or even recognition until now. Even more unbelievably, the sparse marine life claimed to exist in our waters must somehow conspire to be caught at rates per unit of effort that would be considered excellent elsewhere.

Continuing to import more and more of our seafood consumption (Fig. 19) when we have the largest least exploited marine area *per capita* area of any nation and the highest foreign debt in relation to GDP of any OECD nation is poor management. Paying for these imports by selling off non-renewable resources and calling it sustainable management is nonsense. Imposing our consumption on the resources of nations whose harvest rate is orders of magnitude greater than our own is unconscionable.

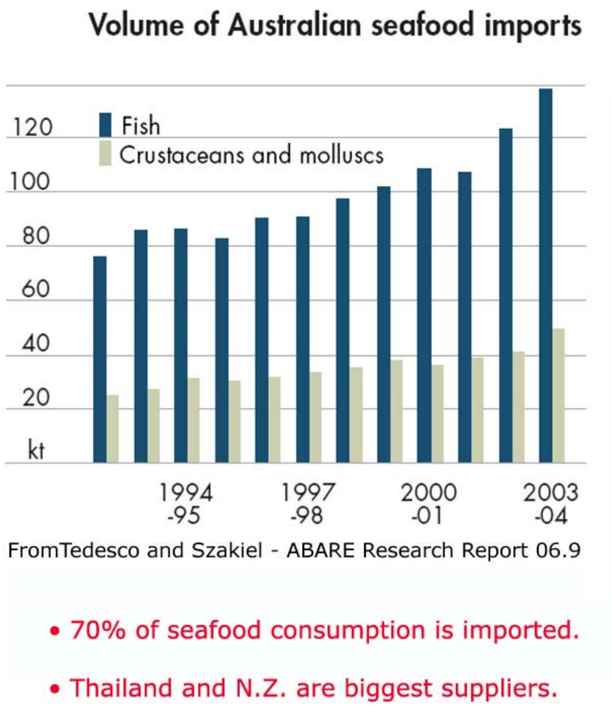


Fig. 19. Australian seafood imports are rapidly increasing

Australia has the largest remaining underexploited potential for fisheries and aquaculture in the world. Properly developed it could be a major drought-proof food producing sector, a significant contributor to the health and wealth of the nation and a wholly renewable resource. This is a problem of national importance and government is being badly misadvised by office based theorising bearing little resemblance to the actual resource. Genuine science is based on evidence not opinions. Our marine resource management has come to be dominated by claims of scientific authority based on unverified theories and models plus a generous misapplication of the precautionary principle with scant empirical evidence.

No one wishes to wreak damage on our marine ecosystems but every species has its impacts and we cannot exist without them. Misguided environmental concerns and the development of a powerful eco-bureaucracy has become a major impediment to a healthy balanced integration of human needs into the ecosystems of which we are a part. The following quote from a recent EU aquaculture report is worth consideration.: "The marine environment can not be understood as an undisturbed natural area, where all kinds of changes caused by human activities are seen as damage or unacceptable impact. Marine research has to provide information on the tolerance of marine ecosystems. The level of unacceptable change has to be discussed on a sound scientific basis, which is lacking in many cases and replaced by assumptions." It is also worth noting that even with limited available space, generally higher costs and less favourable environmental conditions their total aquaculture production is some 40 times larger than our own.

The end result of several decades of increasingly costly management has been a dying industry that has become the most expensively managed in the world. The AFMA budget alone amounts to over $100,000 per vessel each year.

Such criticisms of management are not uniquely my own either. Here are some examples of similar comments from three of the world's most respected fisheries biologists:

Ray Hilborn is Professor of Fisheries Management at the School of Aquatic and Fisheries Sciences at the University of Washington in Seattle. His recent essay (Hilborn, 2006) entitled "Faith-based Fisheries" published in the professional journal *Fisheries* stated:

> "I suggest the fisheries community needs to look at itself and question whether there is not a within our own field a strong movement of faith-based acceptance of ideas, and a search for data that support these ideas, rather than critical and skeptical analysis of the evidence. This faith-based fisheries movement has emerged in the last decade, and it threatens the very heart of the scientific process...."

> "A community of belief has arisen whose credo has become "fisheries management has failed, we need to abandon the old approaches and use marine protected areas and ecosystem-based management." "

> "Although the scientific community was unanimous in its condemnation of faith-based teachings in evolution, we need to also reject agenda-driven, faith-based publication in fisheries and revive the peer review and publication process within our own community. Let's go back to testable hypotheses and evidence, and make sure that the

> peer reviewers know the data and the problem, and are not chosen because of their faith."

Bob Kearney, Emeritus Professor of Fisheries at the University of Canberra in an address to the Australian Society for Fish Biology last year. It was entitled "The Pros and Cons of Marine Protected Areas in New South Wales: Who's Been Hoodwinked?" In it he says:

> "The documentation relating to the creation of the Batemans Marine Park is perhaps best described as very poorly disguised advocacy marketed to the unsuspecting public as science. This is a sham. So much so that not only does it totally discredit the Batemans Marine Park but it calls into question the credibility of the Marine Parks Authority and the justification of all existing and proposed marine parks in New South Wales."
>
> "It is such a pity tax payers' money and public good-will for conservation have been so needlessly misdirected by advocacy for more parks posing as science in the asserted cause of conservation and sustainability. The goal of having effective marine parks in NSW based on sound science has been seriously set back. And to date, we fish biologists have sat back and watched it happen."

Closer to home for the NDSF are the comments of one of the world's leading fisheries biologists, Dr, Carl Walters of the University of British Columbia Fisheries Centre, who was brought in to advise on Northern Territory fishery development. In their Workshop Review report (Walters *et al.* 1997) he had this to say:

> "There is considerable evidence now to suggest that the biggest and most catastrophic disasters that are pertinent to world fisheries are directly attributed to bad scientific advice and bad scientific assessments."
>
> "We are seeing, worldwide, an astounding dependence of fisheries sustainability on this thing we call 'scientific stock assessment' where we try to figure out how many fish are out there, and what kind of harvest rates they are able to withstand on a sustainable basis. The NT looked to me, as an outsider, as providing a real chance to study a fishery situation that had not proceeded to the point many have reached around the world, where negotiations between industry and government becomes impossible, where cooperative solutions to management become impossible, where the whole syndrome of bad scientists, bad management, and bad everything is combined. In situations where scientific mistakes have been made, the characteristics of those situations is that they are all fisheries that were developed and managed on the basis of what I call the British model. The basic British model of fisheries management is that fishermen go out to fish, and do their best to make a living, and the government sits back and watches what those fishermen do, and collects what data it can from their fishing activities. The government then puts a squeeze on fishermen, at some appropriate time, to prevent them from overfishing. But that model does not work."
>
> "…we sat down and tried to redo some of the computer based analyses that are widely used today in fisheries stock assessment, and correct some of the problems that have caused major fisheries collapses. We tried to make those models and methods work for NT data, and that was by and large not successful."
>
> "…there is a really critical need for getting out there and looking carefully at the habitat available for fish instead of just trying to stick catch statistics into a computer.

> That critical need says 'get out there and really look at the fish', and look at the environment they live in much more closely. You have got the capability here to do this, what has been lacking, I think, is the incentive in the form of people like me coming and saying 'guys, the computer is not going to give you your answers, you have got to get out in the field'."
>
> "There is a critical need for some very innovative experimental management approaches to find out how many fish are out there."

Recent Management Reports

2002 ESD Report Republication-

In June/July 2008 two new NDSF management reports became available on the Department of Fisheries, Western Australia website at: http://www.fish.wa.gov.au/. The first of these (Newman *et al.*, 2008) is an Ecologically Sustainable Development (ESD) report on the NDSF. The most recent information it presents for the fishery, however, is for 2002 and all of it had already been published in the June 2004 application to the Commonwealth government for approval of the NDSF as an ecologically sustainably managed fishery (Anon. 2004b). Why this already published, readily available, six years out of date material was deemed worth republishing under a new title is difficult to understand.

Several items in this report are worth noting:

> p. 9
> "...the initial series of assessments for fisheries has concentrated on the environmental and governance components of ESD of this fishery. The social and economic elements of ESD will be covered in the next phase of asessments."
>
> p. 10
> "As stated in the Department's ESD policy, it is expected that the ESD report, and therefore the objectives and performance measures, will be reviewed every 5 years...."

Comment: The socio-economic elements have until now been widely and seriously neglected in Australian fisheries management. In the case of the NDSF the entirety of management effort appears to have been directed toward assessment of the resource with little or no consideration of the socio-economic impacts of any management measures. With a new ESD report soon due and the promise of the past one in this regard the industry looks forward to seeing the outcome of such consideration.

> p. 77
> "As an indicator of a consultation process in accord with Fish Resources Management Act 1994: "The level to which licensees, the MAC and other stakeholders consider that they are adequately and appropriately consulted."
>
> "Each year in late October or early November, the Department holds meetings with the Northern Demersal Scalefish licence holders. These meetings typically involve discussions about management, research and compliance issues in the fishery, and provide a forum for industry to raise concerns and/or ask questions of the Department concerning management arrangements."

Comment: NDSF fishers strongly feel that their concerns have been dismissed, their questions unanswered and their suggestions ignored. Whatever the validity of such perceptions it is clear that as an indicator of "The level to which licensees, the MAC and other stakeholders consider that they are adequately and appropriately consulted." the consultation process must be deemed a failure.

> p. 88
> "Finally, once completed, the full ESD Report for the NDSMF will be made publicly available via publication and electronically from the Departmental website. This will provide increased transparency through explicitly stating objectives, indicators, performance measures, management arrangements for each issue and how the fishery is currently performing against these criteria. As a result, the Department of Fisheries is meeting this guideline."

Comment: Publication of an assessment report 6 years after the end of the period being assessed would not seem to be meeting the intention of the performance guidelines.

> p.95
> "The trap catch rate of goldband snapper increased after 1998 and also became more variable (Figure 15). These variations were assumed to reflect changes in efficiency by trap fishers as they attempted to maximise their return from each day spent in the fishery (as fishing days are limited)."

Comment: The Figure 15 referred to is actually for spangled emperor and it appears some 40 pages earlier. Figure 16 is for goldband snapper (as reproduced here).

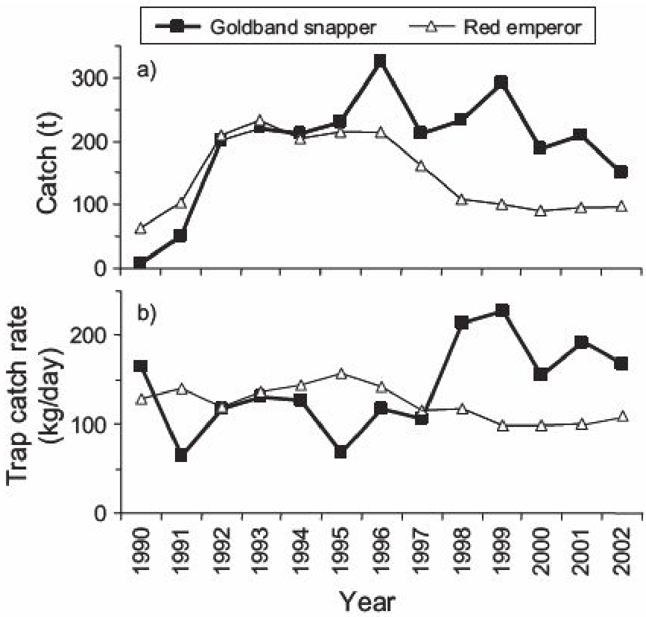


Figure 16 Annual a) catch levels and b) catch rates, of red emperor and goldband snapper in the NDSMF from 1990-2002.

Fig. 20. = Fig. 6 from Newman et al., 2008

More importantly it is difficult to reconcile the description that the trap catch rate "increased after 1998 and also became more variable "with the graph. The most dramatic increase was between 1997 and 1998, not after 1998 and variability remains high throughout but could hardly be said to increase. The assumption that these variations are due to changes in efficiency by the fishermen also appears unlikely. It would require that the purported changes somehow affect catches of goldband much more than red emperor. It would also mean inexplicable declines in efficiency in 1991, 1995 and 2000. A far more plausible explanation would simply be natural variability in the population as commonly found in most fisheries. That this may not be in accord with the results from the models is reason only to be aware that modelled outcomes are often incorrect.

State of the Fisheries Report 2006/07-

The second recent NDSF publication is the State of the Fisheries Report 2006/07 (Newman and Skepper, 2007b). Although the publishing date is 2007 it only appeared on the Department of Fisheries website in mid 2008. While far more timely than the six year delay of the ESD report, the six months or more of delay from print publication until making it readily available by electronic means still falls somewhat short of timely transparent communication with stakeholders.

The following quotes from this report are commented upon:

> p. 162
> "The performance measures for this fishery relate to the maintenance of adequate breeding stocks for the key indicator species as indicated by the catch levels. In 2006, the catches of red emperor, goldband snapper and the cod/grouper complex either exceeded the trigger point of a 20% increase in catch, or were close to the trigger point despite a reduction in effort from 2005. As abundance has probably been maintained at higher catch levels, all 3 species/groups were still considered to have adequate breeding stock levels. However, the increasing trend in catch for these species has triggered the requirement for an updated stock assessment review that is currently in progress."

Comment: It is significant that despite the reduction in effort (imposed by management) the total catch remained high. Not mentioned here, but known to the authors, the 801 t catch being reported for 2006 increased still further to 907 t in 2007 (Newman, 2008). This cannot with credibility be yet again attributed to ever increasing efficiency of the fishermen. If it is indeed such, then the same marvellously efficient people might better be managing their own fishery. Although an updated stock assessment may be required it is clearly evident that the validity of the assessment methodology itself is what most needs reassessment.

> p. 163
> "The 2006 catch of goldband snapper and the cods/groupers complex were above the acceptable levels for the third consecutive year (see 'Fishery Governance' section). The 2006 catch of red emperor was only marginally below the acceptable level."
>
> "The catch per unit of effort from the fishery provides an indicator of annual variations in stock abundance, although changes in vessel efficiency need to be taken into account when using the data as a time series."

“The introduction of management controls in 1998 resulted in an increase in CPUE for trap vessels in the NDSF. This increase was related to increases in efficiency, as fishers sought to maximise their catch return from each day fished in the fishery, as the available fishing effort was limited.”

“A stock assessment review of the key target species in the NDSF will be undertaken in 2007 – 2008.”

“The spawning biomass of the key target species in the NDSF has been estimated by an age-structured stock assessment model and assessed in relation to the accepted international reference point for these types of species of 40% of virgin biomass.”

Comment: It would appear that the acceptable levels of catch being used are inconsistent with the evident abundance of the stocks actually present and the acceptable levels themselves require reassessment. It is good to see that after two decades of sustained high levels of CPUE it is finally being considered as providing an indication of stock abundance and not just dismissed as an artefact of “hyperstability”. It is also interesting to note increased efficiency being attributed to the imposition of controls. One wonders if controls on management might not also result in improved efficiency. It would further be particularly appropriate to the aims of transparency and good communication if the new stock assessment would include full disclosure of the materials and methods employed including those used for determining virgin biomass.

p. 164
“In addition to the overall catch target, performance measures state that the annual catch of each of the key target species/groups (red emperor, goldband snapper and the cod/grouper complex) by the fishery should not increase by more than 20% above the average for the previous 4 years.”

“Thus in 2006, the acceptable level of catch (average + 20%) for red emperor was less than 167 t, for goldband snapper less than 327 t, and for the cods/groupers less than 101 t. 2 of these individual trigger points were exceeded in 2006, with 1 being only marginally below the trigger level.”

“Current fishing (or effort) level: Not Acceptable
The reduction in the effort allocated in 2006 translated into a level of catch equivalent to the notional TAC with very little unutilised effort. Catches have either exceeded, or are close to, the trigger levels. The current level of fishing is therefore considered to be not acceptable. A stock assessment review of the fishery is in progress.”

“**New management initiatives (2006/07)**
The zoning arrangements for the fishery need to be incorporated into the management plan.”

Comment: The use of catch variability as a performance measure seems inconsistent with the natural variability common to many fisheries and seemingly apparent in the NDSF data. In effect this results in periods of good catches being curtailed and becoming an added penalty on the poorer years that will inevitably follow.

It is particularly remarkable that better catches for less effort than ever before is in itself deemed “Not Acceptable”, even with no other evidence to indicate overfishing. In any other fishery in the world this would be seen as an ideal outcome. It seems that the NDSF is managed from the unique perspective that if real world evidence does not conform to the management model something is wrong with the real world, not the model.

The frequently changed and varyingly depicted zoning arrangements do indeed need to be clarified. An exposition of the rationale for the boundaries would also be of considerable value in accord with transparency and good communication.

> p. 165
> “External Factors
> The impacts of environmental variation on the fishery are not considered to be large. There are no data to indicate significant variation in recruitment amongst years for either of the 2 key species.”
>
> The level of catch in the NDSF is controlled through a complex time-gear unit management system. Any additional level of catch from this fishery may adversely impact on the stock assessment models for this fishery and thus future effort allocations.

Comment: Variability in recruitment is more the norm than the exception in most fisheries and there is no reason not to expect it here. Both the age structured data and the inter-annual variability of the catch indicate considerable variability in recruitment probably does in fact occur. Unfortunately, such variability would cast serious doubt on the applicability of the modelled estimates and projections now being used for management. Recognition of unpredictable natural variability would demand a more empirical approach based more on data and less on modelled projections, Rejection of variability does seem to be based more on convenience than on evidence or even probability.

The last paragraph cited above appears to effectively encapsulate the current approach to management, The emphasis is clearly on bureaucratic complexity and modelled results. Variability in nature is only an inconvenience that is best ignored and any performance not in accord with the models shall be penalised until it does conform.

The following tables and figures from this report are also worth noting:

NORTHERN DEMERSAL SCALEFISH TABLE 1

Recent annual catches of major target and by-product species or species groups by the NDSF.

Species	NDSF annual catch (tonnes)					
	2002	2003	2004	2005	2006	2007
Goldband snapper (*Pristipomoides* spp.)	152	226	283	429	336	393
Red emperor (*Lutjanus sebae*)	101	118	144	192	166	176
Scarlet perch (*Lutjanus malabaricus*)	61	48	68	92	79	96
Spangled emperor (*Lethrinus nebulosus*)	35	39	33	21	28	14
Cod/grouper (Serranidae)	49	74	103	110	129	121
Other species	36	47	59	78	63	106
Total demersal scalefish catch	**434**	**552**	**690**	**922**	**801**	907

NORTHERN DEMERSAL SCALEFISH TABLE 2

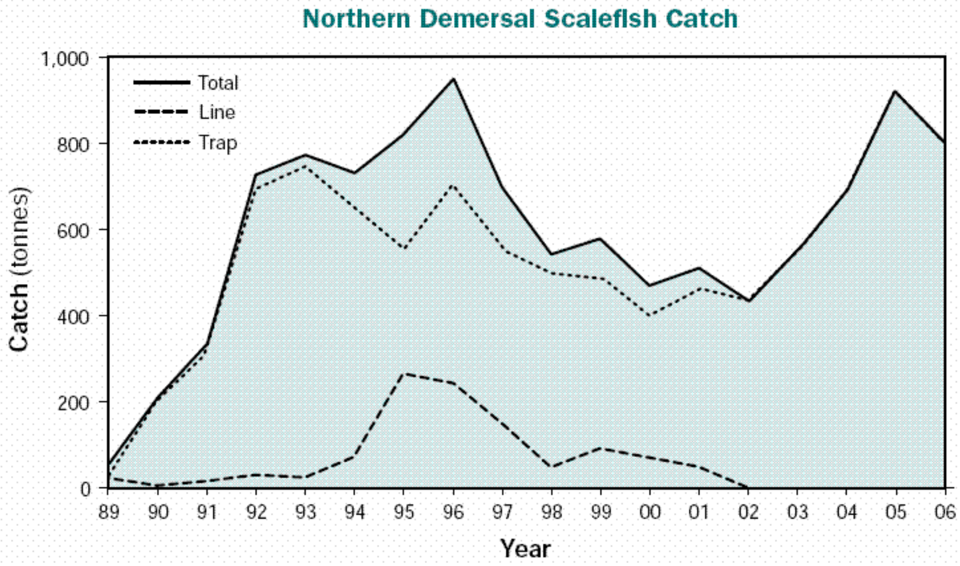
Total catches (tonnes) of demersal finfish and effort (days) by line and trap vessels in the NDSF since the introduction of full management arrangements in 1998.

Year	Total allowable effort (days)	Line catch (t)	Line catch (days)	Trap effort (t)	Trap catch (days)	Total (t)
1998	1,684	45	78	497	916	542
1999	1,716	91	228	486	992	577
2000	1,562	67	155	409	890	476
2001	1,672	47	136	462	928	509
2002	1,760	0	0	434	900	434
2003	1,760	0	0	552	1,060	552
2004	1,760	0	0	690	1,300	690
2005	1,760	0	0	922	1,318	922
2006	**1,144**	**0**	**0**	**801**	**1,193**	**801**
(Estimated Catch: Zone A = 60 t, Zone B = 741 t; Estimated Effort: Zone A = 127 SFDs, Zone B = 1,066 SFDs)						
2007	1144	0	0	907	1195	907

(Reported Catch: Zone A = 97 t, Zone B = 810 t; Reported Effort: Zone A = 130 SFDs, Zone B = 1065 SFDs)

Fig. 21. Tables 1 and 2 from Newman and Skepper, 2007b

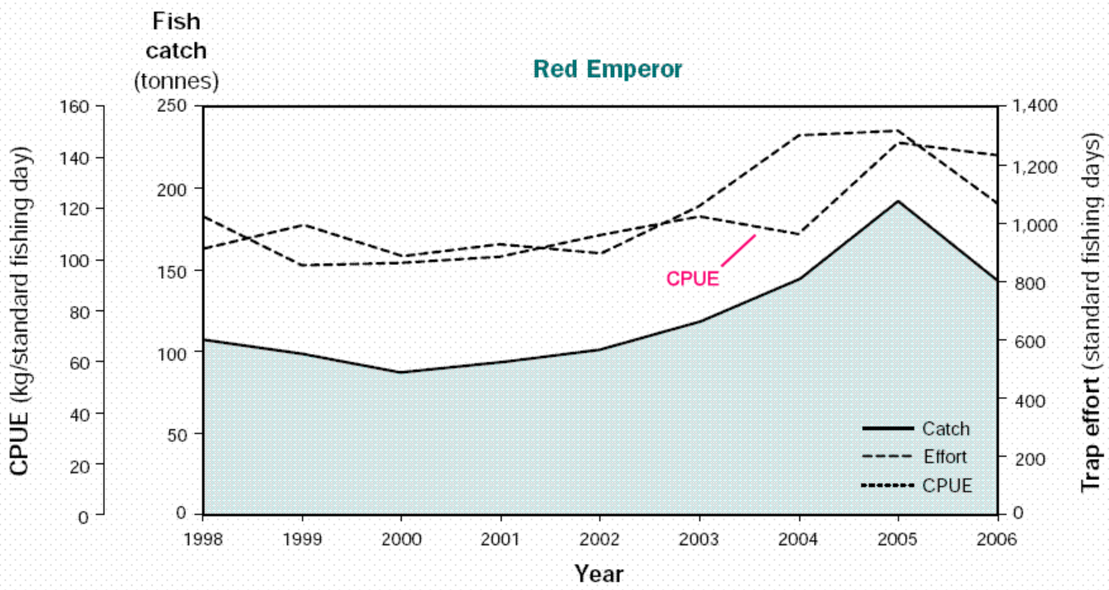
The red additions for 2007 are from Newman, 2008. Note the continued reduction in total allowable effort to 1144 SFDs and the significant increase in total catch to 907 t. Note also that the column headings in Table 2 are mislabelled. “Line catch (days)” should be Line effort (days), “Trap effort (t)” should be Trap catch (t) and “Trap catch (days)” should be Trap effort (days). Note too that the total allowable effort is for Zone B only whereas the catch and effort are for both A and B zones together. This makes the actual effort appear to exceed the total allowable. These kind of confusing errors and discrepancies have been noted throughout the NDSF literature. It presents the unfortunate impression that it has been thrown together without much care with the not unreasonable assumption that it will never be carefully examined by anyone anyway.



NORTHERN DEMERSAL SCALEFISH FIGURE 2
Catch levels of demersal finfish in the NDSF by line and trap, 1989 – 2006.

Fig. 22. = Fig. 2 from Newman and Skepper, 2007b

In figure 2 of the report it is worth noting that the peak catch in 2005 after falling slightly in 2006 has since been exceeded by the 2007 figure which is very close to the all time high of 1996. In terms of CPUE 2007 is in fact far higher than any previous year because of the restricted effort.



NORTHERN DEMERSAL SCALEFISH FIGURE 3
Catch, effort and catch per unit of effort of red emperor in the NDSF by trap, 1998 – 2006.

Fig. 23. = Fig. 3 from Newman and Skepper, 2007b

The red CPUE notation in the above graph has been added to clarify another error in which the CPUE trace which was apparently intended to be a dotted line was rendered as a dashed line thus confusing it with the dashed line for effort.

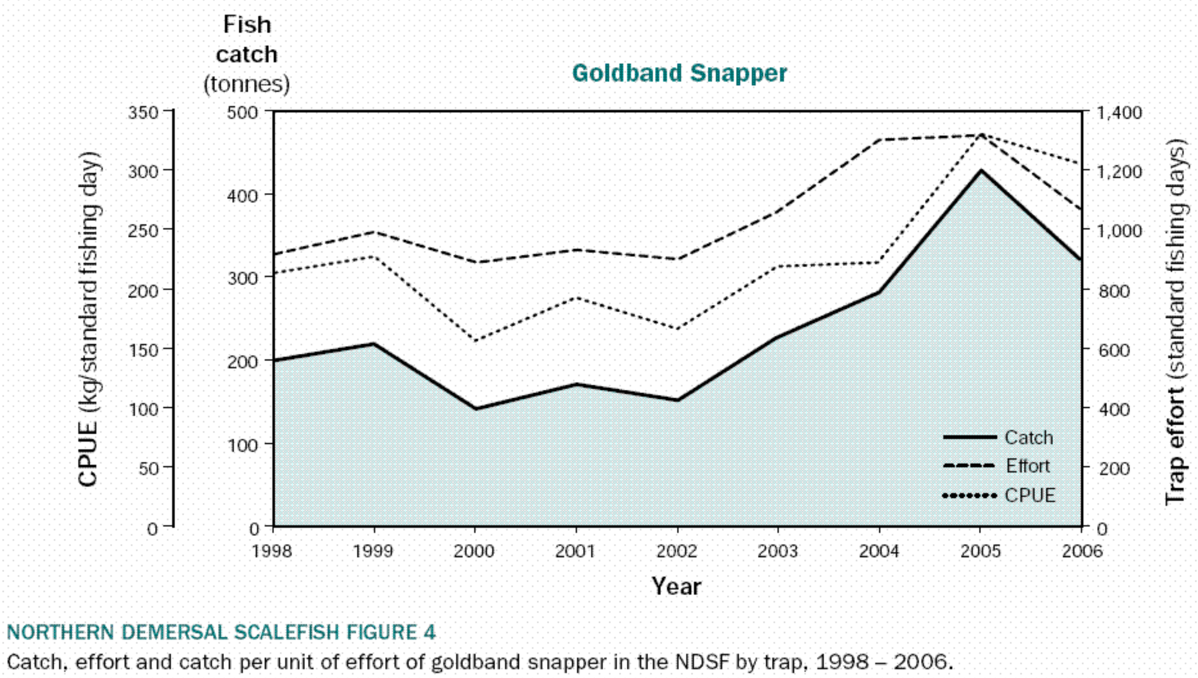


Fig. 24. = Fig. 4 from Newman and Skepper, 2007b

Figures 3 and 4 of the report are most interesting to examine in comparison to the following graphs which were created using the data presented in Anon. 2005b, Anon. 2007a, the Table 1 of Newman and Skepper, 2007b reproduced above and Newman 2008. Authorship of the two Anon. references can be assumed to be the same as Newman *et al.* 2008 as some of the same figures are used without different attribution.

The aim has been to present an overall view of catch, effort and CPUE of these two principle species over the whole time period from 1990 through 2007 instead of selected segments of time employing differing scales for the two species.

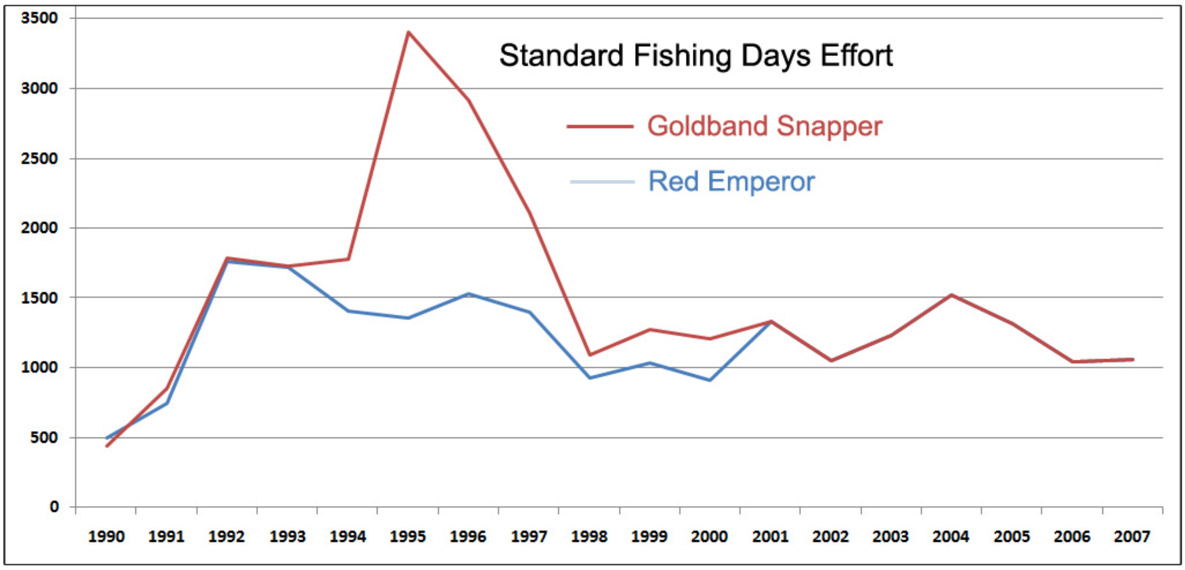


Fig. 25. Snapper fishing effort graph from 1990-2007

The effort data show a huge increase in goldband fishing effort in 1995 and 1996 that is unexplained and not commented upon. It is also not commensurately reflected in the catch and CPUE. Perhaps this is why Newman and Skepper, 2007b start their graphs in 1998.

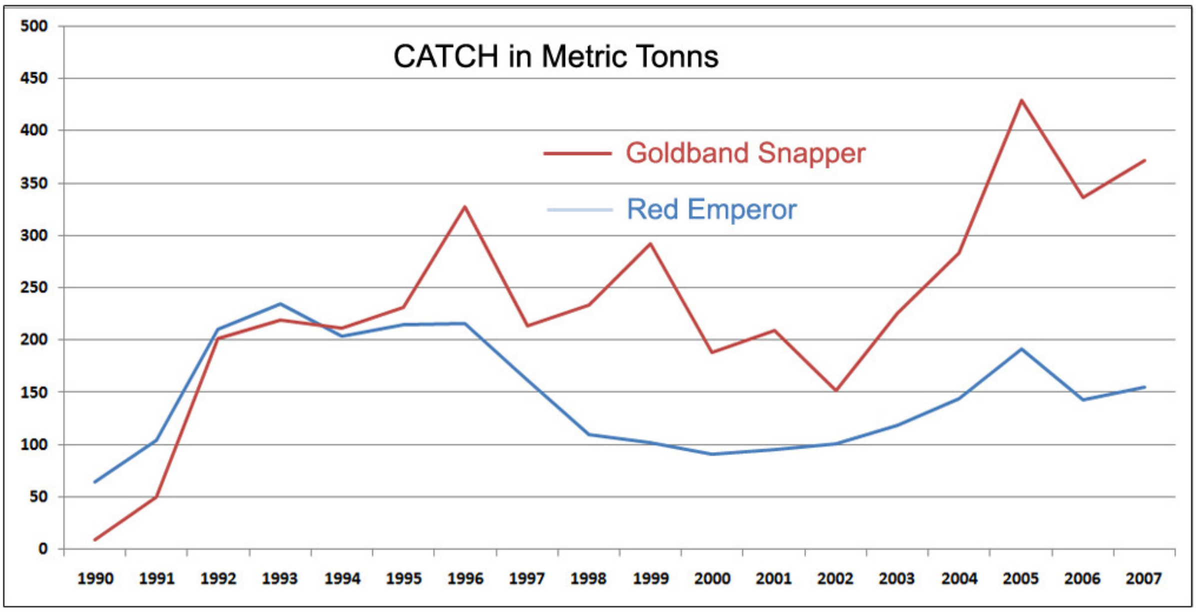


Fig. 26. Graph of data from Anon. 2005b, Anon. 2007a,
Newman and Skepper, 2007b and Newman 2008

A downward trend in catch from 1996 to 2002 corresponds generally with the effort reduction: but the large subsequent increase clearly results from a greatly increased CPUE.

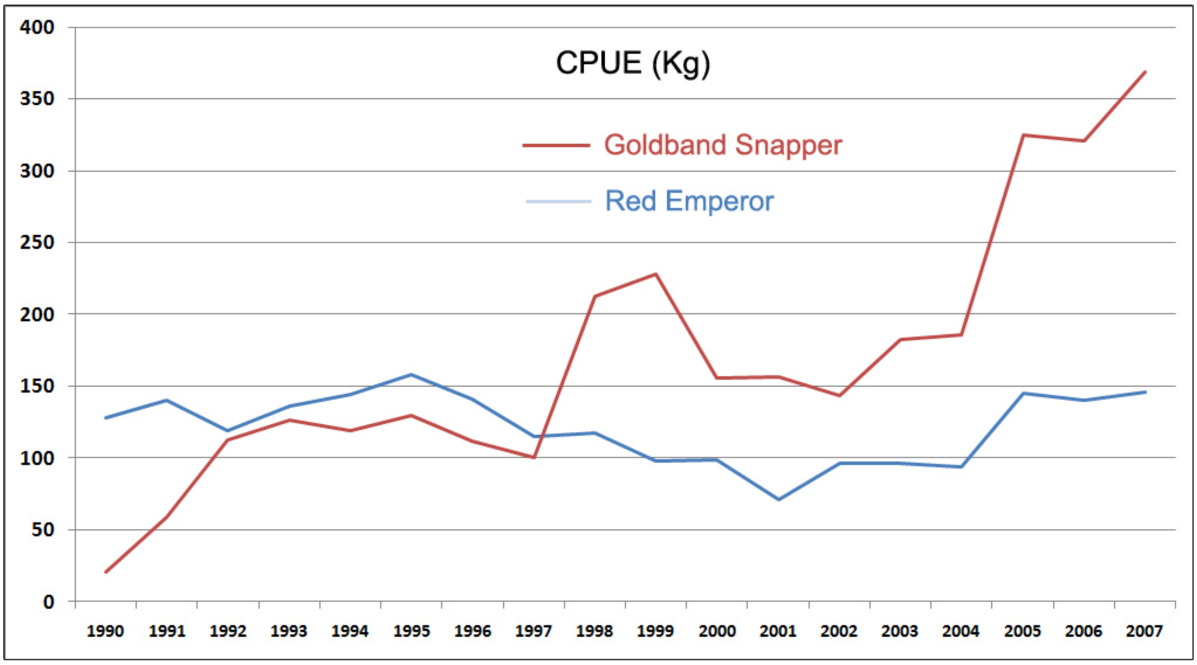


Fig. 27. Graph of data from Anon. 2005b, Anon. 2007a,
Newman and Skepper, 2007b and Newman 2008

The CPUE data are those presented by the references cited. In some years the CPUE directly relates to the catch and effort figures but in a number of years there is a significant discrepancy. Whether this is the result of error or some adjustment is unknown. In particular the handling of equivalencies between trap and line effort would seem highly problematic but none of this is explained or even acknowledged. To further muddle the picture the goldband catch data includes an unassessed but significant portion of two other species, *P. typus* and *P. filamentosus*.

The data are used here as presented by NDSF management and it is simply impossible to see any indication of ongoing overfishing. The principle species. goldband snapper, clearly shows a distinct trend to markedly better catches and strong indication of significant natural variability unrelated to fishing effort.

Some Important Questions for Management

In accord with the goals of transparency and good stakeholder communication the KPFA would like to formally request that answers be provided to the following questions. All pertain to management issues which we believe to be of critical importance to our industry and about which our clear understanding is of great importance.

1. What, in tonns, are the actual virgin biomass figures used in NDSF management for goldband snapper, red emperor and for the total fishery?
2. What assessment has been made of the gear selectivity involved with the trawl data used for estimation of virgin biomass?
3. Why is the vastly more extensive and standardised population sampling effected by the trap fishery itself not used for stock assessment?
4. What is the evidence for hyperstability and how is it reconciled with the occurrence of good catches over individual trapline sets extending several kilometres in length at myriad different locations throughout the B zone?
5. Does the age structured stock assessment show an ongoing reduction in age classes as would be expected from ongoing overfishing?
6. What criteria have been used in determining sample selection locations for age structured stock assessment and have the same locations been used for subsequent annual samples?
7. What is the evidence for ever increasing efficiency and how is this reconciled with the occasional significant downturns that have also occurred?
8. Why is the observed variability in catch rate and age structure data not evidence of recruitment variability?
9. Have the models (and the estimates and assumptions used in them) been subject to verification with regard to their appropriateness for this fishery?
10. What appropriate statistical testing has been applied to determine whether the observed age structures are associated with fishing effort or with natural variability between locations and over time?

11. With a total annual effort that by even the most generous estimate only fishes less than 1% of the B zone how is it even remotely possible that this fishery could be overfished?
12. What is the purpose of having A, B and C zones? Would it not be preferable to permit the fishery to operate freely in all three zones and in the process provide a better assessment of the entire resource at no extra cost?
13. What is the purpose of the current trap specifications? Has it been determined to be optimal in some regard or might it also be preferable to permit experimentation in order to gain better understanding at negligible cost or risk?
14. After nearly two decades of ongoing management concerns regarding overfishing with all evidence indicating only improvement in stocks and catch rates, is it not time to seriously consider a new approach to management?

These last two questions are not intended as simply rhetorical. They go directly to the competence and intent of management. Without satisfactory answers to these questions, management credibility can only further deteriorate. A willingness to acknowledge deficiency and consider a new approach would meet far better acceptance than an attempt to justify the indefensible.

What is being sought here is not elaborate explanation or documentation but only a simple clear statement of the management position on these matters plus a copy of any data and/or documentation on which it is based. What we wish to obtain is materiel sufficient for peer review in accord with good scientific practice. Our aim is not disputation but understanding and the ability to seek qualified independent opinion if such seems warranted.

A Way Forward

Fisheries around the world are under severe economic stress from rising fuel prices. Management imposed costs, restrictions and inefficiencies that were bearable in more profitable times may now become impossible burdens. The NDSF operators feel that significant further restrictions threaten the viability of their fishery. They also know that fishing pressure is very low, the fish are abundant and catches are excellent. They are highly sceptical about claims of overfishing based on theories and models applied by remote managers having minimal direct experience of the actual fishery. The fishermen feel their livelihood is threatened and are prepared to put up a fight against what clearly appears to be out of touch management of doubtful competence.

There would appear to be only two ways forward, to either fight or seek to co-operate. While management, having the power and resources of government behind them might be inclined to fight, current circumstances are not so favourable as they have been. A global energy and food crisis is developing and public sentiment will be more sympathetic to struggling producer than to dubious restrictions imposed by remote bureaucrats. The arguments that refute overfishing are powerful, easy to understand and difficult to credibly refute. In the court of public opinion via the mass media this is an issue that has several newsworthy slants. Some aspects would afford good material for question time in parliament. Then too, government is looking for bureaucratic waste and excess to cut back. Greatly expanded management that has delivered only declining production and profits is not easy to defend. Even if management manages to prevail it will come away damaged and there will be no kudos for presiding over what would be just another declining Australian fishery.

On the other hand, a genuine co-operative approach could be a win-win situation. There is clearly a much more substantial resource in the NDSF than has been estimated. Implementation of a much more empirical, experimental and less restrictive approach to management with improved data collecting and monitoring could be undertaken with no risk of any significant damage. Management that reverses the downward trajectory in Australian fisheries and results in increased production and productivity would be a major achievement well deserving of all due recognition for those who might achieve it. Effecting this would require good co-operation and some degree of compromise on both sides but it is eminently doable. It is worth giving serious consideration.

Some examples where a co-operative experimental approach could yield improved knowledge of the resource and a more productive fishery might be:

1. Expand the fishing area to better determine stock distribution.
2. Increase trap numbers and fishing days incrementally while monitoring effects.
3. Evaluate trapping effectiveness with aim of better estimating stock size.
4. Remove restriction on trap construction to gain better understanding of effects of trap design.
5. Use of inexpensive video technology to assess trap performance and better determine stock density.
6. Implement tagging program.
7. Investigate age determination from scale rings.


Fig. 28. Red Emperor fresh from an NDSF trap

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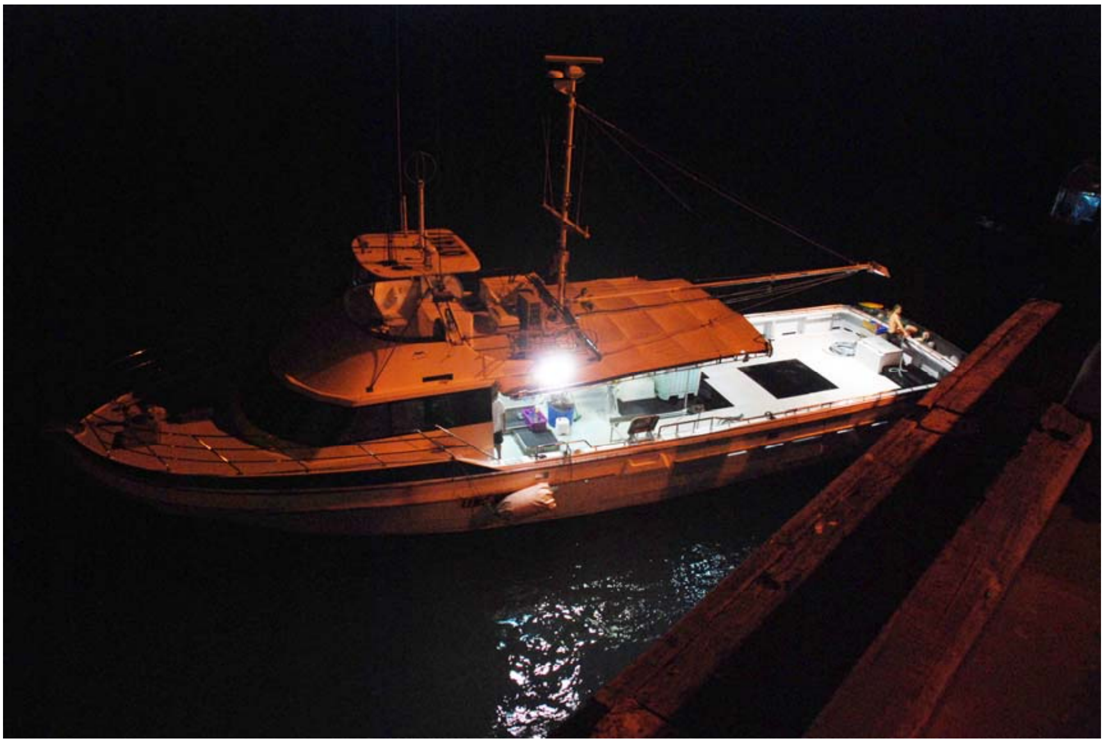

Fig. 29. 5:00 a.m. arrival at Broome wharf to unload a week's catch from the NDSF

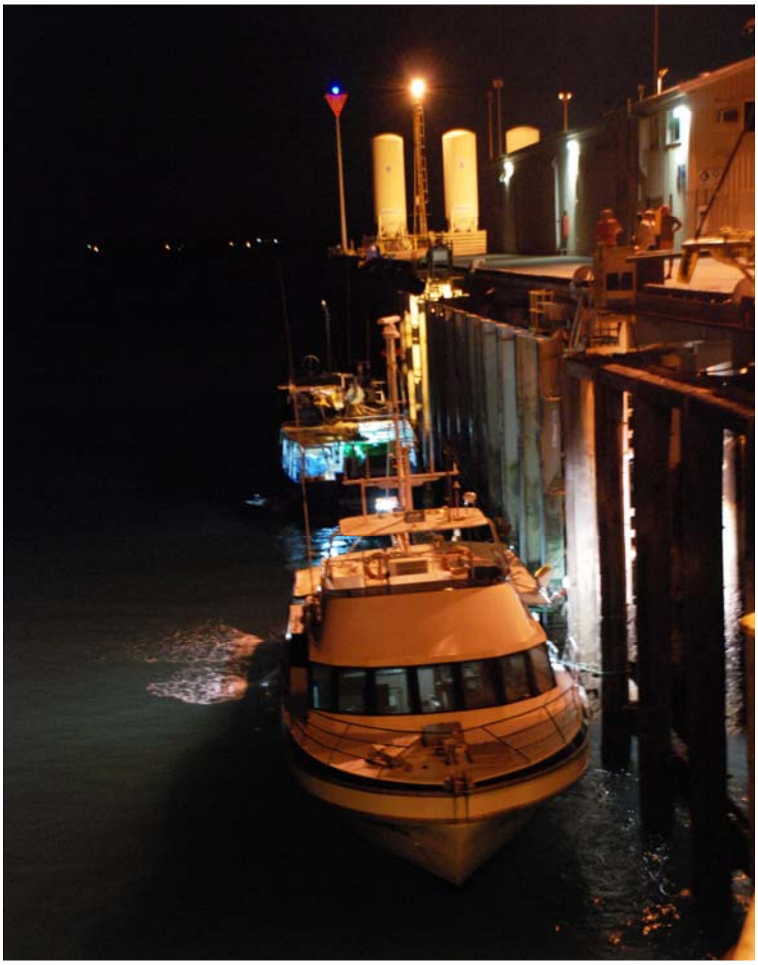

Fig. 30. Alongside the Broome wharf to unload

Fig. 31. Goldband snappers from the NDSF

Fig. 32. Packing catch in ice for shipment to distant markets

Fig. 33. Lifting pallet of catch onto wharf
Each unloading operation costs several thousand dollars in fees and labour.

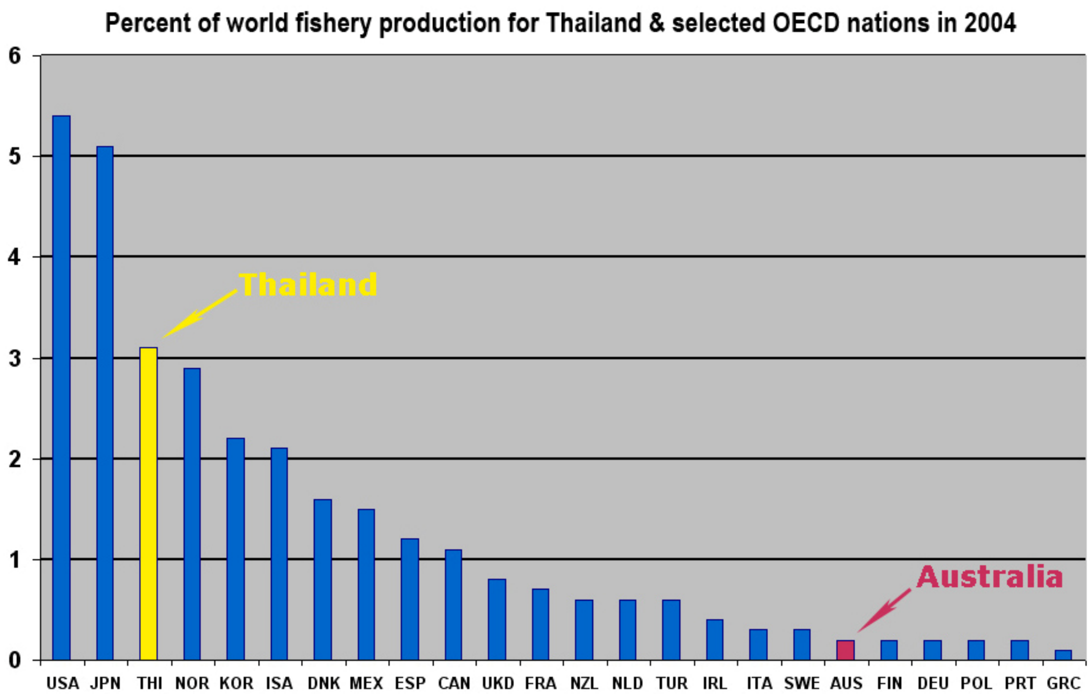

Fig. 34. Australian fishery production is on a par with Finland, Germany, Poland and Portugal.

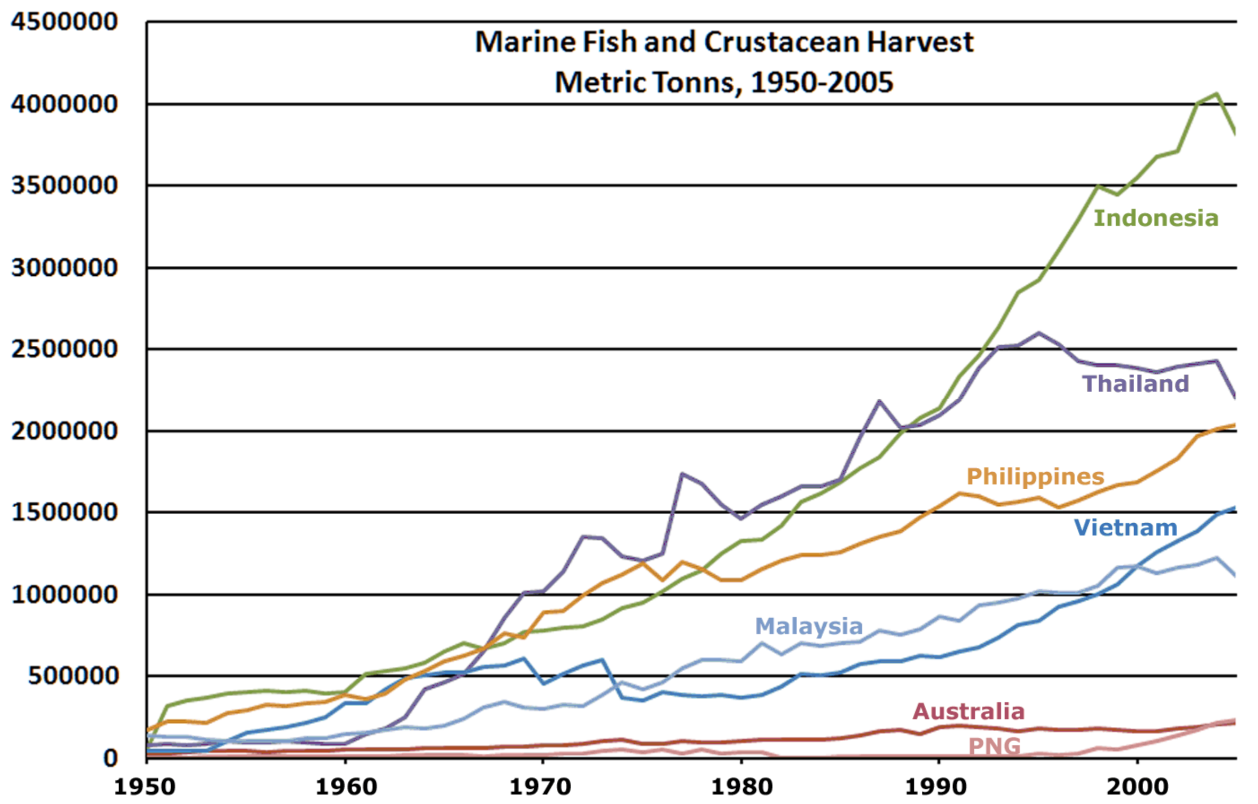

Fig. 35. Australian fishery production is far below all our much smaller neighbours.

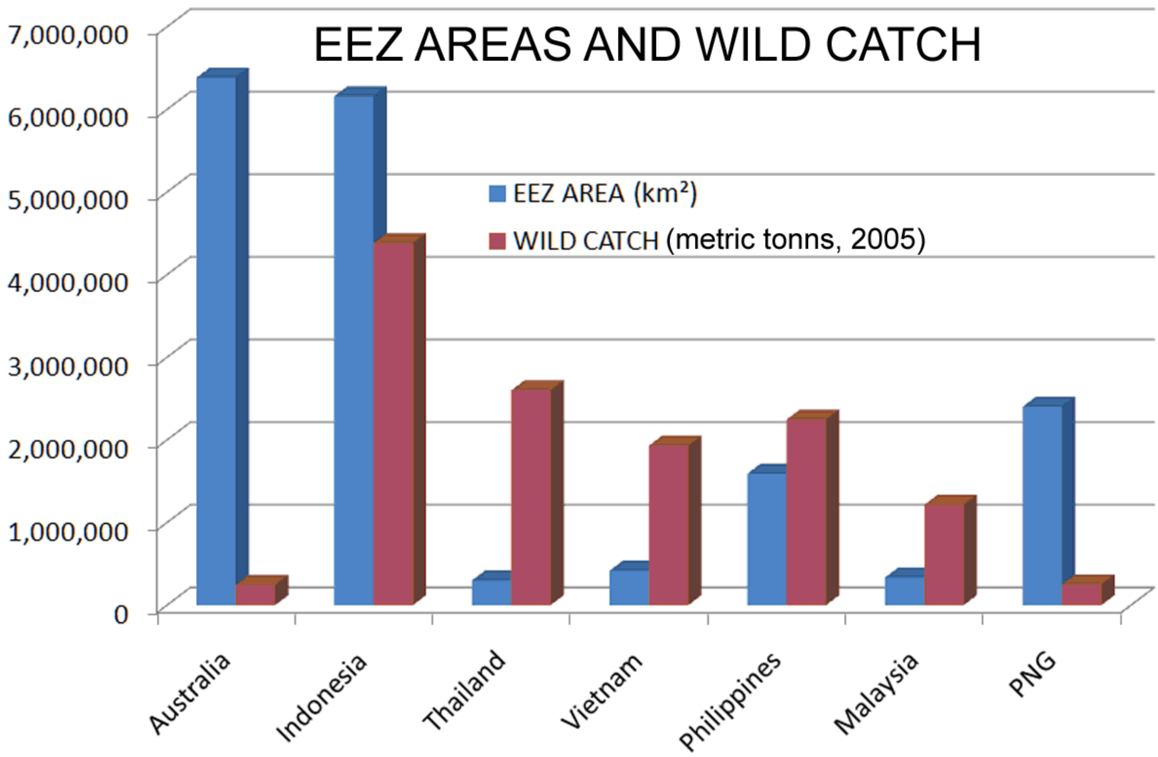

Fig. 36. With the worlds third largest EEZ area our total catch is even below that of PNG.

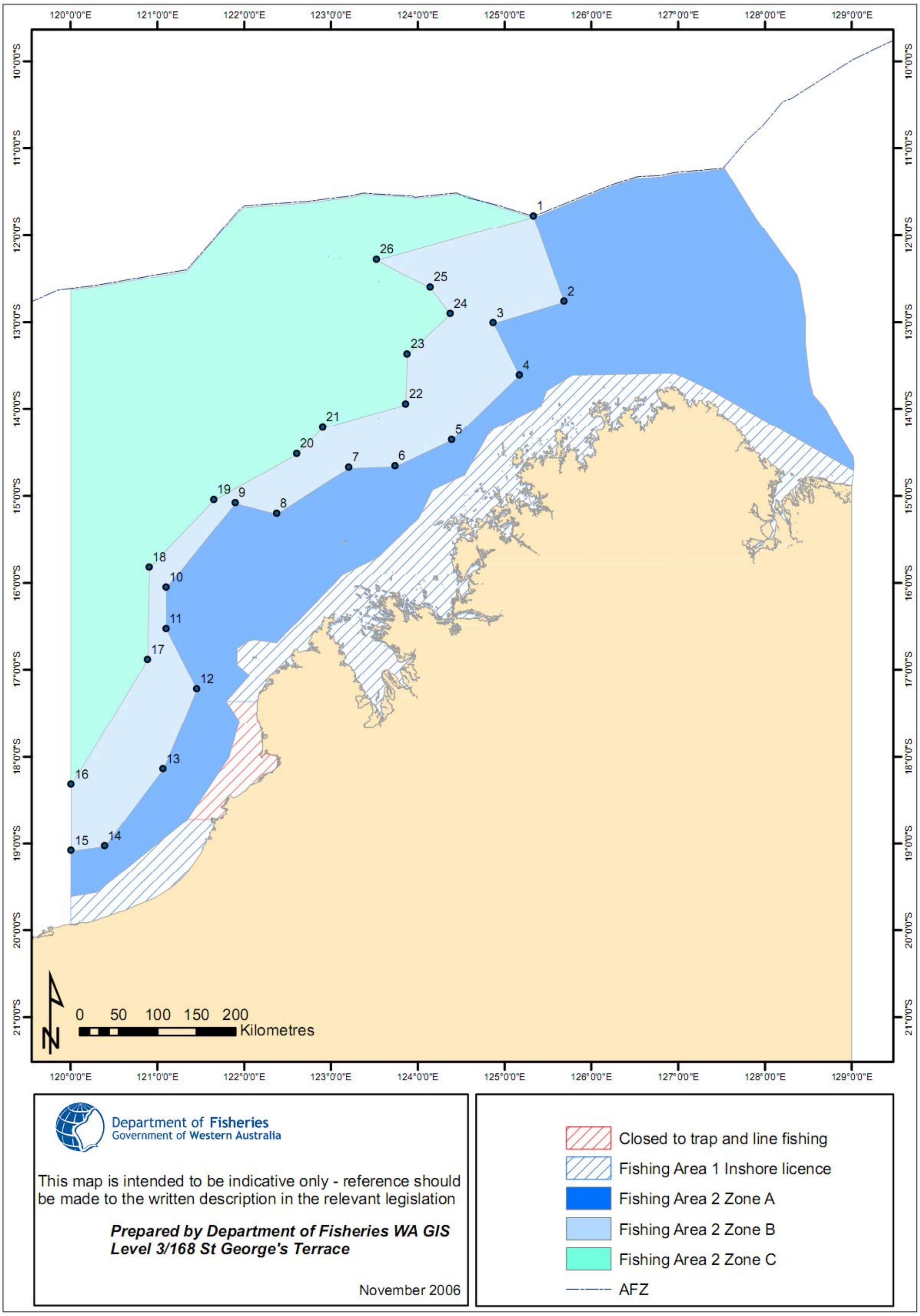

Fig. 37. NDSF Areas and Zones from Department of Fisheries map dated November 2006. Note that differences in boundaries from both Figs. 15 and 16 are present. Note also that “Zones” here are called “Areas” in Fig. 15 and “Zones” are subdivisions of “Areas”. Confused? So are the NDSF fishermen and quite obviously WA Fisheries is as well.

Fig. 38. A good catch of goldband snappers explodes into a frenzy of flapping fish when hauled aboard.

Fig. 39. The fresh catch goes immediately into iced brine.

Fig. 40. Sorting and packing the previous days catch at 3:00 a.m.

Fig. 41. 40% of the NSDF fleet. A third vessel making a total of 60% is moored just out of the picture. Somehow these few vessels already restricted to fishing less than 1/3 of the year are claimed to be overfishing some 200,000 Km^2 of ocean while actually fishing only about ¼ of 1% of it each year.