Potential Impacts of the Draft Commonwealth Fisheries Harvest Strategy Policy on Selected Domestic Fisheries

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Background

The development of a Commonwealth Fisheries Harvest Strategy Policy (Draft HSP) is part of the Section 91 Ministerial Direction to the Australian Fisheries Management Authority from the previous Minister for Fisheries, Forestry and Conservation.

When implemented, the Draft HSP will provide a framework that allows a more strategic, evidence-based approach to setting catch limits in all Commonwealth fisheries on a fishery by fishery basis.

The Bureau of Rural Sciences (BRS) has reported on the assumed impacts that the Draft HSP will have on domestic fisheries on a fishery by fishery basis.

Given the fundamental change to Commonwealth fisheries management that the Draft HSP represents and the likely impact that this will have on fishery operators, the Department of Agriculture Fisheries and Forestry (DAFF) is seeking independent assessment of the Draft HSP impacts to add to the advice provided by BRS.

This report provides an independent assessment of the impacts the Draft HSP may have on selected domestic fisheries. It is important to note that this report is not a critical review of the entire Draft HSP and the Guidelines.

Methods

The report is to provide informed comment on the potential impacts of the Draft HSP on the following Commonwealth domestic fisheries:

- Northern Prawn Fishery (NPF);
- Southern and Eastern Scalefish and Shark Fishery (SESSF);
- Southern Squid Jig Fishery (SSJF);
- Eastern Tuna and Billfish Fishery (ETBF);
- Southern and Western Tuna and Billfish Fishery (SWTBF);
- Southern Bluefin Tuna Fishery (SBT);
- Heard Island and McDonald Island Fishery (HIMI).

Given the timeframe and resources of the consultancy, it was recognised that only a qualitative description of the impacts would be possible, not a quantitative analysis. Information for the report was obtained through consultation with industry and Departmental representatives as well as literature on current stock assessments and BRS papers on expected impacts.

For reasons of clarity and to avoid repetitious arguments applied to each fishery, the report has been structured by looking at particular issues of the Draft HSP, providing general comments and then exploring potential impacts on each fishery to which the issue might be relevant. Some examples are provided to help clarify the issues.

Following preliminary discussion with DAFF representatives about the issues and their potential impacts raised in this report, it was agreed that it would be helpful if the report contained a final section on a suggested process that is consistent with the intent of the Draft Policy.

General comments

There is good support for the concept of harvest strategy targets that aim to achieve maximum economic returns from a fishery. The certainty and transparency that should result from application of specified harvest strategies to Commonwealth fisheries will generally be welcomed as an important and positive step forward. Historically, industry has continually bemoaned the lack of consideration given to the economics of fisheries. The Maximum Economic Yield (MEY) target should address this whilst ensuring the fishery also operates at the conservative end of the yield curve.

The real value of the Draft HSP will be realised in the longer term when the biomass of stocks has achieved a level that supports MEY and this can be marketed as a key attribute of a product that is derived from sustainable and well managed fishery. In the short term, however, there are a number of major issues that will generate significant industry concern and uncertainty and will certainly cause them to suffer financially if the Draft HSP is implemented on 1st January 2008 in its current form. These major issues include:

- The immediate introduction of the Draft HSP without prior quantitative Management Strategy Evaluation (MSE) of the strategy and the appropriateness of the theoretical MEY target and biological limit reference points;
- The modelling that will be necessary to generate credible estimates of MEY across a range of fisheries will take a considerable amount of time and resources to do properly;
- The assumption that 1.2 B_{MSY} is a valid proxy for B_{MEY}, especially in a multi-species fishery;
- The very little information available on a considerable number of key species in Commonwealth fisheries determines that MEY, Maximum Sustainable Yield (MSY) or even proxies for these will not be able to be applied and significant innovation and trials of appropriate alternative harvest strategies will be needed;
- In situations where stock rebuilding is required under the Draft HSP, continuing lack of complementary management of shared stocks between the Commonwealth and states will have a disproportionately negative impact on the Commonwealth sector;
- The need to consider the combined impact when the draft HSP is implemented in conjunction with other current fisheries policies, management tools, processes and legislation such as the Fisheries Management Act (FMA) and the Environment Protection and Biodiversity Conservation (EPBC) Act;
- Notwithstanding the correct intent in applying HCRs to data-poor species, if not carefully developed and tested, significant technical problems can result in unexpected and unintentional outcomes that may not necessarily be in line with the intent of the harvest strategy; and,
- That Australian-caught product competes in an open market with imported product from fisheries and aquaculture that are in many cases not sustainable. Application of the HSP will ensure seafood derived from Australia's Commonwealth fisheries is sustainable but it will take time to develop markets that recognise, appreciate and are willing to pay for demonstrably sustainable product from well managed fisheries. Until this occurs there could be some short term negative economic impacts as a result of the HSP.

Evaluation of Harvest Strategies

One of the most difficult aspects of endeavouring to determine the impact of the Draft HSP on different fisheries is that there has been virtually no formal Management Strategy Evaluation (MSE) of any Commonwealth fisheries using the MEY target reference points. The Policy states "Harvest strategies should be formally tested in order to demonstrate that they are highly likely to meet the Core Elements of the Policy". The Guidelines recommend that "MSE should be used prior to implementation of a harvest strategy". Neither of these requirements will be met if harvest strategies must be developed and implemented by 1 January 2008. There are simply not enough resources or time.

As a result, managers will be effectively applying the policy without any prior testing of the management strategies that underpin it. Is indicated below for the SESSF, this has caused a number of problems and uncertainty in the development and application of harvest strategies. One of the key aims of the Draft HSP is to provide for increased certainty and predictability in the operating environment surrounding Commonwealth-managed fisheries. ***Without conducting a quantitative MSE prior to the implementation of harvest strategies, in the short term there will be extreme uncertainty and unpredictability if the Policy is implemented.***

Application of MEY in multi-species fisheries

The strong focus of the Guidelines is to estimate the MEY biomass for each species. This is appropriate when each species is subject to a targeted fishery and is otherwise caught only incidentally as part of other fishing operations. Of the selected fisheries discussed in this paper, there are only a few that can be described as target, single species fisheries. The SSJF and SBT fall reasonably into this category with few, relatively low value byproduct species. The SESSF, although a multi-species fishery, has a number of sub-fisheries that can be similarly categorised: Cascade roughy, eastern roughy; spawning blue grenadier; and to a lesser extent Danish seine whiting, spawning eastern gemfish and royal red prawn. The comments below do not apply to these fisheries / sub-fisheries.

There are a number of issues that should be considered in the application of a MEY target to multi-species fisheries. As one of the only multi-species fisheries in Australia for which an MEY target has been attempted, the NPF – an example in the Guidelines – is used below to provide some insights into the difficulties of estimating MEY and setting MEY targets for a harvest strategy.

Theoretical application

If there is acknowledgement that more than one species is targeted at once, MEY should be estimated across the suite of species being targeted as this is the unit at which the fishing effort and capital is being directed. As various sub-fleets with different cost structures target various overlapping species groups this is a complex task that can only be addressed through bio-economic modelling. Thus, a key issue with the use of MEY in the Draft HSP is the difficulty in estimation, particularly in a multi-species fisheries context. Generally, there have been very few published estimates of MEYs for Australian fisheries over the last 20 years. This is because of the difficulties in obtaining robust economic data and the complexity involved in the bio-economic modelling of multi-species fisheries.

Of the fisheries being reviewed in this report, the NPF is the only one where stock status can be compared to the B_{MEY} target based on an integrated bio-economic model. This is the approach that should be taken generally in multi-species fisheries. The Guidelines, in section 5.4, correctly acknowledge this to be the appropriate approach in multi-species and multi-method fisheries.

The NPF is a relatively simple fishery with 3 target species and a quite homogeneous fleet of vessels using a common gear type. One stock, banana prawns, is however excluded from the model because of its high year-to-year variability. The implicit assumption is likely to be that the banana prawn fishery does not affect the amount of effort or capital directed at the tiger prawn fisheries in the long term and hence it is still meaningful to estimate separate tiger prawn MEYs. This is a judgement about fisher investment behaviour that would almost certainly have a significant influence on the model outcomes.

The NPF model has a single profit function, where the individual tiger prawn MEYs are estimated simultaneously with the model allocating an optimal amount of fishing effort (that maximises fishery profits) to each species based on relative costs and returns per unit catch and available harvests. That is, the optimal (MEY) amount of effort for the fleet is determined by reference to both tiger prawn species and is allocated between them to give individual species MEYs. The current model does explicitly include assessment of the impact on endeavour prawns which was likely to overstate profits.

Assuming there are no future effort increases subsequent to the recent Structural Adjustment Package (SAP), the model estimated that B_{MEY}/B_{MSY} ranges from 1.18 to 1.24, i.e. B_{MEY} is 20% above B_{MSY} and that based on this model the fishery was broadly in line with the 5-year target of achieving MEY by 2008. ***Based on this model outcome alone, there would be little if any expected impact of the application of the Draft HSP on the NPF tiger prawn fishery.*** It is important to reiterate, however, that the new combined bio-economic model will include the endeavour assessment results and the parameters and assumptions underpinning this assessment have yet to be reviewed. The updated model that can perform MSE on all main species (including endeavour prawns) as well as incorporating size and season influences of price structure is planned to be run in late 2007. The inclusion of the endeavour assessment results during 2007 could significantly change the outcome of the combined bio-economic model and therefore the impact of the Draft HSP on the NPF. The other factor that is likely to affect application of the Draft HSP to the NPF is the implication of natural variability of stocks and the probability levels of triggering the B_{Lim} reference point. This issue is discussed elsewhere in the report.

Practical Application

Aside from the theoretical issues associated with the application of MEY in a multi-species fishery, there are some real practical issues that must be considered when applying a harvest strategy as only one component of a fisheries management package.

The Draft HSP states "…harvest strategies should be implemented using an integrated approach with other fisheries policies, management tools and processes……..for example reducing the impact on bycatch by using specific gear types or temporal or spatial closures". ***The impacts of the draft HSP on a fishery must be considered in conjunction with other current fisheries policies, management tools and processes. Any MSE must recognise this; otherwise it will lead to spurious options for management arrangements.*** This does not appear to be fully appreciated in the BRS analysis of potential impacts.

An example of this is how the draft HSP might be applied in conjunction with the AFMA Policy to have zero discarding of quota species in 2008.

In a multi-species fishery, restrictions on the catch of one species will often impact on the potential catch of other species. Where key commercial species co-exist in the same habitat and have similar behaviour, they will almost always be caught together regardless of the skipper's attempt to target a single species. Although the catch composition of these so-called "companion species" may vary

somewhat from shot to shot or between seasons and places, overall they are often caught together in a broadly similar ratio. This does not necessarily represent a problem for fisheries managed under input controls because the level of effort is the controlling factor regardless of the catch composition. It is also not necessarily a problem for output control fisheries when the Total Allowable Catches (TACs) of the companion species are in accordance with the usual catch ratio. ***In cases where the relative TACs for companion species do not generally align with their usual catch ratios, it presents a significant problem.***

A classic example from the SESSF is the catch of mirror dory in association with the spawning eastern gemfish migration. Both species are caught by trawlers generally in the same depth, over the same habitat at the same time of the year, but unfortunately, in contrast to mirror dory, eastern gemfish is overfished ($B<B_{20}$). Gemfish is under a rebuilding plan with a low (150t) bycatch TAC. When fishing for mirror dory in this region during winter some unavoidable bycatch of eastern gemfish will occur. Presently, this level of "unavoidable" gemfish catch is above the bycatch TAC and is discarded. In this case it appears that appropriate fishery management can not be achieved by TACs alone.

AFMA has indicated that in 2008 discarding of quota species will be illegal. This will exacerbate the problem of inappropriate TAC ratios for companion species of differing stock status. Under the Draft HSP, it would appear that either fishery closures or a reduction in the TAC of the companion species (mirror dory) to an appropriate ratio with the overfished stock (eastern gemfish) would be a possible management response. It is unclear whether this so called "weak link" management could lead to a one-way trip of decline for our commercial fisheries.

In the BRS summary of the immediate impact of implementation of the Draft HSP (BRS 2007a) it is stated of mirror dory "that there will be no immediate direct effect, however, future levels of catch may be affected by rebuilding plans for eastern gemfish". ***This statement may reflect some assumed level of staged response to the situation, but if introduced in parallel with the other management arrangements and it remains true to its intent, the Draft HSP will cause a more immediate and greater impact.***

The above is only one example of this issue, similar concerns could be raised for school shark and its impact on the companion species gummy shark; blue warehou on its companion species flathead, morwong and silver warehou; redfish on companion species John dory, flathead and silver trevally etc. It could also apply to albacore tuna as a companion species to a number of overfished stocks in fisheries managed under RFMOs. Although not known at this stage, the potential also exists in the NPF with respect to some of the secondary prawn species if the fishery moves to output controls.

Cost and resources

The NPF is the fishery most studied by economists and many years have been devoted to developing bio-economic models of the fishery. The first sophisticated bio-economic model of the fishery was developed almost 20 years ago (Haynes & Pascoe, 1988). The latest bio-economic model is still being developed by Kompas and Dichmont (unpublished) and will be tested and applied in late 2007.

Although the implementation of the Policy may lead to more economic resources being directed at this issue, ***the modelling that will be necessary to generate credible estimates of MEY across a range of fisheries will take a considerable amount of time and resources to do properly.*** Lack of data to run the MSY / MEY models could be a key issues for coordinated and strategically focused R&D in the mid to long term. The potential costs associated with the collection of data and the economic modelling required for the estimation of MEY for the various fisheries will be a significant financial impact for most fisheries.

Application of MEY target using biomass proxies

The economics of catching a particular species are often directly affected by the expected returns achieved by catching other associated species. Estimating multiple MEY's on a single species basis in a multi-species fishery is meaningless from an economic perspective. Yet, the use of a B_{MEY} proxy based on a single species current biomass relative to its unexploited biomass is, in effect, applying single species MEYs in a multispecies fishery.

In a multi-species fishery, the only way of establishing B_{MEY} for each species is to calculate it using a joint maximization bio-economic model across all of the main species. The ratio of B_{MEY}/B_{MSY} can range considerably as demonstrated for the SESSF species in the Guidelines (1.03 – 1.47). Use of proxies such as B_{MEY} = 1.2 B_{MSY} = 48% B_0 have only been estimated from single species theoretical models. Their validity in multi-species fisheries is yet to be determined but is unlikely to be correct for most species. Notwithstanding the above, under the Draft HSP the proxy for the target reference point B_{Targ} = B_{MEY} is 48% B_0 and F_{Targ} (F_{48}) is the fishing mortality that would be required to maintain the stock at B_{Targ}.

The B_{MSY} (= B_{40}) reference point is universally recognised as a standard in fisheries management but it is based on biological productivity rather than economic considerations. The SESSF developed initial Harvest Control Rules (HCR) for Tier 1 species based on a limit of 20% of unfished biomass (B_{Lim}), a break point (B_{Break}) defining the biomass level at which the exploitation rate (F) starts to reduce below the target level, and the target biomass (B_{Targ}) of 40% of unfished biomass (B_{40}) This is described as the 20:40:40 HCR for B_{Lim}, B_{Break}, B_{Targ} respectively. For Tier 2 species, a more precautionary 20:50:50 HCR was applied.

Although not clear (the figures seem to be at odds with the text), the HCR that appears to be in accordance with the Draft HSP and the Guidelines is the 20:48:48 rule ie the fishing mortality has to be altered if the stock falls below B_{48}. Although the Guidelines state that the level of fishing should progressively reduce when a stock moves below B_{MSY} suggesting 20:40:48, the 20:48:48 HCR is also consistent with the draft HSP. Both these are considerably more conservative than the 20:40:40 rule currently applied in the SESSF. ***If the 20:48:48 approach is adopted for Tier 1 and Tier 2 species in the SESSF under the Draft HSP, it will lead to a significant immediate reduction in the catches of most Tier 1 and Tier 2 species*** (Table 1). This appears to conflict with the initial BRS analyses (BRS 2007a) in the SESSF in estimating the immediate impacts.

Application of MEY in data poor situations

Unlike the situation above, there are a considerable number of key species in Commonwealth fisheries for which little information other than raw catch and effort data is available. In such cases, biomass or fishing mortality reference points can not be applied. Although poorly represented in the draft HSP this situation is acknowledged well in the Guidelines. The Guidelines state "It is recognised that information about many stocks is limited or uncertain, and that it may not be possible to make direct use of the target and limit reference points described in the Policy. …… In such cases alternative approaches to setting proxies for reference levels will need to be formulated and applied using available information."

The SESSF has endeavoured to address data poor situations with the application of quantitative and explicit HCRs more than any other Commonwealth fishery (see the case study in the Guidelines p 33). There were, however, few resources available for their development and evaluation. Importantly, with two years of experience in the application of low information (Tier 3 and Tier 4) HCRs behind them, scientists and managers are rethinking their technical approach.

Table 1 Current biomass estimates of Tier 1 and Tier 2 species in the SESSF and potential impacts of Draft HSP application using the 20:48:48 Harvest Control Rule relative to 20:40:40 (derived partly from CSIRO 2007 and 2006 stock assessments reports).

Sub-Fishery	Species	BCur/B_0	20:40:40	20:48:48 relative to 20:40:40
Common-wealth Trawl & Gillnet Hook and Trap	Blue grenadier	0.36	5% decrease	42% decrease
	Blue warehou (west)	0.13	Decrease to 0 target	Decrease to 0 target
	Blue warehou (east)	0.16	Decrease to 0 target	Decrease to 0 target
	Flathead	0.41	6% decrease	34% decrease
	Jackass morwong	0.15	Decrease to 0 target	Decrease to 0 target
	Orange roughy (East)	0.13	No change to 0 target	No change to 0 target
	Orange roughy (South)	0.18	No change to 0 target	No change to 0 target
	Orange roughy (West)	<0.20?	No change to 0 target	No change to 0 target
	Orange roughy (Cascade)[1]	0.73	N/A but Increase	5% Increase
	Silver warehou	0.48	No change	22% Decrease
	Pink ling [2]	0.39?	?? Likely decrease	?? Likely decrease
	School whiting [2]	?	Unknown	Unknown
Great Australian Bight	Bight redfish	0.94	>100% increase	>100% increase
	Deepwater flathead	0.50	4% Increase	38% decrease
Southern Shark	Gummy shark	0.39[3]	24% decrease	29% decrease
	School shark	0.14[3]	No change to 0 target	No change to 0 target

[1] Maybe over-ridden by Orange Roughy Conservation Plan

[2] Uncertain Tier 2 assessments assumed for 2007

[3] Based on pup production from virgin population

Notwithstanding their correct intent, it was realised that there were significant technical problems in the actual application of these data-poor HCRs. This resulted in unexpected and unintentional outcomes that were not necessarily in line with the HCR intent or the harvest strategy. This precipitated the need to apply over a dozen "Principles" that were, effectively, exceptions to the rules. This situation should be avoided because it tends to undermine the goal of HCRs to "provide an unambiguous prescription for the management response". In situations of poor information, HCRs need to be simple and effective. They too, maybe even more-so because of their uncertainty, should also be fully evaluated before implementation.

The important point here is not that the development of proxies and HCRs for data poor species should not be attempted as part of the draft HSP, but that getting them right takes commitment and time. If done carefully and correctly, the development of HCRs will be in line with the Policy aim "to provide for increased certainty and predictability". If done hastily and incorrectly they will cause the opposite and frequent changes to the harvest strategy will be required. This has the strong potential to undermine credibility and confidence in the policy itself.

Highly variable species

Application of the HSP to highly variable species is of concern because without formal testing it is difficult to determine if even the natural variability in the stocks without fishing would meet the limit reference points risk criteria.

There are two types of species that need to be considered in this issue, short-lived species such as prawns and squid and longer-lived species with episodic recruitment such as blue grenadier.

Short-lived species

The banana prawn fishery in the NPF is a classic example of a species with a highly variable stock biomass as a result of variable annual recruitment driven largely by environmental variables such as rainfall. The current harvest strategy depends on within season monitoring and an assumption that historical fishing effort allowed sufficient escapement from the fishery to ensure an adequate spawning biomass of banana prawns. The strategy aims to maximise the economic return from the fishery within the above parameter and minimize the take of tiger prawns. If the assumption regarding escapement is correct, and as it has been "field tested" over a number of years, this harvest strategy appears reasonably robust and seems to "be consistent with the intent of the policy". As such, ***it is unlikely that the implementation of the HSP will have any significant impact on the banana prawn fishery of the NPF.***

Another species which falls under this category is the arrow squid caught in the SSJF. This stock of this short-lived (18 month) species also appears to have highly variable annual recruitment but the drivers of this variability are unclear. Historically, annual catches over a 3-4 year period have been much higher than current levels. Current trigger levels for the fishery are considerably higher than current catch levels but the general perception for this fishery is that the stocks are under-exploited compared with historical levels. The difference of the SSJF to the prawn fisheries mentioned above is that the key target species is a relatively low value and as a result, the capacity of the fishery to pay for extensive research and monitoring is limited. Consequently, there is no pre-season survey of abundance or within season monitoring taking place. Preliminary harvest strategies are being developed, but probably need to be further refined before they could be considered consistent with the intent of the HSP. ***While the squid stock/s in the SSJF are considered under-exploited and ongoing refinement of the preliminary harvest strategy is occurring, it is unlikely that the implementation of the HSP will impact significantly on this fishery.*** There is, however, one potential issue that may influence this outcome; and that is whether this species is considered a key trophic species which requires maintenance of higher biomass targets than are generally prescribed in the HSP.

Longer-lived species with episodic recruitment

Blue grenadier in the SESSF is moderately long-lived (can live to 25 years old) but the current fishery is characterised by large episodic recruitment events that only occur every 7-8 years. As a result, the variability of this stock may be such that it periodically triggers the biological limit reference point after long periods with minimal recruitment. In keeping with the economics of the fishery, it may be necessary to develop harvest strategies that recognise that a stock will periodically drop below B_{Lim} without the need to classify it as overfished and implement a formal rebuilding plan.

Comanagement of shared stocks

There are obvious difficulties in the application of the Draft HSP in situations where Commonwealth fisheries harvest stocks shared with other jurisdictions. In the case of stocks shared internationally under Regional Fisheries Management Organisations (RFMOs), the Draft HSP states "…it is Australian Government Policy to adopt catch levels decisions taken by these organisations. In the absence of agreement, Australia's domestic catch allocation decision would be consistent with the agreed whole of government position". The fisheries to which this applies includes the ETBF, SWTBF, SBT and HIMI (Table 2). Although Australia will advocate the Draft HSP as best practice, the above statement effectively prevents any negative impacts on Australian interests relative to the other members of the RFMO regardless of the stock status or fishing pressure.

Table 2 Status of stocks shared internationally under Regional Fisheries Management Organisations (Fisheries Status Reports 2005).

Fishery	Species	Overfished	Overfishing
ETBF	Yellowfin tuna	No	Yes
	Bigeye tuna	No	Yes
	Broadbill swordfish	Uncertain	
	Striped marlin	Uncertain	
	Albacore	No	No
SWBTF	Yellowfin tuna	Uncertain	Yes
	Bigeye tuna	No	Yes
	Broadbill swordfish	Uncertain	
	Albacore	No	No
SBT	Southern Bluefin tuna	YES	YES
HIMI	Patagonian toothfish	No	No
	Mackeral icefish	No	No

Nevertheless, a number of the key species in the ETBF, SWTBF, SBT are considered to be either overfished or subject to overfishing. As a result, it is likely that an agreed recovery plan will need to be implemented. By their very nature though, through the involvement of numerous countries with differing views on sustainability, change associated with a recovery plan is likely to be slow but it will most likely be in the direction of reduced catches for bigeye tuna, yellowfin tuna and swordfish in the ETBF and SWTBF. This may also apply to marlin in the ETBF. Similarly, a recovery plan that involves a reduction of global catches is being implemented for SBT which is classified under the Draft HSP as overfished and still subject to overfishing.

Based on the above, any immediate impact of the Draft HSP on Australian catch levels in the ETBF, SWTBF and SBT is likely to be negligible compared to that which would be required by direct application of the Draft HSP if the fisheries were not under an RFMO. This is considerably different compared to application to the purely domestic fisheries and could be construed as creating a 2-class system of management of Australian fisheries.

Although unlikely, if Australia successfully argued for stock management in line with the Draft HSP, the stock rebuilding strategies would be far more stringent than currently agreed for SBT and Pacific bigeye tuna and yellowfin tuna in the ETBF and SWTBF. This would result in a very significant reduction of catch levels for these species.

Concerns also exist in how the Draft HSP will be applied in international fisheries in which there is no RFMO, such as on the Lord Howe Rise and South Tasman Rise. In the case of the latter where the orange roughy stock is classified as overfished, there could be a significant impact on catches taken by Australian vessels. The question as to whether fish could be landed in Australia from vessels working in fisheries without RFMOs was raised.

In the case of the HIMI fishery, the median spawning biomass of both Patagonian toothfish and mackerel icefish is above B_{48}. As a consequence, catches of these species would not be impacted by the Draft HSP even if they were not under the agreement of an RFMO.

In cases where Commonwealth fisheries share stocks with another Australian jurisdiction, whether under a joint authority agreement or not, it is less clear how the Draft HSP is to be applied and the Guidelines provide no further clarification. In these cases, the interests of industry in the Commonwealth sectors are not as well “protected” in the Draft HSP as for international arrangements under RFMOs. An example from the SESSF illustrates this point.

About 75% of the silver trevally catch is taken outside of the SESSF by state fishers in NSW and Victoria. Although uncertain, stocks of silver trevally are likely to have been significantly depleted and some level of rebuilding will be necessary. Under the Draft HSP and with no direction in the Guidelines, the TAC, which only applies to the Commonwealth sector, would need to be reduced. If there was no corresponding management response from the State governments, overfishing is likely to still occur. Negotiations for complementary management between the Commonwealth and states, particularly NSW have been ongoing for many years but to date they have failed to deliver. Under this scenario, the Commonwealth sector will continue to be impacted by quota reductions even though this will have minimal influence on the overall catch levels. Situations where State fisheries take a significant component of the catch of stocks shared with Commonwealth fisheries exist for a number of species, including silver trevally, school whiting, deepwater shark, ocean perch and John dory in the SESSF.

In situations where stock rebuilding is required under the Draft HSP, continuing lack of complementary management of shared stocks between the Commonwealth and states will have a disproportionately negative impact on the Commonwealth sector.

MEY targets in a global market

As written, the Draft HSP and Guidelines focus on mainly within-fishery targets of achieving MEY. ***Many fishers, however, operate in more than one Commonwealth fishery or in a combination of Commonwealth, State and international fisheries. Obviously, MEY targets in such situations could be very complex to determine in such situations.***

Further, and maybe even more importantly, ***Australian-caught product competes in an open market with imported product from fisheries and aquaculture that are in many cases not sustainable.*** Application of the HSP will ensure seafood derived from Austalia's Commonwealth fisheries is sustainable and this will be a big advantage in applying the draft HSP in the long term. Presently, however, sustainability is not a factor being considered by most consumers of Australian seafood. ***It will take time to develop markets that recognise, appreciate and are willing to pay for demonstrably sustainable product from well managed fisheries.*** Until this occurs there could be some short term negative economic impacts as a result of the HSP.

Other technical issues

Biomass target equal to or greater than B_{MEY}

The Draft HSP states that harvest strategies will "maintain fish stocks, on average, at a target biomass point (B_{Targ} or proxy) equal to ***or greater than*** the stock size required to produce a maximum economic yield (B_{MEY}). Given the theoretical shape of the yield curve relative to the linear relationship of total costs against fishing effort, maintaining stocks at a size greater than that required to produce maximum economic yield will actually lead to less than maximum economic yield. Further, if this is the target, then one should expect that on average the fishery will spend 50% of the time over the target and 50% of the time under the target for both biomass (B_{Targ}) and fishing mortality (F_{Targ}) reference points.

Linking of MEY with biological reference points

There is a general concern that assessment and measurement of 'fish stock health' should remain independent of the economics in a fishery. It may be appropriate to set lower 'total allowable catch' levels for economic reasons, but that should not alter the measure of stock health, which is a biological measure.

By having a MEY target in the HSP it may stifle innovation and development within a fishery. For example, it could be that economics dictate fish stocks being caught by longline methods are non-viable. This would result in a B_{Targ} being set at 100% of the fish stock (so zero TAC). If, however, the fish stock is biologically healthy (eg some level above B_{MSY}) and a TAC is set, then operators will modify their gear, or vessels, or fishing strategies to become economically viable.

It is inappropriate to measure the "health" of a stock based on an economic factor. That is because economics can rapidly change, producing "apparent" rapid movements in the health of stocks as B_{Targ} and B_{Lim} would similarly move. This is because economic indicators that impact on the fishing industry include many aspects, outside the control of Australia. As some examples: fuel costs have a direct impact on all Commonwealth fisheries; foreign exchange rate fluctuations have significant impacts on export fisheries; aquaculture production of small prawns reduces prices paid for prawns domestically and internationally.

Choice of B_{Lim} and probability triggers

There is some concern that a higher more precautionary B_{Lim} is required for longer-lived lower productivity species (not that this is stated in the HSP or Guidelines). The target of B_{60} for Cascade roughy in the Orange Roughy Management Plan is evidence of this thought process. Managed properly from the outset, these are the stock that will be characterised by more certainty of stable biomass and appropriate fishing pressure. Historically it has been because these stocks were very vulnerable and subject to poorly regulated fishing that has caused the problem. Further discussions on the whether it is necessary to have more precautionary B_{Lim} measures for low productivity species need to be undertaken. It is possible that this requirement may be more necessary for highly variable species.

The Ministerial Direction to AFMA states "….*the harvest strategy must achieve the objective of avoiding overfishing and avoiding overfished stocks with at least 80% probability*…." This is a reasonable position given scientific uncertainty and knowledge. In the Draft HSP though, it states "….*Fish stocks may not fall below B_{lim} with a likelihood of more than 10% in one generation time*…" This can only really be assessed using MSE, because it involves a forward projection of the application of the harvest strategy itself. This in itself is a problem as it can not be assessed or measured in a fishery in any one year.

The implications of applying a 90% certainty of being above B_{Lim} requires quantitative evaluation. Simple levels of uncertainty about stock status may trigger this limit point. Of more concern, by requesting 90% certainty above the limit, it is more likely that a stock could trigger the limit reference point at the same time it is meeting its target reference point. Given the above, the draft HSP should align with the 80% certainty initially outlined in the Ministerial Direction.

Rebuilding of stocks already below B_{Lim}

Most stocks that are below B_{Lim} have reached that state from historically unstainable catch levels. In short-lived species that can be rectified in a relatively short time period through timely introduction of appropriate management actions. For long-lived species, however, it may take many decades for the stock to

recover despite the introduction of appropriate management actions. The allowance of one year in the HSP to address this situation will be of very little consequence.

Fish down

In the Guidelines, fish-down strategies are considered only appropriate when there is strong evidence that stock biomass "is well above B_{Targ}". If there is strong evidence available on stock status, it is not clear why a fish-down can not be allowed when stock biomass is simply above B_{Targ}.

In line with this, the diagram representing 'overfishing' and 'overfished' definitions requires changing, to correctly include the definition of 'fishdown'. There needs to be a line running from the top right hand corner of the box, directly to the intersection of B_{Targ} and F_{Targ}. Inside this line (ie to the right hand side of the line) would be cross hatched, and then fits the definition of 'fishdown' as outlined in the document.

Current RAG capacity

Whilst not specifically a technical issue, the current structure and capacity of the Research Assessment Groups (RAGs) that conduct the stock assessments and outline the recommended catches is not well suited to providing advice on MEY targets. The scientific members often have a biological rather than economic background and the stock assessment modeling is usually done without any input on the economics of the fishery at the RAG level. As far as I know there are no economist members of RAGs although recently they have been invited to attend to explain economic issues. Also, the RAGs may not conduct assessments on the entire fishery – maybe just a subset or one or two species. In this case the coverage of the RAG is not able to provide advice on suitable catch/effort levels suitable for integration into an MEY target; this is best done by a group that encompasses the entire fishery – say the Management Advisory Committee.

Process for improved implementation of the HSP

As stated at the outset, the *concept* of a Harvest Strategy Policy that has targets that aim to achieve maximum economic returns from a fishery is sound and should be welcomed by industry. Implementation of the final HSP should ultimately result in beneficial outcomes for Australia's Commonwealth fisheries.

In reviewing the potential impacts of the draft Commonwealth Fisheries HSP on selected domestic fisheries a number of significant issues have been raised that will potentially have negative impacts on industry. Consideration of the nature of these issues, however, highlights how they might be addressed and a potential way forward that should minimise these impacts.

Many of the issues and potential negative impacts of the draft HSP relate more to the process by which the HSP is implemented and MEY targets are achieved than the fact that the HSP has MEY as the goal. A recurring theme in many of the issues above was that time and resources were required to adequately plan and evaluate HCRs and harvest strategies with an MEY goal before they are implemented under the Policy. With the aim to fully implement the Policy by 1 January 2008 this is not possible. If the Policy specifically allowed for a planned, staged approach for fisheries to achieve the MEY goal it would be quite feasible to introduce the Policy by 1 January 2008 and minimise the impact on industry without compromising the intent of the Policy.

Presently, the draft HSP only has two critical reference points: B_{Lim} and B_{MEY} (and F_{Lim} and F_{MEY}) representing a biological minimum reference point and an economic target reference point respectively. It is suggested that the reference point, B_{MSY} be specifically introduced as a biological target reference point. This is a

universally recognised reference point in fisheries management that is between B_{Lim} and B_{MEY} and is generally considered to be a reasonable compromise between the competing interests of sustainability and utilisation.

As the most critical minimum biological reference point, the strict management responses to stocks being below B_{LIM} need to remain a feature of the Policy. As for whether the probability of being above B_{LIM} should be 80% or 90%, at least some modelling needs to occur to inform this decision. Blindly picking one or the other because it is more or less precautionary without an understanding of natural stock variability or the level of uncertainty in stock size estimates is only likely to cause problems. Similarly, the choice of whether some stocks should have a B_{LIM} higher than ½ B_{MSY} or B_{20} warrants further investigation based on stock productivity, stock variability and the real risk of triggering this limit.

It is important to note that except for species with highly variable or episodic recruitment, the implementation of harvest strategies should prevent stocks getting anywhere near B_{LIM}. In this case, the issues of B_{LIM} are most likely to apply to stocks that were severely depleted before the implementation of formal harvest strategies.

Having established that stocks are above B_{LIM}, the next reference point is ensuring they move towards a larger, more precautionary stock size where the risk of overfishing is negligible yet good yields can be obtained from the stocks - B_{MSY}. Similar to B_{LIM}, B_{MSY} is a biological reference point and makes no assumptions about the economic situation of the fishery. Importantly, most of the current stock assessment models can already estimate this reference point and the current structure and capacity of the RAGs is well suited to provide advice at this level. Moreover, the RAGs also have the capacity to develop suitable proxies for this reference point for species where formal stock assessments are not in place – ie data-poor stocks.

The development and evaluation of harvest strategies for all Commonwealth fisheries will not be achieved before 1 January 2008 but should be a major priority during 2008. There is already a project in place to develop these strategies, but there are limited resources available to conduct the formal evaluations. This will probably take at least one year if sufficient resources made available. Once this is done, the strategies can be put in place to move all fisheries to B_{MSY}. This can be achieved within the current structure and capacity of the RAGs and MACs.

Finally, fisheries need to move towards the ultimate MEY target. This will involve considerable further work to conduct the economic modelling and to achieve an understanding and buy-on from all stakeholders. The correct forum for this move probably lies in the MACs rather than the RAGs but they will require increased economic skills and capacity if it is to be achieved. Equally as important as the availability of economic skills is the need to work with industry to take the concept of MEY and turn it into a practical realisation. At present the MEY theory appears to be a long way off from the realistic application to fisheries in a global market in most situations. The development and understanding of the reality of moving to a MEY target will take a considerable amount of time, but might be expected to be achieve in the next 5-10 years for most fisheries.

Table 3. Suggested process and timeline for improved implementation of the HSP

Priority	Goal	Capacity / resources	Suggested Timeframe
1	Management response to fisheries certain to be below B_{Lim}	Exists in the RAGs	Immediately
2	Management response to low data stocks suspected to be below B_{Lim}	Exists in the RAGs Priority for formal assessment Proxies may need to be developed	Immediately
3	Development of trial management strategies to bring stocks to B_{MSY}	RAGs need to develop proxies for low data species AFMA/CSIRO project in place to be completed by end 2007	6 Months
4	B_{MSY} Management Strategy Evaluation	Some oversight capacity exist in the RAGs but needs external resources to conduct and implement	1-2 Years
5	Final B_{MSY} management strategies developed	Will need iteration between RAGS and some extension of current AFMA/CSIRO project	2 Years
3	Development of trial management strategies to bring fisheries to MEY	Economic data needs to be collected. Needs economic input into MAC level and significant work with stakeholders.	3 Years
4	MEY Management Strategy Evaluation	Capacity resources do not exist in most fisheries (none except NPF). New project resources and skills required. Economic input into MACs needed	5 Years
5	Final B_{MEY} management strategies developed	Capacity resources do not exist in most fisheries (none except NPF). New project resources and skills required. Economic input into MACs needed.	6 Years
6	All fisheries operating at MEY		> 6 Years

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