

DISCUSSION OF SESSION 5

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Discussion which followed each panel presentation is presented here, followed by a general discussion.

Chris Francis opened the discussion on Kevin Rowling's presentation by asking what was the major uncertainty in the model on eastern gemfish. Kevin Rowling replied that he thought that it was the estimate of biomass, because there was no fishery independent index of abundance to support the biomass estimate. This may be an order of magnitude out, however, one has to have faith in the way that the model was constructed - the information put into the model is independent and it has come up with an answer that seems to fit. Chris Francis asked more specifically what were the major assumptions in the model. Kay Allen replied that the cohort analysis is a backward moving process, and much depends on what is the situation in the final year of the series. The estimate of the "within-each-age-group" is obtained from the catches and from some assumption of fishing mortality rate at each age group in the last year. There have been some problems in making a suitable assumption because of the absence of fish, the various regulations made and what the industry has done in the light of the regulations.

Jeremy Prince pointed out that the definition of the unit stock could be important in the gemfish model. This is because Australia may be sharing the stock with New Zealand. Both Kevin Rowling and Jeremy Prince have noted a similarity in length composition of catches on

both sides of the Tasman Sea. It was also interesting to note that in the mid- to late 1980s, at the same time as the stock and recruitment collapses took place in eastern Australia, NZ catches increased dramatically.

After Terry Walker's presentation, Julian Pepperell asked what was his suggested mechanism for the natural mortality being density dependent? Terry Walker replied that growth and reproduction could be ruled out, and there were no data on natural mortality, or to show how it works. John Stevens and Terry Walker will be involved in monitoring juveniles so data may be obtained over time. At this stage it is hypothetical.

Alistair Gray asked whether in the absence of data, there was any likely mechanism for such mortality. Terry Walker was sure that it was not cannibalism or predation, since no gummy sharks were found in stomach analyses of sharks and other fish species. As far as crowding is concerned, gummy sharks are distributed widely in both shallow and deep waters, and this can be discounted.

John Keesing opened the discussion on Roland Griffin's presentation on barramundi by asking, (because one of the models showed that if fishing was stopped or reduced, the stock would respond quite dramatically), whether the recreational fishery or the value of fish to the NT tourist industry had been modelled. Roland Griffin pointed out that most of the management

over the past 8 - 9 years has concentrated on allocation of the resource to the point where in many areas there is only recreational fishing - for the managers this has certain advantages because to try to manage the stock for both is quite impossible. There are insufficient data on the value of the recreational fishery to input into the model. One of the recommendations of the 1979 review was to undertake an economic study, but this has not happened yet, mainly because of the non-cooperation of commercial fishers.

John Harris noted a suggestion of an inverse relationship between stock and recruitment, and asked to what degree might the relationship be driven by the density dependent vulnerability of the juveniles to predation? Roland Griffin answered that cannibalism is quite common. For example, in the Daly River, barramundi taken in the commercial fishery had small barramundi in the stomachs, and he has thought about using them as an index of recruitment.

Frank Prokop expanded further on recreational fishing, by pointing out that although they had almost no data on the recreational fishery, the Northern Territory government carried out a substantial re-allocation of the resource which has been held up as a model for preferential recreational management throughout Australia. He asked Roland Griffin, 1) how comfortable biologists were with that program, and 2) whether there was any biological evidence at all for the recreational management embarked upon, which was seen at the time as a significant restriction? Roland Griffin replied that they did have some data. Also, there were significant controls on the recreational sector - essentially the problem didn't start out as one of re-allocation but of restraining the catch. The management plan was working quite well throughout NT, but there were some areas near Darwin where the stocks were being badly overexploited by both sectors, and quite clearly the CPUE was not recovering in those areas. For example, there was a need to do something in the Mary River, in particular, as

it was both a popular recreational and commercial area. The stock was clearly in trouble and there was justification for ceasing commercial fishing and restricting recreational fishing. For other areas there was no such justification.

Mike Moran wanted to know whether, since there was little movement between river systems, Roland Griffin had modelled individual rivers, particularly as commercial fisheries had been cut out, and whether the model was better or worse than the model for the whole fishery? Roland Griffin replied that surplus production models have been investigated for individual systems with some having longer periods of exploitation than others. In some, the data were insufficient. The individual rivers give a similar overall picture; however, the results differ for each system.

Discussion of *John Harris's* presentation was opened by Chris Francis who commented that it is impossible to manage a fishery on the basis of a comprehensive ecosystem model (i.e. a model which includes the whole range of biotic and abiotic components of an ecosystem and the interactions between them). However, it is a good thing to model the input of one environmental parameter to recruitment - but this isn't ecosystem modelling. Chris Francis also questioned the graphs which showed variation in recruitment which was well explained by stream flow, but did not show the cause of decline in recruitment. John Harris agreed that this decline was a major concern and that it could possibly result from an error in the estimate of the total mortality that was used to derive it. The total mortality from the catch curve appeared to fit quite well, however. There were ways of demonstrating the period of falling recruitment, and he has direct estimates of recruitment through fishways, etc. He felt that there was an overall decline, but was not sure what was driving it. The decline has continued since 1980 with only one or two peaks producing strong year classes. Reverting back to the comment on the ecosystem model, John Harris mentioned that he had a number of other inputs

to understand recruitment in various years, and a variable such as the area of macrophyte beds into which juvenile fish can recruit is one of those. He believes that such data are available, and can be added to a growing ecosystem model which is focussed on stream flow but has other inputs which are obviously important.

Sandy Morison mentioned that while he was pleased to see an attempt at this type of modelling, in addition to the flood-cued species and non-flood-cued species there was a third group which reproduce each year quite successfully regardless of a flood. A number of small native species (smelts, rainbow fish and small gudgeons) as well as introduced species fall into this category and these reproduce quite successfully most years. There may be large pulses in recruitment for these species too during flood years, and they may get the benefit from the floods, but the floods are independent of their spawning. Thus, in order to make the model complete, one needs to incorporate these also. John Harris commented that there may also be an inverse relationship for these smaller species, with floods in some cases damaging recruitment.

In the *general discussion* on Session 5, the chair asked if the audience could centre its comments on two issues in relation to the modelling - the concept of the unit stock and the "leakage" factor of lack of recreational data. Terry Walker began by discussing the concept of the unit stock in modelling the gummy shark fishery. If the catch and effort data on gummy shark from Bass Strait and South Australia (SA) are put through the model, the stock will inevitably crash - this is because the catchabilities and abundances for the two areas differ. If two stocks are assumed, we find that the Bass Strait stock is double the size of that in SA. At the beginning of the time series, catch per unit effort (CPUE) in Bass Strait is much higher than for SA and similarly, at the end of the time series, it is higher in Bass Strait than in SA. What has happened during the development of the fishery, (it began firstly in Bass Strait and 10 years

later it developed in SA), the effort was higher in SA at the end of the time series and much lower in Bass Strait than it had been. When the data are combined, the CPUE declines much more dramatically than when the two areas are treated separately.

John Glaister took up the point about the recreational "leakage", and asked Chris Francis about the situation for snapper in New Zealand, and whether the government was collecting recreational data on this species. Chris Francis replied that collection occurred in two different ways - tagging studies (where a significant proportion is coming from amateur fishers), and more recently, through recreational fishing surveys which were originally aimed at determining quantitatively the most important recreational species and are now to target the more difficult question as to how much they were catching. John Glaister asked whether this was an annual or regular activity, and Chris Francis replied that it is only just starting, and whether it will become a regular pursuit remains to be seen. The chair then asked Chris Francis whether there should be a recommendation from such a workshop as this, that it is essential that equal emphasis be put on getting information from the recreational sector as the commercial sector, and somehow vector this into the analyses? Chris Francis replied that this has to depend on the relative importance for the particular species - for example, they knew it was important for snapper, however, they wouldn't do it for orange roughy! They wouldn't do it for terakihi. The chair asked him whether they would do it for rock lobster? Chris Francis replied that they would not, but perhaps they should? The chair asked him why not for rock lobster as it was probably substantial, but Chris Francis answered that he had less experience with that species.

Frank Prokop noted that there has recently been a veritable explosion of recreational management in a very short time, almost exclusively based on social parameters, i.e. setting bag limits for establishing catch "caps" which the average recreational angler is highly unlikely to

catch, and at a level above which some sinister motive is inevitably involved. In a number of cases, this is done without a great deal of supportive biological information and is done with more consideration of the various spatial, temporal and attitudinal differences which exist within the recreational fisheries. There has been only a modest increase in research funding to determine biological parameters necessary for managing recreational fisheries. It is interesting to note the earlier comment that recreational fisheries are minor in terms of their economic value even if the multipliers in the recreational are difficult to attribute to their sport. One of the outcomes of the development of the draft national recreational fishing policy which was put to Standing Committee, is to get FRDC restructured to incorporate research programs which are purely for recreational benefit, rather than couch them in terms of indirect commercial benefit, in order to get them through the FRDC committee. It will be very interesting to see whether more direct funding results in some direct benefit and some closing up of the leakages by quantifying recreational catches. Regarding the latter point, it is interesting to note that a lack of information on recreational impact can be used to account for significant discrepancies between models and real catches over time, i.e. if a model is out by 25% - that must be the recreational catch. In the longer term, Frank Prokop thought that better recreational information was important in improving models for multi-use fisheries.

Chris Chubb continued the discussion on recreational fishing data in the use of models by giving the example of the western rock lobster fishery, in which a large recreational survey was carried out several years ago and followed up by

continuing annual mail surveys. The overall recreational catch in this fishery was about 3 - 5% of the total catch, which is insignificant, but when investigated in more detail, the spatial aspects of the relative catches of recreational and commercial catches become important. Thus, in the areas where recreational and commercial fisheries compete, e.g. Fremantle in the shallows, the recreational fishers take about 20 - 25% of the catch. Farther away from Perth, but still within the 0 - 10 fm line, recreational fishers catch the equivalent of 32 commercial fishing boats working in the area. That becomes reasonably significant in terms of the stock assessment, not so much in its effect on the breeding stock which can be attributed entirely to the commercial fishers but in terms of recruitment coming through from the shallows to the deeper water. Thus, what appears to be insignificant in the first place is much more significant when investigated in more detail.

Dave Smith stressed the point that although all institutions have good means for collecting commercial catch and effort statistics, everyone knows how hard it is to get recreational data. He did not think that we had invested nearly enough in collecting recreational catch and effort statistical data.

Duncan Leadbitter pointed out the need to include the effects of habitat modification into the models on fish populations. For example, along the northern NSW and south-eastern Queensland coasts the scale and intensity of habitat modification is such that it is probably having a major impact on the fish populations. It would be extremely productive to incorporate the habitat component into some of these models as well as recreational fishing.