DISCUSSION OF SESSION 4

Recorded by M.I.Kangas

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Questions were addressed to individual speakers and followed by more general discussion.

After the presentation by *John Koehn*, Peter Jackson commented that when looking at the key variables determining fish populations in streams we have to accept that these key factors will differ between different river systems and that there is a need for 'regionalisation' of river systems. In addition, biotic interactions need to be considered. John Koehn agreed and highlighted the need to consider introduced species and their interactions.

Karen Edyvane pointed out that we should also be looking at community level indicators, like Karr's Index of Biological Integrity. John Koehn responded that to look at the integrity of the system you need to consider the whole system and all linkages, and this knowledge at all levels is lacking.

Jim Puckridge raised the point that one key factor that had been omitted in the preceding discussions was one of temporal variability, particularly hydrological variability in riverine environments. This factor needs to be recognised as it is one that is commonly under threat. Bryan Pierce agreed with Jim Puckridge's comments regarding freshwater and estuarine systems.

Murray Macdonald questioned whether *Peter Young's* definition of habitat in terms of physico-chemical attributes, without mentioning species interactions, was intentional or otherwise. Peter Young responded that he prefers to call the physico-chemical attributes an 'ecotome' rather that a habitat, the habitat actually being within an ecotome. His definition of a habitat is one of a fairly restricted area or 'patch' which can be defined by a number of various descriptors.

Russel Reichelt commented on the complexity of systems and the small amount of resources available to study the key factors and asked the panel to comment on some of the processes needed to filter and select priorities for research.

Neil Loneragan described the work that has been done in Western Australia regarding estuarine systems by defining levels of environmental variation in distinct regions of systems. The sort of questions they can be moving towards is looking at specific habitats within a zone. He noted that in estuarine work the linkages are poorly defined between estuaries and shallow inshore systems. In the case of the Peel Harvey system the future directions would come from some appropriate ecological modelling and making predictions and testing these predictions.

John Koehn emphasised that research priorities depend on what the question is. Managers come up with questions set at various levels, either on an ecosystem level or a specific question. For example the habitat work conducted in Victoria was essentially stimulated by funding of streamflow determination and from this came

the recognition that we did not have the knowledge of the parameters required to plug into those sorts of models. It was also recognised that habitat data were required in order to manage things. In addition a lot of research, particularly in freshwater work is externally funded and these are specific projects; no-one will fund ecosystem projects.

Peter Young was of the view that experimental management is feasible for freshwater and estuarine systems. Modelling, such as that proposed in Port Philip Bay and done in Western Australia, will actually identify the critical things that we need to know. For offshore situations it is still guesswork. It is more likely that the effects of fishing on the habitat are more important compared to other things impacting on the habitat. We need to know what the gear is doing. John Koehn emphasised that in freshwater systems it is the changes to habitat or habitat degradation that are more of a problem than fishing.

Gina Newton focussed on an issue that had not been raised previously, linking estuarine and marine environments, that of the retention of larval and juvenile organisms, related to the geomorphology of the estuarine mouths in terms of the flow regimes. Also the stratification of those waters in estuaries.

Peter Jackson brought the discussion back to the question of the important variables to measure. He suggested that since there has been some excellent work in the freshwater systems by John Koehn and his team in Victoria and Angela Arthington in Queensland, an Australia-wide freshwater habitat group be established to see whether certain areas can be agreed on as needing work. Expanding on Gina Newton's reference to hydrological regimes he restated his earlier comments on classifying rivers according to their hydrological regime as being a starting point to putting groups of rivers together. Due to a lack of resources any work done should try to look at aspects that are as widely applicable as possible.

Bryan Pierce highlighted the fact that most of us are working in a 'reactive' mode so we cannot collect data that will allow us to 'shape' things in the future so that episodes such as that with the Murray cod do not occur again. He believed that we need to go beyond a reactive mode.

Peter Gehrke commented that there is a problem with defining a fish habitat but in all three systems we can group key factors as; limiting, controlling or masking. We should be able to come up with a suite of variables which are major controlling factors in one major habitat type and which factors are limiting. For some freshwater systems the limiting factors may change. He gave an example of this. He then invited the panellists to give a summary of what they consider limiting factors and controlling factors for their various systems.

John Koehn responded that there certainly are critical and limiting factors in freshwater systems. We can group rivers which have similar attributes such as upland versus lowland. To determine critical factors we need to consider each species; some factors may involve several species but some factors may affect only one species. It is not easy to come up with just a few factors. On further thought he stated that there are some critical stages that could be concentrated on, such as the critical factors affecting spawning inducement and larval feeding.

Neil Loneragan said that for the estuarine systems, looking at the habitat level, seagrass and algal species are limited by flow and light regime. Key factors for fish species become more complex depending on whether you are considering the community level, recreational species, commercial species etc. Factors influencing fish communities are salinity regime, distance from estuary mouth, rainfall and water flow, but he was not sure whether these can be classified as key factors.

Peter Young responded that for estuarine systems, salinity would definitely be a factor. In the open ocean, zoogeography would play a

part as would depth. There is not enough knowledge to state key factors there.

John Glaister tried to focus the discussion towards considering when fisheries managers are making decisions about fish habitats - what do they need to know? Jenny Burchmore supported John Glaister's comments and expanded as a manager she is confident in the current information available that seagrasses are important as fish habitats and that more emphasis needs to be placed on other less studied areas such as the impact of dredging.

Roland Pitcher raised the need for modelling to help highlight priorities in research and asked Norm Hall to explain modelling in more detail. Norm Hall responded that models try to put together people's understanding of processes in a very simple form. Modelling plays a part in trying to identify the questions you need to ask and the data that are needed, and then trying to put them together and finding areas where the model doesn't actually work. In other words modelling is the formality of putting your thoughts down on paper, testing them and trying to improve on your knowledge.

Bryan Pierce then tried, as chairperson, to bring the threads of the discussion together. We have tried to elucidate the key factors that link fish and their environment. For all the three environments discussed we know they are complex and that the detailed knowledge of key factors for many species is limited. Any model produced would be preliminary. The only place where habitat is not a major management issue in terms of human impact is in the offshore environment. Everywhere else it is a critical issue and needs to be continually focussed on, whether we do it through modelling and taking the predictions and testing them, or through adaptive management in the field. We need to come up with results that mean more fish in the water because in all habitats we are looking at a continuing decline trend.

Jeremy Prince thought that marine fisheries scientists can learn from the freshwater scientist in such areas as methods of describing fish habitats. He stressed the need to understand the spatial and temporal structure of fish stocks to lay the framework for measuring and monitoring abundance in the field instead of just monitoring the CPUE (catch per unit effort).

Campbell Davies noted that for coral reef communities there is very strong evidence of habitat preferences. When attempting stock assessment, spatial heterogeneity must be considered.