State Government Victoria
Department of Natural Resources and Environment

MAFRI PROJECT SPOTLIGHT
No. 22 ***June 4, 2002***

CAN WE TRAIN COMPUTERS TO AUTOMATICALLY ESTIMATE THE AGE OF A FISH?

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Researchers at Queenscliff's Marine and Freshwater Resources Institute (MAFRI) have completed a study to investigate whether mathematical models could be used to accurately predict the age of fish.

Current fish ageing techniques require researchers to examine fish otoliths or ear bones. Experienced technicians carefully prepare the otoliths so that they can identify and count the number of rings under a microscope. The process relies on interpretation by an experienced reader and is laborious, time consuming and relatively expensive.

Worldwide, scientists have been looking at developing other techniques to age fish that could reduce sample processing time, increase the number of samples able to be processed in a given period of time and reduce discrepancies in age estimates between readers and between organisations.

This MAFRI project investigated the application of artificial neural networks (ANNs) to age estimation in fish. These mathematical models are so called because of their similarity to a network of interconnected neurons in an animal's nervous system. ANNs give a computer the capacity to actually learn from input data. By exposing the ANN to a large amount of input and output data, the ANN can effectively train itself to correctly estimate outputs for certain inputs.

ANNs provide solutions to problems that normally require human observation and thought processes. They are used in many real-world applications including economic and financial forecasting, speech and pattern recognition, oil and gas exploration and bankruptcy prediction. This project was the first time that ANNs had been trialed in fish ageing processes in Australia.

To establish the ANN, data including fish length, fish weight, otolith weight, otolith image data, sex of fish, area of capture and date of capture from nine species of popular fish were used as inputs to the model. Outputs entered into the models were age estimates from over 37,000 individual fish.

Different combinations of this data and different neural network models were tested. A number of these combinations produced successful age estimates, but not for all species of fish tested. The models frequently over-estimated the age in the youngest fish and under-estimated the age in the oldest fish.

Results of the project indicated that ANNs generally demonstrated acceptable accuracy in age estimation, but were still not as precise as those obtained by an experienced otolith reader. However, the precision levels obtained with the ANNs could well be acceptable for some applications, where the disadvantage of poorer precision may be offset by the increased sample sizes that the neural networks offer. It was recommended that the development and implementation of this technology to fish ageing requires further work. This project was funded by the Fisheries Research and Development Corporation and Fisheries Victoria.