

Tags reveal life and times of tuna

Scientists from CSIRO's Division of Fisheries are buoyed by the success of field experiments using the new archival or 'smart' tag to track the southern bluefin tuna. Innovative techniques being used to study the tuna's biology and abundance, aimed at helping to ensure its sustainability, were described in the winter 1994 issue of *Ecos*. Since then, preliminary results from two field experiments involving tagged tuna in the wild and in a cage have given new insight into the tuna's behaviour.

In the first experiment, tags were implanted in caged tuna that were towed 250 nautical miles to a holding bay for six months. This provided controlled conditions under which estimates of geolocation based on light and time data from the tag could be compared with the known positions of the caged fish. In the second experiment, tags retrieved from two of the 180 juvenile tuna tagged off South Australia in January 1994, recorded the tuna's behaviour over days, weeks and months.

In December 1993, tags were implanted in three tuna caught at Fowler's Bay in the Great Australian Bight. They were among a school of 2000 tunas that were towed across the Bight to Port Lincoln, and fattened for sale to Japan. The main aim was to examine the archival tag's ability to estimate position, but scientists were also able to gauge the impact of weather and sea conditions on tag data, and learn more about the tuna's biology.

The first of the three tags from the caged tunas was recovered in early May 1994, and another was returned in November. After six months in the cage, the first fish had grown nine centimetres and had no problems due to the tag placement. Data from the tag indicated that the tuna had taken some 16 to 17 days in the cage to 'settle in'. After that time, the tags recorded a regular, 24-hour temperature cycle which the scientists believe linked to the farm's feeding program.

A drop in the tuna's internal body temperature coincided with the feeding of pilchards between 8.30 am and 10 am each day. For 12-15 hours following feeding, the fish's body temperature rose until about midnight, reaching 30°C, some 10°C above the water temperature. After midnight, the body temperature fell before stabilising at dawn at about 5°C above the water temperature, steady until the next feeding.

A puzzling feature of this cycle was the regular drop-off in body temperature after midnight, a decline arrested at dawn each day. The division's Dr John Gunn suggests it may be that this period is similar to 'sleeping', with the tuna resting though still swimming to maintain buoyancy. It is not yet known how the timing and length of the feeding period may affect the tuna's metabolism, but this could be important to fish-farm management.

Following the observations made on the caged tuna, the research team postulated that if similar fluctuations in body temperature were seen in wild fish, these may be indicative of feeding. By matching records of 'feeding' with information from the other sensors, it may be possible to examine the tuna's preferred times, depths and water temperatures for feeding. This would interest scientists and be of use to fishers seeking the best places, depths and times to set longlines.

Future work on these data, and those from the other fish yet to be harvested, will focus on determining the regularity of cycles among different fish from the same cage and in estimating metabolic rates.

The wild experiment

The first recapture of a tagged, southern bluefin tuna 'from the wild' in February 1994, less than a month after the archival tag had been fitted, provided some quick feedback on the success of the device in an uncon-



Environment text has it all

Environmental subjects are gaining popularity in secondary schools across Australia. To help nourish this growth, the Australian Academy of Science has published a text about environmental issues.

The book's six chapters cover natural systems, humans in the system, the global effect of modern humans; the Australian environment and our interaction with it; and environment and society. Each section is supported with informative pictures and illustrations, and includes a range of questions and discussion topics.

Environmental Science is clearly written and presented, and is packed with fascinating case studies that challenge its readers to consider their place in the environment. Although the book is written for students, people with a general interest in environmental science are bound to enjoy it too.

Contact: The Australian Academy of Science, (06) 257 4620, fax (06) 247 5777. Cost: \$34.95 (465 pages).

trolled situation. A second 'wild fish' tag was recovered in August. This fish had spent three months in the Great Australian Bight before being purse-seined and placed in a cage in Port Lincoln for four months before being harvested.

Its three months in the wild have provided excellent records of different behavioural patterns, such as feeding, moving off the continental shelf and 'sun-baking' on the surface (the fish spends periods of up to 10 hours in the top one to two metres of the water when its body temperature increases by up to 3°C). This record of the fish doing the same things, day-in, day-out, indicates these are likely to be innate or natural behaviour patterns.

Interestingly, the data also showed clear indications of feeding by the tuna, both in the wild and in the cage. At times the fish went without food for weeks, a period of starvation followed by very active feeding.

The new SBT 200 generation archival tags, due soon, will be half the size of the present tags, making them suitable for use in a wide range of fish. The tags will contain new flash RAM chips, guaranteeing the security of the data, regardless of power supply. More information on the tuna will help to secure the sustainability of the tuna.

Contact: Dr John Gunn, CSIRO Division of Fisheries, GPO Box 1538, Hobart, Tas. 7001, (002) 32 5375, fax (002) 32 5000.