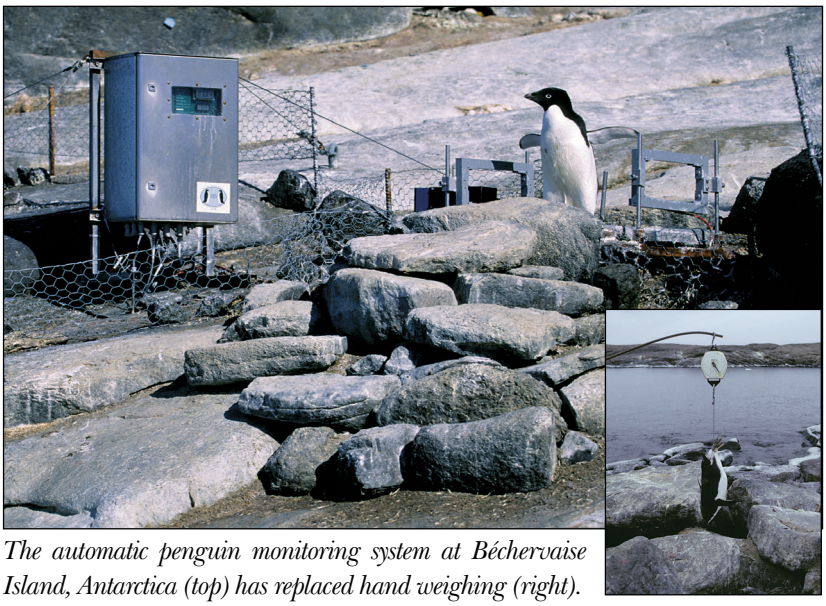
Measuring penguins from a distance

If we are to conserve the living resources of the Southern Ocean, we need to monitor the region's ecosystems so that we can distinguish between changes due to harvesting and those caused by environmental variability. These are essentially the aims of the CCAMLR Ecosystem Monitoring Program (CEMP).

Australia has supported CEMP with field studies since 1990 centred on the breeding biology and foraging ecology of the Adélie penguin. The studies seek to determine the degree to which the harvest of krill, the major food of Adélies, can effect their breeding performance. Parameters being monitored include the penguins' weight on arrival to breed, the duration of parents' incubation shifts, age-specific annual survival and recruitment, duration of foraging trips, breeding success and chick weight at fledging.



Wayne Papps

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The automatic penguin monitoring system at Béchervaise Island, Antarctica (top) has replaced hand weighing (right).

Standard methods were established with the aim of detecting a 10 percent change in a parameter with a 95 percent degree of confidence.

The CEMP program required that animals be captured for measurement. But we decided to automate the data collection with a system for weighing and identifying penguins as they walk freely to and from their colony. This system would enable weighing and recording of large numbers of penguins with minimal stress and trauma.

Our first automated penguin monitoring system (APMS), developed by AAD technicians, was installed at Béchervaise Island near Mawson in November 1990.

The system involved use of infra-red beams to determine birds' direction of travel. The 600 mm-wide weighing platform was placed on the natural pathway taken by the penguins as they moved between their colony and the sea. Guiding fences were set up on either side to ensure birds crossed the platform. The following and subsequent seasons adults and chicks were given an electronic identification tag which was implanted under the skin. All adults were sexed by cloacal examination.

At this point the system became a remote sensing device. It is solar powered and the data can be retrieved by computer on site or remotely via radio and telephone.

At the heart of the system is the novel method of determining the weight of an unrestrained penguin crossing the weighing platform. We have called this *dynamic* or *in motion* weighing. The dynamic weight bears a statistical relationship to the mass of the bird but the method of measurement is different from that of both mass and weight. Mass, an absolute number, is determined by direct comparison with a standard weight on a balance (set of scales), while weight is determined by a device – a spring balance or a weighing platform – that measures the effect due to gravity.

The system records a series of instantaneous weights as the penguin moves across the weighing platform. The dynamic weight of the bird is then calculated from these through an algorythm which takes into account all instantaneous weights obtained, including the ramping up and

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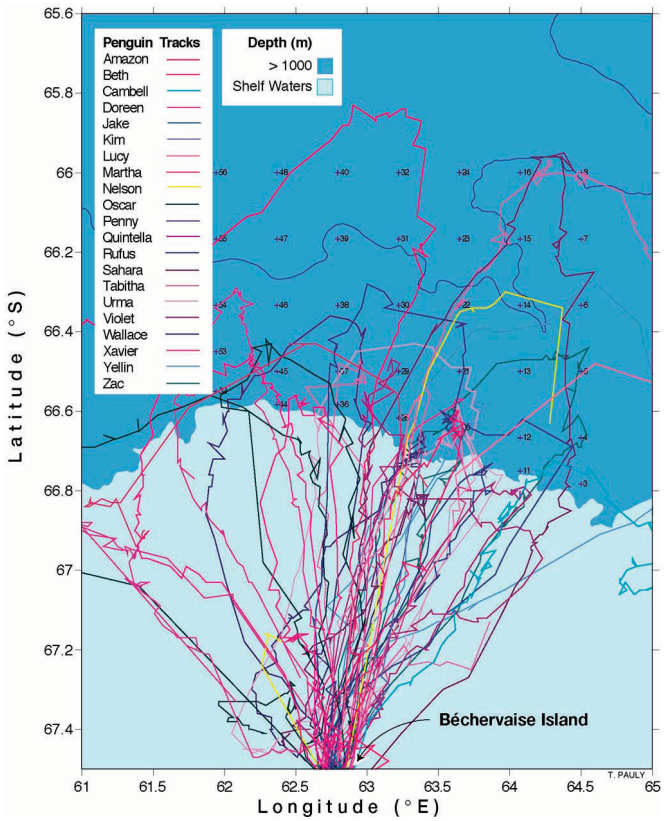

Tim Pauly

Travel routes of Adélie penguins as they forage for krill for their chicks at the edge of the continental shelf. Signals from satellite-tracked transmitters fixed to selected penguins give the exact location of each bird whenever a signal is received.