

added costs. There is the need to provide facilities and accommodation for stranded passengers — both at the station and at the airstrip — together with the need for improved meteorological forecasting at the actual landing strip. We haven't yet established whether it is possible to overcome all these problems and be completely cost effective."

With Australia's recent A\$10 million investment in the icebreaker *Aurora Australis*, the federal government is unlikely to invest in an expensive and possibly unreliable new transport system.

The Antarctic Division, however, is planning to install automatic year-round weather stations at Casey. "This will give us the long-term data we need about snowfall, solar radiation, melt rates and cloud formation before embarking on another trial. An air system may well cost more than it is worth to get people down there faster. There is certainly a low level of supervision by senior scientists of research at the stations. Because of this we are doing less forefront research. We may be better off spending the money to pay senior scientists to spend up to eight weeks travelling to the continent. This may be cheaper in the end," Moncur says. **T.E.**

How much krill to fish?

Hobart

SCIENTISTS in Australia have a peculiar relationship with krill. In 1985, the world's longest living krill ever held in captivity was inadvertently flushed down a Tasmanian sink. At nine years old, Alan was three times the then average maximum age and was the pride of the Antarctic Division in Hobart.

In the early 1980s, the keeper of Alan, Tom Ikeda, successfully raised individual live krill in glass jars. Today the Antarctic Division in Hobart is home to the world's largest continuous krill-holding facility outside the Antarctic.

Containing between 2,000 and 3,000 krill at a time, the system, developed by Steve Nicol, senior research scientist at the Antarctic Division, is fairly crude, with the krill being kept in large plastic buckets in a cold room. Nicol attributes his success to a clear, continuous water supply, brought in from the east coast of Tasmania.

A planned conversion to a more complex system of several tanks with flow-through water and facilities to monitor gas and food levels may, Nicol fears, end the Antarctic Division's run of good luck. A similar system in Britain has so far been unsuccessful.

Much of the need for krill research arises from two research programmes, both with heavy emphasis on the management of krill fishing. In 1976, the Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS) was instigated under the auspices of the international Scientific Committee for Antarctic Research (SCAR). The then 12 Antarctic Treaty nations were involved in the BIOMASS project looking at the potential threat to fish stocks by a large krill fishing industry.

In 1982, in response to fears that krill fishing would escalate to the detriment of other fish stocks in the Southern Ocean, the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) was created. The European Communities, the Antarctic Treaty nations and countries fishing in the Southern Ocean agreed to sign. The CCAMLR approach is unique in that it deals with the problems and management of overfishing before it occurs.

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But the convention suffers from some important loopholes: it cannot institute any conservation measures unless all members agree to it. Second, any member can escape the requirements of any conservation measures adopted by the convention members by giving notice within 180 days.

Nicol is frustrated that, despite krill being the principal reason for the creation of CCAMLR, only the last two annual meetings in Hobart have discussed specific management programmes. "It [krill fishing] is the single biggest economic activity in the Southern Oceans and the treaty, which was raised to prevent overharvesting, has yet to put a resolution to place a cap on the amount of krill that can be fished."

Nicol is frustrated that the Soviet Union and Japan will not agree to a cap on fishing until more is known about krill biology. According to notes from the 1990 CCAMLR meeting, the Soviets, who in 1989-90 harvested 302,376 tonnes, or 80.1 per cent of the season's catch, argue that there is "an abundance of krill" and that talk of management is "premature... and clearly expressed intentions of the fishing nations with regard to their future plans for the krill fishery... should be sufficient to allay the concerns of members".

Certainly little is known about krill biology in its natural state. It is not known why krill swarm, if they are seasonal, why they shrink in size in captivity, and why they regress sexually in response to a lack of food.

But the chief concern is that, at 5-10 per cent of the Southern Ocean zooplankton, overfishing of krill could seriously effect the food sources of larger fish, squid, birds and mammals. The most recent CCAMLR meeting held in October last year concluded, according to CCAMLR's executive secretary Dr Darryl Powell, that by the 1991 meeting all CCAMLR signatories must agree to the principle of setting a limit on krill fishing.

Nicol believes this interpretation is overly optimistic. "The Scientific Committee asked 'for an indication of it's best estimates of a precautionary limit for krill in various statistical areas' and 'to identify the various options for the basis on which such a precau-

Dry as dust

Davis

THE harsh, dry winds at the Australian station at Davis are being used to freeze-dry large wooden archaeological artefacts that have spent hundreds of years soaking in water.

According to Wal Ambrose, experimental archaeologist, James Neale, senior technical officer, both from the Research School of Pacific Studies at the Australian National University in Canberra and Ian Godfrey, from the West Australian Maritime Museum, waterlogged archaeological finds are normally treated by replacing the water with a polymer such as polyethylene glycol, which reduces drying and shrinkage and stabilizes the wood. However, for large objects such as the many seventeenth and eighteenth century Dutch sailing ships lying off the West Australian coastline, this technique is too expensive.

Davis station is the driest base in the Antarctic, with little snow and almost constant winds. This means that those living at



Wind assistance: the venturi in action.

Davis have to contend with year-round water restrictions, but conditions are ideal for freeze-drying large wooden objects.

Last summer (1990-91), Ambrose and Neale buried a 3,000-year-old house stump from Papua New Guinea and several pieces of oak from a West Australian shipwreck from the 1840s. Control sections of the stump and shipwreck will be treated using conventional vacuum treatments back in Australia.

The artefacts are lying in a box connected to the outside by a wind tracking funnel-like venturi. "The water-vapour pressure of the ice within the wood is higher than the surrounding air because of suction caused by the venturi. The wind-driven system removes the water vapour from the container, slowly drying the frozen wooden material in the process", Ambrose says. **T.E.**

tionary limit could be established. Furthermore the Commission requested that if an increase in fishing is anticipated (these nations) should notify the Commission within four months of its next meeting'. This is, supposedly, the start of discussions on ways in which the fishery might be managed. It is still a long way from actually implementing management measures." **T.E.**