Pilot survey

A pilot survey has been conducted in May 1990 and to be completed on July 1990. The aim of the pilot survey is to test the different survey methods (transect, quadrat and Manta Tow) and test the different sizes for sample optimisation in terms of cost and the precision of the abundance estimate.

Results of the distribution of the commercial species in terms of habitate and depth from the pilot survey will be an invaluable help to the above. Plans and the survey methods to be used in the provincial surveys will rely on the results of the pilot survey.

Sea cucumber research in Washington State

by Alex Bradbury
Washington State Department of Fisheries, USA

The only species of commercially exploited holothurian in Washington State, USA, is *Stichopus californicus*. Alex Bradbury, biologist in charge of managing echinoderm fisheries with the Washington State Department of Fisheries, sent us the following notes about his work.

' We have a single commercial species here, *Stichopus californicus*. The commercial dive fishery is long established, but only in the last few years has it grown to a size that warranted more than cursory management. We also have an experimental beam trawl fishery that began in 1987.

Over the last few years, the urchin and cucumber fisheries have grown seven-fold in terms of fleet size, and this winter I have been swamped in legislative battles for limited-entry, lawsuits, emergency closures, etc. I have little time to think about biology.

We still do not actively survey state waters for these animals; only during our dive surveys for sea urchins and geoduck clams do we make incidental counts of cucumbers. This began in 1986, and I have real reservations about its usefulness to management. I have requested funds for video equipment, since this seems the ideal way to make quantitative surveys. So far, we haven't got either the money or time to do these surveys. Instead, our management continues to rely on analysis of fisherman logbooks for catch-per-unit-effort data.

When we do our underwater surveys, we swim a 900 square-foot transect (83.6 square meters) and simply count animals. We use a spool containing 150 feet of polypropylene line weighted at intervals with bits of lead. The spool itself has handles that extend 3 feet on either side of the spool centerline, so that we survey a 3-foot by 150-foot area. Two divers operate the spool, one on either handle, so that each has to count a 450 square-foot area—with our poor visibility in these waters, that's about the most we can expect to cover and see all animals. During our regular geoduck clam surveys, we run continuous transects from the -18 foot level to -60 foot level, with a line of such transects made every 500 feet of shoreline; we survey about 300-500 acres of geoduck habitat each year. During our sea urchin surveys, we run about 70 transects per year. As I said, we count sea cucumbers during both the geoduck and urchin dives.

This year's season began on May 1; by the time you receive this, we'll have completed our seventh underwater survey at Pulali Point, the area we are monitoring for recovery following commercial harvest. So far we have performed six surveys prior to the area being fished; these surveys were performed every two months over a year's time. During each survey, we counted sea cucumbers within 12 transects, each measuring 83.61 square meters. Transects were placed at four different depths, ranging from -7.62 m to -25 m (corrected for datum tide level). Our seventh survey will be the first since the area was opened for fishing on 1 May 1990. We are monitoring the fishery at this site via mandatory fishing logs, so we should have some catch-per-effort data as well as total harvest data. Naturally, we will continue our dives every two months for several years to monitor recovery.

We have done some simple research projects near our lab on Hood Canal. We have completed two years of work collecting monthly samples of cucumbers from a discrete, unfished area. While we haven't fully analysed the results, the data show pretty clearly that cukes cease feeding in the fall and lose weight in the winter. Longitudinal muscle weight during the first year peaked in May and reached its lowest level in November, a drop of 37 per cent. Body wall weight peaked in October and reached its lowest level in January, declining 20 per cent. Peter Fankboner found a similar thing occuring to cukes during the winter.

We began an ambitious tagging/movement study in fall of 1988. Our objective was to determine if cucumbers moved between shallow and deep water. We used Floy tags with a double 'T' at each end (on the assumption that cukes could withdraw a single-T tag into their body cavity and expel it). We held 18 tagged cukes for 88 days and found that 28 per cent died during this time. Untagged 'control' cukes experienced no mortality during the same period, although all animals held for this study showed a decrease in size index. Only one cuke that survived this 88-day period lost its tag. We then dived an open, rocky area near our lab and tagged 720 cukes in 35 feet of water over a three-day period. Every two months since then we have dived the area, counting cukes at various depths within a series of 900

square-foot transects. Our most recent survey occurred 380 days after the initial tagging, and we found only one tagged individual out of 274 counted along transect lines. We don't closely examine all the cukes along the transect lines, but we have noticed on occasion that some cukes have tag scars; we have also picked up 7 loose tags. In short, we suspect that tag loss rather than movement or any other biological factor probably accounts for our findings, and the experiment is a dud. We did find one animal that had moved from 35 feet down to 90 feet, the deepest depth we have surveyed. This whole area will be opened to commercial diving for six months beginning May 1990, and we will be looking for tags in the catch, but I doubt we'll find many. We think that the hole never really heals and that the tag works its way out of the skin eventually.

Our fourth stab at cucumber research began in April 1989. We have been running a series of 900 square-foot transects along four depth contours in a nearby area every two months since April 1989. We will continue this procedure for several years. Meanwhile, we'll be opening up the fishery there in May 1990 for a six-month period. We'll be able to monitor the catch there and follow the recovery of the population over time. This strikes me as a much more realistic approach than making density counts in a small area and then experimentally removing animals; here we have the experimental area being harvested as well as a huge surrounding area, so that recovery cannot depend simply on animals from nearby unfished areas migrating into the experimental area. Obviously, it will be some time before we have any results, but I'll keep you posted.

Otherwise my principal concerns at this point are developing a long-lasting tag (i.e., one that will be retained more than six months), developing a reliable method of sizing live cucumbers, age/growth studies, recruitment studies, and long-term movement studies.'

Pollution problems

by Bernard Fao
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Background

Interest in beche-de-mer harvesting, for export in dried form, was revived in New Caledonia through the efforts of a number of private operators and exporters and has greatly grown in recent years. Beche-de-mer fishing helps diversify the sources of income of New Caledonia's coastal communities.

In the past three years, beche-de-mer exports have amounted to 96 tonnes, 136 t and 55 t respectively, i.e. a total of 287 tonnes.

Besides the need to monitor the factors affecting the sustainability of the resource (stock renewal, recruitment, markets), the development of beche-de-mer harvesting, or more precisely the increasing number of processing workshops springing up on the foreshore, entails a number of serious hazards for the neighbourhood and the marine environment.

Toxicity of beche-de-mer

Case of Pam Bay (in the Ouegoa District)

Following a protest lodged through a process-server on the marine pollution caused by waste from a beche-de-mer storing and processing workshop, two officers from the territorial fisheries department inspected the site.

They found an abnormal number of dead bivalves on the foreshore adjacent to the workshop. The above-mentioned report furthermore mentioned the presence of several thousand dead sardines.

From discussions with the fishermen it emerged that both the fluid released by fresh stored beche-de-mer and the water in which they have been boiled are poured directly into the sea, while the guts are partly buried in the sand but always within the upper limit of wave wash at high tide.

Samples of the fresh juice and cooking stock were tested at ORSTOM-Noumea for ichtyotoxicity. The tests revealed the presence of a toxin called "holothurine". This toxin is thermostable and believed to interfere with the action of the fish branchiae, a property which has long been made use of by Pacific fishermen to catch fish by poisoning.

Test methods and results

About ten small fish (tilapia and guppy) in a one-litre tank were exposed to various concentrations.

- Fresh juice :

1 cc/litre:	all fish dead within 1 hour
55 cc/litre	all fish dead within 15 minutes

- Cooking stock :

1 cc/litre:	1 dead within 6 hours
	2 dead within 12 hours
	2 still alive after 24 hours
5 cc/litre:	all dead within 1 hour

To guard against pollution, the operators were advised to dispose of the fresh juice, the cooking stock and the guts in ditches dug at a sufficient distance from the sea, in the hope that the sand will act as an effective filter.