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SHELLFISH MONITORING: MAKETU ESTUARY

(Short Answers in Conservation Science)

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SHELLFISH MONITORING: MAKETU ESTUARY
FOR
DEPARTMENT OF CONSERVATION - ROTORUA

By Dr S F Thrush
26 November 1992

This document stems from a request from DoC Rotorua for assistance in the design if a shellfish monitoring programme for the Maketu estuary which will determine whether the diversion of the Kaituna River into Maketu estuary affects the distribution and abundance of shellfish within the estuary.

The document is in two parts: Firstly, some notes of general points discussed during a meeting between Mr Grant Bridgwater (DoC - Rotorua) and Dr Simon Thrush (Water Quality Centre, National Institute of Water and Atmospheric Research) on 3 November 1992. Secondly, some recommendations which stem from these discussions as to how to proceed with a preliminary pilot survey programme.

General Points Re-Biological Monitoring

* Monitoring is inherently retrospective.

* Ideally good environmental management involves predicting and preventing damage rather than documenting it and then trying to correct the situation after the event. This requires knowledge of changes and of the factors which lead to these changes.

* Without a long term perspective, natural fluctuations in many biological variables (e.g., abundance, recruitment, growth) may be mistakenly attributed to human impacts.

* Distinguishing variability associated with natural change from that resulting from human activities can help to avoid the unnecessary expense of over-defining trivial change which may be well below practical thresholds of concern.

* Monitoring involves collecting data over time, thus long-term commitment is important.

* It is important to reduce the influence of spatial variation on the time series by accounting for variation within sites. Many studies place less emphasis on the number, of within-site samples, possibly under the belief that increasing the number of sampling occasions increases the power and conservativeness of future statistical tests. Unfortunately, temporal autocorrelation, which is common in environmental data, can lead to frequently collected samples of being independent. This raises the question of how to best apportion effort in accounting for spatial and temporal variability within a site. For many long-term macrofaunal studies effort may best be spent obtaining accurate density estimates to prevent spatial variation from confounding the temporal sequence.

* It may be difficult to decide whether 20%, 50% or 100% changes in mean density will be ecologically significant without information on species ecology. In making these kinds of decisions the relationship between spatial and temporal variance are also important (e.g., a standard error of 20% might be sufficient if the population varies temporally by much more than this or may be quite insufficient if the temporal variation is small).

* Separating trends from greater than annual cycles will always be limited by the length of the time series:

* A monitoring programme should relate to four areas important for ecosystem management: identification of long-term trends;

definition of long-term variability and generation of testible hypothesis on observed patterns; identification of relationships between organisms under changing environmental conditions; and an indication of possible problem areas where particular sites deviate from a general common pattern.

* Ultimately it is important that the design of a time series or impact study defines specific and answerable questions, relevant to information users and environmental managers, such that appropriate data is collected within logistic and cost constraints. In the case of generating a time series, design is particularly important because of the long-term commitment and cost. Investing in pilot sampling programmes at the outset are well worthwhile.

Development of Pilot Sampling Programme.

The purpose of this exercise is twofold; to assess the variability in shellfish density within and between sites, and to identify the costs involved in sampling. This will identify an appropriate allocation of effort, in determining the number of samples within sites, the number of sites and identify appropriate sampling protocols. This sampling will also identify any tidal height variation in the distribution of both individual shellfish and population sizes.

During our discussions it was agreed that a corer (13 cm dia. x 15 cm depth) should be used.

Pilot sampling will be focused on a small number of sites (6), which after preliminary observations are considered to encompass typical density variations for the three species of shellfish considered (wedge shells [*Macomona liliana*], pipis [*Paphies australis*] and cockles [*Austrovenus stutchburyi*]).

Each site is to be a large apparently homogeneous area so that within the monitoring programme mean densities from individual sites are

representative of the sandflat. It was considered that a site size of 1000 m^2 would probably be the smallest desirable. The geometry of each site should be roughly similar, but can be constrained to the local topography. It is expected that sites will be rectangular and parallel to the shore to reduce the influence of changes in tidal height on within site density variation.

From each site at least 20 core samples should be collected to provide good estimates of mean and variance on which to determine sample size for the monitoring programme. Randomly allocating samples within grids within each site enables random samples to be taken while ensuring dispersion.

It is likely that the distribution of the three shellfish species will vary with tidal height. Thus it is envisioned that groups of three sites will be staggered down the shore one centred on high density areas of each species. However, all shellfish will be collected from each site. For the pilot study the six sites should be arrayed in two such transects one on each side of the harbour.

In one transect samples should be sieved on 1, 2 and 4 mm sieves. It is important that the monitoring programme obtain some information on bivalve recruitment times and peak sizes. While it potentially will be too expensive to collect this information from all sites, the extra cost involved should be assessed. It was not considered practical to count and identify shellfish smaller that 1 mm. Along the other transect samples should be sieved on only a 2 mm mesh.

For large-scale comparisons monitoring will also occur in Little Waihi estuary, thus one pilot site will need to be sampled in this estuary.

Costs which need to be estimated by the pilot programme include fixed costs (equipment, travel time etc) which may increase as a step function and variable costs (sample containers, sieving, sorting, identifying data entry) which increase with every sample collected.

Once samples are collected from the pilot programme, species identified and counted, data can be analysed. The object here is to identify a suitable and

affordable level of within site precision in line with the number of sites which will be utilized in the monitoring programme:

There are a number of formula to determine sample size, however because of the inherent patchy spatial arrangement of shellfish (Thrush *et al* 1989, Pridmore *et al* 1990) and data rarely fitting known- distributions (e.g. normal) sample size formula are at best approximations.

The most appropriate techniques are randomization procedures developed by Bros and Cowell (1987), with technique improvements by Manley (1992) and Hewitt *et al* in press.

The following references should guide the use of these techniques. However, it could be more efficient in terms of time and resources to commission the Water Quality Centre to analyse pilot survey data and assist with the design of the actual monitoring programme.

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* = Available from Environment and Planning Division - Auckland Regional Council