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SURVEYS OF PAUA *(HALIOTIS IRIS)* OFF NUGGET POINT, SOUTHEAST NEW ZEALAND

(Short Answers in Conservation Science)

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Surveys of paua *(Haliotis iris)* off Nugget Point, southeast New Zealand

A report to the Coastal Section, Department of Conservation, Wellington

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Summary

A survey of paua *(Haliotis iris)* conducted in the proposed marine reserve off Nugget Point showed that paua were common only in the southern part of the proposed reserve, probably because of the greater availability of habitat compared with the northern part. The abundance and size composition of paua from the southern part of the proposed reserve were similar to adjacent populations (Catlins north and south Otago). The abundance of juvenile paua from the southern part of the propcsed reserve was significantly greater than that of adjacent populations. The results did not permit an assessment of likely sustainable harvests for paua.

Introduction

The coastal area surrounding Nugget Point, southeast New Zealand, has been proposed as a marine reserve. Little information is available on the relative abundance and species composition of the subtidal reef communities off Nugget Point. Some surveys of paua *(Haliotis iris)* off Nugget Point (McShane 1992a, McShane et al. 1993) were part of a wider survey of paua in the region (McShane 1992a).

The commercial fishery for paua is managed under a system of annual catch quotas applied to quota management areas (QMAs). Nugget Point falls within PAU 5, a large area encompassing the bottom half of the South Island and Stewart Island (McShane et al. 1993). Stock assessment of paua is based on population surveys aimed at measuring change in relative abundance (McShane et al. 1993). For the purposes of stock assessment, each QMA is considered to consist of many discrete populations linked by limited larval dispersal, with a population typically occupying about 60 km of coastline. Thus paua in the Nugget Point area may not necessarily be a discrete population, and may in fact be part of a larger population.

Our surveys were directed at addressing three main questions. First: what is the proportion of suitable paua habitat in the proposed reserve compared with adjacent areas? Second: what is the relative abundance of paua in the proposed reserve compared to the adjacent areas? Third: can an annual harvest of 15 to 30 t be sustained from the proposed reserve? This catch range encompasses estimates of current harvest

from the proposed reserve (MAF South unpublished data, New Zealand Federation of Commercial Fishermen unpublished data).

Materials and Methods

The survey area was subdivided into two strata, north and south (Fig. 1) because a previous survey had revealed few paua immediately north of Nugget Point (McShane et al. unpublished data). Random sample sites were allocated to each stratum; 5 to the southern stratum and 4 to the northern stratum. Each site contained about 250 m of coastline.

Surveys were conducted on 10 February 1994 according to a modified timed swim method. This method was adopted because it was less subject to operator dependence (McShane in press), minimised the handling bias encountered when paua were abundant, and provided a quantification of the patch structure of a population and of the relative abundance of juveniles. If a site did not have suitable habitat for paua, i.e., there was no reef habitat or the depth was in excess of 10 m, the site was reallocated.

Surveys were limited to 10 m depth because paua have a preference for shallow habitat (McShane et al. 1993).

Two research divers dived on alternate sides of the research vessel. The two sides of the research vessel, bounded by the 100 m arc described by the research diver's air hose, were treated as subsites. Thus, at any one site, individual divers would sample two replicate subsites separated by tens of metres, but by no more than 100 m. Each diver began a 10 min search upon encountering a paua.

All patches of paua seen during the 10 min search were recorded. A patch is defined one or more individuals separated by less than two body lengths (30 cm). For large patches, a maximum of four individuals (nearest the diver) was collected. Patch size *(PS)* was recorded according to the following groups of individuals: **1**, 1 - 4; **2**, 5 -10; **3**, 11-20; **4**, 21-40; **5**, 41-80; **6**, 80 +.

A further 10 min was spent by each diver searching cryptic habitat, i.e., under boulders and in cracks and crevices. Thus surveys were stratified to include both emergent and cryptic individuals.

All paua collected were returned to the research vessel where shell length was measured to the nearest millimetre. Note was taken at each site of the habitat topography (standard geological scale from solid reef to sand), the sea conditions, and the dominant epibiota (see Appendix).

For estimation of the relative abundance of paua at each subsite (A_s), patch frequency was multiplied by the median of each category of patch size:

$$A_s = \Sigma N_i (PS)_i$$

where N_i is the number of patches of the ith category per 10 min. search at each subsite and $(PS)_i$ is the median of patch size of the ith category (1.28 for patch 1). Shell length was converted to weight by the appropriate length weight conversion (McShane and Mercer unpublished). Abundance data for each subsite were converted to biomass with the product of the mean weight. The relative biomass of *H. iris* was compared with analysis of variance (ANOVA) by nesting sites within strata (stratum considered as a fixed factor).

All data were assessed for homogeneity of variance (Cochran's test) and, if necessary, transformed (n+l) (Sokal and Rohlf 1981). After ANOVA, means were compared with SNK tests (Underwood 1981). For the comparison, two adjacent populations were considered: Catlins north (Long Beach to Duff Island) and south Otago (Kaka Point to Cape Saunders).

Results

General observations

The reef habitat differed between the two strata surveyed off Nugget Point. Within the northern stratum there were also differences between the Nuggets themselves and the much shallower reef to the north. Sites north of the Nuggets consisted of solid high

relief reef, interspersed with sand. The reef/sand interface in this area occurred at about 4 m depth. Off the Nuggets, near -vertical solid rock walls merge with sand and low relief reef at a depth of about 14 m. Sites surveyed in the southern stratum consisted of solid reef of low to medium relief with large and small boulders.

The macroalgal community in the northern stratum was dominated by turfing reds including articulate coralline algae. Other common seaweds in the northern stratum included *Xiphophora gladiata* and *Microzonia velutina*. *Macrocystis pyrifera* was abundant at the far northern end of this stratum. *Durvillaea antarctica* was predominant in the immediate subtidal throughout the stratum and was also common in the southern stratum, as was the brown seaweed *Marginariella urvilliana*.

The epibiota in both strata was dominated by encrusting barnacles, sponges, and ascidians, and mussels were common in the mid-littoral zone north of the Nuggets. The sea tulip *Pyura pachydermatina* was abundant at all sites surveyed in the northern stratum and around the Nuggets themselves. *Lessonia variegata* and *Schizoseris* sp. were also plentiful off the Nuggets.

Rock lobsters *(Jasus edwardsii)* and sea urchins *(Evechinus chloroticus)* were scarce in both strata.

Relative abundance and size composition

The relative abundance of paua was much higher in the southern stratum than in the northern stratum (means + standard error (*s.e.*) : south 70.1 $\pm$ 15.2; north 10.6 $\pm$ 7.0, Fig. 2). The mean size of paua from the two strata was similar (shell length means $\pm$ (*s.e.*) : south 121.8 $\pm$ 1.2 mm; north 128.0 $\pm$ 2.8, Fig. 3). The relative biomass of paua in the southern part of the proposed reserve area was more than that in the northern part, but similar to the relative biomass of adjacent populations (Catlins north and south Otago) (by ANOVA, SNK test $P < 0.05$, Fig. 4).

The frequency of large patches (> 4 paua per patch) in the southern stratum (2.9 $\pm$ 0.7/10 min searching time) was similar to that of Catlins north (2.6 $\pm$ 0.5/10 min) and south Otago (2.8 $\pm$ 0.8/10 min), but greater than that in the northern stratum (0.4 $\pm$

0.3/10 min). However, the number of paua per patch was similar in both strata and Catlins north and south Otago (Fig. 5).

No juvenile paua were found in the northern stratum. The abundance of juveniles varied between the southern stratum of the proposed reserve and the adjacent populations (by ANOVA, $P < 0.0\,1$, Fig. 6). SNK tests revealed that juvenile paua were significantly more abundant than those from adjacent populations ($P < 0.05$). Juveniles sampled in the southern stratum were mostly large; few paua less than 30 mm shell length were found (Fig. 7).

Discussion

The information presented here is based on a short survey of paua in the proposed marine reserve area off Nugget Point. The precision of the estimates provided (*s. e.* of about 20% of means) reflects the relatively small sample size in the two strata surveyed. The results are discussed in terms of the questions originally posed.

What is the proportion of paua habitat in the proposed marine reserve compared to adjacent areas?

The area north of Nugget Point has poor paua habitat. Steep relief reef, sand, and an abundance of articulate coralline algae are not generally favoured by paua (McShane, P.E. personal observations). The results confirm the findings of a previous survey which revealed no paua off Nugget Point (McShane et al. unpublished data). In contrast, paua were common in the southern area of the proposed reserve, particularly in shallow waters (1 to 4 m). Paua occurred on smooth rock ledges or on flat reef, and were often found under large boulders which afforded protection for small paua (< 125 mm shell length). Such habitat is typical of the general Catlins region.

What is the relative abundance of paua in the proposed reserve compared to adjacent areas?

Paua were abundant only in the southern part of the proposed reserve. There, the relative biomass and frequency of large patches of paua were similar to adjacent populations.

Juvenile paua were found only in the southern area of the proposed reserve. In that area juveniles were comparatively abundant, possible because the hydrodynamics near headlands concentrates larvae of paua (McShane 1992b).

Can an annual harvest of 15 to 30 tonnes be sustained in the proposed reserve?

There is insufficient information available to answer this question. Regular population surveys, such as reported here, and known harvest levels would be required to address issues of sustainable harvest.

Conclusions

Paua are more common in the southern than in the northern part of the proposed marine reserve, probably due to habitat differences immediately north and south of the Nuggets. Most indicators of abundance for the area south of Nugget Point show similarity to adjacent populations of paua. The precision of the estimates of relative abundance of paua in the proposed marine reserve could and should be enhanced by further replication in additional surveys.

Acknowledgements

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References

McShane, P.E. (1992a). Paua fishery assessment 1992. New Zealand Fisheries Assessment Research Document 92/3. 26 p.

McShane, P.E. (1992b). Early life history of abalone. In, Abalone of the world: biology, fisheries and culture, edited by S.A. Shepherd, M.J. Tegner and S.A. Guzman del proo, Blackwells, Oxford. pp 120-138.

McShane, P.E. (in press). Estimating the abundance of abalone *(Haliotis* spp.) stocks - examples from Victoria and southern New Zealand. *Fisheries Research.* (in press).

McShane, P.E. and Mercer, S.F. (unpublished manuscript). Morphometric variation in Haliotis iris (Mollusca: Gastropoda): an analysis of fifty populations. submitted to *Australian Journal of Marine and Freshwater Research.*

McShane, P.E., Mercer, S. and R Naylor. (1993) Paua *(Haliotis* spp.) fishery assessment 1993 NZ Fish Ass Res Doc 93/6. 22 p.

Sokal, R.R. and Rohlf, F.J. (1981). Biometry. 2nd edn. W.H. Freeman, San Francisco.

Underwood, A.J. (1981). Techniques of analysis of variance in experimental marine biology and ecology. *Oceanography and Marine Biology Annual Review 19,* pp. 513-605.

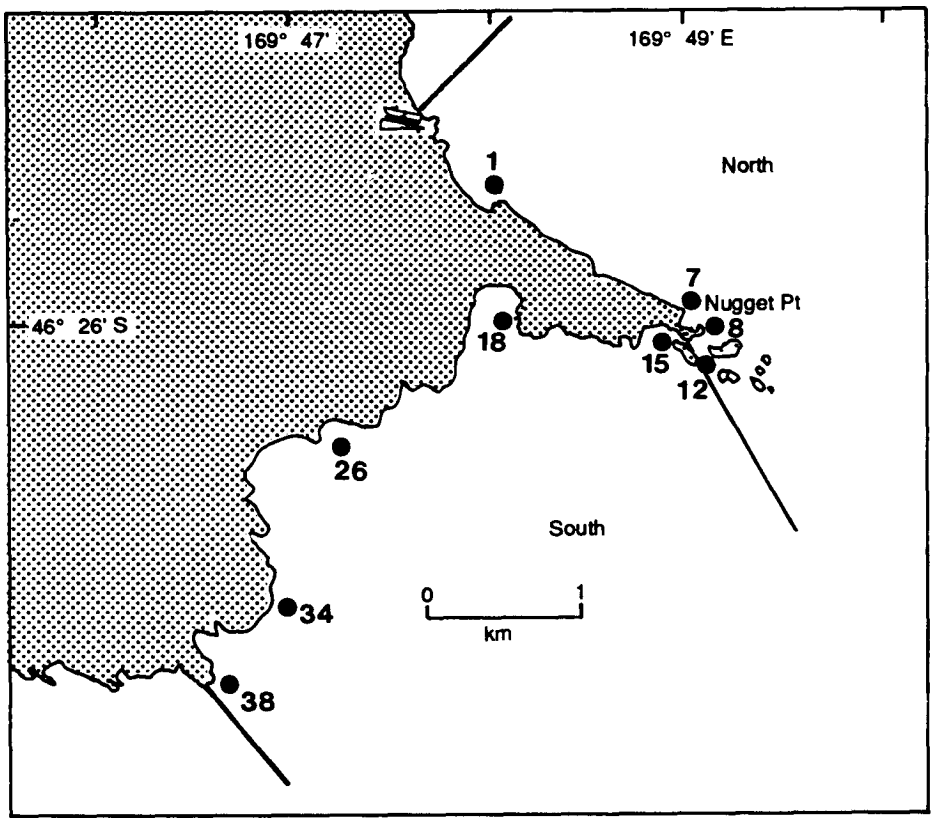

Figure 1. Stratum boundaries and sample sites, Nugget Point.

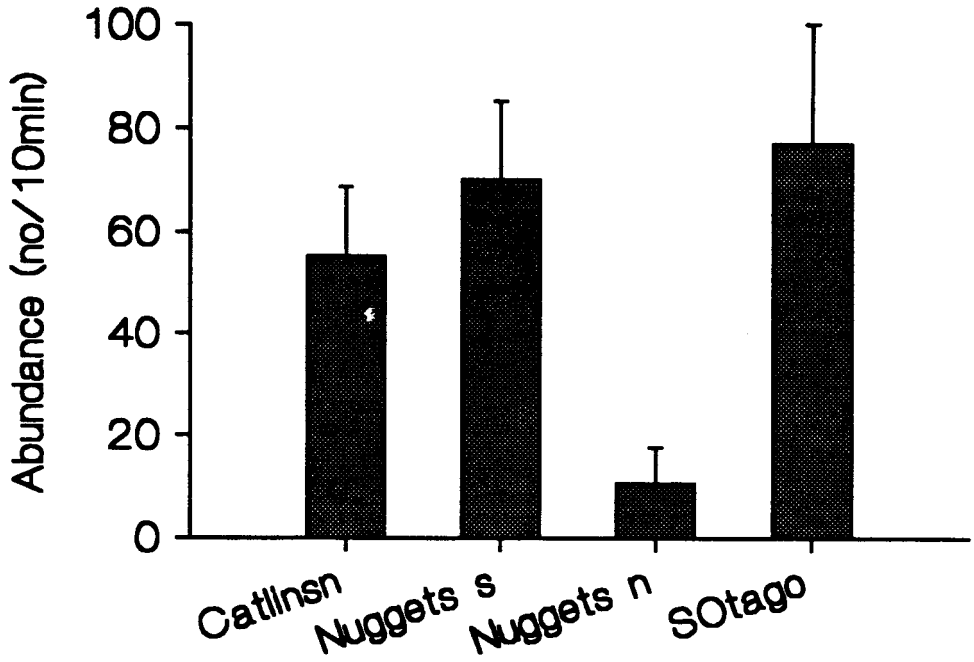

Figure 2. Comparison of the relative abundance of paua sampled south and north of Nugget Point with adjacent popuations. Means with *s.e.* are shown.

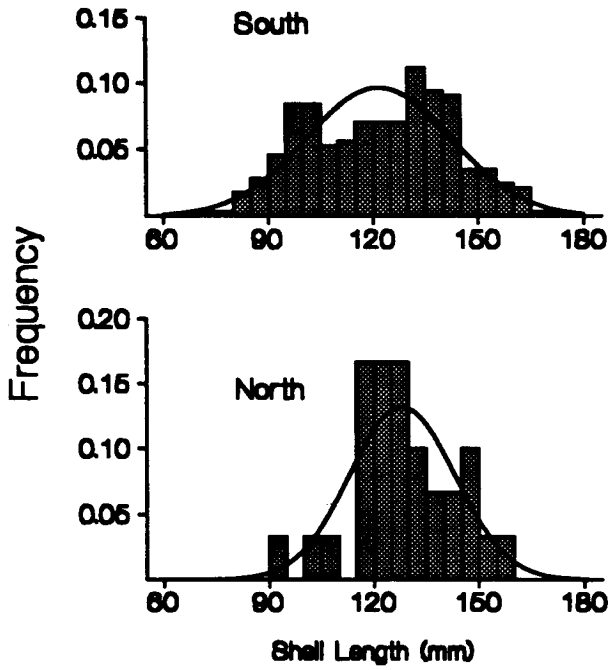

Figure 3. Length frequency distributions for paua sampled south and north of Nugget Point. Frequencies are shown as percent of the total sample with fitted normal distributions

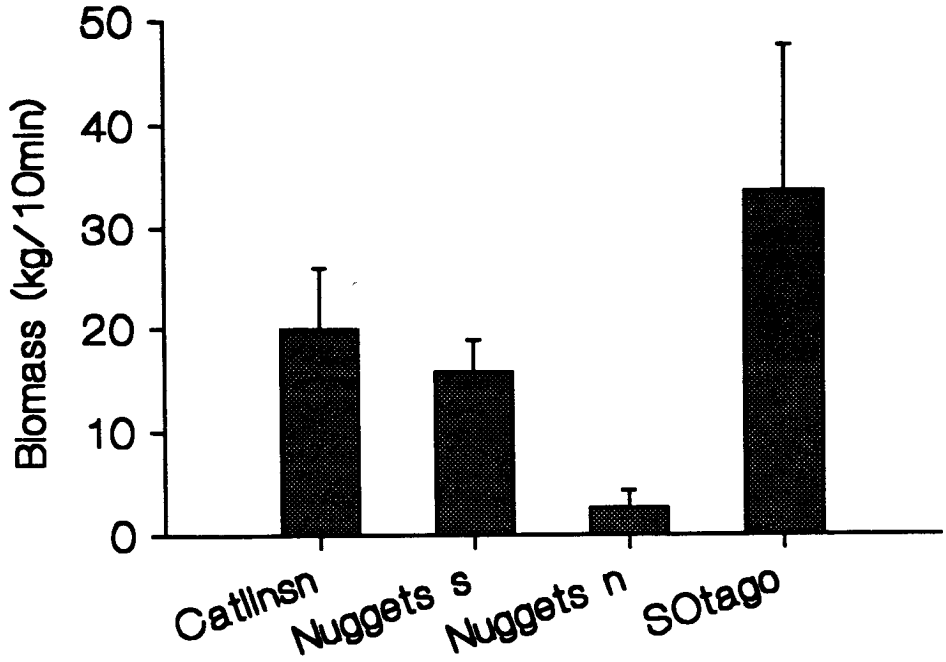

Figure 4. Comparison of the relative biomass of paua sampled south and north of Nugget Point with adjaent populations. Means with *s.e.* are shown.

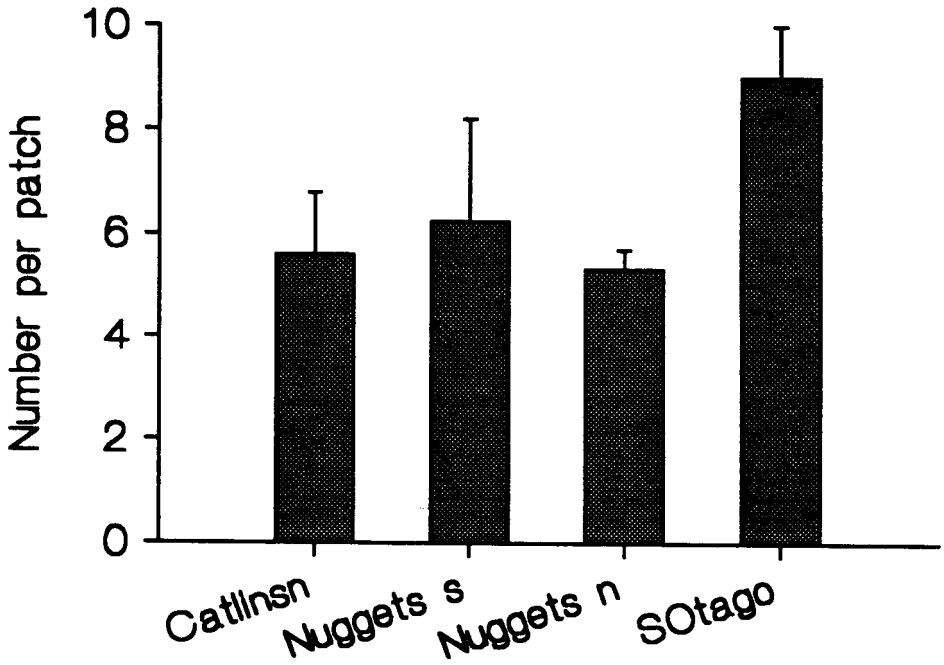

Figure 5. Comparison of the number of paua per patch for samples taken from south and north of Nugget Point and from adjacent populations. Means with *s.e.* are shown.

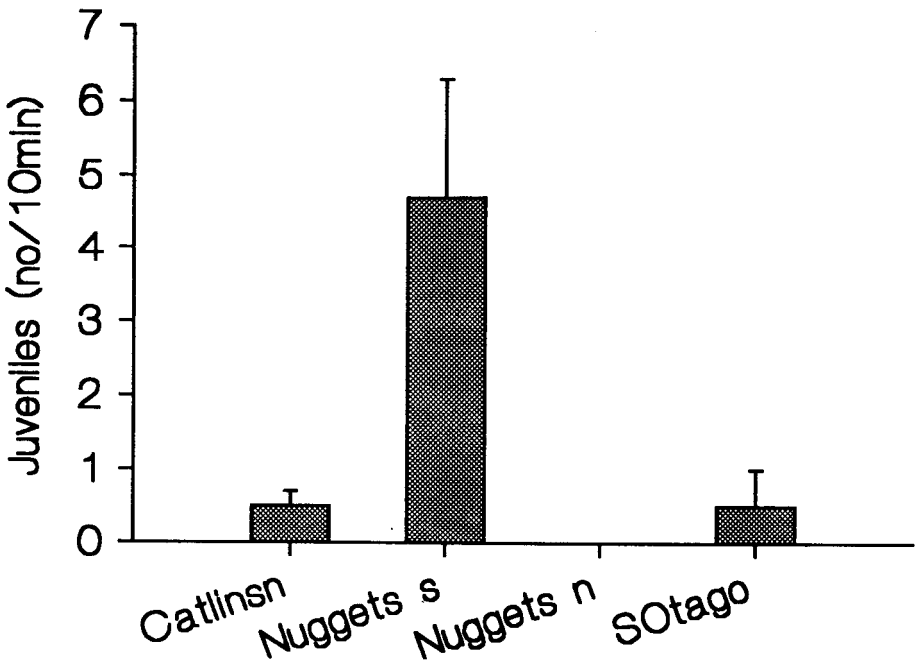

Figure 6. Comparison of the relative abundance of juvenile paua sampled south and north of Nugget Point with adjacent populations. Means with s.e. are shown.

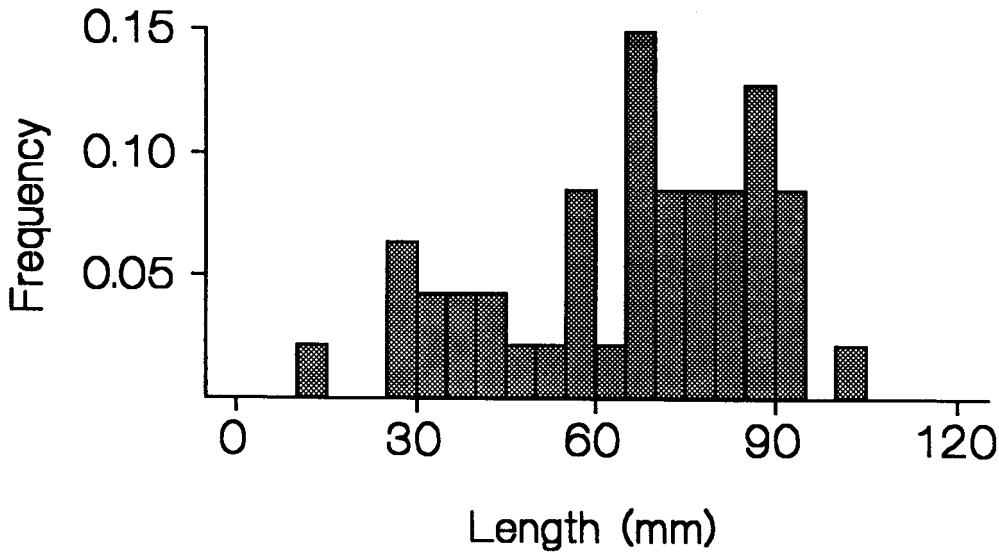

Figure 7. Comparison of the length frequency of juvenile paua sampled south and north of Nugget Point. Frequencies are shown as percent of the total sample.

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