POTENTIAL IMPACTS OF BOTTOM TRAWLING ON BENTHIC COMMUNITIES IN PRYDZ BAY, ANTARCTICA

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Abstract

This paper presents data on benthos retrieved in bottom trawls during a survey of demersal finfish species in Prydz Bay by Australia in the 1990/91 season. The data collected are used to examine a potential impact of bottom trawling on benthic communities in this region. The benthos was examined in trawls at 14 of the 22 random stations providing representative samples from different areas in the Prydz Bay. All benthos in the codend was sorted into major taxa and wet-weighed. The composition of the benthos retained was primarily sponges and ascidians. Holothurians and crinoids were the next most abundant taxa in terms of biomass. The wet-weighed ratio of benthos to finfish in the codend was greater than 1 at 12 out of the 14 stations and was mostly greater than 10. The results of this study demonstrate that the biomass of benthos that could be disturbed by commercial bottom trawling could be high in Prydz Bay. Also, the results indicate that there is a need to examine the nature of benthic communities in areas in which commercial bottom trawling may occur so that measures can be taken to ensure the integrity of these communities are maintained.

Résumé

Ce document présente des données sur le benthos prélevé des chaluts de fond lors d'une campagne d'évaluation des espèces de poissons démersaux dans la baie Prydz effectuée par l'Australie pendant la saison 1990/91. Les données collectées servent à l'examen des effets potentiels des chalutages de fond sur les communautés benthiques de la région. Le benthos examiné dans les chalutages de 14 des 22 stations aléatoires fournit des échantillons représentatifs des différentes zones de la baie Prydz. Tout le benthos du cul de chalut a été trié en taxons dominants et pesé humide. Le benthos prélevé était composé principalement d'éponges et d'ascidiens. Les holothuriens et les crinoïdes formaient ensuite les taxons les plus abondants en matière de biomasse. En poids humide, le rapport benthos/poisson dans le cul de chalut était supérieur à 1 dans 12 des 14 stations et, dans la plupart des cas, supérieur à 10. Les résultats de cette étude révèlent l'importance quantitative potentielle de la biomasse du benthos qui pourrait être dérangé par les chalutages de fond commerciaux dans la baie Prydz. De plus, les résultats mettent en évidence la nécessité d'examiner la nature des communautés benthiques dans les zones potentielles de chalutage de fond commercial afin que soient prises des mesures qui préservent l'intégrité de ces communautés.

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Резюме

В настоящей работе представлены данные по бентосу, удержанному при донном тралении во время австралийской съемки демерсальных плавниковых рыб в заливе Прюдз в 1990/91 г. Собранные данные использовались в изучении потенциального воздействия донного траления на бентические сообщества в этом районе. Бентос был исследован в тралах на 14 из 22 произвольных станций, что обеспечило образцы с разных участков залива Прюдз. Все бентические виды в кутке были рассортированы на основные таксономические категории и взвешенные. В составе удержанных бентических видов в основном находились губки и оболочники. Голотурии и морские лилии были следующими из самых многочисленных таксономических категорий в отношении биомассы. Соотношение взвешенного бентоса к плавниковым рыбам в кутке было больше 1 на 12 из 14 станций, и в основном было больше 10. Результаты этого исследования показывают, что биомасса бентоса, который может быть выведен из состояния покоя коммерческими донными тралениями, может быть высокой в заливе Прюдз. Результаты также указывают на то, что необходимо исследовать природу бентических сообществ в районах, в которых может осуществляться коммерческое донное траление, в целях принятия мер по обеспечению сохранения целостности этих сообществ.

Resumen

Este trabajo presenta la información sobre el bentos recogida durante una prospección de peces demersales realizada por Australia en la temporada 1990/91 en la bahía de Prydz, en la que se utilizaron arrastres de fondo. Los datos recogidos servirán para estudiar los posibles efectos de los arrastres de fondo en las especies bénticas de la zona. Se estudió el bentos en los arrastres realizados en 14 de las 22 estaciones aleatorias, los cuales proporcionaron muestras representativas de diferentes zonas de la bahía de Prydz. El bentos retenido en el copo se clasificó en los grupos taxonómicos principales y se determinó su peso húmedo, que en su mayoría estaba compuesto por esponjas y ascidios. En cuanto a la biomasa, los grupos taxonómicos más abundantes lo constituyeron los holotúridos y los crinoideos. La razón en peso humedo entre bentos y peces en el copo fue superior a 1 en 12 de las 14 estaciones realizadas, siendo en su mayoría superior a 10. Los resultados de este estudio demuestran que una parte importante de la biomasa del bentos podría sufrir daños a resultas de la pesca comercial de arrastre de fondo de la bahía de Prydz. Asimismo, los resultados indican que es necesario estudiar la naturaleza de las comunidades bénticas en las zonas de pesca comercial con arrastres de fondo, para poder tomar medidas que salvaguarden su integridad.

1. INTRODUCTION

In the last 10 years, a number of studies have highlighted the impacts of bottom trawling on benthic communities in heavily fished areas (e.g., De Groot, 1984; Hutchings 1990). On the basis of published data on benthos in the Antarctic, Kock (1990) examined the differences in the characteristics of benthos between commercially fished and unfished areas in the South Atlantic and suggested that bottom trawling in the past 20 years has had a considerable effect on the community structure in the fished areas. He proposed that bottom trawling in this region may have had similar effects on benthic communities as those found in the North Sea and elsewhere.

This paper presents data on benthos retrieved in bottom trawls during a survey of demersal finfish species in Prydz Bay by Australia in the 1990/91 season. The results are used to examine the potential impacts of bottom trawling on benthic communities in this region.

2. METHODS

The survey of demersal finfish in Prydz Bay was conducted at 22 random stations in the bay using a bottom trawl. The headline length was 35 m. Mesh size was 15 cm in the front panels and 5 cm in the codend liner. Ground rope was equipped with a 40 cm diameter bobbin gear. The mouth opening was, on average, 12 to 13 m wide with a headline height of 4 to 5 m. Nets were towed for a standard haul duration on the bottom of 30 minutes at 3 knots. The sweeps (25 mm diameter combination rope) were 25 m long. The length of the bottom bridle was 10 m. Disturbance of the benthos was caused by the bobbin gear, bridle and sweeps. Disturbance also resulted from the dragging of the steel 'V' doors (2 x 1. 3 m) along the bottom.

The benthos was examined in the trawls at 14 of the 22 stations (see Table 1, Figure 1) providing representative samples from the different regions in Prydz Bay. All benthos in the codend was sorted into major taxa and wet-weighed. Benthos entangled in the wings of the net was not retrieved.

3. RESULTS

The wet biomass of the major taxa at each station are illustrated in Figure 1.

Catches of fish only exceeded 50 kg at two stations near the shelf break (stations G and H). The remaining catches of fish were mostly less than 20 kg. Catches in the centre of the bay (stations L, M and N) were very low with little benthos in the net.

Of the benthos, sponges were usually the most abundant taxon in the codend. At four stations, the biomass of sponges exceeded 100 kg with the maximum being 202 kg at station B. Occasionally, ascidians formed a considerable portion of the biomass (stations A, B and H). Echinoderms were the most prominent taxon of the remaining benthos, of which holothurians were the most abundant (Table 2).

The wet-weight ratio of benthos to finfish in the codend was greater than 1 at 12 out of the 14 stations and mostly was greater than 10 (Table 3).

4. DISCUSSION

Nets used in bottom trawls for finfish are designed to minimise the catch of benthos. Nonetheless, bottom trawling in Prydz Bay in February 1991 showed that on most occasions the biomass of benthos in the codend after a 30 minute trawl was greater than the biomass of

finfish caught and often greater than 10 times the biomass of fish. The composition of the benthos retained in the codend was primarily sponges and ascidians. Holuthurians and crinoids were the next most abundant taxa in terms of biomass.

The magnitude of the disturbance and displacement of species through bottom trawling is underestimated in these analyses as a considerable biomass of crinoids and other species were entangled in the wings of the net. Also, the total number and biomass of species that will have been disturbed by the action of the doors and the other bottom gear but not caught in the net could not be detected with this method. Thus, the ratios presented in Table 3 are likely to be underestimates of the mass of benthos disturbed per unit mass of finfish caught.

Kock (1990) has highlighted the need to examine the potential impacts of bottom trawling on benthic communities in the Antarctic. The results of this study demonstrate that the biomass of benthos that could be disturbed by commercial bottom trawling could be high in Prydz Bay. Also, the results indicate that there is a need to examine the nature of benthic communities in areas in which commercial bottom trawling may occur so that measures can be taken to ensure the integrity of these communities are maintained. Given the low resilience, low reproductive rates and the comparatively sessile nature of many Antarctic benthic species (Clarke, 1979 and 1983), a suitable approach to the conservation of these communities would be to have areas within trawling grounds set aside to aid the re-establishment of disturbed species in trawled areas.

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Table 1: Co-ordinates of stations for bottom trawls in Prydz Bay, February 1991. Symbols for stations are the same as those used in Figure 1.

Station	Latitude (S)	Longitude (E)
A	67° 26.54'	70° 20.24'
B	67° 27.35'	68° 50.34'
C	67° 16.35'	68° 57.68'
D	67° 16.66'	70° 05.05'
E	67° 02.37'	70° 18.83'
F	66° 53.36'	70° 40.54'
G	66° 59.98'	74° 18.71'
H	66° 59.68'	75° 06.11'
I	66° 59.47'	76° 26.65'
J	67° 20.64'	77° 14.33'
K	67° 34.17'	77° 32.92'
L	68° 03.77'	73° 09.33'
M	68° 27.91'	75° 26.60'
N	68° 31.73'	73° 13.00'

Table 2: Mean biomass of echinoderms retrieved in bottom trawls in Prydz Bay in February 1991 (n = 14).

Echinoderm Class	Mean (g)	Standard Deviation
Echinoidea	311	736
Asteroidea	1 809	2 511
Crinoidea	1 506	4 615
Ophiuroidea	74	95
Holothuroidea	4 041	6 482

Table 3: Frequency of trawls within each group of ratios of benthos to finfish (by mass) retrieved in bottom trawls in Prydz Bay in February 1991 (n = 14).

Ratio of Benthos/Finfish	Number of Trawls
0 - 1.0	2
1.1 - 10.0	4
10.1 - 50.0	5
> 50.0	3

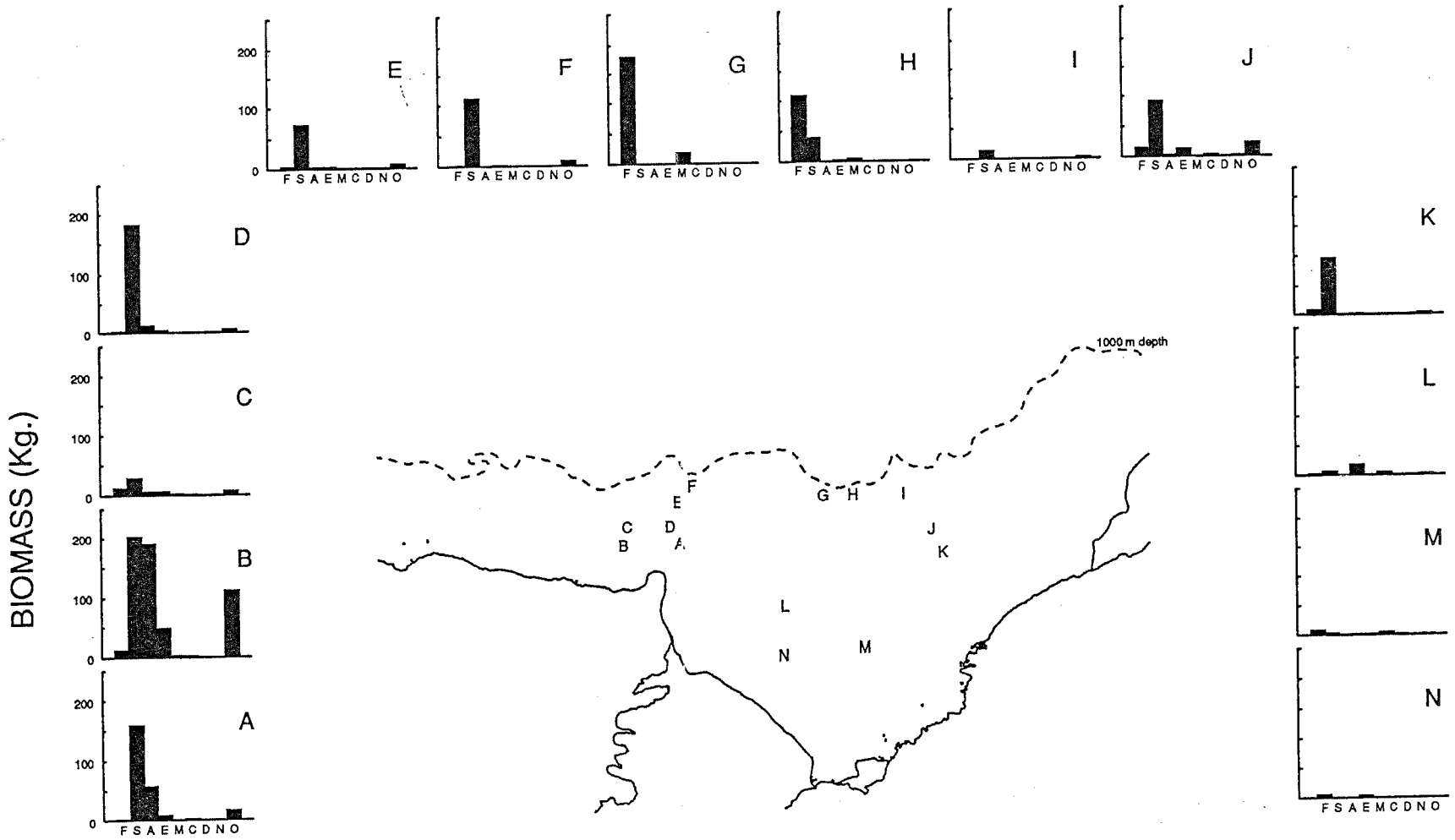

Figure 1: Biomass of major fauna taxa retrieved in bottom trawls in Prydz Bay, February 1991. Each graph shows the catch from stations marked with corresponding letters. Station coordinates are in Table 1. Legend for bars on each graph: F = fish; S = sponges; A = ascidians; E = echinoderms; M = molluscs; C = coelenterates; D = decapods; N = nereids; O = other.

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