Fisheries and Oceans Canada | Pêches et Océans Canada

Canadian Stock Assessment Secretariat
Research Document 99/104

Not to be cited without
permission of the authors[1]

Secrétariat canadien pour l'évaluation des stocks
Document de recherche 99/104

Ne pas citer sans
autorisation des auteurs[1]

Inshore Acoustic Estimates of Cod Distributions Near Bottom in Bonavista Bay

By

John T. Anderson, Edgar L. Dalley, Arnold Murphy and Chris Lang

Department of Fisheries and Oceans
Science Branch
P.O. Box 5667
St. John's, NF
A1C 5X1

[1] This series documents the scientific basis for the evaluation of fisheries resources in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research documents are produced in the official language in which they are provided to the Secretariat.

[1] La présente série documente les bases scientifiques des évaluations des ressources halieutiques du Canada. Elle traite des problèmes courants selon les échéanciers dictés. Les documents qu'elle contient ne doivent pas être considérés comme des énoncés définitifs sur les sujets traités, mais plutôt comme des rapports d'étape sur les études en cours.

Les documents de recherche sont publiés dans la langue officielle utilisée dans le manuscrit envoyé au secrétariat.

ISSN 1480-4883
Ottawa, 1999
Canada

Abstract

A new program of research carried out in coastal Newfoundland has focused on developing acoustic tools to measure both seabed habitats and fish use of these habitats. As part of this work, considerable effort has been directed to understanding the behaviour and distribution of juvenile Atlantic cod (*Gadus morhua*) on and near the seabed using submersibles. Recent use of a high resolution digital acoustic echosounder has demonstrated the degree to which cod are observable near the seabed in Bonavista Bay, Newfoundland. In addition, we demonstrate diurnal behaviour in Atlantic cod in December 1998, where cod occur on and near the seabed by day and rise and disperse into the water column at night.

Résumé

Un nouveau programme de recherche réalisé dans la région côtière de Terre-Neuve a été axé sur l'élaboration d'outils acoustiques de mesure des habitats benthiques et des poissons qui les utilisent. Dans le cadre de ces travaux, beaucoup d'efforts ont été consacrés à l'étude, à l'aide d'engins submersibles, du comportement et de la répartition des morues de l'Atlantique (*Gadus morhua*) juvéniles se trouvant sur le fond ou à proximité du fond. L'utilisation récente d'un échosondeur acoustique numérique à haute résolution a permis de montrer dans quelle mesure les morues pouvaient être observées à proximité du fond dans la baie Bonavista, à Terre-Neuve. Nous avons aussi décelé l'existence d'un comportement diurne de la morue de l'Atlantique en décembre 1998 : les morues se trouvant sur ou à proximité du fond pendant le jour et remontant ensuite pour se disperser dans la colonne d'eau pendant la nuit.

Introduction

We have conducted research on the distribution dynamics of juvenile cod within the coastal waters of Newfoundland since 1992. In particular, we have concentrated on habitat dependencies of juvenile cod and how this changes with size and age as these juveniles grow to maturity. The program has used a variety of techniques, beginning with demersal trawls and beach seines and later evolving into observational techniques using SCUBA and submersibles. An important component of the research program has involved digital acoustic classification of seabed habitats using a QTC VIEW system. Most recently, we have developed a dual frequency high resolution BioSonics digital acoustic system to map fish distribution and abundance close to the seabed.

Over these years we have developed a realistic conceptual model of how cod are distributed with respect to their seabed habitats. This model has been developed based primarily on a two and a half year program of submersible observations within Placentia Bay and Bonavista Bay, including dives in the late winter and during the autumn. From this program of diving, we observed cod of various sizes lying on the ocean bottom and using crevices and rock terrain to hide in. We also observed strong differences between day and night, where cod became much more active at night.

Recently, we have applied the BioSonics digital acoustic system to our studies in Bonavista Bay. In this paper, we present some preliminary observations of cod distributed close to the seabed and an example of diurnal differences in distribution.

Results

The observations presented here occurred in Southern Bay, Bonavista Bay (Figure 1). Day and night observations were made in December 1998 on a large school of cod located within Southern Bay. This school of cod was approximately two nautical miles in extent. The night observations were made at approximately 8 PM while running up the centre of Southern Bay at approximately 5 nm h^{-1}. The echogram shown here demonstrates that cod were distributed near the seabed and up to 10 m off the bottom, well spread out (Figure 2). We returned to this same area the following morning and ran a series of parallel transects across Southern Bay, mapping the spatial extent of the cod school. The echogram shown here for the day was geographically near the echogram shown at night, although run orthogonal to it at approximately 7:30 AM (Figure 2). During the day we observed these same cod distributed near the bottom, packed tightly together. Target strength values on these fish indicate a mixture of juveniles and adults, where many of these cod are in excess of 1 m length.

We have made many observations with the BioSonics acoustic system, where we suspected that cod were lying on the bottom. However, when cod are lying on the bottom it is impossible to detect individual targets due to the bottom exclusion

zone. When we fish such areas it is common to catch cod. The echogram shown in Figure 3 is an example of cod detected on the bottom as well as individual fish which have risen off the bottom. These observations were made in June 1997 in Southern Bay, further out than the day/night samples shown in Figure 2. Target strength and biological samples again indicated a mixture of juvenile and adult cod, ranging from 17-80 cm. When examined in detail (the enlarged sections in Figure 3) it is possible to detect cod in the process of rising off the bottom, possibly disturbed by the ship as it passed overhead.

Discussion

In general, we characterize the behaviour of Atlantic cod that we have observed in Bonavista Bay to be different day and night. During the day, cod tend to be closely associated with the bottom and often physically lie on the bottom. At night, they tend to rise up into the water column and become more dispersed among individuals. We caution, however, that diurnal behaviour may vary among areas and possibly from year to year.

Cod lying on the seabed cannot be detected acoustically as identifiable signals. However, it would appear that acoustic surveying of Atlantic cod inshore would be more tractable at night when they rise off the bottom and become much more dispersed. It is our belief that surveying abundance and distribution of Atlantic cod within the inshore may be possible using high resolution acoustics used in conjunction diurnal differences in behaviour. To determine the feasibility of such surveys, it would be necessary to carry out a directed research program to answer specific questions.

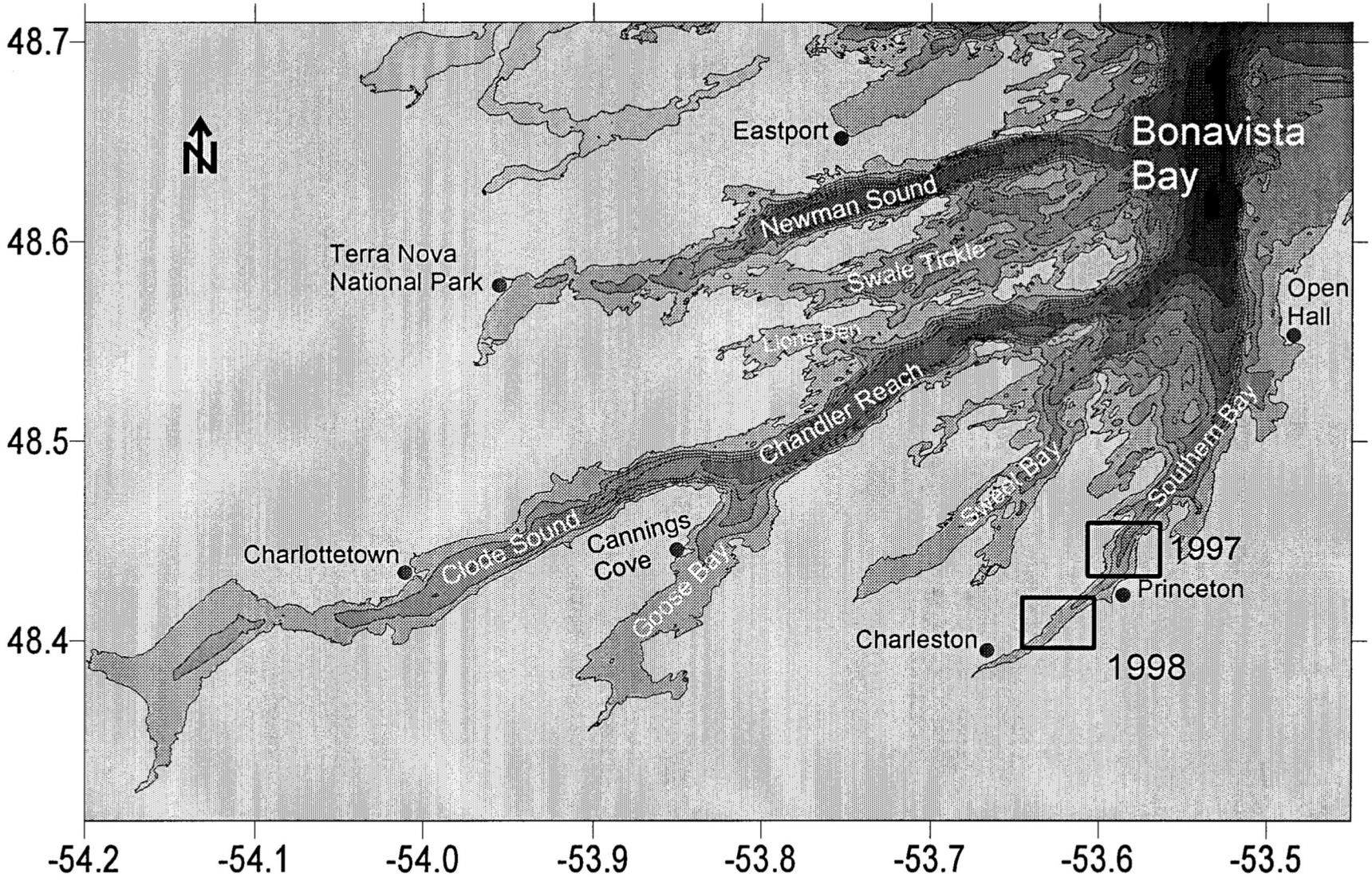

Figure 1. Southern Bonavista Bay study area. The two boxes outline the areas where the echograms of cod fish distributions were obtained in 1997 and 1998.

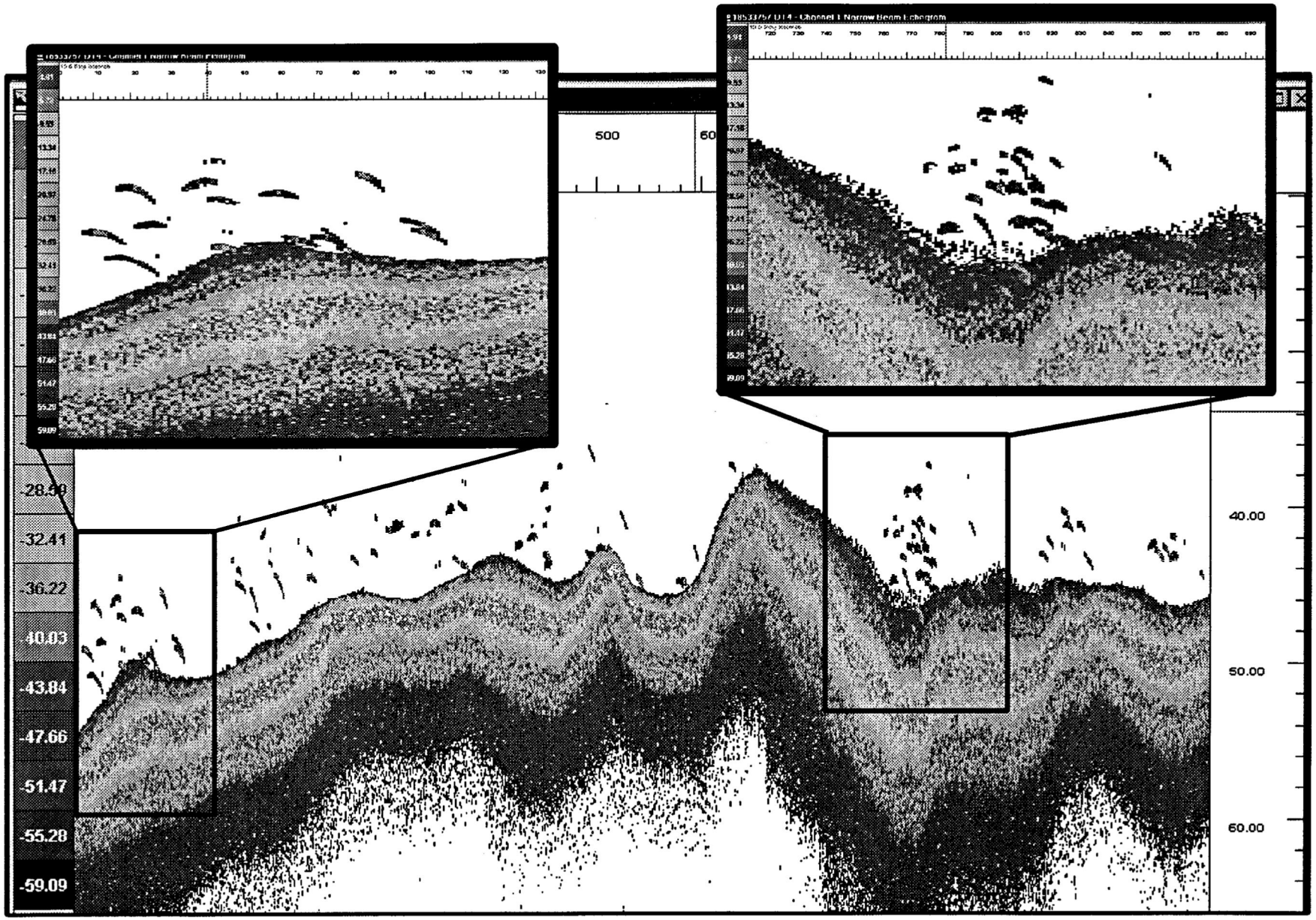

Figure 3. Echogram of Atlantic cod distribution in Southern Bay, June 1997. The enlarged sections detail distributions of cod (17-80 cm) near the seabed.

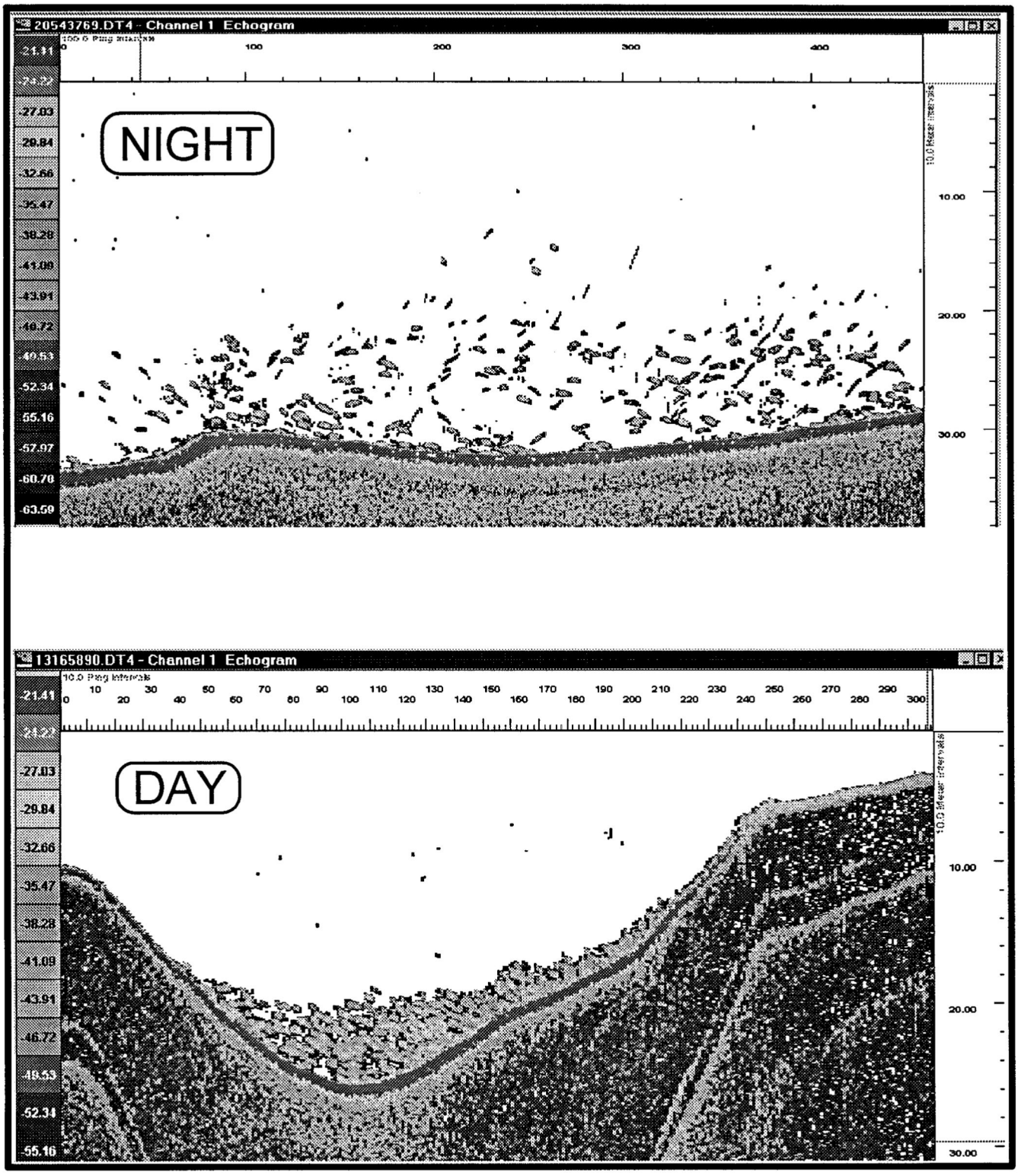

Figure 2. Echograms of Atlantic cod sampled during night and day, in Southern Bay, Bonavista Bay, December 1998.