

DET KGL. NORSKE VIDENSKABERS SELSKAB  
MUSEET

MISCELLANEA

17



Tor Strømngren

ZOOPLANKTON AND HYDROGRAPHY IN TRONDHEIMSFJORDEN

ON THE WEST COAST OF NORWAY

TRONDHEIM 1974

## EDITORIAL BOARD

Konservator Fredrik Gaustad  
Amanuensis Asbjørn Moen  
Førstebibliotekar Bo Harald Nissen  
Amanuensis Jon-Arne Sneli

## INFORMATION FOR CONTRIBUTORS

"Det Kgl. Norske Videnskabers Selskab, Museet, Miscellanea," will mainly present original papers within the area of work and responsibility covered by The Royal Norwegian Society of Sciences and Letters, the Museum, — i.e. archaeology, cultural history, botany and zoology. The series is printed in offset.

## LANGUAGE

Contributions are accepted in English and Norwegian or exceptionally in other languages.

## MANUSCRIPTS

Authors should submit the original manuscripts to the editorial board and the authors are requested to retain one complete and corrected copy.

Manuscripts should be typed double-spaced on one side of the paper, with top and left-hand margins at least 3 cm wide.

Separate sheets should be used for the following:

- 1) title pages, with the authors name and institution,
- 2) an abstract in English not exceeding 200 words;
- 3) a summary not exceeding 3% of the original manuscript;
- 4) references;
- 5) Tables with their headings;
- 6) legends to Figures.

In case of papers submitted in a language other than English, the title page, summary, table headings and figure legends must also be translated into English.

## ILLUSTRATIONS

All illustrations and diagrams other than Plates are to be considered as Figures. Line drawings should be drawn with black Indian ink, in size allowing for reductions. Photographs should be unmounted glossy enlargements showing details. The authors name and number of the figure should be written on the back of each.

REFERENCES should be quoted in the text as Brown (1957), Brown & White (1961) or if more than two authors, Green et al. (1963). Multiple references should be given as "Several authors have reported (Brown 1957, Brown & White 1961, Green et al. 1963)," i.e. in chronological order, no comma between name and year.

Lists of references are to be unnumbered and in alphabetical order. The international alphabetical order of Scandinavian and German vowels is: Å = AA, Æ and Ä = AE, Ø and Ö = OE, Ü = UE. Indicate 1st, 2nd, 3rd, etc. works by the same author in the same year by a, b, c, etc. (White 1966a). Titles of journals should generally be abbreviated according to the last edition of World List of Scientific Periodicals.

Examples.

Brogger, A. W. 1925. *Det norske folk i oldtiden*. Oslo.

Gjærevoll, O. 1963. Survival of plant on nunataks in Norway during the pleistocene glaciation. pp. 261–283 in A. & D. Löve (ed.), *North Atlantic Biota and Their History*. Oxford.

Sivertsen, E. 1935. Über die chemische Zusammensetzung von Robbenmilch. *Nytt Mag. Naturvid.* 75: 183–185.

## PROOFS

The author will receive one copy of the offset plates, which should be carefully corrected and returned within the specified time. Due to the printing method the author can be charged for alterations.

## OFFPRINTS

Authors will receive 100 offprints gratis. Additional copies can be ordered when the proofs are returned.

CORRESPONDENCE concerning manuscripts, offprints, subscription and other editorial matters should be addressed to: Universitetet i Trondheim, Det Kongelige Norske Videnskabers Selskab, Museet, Miscellanea, Erling Skakkes gt. 47 b, N-7000 Trondheim.

K. norske Vidensk. Selsk. Mus. Miscellanea 17 - 1974

ZOOPLANKTON AND HYDROGRAPHY IN TRONDHEIMSFJORDEN

ON THE WEST COAST OF NORWAY

by

Tor Strömngren

University of Trondheim

The Royal Norwegian Society of Sciences and Letters, The Museum

ISBN 82-7126-044-8

ABSTRACT

Strömngren, Tor. 1974. Zooplankton and hydrography in Trondheimsfjorden on the west coast of Norway. *K. norske Vidensk. Selsk. Mus. Miscellanea* (17): 1-35.

An analysis of the relationship between hydrography and the zooplankton in Trondheimsfjorden is presented on a basis of zooplankton samples and hydrographic data collected during 1963-1966 and 1968-1972.

A highly significant correlation was found between the size of the spring generation of the most important copepod species present, *Calanus finmarchicus*, and the discharge of riverine freshwater into the fjord prior to the main spring flood. The brackish water run-off is assumed to transport the juvenile stages of *C. finmarchicus* out of the fjord.

During the late summer and autumn, a highly significant correlation was found between the numbers of *C. finmarchicus*, copepodite stage V, and the salinity below threshold levels. The increased salinity at this season is assumed to indicate an inflow of deep water, which carries with it fresh stocks of *C. finmarchicus*, thus compensating for the vernal loss of the juvenile stages.

Several autochthonous temperate species show a decrease in abundance from the mouth to the inner parts of the fjord during summer and autumn, which is correlated with warm water influxes. The immigrants carried in by these influxes contribute significantly to the local stocks.

A number of allochthonous species are indicators of surface or deep-water inflows in the autumn.

The close relationship found between zooplankton and hydrography, demonstrates that establishment of the stocks of the various species is affected by the complex interaction of several independent biological and physical factors. This probably explains the large temporal and spatial variations of the zooplankton found in Trondheimsfjorden.

A comparison with data from Hardangerfjorden indicates similar relationships between zooplankton and hydrography.

*Tor Strömngren, University of Trondheim, The Royal Norwegian Society of Sciences and Letters, Zoological Department, N-7000 Trondheim.*

## CONTENTS

	Page
INTRODUCTION .....	7
THE INFLUENCE OF BRACKISH WATER RUN-OFF IN SPRING .....	8
THE INFLUENCE OF DEEP INFLOWS IN SUMMER AND AUTUMN .....	14
TEMPERATE AUTOCHTHONOUS SPECIES AND THE HYDROGRAPHY IN SUMMER AND AUTUMN .....	21
IMMIGRATION OF ALLOCHTHONOUS SPECIES IN AUTUMN .....	27
ASPECTS OF THE DYNAMICS OF THE ZOOPLANKTON IN TRONDHEIMSFJORDEN .....	30
ACKNOWLEDGEMENTS .....	32
REFERENCES .....	33

### INTRODUCTION

In Trondheimsfjorden marked annual variations occur in the composition of the zooplankton and the abundance of the different species. The cause or causes of these variations are not yet fully understood. Several events may determine success or failure, such as food supplies, predation, the reproductive dynamics of the various species and certain abiotic factors, e.g. currents. The long-term investigations made in Trondheimsfjorden, permit an analysis of the relationship between hydrography and the occurrence and abundance of many zooplankton species.

This paper is a discussion of the results of previous investigations in Trondheimsfjorden made during 1963-1966 and 1968-1972 (Strömngren 1973a, b, c; Wendelbo 1970). Comparisons are made with similar investigations in Hardangerfjorden in 1950-1951 (Gundersen 1953) and 1955-1956 (Lie 1967, Saelen 1962). The sampling stations for Trondheimsfjorden are shown in Fig. 1, and the sampling dates during the investigation period are shown in Table 1.

The methods used in sampling the zooplankton, together with their limitations, have been discussed previously (Strömngren 1973a).

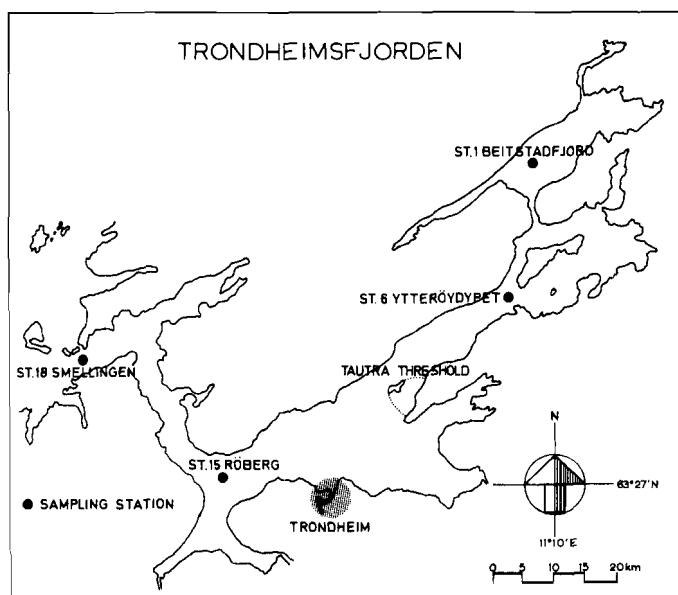


Fig. 1. The positions of the four sampling stations in Trondheimsfjorden.





































































