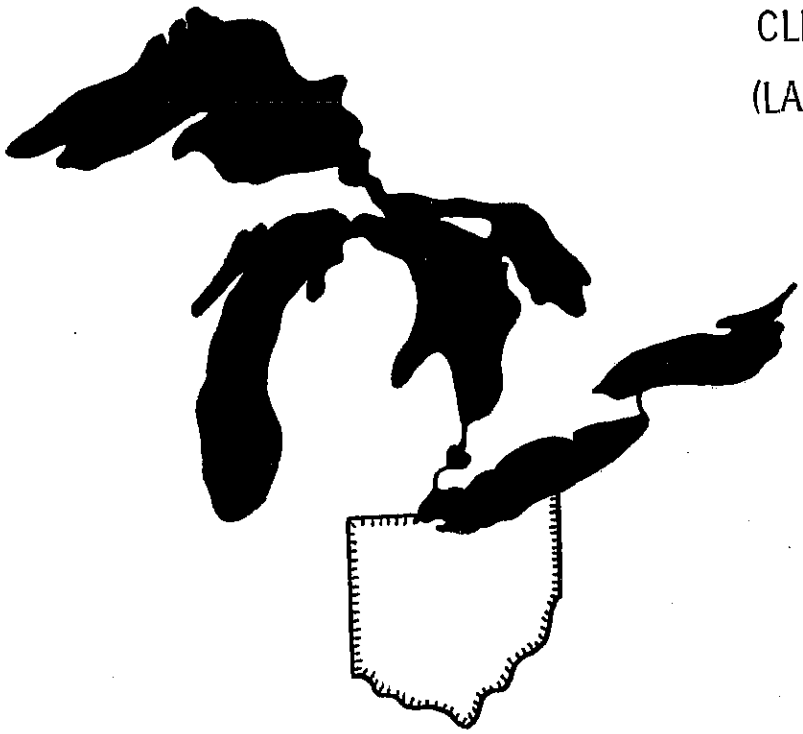

CLEAR TECHNICAL REPORT NO. 243

(LAKE ERIE TAT CONTRIBUTION NO. 18)

LAKE ERIE INTENSIVE STUDY: MACROINVERTEBRATES IN MAIN LAKE AND NEARSHORE SEDIMENTS

Prepared by

Patricia E. Steane
and
C. Lawrence Cooper

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THE OHIO STATE UNIVERSITY
CENTER FOR LAKE ERIE AREA RESEARCH
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INTRODUCTION

Benthic macroinvertebrates, commonly referred to as benthos, are bottom-dwelling invertebrates larger than 0.5 mm. These organisms are a large component of the aquatic biota and as a food resource of fish are consequently linked to man.

Their ability to adapt and the fact that they are relatively stationary makes them excellent monitors of environmental processes. Some of these processes are the cycling of various materials through migration from the sediments to the water column (Pliodzinskas 1978). Due to benthic regulation studies made during the intensive survey on sediments, concentrations of metals and pesticides can be directly related to population densities of these organisms, and in turn studies of these communities can be used as indicators of long-term water quality.

Historical benthic studies have normally consisted of general reports of industrial contaminants and special reports on specific organisms and their habitats. Although early studies did not deal with species density ratios, later reports did, and the relationship of diverse taxa to clean water habitats became an established fact. An in-depth review of these historical studies is contained in TAT contribution no. 17 (Keeler 1981).

At best the following contribution should be approached as a preliminary status statement as it contains only the information made readily available by members of the intensive study. Several important data sets are not represented here and others are referenced only in their preliminary forms.

Methods

Consistent station locations for all intensive study participants were not maintained from year to year (Figures 1,2,3), and as a result marked differences were observed in data sets. Seasonal sampling caused inconsistencies in taxa numbers and species variations (Table 1), possibly due to emergence, recruitment, growth and mortality differences (Kreiger 1981).

The mechanics of sampling were fairly consistent throughout the intensive study participants. In most instances samples were obtained by Ponar grab, washed in varying sizes of wire screens, sorted, and identified to genus and to species where possible. The details of these methods were available only for the Water Quality Laboratory at Heidelberg College and for the Ontario Ministry of the Environment, Southwestern Region. All that is known of the collections by the State University of New York College at Buffalo is that in 1978, 38 samples were collected and that only 35 of the samples were considered quantitatively and qualitatively representative of the sampling area (SUNY 1981).

RESULTS AND DISCUSSION

Quality control by most participants was obtained by the replication of samples. The Water Quality Laboratory at Heidelberg College replicated samples at each of 12 stations. They summarized that total numbers of organisms and taxa differed markedly and that the practice of replicate sampling based on previous experience (Brinkhurst 1967) was well-founded.

Ontario Ministry of Environment maintained replicate sampling for their 16 stations and experienced the evidence of large emergent swarms with sediments in the area devoid of benthic larvae (May 24, 1979 at OME station 423). A taxonomic listing for reporting participants is provided in Tables 2, 3 and 4.

Several systems of benthic pollution classification have been devised (Goodnight and Whitley 1961; and Wright et al. 1955) on the basis of numbers of benthic organisms per square meter and percent of individuals per square meter.

The Goodnight and Whitley method relates percentage of Oligochaeta densities to water conditions with less than 60 percent denoting good conditions, 60-80 percent doubtful conditions and greater than 80 percent polluted conditions. Since all participants reported some presence of Oligochaeta this method could be used in water quality forecasting.

Oligochaeta density as opposed to percentage is the basis for the Wright standard. Less than 100 Tubificids/m^2 and more than 100 Hexagenia/m^2 connotated clean conditions, 100-1000 Tubificids/m^2 light pollution conditions, 1001-5000 Tubificids/m^2 presented moderate pollution conditions and greater than 5001 Tubificids/m^2 indicated heavy pollution. Since Hexagenia nymphs were reported only by MOE in the western basin at stations 318, 323 and 327, all other waters sampled would be considered to have some level of pollution.

Obviously neither of these methods of classification consistently represents water quality relationships, but the Wright Index can properly represent a quantitative suggestion of pollution levels. Examples of these classification standards for the Vermilion to Ashtabula nearshore area are represented in Figures 4 and 5.

Taxonomic results according to dominant organisms revealed that oligochaeta represented 74-75 percent of all organisms collected by the Ontario Ministry of the Environment in 1979 and 65 percent of all organisms in the nearshore areas sampled by Heidelberg College. The State University of New York College at Buffalo's Great Lakes Laboratory concluded that in Eastern basin sampling, 83 percent of the total organisms were tubificid worms. Of this 83 percent, eleven of the stations sampled contained 80 percent or more tubificid worms (stations Buffalo 9, 10, 12, and 16; Dunkirk 4; and Erie 2, 8, 10, 12, 15 and 16).

Limnodrilus sp. was reported the dominant species by both the Ontario Ministry of the Environment and Heidelberg College. The highest densities appeared at harbor mouths (MOE station 386; 14233/m^2) and a tendency toward lower numbers in 1979 with the exception of the Fairport Harbor-Ashtabula area, which remained a trouble spot.

Sphaeridae clams were present at all Ontario Ministry of the Environment stations except 1052 with an average of 35/m^2 organisms in May and 68/m^2 in August. From Vermilion to Ashtabula in the nearshore area, clams were the second most abundant group. This was probably due to the late sampling dates in 1979 as is revealed by the appearance of 4,183 individuals per square meter at Heidelberg College station 57.

Open water areas generally supported more species and, according to Krieger (1981) the individuals of Psidium henslowanum, P. nitidum and Sphaerium corneum display a gradient of increasing frequency from west to east.

Chironomidae were the second and third most abundant macroinvertebrates, respectively, to the Ontario Ministry of Environment and Heidelberg College. The State University of New York College at Buffalo reported chironomids as second to the Oligochaetes in dominance.

The Vermilion to Ashtabula sampling reach again experienced improportionate increaes from 1978 to 1979, but the obvious reason of inconsistent sampling dates could not be determined as the cause. Pupae were obtained with much less frequency and densities between open water and harbor areas differed inconsistently. This could be relative to the sampling differences or a possible inability of larvae to pupate in certain conditions.

Several other zoobenthos appeared in the study samples: Crustacea, Gastropods, and Hirudinea, but the appearance of the burrowing mayfly Hexagenia limbata was a remarkable find. Very few were collected, with 1 to 4 individuals per grab sample at MOE stations 321 and 323 in May and 318, 323 and 327 in August of 1979. These stations near the mouth of the Detroit River showed an abundance of extrapolated individuals, 20 per square meter.

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TABLES

TABLE 1

APPROXIMATE CRUISE SCHEDULES FOR BENTHOS SAMPLING
IN 1978 AND 1979.

Heidelberg College, Water Quality Laboratory
June 16-28, 1978 and September 1-9, 1978 and July 12-23, 1979

State University of New York College at Buffalo, Great Lakes Laboratory
June-July 1978

Ontario Ministry of the Environment, Southwestern Section
May and August 1979

TABLE 2
HEIDELBERG COLLEGE, WATER QUALITY LABORATORY, BENTHIC MACROINVERTEBRATE SPECIES LIST FOR 1978 AND/OR 1979.*

OLIGOCHAETA

Naididae

Nais sp. (1978)
Piguetiella michiganensis (1978)
Pristina foreli (1978)
P. idrensis (1978)
P. menoni (1978)
P. plumaseta (1978)
Ripistes parasita (1978)
Specaria josinae (1978)
Stylaria lacustris (1978)
S. fossularis (1979)
Vejdovskyella intermedia

Tubificidae

Aulodrilus amercanus
A. limnobius
A. pigueti
A. pleuriseta
Branchiura sowerbyi
Limnodrilus angustipenis (1978)
L. cervix
L. cervix ciaparedianus intermediate
L. ciaparedianus (1978)
L. hoffmeisteri
L. maumeensis
L. spiralis
L. udekemianus
Peloscolex ferox
P. freyi
P. multisetosus longidentus
P. multisetosus multisetosus
Potamothrix moldaviensis
P. vejdovskyi
Psammoryctides californianus (1978)
Tubifex ignotus
Tubifex tubifex

CHIRONIMIDAE

Chironomus sp.
Clinotanypus sp.(1979)
Coelotanypus sp.(1979)
Constempellina sp.(1978)
Cryptochronomus sp.
Dicrotendipes sp.(1978)
Einfeldia sp. (1978)
Glyptotendipes sp. (1978)
Microtendipes sp.(1979)
Parachironomus sp.(1978)
Paracladopelma sp.(1978)
Paralauterborniella sp. (1978)
Tribe Pentaneurini (1979)
Phaenospectra sp. (1979)
Polypedilum sp.
Procladius sp.
Pseudochironomus sp. (1978)
Rheotanytarsus sp. (1979)

SPHAERIIDAE

Musculium partumeium
M. transversum
Pisidium amnicum
P. casertanum
P. compressum
P. henslowanum
P. lilljeborgi (1978)
P. nitidum
P. subtruncatum
P. ventricosum (1978)
P. variabile (1979)
Sphaerium corneum
S. fabale (1978)
S. nitidum (1978)
S. rhomboideum (1979)
S. simile (1979)

AMPHIPODA

Gammarus fasciatus

ISOPODA

Asellus racovitzai racovitzai

HIRUDINEA

Helobdella stagnalis

* The year is shown for those taxa collected only one year.

TABLE 3

STATE UNIVERSITY OF NEW YORK COLLEGE AT BUFFALO,
GREAT LAKES LABORATORY, BENTHIC MACROINVERTEBRATE
SPECIES LIST FOR 1978

OLIGOCHAETA

Naididae

Stylaria lacustris
Uncinais uncinata

Tubificidae

Aulodrilus americanus
A. limnobius
A. pigueti
A. pluriseta
Limnodrilus cervix
L. cervix (var.)
L. hoffmeisteri
L. maumeensis
L. udekemianus
L. sp.
Peloscolex ferox
P. freyi
P. multisetosus
P. multisetosus longidentus
Potamothrix moldaviensis
P. vejdovskyi
Tubifex tubifex

CHIRONOMIDAE

Chironomus attenuatus
C. sp.
Coelotanypus concinnus
C. sp.
Cryptochironomus fulvus
C. sp.
Microtendipes sp.
Paracladopelma sp.
Paralauterborniella sp.
Paratendipes sp.
Procladius sp.
Pseudochironomus sp.
Tanytarsus sp.

SPHAERIIDAE

Pisidium (c.) milium
Sphaerium (s.) corneum
S. (m.) fabale
S. (m.) lacustre
S. (m.) securis
S. simile
S. striatinum

AMPHIPODA

Gammarus fasciatus

ISOPODA

Asellus racovitzai
A. sp.

GASTROPODA

Amnicola limosa
A. lustrica
A. integra
Bithynia tentaculata
Physa sp.
Valvata sincera
V. tricarinata
V. t. basilis
V. t. mediocarinata
V. t. perconfusa
V. t. simplex
V. t. tricarinata
V. t. unicarinata
V. sp.

HIRUDINEA

Helobdella elongata
H. stagnalis

TABLE 4

ONTARIO MINISTRY OF THE ENVIRONMENT,
SOUTHWESTERN REGION, BENTHIC MACROINVERTEBRATES LIST
FOR 1979, MAY AND AUGUST

OLIGOCHAETA

- Naididae
  - Nais communis
- Tubificidae
  - Aulodrilus pluriseta
  - Branchiura sowerbyi
  - Limnodrilus angustipenis
  - L. cervix variant
  - L. claparedeianus
  - L. hoffmeisteri
  - L. maumeensis
  - L. profundicola
  - L. udekemianus
  - Peloscolex ferox
  - P. multisetosus
  - Potamothrix vejdovskyi
  - Tubifex tubifex
  - *Peloscolex freyi
  - *Potamothrix moldaviensis
- *Lumbriculidae
  - Stylodrilus heringianus

CHIRONOMIDAE

- Chironomidae
  - Tanypodinae
    - Tanypus sp.
    - Ablabesmyia
    - Procladius sp.
    - Psectrotanypus
    - Coelotanypus sp.
  - Chironominae
    - Chironomus sp.
    - Cryptochironomus
    - Polypedilum
    - Tanytarsus
    - *Rheotanytarsus
    - *Micropsectra
    - *Constempellina
    - *Tribelos
    - *Glyptotendipes

SPHAERIIDAE

- Pisidium
- Sphaerium

AMPHIPODA

- Gammarus sp.

GASTROPODA

- Amnicola sp.
- Compeloma sp.
- Somatogyrus
- Valvata sincera
- V. tricarinata
- *Bithynia tentaculata

HEXAGENIDAE

- Hexagenia limbata

*Found only during August Cruise.

FIGURES

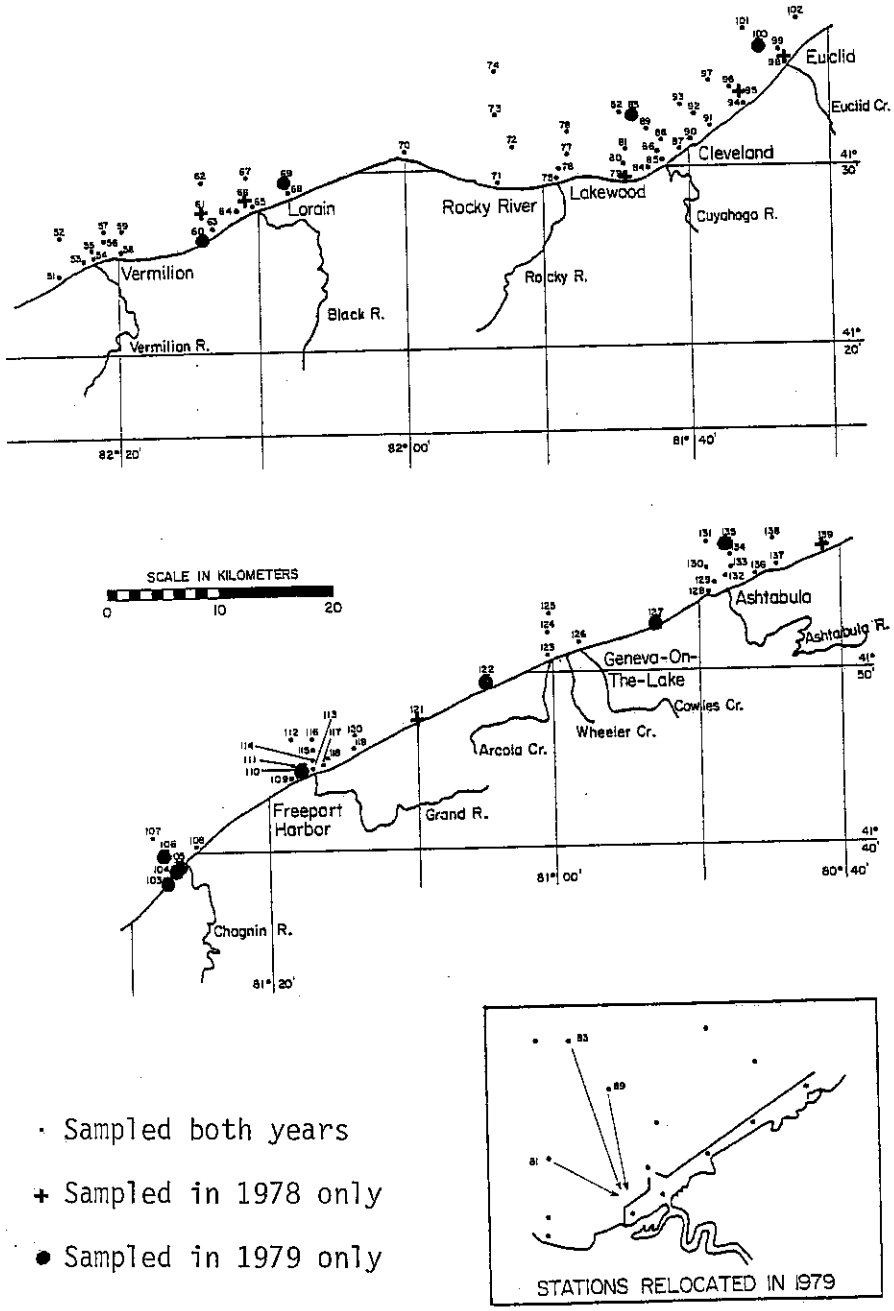

Figure 1. Heidelberg College, Water Quality Laboratory, Stations sampled for macroinvertebrates in 1978 and 1979.

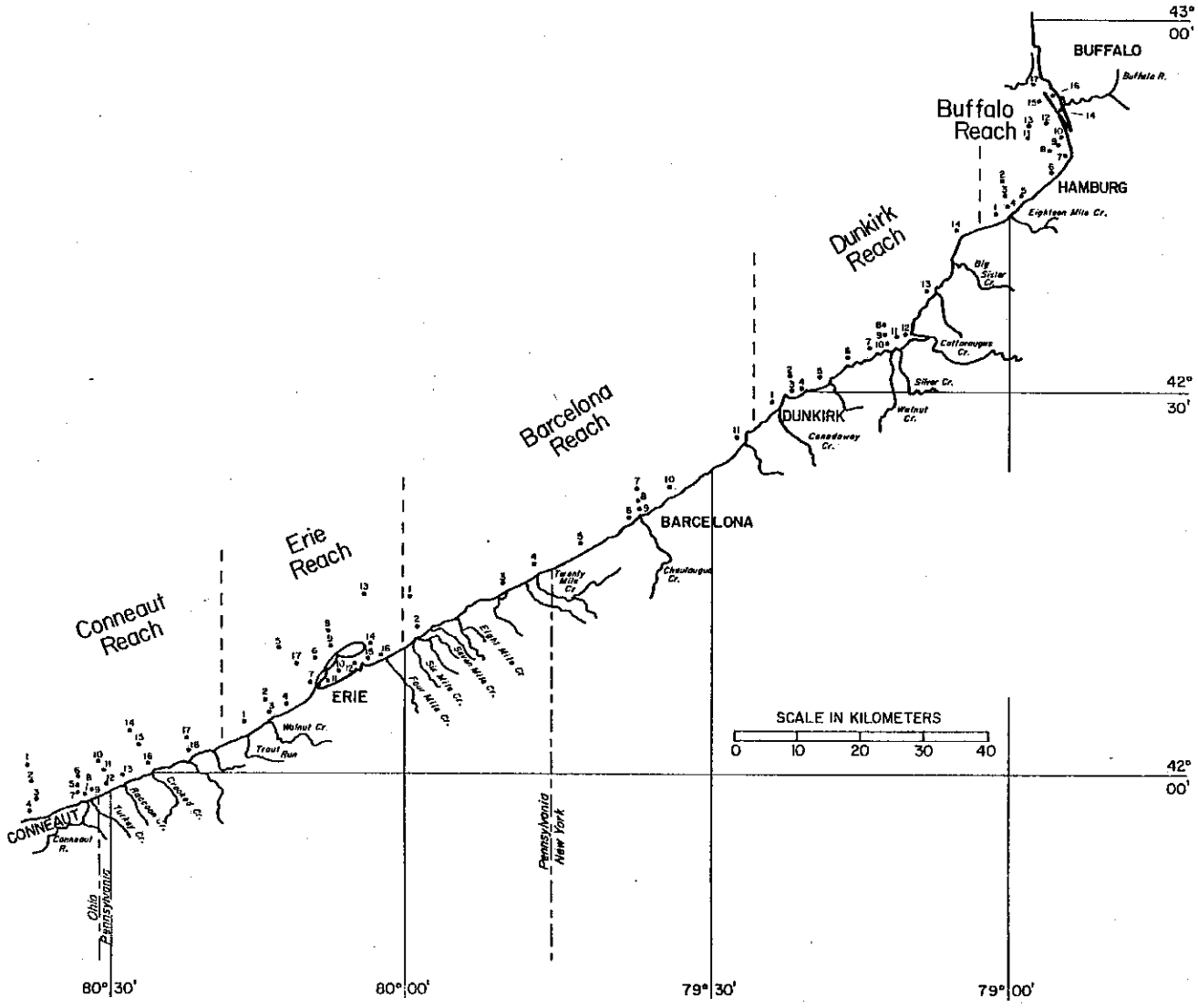

Figure 2. State University of New York College at Buffalo, Great Lakes Laboratory, Station locations for Intensive Study in 1978 and 1979.

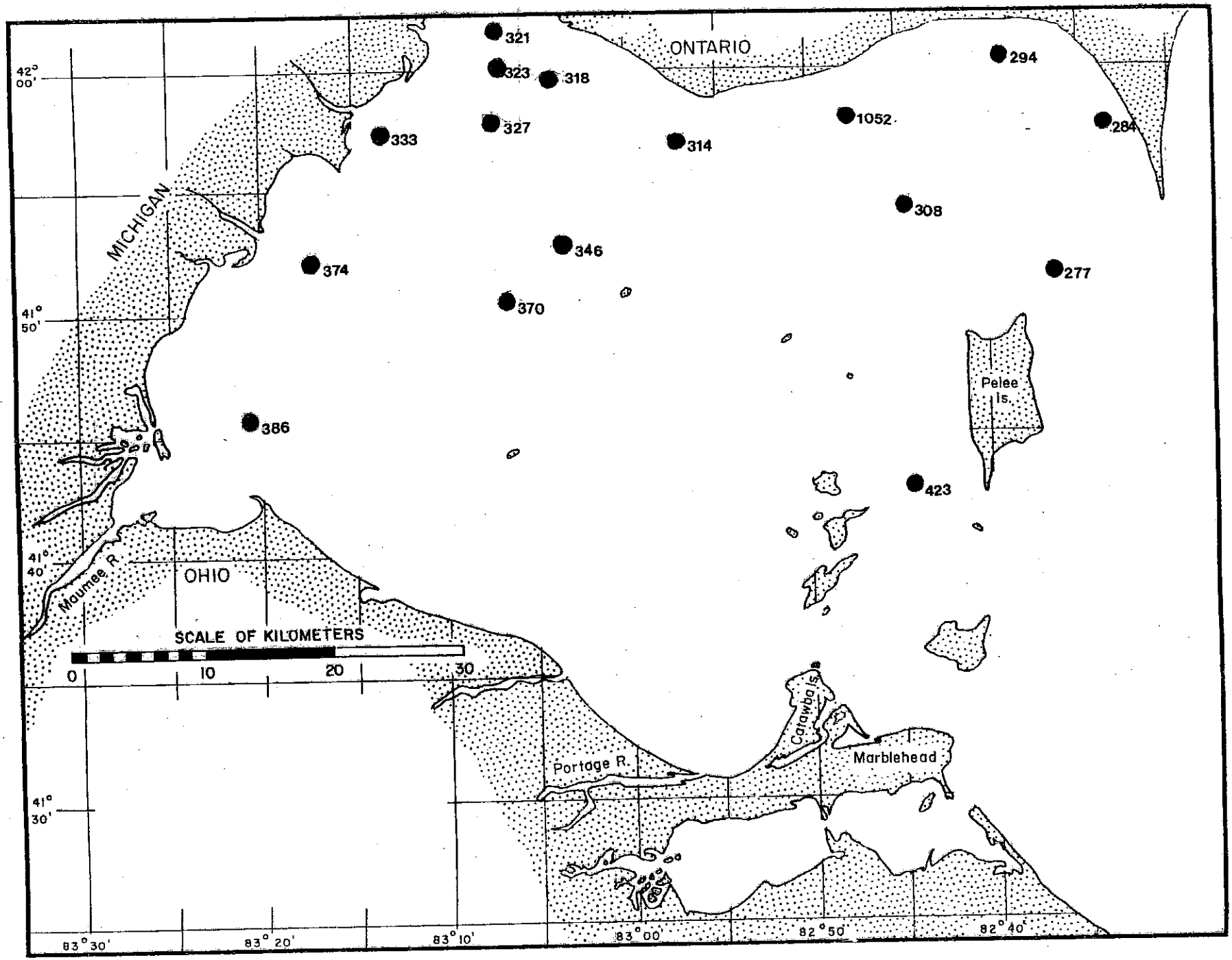

Figure 3. Ontario Ministry of the Environment, Southwestern Section, Stations sampled for Macroinvertebrates in 1979.

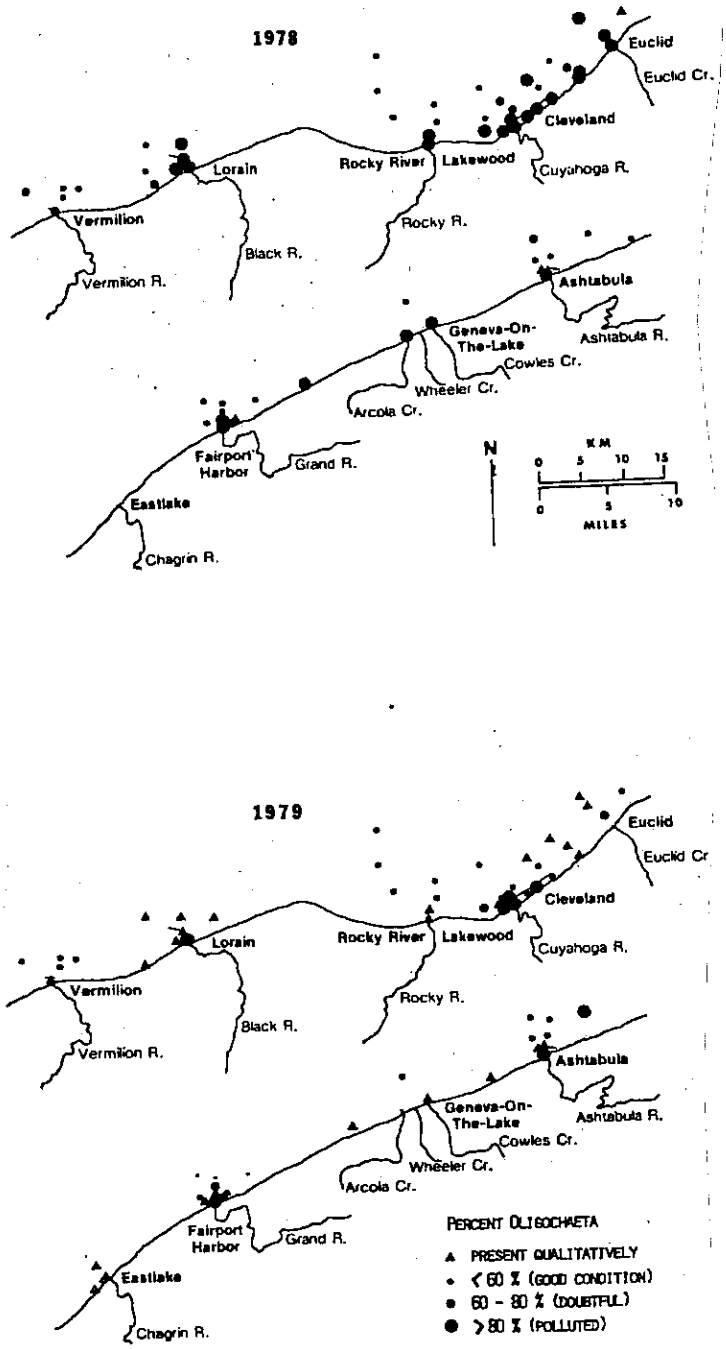

Figure 4. Heidelberg College, Water Quality Laboratory, Percentage of Oligochaetes at individual near-shore stations in 1978 and 1979.

(Taken from: Kreiger 1981)

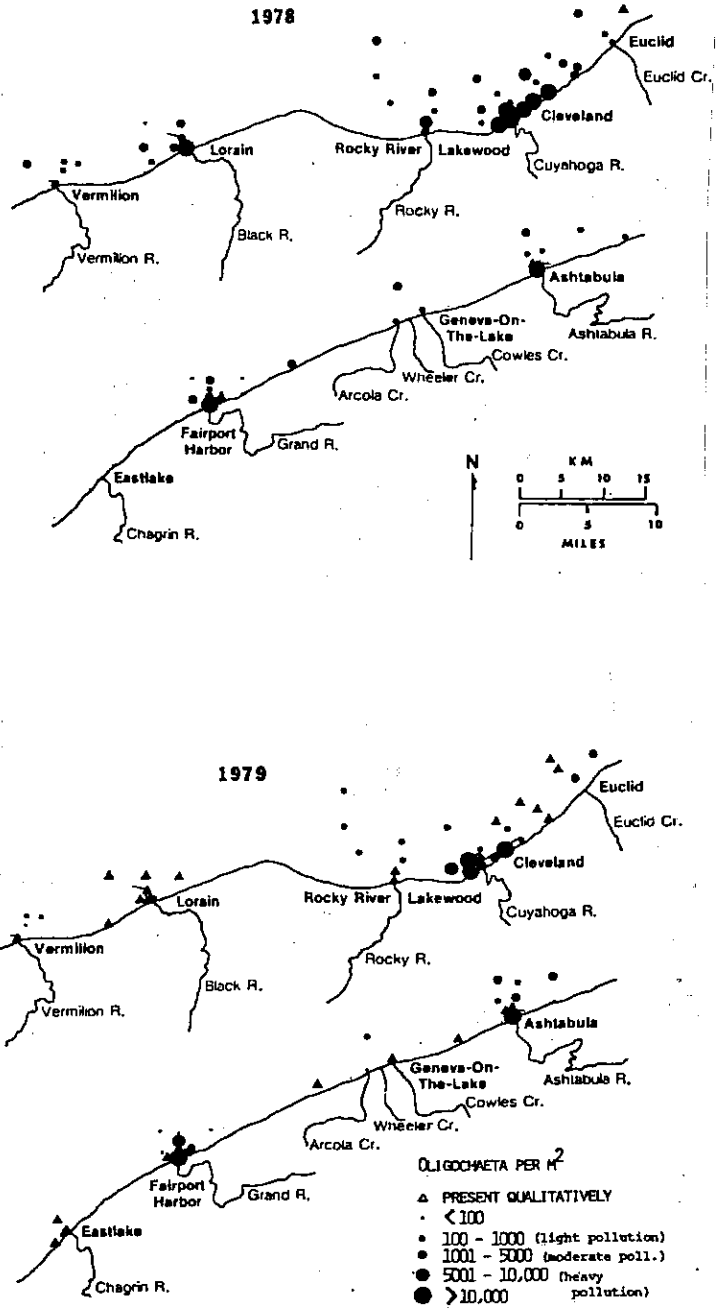

Figure 5. Heidelberg College, Water Quality Laboratory, Abundance of Oligochaetes at individual near-shore stations in 1978 and 1979.

(Taken from: Kreiger 1981)