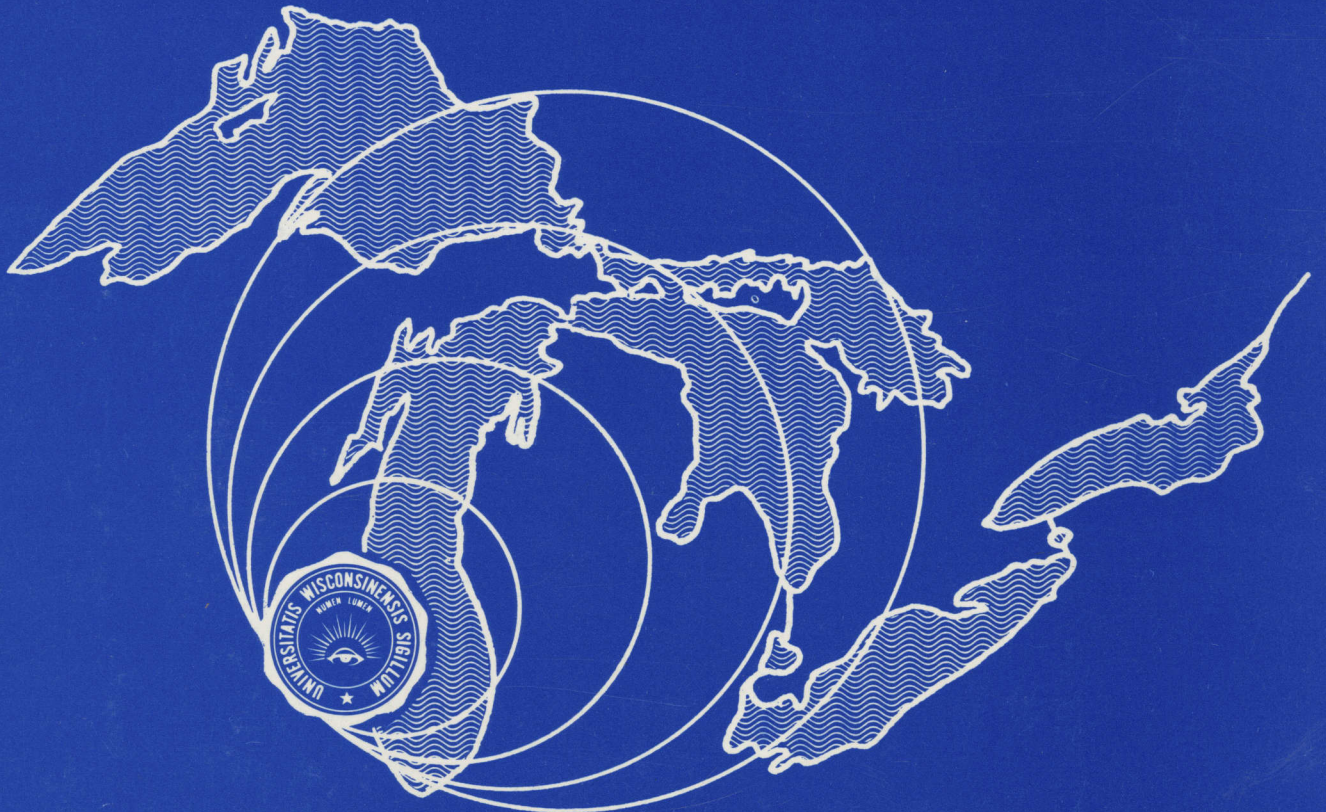
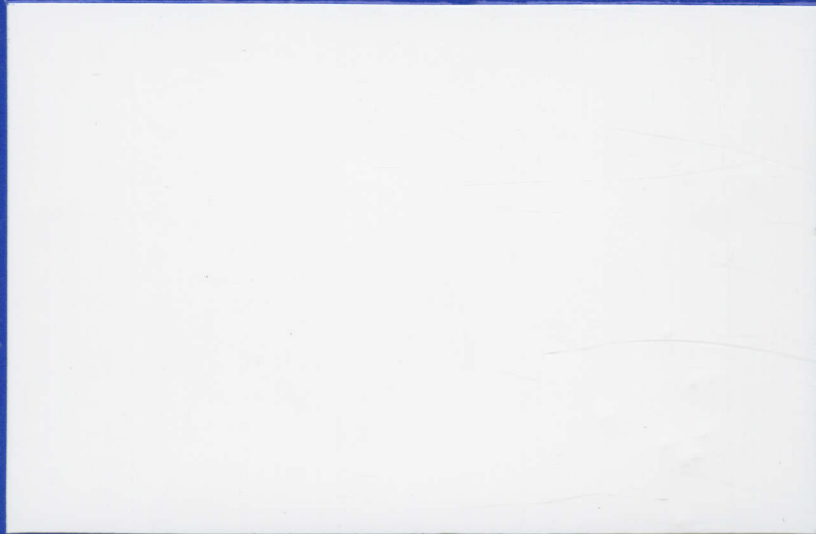
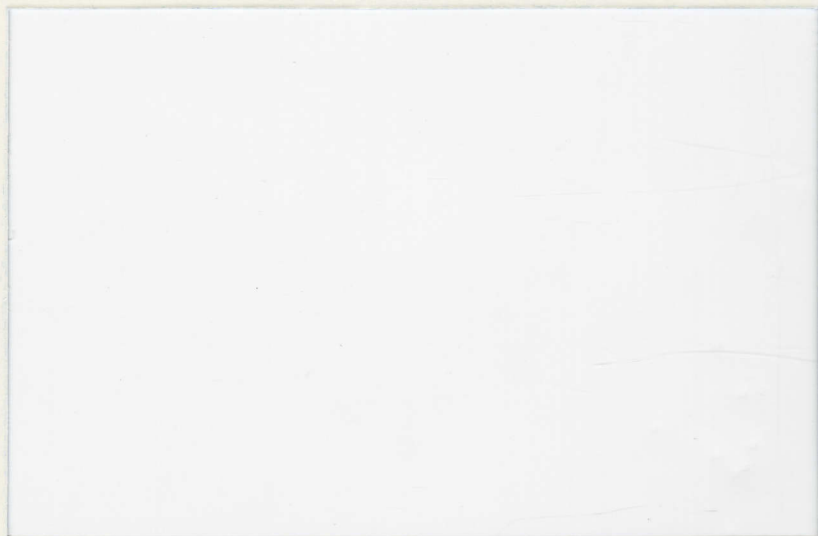


THE UNIVERSITY OF WISCONSIN—MILWAUKEE

CENTER  
FOR  
GREAT LAKES STUDIES



MILWAUKEE, WISCONSIN 53201 U.S.A.

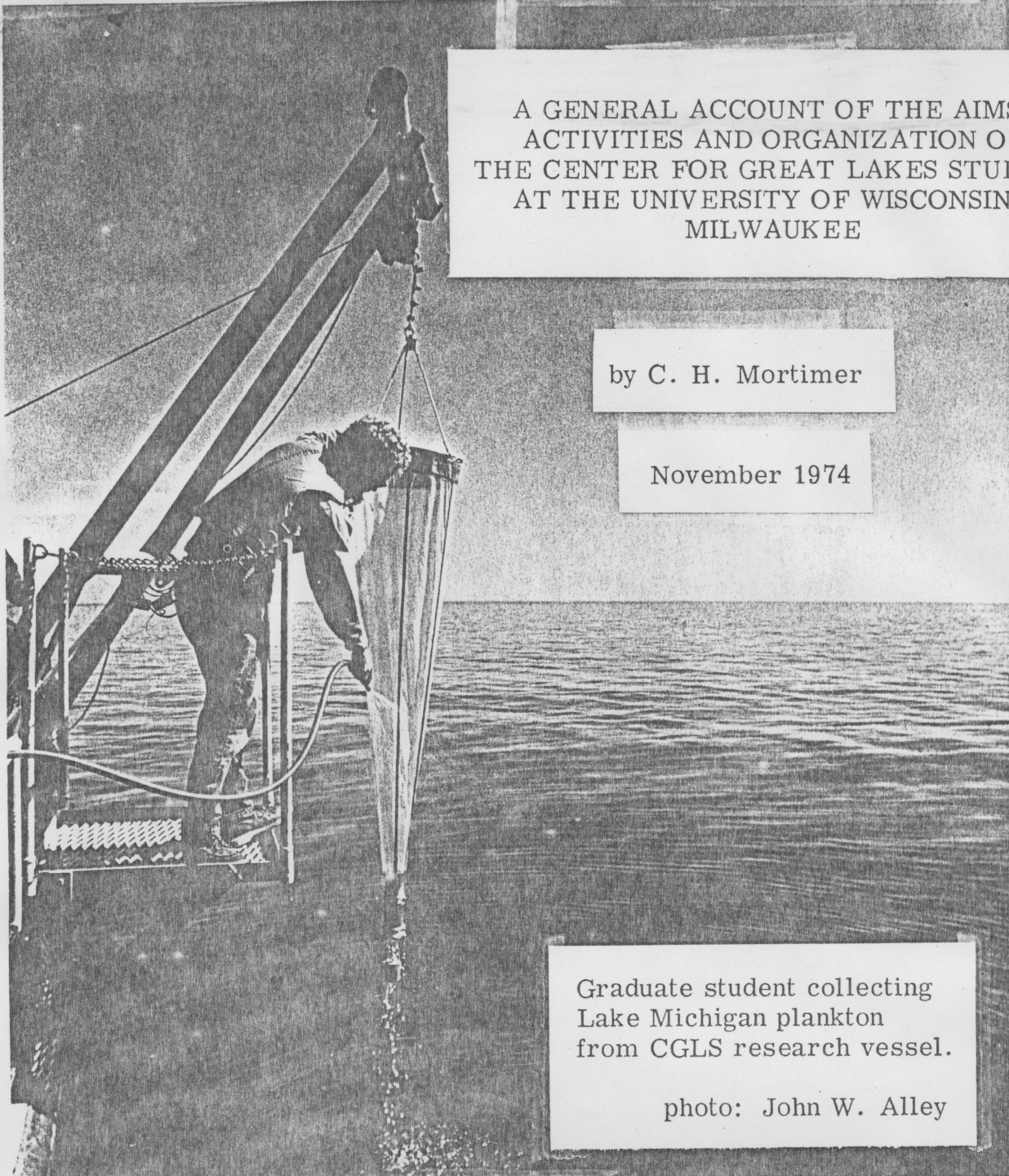


7/27/00

A GENERAL ACCOUNT OF  
THE AIMS, ACTIVITIES AND  
ORGANIZATION OF THE  
CENTER FOR GREAT LAKES STUDIES  
AT THE UNIVERSITY  
OF WISCONSIN--MILWAUKEE

by C. H. Mortimer

November 1974



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Graduate student collecting  
Lake Michigan plankton  
from CGLS research vessel.

photo: John W. Alley

### HISTORY AND OBJECTIVES

Universities often pay lip-service to interdisciplinary modes of teaching and research, particularly in the environmental field; but it has proved to be much easier to talk about interdisciplinary plans than to bring them to successful fruition. The Center for Great Lakes Studies (CGLS in short) has attempted to devise a mode of operation which will increase the chances for success and at the same time produce a continuing output of qualified students, with attitudes and training fitting them for the tasks facing the community in wise management of resources and environment. Although it is dedicated to research on the Great Lakes, principally using Lake Michigan as an extension of University classrooms and laboratories, CGLS is not parochial in outlook or product. Its students (see Appendix 3) have been sought after for positions (some marine) nationwide and in Canada; although most find employment in the Great Lakes region.

In Wisconsin it is often said that the boundaries of the University are the boundaries of the State. Lakes Michigan and Superior shorelines form forty percent of those boundaries; and more than one-third of the State's population live in cities or towns on the Great Lakes waterfront. Subject to a variety of uses and mis-uses, the waters and the shores of the Great Lakes are therefore a precious resource for the Lake States and for two Nations. They are also objects of considerable interest and represent a rich training ground and research field for natural and social scientists, environmental engineers, and planners. It is natural, therefore, that a university located in a major port city, and with basic, water-related curricula and research programs, should strive to exploit unique capabilities and facilities for teaching and research connected with the Great Lakes. To grasp these opportunities, CGLS was established, in its present form in 1966, as a Center singled out for special development as a multi-disciplinary, interdepartmental facility for research and instruction on the Milwaukee campus.

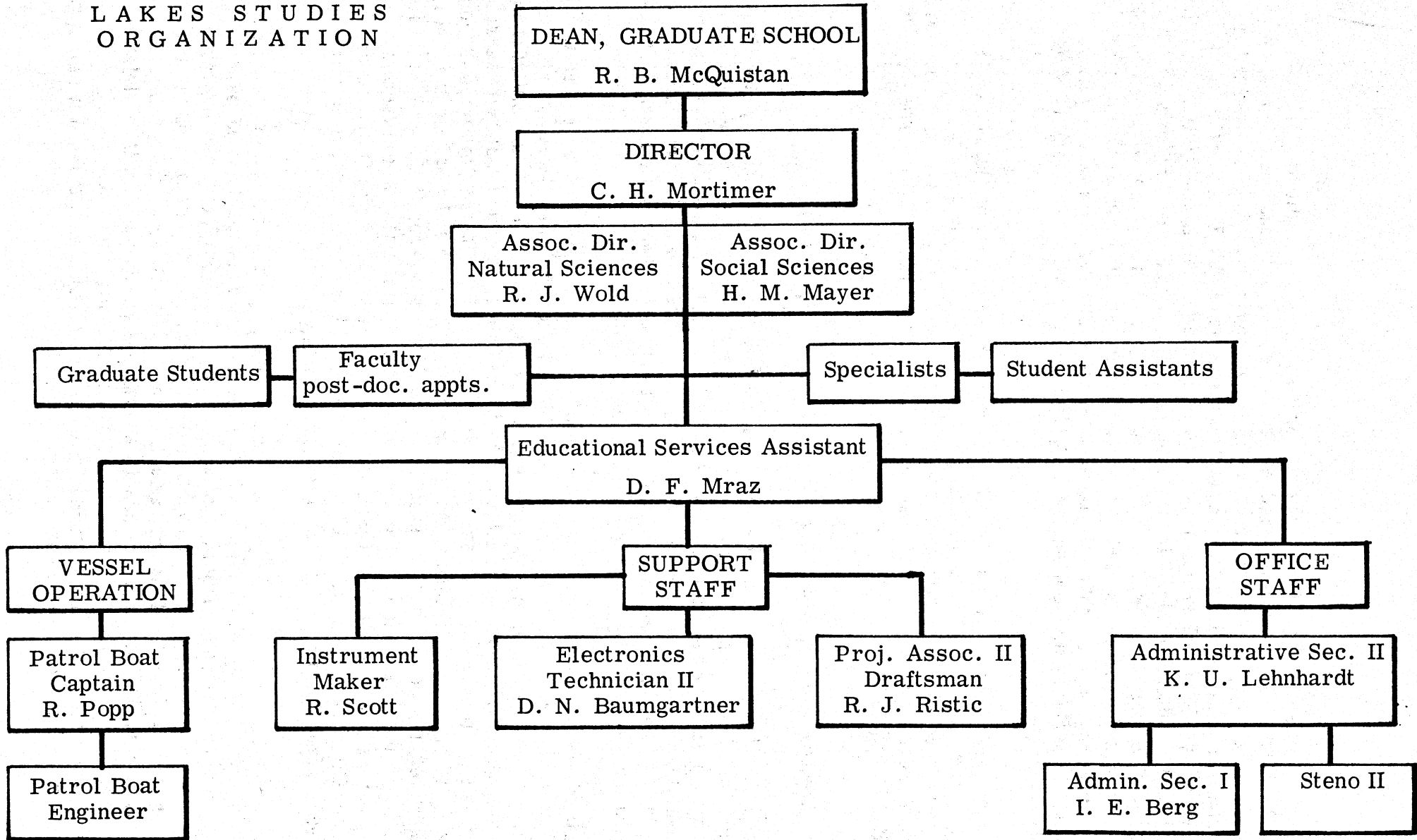
As a multi-disciplinary Center, CGLS does not itself offer specific Lake- or marine-related undergraduate courses; these are taught by individual faculty members in their respective departments and colleges. The CGLS instructional role begins at the graduate level -- it is a unit of the Graduate School -- with seminars, training cruises, and above all, education through research which CGLS is equipped to facilitate.

The research program has the following general objectives:

- (1) to deepen understanding of how the Great Lakes, their drainage basins and coastal zones, function as natural systems -- physical, chemical, and biological;
- (2) to study and predict man's influences on the natural systems;
- (3) to train scientists, environmental engineers, and planners;
- (4) to help develop the engineering and institutional tools needed for enlightened planning and management of the Great Lakes environment; and
- (5) to serve the University as the focus for marine-related programs, and to serve the city, state, and nation as a source of expert and impartial advice.

In pursuing these objectives the CGLS plan of campaign has been to concentrate on those lines of work which match the interests and talents of those UWM faculty members and students, who have chosen to work with the Center, and to fill important gaps in the program by judicious recruiting. Recognizing that much basic research still remains to be done, but that rigid separation of basic and applied research can be counter-productive in the environmental field, the Center's research programs have been preponderantly strategic, i. e. research of a fundamental nature, designed to contribute to a sound, predictive and problem-solving capability.

CENTER FOR GREAT  
LAKES STUDIES  
ORGANIZATION



November 1974.

Stated more specifically, CGLS has hitherto specialized in the fields of geophysical fluid dynamics, marine geophysics, hydrobiology, and marine transportation economics. It played a major role in the initiation and implementation of the UW System Sea Grant Program and continues to provide facilities and to serve as a UWM focus for Sea Grant participation and growing activities in the area of coastal zone management. Advanced plans for an integrated lakefront research building and vessel base, designed and funded for 1972 completion, were unexpectedly frustrated by a contretemps at the chosen site; but eventually the funds were used to purchase another much larger building and dock, to be used as a UW System and regional facility and to house the at present scattered CGLS components when remodeling funds become available.

Progress towards the objectives listed above will, in the end, depend on how effective the Center has been in encouraging interdisciplinary endeavors, and -- by proof of performance -- in building up a national reputation which attracts extramural support and the active participation of faculty and graduate students. These considerations dictate the organizational structure.

#### ADMINISTRATIVE STRUCTURE, STAFFING AND BUDGETING

As shown in the attached organizational chart and lists in Appendix 1, the CGLS staff is at present made up of (a) sixteen faculty members, portions of whose salaries ranging from 25% to 100% are paid from the CGLS's budget, and (b) eight civil service members, wholly paid from CGLS funds. In addition there are at present three specialists, three limited term employees, fifteen graduate student Fellows (7 Ph. D. and 8 M. S. candidates) and ten undergraduate student helpers.

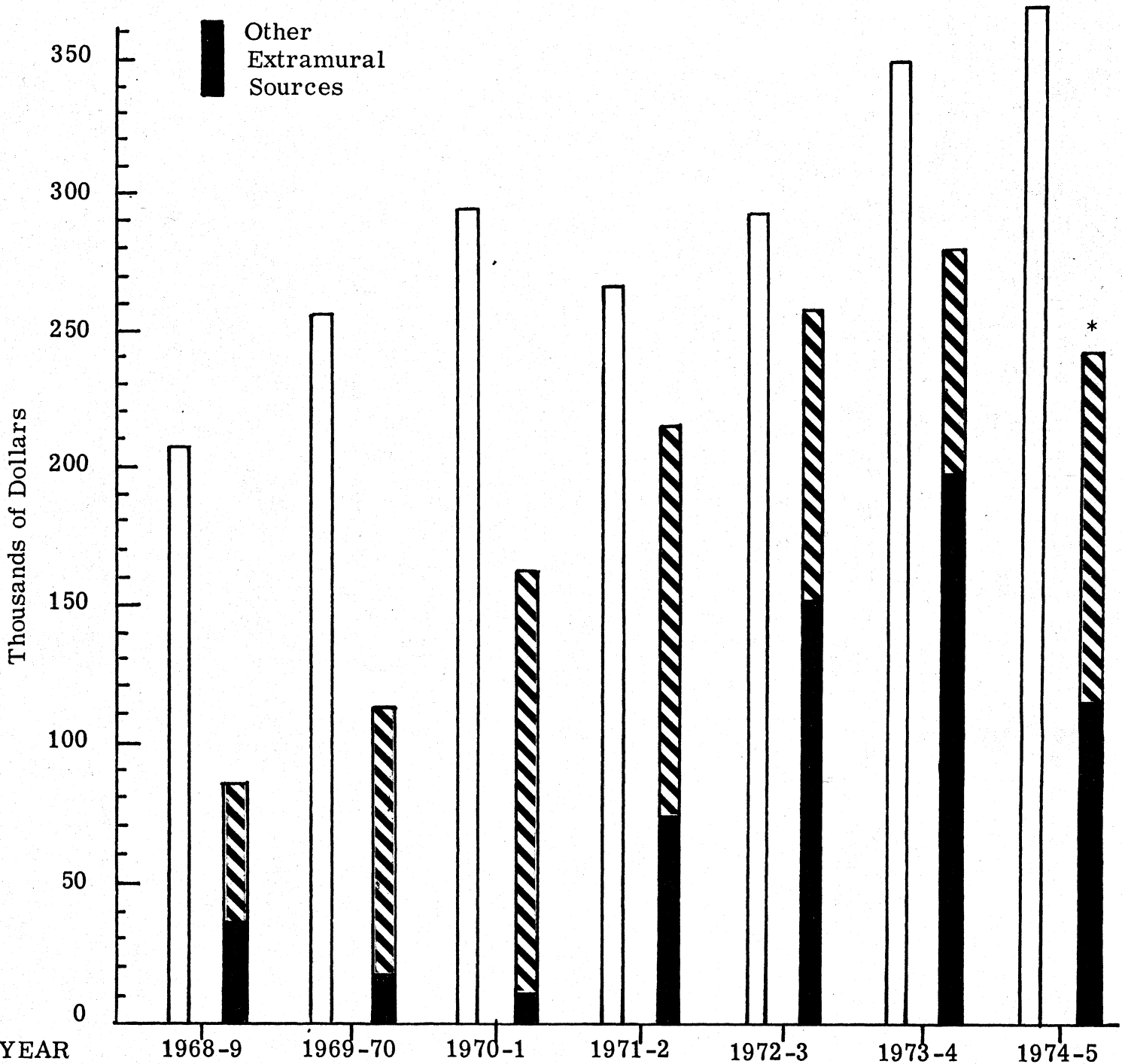
The Director and Associate Directors form an Administrative Committee which meets regularly, with the Dean and Associate Dean of the Graduate School in attendance by invitation. The sixteen faculty members (listed in Appendix 1) -- who hold salaried positions in CGLS by virtue of their substantial involvement in Great Lakes research including direction of graduate studies -- and thirty-five other faculty members, who have expressly requested association, together form a CGLS Affiliated Faculty Group which meets at least once every semester to report and elect annually four members of the CGLS Steering Committee. That Committee, which includes two members appointed by the Dean of the Graduate School, reviews reports by the Director or Administrative Committee and advises the Director and the Dean on allocation of certain research funds and on general policy matters.

Sources of funds -- state, UW Sea Grant Program, and other extramural sources -- and their growth year by year are illustrated in the diagram on the next page. The grants and contracts currently administered directly through CGLS -- another measure of progress -- are listed in appendix 2. Campus-wide, twenty of the forty-seven members of the CGLS Affiliated Faculty Group have attracted Great Lakes-related grants and contracts totalling at the present date approximately 1.7 million dollars spread over forty projects and sixteen agencies. That sum, about five times the current annual rate of UWM funding in the Center, is welcome evidence of a multiplying effect in large part attributable to the efforts of CGLS.

# C. G. L. S. FUNDING PATTERN BY FISCAL YEAR

State Funds
  UW Sea Grant Program\*\*

Other Extramural Sources



\*\*Administered directly through CGLS; substantial additions (more than doubling the total in some years) were funded through other UWM departments.

\*incomplete year

## FACILITIES

Facilities operated by CGLS provide a year-round capability for research on Lake Michigan, on other Great Lakes, and on smaller lakes. These facilities include a well-equipped 65-foot research vessel (R/V NEESKAY) details of which are given below; smaller craft; chemical and biological laboratories; mobile field laboratory; machine shop; instrument shop; aquarium room; cartographic unit; library (including 50,000 reprints); and a comprehensive array of standard and specialized equipment for in-lake sampling and navigation.



C. G. L. S. Research Vessel

photo - C. H. Mortimer

Name: "Neeskay" (trans. from Winnebago Indian, "pure clear water").

Army T-Class: 1970 conversion (incl. ice sheathing and bilge keels) Peterson Builders, Sturgeon Bay, Wisc., U.S.C.G. reg. no. 512552.

Dimensions: (overall) length 65 ft., beam 18 ft., draft (aft) 8 ft., 69 tons.

Propulsion and power supplies: 270 hp Buda diesel (speed 10 knots, range 900 miles); 220 and 115 v AC, 1 ph, 25 kw; 110 v DC 7 kw; 24 v DC.

Navigation: Gyrocompass (autopilot); radar (40-mile range); search sonar; echosounder; radiotelephone; Motorola Miniranger.

Deck equipment: diesel hydraulic crane (HIAB, reach 5-29 ft., 370° slew) and winch (1500 ft. 1/4" cable); A-frame forward, davit aft, each 2000 lb. lift.

Laboratories: 270 sq. ft., with services, one on deck, one in forward hold.

Accommodation: for master, engineer, and four scientists.



The U.W. Great Lakes Research Facility  
(before purchase, dock leased to a contractor)

photo - Allen-Bradley Co.  
boundary

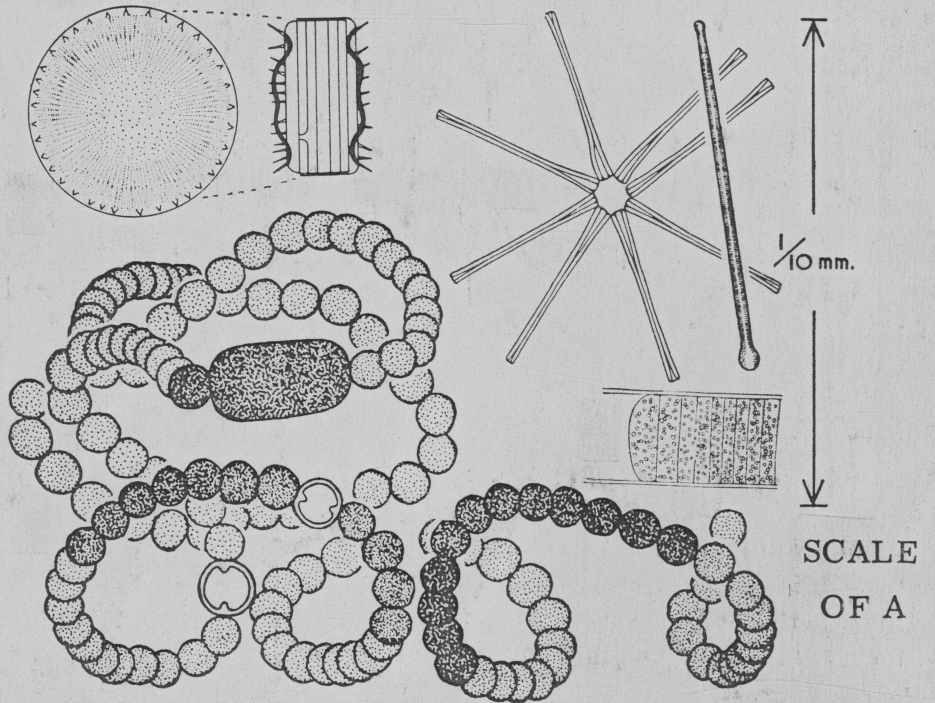
A notable acquisition, using State and Wisconsin Alumni Research Foundation (WARF) funds previously approved for a new CGLS building and research vessel base on the lakefront, was the purchase in 1973 of a large modern plant and deep-water dock (formerly the Allen-Bradley Tega tile factory) at 600 East Greenfield Avenue on Milwaukee Harbor. Guided by a UW System Council, that property -- University of Wisconsin Great Lakes Research Facility (with 9 acres of land, 125,000 square feet of floor space, 1,300 feet of dock) -- will house not only the principal activities of CGLS, but also projects from other components of the UW System and (with support anticipated from outside agencies) the research projects of other universities and investigators, principally from the upper Great Lakes region. Some CGLS activities, including research vessel, instrument shop, and a bioassay project funded extramurally, have already been transferred to the Facility. Further transfers await remodelling funds.

More detailed particulars are given in appendix 3.

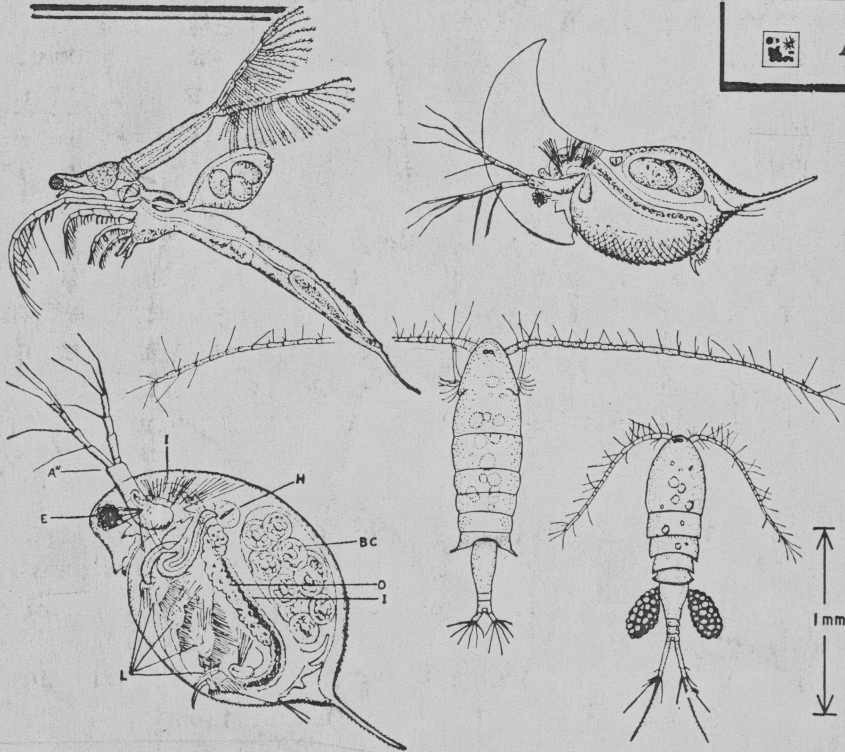
THREE LINKS IN THE CHAIN OF BIOLOGICAL PRODUCTION IN LAKES\*

A. PHYTOPLANKTON

drawings by  
C. H. Mortimer  
in: Sellery, G. C.  
1956. "E. A. Birge"  
Univ. Wisconsin  
Press



B. ZOOPLANKTON



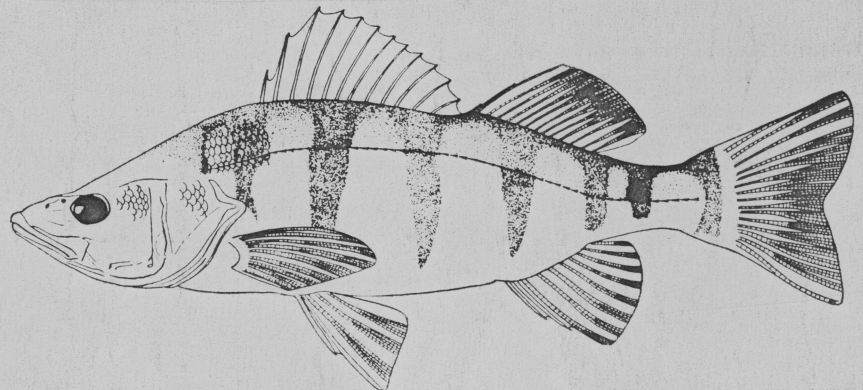
A ON SCALE OF B

\*WHO EATS WHOM?

SCALE OF B  
1 mm.

B ON SCALE OF C

C. FISH



## PRINCIPAL RESEARCH THEMES, ONGOING AND PLANNED

With twin goals -- to understand how the Great Lakes function and react as natural and social systems and to develop management tools in the environmental engineering and institutional fields -- CGLS has concentrated its effort along four main lines: hydrobiology, hydrodynamics, shipping economics, and geology and geophysics. Substantial progress has been made along all four, and one measure of the growing CGLS reputation is the increase in extramural funding shown in a previous diagram.

### Hydrobiology

Much present hydrobiological research in the Great Lakes is necessarily descriptive, taxonomic, and concerned with seasonal life histories and distributions of organisms. This is because, as far as biological populations are concerned, the Lakes are still partially unexplored territory. To detect short-term and long-term changes in water quality, or significant regional differences, or influences of inputs of waste materials and heat, or of recreational loading, the biota act as sensitive indicators and as early warning systems. Thus, in the Center's applied hydrobiological contract work, new bioassay methods have been developed, by A. S. Brooks for example, to provide sensitive assessment of power station effects on Lake Michigan waters. However, the most significant discovery by A. M. Beeton and his associates are the strongly persistent biological and nutritional differences between coastal and off-shore waters, an important factor in the biological economy of the Great Lakes and in the design of any effective program for monitoring water quality and pollution loading.

Increasingly, water from the Great Lakes is being extracted in large volumes for drinking supplies and for industrial cooling purposes. Eventually most of the extracted water returns to the Lakes, some through treatment plants, but all with added waste materials or heat. Often the treatment includes addition of chlorine -- a potent biocide -- and a part of the effort in applied limnology in CGLS (A. S. Brooks) has focussed on the influence of chlorine and chlorinated compounds on Lake Michigan organisms.

Recognizing the need to strengthen teaching and research in microbiology at UWM, recent CGLS recruitment has included an aquatic microbiologist, who will apply the techniques of microbiology and molecular biology to environmental problems.

CGLS anticipates that its personnel and its research themes will provide important components of the proposed Ph. D. Program in Biological Sciences.



Milwaukee Harbor

photo - Clair J. Wilson

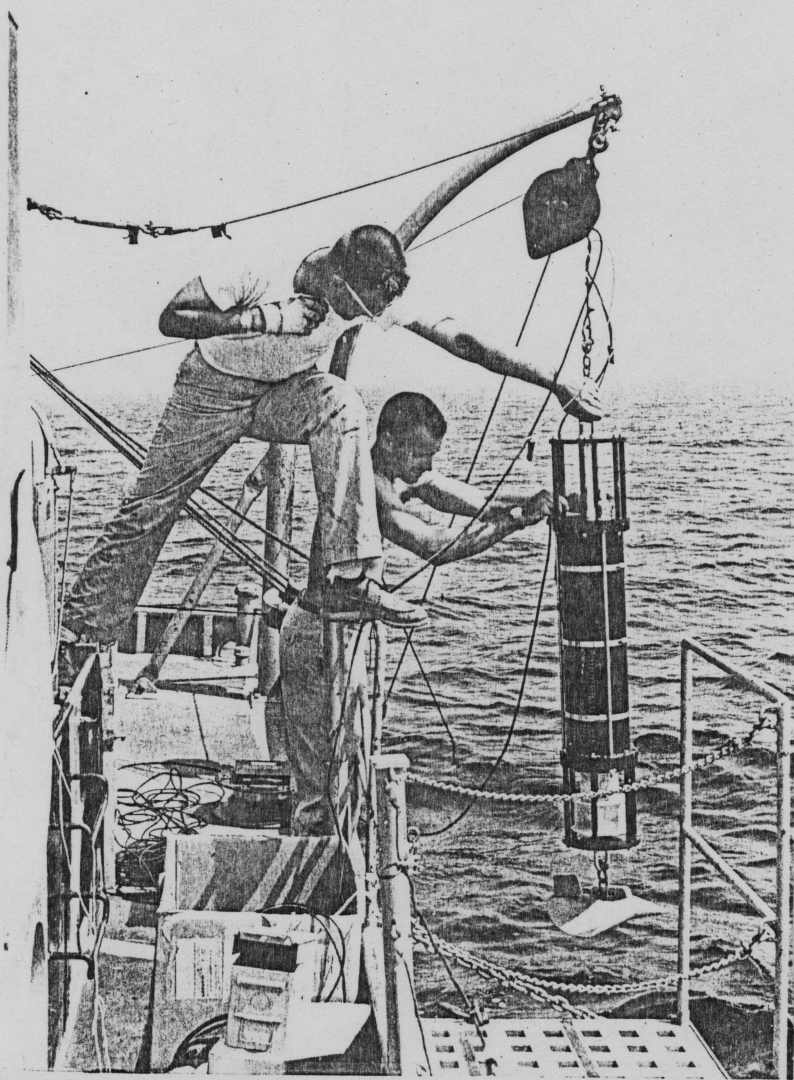
The second CGLS program concentration concerns Great Lakes shipping, port development, and associated regional economic interactions (E. Schenker, H. M. Mayer, H. C. Brockel, and associated faculty and students). This has formed a substantial UWM-based component of the UW Sea Grant Program, with major reports and an international symposium as milestones, which have generated world-wide interest.

With the recent recruitment of H. M. Mayer, urban and marine transportation planner ~~and economist~~, to join Schenker and Brockel, CGLS has assembled a unique concentration of talent in this particular field, which has led to proposals for cooperative endeavors with other groups with similar interests, for example the Center for Maritime Studies, The University of Haifa, Israel.

(\* U.W. Great Lakes Research Facility)

## Great Lakes Hydrodynamics

This third program concentration has developed as a combination of numerical modelling (D. B. Rao and associates) with verification through field measurements of temperature and current fields, using research vessels, commercial ferries, and moored recording instruments (C. H. Mortimer and students). This combination has yielded new interpretations of whole-basin motions. These were used in the planning of the International Field Year For The Great Lakes (IFYGL) -- a major joint Canadian-U. S., whole-year study of the hydrodynamics of Lake Ontario, in which CGLS played a significant part. The subsequent analysis of the IFYGL findings and investigations of the current and dispersal patterns in nearshore regions of Lake Michigan represent the chief research directions (C. H. Mortimer, D. L. Cutchin) in recent years.



In this field, also, CGLS recruiting efforts have filled an identified gap in a UWM curricular area -- in this case geophysical fluid dynamics. Appointments of D. B. Rao, D. L. Cutchin, R. Y. Lai, W. A. Lyons, and K. K. Lee in the College of Engineering and Applied Science have created an effective nucleus for teaching and research, which in turn is beginning to feed graduate students into ongoing projects in coastal hydrodynamics and in lake and urban meteorology. These research areas we expect will form substantial components of the proposed Ph.D. Program in applied earth sciences.

Graduate students measuring currents on Lake Michigan.  
photo - C. H. Mortimer

## Geology and Geophysics

Based principally in UWM's Department of Geological Sciences, broad regional geophysical investigations have been carried out on Lakes Superior and Michigan, using gravity, magnetic, and seismic methods to determine the structure of sediments and bedrock (R. J. Wold). Detailed studies of Lake Michigan beach structure and shore erosion have been pursued, in the field and with the aid of a large experimental wave and beach tank (R. G. Pirie, N. P. Lasca). Recently, investigations of ice physics, ice formation, and beach effects have begun (N. P. Lasca, D. E. Willis).

## Future research directions

These will be strongly dependent on two key selection processes: (a) selection of priorities and (b) attraction and selection of faculty recruits and students. Also, because all CGLS faculty have departmental duties and affiliations, decisions under (b) will bear on the development of instructional programs. While necessarily selective, the CGLS program will be characterized, as hitherto, by substantial components of basic science (physics, chemistry, geology, biology, and economic geography) but will remain generally of a strategic nature, aimed to fill gaps in knowledge for the solution of present or anticipated problems. Applied research will also continue, selectively restricted to those projects in which CGLS talents can be related to problems which combine urgency and basic interest.

Projections of present lines of research will include:

(i) Lake Michigan hydrobiology and related water quality investigations, continuing basic work on taxonomy, natural histories, and biological dynamics, with particular applications to living resources and to the influences of introduced toxins, wastes, nutrients, and heat.

(ii) Shipping, port development, and related regional economics. This research area, expanded and strengthened with H. M. Mayer's appointment, will continue to explore the interactions of economic and geographic trends in the Great Lakes marine industry. Comparative studies with other world centers are anticipated; and the group will make substantial contributions to the analysis of coastal zone processes and to planning of management strategies.

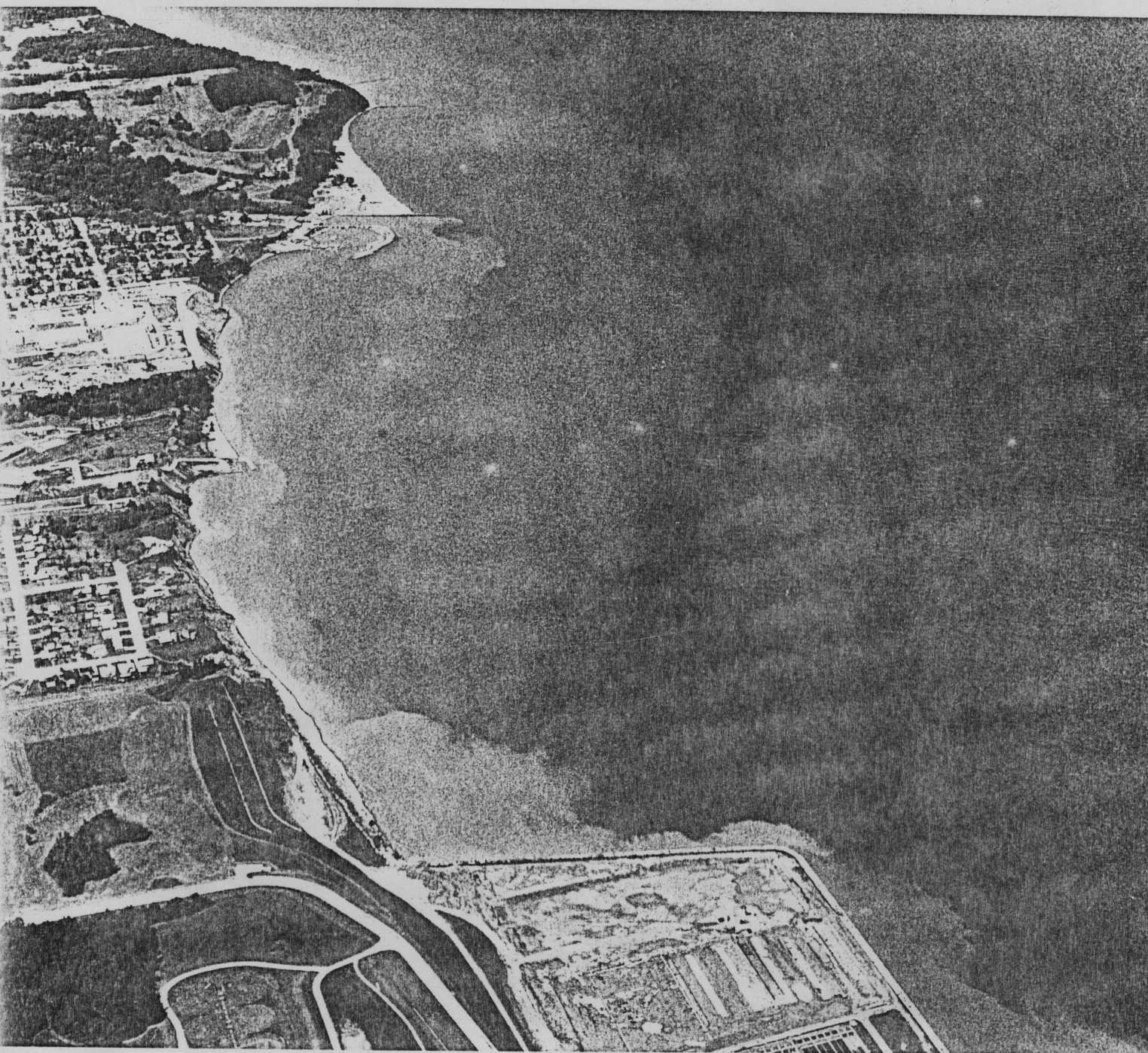
(iii) Hydrodynamics of large basins. Theoretical work, numerical simulations, and field measurements will find combined application to elucidating the responses of large basins to applied stresses, with particular application to coastal regions of Lake Michigan.

New departures in research and related instruction are anticipated in the following principal fields:

(iv) Roles of microorganisms in aquatic environments. The fundamental roles played by microorganisms in the aquatic environment -- breakdown of organic matter, recycling of plant nutrients, purification of added wastes -- needs to be defined with better precision and range to improve predictive modelling (and therefore management) of aquatic systems. In spite of large resources being committed to modelling of aquatic ecosystems, for example by several federal agencies, the results are likely to remain disappointing unless there is a better balance between carefully verified modelling, on the one hand, and elucidation of key mechanisms on the other. C. C. Remsen, arriving in 1975, will lead CGLS effort in this field.

(v) Lake geology and geophysics. Although not in fact a new departure (see the work of Wold, Lasca, and Pirie in the Department of Geological Sciences) increased emphasis is anticipated on sediment stratigraphy (throwing light on basin history), coastal and beach zone processes, and ice physics. This work will contribute to the interdisciplinary endeavor now to be outlined.

(vi) Interdisciplinary approach to study and predictive modelling of coastal zone processes and management strategies.



Land/Lake interactions, South Milwaukee

photo - C. H. Mortimer

The experimental part of this approach will concentrate on coastal processes, by means of field observations and large-scale hydraulic experiments in the Great Lakes Research Facility. A specific objective will be the understanding of wave and nearshore current regimes, ice properties and distribution, beach structure and shore erosion, and offshore sedimentation and re-suspension in the Great Lakes setting. The experimental findings will be applied to studies of the engineering feasibility of particular management strategies. These could combine, for example, disposal of harbor dredgings or other solid wastes with shore protection, and with the creation of recreational landfills or islands, with the aim of turning environmental liabilities into environmental assets. Lake circulation patterns will also be actively explored, because knowledge of the scales and mechanisms of the dispersal in the Lakes of man-made inputs, and their ultimate fates, is fragmentary and imperfect; and an unravelling of this complexity is essential if the responses of the coastal zone to those inputs are to be predicted with confidence.

Because the implementation of any selected management strategy would require particular fiscal and institutional arrangements, the economic, jurisdictional, and political factors assume critical importance. Therefore the physical/biological (environmental engineering) models must eventually be coupled with economic/jurisdictional models to be meaningful or useful in real life. This coupling poses a series of difficult problems, many of which will require combined inputs from UWM's School of Architecture, Urban Research Center, and CGLS. The best hope of success lies in an iterative approach, walking before running and starting with sub-model construction, leading to design of a verification program, in turn leading to improved model design and step-by-step combination of the improved sub-models into a system model.

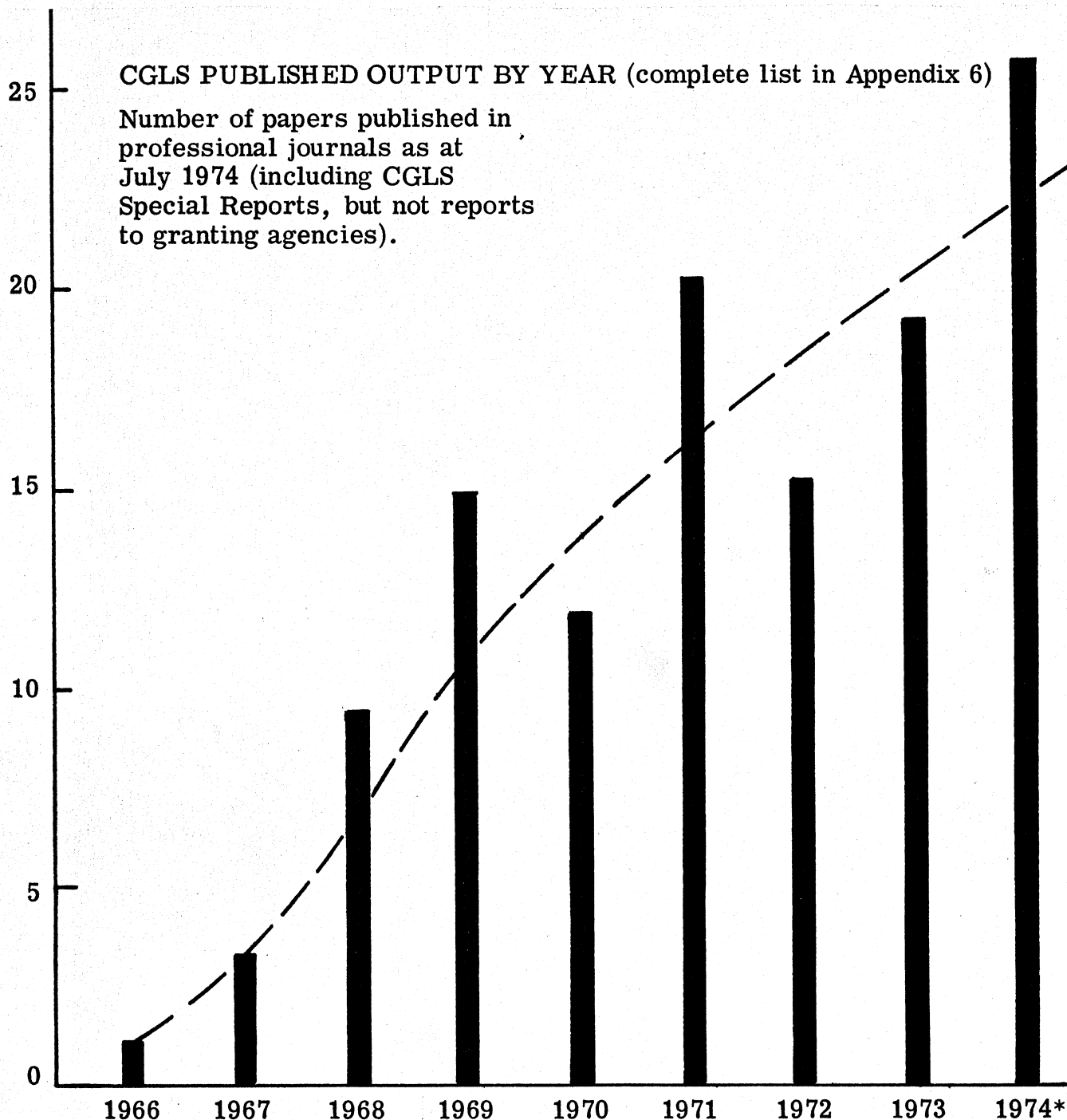
**OUTPUT: STUDENTS PREPARED FOR HIGHER DEGREES;  
PROFESSIONAL AND PUBLIC SERVICE; PUBLICATIONS**

"By their fruits ye shall know them" applies to organizations as well as to individuals. CGLS "fruits" are: its publications; the trained scientists, engineers and planners it sends out into the world; and the advice, assistance, and service its associates give within the University System and outside, in the City, State and Nation.

Students come to CGLS first as graduates, having been accepted by the Graduate School for study in an appropriate department. During the past eight years CGLS-associated students have earned higher degrees: 6 Ph.D.'s, 16 Masters'. Their names, titles of theses, and present employments are listed in appendix 4, which also lists the names of current graduate students and their departmental affiliations. As tangible evidence of CGLS success it may be noted that all qualified students have found good positions in their particular fields. Indeed, as an additional measure of demand for CGLS graduates, they are often offered and sometimes accept appointments before obtaining their degrees, which can sometimes pose problems.

Professional and public service is difficult to measure, for CGLS-affiliated faculty the list would be long; but the elective offices or appointments at the national or international level listed in appendix 5 will serve as examples.

CGLS publications appear either (i) in a Special Report series (in addition to reports to research granting agencies) or (ii) as papers in professional journals. Titles under categories (i) and (ii) are listed in appendix 6, and the growth of published output by year is illustrated in the accompanying diagram.



\*incomplete year, includes "in press"

**LIST OF FACULTY MEMBERS WHOSE SALARY OR PART-SALARY IS FUNDED BY  
THE CENTER FOR GREAT LAKES STUDIES\***

|                    |  |      |
|--------------------|--|------|
| <u>Director</u>    | Distinguished Professor C. H. Mortimer (Zoology) | 100% |
| <u>Assoc. Dir.</u> | Professor H. M. Mayer (Geography)                | 50%  |
|                    | Professor A. M. Beeton (Graduate School)         | 50%  |
|                    | Professor J. L. Blum (Botany)                    | 50%  |
|                    | Professor V. W. Bacon (CEAS)                     | 25%  |
|                    | Professor C. R. Norden (Zoology)                 | 25%  |
|                    | Professor D. B. Rao (CEAS)                       | 25%  |
|                    | Professor E. Schenker (Economics)                | 25%  |
|                    | Associate Professor K. Bayer (Geography)         | 25%  |
|                    | Associate Professor R. Grunewald (Botany)        | 25%  |
|                    | Associate Professor W. A. Lyons (CEAS)           | 25%  |
|                    | Assistant Professor D. L. Cutchin (CEAS)         | 25%  |
|                    | Visiting Associate Professor K. K. Lee (CEAS)    | 30%  |
|                    | Lecturer H. C. Brockel (CGLS)                    | 100% |
|                    | Lecturer W. Kean (Geological Sciences)           | 40%  |
|                    | Post-Doctoral Fellow J. Janssen (Zoology)        | 100% |

CEAS denotes College of Engineering and Applied Science. Other departments are in College of Letters and Science.

**OTHER FACULTY MEMBERS AFFILIATED WITH C. G. L. S.**

|                                     |                                       |
|-------------------------------------|---------------------------------------|
| Anthony, J. (Zoology)               | Northouse, R. A. (Elect. & Com. Sci.) |
| Arora, S. S. (Economics)            | Petering, D. (Chemistry)              |
| Beimborn, E. A. (Systems Design)    | Pincus, H. J. (Geological Sciences)   |
| Booth, D. (Economics)               | Pirie, R. G. (Geological Sciences)    |
| Bratanow, T. (Mechanics)            | Roderick, G. L. (Mechanics)           |
| Brooks, A. S. (Zoology)             | Rosenthal, P. (Materials)             |
| Broyles, R. H. (Zoology)            | Salamun, P. (Botany)                  |
| Buettner, M. J. (Health Science)    | Shah, V. L. (Energetics)              |
| Chang, Y. A. (Materials)            | Sikdar, D. N. (Geological Sciences)   |
| Cutler, V. C. (Mechanics)           | Sorenson, A. (Mechanics)              |
| Going, J. E. (Chemistry)            | Soule, J. C. (E.P.H.E.)               |
| Griskey, R. (Energetics)            | Staats, G. (Electrical Engineering)   |
| Haney, R. E. (Curric. & Instr.)     | Stearns, F. W. (Botany)               |
| Huber, C. O. (Chemistry)            | Tsao, K. C. (Energetics)              |
| Karadi, G. M. (Mechanics)           | Walter, G. G. (Mathematics)           |
| Kovacic, P. (Chemistry)             | Warner, E. D. (Zoology)               |
| Lai, R. Y. (Energetics)             | Weise, C. (Zoology)                   |
| Lasca, N. P. (Geological Sciences)  | Willis, D. E. (Geological Sciences)   |
| Lech, J. J. (Medical College Wisc.) | Wold, R. J. (Geological Sciences)     |

C. G. L. S. FUNDED GRANTS

APPENDIX 2

| <u>Agency</u>    | <u>Project and Director</u>                         | <u>68-69</u> | <u>69-70</u> | <u>70-71</u> | <u>71-72</u> | <u>72-73</u> | <u>73-74</u> | <u>74-75</u> | <u>75-76</u> |
|------------------|---|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| COE              | Dredged Materials - Beeton                          | \$ 20,005    |              |              |              |              |              | **           | **           |
| NSF              | Undergrad Grant - Mortimer                          | 600          | 600          |              |              |              |              |              |              |
| DNR              | Alewife & Coregonids - Beeton                       | 3,700        | 7,500        |              |              |              |              |              |              |
| Gimbels          | Gift - Mortimer                                     |              |              | 800          |              |              |              |              |              |
| COE              | Temperature Studies - Mortimer                      | 4,571        | 3,000        | 3,000        | 3,000        |              |              |              |              |
| COE              | Undulator - Mortimer                                | 4,422        | 4,421        | 3,000        | 3,000        |              |              |              |              |
| AEC              | Oak Creek - Beeton                                  |              |              |              | 24,000       | 24,000       |              |              |              |
| NSF              | IFYGL - Rao   |              |              |              | 9,900        | 18,000       |              |              |              |
| USFS             | Sylvania - Beeton                                   |              |              |              | 600          | 400          |              |              |              |
| AEC              | Oak Creek - Mortimer                                |              |              |              | 24,000       | 24,000       | 10,000       |              |              |
| NOAA             | IFYGL - Mortimer                                    |              |              |              | 4,500        | 21,401       | 21,448       |              |              |
| EPA              | Milwaukee Chlorination - Beeton                     |              |              |              | 3,000        | 32,185       | 42,300       |              |              |
| USFWS            | TFM - Beeton  |              |              |              | 1,470        | 4,416        | 7,749        |              |              |
| NSF              | Coastal Upwelling - Cutchin & Rao                   |              |              |              |              | 22,000       | 22,000       |              |              |
| DNR              | Oligochaete Fauna - Beeton                          |              |              |              |              | 5,358        | 5,150        | 3,210        |              |
| WEPCO            | Chlorination Survey - Brooks                        |              |              |              |              |              | 1,000        |              |              |
| NOAA             | ENDEX Coding - Beeton                               |              |              |              |              |              | 24,782       |              |              |
| NOAA             | IFYGL - Mortimer                                    |              |              |              |              |              | 47,116       | 49,421       |              |
| NSF              | Doctoral Dissertation Research -<br>Beeton & Bowers |              |              |              |              |              |              | 11,300       |              |
| Michigan         | Plankton Survey - Beeton                            |              |              |              |              |              |              | 4,000        |              |
| Electric<br>Cds. | Chlorination Study - Brooks                         |              |              |              |              |              | 16,100       | 48,325       | 48,325       |
|                  | SUBTOTAL:   | \$33,298     | 15,521       | 6,800        | 73,470       | 151,760      | 197,645      | 116,256      | 48,325       |
|                  | *SEA GRANT:   | 50,560       | 95,495       | 158,534      | 142,128      | 107,300      | 82,513       | 126,464      |              |
|                  | TOTAL:  | \$83,858     | 111,016      | 165,334      | 215,598      | 259,060      | 280,158      | 242,720      |              |

\*Portion administered directly through CGLS; substantial additions (more than doubling total in some years) were funded through other UWM departments.

\*\*Incomplete years.



University of Wisconsin

GREAT LAKES RESEARCH FACILITY

The University of Wisconsin Great Lakes Research Facility is located on a site in Milwaukee on the inner harbor across the Kinnickinnic River from Jones Island. This is the former Allen Bradley TEGA Architectural Ceramics Plant on east Greenfield Avenue.

The site is about ten acres in area or 1250' long by 280' wide and contains a building 550' long by 140' to 220' wide with 120,000 sq. ft. of floor space. There is about 300' of seaway depth water frontage on the Kinnickinnic River and 1200' of water frontage on the slip bounding the northern edge of the site. The building construction was started by Allen Bradley in 1966 and completed in 1968. The building is reinforced concrete with steel reinforced concrete beam and steel support pilings driven to 100' depths. The interior of the building is concrete block with precast concrete planks on the exterior.

This facility will house the Center for Great Lakes Studies located on the Milwaukee Campus and, where appropriate, All-University laboratories related to Great Lakes research. It will, therefore, help to serve the Great Lakes research needs of the University of Wisconsin System. The facility will also be made available for cooperative use by scientists from other institutions who wish to work in the Upper Great Lakes region that's Lakes Superior, Michigan, and Huron. For example, the University of Michigan or University of Illinois might utilize our facility or even Federal agencies such as EPA. This regional use is possible because of funding by the Office for Oceanographic Facilities and Support in the National Science Foundation.

Besides the functions of housing UW System research labs, offices, etc., the facility will provide several ser-

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vices. The most basic service it can provide is the necessary space, power, water, etc. to tie up a research vessel. A service island will be available to provide water, fuel, or sanitary disposal. Also required are suitable means of loading and unloading vessels, equipment storage, and data storage. For instance upon returning from a cruise it may be necessary to store geological or biological samples in freezers or provide holding tanks for fish until they can be transported to the laboratories of the particular research investigator. This facility will be the home port for most UW research vessels and can provide a base of operations for any major regional vessels that might be assigned for Upper Great Lakes studies. This will require maintenance facilities such as machine shop, electronics shop, and woodworking shop. Other services that will be provided by the facility include charts and drafting, communications, computer terminal, conference room, etc.



It is anticipated that by June, 1974 the following services will be available:

- 1) 200' dock space with 24' depth on the east side in the Kinnickinnic River. With this dock space there will be a service island that will provide 120v ac, 1  $\emptyset$ , 100 amp and 220/440v ac, 3  $\emptyset$ , 200 amp electrical services, a two inch fresh water line, sanitary transfer system and a 10,000 gallon diesel fuel storage tank.
- 2) 600' dock space with 20' depth on the north side in 100' wide slip. With this space there will be 120v ac, 1  $\emptyset$ , 100 amp and 220/440v ac, 3  $\emptyset$ , 200 amp electrical services.
- 3) A 12' wide launching ramp for trailered boats and fueling station in the west end of the slip.
- 4) Temporary storage for handling marine samples such as fish, water, ice, geological cores, etc.
- 5) Material handling and staging areas along the north wall of the building adjacent to the slip. An overhead door, ramp, and hydraulic crane will be available for handling equipment and supplies directly from the building to a vessel moored in the slip.
- 6) A complete machine shop for maintenance, construction, and modification of marine equipment.
- 7) A general chemical lab for a variety of studies.

This facility in the Milwaukee harbor presents a unique opportunity to provide year around support to the entire Upper Great Lakes Region. It is an initial step in providing the services required to tackle the multi-disciplinary and multi-university research problems facing our Great Lakes.

STUDENT PREPARATION FOR HIGHER DEGREES  
LIST OF CURRENT GRADUATE STUDENTS

Ph.D. candidates

F. Arrizabalaga  
Max L. Bothwell  
James A. Bowers  
Larry W. Claflin  
Lynn L. Frederick  
Nevin E. Grossnickle  
G. Kenneth Sato  
David J. Schwab  
C. Steven Sikes  
Byron G. Torke  
J. F. Lubner

M.S. candidates

Philip J. Emmling  
William C. Jennings  
David Latimer  
A. T. Ott

LIST OF GRADUATE STUDENTS WHO FOUND EMPLOYMENT  
BEFORE COMPLETING DEGREE

Brian Gallagher - President, Limnetics, Inc.  
F. W. N. Bates - Physical limnologist, Limnetics, Inc.  
Jeffrey B. Bode - Biological limnologist, Wisconsin Department of Natural Resources  
Mary C. Mayhew - Biological limnologist, Industrial Bio-Test, Inc.  
Merle H. Maass - Biological limnologist, Limnetics, Inc.  
Theodore G. Ringger - Biological limnologist, Limnetics, Inc.  
G. Kenneth Sato - Physical limnologist, Canada Centre for Inland Waters

## LIST OF PH. D. AND M. S. THESES AND PRESENT EMPLOYMENT

Doctor of Philosophy

- John H. Judd, "Effect of salt runoff from street de-icing on a small lake", now Executive Officer, New York State Sea Grant Program, State University of New York at Albany.
- Walter J. Hogman, "The larvae of the Lake Whitefish (Coregonus clupeaformis Mitchell) of Green Bay, Lake Michigan", now at Virginia Institute of Marine Science, Gloucester Point, Va.
- Richard P. Howmiller, "The benthic macrofauna of Green Bay, Lake Michigan", now Assistant Professor, Department of Biological Sciences, University of California at Santa Barbara.
- Everett J. Fee, "A numerical model for the estimation of integral primary production and its application to Lake Michigan", now at Freshwater Institute, Fisheries Research Board of Canada.
- John E. Gannon, "The impact of eutrophication and fish predation on recent changes in zooplankton species composition in Lake Michigan and Green Bay", now Assistant Professor, University of Michigan Biological Station.
- John V. Batha, "The distribution and ecology of the genus Hydra in the Milwaukee area of Lake Michigan", now Assistant Professor, Department of Biology, Carroll College.

Master of Science

- Robert Ryckman, "Physical and chemical characteristics of Little Bay de Noc", now in private industry.
- John Morsell, "Food habits of the Alewife, Alosa pseudoharengus (Wilson), in Lake Michigan", now at Department of Natural Resources, State of Wisconsin.
- Hyung T. Huh, "Characteristics of inshore and offshore waters of Lake Michigan at Milwaukee, Wisconsin -- with reference to long-term monitoring of eutrophication", now with Sea Grant Program, University of Wisconsin--Madison.
- Charles D. Barton, "Sediment oxygen demand as a trophic indicator in several inland Wisconsin lakes, Green Bay, and Lake Michigan proper", now in College of Medicine, University of Nebraska at Omaha.
- James M. Barker, "Changes in the total energy content of Mysis relicta (Loven) during its vertical migration", now in College of Medicine, University of Minnesota.

Master of Science (continued)

- Frederick W. N. Bates, "The undulating temperature/depth profiling system and its use in Lake Michigan", now with Limnetics, Inc., Milwaukee, Wisconsin.
- Jeffrey A. Fisher, "The effect of hypoxia on the burrowing behavior of Limnodrilus hoffmeisteri", now in Ph.D. program at Florida State University.
- Richard F. Modlin, "Contribution to the life cycle and ecology of the water mite Hygrobatas neoceptorus Marshall 1924 (Hygrobatidae, Acari)", now in Ph.D. program at University of Connecticut.
- Richard S. Stemberger, "Temporal and spatial distribution of rotifers in Milwaukee Harbor and adjacent Lake Michigan", now at University of Michigan's Biological Station.
- Edmond A. Mayhew, "Water movements in Little Bay de Noc as evidenced by physical and chemical characteristics", now with Industrial Bio-Test Laboratories, Northbrook, Illinois.
- Donald C. Rousar, "Phosphorus and iron in sediment-water systems", working with water treatment plant in North Carolina.
- Theodore G. Ringger, "The aquatic macroinvertebrate fauna of Theresa Marsh, Washington and Dodge Counties, Wisconsin", now with Limnetics, Inc., Milwaukee, Wisconsin.
- Paul S. Hausmann, "The benthic macrofauna of Milwaukee Harbor and adjacent Lake Michigan", now with Wisconsin Department of Natural Resources.
- Nevin E. Grossnickle, "The acute toxicity of residual chloramine to the rotifer Keratella cochlearis (Gosse) and the effect of dechlorination with sodium sulfite", now in Ph.D. program at University of Wisconsin--Milwaukee.
- Ping K. Wu, "Numerical simulation of the wind-driven motions in a two-layered lake motion", now with SouthEastern Wisconsin Regional Planning Commission.
- Federico Arrizabalaga, "A finite element lake model with variable eddy viscosity coefficient", now in Ph.D. Program at University of Wisconsin--Milwaukee.
- David J. Schwab, "A normal mode method for predicting storm surges on a lake", now in Ph.D. Program at University of Wisconsin--Milwaukee.

Examples of University, State, National, and International Service

- C. H. Mortimer:** president, American Society for Limnology and Oceanography;  
 president, International Association for Great Lakes Research;  
 U.S. representative, International Committee of SIL (International Association of Limnology);  
 Member, International Working Group on the Pollution of the Baltic Sea;  
 Member, Research Advisory Board of IJC (International Joint Commission);  
 Member, Milwaukee Mayor's Lakefront Recreational Taskforce.
- A. M. Beeton:** treasurer, American Society for Limnology and Oceanography;  
 chairman, Research Advisory Committee, Wisconsin representative of Natural Resources;  
 Member, National Academy of Sciences Taskforce on Water Quality Criteria;  
 U.S. representative, International Committee of SIL (International Association of Limnology).
- H. M. Mayer and E. Schenker:** Maritime Transportation Research Board.
- R. J. Wold:** Member, UNOLS (National Oceanographic Laboratories System) Committee of the National Science Foundation.
- H. C. Brockel:** Member, Department of Commerce (NOAA) Coastal Zone Management Board.

In addition, the following CGLS members serve, as Wisconsin representatives on the Environmental Protection Agency's Lake Michigan Cooling Water Studies Panel:  
 A. M. Beeton, A. S. Brooks, and C. H. Mortimer.

University service on a System-wide basis has included:

- U. W. Sea Grant Advisory Council (Beeton, Brockel, Mortimer [chmn.]);
- U. W. Water Resources Council (Bacon, Mortimer);
- U. W. Great Lakes Research Facility Council (Bacon, Brockel, Brooks, Mortimer, Wold).

PUBLICATIONS: SPECIAL REPORTS; PAPERS CONTRIBUTED TO  
PROFESSIONAL JOURNALS

CENTER FOR GREAT LAKES STUDIES  
THE UNIVERSITY OF WISCONSIN--MILWAUKEE  
MILWAUKEE, WISCONSIN, 53201

July, 1974

## SPECIAL REPORT SERIES

Special Reports are issued from time to time, usually to provide accounts of work in progress, or completed, which are too detailed for acceptance by professional journals. This method of publication is, for example, convenient when it is desired to record and deposit collections of data in identifiable and recoverable form or to fulfill the terms of contracts, or to make the details of a particular technique available to other potential users. This mode of reporting does not preclude later publication -- usually abbreviated and selected--in professional journals, indeed, authors are urged to regard such publications as a necessary final step in the completion of a piece of literature. The following Special Reports have been issued:

- MORTIMER, C. H. 1968. Internal waves and associated currents observed in Lake Michigan during the summer of 1963. S. R. No. 1, 24 p, 120 figs.
- SCHENKER, E. 1968. Effects of containerization on Great Lakes ports. S.R.No. 2 45 p., 18 tables, 3 app.
- Abstracts, 11th Conference on Great Lakes Research, April, 1968. S.R. No. 3, 83 p., 91 abstracts.
- FEE, E. J. 1968. Digital computer programs for the DeFant method of seiche analysis. S.R. No. 4, 27 p., 4 app., 3 figs.
- SCHENKER, E. 1968. Future general cargo traffic and terminal requirements at the Port of Milwaukee. S.R. No. 5, 13 p.
- FEE, E. J. 1969. Digital computer programs for spectral analysis of time series. S.R. No. 6, 16 p., 3 app., 1 fig.
- GANNON, J. E. 1969. Great Lakes plankton investigations: a bibliography. S.R. No. 7, 65 p., 2 app., 1 fig.
- GANNON, J. E. & A. M. BEETON. 1969. Studies on the effects of dredged materials from selected Great Lakes harbors on plankton and benthos. S.R. No. 8, 80 p., 36 figs.
- HOGMAN, W. J. 1969. Documentation of a computer program for multi-species fish populations. S.R. No. 9, 30 p.
- SCHENKER, E. 1970. Overseas shipping at Great Lakes ports: projections for the future. S.R. No. 10, 80 p.
- BEETON, A. M. 1970. Statement on pollution and eutrophication of the Great Lakes. S.R. No. 11, 35 p.

- MORTIMER, C. H. 1971. Large-scale oscillatory motions and seasonal temperature changes in Lake Michigan and Lake Ontario, Pt. I, text, Pt. II, figures, bound separately, S.R. No. 12.
- HOWMILLER, R. P. and A. M. BEETON. 1972. Report on a cruise of the R/V NEESKAY in Central Lake Michigan and Green Bay, 8-14 July 1971. S. R. No. 13, 62 p., 18 figures.
- FEE, E. J. 1971. Digital computer programs for estimating primary production, integrated over depth and time, in water bodies. S. R. No. 14, 42 p., 4 figs., 4 app.
- SCHENKER, E. 1972. Extending the St. Lawrence Seaway Navigation Season: a cost-benefit approach. S. R. No. 15, 61 p.
- BEETON, A. M. and W. L. CLARKE. 1973. Mysid bibliography. S.R. No. 16, 145 p.
- TORKE, B. G. 1974 (IN PRESS). An illustrated guide to the identification of the planktonic crustacea of Lake Michigan with notes on their ecology. S. R. No. 17, 42 p., plus figures.
- BEETON, A. M. and J. M. BARKER. 1974. Investigation of the influence of thermal discharge from a large electric power station on the biology and near-shore circulation of Lake Michigan - Part A: Biology. S. R. No. 18, 26 p., 72 figs.
- RAO, L. B. and D. J. SCHWAB. 1974 (IN PRESS). Two-dimensional normal modes in arbitrary enclosed basins on a rotating earth: application to Lakes Ontario and Superior. S.R. No. 19, 69 p., 25 figs.

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CONTRIBUTED PAPERS  
(Revised: July 1974)

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2. \*Norden, C. R. 1967. Light penetration studies in the Milwaukee Harbor area of Lake Michigan. Proc. Wisconsin Acad. Sci., Arts, Lett., 56: 197-205.
3. \*Norden, C. R. 1967. Age, growth and fecundity of the alewife, Alosa pseudoharengus (Wilson), in Lake Michigan. Trans. Amer. Fish. Soc., 96: 387-393.
4. \*Norden, C. R. 1967. Development and identification of the larval alewife Alosa pseudoharengus (Wilson) in Lake Michigan. Proc. 10th Conf. Great Lakes Res., 70-78.
5. Beeton, A. M., Moffett, J. W. and D. C. Parker. 1969. Comparison of thermal data from airborne and vessel surveys of Lake Erie. Proc. 12th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res., 513-528.
6. \*Mortimer, C. H. 1969. Physical factors with bearing on eutrophication in lakes in general and large lakes in particular. p. 340-368, In: Eutrophication: causes, consequences, correctives. Nat'l. Acad. Sci., Washington, D. C., 361 pp.
7. \*Beeton, A. M. 1969. Changes in the environment and biota of the Great Lakes. p. 150-187, In: Eutrophication: causes, consequences, correctives. Nat'l. Acad. Sci., Washington, D. C., 361 pp.
8. \*Blum, J. L. 1969. Nutrient changes in water flooding the high salt marsh. Hydrobiologia 34(1): 95-99.
9. \*Mortimer, C. H. 1967. A pictorial account of oscillatory responses to wind stress in large lakes with particular reference to long waves in Lake Michigan. Pres. Autumn Mtg., Nat'l. Acad. Sci., Ann Arbor, (mimeo copy).
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