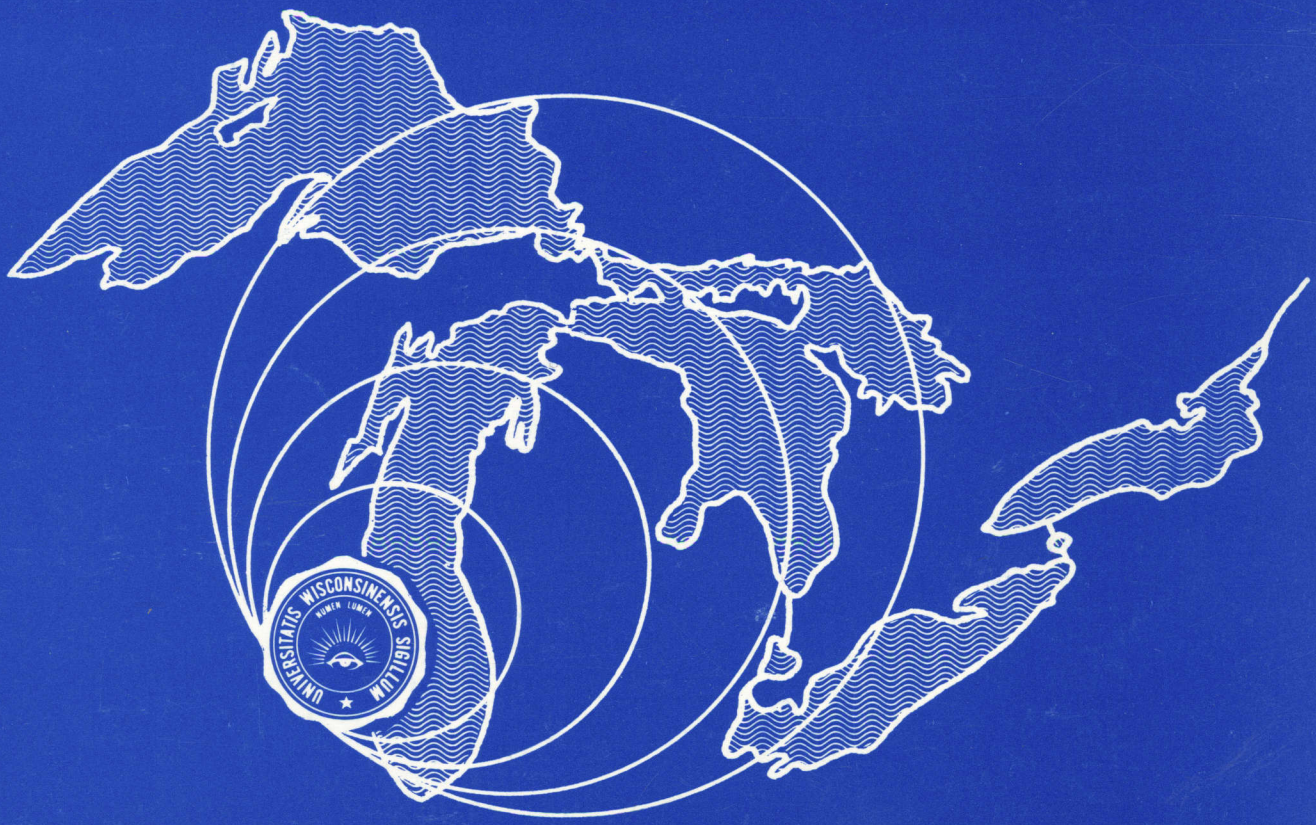
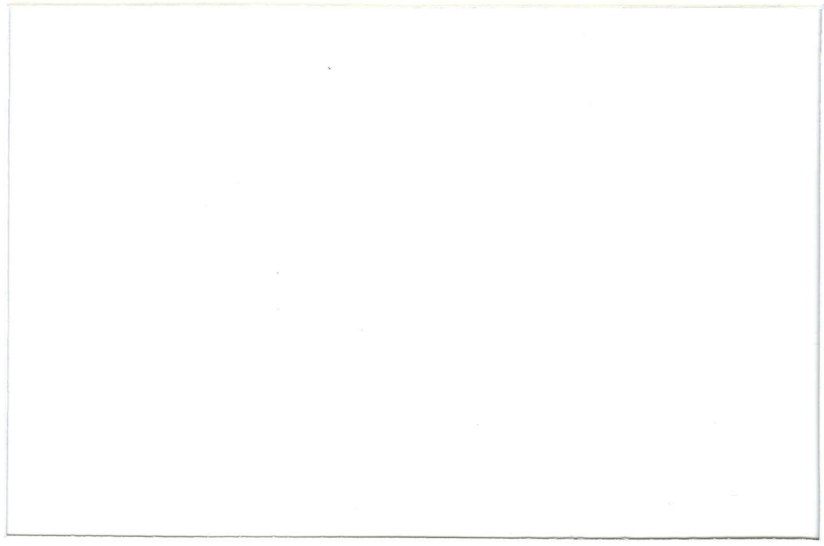
THE UNIVERSITY OF WISCONSIN—MILWAUKEE

CENTER
FOR
GREAT LAKES STUDIES



MILWAUKEE, WISCONSIN 53201 U.S.A.



Recd. 12/20/72

A position paper prepared by C. H. Mortimer
14 April 1972

CENTER FOR GREAT LAKES STUDIES AT UWM: PRESENT STATUS AND PROGRESS DURING THE QUINQUENNIUM 1967-72

pp. 1-22

With additional material, pp. 23-32,
prepared 30 October 1972

14 April 1972

CENTER FOR GREAT LAKES STUDIES at UWM - PRESENT STATUS AND PROGRESS DURING THE 1967-1972 QUINQUENNIUM

Clifford H. Mortimer, F.R.S., The University of Wisconsin--Milwaukee Distinguished Professor of Zoology, Director.

Associate Directors: Dr. Alfred M. Beeton (zoology, limnology) and Dr. Eric Schenker (economics).

CONTENTS

INTRODUCTION

As a component of the general mission of the University of Wisconsin--for which "the boundaries of the university are the boundaries of the state"--the special mission of UWM takes note of the fact that 40% of those state boundaries interface with the Great Lakes, and that Milwaukee is Wisconsin's major industrial, metropolitan area with a port on Lake Michigan. With this in mind, the Center for Great Lakes Studies was established, in 1966 in its present form, as one of UWM's "peaks of excellence" and as a multi-disciplinary, interdepartmental, and (where appropriate) a system-wide facility for research and instruction. The Center forms a coordinating focus for marine and marine-related studies on the campus, with the principal objective of contributing, through

through research and education, to a better understanding of physical, chemical, and biological processes and events occurring in the Great Lakes and of the social influences and regional problems arising from man's interactions with these waters.

FACULTY ASSOCIATES AND STAFF

Center-affiliated faculty, staff and students pursue fundamental studies in lake physics, chemistry, and biology and engage in research programs with applications in environmental engineering, regional economics, and resource management. A number of faculty members work on a part-time basis in the Center; and, conversely, the Center's staff is attached to or works with departments through the channels of part-time appointments, teaching assignments, and above all, through supervision of graduate research.

The following faculty members, listed by department, are those at present most closely associated with the work of the Center.

Faculty supported in whole or in part from Center funds:	Percentage of Salary from Center funds:
Director: Dist. Prof. C. H. Mortimer (zoology)	100
Associate Director: Prof. A. M. Beeton (zoology)	50
Associate Director: Prof. E. Schenker (economics)	50
Prof. J. L. Blum (botany)	50
Assoc. Prof. D. B. Rao (energetics, engineering)	40
Asst. Prof. I. Gyuk (physics)	13
Lecturer, H. C. Brockel (port development and economics*)	100
Post-doctoral Fellow, D. L. Cutchin (physical oceanography*)	100

*area of expertise; not a department

Center associated faculty (S.G. indicates inclusion in 1972-75 Sea Grant Proposal):

Assoc. Prof. K. Bayer (geography, S.G.)
Assoc. Prof. E. A. Beimborn (systems, engineering, S.G.)
Prof. A. Y. Chang (materials, engineering, S.G.)
Asst. Prof. W. A. Garvey (systems, engineering, S.G.)
Asst. Prof. J. E. Going (chemistry)
Asst. Prof. R. Grunewald (botany)
Prof. A. C. Hagensick (political science, S.G.)
Assoc. Prof. C. Huber (chemistry)
Prof. G. M. Karadi (mechanics, engineering, S.G.)
Prof. P. Kovacic (chemistry)
Asst. Prof. R. Y. Lai (energetics, engineering)
Assoc. Prof. N. P. Lasca (geology)
Asst. Prof. W. A. Lyons (geography)
Asst. Prof. M. J. Melancon (pharmacy)
Prof. C. R. Norden (zoology, S.G.)
Asst. Prof. D. H. Petering (chemistry)
Assoc. Prof. R. G. Pirie (geology)
Assoc. Prof. G. L. Roderick (mechanics, engineering)
Assoc. Prof. G. Staats (electrical engineering, S.G.)
Prof. E. D. Warner (zoology)
Assoc. Prof. G. Walter (mathematics)
Assoc. Prof. F. Wegmann (systems, engineering, S.G.)
Assoc. Prof. R. J. Wold (geology)

Non-faculty personnel:

Specialists

D. Rousar - full time		
J. Barker - full time		
R. Beeton - one-quarter time	Total:	3

Student Helpers

varies 4-8 current	5

Civil Service Staff

Administrator (1); Office (3); drawing office (1); vessel (2); machine and electronic shop (2).	9

RESEARCH AND THE PREPARATION OF STUDENTS FOR HIGHER DEGREES

The research programs of the Center are carried out by faculty members and graduate students. Preparation for graduate work is in the basic disciplines of natural and social science, mathematics, and engineering, through the departments mentioned above. At the graduate level, special courses and seminars relate to limnology and marine science and to the investigations in which the Center personnel are engaged. Students interested in graduate work under Center sponsorship must be accepted for admittance by the Graduate School of The University of Wisconsin--Milwaukee for study in an appropriate academic department.

At present, total of fifteen graduate students are supported by the Center on a variety of research projects, carried out principally on Lake Michigan with Center facilities: twelve half-time support, the maximum; two quarter-time; and one no salary but other support. During the past five years the following students have been awarded higher degrees. These are listed below with the titles of their theses.

Doctor of Philosophy

John Judd, Effect of salt runoff from street deicing on a small lake.

Walter Hogman, The larvae of the Lake Whitefish (Coregonus clupeaformis (Mitchill)) of Green Bay, Lake Michigan.

Richard Howmiller, The benthic macrofauna of Green Bay, Lake Michigan.

Everett Fee, A numerical model for the estimation of integral primary production and its application to Lake Michigan.

John Gannon*, The impact of eutrophication and fish predation on recent changes in zooplankton species composition in Lake Michigan and Green Bay.

Masters Degrees

Richard Modlin, Contribution to the life cycle and ecology of the water mite Hygrobates Neooctoporus Marshall 1924 (Hygrobatidae, Acari).

---

*Degree expected in May 1972

Masters Degrees (continued)

Robert Ryckman, Physical and chemical characteristics of Little Bay de Noc.

John Morsell, Food habits of the Alewife, Alosa pseudoharengus (Wilson), in Lake Michigan.

Hyung T. Huh, Characteristics of inshore and offshore waters of Lake Michigan at Milwaukee, Wisconsin--with reference to long-term monitoring of eutrophication.

Charles Barton, Sediment oxygen demand as a trophic indicator in several inland Wisconsin lakes, Green Bay, and Lake Michigan proper.

James Barker*, Changes in the total energy content of Mysis relicta (Loven) during its vertical migration.

To summarize the Center's research objective in one sentence, it is research into the functioning of natural and social systems operating in Great Lakes waters or in the region. The main lines of research (principal investigators in brackets) have been concerned with: Great Lakes biology and the man-made effects of enrichment (eutrophication) and pollution (Beeton); physics of large basins, including water circulation, oscillatory responses to wind stress (Mortimer) and computer-simulation modelling of water motion (Rao); and economics of marine transportation--the St. Lawrence Seaway (Schenker).

A detailed review of the Center's achievements in research would exceed the space available in this outline. The next section (publications) gives some indication of variety and scope. Three outstanding advances may be mentioned, with references to the next section:

(1) Work in the field of lake hydrodynamics (Spec. Rept. 12) has disclosed the principal features of oscillatory motion and stratification in the Great Lakes. Observations of internal waves have been interpreted by analytical modelling of motion in basins, for which the earth's rotation and the boundaries are the dominant controlling factors;

(2) Work in the field of biological productivity (Contributed Papers Nos. 7, 10, 12, 22 and Spec. Rept. 11) has drawn attention to important quasi-persistent differences in nutrient chemistry and biological production between in-shore and off-shore waters and has disclosed a means of measuring an important biological parameter of a Great Lake, namely its maximum production potential;

(3) Studies of development relating to Great Lakes shipping (Spec. Rept. 2, 10, and 15) have been reviewed as major contributions in world shipping journals.

PUBLICATIONS

Lists of the Center Special Report Series and of papers contributed to professional journals follow. They relate to work carried out wholly or mainly in the Center.

Revised: 1/25/72

Center for Great Lakes Studies
The University of Wisconsin--Milwaukee
Milwaukee, Wisconsin 53201

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 publication 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. Spec. Rept. No. 1, 24 p., 120 fig.

Schenker, E. 1968. Effects of containerization on Great Lakes ports. Spec. Rept. No. 2, 45 p., 18 tables, 3 app.

Abstracts, Eleventh Conference on Great Lakes Research, April 1968. Spec. Rept. No. 3, 83 p., 91 abstracts.

Fee, E. J. 1968. Digital computer programs for the Defant method of seiche analysis. Spec. Rept. No. 4, 27 p., 4 app., 3 figs.

Schenker, E. 1968. Future general cargo traffic and terminal requirements at the Port of Milwaukee. Spec. Rept. No. 5, 13 p.

Fee, E. J. 1969. Digital computer programs for spectral analysis of time series. Spec. Rept. No. 6, 16 p., 3 app., 1 fig.

Gannon, J. E. 1969. Great Lakes plankton investigations: a bibliography. Spec. Rept. No. 7, 65 p., 2 app., 1 fig.

Gannon, J. E. and A. M. Beeton. 1969. Studies on the effects of dredged materials from selected Great Lakes harbors on plankton and benthos. Spec. Rept. No. 8, 80 p., 36 figs.

Hogman, W. J. 1969. Documentation of a computer program for multi-species fish populations. Spec. Rept. No. 9, 30 p.

Schenker, E. 1970. Overseas shipping at Great Lakes ports: projections for the future. Spec. Rept. No. 10, 90 p.

Beeton, A. M. 1970. Statement on pollution and eutrophication of the Great Lakes. Spec. Rept. 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). Spec. Rept. 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. Spec. Rept. No. 13.

Fee, E. J. 1971. Digital computer programs for estimating primary production, integrated over depth and time, in water bodies. Spec. Rept. No. 14, 42 p., 4 figs., 4 app.

Schenker, E. 1972. Extending the St. Lawrence Seaway Navigation Season: a cost-benefit approach. Spec. Rept. No. 15, 61 p.

Center for Great Lakes Studies
The University of Wisconsin--Milwaukee
Milwaukee, Wisconsin 53201

CONTRIBUTED PAPERS

(Revised: January 1972)

1. *Beeton, A. M. 1966. Indices of Great Lakes eutrophication. Proc. 9th Conf. Great Lakes Res., Univ. Michigan, Great Lakes Res. Div., Publ. No. 15: 1-8.

2. Norden, C. R. 1967. Light penetration studies in the Milwaukee Harbor area of Lake Michigan. Proc. Wisconsin Acad. Sci., Arts and 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., J. W. Moffett, 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 p.

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., 661 p.

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, Michigan (mimeo copy).

10. Holland, R. E. 1968. Correlation of Melosira species with trophic conditions in Lake Michigan. Limnol. Oceanogr. 13: 555-557.

11. Gannon, J. E. and E. J. Fee. 1970. Surface seiches and currents in Douglas Lake, Michigan. Limnol. Oceanogr. 15: 281-288.

12. Holland, R. E. 1969. Seasonal fluctuations of Lake Michigan diatoms. Limnol. Oceanogr. 14: 423-436.

13. Morsell, J. W. and C. R. Norden. 1968. Food habits of the alewife, Alosa pseudoharengus (Wilson), in Lake Michigan. Proc. 11th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.: 96-102.

14. Norden, C. R. 1968. Morphology and food habits of the larval alewife, Alosa pseudoharengus (Wilson), in Lake Michigan. Proc. 11th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.: 103-110.

15. Gannon, J. E. and D. C. Brubaker. 1969. Sub-surface circulation in South Fishtail Bay, Douglas Lake, Cheboygan County, Michigan. Mich. Academician, 11(2): 19-35.

16. Mortimer, C. H., D. C. McNaught and K. M. Stewart. 1968. Short internal waves near their high-frequency limit in central Lake Michigan. Proc. 11th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.: 454-469.

17. Beeton, A. M. and H. B. Rosenberg. 1968. Studies and research needed in regulation of the Great Lakes. Proc. Toronto Water Reg. Conf., Paper R-5: 311-342.

18. *Mortimer, C. H. and E. J. Fee. 1969. Spectra, coherence, and phase relationships of low-frequency water level fluctuations at shore stations on Lake Michigan-Huron and on Lake Superior. Proc. 12th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res., Ann Arbor, May 1969.

19. Howmiller, R. P. and A. Weiner. 1968. A limnological study of a mangrove lagoon in the Galapagos. Ecology 49: 1184-1186.

20. Howmiller, R. P. 1969. Studies on some inland waters of the Galapagos. Ecology 50: 73-80.

21. Beeton, A. M. and D. Mraz. 1969. Planning principles for water use in Wisconsin. III. Great Lakes. Soil Conservation Soc. Amer. Wisc. Chapter, Madison: 36-49.

22. Fee, E. J. 1969. A numerical model for the estimation of photosynthetic production, integrated over time and depth, in natural waters. Limnol. Oceanogr. 14: 906-911.

23. Howmiller, R. P. and W. E. Sloey. 1969. A horizontal water sampler for investigation of stratified waters. Limnol. Oceanogr. 14: 291-292.

24. Schenker, E. 1968. The St. Lawrence Seaway to date--and its future. Proc. 11th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.: 648-657.

25. *Schenker, E. 1969. The future of the U.S. Great Lakes transportation with particular reference to containerization and general cargo. Canadian Trans. Res. Forum, Toronto, May 1969.

26. *Beeton, A. M. 1969. The Laurentian Great Lakes. Amer. Chem. Soc., Minneapolis, Minn. Mtg., April 1969.

27. Schneider, J. C., F. F. Hooper and A. M. Beeton. 1969. The distribution and abundance of benthic fauna in Saginaw Bay, Lake Huron. Proc. 12th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.: 80-90.

28. Howmiller, R. P. and K. Dahnke. 1969. Chemical analysis of salt from Tagus Crater Lake, Isabela, Galapagos. Limnol. Oceanogr. 14: 602-603.

29. Hogman, W. J. 1970. A computer program for stock analysis in FORTRAN IV Univac 1108. Trans. Amer. Fish. Soc. 99: 426-427.

30. Mortimer, C. H. 1971. Chemical exchanges between sediments and water in the Great Lakes--speculations on probable regulatory mechanisms. Limnol. Oceanogr. 2: 387-404.

31. Brown, E. H., Jr. and C. R. Norden. 1970. Fin degeneration among young-of-the-year alewives, Alosa pseudoharengus, in southern Lake Michigan. Copeia 4: 766-769.

32. Norden, C. R. 1970. Evolution and distribution of the genus Prosopium. p. 67-80. In: Biology of coregonid fishes, Univ. Manitoba Press, 560 p.

33. Hogman, W. J. 1970. Early scale development on the Great Lakes coregonids, Coregonus artedii and C. kiyi. p. 429-436. In: Biology of coregonid fishes. Univ. Manitoba Press, 560 p.

34. *Ludwig, G. M. and C. R. Norden. 1969. Age, growth and reproduction of the northern mottled sculpin, Cottus bairdi hairdi, in Mt. Vernon Creek, Wisconsin. Milwaukee Public Museum Pub.

35. *Judd, J. H. In press. Lake stratification caused by runoff from street deicing.

36. Modlin, R. F. 1970. Hygrobates neooctoporus: descriptions of larva, nymph, and adult. Trans. Amer. Microsc. Soc. 89: 2, 288-295.

37. Modlin, R. F. 1971. Contributions to the life cycle and ecology of the water mite, Hygrobates neooctoporus Marshall 1924 (Hygrobatidae Acari). Amer. Midland Naturalist, 85: 1, pp. 54-62.

38. Howmiller, R. P. and A. M. Beeton. 1970. The oligochaete fauna of Green Bay, Lake Michigan. Pres. 13th Conf. Great Lakes Res. Int. Assoc. Great Lakes Res., Buffalo.

39. Howmiller, R. P. and A. M. Beeton. 1971. Biological evaluation of environmental quality in Green Bay, Lake Michigan. J. Water Pollution Control Fed., 43: 123-132.

40. Modlin, R. F. and A. M. Beeton. 1970. Dispersal of Fox River water in Green Bay, Lake Michigan. Pres. 13th Conf. Great Lakes Res., Buffalo, Int. Assoc. Great Lakes Res., 468-476.

41. Beeton, A. M. 1970. Pollution and eutrophication of the Laurentian Great Lakes. UWM Magazine.

42. Gannon, J. E. and A. M. Beeton. 1971. Simple methods for determining the effects of dredged sediments on biota, I. Benthos variability and sediment selectivity tests. J. Water Pollution Control Fed., 43: 392-398.

43. *Howmiller, R. P. and J. E. Gannon. In press. Paddlefish (Polyodon spathula) with short rostrums and questions concerning the function of the rostrum in paddlefish.

44. Howmiller, R. P. 1971. A comparison of the effectiveness of Ekman and Ponar grabs. Trans. Amer. Fish. Soc. 100: 3, 560-564.

45. *Blum, J. L. In press. The Vaucheriacea. N. A. Flora, N.Y. Bot. Soc.

46. Schenker, E. 1970. An estimation of the quantitative impact of the St. Lawrence Seaway on the hinterland's economy. Proc. 13th Conf. Great Lakes Res., Buffalo.

47. Schenker, E. and M. Bunamo. 1971. The Great Lakes container dilemma. Trans. Res. Forum Papers/1970.

48. Blum, J. L. 1971. Notes on American Vaucheriae. Bull. Torrey Botanical Club, 98: 4, 189-194.

49. *Howmiller, R. P. and J. E. Gannon. 1970. Paddlefish (Polyodon spathula) with short rostrums from the Missouri and Tennessee Rivers.

50. *Hogman, W. J. 1971. Fluctuations in herring and smelt populations in Green Bay 1929-1970. J. Fish Res. Bd. Canada.

51. *Blum, J. L. 1971. Plant ecology in flowing water. Symp. Amer. Fish. Soc.

52. *Walter, G. and W. J. Hogman, 1972. Mathematical models for fish populations. Pres. 14th Conf. Great Lakes Res. 1971.

53. *Gannon, J. E. and A. M. Beeton. 1971. The decline of the large zooplankter, Limnocalanus macrurus Sars (Copepoda: Calanoida), in Lake Erie. Pres. Great Lakes Res. Conf., Toronto, April 1971.

54. *Lin, C. K. 1971. Availability of phosphorus for Cladophora growth in Lake Michigan. 14th Conf. Great Lakes Res., Toronto, April 1971.

55. *Beeton, A. M., J. F. Carr, J. K. Hiltunen and R. P. Howmiller. 1971. A comparative trial of Smith-McIntyre, Petersen, and orange-peel grabs in Lake Michigan.

56. *Holland, R. E. and A. M. Beeton. In press. Significance to eutrophication of spatial differences in nutrients and diatoms in Lake Michigan. Limnol. Oceanogr.

57. *Judd, J. H. 1971. Circulation of water below 4°C. in an ice covered lake.

58. Lyons, W. A. 1971. Numerical simulation of Great Lakes summertime conduction inversions. Proc. 13th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res., 369-387.

59. Gannon, J. E. 1971. Two counting cells for the enumeration of zooplankton micro-Crustacea. Trans. Amer. Micros. Soc. 90(4): 486-490.

60. *Lyons, W. A. 1971. Low level divergence and subsidence over the Great Lakes in summer. 14th Conf. Great Lakes Res., Int. Assoc. Great Lakes Res.

61. *Lyons, W. A. 1971. "Steam devils" over Lake Michigan during a January arctic outbreak. Picture of the Month, Monthly Weather Review.

62. Brockel, H. C. 1971. The modern challenge to port management. Pres. 7th Int. Assoc. Ports & Harbors Conf., publ. Proc., Montreal, Canada, June 1971.

63. Schenker, E. and M. Bunamo. 1971. Trends and implications of container shipping. Pres. 7th Int. Assoc. Ports & Harbors Conf., Montreal, Canada, June 1971.

64. *Beeton, A. M. and W. T. Edmondson. In press. The eutrophication problem. J. Fish. Res. Bd. Canada, Oct. 1971.

CGLS, Contributed Papers, Cont'd.

65. *Huber, C. O., C. I. Lin and R. W. Looyenga. Determination of phosphate, silicate and sulphate in natural and waste waters by atomic absorption inhibition titration. To be presented at Nat'l. Mtg., Amer. Chem. Soc. Boston, April 1972.

66. *Gannon, J. E. 1972. Extended abstract. Effects of eutrophication and fish predation on recent changes in zooplankton crustacea species composition in Lake Michigan. Trans. Amer. Micros. Soc. 91: 1.

67. *Strand, J. W. and P. Kovacic. 1971. Preferred route for vic-dichloride formation from Alkenes. Comparison of cyclohexene chlorination with chlorine, sulfuryl chloride, and trichloramine.

68. *Grunewald, R. and E. J. Fee. 1971. Alternative to the use of ampoules for ^{14}C primary productivity studies and a simple method for determining the radioactivity of ^{14}C stock solutions.

69. *Lyons, W. A. and H. S. Cole. 1972. Fumigation and plume trapping: aspects of mesoscale dispersion on the shores of Lake Michigan during periods of stable onshore flow in the warm season. J. Applied Meteor.

70. *Rao, D. B. and A. Kasahara. Instability of frontal motions in the atmosphere. Ms. 72-17, Nat'l. Ctr. for Atmos. Res. (submitted to J. Atmos. Sci.).

71. *Rousar, D. C. and A. M. Beeton. Distribution of phosphorus, silica, chlorophyll a, and conductivity in Lake Michigan and Green Bay.

72. *Lyons, W. A. and H. S. Cole. The impact of the Great Lakes on the air quality of shoreline urban areas: some practical applications with regard to site location, development and air pollution control quality.

73. *Lyons, W. A. and S. R. Pease. 1972. A year-round all-sky-time-lapse camera system designed for mesoscale cloud mapping during IFYGL. Pres. 15th Conf. Great Lakes Res., Madison, Wisc.

74. Lyons, W. A. Forecasting the Chicago lake breeze. To be presented 4th Nat'l. Conf. Weather Analysis and Forecasting. (submitted to J. Applied Meteorology).

*not yet available for distribution; in press.

FACILITIES

Actively participating in the academic activities, research programs and operations of the Center for Great Lakes Studies are some forty-five persons, including faculty, staff, graduate students, specialists, and student helpers. The Center's facilities are presently scattered about campus at Lapham Hall, Kenwood Conference Center, Oakland Garage, and a research vessel is moored in the Milwaukee River. Consolidation of all these components at a waterfront site will produce a much more efficient organization, with greatly improved opportunities for expanding the fields of activity with extra-mural support and for extending the University's instructional and research effort on Lake Michigan.

Over the past two years, the Center has been planning a new building to house all its personnel and facilities. Space analysis figures, from the approved Building Planning document, are as follows: square feet - offices, 4,160; laboratories, 10,000; support, 9,700; ancillary, 1,640; total assignable square feet, 25,500. These figures represent a much "pared down" version of original plans, dictated by the funds approved by the State Building Commission (1 M $) plus a 50% match to be found from other sources. Site availability has held up construction; but acquisition of the AB Building and Dock will, it is hoped, produce an excellent and indeed a better alternative.

As planned, the integrated instructional, research, and facilities system will house the Center's at present scattered components and support as follows:

Research Vessel, R/V "Neeskay", detailed specifications of which appear on the next page. From March 1, 1971 through February 29, 1972 the vessel conducted research cruises on 90 days, plus 12 days in the shipyard for repairs and further fittings, for a total of 102 operational days, during its first full year of use. While most of the cruises were in the Milwaukee area, the vessel tied up for at least one night in each of the following ports; Chicago, Ill.; Michigan City, Ind.; Benton Harbor, Muskegon, Ludington, and Frankfort, Mich.; and Sturgeon Bay, Green Bay, and Manitowoc, Wis.

CENTER FOR GREAT LAKES STUDIES
RESEARCH VESSEL

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

T-Class; conversion (incl. ice sheathing and bilge keels) Peterson Builders, Sturgeon Bay, Wis.; USCG reg. no. 512552

Dimensions: (waterline) length 62 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 110 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

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

Accommodation: for master and engineer and four scientists; 120 sq.ft. labs and services on deck and in forward hold

THE UNIVERSITY OF WISCONSIN-MILWAUKEE

Boston Whaler (18 ft., 85 hp outboard motor) was used 66 times during 1971 in Lake Michigan near Milwaukee.

Vehicles: Ford station wagon, an International Harvester Scout, and a Dodge 3/4 ton pickup body with camper.

Sampling Gear and recording instruments: The large inventory of scientific equipment now on hand is stored at several locations.

Instrument Shop: The Center maintains a well-equipped machine shop (metal lathes, milling machine, drill press, band saw, welding machine, sheet metal shear, pipe cutter and threader are some of the basic machines) that serves as a support for the research activities. This will be located at the equipment base for maximum efficiency.

Electronics Shop: The Center also maintains a reasonably well-equipped electronics shop to service instruments and to foster development of new equipment. Again, as this work is done in close conjunction with vessel operation, instrument shop activities and equipment storage facilities, it will be operated at the same site as these other activities.

Laboratories, offices, and services - included in the plan are:

1. Limnology Lab.
2. Water analysis lab and instrument room
3. Microbiology lab and autoclave room
4. Algal culture lab
5. Plankton lab
6. General and organic chemistry lab and stock room
7. Physical limnology lab
8. Sedimentology lab
9. Radioactivity lab and instrument room
10. Icthyology lab and aquarium
11. Fluid dynamics lab
12. General Services:
    - Drawing and Cartographic Office
    - Photo and copy rooms
    - Computer terminal and data handling
    - Machine shop, Materials store and Assembly area
    - Instrument shop and Component store

12. General Services (continued):

Vessel base, jetty and stores
Small boat and heavy equipment storage
Environmental chambers

13. Teaching Services:

Work space for students
Seminar and Reading Room
Library
Demonstration Prep. room
Instructional Communications

14. Administration and Research Offices

In general, the AB Building and Dock will, it is proposed, serve the Center as a vessel and equipment base, as a services and support base, as laboratory, office and instructional space, and as a coordinated headquarters for university-supported and extramural projects funded from grants and contracts, listed in the next section. In addition it is proposed that the building will also serve as a Regional Marine Facility and research vessel base, funded by the National Science Foundation under the Universities National Oceanographic Laboratories System (UNOLS), to support (principally) university research programs in the Upper Great Lakes region, and also as a facility for other UWM investigators and for other UW Campus groups who are engaged or who may wish to become engaged in Great Lakes and marine-related programs.

EXTRA-MURAL FINANCIAL SUPPORT

Hitherto the Center's running expenses and capital acquisitions have been mainly funded from university sources, through the College of Letters and Science and the Graduate School. In 1971-72 the university portion of the budget was approximately $270,000. At the same time there has been substantial increase in extra-mural support from grants and contracts as follows.

Research Projects Currently Funded (Total $168,179; 1972-3 portion approximately $107,000):

1. Atomic Energy Commission: "Investigation of the Influence of Thermal Discharge from a Large Electric Power Station on the Biology and Near Shore Circulation of Lake Michigan." Principal Investigator, Dr. C. H. Mortimer. $48,000 for period June 15, 1971-June 14, 1973.

"(Same title) - Part A: Biology." Principal Investigator, Dr. A. M. Beeton. $24,000 for period August 1, 1971-July 31, 1972 (to be re-submitted for 1972-3 at $36,000).

This project is a combined study of the ecology of natural populations and the physics of nearshore circulation, the main object of which is to assess the influence on Lake Michigan of a large thermal source which has been in operation for many years. Specifically the Wisconsin Electric Power Company, Oak Creek, Wisconsin, plant.

2. Army Corps of Engineers: "Development of an Automatic Vessel-operated Temperature Depth Profiling System." Principal Investigator, Dr. C. H. Mortimer. $14,893 for period July 1, 1968-June 30, 1972.

This project is concerned with the development of a temperature depth profiling system for use from commercial vessels, including railroad car ferries which travel at 16 knots, the data such an instrument would collect would then be used in the study of upwellings and dominant internal wave patterns. This instrument will be used in the International Field Year on the Great Lakes (IFYGL) Program, see No. 4 below.

3. National Science Foundation: "Numerical Studies in the Circulation and Storm Surges in Lake Ontario." Principal Investigator, Dr. D. B. Rao. $27,900 for period January 15, 1972 through June 30, 1973.

This project is also a contribution to the IFYGL. It involves integrations on a sequence of numerical models to determine the three dimensional circulation patterns induced by seasonal winds; the changes in the mean circulation patterns in response to changes in the seasonal winds

as a function of the intensity and duration of those changes; and the lake level response induced by severe atmospheric disturbances (the storm surge problem).

4. National Oceanic and Atmospheric Administration: "Lake Ontario Temperature Transects Continuously Repeated." Principal Investigator, Dr. C. H. Mortimer. $4,500, 1971-72; $21,000, 1972-73; $21,000, 1973-74.

This project is a contribution to the IFYGL Program on Lake Ontario. It concerns measurement and preliminary analysis of variations in temperature distribution in two Lake Ontario cross-sections on a continuous shuttle operation during three five-day periods. The purpose is to contribute to the understanding of the structure and mode of generation of upwelling and dominant internal wave patterns.

5. U. S. Department of the Interior: "Microbial Degradation of TFM." Principal Investigator, Dr. A. M. Beeton. $5,886, March 15 1972 through March 15, 1973.

This is a one-year study on the fate of the selective lampricide TFM in an aquatic environment. Specifically to determine the rate of decomposition of IFM by microbes present in river sediments and to identify the intermediate compounds formed during this process.

6. U. S. Department of Agriculture, Forest Service: "Limnological studies at the Sylvania Lakes". Principal Investigator, Dr. A. M. Beeton, $1,000 August 1 1971 through June 30, 1972.

Projects incorporated in the Sea Grant Proposal 1972-75:

Name of Investigator(s)	Project Title	1972-73 budget including overhead*
Mortimer, C. H.	Administration-Milwaukee	$ 21,100
Bayer, K.	Possibilities of long range forecasting of winter close-down date due to ice and spring opening date of the St. Lawrence Seaway	14,900
Beeton, A. M.	Identification and evaluation of sources of hydrographic data on the Great Lakes	19,400
Beeton, A. M.	Factors affecting energy fixation in Lake Michigan	16,300 (3,500)
Beeton, A. M.	A comprehensive study of the water quality of Milwaukee Harbor and adjacent Lake Michigan	21,000 (9,100)
Beimborn, E. & W. Garvey	An examination of the effects of changes in rail transport technology upon Great Lakes bulk shipping activity	15,400
Brockel, H. C.	Seaway Information	16,600
Chang, Y. A.	Corrosion of metals in marine structures	16,200
Cutchin, D. L. and C. H. Mortimer	Feasibility study for complete survey and analysis of Milwaukee Harbor--Lake Michigan exchange roles	15,600 (700)
Garvey, W. & E. Beimborn	The development of models to simulate the St. Lawrence Seaway System	20,500
Hagensick, A. C.	Administrative aspects of water quality management on the Great Lakes	15,200
Karadi, G.	Chemical and biological analysis of dredging wastes	21,400

*Additional UW matching funds in brackets.

Projects (continued):

Name of Investigator(s)	Project Title	Budget
Norden, C. R.	Food requirements and bioenergetics of alewife and smelt in Lake Michigan	28,000 (2,000)
Sawicki, D.	The development of a heuristic game to investigate the processes of "decline" in several non-metropolitan communities	40,200
Schenker, E. Coordination of	Ports and Commerce	27,400
Schenker, E. and H. C. Brockel	Changing technology and the seaway	14,600
Schenker, E. and H. C. Brockel	Containerization and the Great Lakes transportation system	16,900
Staats, G.	Use of generating station thermal discharge for recreational purposes and as a source of process or space heating	13,600
Wegmann, F., Garvey, W. and J. N. Ong	Emerging organizational structures for administering regional port development plans	14,300
Wegmann, F. and E. Beimborn	Regional development of commercial Great Lakes ports--a functional classification analysis	14,800

TOTAL for UWM, 1972-73 which is 22% of the sum requested for the whole UW Sea Grant Program ($1,800,000 including state matching funds). $383,400.
(13,300)
396,700

Research Projects Now under Review by Agencies:

1. National Science Foundation: "Mechanisms of large-scale motions in Stratified 'Great Lakes' and Enclosed Seas; a Combined Program of Measurement and Modelling (analytical and numerical) in Lake Michigan. Principal Investigator, Dr. C. H. Mortimer, amount requested, $230,000 for a 3-year period. This proposal has the general objective of obtaining a better understanding of the mechanisms of whole-basin motions, the processes of their generation and decay, and their influence on circulation patterns of practical interest, e.g., those near shore.

2. U. S. Department of the Interior (~~FWQA~~ EPA): "Project to determine the consequences to the biota of Lake Michigan of chlorinating a large municipal effluent and possible corrective measures." Principal Investigator, Dr. A. M. Beeton, amount requested, $84,000 over a two-year period. Objectives of this project are to determine the effect on the biota of Milwaukee Harbor and adjacent Lake Michigan of chlorination of the effluent of the Jones Island Treatment Plant of Milwaukee and to determine what additional chemical treatment could be employed to eliminate or reduce the toxicity of chloramines in the effluent.

3. Wisconsin Department of Natural Resources: "The Composition of the Profundal Oligochaete Fauna as an Index of Lake Trophy." Principal Investigator, Dr. A. M. Beeton. Amount requested $6,650 over a one-year period. Objectives of this proposal are a survey of the oligochaeta of 26 Wisconsin lakes and discovery of indicator species or assemblages of species, or a method by which the relative abundance of worm species may be used as a key of lake trophy.

TOTALS:

Total, under review:	$ 320,650
Total, in Sea Grant Proposal:	396,700
Total, currently funded	168,179
Combined Total:	885,529

ADDITIONAL MATERIAL (prepared 30 October 1972)
for the position paper:
"CENTER FOR GREAT LAKES STUDIES AT UWM:
PRESENT STATUS AND PROGRESS DURING THE QUINQUENNIUM 1967-72"

by C. H. Mortimer, 14 April 1972

Add. to p. 5 Master's Thesis

Fisher, Jeffrey A. 1972. The effect of hypoxia on the burrowing behavior of Limnodrilus hoffmeisteri (Oligochaeta).

Add. to p. 13 Papers contributed to professional journals

75. Crawford, W. E., C. O. Huber, and C. I. Lin. Atomic absorption inhibition titration and ortho and polyphosphates. Anal. Chim. Acta.

76. Modlin, R. F. and J. E. Gannon. A contribution to the ecology and distribution of aquatic acari in the St. Lawrence Great Lakes. Presented at 15th Conf. Great Lakes Res., Madison, Wisconsin, April 1972.

77. Howmiller, R. P. Effects of preservatives on weight of some common macro-benthic invertebrates. Trans. Amer. Fish. Soc.

78. Lyons, W. A. and L. E. Olsson. Mesoscale air pollution transport in the Chicago Lake Breeze. J. Air Pollution Control Assoc.

79. Howmiller, R. P. Some Naididae and tubificidae from Central America. Hydrobiologia.

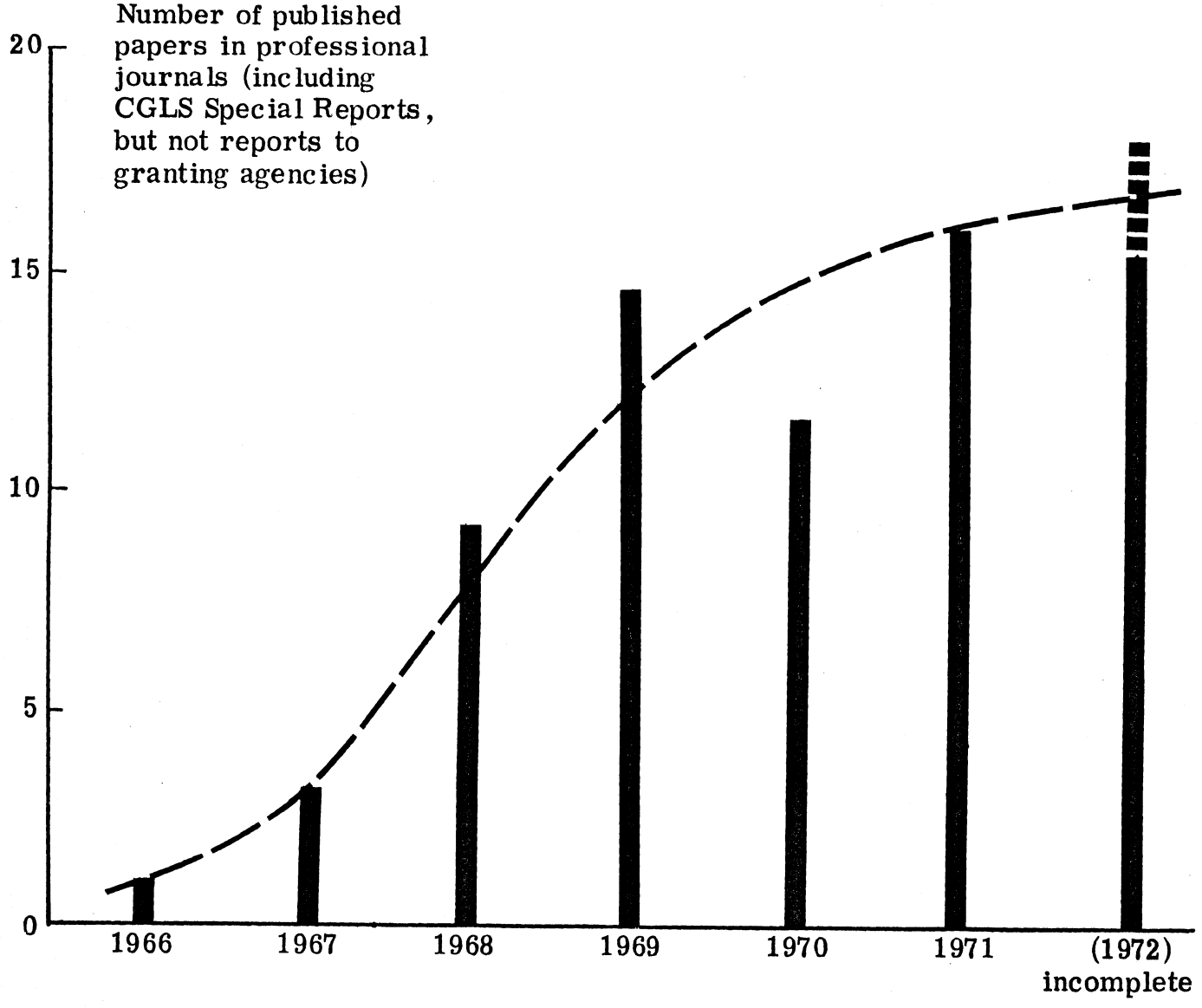
80. Lyons, W. A. and L. E. Olsson. Detailed mesometeorological studies of air pollution dispersion in the Chicago lake breeze. To be submitted to Monthly Weather Review.

81. Kovacic, P. and J. Strand. Amination of toluene, adamantane, and t-butyl chloride with monochloroamine-aluminum chloride. To be submitted to J. Organic Chem., and J. Am. Chem. Soc.

Attached is a graph of the total number of Center publications by year 1966-72.

CENTER FOR GREAT LAKES STUDIES: PUBLISHED OUTPUT BY YEAR

(see attached lists)



Add. to p. 19 The two research projects listed "under review" on p. 22 have now been funded and should be added to the list of funded projects with the following 1972-3 totals:

EPA: "Effects on Lake Michigan of chlorination of the Milwaukee treated sewage effluent", Beeton, $32,185.

Wis. DNR: "Oligochaete fauna as an index of lake trophy", Beeton, $5,358.

The NSF proposal (p. 21, Mortimer) has been withdrawn and will be re-submitted in a different form.

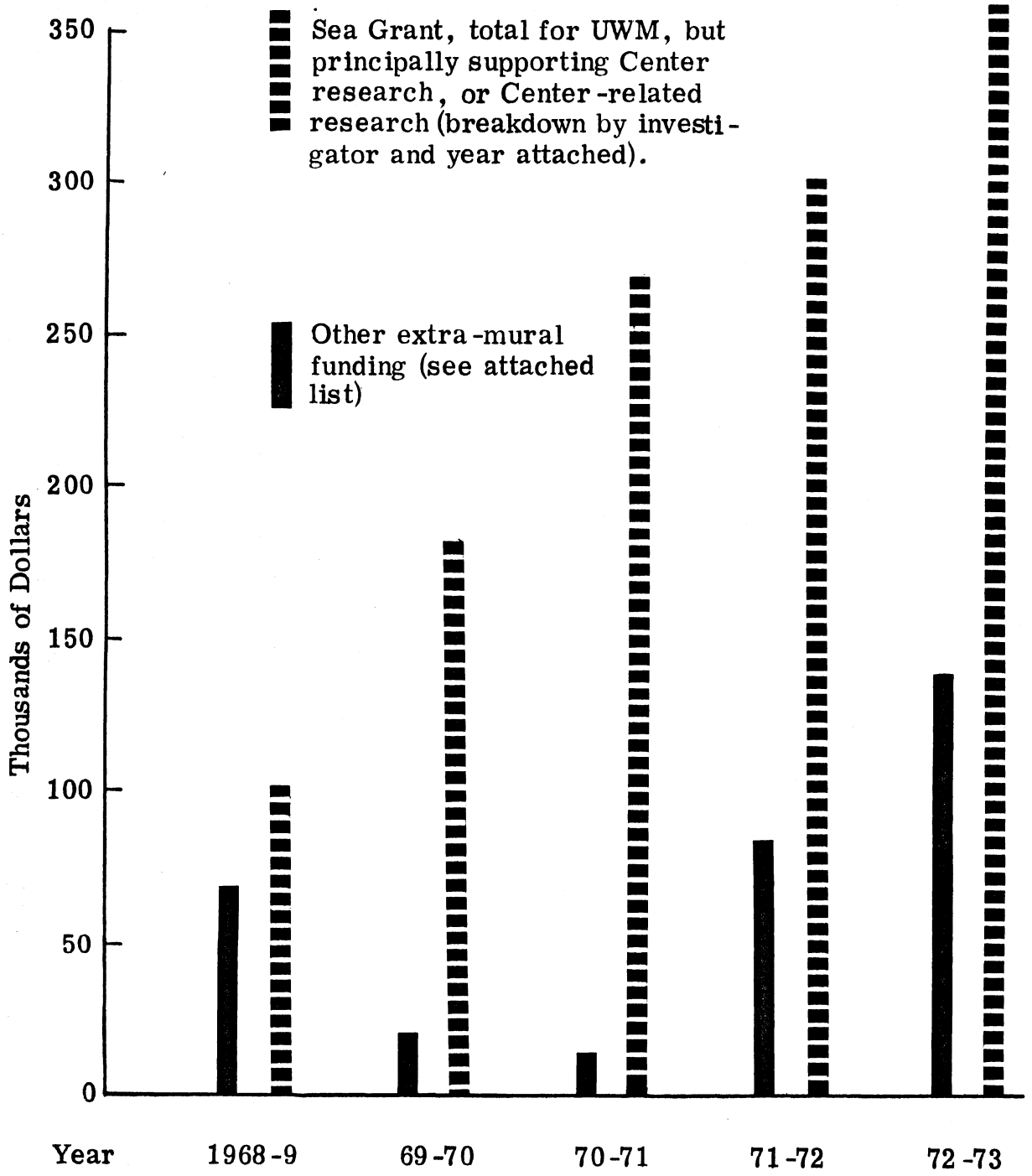
Add. to p. 21 The total funding has now been approved at $360,000.

Add. to p. 21 Attached graph of funded grant totals for the years 1968-9 to 1972-3:

(a) Sea Grant - total amount coming to UWM, of which the major part is for funding Center or Center-related research;

(b) Other extra-mural sources of funds awarded to the Center.

CENTER FOR GREAT LAKES STUDIES: FUNDED GRANTS, TOTALS, 1968-73



Center Funded Grants

Agency	Project and Director	Period 68-69	69-70	70-71	71-72	72-73	TOTAL
COE	Dredged Materials - Beeton	$20,005	-	-	-	-	$20,005
DNR	Alewife & Coregonids - Beeton	3,700	$ 7,500	-	-	-	11,200
COE	Temperature Studies - Mortimer	4,571	3,000	3,000	3,000	-	13,571
COE	Undulator - Mortimer	4,422	4,421	3,000	3,000	-	14,843
NSF	Under-grad Grant - Mortimer	600	600	-	-	-	1,200
Gimbels	Gift - Mortimer	-	-	800	-	-	800
AEC	Oak Creek - Mortimer	-	-	-	24,000	24,000	48,000
AEC	Oak Creek - Beeton	-	-	-	24,000	24,000	48,000
NOAA	IFYGL - Mortimer	-	-	-	4,500	21,401	25,901
NSF	IFYGL - Rao	-	-	-	9,900	18,000	27,900
EPA	Milwaukee Chlorination - Beeton	-	-	-	3,000	32,185	35,185
DNR	Olig. fauna - Beeton	-	-	-		5,358	5,358
USFWS	TFM - Beeton	-	-	-	1,470	4,416	5,886
USFS	Sylvania - Beeton	-	-	-	600	400	1,000
	SUB TOTALS	$33,298	$15,521	$6,800	$73,470	$129,760	$258,849
Sea Grant	all of UWM	64,000	172,000	254,000	288,000	360,000	1,138,000
	TOTAL	$97,298	$187,521	$260,800	$361,470	$489,760	$1,396,849

prep. D.M. 30 Oct. 1972

Sea Grant
1968-1969

	Base	Overhead	Total
Schenker	$3,060	$1,485	$4,545
Norden	5,055	1,608	6,663
Blum (Educ.)	2,500	-	2,500
Beeton & Mortimer (Educ.)	3,000	-	3,000
Mortimer	13,000	2,090	15,090
Harmsworth	8,700	3,300	12,000
Mraz (Admin.)	5,000	2,500	7,500
Beeton	10,000	2,970	12,970
TOTAL	$50,315	$13,953	$64,268

Sea Grant
1969-1970

	Base	Overhead	Total
Mortimer	$ 39,200	$4,675	$43,875
Schenker	6,900	2,200	9,100
Norden	14,518	5,500	20,018
Beeton-Mortimer (Educ.)	3,600	-	3,600
Beeton (Green Bay)	15,000	6,765	21,765
Beeton (Cyclops)	5,500	2,750	8,250
Brockel	8,400	3,465	11,865
Norden	14,500	5,940	20,440
Roderick	2,500	858	3,358
Ong	7,700	3,410	11,110
Wold	9,200	3,465	12,665
Mraz (Admin.)	4,600	1,540	6,140
TOTAL	$131,618	$40,568	$172,186

Sea Grant - 1970-1971

		Base	Overhead	Total
A. M. Beeton	Water Quality	$39,000	$16,280	$55,280
A. M. Beeton	Green Bay	14,000	6,655	20,655
A. M. Beeton	Education	10,100	4,400	14,500
H. C. Brockel	ADVISORY	9,250	3,025	12,275
H. C. Brockel	Disposal	9,200	3,850	13,050
G. Karadi	Social Economic	9,700	4,510	14,210
C. H. Mortimer	Ocean Mechanics	19,048	8,276	27,324
D. F. Mraz	Administration	10,500	4,950	15,450
E. S. Schenker	Green Bay	7,300	3,135	10,435
E. S. Schenker	St. Lawrence Seaway	19,200	9,570	28,770
Norden-Warner-Stanley	Fish	27,600	14,630	42,230
		$174,898	$79,281	$254,179
	TOTAL	$254,179		

Sea Grant
1971-1972

	Base	Overhead	Total
Schenker	$10,100	$ 3,976	$ 14,076
Beeton	14,200	6,944	21,144
Beeton	50,900	16,520	67,420
Blum	5,000	2,800	7,800
Going	8,500	2,184	10,684
Norden	19,600	10,080	29,680
Chang	5,900	3,136	9,036
Roderick	6,800	3,048	9,848
Mortimer	23,800	7,728	31,528
Schenker	15,500	6,911	22,411
Karadi	7,800	3,700	11,500
Wold	9,000	2,128	11,128
Beeton-Mortimer (Educ.)	3,700	300	4,000
Chang	2,850	1,600	4,450
Bayer	1,300	-	1,300
Lai	2,100	784	2,884
Mraz (Admin.)	12,100	5,936	18,036
Bacon	8,000	-	8,000
Melancon	2,000	765	2,765
TOTAL	$209,150	$78,640	$287,790

Sea Grant
1972-1973

	Base	Overhead	Total
Beeton (Hydro data)	$13,900	$ 5,700	$19,600
Mortimer	10,900	5,400	16,300
Beeton (Milw. Harbor)	23,800	6,500	30,300
Beeton (Energy Fixation)	14,700	5,100	19,800
Mortimer (Admin.)	14,700	6,700	21,400
Beimborn & Garvey	10,700	4,700	15,400
Garvey & Beimborn	14,200	6,400	20,600
Wegman	9,800	4,500	14,300
Karadi	10,700	4,500	15,200
Melancon	8,700	3,400	12,100
Beimborn & Wegman	10,100	4,700	14,800
Bayer	10,400	4,500	14,900
Brockel	12,000	4,800	16,800
Schenker & Brockel	10,100	4,500	14,600
Schenker & Brockel	11,600	5,300	16,900
Sawicki	22,900	9,600	32,500
Slaats	9,100	4,500	13,600
Chang	11,200	5,000	16,200
Norden	20,700	9,400	30,100
Wold (Share of Superior Proj.)	3,000	2,000	5,000
TOTAL	$253,200	$107,200	$360,400