

A GUIDE TO WATER AND RELATED LAND USE
IN THE LOWER FOX RIVER WATERSHED

...Selected References and Commentary

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INTRODUCTION

The lower Fox River between Lake Winnebago and Green Bay forms a unique valley, providing the focus for one of the major population and industrial areas of Wisconsin. Its rich and diverse history attest to the important role it has played throughout the history of the state; and although this role has changed from being primarily a trade route during early settlement periods to directly supporting the economic base of approximately 200,000 persons, the close dependency of the valley population on the river continues and grows.

A region such as the lower Fox River valley provides a prime example of much interdependent activity related to a single natural resource, where the use of the water resource is not regulated by normal competitive economic market forces. Instead, some of the so-called "externalities" having indirectly damaging effects on the whole region can only be dealt with through cooperation and coordinated management of the river - a goal which has been clearly recognized by many individuals and organizations, both at the local and state level. For several years efforts have been underway to define the interdependencies which exist in the valley, to consider possible water quality management policies which could be applied to develop predictive models, to evaluate the effects, costs, and regional benefits of alternative control measures, and to consider feasible political and institutional frameworks to provide area-wide management of water quality in the river and bay. In addition to Sea Grant sponsored research activity within the University of Wisconsin system, there has been increasing attention towards these ends within the valley itself, as evidenced by large public and private water quality control investments, and also by coordinating meetings involving persons from the University, Wisconsin Department of Natural Resources (DNR), Institute of Paper Chemistry, public agencies, planning groups, sanitary districts

and other organizations. A major commitment by the State of Wisconsin to move towards comprehensive management is the presently installed automated water quality monitoring system, which is comprised of five stations, each measuring five water quality parameters on an hourly basis for transmission to a central recording station. Recent federal water quality legislation confirms the attention paid at the national level to coordinated management and control of water quality in elements of the Great Lakes system and the nation at large. This is particularly expressed in the objectives to be achieved by use of federal funds available for comprehensive river basin management agencies as defined in Section 208 of PL 92-500 (the 1972 Federal Water Pollution Control Act Amendments).

This report provides some input into the very complex considerations regional water quality management entails by giving specific information on the multiple purposes river waters are called upon to serve. The data base is necessarily incomplete; it represents information currently available to the authors. Included also is a bibliography of a variety of background references available and related to the lower Fox River. The report is essentially a status report, intended to add existing information to augment the included map combining hydrologic and socio-economic background for the valley (see Figure 1 enclosed inside), the monitoring data gathered by DNR, and a statistical analysis of river data underway by a University of Wisconsin Sea Grant project (Litwin and Joeres, 1974). This report is intended to draw together for common reference use some of the information needed by all individuals and organizations interested in improving this most vital resource.

It would be out of the scope of this report to analyze thoroughly the hydrological, economic, political and historical information available for the lower Fox River. An extensive survey of literature on these and associated topics compiled as part of the project "Water Quality Management on the Lower Fox River," however, is given in Appendix B of this report. It is hoped that the current level of interest and involvement, as well as the positive climate towards cooperative management solutions, will continue to foster the development of a realistic regional management approach to water quality management in the valley.

PHYSICAL CHARACTERISTICS OF THE LOWER FOX RIVER SYSTEM

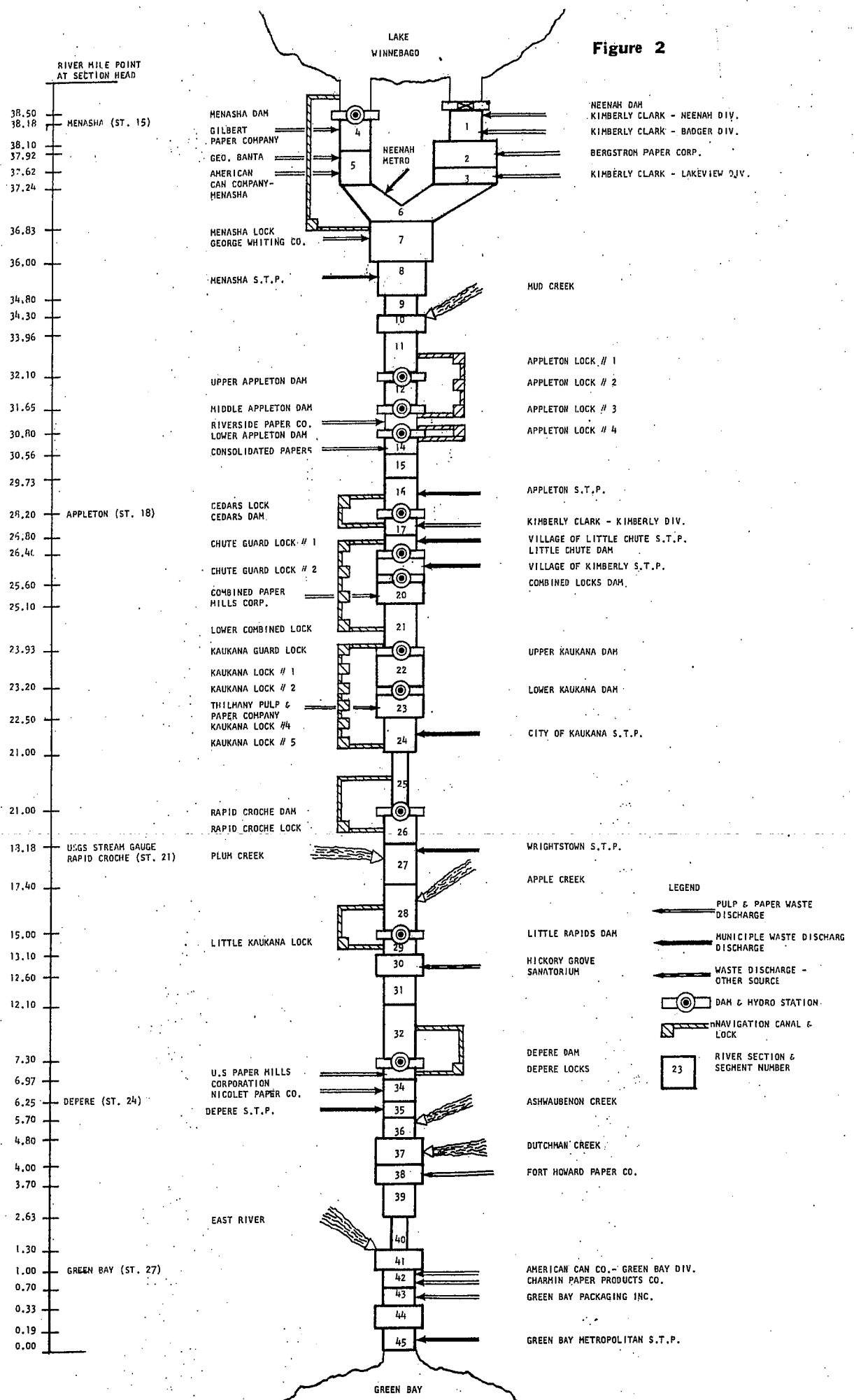
The Fox and Wolf River system forms one of the major drainage basins in Wisconsin and the largest tributary to Lake Michigan. Its drainage area of 6520 square miles consists of the Fox River rising in the east central part of the state (Columbia County) and the Wolf River, considered as a tributary, rising in the northeastern part of the state (Forest County). The two rivers confluence just upstream from Lake Winnebago with the Wolf River contributing approximately 65% of the total flow (Stecker, 1972).

Lake Winnebago, which separates the upper portion of the basin from the lower Fox River, is the largest inland lake in Wisconsin with a length of 28 miles and an area of 215 square miles. Although shallow, it has considerable importance for all types of recreation associated with surface waters.

The lower Fox River (see Figure 1 enclosed inside back cover) descending downstream from Lake Winnebago drains only 413 square miles, which accounts for only 6 percent of the total drainage basin. This unusually small portion of the river system is thought to have developed by the postglacial course change of the upper Fox and Wolf Rivers into a relatively small preglacial stream, creating thus a large river steeply descending over eight successive rapids. Ready availability of water and energy have created most favorable opportunities for industrialization, and in particular for the development of one of the largest concentrations of the paper and pulp industry. The eight rapids of the old lower Fox River are associated today with the eight manufacturing centers along the river--Neenah, Menasha, Appleton, Kaukauna, DePere, Kimberly, Little Chute, Combined Locks and Little Kaukauna.

The lower Fox River system (see Figure 2) referred to in this study is a 33 mile long stretch of the river with 12 dams, 14 navigation locks, multiple water users and pollutants. Its hydrological regime is considerably different from the upstream part

Figure 2



of the basin, due to the presence of both the natural reservoir of Lake Winnebago and along this river section the navigation and hydroelectrical development resulting in a sequence run of pools each having controlled inputs. In its last 7 miles, between DePere and Green Bay, the river is sufficiently large to be subject to seiche waves, a phenomenon very similar to tides in an ocean, causing long period oscillations of the river similar to the waves caused by tides in an estuary. The industrial and political importance of the lower Fox River valley is best demonstrated by the fact that this 6% of the total drainage basin includes nearly all of its urban (200,000 population) and water-oriented industrial development. Inadequate treatment of waste water by industries and municipalities over prolonged periods of time has seriously degraded the water quality of the lower Fox River, to the extent that virtually along the entire stretch of the river water-contact sports and fishing activities are severely limited. To improve the situation the State of Wisconsin Department of Natural Resources recently issued orders in 1968, 1969 and 1970 to the industries and municipalities on the lower Fox River for the construction of adequate treatment facilities, in keeping with the state water quality standards and the recommendations of the Lake Michigan Enforcement Conference. The exact impact of these orders is not known at this time, since it is not likely that their complete implementation will be achieved in the near future by both industries and municipalities. Whatever the impact of these orders will be, it is clear that in order to achieve the established water quality goals, more extensive monitoring, analysis and management efforts will be required, along with the construction and efficient operation of improved treatment facilities.

WATER QUALITY AND UTILIZATION

Water Users and Pollution

Water entering the lower river from the shallow, eutrophic Winnebago pool is already turbid and heavily laden with nutrients. In spring, total phosphate discharge may reach 800,000 pounds (Sager and Wiersma, 1974). This nutrient loading, imposed through discharges from Lake Winnebago, is the most serious long-term hazard posed by the Fox River to Lake Michigan. On occasion the surface water treatment plant at Appleton has been forced into exceptional operational measures in order to overcome the effects of remarkable algae blooms encountered on Lake Winnebago in later summer.

Flow Regulation

Flow from the Winnebago pool is regulated at the Neenah and Menasha dams by the Corps of Engineers. Records from a stream flow gaging station at the Rapids Croche Dam operated by the U.S. Geological Survey show the variability of the flow. The monthly mean flow ranges from a maximum of 7000 cfs in April to a minimum of 2300 cfs in September. A more complete range of the monthly mean flows can be seen in Figure 1, which includes reservoir release data from 1896-1970.

The maximum recorded flow of 24,000 cfs was observed on April 18, 1952 and the absolute minimum of 138 cfs was recorded on August 2, 1936. While solid ice cover is found over portions of the lower river for up to one month of the year, temperatures may reach 27°C in late summer.

Water Use

Total water demand in the valley is very high. For example, it has been estimated that in 1959 (Knowles, 1964), for the Green Bay area alone total water demand exceeded 495 mgd or 755 cfs. Over 98 percent of this was taken from surface sources, with 12.6 percent from the river and 83.8 percent from the Green Bay. Average municipal water pumpage in the Neenah-Menasha and Appleton areas has been estimated at 20 mgd and total use undoubtedly runs many times higher.

Enormous industrial water demands are placed upon the lower Fox River. The largest users are the pulp and paper mills for process water and power stations for cooling water. Other wet industries include shipping, foundries, canning, meat packaging, cold storage, dairy products, sugar, soap, furs, leather and beer.

The paper making industry requires high quality waters as well as large volumes, as illustrated in Table 1, taken from a survey of paper mill water requirements conducted by the Technical Association of the Pulp and Paper Industry (Miller, 1940) and showing the usual limits of turbidities, chlorides, dissolved solids, total solids and pH in process water used in several types of paper mills.

Table 1.
(USUAL LIMITS)
SUMMARY OF SPECIFICATIONS/FOR CHEMICAL COMPOSITION OF
PROCESS WATERS FOR MANUFACTURE OF VARIOUS PAPERS

Substance (Amounts given in mg/l)	Ground- wood Paper	Soda and Sulphate Pulps	Kraft Paper		Fine Paper
			Bleached	Unbleached	
Turbidity as SiO ₂	50*	25*	40	100	10
Color in platinum units	30	5	25	100	5
Total hardness as CaCO ₃	200	100	100	200	100
Calcium hardness as CaCO ₃	--	50	--	--	50
Magnesium hardness as CaCO ₃	--	50	--	--	--
Alkalinity to methyl orange as CaCO ₃	150	75	75	150	75
Iron as Fe	0.3	0.1	0.2	1.0	0.1
Manganese as Mn	0.1	0.05	0.1	0.5	0.05
Silica (soluble as SiO ₂)	50	20	50	100	20
Total dissolved solids	500	250	300	500	200
Free carbon dioxide as CO ₂	10	10	10	10	10
Chlorides as Cl	75	75	200	200	--
Residual chlorine as Cl ₂	--	--	--	--	2.0

*Materials causing turbidity shall not be gritty.

Specifications for chemical compositions of process waters for the manufacture of various papers has been approved as a set of tentative standards by the Water Committee of the Technical Association of the Pulp and Paper Industry. All of the values in the table have been found to be acceptable by paper mills, with the possible exception of the 2.0 mg/1 limit for residual chlorine for waters used in the making of fine paper. Chlorine concentrations greater than 0.3 mg/1 may have effects where dyes are used.

Because of the demand for high quality waters extensive treatment is required for municipal, industrial process and boiler feed water preparation. These treatments, including the addition of corrosion inhibitors, algicides or slimicides result in large volumes of chemical sludges. Some pollution also results from the use of surface water as a coolant.

Domestic water supply is not a major use of the lower Fox River. Neenah-Menasha and Appleton intake surface waters from Lake Winnebago. Appleton provided this intake with a by-pass around Little Lake Butte Des Mortes in 1962. Green Bay withdraws most of its water from Lake Michigan and other communities obtain their supplies entirely from wells.

Users of River Assimilative Capacity

The major industrial water users and waste water generators in the valley are the paper and pulp mills. Effluent from processes may present oxygen demands and solids loadings on the river, but contain relatively little nitrogen and phosphorous.

Actually, oxygen demand is contributed preferentially from pulping operations, and solids turbidity from paper making. Fiber may be contributed by either process. Although the mills do treat their wastes and/or discharge them through municipal systems, much of the waste material still does reach the river. In Table 2 the waste loadings from 17 pulp and paper mills discharging into the lower Fox River are summarized for a ninety-day period in 1972. Two other mills, the Wisconsin Tissue Mills and the

TABLE 2. INDUSTRIAL WASTE LOADINGS

Section Number	Industry	Miles above Mouth	Total Production tons/day		Production Process	Manufacturing Process		Fraction of Production%		Treatment Facilities		Total Effluent		
			Paper	Board Pulp		Product	Process	1972	Future	Primary 1972	Secondary Future	Flow MGD	BOD5 lb/day	SS lb/day
1	Kimberly-Clark Neenah Division	38.4	50	-	VII 2	Bond	100	-	M	-	M	0.7	43	113
2	Kimberly-Clark Badger Globe	38.2	65	-	VII 4	Tissue & towels	100	-	M	-	M	0.5	153	346
2	Bergstrom Paper Company	38.1	300	-	V VII 3	Book & Bond	50 50	CL-DF	CL-DF	-	M	5.0	21580	11362
4	Gilbert Paper Company	38.0	80	-	VII 2	Bond	100	-	M	-	M	0.7	5	2250
5	John Strange Paper Company	37.9	-	300	VI	Paperboard	100	-	M	-	M	1.4	960	3056
3	Kimberly-Clark Lakeview	37.5	230	-	VII 4	Tissue & towels	100	CL	CL	-	-	4.9	499	246
6	George A. Whiting Company	37.1	20	-	VII 2	Bond	100	CL	CL	-	-	0.15	200	-
-	Wisconsin Tissue Mills	36.9	85	-	V VII 4*	Tissue	100	M	M	M	M	-	-	-
13	Riverside Paper Company	31.4	90	-	V	Bond	100	-	M	-	M	0.35	-	-
14	Consolidated Paper Interlake Div.	30.6	-	-	II	Pulp	100	-	M	-	M	5.3	17840	13300
17	Kimberly-Clark	27.3	530	-	IV VII 3	Book & Publication	15 85	CL	CL-C	-	-	11.0	18459	48170
20	Appleton Paper Inc.	25.6	480	-	IV VII 3	Publication	40 60	-	CL-DF	-	-	5.1	23591	40827
23	Thilmany Paper Company	23.2	515	-	I VII 5	Specialty	75 25	-	CL-DF	-	AL	21.0	26157	28061
33	Nicolet Paper Company	7.3	118	-	VII x	Dense Papers	100	CL-DF	CL-DF	-	-	2.5	589	439
-	U.S. Paper Mills	6.9	-	47	VI	Paperboard	100	M	M	M	M	-	-	-
39	Fort Howard Paper Company	3.6	850	-	V VII 4	Tissue & towels	85 15	-	CL	-	AL-SCL	10.3	52957	30793
41	American Can Company	1.0	450	-	II VII 4	Tissue & towels	50 50	SP	SP	-	M	16.6	53158	15979
41	Charmin Paper Company	1.0	997	-	II VII 4	Tissue & towels	50 50	C-I	C-I	-	M	12.5	48650	18638
43	Green Bay Packaging	0.7	-	285	III	Corregating Medium	100	Closed System	Reverse Osmosis	Reverse Osmosis	Reverse Osmosis	3.0	4439	1332

TRIATMENT CODES

C = centrifuge
 CL = clarifier
 DF = disk sludge filter
 I = incenerator

*Tissue from waste paper and purchased pulp

AL = aerated lagoon
 SCL = secondary clarifier
 SP = sludge pond
 M = to municipal plant

U.S. Paper Mills, are also listed to show their contribution to paper and pulp production, even though they have no direct discharge into the river.

Table 2 lists the paper and pulping mills beginning at Neenah and continuing to Green Bay by mile point above the mouth of the river. The combined total production figures of 5492 tons per day make this one of the great concentrations of paper making in the world. Many of the products are of a specialty or high quality nature and through the years have reflected the ingenuity of the valley people.

Only 3321 tons per day of pulp is actually digested in plants along the lower Fox River, showing that about 40 percent of the fiber being used at this time is brought in from other pulping operations. However, of the pulp that is digested along the river, it might be of interest to note that 52 percent is a result of the recycling of waste paper as indicated by the delinking and waste paper production processes.

The production processes referred to in Table 2 represent a slight modification of the classification system set up in the Effluent Limitation Guideline for the Refuse Permit Program for the Pulp and Paper Industry established in June of 1972. A table displaying the classification system can be found in Appendix A.

The following listing illustrates the multiple use categories for end products shown in Table 2:

Tissue	Books & Publications	Board
Tissue & Towel	Specialty	Pulp
Bond	Dense Papers	

The next section of the table summarizes the available and projected wastewater treatment facilities of the mills. In general, only primary clarification was available at the time the data were assembled. This situation is changing as individual mills either improve treatment capabilities or direct their wastes into combined municipal-industrial facilities. The "M" denotes such combined treatment. A plant of this type is under

construction by the Green Bay Metropolitan Sewage District. Table 3 provides the key used to identify production processes shown in Table 2.

Hydroelectric Power

Historically, the operation of hydroturbines at dam sites along the lower Fox River was an important factor in the development of the region; numerous facilities remain today and are summarized in Table 4. In general, the operation of hydropower stations does not impose a direct pollutional load on the stream, although the initial creation of impoundments may have reduced the natural capability for self-purification.

The number of electrical power generation stations in operation on the lower Fox River has been decreasing over the years. The common situation has been that when a turbine-generator unit breaks down it is not repaired since power can be purchased elsewhere at less than the repair cost. There are presently between 12 and 15 separate generating stations in operation. Table 4 summarizes the information obtained on these stations. The installed flow capacities reflect both electrical power generation and mechanical drives for other purposes.

The owners of the power stations can be divided into three classes: industrial, publicly owned utility, and privately owned utility. They produce electricity for commercial, residential, and industrial use. In some cases power is produced exclusively for an individual company while in other cases it is sold to various users.

Under the present operating conditions the cost of obtaining electricity from hydropower is typically 0.55 cents per KW hour or about one-half as costly as purchased electricity.

As mentioned earlier, the Corps of Engineers regulates the amount of flow in the lower Fox River at the Neenah and Menasha dams. Hydroelectric information is relayed from the Corps of Engineers to the various power interests by the consulting firm of Orbison and Orbison Consultants, Inc. Information such as the level of Lake Winnebago and river flow is provided to give the power interests an idea of how

TABLE 3

IDENTIFICATION

PRODUCTION PROCESS

I	KRAFT PULPING AND THE MANUFACTURE OF: 1. Coarse Paper and Liner Board 2. Newsprint 3. Bleached & Unbleached Grades 4. Bleached Grades
II	SULFITE PULPING AND THE MANUFACTURE OF: 1. Paper 2. Dissolving Pulp
III	NEUTRAL SULFITE SEMI-CHEMICAL 1. Bleached (Chemi-groundwood)
IV	GROUNDWOOD 1. Unbleached 2. Bleached
V	DEINKING MILL
VI	PAPERBOARD (No Deinking)
VII	PAPER MANUFACTURE (From Purchased Pulp) 1. Coarse 2. Fine (8% filled) 3. Book (8% filled) 4. Tissue 5. Specialty 6. Wastepaper
VII _x	GLASSINE, GREASE PROOF

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VII _x	GLASSINE, GREASE PROOF

Table 4

Electrical Power Generation on the Lower Fox River

Dam	Power Station Owner	Owner Class*	Turbine Flow Capacity CFS	Generator Capacity KW	Number of Turbines
Ncenah	Bergstrom Paper Co.	I	0	0	
Menasha	George A. Whiting Paper Co.	I	**	250	2
Upper Appleton	Wisconsin-Michigan Power Co.	U	1980	1440	3
Upper Appleton	Kimberly-Clark Corp.	I	2300	1650	3
Middle Appleton	Appleton Woolen Mills	I	0	0	
Middle Appleton	Fox River Paper Corp.	I	2100	1315	7
Lower Appleton	Foremost Dairies, Inc.	I	**	120	2
Lower Appleton	Consolidated Papers, Inc.	I	**	480	**
Kimberly	Kimberly-Clark Corp.	I	4000	1600	3
Little Chute	Kaukauna Electric and Water Dept.	P	**	3300	3
Combined Locks	Appleton Papers, Inc.	I	2370	2890	7
Upper Kaukauna	Kaukauna Electric and Water Dept.	P	4000	5600	4
Lower Kaukauna	Kaukauna Electric and Water Dept.	P	**	4800	2
Rapide Croche	Kaukauna Electric and Water Dept.	P	**	2400	4
Depere	Nicolet Paper Corp.	I	**	1122	**

* I=Industrial, P=Publicly Owned Utility
U=Privately Owned Utility

** Not able to obtain information.

much water will be available for power generation in the near future.

The total installed generator capacity on the lower Fox River represents 6 percent of the design value of the nuclear power station at Two Creeks. The Fox, as a primary source of power, is much less important today than it was in the past. In fact, at a typical flow condition of 2000 cfs, the total power output would be about 25,550 hp having a dollar value of about \$125 per hour. This situation serves to illustrate why the older units have not been repaired, but rather were abandoned as power generators.

The marginal value of the power generated may be increased by shifting hydro-power to serve for peaking to provide a load leveling capability for thermo-power stations. This practice requires adequate automatic gating and control provisions at the machine and causes added fluctuation in impoundment levels.

The structures already installed to provide for navigation and power generation can be used to improve water quality by introducing additional oxygen to the waters through turbine venting. Efforts are currently underway to establish the limits of quality improvement possible through this method.

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"FOX RIVER..." WISC

A DIFFUSION MODEL FOR GREEN BAY, LAKE MICHIGAN,
WISCONSIN UNIV., MADISON. MARINE STUDIES CENTER.
W. F. AHRNSBRAK.

SEA GRANT TECHNICAL REPORT NO. 7 (WIS-SG-71-207), AUGUST 1971. 81 P, 31 FIG,
6 TAB, 34 REF.

DESCRIPTORS

*WATER POLLUTION, *BAYS, *DIFFUSION, *MODEL STUDIES, SEICHES, SEASONAL,
LAKE MICHIGAN, WATER POLLUTION EFFECTS, FRESHWATER, COMPUTER PROGRAMS,
MATHEMATICAL MODELS, MIXING, EFFLUENTS, TURBULENCE.

IDENTIFIERS

*GREEN BAY(WIS), FOX RIVER(WIS).

ABSTRACT

THE EFFECTS AND RELATIVE ROLES OF VARIOUS CIRCULATION FEATURES AS DISPERSIVE MECHANISMS IN GREEN BAY, LAKE MICHIGAN WERE EXAMINED AND EVALUATED. GREEN BAY, WITH ITS LONG, NARROW SHAPE, IS PARTICULARLY AMENABLE TO A ONE-DIMENSIONAL ANALYSIS BECAUSE POLLUTANTS MARK THE FOX RIVER WATER ENTERING AT ITS HEAD. DIFFUSIVITIES CALCULATED ON THE BASIS OF A MATHEMATICAL MODEL OF SEICHE-INDUCED AND WIND-DRIVEN CIRCULATION AGREE WITH THOSE CALCULATED FROM THE CONCENTRATION GRADIENTS OF FOX RIVER WATER, SUGGESTING THAT HIGH DIFFUSIVITY VALUES IN THE BAY'S CENTRAL PORTION ARE PRIMARILY DUE TO SEICHE ACTIVITY. EFFECTIVE DISCHARGE FOR FOX RIVER EFFLUENT INTO GREEN BAY TAKES PLACE NEAR LONG TAIL POINT RATHER THAN AT THE RIVER MOUTH. A SIGNIFICANT PORTION OF POLLUTANTS ENTERING GREEN BAY THROUGH THE FOX RIVER ARE BEING TRANSPORTED INTO LAKE MICHIGAN. TIME REQUIRED FOR THE CENTRAL PORTION OF THE BAY TO RESPOND TO CHANGES IN FOX RIVER DISCHARGE RATE AND TO CHANGES IN POLLUTANT CONCENTRATION, WITHOUT CHANGING THE DISCHARGE OF THE FOX RIVER ARE CALCULATED AS 400 DAYS. DURING THE WINTER ICE SHIELDS THE WATER FROM WIND EFFECTS AND GREATLY DECREASES THE EFFECTIVENESS OF TURBULENCE AS A DISPERSIVE AGENT. (JONES-WISCONSIN)

FIELD 05C, 02H

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W72-10077

"FOX RIVER..." WISC

MIXING PROCESSES IN GREEN BAY,

WISCONSIN UNIV., MADISON. MARINE STUDIES CENTER.

W. F. AHRNSBRAK, AND R. A. RAGOTZKIE.

UNIVERSITY OF WISCONSIN SEA GRANT PROGRAM REPRINT WIS-SG-71-312 FROM PROCEEDINGS THIRTEENTH CONFERENCE ON GREAT LAKES RESEARCH, APRIL 1970, BUFFALO, NEW YORK, INTERNATIONAL ASSOCIATION FOR GREAT LAKES RESEARCH P 880-890, 1970. 8 FIG, 3 TAB, 14 REF.

DESCRIPTORS

*MIXING, *WATER QUALITY, *WATER TYPES, *BAYS, *LAKE MICHIGAN, WATER POLLUTION SOURCES, MODEL STUDIES, ANALYTICAL TECHNIQUES, CHEMICAL ANALYSIS, DIFFUSION, CONDUCTIVITY, SEDIMENT TRANSPORT, HYDROLOGIC DATA, SEDIMENTATION, DATA COLLECTIONS.

IDENTIFIERS

*GREEN BAY(LAKE MICHIGAN).

ABSTRACT

A ONE-DIMENSIONAL DIFFUSION MODEL BASED ON THE PRINCIPLE OF CONSERVATION OF MASS WAS APPLIED TO GREEN BAY, LAKE MICHIGAN. OBSERVED DIFFUSIVITIES WERE COMPARED WITH THOSE PREDICTED ON THE BASIS OF SFICHE ACTIVITY. DIFFUSIVITIES IN THE VICINITY OF LONG TAIL POINT WERE APPROXIMATELY 250,000 SQ CM/SEC WITH AN ABRUPT JUMP TO 1 MILLION SQ CM/SEC A FEW KM FARTHER INTO THE BAY AND GRADUALLY INCREASING TO 3 MILLION SQ CM/SEC IN THE CENTRAL PART OF THE BAY. ELECTRICAL CONDUCTIVITY AND LIGHT TRANSMISSIVITY WERE USED TO OBSERVE THE DISTRIBUTION OF FOX RIVER WATER IN THE BAY. HIGHEST CONCENTRATION GRADIENTS (40% KM) WERE FOUND IN THE VICINITY OF LONG TAIL POINT AND ALONG THE EASTERN SHORE OF THE SOUTHERN END OF THE BAY. NO APPRECIABLE TRANSVERSE GRADIENTS WERE FOUND IN THE MID AND NORTHERN PORTION OF THE BAY. (WOODARD-USGS)

FIELD 02H, 02J, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-13828

"FOX RIVER..." WISC

THE ECONOMICS OF QUANTITY VS QUALITY IN GREEN BAY,

WISCONSIN UNIV., MADISON. MARINE STUDIES CENTER.

VICTOR L. ARNOLD.

IN: PROCEEDINGS OF THE THIRTEENTH CONFERENCE ON GREAT LAKES RESEARCH, APRIL 1970, BUFFALO, NEW YORK, INTERNATIONAL ASSOCIATION, GREAT LAKES RESEARCH, P 141-144. 5 REF.

DESCRIPTORS

*LAKE MICHIGAN, *ESTUARIES, *WATER RESOURCES, *MANAGEMENT, *ECONOMICS, WATER UTILIZATION, WATER POLLUTION, PLANNING.

IDENTIFIERS

GREEN BAY.

ABSTRACT

PHYSICAL, CHEMICAL, BIOLOGICAL AND SOCIO-ECONOMIC RESEARCH IS BEING INTEGRATED THROUGH SYSTEMS ANALYSIS TO IDENTIFY AND MEASURE IN PHYSICAL AND ECONOMICAL TERMS THE INTERRELATIONSHIPS BETWEEN RESOURCE USE AND ABUSE AND THE ENVIRONMENT OF GREEN BAY, AN ESTUARY OF LAKE MICHIGAN. PUBLIC POLICY RECOMMENDATIONS AND DEVELOPMENT OF ALTERNATIVES TO ALLOW PUBLIC DECISION AND POLICY MAKERS, TO BE MORE FULLY AWARE OF QUANTITY VS QUALITY ARE INCLUDED IN THIS ANALYSIS. (SEE ALSO W71-11474)
(FNSTGN-PAI)

FIELD 02H, 02L

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-11473

CHANGES IN THE ENVIRONMENT AND BIOTA OF THE GREAT LAKES,

WISCONSIN UNIV., MADISON.

A. M. SEFTON.

EUTROPHICATION: CAUSES, CONSEQUENCES, CORRECTIVES, P 150-187. PRINTING AND PUBLISHING OFFICE, NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D C, 1969. 15 FIG, 1 TAB, 76 REF.

DESCRIPTORS

*SEDIMENTS, *EUTROPHICATION, *GREAT LAKES, LAKE MICHIGAN, LAKE SUPERIOR, LAKE HURON, LAKE ERIE, LAKE ONTARIO, NITRATES, WATER POLLUTION SOURCES, WATER POLLUTION EFFECTS, PHYSICOCHEMICAL PROPERTIES, BENTHOS, FISH POPULATIONS, DISSOLVED SOLIDS, DISSOLVED OXYGEN, SULFATES.

IDENTIFIERS

CHLORIDES, LITERATURE REVIEW, GREEN BAY, SAGINAW BAY.

ABSTRACT

ALTHOUGH CONCERN OVER CHANGES IN THE GREAT LAKES HAS EXISTED FOR MANY YEARS, THE IDEA THAT THE LAKES ARE UNDERGOING ACCELERATED EUTROPHICATION IS RECENT. ENVIRONMENTAL CHANGES CAN BE CONSIDERED IN THREE CATEGORIES: POLLUTION OF INSHORE AREAS, LONG-TERM CHANGES IN OPEN WATERS, AND CHANGES IN SEDIMENTS. ON THE BASIS OF ACCEPTED PHYSICOCHEMICAL CHARACTERISTICS, LAKES SUPERIOR, MICHIGAN, AND HURON ARE OLIGOTROPHIC, LAKE ERIE IS EUTROPHIC AND LAKE ONTARIO IS IN AN INTERMEDIATE CONDITION. SUPERIOR REMAINS OLIGOTROPHIC, EXCEPT FOR LOCALIZED POLLUTION; CHANGES IN FISH STOCKS ARE TRACEABLE TO COMMERCIAL FISHING AND PREDATION BY LAMPREY. LAKES MICHIGAN AND HURON HAVE UNDERGONE CHANGES INVOLVING DISSOLVED OXYGEN, TOTAL DISSOLVED SOLIDS AND BIOTA WHICH INDICATE INCREASING EUTROPHY, ESPECIALLY IN GREEN AND SAGINAW BAYS. LAKE ERIE HAS SHOWN MAJOR CHANGES IN LIMNOLOGICAL FACTORS AND BIOTA; EFFECTS OF INCREASED POLLUTION AND EUTROPHICATION OF ERIE HAVE SPREAD TO LAKE ONTARIO. THE MOST IMPORTANT CHANGES APPARENTLY ARE THOSE OCCURRING IN SEDIMENTS OWING TO THE CONTRIBUTION OF LARGE QUANTITIES OF ALLOCHTHONOUS MATERIALS RESULTING FROM URBANIZATION AND INDUSTRIALIZATION. CHANGES IN SEDIMENTS ARE IMPORTANT FACTORS IN THE OBSERVED CHANGES IN LIMNOLOGICAL FACTORS AND FISH POPULATIONS. ABATEMENT OF PRESENT CONDITIONS IN LAKE ERIE IS THEORETICALLY POSSIBLE. (SEE ALSO W70-03975). (VOIGTLANDER-WISCONSIN)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W70-07269

"FOX RIVER..." WISC

THE EUTROPHICATION PROBLEM,

WISCONSIN UNIV., MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.

A. M. BEFTON, AND W. T. EDMONDSON.

JOURNAL FISHERIES RESEARCH BOARD OF CANADA, VOL 29, NO 6, P 673-682, JUNE 1972. 6 FIG, 1 TAB, 28 REF.

DESCRIPTORS

*EUTROPHICATION, *NUTRIENTS, LAKE MICHIGAN, *NITROGEN, *DIATOMS, *FISH, LAKE ERIE, OLIGOTROPHY, SEWAGE, LAKE HURON, LAKE ONTARIO, SAGINAW BAY, GREEN BAY, *PLANKTON, *WATER POLLUTION EFFECTS, PRODUCTIVITY, PHOSPHORUS, TROPIC LEVEL, DISSOLVED OXYGEN, OXYGEN, THERMAL STRATIFICATION, WATER POLLUTION, BENTHOS, SALTS, DISTRIBUTION PATTERNS.

IDENTIFIERS

COSCIINODISCUS RADIATUS, DIAPATOMUS OREGONENSIS, DIATOMA TENUF VAR. ELONGATUM, FRAGILARIA CAPUCINA, STEMPANOIDISCUS TENUIS, MELOSIRA BINDERANA, MELOSIRA GRANULATA, ASTERIONELLA FORMOSA, FRAGILRIA CROTONENSIS, MELOSIRA AMBIGUA, DIAPATOMUS MINUTUS, DIAPATOMUS SICILOIDES, HEXAGENIA, MYSTIS RELICTA, COREGONUS ARTEDI, COREGONUS CLUPEAFORMIS.

ABSTRACT

THE TROPHIC STATE OF A LAKE IS MAINTAINED BY CONTINUED INPUTS OF NUTRIENTS. IN VERY LARGE LAKES THE INSHORE ENVIRONMENTS ARE AFFECTED FIRST BY INCREASED NUTRIENT LOADING AND, DEPENDING UPON THE MORPHOLOGY AND MORPHOMETRY, GRADUALLY THE OFFSHORE WATERS ARE ALTERED. THE NEARSHORE WATERS OF LAKE MICHIGAN HAVE GREATER CONCENTRATIONS OF NITROGEN AND PHOSPHORUS AND A LOWER SILICA CONTENT THAN OPEN LAKE WATERS. DIATOMS ARE MORE ABUNDANT INSHORE THAN OFFSHORE, THE DOUBLING TIMES FOR DIATOM POPULATIONS ARE SHORTER INSHORE, AND SPECIES FAVORED BY NUTRIENT-RICH CONDITIONS ARE MORE ABUNDANT INSHORE. DATA ON PLANKTON, NITROGEN CONCENTRATIONS, AND FISH, FROM EARLY STUDIES ON LAKE ERIE, SHOW PROGRESSIVE CHANGES FROM THE SHORE LAKEWARD AND FROM THE WESTERN BASIN EASTWARD. (BYRD-BATTELLE)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W73-04403

"FOX RIVER..." WTSC

WATER RESOURCES OF WISCONSIN, ROCK-FOX RIVER BASIN,

GEOLOGICAL SURVEY, WASHINGTON, D.C.

R. D. COTTER, R. D. HUTCHINSON, F. L. SKINNER, AND D. A. WENTZ.

GEOLOGICAL SURVEY HYDROLOGIC INVESTIGATIONS ATLAS HA-360, 4 SHEETS, 1969.
TEXT, 19 FIG, 4 CHART, 3 TAB, 25 REF.

DESCRIPTORS

*WATER RESOURCES, *SURFACE WATERS, *GROUNDWATER, *WISCONSIN, WATER SUPPLY, WATER YIELD, AQUIFERS, STREAMFLOW, WATER QUALITY, WATER WELLS, WATER LEVELS, HYDROLOGIC BUDGET, LAKES, STREAMS, WATER UTILIZATION.

IDENTIFIERS

ROCK-FOX RIVER BASIN(WIS).

ABSTRACT

THE PHYSICAL ENVIRONMENT, AVAILABILITY, DISTRIBUTION, CHARACTERISTICS, MOVEMENT, QUALITY, WATER PROBLEMS, AND USE OF WATER WITHIN THE ROCK-FOX RIVER BASIN, WISCONSIN ARE DESCRIBED IN ORDER TO AID IN PLANNING FUTURE WATER MANAGEMENT WITHIN THE BASIN. GENERAL INFORMATION IS GIVEN ON THE BASIN, DERIVED FROM DATA OBTAINED FROM FEDERAL, STATE, AND LOCAL AGENCIES. IN ADDITION, NEW DATA WERE COLLECTED FROM AREAS WHERE AVAILABLE DATA WERE SCARCE. THE ROCK-FOX RIVER BASIN COVERS ABOUT 4,750 SQUARE MILES IN THE SOUTHEASTERN PART OF THE STATE. LARGE AMOUNTS OF GOOD QUALITY WATER ARE AVAILABLE IN THE ROCK-FOX RIVER BASIN. OF THE 31.4 INCHES OF AVERAGE ANNUAL PRECIPITATION THAT FALLS ON THE BASIN, ABOUT 6.6 INCHES OR 1,500 MGD RUNS OFF AS STREAMFLOW. GROUNDWATER IS AVAILABLE FROM 4 AQUIFERS IN THE BASIN: THE SANDSTONE AQUIFER, THE PLATTEVILLE-GALENA AQUIFER, THE NIAGARA AQUIFER, AND THE SAND AND GRAVEL AQUIFER. ANY OF THESE AQUIFERS IS CAPABLE OF YIELDING DOMESTIC AND STOCK SUPPLIES. THE SANDSTONE AQUIFER COMMONLY YIELDS OVER 1,000 GPM TO WELLS, AS DOES THE SAND AND GRAVEL IN THE LOWER ROCK RIVER VALLEY. BOTH GROUND- AND SURFACE WATER HAVE HIGH NATURAL HARDNESS; HIGH IRON CONTENT IS A LOCAL PROBLEM IN GROUNDWATER. SOME LAKES AND REACHES OF STREAMS ARE POLLUTED BY INDUSTRIAL, MUNICIPAL, OR DOMESTIC WASTES, RENDERING THEM LESS USEFUL AS WILDLIFE HABITAT AND FOR RECREATIONAL PURPOSES. TWO POTENTIAL PROBLEMS ARE FLOODING AND POLLUTION OF THE ARTESIAN SYSTEM. DATA ARE PRESENTED IN MAPS SCALED 1:1 MILLION, BLOCK DIAGRAMS, CROSS SECTIONS, GRAPHS, CHARTS, TABLES, AND TEXT.
(KNAPP-USGS)

FIELD 02F, 02F

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W70-06577

"FOX RIVER..." WISC

PUBLIC PERCEPTIONS OF WATER QUALITY,

WISCONSIN UNIV., MADISON. DEPT. OF AGRICULTURAL ECONOMICS.

ELIZABETH L. DAVID.

WATER RESOURCES RESEARCH, VOL 7, NO 3, P 453-457, JUNE 1971. 5 P, 2 REF.

DESCRIPTORS

*WATER QUALITY, *POLLUTANT IDENTIFICATION, *SURVEYS, *SOCIAL ASPECT

IDENTIFIERS

LAKE MICHIGAN, FOX RIVER.

ABSTRACT

A SURVEY WAS MADE OF A REPRESENTATIVE SAMPLE OF ADULTS IN WISCONSIN AS TO THEIR DESCRIPTION OF POLLUTION. THE RESPONDENTS WERE SELECTED TO BE REPRESENTATIVE OF BOTH THE URBAN COMPLEXES (ALONG LAKE MICHIGAN FROM THE ILLINOIS BORDER TO MILWAUKEE) AND THE MORE RURAL AREAS OF THE STATE. THE ANALYSIS OF THE DATA WAS OF THREE GENERAL TYPES: CROSS-TABULATIONS, AUTOMATIC INTERACTION DETECTOR ANALYSES, AND MULTIVARIATE (REGRESSION) ANALYSES. MOST RESPONDENTS WERE CONCERNED WITH THE RECREATIONAL ASPECTS OF WATER. WHEN ASKED WHAT WOULD INDICATE POLLUTION IN WATER, 40% OF THE RESPONDENTS CHOSE SCUM AND ALGAE, 25% CHOSE SUDS AND FOAM AND 20% CHOSE DARK, MURKY WATER. ONLY 1% MENTIONED CANS AND GLASS, 3% SAID WEEDS, AND 10% SAID DEBRIS. LESS MENTIONED WERE CHEMICALS OR DISEASE GERMS THAT ARE NOT DETECTED BY THE HUMAN SENSORY SYSTEM. A TABLE WAS PROVIDED WHICH INDICATED PERCENTAGES OF RESPONSES DEFINING POLLUTION IN TERMS OF GIVEN WATER ATTRIBUTES. (VEVEPKA-CORNELL)

FIELD 05G, 06B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-10869

"FOX RIVER..." WISC

WATER QUALITY PERCEPTION AND THE RECREATIONAL USES OF GREEN BAY, LAKE MICHIGAN,
WISCONSIN UNIV., GREEN BAY. REGIONAL ANALYSIS CONCENTRATION.

R. B. DITTON, AND T. L. GOODALE.

WATER RESOURCES RESEARCH, VOL 9, NO 3, P 569-579, JUNE, 1973. 3 FIG, 5 TAB,
14 REF.

DESCRIPTORS

*RECREATION, WATER UTILIZATION, PSYCHOLOGICAL ASPECTS, *LAKE MICHIGAN,
REGIONAL ANALYSIS, *WATER QUALITY, *ATTITUDES, *WISCONSIN, RECREATION
DEMAND.

IDENTIFIERS

*GREEN BAY(WIS).

ABSTRACT

ON THE BASIS OF A SURVEY OF RESIDENT HEADS OF 3,000 HOUSEHOLDS
THROUGHOUT THE FIVE WISCONSIN COUNTIES ADJACENT TO GREEN BAY, THE STUDY
IDENTIFIED HOW PEOPLE PERCEIVED GREEN BAY AS A RECREATION RESOURCE, HOW
THESE PERCEPTIONS DIFFERED AMONG GROUPS, AND HOW THESE PERCEPTIONS
RELATED TO RECREATIONAL USE PATTERNS. FISHING, SWIMMING, AND BOATING
RANKED AS THE MOST POPULAR ACTIVITIES. PARTICIPANTS IN SWIMMING AND
FISHING USED INLAND LAKES MORE FREQUENTLY THAN THEY USED THE BAY BY
RATIOS OF 3:1 AND 2:1, RESPECTIVELY. FOR BOATING, USE BETWEEN INLAND
LAKES AND THE BAY WAS EQUALLY DIVIDED. GROUPS DIFFERED SIGNIFICANTLY IN
DESCRIBING THE BAY AND ITS MOST BOTHERSOME PHYSICAL AND WATER QUALITY
CHARACTERISTICS. GENERALLY, PARTICIPANTS AND THOSE WHO USE THE BAY WERE
LESS APT TO CITE UNPLEASANT SMELL AND DEAD FISH AS MAJOR PROBLEMS AND
MORE APT TO CITE SUCH PROBLEMS AS WINDS, WAVES, AND CLOUDINESS.
COMPARISONS BETWEEN USER GROUPS SHOWED THAT SWIMMERS AND BOATERS
DIFFERED MOST IN THEIR PERCEPTIONS OF THE BAY, WITH THE FORMER MOST
OFTEN CITING DIRTY WATER AND JUNK ON THE BOTTOM OF THE BAY AND THE
LATTER MOST OFTEN CITING WINDS AND WEEDS. BOATERS WERE MOST TOLERANT OF
UNPLEASANT BAY CONDITIONS, SWIMMERS LEAST TOLERANT, AND FISHERMEN
BETWEEN THE TWO POSITIONS. THIS SUGGESTS A RELATIONSHIP BETWEEN THE
AMOUNT OF DIRECT WATER CONTACT OF AN ACTIVITY AND THE TOLERANCE LEVEL
OF THE ACTIVITY PARTICIPANTS. (HOFFMAN-NORTH CAROLINA)

FIELD 05G, 06B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W73-15024

"FOX RIVER..." WISC

MINOR ELEMENT GEOCHEMISTRY OF LAKE MICHIGAN FERROMANGANESE NODULES,

ARGONNE NATIONAL LAB., ILL., AND MICHIGAN UNIV., ANN ARBOR.

DAVID N. EDGINGTON, AND EDWARD CALLENDER.

EARTH AND PLANETARY SCIENCE LETTERS, VOL 8, NO 2, P 97-100, APRIL 1970. 4 P,
1 FIG, 1 TAB, 15 REF.

DESCRIPTORS

*BOTTOM SEDIMENTS, *LAKE MICHIGAN, *TRACE ELEMENTS, *GEOCHEMISTRY,
*MANGANESE, ARSENIC COMPOUNDS, EUTROPHICATION, ANALYTICAL TECHNIQUES,
SURVEYS, DISSOLVED OXYGEN, WATER CHEMISTRY, WATER QUALITY, WATER
POLLUTION EFFECTS.

IDENTIFIERS

MANGANESE NODULES, GREEN BAY.

ABSTRACT

SAMPLES OF FERROMANGANESE NODULES FROM SEVERAL LOCALITIES IN LAKE MICHIGAN WERE ANALYZED FOR THEIR MINOR ELEMENT CONTENT BY NEUTRON ACTIVATION TECHNIQUES. THE THORIUM AND URANIUM LEVELS IN LAKE MICHIGAN NODULES EXHIBIT MARKED DISSIMILARITIES WITH MARINE NODULES. THE RADIUM CONTENT OF THESE FRESHWATER NODULES IS SUBSTANTIALLY HIGHER THAN THE REPORTED MARINE VALUES. THE CONCENTRATIONS OF BARIUM IN THE LAKE MICHIGAN NODULES APPEAR TO BE ABNORMALLY HIGH, AND PATTERNS OBTAINED USING THE ELECTRON MICROPROBE SUGGEST IT IS EVENLY DISPERSED THROUGHOUT THE NODULES. THE AVERAGE ARSENIC CONTENT OF THESE FRESHWATER NODULES IS AT LEAST TWICE AS GREAT AS THAT REPORTED FOR HIGHLY OXIDIZED MARINE SEDIMENTS. IF ALL THIS ARSENIC IS DISSOLVED AND RELEASED INTO GREEN BAY AS A RESULT OF CHANGING ENVIRONMENTAL CONDITIONS (EUTROPHICATION), THE CONCENTRATION IN THE WATER OF GREEN BAY WOULD BE SEVERAL TIMES THE MAXIMUM PERMISSIBLE LEVEL FOR DRINKING WATER. (KNAPP-USGS)

FIELD 02H, 02K, 02J

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W70-06325

"FOX RIVER..." WISC

GREEN BAY, WISCONSIN—JOINT TREATMENT OF PULP MILL AND MUNICIPAL WASTES,
CHARMIN PAPER PRODUCTS CO., GREEN BAY, WIS.; AND GREEN BAY METROPOLITAN
SEWAGE DISTRICT, WIS.

C. R. FAULKENDER, J. F. BYRD, AND DAVID W. MARTIN.

JOURNAL OF THE WATER POLLUTION CONTROL FEDERATION, VOL 42, NO 3, P 361-370,
MARCH 1970. 7 FIG.

DESCRIPTORS

*PULP AND PAPER INDUSTRY, *TRICKLING FILTER, *MUNICIPAL WASTE, *WASTE
WATER TREATMENT, SEWAGE TREATMENT, INDUSTRIAL WASTE, PILOT PLANT, WASTE
TREATMENT, BIOCHEMICAL OXYGEN DEMAND, ACTIVATED SLUDGE, PULP WASTES.

IDENTIFIERS

*COMBINED TREATMENT, GREEN BAY(WIS), CONTACT STABILIZATION, KRAUSS
PROCESS, YEAST TREATMENT.

ABSTRACT

DEVELOPMENT OF THE WASTE TREATMENT PROCESSES AT THE CHARMIN PAPER MILL
PLANT IS GIVEN, BEGINNING WITH A YEAST PLANT CONSTRUCTED IN 1955 WHICH
WAS DESIGNED TO REMOVE 45-50% BOD. IN 1957 FURTHER REDUCTION IN BOD WAS
REQUIRED BY THE STATE. A MULTIPLE EFFECT EVAPORATOR CONCENTRATES THE
YEAST PLANT EFFLUENT FROM 10 TO 12% SOLIDS RANGE TO 55-60% RANGE. AT
THIS CONCENTRATION THE MATERIAL CAN BE ATOMIZED INTO SPECIALLY DESIGNED
BOILERS WHERE ORGANIC MATERIALS ARE BURNED. THE COMBINED FACILITIES
YEAST PLANT EVAPORATION AND BURNING REDUCED THE OVERALL EFFLUENT BOD
FROM PULPING TO MORE THAN 70%, AN AMOUNT OF 140,000 POUNDS OF BOD. FOR
FURTHER REDUCTION IN BOD, A LABORATORY AND PILOT-PLANT STUDY WAS MADE.
THE STUDY WAS MADE TO DETERMINE THE FEASIBILITY OF COMBINING THE
MUNICIPAL WASTE WITH THE INDUSTRIAL WASTE. INDIVIDUAL UNITS WERE FED:
(1) MUNICIPAL WASTE, (2) INDUSTRIAL WASTE, (3) COMBINED WASTE WITH
NUTRIENT ADDITION, AND (4) COMBINED WASTE WITHOUT NUTRIENT ADDITION.
THE INDUSTRIAL WASTE WAS ADJUSTED TO A PH OF 6.5 - 7.5. THE
INVESTIGATION DEMONSTRATED THAT CHARMIN WASTE WAS AMENABLE TO TREATMENT
IN COMBINATION WITH MUNICIPAL WASTE AT THE VOLUME RATIO OF 1:20 AND A
BOD RATIO OF 1:1. PRESENT RESEARCH PROGRAM IS STUDYING THE OPERATION
PARAMETERS OF FOUR DIFFERENT CONTINUOUS FLOW BIOLOGICAL PROCESSES FOR
COMBINED TREATMENT OF MUNICIPAL WASTE AND DILUTE WASTE FROM THE PULPING
PROCESS. THE TYPES ARE: (1) CONVENTIONAL, (2) CONTACT STABILIZATION,
(3) SEPARATION, AND (4) KRAUSS. (HANCUFF-TEXAS)

FIELD 050

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W70-06906

"FOX RIVER..." WISC

AN EXPLORATION OF PESTICIDES IN A LAKE MICHIGAN ECOSYSTEM,

WISCONSIN UNIV., MADISON. DEPT. OF WILDLIFE MANAGEMENT; AND WISCONSIN ALUMNI RESEARCH FOUNDATION, MADISON.

JOSEPH J. HICKEY, J. A. KEITH, AND FRANCIS B. COON.

J APPL ECOL, VOL 3 (SUPPL), P 141-154, 1966. 10 TAB, 28 REF. SUPPORTED BY BU SPT FISH AND WILDLIFE AND FISH AND WILDLIFE SERV.

DESCRIPTORS

*FOOD CHAINS, *PESTICIDE RESIDUES, PESTICIDE TOXICITY, TROPHIC LEVEL, FOOD PYRAMIDS, BOTTOM SEDIMENTS, AMPHIPODA, GULLS, OLD SQUAW DUCK, DOT. CHLORINATED HYDROCARBON PESTICIDES.

IDENTIFIERS

GREEN BAY(WIS), PENTOPOREIA AFFINIS, DDE, TDE.

ABSTRACT

ORGANOCHLORINE RESIDUES IN THE GREEN BAY AREA OF NORTH-WEST LAKE MICHIGAN HAVE BEEN INVESTIGATED. ANALYSES HAVE BEEN MADE OF: (1) SHALLOW AND DEEP WATER MUD SAMPLES, (2) THE AMPHIPOD PENTOPOREIA AFFINIS WHICH IS AN IMPORTANT FOOD SOURCE FOR FISHES, (3) ALEWIVES, WHITEFISH AND CHUB, AND (4) OLD-SQUAW DUCKS, RING-BILLED GULLS AND HERRING GULLS. THIS PRELIMINARY STUDY SHOWS THE BIOLOGICAL CONCENTRATION OF PESTICIDES PREVIOUSLY REPORTED FOR SMALLER LAKES. IN PENTOPOREIA THE CONCENTRATION FACTOR IS ABOUT 50 TIMES THAT OF THE RESIDUE LEVEL IN MUD (DDE INCREASES MOST), AND IN FISH THIS FACTOR IS INCREASED ROUGHLY 10 TIMES MORE STILL. AMONG BIRDS, ALL OF WHICH SPENT PART OF THEIR LIFE CYCLE OFF LAKE MICHIGAN, ORGANOCHLORINE LEVELS WERE PROGRESSIVELY HIGHER IN BRAIN, BREAST AND BODY FAT; IN OLD-SQUAW DUCKS, RING-BILLED GULLS AND HERRING GULLS; AND IN ADULT AS OPPOSED TO YOUNGER BIRDS. BODY FAT AVERAGED 2441 PLUS OR MINUS 334 PPM OF THE THREE COMPOUNDS IN TWELVE HERRING GULLS COLLECTED IN JUNE AND IN A SEEMINGLY HEALTHY CONDITION. (SJOLSETH-WASHINGTON)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W70-02353

"FOX RIVER..." WISC

BIOLOGICAL EVALUATION OF ENVIRONMENTAL QUALITY, GREEN BAY, LAKE MICHIGAN,
WISCONSIN UNIV., MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.

R. P. HOWMILLER, AND A. M. BESTON.

JOURNAL WATER POLLUTION CONTROL FEDERATION, VOL 43, NO 1, P 123-133, 1971. 8
FIG, 2 TAB, 18 REF.

DESCRIPTORS

*EVALUATION, *BIOLOGICAL COMMUNITIES, *OLIGOCHAETES, WATER POLLUTION
SOURCES, ENVIRONMENT, WATER POLLUTION EFFECTS, SAMPLING,
EUTROPHICATION, BENTHIC FAUNA, NEMATODES, AMPHIPODA, CLAMS, ISOPODS,
SNAILS, MIDGES, CADDISFLIES, TUBIFICIDS, LAKE MICHIGAN, MAYFLIES,
INVERTEBRATES, DIPTERA, LARVAE, WISCONSIN.

IDENTIFIERS

*GREEN BAY(WIS), FOX RIVER(WIS), LUMBRICULIDAE, NAIDIDAE, LEECHES,
HEXAGENIA, SPHAERTIDAE.

ABSTRACT

BENTHOS OF LOWER AND MIDDLE GREEN BAY (WISCONSIN) WERE SAMPLED IN MAY
1969 TO CORRESPOND WITH THE SAME DATE 17 YEARS EARLIER, USING THE SAME
STATIONS AND NEARLY IDENTICAL EQUIPMENT IN AN ATTEMPT TO ELIMINATE
DISCREPANCIES DUE TO DIFFERENT APPARATUS, METHODOLOGY AND SEASON OF
PAST STUDIES. IN 1952 OLIGOCHAETA ACCOUNTED FOR AN AVERAGE OF 66% OF
THE BENTHIC ORGANISMS FROM STATIONS 2 TO 10; IN 1969 AN AVERAGE OF 85%.
LEECHES WERE LESS ABUNDANT AND LESS WIDELY DISTRIBUTED IN 1969 THAN IN
1952. SNAILS OCCURRED AT TEN STATIONS IN 1952 BUT AT TWO IN 1969.
FINGERNAIL CLAMS WERE LESS ABUNDANT IN 1969 THAN IN 1952. WHILE NO
NAIAD CLAMS WERE REPORTED IN 1952, LAMPSILIS SILIQUOIDEA WAS FOUND AT
STATION 15 IN 1969. THE DISTRIBUTION OF AMPHIPODS, SIMILAR IN 1952 AND
1969, SHOWED MORE ABUNDANCE AND COMPRISED A LARGER POPULATION
PERCENTAGE IN 1952; HEXAGENIA HAS DISAPPEARED. THE MIDGES, POLLUTION
TOLERANT SECOND ONLY TO OLIGOCHAETA, DECREASED NEAR FOX RIVER MOUTH,
INCREASED NORTH OF LONG TAIL POINT, BUT DECREASED IN RELATIVE
IMPORTANCE. THUS BENTHIC INVERTEBRATES, OTHER THAN OLIGOCHAETA AND
CHIRONOMIDAE, WERE LESS ABUNDANT IN 1969 THAN 1952 SUGGESTING THAT THE
DETERIORATION OF THE BAY ENVIRONMENT IS CONTINUING. (JONES-WISCONSIN)

FIELD 050

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-09174

"FOX RIVER..." WISC

THE OLIGOCHAETE FAUNA OF GREEN BAY, LAKE MICHIGAN,

WISCONSIN UNIV., MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.

RICHARD P. HOWMILLER, AND A. M. BEETON.

PROCEEDINGS 13TH CONFERENCE ON GREAT LAKES RESEARCH, P 15-46, 1970. 31 FIG, 3
TAB, 39 REF.

DESCRIPTORS

*OLIGOCHAETES, *INDICATORS, *DISTRIBUTION PATTERNS, *EUTROPHICATION,
LAKE MICHIGAN, TUBIFICIDS, WATER POLLUTION EFFECTS, BENTHIC FAUNA,
GREAT LAKES, SAMPLING, POPULATION.

IDENTIFIERS

*GREEN BAY(WIS), LUMBRICULIDAE, NAIDIDAE.

ABSTRACT

THE BOTTOM OF GREEN BAY, AN ARM OF LAKE MICHIGAN, WAS SAMPLED AT 103 STATIONS, USING PONAR AND EKMAN GRABS. THE POPULATIONS OF OLIGOCHAETA, INCLUDING LUMBRICULIDAE, NAIDIDAE, AND TUBIFICIDAE SP, COMPRISED FROM 50% TO 60% OF THE BENTHIC MACROINVERTEBRATES. THE PRESENCE OF STYLODRILUS HERINGIANUS AND TUBIFEX KESSLERI WAS CHARACTERISTIC FOR THE NORTHERN, LESS EUTROPHIED PART OF THE BAY. THE POLLUTED LOWER END WAS DOMINATED BY LIMNODRILUS SP, PARTICULARLY L HOFFMEISTERI, WITH OCCASIONAL PRESENCE OF DERO DIGITATA. DECREASED EUTROPHICATION COINCIDED WITH FREQUENT OCCURRENCE OF AULODRILUS AMERICANUS, A PLURISETA, ILYODRILUS TEMPLETONI, PELOSCOLEX FREYI, AND P MULTISETOSUS. THE RESULTS OF THE STUDY SUPPORT THE THESIS THAT THE DISTRIBUTION PATTERN OF OLIGOCHATES SERVES AS A SENSITIVE INDICATOR OF ORGANIC POLLUTION AND SUBSEQUENT DEGREE OF WATER OXYGENATION. THIS PAPER CONTAINS 39 REFERENCES. (WILDE-WISCONSIN)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W71-11031

THE BENTHIC MACROFAUNA OF GREEN BAY, LAKE MICHIGAN,

WISCONSIN UNIV., MADISON.

R. P. HOWMILLER.

AVAILABLE FROM UNIV. MICROFILMS, INC., ANN ARBOR, MICH., 48106 ORDER NO. 71-24,465. PH. D. THESIS, 1971. P 241.

DESCRIPTORS

*BENTHIC FAUNA, *AQUATIC ANIMALS, *DISTRIBUTION PATTERNS, *LAKE MICHIGAN, *BIOINDICATORS, OLIGOCHAETES, MIDGES, WATER POLLUTION, SYSTEMATICS, FRESH WATER, INVERTEBRATES, GASTROPODS, CLAMS, CRUSTACEANS, AMPHIPODA, EUTROPHICATION, LAKE ERIE, MAYFLIES, TUBIFICIDS, ISOPODS, SAMPLING, GREAT LAKES, OLIGOTROPHY, WATER POLLUTION EFFECTS.

IDENTIFIERS

*GREEN BAY (WISC), FOX RIVER, BENTHIC MACROFAUNA, LEECHES, HIRUDINEA, HEXAGENIA, STYLODRILUS HERINGIANUS, LIMNODRILUS HOFFMEISTERI, AULODRILUS SPP., PELOSCOLEX SPP, POTAMOTHRIX SPP, CHIRONOMUS CF ATTENUATUS, CHIRONOMUS CF PLUMOSUS, PROCLADIUS CF CULICIFORMIS, TANYTARSUS SPP, HETEROTRISSOCLADIUS CF SUBPILOSUS.

ABSTRACT

THE MACROSCOPIC BENTHIC INVERTEBRATES OF GREEN BAY WERE STUDIED FROM GRAB SAMPLES TAKEN AT 113 STATIONS BETWEEN 1966 AND 1969. COMPARISON OF THE PRESENT FINDINGS WITH DATA FROM STUDIES DONE IN 1938-39 AND 1952 INDICATES THAT MANY TYPES OF INVERTEBRATES ARE LESS ABUNDANT AND WIDESPREAD NOW THAN TWO OR THREE DECADES AGO. EXCEPT FOR A SMALL AREA AROUND THE MOUTH OF THE FOX RIVER, THE MAJOR POLLUTING INFLOW, OLIGOCHAETA AND CHIRONOMIDAE ARE PRESENT IN GREATER NUMBERS THAN IN EARLIER YEARS. THE OBSERVED CHANGES ARE SIMILAR TO THOSE RECORDED FOR WESTERN LAKE ERIE AND ARE INDICATIVE OF INCREASED EUTROPHICATION AND POLLUTION. OLIGOCHAETA ARE THE MOST ABUNDANT MACROINVERTEBRATES IN THE BAY WITH THIRTY-ONE SPECIES RECORDED. SPECIES DISTRIBUTIONAL PATTERNS, WITH RESPECT TO KNOWN ENVIRONMENTAL PARAMETERS, ARE SIMILAR TO THOSE FOUND IN OTHER INVESTIGATIONS IN THE GREAT LAKES WITH STYLODRILUS HERINGIANUS AT THE OLIGOTROPHIC NORTHERN END OF THE BAY, LIMNODRILUS HOFFMEISTERI DOMINANT IN THE POLLUTED SOUTHERN END, AND AULODRILUS, PELOSCOLEX AND POTAMOTHRIX SPECIES REACHING THEIR GREATEST RELATIVE ABUNDANCE IN BETWEEN. TWENTY TAXA OF CHIRONOMIDAE HAVE BEEN FOUND. THE DOMINANT TAXA IN THE LOWER AND MIDDLE BAY BELONG TO GENERA (CHIRONOMUS, PROCLADIUS) COMMONLY ASSOCIATED WITH EUTROPHIC OR POLLUTED ENVIRONMENTS. THE UPPER BAY MIDGE FAUNA IS MORE DIVERSE WITH SOME STATIONS DOMINATED BY MESOTROPHIC OR OLIGOTROPHIC FORMS (TANYTARSUS, HETEROTRISSOCLADIUS CF. SUBPILOSUS). FURTHER SAMPLING, ON A SEASONAL BASIS, IS NECESSARY TO ACCURATELY DETERMINE THE ABUNDANCE AND DISTRIBUTIONAL PATTERNS OF THE LESS NUMEROUS WORM AND MIDGE SPECIES. (HOLDMAN-BATTELLE)

FIELD 05C, 02L

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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"FOX RIVER..." WISC

MERCURY LEVELS IN FISH FROM SELECTED WISCONSIN WATERS (A PRELIMINARY REPORT)

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.

STANTON J. KLEINFERT, AND PAUL F. DEGURSE.

RESEARCH REPORT 73, 1971. 16 P, 1 FIG, 3 TAB, 15 REF.

DESCRIPTORS

*HEAVY METALS, *STREAM POLLUTION, *PATH OF POLLUTANTS, *PUBLIC HEALTH, WISCONSIN, INDUSTRIAL WASTES, ENVIRONMENTAL SANITATION, WATER POLLUTIONEFFECTS, PULP WASTES, CHEMICAL WASTES, WALLEYE, SUCKERS, CATFISHES, SUNFISHES, YELLOW PERCH, FISH, FISH PHYSIOLOGY, LAKE MICHIGAN, LAKE SUPERIOR, MISSISSIPPI RIVER.

IDENTIFIERS

*MERCURY POLLUTION, *BIOCONCENTRATION, CONCENTRATION, MERCURY, REDHORSE FISH, CRAPPIE, GREEN BAY WISCONSIN.

ABSTRACT

MERCURY DETERMINATIONS WERE MADE ON FISH FILET SAMPLES FROM THROUGHOUT WISCONSIN AND FROM WISCONSIN'S BOUNDARY WATERS OF LAKE MICHIGAN, GREEN BAY, LAKE SUPERIOR AND THE MISSISSIPPI RIVER. ALL WISCONSIN FISH ANALYZED CONTAINED SOME MERCURY, WITH A RANGE OF 0.01 TO 0.60 PPM, AND AN AVERAGE OF 0.19 PPM. THE HIGHEST MERCURY LEVELS, AVERAGING 0.80 PPM, AND RANGING FROM 0.06 TO 4.62 PPM, OCCURRED IN FISH TAKEN FROM BELOW PAPER MILLS AND FROM BELOW A MERCURY CELL CHLOR-ALKALI PLANT. DIFFERENT SPECIES VARY IN MERCURY CONTENT, AND THE LARGER FISH OFTEN CONTAIN HIGHER CONCENTRATIONS THAN DO SMALLER FISH OF THE SAME SPECIES TAKEN FROM THE SAME WATER. WALLEYE, SUCKER, REDHORSE, CRAPPIE AND BULLHEAD FREQUENTLY SHOWED HIGHER MERCURY CONCENTRATIONS, WHILE THE PANFISHES SHOWED LOWER CONCENTRATIONS. IT IS ESSENTIAL, THEREFORE, THAT MERCURY LEVELS IN ALL IMPORTANT SPECIES IN THE FISHERY BE DETERMINED BEFORE THE POTENTIAL POLLUTION PROBLEM CAN BE ADEQUATELY ASSESSED.
(LEGORE-WASHINGTON)

FIELD 05C, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W71-08610

"FOX RIVER..." WISC

EXPLORING LAKE MICHIGAN WETLANDS,

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON. BUREAU OF RESEARCH.

STANTON J. KLEINERT.

WISCONSIN CONSERVATION BULLETIN, VOL 35, NO 1, JAN-FEB 1970, P 18 AND 19.
FIG.

DESCRIPTORS

*WETLANDS, WILDLIFE CONSERVATION, RECREATION DEMAND, COST-BENEFIT ANALYSIS.

IDENTIFIERS

*LAKE MICHIGAN, ATKINSON MARSH, GREEN BAY.

ABSTRACT

THE BENEFICIAL FEATURES OF LAKESHORE WETLANDS ARE EXPLORED AND THEIR USEFULNESS FOR BIRDS, FISH, HUNTERS, RECREATION AND STUDY ARE EXPLAINED. WITH MORE APPRECIATION FOR THE ROLE OF WETLANDS, PEOPLE ARE BECOMING MORE AWARE OF THE IMPORTANCE OF PRESERVING REMAINING WETLANDS. (HOLMES-RUTGERS)

FIELD 06D

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W71-09487

"FOX RIVER..." WISC

LAKE MICHIGAN BASIN STUDY: WISCONSIN SECTION.

LEAGUE OF WOMEN VOTERS, DETROIT, MICH. LAKE MICHIGAN INTER-LEAGUE GROUP.

LEAGUE OF WOMEN VOTERS, WISCONSIN, 1968. 10 P, 11 REF. (MIMEOGRAPHED).

DESCRIPTORS

*LAKE MICHIGAN, WISCONSIN, GEOLOGY, POPULATION, WATER RESOURCES DEVELOPMENT, LEGISLATION, WATER SUPPLY POLLUTION ABATEMENT, FLOOD CONTROL, ELECTRIC POWER, IRRIGATION, NAVIGATION, WATERSHED MANAGEMENT, INDUSTRIAL WASTES, SEWAGE TREATMENT, PULP WASTES, FISHING, WILDLIFE.

IDENTIFIERS

*NORTHEASTERN WISCONSIN, SOUTHEASTERN WISCONSIN, MILWAUKEE, GREEN BAY.

ABSTRACT

THE WISCONSIN SECTION OF THE LAKE MICHIGAN BASIN IS DESCRIBED WITH BRIEF SUMMARIES OF PHYSICAL CHARACTERISTICS, POPULATION CHARACTERISTICS, ECONOMIC CHARACTERISTICS AND WATER RELATED ACTIVITIES AND CHARACTERISTICS. INCLUDED ARE DESCRIPTIONS OF WATER SUPPLY, POLLUTION ABATEMENT, FLOOD CONTROL, POWER GENERATION, IRRIGATION, NAVIGATION, WATERSHED MANAGEMENT, RECREATION, FISH AND WILDLIFE. BECAUSE OF REGIONAL DIFFERENCES THE NORTHEASTERN AND SOUTHEASTERN SECTIONS OF WISCONSIN ARE CONSIDERED SEPARATELY. THE NORTHEASTERN SECTION CENTERS AROUND GREEN BAY. POPULATION IN THIS SECTION IS EXPECTED BY 2020 TO NEARLY DOUBLE THE 1960 LEVEL OF 778,000. PRINCIPAL OCCUPATIONS ARE LISTED AND BECAUSE OF THE IMPORTANCE OF LUMBER THE WASTE LOAD FROM PULP AND PAPER IS AN IMPORTANT CONTRIBUTION TO POLLUTION. THE SOUTHEASTERN SECTION HAS A POPULATION OF 1,674,000 AND WITH A 59.9 INCREASE EXPECTED BETWEEN 1963 AND 1990 IT IS ONE OF THE NATION'S FASTEST GROWING LARGE METROPOLITAN REGIONS. SIX MAJOR AND FIVE MINOR WATERSHEDS ARE LISTED WITH GROUNDWATER AS CONTRIBUTING TO THE WATER SUPPLY. IN MUCH OF THE REGION, FLOODING IS A RECURRING PROBLEM AND WITH CONTINUED URBANIZATION THIS IS EXPECTED TO INCREASE. APPROXIMATELY 59 OF URBAN DEVELOPED AREA IS SERVED BY FACILITIES FROM LAKE MICHIGAN. COMMERCIAL SHIPPING, CONFINED TO THE MILWAUKEE HARBOR AREA, IS DESCRIBED AS ARE RECREATIONAL AREAS. STATE CONTROL OF WATER RESOURCES BROUGHT ABOUT BY 1966 LEGISLATION IS DISCUSSED. FINALLY, THE WORK OF SOUTHEASTERN REGIONAL PLANNING IS REVIEWED. INCLUDED IS A STATEMENT FROM THE AGENCY PINPOINTING MUNICIPAL SEWAGE PLANTS AS THE MOST IMPORTANT SOURCES OF POLLUTION IN THE REGION. (PRECKWINKLE-CHICAGO)

FIELD 06B, 06F

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W70-09624

"FOX RIVER..." WISC

ROLE OF PHOSPHORUS IN EUTROPHICATION,

WISCONSIN UNIV., MADISON. WATER CHEMISTRY PROGRAM.

G. FRED LEE.

PRESENTED AT THE SYMPOSIUM OF AMERICAN CHEMICAL SOCIETY, DIVISION OF WATER AIR AND WASTE CHEMISTRY, LOS ANGELES, CALIFORNIA, APRIL 1970.

DESCRIPTORS

*PHOSPHORUS, *EUTROPHICATION, FERTILIZATION, AQUATIC PLANTS, MATHEMATICAL MODELS, SELF-PURIFICATION, ALGAE, GREAT LAKES, NUTRIENTS, SEDIMENTS, LAKE MICHIGAN, WATER POLLUTION SOURCES, WATER POLLUTION CONTROL, TROPHIC LEVELS, PHOSPHATES, DETERGENTS, BIOASSAY, ANALYTICAL TECHNIQUES, FORECASTING, SILICA.

IDENTIFIERS

FLUSHING, GREEN BAY(WIS), NITRILOTRIACETIC ACID, ALGAL ASSAY PROCEDURES, ALGAL GROWTH, IN-LAKE NUTRIENT CONTROL.

ABSTRACT

SIGNIFICANCE OF PHOSPHORUS AS THE KEY ELEMENT IN EXCESSIVE FERTILIZATION OF NATURAL WATERS IS PRESENTED AND ITS ROLE ON PLANT GROWTH IN LAKES. TOOLS TO ASSESS PHOSPHORUS AND OTHER ELEMENTS FERTILIZING NATURAL WATERS ARE MATHEMATICAL MODELS, ENZYMIC AND TISSUE ASSAY PROCEDURES. APPRAISAL OF NUTRIENT STATUS OF LAKES CAN BE MADE DURING FEBRUARY AND MARCH OF EACH YEAR IN TEMPERATE LAKES TO SHOW THE POTENTIAL PROBLEMS AND STEPS INITIATED TO CONTROL EXCESSIVE DISCHARGE OF NUTRIENTS. SEDIMENTS SERVE AS A SINK FOR PHOSPHORUS WITH THE NET FLUX OF PHOSPHORUS FROM LAKE WATER TO SEDIMENTS. CONTEMPLATED NUTRIENT REMOVAL PROJECTS SHOULD BE ASSOCIATED WITH SOME LABORATORY LEACHING TESTS ON LAKE SEDIMENTS AND RESULTS COMPARED WITH LAKE RECOVERY RATE UPON NUTRIENT REDUCTION. DEVELOPMENT OF MODELS FOR AQUEOUS ENVIRONMENTAL CHEMISTRY OF AQUATIC NUTRIENTS IN NATURAL WATERS IS ESSENTIAL TO IMPROVE THE PREDICTABILITY OF RELATIONSHIPS BETWEEN THE FLUX OF AQUATIC PLANT NUTRIENTS AND GROWTH OF ALGAE AND OTHER AQUATIC PLANTS. IN REPLACING PHOSPHATES IN DETERGENTS, THE PRIMARY PROBLEM IS THE PROCEDURE USED TO EVALUATE THE REPLACEMENT. (JONES-WISCONSIN)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCFSSION NO. W71-12072

SWIMMER'S ITCH,

WISCONSIN UNIV., MADISON. DEPT. OF BOTANY; AND WISCONSIN UNIV., MADISON.
DEPT. OF ZOOLOGY.

GERALD F. LEVY, AND JOHN WILLIAM FOLSTAD.

ENVIRONMENT, VOL 11, NO 10, P 14-21, 1969. 5 FIG, 1 TAB.

DESCRIPTORS

*HUMAN DISEASES, HOSTS, INFECTION, WATER POLLUTION EFFECTS, LAKES,
RIVERS, SWIMMING, SNAILS, WATERFOWL, BIRDS, MUSKRATS, DEEP, MICHIGAN,
COPPER SULFATE, WISCONSIN, CHEMCONTROL.

IDENTIFIERS

*CERCARIAE, *SCHISTOSOME DERMATITIS, MICE, GREEN BAY(WIS), FLATWORMS,
BLOOD FLUKES, AQUATIC SNAILS, SWIMMER'S ITCH, BAYLUSCIDE,
SCHISTOSOMIASIS.

ABSTRACT

SWIMMERS IN MANY NORTHERN LAKES FROM COAST TO COAST AS WELL AS THE
EXTREME SOUTH HAVE DEVELOPED SCHISTOSOME DERMATITIS, A NON-DEBILITATING
SKIN DISEASE CAUSED BY BLOOD FLUKE CERCARIAE, WHICH WHILE SEARCHING FOR
A BIRD, SNAIL, OR MAMMAL HOST ACCIDENTALLY PENETRATE THE SWIMMER'S
SKIN, ALTHOUGH MAN CANNOT ACT AS A HOST. THE DISEASE IS SPREADING DUE
TO EUTROPHICATION OF WATERS WHICH PROVIDES AN ENHANCED ENVIRONMENT FOR
AQUATIC PLANTS SUPPORTING THE INTERMEDIATE SNAIL HOSTS AND THE
CERCARIAE. COPPER SULPHATE AND COPPER CARBONATE HAVE BEEN USED TO
ERADICATE THE SNAILS BUT RESULTS ARE TEMPORARY AND HAVE INDUCED
UNDESIRABLE SIDE-EFFECTS SUCH AS THE MORTALITY OF CLAMS, WHICH COMPETE
WITH THE SNAIL FOR FOOD, AND FISHKILLS DUE TO ASPHYXIATION BECAUSE THE
DECAYING VEGETABLE MATTER, KILLED BY THE COPPER SALTS, REDUCES
DISSOLVED OXYGEN CONCENTRATIONS. COPPER COMPOUND TREATMENT MAY ALSO
PRODUCE MORE NOXIOUS FORMS OF ALGAE. SAFER, ALTHOUGH COSTLIER COMPOUNDS
SUCH AS BAYLUSCIDE, ARE BEING TRIED. NON-CHEMICAL MEASURES, SUCH AS THE
INTRODUCTION OF CERCARIAE RESISTANT SNAILS TO PREY ON THOSE INFECTED OR
COMPETE WITH THEM FOR FOOD ARE UNDER EXPERIMENT. A CONTINUING
COMPREHENSIVE RESEARCH PROGRAM IS REQUIRED TO FILL PRESENT GAPS IN
INFORMATION ON THE DISEASE-CAUSING PARASITE. (POWERS-WISCONSIN)

FIELD 050

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W70-05549

"FOX RIVER..." WISC

FIELD ASSESSMENT OF N₂-FIXATION BY LEGUMES AND BLUE-GREEN ALGAE WITH THE ACETYLENE REDUCTION TECHNIQUE,

WISCONSIN UNIV., MADISON. DEPT. OF BIOCHEMISTRY.

T. H. MAGUE.

PH.D. THESIS, 1971. 177 P, 17 FIG, 10 TAB, 67 REF. OWRR B-024-WIS(2).

DESCRIPTORS

*NITROGEN FIXATION, *ANALYTICAL TECHNIQUES, *LEGUMES, *CROPS, *EUTROPHICATION, *LAKES, *GAS CHROMATOGRAPHY, *CYANOPHYTA, AIR TEMPERATURE, TROPHIC LEVEL, SOYBEANS, GREAT LAKES, WATER POLLUTION EFFECTS, LAKES.

IDENTIFIERS

LIGHT INTENSITY, *NODULES, LAKE MENDOTA(WIS), TROUT LAKE, GREEN BAY(WIS), ACETYLENE REDUCTION ANALYSIS.

ABSTRACT

THE NITROGEN-FIXING ENZYME SYSTEM PRESENT IN NITROGEN-FIXING ORGANISMS HAS PREVIOUSLY BEEN SHOWN TO REDUCE ACETYLENE TO ETHYLENE IN STOICHIOMETRIC AMOUNTS. THE RELATIVELY SIMPLE EQUIPMENT REQUIRED FOR THE ASSAY HAS ALLOWED EXTENSIVE STUDIES OF NITROGEN-FIXATION IN THE FIELD. THE ACETYLENE REDUCTION ANALYSIS ON TWENTY SAMPLINGS FROM LAKE MENDOTA, WISCONSIN REVEALED TWO PEAKS TO N₂-FIXING ACTIVITIES WHICH WERE ASSOCIATED WITH THE PRESENCE OF FILAMENTOUS HETEROCYSTOUS BLUE-GREEN ALGAE. ALSO, THE TROPHIC LEVELS OF FOUR NORTHERN WISCONSIN LAKES WERE DEFINED IN TERMS OF THE RATES OF ACETYLENE REDUCTION. SAMPLES COLLECTED FROM LAKES SUPERIOR, HURON, AND MICHIGAN IN SEPTEMBER 1970 SHOWED PRACTICALLY NO ACETYLENE REDUCTION; WHEREAS, VARIATIONS WERE FOUND IN SAMPLES COLLECTED FROM DIFFERENT REACHES OF GREEN BAY OF LAKE MICHIGAN. DIURNAL VARIATIONS IN ACETYLENE REDUCTION RATES BY SOYBEAN NODULES EXCISED EVERY HOUR FROM FIELD-GROWN PLANTS WERE DEPENDENT BOTH ON LIGHT INTENSITY AND AIR TEMPERATURE. AFTER SUNSET, ACETYLENE REDUCTION RATES OF OVER ONE-HALF THE MAXIMUM DAYLIGHT RATE WERE OBSERVED. THESE EXPERIMENTS DEMONSTRATED THE SUITABILITY OF THE ACETYLENE REDUCTION ASSAY FOR FOLLOWING CHANGES IN RATES OF N₂-FIXATION BY NODULATED LEGUMES IN THE FIELD AND BY BLUE-GREEN ALGAE IN LAKES. IN ADDITION, THE ASSAY SERVED TO DEFINE VARIOUS TROPHIC LEVELS OF LAKES AND TO LOCATE ZONES OF EUTROPHICATION IN THE GREAT LAKES. (BURRIS-WISCONSIN)

FIELD 05C, 02H, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W72-06294

BIOLOGICAL NITROGEN FIXATION IN THE GREAT LAKES,

WISCONSIN UNIV., MADISON, DEPT. OF BIOCHEMISTRY.

T. H. MAGUE, AND R. H. BURRIS.

BIOSCIENCE, VOL 23, NO 4, P 236-239, APRIL 1973. 3 FIG, 3 TAB, 18 REF.

DESCRIPTORS

*NITROGEN FIXATION, *GREAT LAKES, *PHYTOPLANKTON, WATER SAMPLING, OLIGOTROPHY, *EUTROPHICATION, NITROGEN CYCLE, CYCLING NUTRIENTS, CYANOPHYTA, LAKE ERIE, LAKE HURON, LAKE SUPERIOR, LAKE MICHIGAN, METHODOLOGY, DIATOMS, CHRYSOPHYTA, ANABAENA, DINOFLAGELLATES, PYRROPHYTA, CHLOROPHYTA.

IDENTIFIERS

GREEN BAY, *ACETYLENE REDUCTION, FLAME IONIZATION GAS CHROMATOGRAPHY, SAMPLE PREPARATION, ASTERIONELLA FORMOSA, FRAGILARIA, TABELLARIA, OSCILLATORIA, APHANIZOYMON FLOS-AQUAE, MICROCYSTIS AFRUGINOSA, LYNGBYA, PEDIASTRUM, CERATIUM HIRUNDINELLA, VAN DORN BOTTLES, ETHYLENE.

ABSTRACT

THE ACETYLENE REDUCTION TECHNIQUE WAS USED FOR ASSESSING POTENTIAL N₂-FIXATION IN LAKE WATER SAMPLES. WATER SAMPLES FROM GREEN BAY AND LAKES ERIE, SUPERIOR, HURON AND MICHIGAN WERE PASSED THROUGH A 64-MICRON SILK PLANKTON NETTING TO CONCENTRATE THE PHYTOPLANKTON PRIOR TO TESTING. ONE-ML SAMPLES OF THE CONCENTRATE WERE TRANSFERRED TO GLASS SERUM BOTTLES TO WHICH ACETYLENE WAS ADDED DIRECTLY WITHOUT OTHER MODIFICATION OF THE ATMOSPHERE. THE BOTTLES WERE INCUBATED FOR APPROXIMATELY 30 MIN; ACETYLENE REDUCTION WAS TERMINATED BY THE ADDITION OF 5 N H₂SO₄ AND THE SERUM STOPPERS WERE SEALED AGAINST POSSIBLE LEAKAGE. FOUR REPLICATE BOTTLES WERE PREPARED FROM EACH SAMPLING SITE, AND ONE WAS IMMEDIATELY INACTIVATED WITH ACID TO SERVE AS A CONTROL. THE QUANTITY OF ETHYLENE WAS DETERMINED BY FLAME IONIZATION AFTER GAS CHROMATOGRAPHIC SEPARATION FROM ACETYLENE ON A 1.2 M X 2 MM COLUMN OF POROPAK N RUN AT 75 DEGREES C. ACETYLENE REDUCTION BY THE PHYTOPLANKTON IN LAKE SUPERIOR, THE WESTERN END OF LAKE HURON, AND EASTERN LAKE MICHIGAN WAS BARELY DETECTABLE IN SEPTEMBER OF 1970, BUT IN SOUTHERN GREEN BAY OF LAKE MICHIGAN AND THE SHALLOW BASIN OF LAKE ERIE IT WAS COMPARABLE IN RATE TO THAT IN EUTROPHIC WISCONSIN LAKES. ACETYLENE REDUCTION ACTIVITY IN GREEN BAY WAS LOW IN THE MOUTH OF THE MAIN TRIBUTARY, INCREASED TO A MAXIMUM 5-15 KM NORTHEAST INTO THE BAY, AND THEN DECREASED FARTHER NORTHEAST. VIGOROUS ACETYLENE REDUCTION WAS ALWAYS ASSOCIATED WITH AN ABUNDANCE OF HETEROCYSTOUS BLUE-GREEN ALGAE. (HOLMAN-BATTELLE)

FIELD 05C, 05B, 02H

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W73-10511

"FOX RIVER..." WISC

DISPERSAL OF FOX RIVER WATER IN GREEN BAY, LAKE MICHIGAN,

WISCONSIN UNIV., MILWAUKEE. CENTER FOR GREAT LAKES STUDIES.

RICHARD F. MODLING, AND A. M. BEETON.

INTERNATIONAL ASSOCIATION FOR GREAT LAKES RESEARCH, PROCEEDINGS 13TH
CONFERENCE ON GREAT LAKES RESEARCH, PART 1, P 468-476, 1970. 2 FIG, 5 TAB
12 REF.

DESCRIPTORS

*WATER CIRCULATION, *BAYS, *RIVERS, CONDUCTIVITY, WATER POLLUTION
EFFECTS, LAKE MICHIGAN.

IDENTIFIERS

*WATER MASS MOVEMENT, GREEN BAY(WIS), FOX RIVER(WIS), FLUSHING RATES.

ABSTRACT

THE EFFECTS OF FOX RIVER INFLOW ON WATER OF THE SOUTHERN PART OF GREEN BAY (WISCONSIN) WERE INVESTIGATED BY SURVEYS CONDUCTED IN JULY 1968, AND AUGUST 1969. DILUTION OF THE POLLUTED RIVER WATER IN ITS LAKEWARD FLOW WAS DETERMINED ON THE BASIS OF SPECIFIC CONDUCTANCE WHICH RANGED FROM 400 AT THE RIVER'S MOUTH TO 265 MICRO/MHOS ALONG THE MENOMINEE-STURGEON BAY TRANSECT. THE COUNTER-CLOCKWISE MOVEMENT OF THE RIVER WATER ALONG THE EAST SIDE OF THE BAY WAS MARKED BY CONCENTRATION OF ELECTROLYTES, PRESENCE OF DAPHNIA PULEX INHABITING LAKE WINNEBAGO, ABSENCE OF OXYGEN-DEMANDING OLIGOCHAETES AND HEXAGENIA, AND ORGANIC MATTER SEDIMENT ENRICHMENT. THE RIVER WATER EXTENSION INTO THE BAY APPROACHED 40 MILES. THE 1969 FLUSHING WAS 160 DAYS IN THE SOUTHERN AND 36 DAYS IN THE NORTHERN PART OF THE STUDY AREA. LAKEWARD TRANSPORT WAS 199 AT OCONTO TRANSECT, AND 1130 M/DAY AT CEDAR RIVER TRANSECT. (SEE ALSO W72-01094) (WILDE-WISCONSIN)

FIELD 02H

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W72-01104

"FOX RIVER..." WISC

A REGIONAL GEOPHYSICAL INVESTIGATION OF THE GREEN BAY AREA,

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.

N. W. O'HARA.

IN: PROCEEDINGS OF 14TH CONFERENCE ON GREAT LAKES RESEARCH, UNIVERSITY OF TORONTO, CANADA, APRIL 19-21, 1971; INTERNATIONAL ASSOCIATION FOR GREAT LAKES RESEARCH, P 355-367, 1971. 8 FIG, 19 REF.

DESCRIPTORS

*GEOLOGICAL SURVEYS, *PETROLOGY, *LAKE MORPHOLOGY, *HYDROGEOLOGY, *LAKE MICHIGAN, DATA COLLECTIONS, CORRELATION ANALYSIS, ANALYTICAL TECHNIQUES, GRAVIMETERS, MAGNETIC STUDIES, FAULTS(GEOLOGIC), GLACIATION, LAKE BASINS, WISCONSIN, MICHIGAN.

IDENTIFIERS

*GREEN BAY AREA(WISC), AEROMAGNETIC DATA.

ABSTRACT

ASSOCIATED GRAVITY AND MAGNETIC TRENDS WERE QUALITATIVELY ANALYZED TO CORRELATE THE STRUCTURAL TRENDS AND LITHOLOGIC CHARACTERISTICS OF THE OUTCROPS IN WISCONSIN AND NORTHERN MICHIGAN WITH THE BASEMENT COMPLEX BENEATH THE GREEN BAY AREA OF LAKE MICHIGAN. THE REGIONAL AEROMAGNETIC SURVEY OF THE GREEN BAY AREA HAS DELINEATED SEVERAL EAST-WEST TRENDING BELTS OF POSITIVE AND NEGATIVE MAGNETIC ANOMALIES WHICH HAVE BEEN RELATED TO CORRESPONDING GRAVITY ANOMALIES DELINEATED BY THE BOTTOM-GRAVIMETER SURVEY OF GREEN BAY. THE MAGNETIC AND GRAVITY TRENDS HAVE, IN SOME CASES, BEEN RELATED TO BASEMENT LITHOLOGIES IN WISCONSIN. MAGNETIC AND GRAVITY LOWS HAVE BEEN RELATED TO METASEDIMENTS AND FELSIC ROCKS. THE MAGNETIC HIGH EXTENDING THROUGH THE CENTER OF GREEN BAY AND WESTWARD INTO WISCONSIN APPEARS TO MARK THE INTERSECTION OF TWO STRUCTURAL FEATURES HAVING EAST-WEST AND NORTHEAST-SOUTHWEST TRENDS. BOTH GRAVITY AND MAGNETIC EVIDENCE SUPPORT THE EASTWARD EXTENSION OF THE IRON FORMATION ENCOUNTERED IN DRILLING NEAR ESCANABA, MICH. THE -70 MGAL BOUGUER GRAVITY MINIMUM HAS BEEN EXTENDED EASTWARD INTO GREEN BAY FROM WISCONSIN AND MICHIGAN. THE GRAVITY DATA OFFER NO POSITIVE EVIDENCE TO SUPPORT THE EXISTENCE OF A PREGLACIAL DRAINAGE SYSTEM RELATED TO BASEMENT LITHOLOGY AND/OR TOPOGRAPHY. THE GRAVITY AND MAGNETIC TRENDS, EXTENDING ACROSS THE SOUTHERN PORTION OF THE DOOR PENINSULA, CORRELATE WITH THE STRIKE OF TWO PALEOZOIC FAULTS IN THIS AREA. (SEE ALSO W73-02498) (WOODARD-USGS)

FIELD 02H

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W73-02502

"FOX RIVER..." WISC

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,

GEOLOGICAL SURVEY, WASHINGTON, D. C.

PERRY G. OLCOTT.

GEOL SURV HYDROL INVEST ATLAS HA-321, 4 SHEET, 1968. 13 MAP, 4 TAB, 21 PFF
TEXT.

DESCRIPTORS

*WATER RESOURCES, *SURFACE WATERS, *GROUNDWATER, *WISCONSIN, WATER
WELLS, HYDROLOGIC DATA, AQUIFERS, WATER QUALITY, STREAMFLOW,
HYDROGRAPHS, FLOW CHARACTERISTICS, WATER UTILIZATION.

IDENTIFIERS

FOX RIVER(WIS), WOLF RIVER(WIS).

ABSTRACT

THE WATER RESOURCES OF THE FOX-WOLF RIVER BASIN, WISCONSIN ARE
DESCRIBED IN A 4-SHEET RECONNAISSANCE HYDROLOGICAL ATLAS. A GENERALIZED
HYDROLOGIC BUDGET OF THE BASIN IS SHOWN GRAPHICALLY. GROUNDWATER
AVAILABILITY, MOVEMENT, AND QUALITY ARE SHOWN ON MAPS. SURFACE WATER
DISCHARGE, HIGH-FLOW RECURRENCE, LOW-FLOW RECURRENCE, AND
QUALITY-DISCHARGE RELATIONS ARE SHOWN GRAPHICALLY AND BY MAPS. CHEMICAL
ANALYSES ARE TABULATED. IN GENERAL, BOTH GROUND- AND SURFACE WATER ARE
MORE AVAILABLE AND AT HIGHER QUALITY IN OUTWASH AREAS AND LESS IN
LAKE-BED AND GROUND MORAINNE AREAS. INDUSTRY AND COMMERCE USE ABOUT 65%
OF THE WATER WITHDRAWN IN THE AREA, MUNICIPALITIES ABOUT 20%, AND STOCK
RURAL DOMESTIC, AND IRRIGATION ABOUT 15%. USE IS SUMMARIZED BY A MAP
AND A TABLE. RECREATIONAL USE IS ALSO SUMMARIZED BY A MAP AND A TABLE.
POLLUTION IS A PROBLEM IN THE LOWER FOX RIVER. SALINE WATER INTRUSION
FROM AQUIFERS IN THE SE PART OF THE BASIN IS POSSIBLE IF LOCAL AREAS
ARE OVER PUMPED. GROUNDWATER IS GENERALLY HARD. GEOLOGY, LITHOLOGY OF
AQUIFERS, WATER-BEARING PROPERTIES OF AQUIFERS, STREAMFLOW
CHARACTERISTICS, AND QUALITY OF GROUND- AND SURFACE WATER ARE
SUMMARIZED IN A TABLE. (KNAPP-USGS)

FIELD 02F, 02F

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W69-03939

"FOX RIVER..." WISC

GEOCHEMISTRY OF LAKE MICHIGAN MANGANESE NODULES,

MICHIGAN UNIV., ANN ARBOR. GREAT LAKES RESEARCH DIV.

RONALD ROSSMANN, AND EDWARD CALLFNDER.

IN: PROCEEDINGS TWELFTH CONFERENCE ON GREAT LAKES RESEARCH, MAY 5-7, 1969, UNIVERSITY OF MICHIGAN, ANN ARBOR; INTERNATIONAL ASSOCIATION FOR GREAT LAKES RESEARCH, P 306-316, 1969. 11 P, 3 FIG, 6 TAB, 14 REF. FWQA GRANT WP-00311 NSF GRANT GA 1337.

DESCRIPTORS

*GEOCHEMISTRY, *MANGANESE, *LAKE MICHIGAN, *BOTTOM SEDIMENTS, PROVENANCE, WATER CHEMISTRY, CHEMICAL PRECIPITATION, IRON, SEDIMENTATION, SEDIMENT-WATER INTERFACES, ORGANIC MATTER, LEACHING, OXIDATION-REDUCTION POTENTIAL, GREAT LAKES.

IDENTIFIERS

GREEN BAY(LAKE MICHIGAN).

ABSTRACT

MANGANESE NODULES, SIMILAR IN COMPOSITION TO OTHER FRESHWATER AND SHALLOW MARINE NODULES, OCCUR ON THE SEDIMENT SURFACE OF GREEN BAY AND NORTHERN LAKE MICHIGAN. SAMPLES HAVE BEEN ANALYZED FOR THEIR IRON, MANGANESE, CALCIUM, MAGNESIUM, SODIUM, POTASSIUM, INORGANIC CARBON, ORGANIC CARBON, AND TOTAL NITROGEN CONTENT. THE NODULES AVERAGE 20% IRON AND 6% MANGANESE. THE TRACE METAL CONTENT (COPPER, ZINC, COBALT, AND NICKEL) OF THE SAMPLES IS CONSIDERABLY LOWER THAN THAT OF MARINE MATERIAL. INTERSTITIAL WATER IS ONE OF THE MAJOR CONTRIBUTORS OF MANGANESE AND IRON FOR THE GROWTH OF NODULES IN LAKE MICHIGAN. CORES OF GREEN BAY SEDIMENT SHOW AN INVERSE RELATIONSHIP BETWEEN SEDIMENTARY AND INTERSTITIAL MANGANESE WITH THE SEDIMENTARY MANGANESE INCREASING TO A MAXIMUM AT OR NEAR THE SEDIMENT-WATER INTERFACE. SEDIMENTARY IRON REMAINS FAIRLY CONSTANT THROUGHOUT THE LENGTH OF THESE CORES WHILE INTERSTITIAL IRON DECREASES SLIGHTLY TOWARD THE SEDIMENT-WATER INTERFACE. IN ADDITION, LAKE WATER MAY BE MORE THAN A PASSIVE CONTRIBUTOR OF IRON AND MANGANESE. THERE ARE INDICATIONS THAT AS MUCH AS ONE-HALF OF THE MANGANESE FOUND IN LAKE WATER IS PARTICULATE. THE SOURCE OF THIS MATERIAL IS BELIEVED TO BE THE IRON DEPOSITS OF THE CANADIAN SHIELD THAT HAVE BEEN SUBSEQUENTLY LEACHED OF MANGANESE AND IRON. (SEE ALSO W71-05561)(KNAPP-USGS)

FIELD 02H, 02K

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-05563

"FOX RIVER..." WISC

PHOSPHATE DISTRIBUTION IN FOX AND WOLF RIVERS, WISCONSIN,

AAMUND SALVESON.

WATER AND SEWAGE WORKS, P 142-152, MAY 1970. 4 FIG, 15 REF.

DESCRIPTORS

*PHOSPHATES, *WATER POLLUTION SOURCES, *SAMPLING, RIVERS, FISH KILLS, BIODEGRADATION, FERTILIZERS, MUNICIPAL WASTES, WISCONSIN.

IDENTIFIERS

*FOX RIVER(WIS), *WOLF RIVER(WIS), POLY-PHOSPHATES, ORTHO-PHOSPHATES.

ABSTRACT

ANALYSES OF THE SURFACE WATER SAMPLES OF THE TWO RIVERS INCLUDED DETERMINATIONS OF SOLUBLE ORTHOPHOSPHATE, TOTAL AND POLYPHOSPHATES, PH VALUE, FILTERABLE RESIDUE, AND TEMPERATURE. THE WOLF RIVER SHOWED RELATIVELY LOW CONTENTS OF TOTAL AND ORTHOPHOSPHATES, EXCEPT IN THE MARKTON, NEW LONDON, AND FREEMONT SECTIONS, INFLUENCED BY DISCHARGE OF SEWAGE OR BY FERTILIZER-ENRICHED RUNOFF. IN SPITE OF THE ABUNDANCE OF ALGAE AND FISH KILLS, FILTERED WATER OF LAKE POYGAN WAS VERY LOW IN PHOSPHATES SUGGESTING THEIR INTENSIVE FIXATION BY PHYTOPLANKTON. THE UPPER FOX RIVER SHOWED AN EXTREMELY HIGH CONCENTRATION OF PHOSPHATES (1.30 TO 1.50 MG/L OF PHOSPHORUS TETRAOXIDE) NEAR FORT WINNEBAGO AND THE SEWAGE OUTLET OF THE TOWN PORTAGE. THE SECTION FROM MONTELLO TO OMRO PRESERVED A RATHER HIGH CONCENTRATION OF THE TOTAL PHOSPHATES, BUT CONTAINED VERY SMALL AMOUNT OF ORTHOPHOSPHATES (BELOW 0.10 MG/L). THE FOX RIVER FROM NEENAH TO GREEN BAY EXHIBITED ONLY SMALL VARIATION IN MODERATELY HIGH CONTENTS OF BOTH FORMS OF PHOSPHORUS. (WILDF-WISCONSIN)

FIELD 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-05392

"FOX RIVER..." WISC

INVESTIGATION OF THE ENVIRONMENTAL FACTORS WHICH AFFECT THE ANAEROBIC
DECOMPOSITION OF FIBROUS SLUDGE BEDS ON STREAM BOTTOMS,

LAWRENCE UNIV., APPLETON, WIS.

A. M. SPRINGER.

AVAILABLE FROM--UNIV. MICROFILMS, INC., ANN ARBOR, MICH. 48106. ORDER NO.
73-7,166. PH D DISSERTATION, 1972. 178 P.

DESCRIPTORS

*DISTRIBUTION, *BIODEGRADATION, *PULP WASTES, FIBERS(PLANT), CELLULOSE,
MATHEMATICAL MODELS, ENERGY BUDGET, PULP AND PAPER INDUSTRY, SLUDGE,
SLUDGE DIGESTION, WATER TEMPERATURE, *WISCONSIN.

IDENTIFIERS

*FOX RIVER(WIS), GLUCOSE, CELLOBIOSE.

ABSTRACT

REDISTRIBUTION AND DECOMPOSITION OF FIBROUS SLUDGE FROM PAPER MILLS
HAVE BEEN STUDIED IN THE LOWER FOX RIVER BETWEEN LAKE WINNEBAGO AND
GREEN BAY, WISCONSIN. IN JUNE 1970 APPROXIMATELY 50 PERCENT OF THE
RIVER BOTTOM WAS COVERED WITH FIBROUS SLUDGE TO A DEPTH WHICH RANGED
FROM SIX INCHES TO SEVERAL FEET. A MATHEMATICAL MODEL WAS DEVELOPED TO
PREDICT SLUDGE DISTRIBUTION, AND IT APPEARED TO DEPICT ACTUAL RIVER
CONDITIONS QUITE WELL. APPROXIMATELY 4/5 OF THE LOWER FOX RIVER IS
SUBJECT TO SLUDGE DEPOSITION, SCOUR, AND REDISTRIBUTION; WHILE THE
REMAINING 1/5 IS EITHER ALWAYS FREE OF SLUDGE OR CONTAINS PERMANENT
BEDS. THE PRINCIPAL MECHANISM FOR SLUDGE BED DESTRUCTION IS
DECOMPOSITION, SINCE SCOUR AND FLOTATION MERELY RELOCATE THE SLUDGE AT
ANOTHER POSITION IN THE RIVER. A LINEAR TEMPERATURE PROFILE IS FOUND IN
THE BED, INDICATING THAT THE ENERGY GENERATED BY THE DECOMPOSITION
PROCESS IS NEGLIGIBLE IN COMPARISON TO THAT CONDUCTED IN FROM OUTSIDE
THE BED. LABORATORY STUDIES DEMONSTRATED THAT ANAEROBIC DECOMPOSITION
IS THE PRINCIPAL MECHANISM FOR THE DESTRUCTION OF ORGANIC MATTER IN A
SLUDGE BED. CHEMICAL PULPS ANAEROBICALLY DECOMPOSE FASTER THAN DO
GROUNDWOOD PULPS OF SIMILAR SURFACE-TO-VOLUME RATIOS BY A FACTOR OF
ABOUT TWO. THE RATE-LIMITING STEP IN THE ANAEROBIC DECOMPOSITION
PROCESS IS THE BREAKDOWN OF CELLULOSE INTO GLUCOSE AND/OR CELLOBIOSE.
TEMPERATURE HAS AN APPRECIABLE EFFECT ON THE RATE OF FIBROUS SLUDGE
ANAEROBIC DECOMPOSITION. APPRECIABLE DIFFERENCES IN RATE OF
DECOMPOSITION OCCUR AT DIFFERENT RIVER LOCATIONS AND AT DIFFERENT TIMES
OF THE YEAR IN THE SAME LOCATION. THE LIFE OF A FIBROUS SLUDGE BED IN
THE LOWER FOX RIVER WOULD BE ONE TO TWO YEARS IF NO NEW MATERIAL WERE
ADDED TO THE BED. (LITTLE-BATTELLE)

FIELD 05B, 05C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W73-12936

"FOX RIVER..." WISC

NITROGENASE ACTIVITY IN WISCONSIN LAKES OF DIFFERING DEGREES OF EUTROPHICATION,

WISCONSIN UNIV., MADISON. WATER RESOURCES CENTER.

W. D. P. STEWART, T. MAGUE, G. P. FITZGERALD, AND R. H. BURRIS.

NEW PHYTOLOGY, VOL 70, P 497-509, 1971. 5 FIG, 9 TAB, 24 REF. DWRR.
B-020-WIS(4) AND DWRR B-024-WIS(1).

DESCRIPTORS

*NITROGEN FIXATION, *EUTROPHICATION, *OLIGOTROPHY, DIURNAL, ANALYTICAL
METHODS, NITROGEN, LAKES, WISCONSIN.

IDENTIFIERS

*ACETYLENE REDUCTION, *KJFLDAHL DIGESTION, *NESSLERIZATION, LAKE
MENDOTA, LAKE MARY, LITTLE ARBOR VITAE LAKE, CRYSTAL LAKE, TROUT LAKE,
GREEN BAY OF LAKE MICHIGAN, HETEROCYSTOUS ALGAE, GLOEDTRICHIA,
APHANIZOMENON, ANABAENA.

ABSTRACT

NITROGEN FIXATION IN VARIOUS WISCONSIN LAKES WAS COMPARED USING THE
ACETYLENE REDUCTION TECHNIQUE. RATES OF ACETYLENE REDUCTION WERE
UNAFFECTED BY N₂ WHEN SUFFICIENT ACETYLENE WAS ADDED TO THE GAS PHASE.
THUS IN FIELD STUDIES THE NATURAL GAS PHASE NEED NOT BE REMOVED BEFORE
THE ADDITION OF ACETYLENE. ACETYLENE WAS REDUCED RAPIDLY IN EUTROPHIC
WATERS (LITTLE ARBOR VITAE LAKE, LAKE MENDOTA, AND SOUTHERN GREEN BAY)
BUT MORE SLOWLY IN OLIGOTROPHIC WATERS (CRYSTAL LAKE, TROUT LAKE, LAKE
MARY, AND NORTHERN GREEN BAY). ACETYLENE REDUCTION WAS GREATEST IN THE
SURFACE WATERS, WAS LARGELY LIGHT-DEPENDENT AND SHOWED A MARKED DIURNAL
VARIATION. THERE WAS ALSO SIGNIFICANT VARIATION WITH AREA AND WITH
TIME, AND IN GENERAL ACETYLENE REDUCTION WAS DETECTED ONLY WHEN
HETEROCYSTOUS ALGAE WERE PRESENT. THE RATE OF NITROGEN FIXATION IN LAKE
MENDOTA, CALCULATED ON THE BASIS OF WEEKLY MEASUREMENTS TAKEN DURING
MOST OF THE ICE-FREE SEASON, WAS APPROXIMATELY 2.4 KG/HA/YEAR. A DIRECT
CORRELATION WAS CONFIRMED BY THE STUDY BETWEEN THE ABUNDANCE OF
HETEROCYSTOUS ALGAE (GLOEDTRICHIA, APHANIZOMENON, AND ANABAENA) AND THE
ACETYLENE REDUCING CAPACITY OF THE WATER TESTED.

FIELD 05C, 02H

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W72-01373

"FOX RIVER..." WISC

RECREATION AND THE LOCAL ECONOMY - AN INPUT-OUTPUT MODEL OF A
RECREATION-ORIENTED ECONOMY,

WISCONSIN UNIV., MADISON. GRADUATE SCHOOL OF BUSINESS ADMINISTRATION.

WILLIAM A. STRANG.

AVAILABLE FROM NTIS AS PB-195 744, \$3.00 IN PAPER COPY, \$0.95 IN MICROFICHE.
SEA GRANT TECHNICAL REPORT NO 4, WIS-SG-71-204, OCT 1970. 68 P, 2 FIG, 14
TAB, 52 PFF. NSF GRANT GH-102.

IDENTIFIERS

*ECONOMIC DEVELOPMENT, *WISCONSIN, *RECREATIONAL FACILITIES, *LAKES,
REGIONAL PLANNING, INDUSTRIAL MANAGEMENT, WATER QUALITY, MATHEMATICAL
MODELS, CASH FLOW, WATER RESOURCES, STATISTICAL DATA, SEA GRANT
PROGRAM, RECREATION ORIENTED ECONOMICS, GREEN BAY(WISCONSIN), DOOR
COUNTY(WISCONSIN), TOURISM, INPUT OUTPUT MODELS.

ABSTRACT

THE SCOPE WAS BROADENED OF A MARINE RESEARCH PROGRAM CONDUCTED IN GREEN
BAY, A MAJOR BAY OF LAKE MICHIGAN. THE FINDINGS ARE PRESENTED OF THE
FIRST STAGE OF A 3-STAGE PROJECT TO RELATE WATER QUALITY TO THE
ECONOMIC HEALTH OF AN AREA ORIENTED TOWARD OUTDOOR RECREATION. THE 3
PROJECT STAGES ARE: (1) IDENTIFY THE ECONOMIC INTERACTIONS IN THE AREA
AND TRACE THE TOTAL IMPACT OF TOURISM ON THE ECONOMY; (2) MEASURE THE
DIRECT AND INDIRECT ECONOMIC IMPACTS OF SPECIFIC GROUPS OF TOURISTS ON
THE LOCAL ECONOMY; AND (3) RELATE THE SEVERAL DIMENSIONS OF THE QUALITY
OF LOCAL WATER RESOURCES TO THE NUMBER OF TOURISTS DRAWN TO THE AREA IN
THESE SPECIFIC GROUPS. IT WILL THEN BE POSSIBLE TO RELATE WATER QUALITY
TO AN IMPORTANT SEGMENT OF THE LOCAL ECONOMY.

FIELD 06B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-04955

"FOX RIVER..." WISC

MULTIPLICATION OF CLOSTRIDIUM BOTULINUM TYPE E IN THE GREAT LAKES - CASE STUDY
OF GREEN BAY, WISCONSIN,

WISCONSIN UNIV., MADISON. WATER RESOURCES CENTER.

H. SUGIYAMA.

AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE AS PB-206 122,
\$3.00 IN PAPER COPY, \$0.95 IN MICROFICHE. TECHNICAL COMPLETION REPORT,
1971. 22 P, 5 TAB, 16 REF. OWRR A-026-WIS(1), 14-01-0001-3050,
14-01-0001-3250.

DESCRIPTORS

*ECOLOGY, *AQUATIC PLANTS, *BACTERIA, *TOXINS, *INVERTEBRATES, SHORES,
FREEZING, FISH, LAKES, WISCONSIN.

IDENTIFIERS

*CLOSTRIDIUM BOTULINUM TYPE E, *FOOD POISONING, GREEN BAY(WIS).

ABSTRACT

GREEN BAY WAS TAKEN AS THE MODEL TO STUDY THE SOURCE OF CLOSTRIDIUM
BOTULINUM TYPE E WHICH CONTAMINATES FISH OF THE GREAT LAKES TO CREATE A
BOTULISM HAZARD. CERTAIN BOTTOM DEPOSITS HELD IN THE LABORATORY AFTER A
FREEZE-THAW TREATMENT SUPPORTED THE GROWTH OF TYPE E (50 OR MORE FOLD
INCREASE IN MOST PROBABLE NUMBERS). WITHOUT THE FREEZE TREATMENT THE
SPECIMENS DID NOT SUPPORT GROWTH. PRODUCTIVE SAMPLES ALWAYS CONTAINED
VEGETATION AND WERE THOSE COLLECTED DURING THE WARM MONTHS. WHEN PLACED
IN COLUMNS TO OBTAIN DEPTH, ARTIFICIALLY INDUCED ANAEROBIC CONDITIONS
WERE NOT NEEDED. EMPHASIS IS PLACED ON THE SIMILARITY OF THE TYPE E
DATA TO THE ECOLOGY OF C. BOTULINUM TYPE C, THE CAUSE OF WESTERN DUCK
SICKNESS. THE PRIMARY SUBSTRATES IN WHICH TYPE E MULTIPLIES IS BELIEVED
TO BE THE MACRO-INVERTEBRATES ASSOCIATED WITH THE AQUATIC VEGETATION
THAT GROW IN THE SHALLOW SHORE LINE OF GREEN BAY. LABORATORY DATA ARE
INTERPRETED IN TERMS OF THE SITUATION THAT COULD OCCUR IN NATURE.

FIELD 05C, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W72-03528

"FOX RIVER..." WISC

CLOSTRIDIUM BOTULINUM IN THE GREAT LAKES,

WISCONSIN UNIV., MADISON. FOOD RESEARCH INST.

H. SUGIYAMA, T. L. BOTT, AND J. A. SOUCHECK.

SPORES V, P. 314-317. 3 TAB, 16 REF. 1972. DWRR A-026-WIS(2).

DESCRIPTORS

*CLOSTRIDIUM, ECOLOGY, *AQUATIC PLANTS, *BACTERIA, *TOXINS,
*INVERTEBRATES, SHORES, FREEZING, FISH, WISCONSIN, *BOTULISM, GREAT
LAKES, WATER POLLUTION SOURCES, *GREAT LAKES.

IDENTIFIERS

*CLOSTRIDIUM BOTULINUM TYPE E, *FOOD POISONING, *GREEN BAY(WIS).

ABSTRACT

GREEN BAY WAS TAKEN AS THE MODEL TO STUDY THE SOURCE OF CLOSTRIDIUM BOTULINUM TYPE E WHICH CONTAMINATES FISH OF THE GREAT LAKES TO CREATE A BOTULISM HAZARD. CERTAIN BOTTOM DEPOSITS HELD IN THE LABORATORY AFTER A FREEZE-THAW TREATMENT SUPPORTED THE GROWTH OF TYPE E (50 OR MORE FOLD INCREASE IN MOST PROBABLE NUMBERS). WITHOUT THE FREEZE TREATMENT THE SPECIMENS DID NOT SUPPORT GROWTH. PRODUCTIVE SAMPLES ALWAYS CONTAINED VEGETATION AND WERE THOSE COLLECTED DURING THE WARM MONTHS. WHEN PLACED IN COLUMNS TO OBTAIN DEPTH, ARTIFICIALLY INDUCED ANAEROBIC CONDITIONS WERE NOT NEEDED. EMPHASIS IS PLACED ON THE SIMILARITY OF THE TYPE E DATA TO THE ECOLOGY OF C. BOTULINUM TYPE C, THE CAUSE OF WESTERN DUCK SICKNESS. THE PRIMARY SUBSTRATES IN WHICH TYPE E MULTIPLIES IS BELIEVED TO BE THE MACRO-INVERTEBRATES ASSOCIATED WITH THE AQUATIC VEGETATION THAT GROW IN THE SHALLOW SHORE LINE OF GREEN BAY. BACTERIOPHAGES ISOLATED FROM THE GREEN BAY SYSTEM HAVE HOST RANGES LIMITED TO NONPROTEOLYTIC C. BOTULINUM STRAINS THAT PRODUCE TYPE B, E, OR F TOXIN; THEY DO NOT LYSE PROTEOLYTIC CULTURES PRODUCING TYPE A, B, OR F TOXIN. CLOSTRIDIA WHICH ARE TYPE E BY CRITERIA OTHER THAN TOXIN PRODUCTION ARE PRESENT IN THE GREAT LAKES.

FIELD 05C, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W72-11392

"FOX RIVER..." WISC

WISCONSIN WATER RESOURCE PROBLEMS,

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.

L. P. VOIGT.

WISCONSIN CONSERVATION BULLETIN, VOL 35, NO 1, JAN-FEB. 1970, P 3-5. 2 FIG.

DESCRIPTORS

*WATER RESOURCES DEVELOPMENT, WATER POLLUTION CONTROL, FEDERAL FINANCE, PULP AND PAPER INDUSTRY.

IDENTIFIERS

*WISCONSIN DEPARTMENT OF NATURAL RESOURCES, FEDERAL WATER POLLUTION CONTROL ACT, FOX RIVER.

ABSTRACT

THE MAJOR WATER CONCERNS OF THE STATE OF WISCONSIN ARE DESCRIBED. IN ORDER TO CONTINUE WATER TREATMENT EFFORTS, FLOOD PLAIN MANAGEMENT AND RECREATIONAL USE OF WATER SUPPLIES, THE AUTHOR EXPLAINS THE NEED FOR MORE FEDERAL FUNDS. (HOLMES - RUTGERS)

FIELD 06C

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W71-09485

"FOX RIVER..." WISC

WISCONSIN WATER RESOURCE PROBLEMS,

WISCONSIN DEPT. OF NATURAL RESOURCES, MADISON.

L. P. VOIGT.

WISCONSIN CONSERVATION BULLETIN, P 3-5, JANUARY-FEBRUARY 1970. 2 PHOTOS.

DESCRIPTORS

*WATER QUALITY, *WISCONSIN, PHOSPHORUS, PULP AND PAPER INDUSTRY, ALGAE, AQUATIC WEEDS, RECREATION, GROUNDWATER, FISH, FLOOD PLAINS, IRRIGATION, PESTICIDES.

IDENTIFIERS

FOX RIVER BASIN(WIS), FWPCA.

ABSTRACT

WISCONSIN'S WATER PROBLEMS RELATE TO WATER QUALITY AND NOT QUANTITY. THE SOUTHEASTERN AND EASTERN PARTS OF THE STATE ARE PARTICULARLY PROBLEMATIC DUE TO POPULATION AND INDUSTRIAL CONCENTRATIONS, AND SUBSEQUENTLY INCREASING DEMANDS FOR QUALITY WATER FOR RECREATION USE. THE PULP AND PAPER INDUSTRY REPRESENTS THE LARGEST WASTE SOURCE, WITH FOUR TIMES THE BIOCHEMICAL OXYGEN DEMAND OF MUNICIPAL WASTES. ANY SOLUTION WILL DEMAND THAT THE PRODUCT PRICES REFLECT TOTAL COSTS, INCLUDING ENVIRONMENTAL DAMAGES. FEDERAL ALLOCATION FUNDS FOR INDUSTRIAL AND MUNICIPAL WASTE TREATMENT PLANTS WERE ONLY 1/3 OF THE AUTHORIZED AMOUNT, THUS THE STATE'S EFFECTIVENESS IN POLLUTION CONTROL IS HAMPERED. IN THE PAST, THE PROBLEMS OF SILT, NUTRIENTS, AND PESTICIDES HAVE BEEN TACKLED BY EDUCATION PROGRAMS, VOLUNTARY ACTION, AND COST SHARING BUT INTENSIFIED LAND USE MAY REQUIRE REGULATORY PROGRAMS. ONLY THE SYMPTOMS OF EUTROPHICATION HAVE BEEN TREATED TO DATE VIA WEED HARVESTING AND ALGAE POISONING, BUT THE STATE IS COMMITTED TO REDUCE PHOSPHORUS LOADINGS FROM MUNICIPAL AND INDUSTRIAL WASTES IN LAKE MICHIGAN BY 1972. FLOOD-PLAIN MANAGEMENT, FISH CONTROL, AND IRRIGATION ARE OTHER PROBLEM AREAS TO BE RESOLVED. (POWERS-WISCONSIN)

FIELD 05G

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W70-05103

"FOX RIVER..." WISC

PRESERVING LAKES BY PROTECTING THEIR SHORELANDS,

MAINE UNIV., ORONO. WATER RESOURCES RESEARCH CENTER.

DOUGLAS A. YANGGEN.

PROCEEDINGS, WORKSHOP--CONFERENCE ON RECLAMATION OF MAINE'S DYING LAKES HELD
AT UNIVERSITY OF MAINE, BANGOR, MARCH 24-25, 1971, P 27-49. 16 REF.

DESCRIPTORS

*EUTROPHICATION, *LAKE SHORES, *WATER POLLUTION CONTROL, *WISCONSIN,
*LEGISLATION, MAINE, ZONING, LAND USE, FLOOD PLAIN ZONING,
ENVIRONMENTAL SANITATION, SEPTIC TANKS, MINNESOTA, WATERSHED MANAGEMENT.

IDENTIFIERS

*SHORELAND PROTECTION, *FOX RIVER(WIS).

ABSTRACT

LAWS, LEGISLATIVE PROVISIONS, AND ORDINANCES APPLYING TO WISCONSIN LAKE
AND STREAM SHORELANDS TO IMPLEMENT WATER POLLUTION CONTROL ARE
DESCRIBED. THE COMPREHENSIVE PLAN FOR THE FOX RIVER (WISCONSIN) AND THE
MINNESOTA SHORELAND PROTECTION PROGRAM ARE REVIEWED. (SEE ALSO
W72-04279) (WILDF-WISCONSIN)

FIELD 050

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W72-04282

"FOX RIVER..." WISC

ENVIRONMENTAL LIMIT RECOMMENDED BY THE FEDERAL COMMITTEE ON WATER QUALITY CRITERIA. MAPS AND TABLES ARE INCLUDED TO SHOW THE DISTRIBUTION OF THE VARIOUS PESTICIDES THROUGHOUT THE UNITED STATES.
(LITTLE-BATTELLE)

FIELD 05A, 05B

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
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ACCESSION NO. W71-04201

"FOX RIVER..." WISC

JOINT TREATMENT OF PULP MILL EFFLUENTS AND MUNICIPAL SEWAGE.

PAPER TRADE JOURNAL, VOL 156, NO 18, P 30, MAY 1, 1972.

DESCRIPTORS

*PULP WASTES, *WASTE WATER TREATMENT, *SEWAGE TREATMENT, MUNICIPAL WASTES, BIOLOGICAL TREATMENT, EFFLUENTS, PULP AND PAPER INDUSTRY, ACTIVATED SLUDGE, CHLORINATION, TREATMENT, BIODEGRADATION, OPERATING COSTS, CAPITAL COSTS, SULFUR BACTERIA, FEASIBILITY STUDIES, SEWAGE DISTRICTS, *WISCONSIN, CHLORINE, ECONOMIC FEASIBILITY, COSTS, BACTERIA, RECYCLING, NUTRIENTS, NITROGEN COMPOUNDS, PHOSPHORUS COMPOUNDS, SOLIDS CONTACT PROCESSES, RESEARCH AND DEVELOPMENT, MIXING.

IDENTIFIERS

SPENT LIQUORS, *GREEN BAY(WIS), *COMBINED TREATMENT.

ABSTRACT

THE MAJOR FINDINGS OF A FEASIBILITY STUDY ARE REPORTED, IN WHICH THE SEWAGE FROM THE GREEN BAY, WISCONSIN, METROPOLITAN SEWERAGE DISTRICT WAS TREATED JOINTLY WITH EFFLUENTS FROM FOUR LOCAL PAPER MILLS, USING FOUR VARIATIONS OF THE ACTIVATED SLUDGE PROCESS. AMONG THESE VARIANTS, THE CONTACT STABILIZATION PROCESS PROVED TO BE THE MOST SUCCESSFUL. THE GROWTH OF FILAMENTOUS SULFIDE-UTILIZING BACTERIA IN THE MIXED WASTE LIQUORS WAS CONTROLLED BY CONTINUOUS DOSING OF THE RECYCLED ACTIVATED SLUDGE WITH CHLORINE. FOR SATISFACTORY OPERATION OF THE BIOLOGICAL OXIDATION PROCESS, NITROGEN AND PHOSPHORUS COMPOUNDS HAD TO BE ADDED AS SUPPLEMENTARY NUTRIENTS. CAPITAL AND OPERATING COSTS FOR A FULL-SCALE INSTALLATION ARE INDICATED. RECOMMENDATIONS FOR FURTHER RESEARCH ARE ALSO LISTED. (WITT-IPC)

FIELD 05D

WATER RESOURCES SCIENTIFIC INFORMATION CENTER
OFFICE OF WATER RESOURCES RESEARCH
U.S. DEPARTMENT OF THE INTERIOR

ACCESSION NO. W73-12528

"FOX RIVER..." WISC

ON MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS.

WISCONSIN UNIV., MADISON. INST. OF ENVIRONMENTAL STUDIES.

AVAILABLE FROM THE NATIONAL TECHNICAL INFORMATION SERVICE AS N73-13378, \$3.00 IN PAPER COPY, \$1.45 IN MICROFICHE. 1971-1972 PROGRESS REPORT NO NASA-CR-129797, 1972. 83 P, 31 FIG, 13 TAB, 7 REF. CONTRACT NO NGL-50-002-127.

DESCRIPTORS

*REMOTE SENSING, *WATER QUALITY, *MONITORING, *AQUATIC ENVIRONMENTS, *RESEARCH AND DEVELOPMENT, *WATER RESOURCES, GREAT LAKES, POLLUTANT IDENTIFICATION, LABORATORY TESTS, MODEL STUDIES, ON-SITE INVESTIGATIONS, METHODOLOGY, WATER POLLUTION, LAKE SUPERIOR, LAKE MICHIGAN, MATHEMATICAL MODELS, HYDROLOGIC PROPERTIES, POWERPLANTS, AERIAL PHOTOGRAPHY, PHOTOGRAMMETRY, OUTLETS, EUTROPHICATION, INDUSTRIAL WASTES, PULP WASTES, PULP AND PAPER INDUSTRY, AQUATIC PLANTS, PRIMARY PRODUCTIVITY, ECOSYSTEMS, INSTRUMENTATION.

IDENTIFIERS

THERMAL SCANNING IMAGERY, LAKE WINGRA, MYRIOPHYLLUM SPICATUM, MACROPHYTES, INFRARED RADIOMETRY, OEDOGONIUM, NUPHAR, NYMPHAEA, LAKE MENDOTA, DATA INTERPRETATION, WISCONSIN RIVER, FOX-ILLINOIS RIVER, FOX RIVER, GALFNA RIVER, CERATOPHYLLUM DEMERSUM, INFRARED THERMAL SCANNERY.

ABSTRACT

PROGRESS HAS BEEN MADE IN RELATION TO FIVE SPECIFIC WATER RESOURCES PROBLEMS TO WHICH REMOTE SENSING TECHNIQUES HAVE BEEN APPLIED IN ON-GOING RESEARCH. THE PROBLEM AREAS ARE: (1) WATER POLLUTION MONITORING, (2) EFFLUENT MIXING ZONE MODELING, (3) CURRENT AND CIRCULATION MODELING, (4) DETERMINATION OF HYDROLOGICALLY ACTIVE SOURCE AREAS, AND (5) ANALYSIS OF AQUATIC ECOSYSTEMS. BRIEFLY STATED, THE PROGRAMS IN THESE AREAS HAVE THE FOLLOWING OBJECTIVES: (1) TO ASCERTAIN THE EXTENT TO WHICH SPECIAL AERIAL PHOTOGRAPHY CAN BE USED IN MONITORING WATER POLLUTION PARAMETERS THROUGH A COMPARISON OF PHOTO IMAGERY AND ACTUAL POLLUTION CONDITIONS. (2) TO DEVELOP A RELATIONSHIP BETWEEN THE EXTENT OF THE 'MIXING ZONE' IN TERMS OF OUTFALL EFFLUENT, AND WATER BODY CHARACTERISTICS BY UTILIZING THE IMAGERY OBTAINED FROM INTENSIVE AERIAL REMOTE SENSING AND APPLYING THE DERIVED DATA IN DUPLICATING THE 'MIXING ZONE' CHARACTERISTICS IN A SERIES OF LABORATORY MODEL STUDIES. (3) TO DETERMINE THE FINE SCALE STRUCTURE AND EFFICIENCY OF NEARSHORE CIRCULATION PATTERNS IN THE GREAT LAKES THROUGH THE USE OF THERMAL SCANNING IMAGERY AND ANALYTIC PHOTOGRAMMETRIC TECHNIQUES. (4) TO DEVELOP A REMOTE SENSING TECHNIQUE FOR DETERMINING THE LOCATION AND EXTENT OF SOURCE AREAS IN A WATERSHED. (5) TO USE REMOTE SENSING IN THE DEVELOPMENT OF A PRODUCTION MODEL FOR MYRIOPHYLLUM SPICATUM L. IN LAKE WINGRA, AND TO EVALUATE THE FIELD POTENTIAL OF REMOTE SENSING TECHNIQUES IN DETECTING THE OCCURRENCE, INTENSITY, DURATION AND COMPOSITION OF ALGAL BLOOMS IN THE MADISON, WISCONSIN, AREA LAKES. THE METHODS AND DATA FOR EACH OF THE 5 AREAS ARE GIVEN. (MORTLAND-BATTELLE)