FRESHWATER SCIENCES
(SCHOOL OF)

About Freshwater Sciences
The School of Freshwater Sciences offers a graduate program of studies providing students with advanced training and education in four areas:

- Freshwater System Dynamics
- Human and Ecosystem Health
- Freshwater Technology
- Freshwater Policy and Economics

Each of these focus areas is interrelated with the others, and includes biologic, physical, technologic, and policy aspects of freshwater.

The Master of Science program has two tracks designed to provide a strong foundation necessary for the training of graduates that will utilize novel approaches to the sustainable and equitable use and management of freshwater systems worldwide. The Doctor of Philosophy program is a research degree designed to explore and discover novel approaches to the sustainable and equitable use and management of freshwater systems worldwide. These programs will create an interdisciplinary atmosphere for training the next generation of scientists armed with the knowledge, skills, and experience to anticipate and address the freshwater issues of the future.

Departments and Programs
- Freshwater Sciences and Technology, MS (Thesis) (http://catalog.uwm.edu/freshwater-sciences/freshwater-sciences-technology-ms)
- Freshwater Sciences and Technology, MS: Professional Science Track (http://catalog.uwm.edu/freshwater-sciences/freshwater-sciences-technology-professional-science-ms)
- Freshwater Sciences, PhD (http://catalog.uwm.edu/freshwater-sciences/freshwater-sciences-phd)

Freshwater Sciences
FRSHWTR 190 Topics in Freshwater Sciences:
1-3 cr. Undergraduate.
Current issues in freshwater sciences for undergraduates.
Prerequisites: none, except as may be required for specific topics.
Course Rules: May be retaken w/chg in topic to 9 cr max.
General Education Requirements: NS
Current Offerings: http://uwm.edu/schedule

FRSHWTR 191 Great Lakes Ecology
3 cr. Undergraduate.
A select history of Great Lakes ecosystem change.
Prerequisites: none.
Course Rules: Counts as repeat of Frshwtr 190 with similar topic.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 461 Politics and Policy of Sustainability
3 cr. Undergraduate/Graduate.
Principles of environmental policy, governance, and management for global sustainability.
Prerequisites: jr st; CES 210(P) or cons instr.
Course Rules: CES 461, Frshwtr 461, & Global 461 are jointly offered; they count as repeats of one another.
Last Taught: Spring 2015, Fall 2013.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 464 Chemical Hydrogeology
3 cr. Undergraduate/Graduate.
Natural chemical processes that occur in groundwater systems, how they are modified by human activity and contamination, and attempts to regulate them. Lec, lab.
Prerequisites: jr st; Chem 102(P)
Course Rules: Frshwtr 464 & Geo Sci 464 are jointly offered; they count as repeats of one another.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 496 UROP Apprenticeship, Upper-Level
1-3 cr. Undergraduate.
Undergraduate research participation in a project developed with a supervising member of the faculty or staff. One credit for 45 hrs research.
Prerequisites: jr st; acceptance to UROP; prior or conc reg in UROP seminar.
Course Rules: May be retaken to 9 cr max in any combination of UROP apprenticeship courses.
Last Taught: Spring 2017, Fall 2013.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 497 Study Abroad:
1-12 cr. Undergraduate/Graduate.
Designed to enroll students in UWM sponsored program before course work level, content and credits are determined and/or in specially prepared program course work.
Prerequisites: jr st; acceptance for Study Abroad Prog.
Course Rules: May be retaken w/chg in topic.
Last Taught: UWinteriM 2012.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 498 Undergraduate Research
1-3 cr. Undergraduate.
Undergraduate research on faculty-supervised research projects.
Prerequisites: jr st; cons instr.
Course Rules: May be retaken to 6 cr max.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 502 Aquatic Ecosystem Dynamics
3 cr. Undergraduate/Graduate.
Interdisciplinary, quantitative approach to understanding large lake dynamic processes, including geological formation, hydrology, hydrodynamics, chemistry and the dynamics of plankton and fish communities.
Prerequisites: jr st; 1 sem calculus or algebra; 2 sem Physics, Chem, or Bio Sci; or cons instr.
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule
FRSHWTR 504 Quantitative Freshwater Analysis
3 cr. Undergraduate/Graduate.
A fundamental set of tools for the quantitative analysis of environmental data sets, with an emphasis on the calculation of reservoirs, residence times and rates in aquatic systems.
Prerequisites: jr st; 1 sem calculus, Physics, Chem, & Bio Sci; or cons instr.
Last Taught: Spring 2018, Spring 2017, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 506 Environmental Health of Freshwater Ecosystems
3 cr. Undergraduate/Graduate.
The influences of human-induced environmental change on the health of freshwater ecosystems and humans who interact with these systems.
Prerequisites: jr st.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 508 Aquatic Technologies
3 cr. Undergraduate/Graduate.
Interdisciplinary perspective on the function, application and development of technologies used in the aquatic sciences.
Prerequisites: jr st.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 510 Economics, Policy and Management of Water
3 cr. Undergraduate/Graduate.
The impact of economics, policy and management decisions on our freshwater resources and how science and economics affect these decisions.
Prerequisites: jr st.
Last Taught: Fall 2017, Fall 2016, Spring 2016, Fall 2014.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 511 Ichthyology
3 cr. Undergraduate/Graduate.
The diverse biology of fishes focusing on behavioral, biomechanical, genetic, and physiological adaptations to diverse ecological systems.
Prerequisites: jr st; grade of C or better in Bio Sci 310(P); or cons instr.
Course Rules: Bio Sci 511 & Frshwrtr 511 are jointly offered; they count as repeats of one another.
Last Taught: Fall 2017, Fall 2016, Fall 2015, Fall 2014.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 512 Freshwater Sciences Practicum:
2-4 cr. Undergraduate/Graduate.
Diverse opportunities for practical, hands-on experience in the practice of freshwater science with emphasis on team work, problem solving, field work, and dissemination of results.
Prerequisites: jr st, Frshwtr 502(P) & 504(P); or cons instr.
Course Rules: May be retaken w/chg in topic to 9 cr max.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 513 Field Experimentation and Analysis in Freshwater Sciences
3 cr. Undergraduate/Graduate.
Student acquisition of comprehensive investigative procedures in freshwater ecology focusing on field and laboratory interactive assignments.
Prerequisites: jr st; Bio Sci 152(P); Chem 104(P); or grad st.
Last Taught: Fall 2017.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 514 Analytical Techniques in Freshwater Sciences
3 cr. Undergraduate/Graduate.
Modern analytical techniques and genomics principles and methods in freshwater sciences.
Prerequisites: jr st; Bio Sci 152(P); Chem 104(P); or grad st.
Course Rules: Counts as repeat of Frshwtr 650 w/same topic.
Last Taught: Spring 2018.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 522 Aquatic Organic Biogeochemistry
3 cr. Undergraduate/Graduate.
Fluxes and biogeochemical cycling pathways of dissolved, colloidal and particulate organic matter across interfaces in aquatic systems.
Prerequisites: jr st & 1 sem Chem; or cons instr.
Last Taught: Fall 2017, Fall 2015.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 524 Aquatic Isotope Biogeochemistry
3 cr. Undergraduate/Graduate.
Principles and applications of stable and radioactive isotopes and other biogeochemical tracers in aquatic environments.
Prerequisites: jr st.
Last Taught: Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 562 Principles of Aquaculture Systems
3 cr. Undergraduate/Graduate.
Physical and chemical aspects of intensive & recirculating operations of aquaculture production systems.
Prerequisites: jr st; BioSci 152 (P); Chem 104(P); Math 116(P).
Current Offerings: http://uwm.edu/schedule

FRSHWTR 563 Finfish Aquaculture and Nutrition Principles
3 cr. Undergraduate/Graduate.
Principles of aquaculture and fish nutrition; emphasis on Great Lakes; future challenges to aquaculture development in North America.
Prerequisites: jr st; Bio Sci 152(P); Chem 104(P).
Last Taught: Fall 2016, Fall 2015, Spring 2015.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 564 Water Quality in Aquaculture
3 cr. Undergraduate/Graduate.
Principles of water chemistry & microbial conversion of nutrients; microorganisms that impact fish health; for successful operation of intensive aquaculture operations.
Prerequisites: jr st; Bio Sci 152(P); Chem 104(P).
Current Offerings: http://uwm.edu/schedule
FRSHWTR 565 Fish Health
3 cr. Undergraduate/Graduate.
Overview of current and emerging fish diseases and treatment strategies to diagnose and identify pathogens and disease to mitigate spread of disease.
Prerequisites: jr st, Bio Sci 152(P); Chem 104(P).
Current Offerings: http://uwm.edu/schedule

FRSHWTR 584 Aquatic Ecosystem Services Valuation
3 cr. Undergraduate/Graduate.
Economic theory and methods in valuing aquatic and related terrestrial ecosystems.
Prerequisites: jr st.

FRSHWTR 585 Aquatic Ecosystem Services Valuation
3 cr. Undergraduate/Graduate.
Economic theory and methods in valuing aquatic and related terrestrial ecosystems.
Prerequisites: jr st.

FRSHWTR 590 Independent Study in Freshwater Sciences for Biological Sciences Students
1-3 cr. Undergraduate.
Independent and original research on a topic not available as a regular course; conducted under the direction of faculty or staff scientist from the School of Freshwater Science.
Prerequisites: jr st; Bio Sci 310(P), 315(P)/316(P), or 383(P); 2.500 GPA; writ cons instr, dept chair, & asst dean for SAS.
Course Rules: Counts as repeat of Frshwtr 650 with similar topic.
Last Taught: Fall 2016, Spring 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 610 Freshwater Policy and Governance
3 cr. Graduate.
The main theoretical frameworks used in public policy to study environmental problems.
Prerequisites: grad st.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 621 Benthic Ecology
3 cr. Undergraduate/Graduate.
Chemophysical and biological interactions in freshwater and marine systems. Emphasis on invertebrate ecology. 2 hrs lec, 4 hrs lab.
Prerequisites: sr st & cons instr; or grad st.
Course Rules: Req’d field work for which fee is assessed.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 640 Sequence Analysis
3 cr. Undergraduate/Graduate.
Molecular biology underlying nucleic and amino acid analyses and the tools available to conduct comparative sequence analysis.
Prerequisites: jr st; BIO SCI 152(P), BIO SCI 325(P), & CHEM 104(P); or grad st.
Course Rules: Counts as repeat of Frshwtr 512 with similar topic.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 650 Topics in Freshwater Sciences:
1-3 cr. Undergraduate/Graduate.
Current issues in freshwater sciences.
Prerequisites: jr st.
Course Rules: May be retaken w/chg in topic to 9 cr max.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 690 Undergraduate Seminar in Freshwater Sciences:
1-3 cr. Undergraduate.
Seminar on topics of current interest in freshwater sciences.
Prerequisites: jr st.
Course Rules: May be retaken w/chg in topic to 9 cr max.
Last Taught: Spring 2018, Fall 2017, Fall 2016, Fall 2015.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 695 Independent Study for Undergraduates
1-3 cr. Undergraduate.
Independent study on a topic not available as a regular course; conducted under the supervision of a faculty member; requires approved study proposal.
Prerequisites: jr st; cons instr.
Course Rules: May be retaken to 6 cr max.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 781 Water Law for Scientists and Policy Makers
3 cr. Graduate.
The course is formatted to provide five (5) classes each on the Clean Water Act and basic common law concepts of Water Law; The Great Lakes Compact; and Wisconsin’s Groundwater Protection Act. Counts as repeat of Frsh Wtr 650 with similar topic.
Prerequisites: grad st.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 782 Water Resources Planning
3 cr. Graduate.
Emphasis on planning for water across the water cycle (surface, groundwater, wetlands, etc.), integrating non-water resources (habitat, energy, GHG emissions, etc.) in an urban context.
Prerequisites: grad st.
Course Rules: Jointly offered with & counts as repeat of UrbPlan 782.
Last Taught: Fall 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 790 Freshwater Policy and Governance
3 cr. Graduate.
The main theoretical frameworks used in public policy to study environmental problems.
Prerequisites: grad st.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 810 Professional Development for Water Leaders
3 cr. Graduate.
Exploration of skill set needed for lifelong career development: research ethics, communications, teamwork, interpersonal relationships, administration, entrepreneurship, project management, and leadership.
Prerequisites: Counts as repeat of FrshWtr 650 with similar topic. Prereq grad st.
Last Taught: Fall 2017, Fall 2016, Fall 2015.
Current Offerings: http://uwm.edu/schedule
FRSHWTR 822 Molecular & Cellular Basis of Environmental Disease
3 cr. Graduate.
Examines how environmental agents cause changes in gene expression, structure, and activity leading to disease; and resulting alterations in normal cellular processes and physiological consequences.
Prerequisites: grad st
Course Rules: Frshwtr 822 & EOH 822 are jointly-offered; they count as repeats of one another.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 888 Candidate for Degree
0 cr. Graduate.
Available for grad students who must meet minimum credit load requirement. Fee for 1 credit assessed.
Prerequisites: grad st; cons instr.
Last Taught: Fall 2017, Summer 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 900 Colloquium in Freshwater Sciences
1 cr. Graduate.
Lectures by staff and visitors on research in various areas of freshwater sciences.
Prerequisites: grad st.
Course Rules: Retakable up to 2 cr.
Last Taught: Spring 2018.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 901 Seminar in Freshwater Sciences:
1-3 cr. Graduate.
Seminar on topics of current interest in freshwater sciences.
Prerequisites: grad st.
Course Rules: May be repeated w/ chg in topic to 9 cr max.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 980 Graduate Internship
1-3 cr. Graduate.
Students earn credits for serving in an internship that involves work related to freshwater sciences disciplines. They must prepare a report based on the internship. Retakable w/chg in topic to 6 cr max. Satisfactory/Unsatisfactory only.
Prerequisites: grad st; cons instr.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 985 Master's Research and Thesis
1-6 cr. Graduate.
Research and writing of the master's thesis under the supervision of the major professor.
Prerequisites: grad st; cons instr.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 990 Doctoral Research and Dissertation
1-9 cr. Graduate.
Research and writing of the doctoral dissertation under the supervision of the major professor.
Prerequisites: grad st; cons instr.
Last Taught: Spring 2018, Fall 2017, Spring 2017, Fall 2016.
Current Offerings: http://uwm.edu/schedule

FRSHWTR 999 Independent Study
1-3 cr. Graduate.
For graduate students unable to secure needed content in regular courses.
Prerequisites: grad st; cons instr.
Course Rules: Retakable w/ chg in topic to 6 cr max.
Current Offerings: http://uwm.edu/schedule

Faculty

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Degree</th>
<th>School</th>
<th>Graduate Faculty</th>
<th>Emeritus Faculty</th>
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<tbody>
<tr>
<td>Carmen Aguilar</td>
<td>Associate Scientist</td>
<td>PhD</td>
<td>University of Wisconsin - Milwaukee</td>
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<tr>
<td>Fred Binkowski</td>
<td>Senior Scientist</td>
<td>PhD</td>
<td>University of Wisconsin - Milwaukee</td>
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<tr>
<td>Harvey Bootsma</td>
<td>Associate Professor</td>
<td>PhD</td>
<td>University of Manitoba</td>
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<tr>
<td>Tracy Boyer</td>
<td>Associate Professor, Director of the Center for Water Policy</td>
<td>PhD</td>
<td>University of Minnesota</td>
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<tr>
<td>Arthur Brooks</td>
<td>Professor</td>
<td>PhD</td>
<td>Johns Hopkins University</td>
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<td>Michael Carvan</td>
<td>Shaw Professor</td>
<td>PhD</td>
<td>Texas A&amp;M University</td>
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<tr>
<td>Russell Cuhel</td>
<td>Senior Scientist</td>
<td>PhD</td>
<td>Massachusetts Institute of Technology and Woods Hole Oceanographic Institution</td>
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<tr>
<td>Dong-Fang Deng</td>
<td>Senior Scientist</td>
<td>PhD</td>
<td>University of California - Davis</td>
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<tr>
<td>Tim Grundl</td>
<td>Professor, Associate Dean of Academics</td>
<td>PhD</td>
<td>Colorado School of Mines</td>
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<tr>
<td>Laodong Guo</td>
<td>Professor</td>
<td>PhD</td>
<td>Texas A&amp;M University</td>
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<td>John Janssen</td>
<td>Professor</td>
<td>PhD</td>
<td>Michigan State University</td>
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<td>Jerry Kaster</td>
<td>Associate Professor</td>
<td>PhD</td>
<td>University of Colorado</td>
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<td>Jenny Kehl</td>
<td>Associate Professor</td>
<td>PhD</td>
<td>University of Colorado at Boulder</td>
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<tr>
<td>Rebecca Klaper</td>
<td>Professor, Director of the Great Lakes Genomics Center</td>
<td>PhD</td>
<td>University of Georgia</td>
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<tr>
<td>J. Val Klump</td>
<td>Professor, Dean</td>
<td>PhD</td>
<td>University of North Carolina - Chapel Hill</td>
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<td>James Lubner</td>
<td>Professor</td>
<td>PhD</td>
<td>University of Wisconsin - Milwaukee</td>
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<td>Sandra McLellan</td>
<td>Professor</td>
<td>PhD</td>
<td>University of Cincinnati Medical Center</td>
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<td>Ryan Newton</td>
<td>Assistant Professor</td>
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<td>University of Wisconsin - Madison</td>
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<td>Charles Remsen</td>
<td>Professor</td>
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<td>Syracuse University</td>
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<td>Matthew Smith</td>
<td>Assistant Professor</td>
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<td>University of Tasmania</td>
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<td>Osvaldo Jhonatan Sepulveda Villet</td>
<td>Assistant Professor</td>
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<td>University of Toledo</td>
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<tr>
<td>James Waples</td>
<td>Assistant Professor</td>
<td>PhD</td>
<td>University of Wisconsin - Milwaukee</td>
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**Contact Information**

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http://uwm.edu/freshwater/