

THE RIVER PROJECT

Marine Biology Internship Program 2005 - 2006

In partnership with:

New York University's

Wallerstein Collaborative for Urban Environmental Education



Funded by:

The National Science Foundation

With significant contributions from: Helena Rubinstein Foundation, The Bay Foundation, CitiGroup Foundation, Greentree Foundation, through Educational Equity Concepts, and National Institutes of Health, through Mt. Sinai Superfund Basic Research Program.



Pier 26, North River, NYC, NY 10013
(212) 233-3030 ph, (212) 233-3419 fax
www.riverproject.org

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The River Project is a marine science field station at Pier 26, Tribeca, in Manhattan. The Project was founded in 1986, dedicated to protection and restoration of the Hudson River ecosystem through scientific research and environmental education. The River Project has also established an experimental facility at Pier 26 to help restore an ecologically stressed habitat along the Manhattan shoreline.

The **Marine Biology Internship Program** provides for high school, undergraduate and graduate students to become directly involved in the science of urban wildlife, water quality, and the habitats of Manhattan's west side waterfront. This hands-on experience with environmental science is unique in offering three experiences not offered in most high school and university curricula:

- field work,
- research that yields results bearing directly on local policy, and
- supervision by scientist mentors who are acknowledged experts in the research areas.

The Marine Biology Internship Program is funded by the **National Science Foundation**, with significant contributions from the **Helena Rubinstein Foundation**, the **Bay Foundation**, **CitiGroup Foundation**, **Greentree Foundation** (through **Educational Equity Concepts**), and **National Institutes of Health** (through **Mt. Sinai Superfund Basic Research Program**), in partnership with **New York University's Wallerstein Collaborative for Urban Environmental Education**.

BACKGROUND

New York Harbor and its waterfronts are undergoing major changes. Many natural or naturalized areas have been removed, paved over, and developed without knowledge of what was there and how it functioned. Here at Pier 26 we have an opportunity to study a habitat, its water quality, and the plants and animals it sustains, and to try to understand its value, before new development occurs. Habitat restoration, fish and wildlife conservation, and the role of natural areas in performing biological work such as maintaining or improving air and water quality, need to be better understood and more widely recognized before an opportunity is lost to benefit from them. Human uses of the waterfront now include kayaking, and even swimming.

On the west side of Manhattan submerged and intertidal zones sustain a large but under-reported number of plant and animal species that have not been studied as an urban ecosystem, and their populations are as yet undefined. This area has niches well-populated with interesting species such as seahorses and marine subtropical fishes, and supports life-stages and large populations of commercially important species such as black sea bass, striped bass, winter flounder, tomcod and blue crabs. Herons, egrets and bitterns are occasional residents as well. A wide variety of plants grow in small, highly stressed niches on the piers. Water quality in the city is tested by the government (NYC Department of Environmental Protection) only in the main channel of the river, whereas in-water recreation, for which there is increasing demand, occurs mostly near-shore.

The purpose of the interns' research is to investigate habitat, wildlife, and water quality in this reach of the Harbor; to disseminate the knowledge gained to interested parties, including our sponsors and scientist mentors; the city, state and federal environmental agencies, and the public; and to work with the planning community to develop science-based policies that include nature.

PROGRAM DESCRIPTION

This program is designed to enfold young people into the scientific community of the NY/NJ Harbor Estuary, and life on the Tribeca waterfront, and to develop their interest in the Harbor's living resources. Student projects are useful contributions to the New York Harbor database, and they generate discussions, enhance critical thinking, and enrich the policy and planning debate regarding aspects of the local ecosystem about which people always need additional information. This multi-disciplinary, multi-institutional internship encourages young people to pursue careers in marine sciences, earth science, ichthyology, urban design, and a wide variety of associated fields. Since 2000, interns have won eight Intel semi-finalist and other prestigious science awards.

The program introduces students to marine science and immerses them in investigative research through a project that could lead to exciting new discoveries within the capabilities of each student. Interns participate in relevant, on-going basic and applied research. Students help design and execute experimental projects under the supervision of The River Project's science staff and outside mentors, who are recognized experts in their fields from regional environmental agencies and academic institutions. Each intern project builds upon the work of the previous years' interns.

In addition to the research projects, students participate in training sessions for species identification, laboratory techniques, and record-keeping; aid in production of educational materials for The River Project's *Estuarium* exhibit and web site; guide tours of the facilities; and give presentations to increase public awareness of fish and wildlife in the Harbor and heighten community appreciation of the ecology of the waterfront.

RESEARCH PROJECTS

Fish Ecology: This project is based on an 18-year database of inshore fishes of a west side waterfront study area centered at Pier 26. The study area supports numerous and diverse species of fishes, including sea horses, striped bass, flatfishes, black sea bass, tomcod, and rock gunnels, to name a few of the 49 species documented here to date. Traps are deployed off the docks and pilings of the pier. The study includes a survey of the local fishes; documentation of parameters affecting fish distribution, such as temperature, salinity, turbidity, dissolved oxygen, nitrite, nitrate, plankton, and fish eggs and larvae; life cycle studies; and behavioral observations of feeding, inter- and intra-species relationships, and spawning.

Mentor:

Dr. John Waldman, Professor, Biology Department, Queens College, CUNY

Local Fish Community Structure: This new study, related to the above study, will investigate a temporal fish community structure using our fish database and several biological statistic tools. Students will analyze the community structures using canonical correspondence analysis and cluster analysis to determine species richness, abundance and distribution within the study area.

Mentors:

Dr. John Mandersen, Biologist, National Marine Fisheries Service, Sandy Hook, NJ

Dr. John Waldman, Professor, Biology Department, Queens College, CUNY

Distribution of *Tautoglabrus adspersus* (cunner): A mark and recapture study is designed to assess the population of cunners in our study area. This species is a member of the wrasse family, most of whose members are tropical reef dwellers. Cunners are thought to be the most common fish on Manhattan's west side waterfront, and therefore might be assumed to play an important role in the local ecology, though, if so, that role is unknown. Their distribution over space is analyzed by mapping, focused on interpier migrations of individuals. Results to date indicate that these fish remain within a relatively small area and favor certain spots within that area.

Mentor:

Cathy Drew, M.S., Executive Director, The River Project

Mike Ludwig, Ecologist, National Marine Fisheries Service

Human Pathogens: Pathogens from sewage are the limiting factor to primary and secondary-contact recreation in the Harbor (swimming and kayaking). This project is designed to define the range of pathogenicity in the study area over a variety of conditions. Concentrations of *Enterococci*, total bacteria (gram positive and gram negative), total gram positives, and lactose fermenters are measured and analyzed in water samples collected at the study area and correlated with rainfall, dissolved oxygen, temperature, and salinity. Lab work is performed in-house, under the guidance of trained technicians. The study is designed to test a theory from the old days, when Tribeca was the Washington Market, called the "three day rule," which says that if you wait until three days after a rain it's safe to swim off these piers. This old wives' tale makes sense today; raw sewage goes directly into the river after approximately 1/6 inch of rain, and remains locally for a while. Studies over the past three years have been conducted during summer months, when recreational activity is highest. These indicate that the three day rule may be an excellent indicator of when it would be safe to swim; in every case to date pathogens have fallen to beach quality levels (USEPA and NYCDEP levels for swimming at the city beaches) by three days after a rain, although they are often at levels that would close a beach one or two days subsequent to a rain event. This project will next test throughout spring, summer, and fall to gain annual data and more data points.

This study is conducted in partnership with **New York City Department of Health/Bureau of Public Health, NYC Department of Environmental Protection, the Interstate Environmental Commission** and the **Marine Sciences Research Center, SUNY, Stony Brook**. It is the only study of this kind in the area, and is a companion study to the 'Tracking and Mapping' study described below.

Mentors:

Dr. Bruce Brownawell, Associate Professor, Marine Sciences Research Center, SUNY, Stony Brook.

Robert Ranheim, Research Scientist, NYC Department of Environmental Protection/Marine Sciences.

Founding Mentors:

Dr. Egbert Lord, Chief of Microbiology Lab Services, NYC Department of Environmental Protection.

Allen Aigen, Associate PHS II - NYCDOH/Bureau of Public Health and Engineering.

Dr. Boris Rukovets, Asst. Executive Director and Asst. Chief Engineer, Interstate Environmental Commission.

Tracking and Mapping the Movement of Water within an Inter-pier Area: Using drogues designed to move with currents at various depths, this study plots water circulation patterns in the embayment between Pier 26 and Pier 32 under varying conditions such as phases of the moon, droughts, floods, and storm surges. This is a companion study to the pathogen study above, modeling the transport track of

sewage overflows from an outfall in the area. The goal is to develop predictive capabilities for sewage dispersal.

Mentor:

Mike Ludwig, Ecologist, National Marine Fisheries Service

Growth and Mortality of Farmed Oysters: The bottom of the Harbor was once covered with oyster reefs. Due to overfishing and pollution at the turn of the century, the eastern oyster (*Crassostrea virginica*) was virtually eradicated from the harbor. Today, water quality in New York Harbor has improved greatly, and oysters have begun to reappear after an absence of more than 100 years, but only in some places, and in low numbers. Functioning oyster reefs characterize the ecosystems where they exist; they support over 200 species of plants and animals, and filter particles out of large volumes of water. (A single oyster can filter 3 liters of water an hour.) Oysters contributed by Flowers Oyster Hatchery, in Oyster Bay, Long Island, are held in 4' high lantern nets with five tiers each. Results to date indicate that growth rates are highest and mortality lowest in the upper tiers. These rates are now going to be crossed with salinity, temperature, light intensity, turbidity and plankton to determine the significance, if any, of these parameters in growth and mortality. The goals of the oyster study are to define a contemporary New York Harbor Oyster Community by growing seed oysters for further study, attempting to spawn adult oysters, and attracting oyster spat to set. We would like to establish a small oyster reef in Tribeca.

Mentors:

Mike Ludwig, Ecologist, NOAA/National Marine Fisheries

Wild Oyster Population Under Pier 26: The population of wild oysters under Pier 26 is increasing. Mapping of these oysters has been conducted each year since 2004. In 2001, 30 oysters were found in the intertidal zone under a section of Pier 26. In 2002, interns found 37 live wild oysters and 31 dead shells in that study area (approximately 400 square feet). In 2003, 70 live wild oysters and 60 dead were found there, of which 15 were identified as the same oysters from 2002. Results indicate an increase in the population again in 2004, to 149 oysters, of which 31 were alive and 118 dead. In 2005 we plan to bring in divers to locate and map oysters below the intertidal zone in the study area, and interns will continue to survey and map the oysters of the intertidal area. Each year the number of individuals has increased, mortality has also increased, and mean size has decreased. This could be due to a greater number of young oysters, the particularly harsh winter, effects of ferry wakes, or other as yet unidentified causes.

Mentor:

Mike Ludwig, Ecologist, NOAA/National Marine Fisheries

Plankton Ecology: Students collect and analyze data on the base of the food web in New York Harbor. Using plankton nets, a dissecting microscope, a video-microscope, and standard plankton preservation and study techniques, interns collect and identify some of the hundreds of species of local zooplankton and correlate results with temperature and salinity in an effort to characterize environmental conditions that predict the occurrence of various species. In 2003, the first year of this study, data was collected from July through August as part of a summer study. This study is ongoing, and will continue in 2005 to determine if there is a seasonal variation in the species present. During the summer studies it was determined that copepods are found throughout the Hudson River Estuary in all water conditions, in salinities ranging from 10.6 to 20.6 ppt (parts per thousand). *Acartia tonsa* was the most common species, found in every tow, while fish eggs, polychaete worms, crab larvae (zoea), jellyfish and ctenophores were also frequently observed. In 2004, plankton samples were collected in July and

August. Mid water trawls and surface trawl samples were collected for quantitative analysis of copepods and nauplii found in these two cross sections of the Hudson River. It was found that abundance of both species were higher in the mid waters. Data collected from 1996 to 2003 from Pier 26 on the Hudson River and Pier 16 of the East River was also analyzed and compared to the temperature and salinities found in the two bodies of water. Both bodies of water were found to contain 3-7 different types of phytoplankton throughout the year with peaks in the winter months.

Mentor:

Dr. Michael Levandowsky, Professor of Microbiology, Haskins Laboratory, Pace University.

MARINE BIOLOGY INTERNSHIP PROGRAM

Partners

The Hudson River Park Trust
Community Board #1
NYU's Wallerstein Collaborative for Urban Environmental Education

Funders

Bay Foundation
CitiGroup Foundation
Environmental Careers Organization
Greentree Foundation (through Educational Equity Concepts)
Helena Rubinstein Foundation
National Institutes of Health, through Mt. Sinai Superfund Basic Research Program
National Science Foundation
New York City Environmental Fund
New York State Environmental Protection Fund, through the Hudson River Estuary Program of the New York State Department of Environmental Conservation
Norcross Wildlife Foundation

In-Kind and Pro Bono Contributors

American Express
Flower & Sons Oyster Hatchery
Honda Marine
New York Aquarium for Wildlife Conservation

Scientist Mentors

Allen Aigen, Associate PHS II - NYCDOH/Bureau of Public Health and Engineering
Howard Golub, Executive Director, Interstate Environmental Commission
Dr. Marcha Johnson, ASLA, Landscape Architect, New York City Department of Parks and Recreation
Dr. Michael Levandowsky, Professor of Microbiology, Haskins Laboratory, Pace University
Dr. Jeffrey Levinton, Professor, Dept. of Ecology and Evolution, SUNY at Stony Brook
Dr. Egbert Lord, Chief of Microbiology Lab Services, NYC Department of Environmental Protection
Mike Ludwig, Ecologist, NOAA/National Marine Fisheries
Dr. John Mandersen, Fisheries Biologist, National Marine Fisheries Service, Sandy Hook, NJ
Robert Ranheim, Scientist/Water Ecologist, NYC Department of Environmental Protection
Dr. Boris Rukovets, Asst. Exec. Director & Asst. Chief Engineer, Interstate Environmental Commission
Dr. John Waldman, Senior Scientist, Hudson River Foundation
Dr. Isaac Wirgin, Nelson Institute of Environmental Medicine, NYU School of Medicine

Interns' Schools and Organizations:

Barnard College
Bayard Rustin High School for the Humanities
Borough of Manhattan Community College
The Brearley School
Bronx High School of Science
Brooklyn Friends School
Brooklyn Technical High School
Children's Museum of Manhattan

City-As-School
The Calhoun School
The Dalton School
Eastside High School
Elizabeth Irwin High School
Emerson High School
Fordham Preparatory School
Friend's Seminary
Fresh Youth Initiatives
Great Neck South High School
High School for Environmental Science
Horace Greeley High School
Horace Mann School
Institute for Collaborative Education
I.S. 89
John Bowne High School
LaGuardia High School
Lycée Privé Ste. Geneviève
Manhasset Science Research High School
Manhattan Center High School for Science and Mathematics
Manhattan International High School
Manhattan Village Academy
MLK High School of Art and Technology
Mott Hall School
Mount Sinai School of Medicine
Natural Resources Defense Council
Neighborhood Open Space Coalition
New School
New York Academy of Science
New York City Lab School
New York Department of Sanitation
New York University
Northeastern University
Packer Collegiate Institute
Pisces Conservation Ltd.
Plainview High School
Queens College
Ramaz Upper School
Saint Dominic Academy
Saint Ignatius Loyola School
Salk School of Science
Schreiber High School
Settlement High School College Readiness
Sewanhaka High School
South Side High School
Stuyvesant High School
SUNY Binghamton
Syosset High School
The Masters School

Townsend Harris High School
Trevor Day School
Urban Academy
Valley Stream Central High School
Washington Irving H.S.

ELIGIBILITY AND COST

The program is offered to high school, undergraduate and graduate school students. Any enrolled student is eligible. The program runs year-round. Students can enter at any time, and their schedules will be accommodated and arranged individually. A formal summer program begins July 5th and runs through August 31st.

The fee is \$250 per term, with a minimum of 50 hours spent; there is no maximum number of hours (students will receive guidance for as many hours as they care to work). Some scholarships are available, funded by the **Mt. Sinai Superfund Basic Research Program** and **The River Project**. Scholarships are based on documented need or academic achievement.

Students are usually required to have a strong science background and interest in science as a profession. If a student is committed and can help with non-science tasks that student may also be eligible.

Graduate students should apply by contacting us directly instead of filing this form; they will be accepted to perform thesis work based on relevance of their project to our work. Graduate students are usually required to contribute time to supervising younger interns.

APPLICATION GUIDELINES AND PROCEDURES

Applications are considered year-round; internships can begin at any time during the year. Entrance into the program is competitive, based on ability to contribute to our research program. Each internship is tailored to the individual student in cooperation with his or her school or university, adviser, or parent. The site is accessible seven days a week except from November through March, when no one is here Sundays.

Each intern's program is custom-designed. Students may write theses, scientific reports, or journal articles; and/or do presentations, posters, or submissions to science fairs and competitions. Mentors and staff will help with any work product. No specific work products are required; students with no particular project are expected to help on other projects. However, once a student's program is approved (duration of internship, hours, schedule, research project, scientist mentor and work products), it is expected that the program will be completed as planned.

Students apply by submitting the following materials, preferably electronically to hoi@riverproject.org, though any way is acceptable:

- A one-page letter requesting to be considered and stating, in several sentences, what you hope to do here and why,
- The Internship Application Form (next page),
- A note to us from your teacher or professor requesting that we supervise your project, and describing his/her requirements and expectations for your work,
- A letter of recommendation,
- A writing sample, preferably a science report.

If you qualify you will be invited to come for an interview, and then to trail other interns. Shortly thereafter you will be notified of whether or not you have been accepted into the program. If you have questions not answered here, please call The River Project office at 212/233-3030 and ask to speak to the Head of Interns, or e-mail hoi@riverproject.org.

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MARINE BIOLOGY INTERNSHIP PROGRAM**

APPLICATION FORM

Student contact information:

Name: _____ Date: _____

Age and grade level, major (if applicable): _____

Name of parent/guardian, if under 18: _____

Address: _____

Phone: _____ E-mail: _____

Supervisor contact information (if applicable):

Name: _____

Title: _____

Academic institution, sponsoring organization, or department: _____

Address: _____

Phone: _____ Fax: _____ E-mail: _____

Proposed schedule:

Number of weeks, start/end dates: _____

Days of the week and hours each day: _____

Total hours: _____

Fee:

Do you plan to apply for a reduction/waiver of the internship fee? _____ If so, what documents do you plan to submit in support? _____

Please see preceding page for a list of other materials required to complete your application.