

Teachers on the Estuary (TOTE)
Course Syllabus
Waquoit Bay Research Reserve ~ July 8-10, 2009

Course description: This course is a pilot for the Teachers on the Estuary program, a research and field-based teacher training initiative of the National Estuarine Research Reserve System, part of the National Oceanic and Atmospheric Administration (NOAA). The goal of TOTE is to improve teachers' and students' understanding of the environment using local examples and to provide resources and experience to support the incorporation of estuary and watershed topics into classroom teaching. The course is also designed to promote stewardship of watersheds and estuaries.

The course will introduce teachers to information, research, and classroom activities about watersheds, estuaries, and coastal systems. The course incorporates investigations in the field and using on-line data. Course content and activities will be aligned with Massachusetts state science and math frameworks.

Credit: 24 hours of contact time for 2 graduate credits or 45 Professional Development Points. Graduate credit is optional and is available from Framingham State College for \$65.00 per credit. PDPs are free and granted through Waquoit Bay Research Reserve.

Grade levels: The course is designed for science and math teachers in grades 9 through 12. Others are welcome to apply.

Schedule:

Wednesday July 8, 2009	9:00 am – 4:00 pm
Thursday, July 9, 2009	8:30 am – 4:00 pm and 7:00 – 9:00 pm
Friday, July 10, 2009	8:30 am – 2:00 pm
Saturday, November 21, 2009	9:00 am – 12:00 pm

Location: Waquoit Bay National Estuarine Research Reserve, Falmouth, MA

Cost: Thanks to support from a NOAA Bay Watershed Education and Training grant, the course is offered without charge.

Support: Each participant will receive a \$200 grant for education and stewardship projects related to course topics, as well as \$150 in teaching materials. A \$100 stipend will also be awarded to each teacher at the follow up session for successful completion of the course.

Lodging and meals: Optional lodging at a local hotel for 3 nights will be provided for participants during the course. Meals will be provided.

Application: Space is limited and participation is by application. Application may be downloaded at www.waquoitbayreserve.org or www.estuaries.gov

Instructors: Pat Harcourt, Waquoit Bay National Estuarine Research Reserve

PO Box 3092, Waquoit MA 02536
pat.harcourt@state.ma.us (508) 457-0495 x 106

Joan Muller, Waquoit Bay National Estuarine Research Reserve
PO Box 3092, Waquoit MA 02536
joan.muller@state.ma.us (508) 457-0495 x 107

Course objectives: Participants will be able to

1. Access and use the on-line Estuaries 101 curriculum and other NERRS/NOAA educational products with students.
2. Describe major physical, biological, chemical and geochemical estuarine processes as well as impacts of human activities on coastal systems.
3. Locate, download, and use data relevant to lessons about estuaries.
4. Teach basic estuarine concepts by guiding students in using field and laboratory research techniques analogous to those used at Research Reserves.
5. Explain the six Estuarine Principles and Concepts listed below.
6. Lead students in learning activities that improve the students' abilities to become stewards of the environment.

Estuarine Principles and Concepts

Principle 1. Estuaries are interconnected with the world ocean and with major systems and cycles on Earth.

Principle 2. Estuaries are dynamic ecosystems with tremendous variability within and between them in physical, chemical, and biological components.

Principle 3. Estuaries support an abundance of life, and a diversity of habitat types.

Principle 4. Ongoing research and monitoring is needed to increase our understanding of estuaries and to improve our ability to protect and sustain them.

Principle 5. Humans, even those living far from the coast, rely on goods and services supplied by estuaries

Principle 6. Human activities can impact estuaries by degrading water quality or altering habitats; therefore, we are responsible for making decisions to protect and maintain the health of estuaries.

Course expectations: Participants will be expected to:

1. Review pre-course materials.
2. Attend all components of the three-day session plus the follow up session.
3. Complete a pretest and post test.
4. Complete in-class and homework assignments

5. Participate in activities and discussions
6. Develop or adapt a lesson plan based on a standard format and submit by November 21, 2009.
7. Undertake a stewardship project with their students.

Course outline Teachers on the Estuary July 8 – 10, 2009 WBNERR

Optional pre course sessions

Tuesday 7 July 3:00 – 5:00 pm Introduction to Excel for Teachers
 Wednesday 8 July 8:00 – 9:00 am Google Earth in the Classroom

Wednesday 8 July 09

9:00 am – 4:00 pm

Morning

- ♦ Introductions of participants and presenters; overview of course
- ♦ Pretest
- ♦ Introduction to NERRS system, mission, methods, issues, representative research projects
- ♦ Estuary education principles and concepts
- ♦ Estuaries 101 curriculum overview
- ♦ Investigating estuaries with E101: information, labs, data, and activities for estuarine earth science studies.
 Coastal features; land and sea interactions; tides; fresh and salt water; tracking salinity; watershed connections; extreme events

Afternoon

- ♦ Field studies: observing and describing local conditions; variability in estuarine systems; clues to the past; using data loggers with students; try out different types of sampling equipment suitable for student use
- ♦ Meet a scientist: presentation will provide an example of how people study coastal systems and some information about what we have learned

Evening

Time for practice and study (optional)

Thursday 9 July 09

8:30 am – 4:00 pm and 7:00 – 9:00 pm

Morning

- ♦ Review content and answer questions from day 1
- ♦ E101 information, labs, data, and activities for studies in estuarine physical and biological science
 Water: properties, circulation, chemistry; water and heat; tracking and interpreting trends; what's the water quality story?
 Data loggers and experimental design

Afternoon

E101 labs, data, and activities continued

Estuarine species and tolerance ranges; the role of nutrients; assessing diversity; tracking population trends; estuarine productivity, energy, and trophic levels; a closer look at algae, plankton, fish, and birds

- ♦ Support and guidance for adapting E101 for local use
- ♦ Focal issue: climate change: information, activities, and field studies
- ♦ Meet a scientist: how people study coastal systems and what we have learned

Dinner: Wampanoag clambake

- ♦ Evening presentation: people and estuaries

Friday 10 July 09

8:30 am – 2:00 pm

Morning

- ♦ Review content and questions from day 2
- ♦ Watershed study: A model lesson incorporating classroom and field studies of the estuary and its watershed.

Background information and resources; framing a question; designing the sampling; collecting data; interpreting data; reporting results

Afternoon

- ♦ Making it practical: presentation by a teacher on using estuaries in the curriculum; discussion on incorporating estuary concepts
- ♦ Sustaining the learning: materials, equipment, data management, ongoing support and resources available from Research Reserve system and NOAA
- ♦ Post test
- ♦ Evaluation

Follow up class, Saturday 21 November 2009

9:00 am – 12:00 pm

Presentations by teachers on using watershed and estuary lessons with classes, and reports and ideas for stewardship projects

Course texts and materials: Readings and reference materials will be drawn from the following sources, as well as from NOAA and many other web sites. In addition, many lesson plans and curriculum materials for teaching about estuaries will be provided.

Bowen, J.L., and I. Valiela. 2001. The ecological effects of urbanization of coastal watersheds: Historical increases in nitrogen loads and eutrophication of Waquoit Bay estuaries. *Can. J. Fish Aquat. Sci.* 58:1489-1500.

Estuaries 101 <http://www.estuaries.gov/estuaries101/Teachers/Home.aspx>

Geist, M. 1998. Local and Global Effects of Human-Induced Alterations to the Nitrogen Cycle. Waquoit Bay National Estuarine Research Reserve.

Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change 2007. UNEP.

Lambert, K.F. 2005. Nitrogen Pollution: From the Sources to the Sea. Hubbard Brook Research Foundation

Long Island Sound Habitat Restoration Initiative. 2003. Submerged Aquatic Vegetation

Northeast Fisheries Science Center.2007. Ecology of the Northeast Continental Shelf.

Pryor D; E Saarman, D Murray, and W Prell. 2007. Nitrogen Loading from Wastewater Treatment Plants to Upper Narragansett Bay. Brown University

US Global Change Research Program. 2001 New England Regional Assessment.

Course requirements: Participants will be required to complete several exercises using Google Earth and Excel during the course: Support, guidance, and plenty of TLC will be provided before and during the course. Exercises will include

1. Google Earth watershed investigation
2. Entering data and creating Excel spreadsheets and graphs
3. Retrieval and construction of graphs using System Wide Monitoring Program data from Central Data Management Office web site
4. Retrieval and construction of graphs of NOAA data including: tides from NOAA's Tides Online, buoy data from National Data Buoy Center, and weather data from National Weather Service.

There are two major assignments for the course. One is for teachers to develop a **lesson** for teaching estuary and watershed content for their own classes. The lesson should be based on material presented in the course. The lesson does not have to be original. Teachers can choose to modify an E101 lesson or another existing lesson for use with their classes. The goal is for teachers to develop a lesson that they will use. Teachers will present a summary of one of their lessons on the course follow up day, November 21, 2009 (date to be confirmed).

Suggested format: the lesson plan should include sections on

- Title
- Grade level
- Main concepts
- Relevant science or math standards
- Materials and equipment
- Background information
- An outline of the lesson
- Tips and hints for other teachers
- Your sources of information

The second requirement is for teachers to complete a **stewardship project** with their students. Stewardship projects should have components that will benefit their local watershed. Examples of stewardship projects include adopting a water body near the school by making a commitment for monitoring and/or cleanup, making a presentation to the community, recruiting community volunteers for a service project, starting a sustainable practice (such as recycling) in their school, and teaching others in the

community what they have learned. Participants will submit a summary and review of their students' stewardship project at the follow up meeting (and samples or photos of student work if appropriate), or an overview if the project is in the planning stage, with a summary to follow after project activities have taken place.

Stewardship projects should:

- Address a resource management need in the students' own watershed.
- Be student driven.
- Include outreach to a broader community (beyond their own class).
- Utilize knowledge or practice skills learned through TOTE training.
- Be an integral part of the instructional program.
- Collaboration with a community organization or volunteer expert in the community is a plus.

Teachers may work alone or with one or two other participants to develop and carry out the stewardship project and the lesson. The completed lesson and report or plan for a project will be due on the follow-up day, Saturday November 21, 2009. Lessons should be sent to Pat Harcourt via e-mail at pat.harcourt@state.ma.us .

Grading criteria:

Participants earning graduate credit and those earning PDPs must complete exercises assigned as part of classwork. The computer-based activities completed during the course will be worth 20 percent of the grade, participation and contributions to discussions will be worth 20 percent, the lesson plan will be worth 30 percent and the stewardship project will be worth 30 percent.

Sample lesson plans will be provided as guides to the content and extent of the required lesson plans. Participants taking the course for PDPs but not for graduate credit will not be graded, but should complete the lesson plan by the follow-up date in November 2009 and should plan to implement a stewardship project.