



## ***Drug and Hormonal Pollutants in Oyster and Other Cape Cod Ponds***

is the title of the Keynote Address at OPET's Annual Meeting

Kathleen Attfield, Staff Scientist from Silent Spring Institute, is the keynote speaker at OPET's Annual Meeting. She will discuss recent findings from the Institute's study of Cape Cod ponds, human hormones and pharmaceuticals. The Institute discovered these compounds are leaching from septic systems and entering groundwater and then ponds. Oyster Pond was one of the study sites and these compounds were detected more frequently and at higher concentrations here than in areas with less dense development. While risks to human health are yet unknown, concentrations approach those that have been shown to feminize fish.

Kathleen Attfield, biochemist and GIS specialist, co-authored Silent Spring Institute's recent paper published in July 2008 in Environmental Toxicology and Chemistry, "Wastewater-contaminated groundwater as

a source of endogenous hormones and pharmaceuticals to surface water ecosystems."

Silent Spring Institute is a nonprofit research organization dedicated to investigating the links between the environment and women's health. Over the past 10 years, Silent Spring has conducted research on emerging contaminants from septic systems and impacts to drinking water, groundwater, and ponds.

*Please Join us for the  
OPET Annual Meeting  
Thursday, July 16 2009*

*7 pm Light Refreshments*

*7:30 pm Short Business Meeting*

*followed by*

*Kathleen Attfield of the  
Silent Spring Institute*

*Woods Hole Research Center  
149 Woods Hole Road*

### **PRESIDENT'S LETTER**

This issue of *The Watershed* focuses on the well being of Oyster Pond and what each one of us can do to keep it healthy. Many residents are already doing what they can to improve the Pond's water quality. We applaud the Ransom Road community for installing stormwater catch basins on the upper section of the road to diminish runoff into the Pond. We hope they finish the project and install catch basins along the street's entire length.

Others made significant improvements to septic systems to diminish nitrogen flow into the Pond. Barbara Doe at 110 Oyster Pond Road installed a denitrification system when she rebuilt her home, even though the Conservation Commission did not require her to do so — she felt it was the right thing to do. We would like to recognize other projects, please let us know what you have done. Send an email to Lou Turner lturns67@comcast.net so we can recognize your efforts.

Members of the OPET Board monitor the pond chemistry, count the herring as they enter and exit the Pond as well as manicure both the Trunk River and the Lagoon to ensure the herring successfully swim the path between the Sound and the Pond. While the Board is active in many projects to improve the Pond, we have not done as good a job reaching out to the Oyster Pond Community for help in these projects. Please contact us if you wish to join us on these projects.

The elimination of Phragmites along the southern shore of the Pond has taken a major leap forward. We received grants from the Town of Falmouth Community Preservation Committee and the Woods Hole Foundation, but these monies cover only part of our expenses. This will be a costly multiyear project. If you haven't already done so, you should take a walk along the bike path and see how much has been done and how much is left to do. Please make a generous donation to help insure that this invasive plant can be reduced to a nuisance rather than the major problem it now is and please don't forget the Pond when making your charitable giving. *Lou Turner*

## **The Weir and the Water Witch A Success Story**

In the Celtic past, a female deity, a water witch, often oversaw pond water, wells, and rain. She was a good witch believed to haunt ponds and was capable of changing events. For instance, Coventina was the Celtic (Britain) goddess of water and springs known locally in the area of Carrawburgh as the "goddess of the Watershed".



A water witch is also a person skilled at water witching, the supposed discovering of subterranean streams by means of a special divining rod. In a sense, I share a unique part of their story having invented the heat-pulse groundwater flow meter, a high-tech means of identifying the direction and rate of groundwater flow, the often unrecognized movement of water beneath our feet. I also work with Wendi, who samples water quality and tries to better the course of nature of Oyster Pond and its watershed.

However, let's not digress from the main story line. During the past five years, we have seen an initially unexplainable drop in overall total

*(Continued on page 4)*

## What You Can do to Help Oyster Pond



### Limit the amount of storm water runoff from your property

Storm water runoff is a major pollutant to Oyster Pond. Storm water coming off roof tops, driveways, gardens and streets picks up a variety of contaminants. It is a nasty brew of salt, automotive chemicals, metals, grease, garden chemicals, animal waste, dust and dirt that flows unimpeded into the Pond. Contaminants harm fish and other aquatic life and increase nutrient levels. Sediments carried in storm runoff can smother aquatic life, clog fish gills, and cut off the light needed by underwater plants. If each property owner limited storm water runoff from their property this would limit the amount of this toxic brew entering our Pond.

**How:** Divert rain gutters from paved surfaces to grass or other vegetated areas. Replace impervious surfaces such as concrete with brick or paving stones that allow precipitation to run between pavers. Reduce the amount of lawn and replace with trees and other vegetation that absorb more precipitation. Install gravel trenches along your driveway to collect runoff or consider installing a rain garden to collect runoff from your site. Replace asphalt driveways with Cape Cod friendly clamshells. For more information:

<http://www.capecodgroundwater.org/raingardens.html>



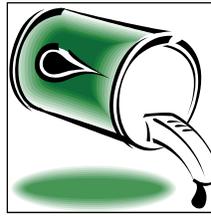
### Dispose of Toxic Chemicals at the Household Hazardous Products Collections

Do not dump toxic chemicals in the ground, ditch or storm drain. They can flow directly into the Pond or the Sound. Never dump toxic chemicals down your drain as they can damage your septic system and migrate through

the groundwater to Oyster Pond. Read the labels of your household products, even some common household cleaners contain harmful ingredients such as dichlorobenzene (mold or mildew control products) or petroleum distillates (furniture polish, paint thinners). If you live in a flood zone keep all toxic hazardous materials in secure cabinets above potential flood waters to prevent contaminants washing into Oyster Pond during storm events.

**How:** Household Hazardous Product Collections are held four times a year at each of the Upper Cape Towns. Remaining collection dates for this year are August 15 from 9am to 1pm at the Mashpee High School and October 17th 9am to 1pm at the Peebles Elementary School in Bourne Call 800-319-2783 for questions. Consider switching to eco friendly products instead of using toxic chemicals.

<http://www.ecocycle.org/hazwaste/recipes.cfm>



**Recycle Used Motor Oil** - Never ever, dump used oil into the ground or storm drains. According to the EPA, used motor oil is the single largest source of water pollution to lakes, streams and rivers. The oil from one engine can produce an eight acre oil slick. Another problem is the oil from motor engines that drip on driveways and streets. Precipitation washes this oil debris down streets into the Pond. Used motor oil is not accepted at the Hazardous Product Collections.

**How:** Used motor oil is accepted at the Town "dump" on Thomas Landers Rd. The oil tank is across from the trailer at the entrance. Check with the gatekeeper before disposing. No dump sticker is required nor is there a fee. Use drip pans or a ground cloth to catch drips from motor engines.



### Regularly pump out your septic system

All septic systems must be pumped every 3 to 5 years to remove the sludge and floating scum to prevent the system from failing. Avoid flushing chemicals and bleach products into your system as they can kill the bacteria that is an important component of a healthy septic system. Don't install or use a garbage disposal as the solids and grease stress the

bacteria and shorten the life of the system.

**How:** Compost what organic waste you can and dispose of grease in the regular trash. Set up a regular pump out timetable with your septic system hauler.



### Maintain a vegetated buffer along the Pond's shoreline.

Keeping buffers along the shoreline is one of the most important things we can do to maintain a healthy ecosystem around the Pond. These buffers serve many important functions by intercepting fertilizer and pesticide runoff, stabilizing soils, preventing shoreline erosion and providing habitat to birds, amphibians and animals in the important zone between land and water. Trees and shrubs provide cooling shade along the shoreline for fish and other aquatic dwellers. Woody debris from fallen limbs provide important habitat. Lawns down to the water's edge are not good for the Pond.

**How:** Let natural vegetation grow along the shoreline. If your area was cleared, consider planting native plants to replace the lost natural buffer. The Falmouth Conservation Commission has a new list of native plants that do well in our climate. Remember to contact the Con Com prior to any work along the banks and shoreline and within 100 feet of the edge of the Pond, even vista pruning.



### **Avoid the use of pesticides on your lawn and in your garden**

Pesticides can run off our gardens and lawns during rainstorms and enter Oyster Pond. The toxins in pesticides contain ingredients that are harmful to fish, birds and wildlife. Many chemicals are especially harmful to fish and other aquatic dwellers. Consider for example, the “weed and feed” lawn chemicals applied to lawns in the spring. Most contain the toxic pesticide 2,4-D that can be acutely toxic to fish depending on the formula. Studies also found it bio accumulates in some fish and is highly toxic to benthic animals.

**How:** Many garden centers now have environmentally friendly alternatives. For a “green” weed and feed lawn product consider using corn gluten, it suppresses seed formation while fertilizing your lawn. It is available from several different manufactures. Spread in early spring, about when the forsythia bloom.



### **Do not flush pharmaceuticals down your toilet!**

For many years the public was told to dispose of expired pharmaceuticals down the toilet. Now, according to studies by the Silent Spring Institute (speakers at OPET’s annual meeting), these drugs and other personal care products enter the groundwater via our septic systems and migrate to our ponds and estuaries. Oyster Pond was one of the study sites and contains higher levels of these pollutants than less populated watersheds on Cape Cod. Other studies found residues of pharmaceuticals in fish, including medicines used to treat high cholesterol, allergies, high blood pressure, bipolar disorder and depression. Very low levels of these chemicals are found to cause the feminization of fish and other reproductive problems.

**How:** Remove unused, unneeded, or expired prescription drugs from their original containers and throw into the trash. If you are concerned about accidental poisoning or drug abuse, mix them with coffee grounds or other undesirable products and seal in a nondescript impermeable container before tossing into the garbage.



### **Recycle lawn clippings and leaves .**

Leave lawn clippings on the lawn to break down and renourish your lawn. Clippings are a free and easy source of nitrogen for your lawn. Contrary to old folk tales, clippings do not cause thatch. Thatch is caused by excessive use of fertilizer. Do not dispose of lawn clippings or leaves in the Pond or in wetlands. It is **illegal** to dump any thing in a wetland area.

**How:** Compost leaves and clippings (if you still think you must take them off the lawn) at your property or take them to the Town’s compost facility where they are accepted for FREE. The facility is on Blacksmith Shop Road (upper Gifford St.) and open Tuesday – Sat 8:15am to 3:30pm. You can also take away free compost. *Wendi Buessler*

### **How to Grow a Falmouth & Oyster Pond Friendly Lawn**

*A major way to contribute to the health of Oyster Pond is to follow the guidelines for a Falmouth Friendly Lawn developed by FACES (Falmouth Associations Concerned with Estuaries and Salt Ponds). OPET is a member of FACES. Excess nitrogen from lawn fertilizers is a major contributor to elevated nutrient levels in Falmouth’s ponds and estuaries. Traditionally, Cape Cod and Falmouth lawns were never fertilized and were allowed to dry out and go dormant during the hot, summer months. These lawns endured for generations without any fertilizer or watering. Follow these steps for a healthier and pond friendlier lawn.*

**1. Test Your Soil:** When pH is below 6.5, add lime so grass can effectively use nutrients. The Cape Cod Extension Office tests soil samples (508-375-6690).

**2. Enrich Your Soil:** Good soil is the key to healthy, vibrant grass. Grass grows best when there is at least 6” of topsoil. Few homes in Falmouth have such soil. To supplement yours spread a ¼” of topsoil or well screened compost to your lawn in the fall. An excellent source of compost is from Watts Family Farms in Mashpee 508- 477-3302. You can also enrich soils by using low-dosage, controlled release organic fertilizers that contain organisms to promote soil conditioning with soil-improving microbes that promote healthy biological activity. When your soil is healthy and your lawn is healthy common lawn care problems such as weeds, disease and drought become much less of an issue.

**3. Minimize Fertilizer:** Traditional Cape lawns don’t need much, if any, fertilizer. If you fertilize, use only 1 lb of Nitrogen per 1000 square foot of grass per year. Use organic slow-release nitrogen fertilizer. Only fertilize when the grass is growing vigorously, in the fall and spring. Don’t fertilize in the summer when the grass is dormant or growing slowly, you are wasting money and feeding the weeds.

**4. Avoid Using Pesticides:** Pesticides stress turf grass. When pesticides are used, fertilizer is also applied to help grass recover. As a result, much more fertilizer is used than the grass needs and the excess nitrogen can runoff to pollute Oyster Pond.

**5. Mow High, Recycle Clippings:** Mow grass to a height of about 3 inches. Leave clippings on your lawn. Leaving turf blades tall retains moisture and crowds out weeds. Resharpen blades to cut rather than tear grass. Clippings contain up to half the nitrogen lawns need.

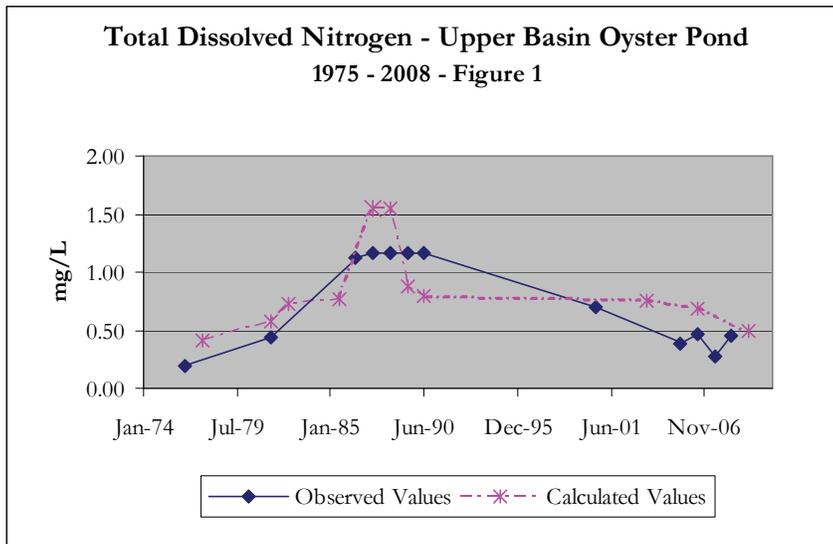
**6. Use Cape Grasses:** Plant fine/tall fescues not Kentucky bluegrass. Kentucky bluegrass is fine for Kentucky, but not Falmouth. A blend of fine leaved fescues or tall fescues does well on the Cape. These blends require little fertilizer, tolerant some drought and is less susceptible to disease.

**7. Minimize the size of your lawn:** Less lawn = less mowing and work! Substitute lawn areas with native trees, shrubs and flowers. This saves on lawn care, water and fertilizer. *Wendi Buessler*

*(Continued from page 1)*

nitrogen concentrations in Oyster Pond. The purpose of this brief story is to explain the role that 1) subterranean streams which feed water to Oyster Pond, 2) the use of an adjustable weir on the outflow, and 3) maintaining a passage way for migrating fish, play in the outcome.

Total nitrogen is the most important nutrient controlling the quality of the water of Oyster Pond. Figure 1



plots the historic changes of total nitrogen in the pond water column and then compares it with total nitrogen values calculated with the Nitrogen Flux equation (explained later), with some mixing equation decay allowed after the peak value (1990).

The rise in total nitrogen content followed the rise in housing units and collapse of the outflow conduit. The highest concentrations peaked during 1989 and have fallen off since, from over a mean annual at 1.17 in 1989 to 0.7 during 2000-2003, to below 0.6mg/L during 2004-2008, despite little change in the total population.

We looked at the changes in the items which control water column concentrations, the amount of nitrogen added to the pond (total annual load), the amount

which is lost out of the column (precipitation and denitrification), the rainwater and groundwater inflow, the pond volume, and the pond water outflow. An important characteristic is the residence time (rt) of water in the pond, found by dividing the outflow into the pond volume and the flushing rate which is its inverse, 1/retention time. The relationship can be expressed simply by the following Nitrogen Flux equation:

$$TN = \frac{L-NL}{Zp}$$

*TN = Total Nitrogen concentration, mg/L or gm/m<sup>3</sup>*

*L = Nitrogen Load, mg/m<sup>2</sup>/yr*

*NL = Nitrogen Loss out of column, mg/m<sup>2</sup>/yr*

*z = mean depth of pond, m*

*p = hydraulic flushing rate, m<sup>3</sup>/m<sup>2</sup>/yr*

This equation allows us to calculate the mean Total Nitrogen concentration in an Oyster Pond water column.

An important difference between Oyster Pond estuarine system and the other estuaries in Falmouth is the adjustable weir at the inlet channel to the pond. The structure was designed by John Ramsey, P.E., Applied Coastal Engineering Research, to limit the amount of salt water entering on the high (return) tide. Since the return water is separated by a distinct salt wedge, the raising or lowering of the weir boards (a narrow for herring, and a broad one for the main gate) can adjust the salinity from 1 to 8 parts per thousand.

After the building of Surf Drive, the salinity and flushing rate was controlled by a long conduit under the road. During 1986-1988, the culvert collapsed, lengthening the time water stayed in the pond (residence time) and trapping nitrogen within the pond while dramatically lowering salinity. During this time, ocean water couldn't enter the pond and high vegetative growth and low dissolved oxygen levels occurred. Unfortunately, a new larger culvert (5 foot diameter) constructed in 1989 resulted in too much salt water intrusion. This was further aggravated by Hurricane Bob in 1991 (Figure 2).

The adjustable weir, built in March 1998, is mainly used to control the salinity level of the pond. The weir

### *Officers & Directors 2008—2009*

<b>President</b> - Lou Turner	Bill Kerfoot
<b>Vice President</b> - Michael McNaught	Stephen Leighton Martin Monk
<b>Treasurer</b> - Bill Rowe	Jonathan Smith
<b>Clerk</b> - Florence Davidson	David Sykes
<b>Directors</b>	<i>Executive Assistant</i> - Wendi Buessler
Alfred Allenby	
Barbara Doe	
Max Holmes	<i>Hon. Board Member</i> - Robert Livingstone

OPET Board meetings are open to all OPET members. Meetings are usually held on the third Sunday of the month, at 4:30 pm in the Treetops Clubhouse.

We'd love to have you come!

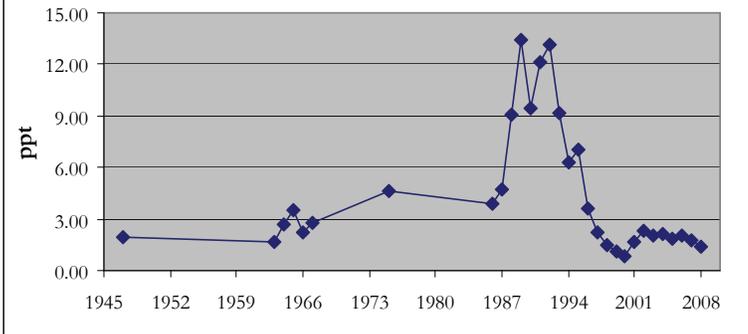
OPET does not have an official phone, but you can leave a message at 508-540-3263. We'll gladly get back to you!

Or email: [lturns67@comcast.net](mailto:lturns67@comcast.net) or

[wbuessler@comcast.net](mailto:wbuessler@comcast.net)

Please visit our website [www.opet.org](http://www.opet.org).

Oyster Pond Surface Salinity - Figure 2



B.L. Howes, MEP 2007

maintains low salinities (1 – 4ppt) during winter and spring. During July the board may be lowered slightly. Because of the low tidal flushing in the inlet, the Trunk River is unlikely to stay fully open without assistance.

The major water inflow comes from groundwater which seeps into the pond from rainwater recharge into the zone of contribution of the watershed. Secondly, is direct rainwater (minus evaporation and plant transpiration) that falls onto the surface of the pond. Thirdly, is storm runoff, but it is small (<2%) because of porous sandy soils.

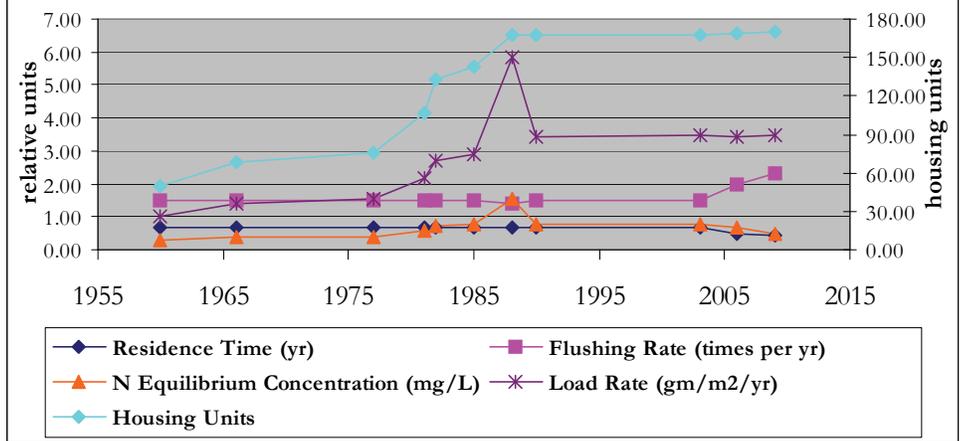
We were able to compute the expected total nitrogen concentrations using information available from the Massachusetts Estuaries Program study and KO Emery's revised book "A Coastal Pond: Studied by Oceanographic Methods". The loading has not changed much from 2000 (Figure 3), adding in only a research facility (which has denitrification) and some limited (3) house lots. The hydraulic flushing rate was interrupted by the collapse of the culvert in 1988, resulting in a substantial rise in nitrogen (to 2.0 mg/L) in the pond and the growth of fresh water aquatic vegetation (due to very low salinity). The nitrogen concentrations dropped once flushing was reestablished with the re-opening of the conduit, even though salt concentrations caused massive die-off of vegetation and low dissolved oxygen concentrations for a time.

With the weir in place, flushing was then slowed by dams of eelgrass in the outlet of the lagoon. It appears by opening (shoveling) a channel to let herring in (April) and out (July), the outflow volume has increased. The flow in 2008 was probably about 3300m<sup>3</sup>/day. This year the outflow on June 14 was measured at 4755 m<sup>3</sup>/day.

When salinity was very low over the winter, aquatic vegetation (Elodea, Millfoil, etc.) would start to become heavy near the northern end (Ransom Road dock). If the aquatic plants became too dense, the weir was opened further during late July. The rising salinity would kill the freshwater vegetation. Coincidentally, the lowering of the weir also boosted outflow, assisting herring in their exit down Trunk River and out to Vineyard Sound. The weir was then returned to proper height in late August. Recently (2008-2009), the aquatic growth has been low enough to not require oscillations of the gate.

The very close match of calculated nitrogen concentrations to observed levels (Figure 1) suggests that groundwater dilution may play an important part in the observed decrease. The ability to predict and manage the nitrogen concentration is made clear by the fact that if you can manage the outflow rate (and groundwater

Nitrogen Flux - Figure 3



inflow rate) as well as nitrogen inputs, you can control the condition of Oyster Pond. For now we have dodged the worst effects of the high total Nitrogen loads with the weir, maintaining good fishing and recreational conditions. Down the road, however, it would be wise to reduce the nutrient sources further.

The weir is working, with assistance of elbow grease and perhaps good tidings from the Good Witch of wells, springs and ponds.

Bill Kerfoot, with great assistance from Wendi Buesseler

References: The Massachusetts Estuaries Project, 2007, Linked Water-shed-Embayment Model to determine Critical Nitrogen Loading Thresholds for Oyster Pond, Falmouth, Massachusetts, University of Massachusetts, Dartmouth, MA 125 pg.

Emery, K.O. 1969. A Coastal Pond Studied by Oceanographic Methods. Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, updated by OPET, 1997.

Please join us for the **OPET Annual Meeting Thursday, July 16th** at the Woods Hole Research Center,  
149 Woods Hole Road 7 pm Light Refreshments, — 7:30 pm Short Business Meeting followed by the talk  
**“Drug and Hormonal Pollutants in Oyster and Other Cape Cod Ponds”**

*Ospreys trying out the nest platform OPET raised two years ago. The pair started work on a nest, but unfortunately abandoned it after a few weeks. Maybe next year?*  
*Photo by Craig Gibson*



**The Oyster Pond  
Environmental  
Trust**

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