DEFINITION OF EXOTIC NUISANCE ALIEN INVASIVE SPECIES AND NATIVE INDIGENOUS SPECIES

From Maine DEP website http://www.maine.gov/dep/water/invasives/invmaterial.html

Discussions of Invasive Aquatic Plants include many words we all recognize, but the context can be unfamiliar and confusing when applied to plants. In addition to the common usage, biologists use these terms to describe the ecological status of plant or animal populations and how they fit into a particular geographical region. Some terms are used interchangeably, such as nuisance and invasive, both with a negative connotation. Four categories (Binggeli 1994) serve to cover the concepts used to describe the status and the distribution of a particular species.

1. **Native, Indigenous:** species naturally occurring or originating in a geographical region since prehistoric time;
2. **Introduced, Alien, Exotic:** deliberate or accidental release of a species into an area in which it has not occurred in historical times;
3. **Invasive:** the establishment of self-regenerating and spreading populations of a naturalized species in a free-living state in the wild, takes possession and may affect injuriously;
4. **Nuisance, Noxious, Weed:** any plant, either native or introduced, with a harmful or destructive influence on existing natural communities, interfering with the objectives or requirements of people.

These categories apply to biological communities, which are always evolving or changing due to fluctuating environmental conditions. Some species may be considered invasive if they occur in Maine but have been transported between watersheds and their introduction has caused detrimental effects to existing populations (e.g. introduction of white perch to brook trout waters has severely curtailed the beneficial values of brook trout in the affected waters). Some species in Maine fit into one or several of these categories, for example:

- Variable milfoil: a common plant in its native range, is invasive and a nuisance when spread to new waterbodies
- Bladderwort: a common native aquatic plant that is occasionally considered a nuisance
- Purple Loosestrife: a rapidly spreading exotic invasive in wetland habitat
- Brook Trout: a desirable native that is not a nuisance
- Brown Trout: an introduced species that is not invasive or considered a nuisance
- Gold Fish or Carp: exotics that are also considered noxious invasives

Binggeli, P. (1994) Misuse of terminology and anthropomorphic concepts in the description of introduced species. Bull. Brit. ecol. Soc. 25, 10-13.
http://members.tripod.co.uk/WoodyPlantEcology/invasive/terminology.htm

DEFINING THE TERM “INVASIVE SPECIES”

Excerpted with permission from a letter to Lori Williams, Executive Director, National Invasive Species Council, U.S. Department of the Interior, from E. Shippen Bright, Interim Chairman, Invasive Species Advisory Committee, dated April 23, 2004

At a number of recent policy forums, the ambiguity of the term “invasive species” has been cited as a reason for delaying new federal programs to combat the problem. Confusion over this particular term is understandable, given the globally diverse terms used in describing the issue. However, the use of the term “invasive species” and its meaning pertaining to U.S. federal programs within the Invasive Species Advisory Committee (ISAC) and the 2001 National Management Plan for Invasive Species (NMP) has been debated and agreed upon. While some areas remain unclear or “gray”, they need not hinder action to prevent and control those organisms that clearly fall within the boundaries of the NMP definitions. This letter is to summarize these important distinctions, hoping that the member agencies of the National Invasive Species Council (NISC) can quickly and decisively respond to programmatic criticisms stemming from definitional concerns, allowing discussion to proceed on more important questions of policy.

Executive Order 13112, which established NISC, utilizes the terms “alien,” “invasive” and “native” species. It defines the term ***“alien species”*** as:

> *“any species, including its seeds, eggs, spores or other biological material capable of propagating that species, that is not native to that [particular] ecosystem.”*

The order defines ***“invasive species”*** as:

> *“an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.”*

It further defines ***“native species”*** as:

> *“a species that, other than as a result of an introduction, historically occurred or currently occurs in that [particular] ecosystem.”*

In continuing this convention, the NMP clarifies the difference between “alien” and “invasive” by stating that the latter are those that cause or are likely to cause harm to the nation’s economy, environment, or public health. It provides a set of examples to illustrate the distinctions between these concepts, and calls for a clear set of screening criteria which will consider potential societal benefits, as well as risks associated with organisms that fall into the gray area.

The consistency between these documents was hard won, but highly worthwhile. To counteract any continuing uncertainty, NISC should actively and clearly reaffirm that actions to manage invasives will focus only on those alien species that cause or are likely to cause economic or environmental harm, or harm to human health. NISC agencies should also ensure that this information is widely disseminated to all relevant field personnel.

In conclusion, the challenges posed by invasive species are already daunting. Eliminating the vagueness associated with the issue’s terminology will contribute greatly to developing new policies and management strategies to protect the economy, environment, and public health of the United States.

Demystifying Milfoil

By
Scott Williams and Roberta Hill
Volunteer Lake Monitoring Program

Almost everyone has now heard of milfoil, that nasty invasive plant that threatens to ruin Maine's lakes, but there seems to be some confusion. How many types of milfoil are there? Is milfoil native to Maine? If not, how long has it been here? If so, why are we so worried about it? Is milfoil the only aquatic plant that threatens Maine's lakes? Much of the confusion may come from the way the term "milfoil" has been used in recent years.

"Milfoil" has been used as a catchword to get the message out about the threat of invasive aquatic plants in Maine. There are the "Maine Milfoil Summits," the "Milfoil Bill," and the formation of the "Maine Milfoil Coalition," etc. Having a word that people could easily identify with has been helpful in raising awareness. *But the practice of reducing a complex problem to a single generic term always has its down side. It fails to provide an accurate and complete picture. The term "milfoil," when used to describe the current threat of invasive aquatic plants to Maine's lakes, is limited and potentially misleading for a number of reasons.*

First, several milfoil species are native to Maine lakes. These plants are not harmful or threatening. In fact, like all of our native aquatic plants, they provide many benefits to the lake ecosystem. Native plants provide essential habitat for wildlife and protect water quality by taking up nutrients and protecting the shoreline from wave and wake action. Native aquatic plants are good for our lakes and ponds. *It would be most unfortunate if the public were to think that all members of the milfoil family were undesirable, and that they should be removed.*

Secondly, there are several non-milfoil plants that are just as likely to invade Maine's lakes in the coming years as the invasive milfoils. The current list of "Maine's most unwanted aquatic plants" (determined by the Maine Department of Environmental Protection (DEP), and included in the laws passed by the Maine Legislature in 2000 and 2001) includes the following eleven: Brazilian elodea, Curly leaf pondweed, European naiad, Fanwort, Frogbit, Hydrilla, Water chestnut, Yellow floating heart, Parrot feather, Variable-leaf milfoil and Eurasian watermilfoil. *Only the last three of these are actually milfoils. But all of these plants have been identified as imminent threats to Maine lakes. Indeed, hydrilla, considered by many experts to be one of the most aggressive and persistent invaders on the list, has now been found in two waterbodies in Maine.*

Here is an example of how generic language can be confusing. A Sebago Lake website posts the following Sebago Lake "fact."

> "Water plants native to the lake include pipewort, bur reed, water lobelia, spikerush, pondweeds, water celery, coontail, water milfoil."

Though the statement above is very likely accurate, in light of the recent attention focused on non-native invasive milfoils, the listing of "water milfoil," without further explanation, has caused some confusion, to say the least. Some have taken the statement to mean that the milfoil that has appeared in the tributaries and coves of Sebago Lake over the last thirty years, Variable watermilfoil (*M. heterophyllum*), is native to Sebago Lake and therefore nothing to worry about.

Variable watermilfoil is *not* native to Sebago, to Maine, or even to New England. According to biologist C. Barre Hellquist, coauthor of *Aquatic and Wetland Plants for Northeastern North America,* the plant migrated, by way of human activity, to New England from the south and west (e.g., Michigan and Oklahoma) some time in the 1940s.

According to Biologist David Cortemanch, former manager of the Environmental Assessment Division at the Maine DEP, variable watermilfoil (*M. heterophyllum*) was first identified in Sebago Lake in the late 70s, and it was likely present in the lake for a few decades before it was identified.

There are many species of watermilfoil (genus *Myriophyllum*) worldwide. The *National List of Plants Species that Occur in Wetlands* lists six milfoils that are native to Maine. This is why the website fact is likely accurate. It would not be surprising to find one or more of these native milfoils in Sebago Lake. Indeed, over the last few years, the Volunteer Lake Monitoring Program (VLMP), Portland Water District (PWD), and the DEP have received requests to identify many aquatic plant specimens that have turned out to be native milfoils.

So variable milfoil is not native to Maine. Yet, it has been here for years, and it *hasn't* taken over Sebago Lake. What's the fuss?

Here's the fuss: Variable watermilfoil, which grows to a maximum depth of ~12 feet, will never overtake a lake like Sebago that is dominated by deep water habitat (often exceeding 100 feet), but it can become a significant nuisance in coves and near shore areas, interfering with boating and swimming and causing property values to decline. Variable milfoil can take over shoreline areas previously inhabited by native plants and negatively impact an important habitat. This is, of course, true for other Maine lakes that are infested with Variable watermilfoil.

Having no baseline data to work with, it is impossible to know how fast the plant is spreading in the lake and how many new colonies are forming each year. The Portland Water District began mapping milfoil sightings on the lake in 2000 and is currently working to organize a comprehensive screening of the lake's shoreline. The VLMP "Invasive Plant Patrol" screening project, a volunteer training program that is open to the general pubic, will be implemented through public workshops on lakes throughout Maine during the next several years. Having baseline data is essential to determining an appropriate action plan for Sebago Lake, and an effective prevention and identification plan for other lakes throughout the state.

Sebago Lake is one of the most popular boating lakes in Maine and in New England. Given that boats are the primary ways these plants get from lake to lake, the invasive milfoil found in Sebago is a potential threat to every other lake in the region.

Make no mistake – the three species of milfoil listed as "unwanted" in Maine lakes are aggressive and invasive. Every effort should be taken to keep them out of Maine lakes. But other invasive species are also present in Maine and more are on the horizon.

A great slogan for this issue has been: "Spread the Word, Not the Plant." *We should make sure that the words we are "spreading" are clear and accurate.* Perhaps it is time to adopt more accurate terminology. When speaking about the issue (and not about a specific plant), the term "invasive aquatic plants" or "lake invaders" works better than "milfoil" in almost all cases. It may not form a nice alliteration with the name of our state and lend itself to such catchy headlines as "Milfoil Makes Mess of Maine Lakes!" but give it time. It may grow on you.

For more information on invasive plants in Maine please visit the following websites:

Maine Volunteer Lake Monitoring Program
www.mainevlmp.org

Maine Department of Environmental Protection
http://www.maine.gov/dep/water/invasives/index.html

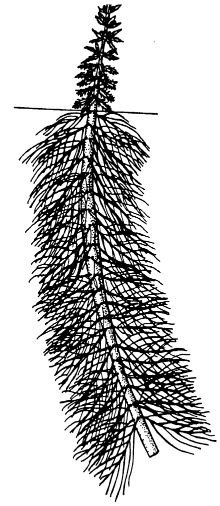
Portland Water District
www.pwd.org

Lakes Environmental Association
http://www.mainelakes.org/?page_id=184

Revised: 4/4/14

INVASIVE SPECIES Q & A

With all the attention being paid to invasive plants like milfoil, people are asking a lot of questions. You can obtain additional information from the Dept. of Environmental Protection at 1-800-452-1942 or by visiting their website at http://www.maine.gov/dep/, or by calling the Dept. of Inland Fisheries & Wildlife at 287-8000.



- **What are invasive species?**

  Invasive species are plants, animals, and even microbes that are introduced from other regions and aggressively out-compete native species.

- **How are invasive species spread?**

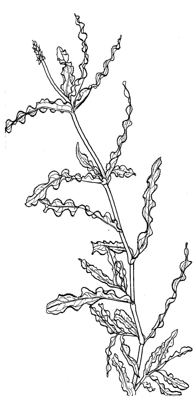
  Invasive species are usually spread as a result of human activity. Examples include carp from illegal fish stocking, Eurasian water-milfoil from boat and gear transport, and zebra mussels from engine cooling water and live wells.

- **What harm do these critters do?**

  It varies with each species. For example, invasive aquatic plants can grow densely, crowd out native plants, reduce fish movement and stunt growth. In dense beds, invasive aquatic plants can shade out the bottom, reduce the number of snails and other useful animals, and change water chemistry.

- **What's at stake?**

  Every year in the United States, government agencies and private citizens spend over $100 million to combat invasive aquatic plants. Closer to home, Vermont has spent over six million dollars since 1980 to control these plants, and in 2009 received over $1,080,000 in requests from municipalities for help in dealing with the problem. In addition, invasive species cost billions of dollars in lost recreation and property values, and ruin habitat for native species.



- **Does Maine have a lot of invasive species?**

  Right now, Maine has at least 45 invasive aquatic species, ranging from green crab in ocean waters to white carp in a number of rivers. There are scores of other invasive species that have spread into other New England states in the last few decades. Maine has documented 23 waterways (encompassing forty-six distinct waterbodies) that are infested with invasive aquatic plants. Variable water-milfoil is still the most widespread of the known invasive aquatic plants in Maine. Other invasive aquatic plants present in Maine include curly-leaf pondweed, Eurasian water-milfoil, European naiad and hydrilla. We know of at least six other aquatic invasive plants which are either in New England or likely to be here soon.

Continued...

- **Aren't all plants good for fish like bass?**

  Plant life in lakes and streams is essential for good fisheries. In moderate densities, aquatic plants provide just the right blend of cover and edge for successful fish growth as well as places to produce forage for smaller fish. The very dense plant growth often seen with invasive species like variable leaf milfoil and water chestnut has the opposite effect.

- **What is Maine doing about the problem?**

  In 2000, Maine launched an effort to prevent the spread of invasive species, starting with aquatic plants, the most obvious problem. This includes educating people on how to recognize invasive aquatic plants, avoid spreading them, and what to do if they find them. The effort also includes thousands of voluntary boat inspections by wardens and volunteers, information given to incoming motorists, and projects to eradicate new infestations where possible. We are also cooperating with other states in our region along with federal agencies.

- **Why bother to do all this if the plants are going to get here anyway?**

  We know from other states' experiences that we can slow down the spread (and even prevent introductions) in some instances. The longer we keep these pests out, the more time we have to develop better control methods and the more recreation people can enjoy without these species in their favorite lakes.

- **When is a sticker required?**

  A Lake and River Protection Sticker is required to be posted on the bow of all motorized watercraft when operating on inland waters. This sticker requirement applies to both motorboats registered in Maine and motorboats from other states operating in Maine. For residents, the sticker has been combined with the registration sticker. No sticker is required for watercraft on tidal waters or for canoes and other boats not requiring registration. Contact your regional warden service headquarters for the exact boundary between tidal and inland waters on specific rivers.

- **Where do I get the sticker?**

  The cost is $10 for Maine registered boats (which is included in the watercraft registration fee), and $20 for those registered in other states while operating on Maine's inland waters. New stickers must be purchased annually. Nonresidents can purchase stickers wherever boats are registered, fishing licenses are sold, and through the Inland Fisheries and Wildlife online store.

- **What does this sticker pay for?**

  100% of the funds raised go towards efforts to prevent spread of invasive aquatic species. None of this money will be used for other DIFW or DEP work. Along with new warden staff and DEP specialists, much of the money is going to volunteer work and education efforts along with the boat inspections.

INVASIVE LAKE PLANTS: WHAT ARE THE COSTS?

Maine is the only New England state that has not experienced serious infestations of invasive aquatic plants. Unless real efforts are made to prevent these plants from finding their way into our lakes and ponds, we will have to pay the high cost that other states have faced, including:

RECREATIONAL LOSSES: Heavy Plant Growth = Less Enjoyment for Everyone!

- Entanglement of boats and motors in thick weed beds
- Problems for fishermen
  - Stunted growth of some species due to high plant densities
  - Difficulty navigating
  - Impact on fisheries resulting from plant control measures
- Reduced shore front property values on lakes that are infested
- Reduced tax and retail revenues to communities with affected lakes
- A nuisance and potential danger to swimmers
- Revenues from tourism may decline

METHODS USED TO CONTROL AQUATIC PLANTS: Very Costly and Potentially Damaging to the Environment!

- **Mechanical Plant Harvesting (cutting/mowing):** $350-$1500 per acre. Does not remove rooting systems and ensuing plant fragments could spread plant infestation. Ongoing maintenance generally requires two to three cuttings per season to obtain acceptable control.
- **Herbicide Application:** $200-$1000 per acre. Costs vary depending on treatment rate, chemical used and water depth. Generally needs to be repeated every two years. Negative effects include the loss of beneficial plants, nutrient release, water use restrictions, questions concerning long-term impacts to the ecosystem, and social acceptability.
- **Bottom Barriers:** $10,000-20,000 per acre (Professional installation). Limited application due to cost, difficulty in stabilizing large areas, and impacts on the lake ecosystem.

REAL DOLLAR COSTS TO OTHER STATES:

- **VERMONT:** Since 1980, the state has spent over six million dollars in federal, state, and local funds to prevent and control the spread of invasive aquatic plants. The state currently spends $200,000 annually just to staff invasive plant control programs for only 46 of its 285 larger lakes.
- **NEW HAMPSHIRE:** $100,000 in state and local operating funds is used annually to support 7-9 invasive plant control projects. This amount does not even come close to the public demand for programs for New Hampshire's 55 infested lakes.
- **MASSACHUSETTS:** Massachusetts spends over $290,000 annually on grants for local lake projects, most of which is used to battle invasives in its 298 infested lakes. For state properties alone, $95,000 a year is spent on operations to control invasive aquatic plants.
- **CONNECTICUT:** More than $150,000 a year in state funds is spent to cost share local projects for invasives control.
- Many states have had to hire full time coordinators just to manage invasive plant issues!

Everyone Agrees on the Most Cost Effective Solution:
PREVENTION, PREVENTION, PREVENTION!

Updated 2005

Frightening Factoids

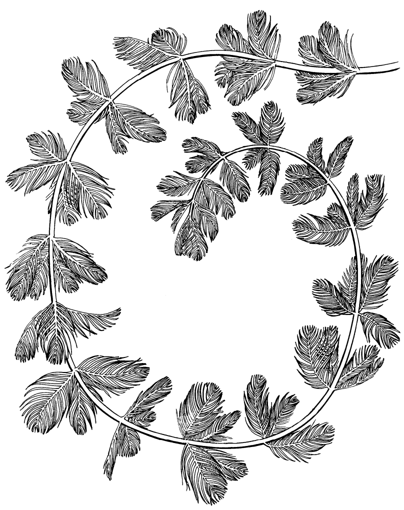
About Aquatic Invaders

~ A tiny plant fragment or a single seed carried on a boat or trailer can begin the infestation of an entire lake. Invasive species, unlike other forms of pollution, are self-sustaining.

~ An invasive plant population in a lake can double or triple in size every year.

~ Invasive plants are forever! There are very few documented cases of successful eradications.

~ Some of the control measures used to fight invasive aquatic plants are nearly as destructive to lakes as the plants themselves. Control measures may threaten rare or endangered species in a water body.



~ Lake associations and towns in other states have been battling Eurasian milfoil (EWM) for decades! Approximately 8-10 million dollars in public money is spent fighting this plant every year.

~ Invasive aquatic plants can compete with and eliminate beneficial native aquatic plants.

~ The introduction of a single invasive species to a lake can virtually ruin recreational opportunities, alter fish and wildlife habitat, affect water quality and lower shoreline property values.

~ Recent research in Vermont shows that invasive plants can cost shore line landowners on infested lakes over $12,000 each in lost property values!

~ Maine's neighboring states spend hundreds of thousands of dollars each year to prevent and control the spread of IAS.

~ All of the New England States, as well as 41 other states and six Canadian provinces are battling Eurasian milfoil, water chestnut, and a broad group of other invasive species.

~ A total of $100 million is invested annually in the U.S. to control invasive aquatic plants.

~ Hydrilla can be even worse than Eurasian milfoil! This aquatic invader can completely overtake a population of EWM! From $20-$30 million in public money is spent every year battling Hydrilla in the US.

~ Massachusetts spends over $290,000 annually on grants for local lake projects, most of which is spent on battling invasives in their 298 infested lakes.

~ The US Coast Guard estimates that economic losses and control efforts cost the United States about $5 billion each year.

~ Zebra mussels can clog water pipes so severly that city water supplies can be cut-off. This happened in 1989 in the town of Monroe, MI for three days.

The most effective and inexpensive approach to the problem of invasive aquatic species is PREVENTION.

INVASIVE SPECIES AND THE ENVIRONMENTAL ETHIC

From a talk delivered at the 6th Annual Milfoil Summit, 2/25/05

by
Evan Richert, Associate Research Professor, Muskie School of Public Service, University of S. Maine

Adm. Horatio Nelson, the famous British naval commander, once wrote: "But in case signals can neither be seen or perfectly understood, no captain can do very wrong if he places his ship alongside that of the enemy."

Not being a ship's captain, I don't know exactly what that means, but whether in politics or government or business, I have taken this as a metaphor – a piece of good advice to get as close as possible to an enemy, or a problem, or a disagreement and learn about its character and what is driving it as best you can, so that you can try to take it to a satisfactory resolution. The advice seems good, in any case, when it comes to invasive species, some of which are clothed in great beauty and false hope, others of which slip in as hideaways, and a very high percentage of which arrive with the complicity, witting or unwitting, of human beings who did not take the time to get to know what they were dealing with. It is a good idea to take the measure of exotic species, to determine what kinds of problem they are, to determine which may or may not be enemies, and, though they may not be seen and may not be perfectly understood, take the necessary actions to prevent or contain the spread of those that earn the label, invasive.

Here is what I think we know about exotic species in the U.S. in general:

-- Approximately 4,000 species of exotic plants and 500 species of exotic animals have established free-living populations in the U.S. (Alien Plant Working Group, undated) Some were purposeful introductions, brought into their new habitats for economic reasons or for pleasure. Many others were accidental introductions.

-- Of these, nearly 700 are known to cause severe harm to agriculture, and more than 1,000 have been identified as a threat to native flora and fauna as a result of their aggressive characteristics, earning them the label of invasive.

-- This also means that 75% to 85% of exotics are not known to be invasive. Many have cautioned not to paint all exotics with the same brush; many have been incorporated into our gardens, our recreation, and our economy. But those that are invasive have wide-spread, damaging effects: reduced biodiversity, disruption of existing ecosystems, and impacts on the food supplies, recreation, and other resources of human communities.

Beyond these facts, in the interest of getting to know these species, it is useful to ask: is the problem of invasives primarily biological? Or is it primarily economic? And is there an ethical component to the problem—that is, if there were not a direct economic component to the problem, would we care? The answers frame both our public and private responses to invasives: how much we are willing to invest in solving the problem, how much we are willing to regulate ourselves, how much effort we are going to put into education.

BIOLOGICAL

The problem obviously has a biological component, and knowledge of the biology of invasives is central to preventing their arrival, to their eradication if they do arrive, and to their containment if eradication is impossible.

Exotics that are invasive succeed in their invasion for inherent biological reasons. As noted in a recent issue of *Conservation Biology* (Allendorf and Lundquist, 2003), they may be intrinsically better competitors because they evolved in a more competitive environment. They may find themselves relatively free of enemies, parasites and disease, which means that they end up with more resources and opportunities for growth and reproduction than native species that have co-evolved with a community of species, both cooperators and competitors. And they may gain biological advantage in another way. Native populations may have evolved adaptations for their particular habitats that give them an advantage in extreme events, such as storms, drought, or fire that may come into play every 50 or 100 years. But these same advantages may carry a small price in efficiencies in the short term, which may be constraining when compared to an introduced species that has not been burdened by such adaptations. In these cases, the introduced species will pay in the long run, but may cause havoc in the short run.

If the problem of invasive species were only a biological issue, one could be neutral toward them, even admiring of them. We would battle them, because we, too, are biological beings that compete for space and habitat. But we would know that these species are doing what all species are designed to do – disperse, secure a position in a community that allows them to thrive, and from that position to reproduce and widen its territory as much as possible. Human beings could be particularly admiring, since we excel at these things ourselves. And we would understand that nature has a way of evening things out over the very long term: species come and go; ecological communities are structured and re-structured; and nature lives on.

ECONOMIC

But for anyone who might, in some intellectual way, be admiring of the biological capabilities and achievements of successful invasives, the economic component of the problem dampens our enthusiasm immediately. This is a matter of self-interest, a direct harm or threat of a harm that moves us to action. The costs are documented to be high.

For example, Kevin Boyle, Steve Kahl, Roy Bouchard, and others have documented the importance of great ponds to Maine's economy and tax base; and, in turn, have quantified the impact of water clarity on the value of properties around lakes. For example, the loss of 1 meter of clarity in a great pond such as Thompson Lake or Pushaw Lake can cumulatively depress property values by $6 million to $10 million dollars. (Boyle et. al. 1998) And that does not account for the spin-off impacts on tourism and the outdoor recreation industries that rely on healthy lakes and marine systems.

Nationally each year, invasive plants cause economic losses and expenditures in farming, forestry, and rangelands measured in the billions of dollars. The Office of Technology Assessment estimates that invasive species of weeds cost crop and livestock production more than $5 billion per year, plus the direct and indirect costs of using herbicides to try to control the weeds. The National Park Service and the Fish and Wildlife Service alone spend an estimated $12 million per year to control exotic plants.

And all of this apparently is just a fraction of total costs. When everything is accounted for, from lost production, to environmental costs, to the costs of containment, to the costs of anti-fouling measures in utility lines, writers in the journal *BioScience* in 2000 estimated the total cost of invasive species in the U.S. at an eye-popping $125 billion per year.

This, certainly, is what brings all of you here. According to an examination of the role of great ponds in Maine's economy, conducted for the Great Ponds Task Force in 1997, the economic activity associated with lakes and ponds leads to $1.2 billion in annual income for Maine residents and 50,000 jobs. (Boyle et. al., 1997) The economic consequences of milfoil and other invasives in Maine's lakes and ponds are too great to ignore.

ETHICAL

But is there also an ethical component? If so, our reaction takes on a different dimension. By definition, an ethical component requires us to act *contrary* to economic self-interest – to take action, or to refuse an opportunity, out of concern about something bigger than we, or out of obligation to a community or a generation that is not ours.

The ethical component of invasives has at least two parts to it. The first is only partly ethical; arguably it is really another aspect of the economic problem, because it has to do with who pays. The question is whether those who cause the problem appropriately bear the cost of solving it. We know that, while species invasions are a natural biological event, the rate of their occurrence and the distances traversed by species now exceed by orders of magnitude the invasions of a few hundred years ago. They are directly the result of human movement and trade. Some, like carp and European starlings, have been introduced on purpose. But far more often, they are introduced accidentally—such as Eurasian water milfoil by recreational boaters and anglers and zebra mussels via ballast water. Did you know that it is estimated that between 3,000 and 10,000 species of protists, animals, and plants are in motion around the world on any given day, in the ballast of ocean-going ships? The Japanese shore crab, now colonizing Atlantic North America, is one of them.

This is a question of fair distribution of costs and benefits, and that is why it is at least partly an ethical question. Those who have been responsible for inadvertently introducing species into new habitats may not have been willing to make the investment to prevent such accidents from occurring. They may not have realized the dangers, and in any case the dangers would be unlikely to have much economic impact on their own welfare. Rather, the costs of such accidents are borne by people other than those who have catalyzed the accidents. As Jeffrey McNeely, Chief Scientist of The World Conservation Union, has pointed out, the costs are in this way externalized. (Undated)

There is also a more purely ethical component to the invasives problem. The raw, ethical question is this: would we care about invasives if it were not for the direct economic harm to property values, to livelihoods, and to the enjoyment of resources we regard as placed on earth for our use? For that matter, *should* we care?

The non-economic problem associated with invasives is the homogenization of nature: taking a complex, resilient ecosystem that has evolved over thousands of years and simplifying and homogenizing and weakening it. As species invasions have accelerated in numbers and space well beyond background levels, ecosystems are less and less able to absorb their impacts. As a result, they are another manifestation of homogenization that comes with human colonization of local, regional, and global ecosystems. A recent article in the respected journal *Conservation Biology* asserts that the impact of invasive events on biodiversity is widespread – that invasive species are at least partially responsible for the extinction or imperiled status of 49% of the extinct or imperiled species in the United States. (Lodge & Shrader-Frechette, 2003)

If there were no economic consequences to this, I wonder if we would care. A little more than 30 years ago the U.S. passed the first federal statute, the Endangered Species Act, to grant de facto existence rights to species of plants and animals. In concept, at least, the Act recognizes existence rights of other species apart from their potential value as instrumentalities of human beings.

Yet, there is a great deal of evidence that our ethical values—that is, our willingness to act contrary to economic self-interest for a purpose greater than ourselves—do not extend to the homogenization of nature. The best evidence arises from the way in which we have chosen to spread ourselves across the landscape over the last half-century. Sprawl, as this pattern of settlement has become known, is one of the great homogenizers of nature. Even at low densities of one unit per 5 to 10 acres, sprawl reduces or eliminates the interior habitats required for biodiversity. The diversity of life quickly halves, and halves again, as large blocks of open space are reduced to 1,000-acres, 500-acres, and 50-acres, or are punctuated with house lots on 2, 5, or 10 acres. Yet, this is precisely what most suburban zoning ordinances now require.

Suburban sprawl, so far, has been impervious to ethical arguments dealing with pollution of the commons, reduction of wildlife habitat, and the homogenization of nature. Economic arguments simply trump ethical arguments. As a result, those of us who are trying to slow down or reverse sprawl must resort to economic arguments of our own. There are plenty – including tax burdens, loss of the competitive advantage that is our quality of life, inordinate transportation costs, and so forth. And right now, the statewide organization GrowSmart Maine, led by its president Alan Caron, is launching a major analysis of the relationship between sprawl and Maine's economy—an analysis that we believe will definitively link the need to defuse sprawl to the future economic well-being of the state.

But the point is that, when it comes to common resources, like wildlife, the air, the great ponds, and so forth, we must rely on economic rather than ethical considerations if we are to protect them.

This is not exactly what Aldo Leopold had in mind, when he wrote in *A Sand County Almanac*: "Examine each question in terms of what is ethically and aesthetically right, as well as economically expedient. A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

Fortunately or unfortunately, we need not rely on the ethical component to stir interest in invasives. The economic imperatives are strong enough to engage public policy, and, thanks to your efforts, public awareness of the problem is growing. The volunteer efforts and the public service mounted by the people in this room, and many others, around the control of milfoil and other lake invasives are remarkable. And, economically driven or not, it is a testament to Mainers' feelings for nature.

Let me conclude by saying that when I hear or read about invasives, a little poem by Ogden Nash comes to mind. It is about one of the most prolific introduced species in North America, the Rock Dove (now officially known as the common pigeon):

> "Toward a better world I contribute my modest smidgin;
> I eat the squab, lest it become a pigeon." – Ogden Nash

References

Alien Plant Working Group (Undated) "Weeds Gone Wild," National Park Service; at http://www.nps.gov/plants/alien/bkgd.htm

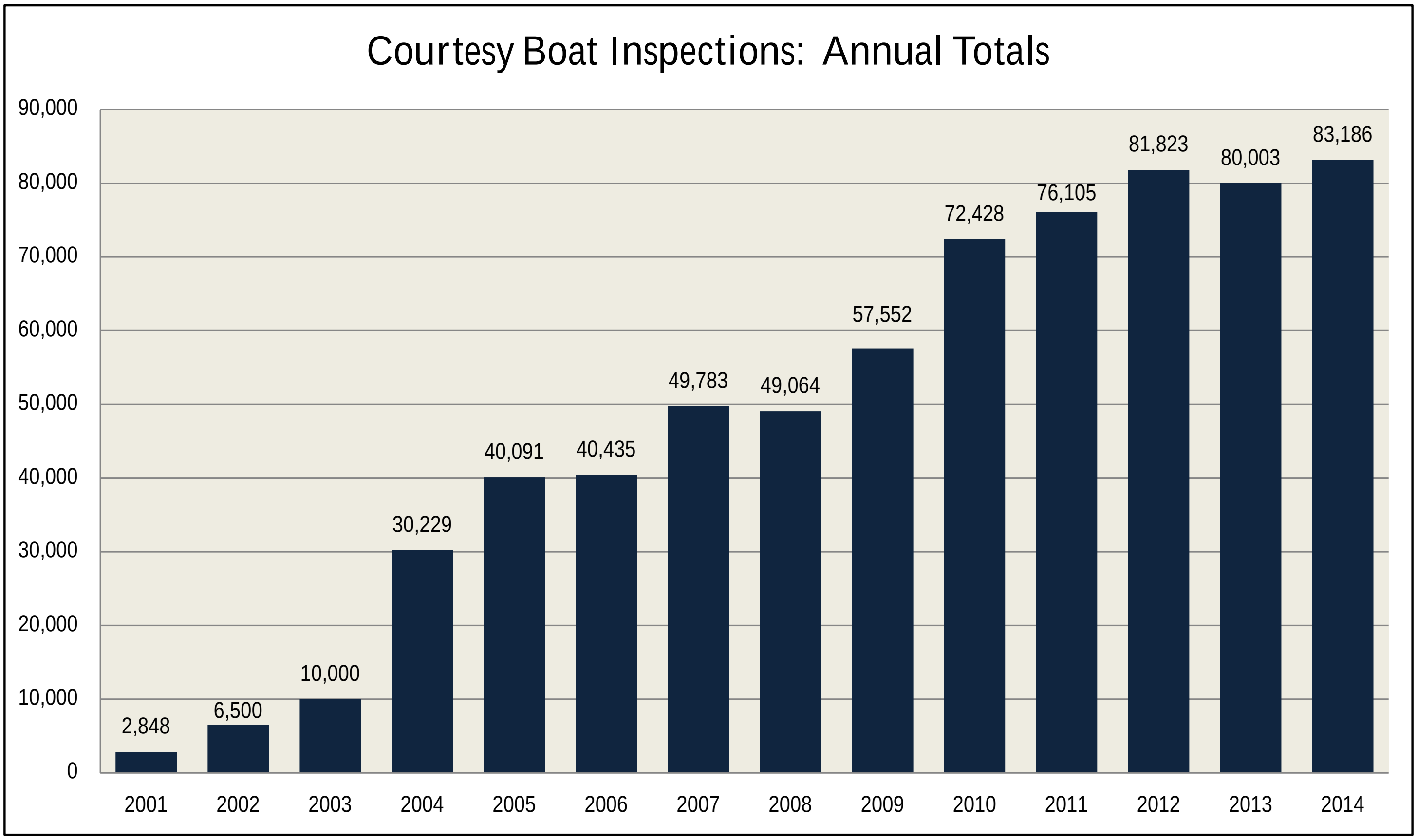
Allendorf, F.W., and Lundquist, L.L. (2003) "Population Biology and Invasive Species," *Conservation Biology*, Vol. 17, No. 1, pp. 24-30.

Boyle, K., Lawson, S., Michael, H., Bouchard, R. (September 1998) "Lakefront Property Owners' Economic Demand for Water Clarity in Maine Lakes," Miscellaneous Report 410, Maine Agricultural and Forest Experiment Station, University of Maine, p. 12.

Boyle, K., Schuetz, J., and Kahl, J. S., "Great Ponds Play an Integral Role in Maine's Economy," REP473, Water Research Institute, University of Maine, p. 29.

Lodge, D., and Shrader-Frechette, K. (2003) *Conservation Biology*, Vol. 17, No. 1, pp. 31-37.

McNeeley, J. A., "The Great Reshuffling: How Alien Species Help Feed the Global Economy," IUCN-The World Conservation Union, at http://www.iucn.org/biodiversityday/reshuffling.htm



CBI statistics	2013	2014
Infested lakes with inspections	15	14
Water bodies with inspections	120	116
Total plants found	2350	2196
Total invasive plants found	171	105
Invasive plants on entering boats	24	6
Invasive plants on leaving boats	147	99
Total inspectors	723	710
Inspection hours	41,119	42,293
Boats with sticker	92%	93%
Participating organizations	105	101*

Source: Maine Department of Environmental Protection

Confirmed 'saves' 2014	Boat direction	Invasive plant
Sebago Lake, Raymond	4 leaving	Variable milfoil
Lake Arrowhead	3 entering 65 leaving	Variable milfoil
Messalonskee Lake	4 leaving	Variable milfoil
Pleasant Pond, Litchfield	1 entering 19 leaving	Variable milfoil
Square Pond	1 entering	Water Chestnet Seed
Songo River	1 entering	Variable milfoil
Thompson Lake	6 leaving	Variable milfoil
Balch Pond	1 leaving	Variable milfoil

***46 participating organizations were BASS clubs and 5,363 inspections were conducted at BASS tournaments.**

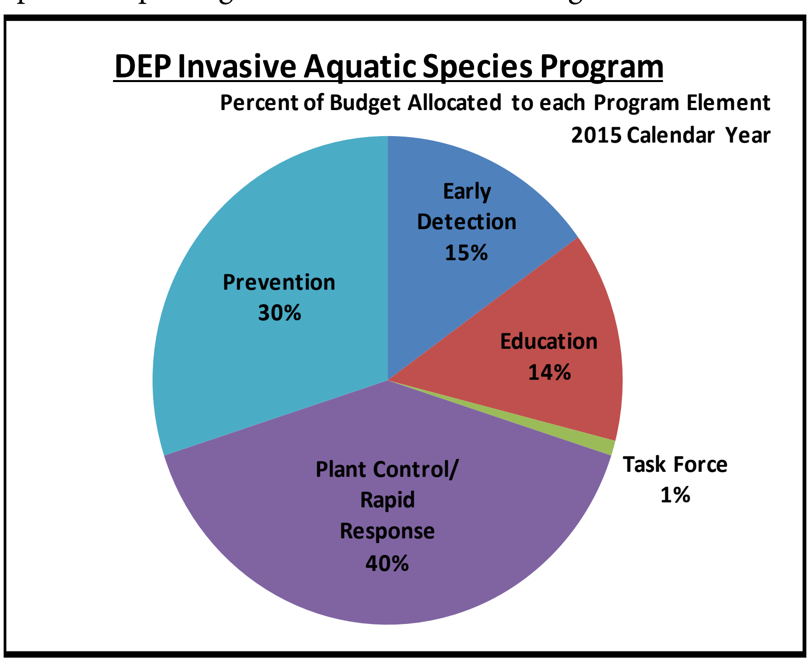
Department of Environmental Protection's Prevention and Control Efforts

Funding

Funding for Department of Environmental Protection's (DEP) Invasive Aquatic Species Program (IASP) comes from a fee on motorboats and seaplanes using inland waters. Boaters with Maine registrations pay $10 and must display the "Stop Aquatic Hitchhikers – Preserve Maine Waters" sticker attached to the boat registration sticker. Boaters with out-of-state registration and all seaplane operators must purchase and display the $20 Lake and River Protection Sticker.

Adoption of LD1626 by the Maine Legislature in April 2014 changed the revenue distribution of invasive species sticker fees. Formerly 60% went to DEP and 40% to Department of Inland Fisheries and Wildlife (DIFW). The new distribution sends 80% to DEP and 20% to DIFW. The impetus of the bill was to provide more funding to lake groups battling established infestations of invasive aquatic plants.

Following are brief descriptions of primary program elements for calendar year 2015. Budgeted salary/benefits for 3.5 DEP staff positions totals $296,310 in 2015. Each program element in the pie chart (below) includes cost of estimated staff time (see below for staff time estimates). Overhead is approximately 16 percent on every dollar spent except for grant funds. The 2015 budget includes $63,407 in overhead. Please email milfoil@maine.gov with questions regarding DEP funding and budget.



Early Detection

Over 3,500 "citizen scientists," trained and supported by the Maine Volunteer Lake Monitoring Program through a grant with DEP, form the state's early detection program. They provide a core force for surveying boat ramps, inlets, dock and swim areas and other areas for potential plant invasion. An estimated 18 percent of DEP's IASP staff time is allotted to early detection.

Education

IASP staff engages in educational activities to inform residents and visitors of the invasive species threat, promotes behaviors that prevent the spread of new infestations and advises lake groups on plant control strategies and techniques. These activities include the following:

- assisting lake groups with spread prevention and plant control programs
- speaking about the invasive aquatic species threat to varied audiences and responding to requests for information from media outlets
- distribution of brochures and other collateral materials
- technical assistance to plant retailers and schools that use plants as classroom tools
- distribution of warning signs on infested and non-infested lakes and ponds

An estimated 30 percent of IASP staff time is allotted to education.

Boat Inspections

One day, all boaters will inspect their watercraft and trailers for hitchhiking plants and other biological debris that migrate from lake to lake. Until then, posting inspectors at ramps is the most effective way to assure biological threats do not spread and provides an opportunity to show boaters the importance of inspecting and removing plants and debris. Boat inspectors are trained and grant funds are provided to support lake association and municipal boat inspection programs. Inspections have increased from 2,500 in 2001 to over 80,000 in each of the last three years (2012, 2013 and 2014.) The 2015 Courtesy Boat Inspection Program budget includes a competitive grant program for organizations on uninfested waters and allocates funding to organizations on infested lakes to prevent spread from those waters. An estimated 22 percent of IASP staff time is allotted to boat inspections.

Plant Control and Rapid Response

Local and regional lake groups work tirelessly to control established infestations. Due to the change in revenue distribution in LD1626, the 2015 budget includes greater funding than ever for plant control grants to local groups. The IASP responds to newly-discovered infestations to limit spread both within the infested lakes and beyond. Efforts include manual removal of plants by trained volunteers and SCUBA divers, deployment of warning buoys to direct boat traffic away from infested areas, and—in worst-case situations—the application of herbicides. The 2015 budget includes funding for potential rapid response by the IASP to a new infestation and for the IASP's ongoing management of existing infestations, including hydrilla in Pickerel Pond and Damariscotta Lake. An estimated 28 percent of IASP staff time is allotted to plant control and rapid response.

Task Force/Interstate efforts

Collaboration, both with neighboring states that have more extensive invasive plant problems and with Maine stakeholders, is essential to set priorities and find efficiencies. Not only do nearby states have a greater variety of invasive species able to migrate into Maine, they also have more experience in curbing or controlling plant infestations. Communication and the free exchange of experience are essential.

Within Maine, a Governor-appointed panel of stakeholders, the Interagency Task Force on Invasive Aquatic Plants and Nuisance Species, overviews and advises how revenues coming to the IASP serve the state best. An estimated 2 percent of IASP staff time is allotted to Task Force/Interstate efforts.

Total milfoil sticker sales and revenue, 2002-2014

Calendar Year	Resident	Amount	Non-resident	Amount	Grand Total	DIFW Share	DEP Share
2002	100,049	$900,441	9,814	$186,466	$1,086,907	$434,763	$652,144
2003	94,451	$850,059	9,135	$173,565	$1,023,624	$409,450	$614,174
2004	96,713	$870,417	9,260	$175,940	$1,046,357	$418,543	$627,814
2005	98,393	$885,537	10,239	$194,541	$1,080,078	$432,031	$648,047
2006	99,947	$899,523	10,449	$198,531	$1,098,054	$439,222	$658,832
2007	98,255	$884,295	11,666	$221,654	$1,105,949	$442,380	$663,569
2008	94,451	$944,510	11,190	$212,610	$1,157,120	$462,848	$694,272
2009	94,568	$945,680	11,052	$209,988	$1,155,668	$462,267	$693,401
2010	97,250	$972,500	11,096	$210,824	$1,183,324	$473,330	$709,994
2011	92,675	$926,750	10,203	$193,857	$1,120,607	$448,243	$672,364
2012	93,477	$934,770	10,108	$192,052	$1,126,822	$450,729	$676,093
2013	93,945	$939,450	9,402	$178,638	$1,118,088	$447,235	$670,853
*2014	92,764	$927,640	10,171	$193,249	$1,120,889	$251,142	$869,747
Totals	**1,246,939**	**11,881,582**	**113,785**	**2,541,915**	**14,423,497**	**5,572,185**	**8,851,312**

Source: Maine Natural Resources Services Center. Revenues collected January 1 - December 31.

**DEP's share increased and DIFW's decreased in 2014 due to the revenue distribution change approved by the Maine Legislature in April 2014. See Funding section on page 17 for explanation of the revenue distribution change.*

DIFW's invasive species program

Biologists from DIFW's Fisheries Division continue to respond to reports of non-native fish and other aquatic organisms. In 2014, reports of new invasive fish introductions were confirmed in seven waters. The species included northern pike, muskellunge, black crappie, smallmouth bass, largemouth bass, walleye, and rudd. In addition, staff biologists responded to reports or addressed invasive fish issues on 28 waters. Four private ponds containing goldfish were reclaimed with the cooperation of individual landowners.

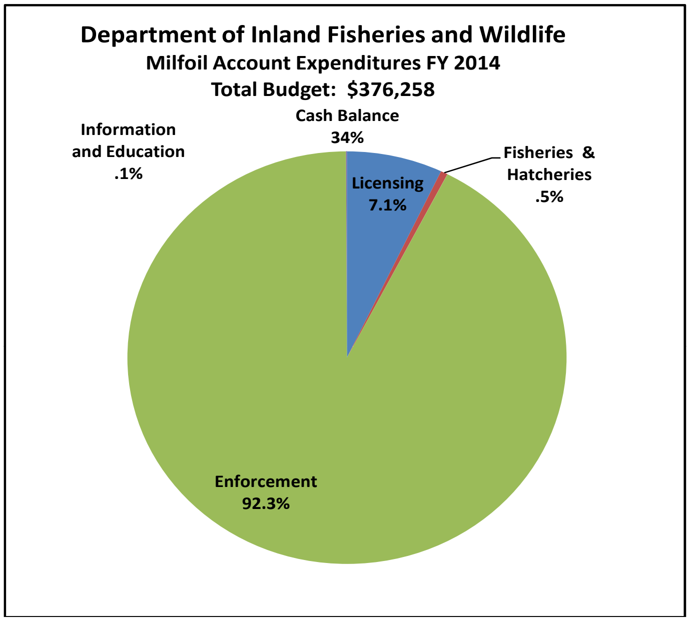
Rainbow smelt were illegally stocked into Wadleigh Pond, located in a remote section of northern Piscataquis County, and imperiled populations of wild brook trout and Arctic charr. The reclamation appears to have been successful and the pond was re-stocked with brook trout and charr in 2013 and 2014. The reintroduced trout and charr were stocked from Wadleigh Pond that were retained at a private hatchery until the reclamation was complete. Regional Biologists will monitor the progress of the re-introduction for several years to come.

Thissell Pond, located just outside Baxter State Park, was also illegally stocked with rainbow smelt. This smelt introduction eliminated the opportunity to maintain a wild brook trout population. Thissell Pond was reclaimed in 2013. A multi-year program to reintroduce a local strain of wild brook trout from nearby Sourdnahunk Lake. This work began in late 2014.

Broken Bridge and Crocker Ponds in in the White Mountain National Forest were colonized with non-native fish species such as rainbow smelt, golden shiner, chain pickerel and brown bullhead. The presence of these fish compromised DIFW's ability to successfully manage Broken Bridge as a high-quality stocked brook trout fishery. Both ponds were reclaimed in 2014. Broken Bridge and Crocker Ponds had previously been reclaimed in 2000, yet invasive species were reestablished. Crocker was reclaimed again to prevent downstream movement of invasive species into Broken Bridge Pond via a secondary overflow outlet. Regional fisheries biologists will carefully evaluate the success of the reclamation in 2015, prior to reestablishing the pond's brook trout fishery. These "extreme" responses to illegal fish introductions are costly and logistically challenging, and place enormous demands on DIFW's small fishery staff.

Bald Mountain Pond in Somerset County has been the focus of work in 2014 to study and protect Arctic charr from illegally introduced rainbow smelt. Rainbow smelt had likely been introduced into Bald Mountain Pond prior to 2007, but were not documented by DIFW until recently. Biologists worked throughout the summer and fall to trap live Artic charr, implant radio tags and study fish movement throughout this large waterbody to potentially identify spawning shoals. Arctic charr weight at age and condition has declined since the smelt introduction and few fish were captured and tagged in 2014. Additionally, the charr spawning locations were not identified. Major work in 2015 will focus again on radio tagging charr and also identifying potential spawning habitat using new side-scan sonar imaging equipment.

The Fisheries Division takes an active role in educating the public in regards to invasive fish species and the impacts to native fisheries resulting from these illegal activities. Most recently, DIFW received a grant from Maine's Outdoor Heritage Fund to install over 350 informational signs that focus on perils of illegal fish introductions. These signs were installed at over 300 water access sites across the state.



WHAT CAN WE DO TO PREVENT INVASIVE PLANTS?

Here are some things that can be done locally to prevent the introduction and spread of invasive aquatic species, in particular exotic plants. There are also a few notes about what cannot or should not be done.

The first thing to understand is that the threat of invasive aquatic species is not going to go away at any time in the foreseeable future. As long as people travel from one waterbody to another, the potential for the spread of unwanted aquatic organisms will persist. For any prevention effort to be effective it must be sustainable "over the long haul." It is important, therefore, to choose the strategies that are most suited to the particular circumstances and needs of your community, and that can be adapted over time. The best way to do this is to organize a committee, with members representing a broad spectrum of community interests, to collect information and develop a comprehensive plan for addressing the invasives issue locally.

Many of the most effective strategies are very simple and inexpensive. Others will require more time, effort and funding. Volunteers can do much of the work, but there may be instances when the assistance of professionals may be warranted. For each project, there should be a designated individual who takes on the job of monitoring things over time, e.g., checking periodically that signs are still up, brochures are still being given out, etc.

1. Make sure that all public launch ramps have warning signs

Use the signs developed by the VLMP and the DEP or make your own. Whichever you choose, remember that visual clutter can be an issue. Think about placement to increase the likelihood that boaters will actually see the signs. When placing signs, make sure to identify who owns the ramp and talk with them about sign placement etc.

Kiosks at landings are a good way to offer more information, but again, the best information is not useful if it is not seen. Sometimes the shorter, simpler, and more attention-getting the message is, the stronger its effect. Be sure to avoid alarmist rhetoric – that turns many people off.

2. Post informational posters and flyers

Look for key areas in your community where boaters (especially those from away) are likely to see public notices, such as community bulletin boards, local stores, sportsmen's clubs, etc. Post the VLMP flyer material, both sides of the color brochure, or develop your own posters and flyers. The use of color and keeping the message simple increases the chances that the information will be read. (Electronic files of the VLMP brochure graphics are available upon request. Also, please feel free to take illustrations off our website.)

3. Ask your town office to hand out brochures

Contact your town office and ask if they will hand out brochures (your own brochure and/or those developed by the DEP, VLMP or others) whenever boat and boat trailers are registered and when fishing licenses or the new "Protect Maine Waters" boat stickers are purchased. Non-resident fishing licenses and the boat stickers are also sold through local stores and agents, so they should be contacted as well.

Be sure to ask stores, tourist information locations, town offices etc. to put up posters (in effective locations) and stock brochures.

4. Distribute flyers and/or brochures at ramps

a) Organize volunteers to stop by public boat ramps a few times each day and place flyers on vehicles with trailers. To reduce the chances of "reflyering" frequent ramp users, keep records of which vehicles have been "flyered" and avoid repeats when possible.

b) Put flyers in a box at the ramp for people to pick up.

One problem with both of these distribution methods is the potential for litter, so be prepared to pick up a few flyers from time to time. As with placing signs, it's good to discuss the project with the ramp owner before hand.

5. Create a portable display of posters, signs and brochures

A portable display can be a terrific way to reach a wide audience. Move the display around the community – place it in schools and libraries, or set it up at public meetings and events, etc.

6. Inventory all places where boats are launched and contact the owners

Keep a list of who has ramps likely to be used by boats from other lakes, including the contact person and when last contacted. It's good to renew these contacts in May and July each year.

a) Private ramps open to others (such as marinas and sporting camps): When someone launches at a commercial facility, the staff there can use the opportunity to hand out brochures and may be willing to check boat trailers for plants. If you get this kind of cooperation, please make sure to acknowledge the owner and staff in your newsletter or newspaper article. The owner can also post a sign/poster for you.

b) Other private ramps: Alert owners to potential problems. If they have guests use their boat launch, ask them to check the boat before launching.

7. Boat inspection at ramps

Having boat inspectors at ramps is perhaps the single most effective way to prevent the spread of invasive plants. It is imperative that the owner of the ramp (IF&W, DOC, Town, Sporting Club, etc.) knows and agrees with what you are doing. Above all, avoid conflicts with boaters by observing a few simple rules:

a) Boater participation in your inspections is completely voluntary. View it as an opportunity to educate them. If they object to an inspection, or are "too busy", simply offer them a brochure.

b) Try to talk with boaters before launch; preferably while they are preparing their boat, and not while it is on the ramp if the facility is busy.

c) Keep your message short. Boaters are often impatient to be off, and they will be more receptive to a few sentences (and maybe let you quickly show them the inspection process) if you are brief.

d) Never "expect" boaters to accept your message. Some people are very sensitive to implications that they should do things differently. If they are resistant or show signs of wanting to argue, it is best to thank them for their time and let them continue on their way.

You may want a mixture of volunteer help and paid interns, depending on your resources and the amount of time you think you can arrange for coverage at the landing. Obviously, you want to cover the highest use times -- weekends, vacation times (Memorial Day, July 4th), fishing tournaments, etc.

Lakes Environmental Association (LEA) offers boat inspection training for volunteer groups. Please contact LEA at 207-647-8580 or lakes@leamaine.org for more information.

8. Boat Washing Stations

Boat washing stations can be effective, but are generally quite costly to set up and operate. They may not be much more effective than careful inspections at preventing plant infestations. However, zebra mussels may be transported in engine cooling water and any container with lake water from another area. If an engine has not been flushed out with clean water before launching, at least run it "dry" for a few seconds so most of the cooling water will be expelled, preferably away from the ramp so it soaks into the ground. A few seconds should do it, and will not overheat the engine. Some boat owners will not agree to that. A better alternative would be to have a "boot" and clean water source for flushing the cooling system completely.

9. Incentives to cooperate

Getting people to cooperate can be helped if something useful comes along with the education (key chain, water bottle, etc.). This can also carry your message: association logo or whatever take-home message you want.

10. Survey the ramp area and other likely sites for invasive plants

The VLMP offers Invasive Plant Patrol training to help volunteers in your community conduct invasive plant surveys of lakes, ponds or streams. Please contact the VLMP for upcoming workshop dates and locations.

11. Using local media to put out the word

Many areas have free advertisers or seasonal papers that will print short articles if you provide the information and especially a selection of clear pictures or graphics. The papers are often looking for content, and reviewing a few past issues will give you an idea for length, style etc. of what they may print.

The message might vary depending on the time of year and the project you choose. While you want to avoid sensational statements, your story should be presented in a way that will be of interest to the public. Any time you can put your issue in a local perspective, especially how the issue affects people, it makes for a better read. Some of these papers will print articles for you several times a year, particularly if you offer something a bit different each time. Media exposure works best if the message is short, positive and repeated in different ways.

Explore other outlets such as newsletters from organizations (besides lake associations) that make regular mailings and may be receptive to including your information. These can include local service groups, churches or clubs.

Some other things you should know:

State law, or other considerations may limit what can or should be done in some instances.

Restricting Public Access: Unless the town or private club etc. owns a launch ramp and has the right to close it, it will not be possible to close the lake to boats and gear coming "from away". Campaigns to do this can cause bad feelings among local people who rely on these access points to use lakes.

Restricting Surface Use (such as allowing only non-motorized craft)**:** Only IF&W can set restrictions on surface use, such as maximum horsepower and the like, and they are limited by law as to what they can limit (horsepower size, use by personal watercraft) and for what reasons (public safety). There is a process to restrict surface use by petition for these reasons, but limitations apply to everyone using the lake (including camp owners). In the case of restricting personal watercraft, it also requires municipalities involved to agree to identical standards. For more information, call IF&W at 207-287-8000 or see their website at http://www.maine.gov/ifw/laws_rules/boatlaws.htm.

Use of Herbicides: Except in private ponds with no outlets, herbicide application to water requires a discharge permit from the DEP and in many cases, application by a licensed pesticide applicator. Pesticides themselves and professional applicators are regulated by the Department of Agriculture, Pesticides Control Board. For more information, please call 207-287-2731 or check the web at www.maine.gov/agriculture/pesticides/index.htm.

Discharge licenses for pesticides to lakes are not allowed by DEP: Under current law, DEP can apply herbicides for the sole purpose of restoring a water body. Repeated applications or the use of herbicides to simply suppress or manage, but not eliminate a plant population is not allowed.

There is growing anecdotal evidence that property owners are buying herbicides from local suppliers, through the mail, or over the Internet and using them illegally in lakes. Herbicides have been used on native populations of plants to eliminate them in front of camps. People may have the misimpression that because the chemicals are EPA registered, they are safe and benign. The suppliers rarely tell a person that applying them without proper permission is a serious legal offense and is hazardous to the environment (and to themselves if not done properly).

Physical Control Methods: Methods such as dredging, bottom barriers and weed harvesting require an "NRPA" permit. DEP can apply control methods without getting a permit provided it is for the *immediate eradication* of an infestation. If such physical control methods are to be done by parties other than the DEP or for management/suppression (without the prospect of eradication) then a regular NRPA permit is required.

Homeowners are allowed to *hand-remove* a swath of vegetation 10 feet wide perpendicular from their shoreline out into the lake. This will allow a place to swim and passage for boats. To do this, an owner needs to get a "Permit by Rule" from the DEP. Although a quick and simple process, PBR carries clear standards, which must be met. For information on NRPA and PBR standards, call a DEP agent at 207-287-3901 or 1-800-452-1942 or visit the web: http://www.maine.gov/dep/land/nrpa/index.html.

Can Volunteers Make a Difference? You Bet!

Volunteer Early Detectors Help Local Authorities Nip New Infestation in the Bud

The Great East Lake Improvement Association (GELIA) in Wakefield, New Hampshire and Acton, Maine has an active Weed Watcher program. (Weed Watchers is the New Hampshire corollary to Maine's Invasive Plant Patrol.) GEILA's early detection program has grown steadily every year since its inception, and the association now has over 60 volunteer "watchers" on the lake, covering nearly all of Great East's eighteen miles of shoreline. On July 11, 2006 Great East Lake resident and volunteer weed watcher, Carol LaFond, was surveying her assigned sector near the public boat launch, on the Maine side of the lake, when she noticed a suspicious plant "standing out like a neon sign" among the native plants. She collected a specimen and brought it to local authorities. The plant was not in flower at the time and species identification was only possible through DNA analysis. (The flowering parts are needed to positively identify most milfoils.) DNA test results confirmed what had been suspected: the suspicious plant was variable water-milfoil (*Myriophyllum heterophyllum*). The response was swift and carefully executed. Once the invasive plant and its roots were removed, Carol continued to revisit the plant removal site, as well as the surrounding cove area, on a weekly basis for the remainder of the open water season. No additional invasive plants were found. Additional surveys of Great East Lake beyond the cove seem to confirm that the introduced invader was detected and removed before it had a chance to become well-established or to spread to other areas of the lake. Having successfully averted what could have become an ecological and economic disaster for the lake and the region, GELIA has provided us with a compelling example of the enormous--and ultimately incalculable--value of volunteer early detection efforts.

IPP Training on Echo Lake

To learn more about Maine's early detection effort, please contact
Maine Volunteer Lake Monitoring Program
207-783-7733 or vlmp@mainevlmp.org

Maine State Invasive Aquatic Plant Laws

The State of Maine enacted Title 38, Section §419-C Prevention of the spread of invasive aquatic plants in 1999. This statute provides the following prohibitions:

A person may not:

1. Transport any aquatic plant or parts of any aquatic plant, including roots, rhizomes, stems, leaves or seeds, on the outside of a vehicle, boat, personal watercraft, boat trailer or other equipment on a public road;
2. Possess, import, cultivate, transport or distribute any invasive aquatic plant or parts of any invasive aquatic plant, including roots, rhizomes, stems, leaves or seeds, in a manner that could cause the plant to get into any state waters; or
3. After September 1, 2000, sell or offer for sale in this State any invasive aquatic plant.

Title 38 chapter 3 http://legislature.maine.gov/statutes/38/title38sec410-N.html and http://legislature.maine.gov/statutes/38/title38sec419-C.html

Further laws were passed in Title 38, Chapter 20-A to create a dedicated funding mechanism for prevention and control programs and to outline those programs and their goals. It also includes a mechanism for restricting surface use on infested waterbodies.

Title 38 chapter 20-A http://legislature.maine.gov/statutes/38/title38ch20-Asec0.html and http://legislature.maine.gov/statutes/38/title38ch20-Bsec0.html.

Title 12, chapter 935 contains prohibitions against launching contaminated boats and failure to display a lakes and rivers protection sticker (the funding mechanism created in Title 38, Chapter 20-A). A person violating all of these prohibitions could face a combined maximum penalty nearly $13,000.

Title 12 chapter 935 http://legislature.maine.gov/statutes/12/title12sec13058.html and http://legislature.maine.gov/statutes/12/title12sec13068-A.html

Littorally Speaking

Milfoil in Annabessacook Lake

VLMP's Roberta Hill teaches Annabessacook Lake volunteers how to recognize an aquatic invader when they see it.

by Roberta Hill
VLMP Invasive Species Program Director

Late in the summer of 2013, a vigilant Courtesy Boat Inspector (CBI) stationed on Annabessacook Lake spotted a single milfoil fragment floating near the public boat landing. DNA testing confirmed the plant to be variable water-milfoil (VWM, scientific name: *Myriophyllum heterophyllum*), the most prevalent invasive aquatic plant in Maine. Though Annabessacook Lake was not known to be infested, it *is* in fairly close proximity to several waterbodies that *do* have known VWM infestations. Were the wayward fragments left behind by a visiting boat, or did they originate from a new—as yet undetected—infestation in Annabessacook Lake?

The only way to answer this question with certainty was to conduct a comprehensive "level-3" survey of the lake's entire littoral zone (all shallow areas of the lake, anywhere that sunlight reaches the bottom and rooted plants may grow). Conducting a level-3 survey on a lake that is nearly 1500 acres in size, with over 17 miles of shoreline, can be challenging in the best of circumstances. In the case of Annabessacook Lake, the challenge was intensified by several factors: 1) DNA analysis of the milfoil fragment found by the CBI took longer than usual. When the results finally arrived in December 2013, it was too late to conduct even a cursory survey. This delay would significantly cut into greatly needed planning and preparation time. 2) Though invasive aquatic plant (IAP) screening survey activity was being done regularly on Annabessacook Lake, these surveys were generally limited in scope. Conducting a full level-3 survey would require a significant increase in survey capacity. The community elected to accomplish this by building a locally-sustainable volunteer Invasive Plant Patrol (IPP) team, an undertaking that would require a good deal of local outreach, and the development of a comprehensive training program. 3) Most

lake plants in Maine are fully mature and easiest to view and identify from mid to late summer. But in Annabessacook Lake, the growth of planktonic algae in late August can significantly reduce water clarity, and potentially impede survey visibility, thus shrinking the survey window of opportunity. In a nutshell, the local community had barely half a year to plan, gather the resources, and build the volunteer capacity needed to accomplish a high-quality, comprehensive survey within a very short (one-to-two-week) timeframe. A coalition of project partners quickly assembled and mobilized. The VLMP's role in the alliance, which included Annabessacook Lake Improvement Association (ALIA), Friends of Cobbossee Watershed (FOCW), Cobbossee Watershed District (CWD) and the Maine Department of Environmental Protection (DEP), was primarily to assist in informing, engaging, training, and activating a local team of trained citizen Invasive Plant Patrollers.

With Annabessacook Lake Improvement Association playing the vital role of workshop host—securing workshop venues, organizing food, publicizing the workshops locally, etc., the IPP training program was rolled out through the summer of 2014. The program was launched in June with an IPP Plant Paddle led by Friends of Cobbossee Watershed staff. This engagement-level event helped to spur local interest in the Annabessacook survey project and to encourage participation in the more extensive trainings to follow. The IPP Intro Workshop and IPP Survey Field Methods Workshops, which took place in July, were both well-attended, resulting in a formidable cadre of well-trained, certified, locally-based patrollers. The Annabessacook IPP team was born!

While VLMP and ALIA were busy with the trainings, Maine DEP staff began conducting preliminary surveys of the areas closest to the public boat landing. A local leadership team was formed, comprised of one representative from each of the local partners: CWD, FOCW and ALIA. This group took on the task of organizing the full, lake-wide survey, and working out the various logistics needed to ensure its success. The necessary survey equipment was gathered and/or constructed. A series of public and private launch sites were identified around the lake; in the case of the private launches, permission to launch was sought and obtained. Nine survey regions were delineated, each with its own launch site. Each region was divided into several smaller sectors, with

most sectors covering roughly 1000-feet of shoreline. As surveyors signed on to the new Annabessacook IPP Team, they either adopted, or were assigned, one or more survey sectors.

The preliminary survey activity by the DEP revealed yet another challenge. Annabessacook Lake was home to three native milfoil species, all similar in appearance to VWM. The presence of these and other native look-alikes would certainly complicate things, especially for novice patrollers. Survey planners addressed this challenge by teaming more experienced patrollers—acting as “region leaders”—with the novice patrollers in their assigned areas. The team had now grown to thirty-six members, the majority of whom were trained and certified IPP volunteers.

Training of the Annabessacook Lake IPP Team continued with on-the-water instruction and guided practice.

This story cannot be properly told without mentioning the vital role played by Maine's IPP Rapid Response Team: certified IPP volunteers who have agreed to be on-call should a new infestation be identified in Maine. Not only did many of these seasoned “IPPs from away” travel across the State to attend trainings and support the novice patrollers, they also signed on as volunteer region leaders, lending their considerable expertise, experience and mentorship skills to the survey effort. When members of Maine’s IPP Rapid Response Team were introduced at the survey kick-off meeting, they were met with a resounding standing ovation. A palpable sigh of relief spread across the room and someone cheered, "The cavalry has arrived!"

Over the course of the next two weeks—thankfully, with full cooperation from the weather—the level-3 survey of Annabessacook Lake was completed without a hitch. Several significant patches of milfoil were indeed encountered by surveyors. Was this invasive milfoil? None of the specimens looked glaringly suspicious; but neither did they present the features needed to confidently rule out the target invader. The patches were properly marked and mapped, and specimens were collected. Once again, we would have to rely upon DNA analysis.

A few weeks later, the DNA results arrived: two of the twelve specimens came back with a positive identification of *Myriophyllum heterophyllum*, invasive variable water-milfoil. One specimen had been taken from a growing patch in the northern inlet cove; the other was a floating fragment found near the boat landing, at the other end of the lake. Sadly, Annabessacook Lake was now to be added to the list of Maine lakes with known infestations.

The Maine DEP mobilized immediately upon receiving the DNA results, and on September 24 they deployed SCUBA divers who carefully removed the known VWM patch in the northern cove. They also investigated suspicious milfoil plants in the shallows beyond the public boat landing channel, a patch recently discovered by alert CWD staff during routine water-quality monitoring. DNA analysis later confirmed VWM in this area, as well. DEP and CWD returned to the boat-landing area on October 17, and a number of additional, well-established milfoil patches were found. The characteristics of these newly-discovered plants precisely matching those of confirmed VWM, they were also removed.

The Maine DEP mobilized immediately upon receiving the DNA results, deploying SCUBA divers who carefully removed several large patches of VWM from the lake.

Maine's IPP Rapid Response Team played a vital role in the survey. Team Members participating in the Annabessacook survey included: Diane Clay, Bob and Sibyl French, Carol Fuller, Susie Wilding-Hartford, Marsha Letourneau, Dennis Roberge, Lea Stabinski, and Ross and Bunny Wescott. Pictured above are Diane (L) and Susie (R).

Despite this disconcerting result, it is important to note the good news here. The level-3 survey findings suggest that the rooted VWM population may very well be limited to two discrete areas in the lake. With luck, the process that began when the CBI spotted a suspicious plant floating near the boat launch in 2013, and continued with the activation of ALIA’s Invasive Plant Patrol team, has resulted in a timely, early-detection of the infestation. We know from experience that early detection has been key to the successful management of variable milfoil in a number of cases in Maine. If the infestation in Annabessacook Lake proves to be as limited in scope as these early findings suggest; if actions are taken swiftly and deliberately; if the successful collaboration that began in 2013 continues, the prospects for successfully addressing the Annabessacook infestation are very good indeed.

Photos for this article were provided by The Cobbossee Watershed District.

Don't Forget to Keep Track of Your Lake's Ice Cover!

The winter season is upon us, so be sure to keep track of your lake's ice cover. The VLMP acts as a state repository for ice-out records, some stretching as far back as the mid-1800's. Your ice-in (and ice-out) data, when paired with water quality readings, may improve our understanding of the relationship between the duration of ice cover and water quality. You can report ice-in and ice-out via e-mail directly to Christine@mainevlmp.org, or you can report by phone at 207-783-7733.

Battling the Invaders

As of January 2015, twenty-four waterways (encompassing forty-six distinct waterbodies) in Maine are known to be infested with invasive aquatic plants. Variable water-milfoil is still the most widespread of the known invasive aquatic plants in Maine. Other invasive aquatic plants present in Maine include curly-leaf pondweed, Eurasian water-milfoil, European naiad and hydrilla.

Once an infestation has been confirmed, rapid response is crucial. The prospects for eradication (or barring that, effective management at minimum risk to the aquatic ecosystem), is greatly increased by swift, well-planned, and properly executed controls. In developing an invasive aquatic plant management plan, one of the most important questions to be answered is "How, exactly, is the invasive plant infestation to be controlled?" The principal approach in Maine—used primarily by groups currently involved in battling variable milfoil (or its invasive hybrid)—is "manual control." Manual control methods may alternately be referred to as "non-chemical," "physical" or "mechanical" methods. The three primary manual control methods currently being used in Maine are: manual harvesting, benthic barriers, and suction-assisted harvesting.

Variable water-milfoil infestation in the Songo River at Sebago Lake State Park.

Maine has taken a cautious approach to the use of aquatic herbicides to control invasive aquatic plants. Herbicides, like all pesticides, pose a definite degree of risk for people, for fish, and for the integrity of the aquatic ecosystem which depends on that body of water. Though aquatic herbicides are seen by state officials as an "effective tool," it is the state's position that the "benefits of using herbicides rarely exceed the risks of very real adverse ecological impacts." Therefore, "it is only in extraordinary circumstances that the Maine Department of Environmental Protection (DEP) will support the use of herbicides."[1] In recent years, the DEP has approved and overseen the use of aquatic herbicides in four specific instances--the Hydrilla infestations in Pickerel Pond in Limerick and Damariscotta Lake in Jefferson, and the Eurasian water-milfoil infestations in the unnamed gravel pit in Scarborough and Salmon Lake in Belgrade.

IMPORTANT! – All invasive aquatic plant control projects are subject to regulation under Maine's Natural Resources Protection Act. Before planning any control project, contact the Maine Department of Environmental Protection for specific permit requirements. All native aquatic plants are strictly protected by Maine law.

<u>Manual Control Methods</u>
Below is a brief overview of the three primary manual control methods currently being used in Maine: manual harvesting, benthic barriers, and suction-assisted harvesting. More detailed information on each method is located online at www.mainevlmp.org/aquatic-invaders/.

Manual Harvesting (or Manual Removal)

Most of the variable milfoil management efforts currently underway in Maine involve a combination of manual control methods. Nearly all of these projects involve at least some use of the method known as manual harvesting. Manual harvesting is a useful technique for removing scattered individual plants and controlling small, infested patches. With manual harvesting, plants and their root systems are individually removed from the infested area, collected, and transported away from the waterbody for disposal. As even tiny plant fragments can generate new plants, it is very important when using manual harvesting that every attempt is made to remove all plant and root fragments from the project site.

Jim Chandler, using manual harvesting to control variable milfoil in Lily Brook, surfacing with a bag full of milfoil.

The means by which the plants are approached, handled, and even the way in which they are disposed of may vary, but the basic concept remains the same. Think "weeding the garden by hand (or with hand tools)." Now think "weeding the garden under several feet of water." This should give you a pretty good sense of the work. Depending on the water depth, the work is done by waders, boaters, snorkelers and/or SCUBA divers. Though manual harvesting is a labor-intensive process, if done with care it is a "species selective" technique that causes minimal impact to other native species in the vicinity of the control activity. However, despite the level of care and thoroughness, it is nearly impossible to see and remove every stem and root fragment in the infested area. For this reason, ongoing monitoring of management sites and routine control activity is essential.

Benthic Barriers (also called Benthic Mats or Bottom Barriers)

Placement of benthic barriers is another labor-intensive, but effective, method for controlling invasive aquatic plants. Benthic mats are particularly useful in treating small to moderate sized patches of dense growth. They are used to suppress invasive plant growth in high use areas such as public swimming areas. If depths are sufficient, benthic barriers may also be used to clear and define plant-free boating channels through infested areas, reducing plant-boat contact and thereby minimizing the potential for boats to spread the infestation. Controlling larger infestations with benthic barriers is possible, but given the labor and materials involved, larger control projects are generally done incrementally in stages, and in some cases may take several years to reach the desired result.

Benthic barriers may be constructed in various shapes and sizes, using a variety of materials and systems for weighting the mats down. Their basic function, however, is to lay "flat" on the bottom of the lake, pond, or stream, covering the infested area, preventing plants underneath from receiving sunlight, thereby killing them. (Returning to the garden analogy . . . think mulch). The mats are left in place long enough to kill the plants (generally four to six weeks, though in some cases, the mats may be left in place for longer periods). Manual harvesting is often used in tandem with the placement of benthic barriers to control any "outliers" and plants that find their way out from under the mats around the edges. One significant advantage with the use of benthic barriers is that the plants in the treated area are, by and large, killed. The "almost impossible" challenge of extracting every root hair from the substrate (as is necessary to completely kill a plant through manual harvesting) is largely eliminated when this method is properly employed. One disadvantage is that benthic mats are not "species selective" and may cause "collateral damage" to any native flora and fauna that do not have the means to escape out from under the mats.

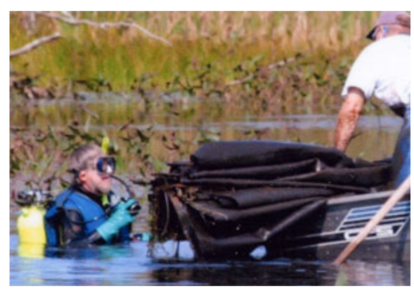


Photo by Nikki Leam
Team installing benthic barriers to control variable milfoil in Lily Brook.

Diver Assisted Suction Harvesting (DASH)

Suction harvesting is the least frequently used, of the three manual control methods now employed in Maine. It is a relatively expensive and cumbersome control option. However in certain circumstances such as large, widespread infestations, suction assisted harvesting is proving to be an important management tool. Groups in Maine utilizing this method have shown enormous industry and innovation in developing the required technology and techniques. As the fine-tuning of the process proceeds and more "rigs" come on line, it is likely that the use of suction-assisted harvesting in Maine will expand.

Little Sebago Lake Association has developed two floating work stations (dubbed HIPPO I and HIPPO II) to support their suction assisted harvesting activity

Suction harvesting is 'manual harvesting' (see above) with the added advantage of a highly efficient way to get the plants to the surface where they are collected for disposal. Rather than swimming the plants to the surface in mesh bags, divers extract plants by hand as above, and then feed the plant material directly into a suction tube for rapid transport to the work platform at the surface (generally a pontoon boat or barge). From the hoses, the plants and any sediments clinging to the plants, are pumped through some form of strainer system, then piled or bagged. The sediment-laden water that comes along with the plants is either returned directly to the waterbody, or (better) is put though another system that removes sediment particles or allows them to settle out.

Plant fragmentation is a concern with all of these manual control methods, but with diver-operated suction harvesting the potential for fragmentation is moderately high. Use of careful technique and fragment barriers can significantly reduce the creation and escape of fragments from the work area.

---

1. Keynote Presentation at the Seventh Annual Maine Milfoil Summit by Commissioner David P. Littell, Maine Department of Environmental Protection.

The Use of Herbicides to Control Invasive Aquatic Plants: Questions and ~~Answers~~ *More Questions...*

Roberta Hill, Invasive Aquatic Species Program Director, Maine VLMP

Twenty-three Maine waterways (encompassing forty-six distinct waterbodies) are known to be infested with invasive aquatic plants. Variable water-milfoil is still the most widespread of the known invasive aquatic plants in Maine. Other invasive aquatic plants present in Maine include curly-leaf pondweed, Eurasian water-milfoil, European naiad and hydrilla.

The increased awareness of existing or new infestations, the alarming rate of advance of some invasive populations, and the significant challenges that arise when one takes on the task of controlling aquatic invaders have all contributed to a growing sense of urgency, perhaps even something more akin to panic. It is not surprising that, in the midst of this deepening climate of concern, the hunt should intensify for the proverbial "silver bullet" that will, if not kill the offending invader once and for all, at least diminish it to the point that it no longer poses a significant threat. It is in this context that some are now asking about the possibility of expanding the use of aquatic herbicides to control the invaders. Some commonly asked questions are "Why can't we just kill the plants with herbicides?" or "Other states routinely use aquatic herbicides to control invasive aquatic plants: Why aren't herbicides more widely used in Maine?"

The purpose of this article is to take a careful look at the prospect of expanding the use of aquatic herbicides in Maine—and to ask some of the questions that will surely arise as we, the citizens of Maine, begin to consider the pros and cons of such a course of action. How are aquatic herbicides currently being used in our state? What is the rationale behind Maine's current "cautious" approach to the use of aquatic herbicides? Are aquatic herbicides safe? Are they effective?

The intention here is not to attempt to provide *answers* to these questions, because to some extent there are no clear answers. Rather, it is to illuminate some of the complexities inherent in the questions themselves, and to suggest the types of questions that should be asked if we wish to ensure the best decisions moving forward. The primary goal of this article, in other words, is to simply get the ball rolling on a critically important public discussion; one that ultimately may impact all of us who have a special place in our hearts for Maine's lakes, ponds and rivers.

Question 1: How are aquatic herbicides currently being used in Maine? What is the rationale behind Maine's current "cautious" approach to the use of aquatic herbicides?

Controlling hydrilla in Pickerel Pond with aquatic herbicides (Photo courtesy of MDEP)

To treat waters of the State with an herbicide one must apply for, and receive, a waste discharge license from the Maine Department of Environmental Protection. Licenses are approved (or not) on a case-by-case basis. The risks and benefits of using a particular herbicide are weighed against the risks and benefits of not doing so. The risks and benefits associated with alternative methods of controlling the particular infestation must also be considered.

The rationale behind Maine's measured and cautious approach to regulating the use of aquatic herbicides was stated succinctly by then Maine Department of Environmental Protection Commissioner, David

Littell, in his keynote address at the 2006 Milfoil Summit: "Herbicides, and all other pesticides for that matter, pose a definite degree of risk for people, for fish, and for the integrity of the aquatic ecosystem which depends on that body of water." Though state officials are currently using aquatic herbicides to control invasive plants in two instances as described below, it is the state's position that the "benefits of using herbicides rarely exceed the risks of very real adverse ecological impacts." Therefore "it is only in extraordinary circumstances that DEP will support the use of herbicides."[1]

Since 2003, Maine DEP has approved and overseen the use of aquatic herbicides in four specific instances—the Hydrilla infestation in Pickerel Pond in Limerick, the Eurasian water-milfoil infestation in the unnamed gravel pit in Scarborough, the Eurasian water-milfoil infestation in Salmon Lake in Belgrade, and the Hydrilla infestation in Damariscotta Lake in Jefferson. According to former Commissioner Littell, all four of the infestations are seen as unique. All occur in small ponds less than 50 acres in size or small coves, "small enough to manage effectively." Both species are considered extremely serious invaders, widely recognized by biologists as among the "most tenacious, most costly, and most environmentally damaging plant species in North America." Containing these two particular invaders and "preventing any opportunity for them to take hold elsewhere in Maine"— is, according to the DEP, " the primary benefit of using herbicide on these four ponds."[2]

Maine DEP's Paul Gregory has explained that the decision to apply herbicides in these four unique situations was something like deciding to treat an aggressive [and in this case highly infectious] disease with chemotherapy, a toxic regimen that interacts with the whole system being treated, not just those parts you are attempting to destroy … "very serious medicine to be used only when all other, less risky treatments have been ruled out as inadequate to the task."

Question 2: Are aquatic herbicides safe?

All herbicides legally used in the United States for controlling aquatic plants must be "registered for use" by the US Environmental Protection Agency (EPA). According to the EPA's own definition, pesticide registration is the "process through which EPA examines the ingredients of a pesticide; the site or crop on which it is to be used; the amount, frequency and timing of its use; and storage and disposal practices. EPA evaluates the pesticide to ensure that it will not have unreasonable adverse effects on humans, the environment and non-target species."[3] It should be noted that the EPA definition does *not* say there will be "no adverse effects." It says that any possible adverse effects will not be "*unreasonable*." So here is one of those niggling complexities that gives rise to more questions…Who gets to define the term "unreasonable"? Under what conditions is an *adverse* effect deemed "reasonable?"

Although pesticide registration is scientifically rigorous it does not guarantee that a product is completely safe. Significant gaps in the research remain. Roy Bouchard, biologist with the Maine Department of Environmental Protection, points to one of the gaps. "I know of very few long-term studies of the effects of herbicide use on ecosystems. Repeated use of herbicides for long term management of aquatic vegetation can fundamentally shift how the system operates, and how the rest of the plant and animal community that depend on aquatic vegetation responds in the long term. Herbicides may not kill organisms such as invertebrates or fish directly, but little is known about what will happen to [these organisms] and their habitat over time."

Part of the problem lies in the fact that for organisms other than humans, the registration process is primarily concerned with "acute toxicity," the study of how much of the product in question it takes to kill this life form or that. When it comes to "sub-lethal effects," especially on creatures other than mammals, very little is known. And what *is* known is not entirely reassuring. Recent studies on endangered Pacific salmon, for example, have suggested there may be sub-lethal or behavioral effects from pesticides. Another problem comes from the way the data is generated. Most of the "effects" are extrapolated from short term, high dose tests conducted on a small number of species. A number of epidemiological studies suggest that the short term animal studies tend to underestimate the effects on humans, and the same studies support the notion that many sub-lethal effects aren't being predicted at all.

Another area where knowledge is scarce surrounds the question of how different compounds interact with each other in the environment. What are the risks to the environment and human health when herbicides applied directly into our water resources are combined with other toxic materials released into the watershed from forestry, agriculture, and home lawn and garden activities? The EPA estimates that there are currently about 87,000 "chemicals in commerce" in the US. Do the math and you will soon understand the complexity inherent in properly assessing all possible interactions between all possible combinations of these chemicals in the environment.

Which begs another question…do we even know which chemicals are already present in our lakes and rivers, and at what concentrations? Following a ten-year national study of rivers and aquifer systems conducted by the EPA and the US Geological Survey (USGS), a report was recently released describing the occurrence of pesticides in our nation's waters. The report concludes that pesticides (a broad group of chemicals that includes herbicides) are "typically present throughout the year in most streams in [developed] areas of the Nation…at concentrations that may affect aquatic life or fish-eating wildlife."[4]

The EPA/USGS study also discovered that detected pesticides seldom occur alone; rather they almost always occur as complex "mixtures." Acknowledging that very little is known about the potential toxicity of such mixtures, the researchers ultimately conclude that "the study of mixtures should be a high priority."

> Most stream samples and about half of the well samples contained two or more pesticides and frequently more. The potential effects of contaminant mixtures on people, aquatic life, and fish-eating wildlife are still poorly understood and most toxicity information, as well as water-quality benchmarks used in the study, has been developed for individual chemicals. The common occurrence of pesticide mixtures, particularly in streams, means that the total combined toxicity of pesticides in water, sediment, and fish may be greater than that on any single pesticide compound that is present. Studies of the effects of mixtures are still in early stages, and it may take years for researchers to attain major advances in understanding the actual potential for effects. Our results indicate, however, that studies of mixtures should be a high priority.[5]

This call for a better understanding of the "potential effects" of herbicides—and in particular the potential effects of herbicides on public health—has been voiced here in Maine as well. Roughly one third of Maine's citizens get their drinking water from "surface waters" of the State (lakes, ponds and rivers). What impact, if any, would loosening the restrictions on the use of aquatic herbicides have upon Maine's drinking water supply? Echoing some of the concerns described above, the Maine Water Utilities Association (MWUA) has taken a clear position on the issue.

> Like all surface waters in the state, [those that serve as] water supplies are threatened by the spread of invasive aquatic plants. As drinking water suppliers, our primary concern is for potential impacts that the spread of these organisms could have upon human health and the long-term safety of the drinking water supply. . . The use of aquatic herbicides to control invasive plant infestations has become common [in the United States]. Despite the advertisements that claim these products leave "no residue" and have shown "no adverse effects," there are still many questions left unanswered about the long-term health risks associated with these agents, for both humans and wildlife.[6]

In making its case, MWUA points to another outstanding gap in the research concerning the safety of aquatic herbicides.

> One significant question yet to be answered is whether or not the chemicals currently used to control aquatic plants are endocrine disruptors. Endocrine disruptors are synthetic chemicals that interfere with the operation of the endocrine system, the system of hormones that regulates an organism's development, growth, reproduction and behavior. Because they may interfere with reproductive function, the adverse affects of these compounds may not be immediate but, instead, passed from one generation to the next . . . At present, the research focused on the effects of these compounds on human endocrine systems is incomplete and inconclusive. According to the EPA, "there currently is not enough scientific data available on most of the estimated 87,000 chemicals in commerce to allow us to evaluate all potential risks.[7]

After consideration of the potential, as yet unknown risks associated with the use of aquatic herbicides, MWUA argues for erring on the side of caution, taking the position that "No herbicides should be used in a public drinking water supply."[8] And if aquatic herbicides are to be used in the *watershed* of a public drinking water supply, MWUA suggests the following conditions should apply:

1. The compound to be used has undergone adequate testing to determine the short and long-term health effects on human health, including the compound's potential to disrupt endocrine systems.
2. The chances for total eradication by this method are excellent, reducing the need for repeated applications.
3. All water utility customers are properly notified of the intended action, given an opportunity to comment, and concerns can be adequately addressed.[9]

Question 3: Are aquatic herbicides effective?

There is a good deal of research and numerous case studies supporting the claim that aquatic herbicides are effective tools in controlling or "knocking back" aquatic plants. But *eradication* of invasive aquatic plant species by *any* means, including by the use of herbicides, is rare indeed.

Case in point: Hydrilla in the state of Florida. Hydrilla, now in more than 40% of Florida's public waters, is reported to be the most abundant submersed aquatic plant in the state. Despite one of the most aggressive (and expensive) invasive plant management programs in the country, involving an extensive use of aquatic herbicides, this "worst of the worst" invader appears in more Florida waterbodies every year.

Hydrilla infestation in Pickerel Pond, 2002

One of the challenges of Hydrilla, is that the herbicides commonly used to control it do not affect Hydrilla seeds, tubers and turions (small vegetative buds capable of reproduction) and repeated applications are needed to control regrowth. The Hydrilla in Pickerel Pond, for example, has been treated with fluridone (the herbicide of choice for this invader) every year since 2003. It is not yet known how many additional treatments may be needed before the "tuber bank" in the sediments will be depleted to the point that regrowth can be handled by manual control methods alone.

Another problem with respect to the efficacy appears to be the result of a phenomenon known as "herbicide resistance." When a plant loses its sensitivity to an herbicide over time through the process of genetic selection, it is said to have become "resistant" to that herbicide. We have been aware of this phenomenon for decades in agricultural systems, so it is not really surprising to learn that evidence is now mounting to show that some aquatic plant species are developing a similar resistance.

An article in the spring 2006 issue of *Aquatics*,[10] the journal of the Florida Aquatic Plant Management Society, reports that some Hydrilla populations in Florida have developed resistance to fluridone; meaning that the herbicide is no longer effective in controlling Hydrilla in these lakes. The authors suggest various strategies for minimizing the potential for resistance, including: avoiding the repeated use of herbicides that kill plants by way of the same "mode of action," alternating the types of herbicides used, and using other non-herbicide methods, such as mechanical and/or manual control, when feasible.

What is the extent of aquatic herbicide resistance nation wide? What are the possible implications of this resistance over time? As for the suggestion that "alternating herbicides" may be one solution to the resistance problem, how does this strategy square with the USGS/EPA caution regarding "herbicide mixtures"? Again, there are many questions to be asked, and limited data with which to answer them.

There seems little doubt that the discussion and debate concerning the question of the "proper" use of aquatic herbicides in Maine will be with us for some time. It is a discussion worthy of careful attention, thoughtful consideration and widespread involvement.

When you come to a difficult crossroad, it is always a good idea to take a few steps back where you can ponder the longer and broader view. Maine proudly claims that ours is the state where life is "as it should be." One assumption inherent in that claim is that we have an environmental condition that sets us apart from other states, and our unique environmental heritage is something to be valued and protected. The shorelines of most of Maine's lakes and streams are vastly different, aesthetically and ecologically, from shorelines in most other states in our country. This is in part due to the fact that we have had less development pressure. But it also stems from having the advantage of learning from the experiences of others who have already borne those higher pressures. Maine's Shoreland Zoning codes, almost unique in the nation, are a prime example of benefits reaped from lessons gleaned from "away." Maine's cautious approach to the use of aquatic herbicides is another example.

Which brings us back full circle to one of the original questions asked here, "Other states routinely use aquatic herbicides to control invasive aquatic plants. Why aren't herbicides more widely used in Maine?" Perhaps the best way to answer this question is to pose another…Just because other states allow the widespread use of herbicides (as well as significant alterations of shoreline and wetland habitat etc.) *is* that a good reason for Maine to follow suit?

Notes:

1. *Keynote Presentation at the Seventh Annual Maine Milfoil Summit* by Commissioner David P. Littell, Maine Department of Environmental Protection.
Text of the commissioner's speech is available on the Maine DEP website at http://mainegov-images.informe.org/dep/pubs/2006%20milfoil%20summit.pdf
2. Ibid.
3. EPA website www.epa.gov/pesticides/regulating/registering
4. *Pesticides in the Nation's Streams and Ground Water*, 1992-2001," Circular is available at http://pubs.usgs.gov/circ/2005/1291 or by calling 1-888-ASK-USGS.
5. Ibid.
6. *Maine Water Utilities Position Paper on Invasive Aquatic Plants*, January 2002.
7. Ibid.
8. Based on MWUA recommendations, Maine law now states that "Chemical control agents may not be used on a water body that is a public water supply without the prior written consent of each public water supplier using that water body" (38 MSRA section 1865) http://janus.state.me.us/legis/statutes/38/title38sec1865.html
9. *Maine Water Utilities Position Paper on Invasive Aquatic Plants*, January 2002.
10. *Aquatic Plant Resistance to Herbicides*, Tyler J. Koschnick, W.T. Haller and M.D. Netherland, Aquatics, Spring 2006/Vol. 28, No. 1, p. 4-9.
For additional information on Hydrilla resistance, see *Pegging a Troublesome Change in Hydrilla*, available on the United States Department of Agriculture (USDA) website at www.ars.usda.gov/is/AR/archive/nov05/hydrilla1105.htm.

We thank our colleages at the Maine Department of Environmental Protection (MDEP), the Maine Board of Pesticide Control (MBPC) and the Auburn Water District (AWD) for their willingness to preview and edit this article: Roy Bouchard (MDEP), Dave Courtemanch (MDEP), Mary Jane Dillingham (AWD), Gary Fish (MBPC), Henry Jennings (MBPC), and John McPhedran (MDEP)