Stockman Associates LLC

MEMORANDUM

TO: MR. MICHAEL GERMAIN (FRIENDS OF LAKE GARFIELD)
FROM: MS. EMILY STOCKMAN (STOCKMAN ASSOCIATES LLC)
SUBJECT: MANAGEMENT OF INVASIVE EURASIAN MILFOIL-LAKE GARFIELD
DATE: OCTOBER 17, 2016

Per request, Stockman Associates LLC performed an assessment of management strategies for the control of the invasive Eurasian milfoil within Lake Garfield. The assessment focuses on effective measures of controlling the milfoil population based on factors such as population density, water column depth, native plant community, economics, etc. Successful control may require the implementation of a combination of management activities. Please note that only the herbicide Triclopyr was considered as this was the herbicide previously presented to and reviewed by MA Natural Heritage Endangered Species Program (MA NHESP), for consideration within Lake Garfield.

Mechanical and Manual Techniques

Benthic/Bottom Barriers

Benthic Barriers have been shown to successfully address nuisance aquatic plant populations, particularly smaller plant populations. Compared to other treatment options benthic barriers can be attractive as they typically do not require significant maintenance/follow-up treatment. The barriers act as a blanket over the lake bottom, blocking light and physically stopping the establishment of aquatic plants. If installed correctly, blankets may be left in place for years, thus reducing time and cost associated with maintenance/follow-up treatment. However, depending on factors such as the size of the problematic aquatic plant community, location, and water column depth, the initial cost associated with the installation of the barrier may be prohibitive. For large-scale treatments, benthic barriers can be one of the most expensive options. As such, benthic barriers are typically used in areas of significant concerns such as around docks, swimming areas and boat access areas. Another concern is impact of the barrier on all aquatic plant species. The barriers are not selective and therefore will impact all plants within the treatment area, this is particularly a concern for those areas which contain rare species. Benthic barriers may also impact fish spawning, benthic organism, gas evolution and macroinvertebrates, depending on the barrier type. For professional installation and depending on type of barrier used costs range from $10,000 to $20,000 per acre,

Suction Dredging

Suction dredging involves the use of a diver and vacuum hose to remove plant materials from the lake bottom sediments. This process is labor intensive and can be quite slow and expensive. Depending on site conditions, removal rates may range from 0.25-acres to 1-acre per day. Typical this method is used for smaller treatment areas that are too large for hand-pulling. A good operator can be selective in the removal, avoiding native plants, however, this process is slow and therefore, from a time and cost perspective, suction dredging may be better suited for smaller areas dominated by the problematic aquatic plant population. The process of vacuuming the plant materials from the sediment does result in disturbed sediment and turbid water. As such a turbidity curtain is typically installed around the treatment area to contain the disturbed sediment. Due to the short-term turbidity associated with the process, public drinking water should not be affected. Despite reports of the immediate removal of approximately 90% of plant materials, re-growth may occur within 1 to two years of treatment, thus requiring additional treatments. Suction dredging has been shown to be most effective on plant species which do not propagate via seed, winter buds and tubers such as Eurasian milfoil and Brazilian elodea. Disruption of the lake sediments may affect benthic organisms and fish spawning. Impacts to rare plant species are depended on operator skills and the ability to selectively vacuum the target problematic aquatic species. Another concern is the necessary use of hydraulic fluids and other petroleum products, which may be leaked into the water column if machinery is not properly maintained or if an unexpected leak occurs. Suction harvesting is expensive, often two to ten times the cost of mechanical harvesting. Suction dredging with one or more scuba divers, dredge operator, and plant material disposal has been estimated at $1,000 to $25,000 per acre, excluding equipment costs.

Rotovation

Unlike suction dredging, rotovation does not remove the plant material from the water column, rather this technique is a tilling of the lake bottom and plant materials. If the plant material is successfully tilled into smaller pieces, these smaller fragments will typically float to the water surface where they can then be collected via raking or vacuuming. The collection of plant fragments is essential to avoid spreading the aquatic nuisance plant species. This technique has been used to removal Eurasian milfoil. To help ensure proper tilling this technique should be applied in the spring of fall when the plant biomass is lower. Rotovation has been shown to removal up to 97% of Eurasian milfoil within and treatment areas with control lasting a couple of years. This technique is not selective and therefore, should not be applied in areas with rare plant species. The process will affect benthic organisms, fish spawning and will likely result in direct fatalities to fish and invertebrates. The contracting cost for rotovation or mechanical raking is typically around $1,500 per acre, excluding collection and disposal of plant materials.

Hand Removal

Hand removal includes practices such as hand pulling, hand cutting and hand raking. These techniques are often most successful in more shallow waters (<3-FT deep), where specialized equipment is not necessary and repeated treatments are more easily performed. Special attention must be given to the collection and removal of the problematic plants from the lake. Improper techniques which result in the fragmentation of plant material can amplify the spreading of the problematic species. Hand removal can result in short-term turbidity. Depending on the knowledge level of the laborer, hand removal can be highly selective. Due to the associated sediment disturbance hand pulling can affect benthic organisms, however, given that this method is slow and labor intensive, it is typically not applied to large areas, thus reducing impacts associated with sediment disturbance. Hand removal is often performed on a volunteer basis, thus minimizing costs. In deeper sections that may require specialized hand removal via scuba divers costs will increase. It is estimated that a scuba diver can pull approximately 90 plants per hour with a cost of $400- $1,000 per acre.

Drawdown

Milfoil can sometimes be effectively controlled by water level drawdowns. Several factors determine success such as: the amount of water bottom exposed; duration of exposure; and weather conditions (colder temperatures are preferred for weed control, this winter drawdowns are typically implemented). Milfoil survives in deeper waters that are typically not impacted by partial drawdowns. Partial short-term drawdowns may successfully control milfoil within shallow shoreline areas. Drawdowns can have an adverse impact on biodiversity, amphibians, fish, reptiles and macroinvertebrates. Compliance with MA Fish and Wildlife drawdown standards, particularly in terms of time of year restrictions and drawdown rates reduces concerns regarding unintended adverse impacts. Drawdown costs are mainly associated with permitting and monitoring.

Chemical Techniques

Triclopyr, ((3,5,6-tricholoro-2-pyridinyl) oxyacetic acid)

Triclopyr (trade names Garlon® 3A and Renovate®) is currently registered with the EPA for aquatic use in controlling Eurasian milfoil. There are two formulations of triclopyr. It is the TEA formation of triclopyr that is registered for use in aquatic or riparian environments. Triclopyr is a growth hormone, which readily dissolves in the water. Triclopyr hinders plant growth by travelling to sugar producing areas of the plant and inhibiting growth. It is used to control invasive aquatic macrophytes such as Eurasian watermilfoil and does not control several native species such as *Potamogeton zosteriformis*. The State of Washington Department of Ecology reports that Triclopyr is an excellent means for controlling of Eurasian milfoil. In general, chemical herbicides require follow-up treatments to successfully control nuisance aquatic species. Studies indicate that at low concentrations Triclopyr does not affect sensitive native species, however, concentrations higher than 2.5ppm may negatively impact native species. To ensure the protection on state-listed rare species, a treatment study area should be evaluated per MA NHESP requirements. Triclopyr is essentially non-toxic to aquatic invertebrates and has a low intrinsic toxicity to animals as well as a low propensity to bioaccumulate. Several studies have documented no adverse impact to invertebrates where Triclopyr was used to control Eurasian milfoil (Foster et all, 1997, Gardner and Grue, 1996, Green et al, 1989, Houtman et al, 1997, Petty et al, 1998, and Woodburn, 1988). It is important to note that toxicity assessments concluding no to low risk are based on concentration, which die not exceed 2.5ppm per the EPA Approved label usage. Concentrations higher than 2.5ppm may pose a low to moderate risk to aquatic invertebrates Triclopyr breaks down in the aquatic environment via photolysis or microbial degradation. The dissipation half-life has been reported at one (1) to seven and a half (7.5) days. Dissipation is variable due to factors such as lake size and water movement. Triclopyr has a low distribution coefficient and does not bind tightly to lake sediments. As such, sediments within a treatment areas should not threaten benthic organisms. TCP is a toxic metabolite of Triclopyr, which has been shown to dissipate to below detectable limits within days, but may persist for up to six (weeks) within the lake environment. Levels of TCP within sediments are typically very low (>0.05ppm). The triclopyr review completed by the MDAR and DEP ADHOC Committee in 1991 stated that triclopyr TEA is "slightly toxic" to fish. Based on studies by Perkins, 2000 and Edginton, 2003, amphibian embryonic and larval toxicity is variable depending on the commercial form of triclopyr (i.e. Garlon 4 vs Garlon 3A), the amphibian species, and pH (increased Release® toxicity was observed under low pH conditions). According to the 1998 EPA RED, reproduction of birds may be affected at levels greater than100 ppm triclopyr TEA. Human health concerns regarding Triclopyr have been evaluated and have shown that the most sensitive population are children who swim for at least 3 hours and ingest treated water. Risk factors are exceed if the child ingest 3.5 gallons of water from a recently treated lake. However, when utilized per the manufactures label use directions and based on toxicology studies, Triclopyr does not pose an adverse health concern. Nonetheless, compared to mechanical and manual treatment techniques, the use of aquatic herbicides appears to have a higher risk of accidental adverse impacts. Care should be given in assessing the appropriate treatment locations and concentrations, licensed herbicide applicator and public water use during and after treatment. Per the federal label, there is no swimming restriction for the use of Triclopyr under 2.5 ppm. However, the New York State Department of Environmental Conservation requires a 3-hour wait period. The Washington Department of Health recommends a 12-hour restriction for re-entry into Triclopyr treated water to assure that the eye irritation potential and any other adverse effects will not occur. Typical costs of herbicide treatments range from $300 to $1,000 per acre.

Biological Treatments

Grass Carp

Grass carp, within the minnow family, has been introduced to freshwater and brackish waterbodies to control nuisance aquatic plants. Impacts on target plant populations may take up to five (5) years after the initial stocking. In the presence of more palatable native species, control of Eurasian milfoil via grass carp consumption may be diminished. Furthermore, the life cycle of Eurasian milfoil enables significant growth in the early spring, when carp populations may not be overly active. While researches have breed sterile grass carp, carp are prohibited from stocking in Massachusetts lakes and use of this method would require more research and discussion with and approval from regulatory authorities.

Milfoil Weevil

The native herbivorous weevil, *Euhrychiopsis lecontei*, has been shown to damage milfoil plants. The milfoil weevil will use Eurasian watermilfoil as its sole host, the Weevil adults climb from plant to plant, feeding on leaflets. Females lay one egg per stem up twice a day. The larvae feed on the growing tip of the Milfoil, then down into the stem consuming tissue along the way. They are nearly invisible even to the trained eye. One concern using the weevil as a control mechanism is the lake drawdown. Since typically undergoes a winter drawdown and the weevil over-winters along the shoreline the drawdown process threatens their long-term survival and may contribute to the small populations in the first place. Benthic barriers and dredging also threaten the long-term survival of the weevil. Heavy motor-boat traffic can also affect survival. In New York studies were conducted within several small lakes and herbivorous insect stockings were deemed a very promising but thus far abstract aquatic plant control strategy. In theory whole lake stocking should be performed, however success has been documented with stocking target areas. Costs associated with the use of herbivorous insects to control Eurasian milfoil can be difficult to assess, but have been estimated at $1,000 per acre.

No Action

Based on a review of previous Eurasian milfoil surveys performed within Lake Garfield and the recent 2016 survey, the population of this invasive species is increasing within the lake. Given the aggressive, invasive nature of the Eurasian milfoil a "no action" strategy will result in the continued expansion of populations.

Recommendations

Given the documented presence of a state-listed rare-species as well as the presence of numerous native aquatic plant species within Lake Garfield, a "no action" strategy is strongly opposed.

Continued hand control within shallow waters via volunteers is recommended with the condition that substantial training be performed to ensure the proper identification and removal of Eurasian milfoil and the protection of native species.

The use of benthic barriers may be beneficial if installed within smaller, dense patches of Eurasian milfoil. Prior to installation, the treatment areas should be evaluated by an aquatic botanist to assess the plant community and determine the presence of any state-listed plant species. In the event, that state-listed species are observed a barrier should not be installed as this method is not selective.

Based on the observed and documented aquatic plant biodiversity along the shoreline of Lake Garfield and the relatively low population of Eurasian milfoil within several shoreline locations, the continuation of the drawdown is recommended.

Given the presence of large monocultures of Eurasian milfoil within Lake Garfield and the desire to prohibit the spread of this invasive species, the use of suction dredging or herbicide treatment should be strongly considered. While it appears that suction dredging may be extremely costly compared to the per acre cost of herbicide treatments, the potential for accidental harm appears greater for herbicides than for a mechanical technique such as suction dredging. As such, the approach of controlling Eurasian milfoil with chemical herbicides should not be taken lightly. It is recommended that further site specific cost estimates and potential success rates be explored for control via suction dredging. With that said, based on the literature reviewed, the proper, lawful, professional use of a selective herbicide, such as Triclopyr may successfully control the Eurasian milfoil while preserving the native aquatic species and protecting human health. To ensure the protection of state-listed rare species, a treatment study area should be evaluated per MA NHESP requirements, prior to any large scale application of herbicide. Although not required per federal labeling a minimum of a 12-hour restriction for re-entry into Triclopyr treated water is recommended to assure that the eye irritation potential and any other adverse effects will not occur.

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