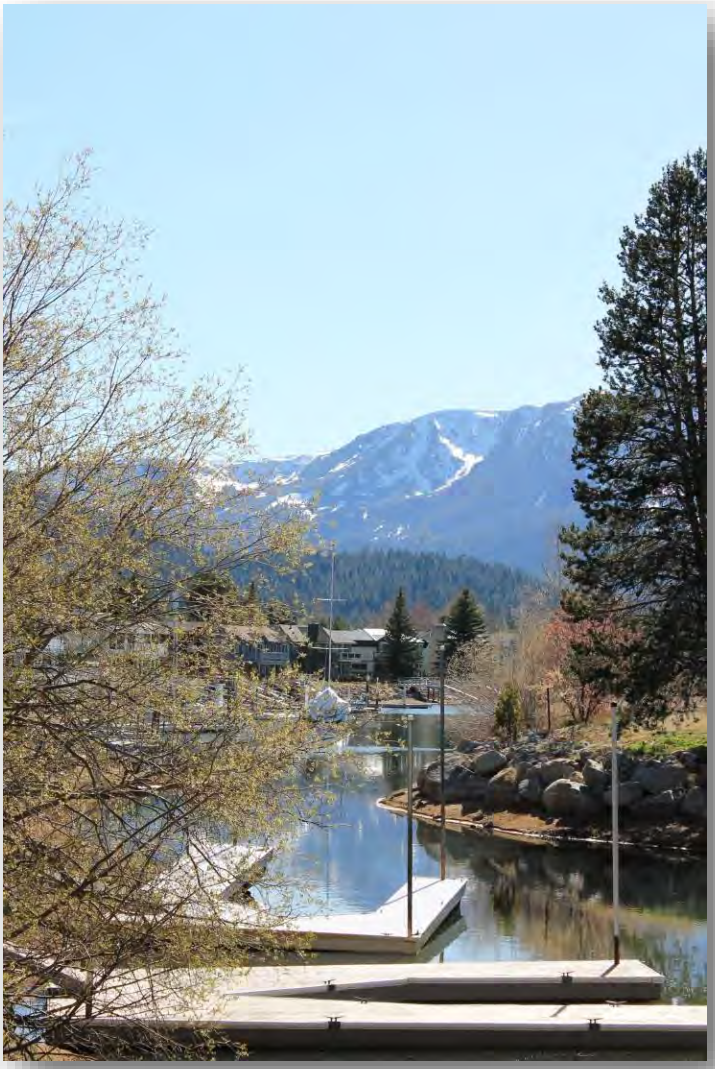
Biological Control of Aquatic Plants and Potential Use in the Tahoe Keys Lagoons



March 27, 2017

Biological Control of Aquatic Plants and Potential Use in the Tahoe Keys Lagoons

Prepared for

Tahoe Keys

Tahoe Keys Property Owners Association
South Lake Tahoe, California

Prepared by

Sierra Ecosystem Associates

TAHOE KEYS INTEGRATED MANAGEMENT PLAN

March 27, 2017

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EXECUTIVE SUMMARY

The Tahoe Keys Property Owners Association (TKPOA) conducted a variety of research or alternative aquatic weed control methods since 2011. Alternative biological methods were investigated specifically in 2016, including herbivorous fish, insects, and fungal plant pathogens.

At this time, none of the biological controls that were addressed in the alternative methods research are available for utilization in the Tahoe Keys lagoons. Available biological controls involve non-native species, and introduction of non-native aquatic species are legally prohibited in the Lake Tahoe Basin. The most plausible method would be the use of grass carp. However, grass carp are not native to the Tahoe Basin and have been found to feed on other aquatic plants, including natives, prior to the target plant Eurasian watermilfoil.

Further research and development are required for insects and fungal plant pathogens as a viable biological control method. The milfoil weevil and the watermilfoil moth (insects) show promise for the reduction of Eurasian watermilfoil in lab settings, however field results are inconsistent. Furthermore, while aquatic plants are susceptible to fungal plant pathogens, successful control of aquatic plants by a mycoherbicide is dependent on delivering forms of the fungus that can attach to aquatic plant stems and leaves and cause sufficient damage or necrosis of the plant tissues to slow the growth or, preferably, kill the target weed.

The information collected from the research conducted during 2016 will help determine future control methods used for management of aquatic macrophytes in the Tahoe Keys lagoons.

1.0 INTRODUCTION

The Tahoe Keys is a residential and commercial development along the south shore of Lake Tahoe, California. The Tahoe Keys provides direct access to Lake Tahoe through two main channels that also connect with a series of smaller lagoons within the development. The Tahoe Keys Property Owners Association (TKPOA) is responsible for maintaining navigation of the lagoons used by its members. The TKPOA also maintains navigational clearance in and around a private marina at the site.

Since the 1980s, the Tahoe Keys lagoons have had an increasing problem with the growth of aquatic plants, also referred to as aquatic macrophytes, to the extent that the growth of these plants has reached nuisance status. The three species of aquatic macrophytes that are of the most concern in the Tahoe Keys lagoons are: *Myriophyllum spicatum* L., Eurasian watermilfoil; *Potamogeton crispus*, curlyleaf pondweed; and *Ceratophyllum demersum*, coontail. Research thus far has targeted control of Eurasian watermilfoil, although some incidental control of other aquatic weeds has been reported. Biological agents against the other invasive aquatic weeds need to be identified for successful control. This is especially a concern for curlyleaf pondweed, which can dominate the infestation of the Tahoe Keys lagoons (TKPOA 2015) and threatens to spread to other areas of Lake Tahoe (LTAIS 2015; L. Anderson, pers. comm. 2016).

In 2016, the TKPOA completed the Integrated Management Plan for Aquatic Weeds (IMP) to fulfill the obligations of the Waste Discharge Requirements issued by the Lahontan Regional Water Quality Control Board (LRWQCB). The IMP describes how to combine the currently approved methods of aquatic plant control to manage the growth of the invasive weeds as effectively as possible. As part of the IMP, the TKPOA proposed to investigate in detail additional methods of aquatic plant control, including biological control. This paper summarizes the current literature on biocontrol methods of the invasive aquatic plants found in the Tahoe Keys lagoons. Thorough reviews of biological controls of other aquatic plants and additional aquatic invasive species have been presented in “Review of Alternative Aquatic Pest Control Methods for California Waters” (SFEI 2004) and in “Biology and control of aquatic plants: a best management practices handbook” (AERF 2009). The reader is encouraged to read those reviews for additional information.

At this time, there are no commercially available biological control products available for use on the types of aquatic weeds in the Tahoe Keys lagoons. Biological control remains in the research and development stage, which includes formulating products that give consistent, effective control. Products may become available for use in the future that could be included in the suite of methods used by the TKPOA when implementing the IMP.

2.0 BIOLOGICAL CONTROL

Biological control is the use of one or more live organisms to suppress the growth or reproduction of the population of a target pest. Biological control offers the advantage of using organisms targeted to a pest and can have reduced long-term costs and may not have harmful non-target effects. This method of control may not eradicate the pest completely because the pest serves as the host organism and eradication of the pest would lead to population collapse and loss of the control organism. The best use of biological control may be to maintain acceptable pest populations and conditions for the treatment area.

In order to develop a biological control method, herbivores or pathogens found in the native range of the target pests are examined for potential use. The control organism is studied in laboratory tests and mesocosm studies that mimic field conditions to determine how effective they are. There are strict federal and state guidelines and review processes that are used to ensure that biological control agents are safe for introduction. Discovery, testing and permitted release of such organisms can take five to 10 years. Development of biocontrol agents has been hindered by difficulties in production, regulatory questions regarding the release of a live organism that is not native to the treatment area, or effectiveness of the organism when released at the treatment area.

The advantages of using biological control methods include the perception by the public that these products have a reduced impact on the environment, that biocontrol agents are less expensive to use, and that pests are less likely to develop resistance to biocontrol. Constraints of using biocontrol include concerns about introducing an organism that is not native to the environment and the impact to native organisms.

The biggest limitation of biological control of aquatic weeds is that, with the exception of herbivorous fish, there is no commercially available product at this time for the weeds found in the Tahoe Keys lagoons. Several potential organisms have been studied, but none has been developed into a readily available, Federal Environmental Protection Agency- (EPA) and California EPA-approved product.

3.0 BIOLOGICAL AQUATIC PLANT CONTROL METHODS

Biological control methods for aquatic plants fall into categories of:

- Herbivorous fish
- Insects
- Fungal plant pathogens

The review of the current literature shows that much of the research is currently directed toward controlling the growth of Eurasian watermilfoil, which is found in many waterbodies in the US. At this time, little research is targeted toward curlyleaf pondweed, an aquatic weed that is becoming more prevalent in the Tahoe Keys lagoons and threatens to spread to other areas of Lake Tahoe (LTAIS 2015).

3.1 Herbivorous Fish

The primary herbivorous fish that has been studied as a biological control is the grass carp, or white amur (*Ctenopharyngodon idella* Val.). This fish is a strict herbivore native to Asia. It should not be confused with the Northern American carp or the Asian carp.

In a mesocosm study conducted in large pools, grass carp were tested against Eurasian watermilfoil, coontail, and several other macrophytes not found in the Tahoe Keys lagoons (Hestand 1978). The results of this study showed that it took approximately seven months for the grass carp to eliminate the aquatic plants growing in the pools.

In another study, grass carp were introduced to Lake Conroe in Houston, Texas, in 1981 to control hydrilla, Eurasian watermilfoil and coontail. Complete eradication of the aquatic plants was achieved in two years (Martyn 1986). Grass carp will consume curlyleaf pondweed, but it can take several years before this plant is controlled to acceptable levels (TAMU 2016).

The level of control of aquatic vegetation with grass carp can vary widely among sites. One factor when considering releasing grass carp is whether, if control is successful, the complete removal of submersed aquatic vegetation is acceptable. Once all aquatic macrophytes are removed, the grass carp and other species that depend on aquatic plants no longer have food or cover. If this is the case, the grass carp may need to be physically removed from the site after treatment. The average adult grass carp is 55 pounds, which could make removal difficult. For effective control, the fish must be stocked in sufficient numbers so that consumption of aquatic plant material outpaces the growth rate of the plants. Only genetically treated triploid fish are legally used in aquatic vegetation management to prevent unintentionally spreading them outside of the treatment area (Sutton 2012). Barriers to confine grass carp to the intended treatment area have also been studied. Maceina, et al, reported that a V-shaped barrier combined with an electric barrier reduced the escapes of fish to less than 2% per year (Maceina 1999).

Table 1. Grass Carp Introduction Estimated Costs

California Department of Fish and Game Fees	
Permit	≈ $100+
Stocking fee	$15.00 per fish
Annual renewal fee	$7.50 per fish
Contractor Fees	
Monitoring and Yearly Reports	≈ $5,000

The California Department of Fish and Wildlife (CDFW) regulates the stocking of grass carp. Section 238.6 of the California Fish and Game Code prohibits permitting stocking grass carp in a major drainage, or in waters having an open freshwater connection to other waters of the state, such as streams, rivers, lakes or reservoirs, and, with a few exceptions, the Code prohibits stocking grass carp in waters within the 100-year floodplain.

In October 2016, the TKPOA sent a letter to CDFW (Appendix A) to investigate the potential introduction of grass carp for aquatic weed control in the Lake Tallac Lagoon. In the letter, the TKPOA requested a consultation with the CDFW regarding the possible permitting of the grass carp in the Lake Tallac Lagoon as it is separated from the main water body by a diversion structure and a culvert. CDFW's response included a link to the Implementation Plan for the Control of Aquatic Invasive Species within Lake Tahoe (Whittmann and Chandra 2015).

According to the Implementation Plan, the use of grass carp is currently not recommended as they are not native to the Tahoe Basin and have been found to feed on other aquatic plants, including natives, prior to Eurasian watermilfoil (Whittmann and Chandra 2015).

3.2 Insects

Several insect species that can control aquatic plant growth have been isolated and identified. Two insects, a weevil and the larval stage of a moth, have been shown to damage Eurasian watermilfoil and to aid in reduction in size and mass of populations of this plant.

3.2.1 Milfoil weevil

The milfoil weevil, *Euhrychiopsis lecontei*, is native to North America and has been reported to feed and reproduce on both native Northern watermilfoil and non-native Eurasian watermilfoil.

In tests conducted in enclosures at two lakes in Vermont, Eurasian milfoil biomass was reduced by 50% in enclosures with the milfoil weevil after 41 days, compared to controls without weevils. The same paper reported that laboratory feeding experiments using the weevil against an array of aquatic macrophytes showed a selective reduction in biomass of Eurasian watermilfoil compared to other aquatic plants in the study (Sheldon 1995).

Laboratory results showed that biomass of plants treated with watermilfoil weevil was significantly reduced compared to controls, but that there was poor correlation between treatment and other parameters such as shoot growth. The reduction in biomass was associated with reduction in root production of the treated plants (Creed 1994).

Mazzie, et al (1999) studied the effect of temperature on milfoil weevil development. The results of this laboratory study showed that up to five generations of the weevil could develop per growing season. Milfoil beetles overwinter by migrating from the water in early to late fall to the interface of soil and leaf litter. Adults re-emerge and return to the water after ice out and before late spring (Newman 2001).

3.2.2 Watermilfoil moth

The aquatic moth Acentria ephemerella, or water veneer, is native to Europe but now appears in waterways in many parts of North America. The moth lives underwater on submersed aquatic plants. Water veneer feeds most often on Eurasian watermilfoil but is found on other native submersed plants such as coontail (Johnson 1998). Laboratory results have shown that the moth significantly reduced the mean change in the length of stems and the number of leaf whorls of treated plants compared to controls. Treatment also resulted in biomass reduction of Eurasian watermilfoil (Creed 1994).

Johnson, et al (2000) reported results of a 12-year study of Eurasian watermilfoil populations and at Cayuga Lake in New York State. Both the water veneer moth and the watermilfoil weevil were present, however the moth was the dominant species of the two at the lake. The results of the study indicated that the mass of Eurasian watermilfoil declined dramatically while native populations of aquatic plants increased.

3.2.3 Summary of Insect Biocontrol

Researchers recognize that many factors, including site specific conditions of application, insect rearing requirements, and interspecific competition between insects need to be investigated to develop aquatic herbivores into a reliable aquatic plant control method. Research studies have shown that milfoil weevils can suppress growth and biomass of Eurasian watermilfoil in laboratory settings and there have been reports of Eurasian watermilfoil declines associated with the presence of milfoil weevils and milfoil moths. However, reports of control of Eurasian watermilfoil by these insects in lakes are inconsistent. In order for either species to be developed as a reliable biocontrol method on Eurasian watermilfoil, research is needed to determine what environmental factors limit in-lake feeding, reproduction and development.

4.0 FUNGAL PATHOGENS

Fungal infection can reduce growth rates or kill plants completely. There are many examples of fungal pathogens in terrestrial systems such as powdery mildew, which can infest herbaceous and woody plants. Aquatic plants are also susceptible to fungal pathogens (Nicholson 1991). Research and development of potential fungal control agents, or mycoherbicides, for Eurasian watermilfoil began in the US in the 1970s by culturing fungi collected from milfoil plants from across the United States (Shearer 2013).

The most promising pathogen tested to date is *Mycoleptidiscus terrestris*, which has shown efficacy against Eurasian watermilfoil in both laboratory and lake conditions (Shearer 2011). The fungus must directly contact and bind to the target weed and virulent propagules of the fungus must be present in sufficient concentration to kill the weed (Shearer, 2006).

A prototype mycoherbicide of *M. terrestris* was developed and tested in the early 1990s under the name Aqua-Fyte. Successful trials were conducted under laboratory conditions but the product was not successful in larger trials against Eurasian watermilfoil (Shearer 2011). Successful control of aquatic plants by a mycoherbicide is dependent on delivering forms of the fungus that can attach to aquatic plant stems and leaves and cause sufficient damage or necrosis of the plant tissues to slow the growth or, preferably, kill the target weed. Research is needed develop a commercially available product that delivers the pathogenic fungus in a manner that performs as well in lake conditions as what has been seen under laboratory conditions.

4.1 Combined Use of Fungal Aquatic Pathogens and Herbicides to Control Aquatic Macrophytes

There are research studies that have shown that mycoherbicides can improve overall aquatic plant control when used in conjunction with EPA-approved aquatic herbicides. These studies indicate that herbicide rates and contact times could be reduced when both methods are integrated.

In a controlled-environment experiment, the EPA-approved aquatic herbicide fluridone was combined with *M. terrestris* and used to treat hydrilla. Additions of *M. terrestris* improved control over treatment with fluridone only and increased hydrilla susceptibility to fluridone at what were otherwise sub-lethal doses (Nelson 2002).

The herbicide 2, 4-D was combined with *M. terrestris* and used in a laboratory setting on Eurasian watermilfoil. The study showed that the herbicide treatments combined with *M. terrestris* resulted in better control of aquatic weed growth than any of the tests where either herbicide or mycoherbicide was used alone (Nelson 2005).

5.0 OPPORTUNITIES AND CONSTRAINTS

Biological control of aquatic weeds is still in the early stages of research and development. Several promising candidate species have been identified, but the level of control is inconsistent and many factors must be addressed before these organisms can be widely used.

Biological control agents of Eurasian watermilfoil and other aquatic weed species, such as hydrilla, have been the subject of research studies, but few, if any studies have been focused on the other aquatic weeds of concern in the Tahoe Keys lagoons, curlyleaf pondweed and coontail. Control of these two species has been reported as incidental impacts when the biocontrol agents were tested.

5.1 Potential for Use in the Tahoe Keys Lagoons

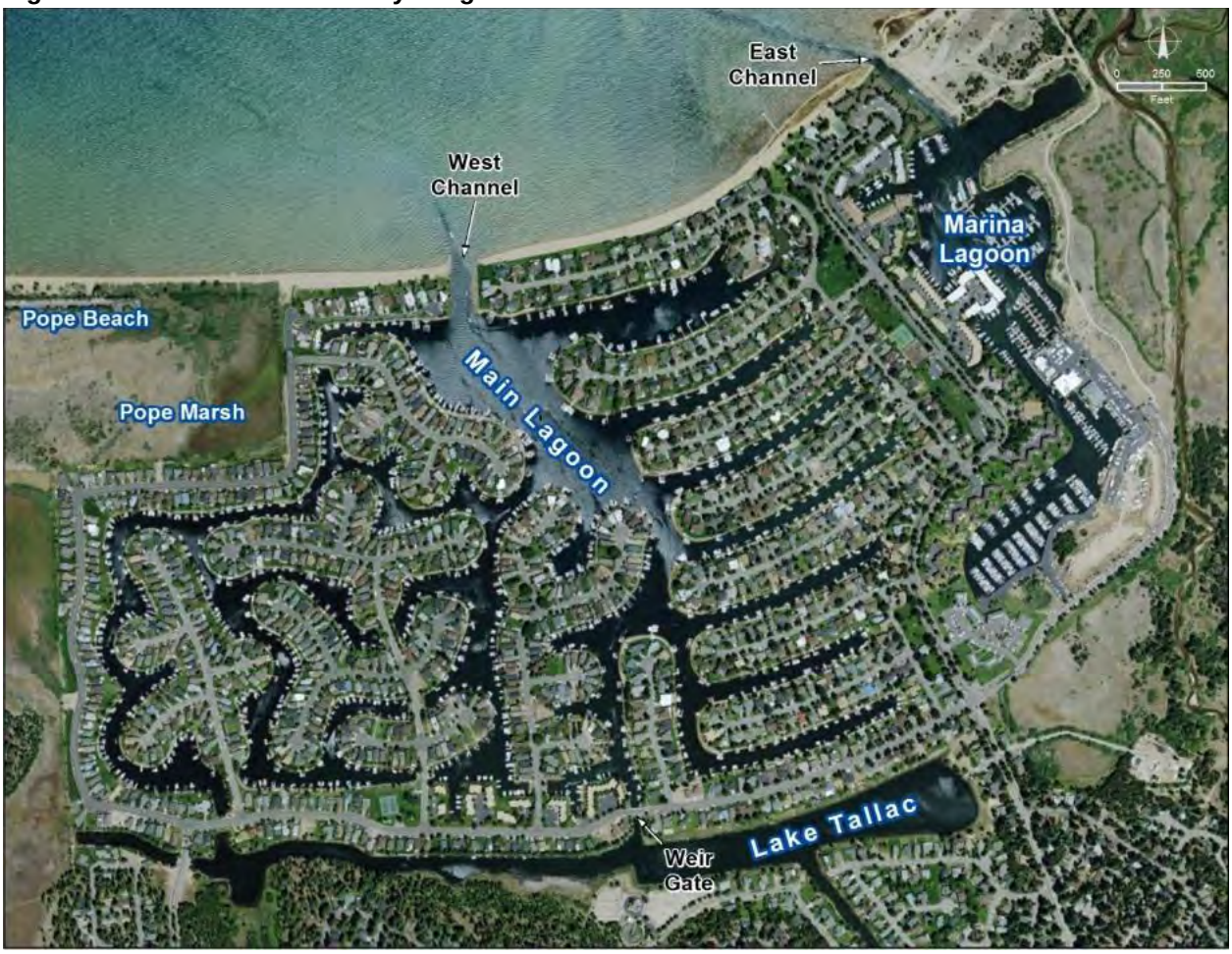
Use of biological agents for successful control of aquatic weeds in the Tahoe Keys lagoons would be dependent on many factors. The important factors to consider at the outset of this evaluation are:

- the compatibility of biological control with the typical use of the lagoons,
- the diversity of aquatic plant species present in the lagoons and if there are biological controls available for those species
- containment of a live, non-native organism to prevent unintentional spread to Lake Tahoe

5.2 Site Specific Conditions

Tahoe Keys lagoons have three different sections with individual characteristics. All three sections are infested with the aquatic weeds Eurasian watermilfoil, curlyleaf pondweed, and coontail. Levels of infestation and distribution of the aquatic weeds is somewhat variable year to year (TKPOA 2015). The Tahoe Keys Property Owners Association currently integrates the use of harvesting and placement of bottom barriers to control aquatic weeds in the lagoons.

Figure 1. Overview of Tahoe Keys Lagoon



On the east side of the development is the Marina Lagoon, which connects to Lake Tahoe through the East Channel. The Marina Lagoon is comparatively open, has many boat docks, and has a high level of both commercial and private recreational boat travel.

On the west side in the Main Lagoon and many smaller interconnected lagoons and coves. This area connects to Lake Tahoe through the West Channel. The Main Lagoon provides recreational access for the individual residents of the Tahoe Keys and does not provide public or commercial access to Lake Tahoe.

To the south is the Lake Tallac Lagoon, a long narrow lake that connects to Lake Tahoe via a weir when the gates are lowered or during high water events and connects to Lake Tahoe via Pope Marsh during high water events at the Lake Tallac Lagoon. Only non-motorized boat use is allowed on the Lake Tallac Lagoon.

Use of biological control at the Tahoe Keys lagoons would be somewhat compatible with the current use of the facility, which is primarily boating, and with other methods of aquatic plant control. Navigation could be hampered if barriers were required to contain the control organisms in the lagoons and while the use of biological control is not strictly

compatible with the use of bottom barriers, which would isolate the control agents from the host plants, given the total size of the infestation in the Tahoe Keys lagoons, the methods could be used in separate areas.

The combined use of mycoherbicides with EPA-approved chemical herbicides shows promise and may prove to provide effective control at reduced herbicide application rates.

6.0 LIST OF PREPARERS

The following individuals prepared the text presented in this report.

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Rayann La France	B.S. Criminal Justice CSU Sacramento	Document Editing, Formatting

7.0 ABBREVIATIONS AND ACRONYMS

AERF	Aquatic Ecosystem Restoration Foundation
CDFW	California Department of Fish and Wildlife
EPA	Environmental Protection Agency
IMP	Integrated Management Plan
LRWQCB	Lahontan Regional Water Quality Control Board
LTAIS	Lake Tahoe Aquatic Invasive Species Coordination Committee
SEA	Sierra Ecosystem Associates
SFEI	San Francisco Estuary Institute
TKPOA	Tahoe Keys Property Owners Association

8.0 REFERENCES

AERF 2009. Biology and Control of Aquatic Plants: A Best Management Practices handbook. Aquatic Ecosystem Restoration Foundation. 2009.

Creed 1994. Creed, R.P. and S.P. Sheldon. 1994. The Effect of Two Herbivorous Insect Larvae on Eurasian Watermilfoil. Journal of Aquatic Plant Management. Vol: 32.

SFEI 2004. Greenfield, B.K., N. David, J. Hunt, M. Wittmann, and G. Siemering. 2004. Review of Alternative Aquatic Pest Control Methods For California Waters. San Francisco Estuary Institute.

Hestand 1978. Hestand, R.S. and C.C. Carter. 1978. Comparative Effects of Grass Carp and Selected Herbicides On Macrophyte and Phytoplankton Communities. Journal of Aquatic Plan Management. Vol: 16.

Johnson 1998. Johnson, R.L., E.M. Gross, and N.G. Hairston. 1998. Decline of the invasive submersed macrophyte *Myriophyllum spicatum* (Haloragaceae) associated with herbivory by larvae of *Acentria ephemerella* (Lepidoptera). Aquatic Ecology 31. Vol: 3.

Johnson 2000. Johnson, R.L., P.J. Van Dusen, J.A. Toner, and N.G. Hairston. 2000. Eurasian Watermilfoil Biomass Associated with Insect Herbivores in New York. Journal of Aquatic Plant Management. Vol: 38.

LTAIS 2015. Wittmann, ME, and S. Cahndra. 2015. Implementation Plan for the Control of Aquatic Invasive Species within Lake Tahoe. Lake Tahoe Coordination Committee. July 2015.

Maceina 1999. Maceina, M.J., J.W. Slipke, and J.M. Grizzle. 1999. Effectiveness of Three Barrier Types for Confining Grass Carp in Embayments of Lake Seminole, Georgia. North American Journal of Fisheries Management. Vol: 19.

Martyn 1986. Martyn, R.D., R.L. Noble, P.W. Bettoli, and R.C. Maggio. 1986. Mapping Aquatic Weeds with Aerial Color Infrared Photography and Evaluating Their Control by Grass Carp. Journal of Aquatic Plant Management. Vol: 24.

Mazzei 1999. Mazzei, K.C., R.M. Newman, A. Loos, and D.W. Ragsdale. 1999. Developmental Rates of the Native Milfoil Weevil, *Euhrychiopsis lecontei,* and Damage to Eurasian Watermilfoil at Constant Temperatures. Biological Control. Vol: 16.

Nelson 2002. Nelson, L.S., and J.F. Shearer. 2002. Response of Eurasian Watermilfoil to Integrated Fluridone-Fungal Pathogen Treatment. US Army Corps of Engineers.

Nelson 2005. Nelson, L.S., and J.F. Shearer. 2005. 2,4-D and *Mycoleptodiscus terrestris* for Control of Eurasian Watermilfoil. Journal of Aquatic Plant Management. Vol: 43.

Newman 2001. Newman, R.M., D.W. Ragsdale, A. Milles, and G. Oien. 2001. Overwinter Habitat and the Relationship of Overwinter to In-lake Densities of the Milfoil Weevil, *Euhrychiopsis lecontei,* a Eurasian Watermilfoil Biological Control Agent. Journal of Aquatic Plant Management. Vol: 39.

Nicholson 1991. Nicholson, R.L. 1991. Mycoherbicide Control of Eurasian Watermilfoil. Purdue University.

Shearer 2013. Shearer, J.F. 2013. Evaluation of a New Biological Control Pathogen for Management of Eurasian Watermilfoil. US Army Corps of Engineers.

Shearer 2011. Shearer, J.F., B.D. Durham, and N. Harms. 2011. Screening of biological control pathogens isolated from Eurasian watermilfoil. Journal of Aquatic Plant Management. Vol: 49.

Shearer 2006. Shearer, J.F., and M.A. Jackson. 2006. Liquid culturing of microsclerotia of *Mycoleptodiscus terrestris,* a potential biological control agent for the management of hydrilla. Biological Control. Vol: 38.

Sheldon 1995. Sheldon, S.P., and R.P. Creed. 1995. Use of a Native Insect as a Biological Control for an Introduced Weed. Ecological Applications. Vol: 5.

Sutton 2012. Sutton, D.L., V.V. Vandiver, and J.E. Hill. 2012. Grass Carp: A Fish for Biological Management of Hydrilla and Other Aquatic Weeds in Florida. Institute of Food and Agricultural Sciences, University of Florida.

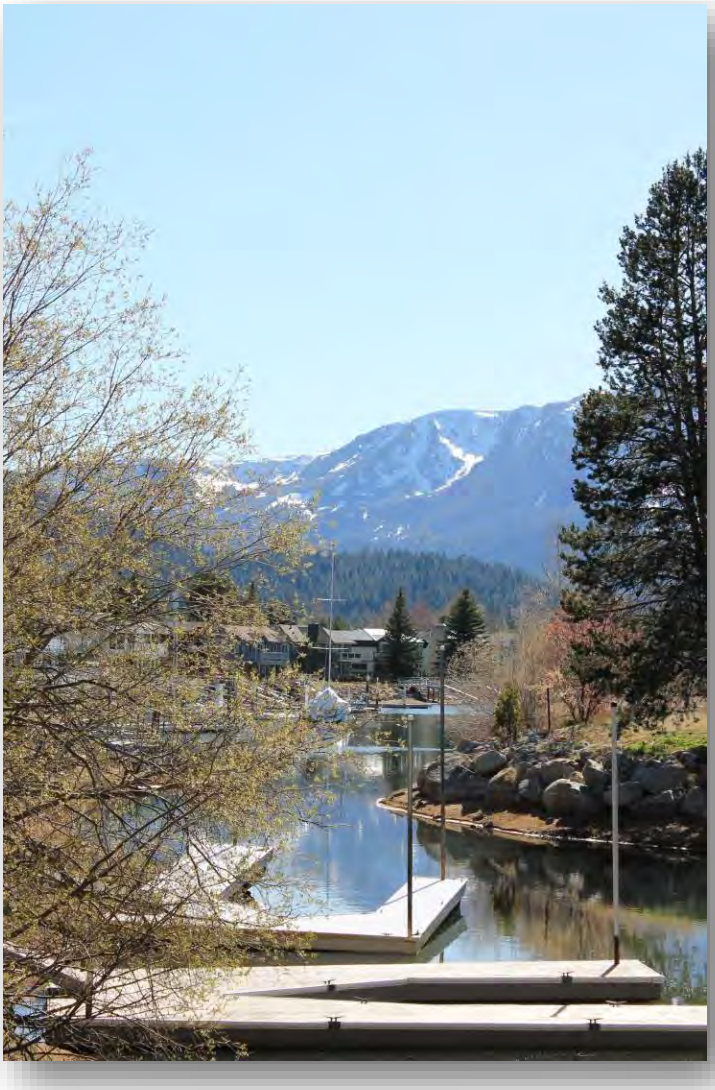
TAMU 2016. Website of Texas A&M University Aquaplant Pond Manager Diagnostics Tool. Website: http://aquaplant.tamu.edu/management-options/curly-leafed-pondweed/ Accessed July 2016.

TKPOA 2015. Tahoe Keys 2015 Aquatic Macrophyte Survey Report. Prepared Pursuant to LRWQCB Order No. R6T-2014-0059. Prepared by Sierra Ecosystem Assoc. 2015.

Wittmann, M.E. and Chandra, S. 2015. Implementation Plan for the Control of Aquatic Invasive Species within Lake Tahoe. Lake Tahoe AIS Coordination Committee, July 31, 2015. Reno, NV. 52 pp.

- APPENDICES -

Biological Control of Aquatic Plants and Potential Use in the Tahoe Keys Lagoons



March 27, 2017

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356 Ala Wai Boulevard South Lake Tahoe CA 96150
530-542-6444 tahoekeyspoa.com

October 19, 2016

Ms. Tina Bartlett, Regional Manager
Department of Fish and Wildlife, North Central Region (2)
1701 Nimbus Road
Rancho Cordova, CA 95670

Subject: Request for Consultation on Possible Use of Triploid Grass Carp for Aquatic Weed Control in Lake Tallac in South Lake Tahoe

Ms. Bartlett,

The Tahoe Keys Property Owners Association (TKPOA) has been working since 2011 with numerous stakeholders in the Lake Tahoe Basin to identify the most feasible methods to bring aquatic invasive plants under control within the Tahoe Keys lagoons. TKPOA is investigating a broad range of possible controls, including biological methods. Of the biological controls available, triploid grass carp appears the most promising and could offer advantages over other methods.

Section 238.6 of the Fish and Game Code regulates the use of the triploid grass carp, but we are uncertain whether one of the Tahoe Keys water bodies (i.e., Lake Tallac) may be eligible for a permitted use of the grass carp. This letter is to request consultation with your agency regarding the possible permitting of the grass carp in Lake Tallac.

Lake Tallac is owned by TKPOA and is one of three water bodies infested with invasive plants within the Tahoe Keys. The other two water bodies are the Main Lagoon and the Marina Lagoon, both of which have open water connections to Lake Tahoe. The attached figure shows the relative location of Lake Tahoe to the three water bodies. Lake Tallac is just over 20 acres in size, receives storm water runoff from the City of South Lake Tahoe, and is isolated from the Main Lagoon by a diversion structure. TKPOA is interested in the possibility of obtaining a permit to test the grass carp in an isolated section of Lake Tallac.

Background information on TKPOA's efforts can be found at www.keysweedsmanagement.org and also in the recent update to TKPOA's Integrated Management Plan that was submitted to the Lahontan Regional Water Quality Control Board. A comprehensive review of the invasive plant problem within Lake Tahoe can be found in a July 2015 report published by the University of Nevada, Reno (Implementation Plan for the Control of Aquatic Invasive Species in Lake Tahoe).

In addition to the above documentation, Joel Trumbo of your staff has been consulted by TKPOA on other aspects of our aquatic plant control evaluations and may be able to supply additional background information. If your agency believes that Lake Tallac may be eligible for permitting of triploid grass carp, we would then request an on-site meeting to review the site and other conditions under which TKPOA might prepare an application to test this control method.

We appreciate your assistance and look forward to your response in the near future. Please contact me at the above number or Rick Lind of Sierra Ecosystem Associates at (530) 541-2433 if you or your staff would like additional information or a site visit to complete your review.

Sincerely,

Kirk J. Wooldridge PCAM®, AMS®, CMCA®, CCAM®, CHA®
General Manager
Tahoe Keys Property Owners Association
356 Ala Wai Boulevard
South Lake Tahoe CA 96150
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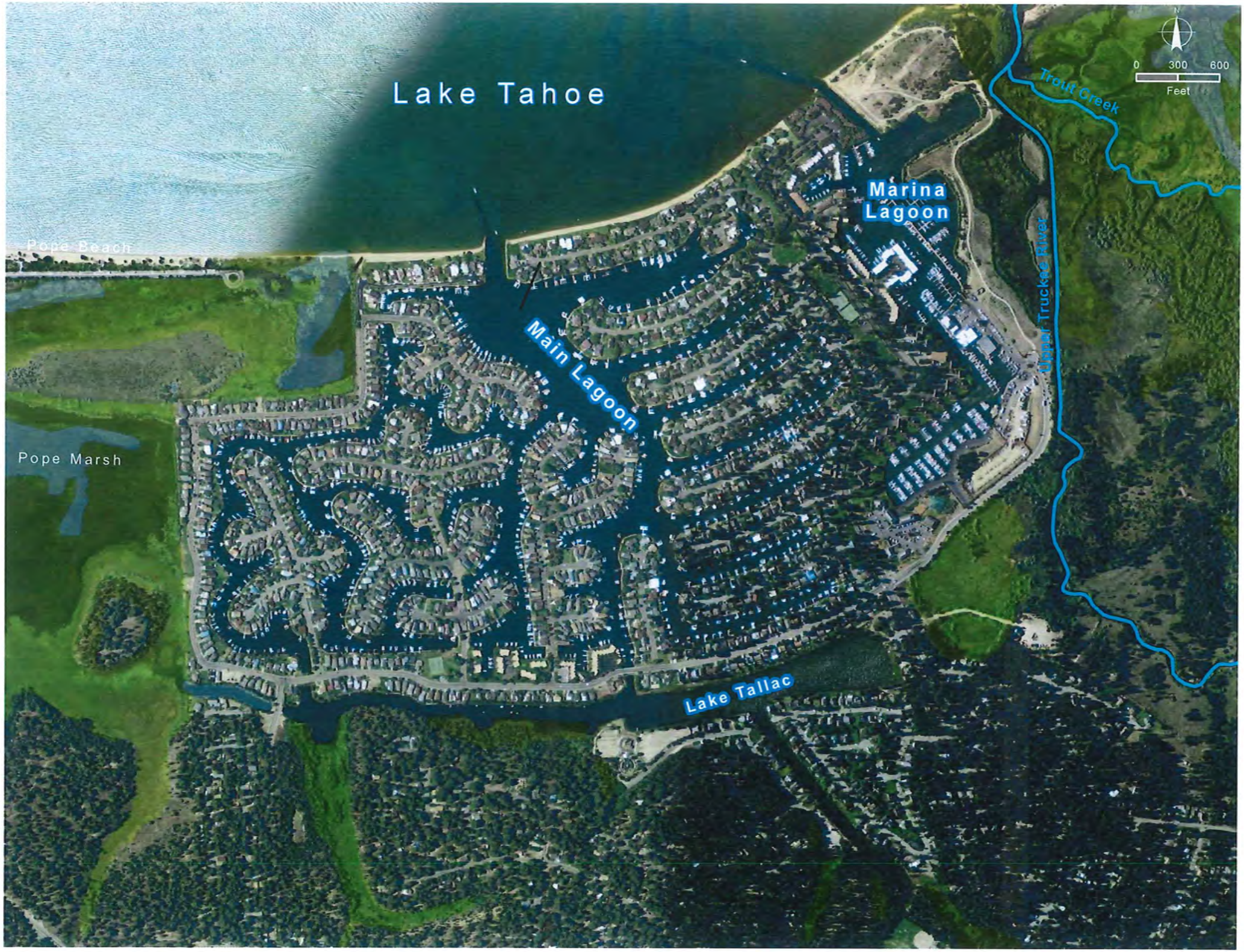
Attachment

CC: Mr. Joel Trumbo, CDFW
TKPOA Water Quality Committee


Lake Tahoe
Pope Beach
Pope Marsh
Marina Lagoon
Main Lagoon
Lake Tallac
Trout Creek
Upper Truckee River
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