

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
DIVISION OF ECOLOGICAL AND WATER RESOURCES

STAFF REPORT 52

**Management of Rooted Aquatic Vegetation,
Algae, Leeches, Swimmer's Itch, 2011**

March 2012

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Algae, Leeches, Swimmer's Itch, 2011**

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Executive Summary 2011 Aquatic Plant Management Program

In Minnesota the state is the owner of wild rice and other aquatic vegetation growing in public waters (M.S. 84.091). The Minnesota Department of Natural Resources (DNR) regulates the harvest, transplanting, and destruction of aquatic plants in public waters through a permit program. The purpose of the Aquatic Plant Management (APM) permit program is to protect the beneficial functions of aquatic vegetation while allowing riparian property owners to obtain reasonable access to public waters.

Public Waters/Permits/Properties/Fees

In 2011 there were 832 public waters with permitted APM activity. The number of public waters where aquatic plant management is permitted increased gradually from 1953 until 2000. In recent years the number of lakes with permitted APM activity stabilized at around 900 per year. In 2011 there were 41 fewer lakes with permitted APM activity than in 2010.

In 2011 there were 442 fewer permits issued than in 2010. The annual increase in the numbers of permits issued from 2003-2007 was approximately 360 permits per year. Permits issued statewide reached their peak in 2007 at 4,633 permits issued. Statewide permit numbers have decreased for the last four consecutive years 2008 through 2011. The Central Region (3A), which includes the seven county metropolitan area, typically issues permits for more properties than any other DNR regional office. In 2011 the Central Region issued 54 fewer permits than in 2010. The largest regional decrease in the number of permits issued was in the Northwest Region, down 170 permits from 2010.

The numbers of property owners applying for APM permit statewide in 2011 decreased for the fifth consecutive year. Statewide there were 904 fewer applications received in 2011 than in 2010. The number of properties with permitted aquatic plant management activities decreased in all regions with the exception of the Central Region 3A.

Permit revenue decreased as a result of the reduction in the numbers of applications for APM permit. In 2010 Permit fees generated \$257,814 in revenue and in 2011 permit fees generated \$238,352 a reduction of \$19,462. The average fee per property in 2011 was \$26.66, up slightly from the average fee per property in 2010.

Automated Aquatic Plant Control Devices

The Department first began issuing permits for Automated Aquatic Plant Control Device's (AAPCD's) in 1997. In 2011 permits for AAPCD's accounted for about 46% of the active APM permits. The remaining 54% of the APM permits issued allowed chemical or other mechanical removal as the method of control.

The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less

(*Minnesota Rules*, part 6280.0450, subp.3, item A). Revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). Due to this change many more permit holders became eligible for an AAPCD permit of three year duration in 2009.

In 2011 there were 196 fewer three-year AAPCD permits than were issued 2010. The number of single season permits issued in 2011 decreased by 29 from 2011. AAPCD permit issuance for both types of permits was down 19% in 2011 over 2010. Persons who obtained a three-year permit in 2011 will not have to apply again for permit until the year 2014.

Most AAPCD permits are issued to a single property owner. In 2011 AAPCD's made up 28% of the permits issued and accounted for 10% of the total number of properties permitted.

Summary of Aquatic Plant Management permits issued in 2011 and active permits.

Region	Mechanical Chemical***	2011 Issued Channel*	<2011 Active Channel**	AAPCD's with chemical control	AAPCD				All Active Permits	Restoration Permits Issued
					Issued 2011		Issued 2010	Issued 2009		
					1 year	3 year	3 year	3 year		
Reg 1	391	27	-	74	214	186	294	764	1876	4
Reg 2A	61	11	-	0	0	6	8	5	91	5
Reg 2B	584	9	-	40	85	205	191	308	1382	4
Reg 3A	772	3	-	6	50	19	48	43	935	7
Reg 3B	343	8	-	15	46	79	127	180	783	15
Reg 4	150	4	-	1	8	35	58	55	310	8
All	2301	62	1035	136	403	530	726	1355*	6548	43

* Channel permits are of unlimited duration issued to the property owner to mechanically maintain a channel to more than 16 shoreline feet wide of vegetation.

** All active permits as of 12/28/2011. Total by Region cannot be calculated because Region boundaries were changed in 2003. All Active Permits = Permits issued in 2010 and all active AAPCD and channel permits excluding restoration permits.

*** Excludes permits for AAPCD's and channel permits.

It is important to note that the numbers of permits and applicants in a single year is only part of the story. In addition to AAPCD permits that can be issued for up to 3-years, a lakeshore property owner can obtain a permit of unlimited duration to mechanically maintain a channel 15 feet wide through emergent vegetation. These multi-year permits account for roughly 56% of the total number of active permits in 2011. In 2011 while there were 2,704 annual permits issued there were 3,844 active multi-year permits. The total number of active permits in 2011 was 6,548.

Summary of all APM permits issued for control of aquatic plants and nuisances, fees collected, numbers of lakes and properties treated in 2011.

Region	All Permits Issued in 2011*	All Lakes**	Fees***	Properties Permitted in 2011	Ave. Fee/Property	All Reporting ****		
						Mechanical Work	Chemical Treatment	Both
Reg 1	826	213	\$ 31,346	871	\$ 35.99	102	164	38
Reg 2A	80	42		80		9	34	4
Reg 2B	884	133		1216		26	462	21
Reg 2 total			\$ 35,246	1296	\$ 27.20			
Reg 3A	849	254		4512		52	588	17
Reg 3B	477	118		1544		16	271	16
Reg 3 total			\$ 156,189	6056	\$ 25.79			
Reg 4	197	72	\$ 15,571	716	\$ 21.75	14	85	7
2011 TOTAL	3313*	832	\$ 238,352	8939	\$ 26.66	219	1604	103
2010 TOTAL	3755	873	\$ 257,814	9909	\$ 25.73	255	1679	119
CHANGE	-442	-41	-\$ 19,462	- 970	\$ 0.93	-36	-75	-16

* Permits issued for restoration work are excluded.

** Includes all lakes, ponds, ditches and streams listed on APM permits for 2011.

*** Revenue from the APM database as of 12/28/2011.

**** Data tabulated from the surveys and commercial applicator reports returned as of 1/25/2011.

Trends and Observations

Aquatic plant control in Minnesota is highly seasonal. Most aquatic plant control in Minnesota takes place in the months of June, July and August. This trend has been consistent for many years because much of the aquatic plant control is recreationally motivated.

Lakeshore residents often hire commercial services to perform aquatic plant control. Statewide commercial services perform approximately 65% of permitted aquatic plant control. However, in the Central Region commercial services perform more than 84% of permitted aquatic plant control. Commercial services perform much less of the permitted control in Greater Minnesota.

Many APM permits are issued on an annual basis. Approximately 78% of 2011 permit holders responding to the survey indicated that they would reapply for permit in 2012. This was a 2% decrease from the previous year. In 2011, roughly 73% of APM permit holders that did their own control used their permit, and nearly 91% of the permit holders that hired a commercial service used their permit.

Lakeshore property owners may apply for a permit to control filamentous algae and chara (a form of macro-algae) with copper sulfate. Applications requesting filamentous and chara control have declined for the past two years in a row.

Blue green algae blooms are a common nuisance in eutrophic Minnesota lakes. Copper sulfate, a common algaecide, can provide temporary relief from nuisances caused by blue green algae. However, the control obtained by lake-wide application of copper sulfate is usually temporary and treatment is often required at least twice per season. In addition, there is the threat of fish kill from oxygen depletion caused by the decomposition of dead algae. The numbers of lakes where the residents seek a permit to control blue green algae with copper sulfate has been declining since 1997.

Swimmer's itch, an infection caused by an immature life stage of flukes common in waterfowl, is present in many Minnesota lakes. Lakeshore property owners can get a permit to use copper sulfate to control snails that harbor the immature life stage. The numbers of permits issued for swimmer's itch control has been increasing steadily since 1997.

INTRODUCTION

Value of Aquatic Plants

Aquatic plants are essential components of most freshwater ecosystems. In many lakes, plants are the base of the aquatic food chain. The habitat aquatic plants provide in the shallow near-shore areas is important to both aquatic and terrestrial animals. They also serve important functional roles in lakes by stabilizing the lake bottom, cycling nutrients, and preventing shoreline erosion.

Many of Minnesota's most sought-after fish species depend heavily on aquatic vegetation throughout their life histories. Yellow perch, northern pike, muskellunge, panfish, and bass all depend on aquatic vegetation to provide food, spawning habitat, and nursery areas. Juvenile fish of most species feed on small crustaceans and insects that are abundant in stands of aquatic vegetation. Even species that may not require vegetation for spawning depend on the cover and forage found in aquatic vegetation.

Many species of wildlife are dependent on aquatic plants for food and nesting sites. Ducks eat the seeds and tubers produced by various water plants. Other aquatic plants, which are not eaten directly by waterfowl, support many insects and other aquatic invertebrates that are important sources of food for migratory birds and their young. Ducks have been known to alter migration patterns in response to food availability. Emergent aquatic vegetation provides nesting cover for a variety of waterfowl, wading birds, shorebirds and songbirds. The reproductive success of ducks that nest near lakes is closely tied to available aquatic plants and the cover it provides to hide young birds from predators.

The muskrat, an important furbearer, is almost entirely dependent on aquatic vegetation for food and shelter. Minnesota's largest mammal, the moose, also relies heavily on aquatic vegetation for food.

The distribution of many amphibians and reptiles is directly linked to the vegetation structure of aquatic habitats. Species preference of particular habitat types is related to

food availability, types of escape cover, and specific microclimates. Emergent and submerged vegetation support invertebrate populations that are an important food source for amphibians and reptiles. During the breeding season some species of frogs call from emergent vegetation at the water's edge and their egg masses are often attached to aquatic plants. Freshwater turtles often eat submerged vegetation, which is an important source of calcium.

Beyond providing food and shelter for fish and wildlife, aquatic vegetation is important in maintaining a stable lake environment. Aquatic vegetation helps maintain water clarity by limiting the availability of nutrients, and preventing suspension of bottom sediments. Aquatic plants limit erosion of shorelines by moderating the effects of wave and ice erosion. A healthy native plant community is also important in preventing the establishment of non-native invasive aquatic plants. In short, aquatic plants serve many important functions for lakes, fish, and wildlife. Many of the things that we enjoy most about lakes are directly linked to aquatic vegetation.

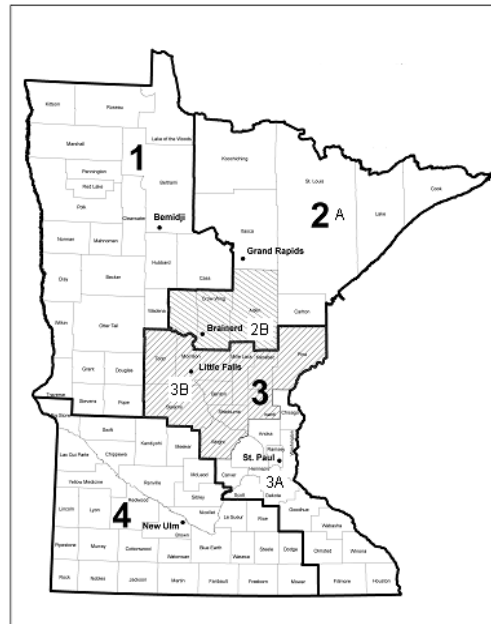
The Aquatic Plant Management Program (APM)

Riparian property owners (lakeshore property owners) in Minnesota have a right to use and access the lake adjacent to their property. Aquatic vegetation may interfere with a lakeshore homeowner's ability to exercise that right. The purpose of the DNR's APM program is to regulate how much aquatic vegetation lakeshore residents can control to ensure that the beneficial functions aquatic plants provide are preserved.

Other aquatic organisms can also interfere with the lakeshore property owner's enjoyment of the lake. Swimmer's itch, caused by the immature life stage of a parasite common in waterfowl, can cause significant and sometimes severe discomfort in humans depending upon a person's sensitivity to the organism. Algae (plankton and filamentous) can also create a nuisance and occasionally unhealthy conditions when they become overabundant. Relief from these nuisances may also be sought under an APM permit.

Administrative Regions

DNR Administrative Regions as of October 2006



NW Region 1

Bemidji
Kittson
Roseau
Lake of the Woods
Marshall
Polk
Pennington
Red Lake
Beltrami
Norman
Mahnomen
Clearwater
Hubbard
Cass
Clay
Becker
Wadena
Wilkin
Otter Tail
Traverse
Grant
Douglas
Stevens
Pope

NE Region 2

Grand Rapids (2A)
Koochiching
Itasca
St. Louis
Lake
Cook
Carlton

Brainerd (2B)
Crow Wing
Aitkin
Cass

Central Region 3

St. Paul (3A)
Anoka
Carver
Chisago
Dakota
Hennepin
Ramsey
Scott
Washington
Goodhue
Wabasha
Olmstead
Winona
Fillmore
Houston

Little Falls (3B)
Benton
Isanti
Kanabec
Pine
Mille Lacs
Morrison
Sherburne
Stearns
Todd
Wright

South Region 4

Big Stone
Swift
Kandiyohi
Meeker
McLeod
Renville
Chippewa
Lac Qui Parle
Yellow Medicine
Lincoln
Lyon
Redwood
Nobles
Jackson
Martin
Faribault
Freeborn
Mower

The DNR's Division of Fish and Wildlife is responsible for the administration of the APM permit program. Riparian property owners apply for an aquatic plant control permit, to the Regional Fisheries Manager, in the region where their lake property is located. APM specialists in each region conduct application review and make permit recommendations.

The recommendation for the decision on the permit application (approval, modification, or denial) is determined during the review process. This decision often involves a discussion with the lakeshore property owner. When applications for APM permits are received for shallow lakes where waterfowl management is the primary focus, the APM specialist will seek the advice of the Area Wildlife Manager. When applications are modified or denied, the applicant may appeal to the Commissioner's Office for review of the permit decision. The purpose of this review is to determine if the permit decision was based upon rule standards. Finally, permit decisions can be appealed to an Administrative Law Judge through the contested case hearing process.

The coordinator of the APM program is in the Division of Ecological and Water Resources. This position is the department's contact with commercial mechanical control businesses, commercial aquatic pesticide applicators, and the Minnesota Department of Agriculture (MDA). The coordinator provides technical expertise on aquatic plant control methods and permitting requirements to lakeshore property owners and Department staff. The coordinator works to insure consistent interpretation of the APM rules throughout the Department. This position administers exams and issues operating permits to commercial aquatic plant harvesters. This person also reviews appeals of permit decisions for the Commissioner. The program coordinator also prepares an annual report on program activities (this document) and coordinates the development of informational materials and forms provided to riparian property owners interested in aquatic plant management.

The APM program coordinator supervises staff in the Division of Ecological and Water Resources whose job responsibilities include enforcement of aquatic pesticide rules and pesticide label requirements. An Aquatic Pesticide Enforcement Specialist conducts inspections of herbicide applications in public waters to monitor compliance with state and federal pesticide law and responds to reports of pesticide misuse (Appendix Tables E and F). The U.S. Environmental Protection Agency (EPA) partially funds DNR's aquatic pesticide enforcement activities through a grant administered by MDA.

Regulations

Authority for the DNR's APM program is found in Minnesota Statutes M.S. 84.091 Subdivision 1, which designates ownership of wild rice, and other aquatic vegetation growing in public waters, to the State. M.S. 103G.615 authorizes the Commissioner of the DNR to issue permits to harvest or destroy aquatic plants, establish permit fees, and prescribe standards to issue or deny permits for aquatic plant control. The standards for the issuance of permits to control aquatic vegetation and the permit fee structure are found in MN Rules Chapter 6280. Minnesota Statutes and Rules can be reviewed at the Revisor of Statutes website <http://www.leg.state.mn.us/leg/statutes.asp>.

The rules governing aquatic plant management (M.R. chapter 6280) were revised in 2009. Significant changes to the APM rules include:

- The addition of specific criteria used to evaluate applications for permit. The decision to issue, modify or deny permits is based on these criteria;
- The revised rules specify conditions that can be placed on permits such as limits on amount of control, restrictions on method and timing of control, and restrictions on the species of plant targeted by the control.
- The revised rules reduce the amount of near shore vegetation that can be removed by individuals to 100 feet or one-half their frontage whichever is less.
- The revised rules specify that automated plant control devices may not be used in areas of soft sediment with an average sediment depth of 3 inches or greater.
- Under the revised rules a provision that allowed certain lakes to exceed the 15% littoral zone limit on plant control with herbicides will sunset in 5 yrs (2014). This provision also requires DNR to work with the affected lake associations to develop a lake vegetation management plan (LVMP).
- The revised rule clarifies conditions for “commercial harvest permits” that allow the harvest of aquatic plants, and plant parts from public waters for sale purposes.
- The revised rules specify when variances may be issued, the criteria to be considered, and allows for mitigation for adverse effects on aquatic habitat caused by an APM permit that includes a variance.
- The revised rules specify when an LVMP can be used and what information the LVMP should contain.

A permit from the DNR is required to use pesticides for aquatic plant and nuisance control in public waters (generally any body of water 2.5 acres or larger within an incorporated city limit, or 10 acres or larger in rural areas, *Minnesota Statutes* 103G.005, subd. 15 and 15a), to use an automated aquatic plant control device, to control emergent vegetation such as cattails, wild rice, or bulrush and to control submerged or floating leaf vegetation above specified limits. A riparian property owner may, without a permit, physically remove (cut, pull, or harvest) *submerged* vegetation along one half the individual’s lake frontage or 50 feet, whichever is less. The total area may not exceed 2,500 square feet. In addition, a boat channel up to 15 feet wide, and as long as necessary to reach open water, may also be maintained by mechanical means without a permit. If floating leaf vegetation is interfering with riparian owner access a channel, not more than fifteen feet wide, extending to open water, may be mechanically maintained without a permit. Aquatic plants that are cut or pulled must be removed from the lake and the managed area must remain in the same location each year.

The mechanical control of purple loosestrife, a plant on the Minnesota Department of Agriculture’s noxious weed list, does not require a permit from the DNR. However, herbicide control of purple loosestrife below the ordinary high water level on public waters does require a permit. Because of the plant’s status as a noxious weed, these permits are issued free of charge.

Beyond the permit requirement, pesticides used in surface waters must be registered with the Department of Agriculture for sale and use in Minnesota. The product must also be registered for aquatic use by the United States Environmental Protection Agency. When using an aquatic herbicide all label instructions and precautions must be followed. The permittee must post areas treated with herbicides so that anyone entering the area is informed of the herbicide application. The signs contain the following information: the name of the applicator, the treatment date, the name of the product used, expiration dates of any water use restrictions on swimming, fishing, household, and other uses. The DNR provides these signs to permittees and commercial applicators at no cost. A list of herbicides commonly used for aquatic plant control and the amount used under permit in Minnesota in 1987-2010 is found in Appendix A and B.

Summary of APM Program Activities in 2011

The following summary of APM program activities in 2011 comes from four sources: permittee survey forms (Appendix Table C and D), commercial aquatic applicator and commercial mechanical control reports, and the APM permit database. When a table or figure in the report describes information taken from permit holder or commercial company surveys, the term “*reported*” is used. When the report discusses data taken from the APM permit database the term “*permitted*” is used.

Commercial applicators, mechanical control companies, and riparian property owners who do control work in public waters are required to provide a yearly summary of their APM activity. With this information the past year’s activities can be summarized, the control of aquatic vegetation in public waters is monitored, and trends in aquatic plant management are identified.

Survey forms are mailed to permit holders that did their own aquatic plant control work. Prior to 2000, permit holders that hired commercial applicators to perform the control work for them were included in the survey. They were asked to answer only those few questions pertinent to their situation. This often caused confusion and permittees would either not respond or would send the form to the commercial service for completion. In addition, when commercial applicators do the control work there are usually many customers on a single permit. However, only one of those customers is listed as the permittee. Hence, this approach relied on one individual to provide accurate information for up to 100 or more other people. Since commercial pesticide applicators are required by law to keep detailed records and their reporting is generally more precise, permit holders who hire a commercial firm are no longer asked to complete a survey form. Survey forms were sent to all permittees that did their own chemical or mechanical control work. Of the 1,018 surveys mailed 936 (84%) were returned. A separate survey was sent to 939 AAPCD permit recipients, with 819 (88%) returned.

Permit Issuance

In 2011, a total of 3,313 permits were issued statewide for APM activities (this includes 43 shoreline habitat restoration permits), 442 fewer than in 2010 (Appendix Table G provides the county by county distribution of permits and permitted properties). In 2011,

there were 939 permits issued for the operation of Automated Aquatic Plant Control Devices (AAPCD). The remaining 2,374 aquatic plant control permits were issued to municipalities and lakeshore homeowners for pesticide use (includes algae and swimmer's itch control), and mechanical control (cutting, pulling, or harvesting) of aquatic vegetation.

Over the last 16 years, the number of public waters where permits are issued has almost doubled. Little increase occurred until 1999 when the number of public waters with permitted APM activity increased sharply (Figures 1 through 3). The number of public waters with permitted APM activity in 2011 was 832, 41 fewer lakes than in 2010.

How many lakes have APM permits in one year and have no APM permits the next? There were 98 lakes with APM permit activity in 2010 that did not have any permitted APM activity in 2011. In 2011 there were 83 lakes (710 acre average size) with permitted APM activity (slightly more than 1.2 permits per lake) that did not have any permitted APM activity in 2010. Finally, 670 lakes had permitted APM activity in both 2010 and 2011. These numbers exclude lakes with multiple year permits (3-year AAPCD and channel permits of unlimited duration).

The average size of the lakes that had permitted APM activity in 2010 and none in 2011 was 121 acres. The average number of permits on those lakes with permitted activity in 2010 and no permitted APM activity in 2011 was 1.9; the range was 1 to 5 permits. In 2011, 332 of the APM permits issued were not used for various reasons. Therefore, if an individual did not use an APM permit in the year it is issued they may not apply for a permit in the following year. In 2010, 224 permit holders surveyed said they did not use their 2010 permit. Of the 224 permit holders that that did not use their permit 123 (55%) did not re-apply for APM permit in 2011.

Figure 1. All permits issued, and the number of lakes with permitted aquatic plant control, by region, in 2011.

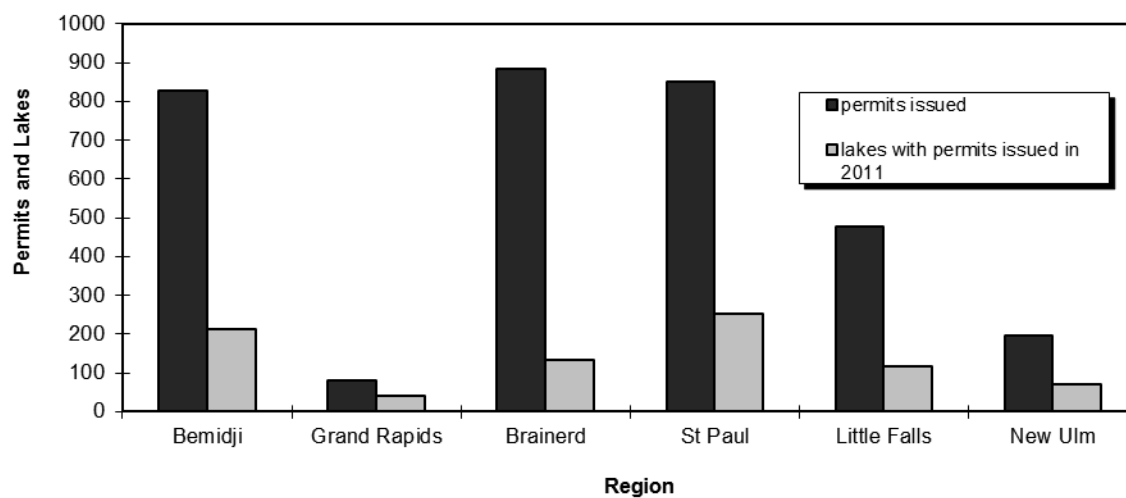


Figure 2. Numbers of permits issued for mechanical and chemical control (excluding AAPCD) of aquatic vegetation, algae, and swimmer's itch, and numbers of lakes where permits were issued 1992-2011.

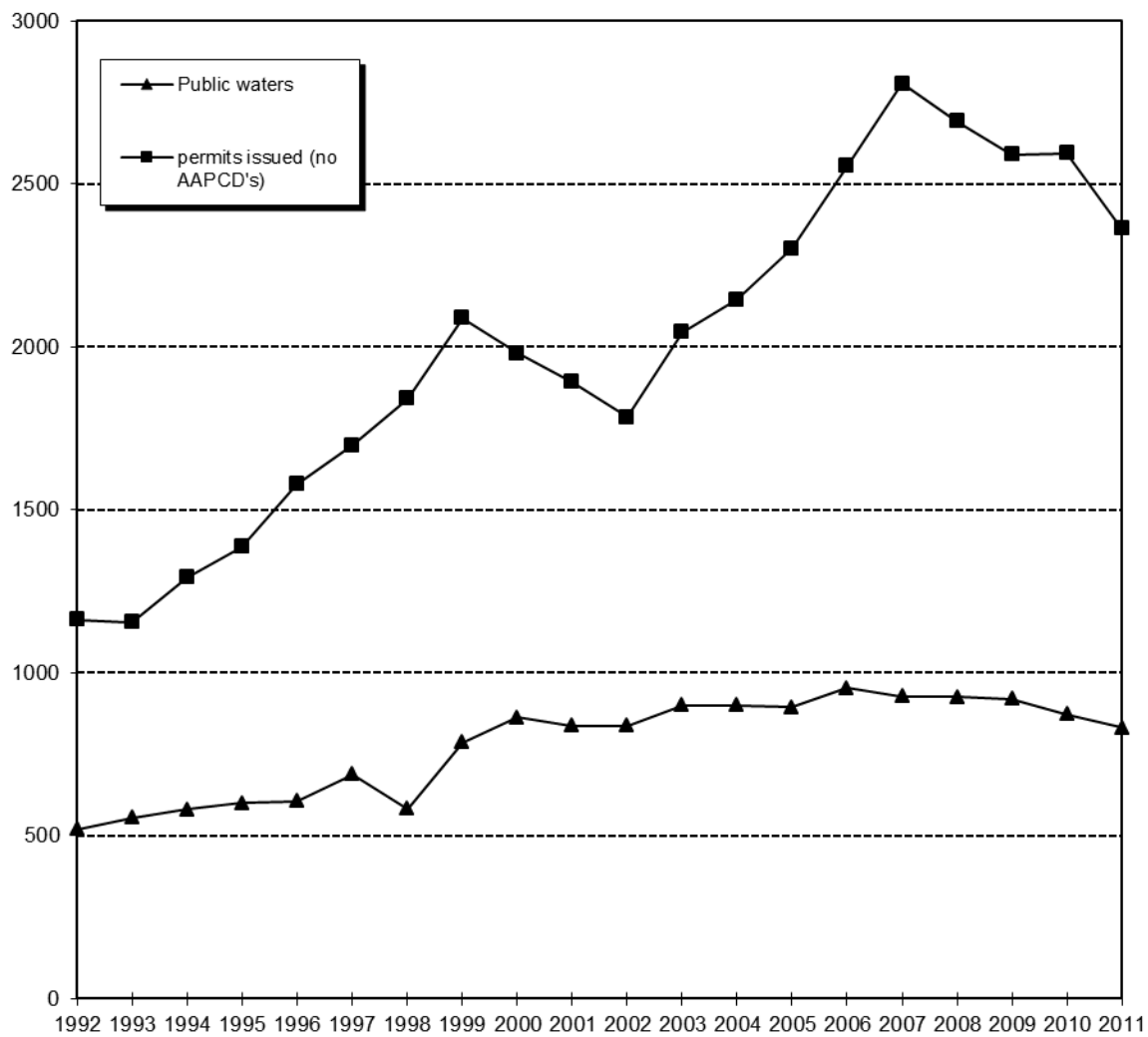
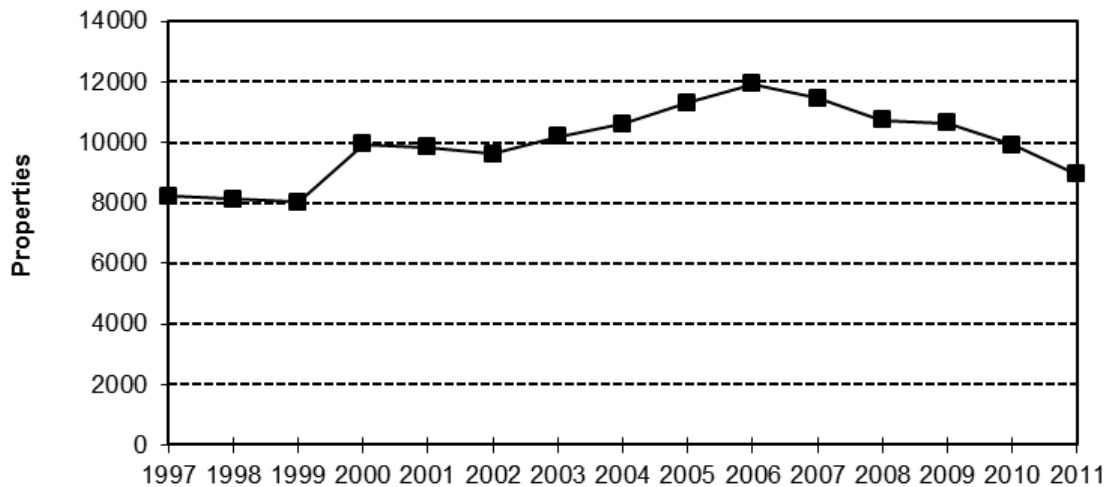


Figure 3. Numbers of properties issued permits for aquatic plant control statewide, 1997-2011.



APM permits increased annually from 1992 until about 1999. In the early 2000's the numbers of permits issued decreased and there was a corresponding decrease in the numbers of participating properties. Permit numbers and properties began to increase again in 2003 through 2006. In 2011 the total number of property owners obtaining permits for aquatic plant control declined for a fifth year in a row. Cooler temperatures in the early part of the open water season resulting in slower plant growth, colder water for swimming, and a sluggish economy may have contributed to the decline in lakeshore property owners participating in the APM program.

Lakeshore homeowners may apply for an APM permit as a group. The average number of properties per permit statewide in 2011 was 2.7, up 0.2% from 2010. Group permits are more popular in the Twin Cities metropolitan area than in Greater Minnesota (Table 1). Homeowner's on large group permits can benefit from the \$750 cap on permit fees. The individual permit fee (\$35.00 per property) begins to decrease for multiparty permits with more than 21 applicants. There are a few permits with more than 100 applicants, or properties, participating on a single permit. In 2011 there were 8,939 properties covered by the 3,313 permits issued. This number excludes the 43 permits issued to lake shore property owners for restoration of aquatic habitat.

The Central Region, which includes the Twin Cities metropolitan area, typically has larger group permits than other areas of the state. In 2011, the Central Region averaged 5.3 properties per permit, up 0.8% from 2010. The Northwest and Northeast

Regions averaged one property per permit. The average number of properties per permit in the Southern Region in 2010 was 2.9, but increased to 3.6 properties per permit in 2011.

Table 1. Permits grouped by the number of properties listed (excluding AAPCD) by Region, 2011.

Region		1	2A	2B	3A	3B	4
Permits/property	>100	0	0	2	3	1	1
	51-100	0	0	0	10	3	1
	21-50	0	0	1	44	13	8
	11-20	0	0	5	41	12	4
	2-10	3	0	6	136	33	11
	1	415	74	579	542	290	129

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

The rules regulating aquatic plant removal from public waters require an inspection of the treatment site for properties with no previous permit history, or when there are changes in the size of the treatment area, methods used, or the target plant species requested from the previously issued permit. APM specialists and area fisheries staff visit these sites to determine if the permit application is consistent with the criteria for permit issuance in APM rules. In 2011 there were 571 site inspections conducted. The site inspection provides an opportunity to determine what kinds of plants and habitat are present in the proposed treatment area. During the inspection, the size of the area may be reduced to protect important habitat based on the observations and professional judgment of the APM specialist. Approximately 83% of all near-shore control permit requests were issued unchanged (Table 2).

Table 2. Percent of permits requesting near-shore control that are issued as requested by region in 2011.

	1	2A	2B	Region		4	Statewide
				3A	3B		
number of applications requesting near-shore control	817	75	852	747	362	147	3
permits issued as requested*	676	61	732	612	299	119	2
% of permits issued as requested	82.7	81.3	85.9	81.9	82.6	81.0	8

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

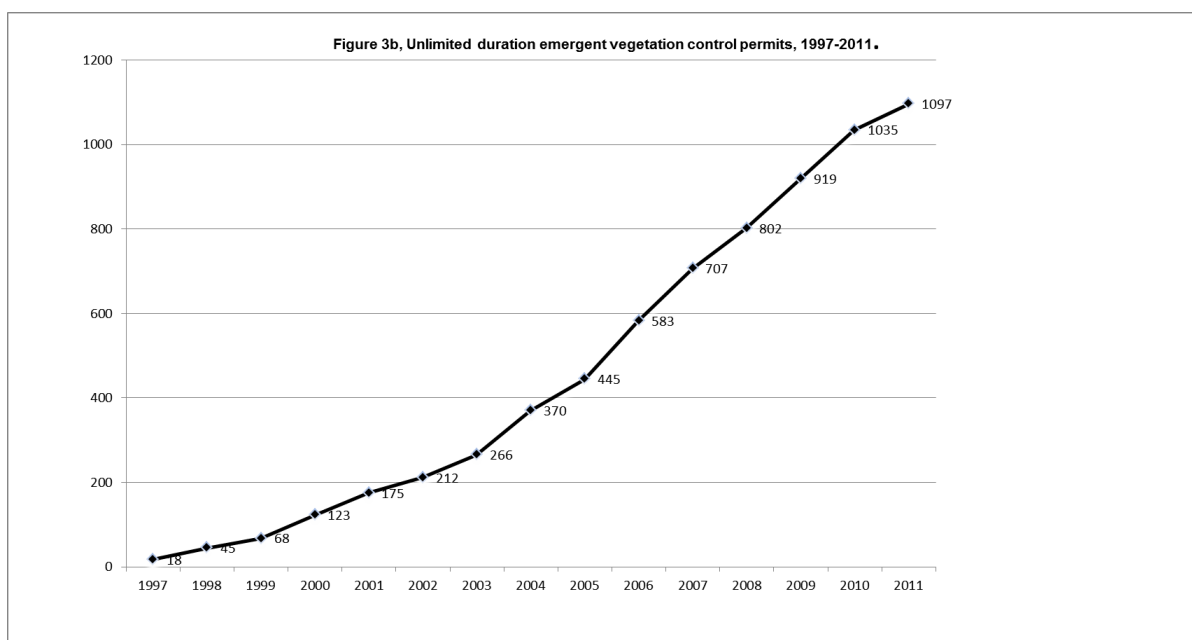
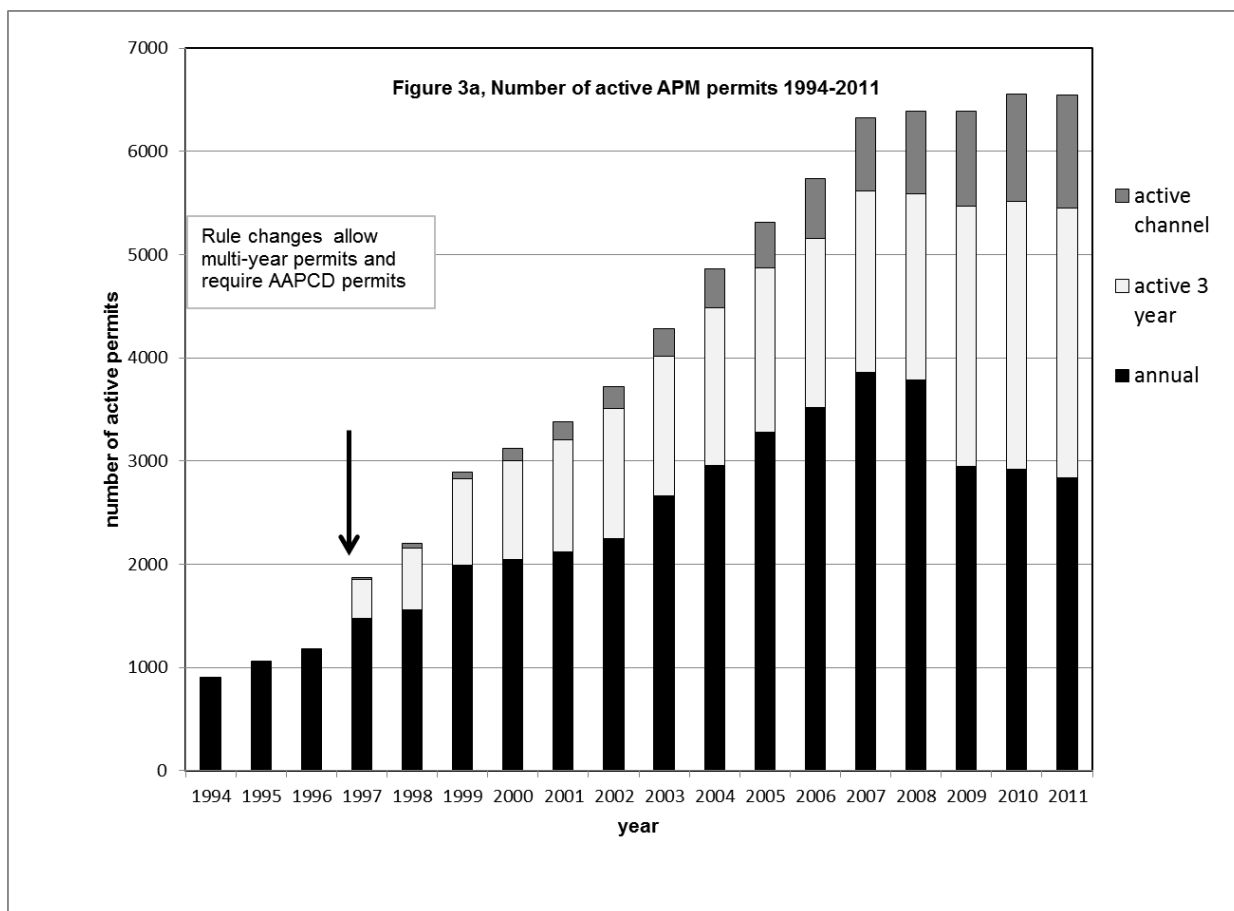
*Includes permits that allowed more shoreline than requested

Permit Duration

Until 1997 aquatic plant management permits were issued for a one year term. However, in 1997 the APM rules were revised allowing two types of permits to be issued for longer than a single season. Emergent vegetation control permits can be issued for a period of unlimited duration if the control is limited to a channel not more than 15 feet wide, that remains in the same location each year, and is maintained mechanically after the first year. A person requesting a permit to use an automated aquatic plant control device can obtain a permit of three years duration if they agree to operate the device in an area not to exceed 2,500 square feet and the device remains in the same location each year. The permit fee for the longer term permits is the same as the permit fee for annual permits.

These longer term permits are intended to offer an incentive to the property owner to remove less aquatic vegetation. In exchange for the smaller area of control the property owner does not have to make an application for a permit on an annual basis and they receive a permit of extended duration at the same cost as a permit issued for a single year. The extended duration permit also benefits the DNR by reducing the annual permit work load for program staff.

As shown in Figure 3a the number of permits of more than annual duration (active permits) is slightly greater than the number of annual permits issued in 2011. Permits issued for more than one year are most often issued to individuals. The number of emergent vegetation permits of continuous duration and the number of three year duration AAPCD permits represents an additional estimated 3,700 properties under DNR APM permit in 2011. Figure 3b shows the number of emergent vegetation channel permits issued annually since 1997. The difference in the total number of permits between years is the number of permits issued that year. For example the total number of active emergent vegetation permits in 2011 was 1,097. The total number of active permits in 2010 was 1035, therefore 62, the difference between the two totals, is the number of emergent vegetation unlimited duration permits issued in 2011.



Permit Fees

Permit fees for APM permit were last increased during the 2003 legislative session. The fee increased many types of APM permits from \$20.00 per property to \$35.00 per property. The cap on group permits to control submersed vegetation was increased from \$200 to \$750.

During the 2010 legislative session some permit fees were reduced. The fee for aquatic plant control on water bodies 20 acres or less was reduced to half of the permit fee for larger lakes. The fee for aquatic plant control on water bodies 20 acres or less in size for an individual is \$17.50 and the cap on permit fees for group permits is \$375.00. The reduction went into effect after most permits had been issued for 2010, therefore the reduction will not be evident until 2011.

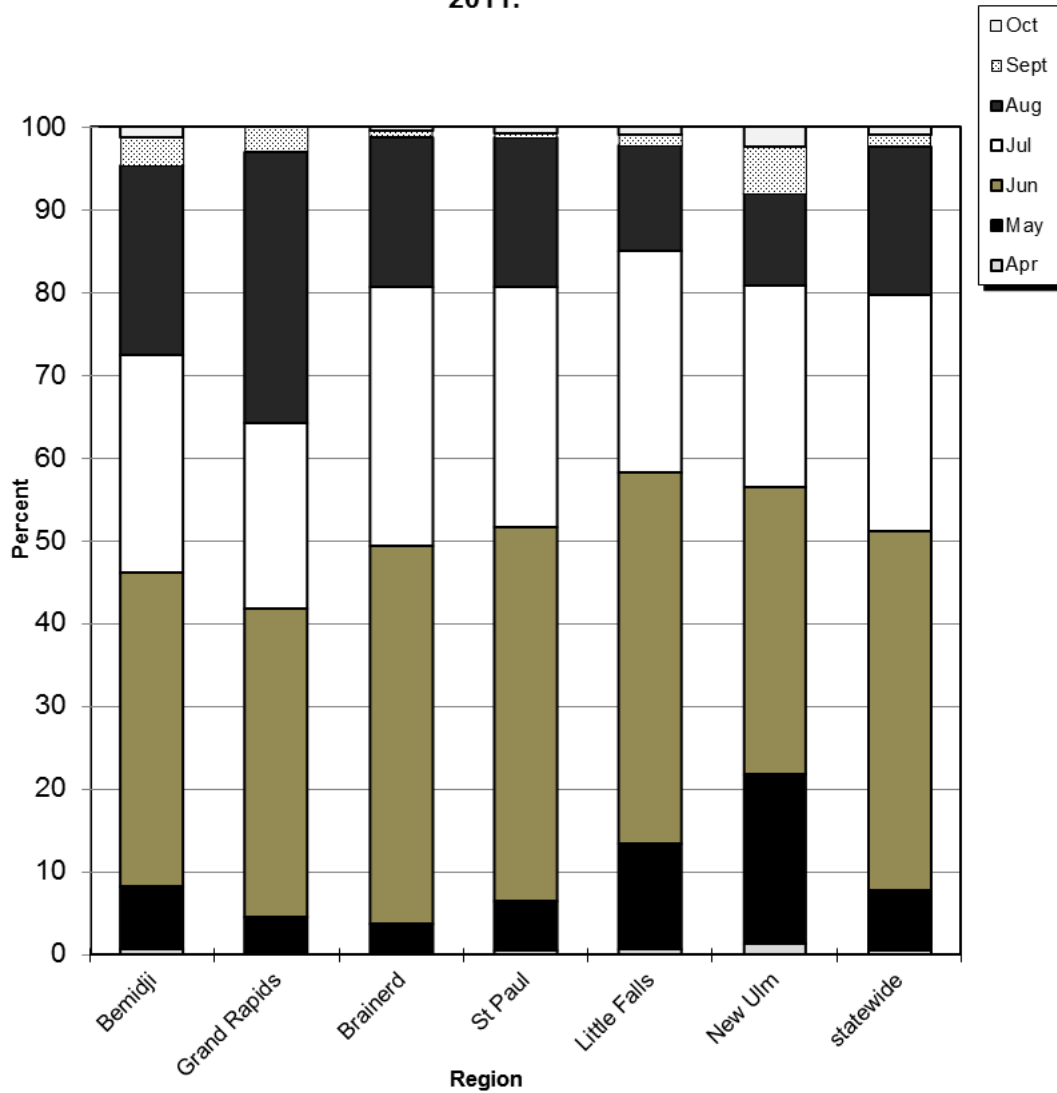
In 2009, prior to the fee change enacted by the 2010 Legislature, there were 71 permits issued for macrophyte control on lakes less than 20 acres in size. Those 71 permits generated approximately \$15,800.00. In 2011, the first full year of the legislative fee change, there were 73 permits issued for macrophyte control on lakes 20 acres or less in size that generated approximately \$9,600.00; a reduction of about \$6,000.00 in permit revenue.

Permit fee revenues in 2011 were lower than 2009 or 2010. In 2011 permit fees were approximately \$238,352 about \$19,462 less than 2010. The average permit fee per property owner in 2010 was \$26.02. In 2011 the average fee per property was \$26.66. The slight increase in the average permit fee is likely due to a reduction in the numbers of properties on multi-property permits and an increase in permits issued to individual property owners in 2011.

Timing of Treatment

Permits are issued for the open water season, generally from May through September 1. However, aquatic plant control can begin as early as January and extend through November. In 2011 about 90% of the permitted work, reported statewide, was completed in June, July, and August (Figure 4). Because most aquatic plant control in Minnesota is recreationally motivated this pattern has been consistent over time.

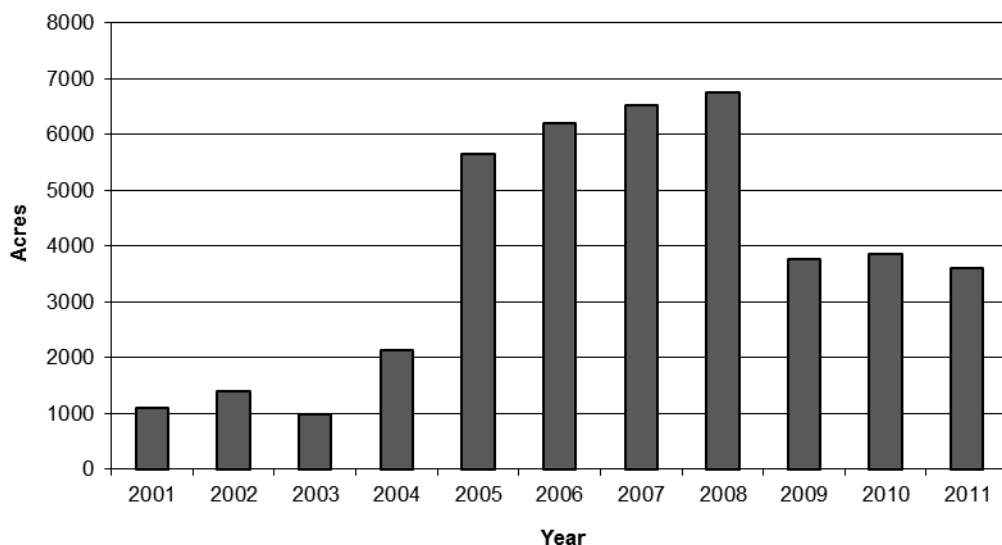
Figure 4. Percent of reported APM work by month for each region in 2011.



Acres of off-shore aquatic plant control permitted

The number of acres permitted for chemical control of submersed aquatic plants has fluctuated annually until 2005 when a sharp increase was recorded followed by continued modest annual increases (Figure 5). One contributing factor is the offshore control of aquatic vegetation focused primarily on non-native invasive species. A few large Eurasian watermilfoil and curly-leaf pondweed treatments can have a significant influence on the total number of acres permitted for treatment. This was evident between 2004 and 2005. In 2005, several lake-wide treatments of curly-leaf pondweed in the Central Region were responsible for the increase in treated acres. These lakes, in addition to Lake Benton, a 3000-acre lake in Lincoln County, (South Region), were treated again in 2006, 2007, and 2008 with an aquatic herbicide to manage curly-leaf pondweed. In 2009, the curly leaf-pondweed treatment in Lake Benton was reduced to 254 acres. In 2010 approximately 120 acres of curly-leaf pondweed was treated in Lake Benton, resulting in a 2,630 acre decrease from Lake Benton alone. In 2011, 419 acres were permitted for treatment in Lake Benton.

Figure 5. Permitted off-shore chemical control acreage of aquatic vegetation statewide from 2001-2011.



Aquatic plant control methods

In 2011, about 28% of all permits issued for aquatic plant control permitted the use of plant removal with AAPCD's, down 2% from 2010. Aquatic plant control using herbicides, plant harvesting, and plant removal by hand, accounted for the remaining 72% of the APM permits issued (Figure 6). It is important to remember that a limited amount of mechanical control of submerged and floating leaf vegetation can be done

without a permit and a permit is always required when herbicides or automated devices are used for aquatic plant control. The total area permitted statewide for the various methods of near shore aquatic plant removal and the average area permitted per property in 2011 are found in Table 3. Permit holders were asked if they performed the control over the entire area allowed in their permit. Nearly 26% of those responding indicated that control work done was less than the area permitted, a 2% increase from 2010.

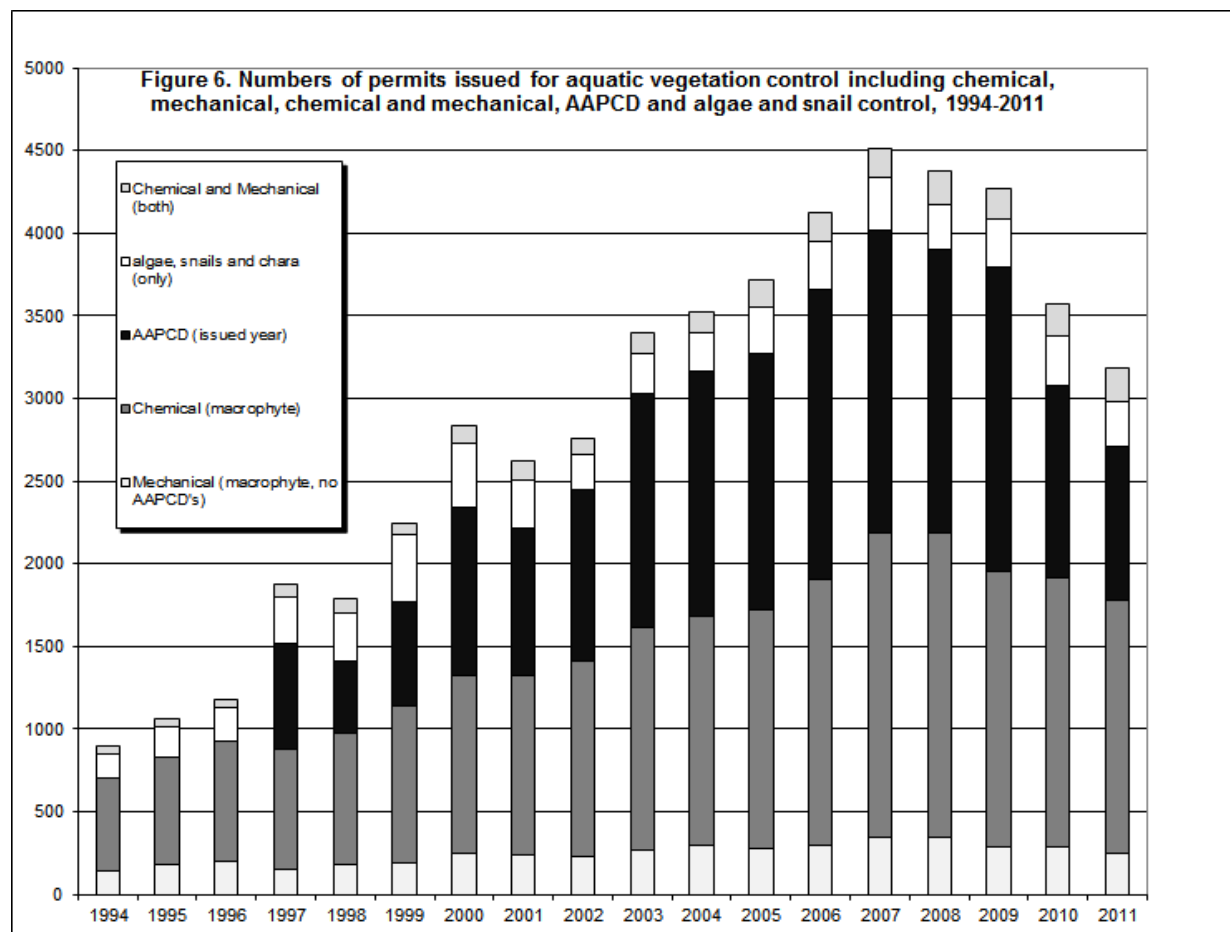


Table 3. Total near-shore area permitted, in acres, by region, for control of submerged vegetation, swimmer's itch and AAPCD use in 2011.

Control	Region						Total number of acres	Props	Ave. Prop. (sq. ft.).
	1	2A	2B	3A	3B	4			
Herbicide control excluding open water treatment	48.3	3.5	63.4	499.4	132.0	67.8	814.4	4959	6810
Mechanical control excluding open water removal	59.5	0.6	30.1	41.3	8.5	17.6	157.6	1470	4563
Swimmer's itch control *	16.0	3.9	25.5	3.6	21.2	3.0	73.2	416	7489
AAPCD 2011 issued	34.7	0.2	16.9	6.5	15.5	2.3	76.1	965	3435

* includes all permits with swimmers itch control

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Percent of Aquatic Plant Removal Permits Used

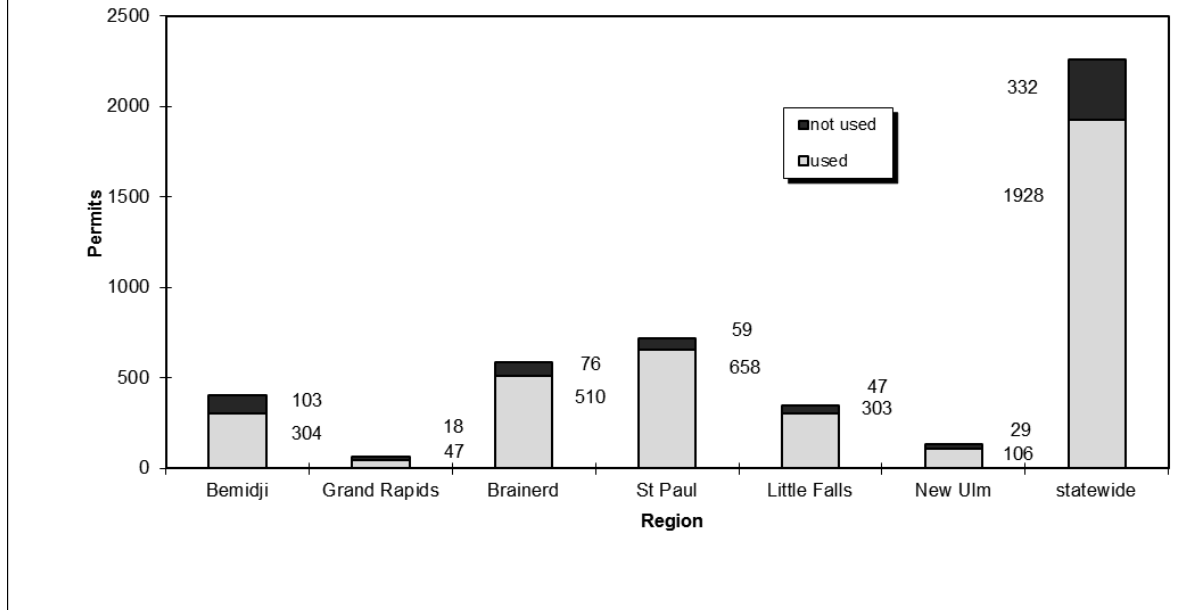
Each year some permits issued for aquatic plant management activities are not used (Figure 7). Statewide, 86% of permits issued were reported used by the permittees who did their own control. Commercial applicators/operators reported using 94% of the permits issued for work they did. Permittees indicating that their permit was not used were asked to indicate why by responding to one or more choices provided on the survey. The results are summarized in Table 4, below. In 2011, the reason most frequently given (43%) for not using an APM permit was for unidentified reasons.

Table 4. Response by permit holders to choices indicating that their APM permit was not used, expressed as a percent by region in 2011.

Region	1	2A	2B	3A	3B	4	Statewide
nuisance condition did not develop	7	0	9	12	13	31	11
got permit too late	5	11	5	5	9	10	6
unable to do the work	32	44	32	14	26	10	27
state shut down	19	28	9	5	7	7	12
other	37	17	44	64	46	41	44
total	100	100	100	100	100	100	100

1 = Bemidji, 2A = Grand Rapids, 2B = Brainerd, 3A = St. Paul, 3B = Little Falls, 4 = New Ulm

Figure 7. Total reported number of permits used and not used by region (excluding AAPCD permit holders), 2011.



Who does control

Commercial applicators and mechanical control companies performed about 65% of the permitted control statewide in 2011. This represents a 6% increase from the percent of the permitted control done by commercial applicator and commercial mechanical control companies in 2010. Permit holders in the Central Region hire commercial services more frequently than any other region (Figure 8). Commercial aquatic plant control companies perform about 84% of the permitted control in the Metro Area. In 2011, 28% of the permitted control in the Northeast Region was performed by commercial service. Most of this control is in the Brainerd Lakes Area of the NE Region. In the Grand Rapids area (2A) of the NE Region most permitted control is done by the homeowner. Permit holders perform about 70% of the permitted control in the Northwest Region and 60% in the South Region. The amounts of homeowner conducted control has decreased slightly over that of 2010 (Figure 8a).

Satisfaction

Permittees who personally undertook aquatic plant control activities were asked to indicate their satisfaction with the results of the aquatic plant control. Generally, permit holders were satisfied with the results of the control. About 75% of the respondents were satisfied with the results of herbicide control. About 70% of those responding were satisfied with the results of treatments to control swimmer's itch and 50% of respondents were satisfied with results of mechanical control. It is important to

Figure 8. Percent of reported permitted APM work done by permittee and by commercial service for each region in 2011.

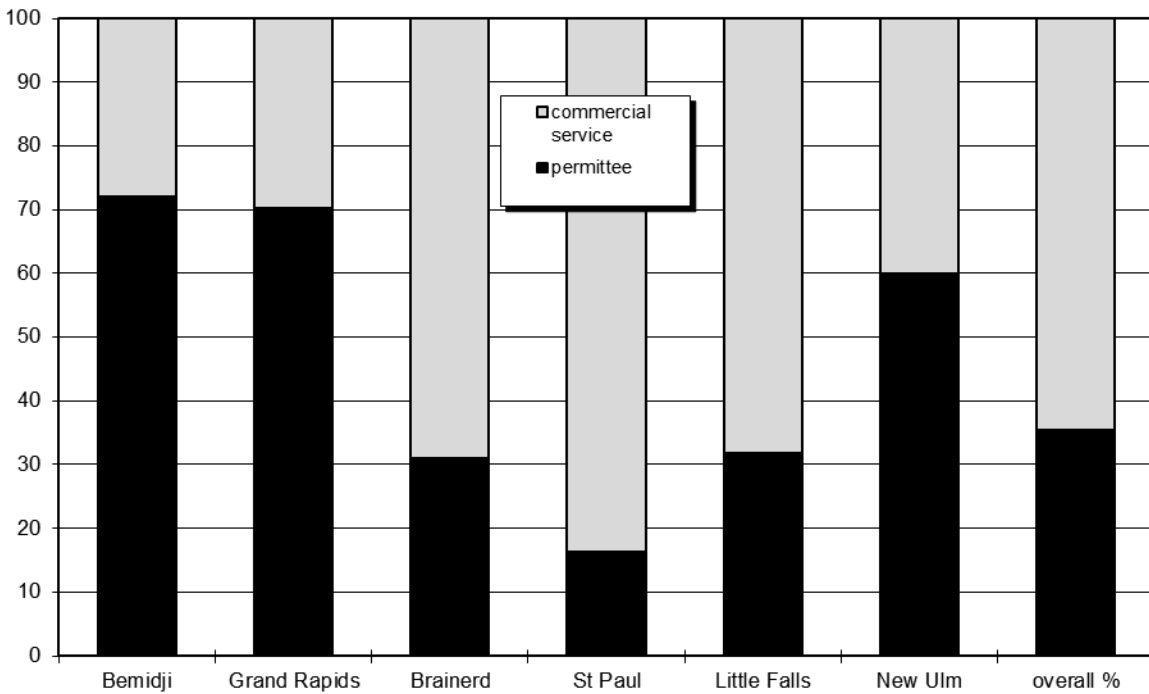
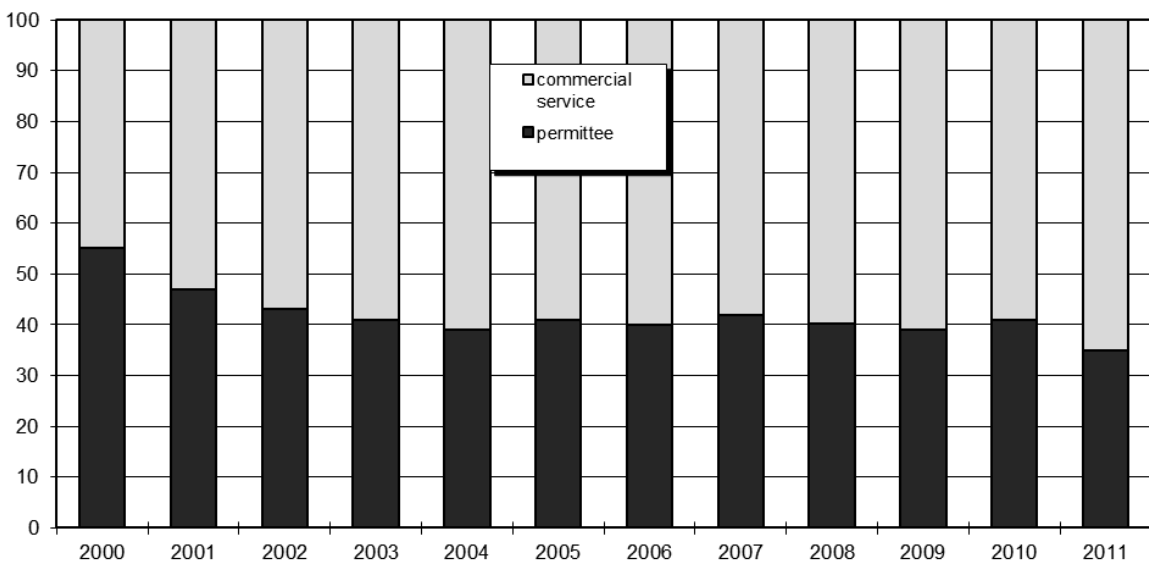


Figure 8a. Percent of reported permitted APM work done by permittee and by commercial service statewide from 2000-2011.



remember that permit holders hiring commercial services were not included in the survey.

Reapply for permit

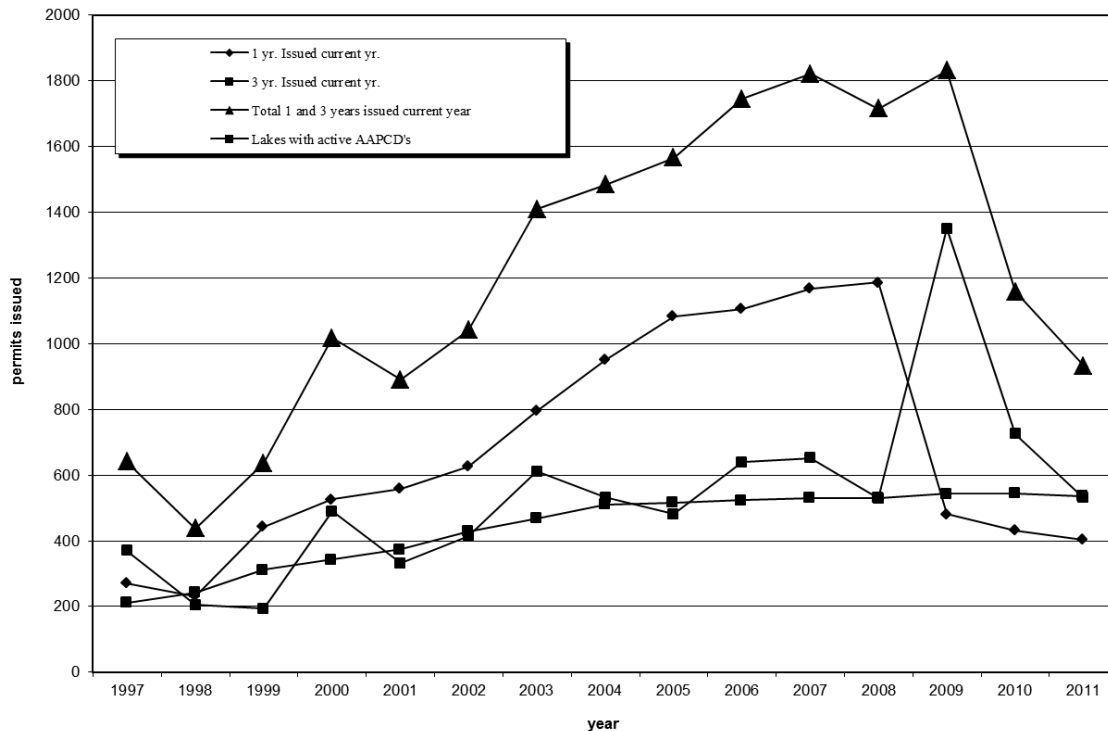
Permit holders, excluding AAPCD permittees, were asked if they would apply for a permit in 2012. Of the 865 responses, 703 (81%) said they would reapply for an APM permit next year, unchanged from 2010. Approximately 16% (138) of the permit holders responding indicated that they were unsure if they would reapply for permit in 2012. The number of permittees reporting that they would not apply (24 or 3%) was slightly higher than in 2010. Regardless of their response, all 2011 permit holders whose permits expire will receive permit application materials prior to the start of the 2012 open water season.

Automated Aquatic Plant Control Devices (AAPCD)

Before 1997 the operation of an AAPCD did not automatically require an APM permit, and few AAPCD permits were issued. The APM Rules were revised in 1997 to require a permit for the operation of these devices because of their potential to excavate bottom sediments, and impact spawning habitat. In 2011 there were 933 permits issued for these devices statewide. Of those permits 403 were issued for a one-year term and 530 were issued for a three-year permit term. About 74 percent of the AAPCD permits were issued in the Northwest and Northeast Regions; up about 4% from 2010. In addition to the permits issued in 2011, there are active three-year permits issued in 2009 and 2010 (1355 and 726 respectively). Of the 933 surveys mailed 819 (88%) of the AAPCD permit holders statewide responded to the questionnaire. Three-year AAPCD permit holders issued permits in 2009 and 2010 were not surveyed.

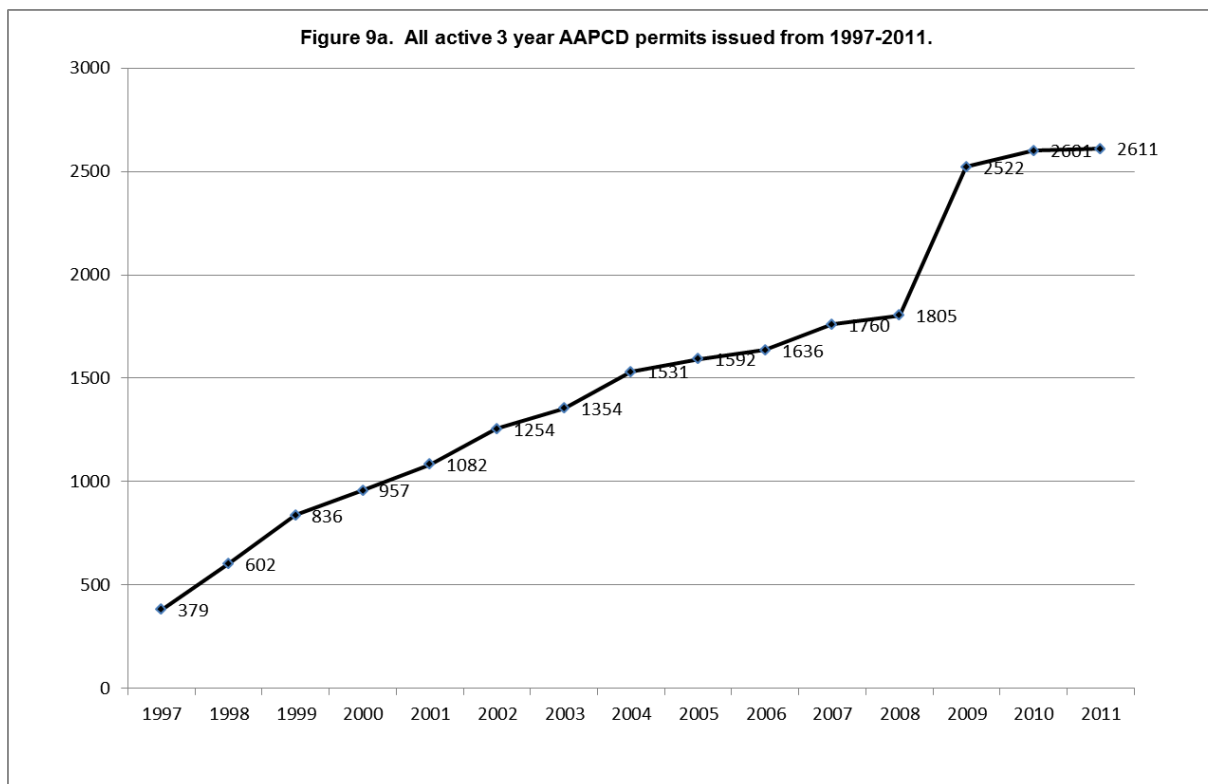
The APM rules provide two permit options for AAPCD operation. A person applying for a permit to operate the device in an area greater than 2,500 square feet is required to obtain an annual permit. However, a three-year permit option is available for persons who limit the size of the area of AAPCD operation to 2,500 square feet or less (*Minnesota Rules*, part 6280.0450, subp.3, item A). In addition, revisions to the APM rules implemented in the 2009 permit season restrict submersed aquatic plant removal to 100 feet of shoreline or one-half the owner's frontage whichever is less (*Minnesota Rules*, part 6280.0350, subp. 1a). Due to this change many more permit holders became eligible for an AAPCD permit of three year duration in 2009.

Figure 9. Numbers of permits issued allowing the use of AAPCD's in Minnesota public waters, 1997-2011



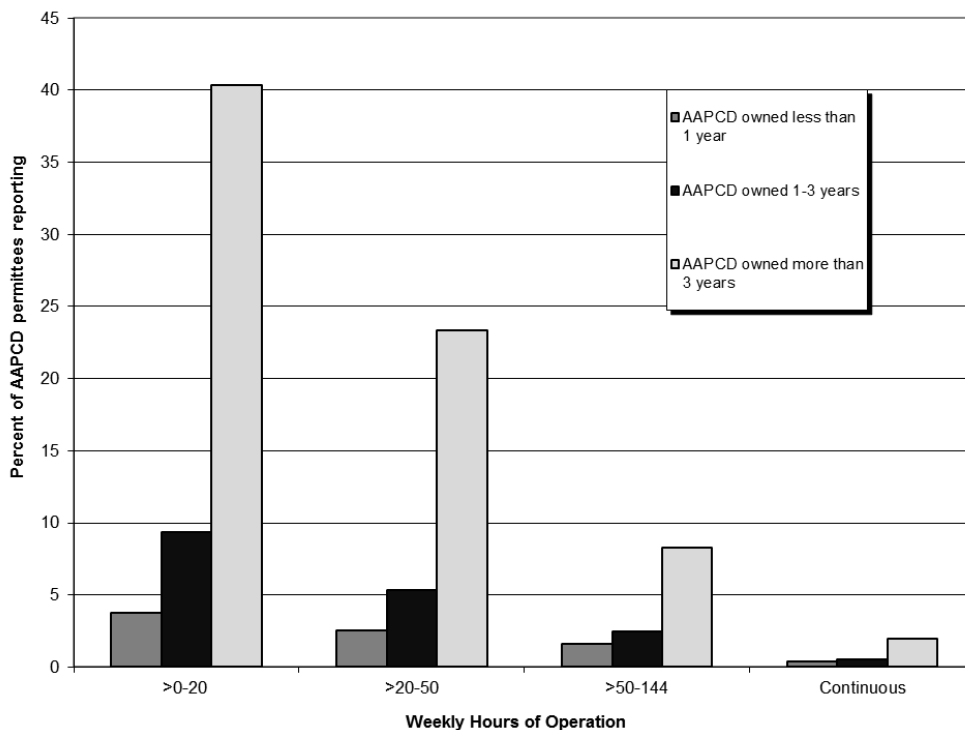
In 2011 there were 196 fewer three-year AAPCD permits than were issued 2010. One year permits show a substantial decrease between 2008 and 2010, more than can be explained by the change in rule. In 2008 there were 1,188 one year permits issued, 756 more than in 2010. There were 933 total AAPCD permits issued in 2011, 225 fewer than in 2010. The number of single season permits issued in 2011 decreased by 29 over 2010 (Figure 9). There was a significant decrease in the total number of permits issued for AAPCD use over the previous two years.

The numbers of permits issued for AAPCD use was down in 2011 and the total number of devices in Minnesota lakes began to level off in 2011. Figure 9a shows all active 3-year AAPCD permits in 2011. If you include the 403 one-year permits issued in 2011 there are approximately 3,014 AAPCDs authorized to operate in Minnesota public waters. About 19 fewer AAPCDs than permitted in 2010.



The manufacturer of the WeedRoller® has stated that with time people will need to use the WeedRoller® less frequently to achieve acceptable control. The company explained that once the plants were gone there would be little need to use the machine. AAPCD permit holders were asked, how frequently do you operate your AAPCD? These responses were sorted by the length of time people had indicated they had owned the machine. Recent AAPCD owners are more likely to operate the device longer than those people who have owned the device for several years (Figure 10). About 141 persons permitted to operate an AAPCD stated that, for various reasons, they did not operate the device in 2011, up slightly from 2010.

Figure 10. AAPCD use from May through August, 2011 catagorized by length of ownership expressed as a percent of all AAPCD permittees reporting.



Filamentous algae control

The APM rules allow the control of filamentous algae with copper sulfate. Filamentous algae can become a nuisance by interfering with swimming and wading. Permit issuance for filamentous algae control has increased at about the same rate as permits for submerged vegetation control (Figure 11). Filamentous algae control is commonly requested on applications for control performed by commercial services. Requests for filamentous algae control declined for the fourth consecutive year in 2011.

Chara control

The APM rules allow the control of chara with copper sulfate. As a result of revisions to the APM rule in 2009 the limits on submersed aquatic plant control (lake shore property owners may receive a permit to control submersed aquatic plants on up to 100 ft, or one-half their frontage whichever less) now apply to the management of Chara. Chara is a macro-algae that can interfere with recreation in some lakes. In 2011 there were approximately 257 lakes where permits were issued for chara control (Figure 12). Applications for chara control decreased slightly in 2011 over the previous year.

Figure 11. Numbers of permits issued for filamentous control, and numbers of lakes where permits were issued 1997-2011.

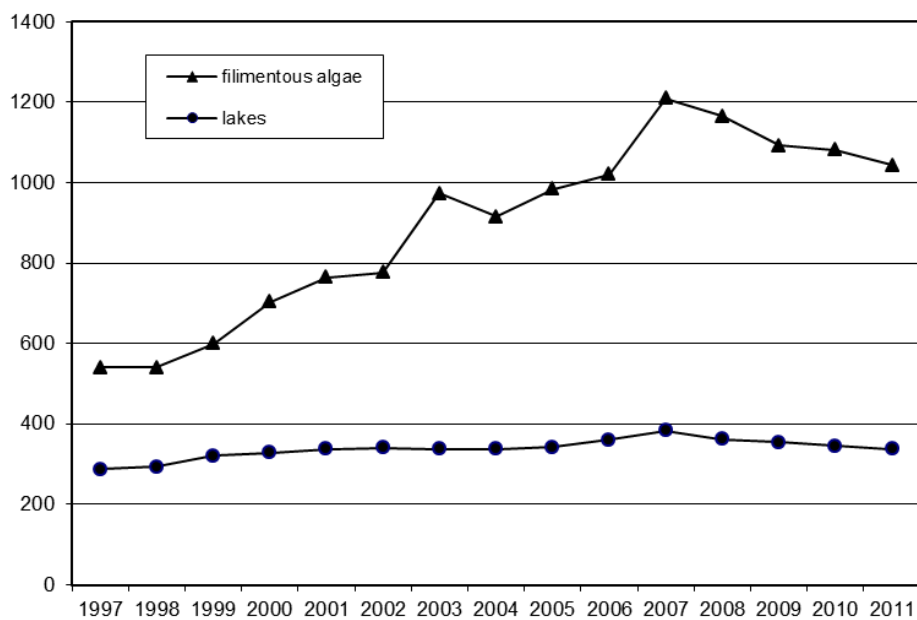
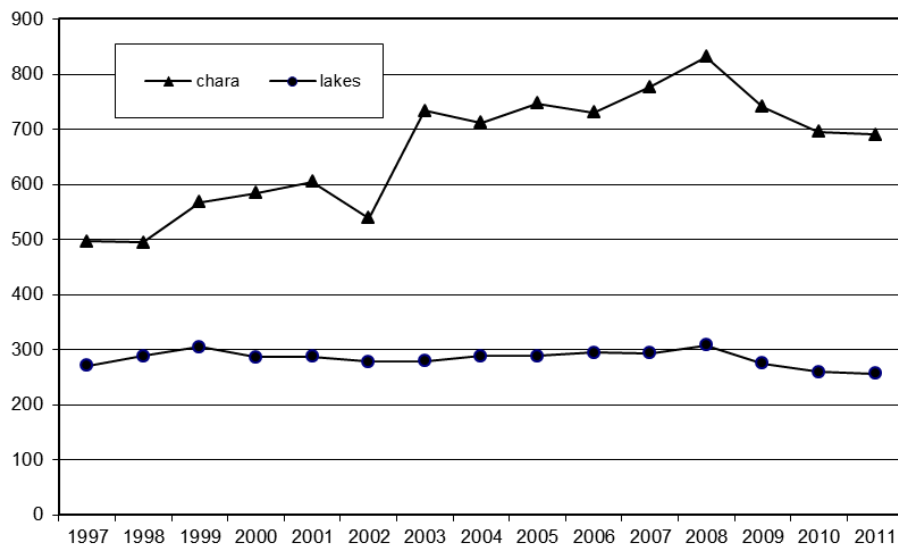


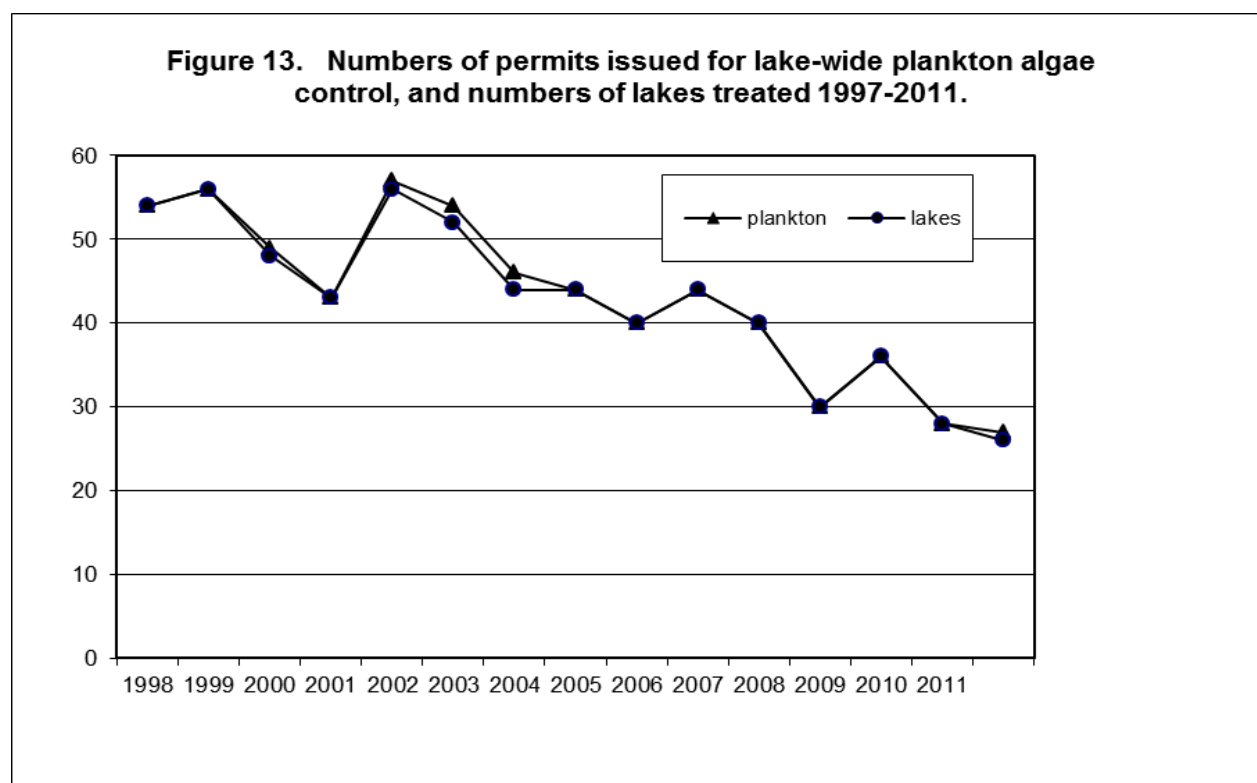
Figure 12. Numbers of permits issued for chara control, and numbers of lakes where permits were issued 1997-2011.



Plankton algae control

The APM rules allow the control of plankton algae when there is an “excessive algae bloom.” The characteristics of an “excessive algae bloom” as defined by the rules are: an algae population dominated by blue green algae, a Secchi disc reading typically 2 feet or less, floating mats or scums of algae have accumulated on the downwind shore, or decomposition of accumulated algae has occurred releasing a blue-green pigment and causing an offensive odor.

The numbers of lakes treated with algaecides to control plankton algae has been decreasing over the last ten years. The overall downward trend in permits issued for plankton algae control continued in 2011 (Figure 13). Copper sulfate treatments can cause an increase in water clarity when the turbidity is due to algae, but the increased water clarity is usually temporary and the treatment may need to be repeated. Due to the temporary nature of control, the possibility of a fish kill caused by a dissolved oxygen decline from decomposing algae, the buildup of copper in lake sediments, and the potential for algae to become resistant to copper, lake-wide plankton algae treatments are discouraged.



Swimmer's itch control in Minnesota lakes

A condition known as Swimmer's itch (a.k.a. lake itch, wader's itch) has garnered complaints from swimmers in Minnesota lakes since at least the 1800's and has likely been around for much longer. The cause of this irritating skin condition was discovered by W.W. Cort in 1928 at the University of Michigan Biological Station (Blankespoor and

Reimink, 1991). Cort discovered that swimmer's itch (cercarial schistosome dermatitis) is caused by the immature life stage of common non-human schistosome trematodes called the cercaria.

These parasites have a complex life history. The adult fluke lives in the blood vessels lining the intestine of its definitive host where it reproduces and releases eggs. The eggs enter the gut and leave the animal in the feces. The eggs hatch when they enter the water becoming a larvae called a miracidia. The miracidia then infects a snail where it develops into a life stage called the cercaria. The cercaria, upon release from the snail, seeks its definitive host, usually some sort of waterfowl. The cercaria does not feed and will only live for about 24 hours unless they find a proper host. When a proper host is located the cercaria penetrates the skin, finds its way to the blood vessels lining the gut, and becomes an adult completing its life history.

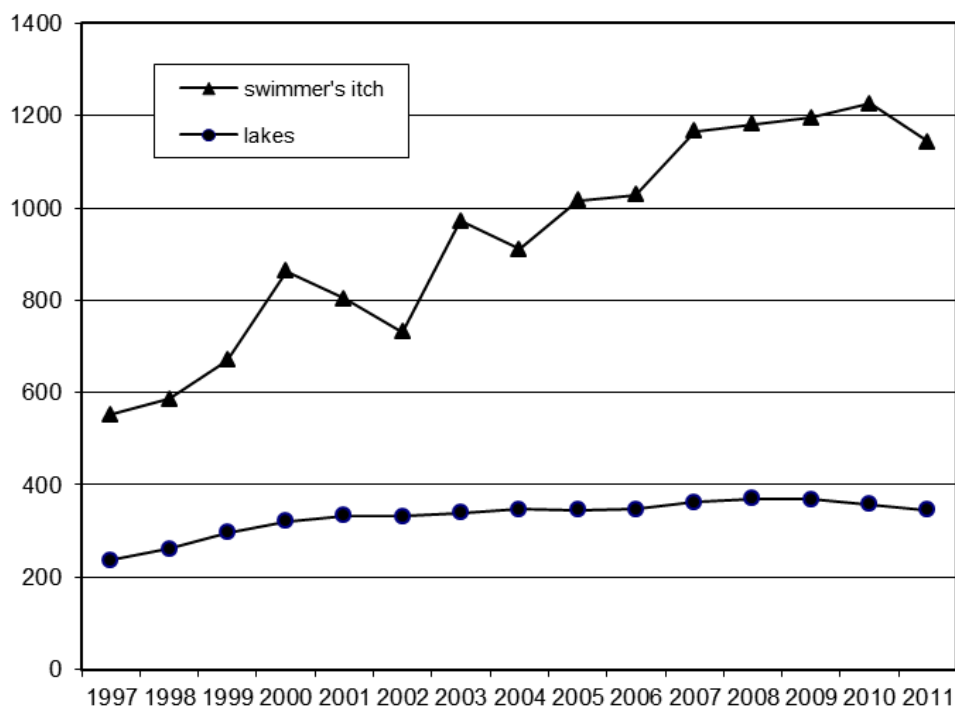
The problem for humans occurs when the cercaria mistakes us for its proper host. When a cercaria penetrates a human's skin it is attacked and killed by the person's immune system. Although the organism cannot complete its life history in humans, individuals sensitive to the infection can suffer from an allergic reaction. The symptoms will appear on areas of the body submersed in the lake and are typified by areas of redness and swelling, similar to a mosquito bite, and are accompanied by a severe itching sensation. These symptoms can last up to two weeks.

Not everyone is bothered by swimmer's itch; about 30 to 40% of the population is sensitive to swimmer's itch infection. This explains why some people swimming in a lake at the same time and place as a person severely affected experience no symptoms. Like other allergic reactions, a person's degree of sensitivity increases with each exposure.

Lakeshore property owners may get a permit from the DNR that allows the application of copper sulfate to the lake for the control of swimmer's itch. The intent of the copper sulfate application is to kill snails that harbor the immature life stage of the fluke that causes swimmer's itch. Individuals receiving a permit to control swimmer's itch with copper sulfate are generally allowed to treat the permitted area 3 times per summer if allowed by the products label.

The numbers of permits issued for swimmer's itch has increased steadily since 1997. The Brainerd Lakes Region has had more lakes per year with permitted swimmer's itch control than any other area of the state. In 2011 there were nearly 346 lakes statewide where permits were issued for swimmer's itch control (Figure 14, Appendix Table H). About 70% of those responding were satisfied with the results of treatments to control swimmer's itch, down slightly from 2010.

Figure 14. Numbers of permits issued for swimmer's itch control, and numbers of lakes where permits were issued 1997-2011.



Invasive species control

In addition to oversight (permitting) responsibilities for aquatic plant management efforts conducted by individuals to improve access or recreational use, the DNR has statewide control programs for four, non-native invasive aquatic plants: curly-leaf pondweed, purple loosestrife, flowering rush, and Eurasian watermilfoil. In 2006, the DNR initiated a grant program to support pilot projects to learn if ecological benefits can be attained from lake-wide control of curly-leaf pondweed or Eurasian watermilfoil or both.

Curly-leaf pondweed

Curly-leaf pondweed (*Potamogeton crispus*) is a non-native invasive, submersed aquatic plant species introduced to Minnesota at the turn of the 20th century. Curly-leaf pondweed is known to occur in 752 Minnesota lakes in 70 of the 87 counties in Minnesota. In many lakes this plant causes severe recreational nuisances.

Curly-leaf pondweed's life cycle is considerably different than native aquatic plants. When native aquatic plants are just beginning to grow (mid to late May) curly-leaf pondweed is forming dense mats on the lakes surface that can interfere with recreation and the growth of native aquatic plants. By mid-summer, (early to mid July) curly-leaf plants begin to die back, which results in rafts of dying plants piling up on shorelines.

Before the plants die they form vegetative propagules called turions (hardened stem tips). New plants sprout from turions in the fall (Catling and Dobson, 1985). The die back is often followed by an increase in phosphorus (Bolduan et al., 1994) and undesirable algal blooms. These algae blooms interfere with light penetration and can also reduce native plant abundance.

Standard control methods provide relief to lakeshore property owners from the recreational nuisances caused by surface mats of curly-leaf pondweed, but have no long-term effect on the abundance of the plant. Research conducted by the U.S. Army Corps of Engineers (ACE) described control strategies that may reduce the abundance of this plant. The key to the new strategies for the control of curly-leaf pondweed is treating the plant early in the season (when water temperatures are between 50 and 60 degrees F). If this early season treatment strategy is repeated in successive years the turion bank should become depleted, resulting in the reduction of overall abundance of the plant, the severity of algae blooms, and give native vegetation a competitive advantage.

Figure 15 shows how interest, reflected by the numbers of permits issued, in curly-leaf pondweed control has increased since the completion of the Army Corp of Engineers research on early season cold-water control.

The Department of Natural Resources is conducting early season curly-leaf pondweed treatments in cooperation with several lake associations on a trial basis to determine the effectiveness of this strategy. In 2011, 26 pilot project lakes were treated with Endothall to control curly-leaf pondweed. One lake and three bays of Lake Minnetonka were treated with herbicide to control both curly-leaf pondweed and Eurasian watermilfoil. These lakes will be treated and monitored for at least five successive years to determine if it is possible to produce ecological benefits such as:

1. Reduce peaks in concentrations of phosphorous and associated algal blooms.
2. Reduce the abundance of curly-leaf pondweed for long periods of time.
3. Increase the abundance of native, submersed aquatic plants.
4. Reduce the interference with use of the lake caused by curly-leaf pondweed.

The development of the pilot project program has significantly influenced the numbers of acres of curly-leaf pondweed and Eurasian watermilfoil treated since the programs beginning in 2005 (Fig. 16). The large decrease in curly-leaf pondweed treated in 2009 is due to the change in treatment strategy for 3,000 acre Lake Benton. Prior to 2009, Lake Benton was subjected to whole lake treatments with fluridone herbicide. In 2010, there was no treatment of curly-leaf pondweed in Lake Benton. However in 2011, 419 acres of curly-leaf pondweed were treated with herbicides in Lake Benton.

More detailed information on this project can be found in the 2011 Invasive Species Program Annual report for
(http://files.dnr.state.mn.us/ecological_services/invasives/annualreport.pdf)

Figure 15. Numbers of permits issued for curly-leaf pondweed and Eurasian watermilfoil control 1998-2011

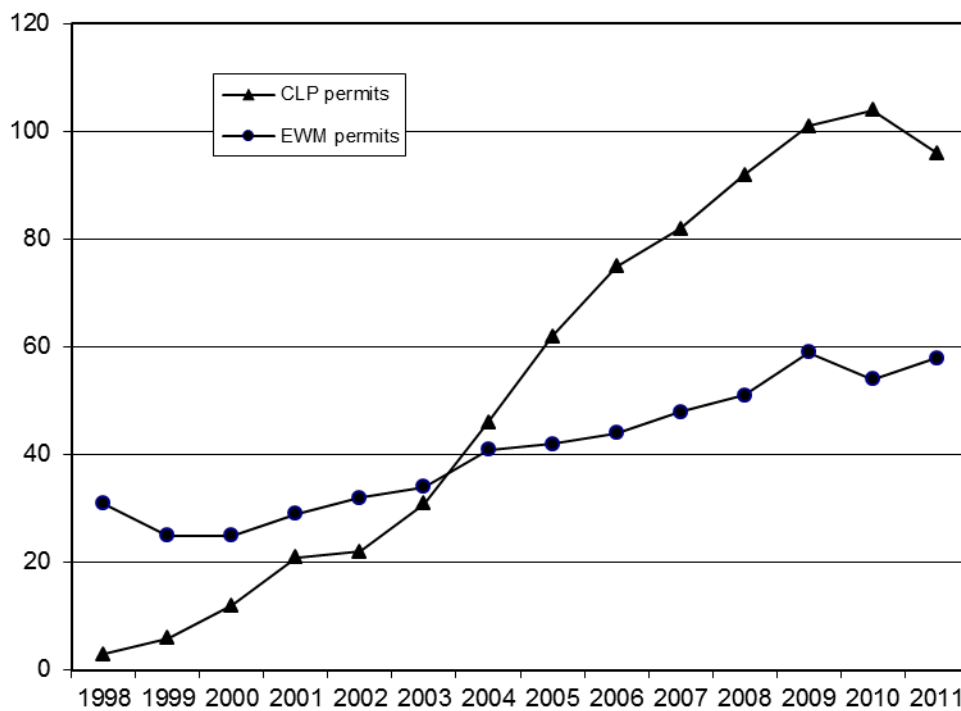
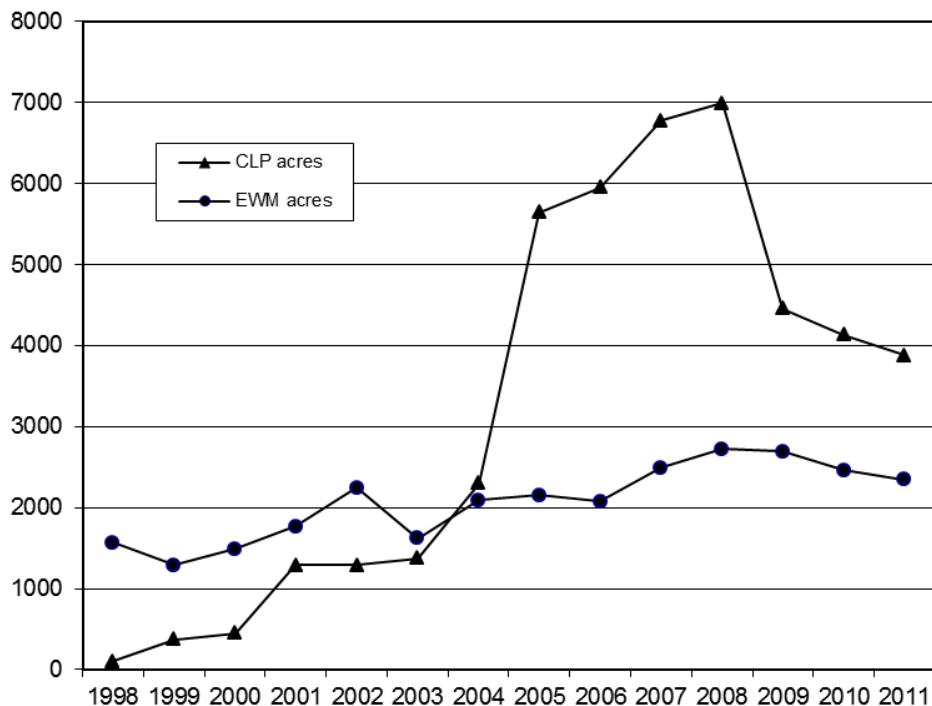


Figure 16. Acres of off-shore curly-leaf pondweed and Eurasian watermilfoil control 1998-2011.



Purple Loosestrife

Purple loosestrife, a non-native invasive plant that can out compete native wetland vegetation, was introduced to North America from Europe in the 1800's and until 1987 was a common ornamental sold by nurseries and landscape companies. Natural resource managers became aware of the plant's invasive nature and disruptive effects on native wetland vegetation in the early 1980's. The DNR, concerned about the plants impact on native species and wildlife habitat, conducted preliminary surveys to determine the status of the plant in Minnesota. The survey revealed that 77 of Minnesota's 87 counties had populations of purple loosestrife in wetlands, lakeshore, stream banks and ditches. In 1987 Minnesota became one of the first states in the nation to develop a program to control this invasive plant. Minnesota has designated purple loosestrife as a noxious weed, which makes it illegal to import, buy, sell, propagate and transport.

The main components of the purple loosestrife program are:

- Inventory purple loosestrife sites to prioritize control efforts.
- Carry out management activities including chemical and biological control.
- Support research to evaluate and improve control efforts.
- Monitor and evaluate the success of biological control and other management efforts.

- Public education/awareness efforts to involve the public in the management of this plant.

Large stands of purple loosestrife are extremely difficult to control because of their enormous seed bank; therefore, it is necessary to prioritize purple loosestrife control efforts. The highest priority stands for herbicide treatment are small, recently established stands, located near the top of the watershed. Because of their small size these newly established sites are poor candidates for biocontrol. Rodeo, a broad-spectrum glyphosate herbicide, is used to spot treat high priority purple loosestrife sites with a backpack sprayer.

Minnesota's herbicide control effort has been reduced dramatically since the introduction of bio-control agents began in 1992. In 2011, DNR staff treated a total of 29 purple loosestrife sites with 0.09 gallons of herbicide. Most of these sites were very small with the majority having fewer than 100 plants. For more detailed information on Minnesota's purple loosestrife program, see the 2011 Invasive Species Annual Program report. (http://files.dnr.state.mn.us/ecological_services/invasives/annualreport.pdf)

Eurasian Watermilfoil

Eurasian watermilfoil, hereafter called milfoil, is an invasive, aquatic plant introduced to North America in the mid-1900's. It was first identified in Minnesota in 1987 in Lake Minnetonka. Milfoil is a submerged aquatic plant that can displace native vegetation. The plant reproduces by fragmentation, establishes itself readily in disturbed areas, and has the potential to become a nuisance in Minnesota lakes. The main strategies of the Eurasian watermilfoil program are:

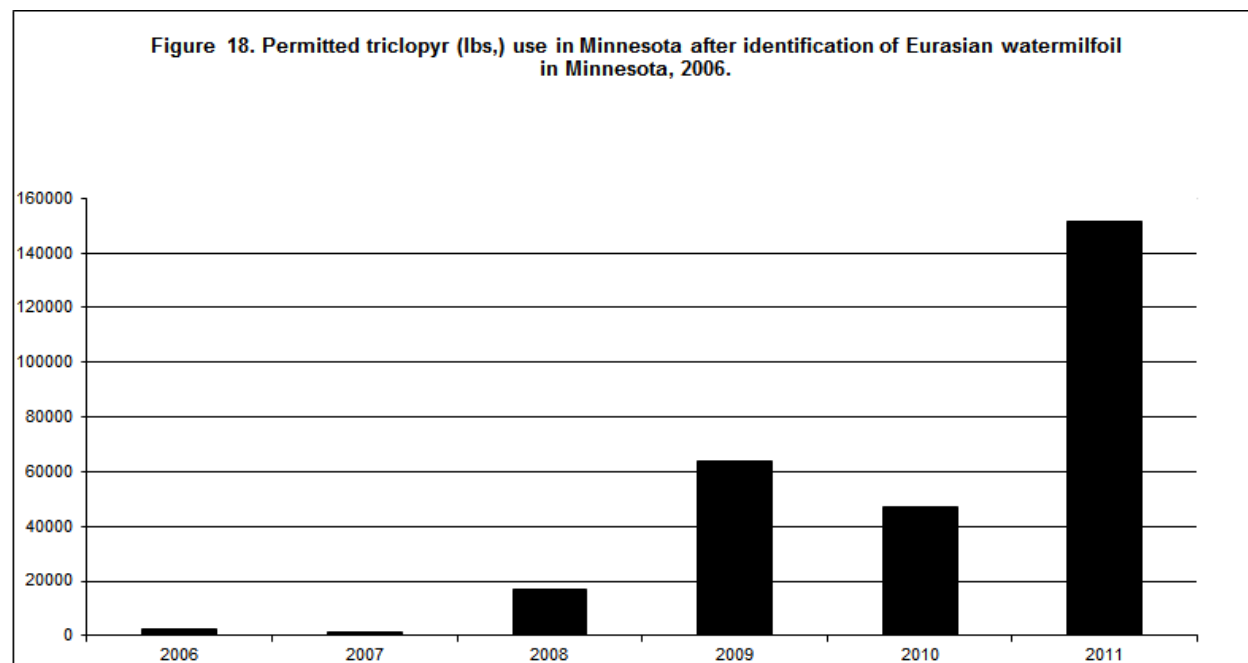
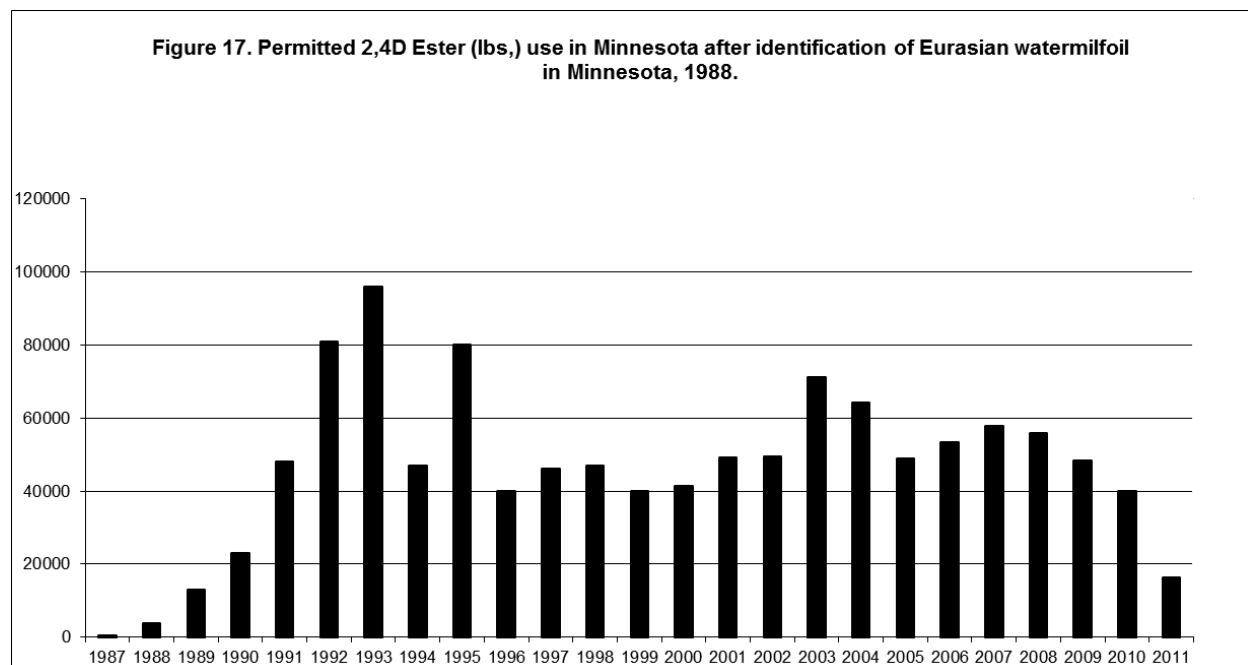
- Slow the spread of the plant through public education and awareness activities.
- Support management by lake associations and local units of government of problems caused by milfoil.
- Maintain an accurate inventory of populations.
- Investigate new control methods and the biology of the plant.

Eurasian watermilfoil was discovered in 10 additional water bodies in 2011. There are now 257 Minnesota lakes known to have populations of this invasive submersed aquatic plant.

The most commonly used herbicide for control of milfoil is a granular 2,4-D ester product labeled for aquatic use. In 2001, a liquid dimethylamine salt 2,4-D product was registered for aquatic use and has been applied to milfoil in Minnesota. Late in 2002, a liquid trimethylamine salt, triclopyr product, was registered for aquatic use and is available for control of milfoil in Minnesota. These systematic herbicides are preferred because they are the most selective products available.

The total reported 2,4-D use in 2011 for milfoil was 16,233 pounds. The total reported annual use of 2,4-D ester products since 1987 is provided in Figure 17. Figure 18 shows the use of triclopyr since 2006.

For more detailed information on the management of invasive species see the 2011 Invasive Species Program Annual Report. The report may be reviewed on line at http://www.dnr.state.mn.us/ecological_services/invasives/index.html.



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APPENDIX

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Table A. A list of commonly used herbicides registered by the EPA for aquatic use and approved by the MN DNR.

Product Name	Selective	Broad Spectrum	Active Ingredient (Formulation)
<u>Part 1. Aquatically labeled systemic herbicides.</u>			
Aquacide (Pellet)	X		2,4 Dichlorophenoxyacetic Acid (Sodium Salt)
Navigate® (Granular)	X		2,4 Dichlorophenoxyacetic (Butoxyethyl Ester)
Riverdaletm (Granular)	X		2,4 Dichlorophenoxyacetic (Isooctyl Ester)
SEE 2,4-D (Liquid)	X		2,4 Dichlorophenoxyacetic (Isooctyl Ester)
Weedtrine II (Granular)	X		2,4 Dichlorophenoxyacetic (Isooctyl Ester)
Sonar (Liquid or Granular)		X	Fluridone
Rodeo (Liquid)		X	Isopropylamine salt of Glyphosate
Pondmaster (Liquid)		X	Isopropylamine salt of Glyphosate
Renovate		X	Triclopyr
Kraken		X	Triclopyr
<u>Part 2. Contact Herbicides.</u>			
Aquathol (Liquid or Granular)		X	Dipotassium salt of endothall
Hydrothol 191 (Liquid or Granular)		X	Mono-amine salt of endothall (liquid by licensed applicator only)
Reward (Liquid)		X	Diquat dibromide (licensed applicator only)
<u>Part 3. Copper Compounds (Algaecides and Herbicides).</u>			
Citrine Plus (Liquid or Granular)	X (A)		Copper-Ethanolamine complex
Komeen (Liquid)	X (H)		Copper-Ethylenediamine complex
Symmetry	X (A)		Copper-Triethanolamine complex
<u>Part 4. Other.</u>			
Copper sulfate	X (A)		CuSO ₄ (wide variety of registered brands)
Aquashade (Liquid)			Acid Blue 9 / Acid Yellow 23 (Filters light in wavelengths required for plant growth)

Table B. Reported various aquatic herbicide use statewide, 1981-2011.

Year	2,4-D ester lbs.	2,4-D salt lbs.	2,4-D amine/ acid gal.	Aquathol lbs.	Aquathol gal.	Diquat (Reward) gal.	Hydrothol 191 lbs.	Hydrothol 191 gal.	Copper sulfate lbs.	Triclopyr lbs.	Triclopyr gal.
1981	150	370	0	1,900	1,300	730	3,200	390	*	*	*
1982	120	320	0	1,700	1,500	550	4,200	44	*	*	*
1983	0	350	0	1,400	1,500	560	11,900	31	*	*	*
1984	110	130	0	730	980	780	7,300	80	*	*	*
1985	25	270	0	740	1,200	870	14,000	100	*	*	*
1986	100	1,400	0	1,100	1,400	1,200	6,900	170	*	*	*
1987	100	1,400	0	1,100	1,400	1,400	13,000	62	*	*	*
1988	3,700	600	0	950	1,300	1,300	11,000	100	*	*	*
1989	13,000	470	0	910	1,300	1,700	12,000	200	*	*	*
1990	23,000	290	0	680	1,100	1,500	9,500	130	*	*	*
1991	48,000	1,300	0	1,400	850	1,400	9,600	210	55,400	*	*
1992	81,000	320	0	870	1,600	1,700	9,000	67	64,000	*	*
1993	96,000	400	0	830	1,000	1,600	5,000	240	34,600	*	*
1994	45,000	700	0	710	940	1,800	10,000	510	59,800	*	*
1995	80,000	87	0	930	700	2,300	8,300	420	55,000	*	*
1996	39,000	400	0	1,000	730	1,900	8,900	830	32,500	*	*
1997	46,000	290	0	1,200	700	2,400	7,800	820	39,700	*	*
1998	47,000	440	0	790	1,280	2,580	4,460	670	50,800	*	*
1999	39,800	650	0	1,050	740	2,280	4,190	740	31,600	*	*
2000	41,500	700	0	1,380	1,850	2,970	5,820	530	41,900	*	*
2001	49,300	1,000	0	700	2,600	2,700	3,900	950	58,200	*	*
2002	49,400	700	20	540	2,660	2,530	4,220	760	42,200	*	*
2003	71,100	634	336	339	2,515	2,370	7,610	429	47,100	*	*
2004	64,100	1,068	216	366	5,200	2,856	8,040	643	53,700	*	*
2005	48,800	1,154	533	1,077	7,054	2,773	6,744	715	63,500	*	*
2006	53,400	805	215	1,530	8,757	2,953	11,653	126	47,000	2,189	28
2007	57,700	971	85	1,320	9,838	3,665	10,105	782	46,000	1,400	46

Table B. Continued

Year	2,4-D ester lbs.	2,4-D salt lbs.	2,4-D amine/ acid gal.	Aquathol lbs.	Aquathol gal.	Diquat (Reward) gal.	Hydrothol 191 lbs.	Hydrothol 191 gal.	Copper sulfate lbs.	Triclopyr lbs.	Triclopyr gal.
2008	56,000	655	74	2,462	13,208	2,643	10,693	550	32,290	17,025	1,882
2009	48,250	655	939	725	13,801	1,791	7,963	1,758	25,234	63,896	662
2010	39,932	731	1,070	737	10,238	1,501	7,973	90	23,200	47,379	1,371
2011	16,233	775	1,066	578	10,936	1,760	5,426	626	22,341	151,593	587

* Date not available

Table C.

2011 AQUATIC PLANT MANAGEMENT SURVEY

Please check the appropriate circle.

1. Was your 2011 permit used? ☐ Yes, permitted work was done.

☐ No, because: The nuisance conditions did not develop.

☐ No, because: I got the permit too late.

☐ No, because: I was unable to get the work done.

☐ No, because:

Thanks! Please use the back for comment

2. When my permit expires:

☐ I will reapply for a permit.

☐ I have a permanent and non-transferable permit.

☐ I will not apply for a permit.

☐ I am undecided at this time.

3. The method of control was

☐ cutting or pulling.

☐ chemical treatment.

☐ cutting or pulling and chemical treatment.

4. A. Were you satisfied with the aquatic plant control work done (for Swimmers Itch control only skip to 4.

☐ YES ☐ NO ☐ wasn't as good as expected

B. If you treated for **Swimmers Itch** were you satisfied with the control

☐ YES ☐ NO ☐ wasn't as good as expected

5. When was the work done?

☐ April ☐ May ☐ June ☐ July ☐ August ☐ September ☐ October ☐ November ☐ uncertain

6. To provide us with some idea of how much control actually took place we would like to know if the control work was the entire area allowed by the permit or less than the allowed area.

☐ Yes, control work was done on the entire area permitted

☐ No, less control work was done than the permit allowed

7. If you used herbicide, please indicate what you used and how much

What Did You Use?

How much concentrated product did you use before mixing? circle the measure

Copper sulphate _____ lbs.

Aquakleen/Navigate _____ lbs.

gran.Hydrothol 191 _____ lbs.

Aquacide _____ lbs.

liq. Aquathol K _____ gal., qts., oz

liq. Cutrine Plus _____ gal., qts., oz.

gran.Aquathol _____ lbs.

gran. Cutrine Plus _____ lbs.

liq. Hydrothol 191 _____ gal., qts., oz

Rodeo _____ gal., qts., oz.

Reward _____ gal., qts., oz

other: _____ lbs., gal., qts., oz

Renovate OTF _____ lbs.

other: _____ lbs., gal., qts., oz

We value your comments. Please use the back. Thanks!

Note: Please return this survey as soon as possible.

Table D.

2011 AQUATIC PLANT MANAGEMENT SURVEY
Automated Aquatic Plant Control Device (AAPCD)

Please check the appropriate circle.

1. The type of AAPCD device I have a permit for is a:
- ☐ WeedRoller
 - ☐ Beach Groomer
 - ☐ Lake Maid
 - ☐ other

2. I used an AAPCD this year.
- ☐ Yes
 - ☐ No, I did not use an AAPCD this year.
 - ☐ I'll explain on the back.

3. The AAPCD I used in 2011-

- | | | |
|---|--|-------------------------------------|
| I have owned for: | Is jointly owned and shared
with the other co-owners and
has been for: | |
| <input type="radio"/> less than 1 year | <input type="radio"/> less than 1 year | <input type="radio"/> was rented. |
| <input type="radio"/> 1 - 3 years | <input type="radio"/> 1 - 3 years | <input type="radio"/> was borrowed. |
| <input type="radio"/> more than 3 years | <input type="radio"/> more than 3 years | |

4. How long each month (in hours) did you operate your AAPCD ?

- | | | | | | |
|------------|-----------------------|-----------------------|----------------------------|--------------------------|-----------------------|
| | not
used | few
hours
>0-20 | several
hours
>20-50 | many
hours
>50-144 | continuous |
| In May: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| In June: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| In July: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| In August: | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

We value your comments. Please use the back. Thanks!

Note: Please return this survey as soon as possible.

Table E. Aquatic Pesticide Enforcement Use Inspections, 2011.

Treatment Date	County	Lake Name	Applicator	Permit
05/09/11	Hennepin	Medicine	Lake Restoration	11F-3A075
05/11/11	LeSueur	Jefferson	Lake Management	11F-4090
05/16/11	LeSueur	Tetonka	Culbert Nursery	11F-4091
05/17/11	Morrison	Long	Professional Lake Management	11F-3A599
05/17/11	Crow Wing	Lower Cullen	Professional Lake Management	11F-2B00202
05/17/11	Washington	Forest 3	Lake Management	11F-3A100
05/19/11	Cass	Margaret	Professional Lake Management	11F-2B00616
05/20/11	Dakota	Orchard	Professional Lake Management	11F-3A382
05/24/11	Morrison	Fish Trap	Professional Lake Management	11F-3B276
05/24/11	Hennepin	Libbs	Midwest AquaCare	11F-3A342
05/25/11	Crow Wing	Lower Mission	Professional Lake Management	11F-2B00330
06/06/11	Ramsey	Owasso	Lake Management	11F-3A384
06/06/11	Hennepin	Weaver	Jacobson Environmental PLLC	11F-3A305
06/07/11	Dakota	Crystal	Lake Restoration	11F-3A297
06/08/11	Hennepin	Mtka Blacks	Lake Restoration	11F-3A254
06/13/11	Scott	Lower Prior	Lake Restoration	11F-3A450
06/16/11	Hennepin	Schmidt	Professional Lake Management DBA Lake Weed Away	11F-3A343
06/17/11	Ramsey	Gervais	Lake Improvement Consulting	11F-3A434
06/23/11	Anoka	Coon	Lake Restoration	11F-3A251
06/23/11	Anoka	Coon	Lake Restoration	11F-3A251
07/22/11	Washington	Forest 3	Lake Management	11F-3A280
07/25/11	Chisago	Rush	Lake Restoration	11F-3A392
07/26/11	Ramsey	Josephine	Lake Management	11F-3A175
07/27/11	Hennepin	Mtka Libbs	Midwest AquaCare	11F-3A342
07/28/11	Chisago	Green	Lake Restoration	11F-3A260
07/29/11	Ramsey	Gervais	Lake Improvement Consulting	11F-3A434
07/29/11	Carver	Zumbra	Midwest AquaCare	11F-3A634
07/29/11	Hennepin	Pauly's Pond	Professional Lake Management DBA Lake Weed Away	11F-3A663
08/03/11	Sherburne	Rush	Lake Management	11F-3A167
08/04/11	Ramsey	Johanna	Lake Restoration	11F-3A451
08/04/11	Hennepin	Wanda Miller Pond	Professional Lake Management DBA Lake Weed Away	11F-3A665
08/05/11	Anoka	Coon	Lake Restoration	11F-3A251
08/08/11	Chisago	Green	Green Lake Association	11F-3A340

Table E. Continued

Treatment Date	County	Lake Name	Applicator	Permit
08/10/11	Chisago	Chisago to Hwy 83 ditch	Critical Connections Ecological Services, Inc.	11F-3A856
08/15/11	Washington	White Bear	Lake Management	11F-3A825
08/17/11	Dakota	Sunfish	Lake Management	11F-3A815
08/24/11	Hennepin	Red Rock	Jacobson Environmental PLLC	11F-3A867
08/25/11	Ramsey	Turtle	Midwest AquaCare	11F-3A599

Table F. Statewide numbers of permits and properties by county, 2011.

County	Permits	Properties
Aitkin	138	150
Anoka	34	115
Becker	145	178
Beltrami	14	14
Blue Earth	4	30
Carlton	18	18
Carver	83	294
Cass	197	200
Chisago	70	286
Clay	2	2
Clearwater	1	1
Cottonwood	2	7
Crow Wing	593	903
Dakota	68	339
Douglas	133	133
Faribault	3	60
Freeborn	7	13
Grant	6	10
Hennepin	336	1622
Hubbard	49	49
Isanti	28	86
Itasca	33	33
Jackson	2	2
Kanabec	9	189
Kandiyohi	65	116
Kittson	1	1
Lake of the Woods	1	1
LeSueur	34	151
Lincoln	3	3
Mahnomen	1	1
Martin	4	4
McLeod	1	2
Meeker	25	164
Mille Lacs	21	32
Morrison	69	283

Table F. (Continued)

County	Properties	Permits
Nicollet	1	1
Nobles	1	1
Olmsted	1	1
Otter Tail	329	334
Pine	27	88
Pipestone	1	1
Polk	3	3
Pope	47	50
Ramsey	95	938
Rice	22	133
Rock	2	2
Scott	70	381
Sherburne	43	168
St. Louis	23	23
Stearns	109	145
Steele	2	2
Todd	78	87
Wadena	7	7
Waseca	7	11
Washington	91	535
Watonwan	1	1
Wilkin	2	2
Wright	146	526
Yellow Medicine	1	3

Table G. Lakes with nine or more total permits issued for swimmer's itch from 1997 through 2011.

Region	County	Lake	Total permits issued
2	Aitkin	Big Sandy	45
2	Aitkin	Clear	19
2	Aitkin	Farm Island	166
2	Aitkin	Gun	53
2	Aitkin	Hanging Kettle	10
2	Aitkin	Minnewawa	33
2	Aitkin	Pine	18
2	Aitkin	Pine	9
2	Aitkin	Pine	26
2	Aitkin	Round	25
2	Aitkin	Spirit	22
3	Anoka	Centerville	14
3	Anoka	Coon	86
3	Anoka	George	23
3	Anoka	Golden	29
3	Anoka	Ham	23
3	Anoka	Harris Pond	9
3	Anoka	Labelle Pond	12
3	Anoka	Linwood	32
3	Anoka	Otter	28
1	Becker	Detroit	54
1	Becker	Height of Land	11
1	Becker	Sallie	18
1	Beltrami	Julia	13
1	Beltrami	Marquette	9
2	Carlton	Eagle	80
2	Carlton	Tamarack	16
3	Carver	Bavaria	21
3	Carver	Burandt	29
3	Carver	Eagle	11
3	Carver	Firemans	14
3	Carver	Grace	12
3	Carver	Lotus	98
3	Carver	Lucy	13
3	Carver	Minnewashta	104
3	Carver	Pierson	58
3	Carver	Riley	62
3	Carver	Schutz	10
3	Carver	Virginia	38

Table G. Continued.

Region	County	Lake	Total permits issued
3	Carver	Waconia	38
3	Carver	Wassermann	10
3	Carver	Zumbra	19
1	Cass	Birch	18
2	Cass	Gull	367
2	Cass	Hardy	11
2	Cass	Margaret	16
2	Cass	Norway	9
2	Cass	Roosevelt	70
2	Cass	Sylvan	42
1	Cass	Ten Mile	9
2	Cass	Upper Gull	27
3	Chisago	Chisago	37
3	Chisago	Fish	18
3	Chisago	Goose	21
3	Chisago	Green	82
3	Chisago	Horseshoe	11
3	Chisago	Kroon	16
3	Chisago	Little Comfort	12
3	Chisago	Mandall	9
3	Chisago	North Center	85
3	Chisago	North Lindstrom	12
3	Chisago	Rush	78
3	Chisago	South Center	101
3	Chisago	South Lindstrom	34
1	Clay	Blue Eagle	15
1	Clearwater	Lamont	12
2	Crow Wing	Bay	100
2	Crow Wing	Bertha	101
2	Crow Wing	Big Trout	110
2	Crow Wing	Blackhoof	12
2	Crow Wing	Clamshell	25
2	Crow Wing	Clark	17
2	Crow Wing	Clearwater	9
2	Crow Wing	Crooked	19
2	Crow Wing	Cross	111
2	Crow Wing	Crow Wing	74
2	Crow Wing	Daggett	75
2	Crow Wing	Eagle	12
2	Crow Wing	Edward	15

Table G. Continued.

Region	County	Lake	Total permits issued
2	Crow Wing	Gilbert	84
2	Crow Wing	Gladstone	18
2	Crow Wing	Hubert	20
2	Crow Wing	Island	22
2	Crow Wing	Little Hubert	22
2	Crow Wing	Little Pine	55
2	Crow Wing	Love	25
2	Crow Wing	Lower Cullen	45
2	Crow Wing	Lower Hay	42
2	Crow Wing	Lower Mission	31
2	Crow Wing	Middle Cullen	27
2	Crow Wing	Nisswa	34
2	Crow Wing	North Long	119
2	Crow Wing	O'Brien	44
2	Crow Wing	Ossawinnamakee	55
2	Crow Wing	Pelican	61
2	Crow Wing	Perch	63
2	Crow Wing	Pig	20
2	Crow Wing	Pine	21
2	Crow Wing	Portage	21
2	Crow Wing	Red Sand	21
2	Crow Wing	Rice	30
2	Crow Wing	Round	152
2	Crow Wing	Roy	65
2	Crow Wing	Rush	123
2	Crow Wing	Serpent	133
2	Crow Wing	Sibley	27
2	Crow Wing	South Long	145
2	Crow Wing	Upper Cullen	22
2	Crow Wing	Upper Hay	76
2	Crow Wing	Upper Mission	30
2	Crow Wing	Upper South Long	68
2	Crow Wing	West Fox	18
2	Crow Wing	White Sand	57
2	Crow Wing	Whitefish	177
2	Crow Wing	Crystal	100
2	Crow Wing	Lee	11
2	Crow Wing	Marion	36
2	Crow Wing	Orchard	27

Table G. Continued.

Region	County	Lake	Total permits issued
3	Dakota	Roseberger	12
3	Dakota	Salem	16
3	Dakota	Sunfish	12
3	Dakota	Warrior Pond	11
1	Douglas	Carlos	29
1	Douglas	Darling	32
1	Douglas	Geneva	16
1	Douglas	Henry	9
1	Douglas	Ida	50
1	Douglas	Irene	93
1	Douglas	Le Homme Dieu	56
1	Douglas	Miltona	54
4	Faribault	Bass	19
4	Freeborn	Morin	9
1	Grant	Pelican	19
1	Grant	Pomme De Terre	13
3	Hennepin	Arrowhead	12
3	Hennepin	Bass	16
3	Hennepin	Bryant	38
3	Hennepin	Bush	15
3	Hennepin	Castle Ridge	14
3	Hennepin	Christmas	35
3	Hennepin	Duck	25
3	Hennepin	Dutch	18
3	Hennepin	Eagle	54
3	Hennepin	Fish	53
3	Hennepin	Forest	25
3	Hennepin	Gleason	26
3	Hennepin	Greentree Pond	14
3	Hennepin	Hadley	19
3	Hennepin	Independence	66
3	Hennepin	Indianhead	10
3	Hennepin	Long	13
3	Hennepin	Lower Twin	22
3	Hennepin	Medicine	84
3	Hennepin	Melody	15
3	Hennepin	Minnetonka Cooks	86
3	Hennepin	Mtka Black	54
3	Hennepin	Mtka Browns	35
3	Hennepin	Mtka Carmans	73

Table G. Continued.

Region	County	Lake	Total permits issued
3	Hennepin	Mtka Carsons	57
3	Hennepin	Mtka Crystal	67
3	Hennepin	Mtka E Upper Lake	30
3	Hennepin	Mtka E Upper Lake	67
3	Hennepin	Mtka Emerald	34
3	Hennepin	Mtka Excelsior	46
3	Hennepin	Mtka Gideons	84
3	Hennepin	Mtka Grays Bay	35
3	Hennepin	Mtka Halsteds	92
3	Hennepin	Mtka Harrisons Bay	43
3	Hennepin	Mtka Jennings	50
3	Hennepin	Mtka Lafayette	81
3	Hennepin	Mtka Lower Lake N	30
3	Hennepin	Mtka Lower Lake S	60
3	Hennepin	Mtka Maxwell	59
3	Hennepin	Mtka North Arm	93
3	Hennepin	Mtka Phelps	74
3	Hennepin	Mtka Priests	60
3	Hennepin	Mtka Robinsons	32
3	Hennepin	Mtka S. Upper Lake	72
3	Hennepin	Mtka Seton	18
3	Hennepin	Mtka Smiths	18
3	Hennepin	Mtka Smithtown	58
3	Hennepin	Mtka Spring Park	45
3	Hennepin	Mtka St. Albans	79
3	Hennepin	Mtka St. Louis	24
3	Hennepin	Mtka Stubbs	36
3	Hennepin	Mtka Wayzata	56
3	Hennepin	Mtka West Arm	51
3	Hennepin	Parkers	33
3	Hennepin	Rebecca	14
3	Hennepin	Red Rock	53
3	Hennepin	Rose	9
3	Hennepin	Round	13
3	Hennepin	Sarah	88
3	Hennepin	Schmidt (Smith)	18
3	Hennepin	Shady Oak	14
3	Hennepin	Stauder Pond	11
3	Hennepin	Weaver	31
3	Hennepin	Wrestling (Unnamed)	12

Table G. Continued.

Region	County	Lake	Total permits issued
1	Hubbard	Alice	13
1	Hubbard	Bad Axe	10
1	Hubbard	Big Sand	24
1	Hubbard	Fishhook	12
1	Hubbard	Portage	15
3	Isanti	Blue	37
3	Isanti	Fannie	30
3	Isanti	Long	15
3	Isanti	Paul	24
3	Isanti	Skogman	9
2	Itasca	Spectacle	19
2	Itasca	Bass	14
2	Itasca	Bowstring	13
2	Itasca	Jessie	19
2	Itasca	Sand	19
2	Itasca	Swan	87
3	Kanabec	Fish	28
3	Kanabec	Mud	13
4	Kandiyohi	Eagle	46
4	Kandiyohi	Elkhorn	17
4	LeSueur	Sekatah	17
4	LeSueur	Tetonka	46
4	LeSueur	Washington	59
4	Meeker	Long	13
2	Mille Lacs	Mille Lacs	55
3	Morrison	Alexander	76
3	Morrison	Crookneck	67
3	Morrison	Fish Trap	38
3	Morrison	Green Prairie Fish	11
3	Morrison	Platte	133
3	Morrison	Shamineau	18
3	Morrison	Sullivan	21
3	Olmsted	George	9
1	Otter Tail	Deer	35
1	Otter Tail	East Battle	19
1	Otter Tail	East Leaf	9
1	Otter Tail	Jewett	25
1	Otter Tail	Marion	34
1	Otter Tail	Rush	27
1	Otter Tail	Stalker	17

Table G. Continued.

Region	County	Lake	Total permits issued
1	Otter Tail	Wall	25
3	Pine	Cross	40
3	Pine	Pokegama	16
3	Pine	Sand	15
3	Pine	Upper Pine	16
2	Pine/Aitkin	Big Pine	73
1	Pope	Amelia	28
1	Pope	Linka	55
1	Pope	Minnewaska	36
1	Pope	Scandinavian	12
1	Pope	Villard	12
3	Ramsey	Bald Eagle	77
3	Ramsey	Dumbell Pond	9
3	Ramsey	Gervais	38
3	Ramsey	Gilfillan	19
3	Ramsey	Island	16
3	Ramsey	Johanna	32
3	Ramsey	Josephine	40
3	Ramsey	Keller	16
3	Ramsey	Kerry Pond	15
3	Ramsey	Kohlman	22
3	Ramsey	McCarrons	41
3	Ramsey	Owasso	35
3	Ramsey	Peppertree Pond	16
3	Ramsey	Pleasant	11
3	Ramsey	Silver (NSP)	18
3	Ramsey	Snail	46
3	Ramsey	Turtle	38
3	Ramsey	Wabasso	24
4	Rice	Cedar	11
4	Rice	Mazaska	10
4	Rice	Roberds	17
3	Scott	Cedar	54
3	Scott	Fish	21
3	Scott	O'Dowd	36
3	Scott	Prior	171
3	Scott	Spring	39
3	Scott	Thole	32
3	Scott	Upper Prior	81
3	Sherburne	Big	48

Table G. Continued.

Region	County	Lake	Total permits issued
3	Sherburne	Briggs	23
3	Sherburne	Eagle	17
3	Sherburne	Elk	15
3	Sherburne	Fremont	17
3	Sherburne	Julia	22
3	Sherburne	Mitchell	31
3	Sherburne	Rush	15
2	St. Louis	Big Sturgeon	20
2	St. Louis	Long	24
2	St. Louis	Prairie	9
2	St. Louis	Big Fish	18
2	St. Louis	Big Spunk	23
2	St. Louis	Carnelian	9
2	St. Louis	Grand	30
3	Stearns	Koronis	18
3	Stearns	Middle Spunk	9
3	Stearns	North Browns	14
3	Stearns	Pearl	29
3	Stearns	Pelican	79
3	Stearns	Rice	41
3	Todd	Big Birch	24
3	Todd	Big Swan	54
3	Todd	Charlotte	9
3	Todd	Little Birch	11
3	Todd	Mons	15
3	Todd	Mound	36
3	Todd	Osakis	121
4	Waseca	Clear	16
3	Washington	Big Carnelian	66
3	Washington	Big Marine	40
3	Washington	Demontreville	16
3	Washington	Forest	197
3	Washington	Jane	21
3	Washington	Lily	15
3	Washington	Mary	14
3	Washington	Olson	15
3	Washington	Pine Tree	10
3	Washington	Sylvan	9
3	Washington	Tanners	21
3	Washington	White Bear	116

Table G. Continued.

Region	County	Lake	Total permits issued
3	Wright	Augusta	11
3	Wright	Bass	34
3	Wright	Beebe	10
3	Wright	Cedar	44
3	Wright	Charlotte	26
3	Wright	Clearwater	146
3	Wright	Crawford	13
3	Wright	Deer	18
3	Wright	Eagle	13
3	Wright	Fish	17
3	Wright	French	29
3	Wright	Granite	10
3	Wright	Howard	13
3	Wright	Maple	59
3	Wright	Martha	11
3	Wright	Mink	16
3	Wright	Pleasant	46
3	Wright	Pulaski	48
3	Wright	Rock	20
3	Wright	Somers	14
3	Wright	Sugar	87
3	Wright	Sylvia	60
3	Wright	Waverly	47

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