



# **Manoomin (Wild Rice) Abundance and Harvest in Northern Wisconsin in 2012**

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## **MANOOMIN (WILD RICE) ABUNDANCE AND HARVEST IN NORTHERN WISCONSIN IN 2012**

### **INTRODUCTION**

As part of its wild rice management program, the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) conducts annual surveys of wild rice abundance on northern Wisconsin waters. These surveys provide a long term data base on wild rice abundance and annual variability in the ceded territory.

GLIFWC also conducts an annual survey to estimate the amount of wild rice harvested off-reservation in the Wisconsin ceded territory. The Wisconsin Department of Natural Resources (WDNR) cooperates with this survey by providing the names and addresses of state wild rice harvest license purchasers, so that both state and tribal harvest can be estimated. The 2012 survey was similar in design to a survey first conducted in 1987, and repeated each year since 1989, with minor modifications as described in the Methods section.

### **METHODS**

#### **Abundance Estimation**

A select group of 30 lakes and 10 river or flowage sites have been ground surveyed most years since 1985; abundance information from these waters is used to derive a yearly index of rice abundance in the ceded territory. The index is derived by multiplying the number of acres of rice on each water surveyed by a factor ranging from 1 to 5 which relates to rice density (1=sparse, 5=dense) and then summing the values derived for each of the 40 waters. In addition to abundance information, ground surveys include information on habitat suitability (e.g. abundance of competing vegetation, presence of beaver, obvious development impacts). Ground surveys were conducted from mid-July through late August.

Aerial surveys of some of these waters, and additional waters not ground surveyed, were conducted on four days between July 31<sup>st</sup> –August 10<sup>th</sup>. Aerial survey information is limited to an estimate of the size and approximate density of the rice beds. These surveys provide abundance information from waters not ground surveyed, help verify ground estimates of manoomin acreage, occasionally fill in survey gaps when ground crews are unable to access lakes, and help the Commission direct ricers to the more productive stands.

#### **Harvest Estimation**

Slightly different techniques were used to estimate harvest by tribal and state ricers. Tribal members who wished to harvest rice off-reservation were required to obtain an off-reservation wild rice harvesting permit. This permit was obtained by 638 individuals in 2012. When individuals obtained their 2012 permit, they were asked to report if they harvested rice (either on or off reservation) the previous year. Forty-three percent (96/225) of the individuals who indicated they had riced in 2011 (categorized as “active” ricers) were surveyed by phone, as well as 21% (87/413) of those individuals who indicated they had not riced the previous year (“inactive” ricers) (Table 1).

The number of tribal members estimated to have harvested off-reservation in 2012 was determined by extrapolating the percent of active respondents in each group (Table 1). Due to differences in sampling and activity rates among groups, separate harvest estimates were made for each group, and then combined to estimate total tribal harvest.

GROUP	TOTAL NUMBER	# SURVEYED	% SAMPLED	% ACTIVE OFF-RESERVATION	EST. # ACTIVE OFF-RESERVATION
ACTIVE <sup>1</sup>	225	96	43%	40.6% (n=39)	91
INACTIVE <sup>1</sup>	413	87	21%	12.6% (n=11)	52
TOTAL	638	183	29%		143

<sup>1</sup> Based on activity the previous year; see discussion in text.

State rickers were required to obtain a state license. A mail questionnaire was mailed to each of the 592 individuals who obtained a state license. All harvest estimates were made by expanding the results reported by the 249 respondents to the state survey (42% of licensees).

## RESULTS AND DISCUSSION

### Abundance Estimation

Ground survey results and abundance information for the 40 waters surveyed annually are reported in Figures 1 and 2, and Table 2. In addition, abundance estimates for 47 additional waters surveyed only from the air are listed in Table 3. A total of 2,098 acres of wild rice was estimated for these 87 surveyed waters. Andryk (1986) estimated that the Wisconsin ceded territories supported approximately 5,000 acres of rice in 1985, a year with an abundance index considerably higher than in 2012.

Survey results and field observations indicate that rice abundance in 2012 was very poor, with the 2012 index being the lowest observed since surveys were started. The abundance index was low both across the state and regionally (Table 2, Figures 1 and 2). In the northwest, the abundance index increased on 7 waters, decreased on 9, and was essentially unchanged on 6, but declines were generally larger than increases, and overall the index declined by 30%. The most encouraging increase observed was on Clam Lake, where the rice appears to be beginning to respond to restoration efforts in the bay that has been protected from carp (Figure 3). A unique observation was made at Blaisdell Lake in Sawyer County. Initially the crop looked to be at least fair, but was essentially completely lost to what appeared to be stem-rot. Loss to stem rot had not been previously observed, but this might be because this loss can occur earlier than when surveys are typically conducted. Among north-central waters, 3 increased, 7 declined, and 8 were largely unchanged (Table 2, Figure 2), with these waters declining 21% overall compared to 2011. Statewide, the 2012 index was just 44% of the long-term index average (1985-2012).

It remains difficult to determine why rice changes in abundance on either the regional or local scale because the environmental factors that influence abundance are not well understood.

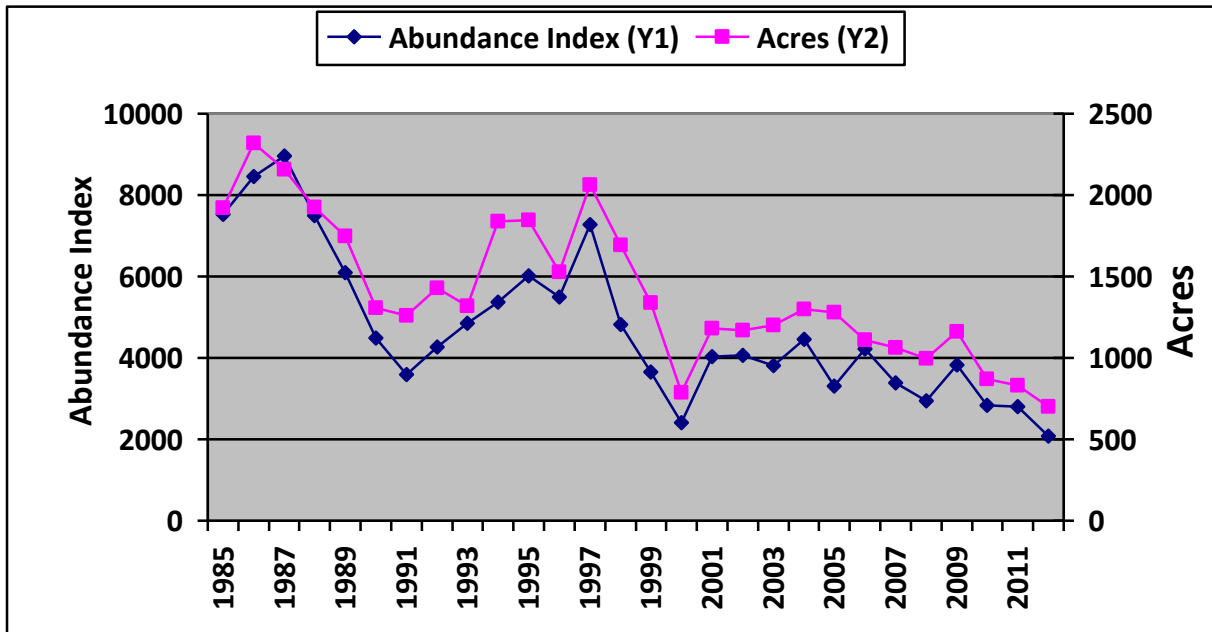


Figure 1. Manoomin abundance index and acreage from 40 Wisconsin rice waters surveyed annually from 1985-2012.

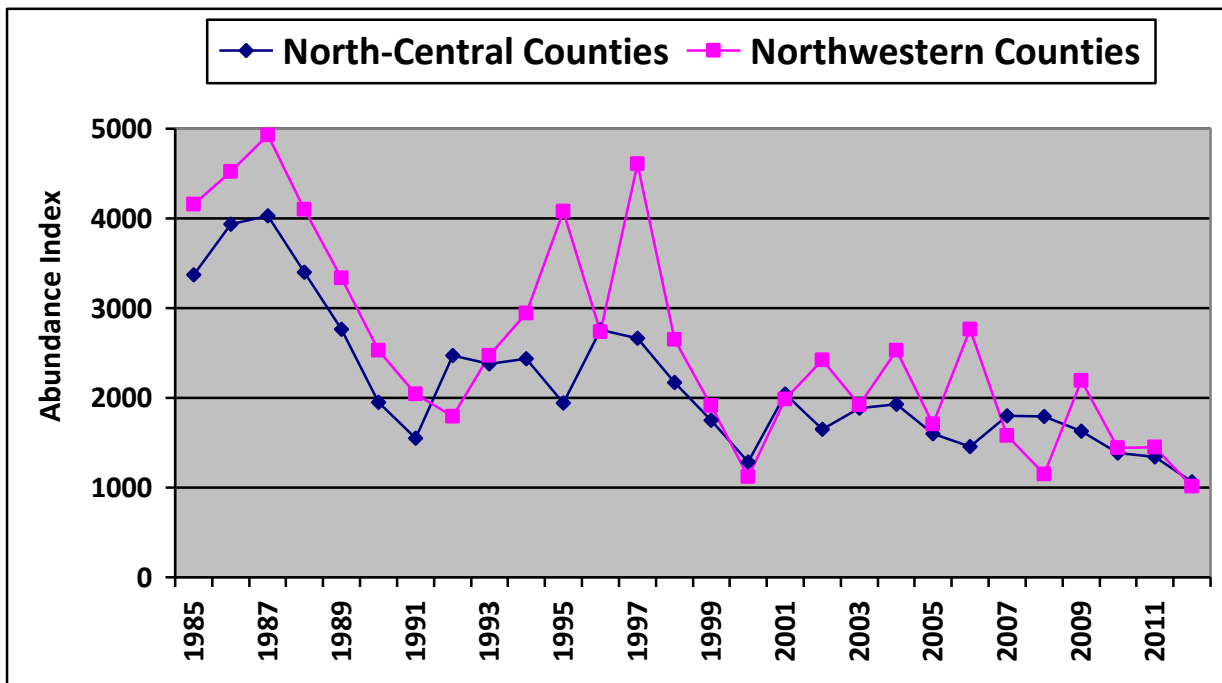


Figure 2. Manoomin abundance index from 40 Wisconsin rice waters surveyed annually from 1985-2012; northwestern versus north-central Wisconsin waters (HWY 13 used to separate northwestern from north-central waters).

Wild rice is affected by a variety of factors, and the relative impact of each varies by year. Some of these factors, such as spring temperatures and water levels, can affect rice regionally, and may account for instances where beds in the north-central counties display one trend in abundance while those in the northwestern region may show another. At the other extreme, a localized impact can cause a stand to fail while those around it flourish. Furthermore, those factors that might explain some of the variation in rice abundance are not being monitored systematically. Thus, explanations about changes in rice abundance remain largely a matter of conjecture.

Annual variability in rice abundance may be inversely related to the amount of water flow through the system. Relatively open systems such as rivers and flowages appear to vary less in rice abundance than relatively closed lake systems. Although open systems may still experience boom and bust years, the level of abundance tends to be closer to the average level most years. This may be because some environmental variables, such as nutrient availability or spring water temperatures, are more consistent in these systems from year to year.



Figure 3. The rice beds on one bay of Clam Lake, Burnett County, in 2008 (left) and 2012 (right). Carp exclosures were erected on this bay by the St. Croix Tribe for the 2011 and 2012 growing seasons. (Rice in other areas of the lake has not demonstrated similar recovery.)

Table 2. Manoomin acreage, density and abundance index from 40 Wisconsin waters for 2009-2012, and the 1985-2012 means. A density value of 1=sparse, 5=dense. (Data for 1985-2008 can be found in previous season reports.)															
WATER	2009			2010			2011			2012			1985-2012		
	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	MEAN ACRES	MEAN DEN.	MEAN INDEX
<b>NORTHWESTERN CTYS.</b>															
<b>BARRON</b>															
SWEENEY CREEK	8	3	24	3	5	15	11	2	22	3	1	3	9	2.5	30
<b>BAYFIELD</b>															
TOTOGATIC LAKE	180	2	360	81	2	162	110	3	330	35	2	70	148	2.5	422
<b>BURNETT</b>															
BASHAW LAKE	0	0	0	1	1	1	1	1	1	0	0	0	9	2.1	24
BIG CLAM LAKE	8	3	24	10	2	20	15	1	15	52	4	208	125	3.2	428
BRIGGS LAKE	21	4	84	8	3	24	20	4	80	10	5	50	26	3.9	103
GASLYN LAKE	16	3	48	20	3	60	4	2	8	8	2	16	21	3.0	73
LONG LAKE	120	4	480	40	3	120	70	4	280	58	2	116	69	2.7	194
MUD LAKE (2)	9	4	36	10	4	40	4	5	20	3	3	9	12	3.6	45
WEBB CREEK	9	4	36	2	4	8	11	5	55	12	5	60	12	4.1	55
<b>DOUGLAS</b>															
MULLIGAN LAKE	0	0	0	0	0	0	0	0	0	0	0	0	21	1.9	50
<b>POLK</b>															
RICE BED CREEK	15	4	60	10	3	30	19	5	95	19	2	38	12	4.2	52
RICE LAKE (1)	50	5	250	45	3	135	24	2	48	0	0	0	43	3.1	151
WHITE ASH LAKE	12	2	24	19	4	76	14	3	42	9	2	18	12	3.1	39
<b>SAWYER</b>															
BILLY BOY FLOW.	15	3	45	1	1	1	19	2	38	12	3	36	13	2.3	40
BLAISDELL LAKE	80	2	160	45	1	45	95	2	190	3	3	9	74	2.6	197
PACWAWONG LAKE	80	4	320	115	5	575	16	2	32	45	2	90	82	3.5	318
PHIPPS FLOWAGE	25	4	100	14	3	42	26	4	104	28	4	112	28	3.9	110
<b>WASHBURN</b>															
DILLY LAKE	2	2	4	5	1	5	1	1	1	1	1	1	17	3.6	69
POTATO LAKE	20	4	80	7	2	14	21	3	63	20	3	60	14	3.0	43
RICE LAKE			58*	5	1	5	5	2	10	9	3	27	19	3.2	68
SPRING LAKE (1)	3	1	3	1	1	1	1	1	1	2	3	6	14	2.6	48
TRANUS LAKE	26	2	52	32	2	64	5	3	15	44	2	88	31	1.7	51
<b>SUBTOTAL</b>	<b>699</b>		<b>2,248</b>	<b>474</b>		<b>1,443</b>	<b>492</b>		<b>1,450</b>	<b>373</b>		<b>1,017</b>	<b>800</b>		<b>2,574</b>
<b>NORTH-CENTRAL CTYS.</b>															
<b>FOREST</b>															
ATKINS LAKE	0	0	0	0	0	0	0	0	0	0	0	0	13	0.5	39
INDIAN/RILEY LAKE	4	3	12	1	3	3	4	2	8	1	1	1	5	2.8	14
PAT SHAY LAKE	15	2	30	25	3	75	12	2	24	2	1	2	31	1.6	53
RAT RIVER	18	4	72	2	2	4	12	3	36	10	4	40	20	4.4	91
WABIKON LAKE	74	3	222	80	3	240	55	3	165	40	1	40	48	2.8	137
<b>LINCOLN</b>															
ALICE LAKE	26	3	78	32	2	64	30	3	90	34	3	102	44	3.0	148
<b>ONEIDA</b>															
FISH LAKE	2	4	8	1	1	1	1	1	1	5	2	10	26	2.9	90
LITTLE RICE LAKE	0	0	0	0	0	0	0	0	0	0	0	0	5	1.0	22
RICE LAKE	0	0	0	10	2	20	5	2	10	40	1	40	54	1.3	92
SPUR LAKE	0	0	0	1	1	1	1	1	1	2	1	2	56	2.7	204
WISCONSIN RIVER	165	4	660	140	4	560	125	5	625	120	5	600	143	4.6	650
<b>PRICE</b>															
BLOCKHOUSE LAKE	0	0	0	0	0	0	0	0	0	1	1	1	13	2.1	46
<b>VILAS</b>															
ALLEQUASH LAKE	25	2	50	10	3	30	16	4	64	14	4	56	57	3.8	235
LITTLE RICE LAKE	48	4	192	8	3	24	12	4	48	16	1	16	19	2.8	60
MANITOWISH RIVER	17	4	68	16	5	80	14	4	56	12	5	60	15	4.5	69
PARTRIDGE LAKE	20	3	60	20	3	60	22	5	110	10	4	40	19	4.1	81
RICE LAKE	36	4	144	36	5	180	12	3	36	4	3	12	26	3.5	94
WEST PLUM LAKE	12	3	36	14	3	42	18	4	72	15	3	45	19	3.1	62
<b>SUBTOTAL</b>	<b>462</b>		<b>1,632</b>	<b>396</b>		<b>1,384</b>	<b>339</b>		<b>1,346</b>	<b>326</b>		<b>1,067</b>	<b>605</b>		<b>2,159</b>
COUNT:			40			40			40			40			40
<b>TOTAL:</b>	<b>1,161</b>		<b>3,880</b>	<b>870</b>		<b>2,827</b>	<b>831</b>		<b>2,796</b>	<b>699</b>		<b>2,084</b>	<b>1,405</b>		<b>4,734</b>
AVERAGE:			97			71			70			52			122

\*water not surveyed; index value estimated as discussed 2009 abundance and harvest report (David, 2010).

Table 3. Estimated manoomin acreage and density for some waters aerially surveyed in 2012.					
COUNTY	WATER	2012 EST. ACRES	2012 EST. DENSITY	2011 EST. ACRES	2011 EST. DENSITY
Barron	Bear Lake	18	sparse-medium	22	sparse-medium
Bayfield	Chippewa Lake	28	medium	50	medium-dense
Burnett	Grettum Flowage	0	(in drawdown)	4	sparse-medium
	Loon Lake (Carters Bridge)	7	sparse-medium	13	medium
	Hay Creek Flowage	14	medium	14	medium
	Mud Lake (Oakland Township)	45	sparse-medium	2	sparse
	North Fork Flowage	62	medium-dense	70	medium-dense
	North Lang Lake	0	-	2	dense
Douglas	Phantom Flowage	90	sparse	10	sparse
	Lower Ox Lake	0	-	5	sparse
	Minong Flowage (Smiths Bridge) <sup>1</sup>	50	medium-dense	50	medium-dense
	Radigan Flowage	40	medium-dense	2	sparse
	St. Croix (Gordon) Flowage	2	sparse-medium	4	medium-dense
	St. Croix River (Cutaway Dam)	26	medium-dense	28	medium-dense
Forest	Upper Ox Lake	1	sparse	4	dense
	Hiles Millpond	35	medium-dense	60	medium-dense
	Little Rice Lake	280	medium-dense	220	medium-dense
Iron	Shelp Lake	7	medium-dense		(not surveyed)
	Little Turtle Flowage	8	dense	13	medium-dense
	Mud Lake	2	medium	3	medium
Langlade	Miniwaukan Lake	3	sparse	7	sparse-medium
	Pickereel Creek (Goose Island)	1	sparse	9	dense
	Spider Creek Flowage	3	medium	8	medium
	Unnamed (Daily) Pond	2	sparse	9	dense
Lincoln	Unnamed Slough (between Little Pine Creek and the WI River)	23	medium-dense		(not surveyed)
Oneida	Big Lake	15	medium-dense	8	medium-dense
	Cuenin Lake	0	-	3	medium-dense
	Roe Lake	1	sparse	13	sparse-medium
	Sevenmile Lake	10	medium-dense		(not surveyed)
	The Thoroughfare	102	medium-dense	96	sparse-dense
Polk	Somers Lake	3	medium-dense	2	medium
Price	(Lower) Steve Creek Flowage	16	dense	2	sparse
	Spring Creek WA Flowages (4)	48	sparse-dense	51	dense
Sawyer	Partridge Crop Lake	6	medium	8	sparse-dense
Taylor	Chequamegon Waters Flowage	155	medium-dense	125	sparse-dense
Vilas	Aurora Lake	8	sparse-medium	10	sparse-dense
	Frost Lake	4	sparse	24	medium-dense
	Irving Lake	110	sparse-medium	86	sparse-medium
	Island Lake	75	medium-dense	90	medium-dense
	Lower Ninemile Lake <sup>2</sup>	13	sparse-medium	33	sparse-medium
	Nixon Lake	9	dense	6	dense
	Rice Creek (north of Big Lake)	29	dense	26	dense
Upper Ninemile Lake	21	medium-dense	30	medium-dense	
Washburn	Long, Mud, & Little Mud Lakes	17	medium-dense	16	medium-dense
	Trego Flowage	10	dense	4	medium-dense

<sup>1</sup> The outlet of this flowage is located in Washburn County, but the rice bed is in Douglas County

<sup>2</sup> The outlet of this flowage is located in Oneida County, but the majority of the rice is in Vilas County



## Harvest Estimation

Responses were obtained from 183 tribal permit holders (Table 1) and 249 state licensees. Survey respondents were asked to report all harvest which occurred under their permit. For state licensees, this included on- and off-reservation harvest; for tribal members it included only off-reservation harvest, since no permit is required to harvest on-reservation. Fifty of the tribal and 214 of the state licensees surveyed reported harvesting rice in 2012. The total number estimated active in each group were 143 tribal members and 509 state licensees (Table 4).

Tribal harvesters active off-reservation reported making from 1 to 8 ricing trips, averaging an estimated 2.8 trips. Tribal survey respondents made a total of 144 off-reservation harvesting trips, gathering 2,587 pounds of green rice (Appendix 1), with an extrapolated total harvest estimate of 6,975 pounds in 396 trips, an average of 18 pounds per trip (Table 4). The total off-reservation harvest per active tribal license averaged 49 pounds.

		SURVEY RESPONSE INFORMATION						ESTIMATED TOTALS		
	# OF PERMIT HOLDERS	# ACTIVE RESPONDENTS	REPORTED TRIPS	REPORTED POUNDS	AVE. # OF TRIPS	AVE. POUNDS/TRIP	AVE. POUNDS/PERSON	# ACTIVE	# TRIPS	# POUNDS
TRIBAL										
ACTIVE	225	39	119	2,195	3.1	18.4	56.3	91	278	5,122
INACTIVE	413	11	25	392	2.3	15.7	35.6	52	118	1,853
TRIBAL TOT.	638	50	144	2,587	2.8	17.6	48.8	143	396	6,975
STATE	592	214	568	11,750	2.7	20.7	54.9	509	1,351	27,947
TOTAL	1,230	264	712	14,337	2.7	20.0	53.6	652	1,747	34,922

Estimated trips for state ricers was the product of estimated number active (509) and the average number of trips (2.65).

Estimated harvest for state ricers was the product of estimated number active (509) and the average pounds per person (54.91).

In comparison, active state licensees reported making from 1 to 16 ricing trips, averaging 2.7 trips. Collectively, state survey respondents made 568 trips, gathering 11,750 pounds of green rice (Appendix 1), with an extrapolated total harvest estimate of 27,947 pounds in 1,351 trips, an average of 21 pounds per trip. The harvest per active state license averaged 55 pounds.

The amount of rice harvested per individual varied greatly (Table 5). The most reported by a state ricer was 600 pounds, while the most reported by a tribal ricer was 200 pounds. On the low end of the range, the percentage of tribal ricers who harvested a total of 50 pounds or less rose from 50% in 2011 (David, 2013) to 65%, but for state ricers the figure showed little change (70% in 2011 versus 68% in 2012).

An estimated 86% of the state-licensed ricers (509/592) gathered rice in 2012, versus 22% for the tribes (143/638) (Table 4). Differences in the cost of the permit likely accounts for part of the difference between the different activity levels observed. The tribal ricing permit is free and is often obtained by individuals obtaining permits for other activities, while the state

requires the payment of a modest fee, and thus is rarely obtained by individuals without a strong intention of ricing. The tribal activity rate is also lowered because members are asked to respond only if they harvested rice off-reservation. When on-reservation rice beds have good stands, many tribal ricers concentrate their efforts there.

Table 5. Distribution of harvest among active respondents to the 2012 harvest survey.			
TRIBAL			
POUNDS OF GREEN RICE HARVESTED	INDIVIDUALS		PERCENT OF TOTAL HARVEST
	NUMBER*	PERCENT	
0 - 50	32	65.3	29.3
51 - 100	9	18.4	26.9
101 - 150	7	14.3	36.1
151 - 200	1	2.0	7.7
201 - 300	0	0.0	0.0
301 - 500	0	0.0	0.0
501 - 1000	0	0.0	0.0
1001 +	0	0.0	0.0
STATE			
POUNDS OF GREEN RICE HARVESTED	INDIVIDUALS		PERCENT OF TOTAL HARVEST
	NUMBER	PERCENT	
0 - 50	146	68.2	27.8
51 - 100	39	18.2	23.6
101 - 150	10	4.7	10.5
151 - 200	11	5.1	16.8
201 - 300	6	2.8	13.3
301 - 500	1	0.5	2.8
501 - 1000	1	0.5	5.1
1001 +	0	0.0	0.0

\* One active respondent did not report pounds.

The data collected in this survey can be used to estimate off-reservation harvest by tribal permit holders and both total and off-reservation harvest by state licensees. It cannot be used to estimate on-reservation harvest by tribal members, who are not required to have a permit to harvest on-reservation.

Using the approach to estimate harvest described above in the Methods section, total off-reservation harvest for tribal permit holders was estimated at 6,975 pounds of green rice and the total harvest for state permittees was estimated at 27,947 pounds (Table 4). Since none of the harvest reported by state licensees in 2012 came from on-reservation waters, the total off-reservation harvest was estimated at 34,922 pounds, with tribal ricers accounting for 20% of the harvest.

These harvest figures make 2012 a very poor harvest year, with an estimated total harvest that was 42% below the long-term (1992-2012) average. Over the past 21 years only 2010 (a year marked by several negative factors including a large outbreak of brown-spot disease which

led to a near state-wide crop failure) and 1992 had lower harvest estimates (Figure 4 & Appendix 2). The poor harvest is apparent in a number of different measures, including the average combined harvest per trip, which was also the second lowest on record. The decrease in participation from 2011 to 2012 (from 796 active ricers to 652) likely also reflects public awareness of the poor condition of many beds.

In comparing the abundance index to estimated harvest (Figure 4) it is important to note that the abundance index uses acreage and stand density factors to create an index of seed abundance, but this methodology does not measure actual seed production. Certain factors – such as pollination problems, high plant density, and disease outbreaks – can result in conditions where seed production is limited even when plant abundance is high. Evidence from the paddy rice industry indicates that infections of brown-spot disease can have particularly marked impacts on seed production, and this has been observed (though more poorly documented) in natural stands as well. While brown-spot outbreaks were not particularly notable for many years, they appeared to markedly affect rice harvest in 2005, and especially in 2010. If factors related to a changing climate are increasing the frequency of brown-spot outbreaks, it may be worthwhile to develop an index to the annual prevalence of this disease.

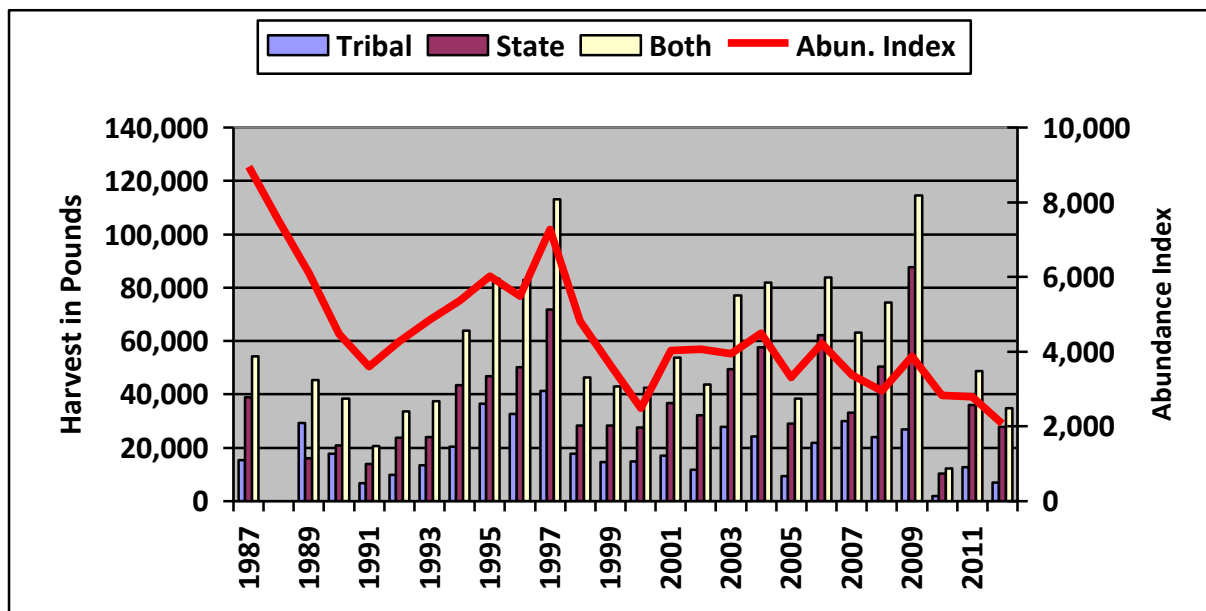


Figure 4. Harvest trends versus abundance index, 1987-2012 (\* no harvest estimates for 1988).

The distribution of ricing effort and harvest has tended to reflect the distribution of rice waters in the state, and the abundance of rice on those waters (Figure 5). On the county level, the 2012 harvest in many counties was fairly similar to the long term average, but Burnett County – usually the leading county in the state - provided only 13% of the harvest compared to 32% in the long term average. Vilas and Taylor counties, at 20% and 15% of the harvest respectively, exceeded their long-term averages of 16% and 5% respectively. In each county which deviated significantly from the long-term average, very good or poor stands on 1-2 important waters appeared to explain much of the variation. In Burnett County, Clam Lake and the Phantom Flowage were near failures, while the Chequamegon Waters Flowage in Price County had a good stand. In 2012, at least 1 pound of harvest was reported from 69 different waters compared to 87 waters in 2011 (David, 2013), another reflection of the generally poor crop in 2012.

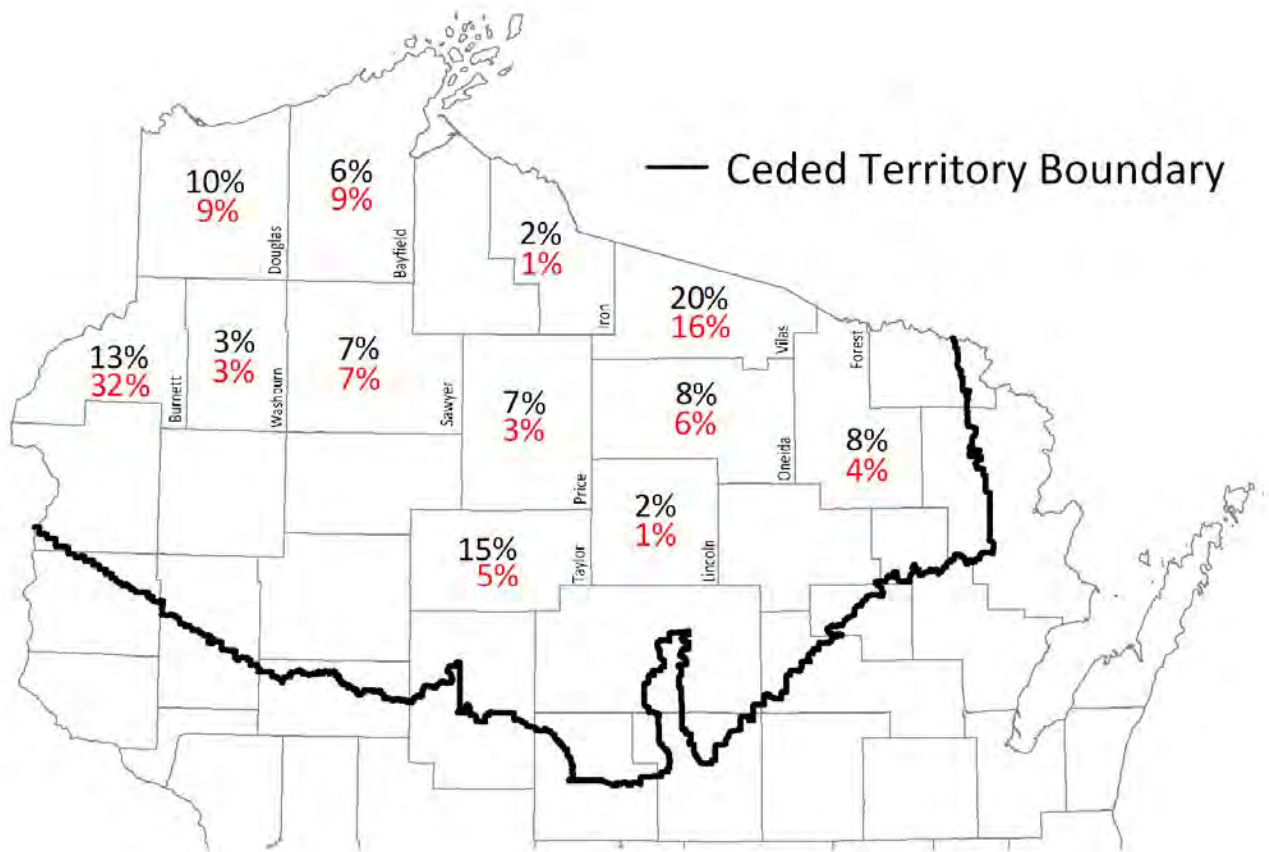


Figure 5. Distribution of the 2012 manoomin harvest among counties (figures in black) compared to the long-term average (1992-2011; figures in red). Data shown for counties which accounted for 3% or more of the harvest in either 2012 or over the long-term.

Only 52 of the 14,337 pounds of rice reported harvested by state survey respondents came from waters outside the ceded territory in 2012 (Appendix 1). At least 23% of the harvest reported from named locations came from sites planted by the WDNR, the U.S. Forest Service, GLIFWC, or other seeding cooperators, including the second and fifth most heavily harvested sites (Chequamegon Water Flowage in Taylor County and Spring Creek Wildlife Area in Price County). (Seeded sites are marked with an asterisk in Appendix 1.) This was the same percentage as in 2011; higher than the 18% in 2010; and similar to the 24% observed in 2009. The corresponding figures for 2008, 2007, and 2006 were 27%, 31% and 26% respectively.

### Opinions of Respondents

Annual Abundance: Individuals were asked if they felt the 2012 wild rice crop was better, the same, or worse than the 2011 crop. Among the 186 active respondents with an opinion, 33% felt 2012 was better than 2011; 24% felt it was about the same, and 43% felt it was worse. Given the poor index to crop abundance, more strongly negative opinions might have been anticipated, but it is worth noting that for state licensees, many individuals with a highly negative opinion of the crop may have simply opted not to go ricing this year; 2012 state license sales were 20% lower than in 2011 (592 versus 740).

Rice Worm Abundance: For the ninth consecutive year, survey respondents were asked how they rated the abundance of “rice worms” (larvae stage of the moth *Apamea apamiformis*) in the current year. Among the 227 respondents who expressed an opinion, 16% rated them as very low, 37% as low, 33% as average, 10% as medium high, and 4% as high (Figure 6).

These figures suggest a third year of modest decline in rice worm abundance from the very high abundance reported in 2009. The annual variation in responses to the question over the nine years suggests that year to year variation in rice worm abundance may be quite marked.

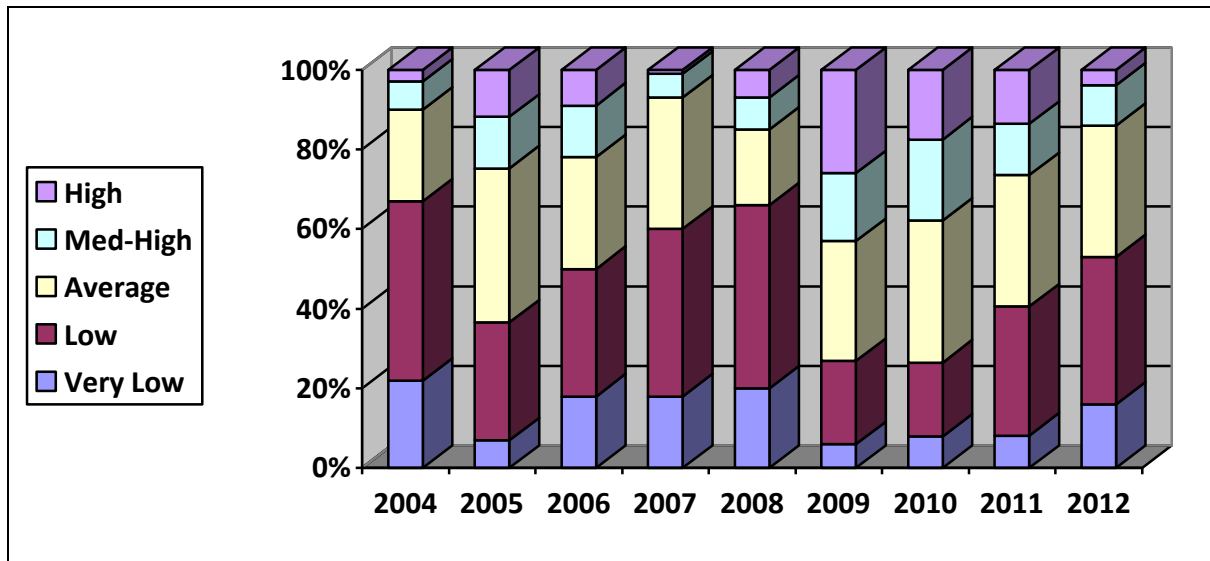


Figure 6. Opinions of manoomin harvest survey respondents on the abundance of rice worms, 2004 through 2012 (for respondents with an opinion).

Brown Spot Disease Prevalence: Following the extensive outbreak of Brown Spot Disease in 2010, a new question was added to the harvest survey asking whether respondents felt there was a minor, moderate or severe presence of Brown Spot Disease for each water they riced.

Many respondents offered no opinions on this question, but a total of 244 opinions were offered in 2012. The severe category was checked 8 times, for 7 different waters (one checked by two individuals); the moderate category was checked 4 times for 4 different waters; and the minor category was checked 232 times for 56 waters (with individual waters checked 1 to 14 times).

While the number of opinions offered was nearly identical to the number offered in 2011 (245), the number of opinions in each category was very different, with the severe, moderate and minor categories being indicated 12, 61 and 172 respectively in 2011, suggesting that brown spot prevalence may have been reduced in 2012 relative to 2011. With additional years of responses to this question, it may be possible to develop an annual index to brown spot prevalence.

Comments: Respondents offered a large number of comments, but relatively few consistent themes emerged. As in most years, the most common comments provided expanded detail on the abundance of rice or rice worms, or their enjoyment of the experience. Unlike some past years, there were few comments about weather limiting harvesting, or about the timing of the

opening of date-regulated lakes. Concern was expressed about a number of specific waters including: Radigan Flowage, Douglas County, 3 comments about low water levels following dam reconstruction; Minong Flowage, Douglas County, 2 comments about possible impacts from the drawdown planned for 2012 for dam repairs; Dilly Lake, Washburn County, 2 comments about general decline, possibly due to a beaver dam on the outlet; Clam River Flowage, Burnett County, 2 comments about high levels of fungal smut; St. Louis River, Douglas County, 1 comment about negative carp impacts; Upper Ninemile Flowage, Vilas County, 1 comment about rocks possibly being added to the outlet; Black Brook Flowage, Washburn County, 1 comment about negative impacts from a drawdown for dam inspection; Loon Lake, Burnett County, 1 comment about general decline; Bear Lake, Washburn County, 1 comment about inappropriate water levels; Phipps Flowage, Sawyer County, 1 comment about the need to maintain the dam; and Loon Creek, near Briggs Lake, Burnett County, 1 comment about high levels of fungal smut.

Potential Waters for Seeding or Other Restoration: Respondents suggested 13 different waters which might be candidates for seeding or other restoration efforts. Sites named are listed in Appendix 3. (Sites already supporting well-established beds but showing temporary decline were not included.)

## **LITERATURE CITED**

- Andryk, T. 1986. Wild rice wetland inventory of northwest Wisconsin. Great Lakes Indian Fish and Wildlife Commission Administrative Report 86-4. 51 pp.
- David, P.F. 2010. Wild rice (manoomin) abundance and harvest in northern Wisconsin in 2009. Great Lakes Indian Fish and Wildlife Commission Administrative Report 10-04. 17 pp.
- David, P.F. 2013. Wild rice (manoomin) abundance and harvest in northern Wisconsin in 2011. Great Lakes Indian Fish and Wildlife Commission Administrative Report 13-04. 18 pp.

Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2012 harvest survey.  
Seeded waters are marked with an asterisk.

COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Bayfield	Chippewa Lake*	20	225	22	334	42	559
	Totogatic Lake	8	109	23	239	31	348
	<b>Subtotal</b>	<b>28</b>	<b>334</b>	<b>45</b>	<b>573</b>	<b>73</b>	<b>907</b>
Buffalo	Pool 5	0	0	2	40	2	40
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>40</b>	<b>2</b>	<b>40</b>
Burnett	Briggs Lake	0	0	6	215	6	215
	Clam River Flowage	1	4	11	151	12	155
	Long Lake	3	16	13	381	16	397
	Loon Lake	0	0	1	28	1	28
	Mud Lake (2) (Oakland Township)	1	25	20	508	21	533
	North Fork Flowage*	0	0	24	461	24	461
	Rice Lake	0	0	2	1	2	1
	Webb Creek (east)	0	0	3	71	3	71
	Yellow River	0	0	2	15	2	15
	<b>Subtotal</b>	<b>5</b>	<b>45</b>	<b>82</b>	<b>1,831</b>	<b>87</b>	<b>1,876</b>
Chippewa	Cedar Creek	0	0	1	8	1	8
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>8</b>	<b>1</b>	<b>8</b>
Douglas	Amnicon Lake	0	0	1	0	1	0
	Bear Lake	0	0	2	30	2	30
	Lower Ox Lake	0	0	1	0	1	0
	Minong Flowage	22	325	26	597	48	922
	Mulligan Lake	0	0	1	0	1	0
	Radigan Flowage	0	0	8	168	8	168
	St Croix River	3	140	9	96	12	236
	St. Louis River	0	0	4	1	4	1
	Unnamed	1	10	0	0	1	10
	Upper Ox Lake	0	0	1	0	1	0
<b>Subtotal</b>	<b>26</b>	<b>475</b>	<b>53</b>	<b>892</b>	<b>79</b>	<b>1,367</b>	
Forest	Hiles Millpond*	0	0	8	158	8	158
	Little Rice Lake	5	120	22	672	27	792
	Rat River	1	30	0	0	1	30
	Scott Lake	3	80	3	47	6	127
	<b>Subtotal</b>	<b>9</b>	<b>230</b>	<b>33</b>	<b>877</b>	<b>42</b>	<b>1,107</b>

(Appendix 1 continued on the next page.)

Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2012 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Iron	Little Turtle Flowage*	4	105	8	103	12	208
	Mud Lake*	0	0	1	0	1	0
	Turtle Flambeau Flowage	0	0	1	0	1	0
	<b>Subtotal</b>	<b>4</b>	<b>105</b>	<b>10</b>	<b>103</b>	<b>14</b>	<b>208</b>
Lincoln	Alice Lake	3	54	4	25	7	79
	Little Pine Creek	0	0	4	100	4	100
	Wisconsin River	2	40	4	80	6	120
	Wisconsin River (at Alexander Lake)	0	0	1	1	1	1
	Wisconsin River (at Lt. Pine Creek Slough)	0	0	1	40	1	40
	<b>Subtotal</b>	<b>5</b>	<b>94</b>	<b>14</b>	<b>246</b>	<b>19</b>	<b>340</b>
Marathon	McMillan Marsh WA	0	0	2	0	2	0
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>
Marinette	Noquebay Lake	0	0	1	10	1	10
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>10</b>	<b>1</b>	<b>10</b>
Marquette	Fox River	0	0	2	2	2	2
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
Oneida	Big Lake	0	0	8	152	8	152
	Rhineland Flowage	0	0	2	40	2	40
	Sugar Camp Creek	0	0	1	12	1	12
	The Thoroughfare	2	45	36	618	38	663
	Wisconsin River	2	32	7	228	9	260
	<b>Subtotal</b>	<b>4</b>	<b>77</b>	<b>54</b>	<b>1,050</b>	<b>58</b>	<b>1,127</b>
Polk	Joel Flowage*	0	0	2	0	2	0
	Rice Bed Creek	0	0	1	20	1	20
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>20</b>	<b>3</b>	<b>20</b>
Price	Lower Steve Creek Flowage*	0	0	2	66	2	66
	Prentice Flowage	0	0	2	32	2	32
	Spring Creek WA Flowages*	10	285	33	557	43	842
	<b>Subtotal</b>	<b>10</b>	<b>285</b>	<b>37</b>	<b>655</b>	<b>47</b>	<b>940</b>

(Appendix 1 continued on the next page.)



Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2012 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Rusk	Lea Lake Flowage	1	5	0	0	1	5
	<b>Subtotal</b>	<b>1</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>5</b>
Sawyer	Barker Lake	0	0	2	0	2	0
	Blaisdell Lake	0	0	1	0	1	0
	Hunter Lake	0	0	1	0	1	0
	Pacwawong Lake	9	39	25	441	34	480
	Phipps Flowage	5	38	23	412	28	450
	<b>Subtotal</b>	<b>14</b>	<b>77</b>	<b>52</b>	<b>853</b>	<b>66</b>	<b>930</b>
Taylor	Chequamegon Waters Flowage*	3	95	20	889	23	984
	Mondeaux Flowage	2	50	29	1,042	31	1,092
	<b>Subtotal</b>	<b>5</b>	<b>145</b>	<b>49</b>	<b>1,931</b>	<b>54</b>	<b>2,076</b>
Unnamed	Unnamed	0	0	5	85	5	85
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>5</b>	<b>85</b>	<b>5</b>	<b>85</b>
Vilas	Allequash Lake	2	35	2	11	4	46
	Aurora Lake	0	0	3	30	3	30
	Frost Lake	0	0	2	1	2	1
	Irving Lake	5	165	17	622	22	787
	Island Lake	13	271	20	619	33	890
	Lac Vieux Desert*	0	0	1	5	1	5
	Little Rice Lake	2	15	0	0	2	15
	Lost Creek	0	0	4	30	4	30
	Lower Ninemile Lake	3	100	2	26	5	126
	Manitowish River	2	35	0	0	2	35
	Mud Creek	3	79	7	81	10	160
	Nixon Lake	1	10	2	90	3	100
	Rest Lake	0	0	13	186	13	186
	Rice Creek	0	0	4	88	4	88
	Rice Lake	0	0	2	37	2	37
	Round Lake	0	0	1	5	1	5
	Upper Ninemile Flowage	0	0	13	339	13	339
	<b>Subtotal</b>	<b>31</b>	<b>710</b>	<b>93</b>	<b>2,170</b>	<b>124</b>	<b>2,880</b>

(Appendix 1 continued on the next page.)



## APPENDIX 2. Wisconsin manoomin harvest summary, 1992-2012

NOTE: The tribal harvest estimate is off-reservation only; state harvest estimate is on and off reservation, although only a small amount is from on-reservation waters.

YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	AVE.
EST. TRIBAL HARV.	9,850	13,500	20,429	36,524	32,643	41,332	17,868	14,766	14,925	17,098	11,713	27,802	24,265	9,378	21,830	30,123	24,055	26,805	2,032	12,773	6,975	19,842
EST. TRIBAL TRIPS	164	205	324	891	680	592	396	370	268	432	352	511	515	255	405	545	552	731	263	422	396	441
EST. STATE HARV.	23,800	24,000	43,534	47,164	50,517	71,741	28,451	28,310	27,698	36,668	32,073	49,358	57,607	29,041	62,091	33,120	50,433	88,008	10,302	36,006	27,947	40,851
EST. STATE TRIPS	506	558	888	1,091	1,094	1,246	954	971	881	1,076	984	1,453	1,581	1,324	1,660	1,316	1,456	2,135	1,032	1,668	1,351	1,201
<b>COMBINED TRIPS</b>	<b>670</b>	<b>763</b>	<b>1,212</b>	<b>1,982</b>	<b>1,774</b>	<b>1,838</b>	<b>1,350</b>	<b>1,341</b>	<b>1,149</b>	<b>1,508</b>	<b>1,336</b>	<b>1,964</b>	<b>2,096</b>	<b>1,579</b>	<b>2,065</b>	<b>1,861</b>	<b>2,008</b>	<b>2,866</b>	<b>1,295</b>	<b>2,090</b>	<b>1,747</b>	<b>1,643</b>
<b>COMBINED HARV.</b>	<b>33,650</b>	<b>37,500</b>	<b>63,963</b>	<b>83,688</b>	<b>83,160</b>	<b>113,073</b>	<b>46,319</b>	<b>43,076</b>	<b>42,623</b>	<b>53,766</b>	<b>43,786</b>	<b>77,160</b>	<b>81,872</b>	<b>38,419</b>	<b>83,921</b>	<b>63,243</b>	<b>74,488</b>	<b>114,813</b>	<b>12,334</b>	<b>48,779</b>	<b>34,922</b>	<b>60,693</b>
<b>COMB. OFF-REZ HARV</b>	<b>33,650</b>	<b>37,500</b>	<b>63,963</b>	<b>83,443</b>	<b>82,949</b>	<b>113,073</b>	<b>46,161</b>	<b>42,752</b>	<b>42,333</b>	<b>52,736</b>	<b>43,542</b>	<b>76,943</b>	<b>81,633</b>	<b>38,186</b>	<b>83,771</b>	<b>63,243</b>	<b>74,247</b>	<b>114,523</b>	<b>12,334</b>	<b>48,080</b>	<b>34,922</b>	<b>60,475</b>
<b>COMBINED # ACTIVE</b>	<b>404</b>	<b>391</b>	<b>499</b>	<b>529</b>	<b>563</b>	<b>641</b>	<b>574</b>	<b>540</b>	<b>460</b>	<b>563</b>	<b>497</b>	<b>663</b>	<b>666</b>	<b>544</b>	<b>721</b>	<b>608</b>	<b>717</b>	<b>1,040</b>	<b>558</b>	<b>796</b>	<b>652</b>	<b>601</b>
% TRIBAL	0.29	0.36	0.32	0.44	0.39	0.37	0.39	0.34	0.35	0.32	0.27	0.36	0.30	0.24	0.26	0.48	0.32	0.23	0.16	0.26	0.20	0.33
<b># TRIBAL PERMITS</b>	<b>607</b>	<b>774</b>	<b>827</b>	<b>857</b>	<b>729</b>	<b>922</b>	<b>911</b>	<b>907</b>	<b>897</b>	<b>884</b>	<b>781</b>	<b>944</b>	<b>831</b>	<b>850</b>	<b>910</b>	<b>1,248</b>	<b>1,306</b>	<b>858</b>	<b>1,019</b>	<b>566</b>	<b>638</b>	<b>870</b>
EST. TRIBAL ACTIVE	162	186	122	171	213	176	158	140	116	139	104	96	86	72	116	101	153	197	95	149	143	138
% TRIBAL ACTIVE	0.27	0.24	0.15	0.2	0.29	0.19	0.17	0.15	0.14	0.16	0.13	0.1	0.1	0.08	0.13	0.08	0.12	0.23	0.09	0.26	0.22	0.16
<b>TRIBAL AVE # TRIPS</b>	<b>1</b>	<b>1.1</b>	<b>2.7</b>	<b>5.2</b>	<b>3.2</b>	<b>3.4</b>	<b>2.5</b>	<b>2.6</b>	<b>2.3</b>	<b>3.1</b>	<b>3.4</b>	<b>5.3</b>	<b>6</b>	<b>3.5</b>	<b>3.5</b>	<b>5.4</b>	<b>3.6</b>	<b>3.7</b>	<b>2.8</b>	<b>2.8</b>	<b>2.8</b>	<b>3.2</b>
TRIBAL LBS/TRIP	60	66	63	41	48	70	45	40	56	40	33	54	47	37	54	55	44	37	8	30	18	45
TRIBAL HARV/ACTIVE	61	73	167	214	153	235	113	105	129	123	113	290	282	130	188	298	157	136	21	86	49	144
<b># STATE PERMITS</b>	<b>285</b>	<b>225</b>	<b>405</b>	<b>402</b>	<b>388</b>	<b>508</b>	<b>488</b>	<b>467</b>	<b>396</b>	<b>488</b>	<b>432</b>	<b>621</b>	<b>665</b>	<b>585</b>	<b>659</b>	<b>605</b>	<b>651</b>	<b>914</b>	<b>611</b>	<b>740</b>	<b>592</b>	<b>530</b>
EST. STATE ACTIVE	242	205	377	358	350	465	416	400	344	424	393	567	580	472	605	507	564	843	463	647	509	463
% STATE ACTIVE	0.85	0.91	0.93	0.89	0.9	0.92	0.85	0.86	0.87	0.87	0.91	0.91	0.87	0.81	0.92	0.84	0.87	0.92	0.76	0.87	.86	0.87
<b>STATE AVE # TRIPS</b>	<b>2.1</b>	<b>2.7</b>	<b>2.4</b>	<b>3</b>	<b>3.1</b>	<b>2.7</b>	<b>2.3</b>	<b>2.4</b>	<b>2.6</b>	<b>2.5</b>	<b>2.5</b>	<b>2.6</b>	<b>2.7</b>	<b>2.8</b>	<b>2.7</b>	<b>2.6</b>	<b>2.6</b>	<b>2.5</b>	<b>2.2</b>	<b>2.6</b>	<b>2.7</b>	<b>2.3</b>
STATE LBS/TRIP	47	43	49	43	46	58	30	29	31	34	33	34	36	22	37	25	35	41	10	22	21	34
STATE HARV/ACTIVE	98	117	115	132	144	154	68	71	81	86	82	87	99	62	103	65	89	104	22	56	55	77
COMBINED # PER TRIP	50	49	53	42	47	62	34	32	37	36	33	39	39	24	41	34	37	40	10	23	20	37
NAMED SITES w/ HARV.	35	50	53	65	71	68	66	76	65	74	71	92	94	110	89	98	102	102	70	87	69	77

Appendix 3. Waters suggested for seeding or restoration by respondents to the 2012 wild rice harvest survey.*		
COUNTY	WATER	NOTES
Barron	Bear Lake	Historic bed in decline, likely water management needed
Bayfield	Sand Bay	On Lake Superior
Burnett	Upper Clam Lake	Restoration efforts underway on this lake
Chippewa	O'Neil Creek	Suggested from campground to the HWY bridge
Douglas	Amnicon Lake	Historic water; cause of loss should be investigated
Lincoln	Lake Alice	Historic stand near junction of CTY D & H in decline
Polk	Blom Lake	No apparent flow through this like; likely unsuitable
	Clam Falls Flowage	Past investigations suggest waterlevels may be slightly too high
	Grass Lake	No apparent flow through this like; likely unsuitable
Rusk	Sobieski Flowage	On Sawyer/Rusk Line; on Flambeau State Forest
Sawyer	Phipps Spring	Maybe not be a public water
	Swamp Lake	Site may have very limited access, but worth exploring
Vilas	Boot Creek	Above Katie Lake Road, to the north

\* Suggested waters with relatively well established beds not included.