



# **Manoomin (Wild Rice) Abundance and Harvest in Northern Wisconsin in 2011**

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## **MANOOMIN (WILD RICE) ABUNDANCE AND HARVEST IN NORTHERN WISCONSIN IN 2011**

### **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 2011 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 August 3<sup>rd</sup> – 25<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 566 individuals in 2011. When individuals obtained their 2011 permit, they were asked if they harvested rice the previous year. Forty-three percent (75/175) of the individuals who indicated they had riced in 2010 (categorized as “active” ricers) were surveyed by phone, as well as 18% (72/391) 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 2011 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>	175	75	43%	38.7% (n=29)	68
INACTIVE <sup>1</sup>	391	72	18%	20.8% (n=15)	81
TOTAL	566	147	26%		149

<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 740 individuals who obtained a state license. All harvest estimates were made by expanding the results reported by the 327 respondents to the state survey (44% 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 48 additional waters surveyed only from the air are listed in Table 3. A total of 2,146 acres of wild rice was estimated for these 88 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 2011.

Survey results and field observations indicate that rice abundance in 2011 was well below average. Overall, the abundance index was very similar to 2010, both across the state and regionally (Table 2, Figures 1 and 2). In the northwest, the abundance index increased on 10 waters, decreased on 6, and was essentially unchanged on 6, but the index was pulled downward by a marked decline on Pacwawong Lake in Sawyer County. Burnett County's Upper Clam Lake, perhaps the most significant lake in this region, also had its fifth consecutive crop failure. Among north-central waters, 7 increased, 5 declined, and 6 were largely unchanged (Table 2, Figure 2). Overall, the 2011 index was just 57% of the long-term index average (1985-2011), and was the second lowest index over the 26 year period.

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. 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

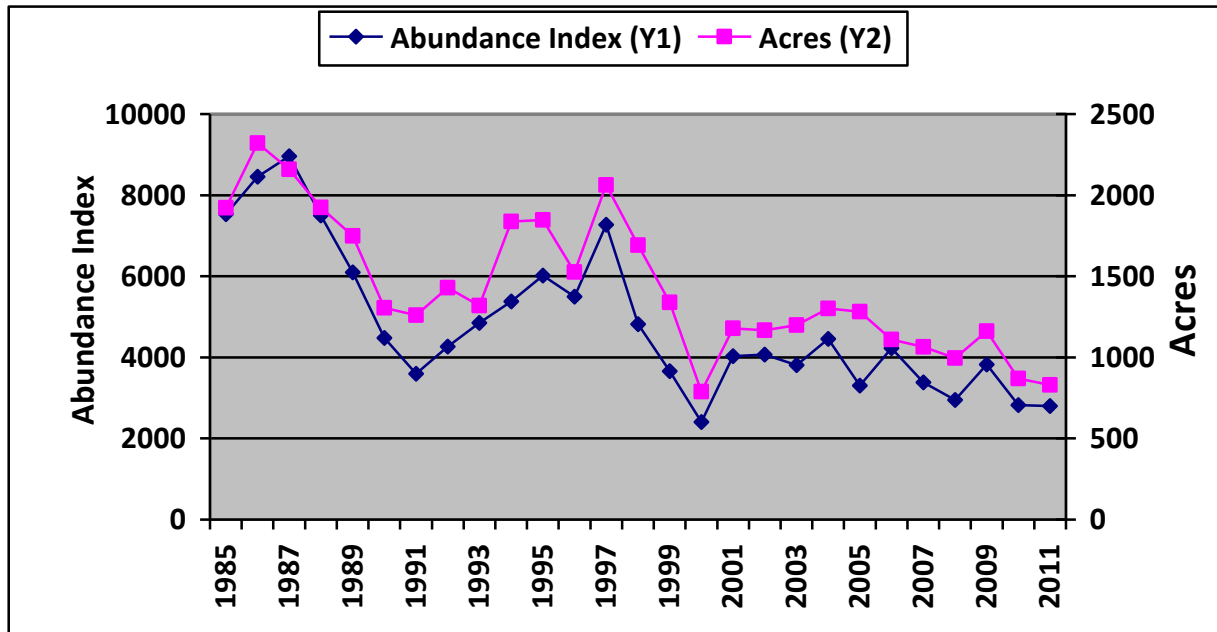


Figure 1. Manoomin abundance index and acreage from 40 Wisconsin rice waters surveyed annually from 1985-2011.

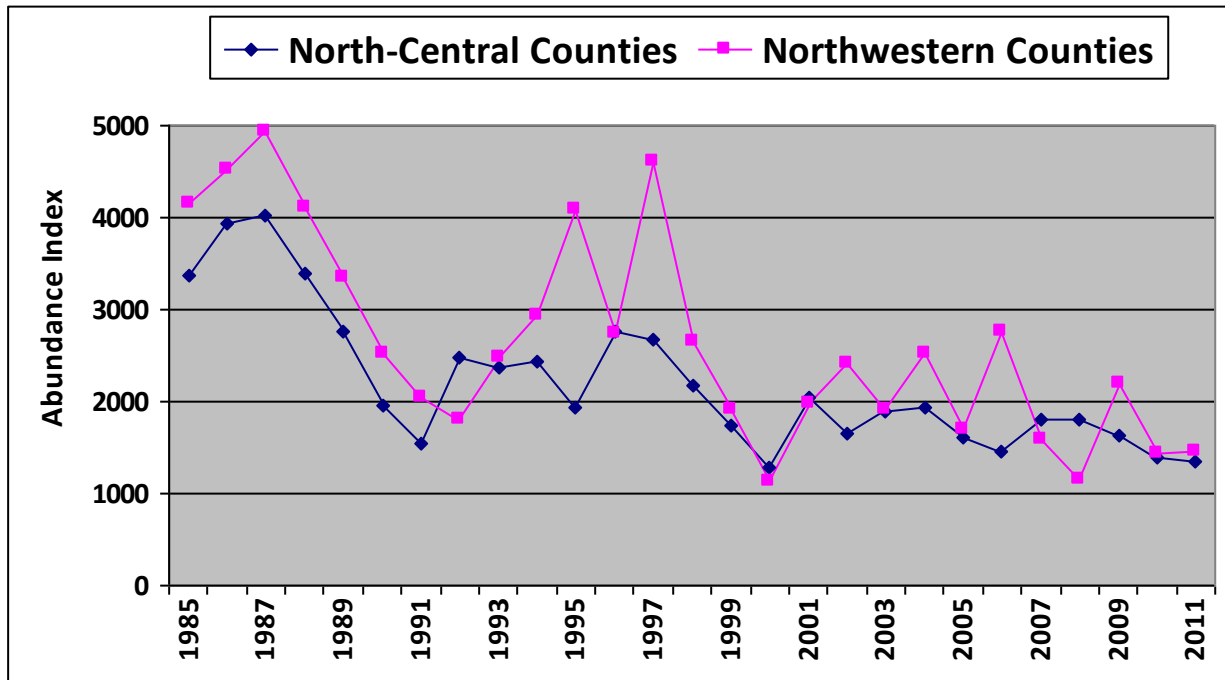


Figure 2. Manoomin abundance index from 40 Wisconsin rice waters surveyed annually from 1985-2011; northwestern versus north-central Wisconsin waters (HWY 13 used to separate northwestern from north-central waters).

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. However, it is worth noting that while the 2011 abundance index was very similar to the 2010 index, the high prevalence of brown spot fungal disease that was noted in 2010 (David, 2012) was not observed in 2011 (Figure 3).



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. Like several other waters, the brown spot disease outbreak that was obvious on the Big Lake Thoroughfare in 2010 (upper image) was not observed in 2011 (lower image).

Table 2. Manoomin acreage, density and abundance index from 40 Wisconsin waters for 2008-2011, and the 1985-2011 means. A density value of 1=sparse, 5=dense. (Data for 1985-2007 can be found in previous season reports.)															
WATER	2008			2009			2010			2011			1985-2011		
	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX	ACRES	DEN.	INDEX
<b>NORTHWESTERN CTYS.</b>															
<b>BARRON</b>															
SWEENEY CREEK	1	1	1	8	3	24	3	5	15	11	2	22	9	2.6	31
<b>BAYFIELD</b>															
TOTOGATIC LAKE	54	1	54	180	2	360	81	2	162	110	3	330	152	2.5	435
<b>BURNETT</b>															
BASHAW LAKE	21	1	21	0	0	0	1	1	1	1	1	1	9	2.1	24
BIG CLAM LAKE	10	2	20	8	3	24	10	2	20	15	1	15	128	3.1	436
BRIGGS LAKE	25	4	100	21	4	84	8	3	24	20	4	80	27	3.8	105
GASLYN LAKE	6	2	12	16	3	48	20	3	60	4	2	8	22	3.1	75
LONG LAKE	64	3	192	120	4	480	40	3	120	70	4	280	69	2.7	197
MUD LAKE (2)	4	4	16	9	4	36	10	4	40	4	5	20	13	3.7	46
WEBB CREEK	11	5	55	9	4	36	2	4	8	11	5	55	12	4.1	55
<b>DOUGLAS</b>															
MULLIGAN LAKE	4	2	8	0	0	0	0	0	0	0	0	0	22	2.0	52
<b>POLK</b>															
RICE BED CREEK	19	5	95	15	4	60	10	3	30	19	5	95	12	4.3	53
RICE LAKE (1)	15	3	45	50	5	250	45	3	135	24	2	48	45	3.3	157
WHITE ASH LAKE	10	3	30	12	2	24	19	4	76	14	3	42	12	3.2	39
<b>SAWYER</b>															
BILLY BOY FLOW.	16	3	48	15	3	45	1	1	1	19	2	38	13	2.3	40
BLAISDELL LAKE	50	3	150	80	2	160	45	1	45	95	2	190	77	2.6	203
PACWAWONG LAKE	35	2	70	80	4	320	115	5	575	16	2	32	83	3.6	326
PHIPPS FLOWAGE	23	4	92	25	4	100	14	3	42	26	4	104	28	3.9	110
<b>WASHBURN</b>															
DILLY LAKE	2	2	4	2	2	4	5	1	5	1	1	1	17	3.7	72
POTATO LAKE	13	3	39	20	4	80	7	2	14	21	3	63	13	3.0	42
RICE LAKE	9	3	27			58*	5	1	5	5	2	10	19	3.2	70
SPRING LAKE (1)	18	2	36	3	1	3	1	1	1	1	1	1	15	2.6	49
TRANUS LAKE	18	2	36	26	2	52	32	2	64	5	3	15	30	1.7	49
<b>SUBTOTAL</b>	<b>428</b>		<b>1,151</b>	<b>699</b>		<b>2,248</b>	<b>474</b>		<b>1,443</b>	<b>492</b>		<b>1,450</b>	<b>827</b>		<b>2,667</b>
<b>NORTH-CENTRAL CTYS.</b>															
<b>FOREST</b>															
ATKINS LAKE	0	0	0	0	0	0	0	0	0	0	0	0	14	0.5	41
INDIAN/RILEY LAKE	2	1	2	4	3	12	1	3	3	4	2	8	5	2.9	14
PAT SHAY LAKE	6	1	6	15	2	30	25	3	75	12	2	24	32	1.6	55
RAT RIVER	13	3	39	18	4	72	2	2	4	12	3	36	20	4.4	93
WABIKON LAKE	70	4	280	74	3	222	80	3	240	55	3	165	48	2.8	140
<b>LINCOLN</b>															
ALICE LAKE	20	3	60	26	3	78	32	2	64	30	3	90	44	3.0	150
<b>ONEIDA</b>															
FISH LAKE	5	2	10	2	4	8	1	1	1	1	1	1	26	3.0	93
LITTLE RICE LAKE	0	0	0	0	0	0	0	0	0	0	0	0	6	1.0	23
RICE LAKE	35	1	35	0	0	0	10	2	20	5	2	10	54	1.3	94
SPUR LAKE	70	1	70	0	0	0	1	1	1	1	1	1	58	2.8	211
WISCONSIN RIVER	150	4	600	165	4	660	140	4	560	125	5	625	144	4.6	652
<b>PRICE</b>															
BLOCKHOUSE LAKE	0	0	0	0	0	0	0	0	0	0	0	0	14	2.1	48
<b>VILAS</b>															
ALLEQUASH LAKE	80	4	320	25	2	50	10	3	30	16	4	64	59	3.8	241
LITTLE RICE LAKE	45	3	135	48	4	192	8	3	24	12	4	48	19	2.8	62
MANITOWISH RIVER	14	5	70	17	4	68	16	5	80	14	4	56	15	4.5	69
PARTRIDGE LAKE	22	4	88	20	3	60	20	3	60	22	5	110	20	4.1	83
RICE LAKE	30	2	60	36	4	144	36	5	180	12	3	36	27	3.6	97
WEST PLUM LAKE	5	4	20	12	3	36	14	3	42	18	4	72	19	3.1	63
<b>SUBTOTAL</b>	<b>567</b>		<b>1,795</b>	<b>462</b>		<b>1,632</b>	<b>396</b>		<b>1,384</b>	<b>339</b>		<b>1,346</b>	<b>623</b>		<b>2,230</b>
COUNT:			40			40			40			40			40
<b>TOTAL:</b>	<b>995</b>		<b>2,946</b>	<b>1,161</b>		<b>3,880</b>	<b>870</b>		<b>2,827</b>	<b>831</b>		<b>2,796</b>	<b>1,450</b>		<b>4,897</b>
AVERAGE:			74			97			71			70			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 2011.					
COUNTY	WATER	2011 EST. ACRES	2011 EST. DENSITY	2010 EST. ACRES	2010 EST. DENSITY
Barron	Bear Lake	22	sparse-medium	16	medium
Bayfield	Chippewa Lake	50	medium-dense	45	medium-dense
Burnett	Black Brook Flowage	1	sparse	1	sparse
	Grettum Flowage	4	sparse-medium	25	dense
	Loon Lake (Carters Bridge)	13	medium	22	medium
	Lower Hay Creek Flowage	14	medium	5	sparse
	Mud Lake (Oakland Township)	2	sparse	45	medium
	North Fork Flowage	70	medium-dense <sup>1</sup>	15	sparse
	North Lang Lake	2	dense	2	dense
	Phantom Flowage	10	sparse	10	medium
Rice Lake <sup>2</sup>	42	medium-dense	5	medium	
Douglas	Lower Ox Lake	5	sparse	10	sparse
	Minong Flowage (Smiths Bridge)	50	medium-dense	5	medium
	Radigan Flowage	2	sparse	10	sparse
	St. Croix (Gordon) Flowage	4	medium-dense	6	medium
	St. Croix River/Cutaway Dam	28	medium-dense	26	medium
	Upper Ox Lake	4	dense	4	dense
Forest	Hiles Millpond	60	medium-dense	15	medium
	Little Rice Lake	220	medium-dense	40	medium
Iron	Little Turtle Flowage	13	medium-dense	not surveyed	
	Mud Lake	3	medium	6	sparse-medium
Langlade	Daily Pond	9	dense	11	medium
	Miniwaukan Lake	7	sparse-medium	7	medium
	Pickrel Creek (Goose Island)	9	dense	0	-
	Spider Creek Flowage	8	medium	18	medium
Oneida	Big Lake	8	medium-dense	15	medium-dense*
	Cuenin Lake	3	medium-dense	16	medium-dense*
	Fourmile Lake	12	medium-dense	13	medium-dense*
	Roe Lake	13	sparse-medium	not surveyed	
	The Thoroughfare	96	sparse-dense	86	medium-dense*
	Wolf River <sup>3</sup>	18	dense	not surveyed	
Polk	Somers Lake	2	medium	9	medium-dense
Price	Lower Steve Creek Flowage	2	sparse	not surveyed	
	Spring Creek WA Flowages	51	dense	0	- <sup>4</sup>
Sawyer	Partridge Crop Lake	8	sparse-dense	5	medium
Taylor	Chequamegon Waters Flowage	125	sparse-dense	not surveyed	
Vilas	Aurora Lake	10	sparse-dense	60	medium-dense*
	Frost Lake	24	medium-dense	5	sparse
	Irving Lake	86	sparse-medium	45	sparse-medium
	Island Lake	90	medium-dense	85	sparse-dense
	Lower Ninemile Lake	33	sparse-medium	5	sparse
	Nixon Lake	6	dense	10	dense
	Rice Creek <sup>5</sup>	26	dense	16	medium-dense
	Upper Ninemile Lake	30	medium-dense	30	medium-dense*
Washburn	Long, Mud, & Little Mud Lakes	16	medium-dense	24	medium-dense
	Trego Flowage	4	medium-dense	20	dense

<sup>1</sup> But site too dry to harvest; <sup>2</sup> Near Hertel; <sup>3</sup> NW of Lennox; <sup>4</sup> Water control structure failure; <sup>5</sup> N of Big Lake  
\* Site appeared highly infected with Brown Spot disease.



## Harvest Estimation

Responses were obtained from 147 tribal permit holders (Table 1) and 327 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. Forty-four of the tribal and 284 of the state licensees surveyed reported harvesting rice in 2011. The total number estimated active in each group were 149 tribal members and 647 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 129 off-reservation harvesting trips, gathering 3,661 pounds of green rice (Appendix 1), with an extrapolated total harvest estimate of 12,773 pounds in 422 trips, an average of 30 pounds per trip (Table 4). The total off-reservation harvest per active tribal license averaged 86 pounds.

		SURVEY RESPONSE INFORMATION						ESTIMATED TOTALS		
	# OF PERMIT HOLDERS	# ACTIVE RESPONDENTS	REPORTED POUNDS	REPORTED TRIPS	AVE. # OF TRIPS	AVE. POUNDS/TRIP	AVE. POUNDS/PERSON	# ACTIVE	# TRIPS	# POUNDS
TRIBAL										
ACTIVE	175	29	2,290	90	3.1	25.4	79.0	68	211	5,370
INACTIVE	391	15	1,371	39	2.6	35.2	91.4	81	211	7,403
TOTAL	566	44	3,661	129	2.8	30.3	85.7	149	422	12,773
STATE	740	284	15,805	732	2.6	21.6	55.7	647	1,668	36,006
TOTAL	1,306	328	19,466	861	2.6	23.3	61.3	796	2,089	48,780

Estimated trips for state ricers was the product of estimated number active (647) and the average number of trips (2.6).

Estimated harvest for state ricers was the product of estimated number active (647) and the average pounds per person (55.7).

In comparison, active state licensees reported making from 1 to 16 ricing trips, averaging 2.6 trips. Collectively, state survey respondents made 732 trips, gathering 15,805 pounds of green rice (Appendix 1), with an extrapolated total harvest estimate of 36,006 pounds in 1,668 trips, an average of 22 pounds per trip. The harvest per active state license averaged 56 pounds.

The amount of rice harvested per individual varied greatly (Table 5). The most reported by a state ricer was 520 pounds, while the most reported by a tribal ricer was 450 pounds. On the low end of the range, the percentage of tribal ricers who harvested a total of 50 pounds or less fell from 85% in 2010 (David, 2012) to 50%; similarly for state ricers, the figure fell from 91% in 2010 to 70%.

An estimated 87% of the state-licensed ricers (647/740) gathered rice in 2011, versus 26% for the tribes (149/566) (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. It is noteworthy that the tribal activity rate in 2011 was higher than in most past years, when ricing was a check-off category on a general natural resource harvesting permit, rather than a unique permit.

Table 5. Distribution of harvest among active respondents to the 2010 harvest survey.			
TRIBAL			
POUNDS OF GREEN RICE HARVESTED	INDIVIDUALS		PERCENT OF TOTAL HARVEST
	NUMBER	PERCENT	
0 - 50	22	50.0	16.6
51 - 100	10	22.7	18.2
101 - 150	5	11.4	14.9
151 - 200	2	4.6	10.0
201 - 300	3	6.8	18.4
301 - 500	2	4.6	21.9
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	198	69.7	26.7
51 - 100	52	18.3	24.4
101 - 150	12	4.2	10.1
151 - 200	7	2.5	7.7
201 - 300	8	2.8	12.8
301 - 500	6	2.1	15.0
501 - 1000	1	0.4	3.3
1001 +	0	0.0	0.0

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 12,773 pounds of green rice and the total harvest for state permittees was estimated at 36,006 pounds (Table 4). Since 1.94% of the harvest reported by state licensees in 2011 came from on-reservation waters, the total off-reservation harvest was estimated at 48,080 pounds (35,307 state and 12,773 tribal), with tribal ricers accounting for 27% of the harvest.

These harvest figures make 2011 a relatively poor harvest year, with an estimated total harvest that was 21% below the long-term (1992-2011) average. However, it was a marked improvement from 2010, which was the poorest harvest year on record (Figure 4 & Appendix 2). The increase in the harvest between years is apparent in a number of different measures, including the average combined harvest per trip, which increased from 10 pounds in 2010 to 23 in 2011 and the combined average harvest per active license, which rose from 22 pounds to 61. The increase in participation was also apparent in the increase in estimated active ricers, which increased over 40% (from 558 to 796) and an increase in the average number of trips made, from 2.3 to 2.6.

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.

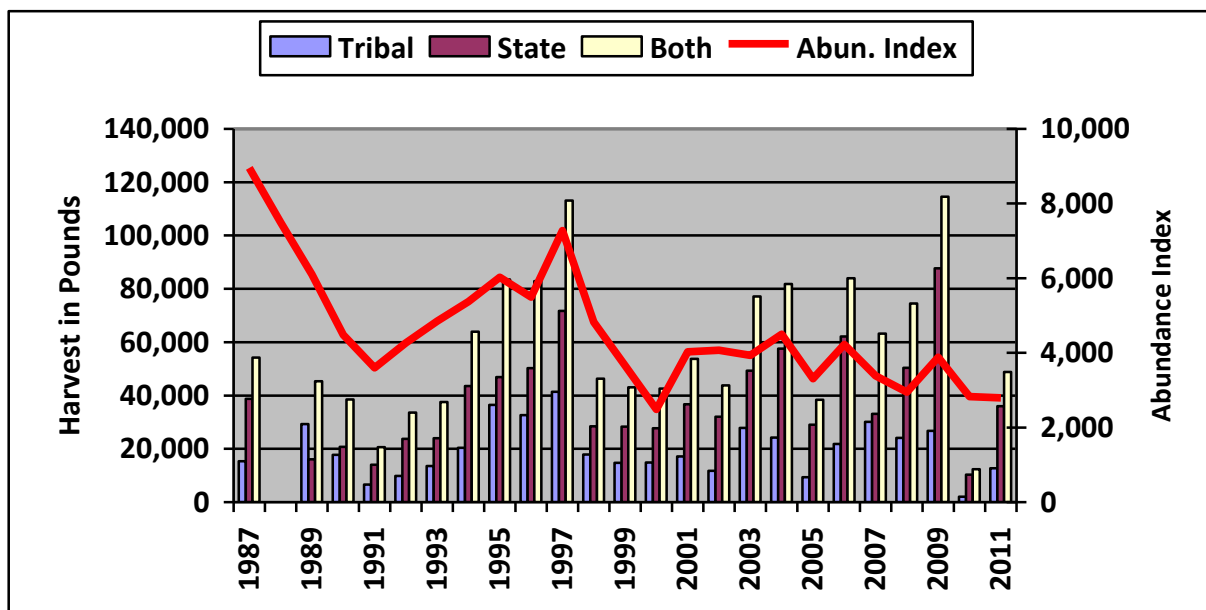


Figure 4. Harvest trends versus abundance index, 1987-2011 (\* no harvest estimates for 1988).

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 2011 harvest distribution differed from the long-term average (1992-2010) in several ways. Harvest in the Douglas, Vilas, Oneida and Forest were very similar to the long-term average. However, Burnett County provided only 16% of the harvest compared to 33% in the long term average, and the percentage of the harvest coming from Sawyer and Taylor was also below

average. Bayfield and Price counties, at 18% and 10% of the harvest respectively, exceeded their long-term averages of 9% and 3% 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, as were Pacwawong in Sawyer and the Chequamegon Waters Flowage in Price. Good stands on Chippewa Lake in Bayfield and the Spring Creek Wildlife Area flowages lifted the contributions from these two counties. In 2011, at least 1 pound of harvest was reported from 87 different waters compared to 70 in 2010 (including 11 sites with only 1 pound of reported harvest that year) (David, 2012), another reflection of the generally better crop in 2011.

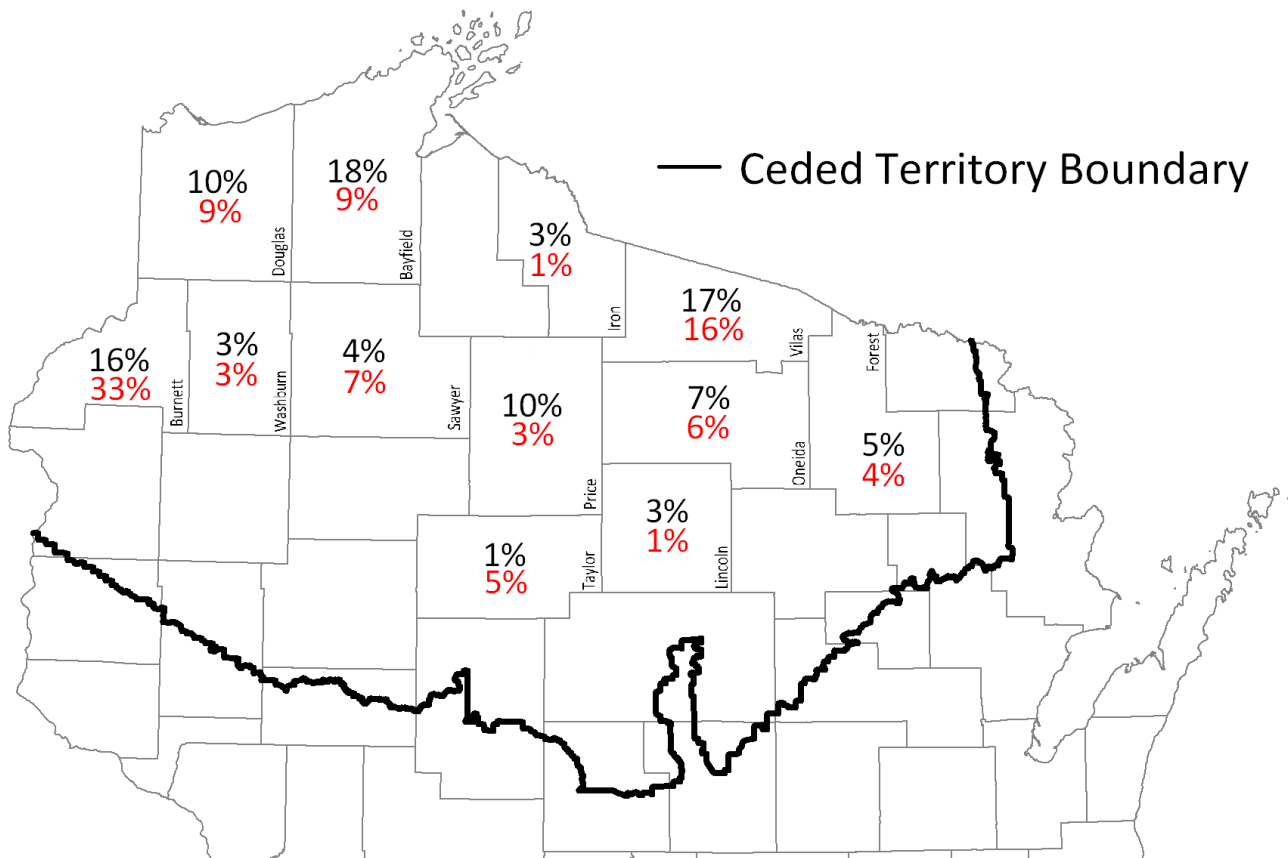


Figure 5. Distribution of the 2011 manoomin harvest among counties (figures in black) compared to the long-term average (1992-2010; figures in red). Data shown for counties which accounted for 3% or more of the harvest in either 2011 or over the long-term.

Only 28 of the 15,805 pounds of rice reported harvested by state survey respondents came from waters outside the ceded territory in 2011 (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 fourth most heavily harvested sites (Spring Creek Wildlife Area in Price County and Chippewa Lake in Bayfield County). (Seeded sites are marked with an asterisk in Appendix 1.) This was up from 18% in 2010 and similar to the 24% observed in 2009, but less than the 27%, 31% and 26% observed in 2008, 2007, and 2006 respectively.

## Opinions of Respondents

Annual Abundance: Individuals were asked if they felt the 2011 wild rice crop was better, the same, or worse than the 2010 crop. Among the 228 active respondents with an opinion, 71% felt 2011 was better than 2010; 16% felt it was about the same, and 13% felt it was worse. This relatively high level of consensus of opinion regarding the crop (with 7 out of 10 opinions indicating the crop was better) is likely largely the result of the very poor crop in 2010, which produced the lowest harvest estimates since GLIFWC began conducting surveys.

Rice Worm Abundance: For the eighth 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 280 respondents who expressed an opinion, 8% rated them as very low, 32% as low, 33% as average, 13% as medium high, and 14% as high (Figure 6).

While these figures suggest a second year of modest decline in rice worm abundance from the very high abundance reported in 2009, they still represent the third highest abundance rating reported since this question was added to the survey in 2004. The annual variation in responses to the question over the eight years suggests that year to year variation in rice worm abundance may be quite marked.

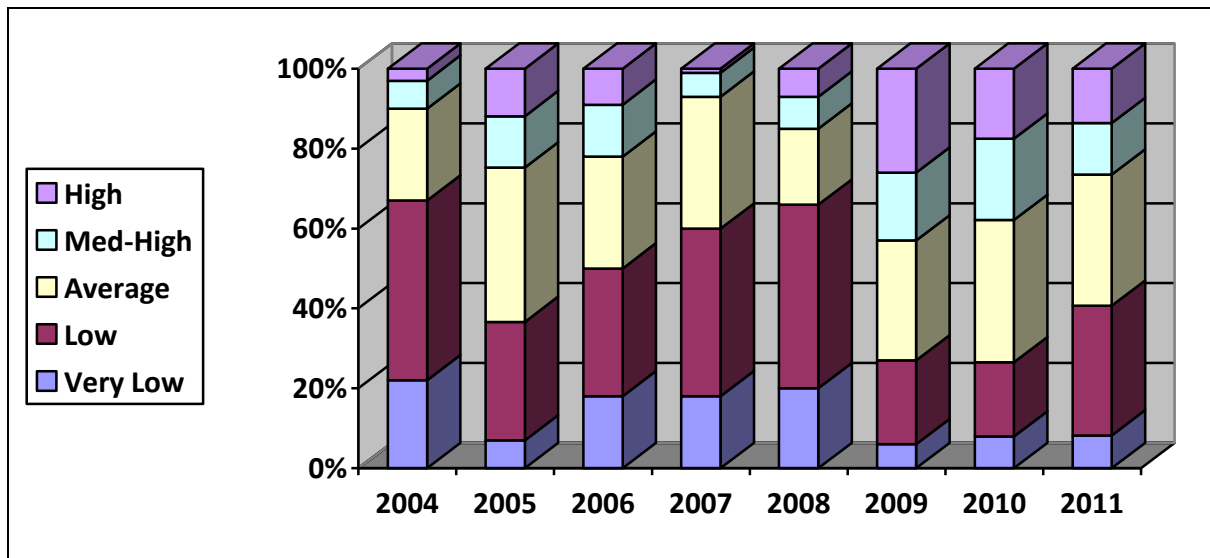


Figure 6. Opinions of manoomin harvest survey respondents on the abundance of rice worms, 2004 through 2011 (for respondents with an opinion).

Brown Spot Disease Prevalence: Following the extensive outbreak of Brown Spot Disease in 2010, a new question was added to the harvest survey for 2011 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 245 opinions were offered. The severe category was checked 12 times, for 11 different waters (one checked by two individuals); the moderate category was checked 61 times for 29 waters (with individual waters checked 1 to 10 times); and the minor category was checked 172 times for 63 waters (with individual waters checked 1 to 18 times).

It is difficult to interpret the meaning of this initial data, but it seems to suggest that brown spot prevalence was fairly minor in 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. Nine individuals did comment on a high prevalence of “ghost rice” or empty hulls; 5 expressed appreciation for the pre-season air photos and abundance information. 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 possible declines in abundance or management needs on a number of specific waters including the flowages at the Crex Meadows Wildlife area in Burnett County (n=3); Radigan Flowage and Mulligan Lake in Douglas (2 each); and Spring Lake in Washburn, Bear Lake in Douglas, and Black Brook Flowage in Burnett (1 each).

Potential Waters for Seeding or Other Restoration: Respondents suggested 18 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 and sites without flowing water 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. 2010. Wild rice (manoomin) abundance and harvest in northern Wisconsin in 2010. Great Lakes Indian Fish and Wildlife Commission Administrative Report 12-04. 17 pp.

Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2011 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Ashland	Kakagon Sloughs	0	0	1	50	1	50
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>50</b>	<b>1</b>	<b>50</b>
Barron	Bear Lake	0	0	2	40	2	40
	Lake Chetek	0	0	1	10	1	10
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>50</b>	<b>3</b>	<b>50</b>
Bayfield	Chippewa Lake*	11	211	54	1165	65	1376
	Totogatic Lake	27	552	62	1455	89	2007
	Unnamed	0	0	1	0	1	0
	<b>Subtotal</b>	<b>38</b>	<b>763</b>	<b>117</b>	<b>2,620</b>	<b>155</b>	<b>3,383</b>
Buffalo	Pool 5	0	0	1	0	1	0
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
Burnett	Briggs Lake	4	165	16	500	20	665
	Clam River Flowage	0	0	10	150	10	150
	Long Lake	3	17	48	1559	51	1576
	Loon Lake	0	0	6	168	6	168
	Mud Hen Lake	2	25	0	0	2	25
	Mud Lake (2) (Oakland Twn)	2	4	0	0	2	4
	North Fork Flowage*	0	0	1	0	1	0
	Peterson Lake	0	0	1	25	1	25
	Phantom Flowage*	0	0	3	100	3	100
	Rice Lake	0	0	8	330	8	330
	Unnamed	0	0	1	10	1	10
	Webb Creek (east)	0	0	2	21	2	21
	Yellow River	1	0	2	53	3	53
	<b>Subtotal</b>	<b>12</b>	<b>211</b>	<b>98</b>	<b>2,916</b>	<b>110</b>	<b>3,127</b>
Chippewa	Cedar Creek	0	0	3	5	3	5
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>3</b>	<b>5</b>	<b>3</b>	<b>5</b>

(Appendix 1 continued on the next page.)

Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2011 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Douglas	Amnicon Lake	0	0	2	0	2	0
	Bear Lake	1	5	0	0	1	5
	Lower Ox Lake	0	0	2	160	2	160
	Minong Flowage	4	75	36	975	40	1050
	Pokegama River/Bay	0	0	6	62	6	62
	Radigan Flowage	0	0	1	0	1	0
	St Croix River	1	7	34	509	35	516
	St. Louis River	0	0	1	20	1	20
	St. Croix (Gordon) Flowage	0	0	1	15	1	15
	Upper Ox Lake	0	0	12	161	12	161
	<b>Subtotal</b>		<b>6</b>	<b>87</b>	<b>95</b>	<b>1,902</b>	<b>101</b>
Forest	Hiles Millpond*	0	0	5	180	5	180
	Little Rice Lake	2	60	9	318	11	378
	Rat River	0	0	1	25	1	25
	Rice Lake	0	0	3	257	3	257
	Scott Lake	0	0	1	0	1	0
	Wabikon Lake	0	0	3	75	3	75
	<b>Subtotal</b>		<b>2</b>	<b>60</b>	<b>22</b>	<b>855</b>	<b>24</b>
Iron	Gile Flowage*	1	45	0	0	1	45
	Little Turtle Flowage*	2	120	24	292	26	412
	Manitowish River	0	0	2	25	2	25
	Mud Lake*	0	0	3	14	3	14
	Turtle Flambeau Flowage	0	0	6	21	6	21
	<b>Subtotal</b>		<b>3</b>	<b>165</b>	<b>35</b>	<b>352</b>	<b>38</b>
Langlade	Pickereel Creek (Goose Island)	0	0	1	50	1	50
	Spider Creek Flowage*	0	0	1	50	1	50
	Unnamed	0	0	2	35	2	35
	Unnamed (Daily) Pond	0	0	1	40	1	40
	Wolf River (Turtle Lake)	0	0	1	35	1	35
	<b>Subtotal</b>		<b>0</b>	<b>0</b>	<b>6</b>	<b>210</b>	<b>6</b>
Lincoln	Alice Lake	0	0	16	101	16	101
	Wisconsin River	0	0	17	533	17	533
	<b>Subtotal</b>		<b>0</b>	<b>0</b>	<b>33</b>	<b>634</b>	<b>33</b>
Marquette	Harris Pond (Harrisville)	0	0	3	8	3	8
	<b>Subtotal</b>		<b>0</b>	<b>0</b>	<b>3</b>	<b>8</b>	<b>3</b>

(Appendix 1 continued on the next page.)



Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2011 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Oneida	Big Lake	4	75	6	131	10	206
	Cuenin Lake	0	0	3	30	3	30
	Fourmile Lake	0	0	2	90	2	90
	Gary Lake	4	90	7	190	11	280
	Little Rice Creek	0	0	1	0	1	0
	Roe Lake*	0	0	1	30	1	30
	The Thoroughfare	2	20	26	260	28	280
	Wisconsin River	0	0	15	430	15	430
	<b>Subtotal</b>	<b>10</b>	<b>185</b>	<b>61</b>	<b>1,161</b>	<b>71</b>	<b>1,346</b>
Outagamie	Wolf River	0	0	1	20	1	20
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>20</b>	<b>1</b>	<b>20</b>
Polk	Apple River	0	0	2	10	2	10
	Apple River Flowage	0	0	1	0	1	0
	Balsam Branch	0	0	3	3	3	3
	Joel Flowage*	2	50	9	38	11	88
	Rice Lake	0	0	1	30	1	30
	Somers Lake	0	0	2	5	2	5
	Unnamed	0	0	3	43	3	43
	<b>Subtotal</b>	<b>2</b>	<b>50</b>	<b>21</b>	<b>129</b>	<b>23</b>	<b>179</b>
Price	Lower Steve Creek Flowage*	0	0	2	200	2	200
	Spring Creek WA Flowage*	6	400	35	1273	41	1673
	<b>Subtotal</b>	<b>6</b>	<b>400</b>	<b>37</b>	<b>1,473</b>	<b>43</b>	<b>1,873</b>
Sawyer	Barker Lake	0	0	3	3	3	3
	Billy Boy Flowage*	1	15	0	0	1	15
	Blaisdell Lake	0	0	3	83	3	83
	Hunter Lake	0	0	1	0	1	0
	Mosquito Brook	1	20	0	0	1	20
	Namekagon River	0	0	3	280	3	280
	Pacwawong Lake	5	90	6	41	11	131
	Partridge Crop Lake	0	0	1	0	1	0
	Phipps Flowage	3	130	12	159	15	289
	<b>Subtotal</b>	<b>10</b>	<b>255</b>	<b>29</b>	<b>566</b>	<b>39</b>	<b>821</b>
Taylor	Chequamegon Waters Flowage*	0	0	1	5	1	5
	Mondeaux Flowage	0	0	7	187	7	187
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>8</b>	<b>192</b>	<b>8</b>	<b>192</b>

(Appendix 1 continued on the next page.)

Appendix 1. Ricing trips and pounds of green manoomin harvested by respondents to the 2011 harvest survey. Seeded waters are marked with an asterisk.							
COUNTY	WATER	Tribal		State		Combined Total	
		Trips	Pounds	Trips	Pounds	Trips	Pounds
Vilas	Allequash Lake	3	210	9	74	12	284
	Aurora Lake	0	0	5	33	5	33
	Boot Creek	0	0	1	0	1	0
	Frost Lake	0	0	3	92	3	92
	Irving Lake	3	230	20	180	23	410
	Island Lake	10	205	15	190	25	395
	Little Rice Lake	1	20	3	45	4	65
	Lost Creek	0	0	6	40	6	40
	Lower Ninemile Lake	1	25	2	7	3	32
	Manitowish River	0	0	1	20	1	20
	Nixon Lake	2	125	7	66	9	191
	Plum Lake	2	75	3	25	5	100
	Rice Creek	1	25	10	456	11	481
	Rice Lake	0	0	4	99	4	99
	Round Lake	4	100	6	94	10	194
	Upper Ninemile Flowage	2	150	26	701	28	851
		<b>Subtotal</b>	<b>29</b>	<b>1,165</b>	<b>121</b>	<b>2,122</b>	<b>150</b>
Washburn	Gilmore Lake	0	0	1	25	1	25
	Potato Lake	1	5	6	70	7	75
	Tranus Lake*	3	70	12	92	15	162
	Trego Flowage	0	0	1	3	1	3
	Unnamed	0	0	4	106	4	106
	Whalen Lake	0	0	2	46	2	46
	Yellow River	0	0	8	181	8	181
	<b>Subtotal</b>	<b>4</b>	<b>75</b>	<b>34</b>	<b>523</b>	<b>38</b>	<b>598</b>
Waushara	Auroraville Millpond	0	0	1	0	1	0
	<b>Subtotal</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
Unnamed	Unnamed	7	245	2	19	9	262
	<b>Subtotal</b>	<b>7</b>	<b>245</b>	<b>2</b>	<b>19</b>	<b>9</b>	<b>262</b>
<b>GRAND TOTAL</b>		<b>129</b>	<b>3,661</b>	<b>732</b>	<b>15,805</b>	<b>861</b>	<b>19,466</b>
<b>A) Total from Seeded Waters</b>		<b>26</b>	<b>911</b>	<b>150</b>	<b>3,439</b>	<b>176</b>	<b>4,350</b>
<b>B) Total (excluding unnamed waters)</b>		<b>122</b>	<b>3,416</b>	<b>720</b>	<b>15,594</b>	<b>842</b>	<b>19,010</b>
<b>A/B</b>		<b>21.3%</b>	<b>26.7%</b>	<b>20.8%</b>	<b>22.1%</b>	<b>20.9%</b>	<b>22.9%</b>

## APPENDIX 2. Wisconsin manoomin harvest summary, 1992-2011

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
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
EST. TRIBAL TRIPS	164	205	324	891	680	592	396	370	268	432	352	511	515	255	405	545	552	731	263	422
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
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
<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>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>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>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>
% 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
<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>
EST. TRIBAL ACTIVE	162	186	122	171	213	176	158	140	116	139	104	96	86	72	116	101	153	197	95	149
% 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
<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>
TRIBAL LBS/TRIP	60	66	63	41	48	70	45	40	56	40	33	54	47	37	54	55	44	37	8	30
TRIBAL HARV/ACTIVE	61	73	167	214	153	235	113	105	129	123	113	290	282	130	188	298	157	136	21	86
<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>
EST. STATE ACTIVE	242	205	377	358	350	465	416	400	344	424	393	567	580	472	605	507	564	843	463	647
% 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
<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>
STATE LBS/TRIP	47	43	49	43	46	58	30	29	31	34	33	34	36	22	37	25	35	41	10	22
STATE HARV/ACTIVE	98	117	115	132	144	154	68	71	81	86	82	87	99	62	103	65	89	104	22	56
COMBINED # PER TRIP	50	49	53	42	47	62	34	32	37	36	33	39	39	24	41	34	37	40	10	23
NAMED SITES w/ HARV.	35	50	53	65	71	68	66	76	65	74	71	92	94	110	89	98	102	102	70	87

Appendix 3. Waters suggested for seeding or restoration by respondents to the 2011 wild rice harvest survey.*		
COUNTY	WATER	NOTES
Barron	Bear Lake	Historic bed in decline, likely water management needed
Bayfield	Bark Bay Slough Bibon Lake Iron River Mill Pond LaPointe Lagoon Preemption Pond Rachet Creek	On Lake Superior Near Port Wing. Small wetland, but may have good potential Esp. upper end; high priority to investigate Small wetland area on Madeline Island Very small (2-3 acre) headwaters pond on National Forest Near mouth on Big Sand Bay; Park Service property
Douglas	Amnicon Lake Cranberry Lk. Flow. Lyman Lake Moose Lake Mulligan Lake	Historic water; cause of loss should be investigated North of CTY T; adjacent to Minong Flowage Fair development, but bay near outlet may have potential Small 13 acre lake with outlet surrounded by county lands Needs beaver control on downstream private land
Iron	Saxon Falls Flowage	Initial suitability appears limited
Langlade	Eau Claire River	Wetland area above Claire Road in town of Neva
Lincoln	Harrison Flowage Lake Alice	Seeding has been done at this site; now working on water levels Historic stand near junction of CTY D & H in decline
Oneida	Lake Julia	Particular bays may be suitable; rice on several nearby waters
Sawyer	Tiger Cat Flowage	Also reportedly seeded by private individual

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