Waupaca Chain O' Lakes District

A Protection and Rehabilitation District

2022 Lake Load Capacity Study
Recreational Impacts

v3

The Waupaca Chain O' Lakes consists of 22 lakes in Waupaca County, Wisconsin. The lakes are quite diverse in their morphology, ecology, and recreational use. Fifteen of the lakes hold WDNR designated Critical Habitat Areas, while three lakes are considered Areas of Special Natural Resource Interest. The Chain boasts one of the most diverse fish communities in Central Wisconsin, with species from all major fish assemblages - warmwater, coolwater, and coldwater species.

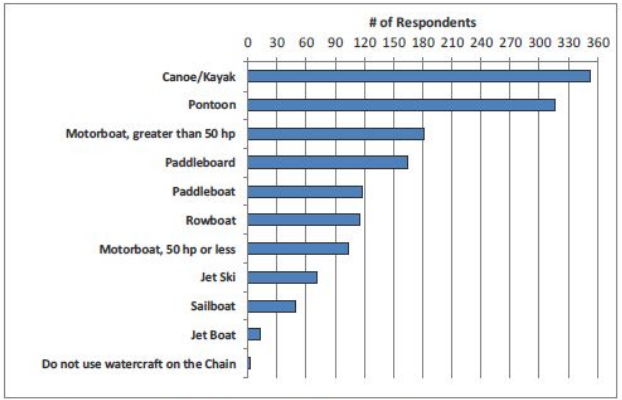
The Chain is a biologically diverse system with numerous documented natural features; however, the Chain is heavily used for a variety of recreation purposes and human disturbance is evident through shoreland development, erosion, and the presence of number of various aquatic invasive species.

During April, 2017, a survey was mailed to property owners on the Chain. Based upon the results of the Survey, much was learned about the people who use and care for the Waupaca Chain O' Lakes. The majority (41%) live on the Chain seasonally, 34% are year-round residents, 17% visit on weekends throughout the year, and 3% own rentals.

Sixty-nine percent of respondents have owned their property for over 15 years and 48% have owned for over 25 years.

Many respondents ranked watercraft traffic as having a negative or somewhat negative impact on the Waupaca Chain o" Lakes.

Question 12: What types of watercraft do you use on the Chain?



Question 15: What type of effect has each of the following factors caused to the Chain waters?

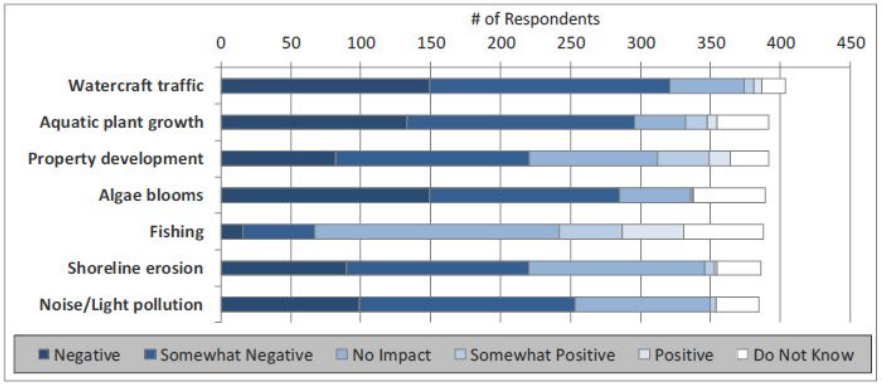


Figure 2.0-1. Select survey responses from the Waupaca Chain O' Lakes Stakeholder Survey. Additional questions and response charts may be found in Appendix B.

Recreation Impact

Recreational carrying capacity is “the amount of development and activity a body of water can handle before it starts to deteriorate.”

Lakes have a Ecological, Safety and Social carrying capacity limits.

What is the number of watercraft that can simultaneously operate on the lake without:

- Causing environmental harm to the resource
- Compromising user safety
- Causing significant user displacement or dissatisfaction

2022 Lake Load Capacity Study - June, July, August, September 2022

Objective: Understand how selected lakes within the Lake District are utilized for recreational purposes.

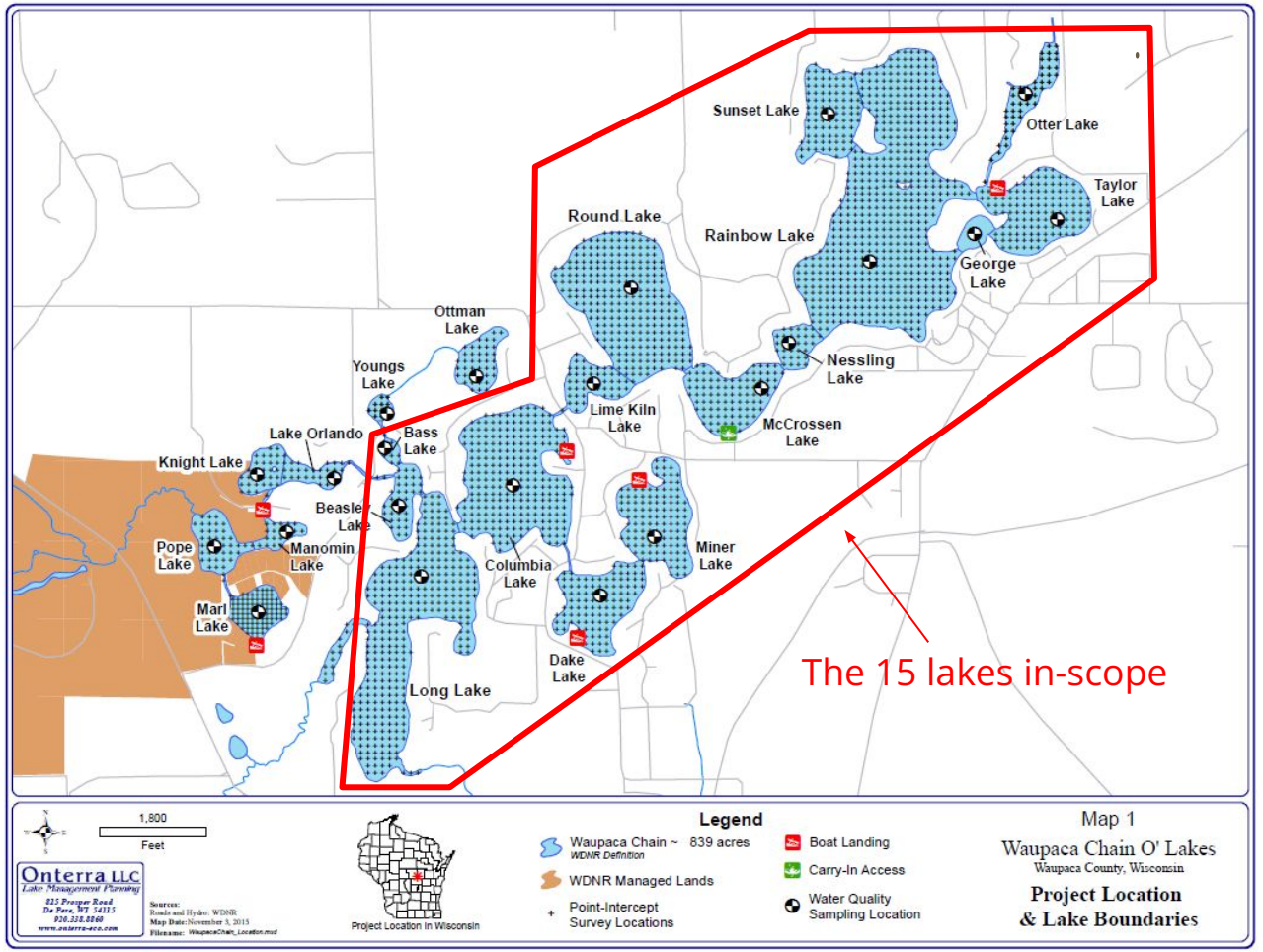
Such understanding may lead to recommending/establishing parameters to guide future decisions regarding the District's support for expanded access, potential regulations and resource allocation.

Process: Document water-based activities on 15 lakes on the Waupaca Lower Chain O' Lakes.

The five lakes of the Upper Chain (50 acres) are out-of-scope at this time due to minimal motorized traffic (and accompanying safety, environmental, aesthetic, impacts and potential multi-user recreational conflicts.)

Observations included:

- Number of active watercraft
- Number of moored/anchored watercraft
- Type of watercraft
  - pontoon, runabout, ski boats, wake boats, canoe, kayak, sailboat
- Watercraft activity
  - fishing, skiing, wakeboarding, wake surfing, sailing, cruising, anchored
- Speed of the watercraft (wake/no wake)
- Congestion/chokepoints
- Evidence of enhanced wakes/chop or bottom churn/propeller plumes
- Available parking spaces at public and private boat launches
- Weather


Sunset Lake
Otter Lake
Taylor Lake
Round Lake
Rainbow Lake
George Lake
Ottman Lake
Youngs Lake
Nessling Lake
Lime Kiln Lake
McCrossen Lake
Lake Orlando
Bass Lake
Knight Lake
Beasley Lake
Pope Lake
Manomin Lake
Columbia Lake
Miner Lake
Marl Lake
Dake Lake
Long Lake
The 15 lakes in-scope
1,800
Feet
Onterra LLC
Lake Management Planning
Project Location in Wisconsin
Legend
Waupaca Chain ~ 839 acres
WDNR Definition
WDNR Managed Lands
Point-Intercept Survey Locations
Boat Landing
Carry-In Access
Water Quality Sampling Location
Map 1
Waupaca Chain O' Lakes
Waupaca County, Wisconsin
Project Location & Lake Boundaries

Aerial View of Surveyed Lakes

Definitions

- Useable Acres
  - Total acres less watercraft to shoreline/pier/raft buffer zones
  - Total acres less water less than 3’ in-depth
- Active Watercraft
  - Under power, beached, or anchored with passengers onboard or adjacent
    - Does not include watercraft moored
- Under power - demonstrating motion
- Motorized - watercraft with engines
- Paddlesports
  - Without engines
    - Kayak
    - Canoe
    - Paddleboard
    - Paddleboat
    - Row Boat
    - Sail Boat
- Runabout - 16’ or less
- Wake Boat - designed by the manufacturer for wake sports - large hull displacement - often with boom and wake enhancing devices.
- Ski Boat - designed by the manufacturer for water skiing/wakeboarding
- Fishing Boat - designed by the manufacturer for fishing
- Towing Activities
  - Waterskiing
  - Tubing
  - Wakeboarding
  - Wake Surfing

Acreage of Surveyed Waters

Slow No Wake Lakes	Shoreline	Acres		Subtract <3' depth	Equals Net Useable Acres for Operation at No Wake speeds
Bass	1614	2.52	n/a	1.1	1.42
Beasley	3766	11.8	n/a	0.5	11.3
Dake	6456	32.06	n/a	4.9	27.16
George	2152	5.4	n/a	0.7	4.7
LimeKiln	3766	13.7	n/a	7.1	6.6
McCrossen	4842	29.59	n/a	2	27.59
Miner	6456	35.46	n/a	2.6	32.86
Nessling	2152	9.27	n/a	0.1	9.17
Otter	5918	14.4	n/a	2.7	11.7
Sunset	10711	89.2	n/a	10.7	78.5
Taylor	5918	34.9	n/a	12.4	22.5
Total		**278.3**			**233.5**
Greater than Slow No Wake Lakes	**Shoreline**	**Acres**	**Less 150' buffer from shoreline**	**Subtract <3' depth outside 150' buffer**	**Equals Net Useable Acres for Operation at Permitted Speeds**
Columbia	9899.2	80.56	55	0.8	54.2
Long	16140	103.8	62.9	0.4	62.5
Rainbow	10560	115.5	91.7	0	91.7
Round	7532	79.8	64.6	0	64.6
Total		**379.66**			**273**

This information was provided by the Waupaca County Land and Water Conservation Dept. using GIS technology and DNR topographic maps.

150’ buffer allows watercraft to pass “at speed” no less than 100’ from shoreline/pier/raft.

Mooring - Parked Watercraft Census

Lake	Date	Pontoon	Jet Ski	Ski Boat	Wake Boat	Runabout	Fishing Boat	Paddle sports
Long	6/10/2022	51	9	20	9	7	5	130
Beasley	6/10/2022	15	4	3	1	1	2	51
Bass	6/10/2022	15	0	1	1	1	2	15
Columbia	6/14/2022	164	13	30	2	2	12	238
Dake	6/7/2022	43	2	7	3	2	7	91
Miner	6/7/2022	35	2	9	1	4	5	103
Lime Kiln	6/10/2022	53	7	12	5	2	2	79
Round	6/14/2022	37	15	13	4	7	7	119
McCrossen	6/14/2022	43	15	15	3	5	8	117
Nessling	6/14/2022	18	8	5			3	49
Rainbow	6/9/2022	21	8	7	2	6	2	35
Sunset	6/9/2022	47	8	13	1	3	5	130
George	6/9/2022	1				1		
Taylor	6/9/2022	67	6	12		3	4	128
Otter	6/9/2022	36	4	3	1		4	61
Totals by watercraft style		**595**	**75**	**96**	**20**	**33**	**47**	**912**
Motorized		**866**						
Non-motorized		**912**						
Total watercraft		**1778**						

This survey was conducted via boat over four days. Recorded watercraft were moored/docked/parked at piers, on lifts or trailers and racks visible on shore. Boats under power were not counted. If they had been, the results would have been immaterial.

It is reasonable to assume that these watercraft are owned by riparian owners on the Chain.

The survey accounted for rental boats at three marinas (41 estimated.)

The survey did not account for empty boat lifts. As a result, the Census count may be understated by 2 to 3%.

Boat Landing Census

Total Available

Taylor Lake	23
Snug Harbor	9
Miner Lake	4
Dake Lake	12
Becker Marine	8
Marl Lake	na
Knight Lake	na
Casino	na
Lot 3 - Clearwater	na
Total	**56**

Per WI DNR NR Policy 1.91- "Reasonable Public Boating Access" for the Waupaca Chain O'Lakes has been determined to be:

Minimum = 22 Maximum = 33

Date	Time	Vacant Spaces	Available Car/Trailer combos	Available as a % of the total
7/2/2022	10:00 AM	23	56	41%
7/2/2022	2:00 PM	15	56	27%
7/9/2022	1:00 PM	6	56	11%
7/10/2022	12:30 PM	6	56	11%
7/16/2022	1:00 PM	26	56	46%
7/23/2022	12:30 PM	15	56	27%
7/30/2022	1:00 PM	8	56	14%
8/6/2022	1:00 PM	4	56	7%
8/13/2022	Rain		56	0%
8/14/2022	1:30 PM	30	56	54%
8/21/2020	1:15 PM	24	56	43%
8/27/2022	Rain		56	0%
8/28/2022	Rain		56	0%
9/3/2022	12:30 PM	35	56	63%

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Drone Survey - Chart 1.0

Weather

Drone Surveys	Day	Time	Degrees	Cloud Cover	Winds
July 2, 2022	Saturday	9:30 AM	70	Sunny	6 mph
July 2, 2022	Saturday	1:00 PM	79	Scattered Clouds	10 mph
July 3, 2022	Sunday	5:00 PM	81	Partly Cloudy	9 mph
July 19, 2022	Tuesday	5:00 PM	82	Mostly Cloudy	16 mph
July 21, 2022	Thursday	9:00 AM	75	Partly Cloudy	9 mph
July 22, 2022	Friday	12:30 PM	84	Fair	14 mph
August 6, 2022	Saturday	9:00 AM	73	Mostly Cloudy	14 mph
August 6, 2022	Saturday	1:00 PM	87	Muggy Partly Cloudy	8 mph
August 6, 2022	Saturday	5:00 PM	88	Muggy Partly Cloudy	7 mph

Drone Survey - Chart 2.1

Active Watercraft

Date	Time	Day of Week	Motorized Watercraft	Non-motorized Watercraft	All Watercraft	Acres per Watercraft
7/2/2022	9:00 AM	Saturday	56	30	86	5.9
7/2/2022	1:00 PM	Saturday	284	39	323	1.6
7/3/2022	5:00 PM	Sunday	152	24	176	2.9
7/21/2022	9:00 AM	Thursday	24	31	55	9.2
7/22/2022	12:30 PM	Friday	83	19	102	5.0
7/19/2022	5:00 PM	Tuesday	42	5	47	10.8
8/6/2022	9:00 AM	Saturday	47	21	68	7.4
8/6/2022	12:00 PM	Saturday	173	50	223	2.3
8/6/2022	5:00 PM	Saturday	150	40	190	2.7

Active = watercraft under power, beached or anchored.

506.5 usable acres
reference slide 10

Drone Survey - Chart 2.2

Motorized Watercraft under power by Date

Date	Time	Day of Week	Motorized Watercraft Under-Power	Acres Per Watercraft
7/2/2022	9:00 AM	Saturday	42	12.1
7/2/2022	1:00 PM	Saturday	158	3.2
7/3/2022	5:00 PM	Sunday	72	7.0
7/21/2022	9:00 AM	Thursday	15	33.8
7/22/2022	12:30 PM	Friday	34	14.9
7/19/2022	5:00 PM	Tuesday	30	16.9
8/6/2022	9:00 AM	Saturday	33	15.3
8/6/2022	12:00 PM	Saturday	80	6.3
8/6/2022	5:00 PM	Saturday	86	5.9

506.5 usable acres - reference slide #10 - Acreage of Surveyed Waters.
Acres per watercraft assume a uniform distribution of boats across all lakes

Drone Survey - Chart 3.0

Towing Events by Date

Date	Time	Day of Week	Water Ski/Wake Board	Wake Surfing	Acres used per Towing Event
7/2/2022	9:00 AM	Saturday	3	2	54.6
7/2/2022	1:00 PM	Saturday	2	0	136.5
7/3/2022	5:00 PM	Sunday	na	na	
7/21/2022	9:00 AM	Thursday	1	0	273
7/22/2022	12:30 PM	Friday	2	2	138.5
7/19/2022	5:00 PM	Tuesday	0	0	
8/6/2022	9:00 AM	Saturday	1	0	273
8/6/2022	12:00 PM	Saturday	13	2	18.2
8/6/2022	5:00 PM	Saturday	na	na	

Rainbow, Round, Columbia, Long Lake = 273 Usable Acres - reference slide 10 / Assumes a uniform distribution across all four lakes.

Drone Survey - Chart 3.1

Towing Activity by Lake during Nine Survey Periods

Lake	Useable Acres	Towing Events	Acres per Towing Event
Columbia	54.2	9	6.0
Long	62.5	11	5.7
Rainbow	91.7	5	18.3
Round	64.6	3	21.5

Rainbow, Round, Columbia, Long Lake = 273 Usable Acres - reference slide 10

Drone Survey - Chart 4.0

Motorized Watercraft Activity by Lake during Nine Survey Periods

Lake	Motorized WaterCraft	Average
Long	160	**18**
Taylor	157	**17**
Rainbow	139	**15**
McCrossen	105	**12**
Columbia	99	**11**
Sunset	87	**10**
Round	62	**7**
Lime Kiln	60	**7**
Nessling	34	**4**
Miner	27	**3**
Dake	25	**3**
Beasley	23	**3**
Otter	17	**2**
George	16	**2**
Bass	0	**0**
Total	**1011**	**112**

Drone Survey - Chart 4.1

Paddlesport Activity by Lake during Nine Survey Periods

Lake	Paddlesports	Average
Long	20	**2**
Taylor	29	**3**
Rainbow	33	**4**
McCrossen	4	**0**
Columbia	48	**5**
Sunset	20	**2**
Round	17	**2**
Lime Kiln	26	**3**
Nessling	0	**0**
Miner	10	**1**
Dake	13	**1**
Beasley	16	**2**
Otter	6	**1**
George	13	**1**
Bass	4	**0**
Total	**259**	**29**

Drone Survey - Chart 4.2

Beached/Anchored
Watercraft by Lake during Nine Survey Periods

Lake	Beached/Anchored	Max	Average
Long	95	36	11
Taylor	95	36	11
Rainbow	62	21	7
McCrossen	53	23	6
Sunset	53	15	6
Beasley	19	5	2
Miner	19	6	2
Lime Kiln	15	6	2
Columbia	13	6	1
Round	10	2	1
George	6	2	1
Dake	5	2	1
Otter	1	2	0
Bass	0	0	0
Nessling	0	0	0
Total	**446**		**50**

Drone Survey - Chart 4.3

All Active Watercraft by Lake during Nine Survey Periods

Lake	All Active WaterCraft	Max	Average
Long	180	**58**	**20**
Taylor	186	**57**	**21**
Rainbow	172	**40**	**19**
McCrossen	109	**39**	**12**
Columbia	147	**41**	**16**
Sunset	107	**28**	**12**
Round	79	**19**	**9**
Lime Kiln	86	**26**	**10**
Nessling	34	**14**	**4**
Miner	37	**4**	**4**
Dake	38	**13**	**4**
Beasley	39	**14**	**4**
Otter	23	**5**	**3**
George	29	**7**	**3**
Bass	4	**0**	**0**
Total	**1270**		**141**

Assumptions and Observations

If car/trailer parking spaces from the Upper Chain were included, another 44 (approx) spaces would be available.

Several potential user conflicts were observed during the drone surveys. They included traveling in excess of slow-no-wake and passing within 100’ of other boats, paddleboarders, piers, and rafts.

Several examples of bottom-churn were observed. Most prevalent was the 6’ hump in the center of Columbia, the gap between the rock-pile and Cleghorn point on Columbia and the reedbed on Long Lake.

The most common location for wake surfing was on Long Lake, with several examples of surfers near the reed bed and often passing within 100’ of other watercraft.

Columbia Lake was observed to have the most “cross-traffic conflict zones.”

Images of Recreational Impact


Columbia Lake
Prop Churn
Congestion

v3


Columbia Lake
Prop Churn
Congestion


Long Lake
Prop Churn
Enhanced Wake


Columbia Lake
Prop Churn


Long Lake
Enhanced wakes


Long Lake
Enhanced Wake

v3


Columbia Lake
Mixed user groups:
28 active watercraft including 4 kayaks in main,
6 kayaks on edges, 2 jet skis, 3 boats towing tubes

What's Next?

Phase Two of this study may include a panel of participants utilizing the data to reach conclusions and make recommendations that will shape future public policy.

*Link to all Drone Survey Photos (approx 350):

https://drive.google.com/drive/folders/19TuXH8XN29cVmF9EByHnPw7umh8uTgIF?usp=sharing

*Link to Drone YouTube Video:

https://www.youtube.com/watch?v=nZthJIDq8tQ

Link to Individual Lake Maps:

https://www.waupacachainolakesassociation.com/motorboat-age-requirements

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To the public and community partners:
Direct all questions and inquiries to: chair.WCOLD@gmail.com