Nick Peterson, Fisheries Specialist, Lake Superior Area, Minnesota DNR

nick.peterson@state.mn.us; 218-302-3272

The PredatorPrey Project (P3) was initiated in winter 2020 to support a larger, lake wide analysis of fish diets (*Status of Food Web Dynamics of Lake Superior Fishes in 2021; Sitar et al.*). The objectives of the lake wide study (*Sitar et al*.) were to measure the diet compositions of all fishes in Lake Superior to report the current status of the food web. State and Tribal natural resource agencies provided in-kind contribution of staff hours, expenses, and equipment for the collection of fish stomachs from multiple length classes captured in their scheduled fish surveys, and stomach samples were frozen for subsequent laboratory analyses. Predator fish diets were analyzed at laboratories at Northern Michigan University (NMU) and Marquette Fisheries Research Station (MIDNR); prey fish diets were analyzed at the laboratory at Lake Superior State University. Unidentifiable larval and juvenile coregonines were taxonomically identified using Single Nucleotide Polymorphism genetic techniques.

The Minnesota DNR also collected diets from some predator fish via a cooperative angling program (the P3). We (Minnesota DNR) recognized quickly that some species would be underrepresented in the lake wide analyses because some species are rarely captured in our standardized lake survey assessments in Minnesota waters (e.g., Chinook, Coho, and Pink salmon). Who catches more salmonids than Minnesota DNR? ANGLERS! And so- the P3 was born! This study is still ongoing and much of the data and sample summaries are being worked on as we speak. The lake wide results (*Sitar et al.*) should be summarized and available by December 2023.

P3 sample collection summary and interesting diet items: 2020-2023

A total of 4,515 fish carcasses were donated by volunteer P3 anglers over the last three years. From that, 4,408 stomachs from 15 different fish species were in good shape (i.e., not cut open or had diets removed), pre-processed (inventoried and bagged), and sent to NMU for diet analyses. The most samples were provided from the open-water season in 2021 (3,615), with less in 2022 (705) because we prioritized a "target sample list" based on the number, shore zone, and size-group of each species we needed to reach target sample sizes. Awesome work folks! The number of fish stomachs (diets) extracted from fish donated by anglers for the Minnesota DNR's PredatorPrey Project by species and year is shown in Table 1, and by species and month is shown in Table 2.

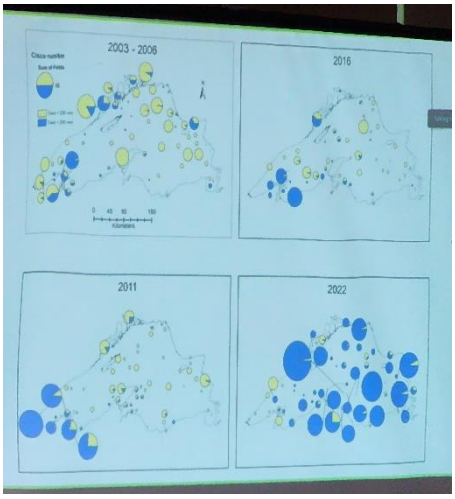
At least 68 individual anglers volunteered for the P3 project over the past three years, of which 66% (45) contributed at least one sample for this study. Participants were a mix of local charter captains and individual anglers. The most samples were provided by AnglerID 22, who had contributed 858 stomach samples over three years! The second most was AnglerID 61 with 480 total samples; this was not just one individual angler, but a bunch of anglers who harvested fish during the Silver Bay Salmon Classic in

2021 and 2022; the Minnesota DNR attended these events and collected samples at the cleaning station at Silver Bay Marina. A summary of carcasses provided by AnglerID is shown in Table 3.

Cool Finds!

Lake Superior fish will eat…. EVERYTHING! Check out some examples found in stomachs of fish provided by P3 anglers (see below)!

Lake Superior Cisco: History is happening NOW!



Anyone who knows Lake Superior can understand how important prey are to predators in what seems to be a relatively infertile environment - and also how FEW prey there are in relation to the size of the waterbody! One of the most important prey for predator fish in Lake Superior is Cisco (also known as Tillibee or Lake Herring). I like to think of Cisco as Snickers bars – delicious snacks full of things that will make you fat and happy! Lake wide efforts to monitor the Lake Superior Cisco populations lake wide over time (via trawling on the RV Kiyi) has found that recruitment (number of small fish to replace the big ones) is an issue. Why? That story is complicated and one for another day.

Trawling data from the RV Kiyi in 2022 found that Cisco, particularly small-sized fish, are more abundant than we have seen in many DECADES! All previous diet studies have occurred in years when Cisco were much less abundant (or close to non-existent!). Therefore, we feel it is vitally important to continue with the PredatorPrey Project in 2023 and help us understand what happens to this big year-class of Cisco over time. Will they survive? If not, what ate them- and when and where?

PredatorPrey Project 2023: The Show MUST Go On!

We will continue to collect stomachs from anglers in 2023 and would greatly appreciate your help! A special thanks to all anglers who contributed heads and guts for P3 over the past three years. Your efforts have greatly improved our understanding of the Lake Superior fishery. We (Minnesota DNR) greatly appreciate the support from anglers over the past few years and look forward to doing good things with you in the future!

If you would like to get involved, please get ahold of me (nick.peterson@state.mn.us; 218-302-3272)!

Table 1. The number of fish stomachs (diets) extracted from fish donated by anglers for the Minnesota DNR's PredatorPrey Project by species and year. The total number of samples provided was higher than this because not all stomachs donated were considered useful.

	Year			
Species	**2020**	**2021**	**2022**	**Total**
Brook Trout		1		1
Brown Trout	2	29	7	38
Burbot			2	2
Chinook salmon	6	315	80	401
Coho salmon	66	815	174	1,055
Kamloops Rainbow Trout	11	35		46
Lake Trout	3	1,840	348	2,191
Northern Pike		4	3	7
Pink salmon		411		411
Round Whitefish		5		5
Siscowet Lake Trout		92	46	138
Splake		3	1	4
Steelhead Rainbow Trout		12	4	16
Tullibbee (Cisco)		8		8
Walleye		45	40	85
Total	**88**	**3,615**	**705**	**4,408**

Table 2. The number of fish stomachs (diets) extracted from fish donated by anglers for the Minnesota DNR's PredatorPrey Project by species and month from 2020-2022.

	Month									
Species	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**Total**
Brook Trout							1			1
Brown Trout		13	8	5	5	2	2		3	38
Burbot			2							2
Chinook salmon		2	3	20	51	80	161	78	6	401
Coho salmon	22	108	80	109	193	205	263	68	7	1,055
Kamloops Rainbow Trout		11	35							46
Lake Trout	3	8	30	156	336	713	432	488	25	2,191
Northern Pike					1	4	2			7
Pink salmon				1	10	118	242	40		411
Round Whitefish							5			5
Siscowet Lake Trout				1	10	47	21	53	6	138
Splake		1	1			1	1			4
Steelhead Rainbow Trout			1	1	3	3	6	2		16
Tullibee (cisco)		1	1			1	3	2		8
Walleye				11	16	27	11	20		85
Total	**25**	**144**	**161**	**304**	**625**	**1,201**	**1,150**	**751**	**47**	**4,408**

Table 3. Number of fish stomach (diet) samples provided per angler by year. Angler ID refers to unique numbers assigned to each angler prior to sample collections.

	AnglerID																																													
Species	**1**	**2**	**3**	**5**	**6**	**7**	**11**	**12**	**14**	**15**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**34**	**35**	**37**	**39**	**40**	**43**	**44**	**46**	**48**	**49**	**51**	**52**	**53**	**54**	**55**	**57**	**58**	**59**	**61**	**62**	**68**	**100**	**MN DNR**	**Total**
Brown Trout						5				4	3		11	1		8			4																											3	39
Chinook salmon					11				1	9	1			31	4	79	36	4	49	1	3				13			3		1	2			1	1			2	7			9				140	408
Coho salmon	1	11	4	31	27	48	5		20	77	15	1	17	48	5	183	48	14	59	15	1	1		1		1		21		2			1	1	1			7	13			104	1		3	297	1,084
Kamloops	4		1			6				1	3																																		1	30	46
Lake Trout					7	1		2	2	59	2	13	10	145	31	480	115	24	249		2	1	18	5	17	21	13	22	9	10		4	1	4	1	5	1		10	3	1	233		2		704	2,227
Northern Pike												4																																		3	7
Pink salmon										19		1		1		8	1		3											1									9			103				291	437
Siscowet Lake Trout										1		2		4	1	53	3	6	13									1	1													29				29	143
Tullibee (cisco)				1						1						2			1				1																							2	8
Walleye														3	1	45	15	2	14															2				2								4	88
Steelhead																			1																							2				13	16
Splake											1		1				1																													1	4
Brook Trout																																													1		1
Round Whitefish						5																																									5
Burbot																																														2	2
Total	**5**	**11**	**5**	**32**	**45**	**65**	**5**	**2**	**23**	**171**	**25**	**21**	**39**	**233**	**42**	**858**	**219**	**50**	**393**	**16**	**6**	**2**	**19**	**6**	**30**	**22**	**13**	**47**	**10**	**14**	**2**	**4**	**2**	**8**	**3**	**5**	**1**	**11**	**39**	**3**	**1**	**480**	**1**	**2**	**5**	**1,519**	**4,515**

Admin · April 14, 2022 ·

As Cameryn Jane Prater discovered, this 500 mm lean lake charr in Minnesota waters of L. Superior near Duluth was a contestant in the 2021 Gichigami hot dog/brat eating contest.

Energy densities on prey items usually take effort in the lab to estimate using a calorimeter, but luckily We can refer to the nutritional label courtesy of Johnsonville.

Note: this is Brat the second. Our friends at MNDNR first reported Brat the first in a survey-caught lake charr in 2012.

Admin · February 19, 2022 ·

A trip to the tropics (for a lake charr) to dine. More evidence that lake charr are foodies as Collin Shinners discovered in this Siscowet stomach collected by our MNDNR friends near Duluth. Black Crappie du jour with Spottail shiner small plate.

February 15, 2022 ·

This is what happens when you stock Coho salmon in Lake Superior: they become a Siscowet's lunch.

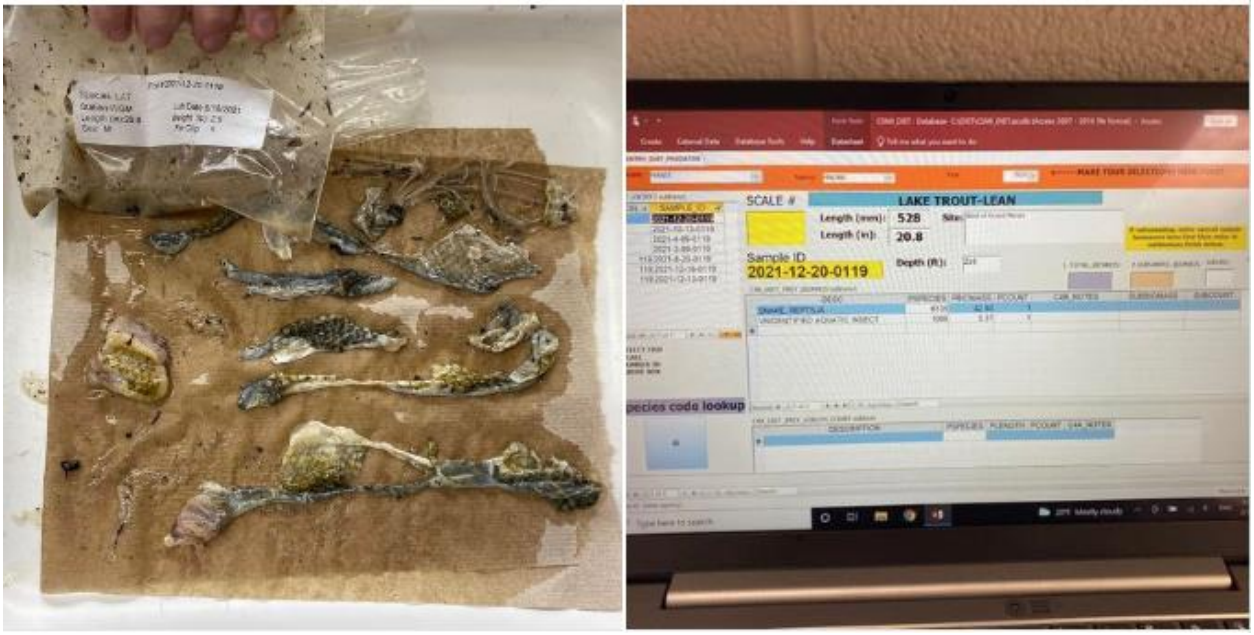
February 7, 2022 ·

Quite the mixed bag for this MNDNR lake trout! My first time finding eurasian ruffe & walleye

February 8, 2022 ·

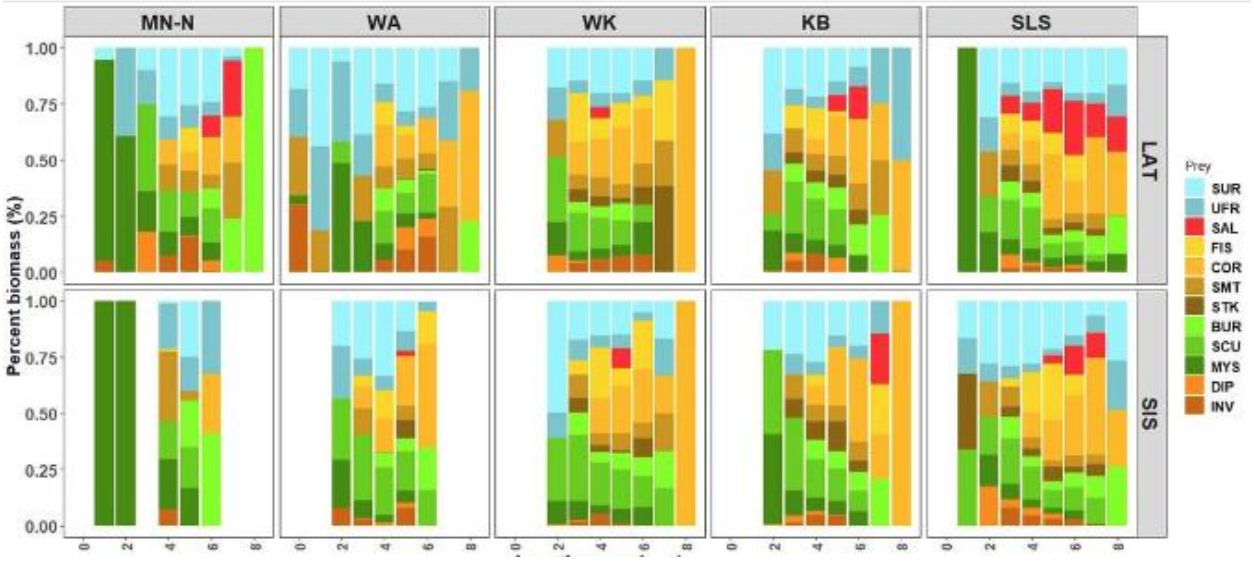
Ahhhh there's a snake in my lake trout!!!!

On Monday I identified some snake remains out of a lake trout stomach from the MNDNR!



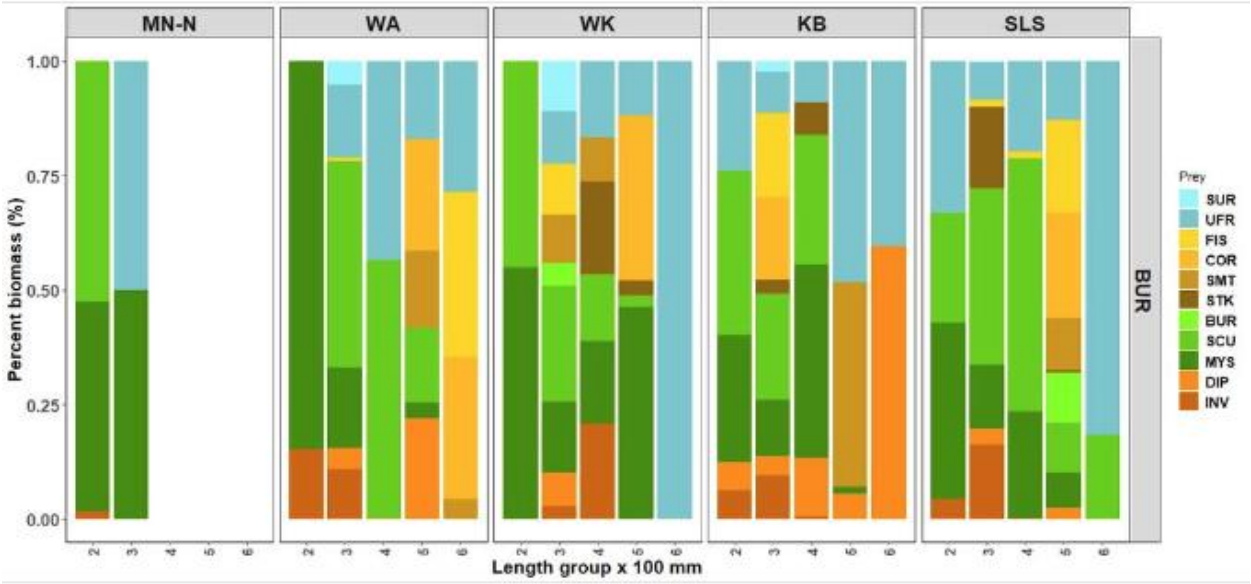
Admin · February 1, 2022 ·

Diet composition data (so far) for lean (LAT) and siscowet (SIS) lake charr from 2021 Lake Superior Food Web Study processed by NMU-MFRS & LSSU.
MN-N=Minnesota North; WA= western Arm (MN & WI); WK=west side of Keweenaw; KB=Keweenaw Bay; SLS=southern Lake Superior (Big Bay-Grand Marais).
Prey: INV= mollusk & Aq. insect; DIP= Dipoeria; MYS= Mysis; SCU= sculpin spp; BUR= burbot; STK= stickleback spp; SMT= rainbow smelt; COR= coregonines spp; FIS= misc fishes; SAL= salmonines; UFR= unid. fish remains; SUR= terr. insect & bird.



Admin · February 1, 2022 ·

Diet composition data (so far) for BURBOT from 2021 Lake Superior Food Web Study processed by NMU-MFRS & LSSU.
MN-N=Minnesota North; WA= western Arm (MN & WI); WK=west side of Keweenaw; KB=Keweenaw Bay; SLS=southern Lake Superior (Big Bay-Grand Marais).
Prey: INV= mollusk & Aq. insect; DIP= Dipoeria; MYS= Mysis; SCU= sculpin spp; BUR= burbot; STK= stickleback spp; SMT= rainbow smelt; COR= coregonines spp; FIS= misc fishes; SAL= salmonines; UFR= unid. fish remains; SUR= terr. insect & bird.



Admin · December 23, 2021 ·

Lauren Yates found that this Minnesota lake charr took too many trips to the all you can eat seafood buffet.

Group expert · October 25, 2021 ·

A 14 in burbot found in a 26 in siscowet from the Minnesota survey

Johnsonville Brat in Siscowet stomach...MN DNR near Duluth.