Summary of Activities in 2017

of the

Lake Trout Suppression Program to Benefit Native Species

in

Flathead Lake

Confederated Salish and Kootenai Tribes

and

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Introduction

This report summarizes results of the fourth year of work conducted under the direction of the Implementation Plan for Lake Trout Suppression in Flathead Lake (2014) by the Confederated Salish and Kootenai Tribes (CSKT). The Implementation Plan is the culmination of a lengthy and often contentious process in management of the fishery of Flathead Lake. It was preceded by the Flathead Lake and River Fisheries CoManagement Plan (CoPlan) that was adopted in 2000 by CSKT and Montana Fish Wildlife and Parks (MFWP). The goals of the CoPlan are to:

1) "Increase and protect native trout populations", and

2) "Balance tradeoffs between native species conservation and nonnative species reduction to maintain a viable recreational/subsistence fishery".

The CSKT concluded in 2009 that ongoing, angler-based efforts to achieve goals of the CoPlan were unlikely to succeed without an expanded suppression program. The CSKT completed a Draft Environmental Impact Statement on June 21, 2013 that summarized impacts of all reasonable suppression methods. The Flathead Reservation Fish and Wildlife Advisory Board voted on August 21, 2013 to recommend that the Tribal Council select one of the three action alternatives rather than the No Action alternative. The Tribal Council unanimously selected Alternative D (75% reduction of Age 8+ lake trout) on September 10, 2013 as their Preferred Alternative. The Tribes released a Final Environmental Impact Statement (FEIS) on February 21, 2014 that addressed all comments received, and released the Implementation Plan for expanded lake trout suppression in March, 2014. The USFWS issued a Recovery Permit on April 1, 2014 to address incidental "take" of bull trout during suppression activities.

The approach for expanded suppression is proceeding under the same guidelines as followed in the initial suppression stages, as prescribed in the CoPlan, and restated in the Implementation Plan, which is to proceed cautiously and incrementally, employing both short-term and long-term components. The short-term strategy is based on a one-year planning horizon to best facilitate frequent review and adjustment. The long-term goal of expanded suppression is to achieve the full harvest level analyzed in the FEIS to achieve a 75% reduction in Age 8 and older lake trout. There is no requirement to meet the goal in any particular year, only to maintain annual progress toward the goal. The pace of movement could be accelerated if bull trout metrics decline below the trigger of "Secure Populations" as defined under the Co-Management agreement, or the pace could be slowed if factors (i.e. new information, excessive bycatch, etc.) indicate unacceptable impacts.

The short-term, or annual process consists of development of a harvest target for lake trout, followed by implementation of suppression activities to achieve the target, and concludes with analysis of results that facilitates setting the next annual harvest target. The purpose of this report is to gauge success and evaluate risks inherent in the suppression program, and plan for suppression in 2018. To do so, we answered the following questions. After the fourth year of expanded suppression efforts in 2017:

1) Are bull trout and westslope cutthroat trout increasing?

2) Are lake trout decreasing?

3) Is angler activity decreasing?

4) Is suppression of lake trout causing unintended consequences?

5) Is the level of risk inherent with suppression acceptable?

6) Based on the result of the first five questions; What is the best lake trout harvest target for 2018?

Implementation Activities Conducted Prior to 2017

Active suppression efforts began in autumn 2002 with the first Mack Days fishing contest. Between 2002 and 2013, anglers participating in the contests harvested 287,952 lake trout. Average length of harvested fish was 452 mm and average weight was 850 g. Total weight harvested in these contests (2002-2013) was 244,674 kg (111,215 pounds). Expanded suppression efforts began in 2014 with initiation of gillnetting. Total harvest from contests and gillnetting from 2014 through 2016 was 187,743 lake trout with average length of 432 mm and average weight of 736 g equaling a total weight of 126,943 kg (57,701 pounds). Total weight of fish harvested by all suppression methods from 2002 to 2016 is 350,112 kg (771,856 pounds).

Table 1. Harvest of lake trout by suppression method from 2002 to 2016.

Method	2002-2013	2014-2016	Cumulative 2002-2016
Spring Mack Days	177,172	89,786	266,958
Spring Gillnetting	0	35,106	35,106
Fall Mack Days	110,780	49,340	160,120
Fall Gillnetting	0	13,511	13,511
Total	287,952	187,743	475,695

Implementation Activities Conducted in 2017

Harvest during 2017 was generated from recreational angling, fishing contests, and gillnetting. The harvest target established in 2016 was 103,000 (see 2016 annual report of suppression) lake trout from these methods, but we were only able to achieve a harvest of 98,618 lake trout (Table 2 and Figure 1).

We estimated that recreational angling accounted for a harvest of 25,000 lake trout (see FEIS, Appendix 5, page 4) in 2017, based on the assumption that harvest in 2017 was similar to the average harvest quantified between 1998 and 2007 when extensive creel surveys were conducted. In Spring Mack Days 37,223 lake trout were harvested in 1,703 angler-trips (Figure 2), and in Fall Mack Days 14,700 lake trout were harvested in 898 angler-trips (Figure 3). Gillnetting in spring produced 16,571 lake trout and gillnetting during fall produced 5,124 lake trout (Table 3). The total of all these activities in 2017 equaled 98,618 lake trout harvested.

Table 2. Methods, and planned and actual harvest of lake trout in 2017.

Method	Projected Lake Trout Harvest Target from Previous Year	Actual Lake Trout Harvest in 2017	Difference Between Projected and Actual Harvest
General Recreational Angling	25,000 (Estimated)	25,000 (Estimated)	0
Spring Mack Days	35,000	37,223	+2,223
Spring Gillnetting	20,000	16,571	-3,429
Fall Mack Days	18,000	14,700	-3,300
Fall Gillnetting	5,000	5,124	+124
Total	103,000	98,618	-4,382

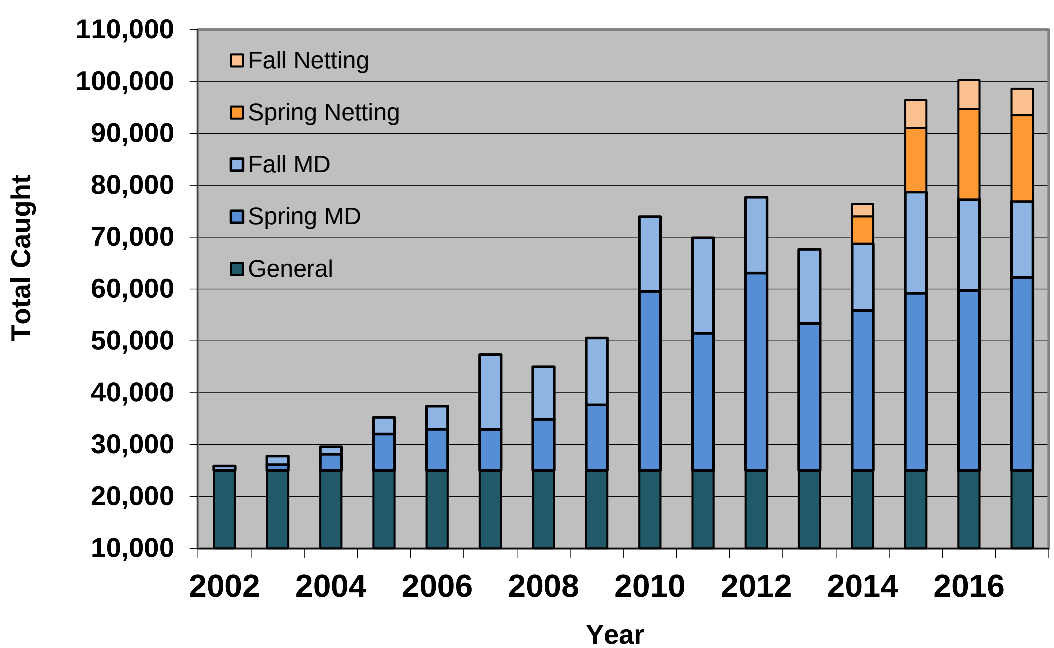

Figure 1. Total harvest of lake trout from general recreational angling, Mack Days fishing contests and gillnetting, 2002 to 2017.

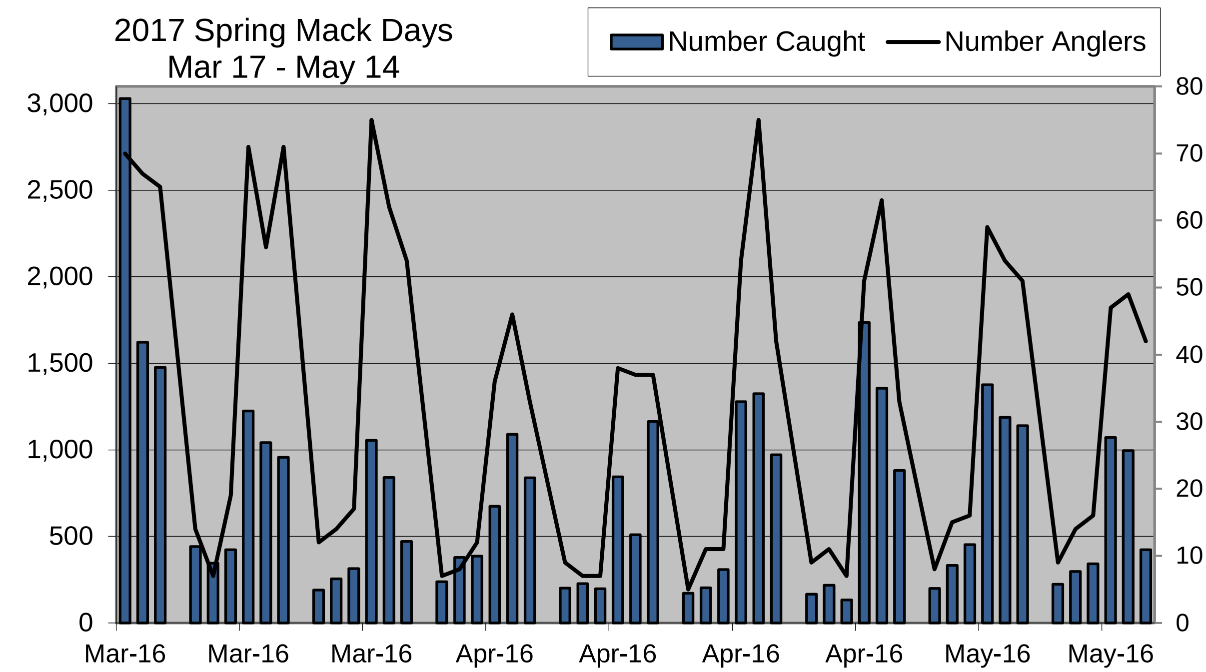

Figure 2. Number of lake trout caught (bars) and angler-days (line) expended during Spring Mack Days, 2017.

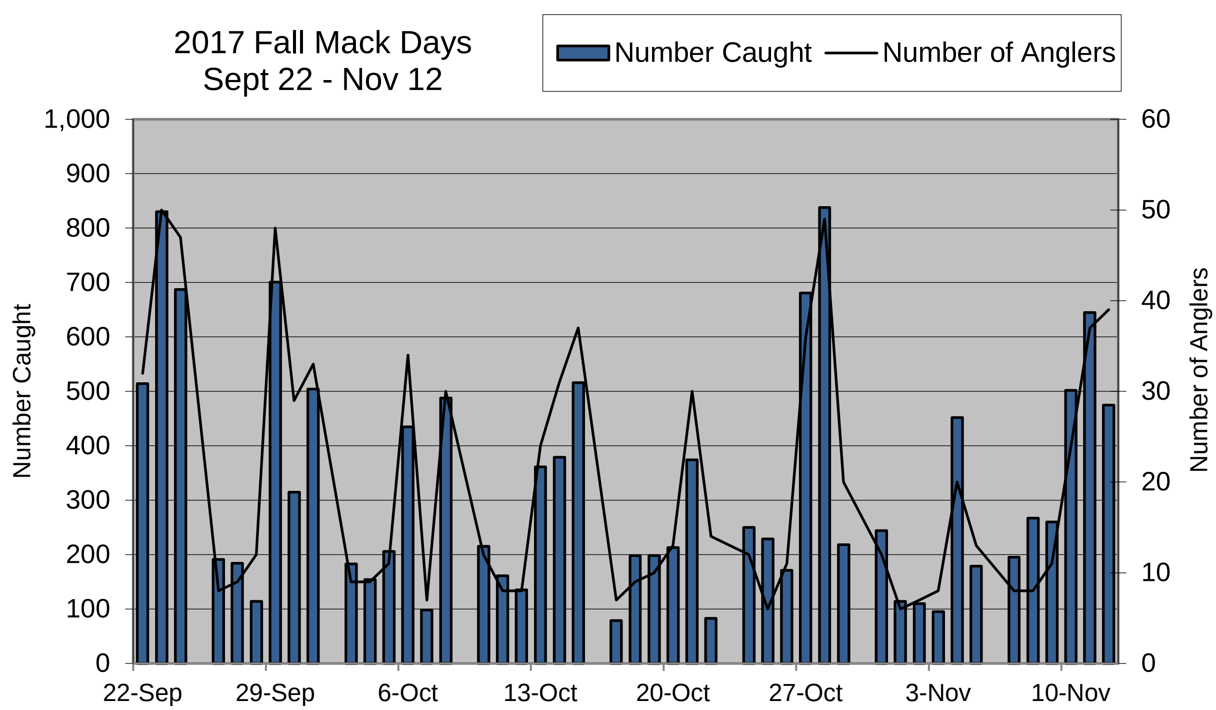

Figure 3. Number of lake trout caught (bars) and angler-days expended (line) during Fall Mack Days, 2017.

Table 3. Results of suppression gillnetting in 2017.

Net #	Date Set	# Boxes	Low Depth	High Depth	Total LT Kept	No. Tags	Total LT Caught	Total Bull Trout	Mesh
1	3/13/2017	10	190	265	128	13	141	0	4
2	3/14/2017	10	110	195	109	26	135	0	4
3	3/15/2017	10	110	190	88	0	88	0	4
4	3/20/2017	5	290	328	24	0	24	0	4
5	3/20/2017	8	295	297	67	0	67	0	4
6	3/20/2017	10	255	288	164	9	173	0	3.5/4.5
7	3/21/2017	10	274	335	115	6	121	1	4
8	3/21/2017	10	259	261	137	5	142	0	4
9	3/21/2017	10			237	7	244	0	3.5/4.5
10	3/22/2017	10	253	265	127	5	132	0	3.5/4.5
11	3/22/2017	10	212	312	108	3	111	0	4
12	3/23/2017	4	155	280	52	0	52	0	4
13	3/23/2017	10	155	280	241	0	241	0	3.5/4.5
14	3/27/2017	10	153	240	147	3	150	0	4
15	3/27/2017	6	169	236	114	7	121	0	3.5/4
16	3/28/2017	10	150	242	191	6	197	0	4
17	3/28/2017	4	156	233	110	0	110	0	3.5/4.5
18	3/28/2017	6	160	240	179	0	179	1	4
19	3/29/2017	10	169	236	256	0	256	0	4
20	3/30/2017	10	187	214	239	0	239	0	4
21	4/4/2017	10	270	330	98	6	104	0	3.5/4.5
22	4/4/2017	10	175	316	222	7	229	0	4
23	4/5/2017	10	260	280	155	5	160	0	4
24	4/5/2017	10	183	262	94	0	94	0	3.5/4.5
25	4/6/2017	10			161	0	161	0	4
26	4/10/2017	10	87	200	224	0	224	0	3.5/4.5
27	4/10/2017	7	110	203	243	0	243	0	4
28	4/10/2017	3	110	203	139	0	139	0	3.5/4.5
29	4/11/2017	10			225	0	225	0	4
30	4/11/2017	2			44	0	44	0	4
31	4/11/2017	5	186	216	255	0	255	0	4
32	4/12/2017	5			16	0	16	0	3.5/4.5
33	4/17/2017	10	245	257	208	1	209	1	4
34	4/17/2017	10	148	245	130	6	136	0	4
35	4/18/2017	10			191	4	195	0	4
36	4/18/2017	10			167	0	167	0	4
37	4/19/2017	10	225	257	399	0	399	0	4

Net #	Date Set	# Boxes	Low Depth	High Depth	Total LT Kept	No. Tags	Total LT Caught	Total Bull Trout	Mesh
38	4/19/2017	10	172	282	195	0	195	0	4
39	4/24/2017	13	166	246	239	0	239	0	4
40	4/25/2017	10	188	284	149	0	149	0	4
41	4/25/2017	10	187	205	179	0	179	0	4
42	4/26/2017	10	227	274	108	0	108	0	4
43	5/1/2017	10	210	232	294	5	299	1	4
44	5/1/2017	10	205	236	129	0	129	0	4
45	5/2/2017	10	226	240	178	5	183	0	4
46	5/3/2017	10	180	292	143	0	143	0	4
47	5/9/2017	10	296	320	159	0	159	0	3/3.5
48	5/9/2017	10	240	260	97	1	98	0	4/4.5
49	5/10/2017	10	244	262	135	0	135	0	4/4.5
50	5/10/2017	10	152	194	161	7	168	0	3/3.5
51	5/15/2017	10	218	254	101	3	104	0	4/4.5
52	5/15/2017	10	255	269	203	12	215	0	3/3.5
53	5/16/2017	10	200	263	186		186	1	4/4.5
54	5/16/2017	10	219	248	257	10	267	0	3/3.5
55	5/17/2017	10	183	232	61	1	62	0	4/4.5
56	5/17/2017	10	186	231	214	0	214	0	3/3.5
57	5/22/2017	10	237	263	84		84	0	4/4.5
58	5/22/2017	10	270	302	264		264	0	3/3.5
59	5/26/2017	10	210	234	78	0	78	0	4/4.5
60	5/26/2017	10	210	234	60	6	66	0	3/3.5
61	5/30/2017	10	207	231	96	3	99	1	4/4.5
62	5/30/2017	10	207	238	207	4	211	0	3/3.5
63	5/31/2017	10	264	322	196	3	199	0	4/4.5
64	5/31/2017	10	210	254	300	0	300	1	3/3.5
65	6/5/2017	10	246	316	256	0	256	0	4/4.5
66	6/5/2017	10	160	206	174	0	174	0	3/3.5
67	6/6/2017	10	268	317	116	0	116	0	4/4.5
68	6/6/2017	10	295	323	337	0	337	0	3/3.5
69	6/7/2017	10	247	252	239	9	248	0	4/4.5
70	6/7/2017	10	258	321	372	0	372	0	3/3.5
71	6/12/2017	10	214	314	333	0	333	0	3/3.5
72	6/12/2017	10	199	226	122	0	122	0	4/4.5
73	6/14/2017	4			49	0	49	0	3/3.5

Net #	Date Set	# Boxes	Low Depth	High Depth	Total LT Kept	No. Tags	Total LT Caught	Total Bull Trout	Mesh
74	6/14/2017	10	275	320	252	29	281	0	3/3.5
75	6/14/2017	10	248	268	117	16	133	0	4/4.5
76	6/19/2017	10	293	319	110	8	118	0	3/3.5
77	6/19/2017	10	291	305	562	11	573	1	4/4.5
78	6/20/2017	10	287	324	393	7	400	0	3/3.5
79	6/20/2017	10	270	297	308	13	321	0	4/4.5
80	6/21/2017	10	280	297	427	0	427	0	3/3.5
81	6/21/2017	10	288	297	209	0	209	0	4/4.5
82	6/26/2017	10	188	243	70	0	70	0	4/4.5
83	6/26/2017	10	285	304	514	0	514	0	3/3.5
84	6/27/2017	10	263	275	346	8	354	0	4/4.5
85	6/27/2017	10	291	313	256	0	256	0	3/3.5
86	6/28/2017	10	264	269	198	3	201	0	4/4.5
87	6/28/2017	10	276	298	112	0	112	1	3/3.5
88	7/5/2017	10	267	326	197	0	197	0	4/4.5
89	8/7/2017	8	292	313	225	0	225	0	3/4.5
90	9/20/2017	10	179	246	112	11	123	0	4.5
91	9/25/2017	10	271	286	17	0	17	1	4.5
92	9/25/2017	10	303	317	137	0	137	0	4
93	9/26/2017	10	251	280	24	0	24	0	4.5
94	9/26/2017	10	296	316	121	0	121	0	4
95	9/27/2017	10	157	245	163	0	163	0	4
96	10/2/2017	5	129	190	180	0	180	4	3
97	10/2/2017	10	101	248	108	0	108	0	4
98	10/3/2017	5	101	248	213	2	215	0	3
99	10/3/2017	10	165	291	121	0	121	0	4
100	10/4/2017	9	264	299	179	6	185	0	4
101	10/4/2017	5	265	308	82	12	94	0	3
102	10/9/2017	10	207	243	55	0	55	0	4
103	10/9/2017	10	245	254	56	0	56	0	4.5
104	10/10/2017	10	258	273	59	1	60	0	4
105	10/10/2017	10	256	320	43	0	43	0	4.5
106	10/11/2017	10	153	195	114	0	114	0	4.5
107	10/11/2017	10	268	308	92	0	92	0	4
108	10/18/2017	10	88	205	254	0	254	0	4.5
109	10/18/2017	10	69	150	252	0	252	0	4
110	10/25/2017	10	76	190	102	0	102	0	4.5
111	10/31/2017	10	86	204	143	0	143	0	4.5

Net #	Date Set	# Boxes	Low Depth	High Depth	Total LT Kept	No. Tags	Total LT Caught	Total Bull Trout	Mesh
112	11/1/2017	8			86	0	86	0	4.5
113	11/1/2017	4	67	177	68	0	68	0	4.5
114	11/21/2017	10	130	170	125	0	125	0	3.5
115	11/27/2017	10	43	174	140	15	155	2	3.5
116	11/28/2017	7	156	221	88	0	88	0	3.5
117	11/29/2017	7	186	212	85	15	100	0	3.5
118	12/4/2017	10	56	200	205	0	205	3	3.5
119	12/4/2017	5	100	245	156	0	156	0	4
120	12/5/2017	5	174	216	35	14	49	0	4
121	12/5/2017	5	174	192	91	3	94	0	3.5
122	12/6/2017	5	125	157	245	28	273	0	3.5
123	12/6/2017	5	135	150	171	0	171	0	4
124	12/11/2017	4	150	212	116	0	116	2	3
125	12/11/2017	10	129	220	183	0	183	1	3.5
126	12/12/2017	10	130	176	265	0	265	0	3.5
127	12/13/2017	10	123	165	438	0	438	1	3.5

In 2017 we placed 88 nets of varying lengths during spring (Figure 4) and 38 nets during autumn (Figure 5) within the constraints prescribed by the Bull Trout Recovery Permit. We conducted gillnetting according to a protocol with minimal sampling in water shallower than 120 ft to avoid bycatch of bull trout.

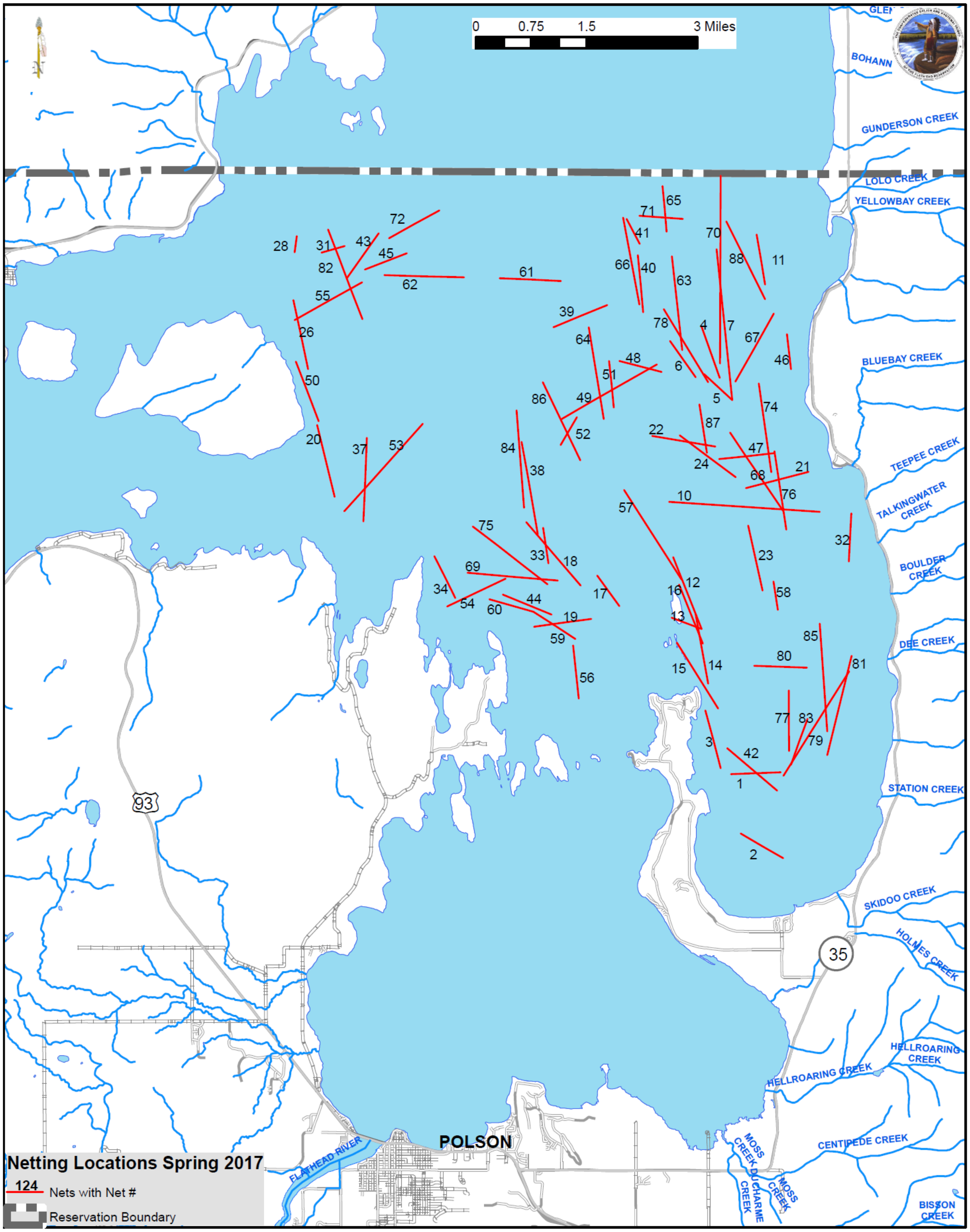

Figure 4. Locations, lengths and identification numbers of gillnets set during spring 2017.

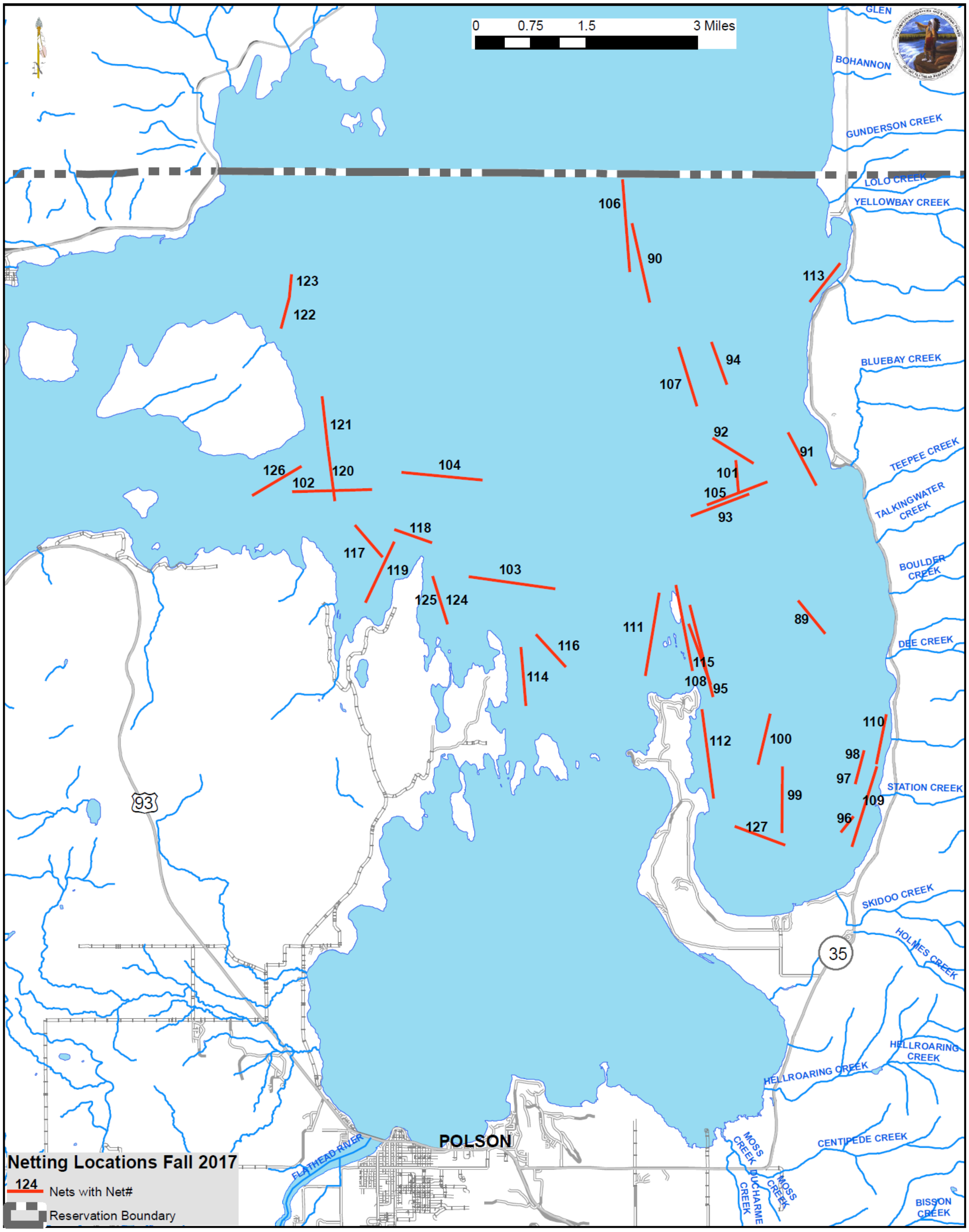

Figure 5. Locations, lengths and identification numbers of gillnets set during autumn 2017.

Evaluation Procedure

The purpose of this report is to answer the six predetermined questions (pages 4 and 5) using the body of evidence currently available. Evidence is presented in the form of metrics derived from data collected in a consistent manner each year. Not all metrics have equal predictive value, but all are included because each one adds to the body of evidence to be weighed in the overall analysis. Rarely do all metrics indicate a consistent direction of change in abundance. Therefore this process requires subjective evaluation of the weight of evidence represented by all available metrics.

Question 1) Are bull trout increasing?

We use four metrics to track changes in bull trout. The bull trout metrics focus primarily on abundance of adult bull trout, which include: 1) redd counts in index streams, 2) fixed-location (five mesh sizes) gillnetting in spring, and 3) random-location (12 mesh sizes) gillnetting in autumn. These metrics should be directly responsive to changes in abundance and therefore we expect each metric to increase if bull trout abundance increases.

1) *Redd counts*

MFWP enumerates redds in index reaches of eight Flathead tributaries annually (Figure 6). Basic assumptions of this metric are that the enumerated adults migrate to Flathead Lake, the number of adults per redd does not vary annually, and alternate-year spawning either does not occur or occurs consistently among years. None of these assumptions have been fully verified. The reliability of this metric is high because the survey is nearly a census in which experts attempt to count every redd within a fixed reach of stream. Variability in counts may result from bull trout spawning outside the boundaries of the fixed index reaches. The period of record for this metric spans the time before the increase of *Mysis* to the present.

Counts in Middle Fork index streams decreased by a total of 42% compared to 2016. Counts in North Fork index streams increased by 18% relative to 2015. No clear trends exists in these data, although three of eight streams counted had fewer than 10 redds, a level we consider to be dangerously low.

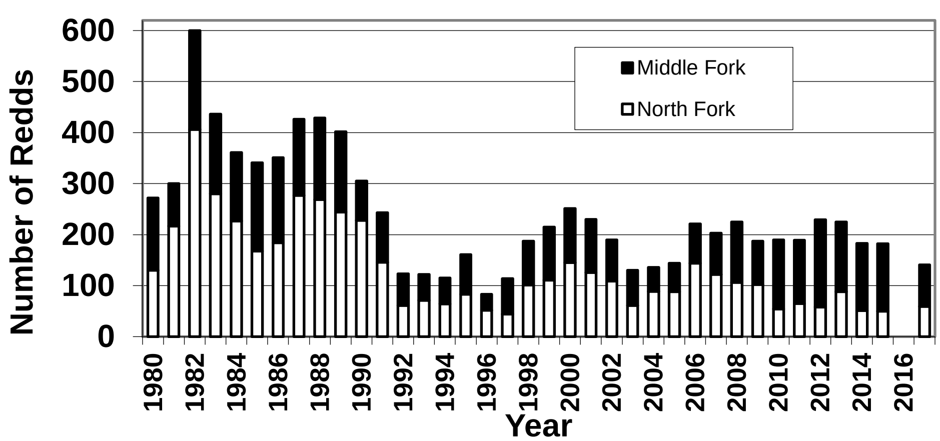

Figure 6. Bull trout redd counts in eight index streams tributary to the North and Middle Forks of the Flathead River, 1980 to 2017, although complete data were unavailable in 2016 for the North Fork (data from MFWP).

2) Catch rates in spring gillnetting

Sample units for spring gillnetting consist of two sinking nets ganged together, each comprised of five panels, each 25 ft long by 6 ft high. Mesh sizes within panels range from 3/4 in to 2 in bar-measure. Fifteen ganged nets are placed in five fixed, nearshore locations. This series was developed to target bull trout in the nearshore environment. The survey has been conducted from 1981 to present, although 1984 to 1991 were not sampled. Reliability of this metric is low because of the small sample size, low capture rate, and non-random sampling design. The basic assumption of this metric is that catch rates in gillnets are proportional to fish density. Capture rates have been highly variable, with the lowest catch on record in 2017 (Figure 7).

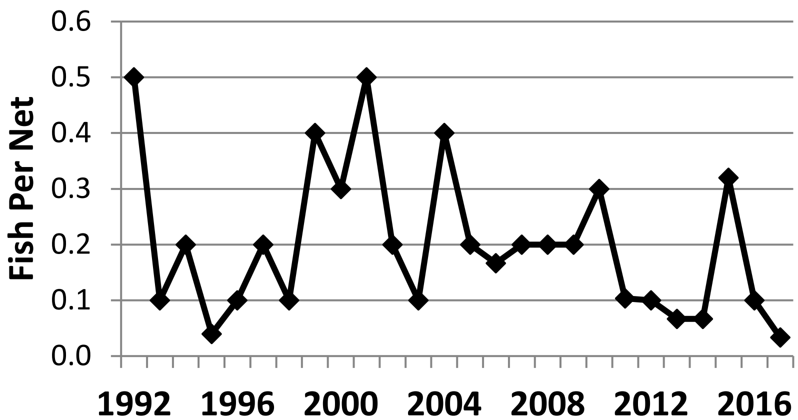

Figure 7. Average annual catches of bull trout in 15 fixed-location gillnets set in spring, 1992 to 2017 (data from MFWP).

3) Catch rates in autumn gillnetting

Autumn gillnetting consists of individual sinking nets constructed from 12 panels, each 25 ft long by 8 ft high for a total net length of 300 ft. Mesh sizes within panels range from 3/8 in to 3 in bar-measure. Nets are placed randomly within five area-strata and five depth-strata at densities proportional to the lake-wide occurrence of those conditions. Numbers of nets within the series have ranged from 44 to 94, while maintaining constant proportionality within strata. All habitats within the lake are included in the survey. This series has been conducted from 1998 to present (Figure 8). The basic assumption of this metric is that catch rates in gillnets are proportional to fish density. Strengths of this metric are that it is derived from a large number of sample units (nets), all identified strata within the lake are sampled, and sample sites are randomly selected. A weakness of this metric for monitoring bull trout is that catch rates are very low.

Catch rates in the autumn series have ranged from 0.06 to 0.5 bull trout per net. The average catch since 2004 was 0.12 bull trout per net. Large variability in catches is the result of patchy distribution of bull trout in which up to five bull trout have been caught in one net, while most nets catch zero bull trout. In 2007, four bull trout were caught in one net, which accounted for 67% of the bull trout caught that year. The average catch in 2017 increased markedly relative to 2016 and relative to the ten year period prior to 2017.

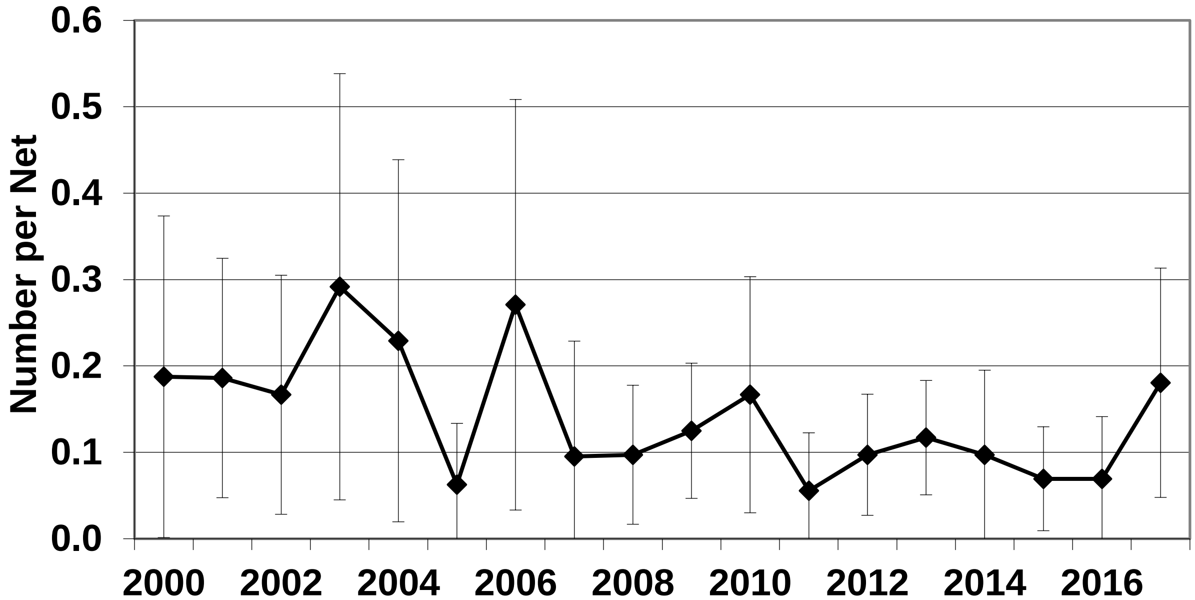

Figure 8. Average annual catches (95% confidence intervals) of bull trout in stratified random gillnets (44 to 94 nets annually) set in autumn, 2000 to 2017.

4) Catch rates in suppression nets

Catch rates of bull trout in suppression nets are not ideal indicators of bull trout abundance because we consciously place suppression nets in locations chosen to avoid bull trout. Nonetheless, because the sample size of suppression nets is so large, the potential exists for meaningful trends to develop (Table 4). One confounding factor in these data is that catches are inflated by the use of 2” mesh nets which have so far caught bull trout at a rate 21 times that of larger meshes, and the percentage of 2” mesh nets used each year is variable. These four years of data do not indicate any clear trend in catch rates.

Table 4. Catch rates of bull trout in suppression nets, 2014 to 2017.

Year	Number of Sets	Feet of Net	Number of Bull trout captured	Bull trout per 1,000 feet
2014	37	135,000	8	0.059
2015	68	405,900	12	0.030
2016	98	677,700	22	0.032
2017	127	1,034,100	23	0.022

Summary conclusion: Are bull trout increasing?

None of the indices of bull trout abundance indicate a clear change in abundance over the last ten years. Catches in the spring gill-netting series were the lowest on record in 2017, while catches in the autumn series were well above the recent 10-year average. Redds in the North Fork Flathead tributaries have been at near record low levels, while redds in Middle Fork tributaries declined in 2017 from previously high levels. No clear downward trend in abundance is evident for the metapopulation. Based on these metrics (Table 5), we conclude there is no downward trend in abundance of bull trout in the near term, or over the last 10 years. Despite the absence of a discernible trend, abundance of several subpopulations is dangerously low.

Table 5. Summary of metrics describing trends in bull trout abundance and interpretations of their meaning.

Metric	Direction of Change	Value of Metric	Comments
1) Redd Counts	No Trend, or slightly downward	High, accurate and reliable	Low counts, especially in North Fork tributaries, are a large concern
2) Catch rates in autumn gillnetting	No Trend, but increase in 2017	Moderate	High variability and low capture rates undermine predictability
3) Catch rates in spring gillnetting	Downward trend since 2004, and lowest count in 2017	Low	Small sample size, small capture rate, discouraging result in 2017
4) Catch rates in suppression nets	No trend, or slightly downward	Low	Insufficient length of record

Are westslope cutthroat trout increasing?

The primary index of westslope cutthroat abundance is derived from annual catches in floating gillnets set in Flathead Lake during spring. Sample units for spring gillnetting consist of two floating nets ganged together, each comprised of five 25 ft long by 6 ft high panels. Mesh sizes within panels range from 3/4 in to 2 in bar-measure. Fifteen ganged nets are placed in five fixed, nearshore locations. The survey has been conducted from 1981 to present, although 1984 to 1991 were not sampled. The basic assumption of this metric is that catch rates in gillnets are proportional to fish density. A weakness in this metric is the small number of nets (15) in the series, sample locations are fixed rather than random, and average catches are often fewer than one cutthroat trout per net. Captures since 1992 vary by over 100% around an average catch of 0.9 cutthroat trout per net (Figure 9), and counts in the last three years were among the highest and lowest in the period of record. This metric provides no evidence of an upward or downward trend in abundance of westslope cutthroat trout in Flathead Lake.

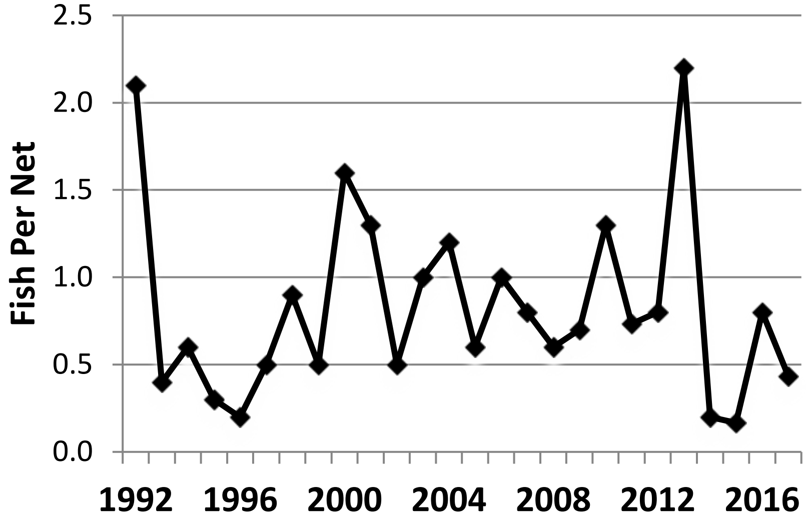

Figure 9. Average annual catches of westslope cutthroat trout in 15 standardized gillnets set in spring, 1992 to 2017 (data from MFWP).

Question 2) Are Lake Trout Decreasing?

Total harvest in 2017 was 98,618 lake trout (see Table 2). We use 13 metrics that directly or indirectly indicate abundance of lake trout. Lake trout were captured by numerous methods and under a variety of sample designs to generate metrics of absolute and relative abundance, as well as metrics reflective of density-dependent changes in lake trout growth.

The first two metrics address population abundance as estimated by mark and recapture techniques. For these estimates we capture lake trout by angling and by gillnetting throughout the year, mark them with PIT tags placed in the left cheek, clip the adipose fins for permanent marks, and release them. Lake trout are recaptured during Mack Days fishing contests in which each fish submitted to the contest is examined for a mark. The marking period spans the full year prior to the first day of each contest, and the recapture period spans the duration of the contest, ranging from 7 to 11 weeks. This estimate is restricted to lake trout within the size limits targeted in the contests which range from 175 mm to 762 mm TL. Approximately 1,000 fish are marked prior to each contest, and the recapture sample has ranged from 12,000 to 38,000 fish. Numbers of lake trout previously marked and recaptured for each estimate have ranged from 26 to 82 individuals. Population estimates are generated from standard mark and recapture protocols. A shortcoming of this method has been uneven distribution of tags, as the north half of the lake receives less angling and fewer tags are placed there than the south half, and deep fish are difficult to capture and release in healthy condition because of barotrauma.

We consider these population estimates to have a high level of reliability because they: 1) are conducted uniformly each year, 2) are the product of a very large sample of the population, 3) have low variability between years, and 4) monitoring indicates that marked fish have low levels of tag loss and high post-relese survival. With the exception of the estimate generated in spring 2010, the estimates since fall 2010 have not varied by more than 20% of the mean of the 12 estimates. We assume tag loss to be low based on an ongoing test of 140 double-tagged fish, of which 34 have been recaptured and all have retained both tags. Survival tests of variable time spans following tagging have indicated very low post-tagging mortality. A final indicator of reliability is that recapture rates have been consistently proportional to the size of the harvest (Figure 10). These estimates have not been robust enough to indicate relative changes in abundance of separate age groups, and they only refer to the segment of the population less than 30 inches in length.

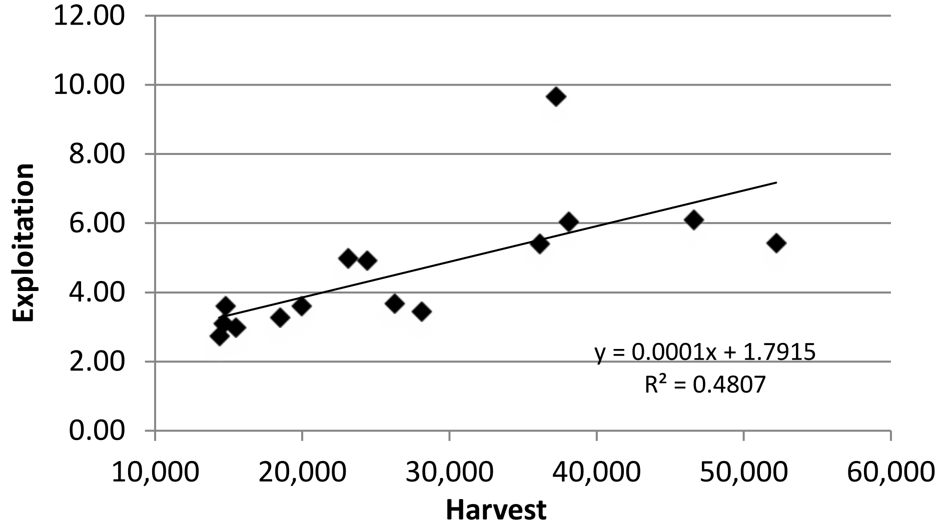

Figure 10. Exploitation of lake trout, as the percentage of marked fish recaptured, in relation to harvest during spring and autumn, 2010 to 2017 (excluding spring 2010).

1) *Mark/Recapture Population Estimates in Spring*

We generated eight mark and recapture estimates during spring over the last eight years. Excluding the 2010 estimate that was likely inflated by disproportionately high catches in deep water, the estimates are non-trending, although the 2017 estimate is the lowest measured over this time period (Figure 11).

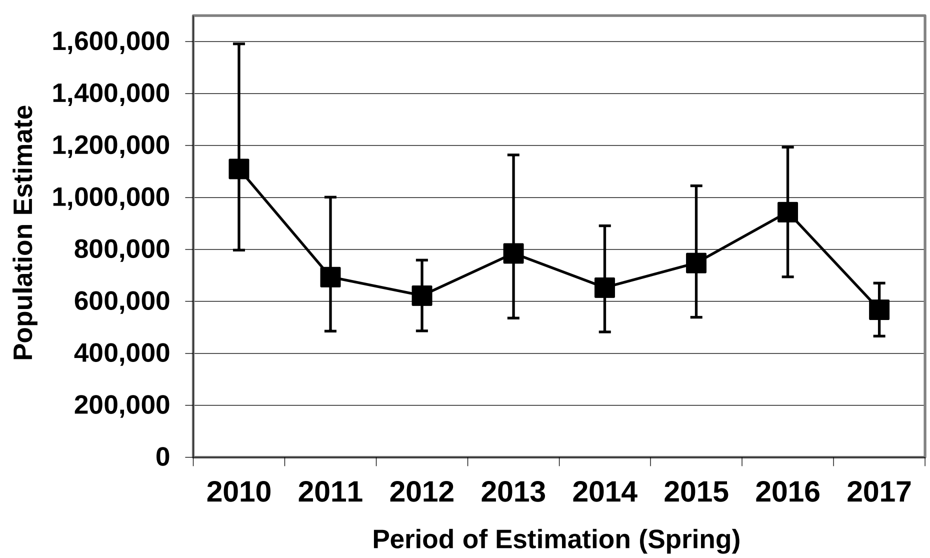

Figure 11. Mark-and-recapture population estimates for lake trout, completed during spring, 2010 to 2017.

2) *Mark/Recapture Population Estimates in Autumn*

We generated eight mark and recapture estimates during autumn over the last eight years. The estimates are non-trending, so give no indication that total population size has changed over this time period (Figure 12).

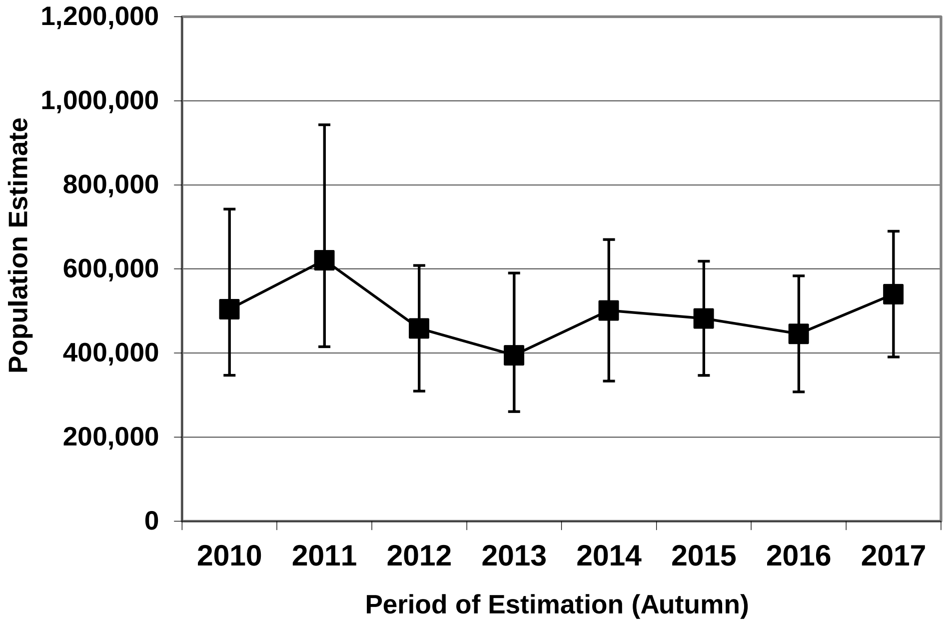

Figure 12. Mark-and-recapture population estimates for lake trout, completed during autumn 2010 to 2017.

3) Catch rates in spring gillnetting

This metric is derived from lake trout sampled in fixed-location gillnetting in spring. Sample units for spring gillnetting consist of two sinking nets ganged together, each consisting of five 25 ft long by 6 ft high panels. Mesh sizes within panels range from 3/4 in to 2 in bar measure. Fifteen ganged nets are placed in five fixed, nearshore locations. This series was developed to target bull trout and therefore only samples a portion of available lake trout habitat near shore, and likely represents trends in abundance specifically of the lean stock of lake trout. This series has been conducted from 1981 to present, although 1984 to 1991 were not sampled. Weaknesses of this metric for indexing changes in lake trout abundance are that it is produced from samples of only the nearshore environment, and from a small number of gillnets. We therefore consider the reliability of this metric to be low. Catch rates have been variable, but non-trending over the period of record (Figure 13).

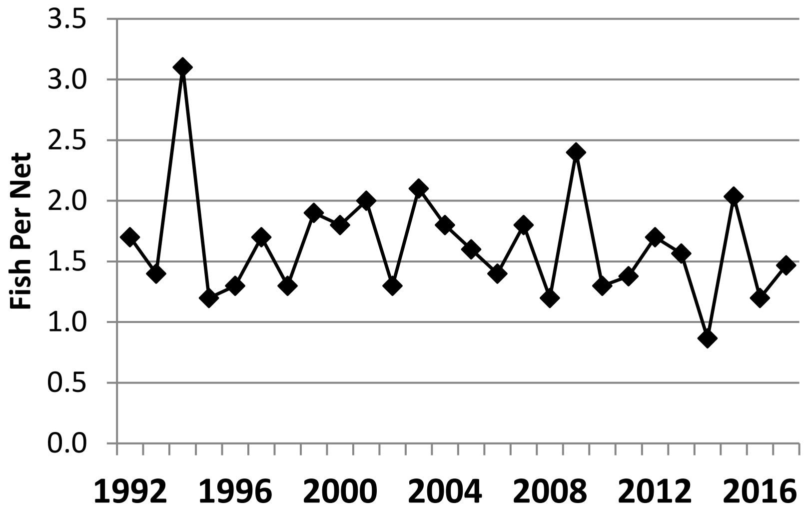

Figure 13. Mean catch rates of lake trout in fixed location sinking gillnets set during spring in Flathead Lake, 1992-2017 (data from MFWP).

4) Catch rates in autumn gillnetting

Several metrics are derived from lake trout sampled in stratified random gillnetting in autumn. Autumn sampling consists of individual sinking nets made of 12 panels, each 25 ft long by 8 ft high with one meter space between, for a total net length of 300 ft. Mesh sizes within panels range from 3/8 in to 3 in bar measure. Nets are placed randomly within five area-strata and five depth-strata at densities proportional to the lake-wide occurrence of those conditions. Numbers of nets set each year have ranged from 44 to 94. This series has been conducted from 1998 to present. Strengths of this metric are: 1) the large number of sample units (nets), 2) all available habitats are sampled, 3) all sizes of fish are sampled, and 4) the sample locations are randomized. A potential problem with this metric is that two stocks of lake trout, lean and dwarf, that have different life histories, are included in the sample and seasonal movements may cause some disproportionate catches of one or the other.

Catch rates have been highly variable over the period of record (Figure 14), ranging between 2 and 6 geometric mean captures per net. Reliability of this metric should be high because it is based on a rigid stratified random sampling design, although large variability in capture rates among years is a concern. A downward trend in catches is evident over the last 16 years of record. The capture rate in 2015 was the lowest in the 17 years of record.

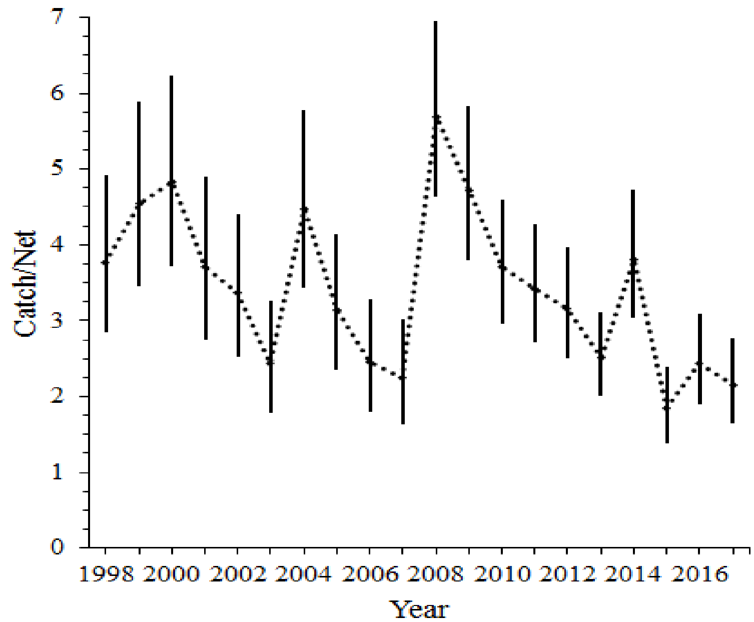

Figure 14. Geometric mean catch rate of all lake trout in stratified random gillnet sampling in Flathead Lake, 1998-2017. The dashed line and equation depict the linear trend through time of geometric mean catch/net during 1998–2017.

5) Catch rates in suppression gillnetting

Catch rates of lake trout in suppression nets provide an indirect index of lake trout abundance. Factors confounding these data are that an inconsistent variety of mesh sizes are used each year, fish may develop net-avoidance behavior, and locations for netting are not chosen randomly. The primary advantage of using these data is that suppression netting represents an enormous amount of sampling effort. A uniform decline in catch rate occurred between 2014 and 2017 (Figure 15), indicating a decrease in abundance of lake trout greater than 450 mm TL.

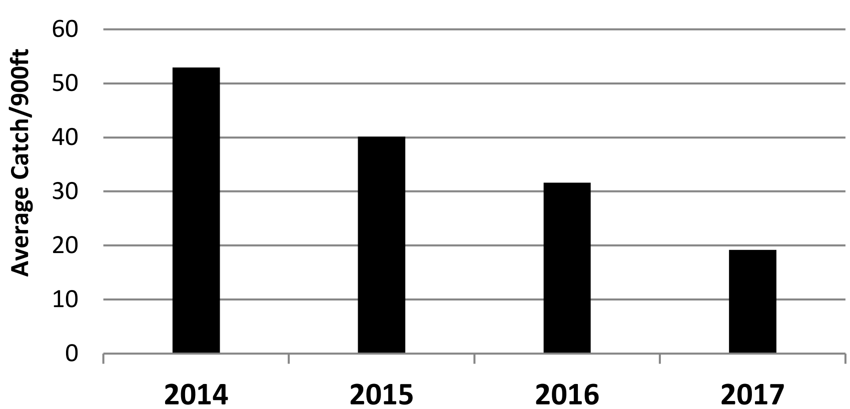

Figure 15. Average catches of lake trout in all suppression nets set during spring and autumn, 2014 through 2017.

6) Relative weight

Relative weight is a measure of body condition relative to a standard for lake trout across their range. Typically, relative weight increases as density decreases, serving as a potential surrogate indicator of abundance. An exception occurs when changes in condition result from changes in the density or type of prey base available, although no such change has occurred in Flathead Lake in recent years. Weights are taken from both male and female lake trout collected in the autumn gillnetting survey. Trends in relative weights over the period of record have been variable, with an upward trend evident from 2008 to 2014, and a small decline over the last two years (Figure 16).

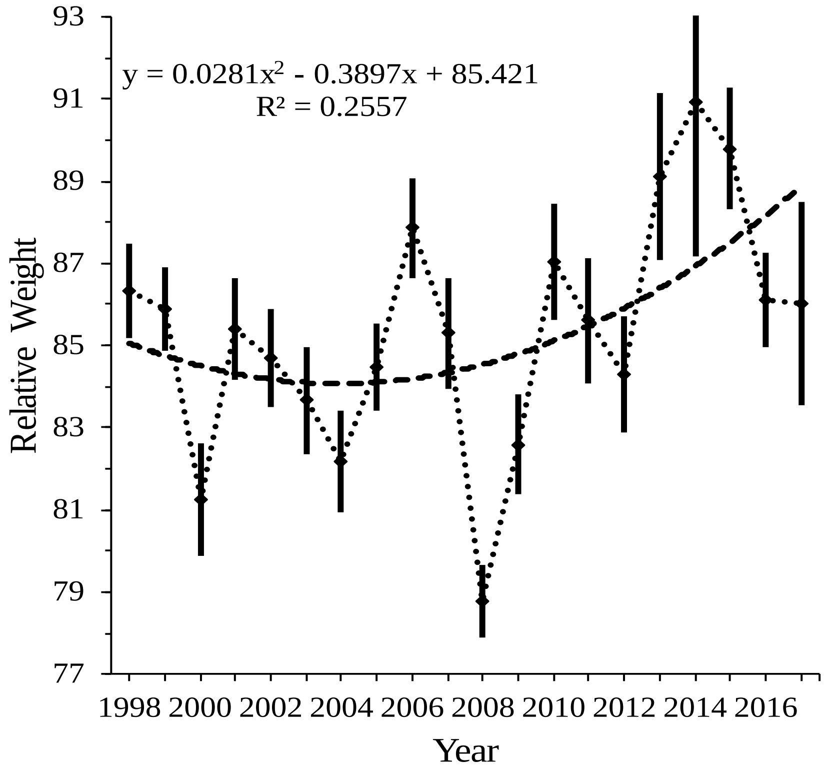

Figure 16. Mean annual relative weight (± 95% confidence limits) of lake trout (N = 5,065; 179–500 per year) caught in standardized-gillnet surveys in Flathead Lake, Montana during 1998–2017. The dashed line and equation depict the nonlinear trend through time of mean annual relative weight from 1998 to 2017.

7) Mortality rate

Mortality rate is measured as the decline in relative abundance of progressively older year classes starting from the youngest year class with full vulnerability to the sampling gear. This metric is derived from lake trout collected in the autumn gillnetting survey which incorporates 12 mesh sizes. The presence of separate stocks of lean and dwarf lake trout that have differing average rates of exploitation and natural mortality, complicates the reliability of this metric because the relative percentage of each stock in the sample likely varies from year to year.

Mortality rate has been trending upward since 2008 (Figure 17). The degree of change has been relatively small and the variance in the estimates has been large, and therefore it is difficult to conclude whether these are real changes in abundance or measurement error.

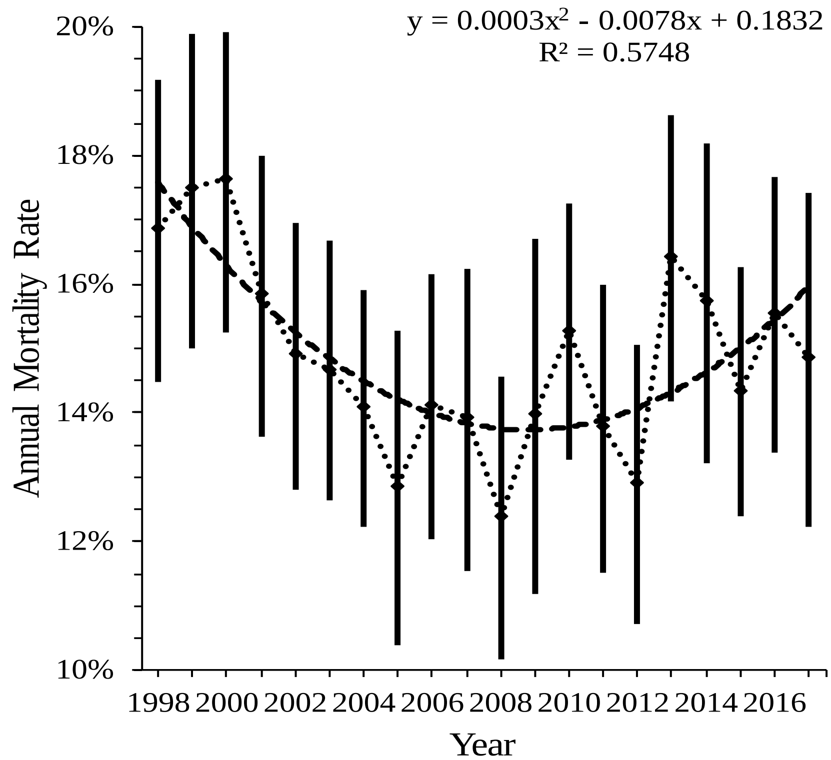

Figure 17. Mean annual mortality (± 95% confidence limits) estimated from age frequency samples of age-8 and older lake trout caught in standardized-gillnet surveys in Flathead Lake, Montana during 1998–2016. The dashed line and equation depict the nonlinear trend through time of annual mortality from 1998 to 2017.

8) Length at 50% maturity

Maturity is determined by visual examination of gonads and this metric is computed as the length at which half the individuals of that length are mature. Decreasing density typically results in improved condition and faster growth, so maturity is reached at younger ages. Because some research indicates that length at maturity occurs at a fixed percentage of asymptotic length, it is not clear how reduced density will affect length at maturity, except that it will likely change. Length at maturity has trended downward since 2006 (Figure 18).

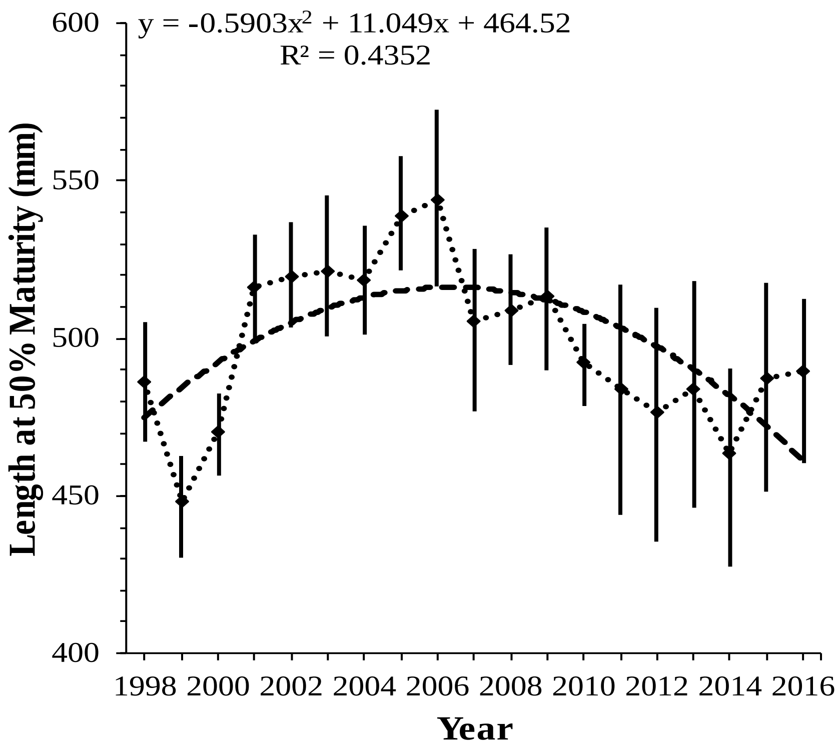

Figure 18. Length at which 50% of lake trout were mature (+ 95% confidence limits) from standardized-gillnet surveys in Flathead Lake, Montana during 1998–2017. The dashed line depicts the nonlinear trend through time in length at 50% maturity.

9) Relative abundance of size groups

Increases in exploitation by angling and netting cause decreases in size classes vulnerable to those methods. Compensatory responses to exploitation typically result in increases in recruitment and increased abundance of smaller, less vulnerable size classes. The catch rates of lake trout >500 mm and lake trout >750 mm in standardized gillnet surveys are trending downward over the last 10 years, while the catch rate of lake trout in the >300 mm group is trending slightly upward (Figure 19).

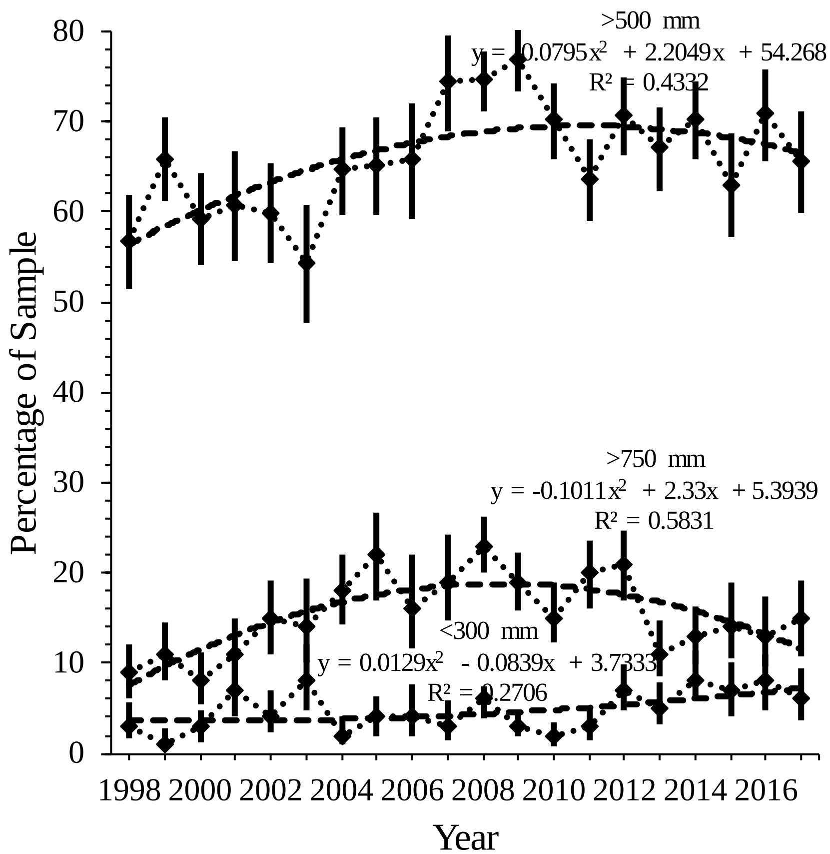

Figure 19. Percent of lake trout <300 mm, ≥500 mm and ≥750 mm in standardized-gillnet surveys in Flathead Lake, Montana during 1998–2017. Dashed lines and equations depict nonlinear trends through time in the percent of lake trout <300 mm, ≥500 mm and ≥750 mm.

The following three metrics are derived from a subsample of angler-caught lake trout submitted to Mack Days contests, and therefore are not derived from of a specifically designed study. Interpretation of these metrics can be confounded by undocumented changes in angler behavior such as changes in locations targeted (deep vs. shallow) and methods used (jigging vs. trolling). Sample sizes collected in each contest range from 500 to 2,000 fish.

10) ***Length of fish captured by angling in spring***

Angling in spring is dominated by jigging in deep water for lake trout that are typically shorter than fish caught in autumn because dwarf lake trout and juveniles of both stocks predominate in deep water fish. Average lengths have consistently trended downward since 2010 (Figure 20).

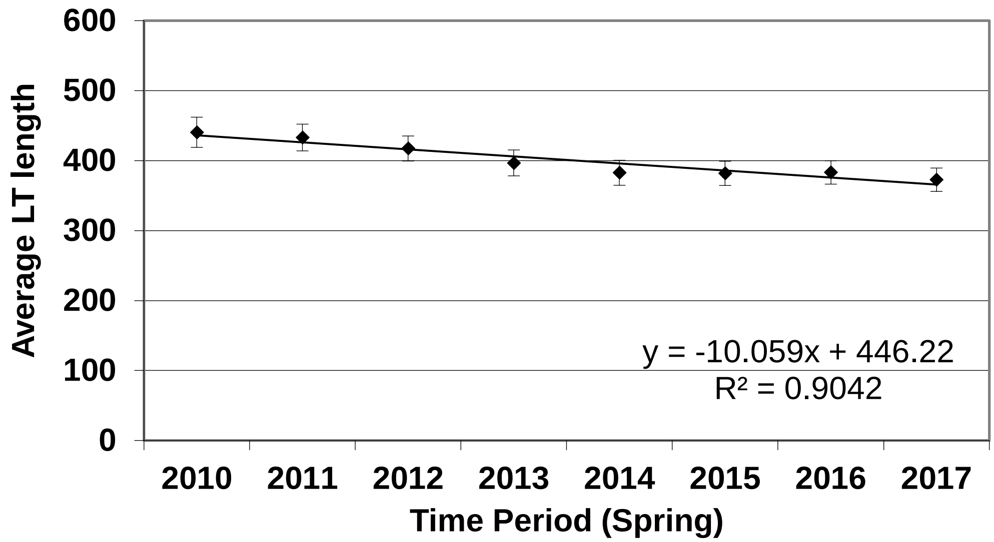

Figure 20. Average lengths of lake trout submitted to the Spring Mack Days contests, 2010-2017.

11) ***Length of fish captured by angling in autumn***

Angling in autumn includes more trolling and casting in shallow water than typically occurs in spring, resulting in catches of longer lake trout relative to the spring period. Average lengths have trended slightly downward since 2010 (Figure 21).

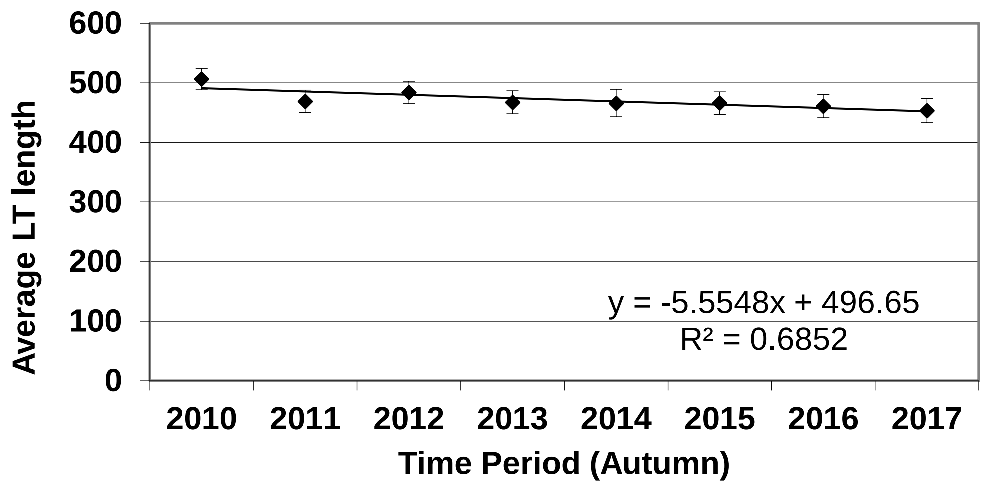

Figure 21. Average lengths of lake trout submitted to the Fall Mack Days contests, 2010-2017.

Angling catch rates are typically correlated with density of fish being targeted. An assumption of angling metrics is that catch rates are directly correlated with changes in abundance. Additionally, this metric is meant to indicate changes in the quality of the fishery over time, in the absence of targeted creel surveys, which are not currently being conducted. Data from Mack Days contests provide a readily available surrogate for tracking trends in abundance. Problems with use of this metric are that catch rates increase with improvements in angling technology under conditions of constant or even decreasing abundance, and trends in the competitive anglers group may not be representative of trends in the larger angling public.

The top anglers in Mack Days have made large investments in gear to increase their competitiveness. One of the most effective new tools is the anchorless boat positioning system with integrated GPS, which most top anglers have been acquiring over the last several years. This tool facilitates pinpoint positioning and allows anglers to spend more time fishing and less time positioning their boats. Many, but not all, of these anglers occupy this category in all six years examined.

12) Average catch rate of top 25 anglers in Spring Mack Days

Catch rates increased from 2010 to 2017 (Figure 22). We consider it more likely that this increase is the result of improvements in angler skills, and in fishing gear, than increases in abundance.

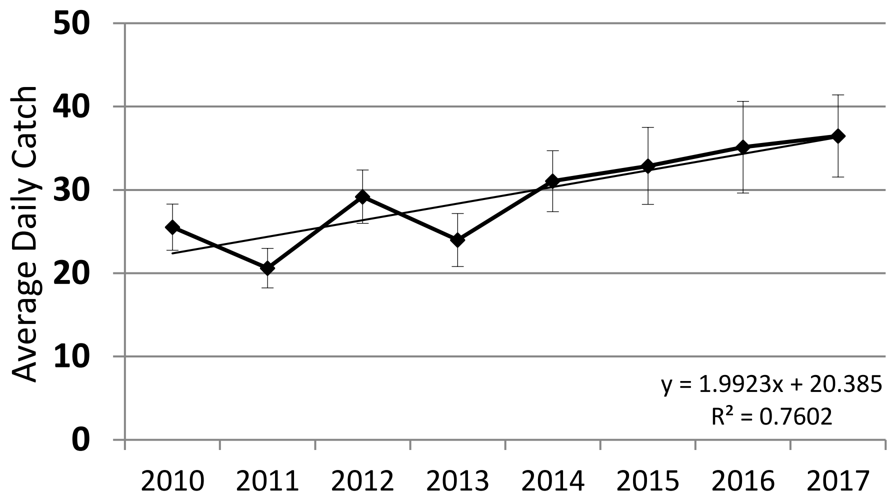

Figure 22. Average daily catch of the “top 25 anglers group” in Spring Mack Days, 2010 to 2017.

13) Average catch rate of top 25 anglers in Fall Mack Days

No clear trend in catch rates exist for Fall Mack Days (Figure 23), and therefore this metric gives no indication of change in abundance.

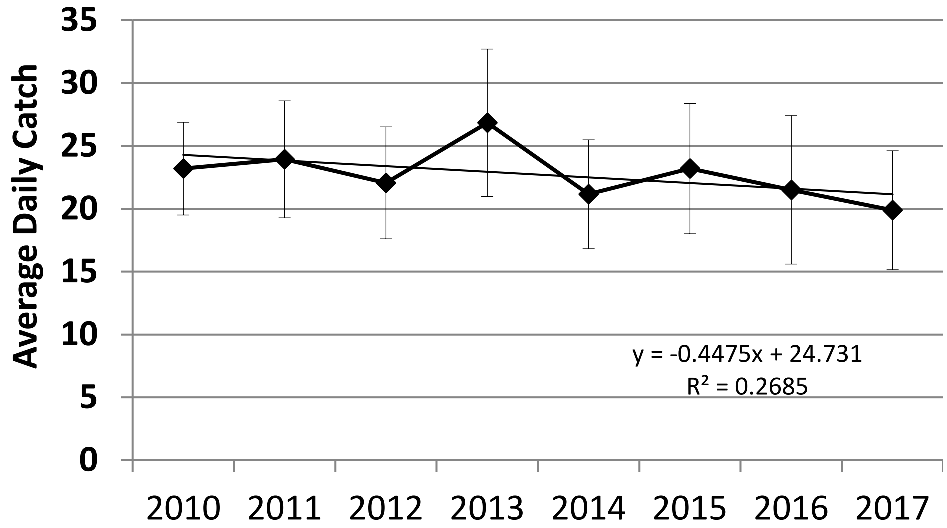

Figure 23. Average daily catch of the "top 25 anglers" group in Fall Mack Days, 2010 to 2017.

Summary conclusion: Are lake trout decreasing?

The 13 metrics used to answer this question do not provide uniformly consistent indications of change in the lake trout population (Table 6). Four metrics (1, 2, 4, and 13) are non-trending, indicating no increase or decrease in abundance over the last decade. One metric (12) is trending upward, suggesting an increase in abundance, although we assume the increase is the result of increasing angler expertise. Eight metrics (3, 5, 6, 7, 8, 9, 10, 11 and 13) are trending in the direction indicating a decrease in abundance of lake trout. Collectively, the 13 metrics suggest the early stages of a density-dependent response to stress from exploitation. The biological indices, body condition, maturity, mortality and size structure, are most indicative of population change. Not all abundance indices (mark-recapture estimates or gill-net catch rates) indicate changes in abundance, which may be the result of slower time lags, lower power to detect changes, and less precision than biological indices. We conclude that the current harvest level has reduced the abundance of adult lake trout to an extent sufficient for biological adjustments to be taking place, primarily among lake trout age 8 and older.

Table 6. Summary of metrics of lake trout abundance and interpretations of their meaning.

Metric	*Direction of Change*	*Value of Metric*	*Comments*
1) Mark/Recapture Spring Population Estimates	No Trend	Moderate	Low precision, possible decline in 2017
2) Mark/Recapture Autumn Population Estimates	No Trend	Moderate	Low precision
3) Catch rates in autumn gillnetting	Downward	High	Low precision
4) Catch rates in spring gillnetting	No Trend	Low	High variability in catches
5) Catch rates in suppression netting	Downward	Moderate	Declines are substantial
6) Relative weight	Upward	Moderate	A good early indicator of change in abundance
7) Mortality rate	Upward	High	Does not address younger year classes
8) Length at 50% maturity	Downward	Moderate	Potentially biased by two stocks of lake trout
9) Abundance of size groups	Downward for larger sizes	High	Decline in capture of the >500 & >750 mm groups
10) Length of angled lake trout in spring	Downward	Moderate	Small, consistent change over time
11) Length of angled lake trout in autumn	Downward	Moderate	Small change
12) Average catch rate of top 25 anglers in Spring Mack Days	Upward	Moderate	Driven in part by improving angler skill and increasingly effective use of technology
13) Average catch rate of top 25 anglers in Fall Mack Days	No Trend, possibly slightly downward	Moderate	Driven in part by improving angler skill and increasingly effective use of technology

Question 3) Is Angler Activity Decreasing?
The Flathead Lake and River Fisheries CoManagement Plan directs managers to maintain a viable recreational fishery while reducing lake trout abundance. The CoPlan identified 50,000 angler-days on Flathead Lake as the definition of a viable fishery. This metric has exceeded 50,000 angler-days in only three of the last eight years it has been monitored. Further, in at least one of those three years, fishing for lake whitefish was at peak levels.

1) statewide angler mail-in survey of pressure on Flathead Lake

This metric is generated every other year from mail-in surveys of licensed anglers, although data from 2015 and 2017 are not currently available. It is likely not as accurate as on-site creel surveys with direct counts of anglers, but represents a useful long-term trend indicator of angler activity on Flathead Lake. This metric assumes that changes in pressure are directly related to the quality of angling which in turn is related to the abundance of the fishery, although several other social and economic factors also influence pressure. Biennial estimates have been variable and are trending neither upward or downward (Figure 24), but these data are not recent enough to be of value in determining the effect of lake trout reduction efforts.

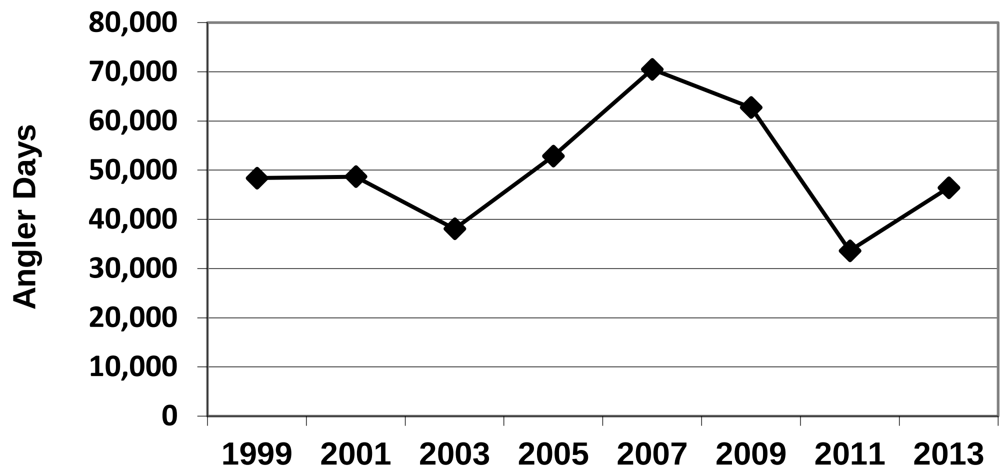

Figure 24. Total angler pressure on Flathead Lake derived from mail-in surveys by MFWP, 1999 to 2013.

2) statewide angler mail-in survey of pressure on the Flathead River system

The river system is divided into three different segments. Angler pressure in the Forks of the Flathead is non-trending, while pressure on the mainstem segment of Flathead River increased substantially since 1995, and decreased over the last two cycles (Figure 25).

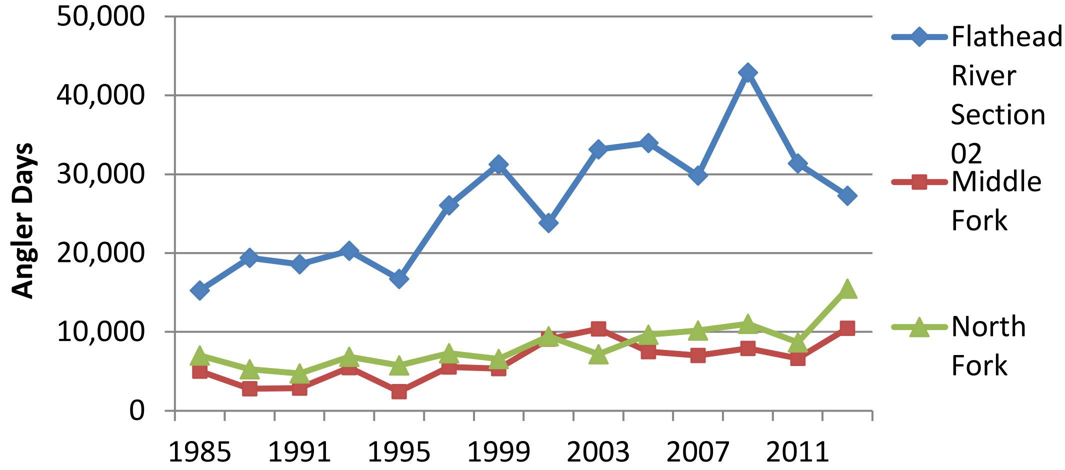

Figure 25. Total angler pressure on segments of the Flathead River system derived from mail-in surveys by MFWP, 1985 to 2013.

3) participation in fishing contests

The number of participants in Mack Days contests represents an index of a portion of angling activity on Flathead Lake (Figure 26). Interpretation of these data requires some caution because contestants represent a unique group of anglers, and their behavior can be influenced by factors that may not influence the larger angling public. For example, some anglers may choose to boycott the contests but continue to fish Flathead Lake at other times. Participation in both spring and fall events decreased rapidly over the period from 2010 to 2014, and decreased more slowly since 2014.

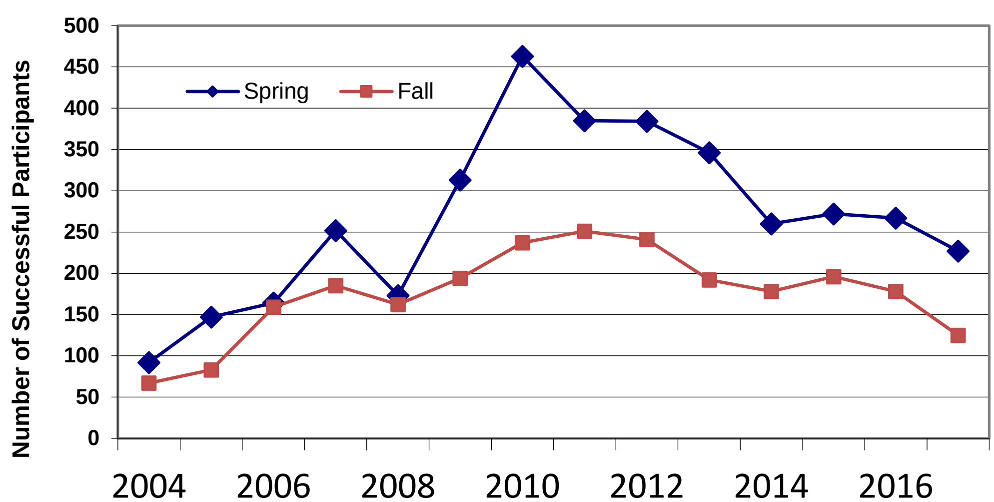

Figure 26. Number of successful participants in the Spring Mack Days (blue) and Fall Mack Days (red), 2004-2017.

Summary conclusion: Is angler activity decreasing?

The two metrics available for evaluating pressure on Flathead Lake do not provide strong evidence to indicate any change in total angler activity (Table 7), although recent data are not yet available. The mail-in survey has produced highly variable estimates, and the reduced participation in Mack Days may not reflect changes in overall pressure on the lake. We conclude insufficient evidence is available to indicate any change in angler activity on Flathead Lake. We further conclude from the mail-in survey that angler pressure on the Forks of the Flathead has been upward trending over the last decade, while activity on the mainstem increased since 2004, but recently decreased.

Table 7. Summary of metrics of angler activity and interpretations of their meaning.

Metric	Direction of Change	Value of Metric	Comments
1) statewide angler mail-in survey of pressure on Flathead Lake	No Trend	Moderate	Problems with small sample size and recall of anglers
2) statewide angler mail-in survey of pressure on the Flathead River system	Up and down in Mainstem, Upward in Forks	Moderate	Problems with small sample size and accuracy of recall of anglers
3) participation in fishing contests	Downward since 2010	High	Non-biological factors also influence participation

Question 4) Is suppression of lake trout causing unintended consequences?

We have identified three specific concerns for unintended consequences of suppression. They are bycatch of bull trout and lake whitefish, and increases in *Mysis* that could cause cascading ecological changes.

1) Is bycatch of bull trout too high?

Bycatch of bull trout impedes progress toward the goal of increasing bull trout abundance. To date, we have not defined a threshold of bycatch that would be unacceptable and likely to preclude success of the program. Nor have we defined a maximum level of mortality that is sustainable. In the absence of these analyses, the Tribes have taken a conservative approach and made it a priority to minimize bycatch at the expense of expanded harvest of lake trout. One reference level of acceptable bycatch is the level permitted by USFWS in the Recovery Permit, which allows 113 bull trout mortalities from Mack Days and 80 mortalities from gillnetting.

Netting and angling are suppression activities causing mortality of bull trout. During Mack Days contests mortality has resulted from anglers mistaking bull trout as lake trout. In 2017 anglers submitted 3 bull trout to the contests, mistakenly thinking they were lake trout (Table 8). An additional source of mortality occurs when Mack Days anglers catch bull trout, correctly identify and release them, but a percentage die from injuries. We estimate bycatch during 2017 contests of 1,090 bull trout (21 bull trout for every 1,000 lake trout caught based on previous creel surveys). Of those, we estimate that 5%, or 55 die from hooking and handling injures.

Bull trout bycatch in suppression nets has been low, and the resulting mortality has been even lower as roughly half of the bycatch survives and is released. In 2017, we caught 23 bull trout in 127 nets, 9 of which died (Table 9). Therefore total bull trout mortality, known and estimated that we attribute to suppression, was 67 (55 post-release from angling, 3 mistaken identity from angling, and 9 from netting).

Table 8. Bull trout mistaken for lake trout and submitted in Mack Days contests, 2010 to 2017.

Year	Annual Harvest	Spring Mack Days	Fall Mack Days	Total Known Bull Trout Mortalities from Angling	Bull Trout as Percent of Lake Trout Harvest	Ratio of LT:BT
2010	48,914	6	0	6	0.01	8,152
2011	44,847	12	13	25	0.06	1,794
2012	52,717	10	6	16	0.03	3,295
2013	42,676	11	2	13	0.03	3,283
2014	43,763	16	2	18	0.04	2,431
2015	53,704	8	2	10	0.02	5,370
2016	52,259	1	3	4	0.008	13,065
2017	51,923	2	1	3	0.006	17,308

Table 9. Catch and mortality of bull trout in suppression nets, 2014 to 2017.

Year	Feet of Net	Number of Bull trout captured	Number of Bull trout released	Number of Bull Mortalities	Ratio of LT:BT Mortalities
2014	135,000	8	7	1	7,657
2015	405,900	12	4	8	2,222
2016	677,700	22	10	12	1,920
2017	1,034,100	23	14	9	2,411

Nearly all of the known bull trout mortalities were juvenile or subadult individuals (Figure 27). Additionally, we estimate that 25% of the Mack Days bycatch would continue in the absence of Mack Days (because not all Mack Days activity is additive to general angling pressure). Therefore, total known and estimated bull trout mortality that is attributable to suppression activities is 53 (41 post-release from angling, 3 mistaken identity from angling, and 9 from netting). We assume that the loss of 53 subadult and juvenile bull trout is unlikely to cause a decline in the Flathead metapopulation of bull trout.

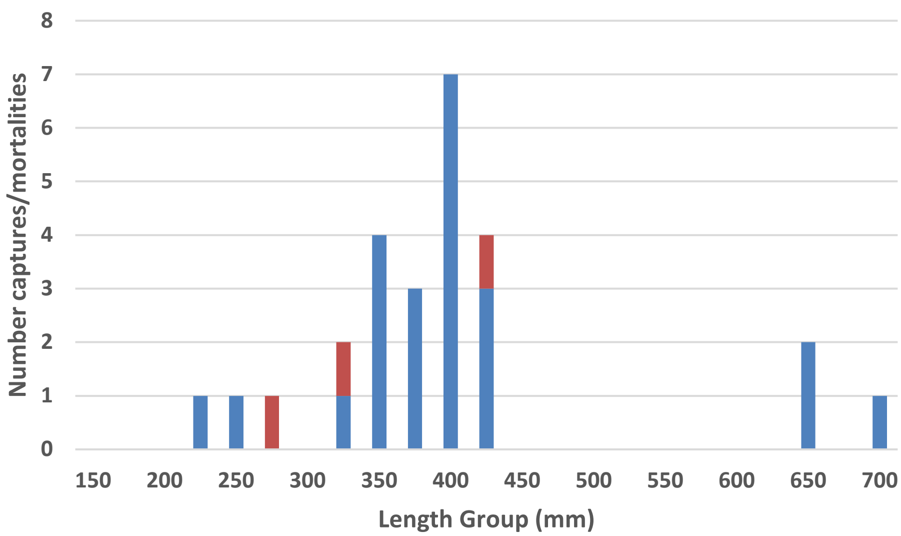

Figure 27. Length frequency distribution of known bull trout mortalities from Mack Days contests (red) and both live and dead captures in gillnets (blue), 2017.

In 2017 we caught bull trout in gillnets evenly across all areas and depths (Figure 28), indicating that bull trout are occupying all habitats within the lake. This broad distribution of predominantly immature fish may be an indicator of future increases in abundance.

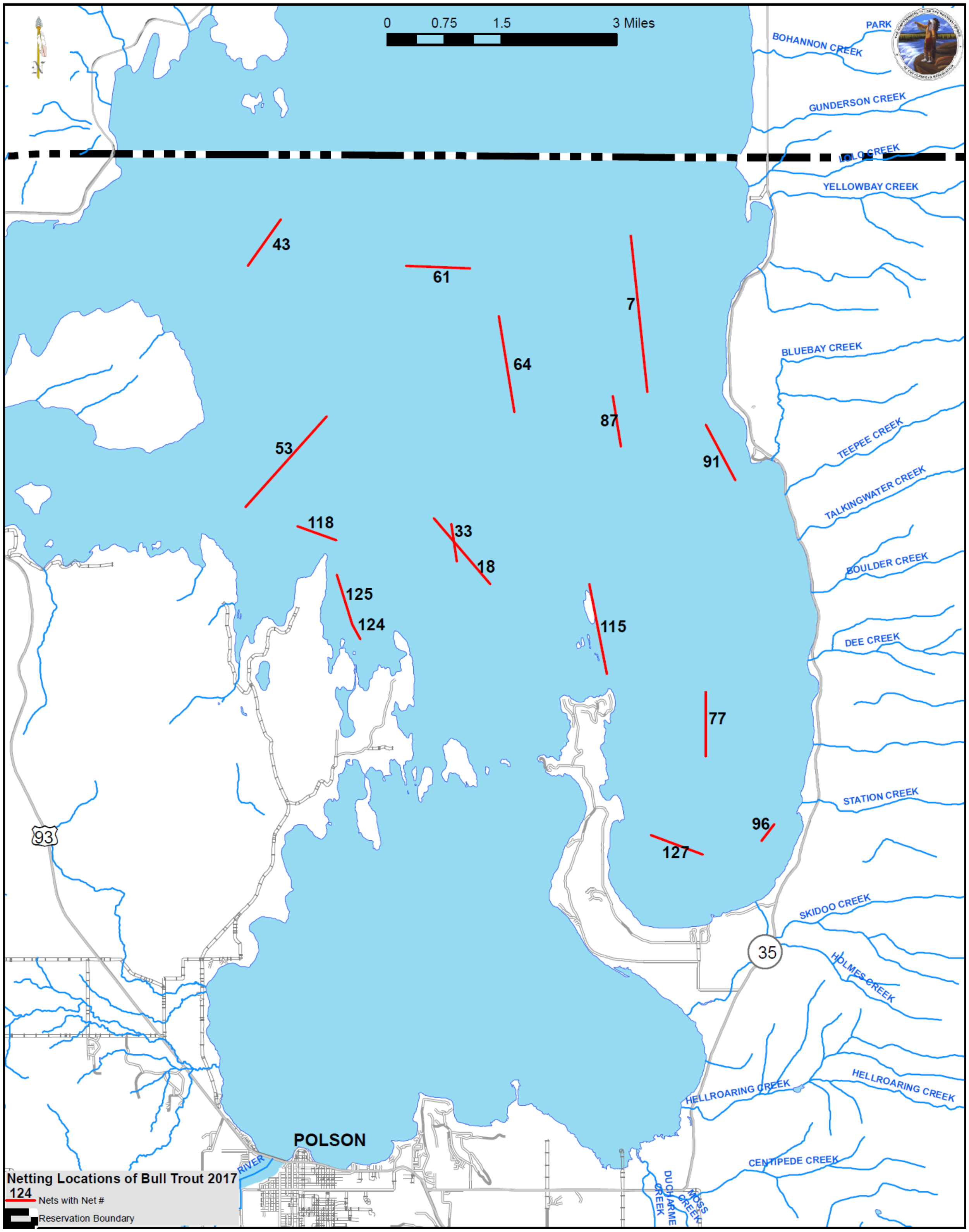

Figure 28. Locations of bull trout captured in nets during 2017, with net identification numbers.

b) Is bycatch of lake whitefish too high?

CSKT set a total of 1,034,100 ft of suppression gillnets in 127 locations during 2017, resulting in a bycatch of 24,361 lake whitefish, or less than one percent of estimated standing stock. The spring gillnetting survey has produced highly variable results, without any upward or downward trend since 1992 (Figure 29). The autumn survey has been less variable than the spring survey, and also provides no clear indication of an upward or downward trend (Figure 30). The abundance of lake whitefish has been very high in Flathead Lake (estimated at greater than two million), exploitation is very low, and they exhibit high fecundity and high resiliency. We therefore conclude that lake whitefish abundance has not changed during the period of record.

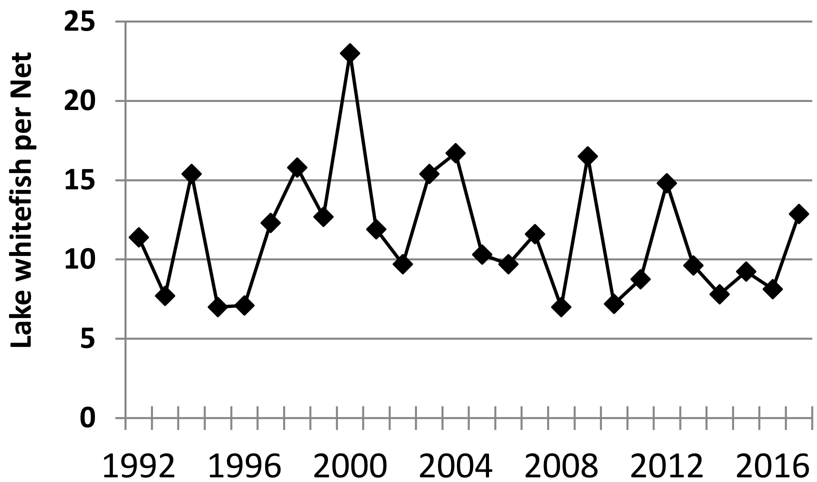

Figure 29. Average annual catches of lake whitefish in 30 fixed-location gillnets set in spring, 1992 to 2017 (data from MFWP).

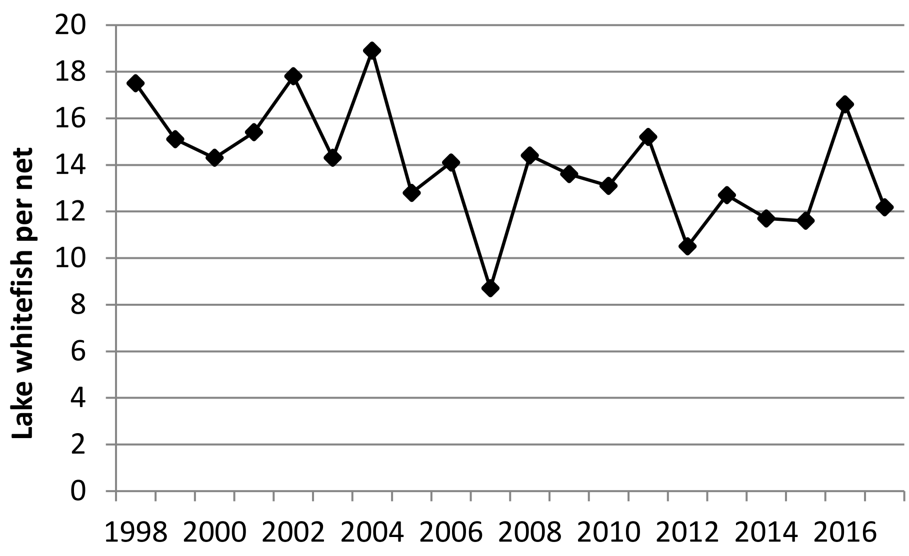

Figure 30. Average annual catches of lake whitefish in stratified random gillnets (from 48 to 94 nets) set in autumn, 1998 to 2017.

3) Is abundance of Mysis diluviana increasing?

Mysis diluviana are the primary prey of juvenile lake trout of both lean and dwarf stocks. Suppression of either of these stocks would reduce predation on Mysis and likely result in increases in abundance of Mysis. This cascading effect is complicated by the presence of two stocks of lake trout, one more dependent on Mysis than the other, and compensatory recruitment potentially causing a near-term increase in juvenile, Mysis-eating lake trout.

An increasing trend in Mysis density is evident from 2004 to 2014 (Figure 31), although recent data indicate a large decline. Mysis abundance seems to be driven both by bottom-up and top-down factors. Nutrient availability varies with the magnitude of runoff, partially explaining the inter-annual variability in Mysis abundance, and may also overwhelm the effect of changes in lake trout abundance in recent years.

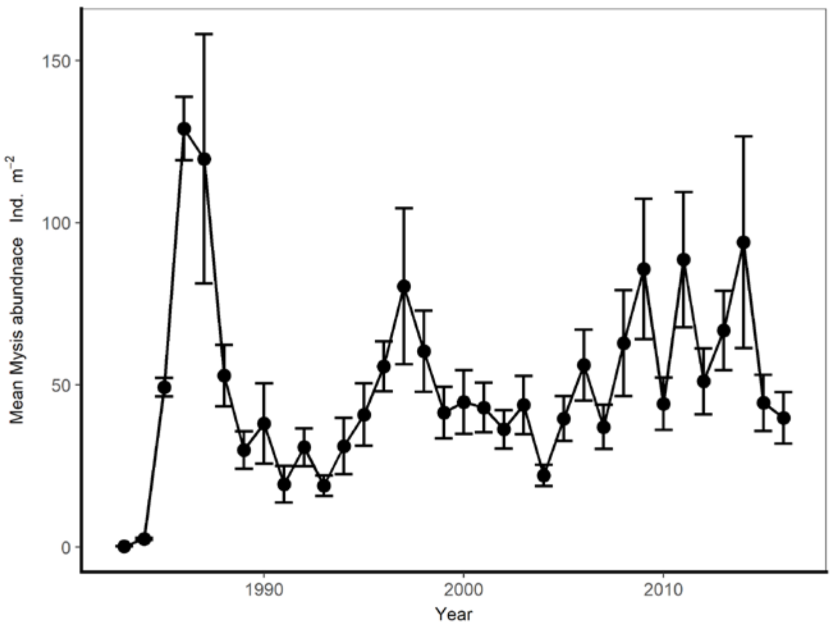

Figure 31. Number of Mysis diluviana per square meter averaged across 40 sampling locations in Flathead Lake, 1980 to 2016 (data from Flathead Lake Biological Station).

Mysis prey on cladocerans (primarily Daphnia sp.) who in turn consume algae. If Mysids increase, then cladocerans are expected to decrease, leading to an increase in algae. The production or density of phytoplankton is measured by several methods, which include annual primary production in grams of carbon and weight per liter of Chlorophyll a. Primary production has been stable and non-trending (Figure 32), although recent data are not currently available. Density of chlorophyll a has been trending upward, although the recent peak is within the range of variability observed over the last 20 years (Figure 33).

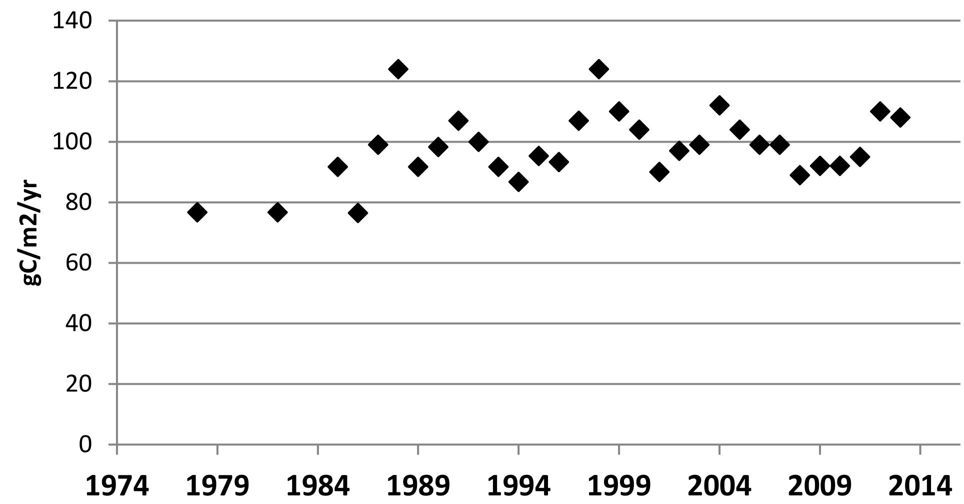

Figure 32. Average annual primary productivity (gC/m2/yr) in Flathead Lake, 1978-2013 (data from Flathead Lake Biological Station).

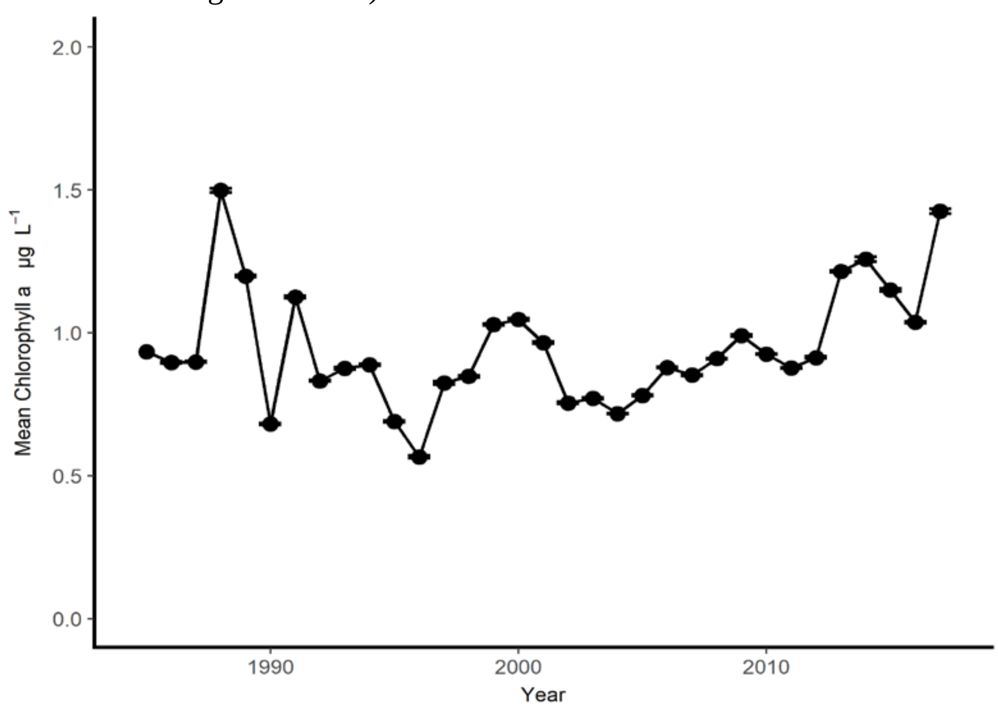

Figure 33. Chlorophyll a (ug/L) in Flathead Lake, 1978-2017 (data from Flathead Lake Biological Station).

Summary conclusion: Is suppression of lake trout causing unintended consequences?

We assume that it is too early in the suppression process, and the scale of harvest is too small to reasonably expect to identify unintended consequences. Nonetheless, we evaluated three metrics to determine if early signs of suppression are evident. Bycatch mortality of both bull trout and lake whitefish has been very small, and therefore bycatch is extremely unlikely to have measurably affected their abundance. Mysis abundance has varied widely, but with no consistent upward trend as might occur if predation by lake trout was greatly reduced.

Question 5) Is the level of risk inherent with suppression acceptable?

None of the risks that have been identified to date are at a level that is unacceptable. Mortality of bull trout has been low, and bycatch of lake whitefish has been small relative to their population size. Earlier increases in *Mysis* and Chlorophyll a were noteworthy, but temporary and well below levels present in 1986, and we cannot attribute those increases to decreases in lake trout abundance at this time.

6) Based on the results of the first five questions; What is the best lake trout harvest target for 2018?

In 2018, the fifth year of expanded suppression efforts, we expect few of the constraints from the limitations of infrastructure that we experienced in past years. The biggest change for 2018 is the acquisition of a 38 ft netting boat, which should facilitate increased harvest from netting. The primary objective each year is to exceed the harvest achieved in the previous year, although we anticipate problems in maintaining that trend in 2018. Mack Days contests will be conducted as they were in 2017 because we think we have arrived at the optimal format leaving no additional opportunity for cost-effectively increasing harvest. We will attempt to repeat or exceed the netting effort expended in 2017 which equaled 70 days and 1,034,100 ft of net. Unfortunately, catch rates from netting have been declining each year (Figure 15), making it unlikely that total catch from nets will increase in 2018. Assuming constant angling catch and reduced catch from netting, we project that it is feasible in 2018 to harvest 91,000 lake trout (Table 10). We consider this target to be a realistic one to achieve, although it fails to meet the objective of sustaining annual increases in harvest and is well below the long-term goal for harvest. Current indications are that suppression is effectively reducing adult lake trout abundance at harvest levels well below modeled targets. We will evaluate this seeming contradiction over the coming year and the need to make additional adaptive changes.

Table 10. Methods of suppression, harvest achieved in 2017, harvest projected for 2018, and projected bull trout and lake whitefish bycatch for 2018.

Method	Lake Trout Harvest 2017	Projected Lake Trout Harvest Target for 2018	Projected Bull Trout Bycatch / Mortality	Projected Lake Whitefish Bycatch
General Recreational Angling	25,000 (Estimated)	25,000 (Estimated)	525/57	Small
Spring Mack Days	37,223	35,000	735/37	0
Spring Gillnetting	17,468	10,000	<10/4	10,000
Fall Mack Days	14,700	15,000	315/16	0
Fall Gillnetting	5,569	6,000	<15/5	6,000
Total	99,960	91,000	1,600/119	16,000