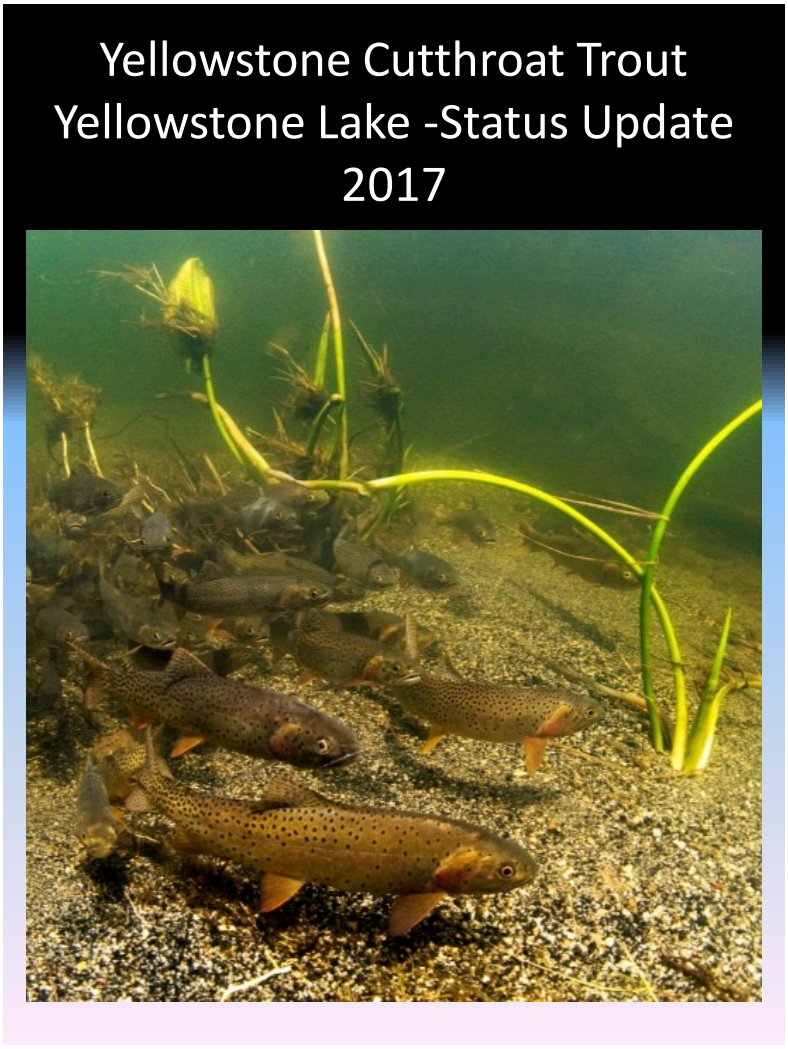
Update on Yellowstone Cutthroat Trout Recovery

in Yellowstone Lake and the Upper Yellowstone River System

January, 2017



To view a 5 minute video on the implications of the decline of Yellowstone Cutthroat trout to the Yellowstone ecosystem, click here.

Overview and History

Wyoming Trout Unlimited (WY TU) and the East Yellowstone Chapter of TU (EYCTU) have collectively been focused on recovering the Yellowstone Cutthroat Trout (YCT) population of the upper Yellowstone

River and Yellowstone Lake system (YL) since 2008. Our focus has been on aiding and encouraging the National Park Service (NPS) in their efforts to suppress the invasive and predacious lake trout (LT) that were introduced into that system around 30 years ago and in aiding the US Geological Survey (USGS) in their multi-pronged efforts to locate the LT spawning beds in that system, to learn about LT spawning behavior, and to develop alternative suppression techniques focused on LT ova and fry. The primary focus of the USGS/TU joint effort is a major telemetry study of LT movements through the use of hydro-acoustic telemetry transmitters. Trout Unlimited in Wyoming has been the major fundraising source for the USGS efforts along with the Greater Yellowstone Coalition (GYC), the National Parks Conservation Association (NPCA), the Federation of Fly Fishermen (FFF), and TU chapters and councils in many states but especially Colorado, Montana and Idaho.

Yellowstone Lake Working Group:

The Yellowstone Lake Working Group which consists of representatives from all of the above agencies and non-governmental organizations (NGO's) along with representatives from Montana State University Fisheries (MSU), and the Yellowstone Park Foundation which is now named Yellowstone Forever (YF, the major funding source for the gill netting on the Lake). This Working Group along with several contract researchers meet on a regular basis to review progress in the effort and to set the agenda for future efforts. They most recently met on December 7th in Bozeman, MT to review the current status and direction for 2017 of the program. This report is a synopsis of that meeting.

Overall Summary of the Progress:

The efforts to remove LT from the YL system and recover the YCT population is a long term project that has no simply and quick fix. The LT is a voracious predator and has high reproductive potential in the YL system. Its population numbers roughly 700,000 age two and older fish. YL itself is a huge lake with great depths (up to 400 ft.) making suppression a difficult and lengthy process. The effort has at its core a major netting campaign to remove both adult and juvenile LT. Longer term suppression is focused on finding the LT spawning beds through telemetry and then developing specific techniques aimed at cutting off LT recruitment by targeting the LT ova and fry.

The netting campaign is now over 20 years old, although only in the last 6 years has it reached the level that is acknowledged to be sufficient to reverse the population expansion. The telemetry study is currently 6 years old.

The population of LT in the system is in decline although only modestly so. A crash has not yet occurred although it is still anticipated. It is most heartening that the adult LT population is definitely showing signs of decline. The telemetry study has met its primary goal of identifying many (although certainly not all) of the LT spawning areas. Due to funding limitations, this telemetry study is scheduled to be discontinued for the 2017 season. Ova and fry suppression studies are progressing on several fronts and results are encouraging although the "silver bullet" for LT ova and fry suppression has not yet been found. Meanwhile, the YCT population is showing signs of recovery. Every metric studied to monitor this population is on a positive trend. Included are: angling catch rates, spawning stream monitoring studies,

distribution netting results, by-catch rates, and visual observations in critical YCT spawning areas. The population of YCT in the system is not yet where it should be; progress is being made.

The ecosystem that depends upon the YCT population as a food source has been negatively and in some cases, severely impacted. But there are signs of recovery. In 2016 and for the first time in many years, a grizzly was filmed while feeding on YCT during the spring spawning run.

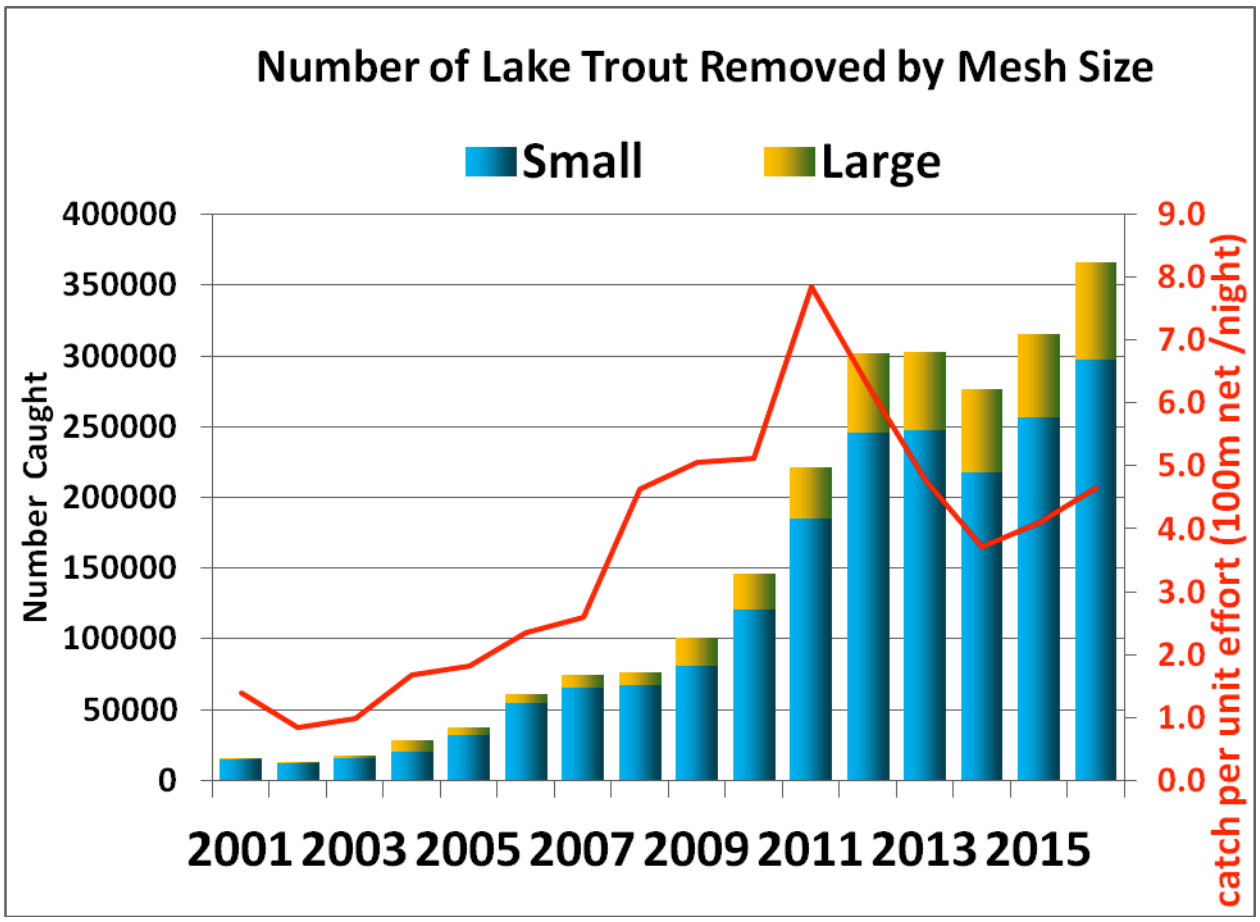
Details of the Status of the LT Suppression and YCT Recovery

Status of the Gill Netting:

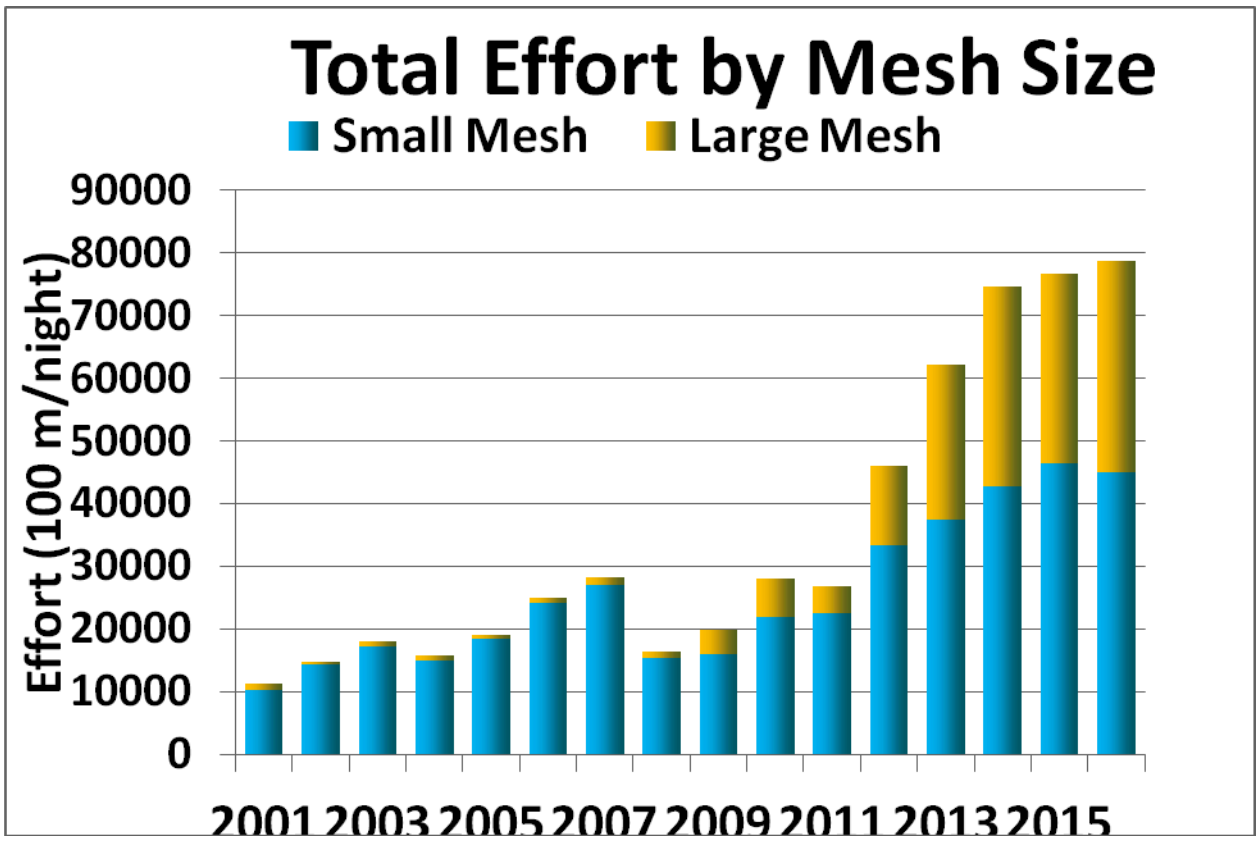
Gill netting remains the primary defensive method of LT population control. During summer, 2016 a total of 365,000 LT were removed from the system by netting. See Graph 1 below for the yearly breakdown. That number pushes the total number of LT removed to date to approximately 2.3 million. Four boats participating in the gill netting are now operated by the contract gill netting crews from the Hickey Bros. and a fifth boat has now joined the effort in 2016 and is operated by the NPS. This yearly removal of LT is higher than the average removal of the last four years which was about 300,000 per year. The increase in LT removal was predominantly in juvenile LT while the mature LT removal number stayed about the same. There was an increase in total netting effort units (100 meters of net soaked for one night equals one unit) from about 76,000 in 2014 and 2015 to 78,000 in 2016. The resultant catch per unit of effort (CPUE) for all mesh sizes was up slightly in 2016 over the past three years but remains significantly lower than the highs of 2010, 2011, and 2012. This decline in CPUE over these past four years is a very strong indicator that the LT numbers have declined during this time. This is especially true of the adult lake trout numbers. The netting crews continue to gain more experience every year in locating LT and were further guided by a mobile tracking study that the NPS initiated during 2016 that has increased the crews efficiency especially for adult LT.

Graph 2 shows the division of the netting effort between small mesh nets which target juvenile LT and large mesh nets which target adult LT. The proportion of net that targets adult LT has grown over the years but has stabilized for the past 3 years.

Graphs 3 and 4 show the catch numbers of LT in small mesh and large mesh nets respectively over the past 15 years as well as the CPUE values for those net sizes. Of particular note is that the CPUE (which is an indicator of relative LT abundance) in the large mesh netting has declined significantly for the past several years. This is strong evidence of a declining adult LT population. Indeed, when a population model is compiled for the LT, a clear decrease in adult LT is seen (see Graph 5). The slight increase in juvenile LT numbers this year shown on Graph 5 is believed to be a compensatory reaction to the adult LT decline.

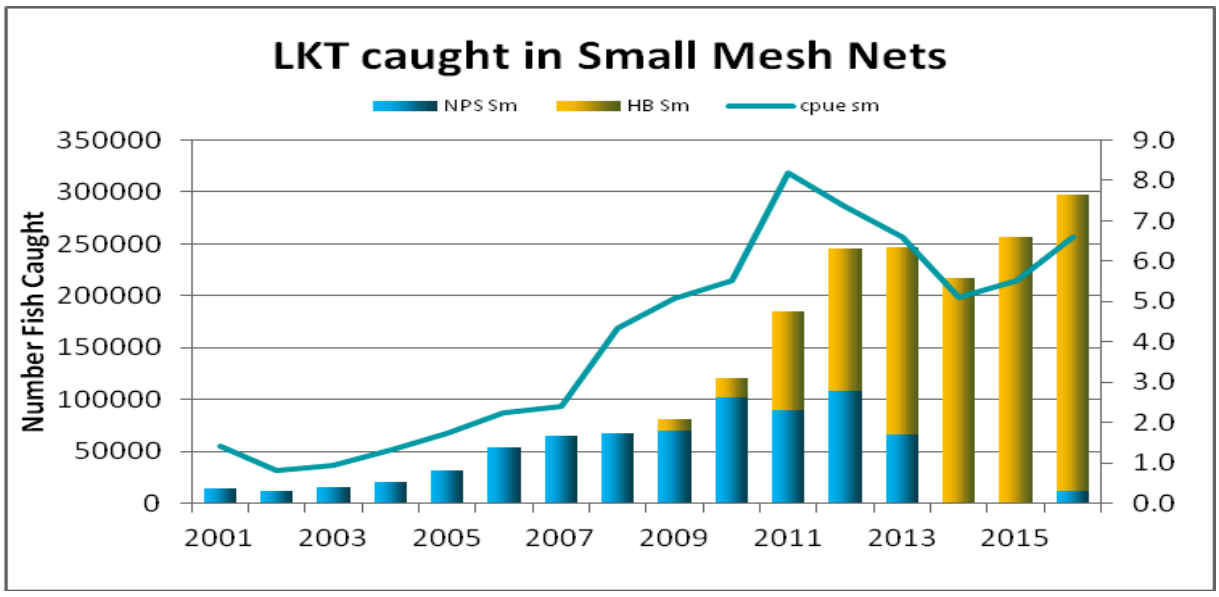


Graph 1: Total LT removal by gill netting by year since 2001 and CPUE for the same time period.

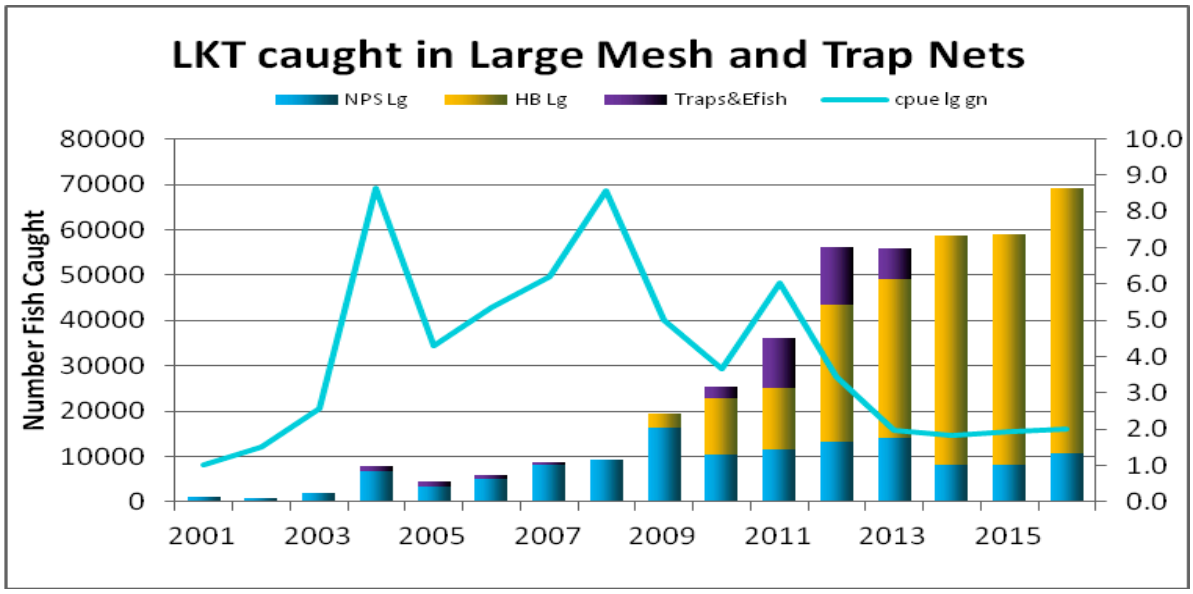


Total netting effort for 2001-2016 (1 unit = 100 meter of net for one night).

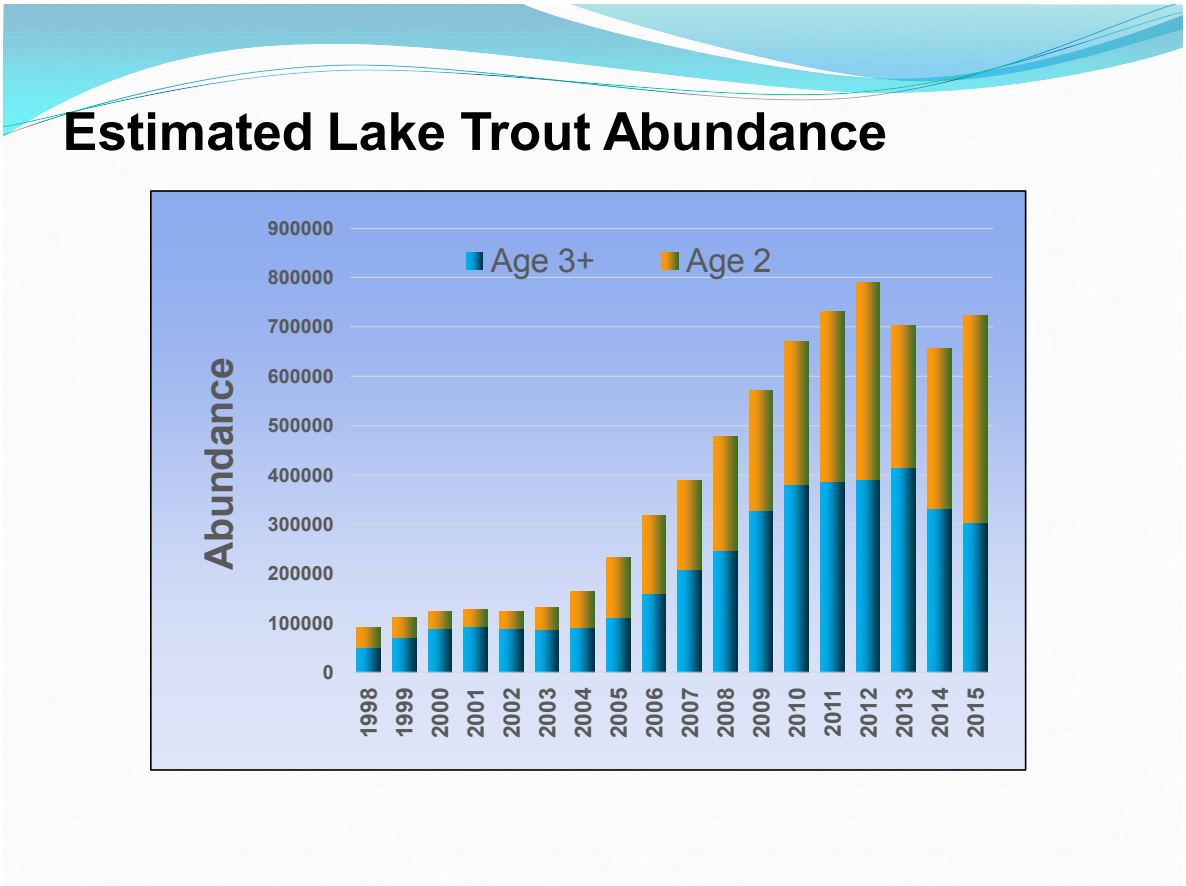
Graph 2: Division of the gill netting effort into small mesh (targeting juvenile LT) and large mesh (targeting adult LT).



Graph 3: Lake trout catch numbers and CPUE values for 2000-2016 in small mesh gill nets.

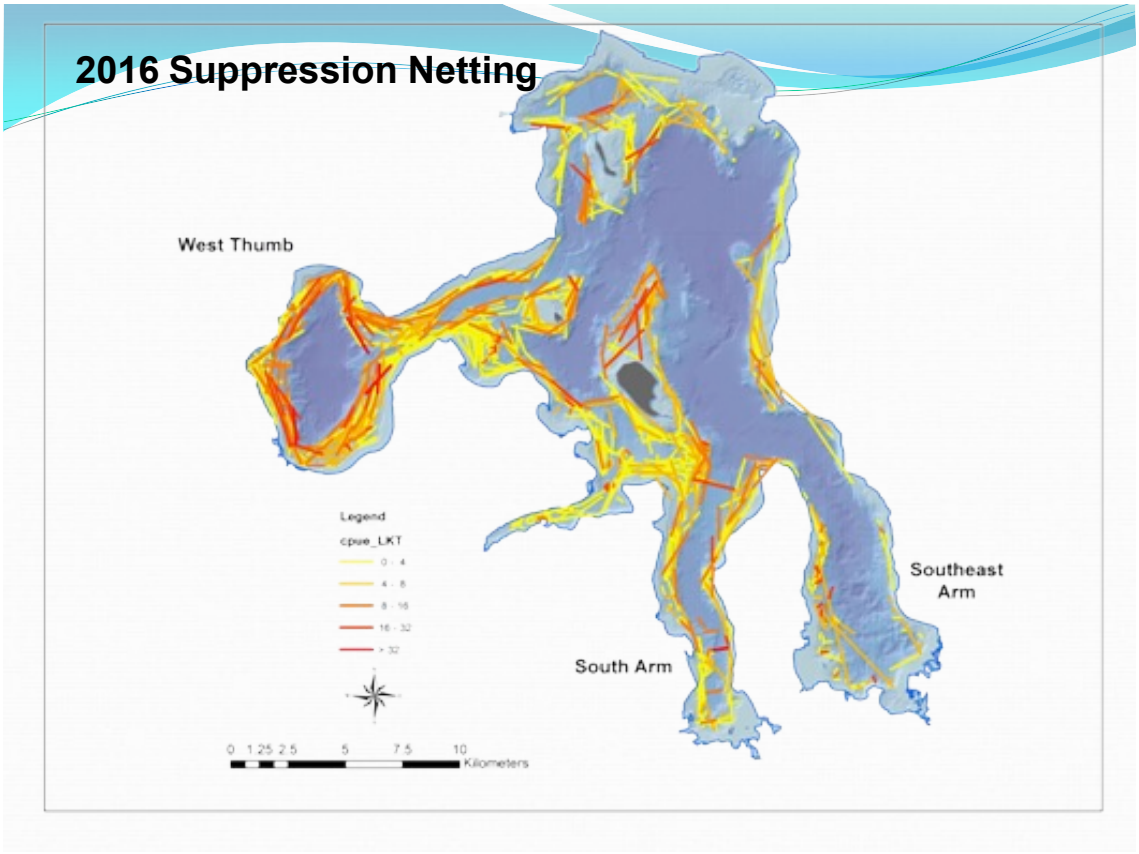


Graph 4: Lake trout catch numbers and CPUE values for 2000-2016 in large mesh gill nets.

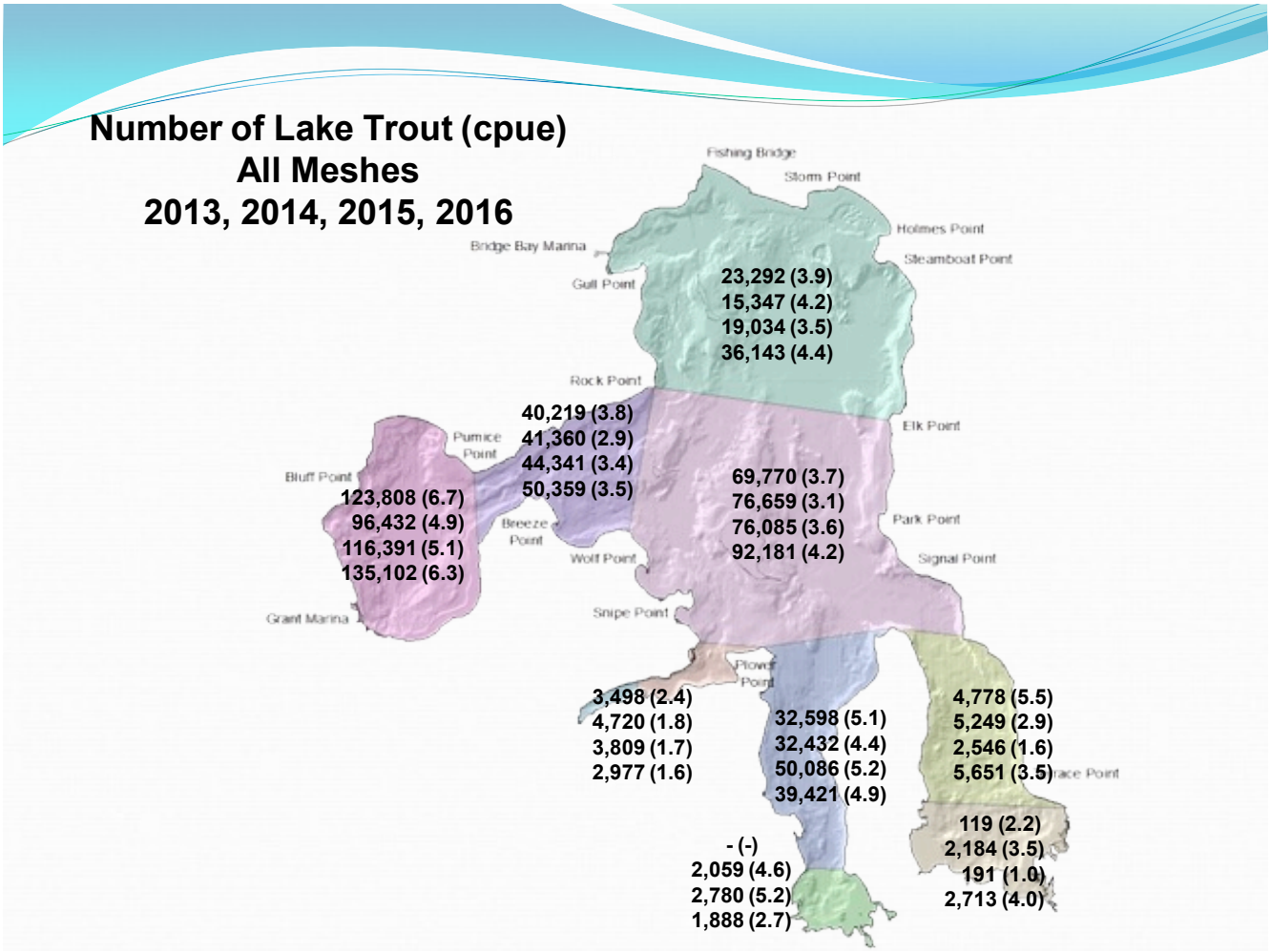


Graph 5: Estimated LT abundance in YL by age structure.

Netting distribution across the area of Yellowstone Lake has continued in 2016 as shown in Graph 6. This is due to the widespread and very mobile distribution of the LT across all areas of the Lake as determined by the telemetry study. Another significant development in the netting effort since 2014 is that the netting crews have been able to continue to net in the South, Southeast and Flat Mountain Arms of the Lake for the past 4 years. This is a result of a relaxation of the boating restrictions in those areas which is especially important as we try to keep pressure on the population throughout the system. Graph 7 shows the CPUE over all areas of the lake over the past four years and also demonstrates the wide distribution of these invaders.



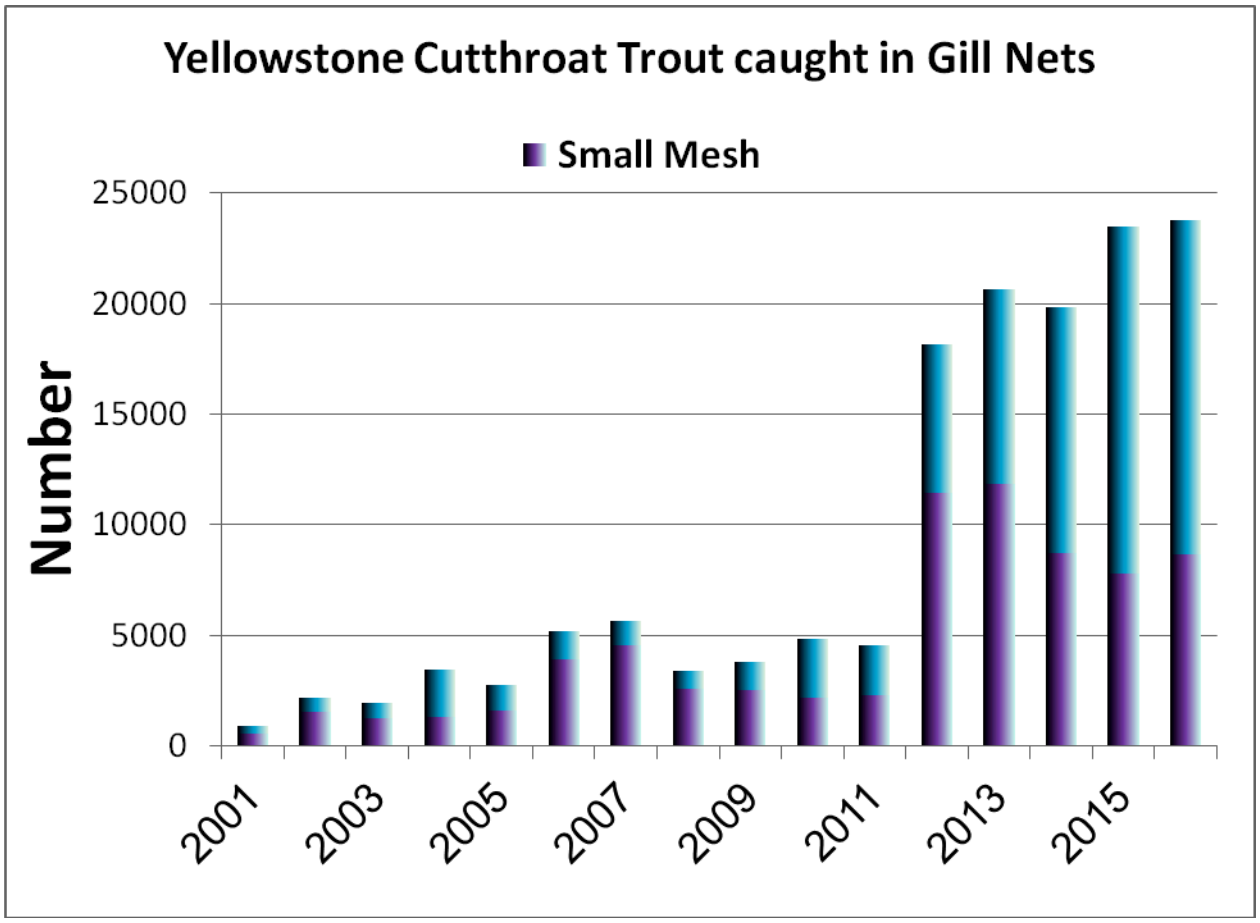
Graph 6: Gill netting actual locations in Yellowstone Lake for 2016 with CPUE ranges for the nets indicated. The darker the red, the higher the catch rate in those nets.



Graph 7: Overall catch rates (CPUE) in various segments of the Lake over the past 4 years.

By-catch of cutthroats in the nets is always a concern (see Graph 8). During the early years of the netting (late 1990's and early 2000's) by-catch as a percentage of LT harvest, was a significant issue as the cutthroat population was still somewhat strong and the knowledge of how to avoid the cutthroats was being developed by the netters. Since the total amount of netting was relatively low, the total YCT by-catch was low even though it was high on a percentage basis. Then, during the early to mid 2000's, by-catch declined as a percentage of LT harvest. This was due to the cutthroat population decline and cutthroat avoidance knowledge being gained. Now, for the past four years, by-catch as a total number has increased even though the by-catch rate relative to LT catch is still low. This is most likely due to a

recovery of the cutthroat population. Although we would like to avoid all by-catch, the increase certainly indicates a recovering population of cutthroats.

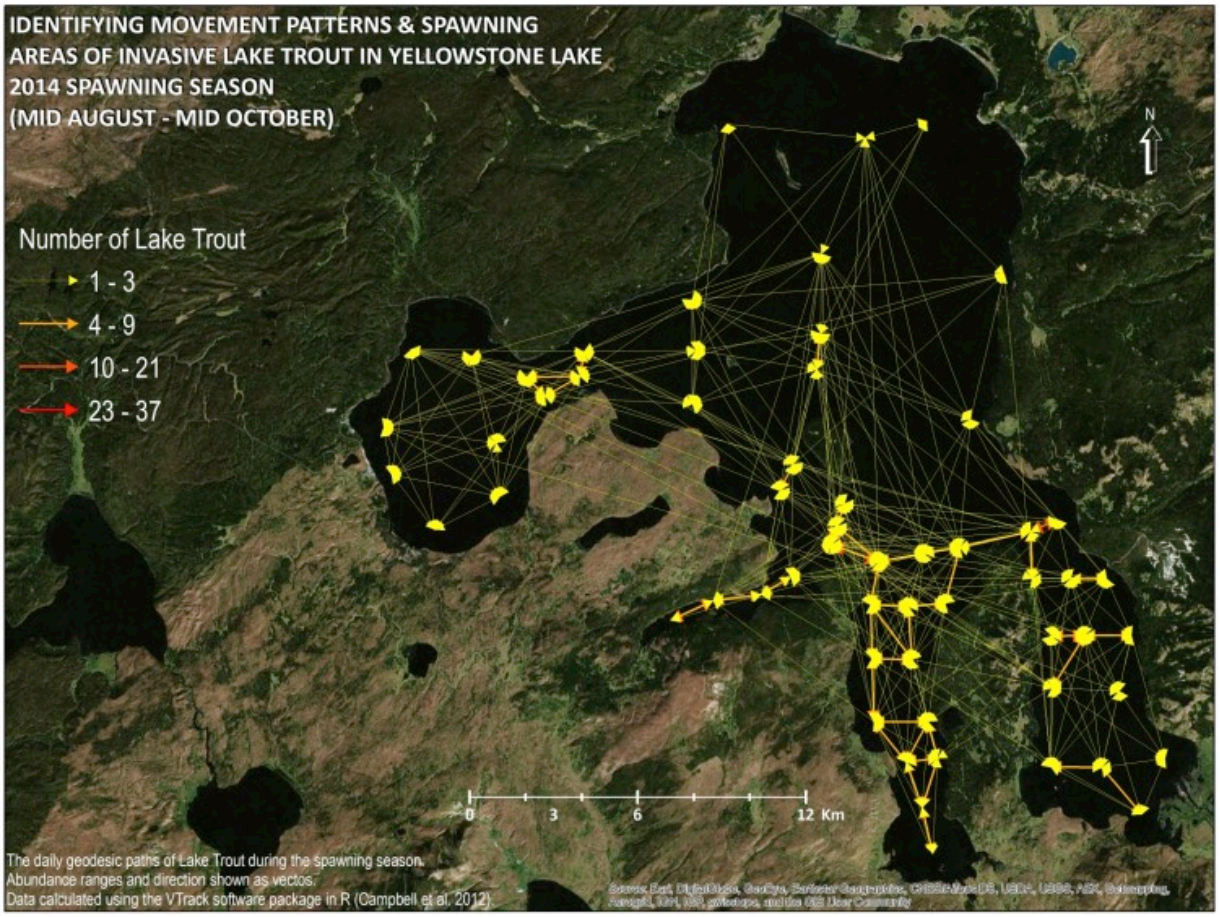


Graph 8: By-catch of YCT in gill netting over time.

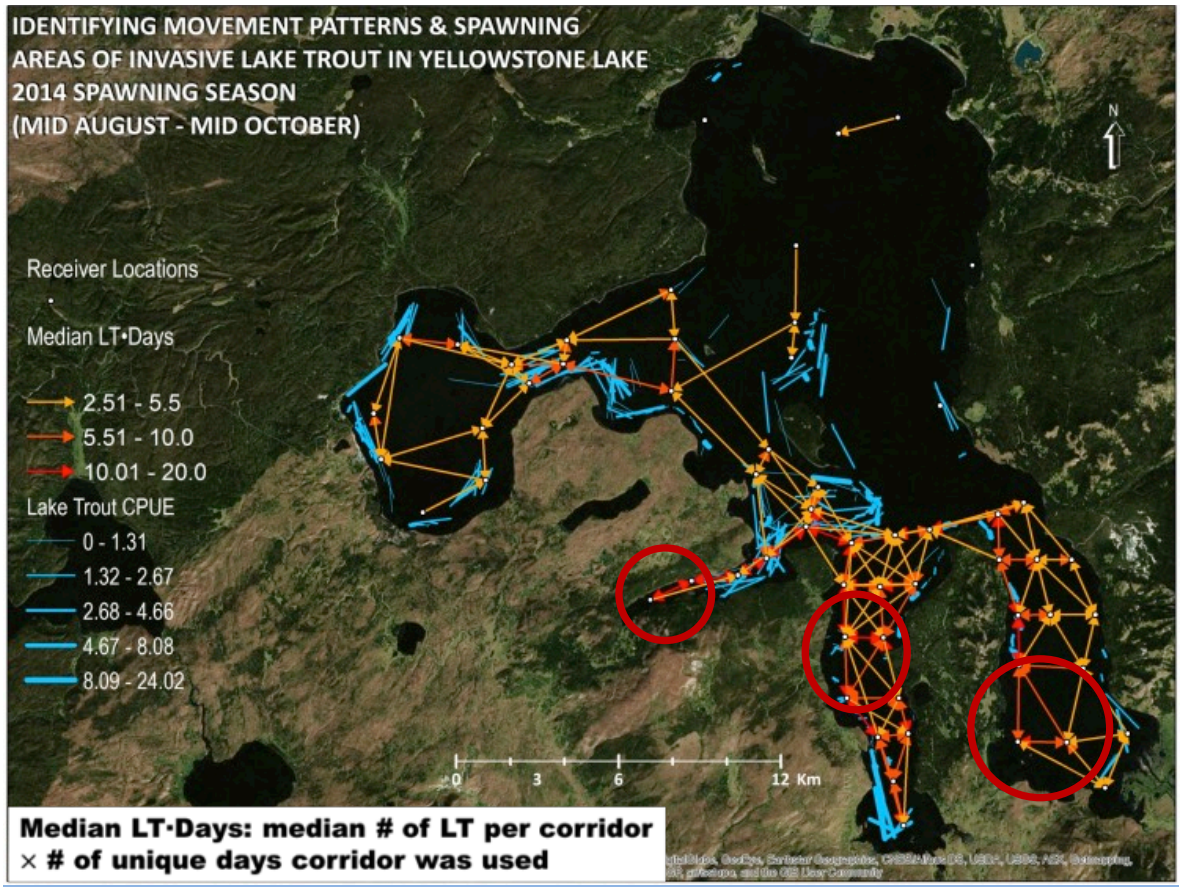
Telemetry Studies:

2016 was also a good year for the telemetry study. During this summer, a total of 97 hydro-acoustic transmitters were surgically implanted into LT. This was accomplished by the biggest volunteer effort on the Lake since TU's involvement. A total of 125 volunteers and 25 fishing boats spent 8 days on the Lake catching LT for the study. The number of tags has to be constantly replenished as the tagged LT are being caught in the gill nets and the tags harvested for re-implantation. The signals from tagged fish are picked up anytime one of these fish swims within listening range (roughly 500 meters depending on water conditions) of a semi-permanently positioned receiver. There are about 50 receivers in the

system. This provides data on movement patterns, congregation areas, and travel corridors of the LT. All of this information is intended to aid the netting crews. These data that indicate broad scale movement patterns are analyzed by Dr. Lee Gutowsky of Carleton University under contract with TU. Just one of many maps of the Lake showing movement patterns is shown in Graph 9. It is obvious that the LT move dramatically throughout the system. However, by studying this information it is possible to locate travel corridors and "hot-spots" of LT congregation by season. See Graph 10.



Graph 9: Typical movement patterns of LT in YL as developed by telemetry study.



Graph 10: Broad scale movement patterns of LT showing areas of concentration.

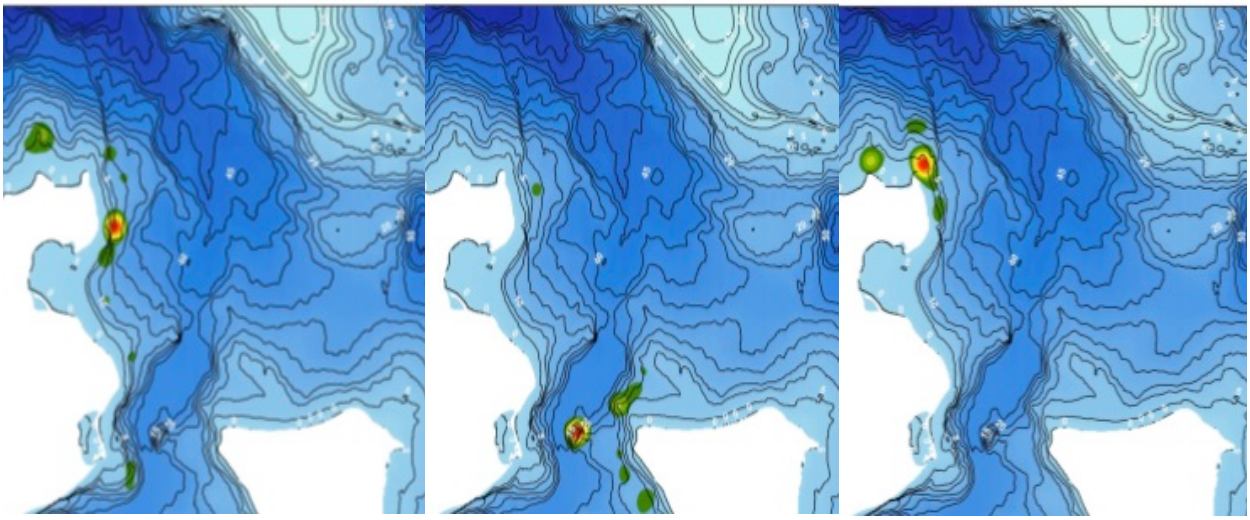
Then in the fall, the goal of the telemetry study and the receiver deployment change. The focus shifts to positioning the receivers in close proximity arrays to pinpoint suspected spawning areas. These are called VPS (Vemco Positioning System) arrays. With the help of a reference signal and triangulation, exact location of each fish within the array can be determined. This helps identify specific sites for further study as potential spawning beds. These data are analyzed by Dr. Jason Romine of the US Fish and Wildlife Service again under contract with TU. During fall of 2016 the areas studied with these arrays were the SE Arm and Breeze Channel (see Graph 11). Complete data analysis is not yet complete from these arrays but Graphs 12 and 13 show the type of kernel density plots that lead to suspected spawning sites. Data from these arrays set in 2015 revealed spawning areas that are now confirmed in the Flat Mountain Arm and in the South Arm. The spawning area at Carrington Island is also shown.

VPS Arrays

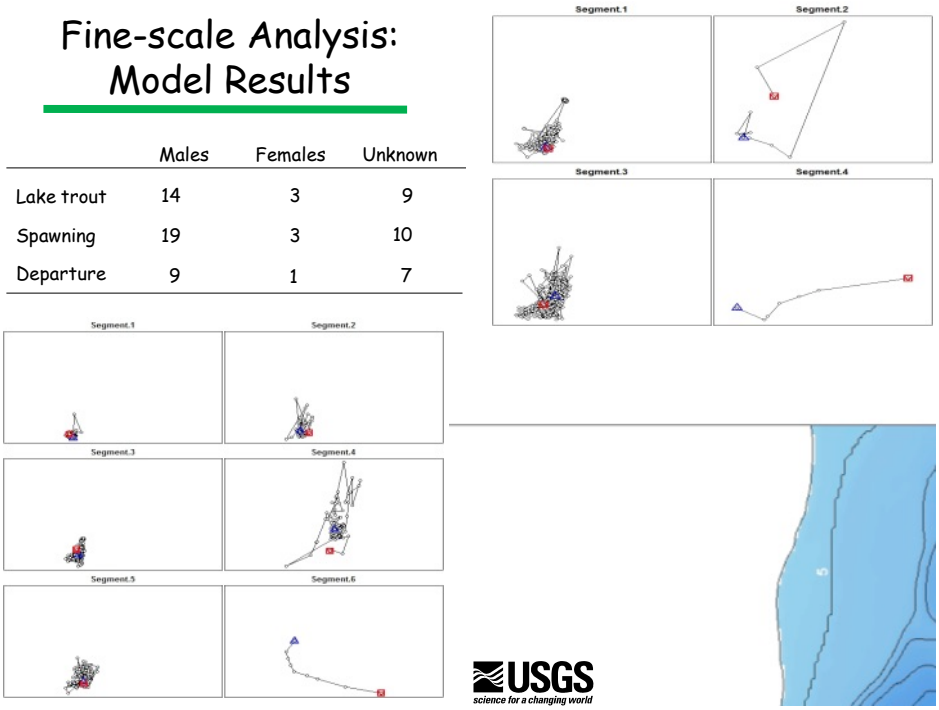
- 2016 arrays
  - Breeze Channel
  - Southeast Arm
- Deployed
  - ~ August 20, 2016- October 20

Graph 11: VPS arrays deployed in 2016 (circled) with the previous arrays indicated.

Kernel Densities for Individual Lake Trout

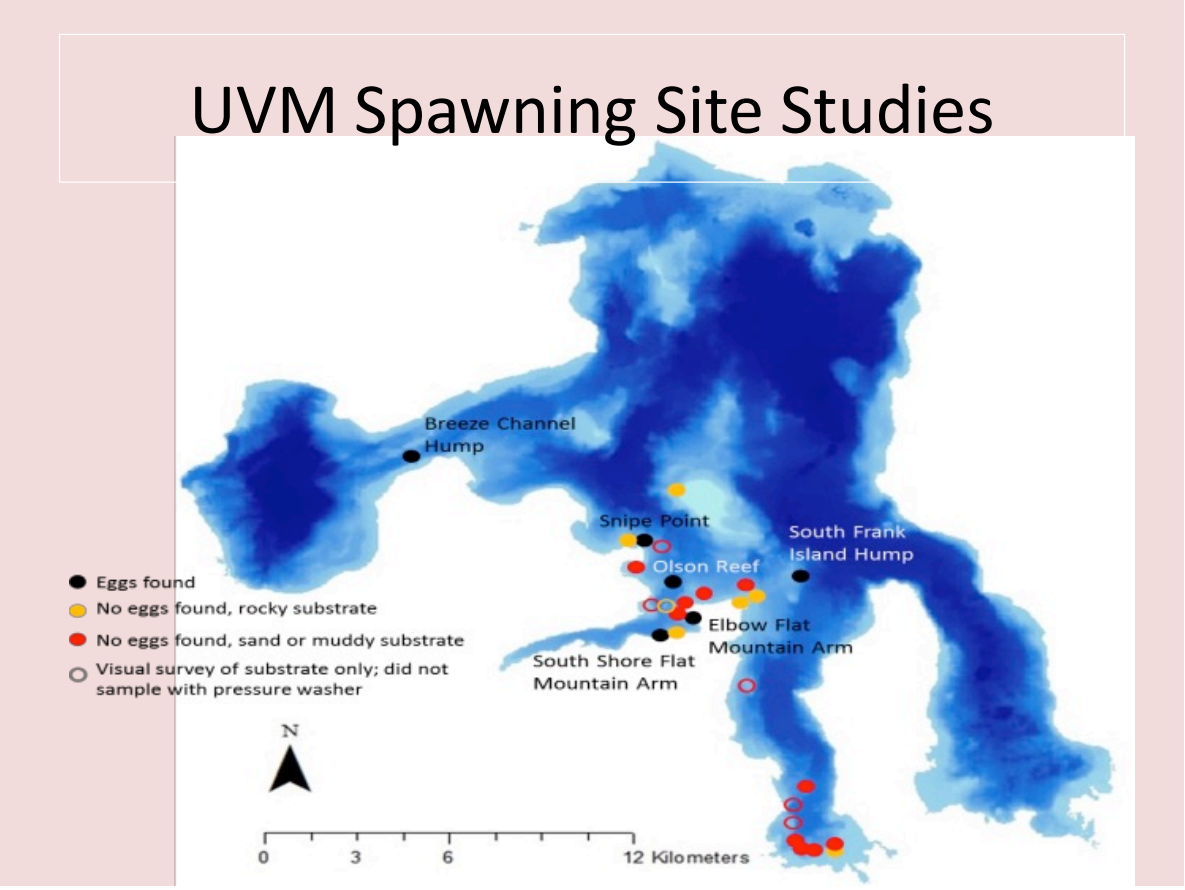


Graph 12: Kernel density plots which show areas of high LT concentration and potential spawning areas (indicated by red areas).



Graph 13: Individual LT movement patterns at Carrington Island spawning bed showing definite spawning behavior.

After suspected spawning areas are identified by the arrays, they are confirmed or ruled out by underwater divers, egg collection baskets, fry traps, and/or the use of underwater robotics and cameras. Much of this work is done either by NPS personnel or under contract with Dr. Ellen Marsden of the University of Vermont. Using these techniques, at least 12 spawning sites have been investigated and confirmed as shown on Graph 14.



Graph 14: Potential and confirmed spawning sites on YL.

Alternative Suppression Techniques:

Trout Unlimited has had a long term goal of not only knowing where lake trout spawn, but also to assist in the development of alternative suppression technology which will allow NPS crews to target the other life stages (ova and fry) of lake trout. It is anticipated that once the time consuming and expensive netting operation has reduced the lake trout population to the point that the cutthroats can rebound, a less expensive and less time consuming method will be needed to keep the numbers of LT from rebounding. There are now several techniques under study that have potential to be useful in this effort, among them electro-shock treatment, suction dredging, tarping with or without treatments such as rotenone under the tarp, and the deployment of LT carcasses onto the spawning beds. Each has its advantages, disadvantages and short-comings. Electro-shocking has been shown to be effective on both ova and fry but has some limitations on penetration into the large cobble substrate and is difficult to deploy on deep water spawning beds. Some have been found as deep as 65 feet. It has been shown to

be lethal to eggs at up to 20 cm into the substrate but eggs are known to penetrate deeper than that. There are also limits due to the low conductivity of YL water. See graph 15 for a picture of the electro-shocking gear. Suction is focused on LT eggs and is also difficult to deploy at depth. See Graph 16. Rotenone is effective at killing both ova and fry but the exposure times are long which limits its effectiveness. The use of LT carcasses is the most recent technique being evaluated. It has shown potential to be effective as the decaying of the carcasses depletes the oxygen from the water and also introduces fungus into the spawning beds which is believed to be lethal to the eggs. During 2016, NPS crews evaluated the LT carcass technique at both Carrington Island and Flat Mountain Arm spawning beds. The results are encouraging but the robustness of this technique still needs to be determined.

Graph 15: Getting ready to deploy electro-shocking gear at Carrington Island

Graph 16: Suction dredge being deployed at Carrington Island to remove LT eggs.

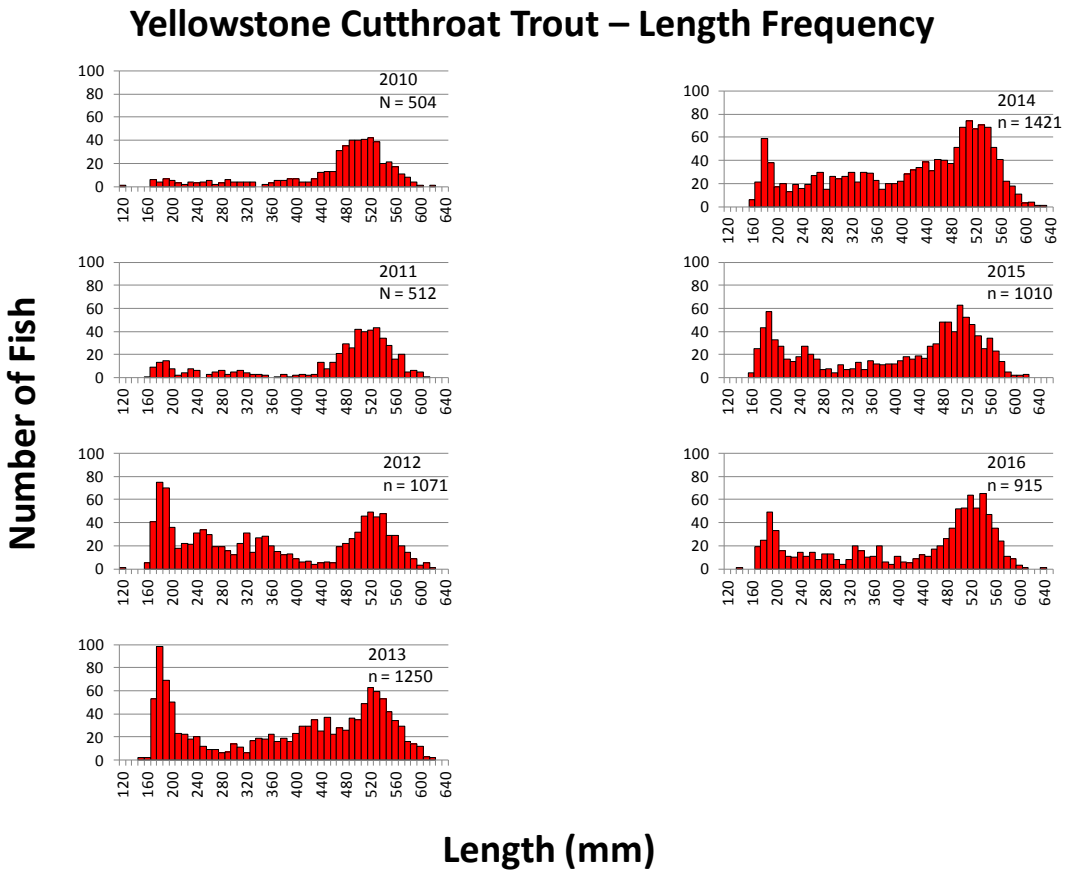
Graph 17: LT carcass treatment of spawning beds.

Development of the most effective technique(s) for killing LT ova and fry is an ongoing project that will extend into 2017 and beyond. It will become an important part of the TU effort.

Cutthroat Trout Recovery:

The ultimate goal of all of our efforts is not to just remove lake trout; it is to recover the cutthroat population. There are many direct indicators of how we are progressing towards this goal. The by-catch numbers discussed above is one of those indicators. But a better indicator is the YCT distribution netting. This scientific tool utilizes a specific set of nets placed at exactly the same locations around the Lake at the same time of year (early August) and soaked for the same length of time. Although the results are not a true population estimate of the cutthroats in the system; they are very important and meaningful if multi-year trends are compared. During the mid 2000's and into 2011, the population distribution by size of the cutthroats was very skewed to the very large cutthroats. There simply were very few young cutthroats left in the system. The most logical reason was that small cutthroats were being eaten by the lake trout either as they emerged from the spawning tributaries or shortly thereafter. This was particularly disturbing since there were also very few mid-sized (mid-aged) cutthroats in this system that provide the bulk of the spawning age class. Starting in 2012 and continuing through 2016, this trend is being broken. For five years now, we have seen both a higher number of

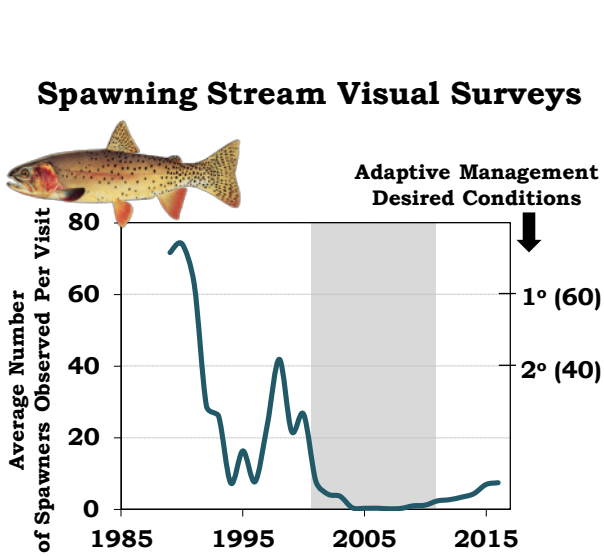
cutthroats in the distribution netting and more significantly, a stronger survival of young and mid-aged fish. The results are extremely encouraging. See Graph 18 for details.



Graph 18: YCT distribution netting results (number of fish versus size in mm) for 2010-2016.

An additional indicator of cutthroat population health is the number of cutthroats entering the tributaries in the spring to spawn. Of course, the most famous of these streams is Clear Creek. The spawning runs up this stream were epic, with tens of thousands counted every year. Those that follow this project regularly will remember that the numbers counted in 2006-2007 declined to less than 500 per year. After the weir blew out in 2008 from high water, this count was lost and still hasn't been recovered in spite of efforts to install an automated system called a Didson. The only other spawning stream monitoring that is still in place involves visual monitoring of about a dozen smaller spawning streams along the road system around the Lake. This has been going on for years by the grizzly

monitoring crews. The observed cutthroats declined precipitously during the early years of LT predation until essentially no cutthroats were observed. Over the past few years, a small but significant rebound has been observed. See Graph 19.



Graph 19: Visual survey results of 12 small streams for YCT spawning activity.

The presence of these spawning cutthroats in tributaries to Yellowstone Lake is having another positive impact. The ecosystem of the YL area was significantly impacted by the cutthroat decline; some 40 species used to depend on these fish for at least a portion of their diet. With the decline, the species had to rely on other food sources or suffer from population decreases. No species was impacted more than the grizzly. They used to rely on cutthroats for a major portion of their diet in the spring as the cutthroats ascended the tributaries to spawn and the grizzlies had a high protein feast. Over the past dozen or so years, no grizzlies had been observed feeding in these tributaries; until last spring. One bear, in particular, set up on Little Thumb Creek last June and spent many days there feeding on the recovering cutthroat numbers found. To see a video of this bear go to https://www.youtube.com/watch?v=jzxVkes0i_Q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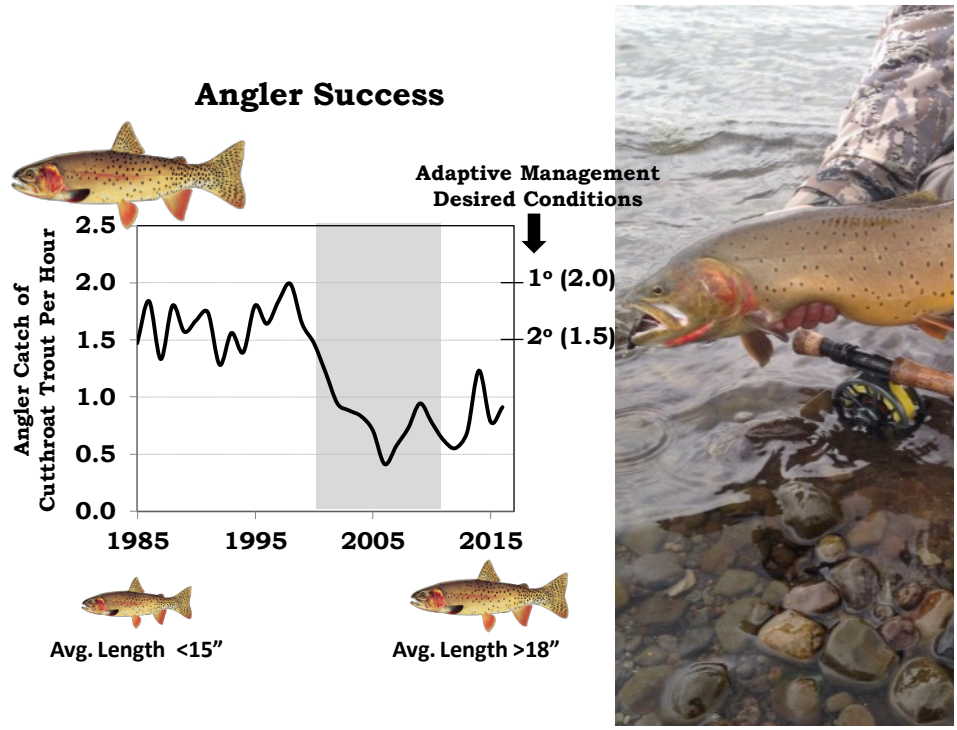
And finally, anglers are reporting more cutthroat in their catch than for many years. The best measure of this is the angler survey results. During the "glory years" of cutthroat fishing, anglers reported catch rates of 1.5-2 cutthroats per hour of angling. That number declined to around 0.5 in the mid 2000's. It has now rebounded somewhat and is approaching 1.0 again. See Graph 20.



Graph 20: Angler survey results for the past 30 years showing YCT catch rates per hour.

Last June, one of our Trout Unlimited staff members, Walt Gasson of Cheyenne, had the opportunity to pack into the Thoroughfare District of the Bridger Teton National Forest with Dave Hettinger Outfitting. Dave was considering offering fishing/pack trips into this remote area that is the headwaters of the upper Yellowstone River above the Lake. Reports had been circulating that the spring spawning runs of cutthroats into that system were once again robust and the fishing was outstanding. Longtime followers of this fishery will remember that 20 years ago there were a number of outfitters who booked clients for pack trips into this area for the incredible early summer fishing. Then, with the population crash, the trips stopped. Walt and Dave took a chance and made the 30 mile trip and the results surprised both of them. The fish were there, were large and the fishing was spectacular. Below is a picture of Walt with one of those tremendous fish. Another sign of a recovering population. The Spring 2017 issue of "Trout" magazine will report on his trip.

Fundraising:

The Yellowstone Park Foundation (now Yellowstone Forever) continues to be the principle funding source for the gill netting outside of the NPS fisheries budget. They have pledged $1 million per year for this effort.

Trout Unlimited, along with the other NGO's on the Working Group, are the principle funding sources for the telemetry study, spawning bed identification, ova/fry life history studies, and other studies related to alternative suppression. To date, these groups have raised almost $1.1 million. The biggest contributor has been the Wyoming Wildlife and Natural Resources Trust with a 4 year grant of $771,000 secured by Wyoming Trout Unlimited. This grant has to be matched by private funding so the NGO's are constantly looking for assistance and donations. The year 2017 will be the last year of this significant grant. Other funding sources are being explored. To help with these efforts, click on the following link:

I want to help Save the Yellowstone Cutthroats

Conclusions:

The Yellowstone cutthroat trout population in the Yellowstone Lake system is recovering. However, that population is still a long way from its historical levels. The lake trout problem is not over. It has been lowered, but it will never be wiped out. We must continue to drive down the adult and juvenile LTpopulations while working on reducing recruitment of this voracious predator by targeting the ova and fry. With everyone's constant vigil, we will "Save the Yellowstone Cutthroats" of this system.