

COLORADO RIVER RECOVERY PROGRAM
FY 2017 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 123b, 123d, 126a

I. Project Title: **Evaluation of walleye removal in the upper Colorado River Basin**

II. Bureau of Reclamation Agreement Number(s):

USFWS Grand Junction: R15PG400083

USFWS Vernal: R13PG40020

UDWR Moab: R14AP00007

UDWR Vernal: R14AP00007

Project/Grant Period:

Start date (Mo/Day/Yr): 05/01/2014

End date: (Mo/Day/Yr): 09/30/2018

Reporting period end date: 10/31/2017

Is this the final report? Yes _____ No X

III. Principal Investigator(s):

Chris Michaud

Utah Division of Wildlife Resources

1165 S Hwy 191, Suite 4, Moab, UT 84532

Phone: 435-259-3784; E-mail: cmichaud@utah.gov

Travis Francis

U.S. Fish and Wildlife Service

Grand Junction FWCO

445 West Gunnison Ave., Suite 140

Grand Junction, Colorado 81501

Phone: 970-628-7204 E-mail: travis_francis@fws.gov

Richard R. Staffeldt and Mike Fiorelli

Utah Division of Wildlife Resources Northeast Region

318 North Vernal Ave. Vernal, Utah 84078

Phone: 435-781-9453; E-mail: rschelly@utah.gov, mfiorelli@utah.gov

M. Tildon Jones

U.S. Fish and Wildlife Service

1380 S 2350 W, Vernal, UT 84078

Phone: 435-789-0351; E-mail: tildon_jones@fws.gov

E. Kluender

Larval Fish Laboratory

Dept. of Fish, Wildlife, and Conservation Biology

Colorado State University

Ft Collins, Colorado 80523

Phone: 970-491-1848; E-mail: kluender@rams.colostate.edu

IV. Abstract:

Field crews removed a total of 229 walleye (*Sander vitreus*) throughout the Green River sub-basin during various field efforts in 2017. Overall, both numbers of walleye encountered and catch-rates fell in 2017. The middle Green River accounts for the majority of this change. Removals occurred under projects specifically targeting walleye as well as projects targeting other species where walleye were collected as ancillary captures. Electrofishing accounted for 221 captures and fyke netting for six captures; two walleye were encountered while draining a wetland. Targeted walleye removal passes produced higher catch rates than did other sampling efforts within reaches. Green River sub-basin-wide walleye catch rates were considerably higher during the spring than they were through the summer and early fall. The data illustrate that we are able to increase the efficacy with which we remove this predatory nonnative fish from the Green River by timing our effort properly and focusing that effort on reaches containing high value walleye habitat. However, it is also important to continue to remove this nonnative predator when encountered during other sampling efforts as well.

In 2017, field crews removed a total of 116 adult walleye throughout the upper Colorado River sub-basin, primarily under targeted walleye removal efforts. Targeted efforts to remove walleye were split fairly evenly between spring and fall and concentrated on the reach between Bighorn Camp (lower Westwater Canyon; RM 114.0) to Potash, UT (RM 47.2). Our fall catch rates declined from 1.04 fish/hr in 2015 to 0.45 fish/hr in 2016, and increased to 0.80 fish/hr in 2017. Large monsoonal events and corresponding spikes in the hydrograph experienced in the fall of 2016 were lower than those in 2014, 2015 and 2017. Anecdotal evidence suggests these spikes may increase walleye catchability in the fall.

V. Study Schedule: 2014-ongoing.

VI. Relationship to RIPRAP:

GENERAL RECOVERY PROGRAM SUPPORT ACTION PLAN

III. Reduce negative impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A. Reduce negative interactions between nonnative and endangered fishes.

III.A.2. Identify and implement viable active control measures.

GREEN RIVER ACTION PLAN: MAINSTEM

III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

III.A. Reduce negative impacts to endangered fishes from sportfish management activities.

III.A.4. Develop and implement control programs for nonnative fishes in river reaches occupied by the endangered fishes to identify required levels of control. Each control activity will be evaluated for effectiveness, and then continued as needed.

COLORADO RIVER ACTION PLAN: MAINSTEM

III. Reduce impacts of nonnative fishes and sportfish management activities (nonnative and sportfish management).

- III.A. Reduce negative interactions between nonnative and endangered fishes.
- III.A.2. Develop basinwide aquatic management plan to reduce nonnative fish impacts while providing sportfishing opportunities.

VII. Accomplishment of FY 2017 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Initial findings and preliminary results for 2017 are provided in the attached report, but are subject to change as data are further analyzed.

VIII. Additional noteworthy observations: See attached report

IX. Recommendations:

Basin Wide

- The contribution of Lake Powell to the fluvial walleye populations in the upper basin should be investigated.
- Complete USGS otolith microchemistry analyses to determine the origin of walleye collected in the Colorado River and supply report to the Recovery Program. Consider management actions at specific locations based on the results of the study. Evaluate other potential habitable locations these fish may have occupied beyond their origination.

Upper Colorado River Sub-basin

- Continue targeted walleye removal as a component of Projects 126a and 123d.
- Increased effort to maximize exploitation may warrant further consideration.

Green River Sub-basin

- Continue walleye removal as a component of existing projects, especially Project 128: Abundance estimates for Colorado pikeminnow in the Green River.
- Continue targeted walleye removal as a component of Projects 123b and 123d.

Lower Green River

- Additional effort should be applied between Tusher Diversion and Green River State Park (RM 128-120) as this segment has the highest catch rates for walleye in the reach. Removal should be conducted in early spring (as early as flows allow) through mid-May and again in October as flows allow.

Desolation and Gray Canyons

- Although catch rates do not currently warrant targeted removal in this reach, continued removal of walleye under existing projects, especially 128 and 123a, is justified.

Middle Green River

- We recommend continuing walleye-specific removal efforts between the White River confluence and Sand Wash during spring sampling, with more extensive efforts in Project #128 off years. Specifically, in years we conduct Project #128, our spring walleye targeting will only focus on the reach mentioned above and the Split Mountain spawning riffles in Dinosaur National Monument.

Upper Green, Yampa and White Rivers

- Targeted walleye removal efforts are not warranted at this time. Continue the removal of walleye as ancillary captures through ongoing sampling efforts.

Duchesne River

- We recommend conducting walleye-specific removal efforts in the lower Duchesne River during spring peak flows, which is the only time that passage by electrofishing boats/rafts is possible in this system. The Ute Indian Tribe expressed interest in conducting a nonnative removal project in the Duchesne River in the future, otherwise UDWR can only sample this reach on an opportunistic basis; as state funds and tribal access allow.

X. Project Status: on track and ongoing

XI. FY 2017 Budget Status

See annual reports for Projects 123a,123b and 126a for budget descriptions.

XII. Status of Data Submission: Data are compiled and will be submitted to the database manager by January 2018.

XIII. Signed: Christopher Michaud 11/14/2017
Principal Investigator Date

APPENDIX:

A. Preliminary results of walleye removal in the upper Colorado River Basin.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AP00007

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 123d

Project Title: Walleye control in the lower Green and Colorado Rivers

Principal Investigator:

Chris Michaud

Utah Division of Wildlife Resources

1165 S Hwy 191, Suite 4, Moab, UT 84532

Phone: 435-259-3784; E-mail: cmichaud@utah.gov

Project/Grant Period:

Start date (Mo/Day/Yr): 05/01/2014

End date: (Mo/Day/Yr): 09/30/2018

Reporting period end date: 9/30/2017

Is this the final report? Yes _____ No X

Performance:

Walleye removal on the Green River

Twenty-five hours of electrofishing effort, targeting walleye on the lower Green River, was completed between 8 March and 13 October, 2017. All effort was focused on high value walleye habitat between Tusher diversion and Green River State Park (RM128-120). A total of 32 walleye were removed from the Green River (CPUE=1.28) in 2017.

Walleye removal on the Colorado River

Utah Division of Wildlife Resources crews completed seven hours of targeted walleye sampling on the Colorado River between Big Hole and Cisco boat ramp (RM 115.8-110.5) in 2017. Targeted walleye removal began on 4 October and concluded on 12 October, 2017. Nineteen walleye were encountered over the sampling period (CPUE=2.7). Other notable encounters include 35 smallmouth bass (CPUE=4.96) and 37 gizzard shad (CPUE=5.25).

All 2017 work was completed under Tasks 4, 5 and 6 of the FY17 123a Scope of Work. Future work will be completed under the 123d Scope of Work.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: #R14AP00007

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 123b

Project Title: Nonnative fish control in the middle Green River

Principal Investigator:

Richard R. Staffeldt, Robert C. Schelly, and Matthew J. Breen
Utah Division of Wildlife Resources
Northeast Regional Office
318 North Vernal Ave.
Vernal, Utah 84078
Phone: 435-781-9453; Fax: 435-789-8343
E-mail: mattbreen@utah.gov

Project/Grant Period: Start date (Mo/Day/Yr): 5/1/2014
 End date: (Mo/Day/Yr): 9/30/2018
 Reporting period end date (Mo/Day/Yr): 9/30/2017
 Is this the final report? Yes _____ No X

Performance:

All walleye removal effort for the middle Green River described in this report occurred under the Upper Colorado River Recovery Program's Project #123b, which also includes mechanical removal efforts for other species not mentioned here (northern pike, white sucker, and smallmouth bass). All work was completed under Tasks 1 & 3 of the Project#123b scope of work.

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R15PG00083

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 126a

Project Title: Removal of Non-native Fish in the Upper Colorado River between Grand Valley Water User's Dam [Government Highline Diversion Dam] near Palisade, Colorado, and Potash, Utah.

Principal Investigator: Travis Francis, Fish Biologist
Dale Ryden, Project Leader
U.S. Fish and Wildlife Service
Grand Junction FWCO
445 West Gunnison Ave., Suite
140 Grand Junction, Colorado
81501 Phone: (970) 628-7204
Fax (970) 628-7217
Email: travis_francis@fws.gov
dale_ryden@fws.gov

Project/Grant Period: Start date (Mo/Day/Yr): 10/1/2014
End date: (Mo/Day/Yr): 9/30/2019
Reporting period end date (Mo/Day/Yr): 9/30/2017
Is this the final report? Yes _____ No X

Performance:

GJ FWCO was tasked with completing 4 full passes of targeted walleye removal from Cisco to Potash, UT. During the spring (2017), two full passes were completed; and during the fall (2017) two full passes were completed between Lower Westwater Canyon and Takeout Beach. An additional 9 days of effort (two e-fish boats per day) was applied to the reach from Bighorn Camp to Fish Ford. A total of 97 walleye were removed. For additional details pertaining to other non-native fishes removed please see annual report for project 126a.

Appendix A:

Preliminary results of the removal of walleye from the upper Colorado River Basin, 2017.

Michaud C. & B. Shelley (UDWR), T. Francis & T Jones, (USFWS), & E. Kluender (CSU).

Background

The introduction, establishment, and proliferation of nonnative fishes is considered the primary threat to the recovery of four Colorado River large bodied endangered fishes: Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*). Warm water game fish, primarily stocked in reservoirs for recreational purposes and then establishing in downstream river reaches, are thought to have the greatest adverse effect on endangered native fishes. Of those species, large bodied predators are considered the most problematic, specifically smallmouth bass, northern pike, and walleye.

Walleye (*Sander vitreus*) are a large bodied, highly piscivorous fish native to the Mississippi and several coastal northeastern drainages (Etnier and Starnes 1993). This species is often potadromous, residing mainly in lakes and reservoirs and making seasonal spawning migrations into rivers during early spring. Spawning occurs just post ice-off when temperatures reach 6–11°C over gravel or cobble substrates (Paragamian, 1989; McMahan and Terrell 1984). Adult walleye pose a particularly high threat to native species recovery in the upper Colorado and Green River sub-basins because of their overlapping niche (with Colorado pikeminnow) and their high predatory threat (with all native fishes). This was demonstrated by the discovery of three juvenile Colorado pikeminnow (2014 (n=2), 2015 (n=1)) and seven bonytail (2014 (n=1); 2015 (n=3), 2016 (n=3)) in the stomachs of walleye (Francis et al. 2015). In fact, abundance estimates for Colorado pikeminnow have declined in the upper Colorado River basin since walleye numbers have increased in both sub-basins.

There is scant evidence of the initial introduction of walleye into the Upper Colorado River Basin. In their 1966 publication: Glen Canyon Reservoir Post Impoundment Investigation, Roderick Stone and Kent Miller reference a stocking report noting the introduction of walleye into Strawberry reservoir in the 1950s. This impoundment, located on the Strawberry River, a tributary of the Green River, was a likely early source population of walleye in the upper Colorado River basin. By 1962, walleye were encountered on the Green River within Dinosaur National Monument (Azevedo 1962) and on the Colorado River in the nascent waters of Lake Powell (Stone and Miller, 1966). Between both state sanctioned and illegal introductions, walleye populations had been established in ten reservoirs in the upper Colorado River basin by 1990. Then, in 1998, gizzard shad (*Dorosoma cepedianum*) were accidentally stocked into Morgan Lake in the San Juan River basin. Gizzard shad are a preferred prey species for walleye and are known to support robust walleye populations; as such, gizzard shad are used by fishery managers to bolster walleye condition and populations where they are desired. Gizzard shad escaped Morgan Lake and colonized Lake Powell by 2000. Annual gill net surveys, provided by George Blommer (UDWR; Figure 1), in Lake Powell provide evidence that the walleye population in Lake Powell responded as expected and has grown substantially over the past 15 years. By the mid 2000s gizzard shad populations had expanded upstream, invading both the Green and Colorado Rivers (Figure 2). Between 1962 and 2006 walleye were encountered in the Colorado River and its tributaries; however, numbers remained relatively low. Researchers noted a dramatic increase in walleye encounters, first on the Green River in 2007 then on the Colorado River in 2010 (Figure 3). Therefore, a dominant hypothesis is that the introduction and

expansion of gizzard shad in the upper Colorado and Green River sub-basins has led to increased walleye numbers in endangered fish habitats.

Research efforts have shown that walleye reach various portions of endangered fish habitat through escapement from multiple reservoirs in the upper Colorado and Green River sub-basins. Researchers used chemical fingerprinting (strontium isotopes laser ablated from otoliths), to identify three reservoir sources of walleye (Red Fleet and Starvation in the Green River sub-basin and Rifle Gap in the upper Colorado River sub-basin) as well as in river reproduction (Green River) from samples collected through 2008 (Johnson et al, 2014). In response to this escapement, both the states of Utah and Colorado have been proactive in containing these sources through various means. Colorado Parks and Wildlife installed a downstream screen on Rifle Gap Reservoir and is managing against the fertile walleye population. Utah Division of Wildlife Resources (UDWR) chemically treated Red Fleet Reservoir and replaced fertile walleye with a sterile population. UDWR also installed a downstream screen on Starvation Reservoir and is investigating if sterile stocking can replace the existing fertile population.

Ongoing Research

Unfortunately, all of the tissues analyzed by Johnson et al. (2014) were collected before large numbers of walleye were discovered in the lower Green and Colorado Rivers. Therefore questions remained as to the source of the increased abundance of riverine walleye, especially in light of the increasing walleye population in Lake Powell. In 2015, U.S. Fish and Wildlife Service funded the U.S. Geological Survey to analyze more recent otoliths collected from these reaches and both McPhee Reservoir and Lake Powell which could be potential source populations. The results of this study should be available in early 2018, at which time more management options can be considered. Based on the findings of the study, we expect that stakeholders may consider the following management options:

1. If walleye are coming from McPhee Reservoir, management decisions for the reservoir will be informed to disadvantage escapement (such as screens, in reservoir removal, etc.). If walleye are shown to definitively not be coming from McPhee Reservoir, managers could focus efforts on other locations.
2. If walleye are coming from Green River sources, in concert with the new escapement prevention systems at Starvation and Red Fleet Reservoirs, managers could apply an increase in electrofishing removal effort that may drive the river population of walleye down.
3. If the walleye are coming from Lake Powell, managers will be more informed and will need to find solutions to manage this species in a large reservoir. For example, managers may need to better understand the life history of this species and focus removal effort on out-migrating individuals during reservoir population expansions.

In-river Mechanical Removal Efforts

Green River Sub-basin

Walleye encounters on the Green River began increasing in 2007 and, although they have leveled off in recent years, encounters remain at relatively high levels. Both the middle and lower Green River have consistently yielded higher catch rates and a greater number of encounters than other reaches within the sub-basin. Both reaches are also considered especially

important habitats for Colorado pikeminnow recovery as they serve as nursery habitat for younger age classes. Survival of young age classes is important to preserve recruitment into the adult population. Beginning in 2014, the Upper Colorado River Endangered Fish Recovery Program added a targeted walleye removal element to Projects 123a and 123b within the lower and middle Green River. In 2017, targeted walleye removal under project 123a was assigned a separate scope of work. This effort is now directed under project 123d. These targeted walleye efforts have thus far been successful in that they consistently yield higher catch rates than do other projects operating within these reaches. Also, they provide an early spring removal effort in years in which Colorado pikeminnow abundance estimate sampling does not take place and additional effort in sub-reaches containing high value walleye habitat.

Colorado River Sub-basin

After a two year hiatus from sampling the lower 112 miles of the upper Colorado River sub-basin, our 2013 catch of walleye significantly increased during our springtime Colorado pikeminnow sampling from 46 individuals in 2010 to 268 in 2013 (Figure 3). In response, walleye specific removal began during the summer and fall. Experimental removal in 2013 provided evidence that summer efforts provided minimal success as walleye were most likely occupying a thermal niche that placed them deeper than our gear could effectively reach. It was also documented that our best success during the fall occurred in the reach from Cottonwood Wash (RM 112.3) to Potash (RM 47.2). Beginning in 2014, in years when Colorado pikeminnow abundance estimate work is occurring during the spring, all targeted walleye removal work will occur in the fall. During years when Colorado pikeminnow estimate work is not occurring, targeted walleye removal work will be split between the spring and fall. The first of a two year break from Colorado pikeminnow sampling began in 2016. Targeted walleye removal was split between the two seasons in 2017 (spring work began 26th April and concluded 25th May; fall work began 30th August and concluded 24th October). Additional sampling occurred in lower Westwater Canyon (Bighorn Camp to Cisco) based off of last year's findings of many non-native piscivores in this reach (these additional passes began 25th July and continued through the end of October).

Study Area

For the purpose of this study the Green River Sub-basin has been broken down into seven reaches (Table 1). Reaches are designated based on geologic or habitat transitions or commonly used access points and do not necessarily reflect the starting and stopping points of individual projects. Consequently, figures contained in this report may differ from those published in individual annual reports. Targeted walleye removal occurred in three relatively small sub-reaches within the main-stem Green River – a twenty-mile reach near Jensen, Utah, a forty-mile reach near Ouray, Utah and a thirty-mile reach near Green River, Utah (Table 2).

Walleye are targeted in the upper Colorado River from lower Westwater Canyon to the confluence with the Green River, although effort has been broken down into four reaches where walleye are currently encountered. The four reaches are: 1. lower Westwater Canyon (RM 116) to Dewey Bridge (RM 94.6), 2. Dewey Bridge to Takeout Beach (RM 74.2; Professor Valley), 3. Takeout Beach to Potash (RM 47.2), and 4. Potash to the confluence of the Green River (RM 0.0).

Methods

Data from all reaches was collected using electrofishing gear mounted on a variety of watercraft with the exception of a small fyke netting effort on the middle Green River and trammel netting during Colorado pikeminnow and humpback chub sampling in the Colorado River. Aluminum jonboats, rafts and catarafts were all employed on different river reaches. Data from three types of projects are summarized in this report: targeted walleye removal projects (123d, 123b and 126a), projects targeting smallmouth bass and northern pike (123a, 123b, 126a, 125, 98c, 110 and 167) and endangered fish monitoring projects (127, 128 and 130). Detailed methodologies may be found in the annual reports for each project.

Results and Discussion

Green River Sub-basin

In 2017, walleye were encountered in all sampled reaches of the Green River sub-basin except the middle Yampa River and the White River (Figure 7). A total of 229 walleye were removed from the system, 221 with electrofishing gear, six in fyke nets and two fish encountered while draining a wetland pond. A total of 1,678.8 hours of electrofishing effort was completed in 2017 producing basin wide catch rates of 0.13 walleye per hour, down slightly from 2016 (0.18 walleye per hour). Sampling in this sub-basin began in early March and continued through mid-October. Walleye catch rates were higher in spring and fall than in summer (Figure 4) a trend consistent over the past several years. Further, CPUE was notably higher within several discrete sections of the Green River sub-basin. In 2014, researchers identified these small sub-reaches (RM 319.3-295.8 and RM 128-97) as important spawning habitat for this invasive species. These sub-reaches continue to produce high catch rates and yield numbers of walleye in spawning condition (Figures 5 and 9).

Targeted walleye removal passes on the lower Green River and Utah three species monitoring on the lower Duchesne River, produced the highest catch rates in the sub-basin during 2017 (Figure 6). The success of targeted efforts at effectively removing walleye stems from a number of factors. First, sampling is concentrated within sub-reaches that have yielded high catch rates for walleye in the past. Second, researchers maintain the flexibility to modify timing and location of sampling as well as sampling methods with the goal of maximizing walleye captures. Third, our effort is focused in early spring, a time when catch-rates are consistently higher in the Green River sub-basin. Consistent with data from 2016, Colorado pikeminnow abundance estimate passes (Project 128) achieved better than average CPUE. The effectiveness of abundance estimate sampling at removing walleye is likely due to two factors. First, Project 128 runs from April through June, a time we achieve the highest catch rates for walleye across all projects. Second, walleye and the target species, Colorado pikeminnow, display considerable niche overlap and consequently occupy similar habitats during sampling.

Overall, both numbers of walleye encountered and catch-rates fell in 2017. The middle Green River accounts for the majority of this change.

Lower Green River

Researchers with the Utah Division of Wildlife Resources Moab Field Station (UDWR-Moab) completed 298 hours of electrofishing effort on the lower Green River in 2017 (Table 3). Crews removed 101 walleye through both targeted efforts and ancillary captures during Colorado pikeminnow abundance estimate passes (Figure 7). Overall catch on the lower Green River

increased from 86 walleye in 2016 and CPUE increased slightly, from 0.24 fish/hour to 0.34 fish/hour.

Targeted walleye removal on the lower Green River (Project 123d), began on 8 March 2017 and concluded on 13 October 2017. Removal was focused between Tusher Diversion and Green River State Park (RM 128-120). Thirty-two walleye were removed over 25 hours of electrofishing effort; catch-per-unit-effort was 1.28 walleye/hour a marked increase over 2016 (eight walleye and 0.52 walleye/hour).

All additional sampling in this reach occurred under Project 128 (Colorado pikeminnow abundance estimates). Sampling for Project 128 began on 18 April and concluded on 30 May 2017. Three passes were completed during this time interval; 69 walleye were removed from the lower Green River (RM 120-0) during 273 hours of electrofishing yielding a catch rate of 0.25 walleye/hour (Figure 5). Catch rates were higher (0.86 walleye/hour) in the upper 23 miles of this reach than the lower 97 miles (0.14 walleye/hour). This data lends support to the current practice of restricting targeted walleye removal effort to the uppermost 31 miles of the lower Green River.

Desolation and Gray Canyons

Researchers with U.S. Fish and Wildlife Service Vernal Office (USFWS- Vernal) and UDWR-Moab began sampling in Desolation and Gray Canyons (RM 206.5-128) on 20 April and finished on 2 July 2017 under Projects 128 and 123a. Crews completed 184.7 hours of electrofishing effort, harvesting nine walleye and yielding a CPUE of 0.05 walleye/hour (Table 4, Figure 7). Both harvest and catch rates in Desolation and Gray Canyons were down from 2015 and 2016.

Middle Green River

Utah Division of Wildlife Resources Northeast Region (UDWR-Vernal) and USFWS-Vernal crews completed 709.8 hours of electrofishing effort in the middle Green River in 2017. Researchers removed 68 walleye from this reach between 13 March and 28 September 2017 yielding a catch rate of 0.10 walleye/hour (Table 5, Figure 7). Additionally, six walleye were captured in fyke nets in the Ashley Creek/Stewart drain area (RM 304.8-299.1) and two walleye were trapped while draining the Johnson Bottom wetland.

Crews completed 100.7 hours of targeted effort under project 123b, in the middle Green River between 13 March and 27 June 2017. Twenty-two walleye were removed, yielding a CPUE of 0.22 fish/hr. All targeted effort was applied between Split Mountain boat ramp and Spring Hollow (RM 319.3-295.8) and between Wyasket Bottom and Sand Wash boat ramps (RM 255.8-215.8). These sub-reaches have produced substantial walleye captures in the past and are therefore the focus of targeted walleye efforts under Project 123b. An additional 10 walleye were encountered in the middle Green River during 363.6 hours of targeted smallmouth bass removal under Project 123b (Table 5).

Pikeminnow abundance estimate sampling (Project 128) began on 18 April and concluded on 21 May 2017 in the middle Green River. Thirty-six walleye were removed over 245.5 hours of sampling yielding a catch-rate of 0.15 walleye/hour (Figure 6).

Upper Green River

Sampling in the upper Green River began on 18 April and concluded on 14 August 2017. Catch rates for walleye in the upper Green River were the lowest recorded on the Green River in 2017 (0.01 walleye per hour). Researchers with USFWS-Vernal, UDWR-Moab and Vernal and Colorado State University (CSU) removed a total of 4 walleye over 358.2 hours of effort (Table 6, Figure 7).

Yampa River

Sampling in lower Yampa Canyon began on 6 June and concluded on 29 June 2017 under project 110. Researchers encountered only one walleye on the Yampa River in 2017 (Figure 7). Electrofishing effort (Project 110) within the lower Yampa Canyon totaled 97.6 hours, yielding a CPUE of 0.01 walleye per hour (Table 7). Additional effort was completed in middle and upper Yampa River (Projects 125, 98c), however no walleye were encountered and this effort was excluded from CPUE calculations for the Green River Basin.

White River

Crews from USFWS-Vernal, UDWR-Vernal and CPW encountered no walleye on the White River in 2017. Effort from the White river was excluded from CPUE calculations for the Green River Basin.

Duchesne River

UDWR-Vernal and the Ute Indian Tribe cooperated on a monitoring project focusing on three sensitive native species: flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*) and roundtail chub (*Gila robusta*). Researchers conducted multiple electrofishing passes between the confluence of the Green River and a location 15 miles upstream. This reach has not been sampled regularly in the past. Crews completed 30.5 hours of electrofishing, removing 38 walleye and yielding CPUE of 1.25 fish/hour¹. This is the second highest catch rate for any section within the Green River sub-basin (Table 8).

Size Structure

Mean total length for walleye removed in 2017 was 493 mm, lengths ranged from 208 mm to 701 mm (Figure 8). Six walleye with lengths less than 300 mm were encountered in 2017, five in the middle Green River and one in the Duchesne River. This is an increase from one walleye in 2016. Overall, this size structure supports the assumption that the lotic walleye population is not able to consistently recruit at this time and is therefore supported by escapement from reservoir populations. However, increasing numbers of age three and four fish are concerning, and may be indicative of some, albeit low, in-river recruitment. No obvious differences in size structure were noted between reaches.

Spawning Observations

Fifty-five walleye in spawning condition were encountered in the Green River between 3 April and 21 May 2017 and an additional 12 ripe walleye were collected in the Duchesne River between 1 June and 19 June 2017 (Figure 9). Overall, 28% of walleye encountered in 2017 were in spawning condition. The majority of these fish were male (91%). Aggregations of ripe fish were noted in the uppermost reach of the middle Green River as well as several locations downstream including an eight-mile section below Tusher diversion where 22 walleye were encountered in spawning condition. Successful walleye reproduction has been documented in

¹ Data courtesy of Kelly Cambridge, Fisheries Biologist with the Ute Indian Tribe.

the Green River. In 2014, two larval walleye were identified within light trap samples taken from the lower Green River (Howard, 2014). Researchers have encountered few walleye under 300 mm in the past several years. During field work in 2017 crews collected six walleye below 300 mm total length. Otoliths from these individuals were collected for future isotopic analysis to determine natal origin. Still, it appears as though walleye are not able to successfully recruit within the Green River and most of the individuals we encounter are emigrating from reservoir populations elsewhere in the basin.

Upper Colorado River Sub-basin:

In 2016 and 2017, two offices cooperated to conduct targeted walleye removal in the upper Colorado River. Because no Colorado pikeminnow population estimates (project 127) were ongoing during these years, efforts were roughly half of the total electrofishing effort expended in 2015 when Colorado pikeminnow sampling was conducted (Figure 10). The Grand Junction Fish and Wildlife Conservation Office (GJ FWCO) conducted two full walleye removal passes in the spring in all three reaches (Cottonwood Wash to Dewey Bridge {RM112.3 to RM94.6}, Dewey Bridge to Takeout Beach {RM94.6 to RM74.2}, Takeout Beach to Potash {RM74.2 to RM47.2}) for a total of 103.7 hours of electrofishing effort. During the summer and fall, GJ FWCO completed two full walleye removal passes in the upper two reaches and nine additional mini passes from Bighorn Camp (RM114) to a variety of ending points upstream of Fishford (RM105.8) for a total of 148.5 hours of electrofishing effort. Beginning in 2015, UDWR Moab provided additional removal effort in the Upper Colorado River sub-basin. Their efforts are targeted to specific walleye areas, and are thus shorter in duration and length than GJ FWCO. In 2017, UDWR Moab contributed 8 hours of electrofishing effort.

In 2017, 116 adult walleye were removed with a mean total length of 455 mm and lengths ranging from 324-653 mm (Figure 11). Our 2017 walleye spring catch rate was lower (0.15 fish/hr) than our summer/fall catch rate (0.64 fish/hr) and was similar to both our 2014 walleye fall and spring catch (spring 0.44 fish/hr, fall 0.73 fish/hr). These were an increase when compared to our 2015 and 2016 walleye fall catch (0.34 and 0.15 fish/hr) and spring catch (0.29 and 0.32 fish/hr). Walleye catch rates varied amongst reaches when comparing the spring and fall (Table 9, Figure 12). Anecdotal evidence suggests that higher magnitude flows from monsoonal inputs may increase walleye captures, as they may take refuge closer to shore where electrofishing is more effective. The 2016 fall hydrograph didn't receive the large monsoonal pulses experienced in fall 2014, 2015 and 2017; thus, likely reducing the catch rate in 2016 (Figure 13).

Extra effort was expended in the Lower Westwater Canyon to Coates Creek reach (at various lengths {3-10 mile} within the reach) in response to UDWR-Moab's finding of a large number of non-native piscivorous fish in Lower Westwater Canyon in 2016. This same additional effort was not expended in any of the other reaches occupied with walleye, so comparing catch rate indices between reaches is not warranted. This effort produced a high catch rate of 0.85 walleye per hour (n=68 walleye). Most of these walleye were collected within four to five miles of the Westwater Canyon humpback chub population which is of particular concern and warrants the same additional effort in the future.

Most walleye collected since 2014 have been dissected to determine gonadal development, sex and diet of the fish occupying the Upper Colorado River. All walleye have been scanned with a PIT tag reader to determine predation of endangered fishes. All of these results can be found in

Table 9. New for 2016, while UDWR Moab and Grand Junction FWCO were doing their annual razorback sucker monitoring in the Colorado River arm of Lake Powell fifty walleye were PIT tagged. Expectations were to tag many more fish; however, the site closest to the river/lake mixing zone became covered in high water debris and made it impractical to sample with trammel nets early during the season. This work was completed in hopes to determine if fish in the lower sections of the Upper Colorado and Green Rivers were originating in Lake Powell. Fortunately, UDWR out of Wahweap continued tagging more Colorado arm of Lake Powell walleye in 2017.

Cataract Canyon:

Utah Division of Wildlife Resources removed seven walleye from the Colorado River within Cataract Canyon in 2017. These were ancillary captures while engaged in Project 130: Humpback chub monitoring in Cataract Canyon. Six walleye were captured in trammel nets and one while electrofishing. All captures were between river mile -4.5 and -10.

References

- Azevedo R.L. 1962. Fishery management report: Dinosaur National Monument - Green River fish collections. U.S. Fish Wildl. Serv.
- Etnier, David A. and Wayne C. Starnes. The Fishes of Tennessee. Knoxville, TN: University of Tennessee Press, 1993.
- Francis, T., Ryden, D. 2015. Removal of Smallmouth Bass in the Upper Colorado River between Price-Stubb dam near Palisade, Colorado, and Westwater, Utah. Annual report of U.S. Fish and Wildlife Service, Grand Junction FWCO to Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Howard J. 2014. Assessment of stocked Razorback Sucker reproduction in the lower Green and lower Colorado rivers. Annual report of Utah Division of Wildlife Resources to Upper Colorado River Endangered Fish Recovery Program. Denver, CO.
- Johnson, B.M., B. Wolf, and P.J. Martinez. 2014. Chemically Fingerprinting Nonnative Fish in Reservoirs. Final Report of Project C18/19 to the Upper Colorado River Endangered Fish Recovery Program.
- McMahon, T.E., J.W. Terrell and P.C. Nelson. 1984. Habitat suitability information: Walleye. U.S. Fish Wildl. Serv. FWS/OBS-8210.56. 43 pp.
- Paragamian, V. L. 1989. Seasonal habitat use by walleye in a warmwater river system as determined by radio telemetry. North American Journal of Fisheries Management. 9:392-401
- Stone, R , Miller K. 1966. Glen Canyon Reservoir Post Impoundment Investigation. Utah State Division of Fish and Game. Progress Report No. 4

Table 1: Location of study reaches in the Upper Colorado River Basin.

River	Reach	Projects	Agency	River miles	Length (miles)
Green River	Upper Green	123a, FR-115, 128	CSU, UDWR, USFWS	380 - 319.3	60.7
	Middle Green	123b, 128	UDWR, USFWS	319.3 - 206.5	112.8
	Desolation	123a, 128	UDWR, USFWS	206.5 - 128	78.5
	Lower Green	123a, 128	UDWR	128 - 0	128
Yampa River	Middle Yampa	125, 98c	CPW, CSU, USFWS	189.2 - 46	143.2
	Lower Yampa	110	USFWS	46 - 0	46
Duchesne River	Lower Duchesne	Utah 3-Species	UDWR	15 - 0	15
White River	White River	167, 128	CPW, UDWR, USFWS	104 - 0	104
Colorado River	Lower Colorado	127,126a	UDWR, USFWS	116 - 0	116
	Cataract Canyon	130	UDWR	-4.5 - -10	5.5

Table 2: Locations of targeted walleye removal projects.

Project	River	Reach	River miles	Length (miles)
123b	Green River	Middle Green	319.3 – 295.8	23.5
		Middle Green	255.8 - 215.8	40
123d	Green River	Lower Green	128 - 97	31
126a	Colorado River	Lower Colorado	116 - 47.2	68.8

Table 3. Walleye captures on the Lower Green River (RM 128-0) under Project 128 are ancillary captures, while captures under 123d are targeted captures.

Lower Green River	Effort (h)	Number of walleye	CPUE (fish/hour)
128	273	69	0.25
123d	25	32	1.28
Total	298	101	0.34

Table 4. Walleye captures on the Green River within Desolation and Gray Canyons (RM 206.5-128). All captures are ancillary captures under existing projects.

Desolation and Gray	Effort (h)	Number of walleye	CPUE (fish/hour)
128	136.2	8	0.06
123a	48.4	1	0.02
Total	184.6	9	0.05

Table 5. Walleye captures on the middle Green River (RM 319.3-206.5). Captures under Projects 128 and 123b are ancillary captures. Captures under 123b(t) are targeted removal efforts.

Middle Green River	Effort (h)	Number of walleye	CPUE (fish/hour)
128	245.5	36	0.15
123b	363.6	10	0.03
123b(t)	100.7	22	0.22
Total	709.8	68	0.10

Table 6. Walleye captures on the upper Green River (RM 380-319.3). All captures are ancillary captures under existing projects.

Upper Green River	Effort (h)	Number of walleye	CPUE (fish/hour)
128	18.5	0	0
123a	265.4	3	0.01
123b	10.4	0	0
FR-115	63.9	1	0.02
Total	358.2	4	0.01

Table 7. Walleye captures on the lower Yampa River (RM 46-0). All captures are ancillary captures under existing projects.

Lower Yampa River	Effort (h)	Number of walleye	CPUE (fish/hour)
110	97.6	1	0.01

Table 8. Walleye captures on the Duchesne River (RM 15-0). All captures are ancillary.

Duchesne River	Effort (h)	Number of walleye	CPUE (fish/hour)
UT 3 Species	30.5	38	1.25

Table 9. Catch/effort (CPE, fish/hr) comparison by year for four different length classes (total length) of walleye (< 200mm = age-0; 200-299 mm = juveniles; 200-374mm = adults, > 375 = piscivore) for the Upper Colorado River Sub-basin's four reaches. Catch/effort data is partitioned by season. Note: a) Effort hasn't been electronically entered into a spreadsheet for Spring 2013 data, and b) spring collections occur by two methods; electrofishing and backwater scare and snare with trammel nets, catch/effort is reported only for electrofishing.

River Section	Length Class (mm)		Walleye									
			Time Period									
			Fall 2017	Spring 2017	Fall 2016	Spring 2016	Fall 2015	Spring 2015	Fall 2014	Spring 2014	Fall 2013	Spring 2013 No Effort Key Punched
Lower Westwater Canyon to Dewey Bridge	< 200	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	200-299	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	300-374	No. of fish	4 E-fish	0	1 E-fish	0	0	0	1 E-fish	0	0	0
		E-fish C/E	0.04		0.02				0.02			
	> 375	No. of fish	67 E-fish	0	7 E-fish	4 E-fish	30 E-fish	18 E-fish	64 E-fish	(5 total) 4 E-fish	19 E-fish	20
		E-fish C/E	0.71		0.13	0.14	0.46	0.46	1.32	0.1	0.62	NA
Dewey Bridge to Takeout Beach (Professor Valley)	< 200	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	200-299	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	300-374	No. of fish	1 E-fish	0	0	0	3 E-fish	0	0	0	0	0
		E-fish C/E	0.03				0.04					
	> 375	No. of fish	9 E-fish	0	7 E-fish	8 E-fish	25 E-fish	18 E-fish	8 E-fish	(19 total) 18 E-fish	3 E-fish	67
		E-fish C/E	0.31		0.16	0.24	0.34	0.28	0.44	0.29	0.18	NA
Takeout Beach to Potash, UT	< 200	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	200-299	No. of fish	0	0	0	0	0	0	0	0	0	0
		E-fish C/E										
	300-374	No. of fish	5 E-fish	0	0	2 E-fish	2 E-fish	0	0	1 E-fish	0	0
		E-fish C/E	0.14			0.04	0.02			0.02		
	> 375	No. of fish	14 E-fish	16 E-fish	4 E-fish	23 E-fish	15 E-fish	(18 total) 14 E-fish	34 E-fish	(45 total) 39 E-fish	1 E-fish	94
		E-fish C/E	0.39	0.32	0.14	0.44	0.18	0.22	0.35	0.74	0.04	NA
Potash, UT to the confluence of the Green River	< 200	No. of fish	No sample		No sample	0	No sample	0				
		E-fish C/E										
	200-299	No. of fish	No sample		No sample	0	No sample	1				
		E-fish C/E										
	300-374	No. of fish	No sample	1 E-fish	No sample	0	No sample	2				
		E-fish C/E						0.01				
	> 375	No. of fish	No sample	(28 total) 26 E-fish	No sample	(39 total) 31 E-fish	No sample	84				
		E-fish C/E						0.23		0.35		

Table 10. Walleye dissection results from the Colorado River 2014-2017.

Year	2014	2015	2016	2017
# WE removed	216	158	56	116
# WE dissected	70	156	53	113
# gender identified	70	104	39	103
% Male	53	38	28	48
% Female	47	62	72	52
# WE empty stomachs	28	102	34	80
# WE unidentifiable fish remains in stomach	34	24	6	14
# WE with NNF in stomachs	6	21	3	13
# WE with T&E fish in stomachs	2	4	3	0
# WE with other native fishes in stomachs	0	4	7	6
# WE with mammals or crustaceans in stomach	0	1	0	0
% positively identified stomach contents native	25	28	77	32
% positively identified stomach contents non-native	75	72	23	68

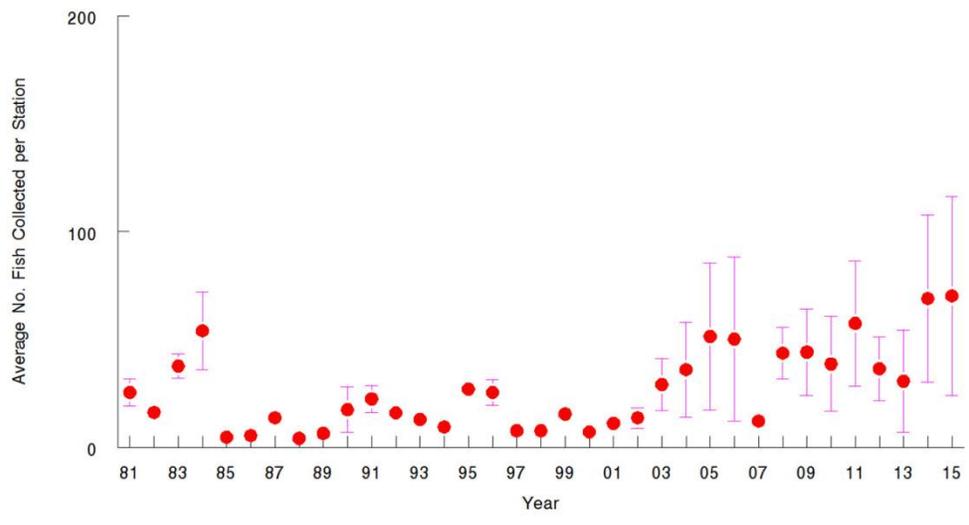
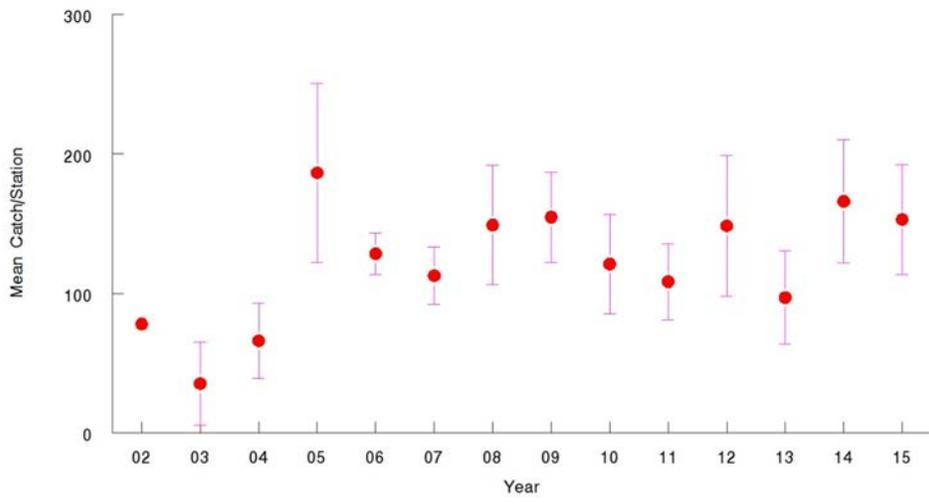


Figure 1. Upper graph: Mean catch/station of gizzard shad from the annual gill-netting survey with SE, Lake Powell, UT. 2002-2015. Lower graph: Average catch of walleye per station from the fall gill-net survey with SE, Lake Powell, UT. 1981-2015. Provided courtesy of George Blommer, UDWR Wahweap.

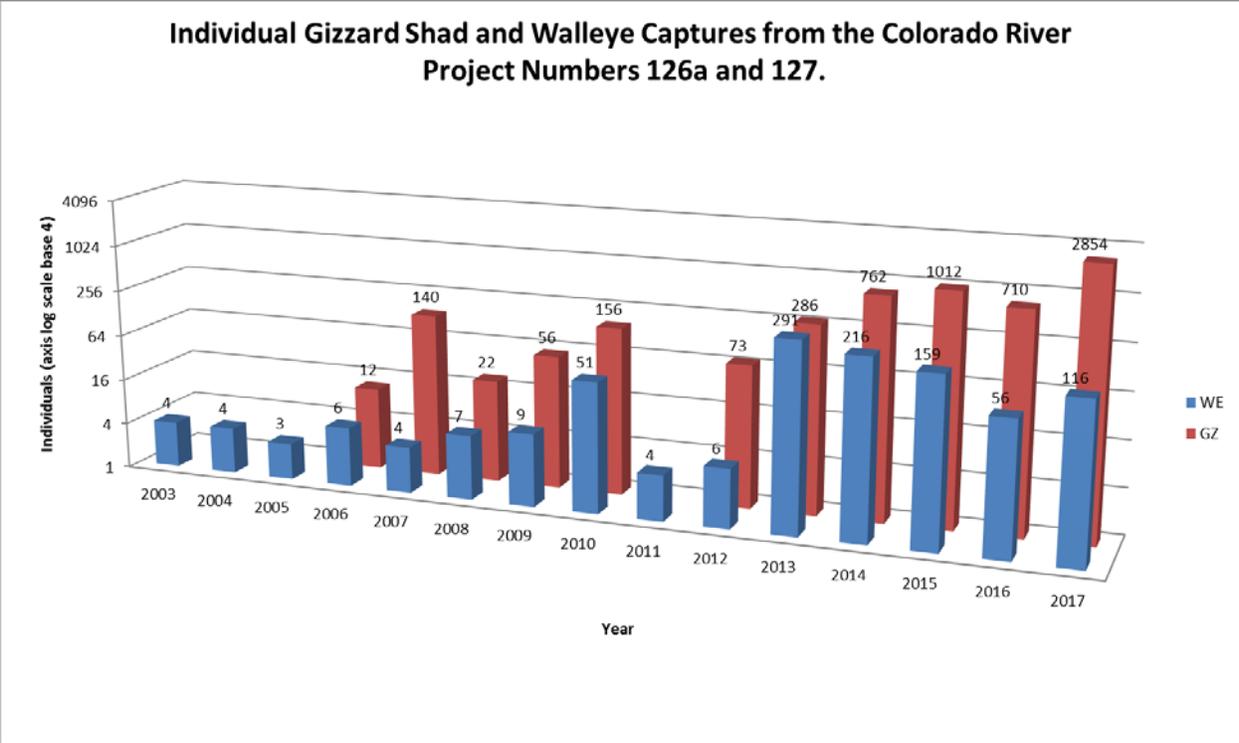


Figure 2. Individual gizzard shad and walleye captures from the Upper Colorado River; 2003-2017.

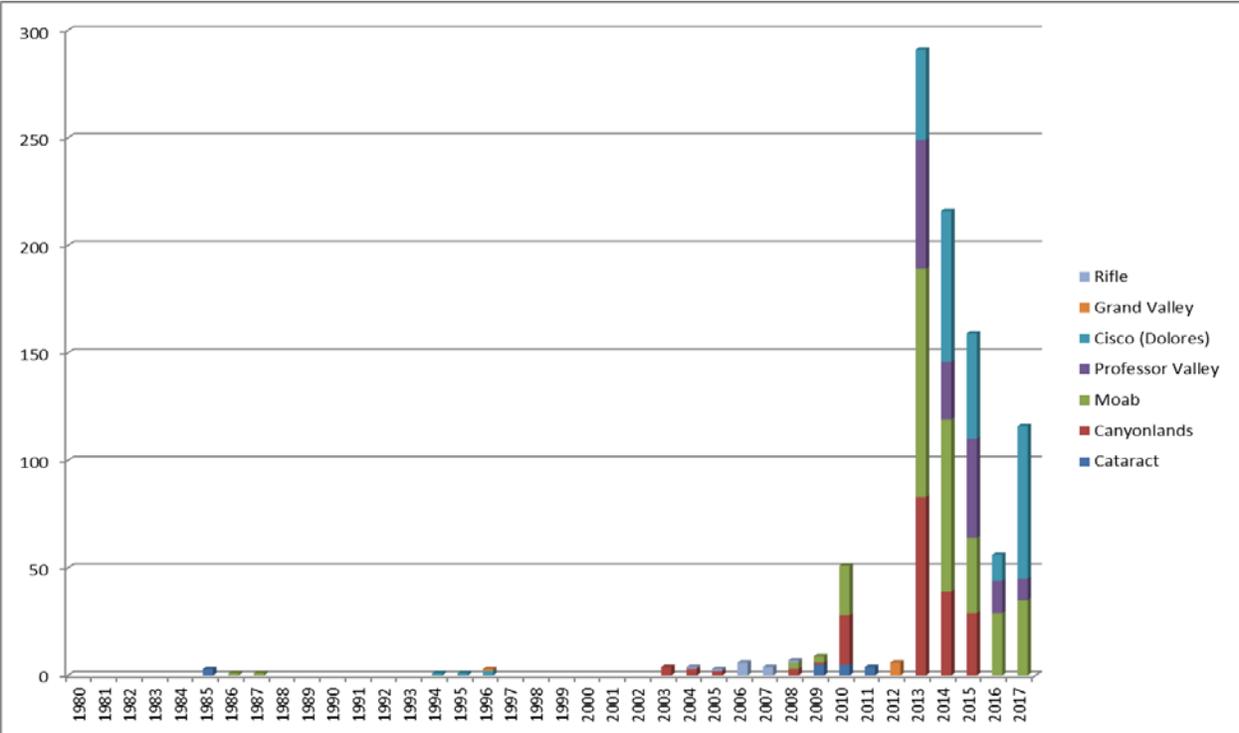


Figure 3. Annual captures of walleye in the Upper Colorado River Sub-basin. Note: captures are not standardized for effort.

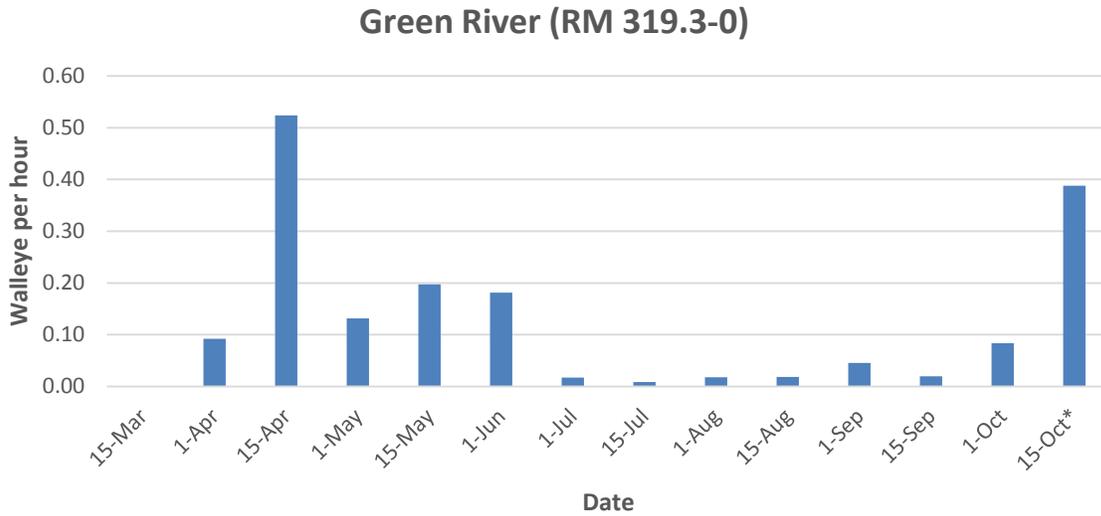


Figure 4. Catch per unit effort by month for walleye encountered on the Green River (all projects). * 15-Oct. CPUE based on 2.58 hours of effort.

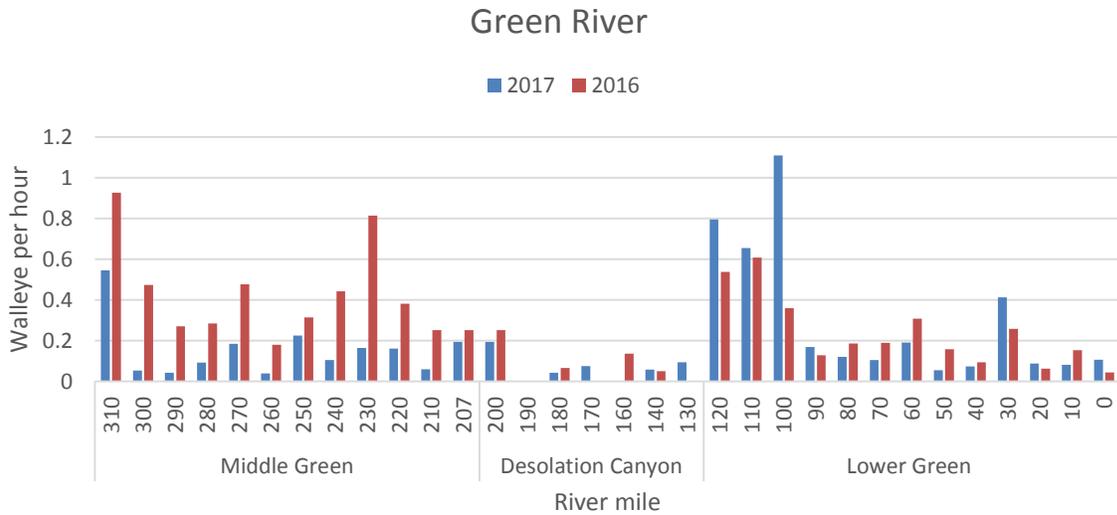


Figure 5. Catch-per-unit-effort for walleye on the Green River between 9 April and 8 June 2016 and 13 March and 8 June 2017.

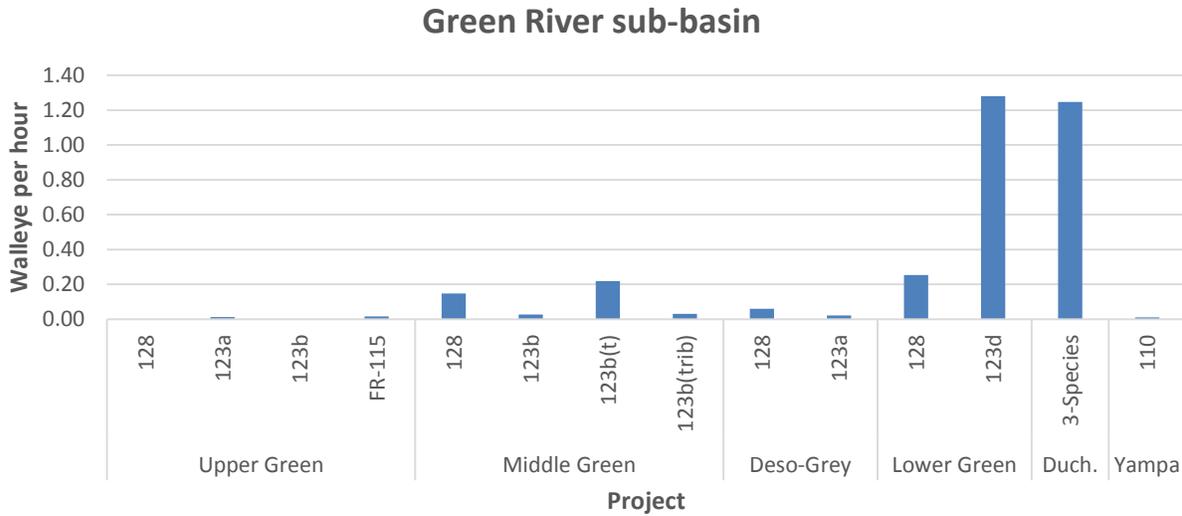


Figure 6. Catch per unit effort by project and reach for 2017. (t) denotes targeted walleye effort, (trib) denotes tributary focus effort.

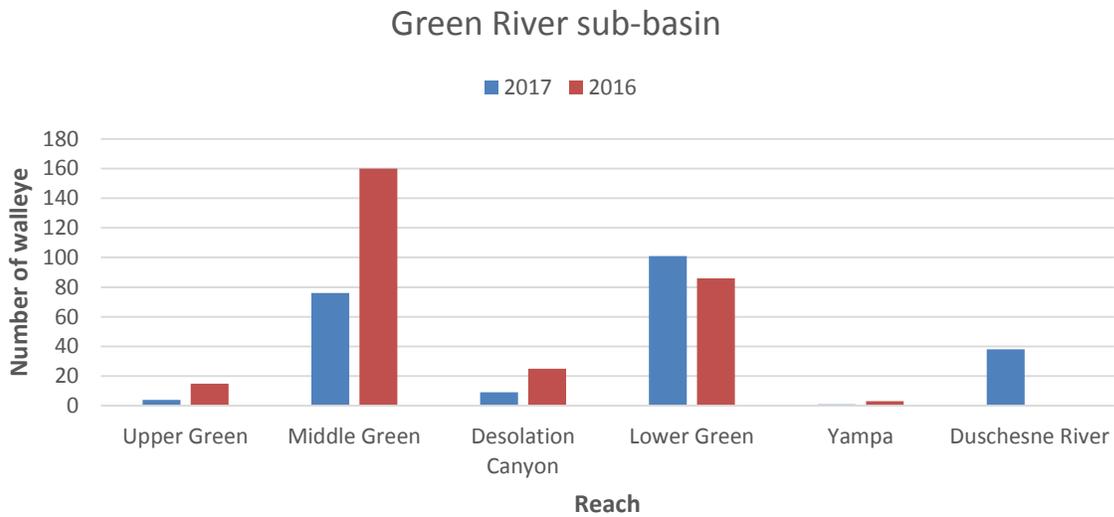


Figure 7. Number of walleye removed by reach. Duchesne River sampled in 2017 only.

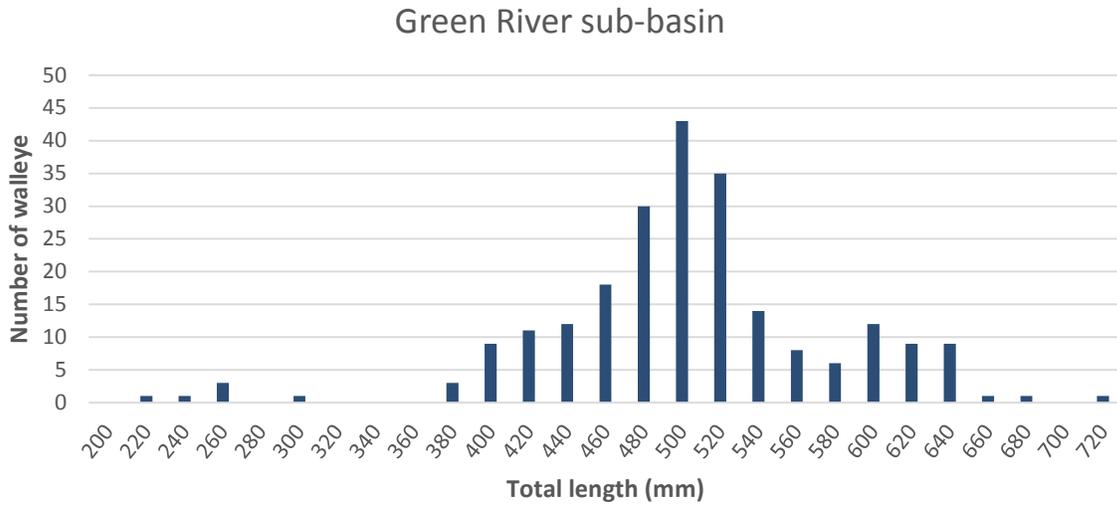


Figure 8. Length histogram for walleye encountered in the Green River Basin during 2017.

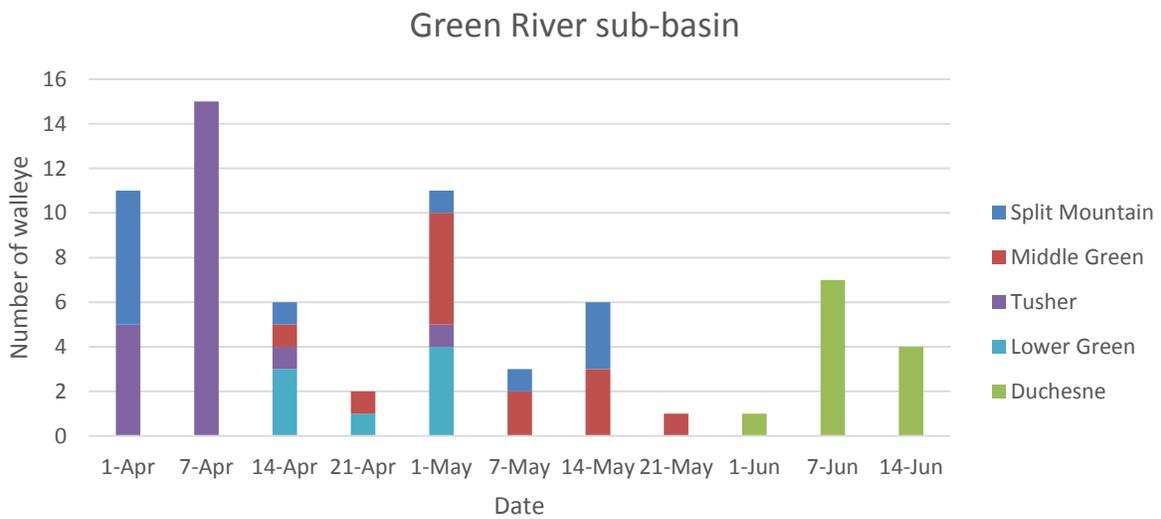


Figure 9. Encounters of ripe walleye by date and location. Split Mountain and Tusher refer to the area within 20 miles of known spawning locations (RM 319-300 and 128-110 respectively). Middle and Lower Green refer to all other locations within these reaches. All captures within the Duchesne River are located within 15 miles of the confluence of the Green River.

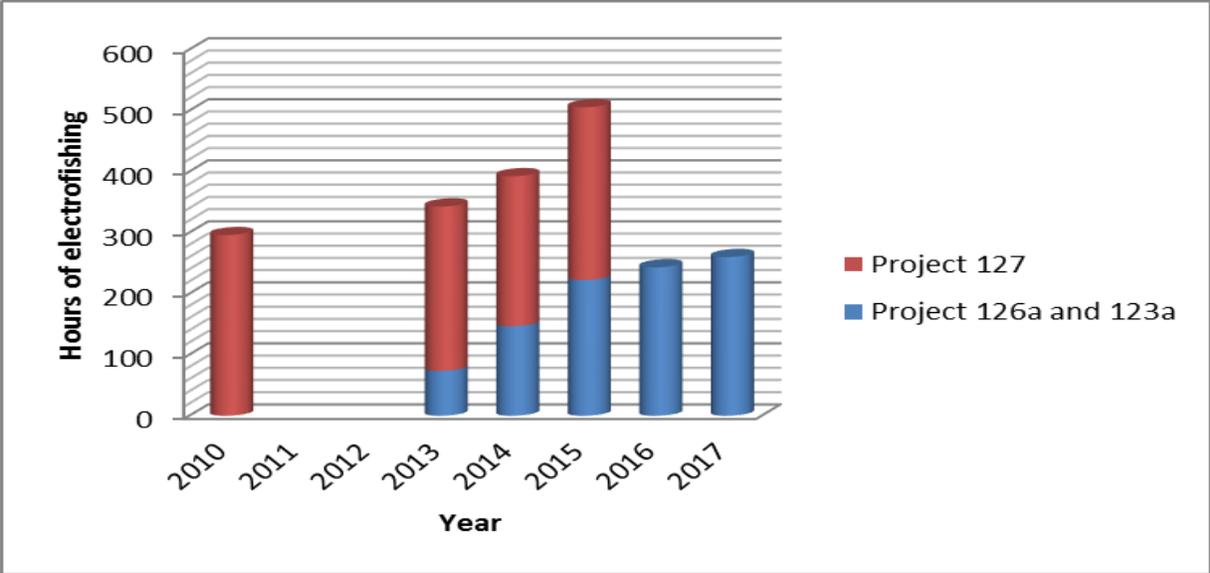
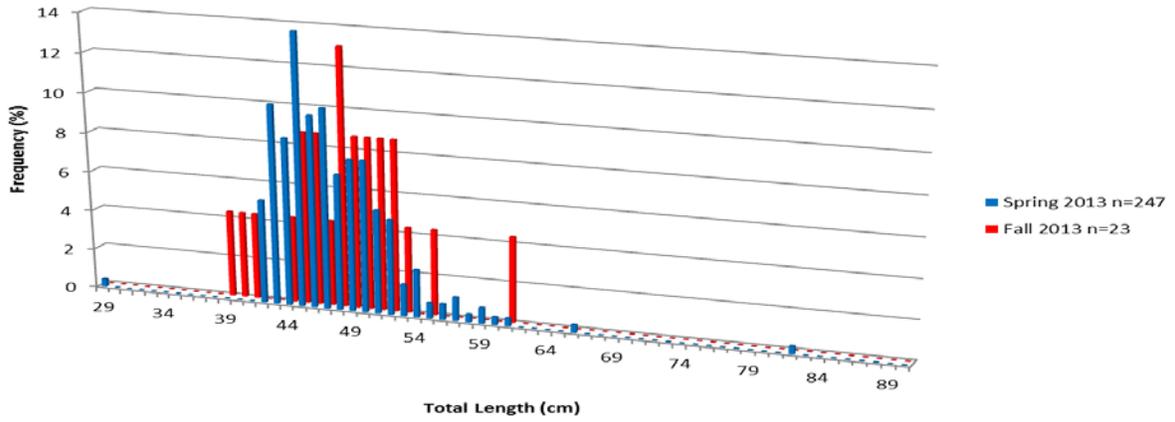
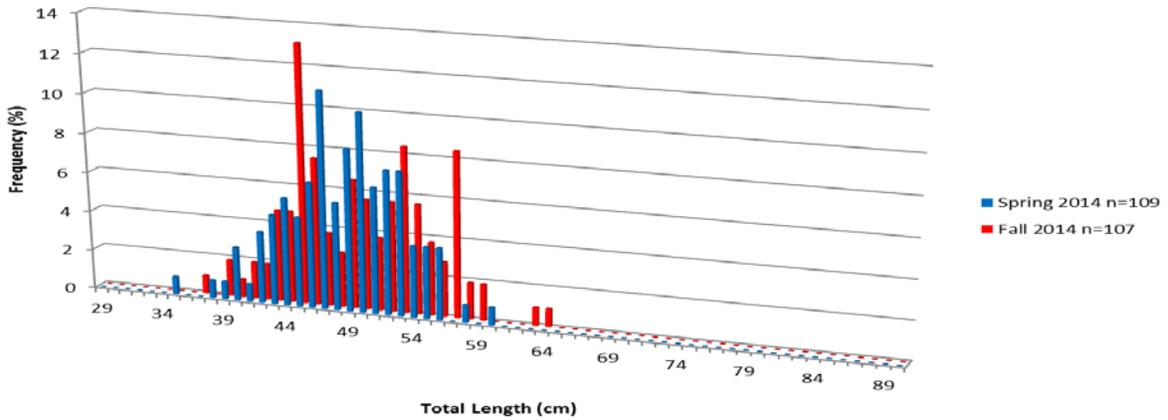


Figure 10. Total electrofishing effort expended from 2010-2017 by Colorado pikeminnow abundance estimate work (Project 127) and non-native fish removal projects (Projects 126a and 123a) in the lower 116 miles of the Upper Colorado river Sub-basin.

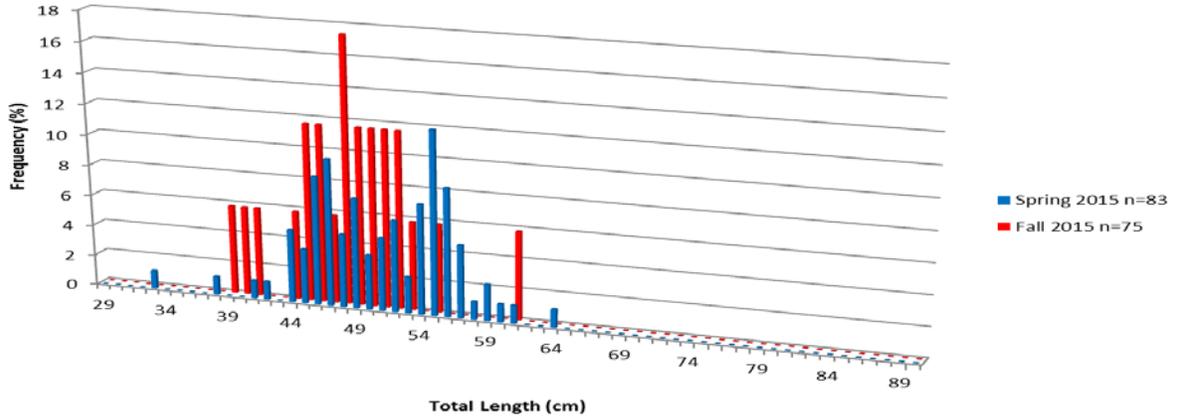
WE Length Frequency 2013
n=270



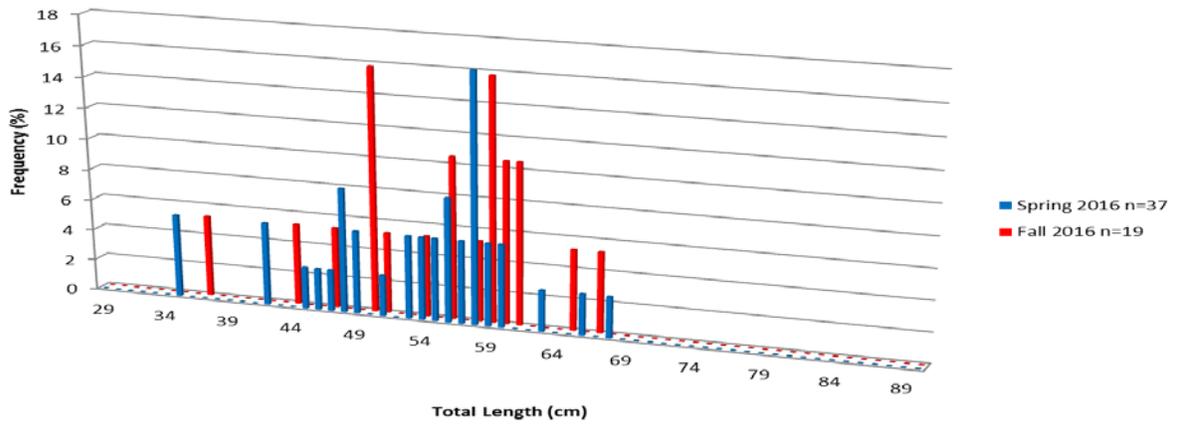
WE Length Frequency 2014
n=216



WE Length Frequency 2015 n=158



WE Length Frequency 2016 n=56



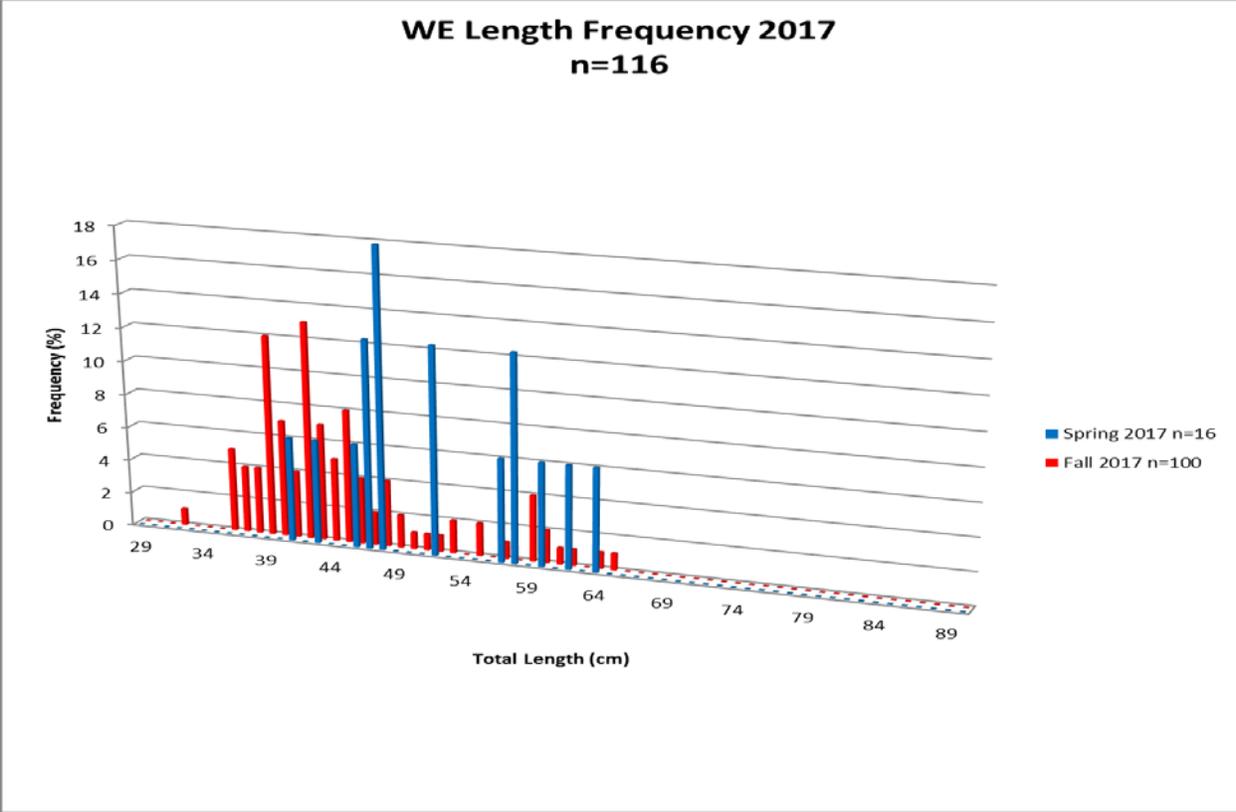


Figure 11. Length frequency histograms for walleye removed from the Colorado River from river mile 116 to the confluence of the Green River (RMI 0.0), UT 2013 through 2017.

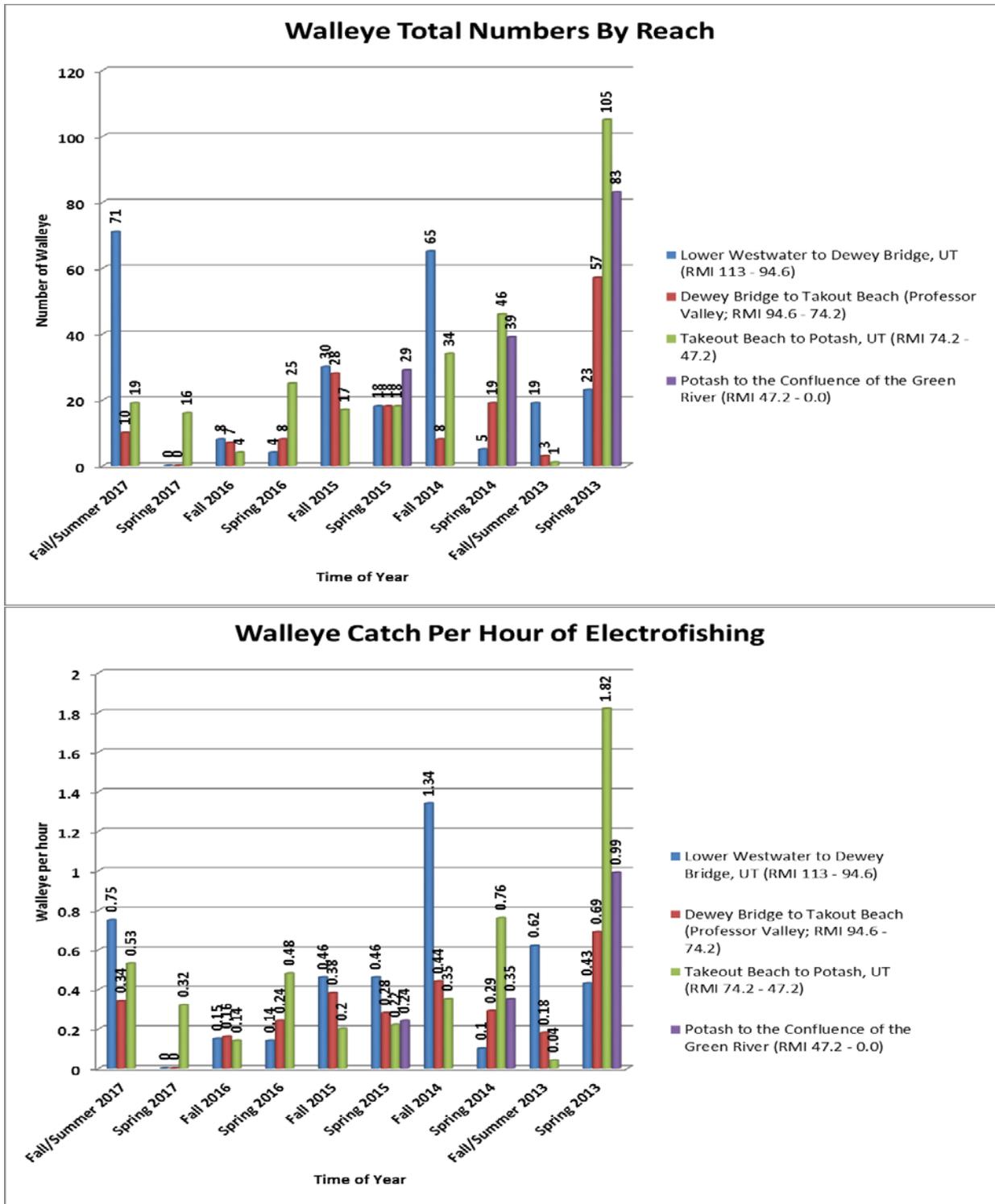
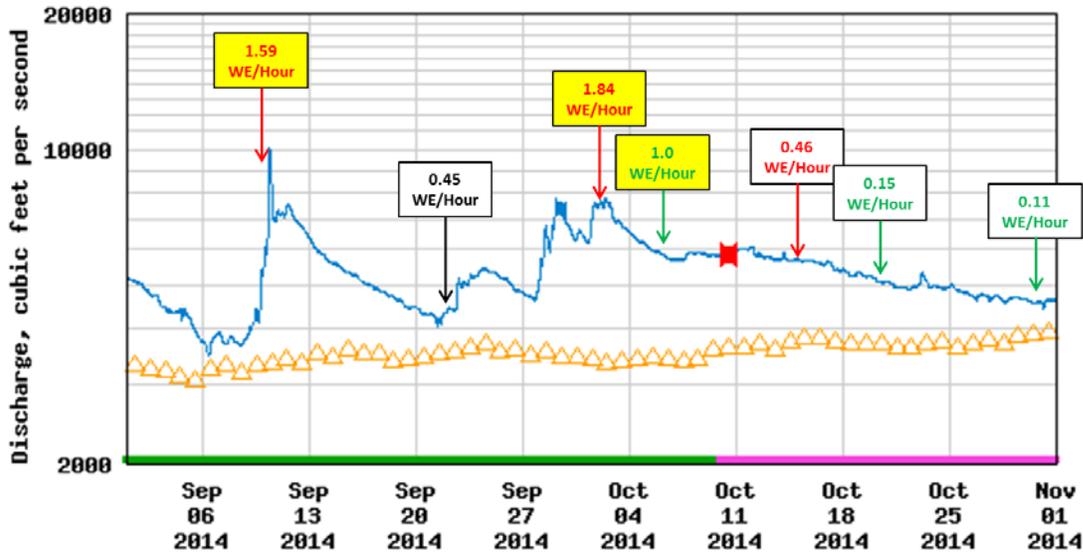


Figure 12. Walleye catch per effort and total numbers removed by season 2013-2017.



2014

USGS 09180500 COLORADO RIVER NEAR CISCO, UT



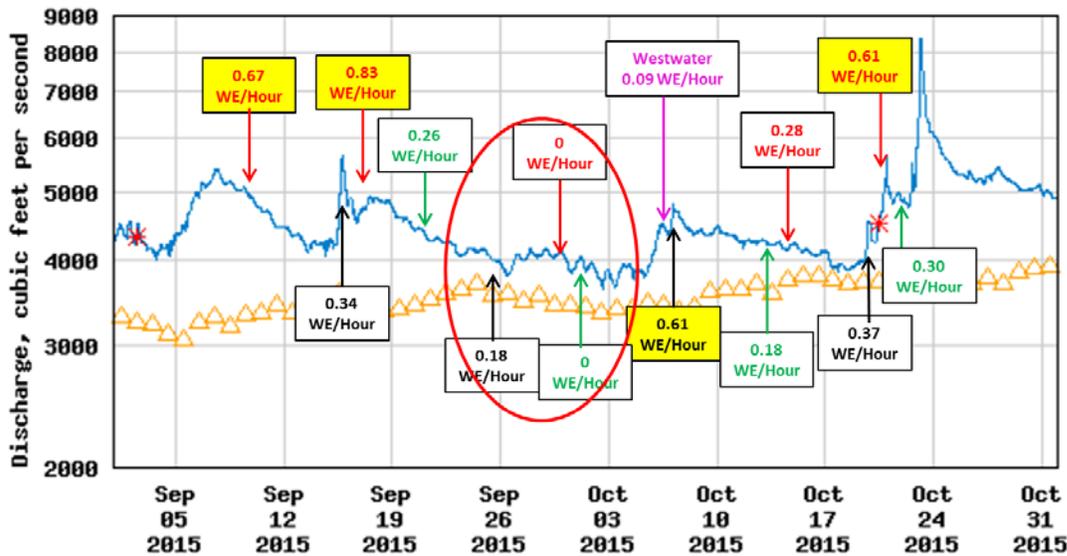
△ Median daily statistic (96 years) — Period of approved data
 — Discharge * Measured discharge
 — Period of approved data

Red Cisco to Dewey
 Black Dewey to Takeout
 Green Moab



2015

USGS 09180500 COLORADO RIVER NEAR CISCO, UT



---- Provisional Data Subject to Revision ----

△ Median daily statistic (96 years) * Measured discharge
 — Discharge

Red Cisco to Dewey
 Black Dewey to Takeout
 Green Moab

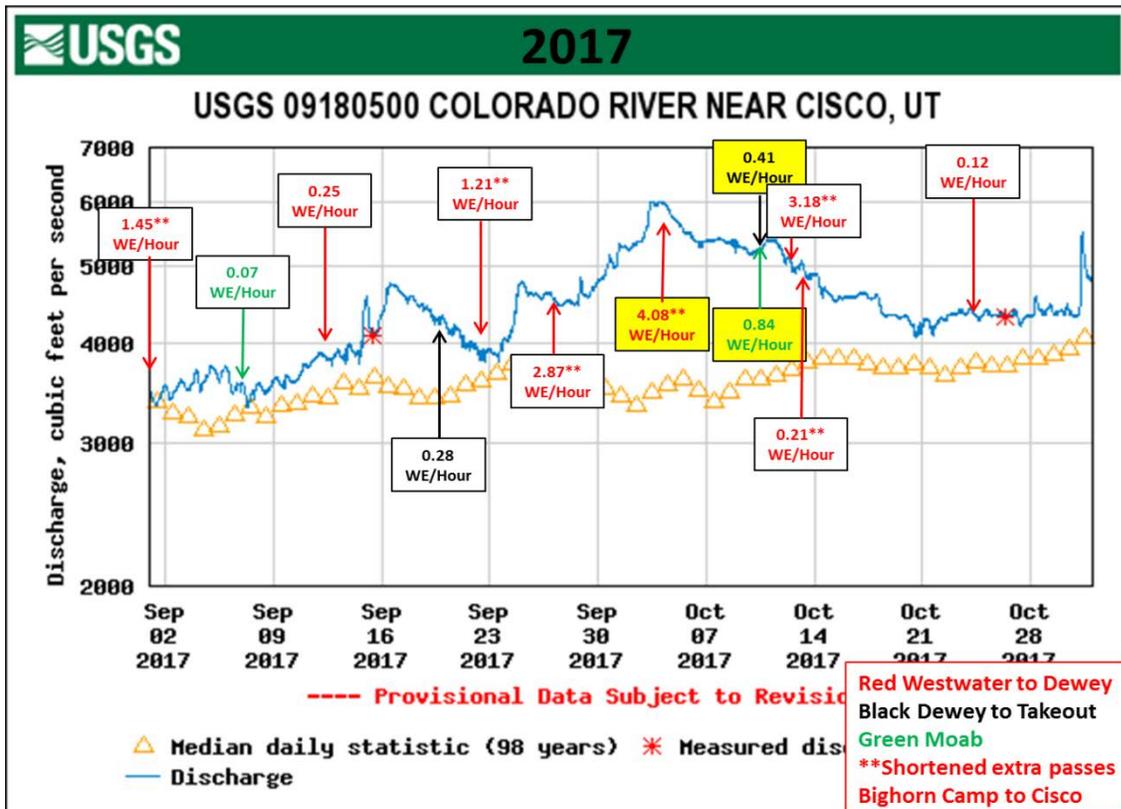
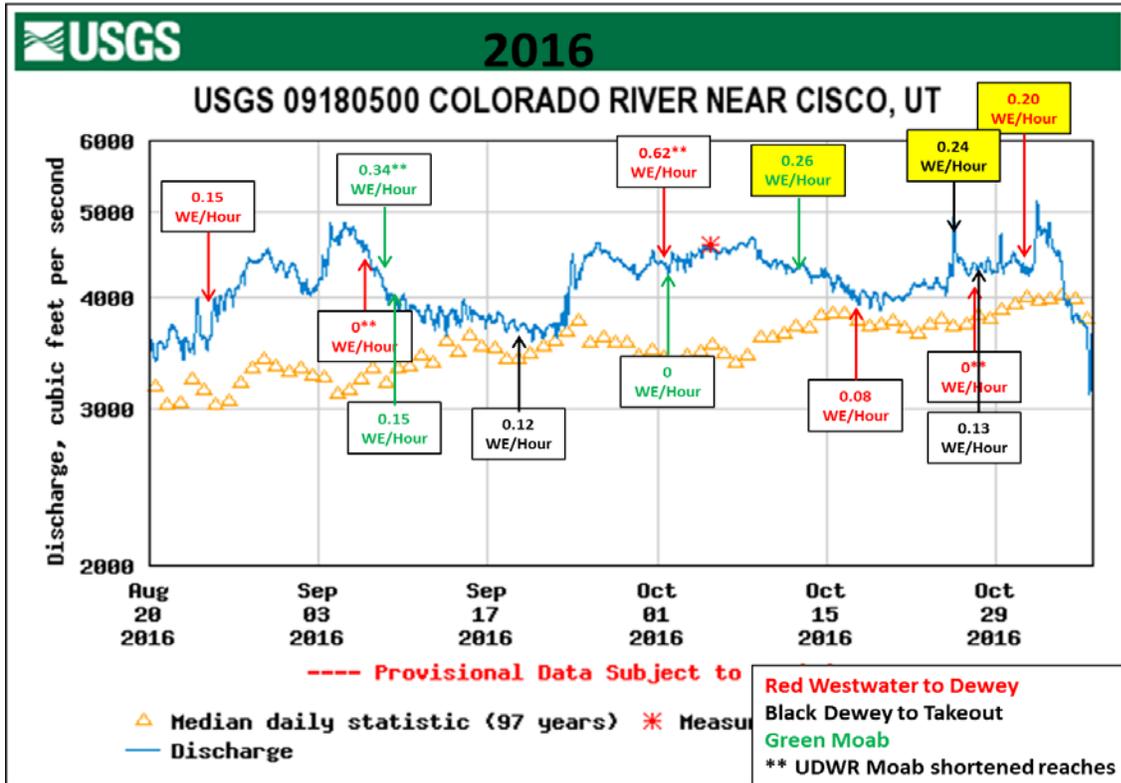


Figure 13. Fall walleye catch per effort plotted on USGS hydrograph data collected from their gauge on the Colorado River downstream of the Dolores River confluence near Dewey Bridge; 2014-2017.