

## **Strawberry Reservoir Fishery Management Plan**

1/28/2014 Draft

The following management plan drafted for Strawberry Reservoir was developed by the Friends of Strawberry Valley (FOSV) working group. During the plan development process, the following 17 different entities were represented:

- US Forest Service
- Central Utah Water Conservancy District
- Wasatch County Planning Office
- Wasatch County Public Lands Committee
- Heber Valley Chamber of Commerce
- Utah Division of Water Quality
- Strawberry Water Users
- Utah Division of Wildlife Resources
- Strawberry Bay Marina
- Trout Unlimited
- Strawberry Anglers Association
- Sportsmen for Fish and Wildlife
- Fish Tech Outfitters
- Blue Ribbon Fisheries Advisory Council
- Habitat Council
- Strawberry Land Owners
- Friends of Strawberry Valley

Data from UDWR angler opinion surveys conducted during 2012, and the biological data obtained from the Strawberry Reservoir Special Project Office of the UDWR were also used to help guide the discussion and provide a basis to build the plan upon. Due to the high profile nature of Strawberry Reservoir, it was imperative that considerable public input from the opinion surveys, and the diversity of the FOSV group, be allowed to drive the ultimate direction that this plan would take. The previous plan was developed in 1987, and was in need of being updated with the most current biological data and public opinions. The 1987 plan was successful in building one of the most important sport fisheries in the Western United States, which receives as much as 1.5 million angler hours annually. In 2006, the Strawberry Project received a distinguished award as the “Outstanding Project of the Year” in North America by the National American Fisheries Society, further validating the success of the program at Strawberry Reservoir. It is the intent of the FOSV working group that the following plan serve as the guiding document to help managers maintain, and even improve, this important world class fishery into the foreseeable future.

The following Strawberry management plan is comprised of two major components: Goals and Objectives. The “Goals” are the basic concepts that the group decided upon as overriding visions of what is desired from the fishery at Strawberry Reservoir. The “Objectives” outline more specific outputs that need to be met to provide the desired components to the fishery. In addition, a “Discussion and Strategies” section provides more detail and background validating the reasoning for each Goal and Objective, and the “Strategies” are a list of possible tools or methods to obtain the related objective. It is important to note that the listed strategies are not a comprehensive list, nor do they provide a checklist, or stepwise approach, to meeting the objectives. They are simply a list of potential tools that should be considered in meeting the Goals and Objectives.

## **Strawberry Reservoir Management Plan**

### **Guiding Statement**

*“Protect and enhance the unique, year-round angling experience that Strawberry Reservoir provides as one of Utah’s premier coldwater fisheries”*

### **Goals**

#### **1. Prevent chubs from negatively impacting the sport fishery at Strawberry Reservoir**

##### **Objectives**

1. Maintain minimum daily growth rate of at least 0.8mm per day in length for age I cutthroat trout (June-October)
2. Limit total catch rate of chubs sampled in gillnet surveys to 1.0/net-hour
3. Maintain number of 18” or greater cutthroat trout sampled in gillnet surveys at 0.20/net-hour

#### **2. Ensure a high quality, diverse fishery and associated habitats**

##### **Objectives**

1. Meet or exceed water quality standards for Strawberry Reservoir and tributaries within 10 years
2. Maintain overall gamefish catch rate of 0.5 fish per hour
3. Maintain average size of cutthroat trout in gillnets at 18”
4. Maintain average size of rainbows in the creel at 16”

#### **3. Ensure a variety of fishing experiences**

##### **Objectives**

1. Maintain fishing pressure at 1.2 million angler-hours annually
2. Maintain at least 200,000 ice angler-hours per year
3. Explore potential for increasing fishing opportunities on Strawberry tributaries
4. Enhance non-angling opportunities

#### **4. Improve natural reproduction of cutthroat trout and Kokanee salmon populations**

##### **Objectives**

1. Increase average annual recruitment of Age I cutthroat trout to 150,000 fish per year within 10 years
2. Explore opportunities to expand kokanee salmon population and natural recruitment

\*A formal review of this plan should be conducted every five years.

## Discussion and Strategies

### Goal #1 - Prevent chubs from negatively impacting the sport fishery at Strawberry

**Reservoir** - *Utah chubs have had negative impacts on the fishery at Strawberry Reservoir during the past. Strawberry has been chemically treated on two occasions in the past (1961 and 1990) in attempts to remove these unwanted introduced species. It is critical to the overall health of the sport fishery that we control the Utah chub populations to try to avoid future problems including the need for expensive and difficult chemical treatments. Proper management of the predatory Bear Lake cutthroat has provided sustainable top down control of the Utah chub populations since 2003, thereby providing a template for control into the future.*

#### Objectives

1. Maintain minimum daily growth rate of at least 0.8mm per day for age I cutthroat trout (June-October) <sup>1</sup> – *Daily summer growth rates of age I cutthroat have averaged roughly 0.8mm per day during the years when they have provided adequate chub control. It is critical to maintain good growth rates during the first year for the cutthroat to ensure sufficient survival and recruitment to adult sizes for chub control.*

#### Strategies

- a. Monitor zooplankton for composition, abundance, and size – *Current zooplankton sampling includes tows taken during the second week of February, third week of May, first week of August, and the second week of October. The May and October sampling dates coincide with the spring and fall stocking to assess what is available during these periods for stocked fish, and compare it to what is seen in fish diets from gillnetting. Data collected will be used to assess whether significant changes in zooplankton abundance and/or size could be affecting growth and survival of cutthroat trout.*
  - b. Monitor water quality annually to assess limitations in growth and survival for cutthroat – *Basic water quality parameters such as temperature, dissolved oxygen, and pH will be monitored in the water column in conjunction with zooplankton sampling to assess conditions and potential limitations to survival and growth for the cutthroat and other fish. Receiving water will also be monitored during stocking events to ensure that stocked fish are being placed into favorable conditions.*
  - c. Implement water quality improvement recommendations contained in “Strawberry Valley Watershed Restoration Report” (USDA, 2004a) and Strawberry Valley Watershed Report Action Plan (USDA, 2004b).
  - d. Monitor interaction of cutthroat trout with other species – *It is imperative that other fish species either currently found in Strawberry, or to be introduced, do not adversely affect the cutthroat trout populations which have proven an effective biological control on Utah chubs in Strawberry Reservoir. Any potential predatory and/or competitive interactions with other game fish should be closely monitored and adjusted to ensure adequate growth and survival in the cutthroat populations to provide the needed chub control.*
2. Limit total catch rate of chubs sampled in gillnet surveys to 1.0/net-hour <sup>1</sup> – *Since 2003 it has been shown that Utah chub numbers can be held below this threshold level, while also maintaining a quality sport fishery. The ability to keep Utah chub numbers below this level will help ensure that a quality sport fishery can be sustained into the future.*

#### Strategies

- a. Adjust cutthroat trout population and age structure to control chubs – *Since 2003 it has been shown that the Bear Lake cutthroat have been extremely effective at controlling*

*Utah chub populations in Strawberry Reservoir: During a diet study conducted in 2005 it was estimated that cutthroat ate 64 million chubs during the year. However, adjustments in the management of the cutthroat have been necessary to provide the needed population structure to obtain chub control. In 2003, special regulations (a slot limit eliminating harvest from 15" to 22") controlling the harvest of cutthroat were placed on the reservoir and have provided more, and larger sized, cutthroat needed to effectively control the chub populations. Adjustments to numbers, size, and timing of stocked fish have also been necessary to provide the cutthroat numbers and age/size structure needed to control chubs. Future adjustments may also be needed to make sure that cutthroat populations remain robust enough to control chub populations.*

- b. *Consider commercial harvest of chubs – Commercial harvesters have taken Utah chub from Strawberry Reservoir in the past, particularly when the numbers of small chubs were high. These smaller chubs were primarily sold as bait. During 2004 (right in the peak of chub numbers since the 1990 treatment) the harvester sold 7,798 packages of a dozen chubs (93,576 chubs) harvested from Strawberry. This number pales in comparison to the estimated 64 million eaten by cutthroat predators the next year in the diet study, but does offer some help in chub control, and provided a viable commercial operation at the time. Currently these harvesters are not taking fish from Strawberry, largely because numbers of smaller chubs have diminished due to cutthroat predation, making baitfish harvesting there less profitable than elsewhere. If chub numbers increase, or another market opens up for a beneficial use of the chubs available in Strawberry, allowing these operations should be considered. However, making sure that the harvesting operations do not negatively impact sportfishing in any way is paramount. In addition, it would be crucial to make sure that these operations would not spread any unwanted aquatic invasive species or diseases through equipment being used elsewhere and actively being transported to other bodies of water.*
- c. *Consider spot treatment for removal of chubs – If Utah chub numbers increase to a point where the current biological control provided through cutthroat predation is not keeping up with their expansion, then it may be advantageous to consider chemical spot treatments to kill off large concentrations of chubs, such as spawning concentrations. It is important to realize that spot treatments alone would not be completely effective at controlling chubs by itself, and that the biological control mechanism currently provided through cutthroat predation is more effective in the long-term. However, spot treatments may allow a short-term control mechanism that may help get the system back in balance if cutthroat populations suffer, and chubs get a stronger foothold. Spot treatments with chemicals would obviously have many unwanted side effects through its non-selective nature, and many sport fish could also be killed. It would be critical to run smaller test runs to determine methods and timing that would minimize the unwanted side effects.*
- d. *Consider introducing another sterile salmonid as a predator (while maintaining the rainbow fishery) – If the Bear Lake cutthroat currently being used as a biological control mechanism to reduce chub numbers proves ineffective at some point, other salmonid species could also be considered in addition to the Bear Lake cutthroat, or as a replacement if necessitated. The issue of sterility is important if introgression with cutthroat is likely, and/or if a positive control on the newly introduced population needs to be maintained, particularly during initial trial periods. However, the Bear Lake cutthroat have proven to be extremely effective for the past 10 years, and nothing at this point would dictate a need for a change. In addition, current public opinion dictates that the rainbow fishery be continued at Strawberry Reservoir, thereby negating the substitution of another species for the rainbows as a strong possibility.*

3. Maintain number of 18" or greater cutthroat trout sampled in gillnet surveys at 0.20/net-hour<sup>1</sup> – *In addition to the needed chub control provided by the cutthroat, the anglers at Strawberry Reservoir have become accustomed to catching numerous large cutthroat, and would like to see that continue. During the mid to late 2000's we were able to provide large numbers of cutthroat over 18", and the gillnet catch rates of these fish during that period provided the benchmark of 0.20/net hour. When cutthroat over 18" were present at or above the defined catch rate, chub numbers were either decreasing or stable.*

#### Strategies

- a. Adjust size restrictions and harvest limits on cutthroat – *In order to maintain relatively high numbers of the large (18" and larger) cutthroat in Strawberry Reservoir, care should be taken in adjusting harvest limits based on size and numbers. Strawberry continues to be driven by harvest, and unless overall angling practices/expectations change dramatically, many anglers will continue to harvest as many fish as the regulations will allow. With the considerable pressure that Strawberry Reservoir receives, legal harvest can, and will, quickly deplete cutthroat populations. The current slot limit allowing two cutthroat under 15" and one over 22" has been very effective at providing the 0.20/net hour catch rate of 18" or larger cutthroat for most years since 2003. This level of larger cutthroat has been effective at keeping chub numbers under control.*
- b. Promote voluntary catch and release – *Since the 1990 treatment of Strawberry Reservoir the UDWR has promoted voluntarily releasing cutthroat of any size in an effort to limit the harvest of this fish. It is difficult to quantify the effect of this program, but by continuing to send the same message, the angling public will hopefully further understand the importance of the cutthroat to the biological health of the system, and also reap the benefits of having numerous large cutthroat to catch.*
- c. Adjust stocking of cutthroat trout – *Stocking is one of the most important management tools that can be manipulated at Strawberry Reservoir. Since harvest continues to be an important aspect of the fishery for as many as 50% of the anglers at Strawberry, we have to make sure that stocking keeps up with the demand. Increasing stocking of one species will likely decrease the stocking of other species. Hatcheries are limited in the pounds that can be produced, as well as by funding. If all things remain equal, increased stocking of one species will reduce the potential to stock other species.*
- d. Adjust timing, size, and location of cutthroat trout stocking to optimize survival and growth- *Not only are the numbers stocked important, but size of stocked fish and timing of the stocks can also be critical to survival. For instance, a study conducted in 2008 indicated that cutthroat stocked at 8" had a survival rate 4 times higher than those stocked at 7". Recent information also indicates that stocking the cutthroat early in the year (May as opposed to late June-July) may also improve survival of the stocked cutthroat. Location, such as stocking in the tributaries, may also prove to be important in getting returns to tributaries to promote natural reproduction, and barge stocking in appropriate locations to promote survival may also greatly improve survival. Obviously, there are many more potential alterations to the stocking program at Strawberry that could be tested in attempts to improve survival. It is important that managers continue to look for methods to help boost survival of stocked fish in Strawberry.*
- e. Increased law enforcement emphasis – *For many years one of the most common suggestions/complaints in public opinion surveys conducted at Strawberry Reservoir have been regarding law enforcement presence at Strawberry Reservoir, with most people indicating that they would like to see an increase in law enforcement presence. With the special restrictions placed on cutthroat trout in Strawberry, and the high levels of pressure Strawberry receives, it is important that an adequate law enforcement*

*presence be maintained. The most recent compliance data tallied from road blocks indicates that 96% – 98% of the anglers are not in violation of overlimits/slot limits. However, there is always the need for a certain level of law enforcement presence to maintain, or even improve, those numbers.*

**Goal #2 - Ensure a high quality, diverse fishery and associated habitats** – *One of the main purposes of this goal is to define the fishery that anglers have come to expect, and want to continue to see, at Strawberry Reservoir. It is also important to maintain, and improve, the associated habitats that are critical to the fishery at Strawberry.*

#### Objectives

1. Meet or exceed water quality standards for Strawberry Reservoir and tributaries within 10 years - *Strawberry Reservoir and its tributaries waters are designated by the State of Utah<sup>3</sup> to have beneficial uses of 2b (Recreational contact), 3A (Coldwater fish species) and 4 (Irrigation of crops and watering of stock), also Strawberry Reservoir is classed as 1C (Domestic purpose). Based on a TMDL report (cited below) Strawberry Reservoir is not meeting these beneficial uses because of elevated phosphorus (P) levels and subsequent depressed oxygen levels. Further recent data indicates that some tributaries are not meeting temperature thresholds. The TMDL identified P reduction sources and targeted endpoints of certain physical and chemical parameters: Dissolved oxygen (>50% of the water column above 4 mg/L), Total P load to reservoir (15,1000 lbs/yr), Average Trophic State Index (40-50), Fish habitat indicator (no fish kills), and Blue-Green Algae (overall decrease of dominance). Many documents have identified potential work that can achieve TMDL goals and much of this work has been completed, or is in the planning phase. Works that are not yet completed need to be prioritized and pursued.*

#### Strategies

- a. *Implement water quality improvement recommendations contained in “Strawberry Watershed Restoration Report, Strawberry Watershed Restoration Report Action Plan and Strawberry Reservoir TMDL Study (UDEQ, 2005).*
- b. *Continue Restoration Efforts*
2. Maintain overall gamefish catch rate of 0.5 fish per hour<sup>2</sup> – *Since the 1990 treatment, Strawberry Reservoir has sustained an average angler catch rate of 0.47 fish per hour. The last three surveys conducted in 2001, 2006, and 2011 have averaged just over 0.50 fish per hour, providing the benchmark for this objective. The overall catch rate should currently be a combination of cutthroat trout, rainbow trout, and kokanee salmon. During the last four creel surveys conducted in 1996, 2001, 2006, and 2011 cutthroat have averaged 71% of the catch, rainbows 28%, and kokanee 1%, again possibly providing initial benchmarks for catch rates among species.*

#### Strategies

- a. *Continue year-long comprehensive creel surveys at least every five years – Since 1996, year-long comprehensive creel surveys have been conducted every five years at Strawberry. Supplemental funding from a creel fund housed in the Salt Lake Office of the UDWR for each of these intensive surveys has been needed. A five year rotation for these surveys would be considered a minimum as long as the needed funding remains intact. For obvious reasons, more frequent surveys would be advantageous to stay abreast of catch rates and creel patterns. If funding is available, it would be recommended that the frequency of the surveys be increased to once every 3 years.*
- b. *Consider alternative survey techniques to obtain interim catch rate assessments – The following ideas for obtaining catch rates are intended to help fill in the gaps between*

*the five year comprehensive surveys. It is important to understand that other methods for obtaining catch rates are not going to be directly comparable to the comprehensive surveys, or even among each other, as the methods easily bias the data obtained. However, they can still provide important information on their own, particularly once enough data is obtained to develop a trend line with each type of survey.*

- b.i. *Conduct limited creel survey annually – During previous years, limited catch rate creel surveys have been conducted on an opportunistic schedule. These types of surveys may not be as robust and statistically sound as the year-long surveys; however, they do provide some basic catch information. These surveys are typically limited to seasons when additional seasonal help is available, and to times when the normal Strawberry Project work load is lighter.*
          - b.ii. *Voluntary reporting (Strawberry fishing app) – With the increase in use of mobile “smart phone” devices, it would be logistically easy to develop a networked application (app) that anglers could use to enter daily fishing information. The biggest limitations of this type of survey are that they are limited to only those who have the ability to utilize the app, and to those types of anglers who are willing to voluntarily participate. Again, these types of data would likely have to stand on their own as they would not be directly comparable to other types of surveys; however, they could show trends in catch rates.*
          - b.iii. *Explore other options – Other options may very well exist, or become available, to allow for angler catch rate data to be collected.*
3. *Maintain average size of cutthroat trout in gillnets at 18”<sup>1</sup> – From 2004 to 2013 (years following the 2003 slot limit on cutthroat), cutthroat total length has averaged 17.6” at Strawberry Reservoir. Recent angler surveys have concluded that the majority (nearly 60%) of anglers expect/desire to catch fish 16” and larger at Strawberry. These same surveys also indicated that 73% of all anglers at Strawberry would like to see some “trophy” aspect to the regulations to provide larger fish. The current slot limit protecting cutthroat from 15” to 22” has been effective at producing numerous large cutthroat that many anglers have come to expect and desire in the fishery. In addition, during the years that gill net catches of cutthroat have averaged 18” or greater, are the years we have experienced the most effective chub control. Since the average size of cutthroat harvested at Strawberry are not representative of actual population size structure due to the slot limit, size in gillnets is the best way to track success of this objective.*

Strategies

- a. *See strategies for Goal 1, Objective 3*
- 4. *Maintain average size of rainbows in the creel at 16”<sup>2</sup> – Since the treatment in 1990, rainbows in the creel at Strawberry Reservoir have averaged 15.5”. Again, recent surveys indicated that anglers at Strawberry expect to catch, and harvest, fish over 16” to satisfy their desires. Roughly half of the anglers also indicated that they still desire to have a consistent harvest component to the fishery at Strawberry Reservoir. The rainbows at Strawberry have provided the main harvest component in recent years due to the restrictive nature of the current slot limit on cutthroat. Surveys have also long documented that rainbow trout remain a favorite component of the catch at Strawberry. Since there are currently no size restrictions on rainbow harvest, the size of rainbows in the creel may be a more relevant way of tracking the success of this objective than size in the gillnets.*

Strategies

- a. *Continue stocking 8” rainbows and adjust size and timing as necessary – Studies conducted on cutthroat in 2008, and results of stocking 8” fish since then, have indicated that the stocking of 8” rainbows has been very effective at improving stocking survival and providing a quality rainbow fishery. It is critical to continually monitor the*

*effectiveness of the stocks, and future adjustments in size and timing of these stocks may be needed.*

- b. *If average size drops due to competition, implement strategies for chub control found in Goal 1, Objective 2 – Competition between rainbow trout and Utah chubs has been well documented at Strawberry Reservoir (and elsewhere), and has prompted the past rotenone treatments there. If chubs become a problem again in the fishery, it will likely first be seen in rainbow growth and survival.*
- c. *Publicize growth rate as a way to promote catch and release – Growth rates of the rainbows at Strawberry are very good, and a slight change in the harvest patterns of anglers can have huge impacts on survival and size potential of the fish there. Strawberry continues to be driven by harvest and the promoting of voluntary catch and release with the promise of larger rainbows in the near future may alter some anglers harvest habits. The effectiveness of these types of programs is difficult to quantify, but they may help without much additional effort or cost.*
- d. *Adjust limits (size and/or numbers) as needed – Since Strawberry Reservoir continues to be largely driven by harvest (anglers control populations of sportfish), restricting harvest remains one of the most effective means of controlling size and numbers of sportfish available. However, harvest in general remains important to roughly half of the anglers at Strawberry, and severe reductions in harvest potential will impact those anglers and their desire to fish at Strawberry Reservoir. Care should be taken to ensure that restrictions designed to increase the average size of the rainbows does not overly restrict the harvest potential at Strawberry Reservoir.*

**Goal #3 - Ensure a variety of fishing experiences** – *Strawberry Reservoir receives as much as 1.5 million angler hours on an annual basis, and remains one of the top sport fisheries in Utah. It is critical that a fishery be provided at Strawberry that will appeal to the largest group of anglers possible, which means providing a variety of opportunities. In addition, it is important to make sure that all anglers, and potential anglers, are aware of the opportunities available.*

**Objectives**

- e.i.1. *Maintain fishing pressure at 1.2 million angler-hours annually<sup>2</sup> – Strawberry has sustained an average annual fishing pressure of just over 1.1 million angler hours since the 1990 treatment, providing an obtainable, and sustainable, goal for pressure.*

**Strategies**

- a. *Focus on new recruitment – Organize and promote activities and events that focus on recruiting new anglers of all ages to the sport (e.g. Cast For Kids).*
- b. *Advertisement/outreach – Continue, and possibly increase effort, in advertising events and opportunities such as the following non-comprehensive list:*
  - d.i. *Disabled veterans fishing event, ice fishing clinics, etc.*
  - d.ii. *Publicize rainbow availability and size*
  - d.iii. *Out of state campaign*
  - d.iv. *Trophy aspect (cutthroat trout)*
  - d.v. *Promote kokanee angling opportunities*
  - d.vi. *Publicize and promote watchable wildlife events (e.g. kokanee and cutthroat events)*
  - d.vii. *Web based weather and wildlife cameras*
- c. *Maps/Apps – Provide web based maps and mobile apps that link anglers to all the available information to fishing and recreating at Strawberry Reservoir. Much of the groundwork for these efforts has been laid with current products produced for the Blue*



*Ribbon Fisheries interactive map. It may be possible to expand on this concept and keep it current.*

d. Provide the quality fishery to draw people (Objective 2, Goals 3 and 4) – *If a quality fishery can be developed, it is likely that people will use it. The strategies outlined above provide the means to help accomplish this.*

e. Improve/maintain fishing-related recreational experiences at Strawberry – *For many, fishing at Strawberry Reservoir means more than just catching fish. Camping, ATV riding, hunting, wildlife viewing, and aesthetics/setting are also important to the overall experience. It is important that managers recognize the interactions of these activities, and that a management decision at one level can affect other areas as well. It is critical that all resource managers maintain a high level of cooperation and communication in the Strawberry Valley to ensure that all types of recreational activities are considered in management decisions.*

f. Make Strawberry more user friendly – *Make sure that fishing at Strawberry Reservoir does not seem too difficult or inconvenient for the largest possible group of potential anglers. Information availability, opportunities, fees, regulations, and facilities need to be geared towards making people comfortable with the experience. It is of obvious importance that good working relationships be developed and maintained with all partnering agencies and groups to make sure that the needs of users are being met.*

g. Explore opportunities for increasing and/or improving access for shore fishing (general public and disabled anglers) and for launching personal watercraft, consistent with Forest Plan – *Opportunities to increase and/or improve shore angling and use of small personal watercraft (e.g. float tubes and personal pontoon crafts) need to be explored. Strawberry continues to be a boat oriented fishery during ice-off seasons, and expansion of shore angling and non-motorized watercraft opportunities (including dissemination of information) has great potential to draw more anglers to Strawberry. Included in this concept, is the idea of providing facilities for disabled anglers. Any expansion and/or improvement would obviously have to be taken through the proper channels (typically including the Forest Service), as they are the land managers over the vast majority of the land around Strawberry Reservoir.*

e.i.2. Maintain at least 200,000 ice angler-hours per year <sup>2</sup> – *During the last three creel surveys since 2001, Strawberry has sustained nearly 180,000 hours of ice fishing pressure. Ice angling was identified as one of the most promising areas to expand angling opportunities to a wide array of the public due to the lack of a need for expensive equipment (e.g. boat) and because Strawberry Reservoir could sustain more pressure provided that adequate access can be maintained and even expanded upon. Opportunities to expand and promote ice fishing opportunities should be taken.*

#### Strategies

- a. Improve access and maintain access authorizations – *Currently UDWR coordinates with Utah State Parks and Recreation, Strawberry Bay Marina, and the US Forest Service to keep angler parking areas open during the winter. The parking areas currently provided during the winter are often filled to capacity on busy days, and any efforts to expand ice angling opportunities would need to address access.*
- b. Plowing and parking improvements – *Look for opportunities to improve plowing/parking areas. Possibly consider changes such as providing lots for vehicle with no trailers to provide more parking space. Look for other ways to provide the best possible service with our plowing efforts.*
- c. Explore opportunities to increase facilities to support more ice fishing (parking, restrooms, trash, etc.) - *Look for opportunities to increase parking areas such as*

*development of the proposed Chicken Creek East boat ramp and parking area. If currently proposed developments (or others) that provide winter access come to fruition, look for opportunities to provide ice angler parking areas in conjunction with their efforts. Any expansion of parking/access would obviously need to address other facilities such as restroom and trash services.*

- d. Promote opportunities through advertising and events – *Recent public ice angling events have met with tremendous success, and similar events that promote the sport to the new angler should be explored.*
  - e. Explore funding opportunities for above - *Annually the UDWR is obligated to compete for funding to help pay for snow removal efforts at angler parking areas. This funding is in jeopardy of not being funded on any given year. If this funding were to not get approved for any reason, ice angling opportunities would be severely limited at Strawberry Reservoir. Managers should always be looking for additional opportunities to help fund, and continue, this vital service.*
- e.i.3. Explore potential for increasing fishing opportunities on Strawberry tributaries – *Opportunities to fish the tributaries to Strawberry Reservoir have been much more limited than they were prior to the 1990 treatment. Spawning closures, catch and release restrictions, and special gear restrictions have been used to protect spawning and rearing of naturally produced fish in the tributaries. And though many of these goals are still relevant (see Goal 4), managers should explore the potential to promote and expand fishing opportunities on the tributaries.*

#### Strategies

- a. Stream restoration/improve fishery – See Goal 4
  - b. Promotion – *Promote current and future opportunities for fishing the tributaries. Provide information to anglers through a variety of means (e.g. trailhead signs, maps, etc.).*
  - c. Explore the potential for loosening regulations – *In some instances it may be possible to allow more fishing opportunities on certain streams, or during certain seasons, when and where the impacts to spawning and recruitment will be minimal. Careful monitoring of potential additional impacts to spawning and recruitment should be incorporated into any loosening of the regulations on the tributaries.*
  - d. Monitor tributaries (fish populations and water quality) – *Continue careful monitoring of fish populations and water quality valley-wide. This information would provide the basis for ascertaining the possibilities of allowing more angling opportunities on the tributaries.*
4. Enhance non-angling opportunities – *Not all visitors who come to the Strawberry Valley are anglers. Through good education and information dissemination, non-anglers can also gain an appreciation for the fishery resources at Strawberry, and may potentially gain an interest in angling through these activities. With the connection of the UDWR fish trap facility to the USFS Visitors Center at Strawberry, there is a unique opportunity to connect many non-anglers to the area and resources.*

#### Strategies

- a. Fish viewing events – *Continue an emphasis on activities such as the Kokanee and cutthroat viewing days. Thousands of people come through the Visitors Center and fish trap each year to see the spawning fish. Other opportunities should also be explored to connect people at large with the resources. Providing online viewing opportunities should also be considered. It is imperative that a good relationship be fostered with the USFS, and that the facilities (such as the boardwalk and trap) are maintained to keep these valuable activities ongoing.*

- b. Educational tours – *Continue providing educational tours for a wide variety of people. Each year numerous tours/lectures on spawning and egg taking operations, stream restoration, natural resources and management, and fishing have been conducted for groups ranging from grade school children to US Senators and heads of Federal agencies. Such activities provide valuable information and education that help not only in promoting the resource at Strawberry Reservoir, but in a broader sense as well.*

Goal #4 - Improve natural reproduction of cutthroat trout and Kokanee salmon populations – *Promoting natural reproduction at Strawberry Reservoir has been one of the primary goals since prior to the 1990 treatment. The 1987 management plan for Strawberry identified some lofty goals of natural reproduction (10 million fry produced each year) that were difficult for managers to track the progress of. However, the general idea of enhancing natural reproduction remains a high priority, largely based on the data that on average 32% of the cutthroat and 41% of the kokanee in Strawberry have come from natural reproduction since 1993.*

Objectives

1. Increase average annual recruitment of Age I cutthroat trout to 150,000 fish per year within 10 years <sup>1</sup> – *Since the 1990 treatment, we have estimated that there have been nearly 110,000 age I cutthroat in the reservoir (based on population modeling from the fall gillnets) from natural recruitment. Efforts to promote stream spawning success are intended to increase spawning and recruitment potential, thereby justifying the goal to increase the average annual production.*

Strategies

- a. Research and mitigate pelican impacts – *Pelicans have been shown to limit spawning activity in many streams at Strawberry Reservoir, as well as impacting fish populations through direct predation. Research efforts are currently underway to help quantify these affects, and to help provide a baseline of data to explore opportunities to either control pelican populations at Strawberry, or provide ideas for additional mitigation measures. Efforts to mitigate and control pelican impacts need to be continued and expanded upon as needed, and as possible. Currently, continual hazing and limited physical barriers (string and flagging) where possible have been the most effective methods of deterring pelican activity on spawning tributaries. However, physical hazing is limited by its time consuming nature, and physical barriers have their inherent limitations as well. Other methods should continue to be explored.*
- b. Stream restoration – *Millions of dollars, and a considerable amount of effort, have been spent in attempts to rehabilitate degraded tributaries in the Strawberry Valley since 1990. It is impossible to determine how much affect many of the past efforts have had in increasing natural reproduction, but current efforts have a monitoring component included that should help quantify the effects of the restoration efforts. However, it does seem intuitive, and is backed by considerable research, that certain improvements to stream quality does have a positive impact on spawning and recruitment of fish. Efforts to improve stream quality for fish spawning and recruitment should be continued.*
- c. Improve/increase water flows – *Water is obviously one of the most limiting factors in fish populations. If options arise where water flow regimes can be improved they should be pursued. For instance, studies are currently being undertaken to find out why some valley streams dry up during late summer. Once dewatered reaches are identified and causes of water loss are found, measures to reverse these causes should be undertaken if feasible.*
- d. Promote stream spawning – *Managers should look for opportunities to promote stream spawning activity. For instance, allowing cutthroat to bypass the trap during spawning migrations, looking into imprinting strategies, and stocking the streams to promote natural*

- imprinting of stocked fish should all be considered. Continual monitoring and removal of fish migration barriers, such as beaver dams, is of obvious importance as well.*
- e. *Research potential of tributaries to produce fish (potential of each tributary) – Efforts should be taken to try and quantify the reproductive potential of the tributaries of the Strawberry Valley. This information would be critical in identifying limiting factors as well as the overall potential for natural reproduction.*
2. *Explore opportunities to expand kokanee salmon population and natural recruitment – Kokanee salmon currently do not comprise a large proportion of the sport fish species assemblage at Strawberry Reservoir based on numbers found in the creel (3% to 4% of the harvest in the creel). However, many anglers would like to see the kokanee program expanded at Strawberry. Not only do kokanee provide an important sport fish opportunity at Strawberry, but they also provide an extremely valuable watchable wildlife opportunity (see Goal 3, Objective 4).*

#### Strategies

- a. *Pursue lake spawning strains – Most of the past effort in establishing kokanee populations at Strawberry Reservoir have been focused on stream spawning fish, largely due to the difficulty in obtaining lake spawned eggs, and the difficulties in determining how much lake spawning takes place. Efforts should be pursued to obtain eggs from lake spawning fish at Flaming Gorge (or elsewhere) to try and establish populations of strains of kokanee that have a lake spawning propensity.*
- b. *Investigate/monitor lake spawning activity currently in place – In conjunction with efforts to establish lake spawning kokanee populations in Strawberry Reservoir, being able to determine the amount, and success, of lake spawning activity currently in place is also important. It is possible that considerable lake spawning occurs, or it could be possible that lake spawning will likely not be very successful in Strawberry Reservoir due to unforeseen variables. It is critical that we understand the potential, and the successes and failures, of such efforts to determine how much money and effort should be expended in their pursuit.*
- c. *Explore stocking strategies – Currently most of the kokanee stocked into Strawberry are stocked in late April or May, and they are stocked into the tributaries to promote returns to those tributaries. In recent years managers have stocked some of the kokanee directly into the reservoir in certain areas to try and promote lake spawning activity. In addition, some kokanee have been stocked in January as swim-up fry. The level of success of each of these varied methods and strategies has been difficult to quantify. Managers should look for ways to try and determine the successes and failures of various stocking strategies to try and maximize the returns on stocked kokanee.*
- d. *Annual reservoir monitoring – Currently, managers do not have an effective method of monitoring kokanee populations in Strawberry Reservoir. Gillnetting (even in the open water) has proven to be ineffective at following kokanee population trends. Recent research has indicated that hydroacoustics monitoring could prove to be an effective method of tracking kokanee population in Strawberry; however, a means of determining species composition (such as mid-water trawling) must also be conducted in conjunction with the hydroacoustics. The UDWR does not currently have access to a boat adequate to conduct mid-water trawling at Strawberry Reservoir, and this remains the main obstacle in being able to conduct these surveys.*
- e. *Stock more kokanee – Increasing the number of stocked kokanee into Strawberry Reservoir has the potential of increasing the overall population. However, determining the most effective strategies (see Goal 4, Objective 2, Strategy c.) is also crucial to the effectiveness of stocking more fish. Obviously, increasing stocking is limited to the hatchery production capabilities and funding available. Increasing stocking pounds for one species of fish at Strawberry will likely reduce the pounds stocked for another species. Kokanee currently comprise about 28% of the numbers of fish stocked into Strawberry Reservoir, yet they only*

*represent about 2% of the pounds stocked, largely due to the small size of the kokanee stocked. For these reasons, small changes in the pounds stocked could dramatically increase the numbers of kokanee stocked. Of course, a source for these eggs would also have to be available. Currently, the majority of the kokanee eggs stocked in Utah come from the spawning runs at Strawberry Reservoir, and the number of eggs taken from year to year are highly variable, making consideration of egg availability, and distribution, key factors in our ability to increase stocking numbers at Strawberry.*

- f. Promote the kokanee fishery at Strawberry Reservoir – *The kokanee fishery is often underutilized at Strawberry Reservoir, and anglers often need to know of the availability of a resource before they will utilize it. With the variable nature of kokanee fisheries, having current information explaining the current opportunities is important.*

<sup>1</sup> *Based on a three year moving average from data collected in the fall gillnetting at Strawberry Reservoir (gillnetting must remain consistent with past methods and effort)*

<sup>2</sup> *Based on the comprehensive year-long creel surveys conducted every five years at Strawberry Reservoir, combined with data from limited surveys conducted in the interim years (Thomas and Chamberlain, 2000).*

<sup>3</sup> *Utah Water Quality Standards(Utah Administrative Code R317-2):*  
<http://www.rules.utah.gov/publicat/code/r317/r317-002.htm>

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