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Fish of Bear Lake, Utah

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FISH

There are 13 species of fish found in the waters of Bear Lake. Of those 13, 4 are endemic (found only in Bear Lake). The 4 endemics species are Bonneville cisco, Bonneville whitefish, Bear Lake whitefish, and Bear Lake sculpin. Five of the remaining 9 fish species are native to the region, and 4 are exotic introductions. These native fishes are the Bonneville cutthroat trout, Utah sucker, redside shiner, speckled dace and Utah chub. The exotic fishes are lake trout, common carp, yellow perch and green sunfish.

Four other species of fish are found in tributaries of Bear Lake. These are exotic rainbow trout, exotic brook trout, native mountain whitefish, and native mottled sculpin. These fish have access to the lake at most times of the year, yet they are rarely documented in the lake by either researchers or fishermen. The majority of the fish in Bear Lake occupy benthic habitats, though almost all fish will enter the water column at various times. The one exception is the Bonneville cisco, which feeds in the open water pelagic region of the lakes and uses benthic habitats only during spawning.

Fishermen 2005
Photo from www.larrystark.com/FishingBearLake.jpg

ENDEMICS

One half of the species present in the whitefish genera Prosopium reside only in Bear Lake. They are P. abyssicola (Bear Lake whitefish), P. gemmifer (Bonneville cisco) and P. spilonotus (Bonneville whitefish). Geographic isolation has facilitated niche partitioning within the genus. Both whitefish are benthically oriented, while the cisco feeds and resides in the pelagic zone (Kennedy, 2005).

These endemic whitefishes have distinct life histories and feeding habits. Bonneville cisco feed mainly on zooplankton with diets mainly consisting of the Calanoid copepod, Epischura, Cladocera, and also Daphnia when it is present in the water column. Age-0 cisco will reach lengths of 2 inches during their first summer and reach maturity as 3 year olds when total body lengths exceed 7 inches. Older adults can attain lengths of 12 inches. Cisco are fed on extensively by piscivorous trout. Stomach contents of larger cutthroat and lake trout often consist entirely of cisco. (Wurtsbaugh and Hawkins, 1990; Ruzycki et al., 2001). Cisco are generally present in waters of less than 60°F. During summer these temperatures are present below the thermocline at depths of 50-80 feet (Luecke and Wurtsbaugh, 1993).

Bonneville Cisco *(Propium gemmiferum), Photo from aslo.org/photopost/data/508/8BLT05_Bear_Lake*

Estimates of Bonneville cisco abundance for the lake ranged from 1.9 million cisco in 1991 (Mazur and Beauchamp 1999) to 9.7 million in 2001 (Scott Tolentino personal communication). These abundance estimates, developed using hydroacoustic methodology (Luecke and Wurtsbaugh 1993), indicated that cisco were most abundant in mid-water depths in the eastern and southern regions of the

lake. High population variability is thought to be associated with the impact of water level fluctuations in the lake on cisco spawning success (Wurtsbaugh and Luecke, 1998).

Cisco spawn during the month of January in rocky-bottomed portions of the lake. Rock is often associated with the shallow margins of Bear Lake. Cisco spawning offers a unique angling experience; the fish are scooped out of the water through large holes in the ice by dip nets, when ice is not on the lake boats and waders allow access. Anglers consume some cisco but more use the fish as bait for trout.

The early life history of the Bonneville cisco is reasonably well-known (Bouwes 1995; Bouwes and Luecke 1997). Fertilized eggs deposited in January are subject to predation from a variety of egg predators. Bouwes and Luecke (1997) indicated that less than 5% of fertilized eggs survived to hatching. Age-0 cisco hatch from eggs deposited in early May. These larvae swim to the surface water and begin consuming small crustacean and ciliate zooplankton. Growth is rapid in the warmer, food-rich surface waters of the lake. Predation on eggs and larvae generally exceeds 99% of fertilized eggs and likely determines cohort success in this species (Bouwes, 1995).

Bear Lake and Bonneville whitefish are thought to have speciated from the more common Mountain whitefish (P. williamsoni) during the past 30,000 years (Kennedy, 2005). Mountain whitefish are found in the Bear River and some Bear Lake tributaries, but not in the lake itself. The spawning periods and depth distribution of these 2 closely related species are distinct and contribute to reproductive isolation (Albrecht, 2004; Kennedy, 2005). Spawning of Bonneville whitefish occurs in December on rocky shoreline areas and the Rock Pile near Gus Rich Point. Bear Lake whitefish spawn on the Pock Pile during February (Albrecht, 2004). No good estimate of Bonneville or Bear Lake whitefish has been made, but relative catch rates suggest that several million Bonneville and close to 1 million Bear Lake whitefish are present in the lake.

Bear Lake whitefish reside in the cold waters below the thermocline, where they feed primarily on ostracods (Thompson, 2003). The use of the less productive regions of the lake likely represents a trade off between slower growth in these deep waters, and lower predation risk. Kennedy (2005) indicated that predation rate on juvenile whitefish was 3 times greater in the mid-water depths (50-100 feet) compared to deeper depths (>130 feet). Reduced food quality and colder temperatures present at 130 feet deep (~40ºF year-round) lead to reduced growth rates and smaller lengths at maturity compared to Bonneville whitefish. Bear Lake whitefish have been ages to over 30 years with maximum lengths near 12 inches. They are rarely caught by fisherman and are not usually thought of as a gamefish.

Bonneville whitefish occupy the warmer and more productive mid and upper portions of the lake bottom and thus grow more rapidly and attain larger body lengths. Total body length can exceed 20 inches during their ~20-year life span (Thompson, 2003). Benefits of warmer temperatures and more food availability are offset by increased risk of predation from large trout. Bonneville whitefish demonstrate ontogenetic niche shifts when they reach lengths near 10 inches and become piscivorous (Mazur and Beauchamp, 1999) feeding on small fish of all species but especially sculpin. Fisherman occasionally capture these larger fish.

Bear Lake sculpin (Cottus extensus) are the only sculpin in the western United States that occupy deep water lake habitats. Bear Lake sculpin occupy the benthic regions of the lake where they feed on aquatic macro-invertebrates and zooplankton. They are small fish that rarely attain 4 inches in total body length. They are relatively long lived for a small fish with some aged at 8 years (Ruzycki and Wurtsbaugh, 1995). The population size of Bear Lake sculpin has been estimated at 1-2 million fish (Wurtsbaugh and Luecke, 1998).

Bear Lake sculpin reproduce in late spring with adults moving into shallow rocky areas. Males compete for nesting sites, which are comprised of the undersides of fist sized and larger rock. When males have established territories females circulate through the area looking for a suitable mate. Larger males tend to successfully

defend their breeding site and thus have the most access to females. Females lay adhesive eggs on the roof of the nest, which the males then fertilize. After mating, the females leave the nest site and males care for the young. This parental care includes protection of fertilized eggs from egg predators and cleaning of eggs from fungus and bacteria (Ruzycki et al., 1998). During the 4-6 week incubation males fan the eggs with their pectoral fin to remove waste and provide oxygen, during this time they are not believed to leave the nest even to feed.

Bear Lake Sculpin *(Cottus extensus) Photo from aslo.org/photopost/data/508/8BLT05_Bear_Lake*

The fertilized eggs of Bear Lake sculpin hatch in late May and early June and larval sculpin move to the surface waters where water currents can disperse them around the lake. Soon after dispersal juvenile Bear Lake sculpin begin a diel pattern of vertical migration. These age-0 individuals leave the bottom of the lake at night and ascend up to 130 feet into the water column. This behavior allows these juvenile fishes to occupy warmer water and thereby increase growth rates (Neverman and Wurtsbaugh, 1994).

Bear Lake sculpin are an important food resource for cutthroat and lake trout. Greater than 70% of the diet of intermediate aged lake trout are composed of sculpin. The percent of sculpin in diets of older lake trout decline to 20% (Ruzycki and Wurtsbaugh, 1995). Intermediate ages of cutthroat, 10-14 inches in total length, used Bear Lake sculpin as their major prey source throughout winter and spring months (Wurtsbaugh and Hawkins, 1990). Wurtsbaugh and Luecke (1998) found that predators could consume a substantive portion of the annual Bear Lake sculpin production.

Fluctuating water levels likely affect sculpin populations. Spawning habitat is limited to the ring of rock habitats associated with high water elevations. When water levels are lowered there is increasingly less habitat available for Bear Lake sculpin spawning (Albrecht, 2004). Water levels in the spring of 2005 were down 24 ft. from full pool, these reductions reduced available spawning habitat to less that 5% of total potential (Albrecht, 2004). In low water years, high predation pressure and limited spawning habitat can reduce abundance of Bear Lake sculpin in the lake. A computer simulation model indicated that increased lake trout stocking posed a greater potential threat to Bear Lake sculpin than any other fish species in the lake during these periods of low water (Albrecht, 2004). The Utah Division of Wildlife Resources has reduced stocking of lake trout in response to concerns about prey fish abundance.

NON-ENDEMICS

The Bear Lake strain of the Bonneville cutthroat trout (Onchorhyncus clarki) plays an important role as a population center for this species of conservation concern. Genetically pure lake strains of Bonneville cutthroat are not believed to be found anywhere within their historic range except Bear Lake (Utah Outdoors, 1999). A spawning trap has been established on Swan Creek to capture spawning Bonneville cutthroat each spring. Cutthroats entering the trap are stripped of eggs or milt, and combined to fertilize eggs. These eggs are taken to hatcheries to be raised. Most of the reared young are returned to the Bear Lake, but others are used to replenish other natal populations and are stocked out of their natural range as sport fish.

An estimated 31,000 Bonneville cutthroat (Ruzycki et al., 2001) were present in the lake in 1995. Populations of Bonneville cutthroat were in decline due to dewatering of spawning habitat and increased human exploitation. Conservation efforts by Utah Division of Wildlife Resources, Idaho Fish and Game, and U.S. Fish and Wildlife Services have reinvigorated the species and populations have been on the rise for

over a decade (USFWS, 2001). Regulation is in place to protect the native fish and only allows harvest of marked hatchery raised fish. A limit of 2 total Bonneville cutthroats has been instrumental in increasing population levels.

Distribution of Bonneville cutthroat varies by season. Larger fish (>14 inches) are most often located in cooler waters, except during their spring spawning season. Smaller Bonneville cutthroat are associated with warmer temperatures when available (Wurtsbaugh and Hawkins, 1990). Bonneville cutthroat exhibit food preference shifts as they mature, starting with macro invertebrates, zooplankton and terrestrial insects they shift to Bear Lake sculpin and other small fishes, eventually graduating to a diet of primarily Bonneville cisco.

Bonneville Cutthroat *(Onchorhyncus clarki) Photo from:http://en.wikipedia.org/wiki/Image:Bonneville_cutthroat.jpg*

NATIVE NON-GAME

Four species of native non-game species occupy Bear Lake, Utah Sucker (Catostomus ardens), speckled dace (Rhinichthys osculus), redside shiner (Richardsonius balteatus) and Utah chub (Gila atraria). Chub and suckers occupy benthic habitats. They have sub-terminal mouths designed for feeding on the bottom of the lake. The suckers occupy most depths in the lake where they feed on benthic invertebrates and detritus. The chub are restricted to shallow waters,

usually less than 33 feet, and are often found to have plant matter in their guts along with benthic invertebrates (Wurtsbaugh and Hawkins, 1990).

Utah chub and suckers rarely turn up in the stomach of cutthroat or lake trout. The shallow dwelling practices of their young place them in habitats that are to warm for cold-water predators like trout. Suckers spawn in May and June on very shallow (< 3 feet deep) rock shores (Sigler and Sigler, 1987). Sucker eggs are preyed upon by sculpin and whitefish and are an important seasonal component of their diets. Little is know about chub reproduction in Bear Lake. Neither fish is considered a game fish (Sigler and Sigler, 1987).

Dace and shiners are small, “minnow” type fish that occupy shallow waters and are often associated with habitats provided by rocks and plants. Largest numbers are found near the Utah State Park marina and at shallow weed beds. Both species prey on invertebrates and zooplankton. Neither species is classed as a game fish, but could play a minor role as prey for trout and large whitefish. Humans do not pursue dace and shiners (Sigler and Sigler, 1987).

INTRODUCED

Lake trout (Salvelinus namaycush) are native to the eastern United States, Canada and Alaska. They are a large piscivorous fish that can grow to weights over 70 pounds. They were introduced into Bear Lake in 1911 to increase sport-fishing opportunities and their population has been supplemented by intermittently stocking (Ruzycki, 2001). Lake trout weighing over 30 pounds are rare in Bear Lake due to low productivity. An extensive (1992-1994) population study by Ruzycki et al. (2001) estimated that there were 16,000 Lake trout age 4 and older in Bear Lake.

Stocking of fertile lake trout was greatly reduced after 1990 because of concern for native fishes that served as prey to their predators (Wurtsbaug and Luecke, 1993). Recently Lake trout stocking efforts have been reinitiated through the stocking of sterile triploid stock. These sterile Lake trout may grow faster in that energy used in

reproduction will be shifted to growth, allow better control of population levels and increase Lake trout growth, as no energy will be used for gamete production (Oppedal et al, 2003).

Lake Trout (S*alvelinus namaycush)*

Photo: from www.ittiofauna.org

Lake trout in Bear Lake feed on benthic and terrestrial invertebrates until they are large enough to switch to Bear Lake sculpin, which they consume exclusively until about age 4 when they become large enough to consume Bonneville cisco (Albrecht, 2004). Lake trout can live to ages of over 20 years and grow to lengths greater than 40 inches. Fishermen often exclusively target this game fish from shore and in boats.

Some researchers Ruzycki (2001), Wurtsbaugh and Hawkins (1990), Mazur and Beauchamp (1999), and Wurtsbaugh and Luecke (1998)) have speculated that Lake trout presence may reduce Bonneville cutthroat populations as they compete for limited resources. Albrecht et al. (2004) conducted a computer modeling study to analyze the effects of the stocking of sterile lake trout. Findings of field and computer studies suggest that lake trout and cutthroat trout likely compete for food resources that are limiting to the growth of these predators.

Three other species of fish have intentionally or accidentally been introduced into Bear Lake waters, where they survive in low numbers. They include green sunfish (Lepomus cyanellus), yellow perch (Perca flavescens) and the common carp (Cyprinus carpio). All 3 species can become nuisance invaders and have done so in other water bodies of the west. In Bear Lake these 3 fish have failed to thrive. Sunfish and perch populations are likely limited by a lack of suitable spawning sites, by low productivity, cool temperatures and predators. Carp numbers are kept low by cold water and lack of spawning habitat (UDWR, 2003).

Anglers fishing for trout or whitefish occasionally catch perch, but reports of this are not common. Sunfish are not reported to reach catchable lengths in Bear Lake and carp are not usually fished for in Bear Lake. Figure 12 shows a simplified food web as it can be represented in Bear Lake.

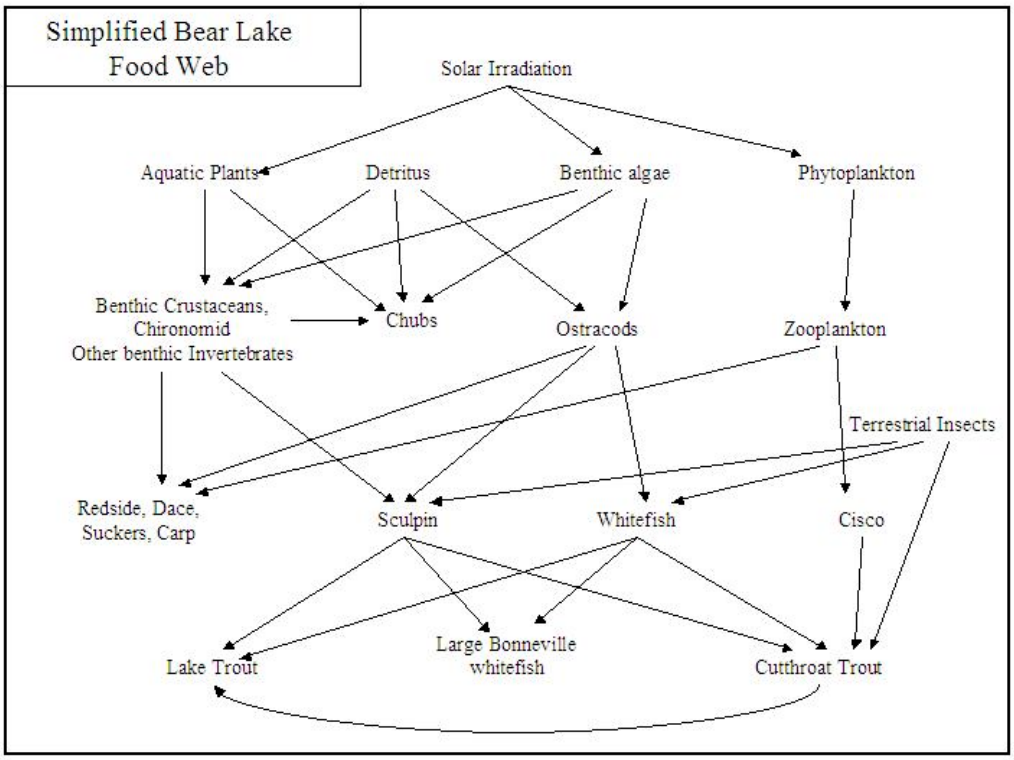

Figure 12: Simplified Bear Lake Food Web.