State of California
Department of Fish and Wildlife

M e m o r a n d u m

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Subject: Lahontan Cutthroat Trout Tagging at American River Hatchery

The California Department of Fish and Wildlife (Department) plants two strains of Lahontan cutthroat trout (LCT; *Oncorhynchus clarkii henshawi*), Pilot Peak strain (LCT-PP) and Independence Lake strain (LCT-I). LCT-I fish originate from the Department's broodstock population at Heenan Lake, Alpine County. The US Fish and Wildlife Service provide LCT-PP eggs to the Department from broodstock at Lahontan National Fish Hatchery Complex, Nevada. All LCT are reared at American River Hatchery (ARH) to sub-catchable size (approximately 6 - 9 inches [in]) and out-planted annually to destination waters in May or June.

In an effort to better understand the growth, survival, and return to creel of planted LCT, the Department chose two study waters managed as stocked LCT fisheries, tagged LCT prior to planting, and attempted to follow the tagged fish via direct creel and voluntary angler surveys. Echo Lake, El Dorado County, and Webber Lake, Sierra County were selected because they receive plants of both strains of LCT and have single access points where creel surveys could be implemented efficiently. On May 23, 2018, approximately 1,000 tagged LCT-PP and 1,000 tagged LCT-I were planted into Webber Lake at the boat ramp. Fish were observed dispersing from the release site. One mortality was observed after release. On May 29, 2018, approximately 1,998 tagged LCT-PP and 2,000 tagged LCT-I were planted into Echo Lake at the Echo Lake Marina. Released fish were seen dispersing from the release site with no observed mortalities.

This memorandum addresses the tagging effort, which is one portion of a larger project including community outreach, voluntary angler surveys, and creel surveys at Echo Lake, El Dorado County, and Webber Lake, Sierra County. The information will help inform the Department's recreational stocking allotments of LCT.

Methods

Fish were collected from a tank or raceway at ARH using decontaminated dip nets and placed in a tray filled with water treated with sodium bicarbonate. Fish remained in the treated water for a few minutes until the fish relaxed and were easier to handle. Once calm, the fish were held in-hand and a Floy t-bar tag was inserted, near the base of the dorsal fin and between the pterygiophores, using Avery tagging guns (Figures 1 and 2). The tagged fish was then weighed to the nearest gram (g) and total length was measured to the nearest millimeter (mm). After processing was complete, the fish was placed in a recovery bucket with cold, fresh water. Once the fish had recovered from the sodium bicarbonate, it was moved into an aerated holding tank or hatchery raceway where they were held until planted into the destination water. To reduce handling stress to the fish, staff wore cotton gloves and all surfaces and gear in contact with fish were sprayed regularly with Vidalife^{tm} solution.

Figure 1: Department staff inserting a t-bar tag near the dorsal fin of an LCT using an Avery tagging gun (Mamola 2018).

Tagging Results

In total, 6,152 LCT were tagged. Of those tagged fish, 56 (0.9%) died throughout the week's effort from improperly inserted tags. In addition, 10 tags were shed and recovered from the raceway. LCT-PP comprised 2,997 (48.7%) of the fish tagged while 3,155 (51.3%) fish were LCT-I. Fish ranged in total length from 96 mm (3.8 in) to 329 mm (12.9 in), but approximately 83.5% (n=5137) of the fish were between 180 and 230 mm total length (7 to 9 in) (Figure 3). Fish ranged in weight from 15g to 237g. Fish ranged in 'age-since-hatch' from 224 days to 344 days. LCT-I were younger with age ranges from 224 to 227 days, while LCT-PP ages ranged from 340 days to 344 days.

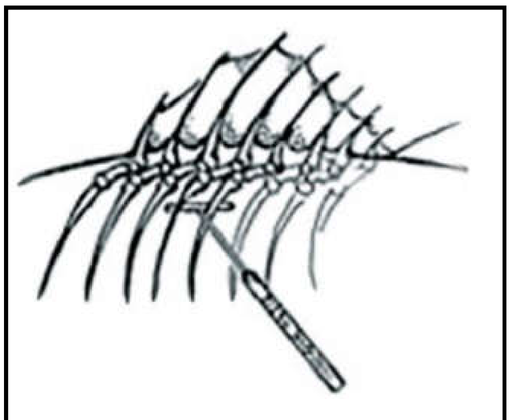

Figure 2: Diagram demonstrating the insertion point of a t-bar tag between pterygiophores (Persons et al. 2013).

Length-Weight Analysis

Fish condition was calculated as relative weight (W_r) using the standard weight (W_s) equations for lentic LCT proposed by Anderson and Neumann (1996). Mean W_r plotted by size class (Figure 3) suggest that LCT-I greater than 210 mm total length (8.3 in) are able to put on more weight than similarly sized LCT-PP in a hatchery setting despite being upwards of 120 days younger. In contrast, LCT-PP less than 190 mm total length (7.5 in) were more robust than similarly sized LCT-I, but again, the LCT-I are significantly younger. This measured difference in condition was noticeable to the naked eye by the handling biologists.

The difference in condition between the two strains of fish is further reinforced by modeling fish weight as a function of total length. Figures 4 and 5 display linear regression relationships of logarithmically transformed length-weight data of LCT-PP and LCT-I, respectively. The slope of these equations suggest something about the body shape of a fish as length increases. In general, slopes less than 3.0 represent fish that are less rotund as length increases while slopes greater than 3.0 indicate a fish whose body shape becomes more rotund as length increases (Anderson and Neumann 1996). The slope of the length-weight model for LCT-PP is 3.1218 while the LCT-I model has a steeper slope of 3.3373. The flatter slope of the LCT-PP model suggests they may be slower to put on weight than similarly sized LCT-I in a hatchery setting.

However, the underlying cause of the observed differences in condition between the two strains may be due to variability in rearing conditions and disease outbreak between tanks of fish and not due to genetically driven differences in growth rates or fitness. For example, both strains of fish experienced significant die-offs in the hatchery during the rearing period and, although both strains are reared at ARH, they are held in different tanks and each tank *can* be exposed to a different set of stressors and conditions.

Irrespective of the reason for differences in W_r between the strains, higher W_r may reflect a difference in fitness and survival once planted into destination waters. In wild populations of other fish species, W_r has been positively correlated to fat reserves, incremental growth rates, and fecundity (Anderson and Neumann 1996). This theory may be testable by means of this work if a sufficient number of tags are returned in future seasons.

Literature Cited

Persons, W.R., Ward, D.L, and Avery, L. A., 2013, Standardized methods for Grand Canyon fisheries research 2015 (ver. 1.1, January 2015), U.S. Geological Survey, Techniques and Methods, book 2, chapter A12, 19 p.

Anderson, R.O. and R.M. Neumann. 1996. Length, weight and associated structural indices. Pages 447–482 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

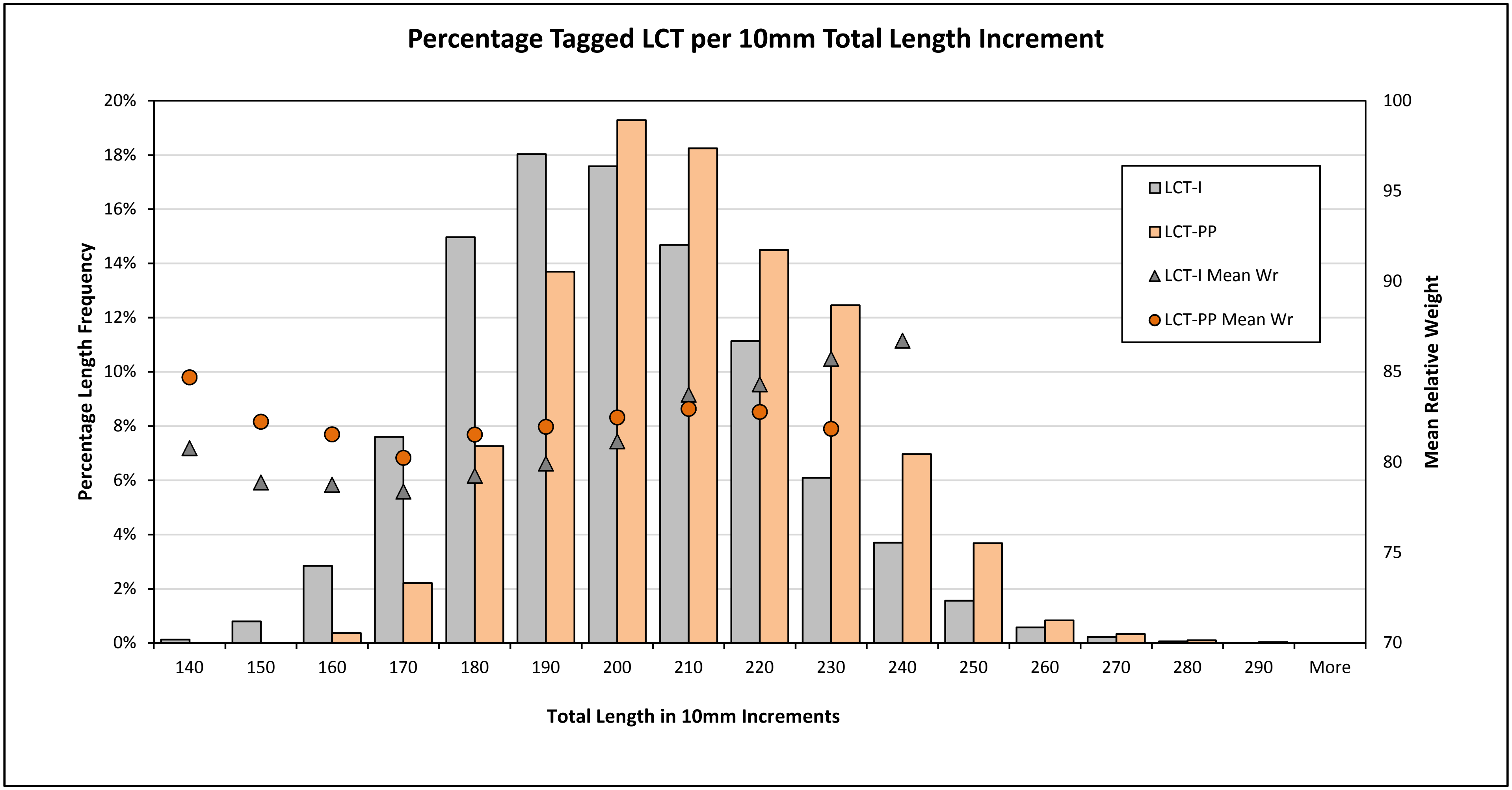

Figure 3: Percentage of total LCT tagged and mean W_r (condition) per 10 mm total length of LCT-PP (orange bars and circles) and LCT-I (gray bars and triangles) reared at American River Hatchery and handled for the purposes of t-bar tagging from May 14 through May 18, 2018.

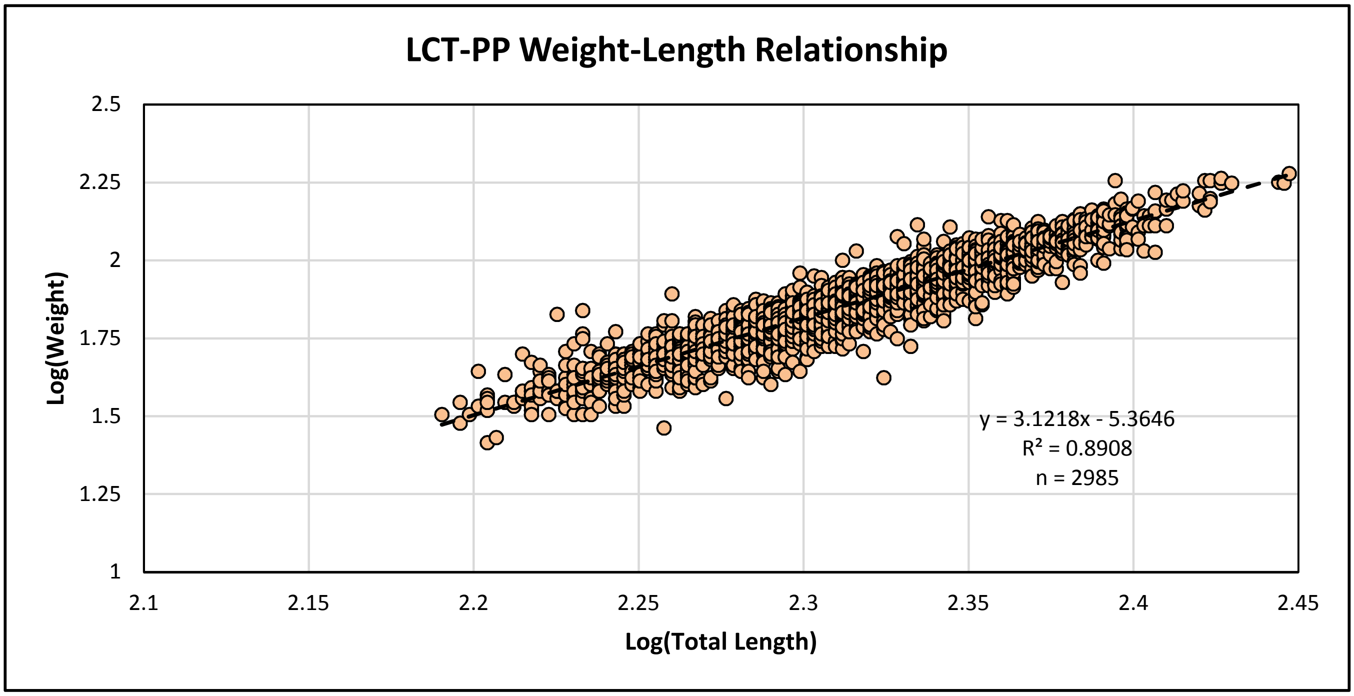

Figure 4: Length-weight relationship of LCT-PP reared at American River Hatchery and handled for the purposes of t-bar tagging from May 14 through May 18, 2018.

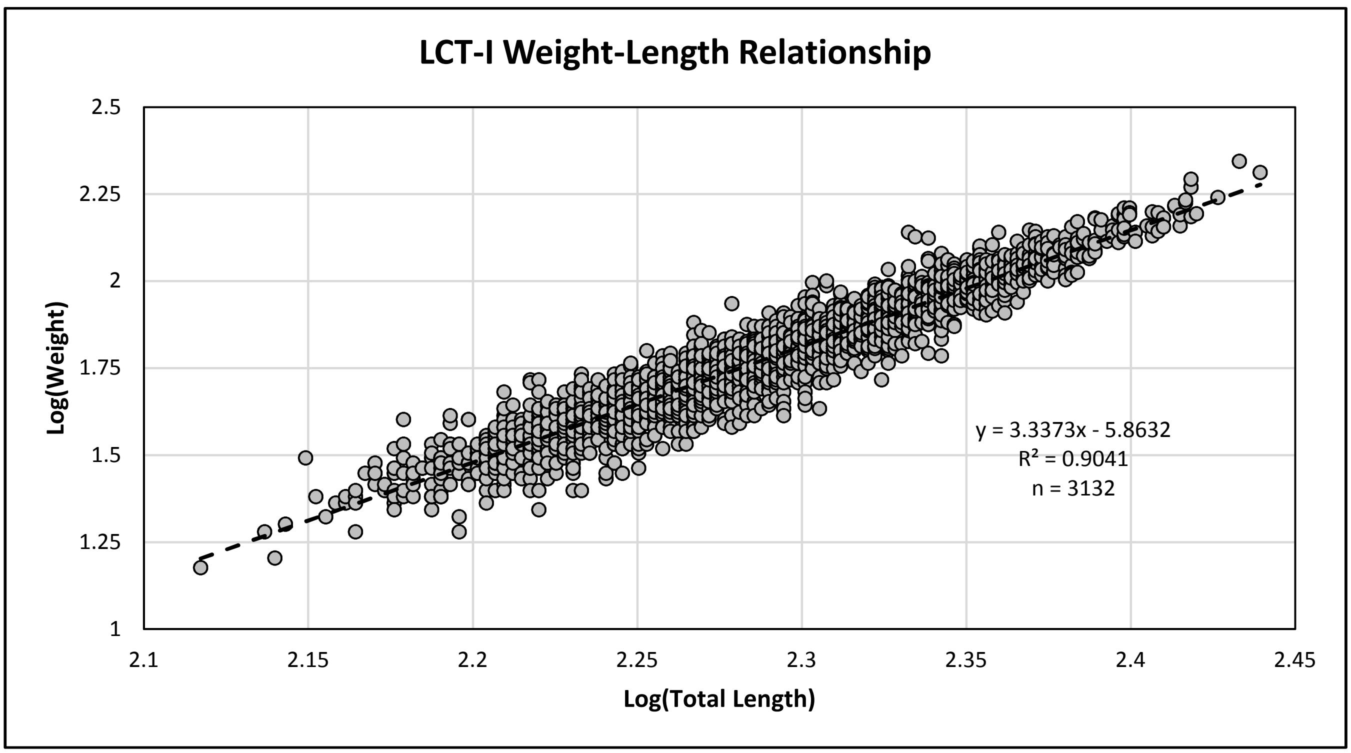

Figure 5: Length-weight relationship of LCT-I reared at American River Hatchery and handled for the purposes of t-bar tagging from May 14 through May 18, 2018.