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NOTES ON A HYBRIDIZATION EXPERIMENT BETWEEN RAINBOW AND GOLDEN TROUT

In an earlier note (Gold, Pipkin, and Gall 1976), we presented the results of a fortuitous hybridization experiment between a rainbow trout, *Salmo gairdneri,* female and a golden trout *Salmo aguabonita* male. The hatch and developmental data from that cross were limited, but supported field observations that hybridization between the two species could occur with ease (Dill 1950; Schreck and Behnke 1971; Gold and Gall 1975). This note is a follow-up on that cross.

By 7 May 1975, only one of the six RT x GT hybrid fingerlings remained alive, the rest having succumbed to *Chondrococcus columnaris* infection or gill disease. On 31 December 1976, the survivor, a 2-year-old female, was stripped of

641 normal-sized eggs. These were divided into four lots of roughly 160 eggs each and fertilized with the sperm of four 2-year-old males from the domesticated rainbow trout strain RTD (Gall 1975). The males were 3 months past their spawning peak, but when examined had numerous motile sperm. No golden trout males were available for the complementary backcross. The four lots of fertilized eggs were water hardened and incubated in separate chambers of a Heath-Tecna incubator. Water temperatures during incubation ranged from 9–13 C (median = 11 C). At this temperature, RTD eggs normally eye-up within 13 days and hatch within 29 days (Gall and Pipkin, unpublished data).

None of the backcross embryos developed normally. After 17 days, roughly 80% of the eggs showed no indication of embryonic development. The remainder displayed a single, large, dark spot (not a true "eye") accompanied by several hemorrhagic streaks. Some of these "spots" grew larger, but by 6 February none of the embryos had hatched. On 15 February all embryos had ceased development and were discarded. A systems failure at the Davis hatchery on 16 June 1976 resulted in the death of the hybrid female.

Meristic and morphometric data from the hybrid are compared with mean values for rainbow and golden trout from our unpublished data (Table 1). Hybrid indices computed after Hubbs and Juronuma (1942) were intermediate (.16–.83) for 8 of 27 characteristics.

Life colors of the hybrid were more or less typical of *S. aguabonita* (Evermann 1905), although much less pronounced. Parr-type marks, typical of adult *S. aguabonita* but not adult *S. gairdneri*, were not present. The dorsal, caudal, and adipose fins were moderately spotted, but the body was almost immaculate (Figure 1). Approximately 20–25 small spots, crescent-shaped and diffuse as in *S. gairdneri,* were present on the dorsal region of the caudal peduncle, posterior to the adipose fin. The parents of the hybrid, *S. gairdneri* (♀) and *S. aguabonita* (♂), were heavily and moderately spotted, respectively. The paucity of spots on the body of the hybrid was suggestive of the pattern typical of the Paiute cutthroat trout (Ryan and Nicola 1976).

Data indicative of interspecific hybridization among western trouts are abundant, and have stemmed by-in-large from field studies where one species was introduced (by man) into waters occupied by a second species (e.g. Schreck and Behnke 1971; Behnke 1972; Gold and Gall 1975). As a result, it has been generally assumed that reproductive isolating mechanisms among most western trouts are less than complete, and that forced sympatry will usually result in introgressive hybridization. The sympatric coastal cutthroat, *S. clarki clarki,* and anadromous rainbow trout, *S gairdneri,* are among the few cited exceptions (Behnke 1972). Miller (1972), however, has pointed out that there is little if any experimental data on western trouts regarding mating discrimination or fertility of hybrids.

The failure to obtain backcross progeny from the RT x GT hybrid female may reflect a barrier to hybridization between the two species. The experimental conditions under which the backcross was made were far superior to those of the original parental cross, and there was partial embryogenesis in about 20% of the fertilized eggs. It is conceivable that "hybrid breakdown" (Dobzhansky 1970) was the cause of embryonic mortality, and that reproductive isolating

TABLE 1. Morphological Data † of RT x GT Hybrid, *Salmo gairdneri*, and *Salmo aguabonita*

Character	*Hybrid* (*n = 1*)	*Salmo gairdneri* (*n = 20*)	*Salmo aguabonita* (*n = 32*)
Standard length, cm	26.9	21.4	10.4
Pyloric caecae	43*	59.6	33.3
Dorsal fin rays	11	12.3	12.1
Anal fin rays	11*	11.3	10.7
Pectoral fin rays	16	14.6	15.7
Pelvic fin rays	9	10.1	9.0
Branchiostegal rays (total)	22	22.0	23.9
Gill rakers (left)	18	18.8	19.9
Vertebrae	62*	62.5	60.0
Scales, lateral line	123	121.5	117.3
Scales, lateral series	154*	135.8	183.0
Scales above lateral line	30	–	–
Scales below lateral line	31	–	–
Interneural bones	13	–	–
Interhaemal bones	13	–	–
Thousands of standard length			
Body depth	264*	268	248
Head length	233	235	289
Head width	145	126	134
Least interorbit	70	75	74
Occiput to snout length	167	177	209
Maxilla length	93*	87	125
Caudal peduncle length	146	164	148
Caudal peduncle depth	113	104	101
Predorsal length	470	509	536
Preanal length	751	782	773
Prepectoral length	265	219	252
Prepelvic length	544	558	560
Dorsal, base length	141	139	140
Anal, base length	116	91	101
Pectoral length	163*	127	181
Pelvic length	138*	103	145
Eye diameter	43	45	71

* Values intermediate between means of parental species (cf. text)
† Data for *S. gairdneri* and *S. aguabonita* represent sample means ($\bar{X}$).

mechanisms among western trouts are more complete than presently believed. Busack (1977), for example, has recently presented evidence of two closely related inland cutthroat trout forms which coexist sympatrically without apparent gene exchange. The introgression frequently observed among western trouts in nature may indicate the well-known relationship between hybridization and habitat disruption (Anderson 1949).

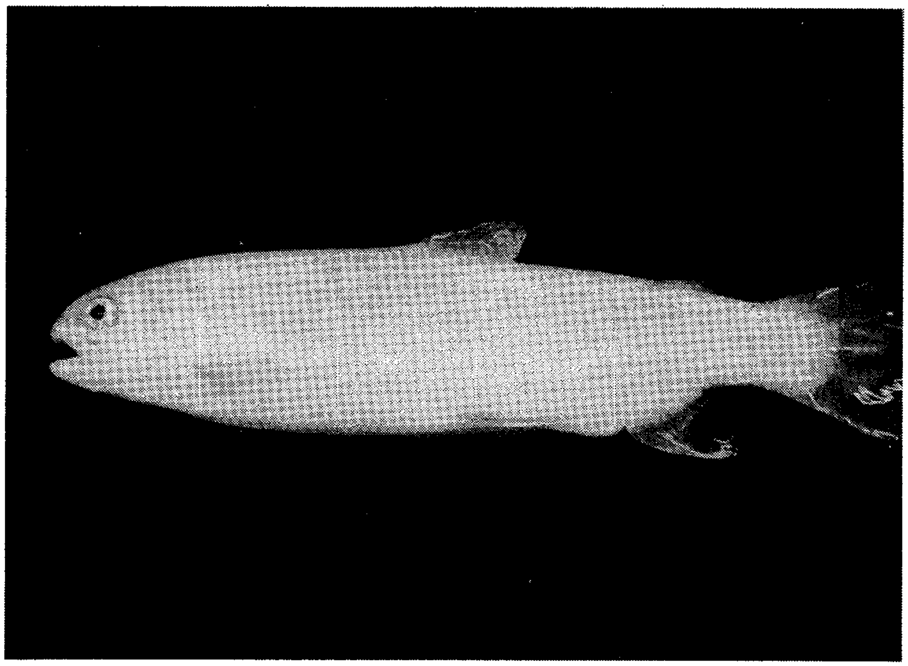

Figure 1. Lateral view of female *Salmo gairdneri* x *Salmo aguabonita* hybrid.

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