DARTER HYBRIDS FOR HOME AQUARIA

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While many native fish species have attractive color patterns, even more attractive colors are possible through production of interspecific hybrids. Successful hybrids have increased size, vigor, and health, as well as more vivid color patterns, when compared with their parental species. All of these attributes can enhance home aquaria.

Existence of naturally produced hybrids is a well known occurrence in North American fresh waters. Nevertheless, even in western states, where natural hybridization is relatively most common, hybrid occurrence at most localities is sporadic and unpredictable. Consequently, the home aquarist is unlikely to obtain field-captured hybrids. In contrast, laboratory production of hybrids is a relatively simple procedure. In many instances, the mere isolation of a reproductive female of one species with a ripe male of another will result in a brood of vigorous hybrids. If this procedure does not work, a little experience will provide success with artificial hybrid production. Careful removal and mixing of eggs and sperm generally results in production of hybrid eggs that can be reared. Careful selection of the female is most critical, as ripe eggs will be extruded with minimal pressure (in effect merely stroking the abdomen), and undue pressure should be avoided. Stripping eggs that are almost ripe will only injure the female, whereas ripe eggs will be produced by that female in a few hours or days under normal circumstances. Visible milt is virtual assurance that viable sperm are available. (Experienced workers can remove and macerate testes to enhance fertilizations, but that action, like the vigorous stripping of females, is lethal.)

Hybridization studies have focused on darters for biological reasons; aesthetics could provide a secondary rationale. Although many darter hybrids seem to be sterile (especially the males), they exhibit striking sexual dichromatism. Hybrid females are like parental-species adult females and have cryptic colors --i.e., they tend to be drab. Hybrid males are quite the opposite. Superficially they seem to have a combination of the parental male color patterns. For example, breeding male Greenthroat Darters (Etheostoma lepidum) have dark and dark-red alternating bands, and in breeding male Orangethroat Darters (Etheostoma spectabile) those bands are dark and orange. Adult hybrids have alternating orange and red bands. Similar, apparently additive colors prevail on fins and the venter. The colors are substantially more spectacular than those of either parental species. Certainly, they are colorful fish for the home aquarium. In this instance, the females are fertile (males are sterile) and it is possible to obtain hybrids with males of other darters. Backcross hybrids do not have the enhanced coloration of F_1 hybrids, and in general

adult backcross hybrid males are more drab than the parental species. We were able to follow a natural hybrid occurrence in this instance because we had previously produced the hybrids experimentally.

The Guadalupe River naturally is inhabited by Greenthroat Darters upstream (in or near constant-temperature springs) and Orangethroat Darters abound downstream where water temperatures fluctuate substantially. A heavy rain prevailed on Guadalupe River watershed in 1961, causing a rapid rise. The river depth increased more than ten meters in less than an hour. Obviously, the fish populations were decimated after the flood; however, in a locality below a small dam, several Greenthroat Darters were found. This locality had been previously sampled more than 20 times without finding any Greenthroat Darters. It seemed likely that many had been washed downstream by the flood and were unable to go farther upstream because of the dam. Under any circumstance, the Greenthroat Darters were concentrated in the riffle immediately downstream from the dam.

During the following year, a large number of hybrids were obtained from this riffle. Hybrid males had no visible milt, and eggs "fertilized" by them did not develop. Like the laboratory hybrids, they showed all signs of being sterile. They did have the size and breeding colors expected of hybrid individuals. They were collected from localities subjectively assumed to be prime breeding territories. The seine hauls with hybrid males had numerous large, ripe females. Presumably the hybrid males "enticed" prime females to "spawn" with them, but this process was without fruition. The following year, several hybrids were obtained along with backcross hybrids with Orangethroat Darters and numerous Greenthroats. Again, males were sterile, and the female hybrids had viable eggs. No backcrosses with Greenthroat Darters were obtained, in large part because the parental species was no longer collected there by the second year after the flood. It is amply evident that those artificial hybrids paralleled natural hybrids in all attributes.

The production of laboratory hybrids is relatively simple. We have made a number of crosses among the darters. One must insure that sperm contamination or other phenomena such as gynogenesis (exclusive maternal inheritance) are not involved, as the goal is to obtain hybrids. Crosses of darters with sunfish, minnows, etc. have met with no real success; however, our data show clearly that darters can be crossed with Walleyes. This cross illustrates the facility with which darter hybrids can occur. Obviously a cross between a Walleye (ca. 500 mm) and a darter (ca. 50 mm) is an unlikely natural event, as predation, not sex, is the likely stimulus. It is our conclusion that any darter hybrid combination can be produced. A summary of our results illustrates this point. We have attempted to rear 26 species of darters by the same methods we have used to rear hybrids (artificial stripping and rearing in enamel pans, utilizing freshly hatched brine shrimp as the primary food). Sixteen of

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Figure 1 Success of darter hybridization experiments. S= hybrids reared to juvenile stage (using criteria established in Texas Memorial Museum Bulletin 13 "Geographic variations in survival of hybrids between etheostomatine fishes"), F= tests in which no eggs survived to juvenile stage. A dash indicated crosses not attempted in our laboratory. Female parent on left, male parent listed on upper row. Five additional experiments indicated by footnotes (R= both reciprocals raised).

	PERCINA									ETHEOSTOMA																
	SCIERA	NIGROFASCIATA	PHOXOCEPHALA	EVIDES	SHUMARDI	COPELANDI	CAPRODES	MACROLEPIDA	AMMOCRYPTA VIVAX	NIGRUM	CHLOROSOMUM	STIGMAEUM	TETRAZONA	EUZONA	ZONALE	BLENNIOIDES	NIANGUAE	JULIAE	PUNCTULATUM	ASPRIGENE	RADIOSUM	CAERULEUM	SPECTABILE	GRAHAMI	LEPIDUM	FLABELLARE	GRACILE	PROELIARE	FONTICOLA	MICROPERCA
	A	B	C	D	E	F	G	H	I	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
A	(S)	-	-	-	S	F	S	-	-	-	S	-	S	-	F	-	S	-	S	S	S	S	S	S	S	-	-	S	S	S
B	F	(F)	-	-	-	-	-	-	F	-	-	F	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-
C	S	-	(F)	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-	-	S	-	-	-	-	-	-	-	-
D	F	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-
E	S	-	-	-	(S)	-	S	-	-	-	S	-	-	S	-	-	-	-	S	S	S	S	S	-	S	-	S	-	S	-
F	-	-	-	-	-	(F)	-	-	-	-	-	-	-	-	-	-	-	S	-	S	-	-	S	-	-	-	-	-	-	-
G	S	F	-	-	S	F	(S)	S	S	-	S	-	S	F	F	S	-	-	S	S	S	S	S	S	S	S	-	-	S	-
H	S	-	-	-	S	-	S	(S)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	S	-	-	-	-	-
I	-	-	-	-	-	-	-	-	(F)	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	-	-	-	-
A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	S	-	S	-	-	-	S	-	-	-	-	-
B	S	-	-	-	F	-	F	-	-	S	(S)	-	-	-	-	-	-	-	S	S	S	-	S	-	S	-	S	-	-	-
C	-	F	-	-	-	-	-	-	-	S	-	(F)	-	F	F	S	-	S	-	-	-	S	S	-	F	-	-	-	-	-*
D	-	-	-	-	-	-	S	-	-	-	-	F	(S)	S	S	S	-	S	S	-	S	S	S	-	S	S	-	-	-	-
E	-	-	-	-	-	-	-	-	-	-	-	-	-	(F)	-	-	-	-	F	-	-	S	-	-	S	-	-	-	-	-
F	-	F	-	-	-	S	S	-	-	S	-	S	S	F	(S)	S	F	-	S	-	S	S	S	-	S	S	-	-	-	-
G	-	-	-	-	-	-	S	-	-	S	S	S	S	-	S	(S)	-	-	S	-	-	S	S	-	S	S	-	-	-	-
H	-	-	-	-	-	-	S	-	-	-	-	-	-	-	F	S	(F)	-	-	-	-	-	-	-	-	-	-	-	-	-
I	-	-	-	-	-	-	F	-	-	-	-	-	S	-	F	-	-	(S)	S	-	-	S	S	-	S	-	-	-	-	-
J	-	-	-	-	-	-	-	-	-	-	-	-	S	-	S	S	-	F	(S)	-	-	S	S	-	S	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	S	-	-	-	-	S	S	S	-	-	-	S	-	-	-
L	S	-	-	-	S	S	S	S	S	S	S	F	S	S	S	S	-	S	S	-	(S)	S	S	-	S	-	S	F	-	S**
M	S	S	-	-	S	-	S	-	S	-	S	-	S	S	S	S	S	S	S	-	S	(S)	S	-	S	S	-	-	F	S
N	S	S	-	-	S	S	S	S	-	S	S	S	S	S	S	S	-	S	S	-	S	S	(S)	S	S	S	S	S	S	S***
O	S	-	-	-	S	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-	F	S	S	(S)	S	-	-	-	-	S
P	S	-	-	-	S	S	S	S	-	F	S	-	S	-	S	S	S	S	S	S	S	S	S	S	(S)	-	S	S	-	-
Q	-	F	-	-	-	-	S	-	-	-	-	-	S	-	S	S	-	F	S	-	-	S	S	-	S	(F)	-	-	-	-
R	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	F	-	-	-	S	-	S	-	(F)	-	-	-
S	F	F	-	-	F	-	F	-	S	-	-	F	-	-	-	-	-	-	-	-	S	-	F	-	S	-	F	(F)	-	S
T	S	-	-	-	-	-	S	-	-	-	-	-	-	F	-	-	-	F	-	S	S	F	S	-	F	-	-	-	(S)	S
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*P. URANIDEA F **E. WHIPPLEI S (R) ***E. PARVIPINNE S E. WHIPPLEI S

the controls (62%) have been reared. We have attempted to produce 17 hybrid Percina (intrageneric) combinations, and 11 (65%) have been successful (the hybrid tabulations separate reciprocals, even though the reciprocals cannot be visually distinguished). Similar intrageneric hybrids in Etheostoma have had 172 attempts, and 149 (87%) have been reared. Intergeneric (between genera) hybrids between species of Ammocrypta, Etheostoma, or Percina have had 97 attempts, and 77 (79%) have been reared.

These data are ample evidence that darter hybrids are relatively easy to produce. Most of the failures involve species (usually the female parent) that seem difficult to rear --often because of few attempts with the hybrids or controls. Rearing of hybrids between Etheostoma proeliare and Ammocrypta vivax is illustrative, as we have not yet reared either control. Percina and Ammocrypta species seem more difficult to rear than Etheostoma species or hybrids. Fortunately, the more colorful species are in Etheostoma. As an example, the Rainbow Darter has had 27 attempts to produce hybrids and 27 successes. Quite an array of colorful fish have been produced.

Logperch (Percina caprodes)
sketch by David L. Hall