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Striped Bass Culture Program Report 1989

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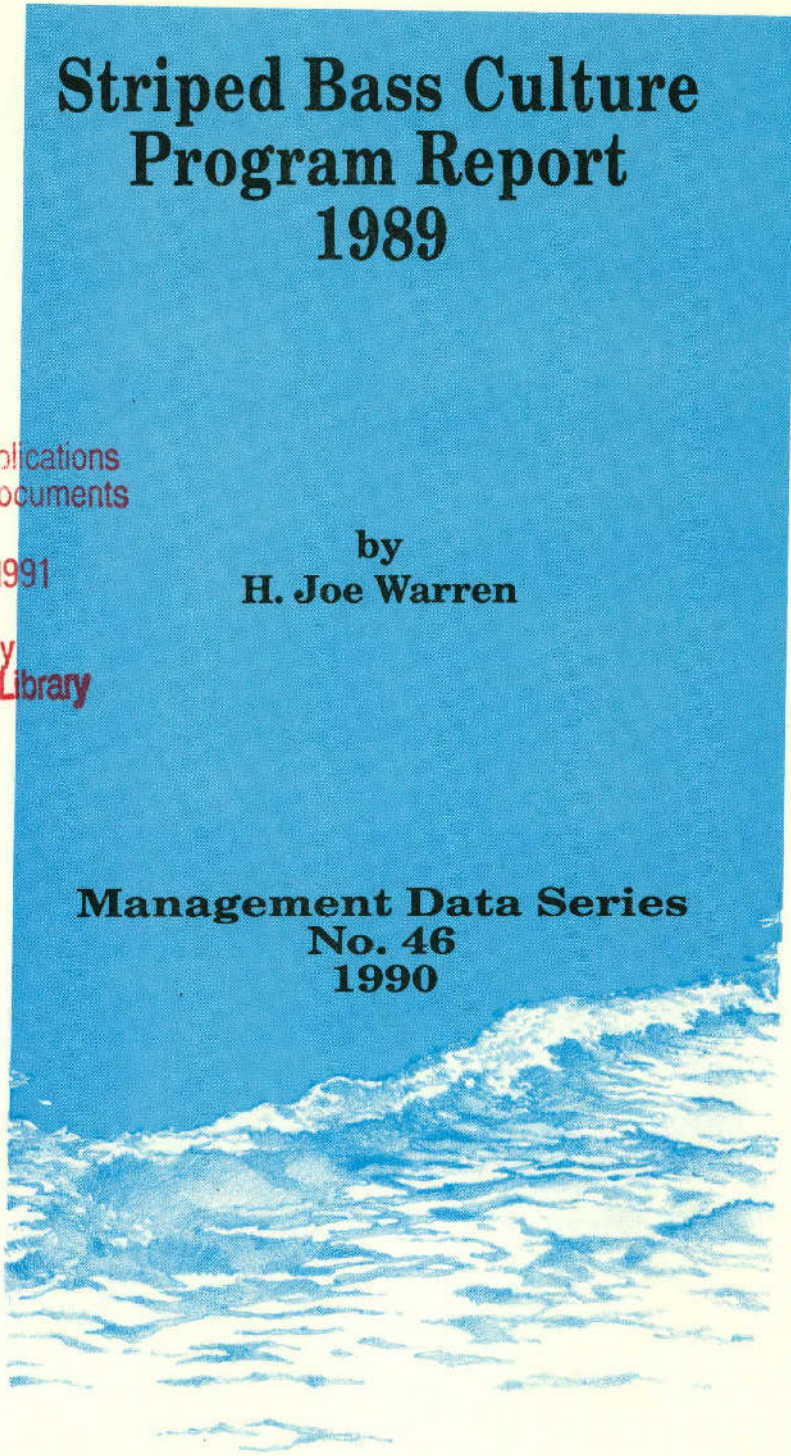
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by
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Management Data Series
No. 46
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STRIPED BASS CULTURE
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ACKNOWLEDGEMENTS

This report was compiled through the efforts of all the personnel at the A. E. Wood, Dundee and Possum Kingdom hatcheries. From collecting fish, to preparing ponds and harvesting, to data collecting, writing and editing, every member's contribution was important and very much appreciated.

ABSTRACT

This report documents the 1989 Texas striped bass (Morone saxatilis) and hybrid striped bass (M. saxatilis x M. chrysops) production and compares 1989 data to those collected in previous years. Recommendations are offered to improve existing procedures and methods.

INTRODUCTION

Striped bass (Morone saxatilis) were once common along the Gulf Coast from Florida to Louisiana and Texas (Stevenson 1893), but now only remnant populations are found in this part of their historical range (Gulf States Marine Fisheries Commission 1986). In 1967, striped bass and hybrid striped bass (M. saxatilis x M. chrysops) larvae from out-of-state sources were brought to Texas. Although methods used for induced spawning of striped bass were developed by Stevens in 1965, Texas did not use them until 1972 when mature broodstock were found in Lake E. V. Spence (Follis 1973). Broodfish from this source were then used to produce striped bass and hybrid striped bass fingerlings.

This report documents 1989 striped bass and hybrid striped bass production. Data from 1989 are compared to those collected in previous years, and recommendations are made to improve the existing program.

METHODS AND MATERIALS

Striped bass broodstock were collected by electrofishing (Warren, in preparation) from the tailraces at Lakes Livingston and Granbury and by gill-netting (Bowling personal communication) at Toledo Bend Reservoir in 1989 (Table 1).

Collections were made for striped bass broodstock at Lake Livingston four times in April and once in May. Collections were made once in April at Toledo Bend Reservoir. Collections were made at Lake Granbury once in April and once in May.

Collections were made for white bass broodstock males in the Brazos River above Lake Granbury twice in March and once in April. Collections were also made in Possum Kingdom Lake on 28 March and in the Colorado River above Lake Buchanan on 29 March. All broodstock were shipped directly to the Possum Kingdom State Fish Hatchery and held until needed in ponds with forage fish.

Striped bass males and females were collected using an electrofishing boat at Lakes Livingston and Granbury tailraces. The fish were then taken to shore by boat and placed in 1.8-m diameter circular tanks containing 15 mg/l MS-222. After the fish were anesthetized, their sex was determined by inspection of the urogenital vent and palpation of the abdominal region. Egg samples were removed from females immediately after capture using a 3.0-mm O.D. glass catheter (Harrell et al. 1990). Eggs samples were then viewed with a binocular microscope and classified as either mature or immature. Mature females that were eligible for induced ovulation were weighed, tagged and injected with 68 I.U./kg female human chorionic gonadotropin (HCG). Mature males were weighed, tagged and injected with 34 I.U./kg.

After injection, broodfish were loaded immediately on transportation vehicles which were equipped with aeration and compressed oxygen. Transportation media contained 1% NaCl, No-Foam[®] and 1 mg/l oxolinic acid.

White bass males were also collected by electrofishing, transported to shore, sexed and loaded immediately into a transportation vehicle. The

transportation media was the same as for striped bass broodstock.

When striped bass broodstock arrived at the hatchery, they were tempered 2 C every 30 min until the transportation water and the holding water temperatures were the same. Broodfish females were placed in 1.8-m diameter circular fiberglass tanks at three or four fish per tank for easy recapture. Males were placed in circular tanks or raceways.

A second egg sample was removed 20 - 28 h after the initial hormone injection for prediction of ovulation. Ovulation was predicted using a set of photographs depicting hourly changes in striped bass eggs as they progressed toward ovulation. Manual palpation of the abdominal region was used to verify ovulation (Harrell et al. 1990).

Spawning, egg and larval incubation, fry and egg enumeration, fingerling culture and transportation procedures were similar to those of Warren (in preparation) and were conducted at the A. E. Wood, Dundee and Possum Kingdom State Fish Hatcheries. To remove eggs, the female was anesthetized with a solution of 21 mg/l MS-222, applied to the gills as a spray. After the female was anesthetized, pressure was applied to the abdominal area, releasing eggs. The eggs were stripped into a clean pan containing water, and milt from two striped bass males per female, or five males per female for hybrid production, was added.

Eggs were estimated before being placed into hatching containers using the water displacement method (Harrell et al. 1990). Eggs were placed in 6-l McDonald hatching jars at 200,000 per jar. The percentage of eggs fertilized was recorded at 6 hours post-fertilization.

At 1 to 3 days post-hatch, larvae counts were estimated using a volumetric method (Harrell et al. 1990). Striped bass and hybrid striped bass prolarvae (1 to 4 days old) were held in various types of containers, from 113-l glass aquariums to 75-l fiberglass vats. Water flow in holding containers was sufficient to maintain water quality and keep the larvae suspended. While being held in containers, larvae were given daily formalin baths at 125 mg/l for 30 - 45 min to control fungus. Compressed oxygen was supplied to static containers when formalin treatments were given. Eggs and larvae were transported in sealed plastic bags with 3.8 l of water and enough oxygen to fill the bag when sealed.

Rearing ponds were prepared by spraying bottoms with an approved herbicide 10 - 15 d prior to flooding to prevent nuisance vegetation. Water used for filling ponds was passed through a 500-micron mesh filter to prevent fish eggs, small fish and fish pathogens from entering the pond. To provide time for adequate plankton development, filling of ponds was begun 10 to 14 d before stocking.

Ponds were fertilized with 280 kg/ha cottonseed meal at filling and then at 56 kg/ha beginning 5 days after the initial application and then twice weekly for 4 weeks. Liquid inorganic fertilizers were diluted with pond water and broadcast on the windward side of ponds at a rate of 0.5 mg/l ammonium nitrate (33-0-0) and 1.0 mg/l phosphoric acid (0-54-0). Liquid fertilizers

were applied 3 times weekly prestocking and twice weekly for three weeks poststocking. Organic fertilizers were not applied when the minimum dissolved oxygen level was below 4.0 mg/l, and ponds with Secchi disc readings less than 24 cm did not receive applications of inorganic liquid fertilizers.

Larvae were stocked into rearing ponds when their mouthparts were functional and when the fish were swimming horizontally, (3 to 5 days post-hatch depending on water temperature). Larvae were stocked at a rate of 121,410/ha. Tempering at stocking took place in holding containers when possible. For the first 5 minutes, the exchange rate of pond water to holding container was 1 l/min, for the next 10 minutes, the rate of exchange was increased to 2 - 3 l/min.

Supplemental feeding was begun 14 days after stocking and a 50% salmon ration was used. The fish were fed three times daily at a rate of 4.5 kg/ha/d.

Harvest operations were completed in the early morning and fresh water was put into the harvest area to cool the pond temperature and attract fish. The fish were netted from the harvest area into a temporary holding tank at the pond site containing a medium of 1% NaCl, 1 mg/l oxolinic acid and No Foam[®]. Compressed oxygen was supplied to the holding tank to maintain dissolved oxygen levels.

Five samples of 20 fish each were weighed during the harvest operation. An average mean weight was calculated from the samples and used to calculate the total number of fish harvested.

Fingerlings were held overnight in holding troughs and transported early the next morning. Hauling units contained a medium of 1% NaCl, 1 mg/l oxolinic acid and an anti-foaming agent. Dissolved oxygen levels were maintained with compressed oxygen. To prepare for stocking, fish were slowly acclimated by tempering with the water into which they were to be stocked until the two temperatures were equilibrated.

RESULTS

Broodstock Collection

The Lake Livingston tailrace continued to be the major source of broodstock for the striped bass program. Ninety-five percent of the eggs and fry produced were from broodstock collected below Lake Livingston, 4% from Toledo Bend Reservoir and 1% from Lake Granbury.

A total of 498 striped bass broodfish, weighing 2,175 kg was collected (Table 1), while 441 white bass were collected for hybrid striped bass production (Table 2). A total of 276 striped bass males and 222 striped bass females was collected. Female striped bass and male striped bass were shipped to the Dundee State Fish Hatchery for the production of fry and fingerlings for stocking inland lakes and for the federal fish hatchery system in a

cooperative program for stocking Texas waters. Female and male striped bass were shipped to the A. E. Wood State Fish Hatchery for the production of fry for stocking Texas waters and to provide eggs and fry for the federal hatchery system program. Female striped bass, male striped bass and white bass males were shipped to the Possum Kingdom State Fish Hatchery for production of hybrid fry and fingerlings for stocking fresh waters, fry for shipment out-of-state, and striped bass fry for shipment to the Dundee State Fish Hatchery for the production of 10-day-old fry for stocking into inland lakes. Distribution of broodfish, eggs, fry and fingerlings are summarized in Figure 1.

A total of 131 males were shipped to the Dundee State Fish Hatchery, 71 males to the A. E. Wood State Fish Hatchery and 30 males to the Possum Kingdom State Fish Hatchery. One hundred thirty-two females were shipped to the Dundee State Fish Hatchery, 50 females to A. E. Wood State Fish Hatchery and 40 females to Possum Kingdom State Fish Hatchery.

Egg and Fry Procurement

A total of 90.1 million striped bass eggs and 12.5 million hybrid eggs was stripped from the 222 female striped bass collected; a total of 57.5 million striped bass eggs was collected at Dundee, which produced 16.3 million fry for a 28% hatch rate. At Dundee a mean of 102,313 eggs/kg of female and 29,004 fry/kg of female was produced. From the 16.3 million fry produced at Dundee, 10.7 million were stocked into culture ponds which produced 2.5 million fingerlings stocked into inland waters; 28,400 5-day-old fry stocked into inland waters; and 900,000 fry went to the federal hatchery system, which produced 428,770 fingerlings that were stocked into inland waters.

A total of 29.4 million striped bass eggs were collected at the A. E. Wood State Fish Hatchery, which produced 13.9 million fry for a 47% hatch rate. A mean of 93,333 eggs/kg of female and 44,126 fry/kg female was produced. From the 29.4 million eggs, 2.0 million eggs were shipped to the federal hatchery system, resulting in a total of 403,000 fingerlings stocked into inland lakes and coastal waters. From the 13.9 million fry produced at the A.E. Wood State Fish Hatchery, 9.0 million were stocked into inland lakes; 1.0 million were shipped to the federal hatchery system, resulting in 223,000 fingerlings being stocked into inland lakes and coastal waters.

The Possum Kingdom State Fish Hatchery collected 3.2 million striped bass eggs, and 2.6 million fry were hatched for a 81% hatch rate. A mean of 118,959 eggs/kg of female and 96,245 fry/kg of female was produced. All 2.6 million fry were shipped to the Dundee hatchery from which 618,237 10-day-old fry were intensively cultured and stocked into Lake Texana. Possum Kingdom also produced a total of 12.5 million hybrid striped bass eggs, yielding 8.7 million fry for a 67% hatch rate. A mean of 152,197 eggs/kg of female and 58,241 fry/kg of female was produced. From the 8.7 million fry produced, 1.6 million were stocked into inland lakes, 3.2 million were shipped to other states, and the 3.4 million stocked into culture ponds.

Pond Culture

Dundee produced a total of 2.7 million striped bass fingerlings from 36 ponds covering 14.2 ha (Table 4). No fingerlings were cultured at the A. E. Wood hatchery.

Dundee's 1989 striped bass pond production data indicated lower productivity when compared with 1988 data (Table 4).

Possum Kingdom produced a total of 1.76 million hybrid striped bass fingerlings from 20 ponds covering 6.0 ha (Table 5).

Possum Kingdom's 1989 hybrid striped bass production data indicated lower productivity when compared with 1988 data (Table 5).

Stocking Data

Fry Stocking

Three lakes were stocked with 4.1 million striped bass fry. A total of 5.0 million 5-day-old fry was stocked into Trinity Bay (Table 6). A total of 1.9 million 5-day-old fry and 2.0 million eggs was distributed throughout the Federal fish hatchery system as part of a cooperative agreement for Texas coastal waters stocking.

Nine lakes were stocked with 1.6 million hybrid striped bass fry, and 3.2 million hybrid fry were shipped to three states (Table 7).

Fingerling Stocking

Twelve lakes were stocked with a total of 3.3 million striped bass fingerlings, one estuary with 349,240 and one river with 117 (Table 6). Of the total number of fingerlings stocked, approximately 3.0 million were produced from the Dundee State Fish Hatchery and 1.0 million were from federal hatcheries. A total of 13 lakes was stocked with approximately 1.8 million hybrid striped bass fingerlings (Table 7).

DISCUSSION

Striped Bass

No problems were encountered in the 1989 collection of striped bass broodfish. Sufficient water flow rates below Lakes Livingston and Granbury allowed for the concentration of striped bass broodfish in numbers which aided in collection efforts. Other possible sources of broodstock closer to the Dundee hatchery, such as Lake Kemp, will be explored in 1990.

The number of striped bass fingerlings produced per ha was above the 5 year mean, while kg/ha, kg/ha/day and percent survival were below the 5 year

mean (Table 4).

Water quality monitoring procedures have been established to measure dissolved oxygen concentrations in ponds. Daily monitoring of dissolved oxygen will help predict when low dissolved oxygen concentrations will occur and appropriate action can be taken.

Ten-Day-Old Striped Bass Fry

Dundee experienced a 77% mortality when rearing 10-day-old striped bass fry. The mortality was attributed to stress caused by handling and inadequate diet. In 1990, techniques of providing brine shrimp nauplii fortified with highly unsaturated fatty acids (H.U.F.A.'s) (Dhert et al. 1989, Rimmer and Reed 1989) are being developed, as well as implementing new methods and guidelines for the culture of ten-day-old striped bass fry.

Hybrid Striped Bass

The number of hybrid striped bass fingerlings produced per ha, the total kg/ha, kg/ha/day and percent survival were all above the 5 year mean (Table 5).

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Table 1. Locations, number, and distribution to hatcheries of striped bass broodfish collected in Texas in 1989.

1989 Date	Site	Temp. (C)	Males		Females		Total		Hatchery distribution									
			No.	Total weight (kg)	Mean weight (kg)	No.	Total weight (kg)	Mean weight (kg)	No.	Total weight (kg)	Mean weight (kg)	Dundee		P.K. ^a		A.E.W. ^b		
											♂	♀	♂	♀	♂	♀	♂	♀
11 April	Livingston TR ^c	17.2	60	141	2.4	46	288	6.4	106	429	4.0	60	31	-	15	-	-	-
12 April	Livingston TR	17.2	57	161	2.8	36	240	6.6	93	401	4.3	-	-	-	-	57	36	-
20 April	Livingston TR	17.5	74	187	2.5	45	260	5.7	119	447	3.8	44	30	30	15	-	-	-
21 April	Livingston TR	18.5	-	-	-	10	63	6.3	10	63	6.3	-	-	-	10	-	-	-
25 April	Toledo Bend	20.5	14	75	5.4	14	68	4.9	28	143	5.1	-	-	-	-	14	14	-
25 April	Granbury ^d	20.5	15	52	3.5	8	52	6.5	23	104	4.5	15	8	-	-	-	-	-
All Collections			-	276	866	3.1	222	1,309	5.9	498	2,175	4.4	175	132	30	40	71	50

^a=Possum Kingdom

^b=A. E. Wood

^c=Tailrace, Trinity River below Lake Livingston

^d=Brazos River below Lake Granbury

Table 2. Locations, number, and distribution to hatcheries of white bass broodfish collected in Texas in 1989.

1989 Date	Site	Temperature (C)	Males			Distribution to Hatcheries
			No.	Total weight (kg)	Mean weight (kg)	
16 March	Lake Granbury	16.0	328	278.0	0.8	Possum Kingdom
28 March	Lake Granbury	13.8	7	3.4	0.5	Possum Kingdom
28 March	Possum Kingdom	19.0	62	22.7	0.4	Possum Kingdom
29 March	Lake Buchanan	18.0	40	12.8	0.3	Possum Kingdom
04 April	Lake Granbury	19.0	4	-	-	Possum Kingdom
Totals			441	316.9	0.7	

Table 3. Striped bass egg and fry production from fish collected in 1989.

Source of Broodstock	Hatchery	Female (kg)	Number of eggs (Millions)	Number of eggs/kg Female	Number of fry produced (Millions)	Number of fry/kg female	Hatch rate (%)
Livingston	Dundee	507	51.6	101,603	14.3	28,205	28
Livingston	A. E. Wood	240	24.8	103,333	11.6	48,333	47
Livingston	Possum Kingdom	27	3.2	118,959	2.6	96,245	81
Livingston	Total	774	79.6	102,842	28.5	36,822	36
Granbury	Dundee	55	5.9	107,272	2.0	36,363	34
Toledo Bend	A. E. Wood	75	4.6	61,333	2.3	30,666	50
Total All Fish		904	90.1	99,668	32.8	36,283	36
Hatchery Totals:							
Dundee		562	57.5	102,313	16.3	29,004	28
A. E. Wood		315	29.4	93,333	13.9	44,126	47
Possum Kingdom		27	3.2	118,959	2.6	96,245	81

Table 4. Striped bass production from earth ponds during the period 1985 through 1989.

Year	Surface area		Weight Harvested			Survival (%)	Total fingerlings (Millions)
	(Ha)	No./ha	Kg	Kg/ha	Kg/ha/d		
1985 ^{ab}	10.5	198,865	1,103	105	3.9	39	2.0
1986 ^{ab}	17.6	119,855	880	50	1.7	19	2.1
1987 ^{ab}	15.0	118,214	1,035	69	2.3	21	1.7
1988 ^a	14.4	252,238	1,642	114	2.0	37	3.6
1989 ^a	14.2	190,140	1,051	74	1.7	26	2.7

^a=Dundee^b=Possum Kingdom

Table 5. Hybrid striped bass production from earthen ponds during the period 1985 through 1989.

Year	Surface area		Weight Harvested			Survival (%)	Total fingerlings (Millions)
	(Ha)	No./ha	Kg	Kg/ha	Kg/ha/d		
1985 ^{abc}	11.5	64,500	828	72	1.7	11	0.7
1986 ^{abc}	10.5	195,586	830	79	2.0	39	2.0
1987 ^a	6.6	321,107	739	112	2.9	43	2.1
1988 ^d	6.4	347,235	973	152	4.1	72	2.2
1989 ^d	6.0	293,333	757	126	3.2	49	1.8

^a=Dundee^b=San Angelo #1^c=San Angelo #2^d=Possum Kingdom

Table 6. Striped bass egg, fry and fingerling stocking data, 1989.

Hatchery	Site Stocked	Fry(age)			Fingerlings
		Eggs	5-day	10-day	
A.E. Wood	Uvalde N.F.H.	1,964,800			
A.E. Wood	Falcon		4,104,206		
A.E. Wood	Trinity Bay		4,972,500		
A.E. Wood	Inks N.F.H.		339,531		
A.E. Wood	San Marcos N.F.H.		662,324		
Dundee	Buffalo Springs		28,400		
Dundee	<u>Tishamingo N.F.H.</u>		<u>899,579</u>		
	Total		10,078,561		
Dundee	Texana			618,237	
Dundee	Buchanan				232,608
Dundee	Canyon				40,500
Dundee	Granbury				87,000
Dundee	Kemp				130,355
Dundee	Lavon				213,826
Dundee	Lewisville				1,282,537
Dundee	Possum Kingdom				196,205
Dundee	Red Bluff				117,367
Dundee	Whitney				235,923
Federal	Corpus Christi				459,686
Federal	Houston				246,000
Federal	Trinity Bay				349,240
Federal	<u>Trinity River</u>				<u>117</u>
	Total				3,258,364

Table 7. Hybrid striped bass fry and fingerling stocking data, 1989. All hybrid fry and fingerlings were produced at the Possum Kingdom State Fish Hatchery.

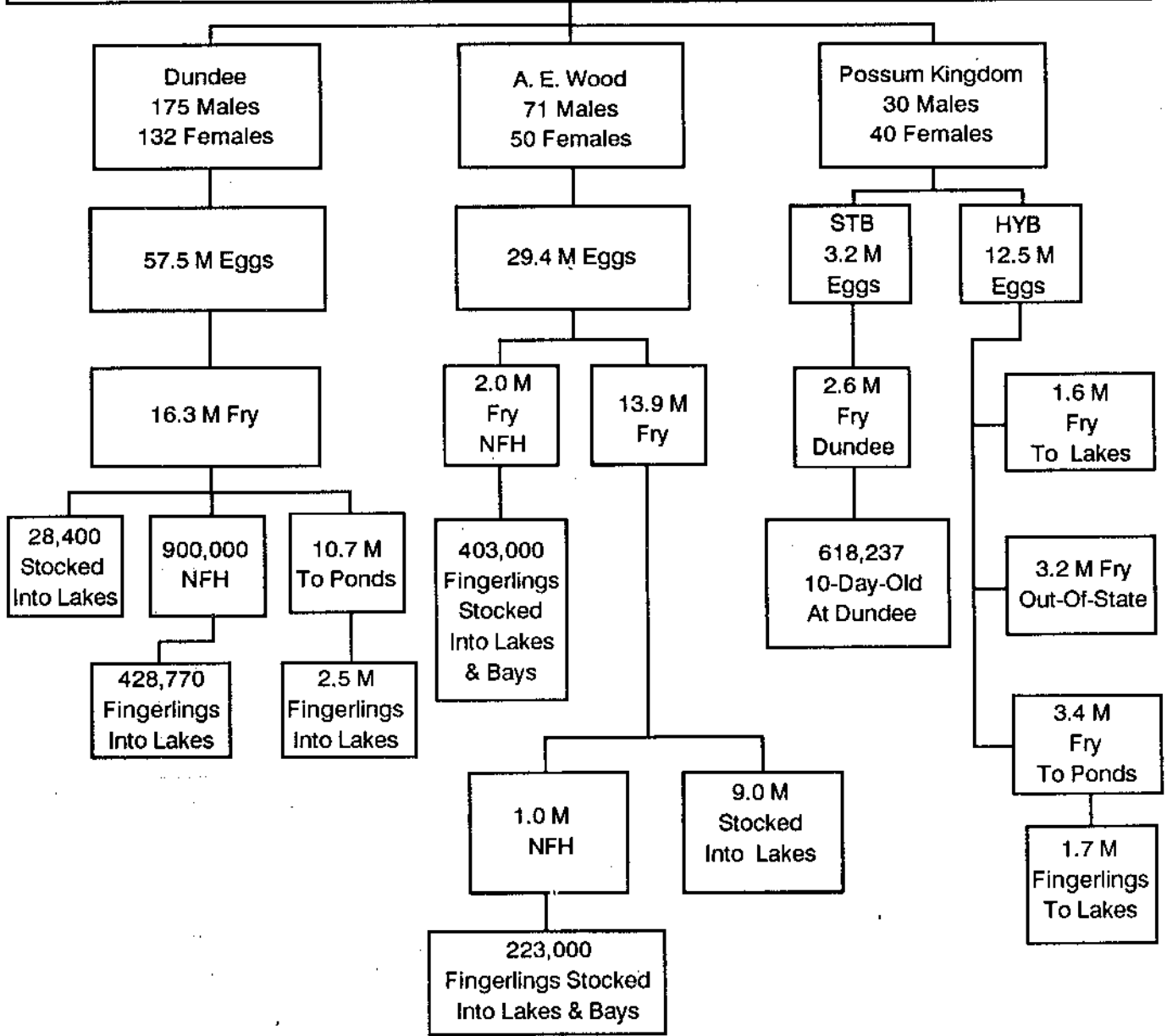
Site Stocked	Five-Day-Old Fry	Fingerlings
Braunig	179,200	
Buster Long	2,700	
Canyon Lake #1	5,500	
Canyon Lake #2	5,500	
Coleman City Lake	250,000	
Dupree Park	2,700	
Leftwich Park	2,700	
Miller Park	2,700	
Sam Rayburn	1,130,036	
State of Colorado ^a	335,000	
State of Missouri ^a	2,011,200	
<u>State of Penn.^a</u>	<u>894,000</u>	
Total	4,821,236	
Arlington		49,700
Belton		88,000
Brownwood		154,470
Calaveras		76,500
Coletto Creek		68,584
Ft. Phantom Hill		102,955
Graham		69,426
Proctor		101,700
Ray Hubbard		460,946
Sam Rayburn		279,748
Somerville		232,497
Walter E. Long		27,554
<u>Wichita</u>		<u>54,359</u>
Total		1,766,439

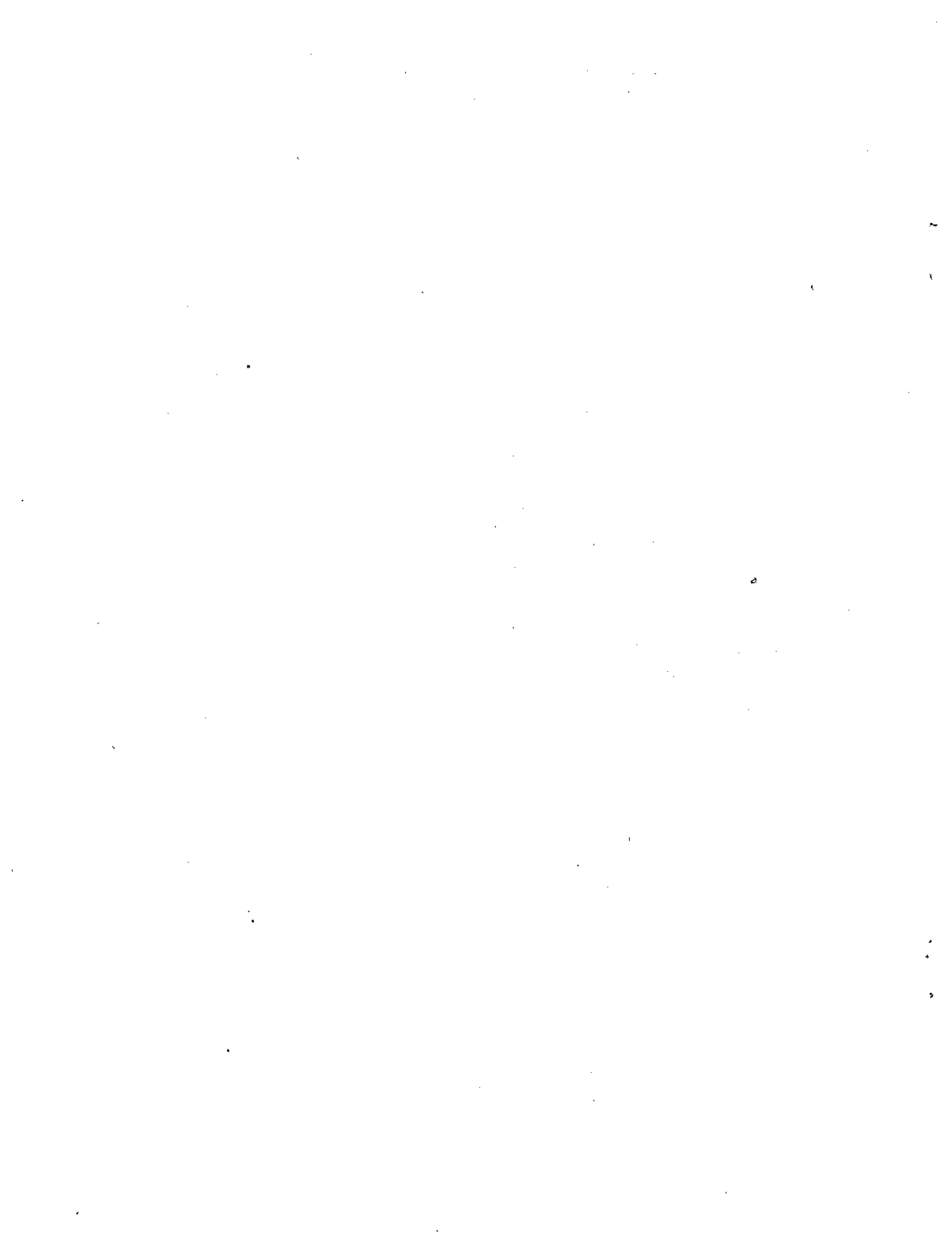
^a Part of a cooperative fish exchange program for other species.

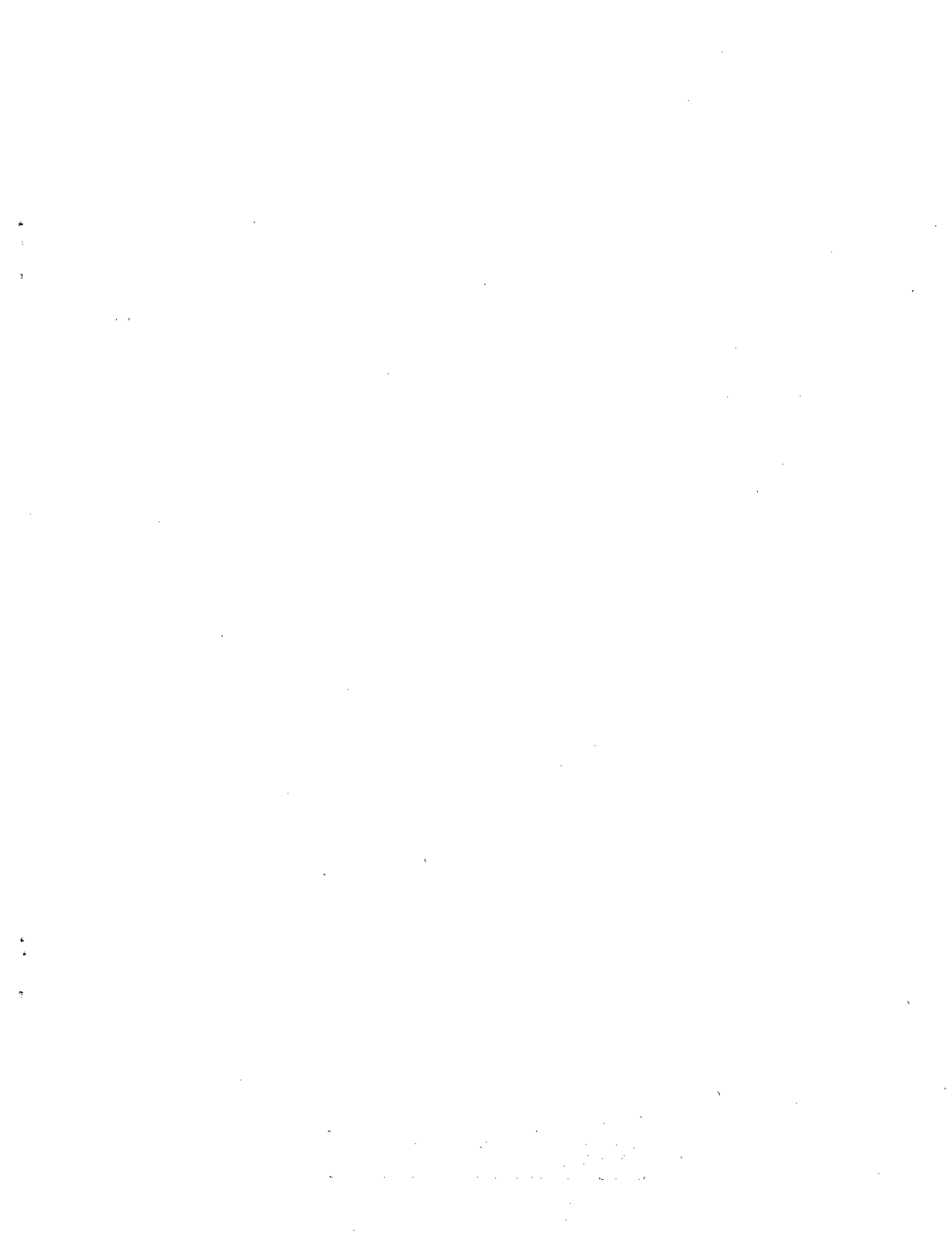
Figure 1. Distribution of broodfish, eggs, fry and fingerlings.

STRIPED BASS BROODSTOCK

276 MALES 222 FEMALES







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