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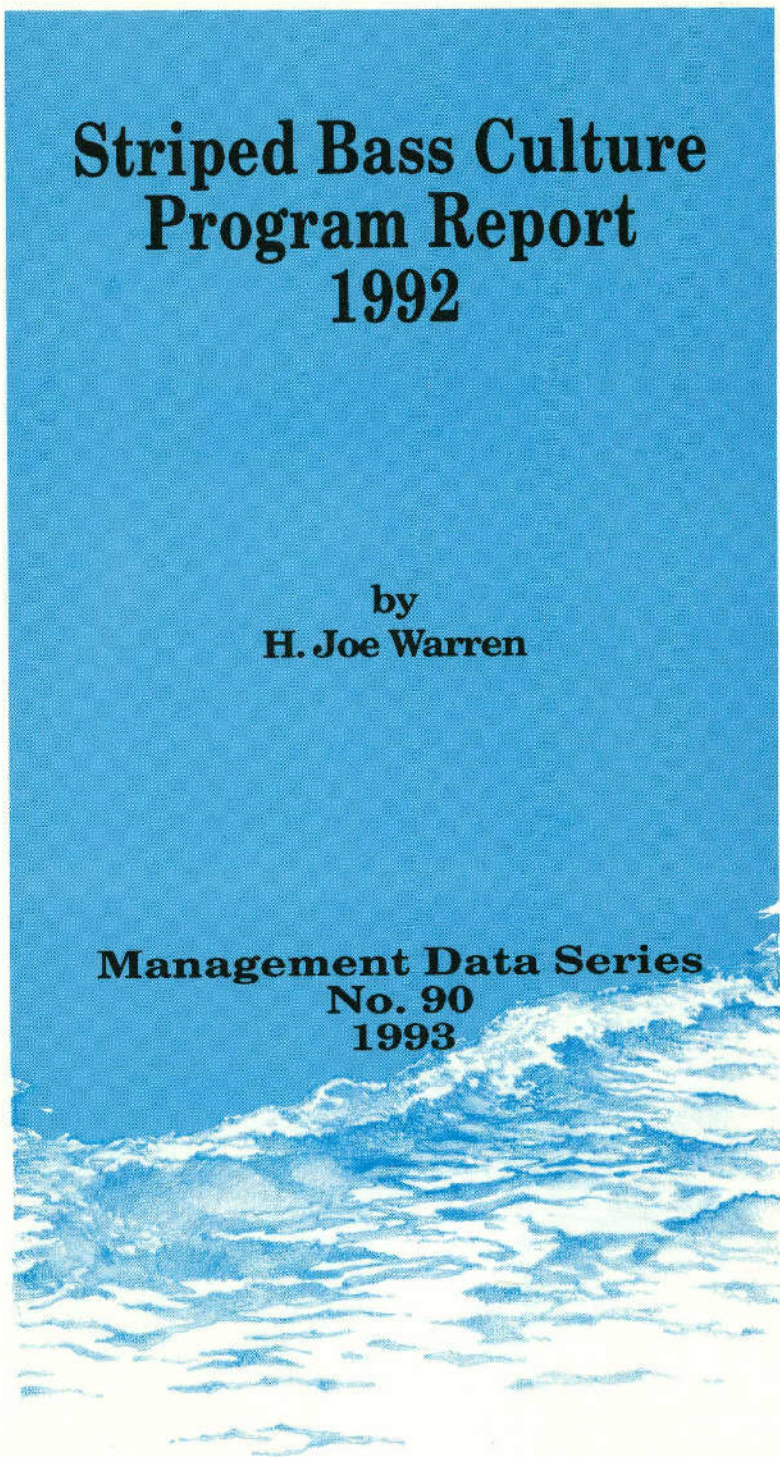
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4200 Smith School Road
Austin, Texas 78744

Striped Bass Culture Program Report 1992

by
H. Joe Warren

Management Data Series
No. 90
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STRIPED BASS CULTURE
PROGRAM REPORT
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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 1992 Texas striped bass (Morone saxatilis) and hybrid striped bass (M. saxatilis x M. chrysops) production and compares 1992 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 1966, 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 1992 striped bass and hybrid striped bass production. Data from 1992 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 from the tailraces at lakes Buchanan, Livingston, Granbury, and Texoma. Collection attempts by hook-and-line were made in the discharge at the Houston Power and Light generating station near Baytown, Texas, on 06, 11, 18 and 25 March, but no eligible broodfish were found.

Striped bass broodstock collections occurred at Lake Buchanan on 14 and 16 April. Collections at the Lake Livingston tailrace were on 21 and 22 April. Collections occurred at Lake Granbury on 28 April and 12 May at Lake Texoma.

Four times in March collections were made for white bass broodstock males in the Brazos River above Lake Granbury. All broodstock collected in the Brazos River were shipped directly to the Possum Kingdom State Fish Hatchery and held until needed in ponds with forage fish.

The striped bass males and females collected using an electrofishing boat were taken to shore by boat and placed in 1.8-m diameter circular tanks supplied with oxygen, and their sexes were determined by inspection of the urogenital vents and palpation of the abdominal regions. Egg samples were removed from females immediately after capture using a 3.0-mm O.D. glass catheter (Rees and Harrell 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 and flowing males were loaded immediately on transportation vehicles which were equipped with aeration and compressed oxygen. Transportation media contained 1% NaCl and No-Foam®.

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. The females were weighed, tagged and injected with 68 IU/kg human chorionic gonadotropin (HCG). Mature flowing males were also weighed, tagged and injected with 34 IU/kg. 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 (Bayless 1972). Manual palpation of the abdominal region was used to verify ovulation (Rees and Harrell 1990).

Spawning, egg and larval incubation, fry and egg enumeration, fingerling culture and transportation procedures were done as recommended in the striped bass culture guidelines (Warren in preparation) and were conducted at the A. E. Wood, Dundee and Possum Kingdom state fish hatcheries. To remove eggs, pressure was applied to the abdominal area, releasing eggs 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 (Rees and Harrell 1990). Eggs were placed in 6-l McDonald hatching jars at 200,000 per jar. The percentage of eggs fertilized was recorded at 6 h post-fertilization.

At 1 - 3 days post-hatch, larvae counts were estimated using a volumetric method (Rees and Harrell 1990). Striped bass and hybrid striped bass prolarvae (1 - 4 days old) were held in various types of containers, from 113-l glass aquaria 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 days 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 - 14 days 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 (Geiger 1983). Liquid inorganic fertilizers were diluted with pond water and broadcast on the windward side of ponds at a rate of 0.5 mg/l nitrogen as ammonium nitrate (33-0-0) and 1.0 mg/l phosphate as phosphoric acid (0-54-0). Liquid fertilizers were applied three times weekly prestocking and twice weekly for 3 weeks poststocking. Organic fertilizers were not applied when the minimum dissolved oxygen level was below 4.0 mg/l, and ponds with Secchi disk readings less than 24 cm did not receive applications of inorganic liquid fertilizers (Boyd 1979). The recommended rate for lined ponds at the Possum Kingdom Hatchery was one-half of the earthen ponds.

Larvae were stocked into rearing ponds when their mouthparts were functional and when the fish were swimming horizontally (3 - 5 days post-hatch depending on water temperature) (Bonn et al. 1976). Striped bass larvae were stocked at a rate of 714,411/ha and hybrid striped bass larvae were stocked at 644,755/ha. Tempering at stocking took place in holding containers when possible. For the first 5 min, the exchange rate of pond water to holding container was 1 l/min, for the next 10 min, the rate of exchange was increased to 2 - 3 l/min.

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

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 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 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 equalized.

RESULTS

Broodstock Collection

A total of 320 striped bass broodfish, weighing 1,391 kg was collected (Table 1), while 327 white bass males were collected for hybrid striped bass production (Table 2). Female striped bass and male striped bass were shipped to the Dundee, Possum Kingdom and A. E. Wood state fish hatcheries for the production of fry and fingerlings (Table 1, Figure 1). Collection attempts by hook-and-line made in the Houston Power and Light generating station discharge were unsuccessful, as no eligible females were found (Table 3).

A total of 103 striped bass males was shipped to the Dundee State Fish Hatchery and 40 to the A. E. Wood State Fish Hatchery. One hundred five females were shipped to the Dundee hatchery, 49 females to the Possum Kingdom hatchery, and 23 females to the A. E. Wood hatchery.

Egg and Fry Procurement

A total of 37.8 million striped bass eggs (Table 4) and 55.3 million hybrid striped bass eggs (Table 5) was collected from the 177 female striped bass (Table 1). At Dundee a total of 26.2 million striped bass eggs was collected, which

produced 9.7 million fry for a 37.0% hatch rate, yielding a mean of 106,504 eggs/kg of female and 39,431 fry/kg of female.

Of the 9.7 million Dundee fry, 6.8 million were stocked into culture ponds which produced 1.3 million fingerlings that were stocked into inland waters (Figure 1). A total of 400,000 fry was shipped to the Tishomingo National Fish Hatchery for pond culture and 750,000 fry to Arkansas in exchange for walleye (Table 6). Also, a total of 27.6 million hybrid striped bass eggs was collected, which produced 11.3 million fry for a 41.0% hatch rate, yielding a mean of 141,538 eggs/kg of female and 57,949 fry/kg of female (Table 5). Of the 11.3 million hybrid fry produced at Dundee, 2.4 million 5-day-old fry were stocked into inland waters; and 7.5 million were shipped to other states to be exchanged for other species (Table 7).

The A. E. Wood State Fish Hatchery collected 11.6 million striped bass eggs, and 1.9 million fry were hatched for a 16% hatch rate (Table 4, Figure 1). A mean of 93,548 eggs/kg of female and 15,323 fry/kg of female was produced. Of the 1.9 million striped bass fry, all were shipped to the federal fish hatchery system, resulting in 461,140 fingerlings being stocked into inland lakes and coastal waters (Table 6).

The Possum Kingdom State Fish Hatchery collected 27.7 million hybrid striped bass eggs, and 9.7 million fry were hatched for a 35% hatch rate (Table 5, Figure 1). A mean of 109,055 eggs/kg of female and 38,188 fry/kg of female was produced. Of the 9.7 million fry produced, 4.6 million were stocked into culture ponds which produced 2.9 million fingerlings stocked into public waters; 829,000 five-day-old fry were stocked into inland waters and 3.1 million were shipped to other states as an exchange for other species (Table 7).

Broodfish from Lake Texoma produced the highest average number of eggs/kg of female at 131,768 eggs/kg, Lake Buchanan broodfish produced 122,237 eggs/kg, Lake Granbury produced 108,876 eggs/kg and Lake Livingston produced 94,996 eggs/kg (Table 8).

Lake Buchanan broodfish produced an average of 51,643 fry/kg of female, 47,238 eggs/kg from Lake Texoma females and 14,791 egg/kg from Lake Livingston females. Lake Livingston females produced hybrid striped bass fry at an average of 86,298 fry/kg, Lake Granbury females produced 80,981 fry/kg, and Lake Texoma females produced 48,151 fry/kg (Table 8).

Pond Culture

Dundee produced a total of 1.4 million striped bass fingerlings from 25 ponds covering 9.4 ha (Table 9). Possum Kingdom produced a total of 2.9 million hybrid striped bass fingerlings from 24 ponds covering 7.2 ha (Table 10).

The 1992 striped bass pond production data indicated lower productivity when compared with 1987-1991 data (Table 9), while hybrid striped bass production increased (Table 10).

Stocking Data

Fry Stocking

Two inland lakes were stocked with a total of 3.2 million hybrid striped bass fry (Table 7). A total of 10.6 million hybrid striped bass were shipped out-of-state as part of a cooperative exchange agreement for other fish species. A total of 2.4 million 5-day-old striped bass fry was distributed throughout the federal fish hatchery system as part of a cooperative agreement for stocking inland and coastal waters, and 750,000 million were shipped to the state of Arkansas for exchange for other fish species (Table 6).

Fingerlings

Nine lakes were stocked with a total of 1.5 million striped bass fingerlings (Table 6). Of this total 1.3 million were produced at the Dundee fish hatchery and 176,950 from the federal fish hatchery system.

As part of a cooperative restoration project agreement with the United States Fish and Wildlife Service, a total of 1.2 million striped bass fingerlings was stocked into two estuaries by the federal fish hatchery system.

Thirty lakes were stocked with 2.9 million hybrid striped bass fingerlings (Table 7). Of the total number of fingerlings stocked, all were produced from the Possum Kingdom hatchery.

DISCUSSION

Sufficient water flow rates below lakes Granbury, Livingston, Buchanan and Texoma allowed for the concentration of striped bass broodfish which aided in collection efforts. Because of high discharges from Lake Livingston, collection efforts were delayed approximately 10 days.

Egg procurement and fry production were within acceptable ranges with the exception of a low hatch rate at the A. E. Wood hatchery (Tables 4 & 5). State-wide all fry commitments were met for stocking production ponds and inland lakes and meeting out-of-state commitments and federal hatchery needs.

The striped bass pond production data indicated lower productivity when compared with 1987-1991 data and a record year for hybrid striped bass when compared to the same period (Tables 8 & 9). Of the striped bass fingerlings produced, fish within the target harvest size (32 mm) produced 66% of fish harvested (916,718) and fish larger than the target size produced 34% (457,018). Ponds harvested within the target size range had a 32% return and ponds with fish larger than the target size had a 11% return (Figure 2). Striped bass production ponds need to be harvested at the target size of 32 mm to increase production numbers.

When Dundee renovation is completed, approximately 16 ha of production ponds will be available for fingerling striped bass production. This will require 12.0 million striped bass fry for pond stocking. The production of 12.0 million

striped bass fry will require approximately 55.0 million striped bass eggs ((55.0 M x 80% fertility x 30% hatch) - 10% fry mortality = 12.0 M fry). At the current level of production, this will require approximately 480 kg of striped bass females, or 90 females.

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Table 1. Locations, number, and distribution to hatcheries of striped bass broodfish collected in Texas in 1992.

1992 Date	Site	Temp. (C)	Males			Females			Total			Hatchery Distribution					
			No.	Total Wt. (kg)	Mean Wt. (kg)	No.	Total Wt. (kg)	Mean Wt. (kg)	No.	Total Wt. (kg)	Mean Wt. (kg)	Dundee		PK ^a		AEW ^b	
												♂	♀	♂	♀	♂	♀
04/14	Buchanan TR ^c	15.6	8	12	1.5	6	26	4.4	14	38	2.7	8	6	-	-	-	-
04/16	Buchanan TR	15.6	50	80	1.6	9	34	3.8	59	114	6.4	50	9	-	-	-	-
04/21	Livingston TR ^d	20.0	23	90	3.9	50	290	5.8	73	380	5.2	23	25	-	25	-	-
04/22	Livingston TR	20.4	40	165	4.1	43	239	5.6	83	404	4.8	-	20	-	-	40	23
04/28	Granbury TR ^e	21.1	-	-	-	5	29	5.8	5	29	5.8	-	-	-	5	-	-
05/12	Texoma TR ^f	17.2	22	54	2.5	64	372	5.8	86	426	5.3	22	45	-	19	-	-
	Total	-	143	401	-	177	990	-	320	1,391	-	103	105	-	49	40	23
	Mean	-	-	-	2.8	-	-	5.6	-	-	4.3	-	-	-	-	-	-

^aPossum Kingdom^bA. E. Wood^cTailrace, upper Inks Lake below Lake Buchanan^dTailrace, Trinity River below Lake Livingston^eBrazos River below Lake Granbury^fTailrace, Red River below Lake Texoma

Table 2. Number of white bass broodfish collected from Lake Granbury and delivered to Possum Kingdom Hatchery in 1992.

1992 Date	Temperature (C)	No.	Males	
			Total Wt. (kg)	Mean Wt. (kg)
17 March	15.0	83	18.2	0.20
20 March	16.0	26	6.3	0.24
23 March	16.0	113	28.8	0.25
24 March	15.0	105	95.4	0.90
Total	-	327	148.7	-
Mean	-	-	-	0.45

Table 3. Striped bass broodstock collected from Houston Power and Light Discharge at Trinity Bay in 1992.

Date	Temp. (C)	No. Females	Egg Stage	Egg Diameter (mm)	Average	No. Males	Average
					Weight Females (kg)		Weight Males (kg)
3/06/92	21.0	9	15+	0.2-0.4	3.9	0	-
3/11/92	12.6	18	15+	0.2-0.4	3.0	0	-
3/18/92	18.0	11	15+	0.2-0.4	3.2	0	-
3/25/92 ^a	18.5	10	15+	0.2-0.8	3.2	1	2.7
Total	-	48	-	-	-	1	-
Mean	-	-	15+	-	3.3	-	2.7

^aOne female was collected which had green eggs with egg stage of 15-14 hours, weight=6.8 kg, egg diameter 1.0-1.2 mm.

Table 4. Striped bass egg and fry production from fish collected in 1992.

Hatchery	Females (kg)	Number of Eggs (millions)	Number of Eggs/kg Female	Number of Fry Produced (millions)	Number of Fry/kg Female	Hatch Rate (%)
Dundee	246	26.2	106,504	9.7	39,431	37
A. E. Wood	124	11.6	93,548	1.9	15,323	16
Total	370	37.8	-	11.6	-	-
Mean	-	-	102,162	-	31,351	31

Table 5. Hybrid striped bass egg and fry production from fish collected in 1992.

Hatchery	Females (kg)	Number of Eggs (millions)	Number of Eggs/kg Female	Number of Fry Produced (millions)	Number of Fry/kg Female	Hatch Rate (%)
Dundee	195	27.6	141,538	11.3	57,949	41
Possum Kingdom	254	27.7	109,055	9.7	38,188	35
Total	449	55.3	-	21.0	-	-
Mean	-	-	123,162	-	46,770	38

Table 6. Striped bass fry and fingerling stocking data, 1992.

Hatchery	Site Stocked	Fry (5-day)	Fingerlings
TO FEDERAL AND OUT-OF-STATE HATCHERIES:			
A. E. Wood	Inks NFH	493,822	
	San Marcos NFH	568,399	
	Uvalde NFH	898,290	
Dundee	State of Arkansas	750,000	
	Tishomingo NFH	400,000	
Total Fry Stocking		<u>3,110,511</u>	
TO INLAND LAKES:			
Dundee	Amistad		339,369
	Buchanan		60,223
	Buffalo Springs		50,621
	Kemp		60,057
	Lewisville		133,786
	Livingston		351,750
	Tawakoni		203,462
Tishomingo NFH	Whitney		123,161
	Buchanan		93,450
	Kemp		20,800
	Spence		62,700
	Total Inland Lakes		
TO COASTAL WATERS:			
Inks NFH	Sabine Lake		233,860
	Trinity Bay		211,860
San Marcos NFH	Sabine Lake		29,380
	Trinity Bay		19,950
Tishomingo NFH	Sabine Lake		218,400
	Trinity Bay		280,850
Uvalde NFH	Sabine Lake		197,900
Total Coastal Waters			<u>1,192,200</u>
Grand Total Fingerlings			<u>2,691,579</u>

Table 7. Hybrid striped bass fry and fingerling stocking data, 1991.

Hatchery	Site Stocked	Fry (5-day)	Fingerlings
Dundee	Sam Rayburn	518,961	
	Red Bluff	1,900,000	
	State of Illinois	1,000,000	
	State of Iowa	2,000,000	
	State of Kansas	2,500,000	
	State of Nebraska	2,000,000	
Possum Kingdom	Sam Rayburn	829,000	
	State of Colorado	2,100,000	
	State of Missouri	1,000,000	
Total Fry Stocking		<u>13,847,961</u>	
Possum Kingdom	Arlington		21,800
	Bell Street		2,896
	Belton		218,884
	Benbrook		30,126
	Braunig		281,085
	Brownwood		40,500
	Buster Long		2,625
	Calaveras		30,341
	Canyon Lake Project #1		10,925
	Canyon Lake Project #2		14,000
	Cedar Creek		521,494
	Coleman City		24,400
	Coletto Creek		31,300
	Corpus Christi		319,700
	Dupree		3,062
	Fairfield		36,265
	Ft. Phantom Hill		44,480
	Graham		25,415
	Houston		103,180
	Leftwich		3,026
	McClellan		5,168
	Miller		1,400
	Navarro Mills		41,240
	Palestine		390,867
	Pat Mayse		98,700
	Proctor		72,322
	Ray Hubbard		325,185
Sommerville		178,626	
Tanglewood Village		51,000	
Walter E. Long		10,087	
Total Fingerling Stocking			<u>2,940,099</u>

Table 8. Comparison of broodfish collection sites for 1992.

Parameter	Texoma	Buchanan	Granbury	Livingston
Striped Bass Eggs/kg ♀	131,768	122,237	108,876	94,996
Striped bass fry/kg ♀	47,238	51,643	-	14,791
Hybrid striped bass fry/kg ♀	48,151	-	80,981	86,298

Table 9. Striped bass production from rearing ponds during the period 1987 through 1992.

Year	Surface Area (ha)	No./ha	Weight Harvested			Survival (%)	Total Fingerlings (millions)
			kg	kg/ha	kg/ha/d		
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
1990 ^{ab}	8.8	172,367	832	94	2.5	29	1.6
1991 ^{ab}	15.2	159,664	946	60	1.9	27	2.4
1992 ^a	9.4	147,205	540	57	1.9	20	1.3
5-Year Mean 1987-91	-	178,524	1,101	82	2.0	28	2.4
Comparison with 1992	-	-31,319	-561	-25	-0.1	-8	-1.1

^aDundee
^bPossum Kingdom

Table 10. Hybrid striped bass production from rearing ponds during the period 1987 through 1992.

Year	Surface Area (ha)	No./ha	Weight Harvested			Survival (%)	Total Fingerlings (millions)
			kg	kg/ha	kg/ha/d		
1987 ^a	6.6	321,107	739	112	2.9	43	2.1
1988 ^b	6.4	347,235	973	152	4.1	72	2.2
1989 ^b	6.0	293,333	757	126	3.2	49	1.8
1990	-	-	-	-	-	-	-
1991 ^{ab}	10.9	177,282	638	58	1.8	31	1.9
1992 ^b	7.2	405,061	1,042	146	4.4	63	2.9
5-Year Mean							
1987-91	-	284,739	777	112	3.0	39	2.0
Comparison with							
1992		+120,322	+265	+34	+1.4	+24	+0.9

^aDundee^bPossum Kingdom

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

1992 STRIPED BASS DISTRIBUTION

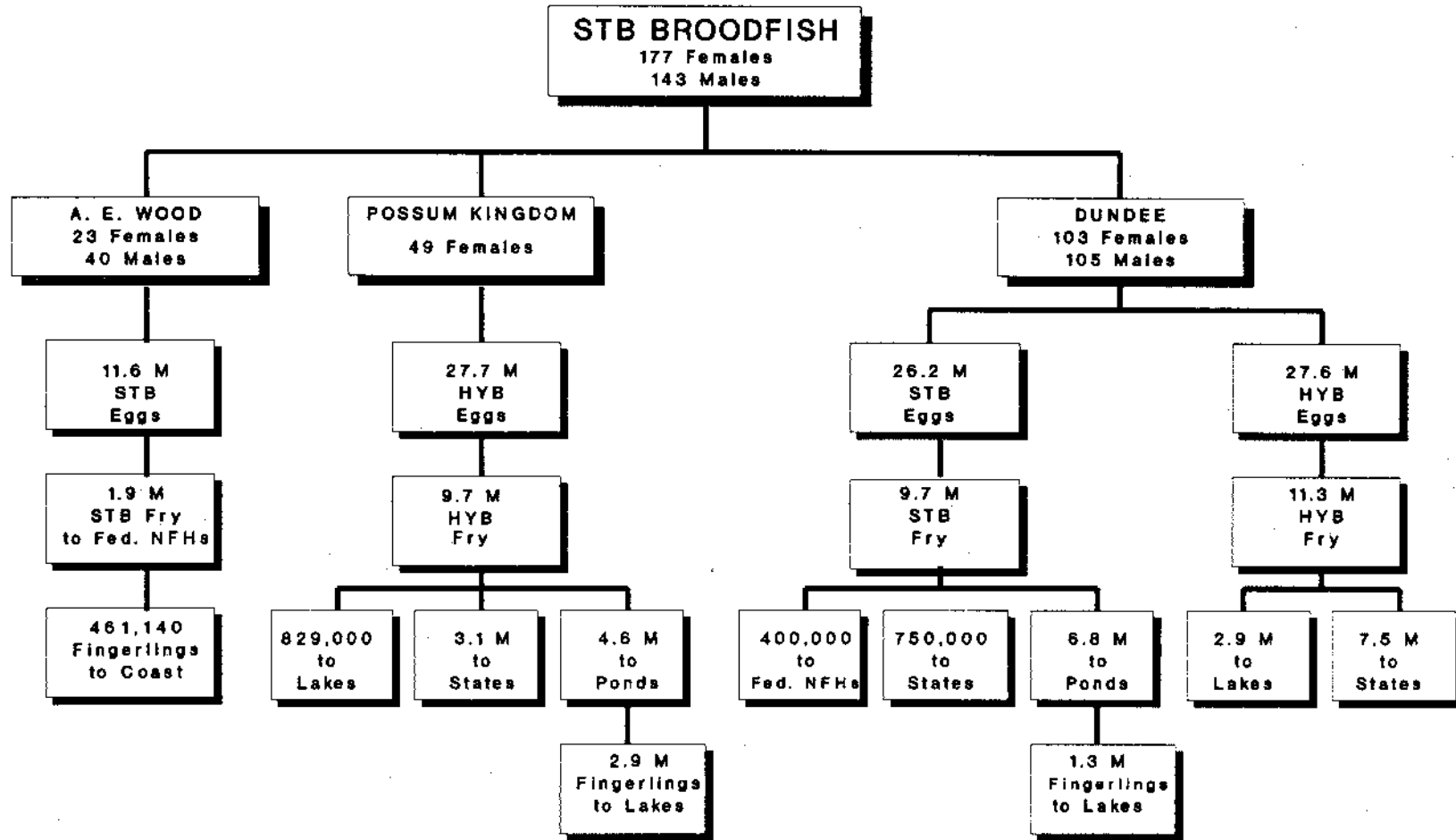
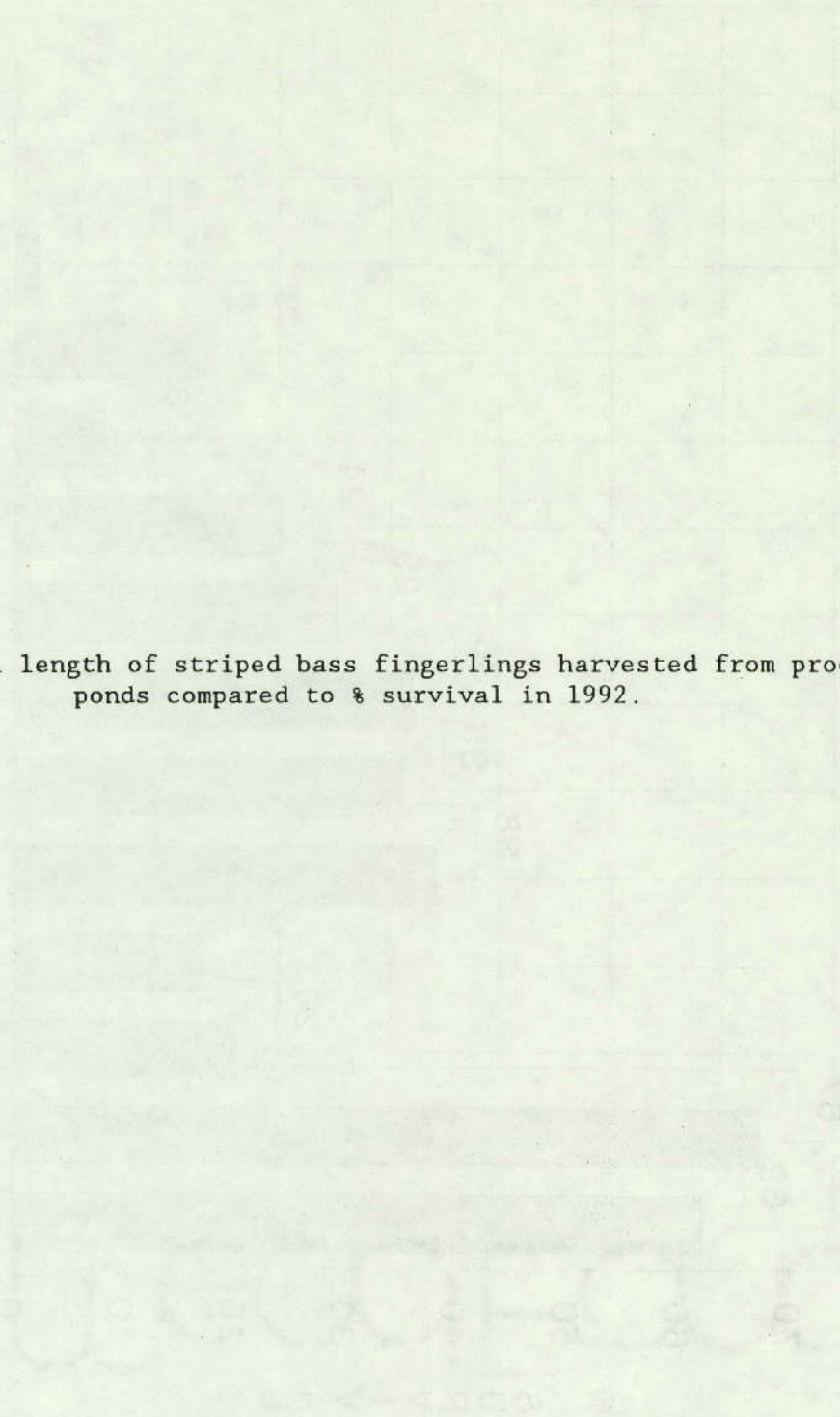
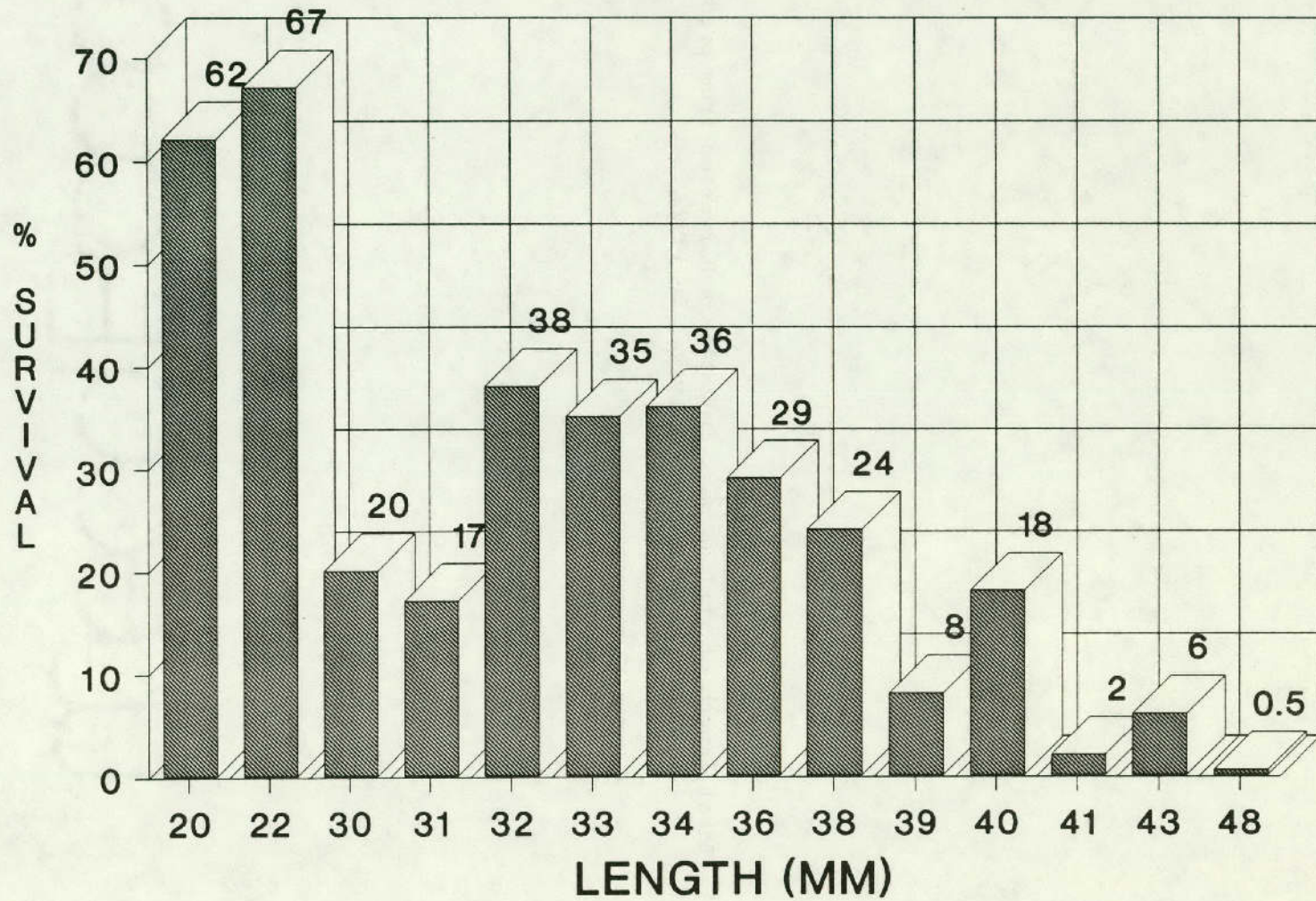
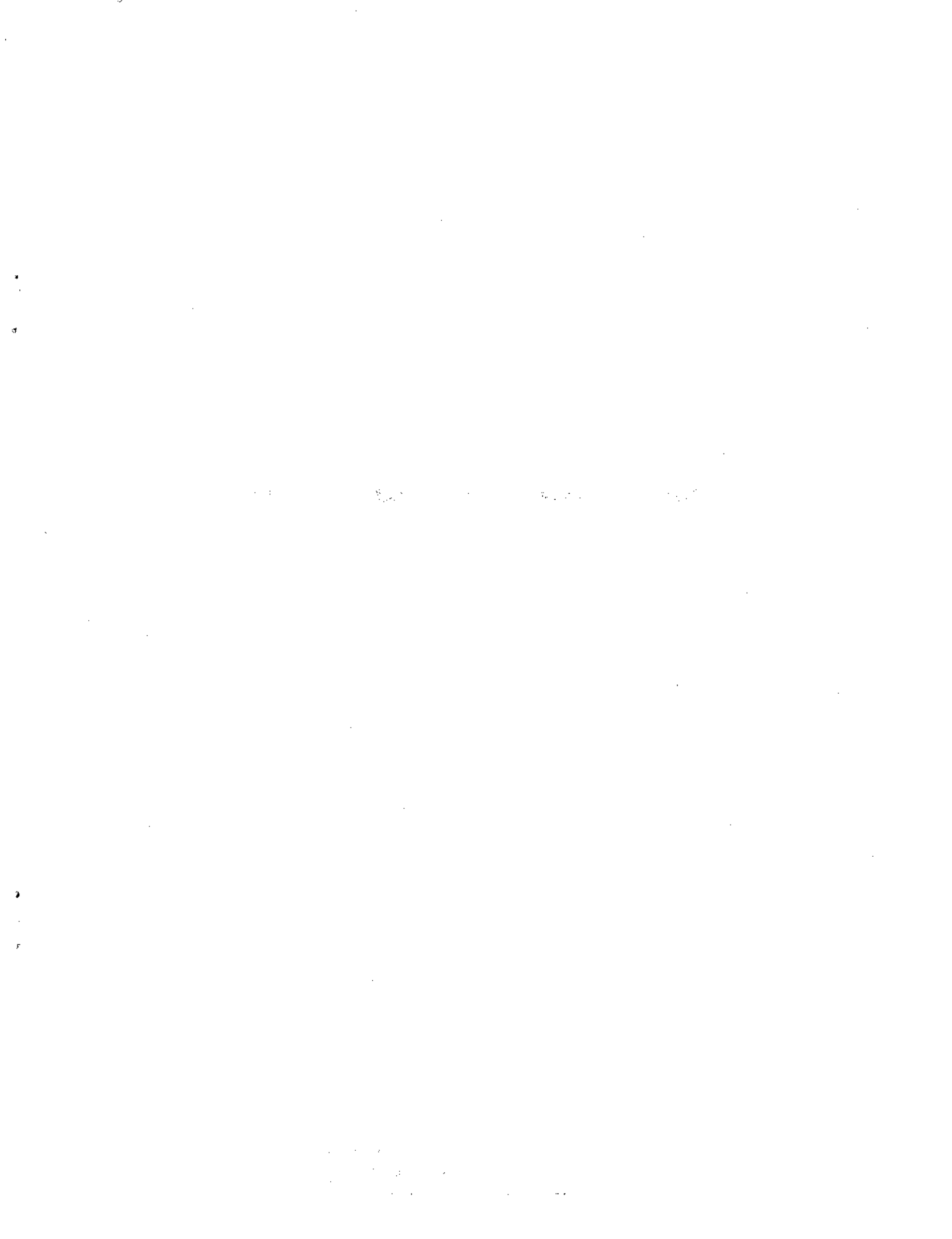


Figure 2. Total length of striped bass fingerlings harvested from production ponds compared to % survival in 1992.



STRIPED BASS PRODUCTION PONDS





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