Bluegill Culture in Texas

by
Ted Engelhardt
and
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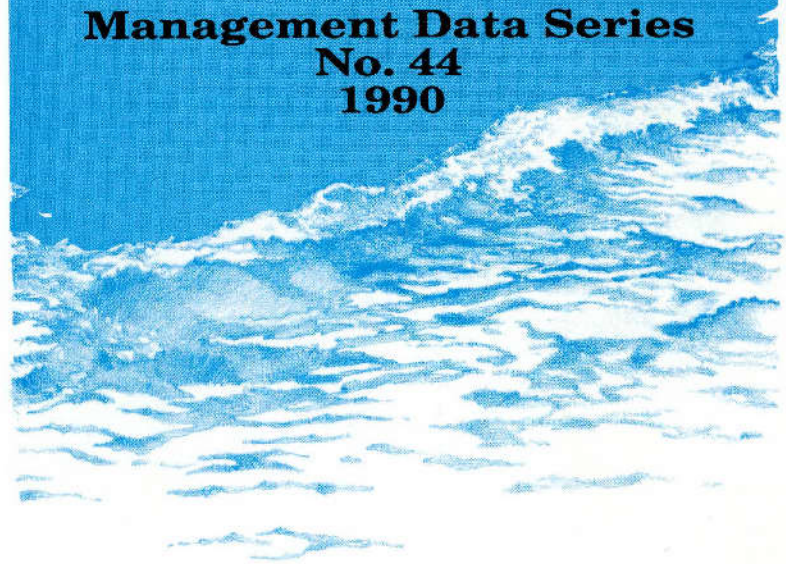
Management Data Series
No. 44
1990



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ABSTRACT

Since 1934, approximately 86,000 common bluegill (*Lepomis macrochirus*) and 6 million coppernose bluegill (*L. m. purpurescens*) were stocked into Texas waters. Fish for stocking were cultured using techniques described in this manual.

INTRODUCTION

Texas Parks and Wildlife Department (TPWD) has been operating fish hatcheries as an integral part of fisheries management since the early 1900's. Hatcheries have produced a variety of species to enhance, restore and maintain Texas fisheries. Throughout this period, culture techniques for all species produced have been continually refined with concomitant improvements in production.

Common bluegill (Lepomis macrochirus) have been produced on Texas hatcheries since 1934. When cultivation of the larger Florida largemouth bass began in the early 70's, the larger, faster growing coppernose bluegill strain (L. m. purpuresens) replaced the common bluegill as the preferred forage species for stocking with largemouth bass. In 1983, the four stocks of coppernose bluegill (CNB) in use within the hatchery system were electrophoretically evaluated. The purest stock, which came from Florida's Lake Okeechobee in 1981, was the only one retained.

The purpose of this paper is to describe bluegill culture methods used on TPWD fish hatcheries today. This document can be provided to interested parties and can serve as an introductory training document for employees without experience in bluegill culture. In addition, this comprehensive manual will ensure more consistency in the methodologies used in hatcheries across the state.

MATERIALS AND METHODS

Traditional culture methodology for production of bluegill was described by Snow (1964). Modifications to these procedures that are used in Texas hatcheries were based on annual program reports containing data from hatchery pond production records plus input from hatchery personnel during annual program evaluation meetings. These changes were incorporated into the program and results reported in annual program production summaries.

RESULTS AND DISCUSSION

Bluegill are produced by spawning captive broodstock, rearing the fry to 25 mm in the spawning pond and stocking the fry into reservoirs (Appendix A). Since 1934, approximately 86,000 common bluegill and 6 million coppernose bluegill were produced and stocked into Texas waters using techniques described in this manual. As facilities and techniques change, culture guidelines will be modified to incorporate these advances.

LITERATURE CITED

Boyd, C. E. 1979. Water Quality in Warm Fish Ponds. Agriculture Experiment Station, Auburn University, Auburn, Alabama.

Boyd, C. E. and F. Lichtkoppler. 1979. Water Quality Management In Pond Fish Culture. Research and Development Series #22, Agricultural Extension Service, Auburn University.

Conroy, D. A. and R. L. Herman. 1970. Textbook of Fish Disease. T. F. H. Publications, Jersey City, New Jersey.

Fassett, N. C. 1966. A Manual of Aquatic Plants. University of Wisconsin Press.

Geiger, J. G. 1983a. A Review of Pond Zooplankton Production, Fertilization and Culture of Larval and Fingerling Striped Bass. Aquaculture 35:3533-369.

Geiger, J. G. 1983b. Zooplankton Production and Manipulation in Striped Bass Rearing Ponds. Aquaculture 35:331-351.

McCraren, J. P. 1978. Manual of Fish Culture: Fish Transportation. U. S. Fish and Wildlife Service, Washington, D. C..

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler and J. R. Leonard. 1982. Fish Hatchery Management. U. S. Department of the Interior, Fish and Wildlife Service, Washington, D. C.

Plumb, J. A. 1979. Principal Diseases of Farm-Raised Catfish. Southern Cooperative Series Number 225.

Schnick, R. A., F. P. Meyer and D.L. Gray 1986. A Guide to Approved Chemicals in Fish Production and Fishery Resource Management. U. S. Fish and Wildlife Service Research Laboratory, LaCrosse, Wisconsin.

Snow, J. R. 1964. Training Manual for Warm-Water Fish Culture. U. S. Fish and Wildlife Services, Marion, Alabama.

White, B. L. 1981. Culture of Florida Largemouth Bass. In: P. L. Hutson and J. Lillie, editors. Midwest black bass culture. Kansas City, Missouri.

Appendix A. Bluegill Culture Manual.

Bluegill Culture

GENERAL INFORMATION

Program Goals	To provide the maximum number of bluegill for stocking into selected Texas waters.
Program Objectives	o Produce the number, size and type (strain or stock) requested by management. o Provide transportation that will maximize survival potential of fish after release. o Maintain genetic diversity of pure subspecies broodstock.

Bluegill Culture

BROODSTOCK MANAGEMENT

Replacement

Annual mortality and broodfish rotation necessitates replacing approximately 25 to 50% of broodstock yearly.

Replacement broodfish are reared in hatchery ponds and the number needed each year is determined by the requirements for meeting production goals.

Broodstock rearing for replacement is as follows:

- Fry to 25 mm total length (TL) -- Fry are produced in fertilized spawning/rearing ponds.
- 25 to 100 mm (TL) -- Future broodfish are stocked at 2,500 fingerlings/ha into fertilized rearing ponds and fed commercial feed at 3 to 4% of their body weight until sexually mature. Future broodfish are sampled monthly to determine growth rates which is the basis for feeding rates.

One year is usually required to produce a 0.045 to 0.068 kg sexually mature broodfish (Snow 1964).

Holding Ponds

Broodstock ponds should be maintained free of aquatic vegetation that could prevent access to food and cause poor water quality.

Ponds are stocked with 200 to 350 kg of broodfish per hectare.

Feeding

A crumble-type feed (20% crude protein) is fed at 3 to 4% body weight in the spring, summer, and early fall. In late fall and winter, the feeding rate is reduced to 1 to 2%. When the water temperature falls below 10 C, feeding can be suspended entirely (Snow 1964).

(Continued)

BROODSTOCK MANAGEMENT (Continued)

Hatchery Transfer and Holding	Handling bluegill broodstock, except during the spawning season, should be restricted. Mortalities have been caused by additional handling (White 1981). Broodfish holding pond draining is scheduled to minimize temperature-related stress. Preferred temperature range for handling is 24 C to 30 C. Transfer tanks should contain salt at a rate of 0.25% by weight. Higher saline rates will cause shock. Net handling should be minimized throughout the handling process. Tempering is necessary if there is a differential of more than 3 C (Piper et al. 1982).

(Continued)

Bluegill Culture

BROODSTOCK MANAGEMENT (Continued)

Fish Health

All stress should be minimized since it reduces resistance of fish to bacterial infection and parasitism (Plumb 1979). The following conditions are consideration stressful:

- dissolved oxygen: < 4 mg/l,
- temperature: > 32 C,
- inadequate nutrition,
- inadequate water quality,
- handling and
- external parasites.

Potential disease problems are monitored and treated according to approved methods (Conroy and Herman 1970).

Water quality must be maintained to insure good fish health (Boyd 1979).

The following prophylactic parasite control treatments are conducted annually (Conroy and Herman 1970).

- Masoten® at a rate of 0.25 mg/l, three times a week for 3 weeks in fall when the temperature is from 15 to 27 C.

- Copper sulfate at 0.25 to 0.5 mg/l (depending upon water hardness) weekly for 3 weeks in spring when the temperature is above 15 C.

Only chemicals approved by U.S. Food and Drug Administration (FDA) and U.S. Environmental Protection Agency (EPA) for aquaculture use are applied (Schnick et al. 1986).

Before chemicals are used, the Material Safety Data Sheet is reviewed and all safety procedures for storage and use followed.

Bluegill Culture

SPAWNING PROCEDURES

Pond Preparation

Earthen pond bottoms are thoroughly dried, disked, bladed, and packed.

Pond filling is initiated at the time prior to stocking that is appropriate for the ponds' use. Incoming water is screened through a 500-micron screen to prevent undesirable fish contamination.

Twenty-four hours prior to filling, ponds are sprayed with Aquazine®, an approved herbicide to retard vegetative growth (Fassett 1966).

Water Quality

Water quality variables affect the survival, reproduction, growth, production and management of fish. Below are variables that are monitored with their associated optimal ranges (Boyd & Lichtkoppler 1979).

- Alkalinity: < 300 mg/l
- Ammonia: < 0.3 mg/l
- Carbon Dioxide: < 5 mg/l
- Dissolved Oxygen: > 4 mg/l
- Hardness: < 300 mg/l
- Hydrogen Sulfide: < 0.0 mg/l
- pH: 6.5-8.0
- Salinity: < 8,000 mg/l
- Temperature: < 32 C
- Turbidity: < 80 mg/l

Fertilization

For the production of 25-mm fingerlings, ponds are fertilized using methods described by Geiger (1983a).

- Initial treatment -- 14 days before fry stocking add 224 kg/hectare of cottonseed meal, 0.5 mg/l of liquid ammonium nitrate, and 1 mg/l of liquid phosphoric acid.

- Follow-up application -- Use applications of 22 kg/hectare of cottonseed meal (twice a week), 0.17 mg/l liquid ammonium nitrate (3 times/week), and 0.33 mg/l of liquid phosphoric acid (3 times/week) (or as needed) for follow-up.

Fertilization should be temporarily discontinued if Secchi Disk reading is less than 200 mm, oxygen levels are less than 5 mg/l at dawn (Boyd, 1979) or aquatic vegetation develops.

(Continued)

Bluegill Culture

SPAWNING PROCEDURES (Continued)

Fertilizer Application	All fertilizers are broadcast into the pond on the windward side over the full length. Liquid inorganic fertilizers are diluted (10 volumes of pond water to 1 volume of fertilizer) before applying (Geiger 1983b). Before chemicals are used, the Material Safety Data Sheet should be reviewed and all safety procedures for storage and use followed.
Zooplankton Sampling	Zooplankton are counted to evaluate pond productivity. o In rearing ponds, plankton samples should be collected 7 days prestocking, 1 day prestocking and weekly poststocking. o Plankton samples should be collected on days 7, 14 and 21 of the pond cycle for spawning/rearing ponds. o Plankton samples are collected using a flexible impeller pump in one location at the drain structure. The total vertical water column is sampled (Geiger 1983b). o Zooplankton numbers should be at least 100 preferred organisms/liter before stocking.

(Continued)

SPAWNING PROCEDURES (Continued)

Pairing Broodfish

Bluegill spawn once water temperature in the holding pond increases to 27 C. If production ponds are not available at that time, or a more uniform hatch is desired, the holding pond should receive additional water less than 24 C (Snow, 1964). This cooling will retard egg development in early-maturing fish to allow fish with slower development to reach a similar maturation stage.

Spawning can also be delayed by harvesting the holding pond when temperatures are around 26 C, separating sexes and placing them into separate holding ponds until pairing is desirable.

Broodfish are most easily sexed when temperatures are 25 C to 27 C. Females will exhibit an obviously distended, soft, pendulous ovarian region and a swollen, red protruding vent. Males will produce a flow of sperm when palpated (Snow 1964).

The most accurate method for determining sexes is to place a capillary tube within the fish's vent searching for eggs. The tube should be 1.1- to 1.2-mm inner diameter for fish in the 0.09-kg range.

For the production of 25-mm fingerlings in spawning and rearing ponds of average productivity, 198 brooders (weight 0.136 - 0.272 kg) per hectare are stocked. With larger brooders or a less productive pond, 148 brooders per hectare is recommended. Young or small adult fish permit an increase of up to 200% in the number of brooders stocked (Snow 1964).

Broodfish are paired in prepared spawning ponds at a 1:1 ratio if possible.

(Continued)

Bluegill Culture

SPAWNING PROCEDURES (Continued)

Production	Weekly samples of 10 fish are taken to determine growth. Oxygen levels are monitored daily and maintained above 4 mg/l. When target production size is reached or zooplankton populations are decimated, fish are harvested. After spawning, about 30 days are needed by brooders for additional egg development. As many as five spawns could occur from the same pair of brooders if food and space are favorable (Snow 1964). Two methods for the production of 25-mm fingerlings are used. The procedures require from 50 to 70 days depending on brooder condition at the time of stocking and pond quality throughout the period. o Broodfish are placed into a prepared spawning and rearing pond. When fry from the first spawn reach 25 mm, the pond is harvested and the broodstock are transferred to another prepared spawning and rearing pond. However, usually there will be a second spawn before the first spawn reaches the desired 25 mm. These small fry from the second spawn can cause inaccuracies in enumeration and most of them will not survive delivery because of their size. o Broodfish are placed into a prepared spawning pond. As soon as the brooders are no longer guarding the fry from the first spawn, they are removed using a > 1 inch mesh seine and transferred to another prepared pond. These brooders should spawn again in about 30 days. The fry are left in the fertilized pond until they are harvested at 25 mm.
Broodstock Removal	When production goals are met or the temperature drops below 25 C the broodfish are moved to their holding pond.

(Continued)

Bluegill Culture

SPAWNING PROCEDURES (Continued)

Culture Activities

POND CULTURE ACTIVITIES

Day	Step	Action	Comments
-20	1	Disk, Blade, Pack	Dried Pond
-16	2	Vegetation Control	Approv.Chem.
-15	3	Begin Filling	Filter water
-14	4	Initial Fert:	
		Organic	224 Kg/ha
		Inorganic	0.5 mg/l N
			1.0 mg/l P
-10	5	Follow-up Fert:	
thru		Organic	22 Kg/ha
-7		Inorganic	0.17 mg/l N
			0.33 mg/l P
-7	6	Sample	Zooplankton
-6	7	Follow-up Fert:	
thru		Organic	Same rate
-3		Inorganic	as step 5
-1	8	Sample	Zooplankton
0	9	Stock Fry	
+3	10	Follow-up Fert:	
thru		Organic	Same rate
+7		Inorganic	as step 5
+7	11	Sample	Zooplankton
+10	12	Follow-up Fert:	
thru		Organic	Same rate
+14		Inorganic	as step 5
+14	13	Sample	Zooplankton
+17	14	Follow-up Fert:	
thru		Organic	Same rate
+21		Inorganic	as step 5
+21	15	Sample	Zooplankton & Fish
+24	16	Follow-up Fert:	
thru		Organic	Same rate
+28		Inorganic	as step 5
+28	17	Sample	Zooplankton & Fish
+31	18	Follow-up Fert:	
thru		Organic	Same rate
+35		Inorganic	as step 5
+35	19	Sample	Zooplankton & Fish

(Continued)

SPAWNING PROCEDURES (Continued)

Culture Activities(Continued)

POND CULTURE ACTIVITIES

Day	Step	Action	Comments
+38 thru +42	20	Follow-up Fert: Organic Inorganic	Same rate as step 5
+42	21	Sample	Zooplankton & Fish
+45 thru +49	22	Follow-up Fert: Organic Inorganic	Same rate as step 5
+49	23	Sample	Zooplankton & Fish (possible harvest)
+52 thru +56	24	Follow-up Fert: Organic Inorganic	Same rate as step 5
+56	25	Sample	Zooplankton & Fish (possible harvest)
+63	26	Sample	Zooplankton & Fish (possible harvest)
+72	27	Sample	Fish
+73	28	Harvest	

Bluegill Culture

HARVESTING PROCEDURES

Pond Draining	Ponds are drained early in the morning while water temperatures are coolest. As water level drops, oxygen levels are monitored and maintained above 4 mg/l by spraying fresh water into the drain box. Fish should not be exposed to sudden changes in water temperature. Tempering is used when moving fish to water of different temperatures. A salt solution not to exceed 0.25% must be used in tanks when moving fish. If pond temperature increases 3 C above transfer or holding tank temperatures, draining should be curtailed. Cooler incoming water can be pumped into the pond to displace the warmer pond water in the harvest area. The fish will be attracted to this cooled area and harvest may continue.
Fingerling Enumeration and Holding	Three 100-gram samples of fingerlings are counted and used to calculate an average number per kilogram. Twenty-five fish are measured to calculate average length (mm). After removal from production ponds, the fingerlings are retained in the holding tanks for 18 to 24 hours to reduce harvest stress (Snow 1964). Fingerlings should be placed in a prophylactic solution of 0.25 % salt for at least 2 hours at harvest.

TRANSPORTATION

Loading Factors

The loading rates will depend on the following factors (McCraren 1978):

- water temperature,
- hauling time,
- condition of fish,
- size of fish,
- aeration system and
- fish species.

Carrying Capacity

If environmental conditions are constant, carrying capacity depends on fish size. Fewer kilograms of small fish can be transported per liter of water than larger fish. For example, one-half as many kilograms of 50-mm TL fish can be hauled as 100-mm TL fish.

Loading density calculation:

$$L = \frac{K}{C - D}$$

L - Loading Density (kg/l)
K - Kilograms of fish
C - Tank Capacity (l)
D - Water Displaced by fish (l)

Approximate Loading Rate

Size (mm)	Density (fish/liter)	Weight (kg/liter)
100	94	0.45
75	253	0.30
50	757	0.23
25	1260	0.15

Bacterial Control

Using a 0.25% salt solution is a preventive measure taken to protect against bacterial infections during hauling (Conroy and Herman 1970).

(Continued)

Bluegill Culture

TRANSPORTATION (Continued)

Stocking	Fish should be acclimated slowly from the water in the transportation unit to the water of the environment into which they are stocked. Rapid changes in temperature, water quality and oxygen levels can significantly affect survival. Proper tempering requires 20 minutes for every 4 C change in water temperature (McCraren 1978). If water temperatures are not significantly different, tempering still occurs to adjust for other water quality parameters (i.e. pH, alkalinity, dissolved oxygen) for not less than 20 minutes.

Bluegill Culture

DATA SUBMISSION

General Overview

Hatcheries data from production and stocking are recorded on two master databases maintained on the Austin mainframe. The databases reside on M204 as:

- o FAD, for the historical stocking of public waters, as required by law, and
- o FAP, historical pond production.

Data may be entered into these files manually or by transferring a data file created by a SAS program at the hatchery.

Duties of Hatchery Personnel

Step	Staff	Action
1	Hatchery Staff	Collect and record data on data sheets.
2	Manager	Edits data sheets.
		Summarizes data or distributes as instructed.
		Compiles program summary and forwards to program leader 14 working days after completion of activity.
3	DP Staff	Local coordinator responsible for assuring timely entry of data and communication with statewide coordinator.
		Monitors data file transfer.
4	Program Leader	Edits summary.
		Prepares and submits annual program summary or current project activities to director of programs within 30 days of completion.

(Continued)

DATA SUBMISSION (Continued)

Duties of Hatchery Personnel (Continued)

Step	Staff	Action
5	Program Director	Edits annual program summary. Combines with other program summaries to produce annual hatchery program report.

How to complete Hatchery Pond Production data sheet

Step	Blank	Action
1	Year	Enter year (example 89).
2	Hatchery	Enter numerical code identifying hatchery (hatchery codes, page 39).
3	Pond	Enter appropriate pond number.
4	Species	Enter numerical code identifying species (species codes, pages 40-41).
5	Season	Enter numerical code identifying season. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
6	Rearing	Enter numerical code identifying rearing (rearing codes, page 39).
7	Paring	Enter pairing number. o 1 = first pairing o 2 = second pairing o 3 = third pairing

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production data sheet (Continued)

Step	Blank	Action
8	Year Class	Enter year class designation (year broodstock was hatched).
9	Pond Acres	Enter pond size (acres).
10	Water Volume	Enter pond volume (cubic meters).
11	Fill Date	Enter date pond filling initiated (mm/dd/yy).
12	Date	Enter date fish were stocked in pond (mm/dd/yy).
13	Temperature	Enter pond water temperature at time of stocking (C).
14	Number	Enter total number of fish stocked.
15	Pounds	Enter total weight of fish stocked (lbs).
16	Pounds Eggs	Enter total weight of eggs stocked in pond (lbs).
17	Average Length	Enter average length of sample of fish stocked (mm).
18	Number Males	Enter number of males stocked.
19	Pounds Males	Enter weight of males stocked (lbs).
20	Number Females	Enter number of females stocked.
21	Pounds Females	Enter weight of females stocked (lbs).

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production data sheet (Continued)

Step	Blank	Action
22	Source Pond	Enter pond number where broodfish or fry originated.
23	Date	Enter date pond was harvested.
24	Temperature	Enter pond water temperature at date of harvest (C).
25	Number	Enter estimated number of fish harvested.
26	Pounds	Enter weight of fish.
27	Average Length	Enter average length of fish harvested (mm).
28	Number Males	Enter number of male broodfish harvested.
29	Pounds Males	Enter weight of males harvested (lbs).
30	Number Females	Enter number of female broodfish harvested.
31	Pounds Females	Enter weight of females harvested (lbs).
32	Number Adults	Enter total number of adults harvested.
33	Pounds of Adults	Enter total weight of adults harvested.
34	Pounds of Eggs	Enter total weight of eggs harvested (lbs).
35	Females w/Eggs	Enter total number of females that produced eggs.
36	Min. D.O.	Enter minimum dissolved oxygen reading during culture period (mg/l).

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production data sheet (Continued)

Step	Blank	Action
37	Max. D.O.	Enter maximum dissolved oxygen reading during culture period (mg/l).
38	Ave. D.O.	Enter average dissolved oxygen level during culture (mg/l).
39	Production Days	Enter total number of days pond was in production.
40	Lbs/Ac/ Day	Enter value calculated (pounds harvested/by the size of the pond in acres/by total number of days in production).
41	Percent Survival	Enter value calculated (number of fish harvested/number of fish stocked X 100).

Hatchery pond production data sheet

HATCHERY POND PRODUCTION

YEAR:__ HATCHERY___ POND___ SPECIES____ SEASON_

REARING CODE: __ PAIRING: __ YEAR CLASS: ___

POND ACRES: ._ WATER VOLUME: _____ FILL DATE: _/_/_

----------STOCK DATA ----------

DATE: _/_/_ TEMP: ._ NO.:_____ LBS: ._

LBS EGGS: ._ AVG LGTH: ._ NO. MALES:___ LBS MALES: ._

NO. FEMALES: __ LBS FEMALES: ._ SOURCE PONDS:_ _ _

----------HARVEST DATA----------

DATE: _/_/_ TEMP: ._ NO.: ____ LBS: ._ AVG LGTH: ._

NO. MALES: __ LBS. MALES: ._ NO. FEMALES: __ LB FEMALE: ._

NO. ADULTS: __ LBS ADULTS: ._ LBS EGGS: ._

FEMALES W/EGGS: __ MIN D.O.: ._ MAX D.O.: ._ AVE D.O.: ._

PROD. DAYS: __ LBS/ACRE/DAY: ._ SURVIVAL % ._

Figure 1.

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production (2) sheet

Step	Blank	Action
1	Organic/ Inorganic	Enter fertilizer source (inorganic or organic).
2	Type	Enter type of fertilizer (i.e. cottonseed meal, phosphoric acid, or ammonium nitrate).
3	Amount	Enter total amount of fertilizer applied to pond (lbs, gal).
4	Pounds/ Gallons	Enter unit of measurement for fertilizer application (lbs, gal).
5	No. Applica- tions	Enter total number of fertilizer applications made.
6	Rate	Enter value calculated (total pounds or gallons applied/pond size in acres).
7	Feed rate	Enter rate at which pond was fed (pounds/acre or percent of body weight).
8	Type	Enter type of feed fed (starter, crumbles or pellets).
9	Total amount	Enter total amount of feed fed (lbs).
10	Total number	Enter total number of feedings made.

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production (2) sheet (Continued)

Step	Blank	Action
	Vegetation control	
11	Kind	Enter type of vegetation to be controlled.
12	Chemical	Enter chemical used in vegetation treatment.
13	Total amount	Enter total amount of chemical applied (lbs, gal).
14	No. applications	Enter total number of applications.
	Forage data	
15	Species	Enter species of forage used.
16	Total pounds	Enter total weight of species of forage (lbs).
17	Total no.	Enter total number of forage.
	Insect/pest control	
18	Kind	Enter species of insect/pest.
19	Material	Enter chemical used.
20	Total amount	Enter total amount of chemical used (lbs,l).
21	No. applications	Enter total number of applications.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Production (2) sheet (Continued)

Step	Blank	Action
	Inoculation data	
22	Organisms	Enter species of organisms used.
23	No./l	Enter total number of organisms/liter.
24	No. applications	Enter total of inoculation applications.
25	Remarks	Enter all pertinent.

Hatchery Pond Production data sheet

HATCHERY POND PRODUCTION (2)

FERTILIZER DATA

ORGANIC/ INORGNIC	TYPE	AMOUNT	LBS/ GAL	NO. APPS	RATE

FEED DATA

FEED RATE: _____

TYPE	TOTAL AMOUNT	TOT NO.

VEGETATION CONTROL

KIND OF VEGETATION	CHEMICAL	TOTAL AMOUNT	NO. APPS

FORAGE DATA

SPECIES	TOTAL LBS	TOT NO

INSECT/PEST CONTROL

KIND OF INSECT/PEST	MATERIAL	TOTAL AMOUNT	NO APPS

INOCULATION DATA

ORGANISMS	AMOUNT NO./L	NO. APPS

REMARKS _____

Figure 2.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Samples sheet

Step	Blank	Action
1	Hatchery	Enter appropriate hatchery code from list (page 39).
2	Pond	Enter appropriate pond number.
3	Season	Enter appropriate season code. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
4	Year	Enter year (example 89).
5	Date	Enter date (mm/dd/yy).
6	Time	Enter time (military time).
7	Fry Length (mm)	Enter mean total length in mm of 10 fish sample.
8	Fry WT (mg)	Enter mean weight in mg of 10 fish sample.
9	Water Temp (C)	Enter pond water temperature at time of fry sample.
10	pH	Enter pH of water at time of sample.
11	D.O.	Enter D.O. of water at (mg/l)time of sample.
12	Secchi Disk (cm)	Enter secchi disk reading of pond at time of sample.
13	Chloro-phyll	Enter mg/l chlorophyll from water sample taken at time of sample.

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Samples sheet (Continued)

Step	Blank	Action
14	NH3N	Enter total ammonia (mg/l) nitrogen reading of water sample taken at time of sample.
15	NO2N	Enter nitrite (mg/l) nitrogen reading of water sample taken at time of sample.
16	NO3N	Enter nitrate (mg/l) nitrogen reading of water sample taken at time of sample.
17	PO4P	Enter phosphorus as (mg/l) ortho-phosphate of water sample taken at time of sample.
18	Alkalinity	Enter total alkalinity from water (mg/l) sample taken at time of sample.
19	Salinity	Enter salinity of (ppt) pond water at time of sample.
20	Volume Filtered	Enter the volume of the filter (ml) plankton analysis.
21	Volume of Conc.	Enter the volume the concentrate (ml) (usually 100 ml).
22	Conc. Factor	Enter the concentration factor.
23	Rotifers	Enter mean number (number/l) of rotifers in plankton sample.
24	Cladocerans	Enter mean number of cladocerans in plankton (number/l) sample.

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Samples sheet (Continued)

Step	Blank	Action
25	Copepods	Enter mean number (number/l) of copepods in plankton sample.
26	Other Type	Enter name of other pertinent organisms (i.e. polychaete larvae).
27	Other Org.	Enter mean number of other organisms (number/l) in plankton number.
28	Other Type	Similar to 26.
29	Other Org.	Same as 27. (number/l)
30	Rotifers (number/l)	Enter mean number of rotifers in gut samples from 10 fish.
31	Clado-cerans	Enter mean number of cladocerans in samples from 10 fish.
32	Copepods (number/l)	Enter mean number of copepods in gut samples from 10 fish.
33	Other Type	Enter name of other type of pertinent organism in gut samples from 10 fish.
34	Other Org.	Enter mean number of other organisms in gut samples (number/l) from 10 fish.
35	Other Type	Similar to 33.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Pond Samples sheet (Continued)

Step	Blank	Action
36	Other Org. (number/l)	Same as 34.

Hatchery Pond Samples sheet

HATCHERY POND SAMPLES

HATCHERY: POND: SEASON: YEAR: DATE: _/_/_ TIME:
FRY LGTH (MM): FRY WT (MG): WATER TEMP (C): PH:____
D.O.: _._ SECCHI DISK (CM): __ CHLOROPHYLL (MG/L):____
NH3N (MG/L):_._ NO2N (MG/L): _._ NO3N (MG/L): _._
PO4P)MG/L): _._ ALKALINITY (MG/L): _._ SALINITY (PPT): _._
VOLUME FILTERED (ML): ___ VOLUME CONC. (ML): ___ CONC. FACTOR: __

----------WATER SAMPLE ----------

ROTIFERS (MEAN/L): ___ CLADOCERANS (MEAN/L): ____ COPEPODS (MEAN/L): ___
OTHER TYPE: _____ OTHER ORG. (MEAN/L): ____
OTHER TYPE: _____ OTHER ORG. (MEAN/L): ____

----------CUT SAMPLE----------

ROTIFERS (MEAN/L): __ CLADOCERANS (MEAN/L): ____ COPEPODS (MEAN/L): ___
OTHER TYPE: _____ OTHER ORG. (MEAN/L): ____
OTHER TYPE: _____ OTHER ORG. (MEAN/L): ____

Figure 3.

(Continued)

DATA SUBMISSION (Continued)

How to complete a Hatchery Fertilizer sheet

Step	Blank	Action
1	Year	Enter year (example 89).
2	Hatchery	Enter hatchery code. (page 38).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 40-41).
5	Season	Enter appropriate season code. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
6	Organic	Enter date, fertilizer type, amount (kgs), and rate of organic fertilizer applications and totals in appropriate rows below.
7	Inorganic	Same as organic.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

Hatchery Fertilizer sheet

YEAR:___ HATCHERY:___ POND:___ SPECIES: ____ SEASON: ___

FERTILIZER

ORGANIC				INORGANIC			
TYPE: CM=COTTONSEED MEAL RB=RICE BRAN				TYPE: PH=PHOSPHORIC ACID AN=AMMONIUM NITRATE UR=UREA			
DATE	TYPE	AMOUNT(L)	RATE	DATE	TYPE	AMOUNT(G)	RATE
TOTAL				TOTAL			
TOTAL				TOTAL			

Figure 4.

(Continued)

DATA SUBMISSION (Continued)

How to complete a Herbicide/Pesticide/ Inoculation/Forage form

Step	Blank	Action
1	Year	Enter name (example 89).
2	Hatchery Code	Enter hatchery code (page 39).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 40-41).
5	Season	Enter appropriate season code. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
6	Vegeta-tion,	Enter date, vegetation treatment chemical, control and amount, and total applications in appropriate rows below.
7	Inocula-tion	Enter date, organism, amount and total in appropriate rows below.
8	Insect/ Pest Control	Enter date, pest, chemical treatment and amount, and total applications in appropriate rows below.
9	Forage	Enter date, species, amount, and totals in appropriate rows below.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

Hatchery Herbicide/Pesticide/ Inoculation/Forage data sheet

HERBICIDE/PESTICIDE/INOCULATION/FORAGE

YEAR: ___ HATCHERY: ___ POND: ___ SPECIES: ____ SEASON: ____

VEGETATION CONTROL				INOCULATION		
DATE	VEGETATION	CHEMICAL	AMOUNT	DATE	ORGANISM	AMOUNT(NO/L)
TOTAL				TOTAL		

INSECT/PEST CONTROL				FORAGE		
DATE	PEST	CHEMICAL	AMOUNT	DATE	SPECIES	AMOUNT(LBS)
TOTAL				TOTAL		

Figure 5.

(Continued)

DATA SUBMISSION (Continued)

How to complete a Hatchery Feed data sheet

Step	Blank	Action
1	Year	Enter year (example 89).
2	Hatchery Code	Enter hatchery code (page 39).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 40-41).
5	Season	Enter appropriate season code. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
6	Feed	Enter date, feed, amount (kgs), and totals in appropriate rows below.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

Hatchery Feed data sheet

FEED

YEAR: ___ HATCHERY: ___ POND: ___ SPECIES: ___ SEASON: ___

DATE	TYPE	AMOUNT	DATE	TYPE	AMOUNT	DATE	TYPE	AMOUNT	DATE	TYPE	AMOUNT
TOTAL			TOTAL			TOTAL			TOTAL		

Figure 6.

(Continued)

DATA SUBMISSION (Continued)

How to complete a Hatchery Water Quality form

Hatchery Water Quality data sheet

Figure 7.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

How to complete Hatchery Trip Sheet

Step	Blank	Action
1	Water Stocked	Name of water body and code as shown on FADS lists.
2	Species	Three-letter PPJ abbreviation and appropriate species code number (pages 40-41).
3	Strain	Indicate strain if appropriate.
4	County	County in which fish were stocked.
5	Prod. Hatchery	Name of hatchery which raised fish and PPJ hatchery code.
6	Delivery Date	Month, day and year.
7	Number loaded	Actual number of fish loaded on truck.
8	Mortality	Number of dead fish estimated.
9	No. Stocked	Number of live fish.
10	Mean Size	Check larvae or adult. Give mean size in mm.
11	Size Range	Size of shortest and longest fish in mm.
12	Split Load	Indicate if more than one water body was stocked from load.
13	Source of eggs	If eggs not produced by hatchery raising fish, then indicate source.
14	Water Temp.	Taken from 4 sources, in centigrade.

(Continued)

DATA SUBMISSION (Continued)

How to complete Hatchery Trip Sheet (Continued)

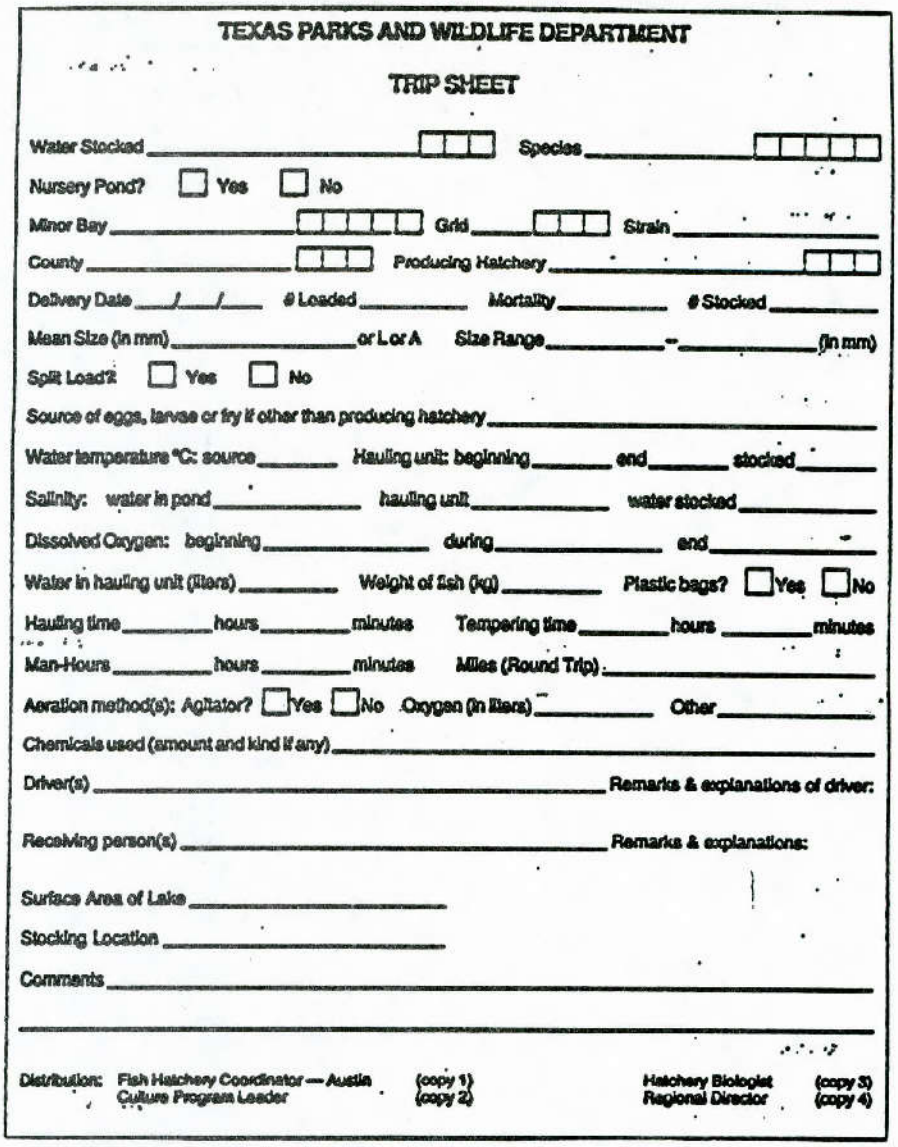
Step	Blank	Action
15	Salinity	Taken from 3 sources, in ppt.
16	Dissolved Oxygen	Taken at beginning, during and at end of trip, in ppm.
17	Man-Hours	Number of man-hours spent, round trip, multiplied by number of persons on trip.
18	Chemicals Used	Salt, etc. used in hauling unit.
19	Receiving Person	If person is there to receive fish, have him sign name and fill in any remarks. If no receiving person, then driver is receiving person.
20	Surface Area of Lake	To be filled in by receiving person.
21	Stocking Location	Unloading site and area where fish were actually put into water.

(Continued)

Bluegill Culture

DATA SUBMISSION (Continued)

Hatchery Trip Sheet



TEXAS PARKS AND WILDLIFE DEPARTMENT

TRIP SHEET

Water Stocked _____ Species _____

Nursery Pond? ☐ Yes ☐ No

Minor Bay _____ Grid _____ Strain _____

County _____ Producing Hatchery _____

Delivery Date ___/___/___ # Loaded _____ Mortality _____ # Stocked _____

Mean Size (in mm) _____ or L or A Size Range _____ – _____ (in mm)

Split Load? ☐ Yes ☐ No

Source of eggs, larvae or fry if other than producing hatchery _____

Water temperature °C: source _____ Hauling unit: beginning _____ end _____ stocked _____

Salinity: water in pond _____ hauling unit _____ water stocked _____

Dissolved Oxygen: beginning _____ during _____ end _____

Water in hauling unit (liters) _____ Weight of fish (kg) _____ Plastic bags? ☐ Yes ☐ No

Hauling time _____ hours _____ minutes Tempering time _____ hours _____ minutes

Man-Hours _____ hours _____ minutes Miles (Round Trip) _____

Aeration method(s): Agitator? ☐ Yes ☐ No Oxygen (in liters) _____ Other _____

Chemicals used (amount and kind if any) _____

Driver(s) _____ Remarks & explanations of driver:

Receiving person(s) _____ Remarks & explanations:

Surface Area of Lake _____

Stocking Location _____

Comments _____

Distribution: Fish Hatchery Coordinator — Austin (copy 1)
Culture Program Leader (copy 2)
Hatchery Biologist (copy 3)
Regional Director (copy 4)

Figure 8.

(Continued)

DATA SUBMISSION (Continued)

Hatchery Codes

Hatchery Code	Hatchery Name
001	Dundee
002	Possum Kingdom
005	Tyler
008	Heart of the Hills
009	A.E. Wood
011	Jasper
014	Management Stocking
015	National Fish Hatchery
016	Other State Hatchery
017	Private Hatchery
018	Other
020	GCCA/CPL Marine Development Center
021	Perry R. Bass
022	Dow

Rearing Codes

Code	Explanation
01	Fry stocking
02	Fry production with paired broodstock
03	Fry production with unpaired broodstock
04	Fingerling growout
05	Broodstock maintenance
06	Egg production with paired broodstock
07	Egg production with unpaired broodstock
08	Egg stocking
09	Spawn and rear

(Continued)

DATA SUBMISSION (Continued)

Species Codes
(Figure 11)

	Species	Code
BIB	Bigmouth Buffalo	00067
BLB	Black Bullhead	00082
BLC	Black Crappie	00137
BDM	Black Drum	00625
BXR	Black X Red Drum	00197
BCF	Blue Catfish	00081
BLG	Bluegill	00124
BXC	Blue X Channel Catfish	00198
BON	Bowfin	00007
BKT	Brook Trout	00032
BRB	Brown Bullhead	00084
BNT	Brown Trout	00030
CHP	Chain Pickerel	00043
CCF	Channel Catfish	00086
CHS	Chum Salmon	00171
COS	Coho Salmon	00172
CNB	Coppernose Bluegill	00194
CXG	Coppernose X Green	00196
HOH	Experimental Hybrids	00173
FHM	Fathead Minnows	00087
FCF	Flathead Catfish	00091
FLB	Florida Bass	00138
FLD	Southern Flounder	00616
FRD	Freshwater Drum	00151
GAR	Alligator Gar	00006
GSH	Golden Shiner	00046
GOF	Goldfish	00044
GSF	Green Sunfish	00120
GXR	Green X Redear Sunfish	00195
HEG	Herring	00193
LAT	Lake Trout	00175
LMB	Largemouth Bass	00134
LES	Longear Sunfish	00126
MIS	Mississippi Silverside	00078
MOE	Mooneye	00011
MUW	Mudminnow	00176
MUE	Muskellunge	00042
NIP	Nile Perch	00180
NOP	Northern Pike	00041
OMC	Orangemouth Corvina	00617
OHS	Other Hybrid Sunfish	00181
OTM	Other Minnows	00054
OSA	Other Salmonids	00182

(Continued)

DATA SUBMISSIONS (Continued)

Species Codes (Continued)

	Species	Code
OTS	Other Suckers	00183
OSF	Other Sunfishes	00184
PAH	Paddlefish	00009
PCB	Peacock Bass	00185
RBT	Rainbow Trout	00027
RDT	Redband Trout	00186
RDM	Red Drum	00629
RBS	Redbreast Sunfish	00119
RSF	Redear Sunfish	00127
REB	Redeye Bass	00130
ROB	Rockbass	00112
SAR	Sauger	00146
SHB	Shoal Bass	00187
SMB	Smallmouth Bass	00131
SAB	Smallmouth Buffalo	00066
SPB	Spotted Bass	00133
SST	Spotted Seatrout	00614
SSC	Spotted Seatrout X Corvina	00199
STB	Striped Bass	00111
SXW	Striped X White Bass	00113
SUB	Super Bass	00188
TAL	Tilapia	00159
TFS	Threadfin Shad	00016
WAE	Walleye	00147
WXG	Walleye X Sauger	00190
WAM	Warmouth	00122
WHB	White Bass	00109
WHC	White Crappie	00136
WHP	White Perch	00624
YLB	Yellow Bass	00110
YEB	Yellow Bullhead	00083
YEP	Yellow Perch	00140
YXS	Yellow X Striped Bass	00191
KOI	Koi Carp	01056
	Snook	00715
	Tarpon	00730
	Black X White Crappie	01039
	Grass Carp(Bighead X Grass)	01059
	Grass Carp (triploid)	01060

PWD-RP-3200-339-11/90

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