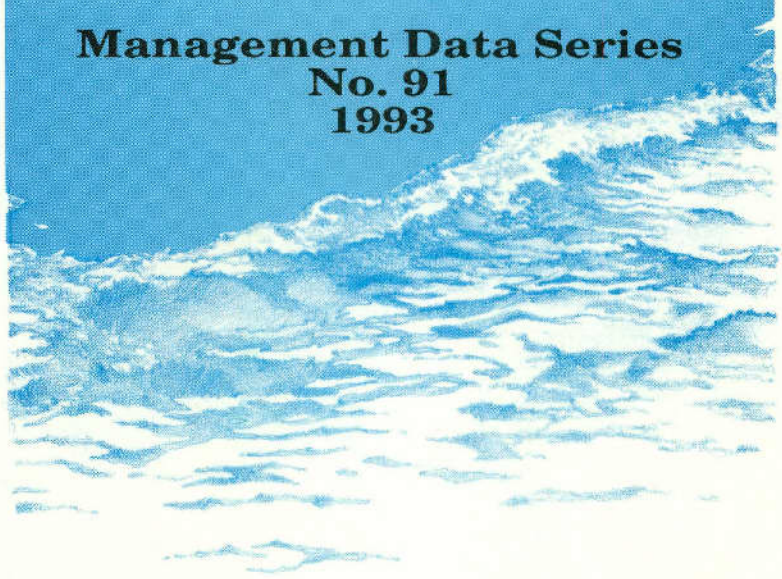
Striped Bass and Hybrid Striped Bass Culture in Texas

by
H. Joe Warren

Management Data Series
No. 91
1993



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ACKNOWLEDGMENTS

This manual was compiled through the efforts of all the personnel at the Dundee, Possum Kingdom and A. E. Wood hatcheries. Their assistance has definitely been appreciated. Special thanks are offered to Gene McCarty, Barbara Gregg, and Michele Nations for their time, patience, and diligence in the production of this manual.

ABSTRACT

Since 1967, approximately 57.4 million striped bass (Morone saxatilis) and 56.2 million hybrids (M. saxatilis x M. chrysops) have been stocked into Texas waters. Fish for stocking were cultured using techniques described in this manual.

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INTRODUCTION

Texas Parks and Wildlife Department 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 recreational fisheries. Throughout this period, culture techniques for all species produced have been continually refined with concomitant improvements in production.

Striped bass (Morone saxatilis) were first produced on Texas hatcheries in 1967 when 5,000 fry were brought to the San Marcos State Fish Hatchery from the Monks Corner Hatchery operated by the South Carolina Wildlife Resources Department (Bonn 1968). In 1973, the first fingerlings produced from Texas striped bass broodfish were stocked into Texas waters (Bonn 1973). This culture program was based upon traditional striped bass culture methodology used in the 1960's as described by Bayless (1972) and Bonn et al. (1976).

While the culture of striped bass and hybrid striped bass (M. saxatilis x M. chrysops) on Texas hatcheries has previously been described, a current, detailed culture manual is not available for the hatchery system. The purpose of this paper is to describe present striped bass culture methods used on Texas Parks and Wildlife Department fish hatcheries. This document can be provided to interested parties and serve as an introductory training document for employees without experience in striped bass culture. In addition, this comprehensive manual will ensure consistency in methodologies used in hatcheries across the state.

METHODS AND MATERIALS

Traditional culture methodology for production of striped bass (Stevens 1966) was modified by Bonn (1969) for use in Texas. Subsequent modifications to culture techniques were based on annual program reports containing data from hatchery pond production records and input from hatchery personnel during annual evaluation meetings. These changes were incorporated into the program and results reported in annual program production summaries. This document represents an update of the original culture guidelines, which includes all changes instituted since the original publication. In addition, this information contains considerably more detail than earlier documents.

RESULTS AND DISCUSSION

Striped bass and hybrid striped bass are produced by collecting native broodstock, stripping and incubating eggs, and rearing fingerlings extensively for 30 to 35 days (Appendix A). Since 1967, approximately 57.4 million striped bass and 56.2 million hybrid striped bass have been stocked into Texas waters using the techniques described in this manual. As facilities and techniques change, culture guidelines will be modified to incorporate these advances.

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Appendix A. Striped Bass and Hybrid Striped Bass Culture Manual.

Striped Bass and Hybrid Striped Bass Culture

GENERAL INFORMATION

Program Goals	To provide the maximum number of striped bass and hybrid striped bass for stocking selected Texas waters.
Program Objectives	o Produce the number, size and type (strain or stock) requested by fisheries managers. o Provide transportation that will maximize survival potential of fish after release. o Electrophoretically certify striped bass and white bass broodstock to ensure genetic integrity.

Striped Bass and Hybrid Striped Bass Culture

BROODSTOCK COLLECTION

Time of Collection

The peak spawning run for striped bass occurs when water temperature is between 16 and 21 C, which in Texas is in April and May.

The peak spawning run for white bass occurs when water temperatures are about 16 C. In Texas such temperatures occur between the last week of March and the second week in April (McCabe 1986).

Collection Sites

Preferred striped bass collection sites are spawning grounds found in rivers containing swift and turbulent waters or tailwater areas at the base of dams.

Striped bass can also be collected in open water in reservoirs.

Mature white bass can be collected from tributary arms of feeder streams of major reservoirs (Bonn et al. 1976).

Collection Methods

Electrofishing is the most desirable and least stressful means of collecting striped bass and white bass broodfish (Bonn et al. 1976).

Certain safety precautions must be taken when using the electrofishing method of collection:

- Wiring should be checked for excessive wear and proper grounding.
- A fire extinguisher and first aid kit should be maintained and kept within the boat.
- All personnel in the boat should be wearing life preservers.
- Personnel assigned to netting of broodfish should wear rubber gloves and boots.
- Dip net handles should be constructed of wood or fiberglass.
- No person in the boat should come in contact with the probe or water when the probe has been activated.
- The driver should wear hearing protection when generator is in operation.

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BROODSTOCK COLLECTION (Continued)

Collection Methods (Continued)

Stationary and drifting gill nets can be used to capture striped bass in open water. Unfortunately, gill nets can cause stress and physical damage, often resulting in broodfish mortality (Bonn et al. 1976). Gill nets should be examined and fish removed every 30-60 min to reduce stress.

Hook-and-line capture is very stressful and is considered the least desirable method for collection of broodfish (Bayless 1972).

Broodfish are anesthetized in holding containers with 15 mg/l tricaine methanesulfonate (MS-222). Since this drug has a 21-day withdrawal period before fish should be eaten, any broodfish that is to be released cannot be anesthetized.

Sexing Broodfish

The best time to sex white and striped bass broodstock is during collection. Fish can be sexed by palpating the abdominal area with enough pressure to cause emission of sperm from the males and by examination of the urogenital area for females. The urogenital area of females, swollen and pink to red in color, will be larger than the male's.

Sexing white bass by palpation early in the spawning season may not be possible because the males may not be in spawning condition. However, by examining the urogenital area, sexes can be distinguished. The female has three distinct openings, whereas the male has only two.

Egg Samples

Egg samples are taken at the collection site immediately after the fish have been captured.

Females should receive minimal handling after capture since associated stress can retard ovulation and reduce egg quality.

To extract eggs, a glass catheter (3.0-mm O.D.) is inserted approximately 48 mm into the vent. To prevent damage to the muscles surrounding the urogenital aperture, the catheter must be carefully inserted and removed. If these muscles are torn, eggs at the posterior end of the ovaries will harden and form a plug, making confirmation of ovulation difficult and preventing the flow of eggs (Bayless 1972).

(Continued)

BROODSTOCK COLLECTION (Continued)

Prediction of Ovulation

Egg samples are viewed with a binocular microscope. Comparisons are made using a set of photographs depicting hourly changes in striped bass eggs as they develop (Bayless 1972).

Eggs are classified as either mature, immature or over-ripe. Immature eggs are light-yellow, with diameters from 0.15 to 0.3 mm. Mature ova, which average 0.75 to 1.0 mm in diameter, are bright green (Bonn et al. 1976). Overripe eggs will show a deterioration of the chorion (Bayless 1972).

Ovulation rates depend on both water temperature and the time of the spawning run. For example, at the end of the spawning season or as water temperatures rise, eggs will mature faster. Although ovulation times can vary, hormone injections help stabilize the process.

Hormone Injection

Mature females, eligible for induced ovulation, are injected at the capture site with 68 IU/kg body weight of human chorionic gonadotropin (HCG). Only those who have an investigational new animal drug (INAD) permit issued by the United States Food and Drug Administration (U. S. Food and Drug Administration 1992) can use HCG at the time of this writing. To obtain maximum milt production, injection of male broodfish with HCG is recommended at a dosage of 34 I.U./kg body weight (Bonn et al. 1976).

Broodfish Transportation

Transportation units should be equipped with aeration and compressed oxygen systems.

Water in these units should be obtained from the collection source and be maintained at a temperature between 13 and 24 C.

To control bacterial infections, promote osmotic regulation (Lewis et al. 1981), and allow proper air-to-water oxygen exchange, transportation water should be treated with 1% salt solution and No Foam®.

(Continued)

BROODSTOCK COLLECTION(Continued)

Broodfish Transportation (Continued)

Only chemicals approved by the U. S. Food and Drug Administration (FDA) and U. S. Environmental Protection Agency (EPA) should be used in spawning of the fish and in transportation units.

Loading densities will depend on the size of the fish, water temperature, and distance to be traveled (McCabe 1986). The loading density should not exceed 0.85 kg/l for females or 1.7 kg/l for males.

When broodfish arrive at the hatchery, they should be tempered 2 C every 30 min until transportation water and holding water temperatures are the same. However, even when water temperatures are the same, fish should still be tempered for at least 20 min to adjust other water quality parameters, such as pH, alkalinity, or dissolved oxygen.

EGG PROCUREMENT AND HATCHING

Broodfish Holding

Striped bass are relatively docile and can be held in circular tanks or raceways. Circular tanks, 1.8-m diameter, are preferred because broodfish are easily recaptured for staging or stripping (Bayless 1972).

Tanks are placed in quiet areas and are partially covered to prevent broodfish from being disturbed by sudden activity or changes in light intensity.

Water temperature is maintained between 16 and 19 C and dissolved oxygen levels > 6.0 mg/l.

Female broodfish are segregated in holding tanks by egg stages to minimize handling of broodfish. Frequent handling of females retards ovulation and increases mortality from stress and infection (Bayless 1972).

Verification of Ovulation

Egg samples must be taken 20 to 28 h after the initial hormone injection. This post-injection egg sample is used to determine when to palpate females. The maximum period between ovulation and over-ripeness of eggs is approximately 60 min (Stevens 1966), so the examinations must be scheduled hourly. Manual palpation should begin 2 h before estimated time of ovulation to be certain the exact time of ovulation will not be missed.

As ovulation progresses, the female swims slowly at the surface of the tank, the abdominal region softens and the vent reddens. After ovulation has begun, slight pressure on the abdominal region will cause eggs to flow freely (Harrell 1984).

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EGG PROCUREMENT AND HATCHING (Continued)

Egg Removal and Fertilization

Each female is anesthetized with a solution of 21 mg/l MS-222 applied to the gills as a spray. After the female is anesthetized, pressure is applied to the abdomen, releasing eggs into a clean pan containing water from the source used in incubation.

Milt from two striped bass males (or five white bass males) per striped bass female is added to the pan. The resultant solution is stirred with a large feather, to mix the eggs and milt without injuring the eggs.

Striped bass spermatozoa become motile immediately upon contact with water and remain active for 35 to 50 sec (Bayless 1972). Because this activity period is short, mixing milt and eggs must be accomplished as quickly as possible.

The percentage of eggs fertilized should be recorded for all egg batches 2 h after fertilization. The eggs will have reached the two-to-four-cell stage by that time (Bonn et al. 1976), and fertilization will be evident.

Lower egg quality (as evidenced by lower mean fertilization rate) is often observed early and late in the spawning season.

Broodfish Certification

After spawning, the genetic makeup of the striped bass and white bass broodfish is verified using electrophoretic analyses (Harvey and Fries 1987).

Approximately 1.0 g of white muscle tissue, from 25 mm below the dorsal fin, is extracted from all male and female striped bass used in the production process. For the production of hybrid striped bass, samples are collected from all of the white bass males and striped bass females.

Each tissue sample is frozen in a plastic bag with the fish's identification tag. The bags are placed in an insulated container packed with dry ice and sent immediately to a fish hatchery genetic laboratory for analysis.

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EGG PROCUREMENT AND HATCHING (Continued)

Egg Incubation

Eggs are either hatched in McDonald jars or fiberglass containers (Bonn et al. 1976). The McDonald jar is preferred because unfertilized eggs can be easily removed. However, if the eggs are highly buoyant, incubation should take place in fiberglass containers.

Since water quality affects hatch rate, dissolved oxygen levels should remain above 6.0 mg/l (Bonn et al. 1976).

Because nitrogen supersaturation will reduce larvae survival due to gas-bubble disease, incoming water is passed through a packed column designed for the removal of gases (Marking 1987).

The optimum water temperature range is 16 to 19 C. Temperatures above 21 C will substantially reduce the percent of hatch for striped bass eggs (Bonn et al. 1976).

The number of eggs will be estimated using the volume displacement method. A known volume of water is placed into the spawning container. After the eggs are spawned into the container, the new volume is immediately measured. Ten samples of 1 ml are taken from each female egg batch. The average number of eggs/ml is established and multiplied by the total ml of eggs displaced.

Approximately 200,000 fertilized eggs are carefully placed into a McDonald hatching jar, containing about two liters of water (Bayless 1972). More eggs will reduce the percentage of hatch because of inadequate water circulation.

Four to six hours after fertilization, take a sample of 300-500 eggs from the jars and determine percent fertilization. Multiply this percentage times the total number of eggs incubating to determine the total number of viable eggs incubating (Rees and Harrell 1990).

(Continued)

Egg Incubation (Continued)	Water flow through the jar causes the eggs to be gently rolled. Since eggs become more buoyant as they harden and could flow out of the jar with sudden water fluctuations, the jars must be watched carefully. Unfertilized, non-ripe, and damaged eggs turn white 12 to 18 h after fertilization. These eggs are more buoyant than live eggs and are removed by siphoning.

LARVAE INCUBATION

Larvae Estimation

Between one and three days post-hatch, larvae are estimated using the volumetric method described by Bishop (1974). Dead larvae will be white and should be removed prior to estimating.

The air and water supply are turned off and the holding water is adjusted to a desired volume. The water is gently stirred to achieve a uniform distribution of fry. A glass tube (i.e., 1.27 cm I.D.) is rapidly inserted (vertically) to the bottom of the holding container; the tube is stoppered to create a vacuum; the sample is withdrawn; and the volume is measured in a graduated cylinder. Depending on fry density and holding container size, between 5 and 20 samples are collected from each container, and the fry in each sample are counted. The highest and lowest sample counts are discarded and mean counts determined and the number of fry per container calculated. Immediately after the samples are collected, the container is refilled and air turned on. The dissolved oxygen in containers should be monitored continuously (Rees and Harrell 1990).

Larvae Handling

Striped bass and hybrid striped bass prolarvae (one to four days old) can be held at high densities (up to 13,000 fry per liter) if water quality and conditions are acceptable. Water temperature should be maintained between 16 and 19 C, with a minimum dissolved oxygen concentration of 6.0 mg/l (Lewis et al. 1981).

In addition, water flow in containers must be sufficient to maintain water quality and keep larvae suspended. For example, in a 100-l aquarium, waterflow should be approximately 4 to 19 l/min.

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LARVAE INCUBATION (Continued)

Larvae Handling (Continued)

While being held in containers, larvae are given daily fungal-control formalin baths at 125 mg/l Formalin-F® for 30-45 min. Oxygen must also be supplied to static containers when formalin treatments are given to maintain dissolved oxygen levels above 6 mg/l.

At four to five days of age, the larvae can maintain a horizontal position and have developed functional mouthparts (Bonn et al. 1976). At this time, larvae are able to feed and should be stocked into rearing ponds.

Swimbladder Inflation

Lack of swim bladder inflation in striped bass larvae is a major cause of decreased growth rates, increased mortality due to stress, and lower survival of stocked fish (Chapman et al. 1986). To inflate swim bladders, striped bass larvae must gulp air; therefore, containers must be well aerated.

In addition to insufficient aeration, a surface oil film from dead eggs or larvae can also cause reduced swim bladder inflation. To alleviate the problem, oil absorbent paper towels are used to remove oil from both the surface of the water and the container sides.

Shipment of Eggs and Larvae

Eggs and larvae are transported in sealed plastic bags with 9.5 l of water and enough oxygen to fill the bag when sealed. Transit temperatures should be between 15.2 and 18.3 C (Rees and Harrell 1990).

Eggs should be shipped at no more than 20,000 per bag, after they have been incubated for a minimum of six hours (Tatum et al. 1966). One to two days after hatch, 50,000 larvae per bag can be packed for shipment (Bayless 1972, Bonn et al. 1976).

Striped Bass and Hybrid Striped Bass Culture

REARING TEN-DAY-OLD LARVAE

Tank Culture

At five days of age, fry are stocked into 1.8-m circular fiberglass tanks, at a stocking rate of 350,000 larvae per tank or 200 larvae per liter. During stocking, fry are tempered gradually from container to tank.

To prevent fry from escaping or becoming impinged on the drain screen, each circular tank's drainage system has a center standpipe fitted with a fine mesh screen (420 μm) and a porous air ring to create an air-bubble curtain. Although the bubble curtain prevents larvae from being pulled into the drain, vigorous aeration of the water should be avoided. Also, lighting should be muted and not changed abruptly during the first week (Lewis et al. 1981).

Water Quality

Water flow in fry holding containers is monitored frequently and adjusted to maintain water quality.

Water quality parameters are maintained as described below:

Parameter	Level or Concentration	Monitoring Frequency
Ammonia	< 0.4 mg/l	daily
Dissolved Oxygen	≥ 7.9 mg/l	hourly
Temperature	16-19 C	hourly

Fungal Control

To control fungal growth, Formalin-F® should be applied daily to the tanks at the rate of 125 mg/l for a period of 30-45 min.

Dissolved oxygen levels are monitored continuously during formalin treatments and not allowed to drop below 6.0 mg/l.

(Continued)

REARING TEN-DAY-OLD LARVAE (Continued)

Feeding Requirements

Because striped bass larvae consume only mobile, planktonic food and have limited swimming ability, maintaining adequate concentrations of suitable food is a critical factor in their survival (Doroshev 1970).

Minimal prey concentrations to initiate a first feeding for striped bass in the laboratory are estimated to be 2,000 nauplii (Artemia sp.) per liter (Miller 1977).

Even after the first feeding, the density of the nauplii is the primary concern, not the number of striped bass larvae in the tank. For example, 9 to 12 h is required for a striped bass larvae to completely digest brine shrimp nauplii, (McHugh 1975). Consequently, each striped bass larvae must obtain sufficient nauplii to fill its digestive tract every nine hours.

Feeding Brine Shrimp

Since incubation of brine shrimp requires approximately 72 h, the process should be initiated before anticipated need.

Brine shrimp cysts (77 to 125 g) are placed into a jar containing a 3% salt solution maintained at 24 C. Cysts will hatch within 72 h.

Brine shrimp should be fed to striped bass larvae each hour, 24 h/day, at a rate of 100-120/ml/day. Nielsen® brine shrimp feeders with timers can be used to automate the process. An airstone should be used with each feeder to distribute the nauplii evenly throughout the tank.

Estimating Larvae

Numbers of larvae in the circular tank can be estimated by volumetric sampling (Bishop 1974).

Removing Larvae

To remove larvae, the water level of the tank is gradually lowered while maintaining a dissolved oxygen concentration in the tank above 6.0 mg/l. Larvae are easily removed with a plastic scoop as they concentrate around the tank's perimeter.

(Continued)

REARING TEN-DAY-OLD LARVAE (Continued)

Removing Larvae (Continued)	To minimize stress, larvae should not be exposed to the air, and no attempt should be made to separate dead from live larvae at this time.
Shipment of Larvae	Larvae are put into doubled bags and a styrofoam box for protection during shipping. Approximately 3.8 l of water and 30,000 ten-day-old larvae are placed inside the inner bag. The bag is then injected with oxygen and sealed with a thick rubberband. The second bag is also injected with oxygen and sealed in the styrofoam box.

Striped Bass and Hybrid Striped Bass Culture

FINGERLING PRODUCTION-EXTENSIVE

Pond Preparation

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

Ten to fifteen days prior to filling, ponds are sprayed with an approved herbicide.

Pond filling is initiated 10 to 14 days before stocking. Incoming water is filtered through a 500-μm screen to prevent contamination with undesirable fish.

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 and Lichtkoppler 1979, Warren et al. 1990).

- 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 - < 0.0003 mg/l
- pH - between 6.5 and 8
- Salinity - < 8,000 mg/l
- Temperature - < 32 C
- Turbidity - < 80 mg/l

Daily dissolved oxygen and temperature readings are taken one hour before sunrise at a depth of 30 cm. Secchi disc and pH readings are taken twice weekly prior to fertilizer applications.

Zooplankton Management

The production of fingerling striped bass is directly proportional to the kinds and abundance of zooplankton available in the pond (Stevens 1975). Five- to ten-day-old larvae select instar stages of cladocera and copepods (Sandoz and Johnston 1966, Humphries and Cumming 1972, 1973). As striped bass reach 20 and 30 mm, the most important food constituent becomes the adult cyclopoid-copepod (Regan et al. 1968, Meshaw 1969, Harrell et al. 1977).

(Continued)

FINGERLING PRODUCTION-EXTENSIVE (Continued)

Zooplankton Management (Continued)

The biological objective of fertilizing rearing ponds is to stimulate the development of all zooplankton foods, including aquatic bacteria, desirable green unicellular algae, protozoa, and organic particulate matter colonized by combinations of these organisms (Geiger and Turner 1990).

Fertilized plankton ponds will provide high plankton populations to inoculate production ponds at filling. The inoculant should contain high levels of adult cladocerans, adult copepods and unicellular green algae but not filamentous algae, fairy shrimp, clam shrimp or tadpole shrimp (Piper et al. 1982, Turner 1984).

Fertilization

For production of 25- to 50-mm fingerlings, ponds are fertilized using methods described by Geiger (1983)

Organic-

- At the time of filling, 280 kg/ha cottonseed meal are broadcast on the windward side of a rearing pond.
- Follow-up treatments at the rate of 56 kg/ha begin five days after the initial application and then continue twice weekly for four weeks.
- Organic fertilizer should not be applied when the minimum dissolved oxygen level is below 4.0 mg/l.

(Continued)

FINGERLING PRODUCTION-EXTENSIVE (Continued)

Fertilization (Continued)

Inorganic-

- Liquid inorganic fertilizers, diluted with pond water, are broadcast on the windward side of the pond at the rate of 0.5 mg/l nitrogen as ammonium nitrate (33-0-0) and 1.0 mg/l phosphorus as phosphoric acid (0-54-0).
- These fertilizers are applied three times weekly prestocking and twice weekly for three weeks poststocking.
- Ponds with Secchi disc readings less than 24 cm should not receive inorganic fertilizers because this reading is within the optimum chlorophyll a range (Boyd 1979).

The recommended rate for lined ponds is one-half of the earthen ponds (Warren 1993).

Plankton Monitoring

Zooplankton are counted to evaluate pond productivity. Plankton samples are taken at one day prestocking and at 7, 14 and 21 days poststocking. The sample one day before stocking will allow managers to adjust stocking rates or delay stocking based upon food availability (Rutledge 1988).

Plankton samples are obtained from two locations in the pond with a flexible-impeller pump apparatus that samples the complete water column (Farquhar and Geiger 1984). Organisms are then identified to the lowest practical taxonomic level, counted and expressed as number of organisms per liter (American Public Association et al. 1975, Fitzmayer et al. 1986).

Zooplankton should number at least 200 to 250 preferred organisms per liter before stocking.

Stocking Ponds

Larvae are stocked three to five days after hatching, when their mouthparts have become functional and they are swimming horizontally (Bonn et al. 1976).

(Continued)

Striped Bass and Hybrid Striped Bass Culture

FINGERLING PRODUCTION-EXTENSIVE (Continued)

Stocking Ponds (Continued)

To produce 32-mm fingerlings in 30 to 35 days, larvae are stocked at a rate of 121,410 larvae/ha.

Larvae are particularly susceptible to stress and complete mortality can occur within 24 h if larvae are overcrowded, netted or touched.

Direct sunlight should be avoided when larvae are handled; therefore, stocking should conclude before sunrise (Bonn et al. 1976). Water temperatures in the pond and the incubator area will be most similar before dawn.

Optimally, the water temperature will be 18 to 23 C. In addition, dissolved oxygen concentrations should be above 4.0 mg/l and Secchi disc readings will be 50 to 60 cm prior to stocking.

Tempering should be done as follows:

- o During the first 5 min, exchange water at a rate of 1 l/min.
- o For the next 10 min, increase the rate of exchange to 2 - 3 l/min.

Even when there are no differences in temperature, tempering should take place to compensate for water quality variations.

Supplemental Feeding

Salmon feed, containing at least 38% protein, is adequate as a supplemental diet (Bonn et al. 1976, Valenti et al. 1976).

Beginning 14 days after stocking, feed is supplied three times daily at a rate of 4.5 kg/ha. Feeding rates should be increased to 6.7 kg/ha at each feeding when zooplankton populations are very low (Bonn et al. 1976) and discontinued if dissolved oxygen levels fall below 4.0 mg/l.

Harvest Size

Weekly samples of 20 fish should be taken from each pond to determine average size and growth rates. When target production size is reached or zooplankton populations are decimated, fish should be harvested.

Production of 33-mm fingerlings in properly managed ponds usually requires 30 days.

(Continued)

FINGERLING PRODUCTION-EXTENSIVE (Continued)

Culture Activities Summary

POND CULTURE ACTIVITIES

Day	Step	Action	Comments
-20	1	Disk, Blade, Pack	Dried pond
-15	2	Vegetation Control	Approv. Chem.
-10	3	Begin Filling	Filter water
		Fertilizer:	
		Initial Organic	280 kg/ha
-9	4	Fertilizer:	
		Inorganic	0.5 mg/l N 1.0 mg/l P
-6 thru -3	5	Follow-up Fert:	
		Organic	56 kg/ha
		Inorganic	0.5 mg/l N 1.0 mg/l P
-1	6	Sample	Zooplankton
0	7	Stock Fry	
+2 thru +5	8	Follow-up Fert:	
		Organic	Same rate
		Inorganic	as step 5
+7	9	Sample	Zooplankton
+9 thru +11	10	Follow-up Fert:	
		Organic	Same rate
		Inorganic	as step 5
+14	11	Sample	Zooplankton
+21	12	Harvest	

(Continued)

FINGERLING PRODUCTION-EXTENSIVE (Continued)

Pond Harvest

Striped bass fingerlings do not tolerate heat as well as most other warmwater fishes, and their tolerance to stress is reduced in warm water normally present during pond harvest operations (Coutant and Carroll 1980). For this reason, handling fish during harvest should be kept to a minimum, and direct sunlight should be avoided whenever possible (Turner 1984)

Draining should be timed so that harvest operations are completed as early in the morning as possible, while the water temperature is low. If necessary, fresh water is pumped into the drainage area to cool the water.

To reduce temperature stress, water in the harvest tank should be filled from the same source as the pond and contain 1% salt and oxygen supplied at the rate of 2 - 6 l/min.

Precautions should be taken to prevent overcrowding in the harvest tanks (Turner 1984). The cumulative total weight of fish as they are loaded into the tank should not exceed 23 g/l.

Fingerlings should be drained from the trailer into the holding troughs with no netting or handling.

Estimating Fingerling Production

Five samples, each consisting of 20 fish, are weighed during pond harvest. An average number of fish/kg is calculated for each pond and, based on the weight of fish harvested from the pond, is used to determine the total number of fish.

Striped Bass and Hybrid Striped Bass Culture

TRANSPORTATION

Preparation

Fingerlings are maintained overnight in holding troughs and transported early the next morning when the temperatures are coolest.

Hauling units should contain a 1% by weight salt solution and anti-foaming agent.

The dissolved oxygen level during the first hour of confinement is most critical in the transport of striped bass (Babcock and Post 1967).

Dissolved oxygen concentrations in transport units are maintained above 6 mg/l using compressed oxygen and agitators. Levels are monitored immediately before and after loading, and every hour thereafter during transit.

Loading Density

Recommended loading densities for temperatures to 21 C are based on the transit time and should not be exceeded.

Transit Time	kg/l
Over 10 hrs	0.018
5-10 hrs	0.024
0-5 hrs	0.030

For every degree above 21 C, loading rates are reduced by four percent. Ice can be added at a rate of 60 g/l for each 5 C decrease desired to reduce temperatures (Anonymous 1971).

Stocking

Fish should be acclimated slowly from the water in the transportation unit to the water of the environment into which they are being stocked.

Rapid changes in temperature, water quality and oxygen levels can significantly affect survival.

(Continued)

TRANSPORTATION (Continued)

Stocking (Continued)	Proper tempering requires 20 min for every 4 C change in water temperature (McCraren 1978). If water temperatures are not significantly different, temper for other water quality parameters (i.e., pH, alkalinity, dissolved oxygen) for not less than 20 min.

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.

(Continued)

DATA SUBMISSION (Continued)

Duties of Hatchery Personnel (Continued)

Step	Staff	Action
4	Program Leader	Edits summary or data. Prepares and submits annual program summary or current project activities to director of programs within 30 days of completion.
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 (i. e., 93).
2	Hatchery	Enter numerical code identifying hatchery (page 57).
3	Pond	Enter appropriate pond number.
4	Species	Enter numerical code identifying species (pages 57-59).
5	Season	Enter numerical code identifying season. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Production Data Sheet (Continued)

Step	Blank	Action
6	Rearing	Enter numerical code identifying rearing (page 56).
7	Pairing	Enter pairing number. o 1 = first pairing o 2 = second pairing o 3 = third pairing
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).
		Stock Data
11	Fill Date	Enter date pond filling initiated (mm/dd/yy).
12	Date	Enter date fish were stocked in pond (mm/dd/yy).
13	Temp.	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).

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Production Data Sheet (Continued)

Step	Blank	Action
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).
22	Source Pond	Enter pond number where broodfish or fry originated.
		Harvest Data
23	Date	Enter date pond was harvested (mm/dd/yy).
24	Temp.	Enter pond water temperature at date of harvest (C).
25	Number	Enter estimated number of fish harvested.
26	Pounds	Enter weight of fish (lbs).
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.

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Production Data Sheet (Continued)

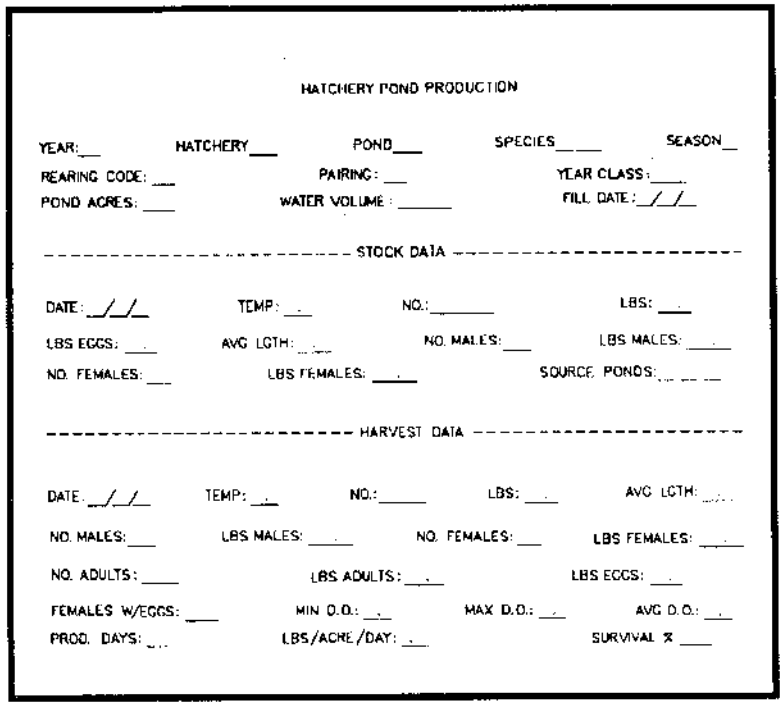
Step	Blank	Action
31	Pounds Females	Enter weight of females harvested (lbs).
32	Number Adults	Enter total number of adults harvested.
33	Pounds of Adults	Enter total weight of adults harvested (lbs).
34	Pounds of Eggs	Enter total weight of eggs harvested (lbs).
35	Females w/Eggs	Enter total number of females that produced eggs.
36	Min. D.O.	Enter minimum dissolved oxygen reading during culture period (mg/l).
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 period (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).

(Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

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:___ LBS FEMALES: ____

NO. ADULTS: ____ LBS ADULTS: ____ LBS EGGS: ___

FEMALES W/EGGS: ____ MIN D.O.: __ MAX D.O.: __ AVG D.O.: __

PROD. DAYS: ___ LBS/ACRE/DAY: ___ SURVIVAL % ____

Figure 1.

How to Complete Hatchery Pond Production (2) Sheet

Step	Blank	Action
		Fertilizer Data
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	Lbs/ Gallons	Enter unit of measurement for fertilizer application (lbs, gal).

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Production (2) Sheet (Continued)

Step	Blank	Action
5	No. Apps	Enter total number of fertilizer applications made.
6	Rate	Enter value calculated (total pounds or gallons applied/pond size in acres).
		Feed Data
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 number feedings made.
		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. Apps	Enter total number of applications.
		Forage data
15	Species	Enter species of forage used.
16	Total Pounds	Enter total weight of that species of forage (lbs).

(Continued)

DATA SUBMISSION (Continued)

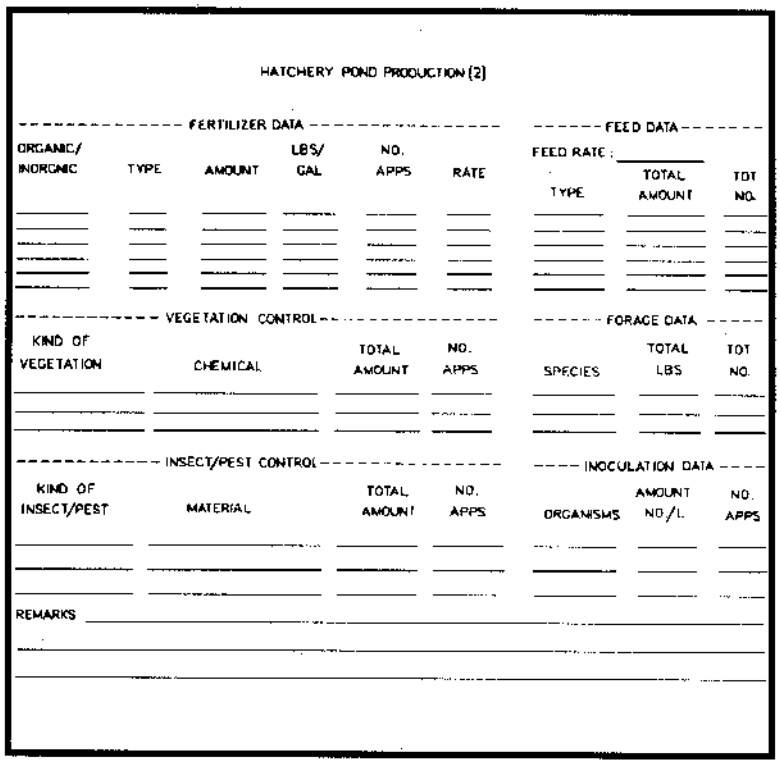
How to Complete Hatchery Pond Production (2) Sheet (Continued)

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

(Continued)

DATA SUBMISSION (Continued)

Hatchery Pond Production Data Sheet (2)



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.

How to Complete Hatchery Pond Samples Sheet

Step	Blank	Action
1	Hatchery	Enter appropriate hatchery code from hatchery code list (page 57).
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 (i. e., 93).

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Samples Sheet (Continued)

Step	Blank	Action
5	Date	Enter date (mm/dd/yr).
6	Time	Enter time (military time).
7	Fry Length	Enter mean total length in mm of 10-fish sample.
8	Fry Wt.	Enter mean weight (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 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.
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.

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Samples Sheet (Continued)

Step	Blank	Action
18	Alkalinity	Enter total alkalinity from water (mg/l) sample taken at time of sample.
19	Salinity (ppt)	Enter salinity of pond water at time of sample.
20	Volume Filtered (ml)	Enter the volume of the sample filtered for plankton analysis.
21	Volume Conc. (ml)	Enter the volume the concentrate (usually 100 ml).
22	Conc. Factor	Enter the concentration factor (vol. filtered divided by the concentrate).
		Water Sample
23	Rotifers (mean/l)	Enter mean number of rotifers in plankton sample.
24	Cladocerans (mean/l)	Enter mean number of cladocerans in plankton sample.
25	Copepods (mean/l)	Enter mean number of copepods in plankton sample.
26	Other Type	Enter name of other pertinent organisms (i.e., polychaete larvae).
27	Other Org. (mean/l)	Enter mean number of other organisms in plankton number.

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Pond Samples Sheet (Continued)

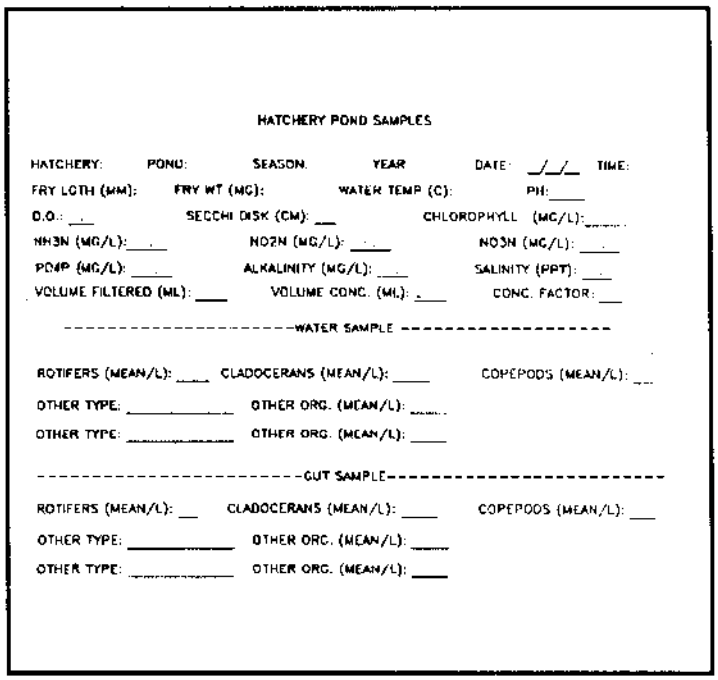
Step	Blank	Action
28	Other Type	Similar to 26.
29	Other Org. (mean/l)	Same as 27.
		Gut Sample
30	Rotifers (mean/l)	Enter mean number of rotifers in gut samples from 10 fish.
31	Clado-cerans (mean/l)	Enter mean number of clado-cerans in samples from 10 fish.
32	Copepods (mean/l)	Enter mean number of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

Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

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): ____

----------GUT 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 Fertilizer Sheet

Step	Blank	Action
1	Year	Enter year (i. e., 93).
2	Hatchery Code	Enter hatchery code (page 57).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 57-59).
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)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

Hatchery Fertilizer Sheet

FERTILIZER

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

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

Figure 4.

How to Complete a Herbicide/Pesticide/ Inoculation/Forage Data Sheet

Step	Blank	Action
1	Year	Enter name (i. e., 93).
2	Hatchery Code	Enter hatchery code (page 57).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 57-59).

(Continued)

DATA SUBMISSION (Continued)

How to Complete a Herbicide/Pesticide/ Inoculation/Forage Data Sheet (Continued)

Step	Blank	Action
5	Season	Enter appropriate season code. o 1 = Spring o 2 = Summer o 3 = Fall o 4 = Winter
6	Vegetation Control	Enter date, vegetation treatment chemical, control and amount, and total applications in appropriate rows below.
7	Inoculation	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)

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.

How to Complete a Feed Data Sheet

Step	Blank	Action
1	Year	Enter year (i. e., 93).
2	Hatchery Code	Enter hatchery code (page 57).
3	Pond	Enter appropriate pond number.
4	Species	Enter appropriate species code (pages 57-59).
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)

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.

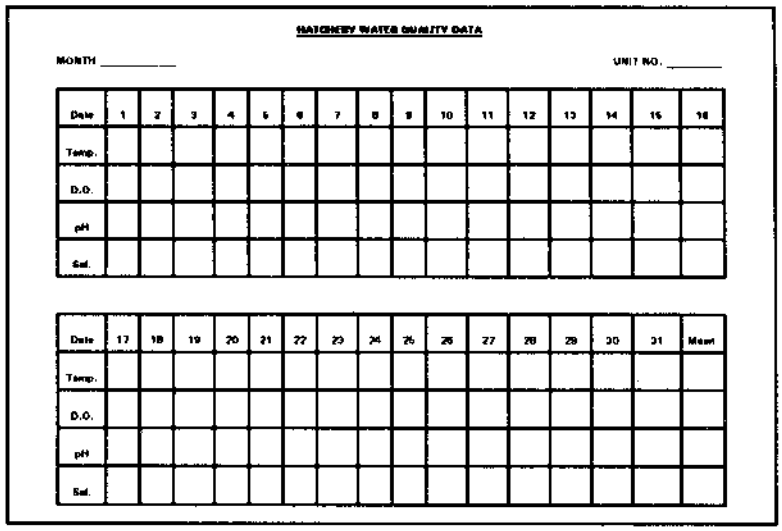
How to Complete a Hatchery Water Quality Data Sheet

Step	Blank	Action
1	Month	Enter month (i. e., 01).
2	Unit Number	Enter unit number (i.e., pond, raceway, trough, tank, etc.).
3	Water Quality	Enter designated water quality values (temperature, D.O., pH, and salinity) in boxes for appropriate date. Calculate monthly means.

(Continued)

DATA SUBMISSION (Continued)

Hatchery Water Quality Data Sheet



HATCHERY WATER QUALITY DATA

MONTH _____ UNIT NO. _____

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Temp.																
D.O.																
pH																
Sal.																

Date	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Mean
Temp.																
D.O.																
pH																
Sal.																

Figure 7.

How to Complete a Hatchery Trip Sheet

Step	Blank	Action
1	Water Stocked	Name of water body and code.
2	Species	Appropriate 3-letter abbreviation and appropriate FADS fish species code number (pages 57-59).
3	Strain	Indicate strain abbreviation.
4	County	County in which fish were unloaded (page 59-65).
5	Prod. Hatchery	Name of hatchery where fish were raised and hatchery code (page 57).

(Continued)

DATA SUBMISSION (Continued)

How to Complete a Hatchery Trip Sheet

Step	Blank	Action
6	Delivery Date	Month, day and year truck was unloaded (mm/dd/yy).
7	Number Loaded	Actual number of fish loaded on truck at hatchery or loading site.
8	Mortality	Number of dead fish as estimated or counted by hatchery personnel.
9	Number Stocked	Number of live fish or eggs stocked.
10	Mean Size	Check appropriate blank to show 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 Egg, etc.	If eggs, etc., are not produced by hatchery which raised the fish, then show where they came from.
14	Water Temp.	Taken from the four sources, in centigrade.
15	Salinity	Taken from three sources, expressed in ppt.
16	Dissolved Oxygen	Taken at beginning, during and at end of trip (ppm).
17	Man-Hours	Number of man-hours spent, round trip, multiplied by number of persons on trip.

(Continued)

DATA SUBMISSION (Continued)

How to Complete Hatchery Trip Sheet (Continued)

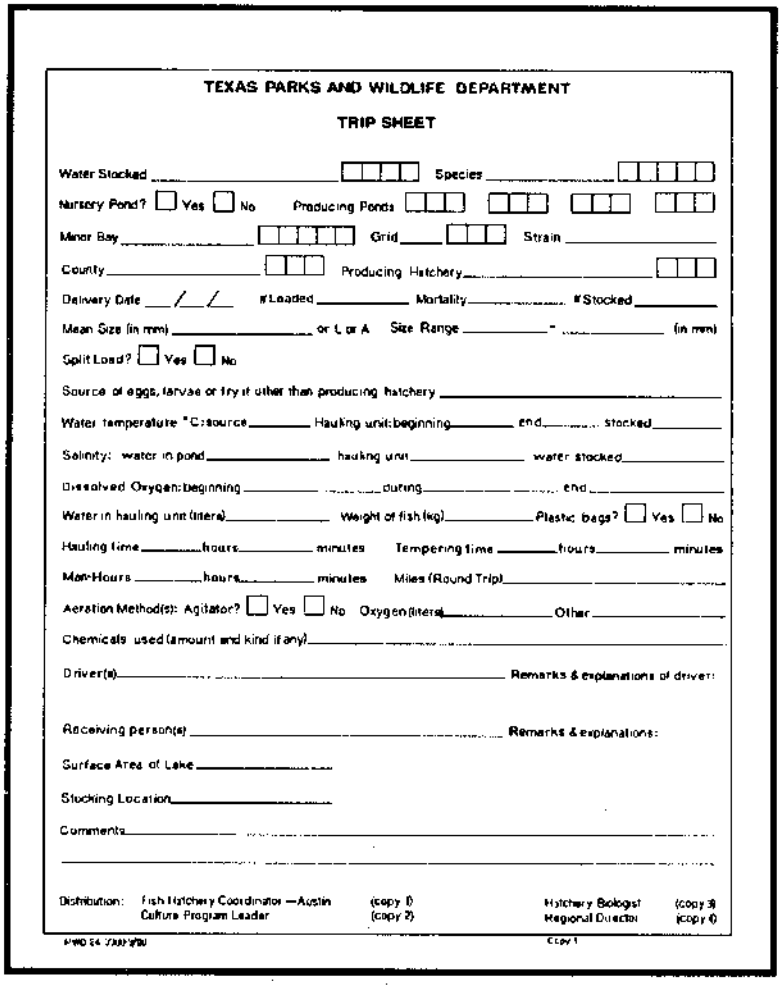
Step	Blank	Action
18	Chemicals Used	Salt, etc., used in hauling unit.
19	Receiving Person	If person is there to receive fish, have them sign name and fill in any remarks. If no receiving person, then driver is receiving person. Names should be legible.
20	Surface Area of Lake	To be filled in by receiving person.
21	Stocking Location	Unloading site and area where fish were put into water.

(Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

Hatchery Trip Sheet



TEXAS PARKS AND WILDLIFE DEPARTMENT

TRIP SHEET

Water Stocked _____ ☐☐☐☐ Species _____ ☐☐☐☐☐

Nursery Pond? ☐ Yes ☐ No Producing Ponds ☐☐☐ ☐☐☐ ☐☐☐ ☐☐☐

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 (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) Hatchery Biologist (copy 3)
Culture Program Leader (copy 2) Regional Director (copy 4)

Copy 1

Figure 8.

(Continued)

DATA SUBMISSION (Continued)

How to Complete a Striped Bass Broodfish Data Sheet (1)

Step	Blank	Action
1	Captured in	Enter capture site.
2	Departure Time	Enter time transportation unit departed collection site (military time).
3	Date of Capture	Enter date fish were captured (mm/dd/yy).
4	Arrival Time	Enter time fish arrived at hatchery.
5	Capture Method	Enter appropriate method by which fish were collected, i.e., electrofishing, hook-and-line.
6	Driver(s)	Enter name of driver(s).
7	Water Temp. Loading	Enter water temperature at of transportation unit when fish were loaded (C).
8	Number	Enter on fish tag.
9	Sex	Enter sex of fish.
10	Egg Stage	Enter egg stage when captured (h).
11	Weight	Enter weight of fish (kg).
12	HCG Time	Enter time HCG injection was given (military time).
13	HCG Amount	Enter amount of HCG injection (cc).
14	Comments	Enter any comments not otherwise noted.

(Continued)

DATA SUBMISSION (Continued)

Striped Bass Broodfish Data Sheet (1)

STRIPED BASS BROODFISH DATA SHEET

Captured in:_____ **Departure Time:**_____

Date of Capture:_____ **Arrival Time:**_____

Capture Method:_____ **Driver(s):**_____

Water Temp. at Loading:_____ _____

No.	Sex	Egg Stage	Wt.	HCG Time	HCG Amnt	Comments

Figure 9.

How to Complete a Striped Bass Broodfish Data Sheet (2)

Step	Blank	Action
1	Date	Enter date fish were collected (mm/dd/yy).
2	Truck	Enter transportation unit on which fish were loaded.
3	HCG Wt.	Enter weight of fish (kg).
4	HCG Time	Enter HCG injection was administered (military time).
5	Amount	Enter amount of HCG injected into fish (cc).
6	Comments	Enter any comments not otherwise noted.

(Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

Striped Bass Broodfish Data Sheet (2)

BROODFISH DATA SHEET DATE _____ TRUCK_____ PAGE 2

No.	Sex	Egg Stage	Wt.	HCG Time	HCG Amnt	Comments

Figure 10.

How to Complete a Striped Bass/Hybrid Culture Work Sheet

Step	Blank	Action
		Lake Information
1	Brooder Number	Enter numerical brooder number.
2	I.D. Code	Enter appropriate tag color.
3	Brooder Wt.	Enter total weight of fish (kg).
4	Source	Enter water source from which fish was captured.
5	Date	Enter date fish was collected (mm/dd/yy).

(Continued)

DATA SUBMISSION (Continued)

How to Complete a Striped Bass/Hybrid Culture Work Sheet (Continued)

Step	Blank	Action
6	Water Temp.	Enter water temperature of collection site at time of collection (C).
7	Lake Egg Stage	Enter egg stage of fish at time of collection (h).
8	Time Injection	Enter time fish was injected with HCG (military time).
9	Hat. Egg Stage	Enter post-injection (20-24 h) egg stage.
	Hatchery Information	
10	Stb_____ or Hyb_____	Check appropriate blank for striped bass or hybrid production.
11	Date Spawned	Enter date fish was spawned (mm/dd/yy).
12	Time Spawned	Enter time fish was spawned (mm/dd/yy).
13	Egg Volume	Enter volume of eggs (ml).
14	No. of Eggs	Enter total number of eggs spawned.
15	% Fertilization	Enter percent fertilization at 2, 4 or 6 h post-fertilization.
	Hatching Information	
16	Date Hatch	Enter date eggs were hatched (mm/dd/yy).
17	Time Hatch	Enter time of day eggs were hatched (military time).

(Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

How to Complete a Striped Bass/Hybrid Culture Work Sheet (Continued)

Step	Blank	Action
18	No. Fry	Enter total number of fry hatched.
19	At_____ Days	Enter total number of days it took for eggs to hatch in hours (h).
20	Avg. Incubation Temp.	Enter average incubation water temperature (C).
	Stocking Information	
21	Date Stocked	Enter date pond was stocked with fry (mm/dd/yy).
22	Time Stocked	Enter time of day fish were stocked into pond (military time).
23	Pond Temp.	Enter pond water temperature at stocking (C).
24	Ponds Stocked	Enter pond number(s) fry were stocked into.
25	Tempering Time	Enter total time fry were tempered into the pond(s) (military time).
	Broodfish Information	
26	Time Checked	Enter time female was palpated (military time).
27	Comments	Enter observations at each palpation.

(Continued)

Striped Bass and Striped Bass Hybrid Culture

DATA SUBMISSION (Continued)

Striped Bass/Hybrid Culture Work Sheet

STRIPED BASS/HYBRID CULTURE WORK SHEET

Lake Information

Brooder No._____ I.D. Code_____ Brooder Wt. _____

Source _____ DateCollected _____ Water Temp_____

Lake Egg Stage _____ Time Injected _____ Hat. Egg Stage _____

Hatchery Information

STB___ of HYB___ Date Spawned _____ Time Spawned_____

Egg Vol. _____ No. of Eggs _____

Percent Fertilization at 2, 4, or 6 hours _____

Hatching Information

Date Hatchery _____ Time Hatch _____

No. fry _____ at _____ days Avg. Incubation Temp. _____

Stocking Information

Date Stocked _____ Time Stocked _____ Pond Temp _____

Ponds Stocked _____

Tempering Time _____

Broodfish Information

Time Checked	Comments

Figure 11.

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)

Striped Bass and Striped Bass Hybrid Culture

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

Species Codes

	Species	Code
BIB	Bigmouth Buffalo	00067
BLB	Black Bullhead	00082
BLC	Black Crappie	00137
BWC	Black x White Crappie	01039
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
GRC	Grass Carp(Bighead x Grass)	01059
TGC	Grass Carp (triploid)	01060
CXG	Coppernose x Green	00196
HOH	Experimental Hybrids	00173

(Continued)

DATA SUBMISSION (Continued)

Species Codes
(Continued)

	Species	Code
FHM	Fathead Minnows	00087
FCF	Flathead Catfish	00091
FLB	Florida Bass	00138
FLD	Flounder-Southern	00616
FRD	Freshwater Drum	00151
GAR	Gar-Alligator	00006
GSH	Golden Shiner	00046
GOF	Goldfish	00044
GSF	Green Sunfish	00120
GXR	Green x Redear Sunfish	00195
HEG	Herring	00193
KOI	Koi Carp	01056
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
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

(Continued)

DATA SUBMISSION (Continued)

Species Codes (Continued)

	Species	Code
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

County Codes

Code	County
001	Anderson
002	Andrews
003	Angelina
004	Aransas
005	Archer
006	Armstrong
007	Atacosa
008	Austin
009	Bailey
010	Bandera
011	Bastrop
012	Baylor
013	Bee
014	Bell
015	Bexar
016	Blanco
017	Borden
018	Bosque
019	Bowie
020	Brazoria

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
021	Brazos
022	Brewster
023	Briscoe
024	Brooks
025	Brown
026	Burleson
027	Burnet
028	Caldwell
029	Calhoun
030	Callahan
031	Cameron
032	Camp
033	Carson
034	Cass
035	Castro
036	Chambers
037	Cherokee
038	Childress
039	Clay
040	Cochran
041	Coke
042	Coleman
043	Collin
044	Collingsworth
045	Colorado
046	Comal
047	Comanche
048	Concho
049	Cooke
050	Coryell
051	Cottle
052	Crane
053	Crockett
054	Crosby
055	Culberson
056	Dallam
057	Dallas
058	Dawson
059	Deaf Smith
060	Delta

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
061	Denton
062	DeWitt
063	Dickens
064	Dimmit
065	Donley
066	Duval
067	Eastland
068	Ector
069	Edwards
070	Ellis
071	El Paso
072	Erath
073	Falls
074	Fannin
075	Fayette
076	Fisher
077	Floyd
078	Foard
079	Fort Bend
080	Franklin
081	Freestone
082	Frio
083	Gaines
084	Galveston
085	Garza
086	Gillespie
087	Glasscock
088	Goliad
089	Gonzales
090	Gray
091	Grayson
092	Gregg
093	Grimes
094	Guadalupe
095	Hale
096	Hall
097	Hamilton
098	Hansford
099	Hardeman
100	Hardin

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
101	Harris
102	Harrison
103	Hartley
104	Haskell
105	Hays
106	Hemphill
107	Henderson
108	Hidalgo
109	Hill
110	Hockley
111	Hood
112	Hopkins
113	Houston
114	Howard
115	Hudspeth
116	Hunt
117	Hutchinson
118	Irion
119	Jack
120	Jackson
121	Jasper
122	Jeff Davis
123	Jefferson
124	Jim Hogg
125	Jim Wells
126	Johnson
127	Jones
128	Karnes
129	Kaufman
130	Kendall
131	Kenedy
132	Kent
133	Kerr
134	Kimble
135	King
136	Kinney
137	Kleberg
138	Knox
139	Lamar
140	Lamb

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
141	Lampasas
142	La Salle
143	Lavaca
144	Lee
145	Leon
146	Liberty
147	Limestone
148	Lipscomb
149	Live Oak
150	Llano
151	Loving
152	Lubbock
153	Lynn
154	Madison
155	Marion
156	Martin
157	Mason
158	Matagorda
159	Maverick
160	McCullough
161	McLennon
162	McMullen
163	Medina
164	Menard
165	Midland
166	Milan
167	Mills
168	Mitchell
169	Montague
170	Montgomery
171	Moore
172	Morris
173	Motley
174	Nacogdoches
175	Navarro
176	Newton
177	Nolan
178	Nueces
179	Ochiltree
180	Oldham

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
181	Orange
182	Palo Pinto
183	Panola
184	Parker
185	Parmer
186	Pecos
187	Polk
188	Potter
189	Presidio
190	Rains
191	Randall
192	Reagan
193	Real
194	Red River
195	Reeves
196	Refugio
197	Roberts
198	Robertson
199	Rockwall
200	Runnels
201	Rusk
202	Sabine
203	San Augustine
204	San Jacinto
205	San Patricio
206	San Saba
207	Schleicher
208	Scurry
209	Shackleford
210	Shelby
211	Sherman
212	Smith
213	Somervell
214	Starr
215	Stephens
216	Sterling
217	Stonewall
218	Sutton
219	Swisher
220	Tarrant

(Continued)

DATA SUBMISSION (Continued)

County Codes (Continued)

Code	County
221	Taylor
222	Terrell
223	Terry
224	Throckmorton
225	Titus
226	Tom Green
227	Travis
228	Trinity
229	Tyler
230	Upshur
231	Upton
232	Uvalde
233	Val Verde
234	Van Zandt
235	Victoria
236	Walker
237	Waller
238	Ward
239	Washington
240	Webb
241	Wharton
242	Wheeler
243	Wichita
244	Wilbarger
245	Willacy
246	Williamson
247	Wilson
248	Winkler
249	Wise
250	Wood
251	Yoakum
252	Young
253	Zapata
254	Zavala

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