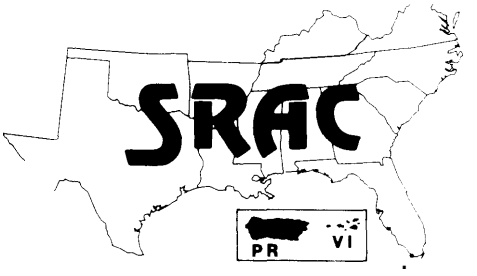
SRAC Publication No. 323

Southern
Regional
Aquaculture
Center



June, 1990

Red Drum

Brood Stock and Hatchery Production

James T. Davis*

The securing of brood stock, inducing them to spawn, and caring for the eggs until hatching requires the most technical expertise of any phase of fish production. Red drum are no exception. As with most fish the selection and care of brood stock determines the success or failure of a hatchery. Well cared for brood stock spawn more readily, produce more eggs with a higher fertilization rate, have fewer disease problems and live longer.

Broodstock collection and handling

Because red drum brood stock have not been reared to maturity in captivity, all brooders in use were captured in the wild. As a general rule all fish must become accustomed to the activities of humans in their vicinity. This is especially true for red drum which become excited with unusual sounds or movement. As soon as the brood stock tank is prepared, arrangements should be made to secure brood stock. Usually a minimum of 6 weeks and up to 6 months in an indoor tank is necessary before the wild fish become acclimated. The design of the tank, the way the fish were handled, the temperature of the water, the feed being used, and the lighting control all affect the time required.

Capture of broodstock

Before any brood fish can be captured, a permit must be obtained in most states. This usually is issued by the state fish and game agency and may require an inspection of facilities and sworn statements or depositions. The length of time required for this will vary between states but usually is 2 to 4 weeks.

Several methods have been used to capture brooders. Most hatcheries have used sport fishing methods, but some success has been achieved using purse seines, beach seines and longlines. If fishing is to be done in the Gulf, time of year will determine the most productive areas and methods to be used. Some brood fish have been caught in impoundments. If fish are caught with sport fishing tackle, use procedures that least stress the fish. Most fishermen recommend a circle tuna hook 3/0 to 7/0. The line should be 30- to 40-pound test with a light action reel and a medium action rod. Live bait is preferred. Fish should be landed as rapidly as possible and placed into the transport container. While handling the fish use wet hands, wet towels or wet burlap sacks to carry the fish. Covering the eyes of the fish has a calming effect. Better handling means less mucus removal and less opportunity for bacterial infections to develop.

Handling of brood stock

The transport container should contain water of identical quality as the bay or reservoir from which the fish are taken. The temperature can be slightly cooler, and the oxygen should be 5 ppm or higher. Do not crowd the fish. Crowding tends to increase fish activity with a consequent rise in ammonia levels. The transport container should be as dark as possible. When fish are added to the container, the cover should be raised very slowly to prevent unnecessary excitement of the fish already in the container.

The dissolved oxygen in the transport container should remain above 5 ppm but less than 9 ppm. In addition the water in the container should be cooled to 70%, if the fish are to be in the container longer than 2 hours.

Antibiotics can be added to the water to reduce the incidence of bacterial infections. Acriflavine and Furacin have

* The Texas A&M University System

been used successfully. In addition, some hatcheries make a practice of injecting fish with tetracycline whenever they are handled.

When the fish are moved from the transport container to the holding tanks, they should be acclimated over a 2- to 6-hour period if the temperature differs more than 5% or the salinity differs more than 3 ppt. A longer acclimatization period is required as the differences increase.

Quarantine of all fish brought into the hatchery should be a standard practice. This requires a separate tank for maintaining the new fish for at least 6 weeks. Some hatcheries prefer to hold new fish in outdoor ponds during this period. After the quarantine period, the fish can be moved to spawning tanks. It is recommended that the fish be sexed and identifying marks recorded. This insures that a desirable sex ratio is established in the tanks and that individual fish can be identified later when spawners are culled.

Preparation for spawning

Some hatcheries prefer to leave the brood fish in ponds and let them mature naturally. When the fish are near spawning in the fall, they are sexed and moved to the spawning tanks. The fish are checked for gonadal condition when they are moved. The males are examined by applying pressure along the sides and belly of the fish to extrude milt. Females are examined by inserting a small (1 to 2 mm) diameter tube into the oviduct and then examining the tissue microscopically. Consult any of several texts on the subject for a complete description of the developmental stages of eggs.

Brooders of 15 to 35 pounds are preferred for tank spawning. Two males and two females per tank are common, but variations have been used depending on the availability of brood fish. Fish usually are fed a mixture of shrimp, squid and liver at about 2.5 percent of their body weight three times per week. Some evidence from wild caught fish show that the kind and quantity of feed is a major factor in successful spawning.

Spawning tanks

Spawning tanks usually are set in a recirculating system. Open water systems are being used in some hatcheries, but disease and parasite problems are more common. Technical details of both systems are discussed in other SRAC publications.

Preparation for spawning

Most hatcheries use temperature and light manipulation to condition the fish for spawning. Generally brood fish are subjected to a 120-day maturation cycle that is intended to simulate an annual cycle. (See Figure 1.) Spawning usually occurs at temperatures of about 75% with 10 to 11 hours of light in a 24-hour period. Salinity of the water varies between hatcheries, but 32 to 34 ppt is standard. Considerable research has been done on the red drum spawning cycle. For more detailed information consult personnel at one of the commercial or state hatcheries specializing in red drum production. Table 1 includes information on photothermal induction methods.

Spawning

After favorable spawning conditions are reached in the tank, a variety of methods may be used. Differences seem to occur between spawning groups, due to tank size, fish size, tank shape or a variety of unknown

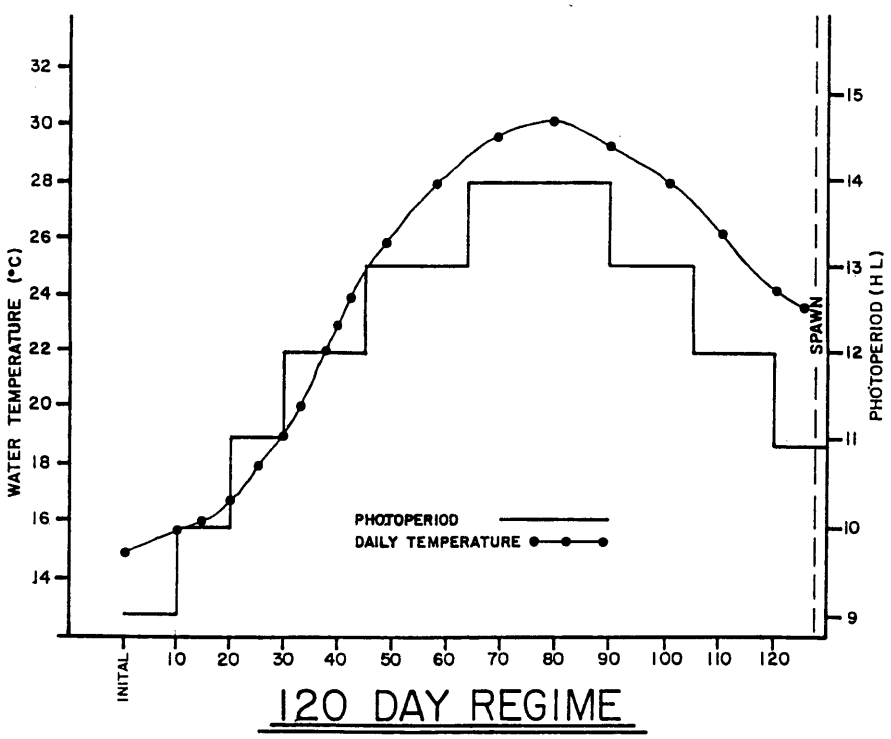


Figure 1. A 120-day induced maturation cycle is imposed under controlled photothermal conditions.

Table 1. Summarized methods for photothermal induction of maturation and spawning of red drum at the John Wilson Marine Fish Hatchery, Perry R. Bass Fisheries Research Station, and Florida Bureau of Marine Research.

	John Wilson Hatchery	Perry R. Bass	Florida Bureau of Marine Research
Tank size (metric tons)	13	10-20	5-20
Filtration system	RBC, FB, SH, S, UV	PT, TF	S, CB, DE
Fish/tank	4	4-6	4-6
Sex ratio (M:F)	2:2	2:2, 2:1 , 1:2	3:3, 3:2, 2:2
Mean fish size (kg)	13	11	11
Regime duration (days)	150	120	120
Max. regime temperature (°C)	30.0	30.0	30.0
Min. regime temperature (°C)	15.0	18.0	18.0
Max. regime photoperiod (HL)	14.0	14.0	16.0
Min. regime photoperiod (HL)	9.0	10.0	9.0
Spawning period (days)	22	30	100
Spawning temperature (°C)	24	26	25
Spawning photoperiod (HL)	11	10	9
Mean no. eggs/spawn period (millions)	20	20	100
Biopsy interval (weeks)	4	12	2-4
Feeding regime (% bw/day)	1.07	3.00	2.85

CB - Conventional biofilter
DE - Diatomaceous earth
FB - Fluidized bed
PT - Packed tower
S - Sand
SH - Shell
TF - Trickle filter
RBC - Rotating biological contactor
UV - Ultraviolet filtration

factors. Normally a group of fish within a tank will respond the same way repeatedly. Fish in other tanks within the same room may respond differently.

Some groups of fish will begin to spawn without other stimuli. As a general rule wait at least 10 days for spawning to begin. If the fish do not spawn naturally, other procedures may be needed. Most success has been achieved by raising the temperature 2 degrees per day for 5 days (up to 83 °F then lowering it 2 degrees per day for 6 days (to 71°F). Repeat this temperature regime until spawning begins. Stabilize the temperature when spawning occurs.

Usually spawning occurs in the evenings between 1 hour before and 4 hours after artificial sunset Males become red-brown above the midline and pronounced drumming sounds begin. Females show additional swelling of the abdomen. Some reports indicate additional swimming activity by the females with the male swimming below and slightly behind the female.

Actual spawning is not very conspicuous. Most operators state that these nuptial behaviors including change of color do not guarantee that egg laying and fertilization will occur.

Usually fish are allowed to spawn for 3 to 4 days if they spawn daily. Lower the temperature to 70 °F over a 12-hour period and spawning should stop . The temperature can be raised to 73 or 74 °F to initiate spawning again when more eggs are desired. Some operators have been successful in obtaining spawns weekly using this procedure for periods longer than 3 months.

Handling of the eggs

Fertilization and water hardening of the eggs occur in the spawning tanks. Because live, fertilized eggs are buoyant, skimming devices on the edges of the tanks are used to collect eggs in filter boxes or other containers.

Hatching

Fertilized eggs are placed in hatching containers at a density of 1,000 to 1,200 per gallon of water. Agitation of the eggs is maintained with gentle aeration. Eggs are very fragile at this stage. Normally 90 to 95 percent of the fertilized eggs hatch. Age of the eggs can be estimated by the number and size of the oil globules. Eggs hatch in 24 to 30 hours at water temperatures of 70° to 74 °F.

Handling of the larvae

After hatching agitation must continue. The larvae are negatively buoyant and drift to the bottom of the tank before swimming to the surface. After 3 days the larvae can swim horizontally. Mouth parts are formed, and the eyes are pigmented. Temperature affects the rate of development. At higher temperature, the larvae develop mouth parts within 40 hours after hatching.

As soon as the larvae are ready to feed, they should be moved to rearing tanks or ponds. Great care must be taken in handling the larvae at this stage. They are quite fragile and easily damaged. Timing of the move is critical. If the larvae are moved too early they may not be able to maintain themselves in the shipping container. If they are moved too late they may not have adequate food available and survival will be poor.

This publication was supported in part by a grant from the United States Department of Agriculture, Number 87-CRSR-2-3218, sponsored jointly by the Cooperative State Research Service and the Extension Service.