

## Southern Regional Aquaculture Center



May 1993

# Alligator Production

## Breeding and Egg Incubation

Michael P. Masser\*

Alligator farming requires specific culture techniques and specialized knowledge on the part of the producer. The commercial production of alligators can be divided into 3 phases:

- management of adult alligators
- egg collection, incubation, and hatching
- grow-out of juvenile alligators to market size

In Louisiana, Florida and Texas eggs and/or hatchlings maybe taken from the wild under special permit regulations. In all other states it is **illegal** to take eggs or hatchlings from the wild (in 1993). Therefore, prospective alligator farmers must either purchase eggs or hatchlings from other producers or produce their own. Louisiana law makes it illegal to sell alligator eggs outside of Louisiana. Hatchlings can be purchased from existing farms or hatcheries in Louisiana, Florida and Texas. The price of hatchlings changes yearly due to the laws of supply and demand. In 1990 hatchlings sold for \$30 each or more. In 1992 the price had fallen to about \$20 each, largely due to the low market price for hides.

This publication addresses the care of adult alligators, their breeding, and the collection, incubation and hatching of alligator eggs. For information on grow-out of juvenile alligators to market size see SRAC Publication No. 232, *Alligator Production: Grow-out and Harvest*.

### Management of breeding alligators

Maintaining adult alligators and achieving successful and consistent reproduction is extremely

difficult. Exact environmental, social and dietary needs of adult alligators are poorly understood. The following discussion is based on the limited amount of research available and from personal communications and observations with both researchers and commercial producers.

Adult alligators that have been reared entirely in captivity/confinement behave very differently from wild stock. Farm-raised alligators accept confinement and crowding as adults much better



Adult alligators feed on red meat in a pond environment.

\* Extension Fisheries Specialist Auburn University, Alabama

than those captured from the wild. Also, adult alligators that have been raised together tend to develop a social structure, and adapt quicker and breed more consistently than animals lacking any established social structure. Inbreeding can be eliminated by obtaining males and females from different clutches. However, it may not be possible to obtain adults using the above criteria.

If adequate numbers of adults cannot be purchased, then the best strategy may be to select future brood stock from your own young animals or purchase young from another producer. Try to select fast-growing individuals. Captive alligators raised in temperature-controlled environments for three years reach sexual maturity at 5 to 6 years of age compared to the 9 or more years that it takes in the wild.

## Pen design for adult alligators

Pens for adult alligators need to be one to two acres in size. Larger pens have been used but can present problems if alligators have to be captured. Pens must be carefully fenced to prevent their escape. Some general recommendations for fence design include:

1. heavy-duty, woven, rust-resistant wire,
2. wire should be a minimum of 6 feet high and buried in the ground to a depth of 1 foot,
3. mesh size should not exceed 2 x 4 inches,
4. a 1 x 6-inch treated board should be attached to the interior base of the fence,
5. fence posts should be spaced on 8-foot centers,
6. fences should have rounded corners (avoid 90° corners as they encourage climbing and piling-up of the alligators),
7. gates must be equal in height to the rest of the fence and of comparable fencing material,

8. gate frames must be heavy-duty, attached by at least 2 hinges, and secured by at least 2 latches along the opening.

Remember, alligators can climb, are very strong, and will probably try to escape. Improper construction of holding pens which allows them to escape is illegal in most states. Check with your state game and fish agency for specific guidelines.

Breeding pen design, particularly the land to water ratio and configuration, is very important. Land area to water area within the pen should be approximately 3:1. Shape of the pond(s) needs to maximize shoreline. Present thinking suggests that an 'M', 'S', 'W', 'Z' or similar shape is best, although other pen designs have been used. One experienced producer observed that male alligators fight less during the breeding season if they cannot see each other in the pond, thus the reason for the shape of the ponds. The pond shoreline should be no closer than 75 to 100 feet from the fence.

Water depth of at least 6 feet must be maintained during the breeding season, which could require a water source (i.e., well, reservoir pond, etc.) When possible, ponds should also be constructed with drains so that water can be removed if the animals need to be captured.

Dense vegetation around the pond is needed to provide cover, shade and nesting material. The natural invasion of wetland plants is sufficient for cover in many areas. However, many producers feel that invading vegetation is not optimal for nesting purposes and prefer to plant alternative types of vegetation. Brush and cane type vegetation (because of its coarse nature) should be discouraged as nesting material because it can puncture and kill eggs as they are being laid into the nest. In general, vegetation for nesting material needs to be a rank growing grass (i.e., tall, deep grass, 24 to 30 inches in height) that will hold

sufficient moisture, not desiccate during incubation, and not rot too quickly. Tall fescue maybe a good candidate for vegetative cover in much of the South. Many producers add bales of hay to the breeding pens in June to supplement natural vegetation for nest building.

Shade is important to prevent overheating during the summer. Alligators will burrow into the pond banks if adequate shade is not provided. Burrowing can be reduced by building shade awnings in the pens.

Stocking density of adult alligators (from farm-raised stock) should be between 10 to 20 per acre. Some producers have been successful at densities as high as 50 per acre; others maintain densities at 6 to 8 per acre. Adults between 6 and 20 years old are usually reliable breeders, females 8 to 10 years old are the most consistent breeders. Female to male ratio should be approximately 3 to 1 (but less than 4:1).

Each pen should have several feeding stations to keep the alligators spread out during feedings. Feeding stations should be established near basking areas where alligators sun themselves or along paths on the shoreline of the pond. Feeding should begin each spring when temperatures rise above 70°F (usually March or April).

Feed 4 to 7 percent of body weight per week (7 percent throughout the summer months). Adults are usually fed only once per week. Early fall feeding appears to be particularly important so that the females are in good condition for egg development. Adults do not need to be fed during the late fall and winter. It is important that adult alligators are not overfed; they should be in trim body condition, **not fat!**

Adult breeders should be disturbed as little as possible from February through August during egg maturation, courting and nesting. Activities such as moving animals or pond maintenance should

be performed between September and January.

Alligators are extremely shy animals and are easily stressed. Stress reduces growth rates, fertility rates and probably predisposes the animals to disease and infertility. Farms should be located in areas where outside disturbance can be minimized. Producers must try to limit all stressful contact with people and other animals (see section on stress in SRAC Publication No. 232, *Alligator Production: Grow-out and Harvest*).

### Courtship and breeding

Courtship and breeding activity is extremely important. Alligators appear to develop a social structure within a group. Wild alligators which are captured and penned

can be very aggressive toward each other during the breeding season. Wild males have been known to kill rival males during the breeding season, and wild females will kill, or not breed with, unacceptable males. Alligators raised in captivity are less territorial and aggressive towards each other, particularly if they have been penned together before they are 3 years old.

Courtship and breeding occur between April and July depending on temperature/weather conditions. Courtship is a time of heightened activity by both sexes. This activity includes vigorous swimming and bellowing. Bellowing is the most common activity associated with courtship, although limited bellowing can occur at other times. Most courtship and

mating occurs just after sunrise in deep water, and repeated copulation is commonly observed. The mating sequence from precopulatory behavior through first copulation takes approximately 45 minutes.

Nest building and egg laying occur at night. The nest is built from natural vegetation (e.g., broomsedge, bullwhip, cutgrass, wiregrass and available annuals), hay (if provided), and soil. Nests are built into a round, mound-type structure. A female may start several nests before a single nest is successfully completed. Eggs are deposited at the top of the mound and then sink to the center forming layers with vegetation. Finally, the eggs are covered with approximately one foot of vegetation. All nesting activity usually occurs within a two week period.

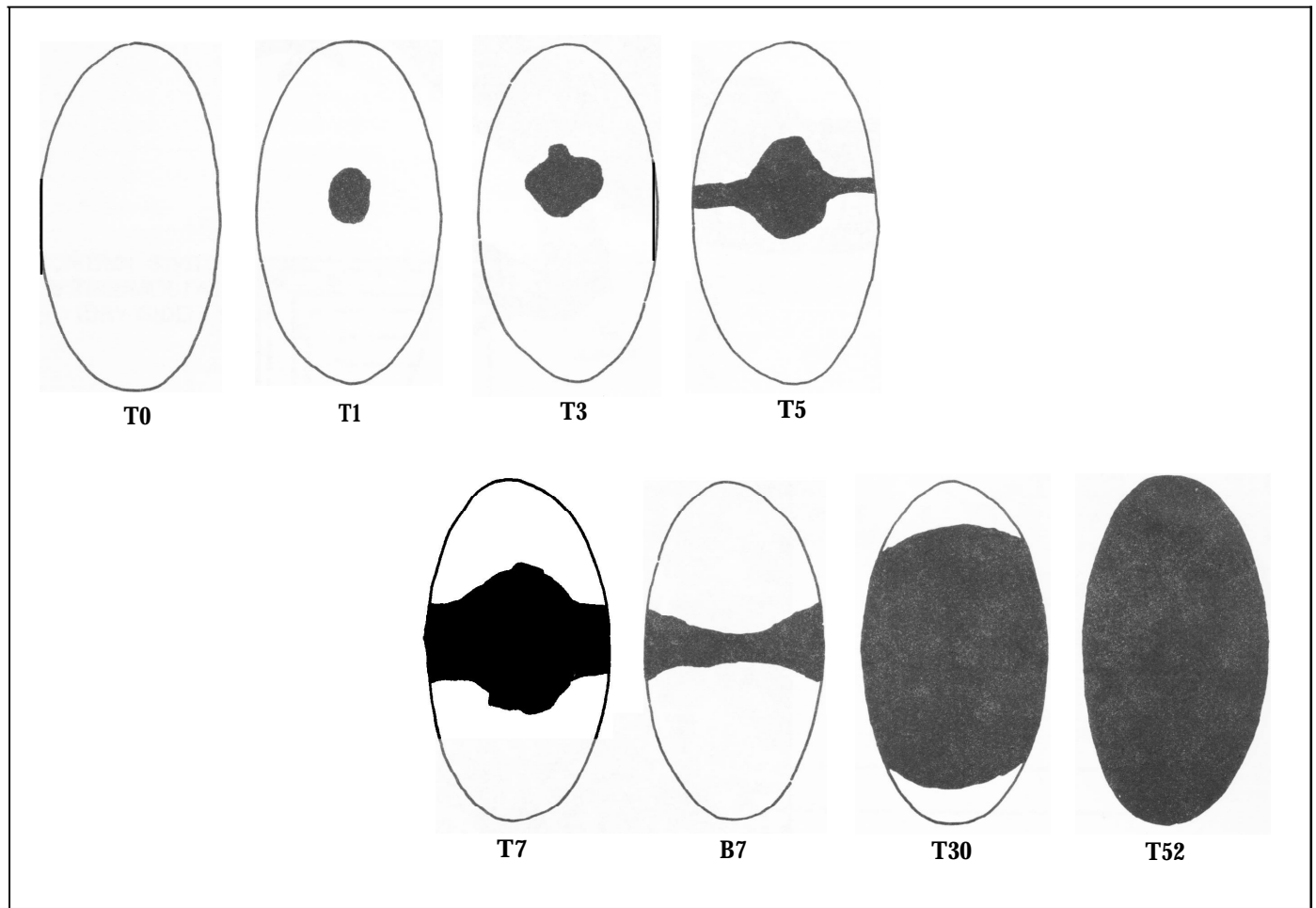
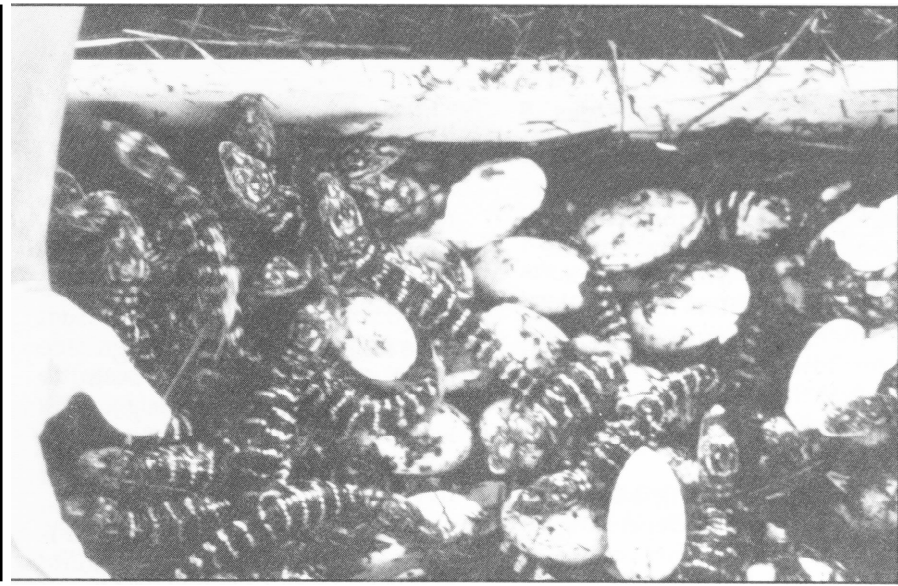
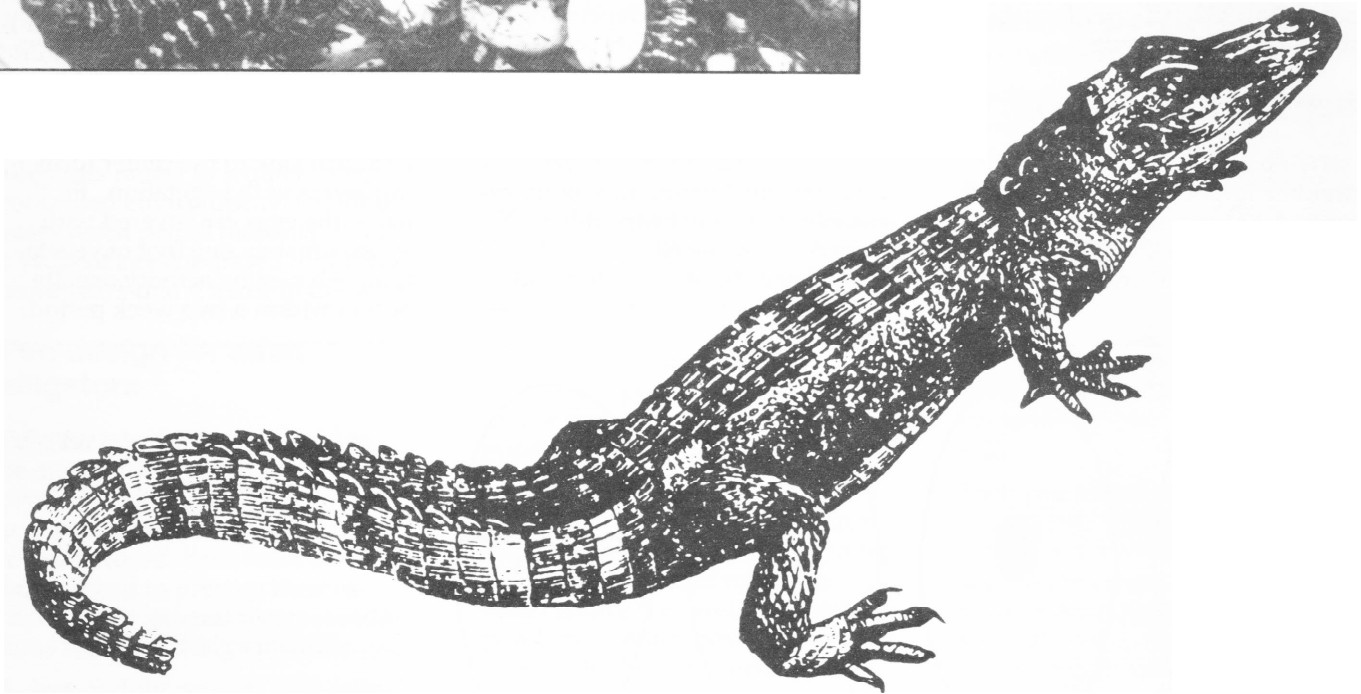


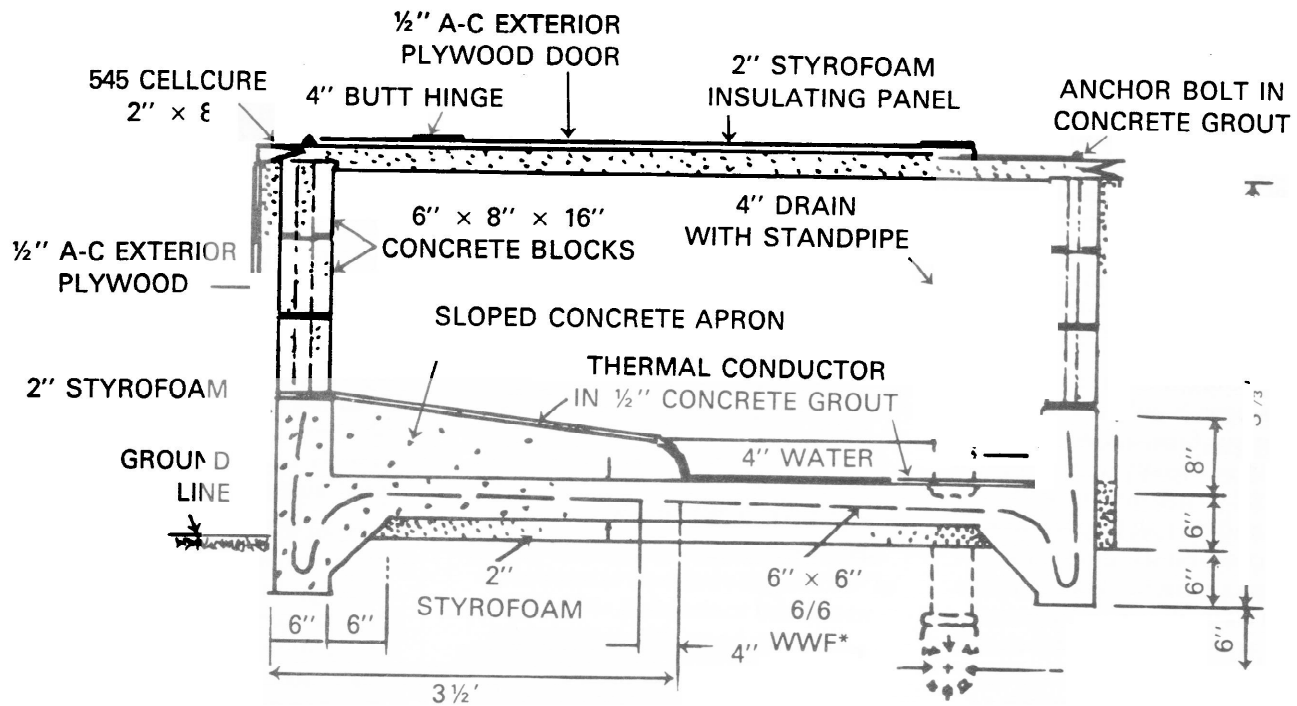
Figure 1. Opaque banding of alligator eggs from day laid through day 52 of incubation (Ferguson 1981). T = top view; B = bottom view; numbers= days of incubation.



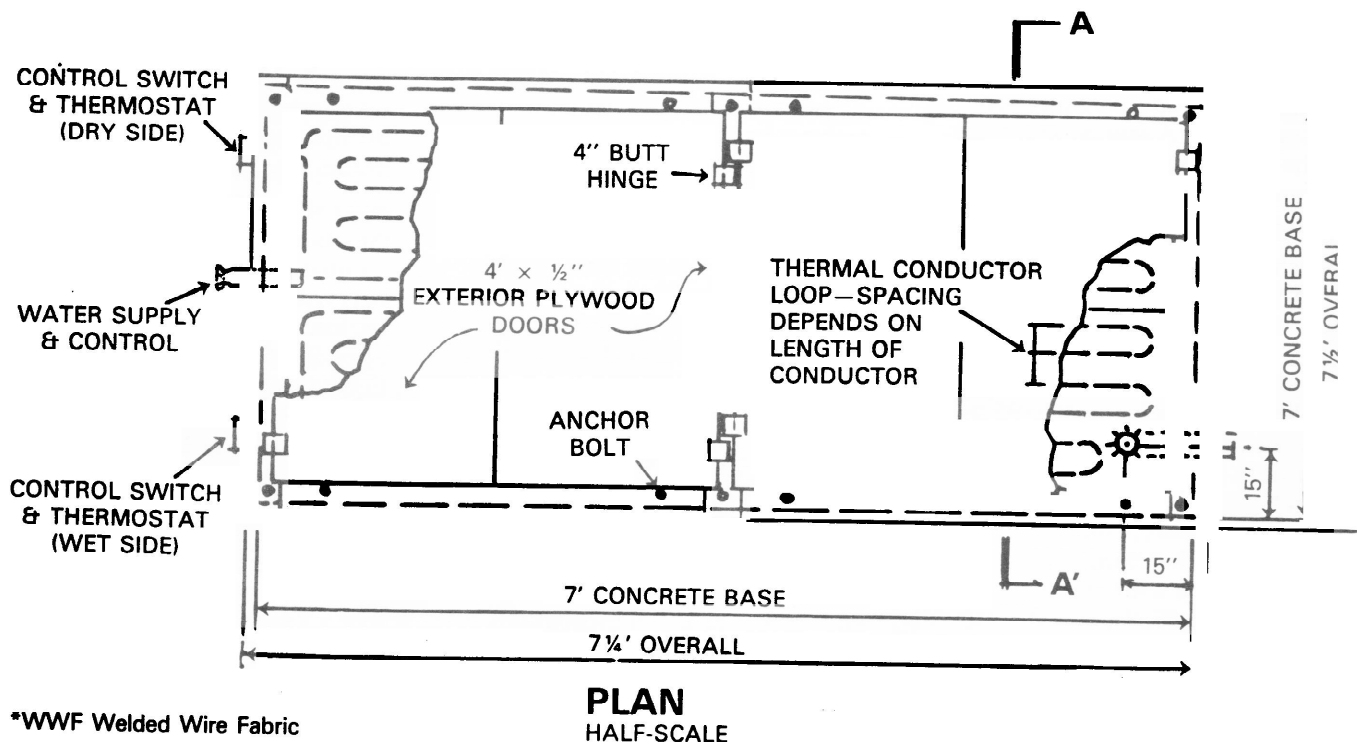
**Baby alligators hatching from eggs.**



**Typical alligator nest in the wild.**



SECTION A-A'



\*WWF Welded Wire Fabric

PLAN  
HALF-SCALE

Figure 2. Diagram of a small environmental chamber for hatching alligator eggs and rearing hatchlings (Joanen and McNease 1976).

The female guards and protects the nest but predation from raccoons and other animals is common. Nests can also be destroyed by other females trying to build nests if pen density is too high or if vegetation for nest building is scarce. Farm-raised females have been known to lay eggs in the same nest, again demonstrating the breakdown of territoriality that is common to wild alligators.

Nesting success in captive alligators has been highly variable. Wild versus farm-raised origin, pen design, density, development of a social structure within the group, and diet all impact on nesting success. Nesting rates for adult females in the wild average around 60 to 70 percent where habitat and environmental conditions are excellent. Nesting rates in captivity are usually much lower, depending on the management skill of the farmer. If farm-raised animals are selected and grouped together at an early age, pens are constructed properly, sex ratios are near three females to each male, densities are around 20 alligators per acre or less, and stress is eliminated, then diet becomes the most important factor in reproductive success (see section on diets). A few good managers have achieved nesting rates of 70 percent of the adult females nesting each year.

Clutch size varies with age and condition of the female. Large and older females generally lay more eggs. Clutch size should average 35 to 40 eggs (range 2 to 58). Egg fertility can vary from 70 to 95 percent. Embryo survival can also vary from 70 to 95 percent. Hatching rate varies from 50 to 90 percent. Egg fertility, embryo survival, and hatching rate of eggs taken from the wild and incubated artificially are 95, 95, and 90 percent, respectively. Captive reproduction can and should approach these values.

Reproductive success of captive alligators has been the most difficult problem for producers to overcome and is probably the greatest

obstacle to face prospective breeders.

## Egg collection

The method and timing of egg collection is very important. Alligator embryos are very sensitive to handling (mechanical injury) from 7 to 28 days after they are laid. Many embryos will die if handled during this period. Current recommendations are either to collect eggs within the first week or wait until the fourth week of natural incubation. Collecting eggs within the first 24 hours after being laid has several advantages:

- Eggs are not easily damaged because the embryo is not yet attached to the shell.
- Egg collection allows the farmer to separate good eggs from infertile or dead eggs.
- Eggs that were laid upright can be repositioned.
- It eliminates losses caused by predation and/or bad weather.
- It eliminates losses in breeding pens when more than one female tries to lay eggs in the same nest.

After 4 weeks of incubation the embryo has developed enough to resist most damage from handling.

Most alligator eggs **cannot** be turned or repositioned when taken from the nest (unlike bird eggs). Eggs should be marked with an "X" across the top before removing them from the nest so that they can be maintained during transport and incubation in the same position as they were laid. Eggs that are laid upright in the nest (long axis perpendicular to the ground) will die unless repositioned correctly (long axis parallel or laying on its side and not on end) before artificial incubation. This repositioning can only take place in the first few hours after nesting.

Some captive alligators will aggressively guard their nests. Use caution collecting eggs. It is a good idea to work with another person

while collecting eggs. If the female is not aggressive then do not antagonize her. Many times an aggressive animal can be chased away or kept at bay using a long sturdy pole.

During collection place 8 to 12 inches of nesting material or grass hay (moisten several days in advance) in the bottom of the collection container to support the eggs. Place the marked eggs in a single layer in the container and in the same position that they were in the nest. Cover the eggs with 2 to 3 inches of nesting material. Transport very gently!

Age of the eggs and developmental progress can be observed by changes in the opaque banding that occurs during incubation. Figure 1 shows the sequence of banding associated with proper egg development.

## Incubation and hatching

Artificial incubation, compared to wild nesting, improves hatching rates because of elimination of predation and weather-related mortality. The best hatching rates for eggs left in the wild is less than 70 percent. Hatching rates for eggs taken from the wild and incubated artificially average 90 percent or higher.

Eggs should be transferred into incubation baskets and placed in an incubator (environmental chamber) within 3 or 4 hours after collection. Air circulation around the eggs during incubation is critical. Egg baskets or trays are best made from PVC coated 1 x 1/2 inch steel wire mesh or 1/2 inch heavy duty plastic mesh. Top, bottom and sides of the baskets should be made from the mesh material to enhance air circulation. Dimensions for egg baskets can vary (1 foot x 2 feet, 2 feet x 2 feet and 2 feet x 3 feet are common) but should be 6 inches in depth to accommodate eggs and nesting material. Eggs must be completely surrounded by nesting material.

The decomposition of the nesting material aides in the breakdown of the egg shell. Without this natural decomposition, hatching alligators will have a difficult time breaking out of the shell and some may die. Fresh, natural nesting material composed mostly of grasses is best. If natural nest material is not available, use grasses which have been soaked for about a week. Sphagnum moss can also be used as incubation material. Producers with captive breeders dip the eggs and incubation substrate in an anti-fungal agent like chlorhexadine diacetate before incubation to reduce potential disease problems. Wild eggs are seldom treated before incubation.

Hatching baskets are set on shelves or brackets about 3 inches above the water in an incubator. The temperature, humidity and water level are controlled in the incubator. Figure 2 is a construction diagram of a small environmental chamber developed at the Rockefeller Wildlife Refuge at Grand Chenier, LA. The cost to build this environmental chamber was approximately \$5,000. Other producers use separate buildings with temperature and humidity control or small tanks housed inside a temperature-controlled grow-out building. Relative humidity should be kept above 90 percent within the chamber, and incuba-

tion media should be moistened with warm water as necessary to maintain dampness.

Incubation temperature is critical to survival and proper development. It also determines the sex of the hatchlings. Temperatures of 86°F and below produce all females while temperatures of 91°F and above produce all males. Temperatures much above 91° or below 86°F, however, cause abnormal development usually resulting in high mortality. Both sexes are produced at temperatures between 86°F and 91°F. The critical temperature period for sex determination is around 20 to 35 days after the eggs are laid. Most producers now incubate eggs at 88° to 90°F. This produces a mixed sex population with good survival and growth.

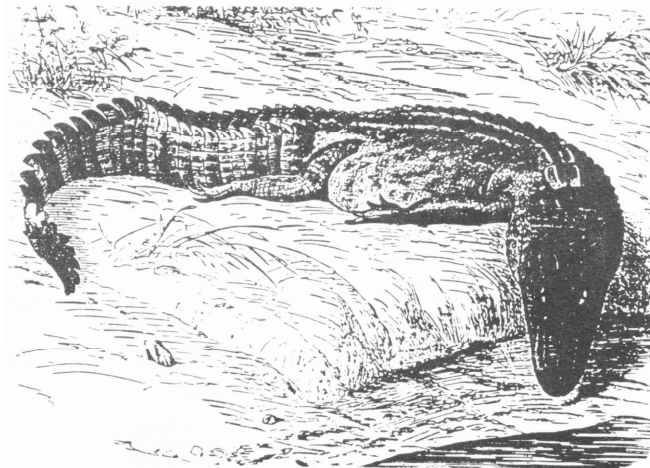
Hatchling alligators make peeping or chirping sounds after hatching. When 10 to 15 percent of the clutch has hatched many producers carefully open unhatched eggs. Eggs are cracked and opened at one end to free the baby alligator, but **care must be taken not to detach or damage the umbilical cord**. If the umbilical cord is broken the hatchling is likely to bleed to death or develop an infection. Hatchlings are retained in their hatching baskets for 24 hours to allow the shell and umbilical cord to separate naturally. After 24

hours the hatchlings are removed from the egg baskets, sorted into uniform size groups, and moved into environmentally controlled grow-out facilities. Closely sizing the alligators is very important. Smaller, weaker individuals will not be able to compete with their larger siblings.

Hatchlings can be moved into small tanks, 2 feet x 2 feet and larger in size, that are heated to 86 to 89°F. Maintaining hatchlings at 89°F for the first week helps to increase yolk absorption. Usually hatchlings will start to feed within three days at this temperature. Some producers do not offer feed until day three or after, while others offer feed immediately. Young that do not start feeding on their own can be force-fed using a large syringe. Hatchling tanks need to be cleaned daily to prevent possible disease outbreaks.

A few producers specialize in producing hatchlings for resale to other farms. Most hatchlings are not sold until they are actively feeding. Once they are actively feeding they are ready to be moved to grow-out facilities.

For information on the grow-out of alligators see SRAC Publication No. 232, *Alligator Production: Grow-out and Harvest*.



The work reported in this publication was supported in part by the Southern Regional Aquaculture Center through Grant No. 89-38500-4516 from the United States Department of Agriculture.