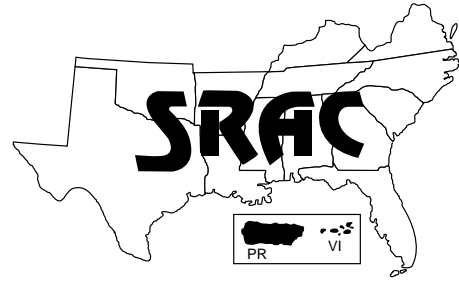


Southern Regional Aquaculture Center



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Pet Turtle Production

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Turtle farming has been practiced for decades in Louisiana. The industry developed to produce baby turtles, specifically red-ear sliders (*Trachemys scripta elegans*), for sale as pets. In the late 1960s, annual production reached 15 million baby turtles. By that time, however, the U.S. Centers for Disease Control had estimated that pet turtles could be responsible for up to 14 percent of salmonella infections in children throughout the country. As a result, interstate commerce in these pet turtles was banned in 1971 unless they could be certified as salmonella-free. In 1975, the U.S. Food and Drug Administration banned domestic sales and interstate transport of turtles with shells less than 4 inches wide, citing continued concerns about salmonella.

At that time, little was known about how baby turtles became infected with salmonella, or how to prevent it. Curiously, other common pets known to harbor salmonella, such as chicks, rabbits and gerbils, were not targeted for regulatory action. Production of baby turtles in Louisiana dropped to roughly 2 million per year—for shipment only to markets in Europe and Asia.

Over the years, much has been learned about the transmission of salmonella from broodstock to offspring within turtle farms, and methods have been developed to produce virtually (99.99 percent) salmonella-free offspring on a regular basis. These treatment methods have become an integral part of pet turtle production for export markets, which currently account for 5 to 10 million animals annually. It is now illegal in Louisiana to sell untreated turtles, even for export.

Broodstock management

Production of baby red-ear sliders involves holding large numbers of adults at high densities in outdoor ponds. Broodstock are generally

collected from the wild or, occasionally, purchased from other farms. Adult turtles are stocked at 7,500 to 15,000 head per water-acre (18,500 to 37,000 per water-hectare). Brood turtles typically require 1 to 3 years to become acclimated to breeding ponds and reproduce reliably.

Brood turtles are typically fed floating catfish feed, although some producers use specially formulated rations. Commercial turtle diets typically contain 22 percent protein, with alfalfa meal or other plant products as a protein source. Vitamins A, D and E are important nutrients; if formulated feeds do not contain enough of these vitamins turtles must be offered green, leafy vegetables.



Turtle production pond, with sandy nesting area and perimeter fence. (Photo by P. C. Braden)

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Feeding rates may reach more than 18 tons per acre (40 mt per hectare) per year. This equates to relatively small amounts of food per turtle. Daily feeding allowances vary, depending on seasonal temperatures.

The high nutrient levels found in many turtle brood ponds can occasionally contribute to health and sanitation problems, including high levels of salmonella in pond water. Disease problems are not uncommon, and many result from poor sanitation caused by high stocking rates. Particular health problems occur during winter, when temperatures fall enough to reduce feeding activity but not far enough to trigger full hibernation. Much of the annual mortality suffered by turtle broodstock is caused by respiratory problems associated with severe diurnal temperature fluctuations during late fall and early spring. In Louisiana farms, red-ear sliders often succumb to pneumonial infections after exposure to sudden or severe temperature changes associated with winter cold fronts.

Breeding ponds are generally surrounded with flat areas of sandy soil for nesting grounds. River sand is usually hauled in for the nesting area. The soft texture of the sand and its tendency to pack together makes it easier for laying females to dig nests. Sandy soils also provide better drainage if excessive rainfall occurs. Pond banks are typically hard clay, but may be covered with plastic liner material to prevent erosion caused by turtles climbing in and out of the water. Pond banks are occasionally overlaid with concrete, but this material can damage turtles' ventral shell surfaces. Access to laying areas is controlled by removable fencing at the top of the pond bank.

Pond and laying area perimeters are usually enclosed with sheet metal fencing to prevent straying and discourage predators. Turtles are easily frightened, so fences should be tall and rigid enough to prevent broodstock from seeing outside the pond enclosure. Fences should be inspected regularly and kept in good condition to prevent loss of breeding turtles.

Nesting and egg collection

Once broodstock are sufficiently comfortable with their surroundings, they reproduce. Nesting season usually begins in late March and lasts for several months. The average female red-ear slider will produce three batches of eggs per season, with roughly eight eggs in each clutch. Growers can control nesting activities to some degree by controlling access to sandy laying areas. Tents, made out of roofing tin, are often erected for nesting-site shelters. Shelters encourage nesting. Less nesting occurs during stormy weather, and females will not build nests in water-saturated soils.

A female red-ear takes pond water (which typically contains a high level of salmonella) into storage bladders in her cloaca before leaving the pond to nest. Once a female has selected a nest site, she releases a portion of this water to make it easier to dig a nesting chamber. From six to twelve eggs may be laid in the nest, which is then sealed with soil and the remaining water from the cloacal bladders. Both internal and external exposure to salmonella-laden pond water during the laying process can cause eggs and hatchlings to be contaminated.

Growers collect newly laid eggs from nests each morning during laying season. Soil is cleared away from nesting chambers (which are usually easy to find), and eggs are

carefully removed and placed in plastic-coated wire baskets. Care must be taken to maintain the vertical orientation of each egg as it was found in the nest, in order to keep the germinal disk at the upper-most point. Eggs that have hardened, perhaps because the nest was overlooked for a day or two, must be destroyed because they can no longer be treated with antibiotics. These eggs will have a chalky white appearance. After nests are excavated, the soil should be replaced and packed down to a smooth surface.

Egg treatment

Eggs are initially washed for 5 to 10 minutes at 95 to 100 °F (35 to 38 °C) with a dilute chlorine solution made by adding 3 to 4 teaspoons of fresh commercial chlorine bleach to 1 gallon of clean water (4 to 5 ml of bleach per liter of water). Eggs are usually washed in machines developed for the poultry industry. Then they are thoroughly rinsed and dried. The next step is to infuse the developing eggs with antibiotics to prevent any salmonella infections from progressing. An antibiotic such as Garasol® (gentamicin) is used as a dip solution (1000 ppm gentamicin) in a vacuum chamber. Suitable chambers are available from a variety of commercial suppliers. Egg baskets are immersed in the solution and the chamber sealed. A 25- to 27-inch (63- to 69-cm) vacuum is held for 5 minutes, then released slowly.



Turtles leave pond to nest. (Photo by P. C. Braden)

ly (over a 1-minute period). Eggs then soak an additional 10 minutes before being removed from the chamber and allowed to drip dry. In this way, the antibiotic can enter the eggs to prevent systemic infection of hatchlings as they develop. Although antibiotic solutions can occasionally be reused, containers must be thoroughly disinfected and solutions must be carefully filtered through 1-micron rated cartridges.

Incubation and care of hatchlings

Treated eggs are incubated for approximately 60 days, at 80 to 85 °F (27 to 29.5 °C) and 60 to 70 percent humidity. Air in incubation chambers must be circulated to keep humidity uniform. Typical hatching rates are 80 to 90 percent, and farmers generally help hatchlings remove shells. Hatchlings are held in baskets, suspended above standing water to provide humidity, in plastic containers. Holding containers are kept in darkness, usually at about 70 °F (21 °C). Containers should be cleaned every 2 weeks, or as needed. Hatchlings are not fed before shipment, so their hardiness generally declines the longer they are held.

Marketing

Quality controls are ensured through both regulation and industry practices. Hatchlings are assigned to specific “lots” of up to 20,000 turtles each. When species

other than red-ear sliders are present (such as map turtles, *Graptemys* sp.), hatchlings are sorted into lots by species. Every lot requires its own health certificate. Certification requires that twelve random samples of five turtles each be drawn from every lot and tested for salmonella. If any sample is contaminated, the remainder of the lot (up to 19,940 baby turtles) must be destroyed.

Hatchlings are typically available from July through the following March, although the bulk are usually sold and shipped by September each year. Ventilated plastic or cardboard boxes are used for shipping baby turtles. During shipping, extremes of heat, cold, dryness or humidity should be avoided.

There have been few marketing channels for red-ear slider hatchlings, with only a handful of major exporters handling most of the industry’s production. This situation is changing, however, as independent producers gain expertise in locating and communicating with customers throughout the globe and in arranging shipments. While supply and demand forces influence prices from season to season, the economic success of individual operations is generally more influenced by capitalization, labor requirements, and laying, hatching and disinfection rates.

Current export markets for baby pet turtles show little sign of dramatic expansion over the next



Box for shipping pet turtles. (Photo by P. C. Braden)

several years, but demand should continue to grow to some degree in Pacific Rim countries. Barring unforeseen complications, however, protocols currently being evaluated under FDA supervision should provide a level of proof necessary to put any lingering concerns over salmonella to rest. This could re-open a huge market for pet turtles throughout the United States.

Future trends

Alternatives to the antibiotics currently used are being evaluated for vacuum-treating eggs. One promising compound, Vantocil®, may make it possible for the FDA to once again approve the sale of pet turtles in the United States. The techniques developed for producing baby red-ear sliders have been adapted in recent years to other turtle species as well. Baby snapping (*Macrolemys* sp., *Chelydra* sp.) and softshell (*Apalone* sp.) turtles are familiar examples, but many other species are also becoming available commercially. With the help of the Internet, marketing efforts are beginning to pay off for some turtle producers and exporters. Overall, turtle production is becoming more standardized and professional.



Hatchlings. (Photo by P. C. Braden)

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