# Rearing Leatherback Hatchlings: Protocols, Growth and Survival

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Leatherback hatchlings are difficult to maintain under captive conditions because they (i) suffer from bacterial and fungal infections when water quality is poor (Frayr 1970) and (ii) are dietary specialists (Bjorndal 1997). Leatherbacks (iii) do not recognize physical barriers (Witham 1977) and can abrade their skin (leading to infections) by swimming into tank walls. To promote their survival in captivity, each of these problems must be solved.

We recently completed a study on the development of leatherback diving and feeding behavior, using juveniles transported periodically to the ocean as subjects. This study required us to rear the turtles for a short time (7 weeks) under laboratory conditions. Here, we report our rearing methods and procedures.

Several workers (Bels 1988; Berkenmeier 1971; Chan 1988; Deraniyagala 1936; Foster & Chapman 1975; Frayr 1970; Phillips 1977; Spoczynska 1970; Whitham 1977) have reared leatherbacks. Water quality was strictly controlled (by continual supply or by filtering) in some efforts (Bels 1988; Chan 1988; Deraniyagala 1936; Foster & Chapman 1975), but not in others (Berkenmeier 1971; Phillips 1977; Spoczynska 1970). Turtles have been fed a variety of marine (cnidarians, fish, molluscs, tunicates, and algae) and non-marine (eggs, bread, chicken liver, beef heart) foods, sometimes imbedded in gelatin or edible agar (Chan 1988). Feeding leatherbacks fish can cause gut impaction and eventually, death (Bels 1988; Foster & Chapman 1975; Witham 1977). But survival was apparently unaffected by other foods as hatchlings survived for long periods on either a variety (Deraniyagala 1936) or a limited array (Bels 1988; Foster & Chapman 1975; Witham 1977) of foods. In some instances (Berkenmeier 1971; Foster & Chapman 1975; Frayr 1970) barriers (netting or foam) were used to protect the turtles from tank walls and surfaces, but in other instances no barriers were present (Bels 1988; Chan 1988; Spoczynska 1970; Witham1977). Three investigators (Bels 1988; Deraniyagala 1936; Witham 1977) succeeded in keeping turtles alive for more than a year (662, 642, and >1200 days, respectively), but these were the few survivors of initially larger groups of hatchlings.

Most of our hatchlings (n=22) were turtles recovered from nests in Palm Beach County, Florida, USA, three or more days after the majority of the clutch had emerged. Many of these turtles were probably stressed, weak, and had sores or injuries. Had they not been captured, most would probably have failed to emerge and have died in the nest. Thirteen hatchlings emerged naturally and were captured as they crawled down the beach. These turtles were in excellent condition.

Captured hatchlings were housed in a large room. Prior to capture, the floor was disinfected with a 10 % Chlorohexadene solution. This procedure was repeated periodically throughout the study. A step pan of Chlorohexadene was placed by the room entrance as a

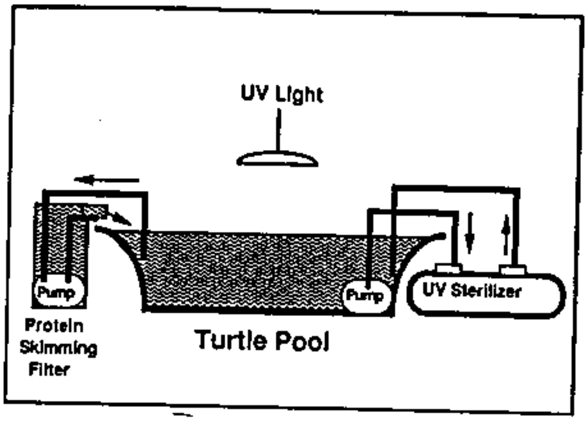


**Figure 1.** Schematic of each turtle pool. Arrows indicate direction of water flow through the filtering systems.

foot wash to prevent outside contamination. We also disinfected our hands with anti-bacterial soap. Any equipment (calipers, plastic containers, scrapers to clear algal growth from the tanks, etc.) that came in contact with the hatchlings or the tanks was cold-sterilized, again using a Chlorohexadene solution.

Hatchlings were maintained in five circular plastic pools (1.5 m wide x 0.3 m deep), filled with 103 L of seawater (Figure 1). Water temperature ranged from 23 - 27° C. Water quality for each pool was maintained by two filter systems: an ultraviolet filter (Startronics™, with a 25W UV element) and a "Skilter" (Supreme 400™) filter containing a protein skimmer, ground carbon and fiberglass mat. A 150W UVA/B incandescent lamp, suspended 0.5 m above each pool, provided UV radiation. Banks of 100W "Vita-lite" flourescent fixtures, suspended ~ 3.0 m overhead, provided full spectrum radiation. Water quality (pH = 8.0 to 8.3; salinity = 28 - 33 ppt; and ammonia concentration) was monitored daily. Partial water changes with ~ 50 L of fresh, sterilized seawater were made every 3-4 days.

On the day of capture, each hatchling was weighed (on an electronic balance) and measured (carapace length and width; front and rear flipper length; body depth). A small (1 cm$^2$) piece of hooked velcro™ was attached to the posterior portion of its carapace with a drop of cyanoacrylic cement. The body and flippers were then immersed in a disinfectant (Betadine) bath. The head (avoiding the eyes) was disinfected with a cotton swab dipped in Betadine disinfectant.

Two long wood dowels were mounted at a 90° angle across the top of each pool. Two short (~ 12 cm) monofilament lines were tied to each dowel, about 15 cm from the inside tank wall. The other end of the line was tied to a small piece of felt velcro. When the velcro patch on the line was attached to the patch on a hatchling's carapace, the line served as a tether that confined the turtle to a tank quarter. Each hatchling could then swim or dive in any direction, but was unable to contact other turtles or the tank bottom and walls.

Turtles began feeding 5-8 days after capture. They were hand-fed strips of formulated food to satiation, once daily. The diet (Figure 2) consisted of prescription (Science Diet™ a/d) cat food, French bread, vitamins (Reptavite™), and minerals (Miner-Al-O™), blended with water and flavorless gelatin. This diet was low in fat (less than 5 %), as is typical of natural foods consumed by leatherbacks (Holland *et al.* 1990; Davenport & Balazs, 1991). When available, fresh gelatinous prey (live jellyfish or ctenophores) were substituted for water in the recipe. Hatchlings were otherwise left undisturbed except when weighed and measured (once weekly), or treated (daily) for external infections or loss of appetite.

Hatchlings with sores and fungal infections were treated with povidone iodine (10 %) solution and anti-fungal topicals (Microcide™). Hatchlings were given a 10 % povidone iodine bath (immersed from neck down). Wounds were then debraded with a soft bristled toothbrush to remove damaged skin and promote healing. The area was coated with a water-resistant anti-fungal ointment before the turtle was returned to its tank. If

**Leatherback Recipe**

**Ingredients:**

Water (2 cups)
Dry French bread (1 cup)
Science Diet (a/d Cat Food; 156g)
1 tsp Reptavite™
1 tsp Miner-Al-O™
6 pk (4.2 g ) Flavorless Gelatin

*(Optional: Jellyfish and/or Ctenophores instead of water. Four cups of gelatinous zooplankton can be used to replace 2 cups of water.)*

Pour two cups hot water into blender. Crumble French bread (one cup) into blender. Add half can of cat food, one teaspoon each of vitamins and minerals, into blender. Add six packets of flavorless gelatin. Blend to a smooth paste. Pour into plastic lidded container and allow it to cool and congeal in a refrigerator. Store in a freezer.

**Figure 2.** Recipe for the leatherback diet.

sores or infections were close to the eyes or mouth, we used Gentamicin Sulfate (eye ointment) instead of the iodine solution or anti-fungal gel. Daily treatment only rarely (3 cases) resulted in healing. Anti-bacterial or anti-fungal creams (such as Terazol™) were, when used alone, ineffective.

We used fine (1 mm inside diameter) flexible tubes attached to a syringe to force-feed the turtles. A liquid rehydrant and an appetite stimulant (Herpcare™) were given daily to induce voluntary feeding. Such efforts met with limited success. Hatchlings that may have had internal infections or that exhibited excess buoyancy were tube-fed with anti-bacterial and anti-gas (Symethicone™) medications (0.3 cc per 50-75g of body weight). These efforts, however, also met with limited success.

While turtles were healthy, they grew rapidly (Figure 3). Growth was apparent even before feeding began (end of week 1), while turtles probably depended upon their yolk reserves. Carapace length over the first 7 weeks increased by ~ 66 % while mass more than doubled.

Our methods focus upon the four problems revealed by previous efforts to rear leatherbacks: diet, water quality, inability to avoid barriers, and treatment of diseases. Our diet was adequate to promote hatchling survival for at least 7 weeks. By tethering the hatchlings we eliminated problems associated with barriers. But because mortality rates remained high, turtles may still have been stressed by our protocols. Dead turtles were necropsied and, in spite of our precautions, most died of a variety of systemic fungal and bacterial infections. These results suggest that the immune system of leatherback hatchlings is fragile under captive conditions. We believe that solving this problem is the key to rearing these turtles in captivity.

At the end of our study, we released 9 hatchling at sea in good condition. Of these, three were initially captured in poor condition while six were survivors of the 13 turtles captured in good condition. Our success with the latter group was encouraging (just under 50 %), especially since all hatchlings were twice taken to the ocean for behavioral tests and exposed to microbes. We hope that others will improve upon our methods, and our survival rates.

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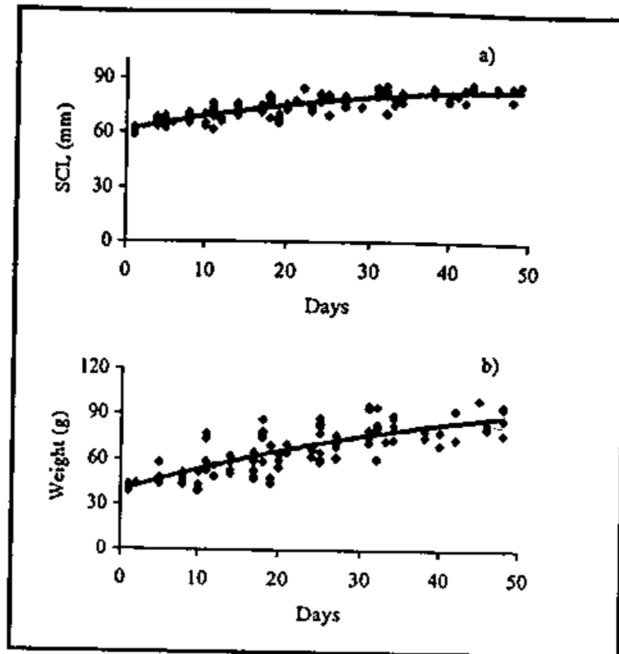


Figure 3. Growth rates of 35 turtles over seven weeks. a) straight-line carapace length (n=135 measurements): $y = -0.0076x^2 + 0.84x + 61.34$ $R^2 = 0.78$; b) mass (n = 159 measurements): $y = -0.011x^2 + 1.54x + 39.04$ $R^2 = 0.68$.

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