Table 13. Weights (g) of hatchling green turtles.

Location	Mean	Range	Nests	Hatchlings	Reference
Pacific Ocean					
Sarawak	21.2	17.7-23.0	4	20	Harrisson (1955)
Sabah	22.1	17.9-24.4		10	de Silva (1970)
Wan-An Is., Taiwan	22.7	16.5-32		327	Chen and Cheng (1995)
Solomon Is.	22.6	17-26			McKeown (1977)
Heron Is., Australia	ca 21				Bustard (1972)
Heron Is., Australia	24.8	19.8-28.4	11	110	Limpus (1980)
French Frigate Shoals, Hawaii	31	25-35		120	Balazs (1980)
Atlantic Ocean					
Kennedy Space Center, Florida	31.1	26.1-34.1	1		Ehrhart (1979a)
Southeast Florida	ca 30				Ehrhart and Witherington (1992)
Tortuguero, Costa Rica	25.9	15-31	20	400	Hirth (1988)
Aves Is.	27	25.1-28.9	1	24	Rainey (1971)
Indian Ocean					
Maziwi Is.	25				Frazier (1984b)
Europa Is.	22.9	18.4-26.2	20	50	Hughes (1974a)
Europa Is.	27.6	18-31		245	Servan (1976)
Moheli Is.	21.7	19-22.6		8	Frazier (1985)
Aldabra Atoll	28.2			64	Frazier (1971)
Tromelin Is.	24	19.8-29.4	17	50	Hughes (1974a)
Karan Is., Saudi Arabia	22	18.2-25	12	120	Miller (1989)
Abdul Wadi, Yemen	23	20-28	1	20	Hirth and Carr (1970)

opsis found a turtle nesting on Tortuguero Beach that had been tagged there in 1962, representing a reproductive life of at least 23 years. If we assume turtles in the Costa Rica population reach maturity in 12 to 26 years (Frazer and Ladner 1986) then the turtles mentioned above may have been between 29 and 49 years of age. The present maximum reproductive lifespan of female green turtles at Heron Island, Australia, is about 22 years and one male green turtle here has been recorded over an 18 year reproductive lifespan (Fitzsimmons et al. 1995b). Frazer (1983) estimated a maximum reproductive life span of 32 years for Georgia loggerheads. Some factors affecting longevity are described in sections 3.3.4 and 4.4.2.

3.3.2 Hardiness

In 1976, Felger et al. published a paper on the dormant, partially buried green turtles overwintering on the sea bottom in the Gulf of California. Here, the Seri Indians harpooned the turtles buried at water depths of from 4 to 8 m, and Mexican fishermen caught dormant turtles at depths of from 10 to 15 m. The green turtle is dormant at water temperatures below approximately 15°C in the Gulf of California. Owens (1993-94) reported that at about 15°C environmental temperature, *C. mydas* became quiescent and at 10°C they are quiescent, do not feed and appear to be hibernating. In retrospect, Carr (1982) noted that some of the immature green turtles off the west coast of Florida went into winter dormancy in the mud. Schwartz (1989) stated that sea turtles do not hibernate and that muddying (digging) in is a response by the turtle to keep from floating upwards. Gregory (1982) has written a comprehensive review of reptilian hibernation and Penny (1987) has reviewed the major physiological mechanisms involved in the overwintering strategies of frogs and turtles.

Witherington and Ehrhart (1989b) reported on several hypothermic stunning episodes that occurred in Mosquito Lagoon, Florida, between 1977 and 1986. Average water depth here is only about 1.5 m. Of 342 green turtles collected, there was an 11.5% mortality. Cloacal temperatures of 22 living turtles averaged 6.1°C. Morning surface water temperatures during these cold-stunning events generally were below 8°C. Schroeder et al. (1990) reported that 246 green turtles were recovered cold-stunned in the Mosquito Lagoon area in December 1989; 67 were dead or died within 12 hours. Minimum water temperature was below 10°C during the episode. A few cold-stunned juvenile green turtles have been collected in New York waters (Morreale et al. 1992). Schwartz (1978) stated that the lethal temperature for *Chelonia mydas* is about 5 - 6.5°C. Ogren and McVeay (1982) compared the apparent hibernation and hypothermic stunning of green and loggerhead turtles.

The body temperatures (thermoprobe inserted about 15 cm into the cloaca) of fifty immature turtles with an average curved carapace length of 55.7 cm (range 42.1-85.1

cm) were taken in Moreton Bay, Australia. The body temperatures did not deviate significantly from water temperatures throughout seasonal fluctuations in water temperatures in the range of 15 to 22.7°C (Read et al. 1996). The authors raise the possibility that immature green turtles in Moreton Bay are more tolerant of cold water than individuals in some other populations.

On the other end of the thermal spectrum, it has been found that when a hatchling's body temperature reaches about 36°C, it starts seeking shade (Bustard 1970) and that sea turtles may extend their normal ranges in response to warmer water temperatures (Radovich 1961).

The normal resting and active body temperatures of green turtles are discussed in section 3.4.4.

As far as is known, the green turtle is the only sea turtle that spends time on land for non-nesting purposes. This behavior has been observed in Australia (Garnett et al. 1985a), Hawaiian Archipelago (Balazs 1980; Whittow and Balazs 1982), Socorro Island and Galápagos Islands (Fritts 1981; Snell and Fritts 1983) and in Namibia (Tarr 1987). Non-nesting emergences of both sexes have been seen in daytime and at night and involve some small but mostly large individuals. In the Wellesley Group, Australia, basking solitary turtles or sometimes groups of up to 400 in a small embayment (made up mostly of internesting females and some adult males) can periodically be seen (Limpus et al. 1994a). Hawaiian green turtles of all sizes regularly "bask" in captivity (Balazs and Ross 1974; Kam 1984). Garnett et al. (1985a) review some of the reasons for non-nesting emergences, including avoidance of courting males by females, synthesis of vitamin D, acceleration of digestion, egg maturation, avoidance of predation by sharks and energy conservation. Congdon (1989) reviews the basking habit of turtles and in addition to the aforementioned possible reasons for non-nesting emergences, he cites elimination of ectoparasites and epizoic algae and drying of integument to reduce bacterial and fungal infections.

The green turtles' sensitivities to parasites and diseases are discussed in section 3.3.5. The fact that green turtles can be raised and kept in captivity for years, albeit not without major problems, attests to their hardiness. There is some nipping and biting between males and between males and females in the courtship and mating repertoire (see section 3.1.3).

Evidently because of the lack of food, little feeding occurs off nesting beaches (but see section 3.4.1). Some long-range oceanic migrations during which adult turtles are presumed not to feed are described in section 3.5.1.

Stabenau et al. (1993) review the suggested methods for resuscitation of comatose sea turtles (compression of plastron, electrical stimulation of pectoral region, insertion of plastic tube into trachea followed by blowing into the tube) and they recommend a method that has been used successfully with Kemp's ridley turtles. The field method involves maintaining the turtle in a prone position, intubation with an endotracheal tube fitted with a low-pressure cuff, and ventilating with a manual resuscitator.

The current method being used to treat carapace injuries at Sea World in Florida is a transparent wound dressing known as tegaderm (Walsh et al. 1994). The healing sequence in these types of wounds starts with granulation of healthy tissue, followed by re-epithelization and pigmentation, and then calcification.

Campbell (1996) describes rehabilitation of injured and sick sea turtles. Some of the common broad-spectrum antibiotics used are chloramphenicol succinate, enrofloxin and trimethoprin-sulfadiazine.

3.3.3 Competitors

Heinsohn et al. (1977) briefly describe how, in some Australian waters, food (seagrasses) competition between green turtles and dugongs is reduced by the former's reliance also on algae while the latter's primary food sources are seagrasses. In the Torres Strait where much seagrass is eaten by dugongs, Garnett et al. (1985b) found that the most common plants consumed by green turtles were five genera of algae and the seagrass *Thalassia.*

In the Caribbean grass meadows, sea urchins and certain fishes are the main competitors of green turtles. Three species of sea urchins that graze extensively on seagrass are *Diadema antillarum, Tripneustes ventricosus* and *Lytechinus variegatus.* The sea urchins tend to graze the distal portions of the grass blades. The bucktooth parrotfish, *Sparisoma radians,* feeds primarily on *Thalassia testudinum.* Several other species of parrotfish and surgeonfish feed on seagrasses, especially on the epiphytized tips of the blades (Zieman et al. 1984). Along with *C. mydas,* grazers in the tropical western Atlantic seagrass communities include gammarid amphipods, gastropods, echinoids and fish (references in Dawes et al. 1991).

In the Arabian region, dugongs are among the larger grazers of seagrasses. The smaller grazers include the urchin *(Tripneustes gratilla),* surgeonfish *(Zebrasoma xanthurum* and *Ctenochaetus striatus)* and rabbitfish *(Siganus rivulatus).* In a quantitative study, urchin consumption was equivalent to about 33% of the total seagrass growth and consumption by fish amounted to less that 5% of the total plant growth (references in Sheppard et al. 1992).

Intraspecific density-dependent nest destruction may prevail on beaches, usually small island beaches, where nesting space is limited (Bustard and Tognetti 1969). Monk seals with pups sometimes compete with green turtles for choice basking spaces on French Frigate Shoals (Balazs 1980).

Humans sometimes compete with marine turtles for beaches. An example is the drive to acquire beachfront

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Fish and Wildlife Service
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