

Turtle migration

Loggerhead sea turtles

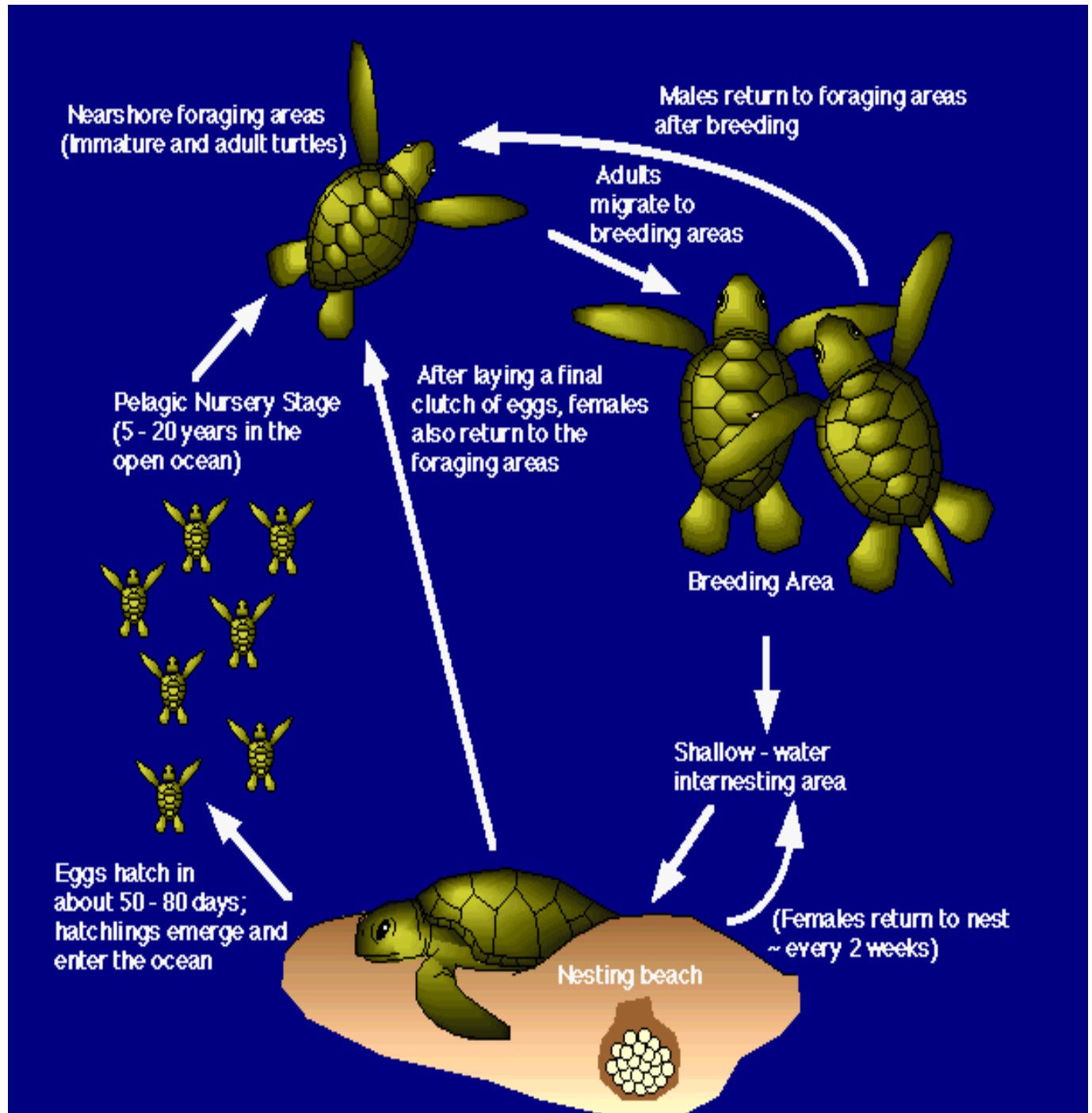


Diagram from <http://www.unc.edu/depts/oceanweb/turtles/>

3 separate mechanisms needed for navigation:

1. Find ocean

- use visual system

2. Swim in correct initial direction in ocean

- use vestibular system

3. Swim in correct direction in open ocean

- use magnetoreception

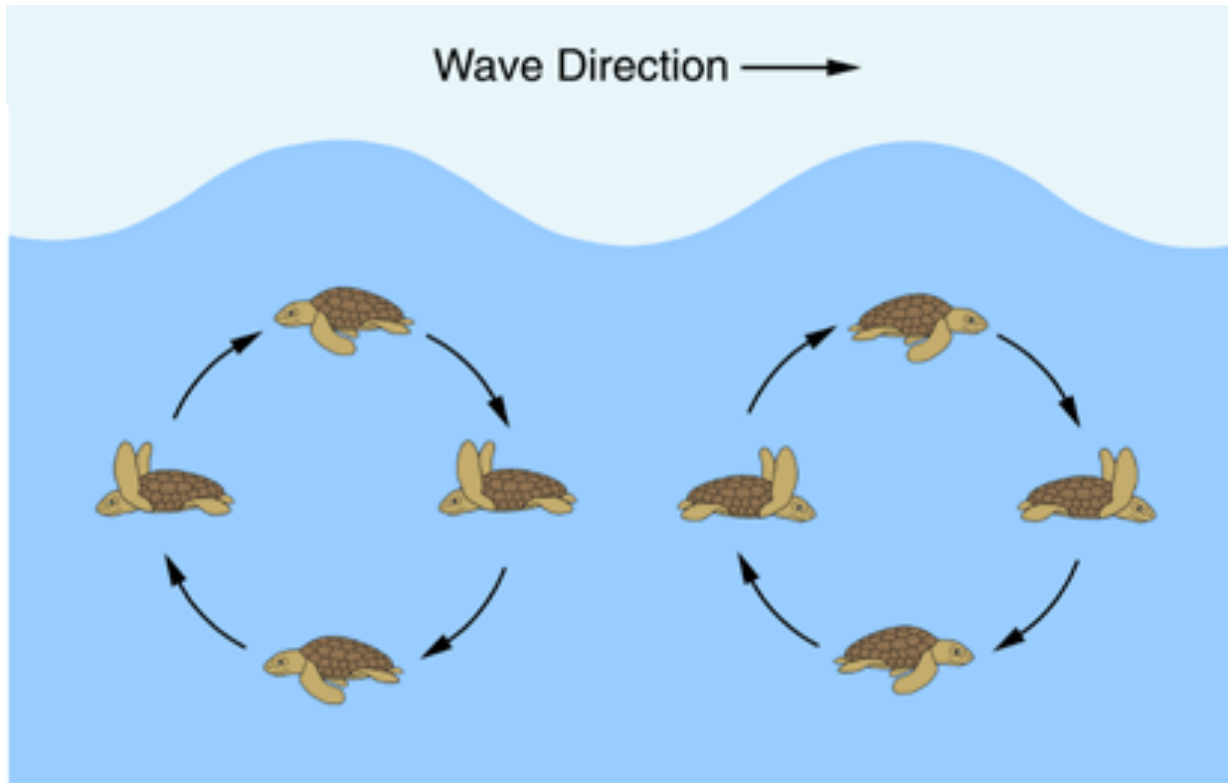
Hatchlings



- Turtles use light contrast to find the ocean; typically the ocean is brighter than the hills/coast behind. Although this picture shows otherwise, turtles usually hatch at night.
- Eggs moved from the east to the west coast of Costa Rica: Turtles were still able to go in the direction of the water, implying that turtles do not inherit a specific direction (Carr and Ogren, 1960).

← Adult ♀ making nest

Finding Open Ocean



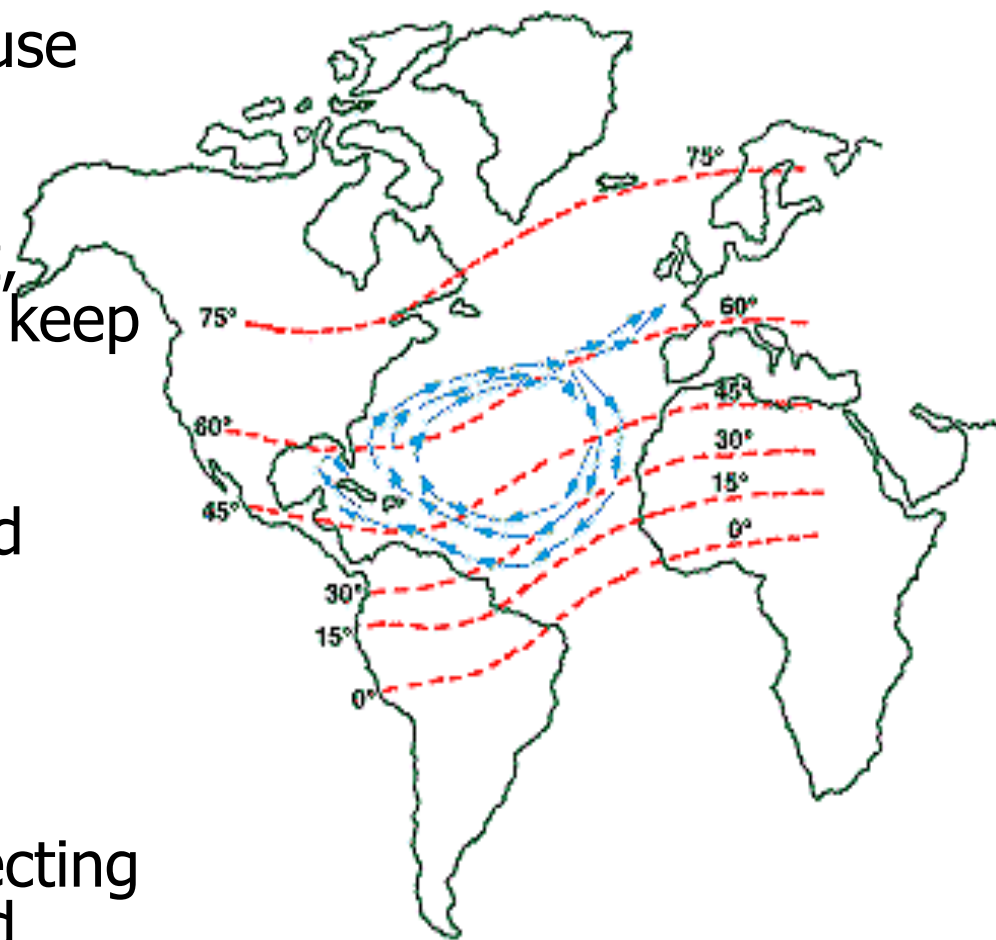
The hatchlings use wave direction to navigate out into pelagic waters.

Facing waves:
up → back
↓
forward ← down

With waves:
up → forward
↓
back ← down

Open ocean migration

- Deep open water - cannot use waves as a navigation tool.
- First orientate towards light, then use magnetic fields to keep going in that direction.
- Reversing the magnetic field after the initial orientation causes the turtles to turn around.
- Latitude recognized by detecting differences in magnetic field inclination and intensity.



(Lohmann and Lohmann, 1994)

Turtle references

- Carr, A. and Ogren, L. 1960. The ecology and migrations of sea turtles, 4: The green turtle in the Caribbean Sea. *Bulletin of the American Museum of Natural History*, Volume 121:Article 1, pp. 1-48. Available at <http://www.sefsc.noaa.gov/seaturtlepeerpublications.jsp>
- Lohmann, K. J., Lohmann, C. M. F., Ehrhart, L. M., Bagley, D. A., and T. Swing. 2004. Geomagnetic map used in sea turtle navigation. *Nature*. 428: 909-910.
- J. and C. M. F. Lohmann. 2006. Sea turtles, lobsters, and oceanic magnetic maps. *Marine and Freshwater Behaviour and Physiology*. 39(1): 49-64.
- Lohmann Lab Website
<http://www.unc.edu/depts/oceanweb/turtles/>
- Caribbean Conservation Corporation and Sea Turtle Survival League
<http://www.cccturtle.org/>



How do you synchronize circannual oscillators?

Answer: Use a seasonal cue!

Some possibilities:

In temperate zones: day length, temperature, food availability

In tropical zones: dry vs rainy season.

(Nice behavioral example is weakly electric fish)