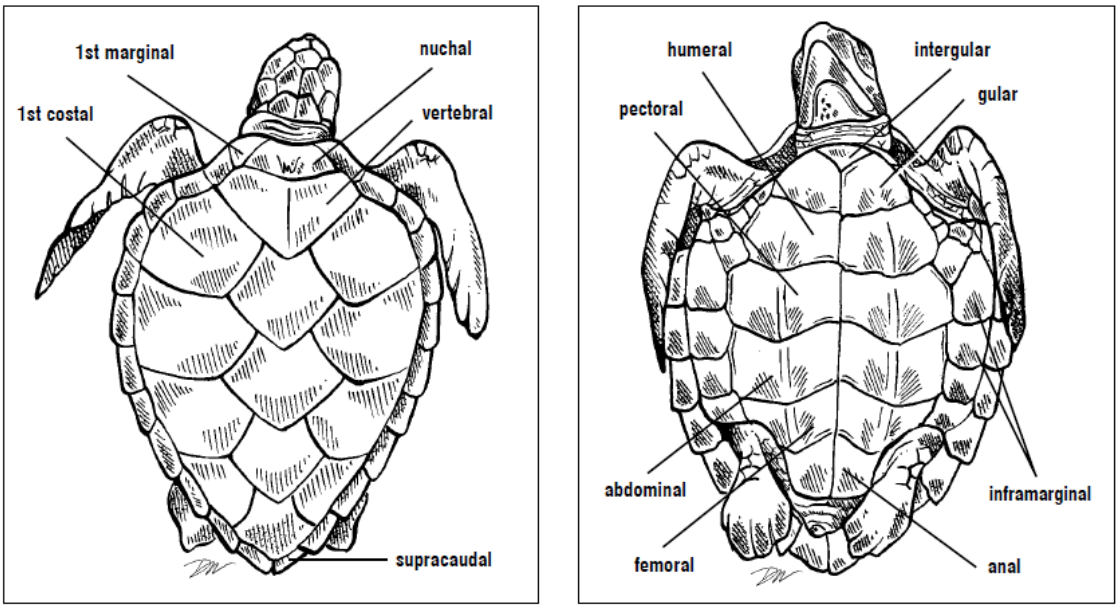
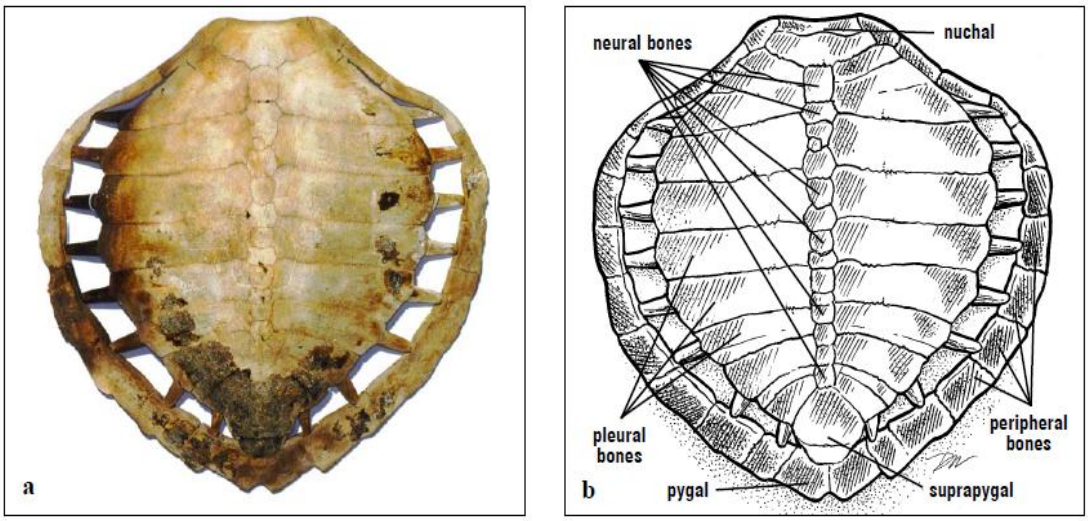
Assignment #1: Anatomy and Functional Morphology of Shell

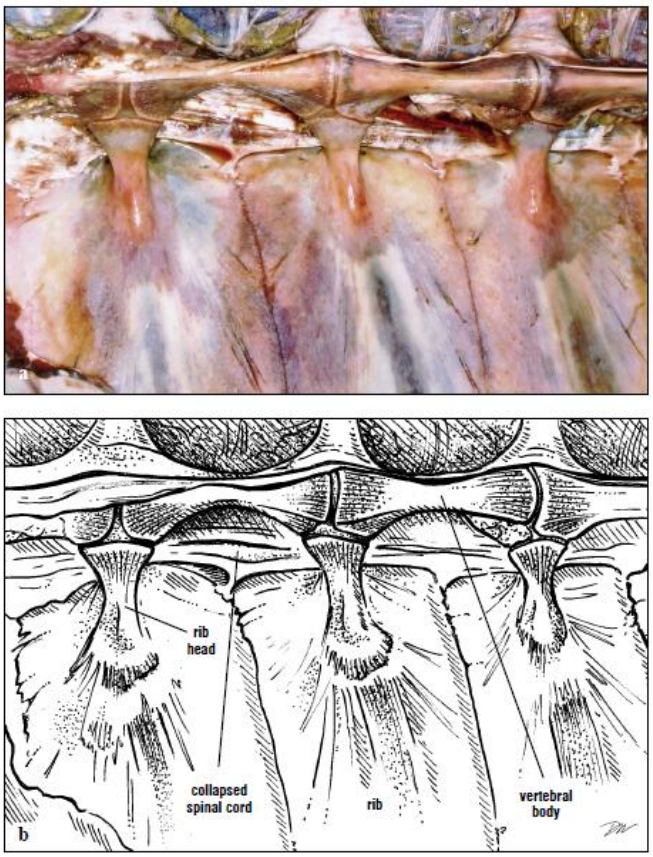
The shell in sea turtles is a complex structure, composed of the dorsal *carapace* and ventral *plastron*. The carapace is composed of bone, covered by keratinous scutes in Cheloniid turtles, or blubber and skin in *Dermochelys*. The margins of cheloniid scutes and the bones do not align with one another. In the leatherback, the blubber overlies ribs and vertebrae and is covered dorsally with waxy skin and embedded dermal ossicles.



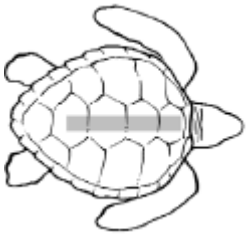
Morphology of carapace and plastron in Cheloniid sea turtles. The scutes are keratinous epidermal structures that grow above the bones. Scutes grow two ways. They increase in size (area) at their margins. The entire scute can increase in thickness.



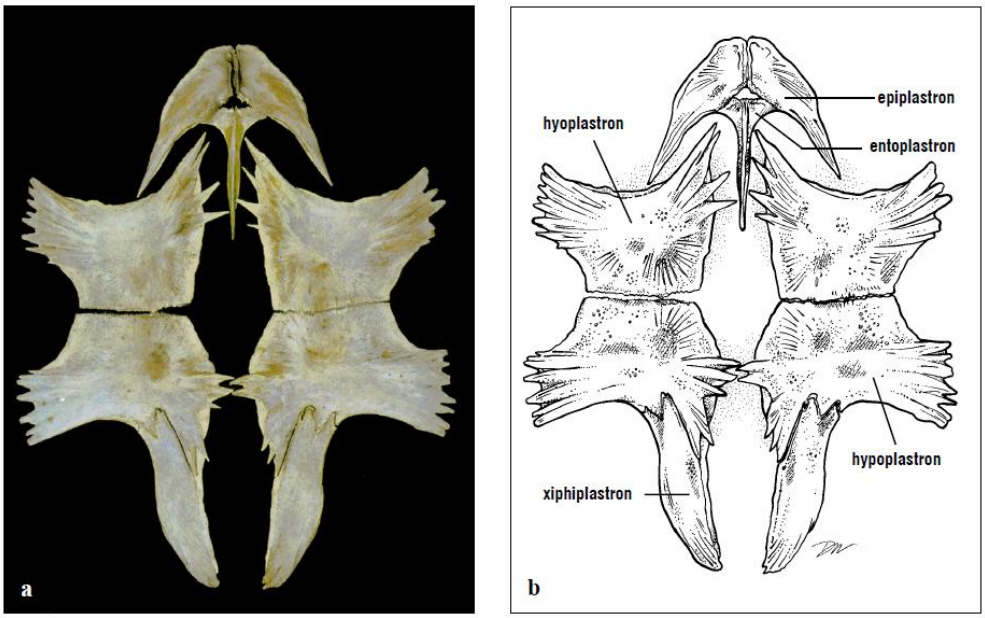
Anatomy of carapace in Kemp's ridley sea turtle (dorsal view).



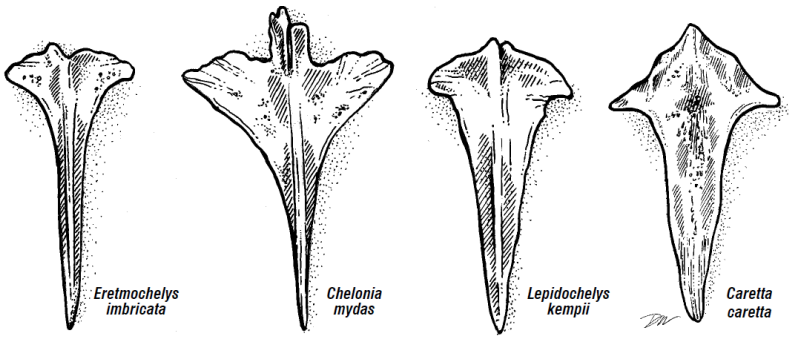
Ventral view of the carapace, showing the arrangement of the ribs and vertebral bodies. The vertebral arch is incorporated into the vertebral (neural) bones of the carapace and hence, is not seen in this view. The spinal cord travels in the space formed between the neural bones and the vertebral bodies.



The plastron of Cheloniids is a composite including derivatives of the axial and appendicular skeleton (ventral ribs plus shoulder elements). It is composed of 4 pairs of bones in sea turtles and 1 unpaired bone (entoplastron). The shape of the entoplastron bone is sometimes used as a key characteristic for species identification.



Anatomy of plastron of Cheloniid sea turtles. The plastron is composed of 9 bones that are separate in hatchlings but become fused in older turtles.



Entoplastron morphology. The distinct shape of the entoplastron bones may serve as a key characteristic to distinguish some cheloniid species. In *E. imbricata* and *C. mydas* the elongated shaft is narrow. The bone is roughly T-shaped in hawksbills and the shaft narrows abruptly. It is arrow-shaped in green turtles; wide anteriorly with a shaft that narrows gradually. In L. kempii and *C. caretta*, the shaft is wide. The overall shape is almost dagger-like in the Kemp's ridley as the shaft narrows gradually. The bone is cruciform in loggerheads; the lateral processes are distinct and the shaft tapers along its posterior half. The entoplastron has not been described diagnostically for the olive ridley. Entoplastron bones change shape during ontogeny, hence it is recommended that this characteristic be used only in adults.

Assignment: Anatomy of sea turtle carapace

1) Investigate anatomy of sea turtle carapace. Which anatomical elements can you see?

2) By using identification key, can you determine the species of sea turtle based upon carapace only, if you know that the animal was recovered in the Mediterranean? Explain your answer.

Assignment #2: Species identification and morphometry

1) By using identification key, determine the sea turtle species.
2) List all morphological characteristic upon which you identified the species.
3) Perform and write down the carapace measurements:
    a) Maximal Curved Carapace Length or tip-tip Curved Carapace Length (CCLt-t)
    b) Standard Curved Carapace Length or notch-tip Curved Carapace Length (CCLn-t)
    c) Minimum Curved Carapace Length or notch-notch Curved Carapace Length (CCLn-n)
    d) Curved Carapace Width (CCW)

Species 1:

Morphological characteristics:

CCLt-t = _____ cm; CCLn-t = _____ cm; CCLn-n = _____ cm; CCW = _____ cm

Species 2:

Morphological characteristics:

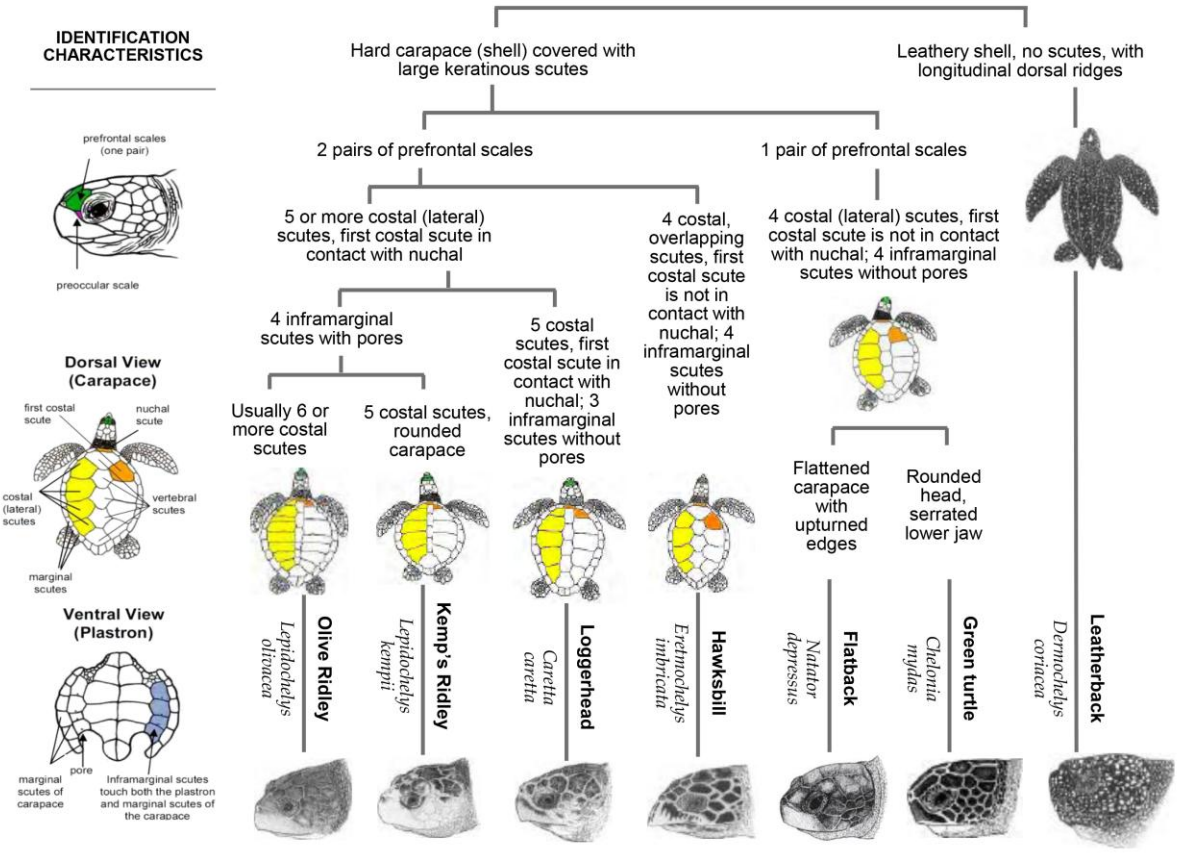
CCLt-t = _____ cm; CCLn-t = _____ cm; CCLn-n = _____ cm; CCW = _____ cm

Species 3:

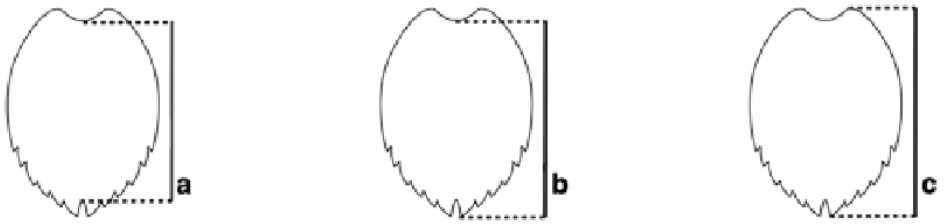
Morphological characteristics:

CCLt-t = _____ cm; CCLn-t = _____ cm; CCLn-n = _____ cm; CCW = _____ cm

Sea Turtles Identification Key



Sea Turtle Carapace Morphometry



The anterior and posterior pairs of anatomical points for three carapace length measurements. (a) Minimum curved carapace length (CCLmin) are measured from the anterior point at midline (nuchal scute) to the posterior notch at midline between the supracaudals. (b) Curved carapace length notch to tip (CCLn-t) are measured from the anterior point at midline (nuchal scute) to the posterior tip of the supracaudals. (c) Maximum curved carapace length (CCLmax) is measured from the anterior edge of the carapace to the posterior tip of the supracaudals. Anterior and posterior locations must be on the same side of the carapace.

Assignment #3: Hatchling species identification

1) By using identification key, identify species of sea turtle hatchlings.
2) List all morphological characteristic upon which you identified individual species.

Species 1:

Morphological characteristics:

Species 2:

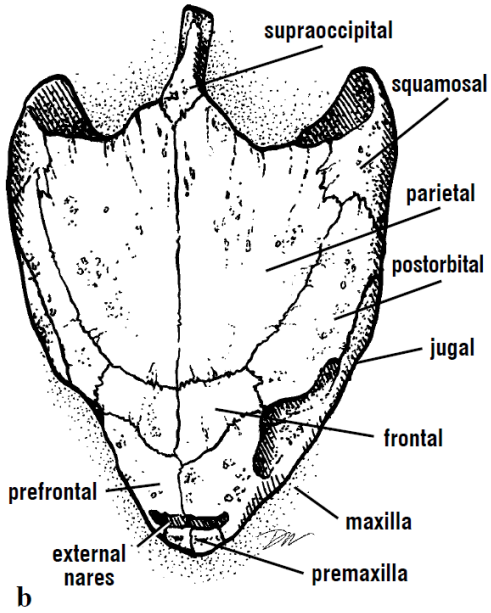
Morphological characteristics:

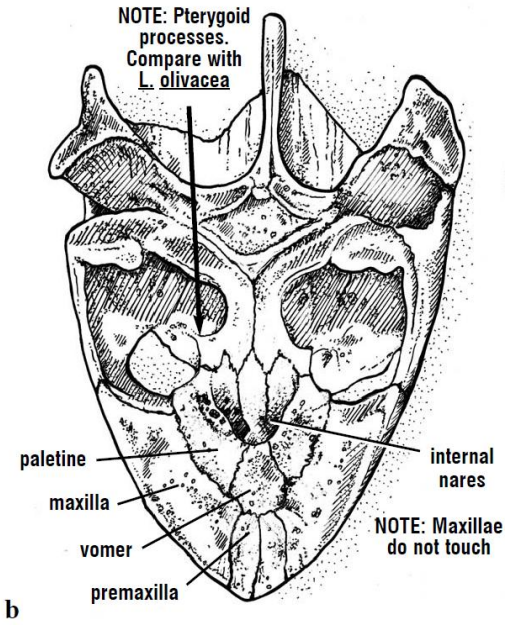
Species 3:

Morphological characteristics:

Assignment #4: Skull anatomy and species identification

In sea turtles, the specific articulations and forms of the skull bones are characteristic of each species. The bones that make up the palate are frequently used as key characteristics for species identification. For example, in this ridley sea turtles, the vomer prevents the maxillae from touching. In the loggerhead, a grossly similar skull, the vomer does not reach the premaxillae, so the maxillaries articulate. The pterygoid process shape and position are also used as identification characteristics.



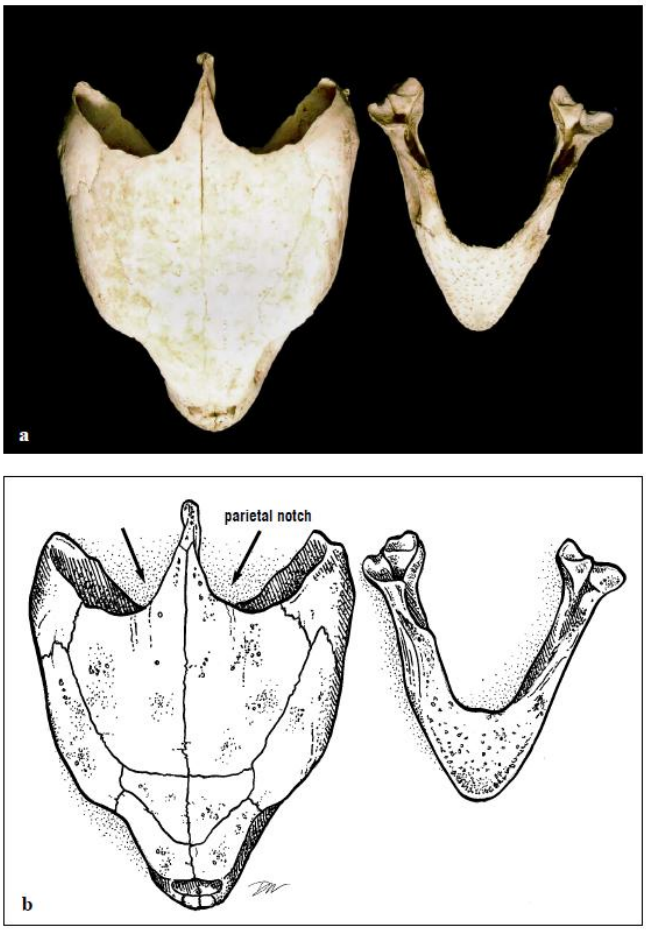




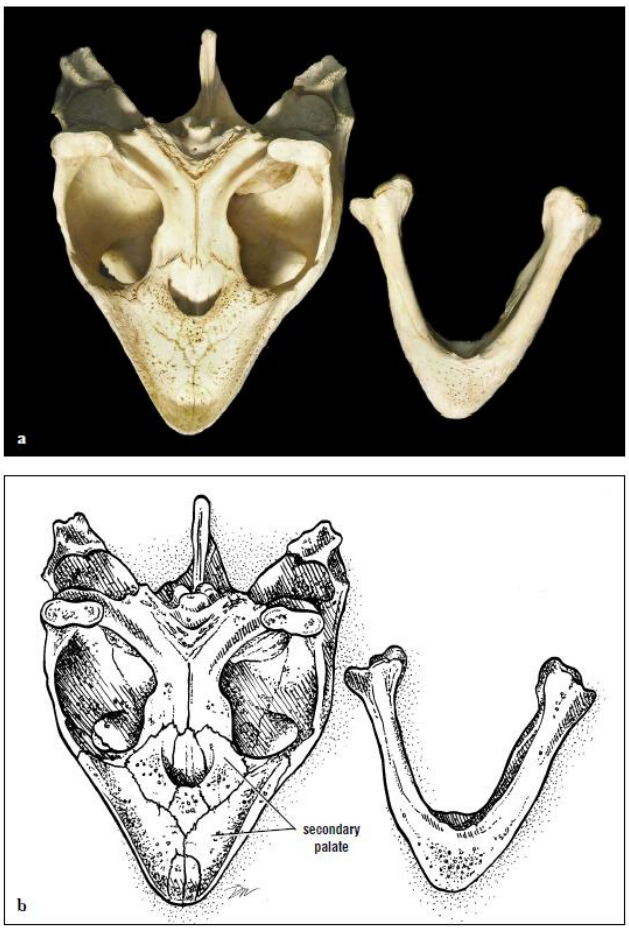
Dermochelys coriacea (a), *Eretmochelys imbricata* (b), *Chelonia mydas* (c), *Lepidochelys olivacea* (d), *Lepidochelys kempii* (e), *Caretta caretta* (f). The hawksbill, green turtle and Kemp's ridley skulls are from immature animals, others are from adults.

Caretta caretta

The head of the loggerhead is relatively large, wide posteriorly, and the snout tapers anterior to the orbits. The parietal notches (wide U-shape emarginations formed by the posterior borders of the squamosal, parietal and supraoccipital bones) are large (Fig. 34). The jaws are robust and shaped like a wide V. Loggerheads have a relatively long secondary palate. (The secondary palate is the shelf of bone that separates or partially separates food and air passages.) The palate lacks alveolar ridges and *the two maxillary bones contact one another posterior to the premaxillary bones*.



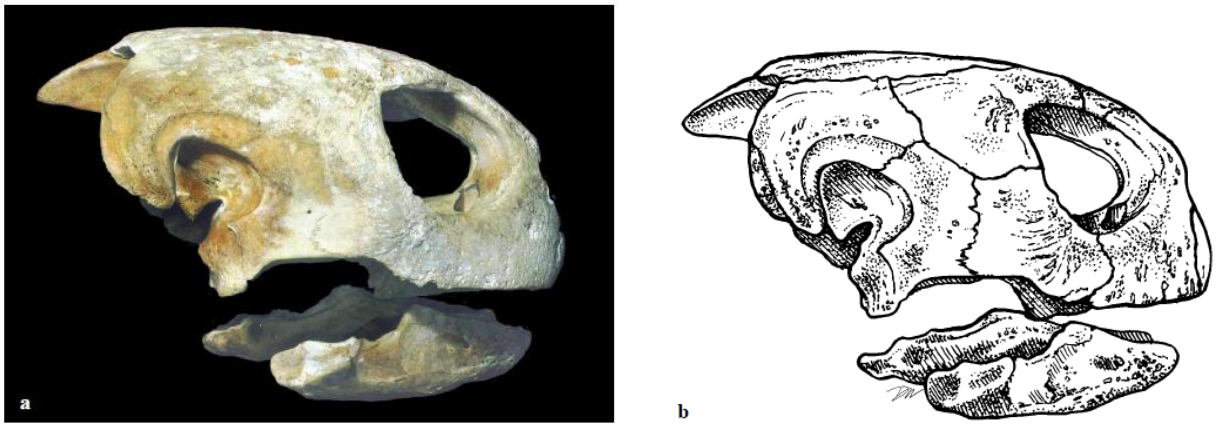
Caretta caretta, dorsal skull and lower jaw. Parietal notches are at arrows.



Caretta caretta, ventral skull and lower jaw. Note that the two maxillary bones touch at the middle of the palate.

Chelonia mydas

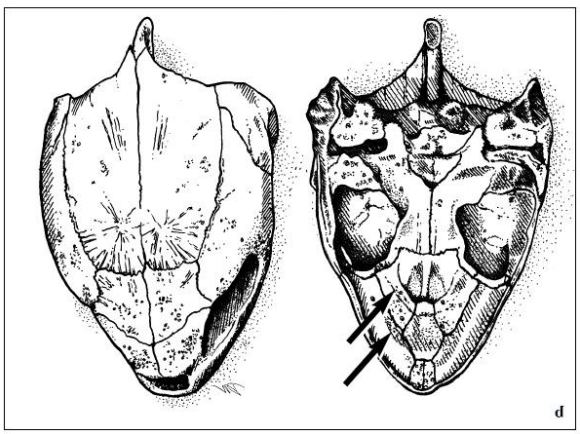
The skull is rounded with a short snout and shallow parietal notches. The upper jaw is described by a smooth U-shaped outline; the palate between the margins of the upper jaw and the internal nares (the alveolar surface) has a pair of ridges that run parallel to the outer edge of the jaw. The lower jaw, has a ridge running parallel to the inner surface and a midline cusp.



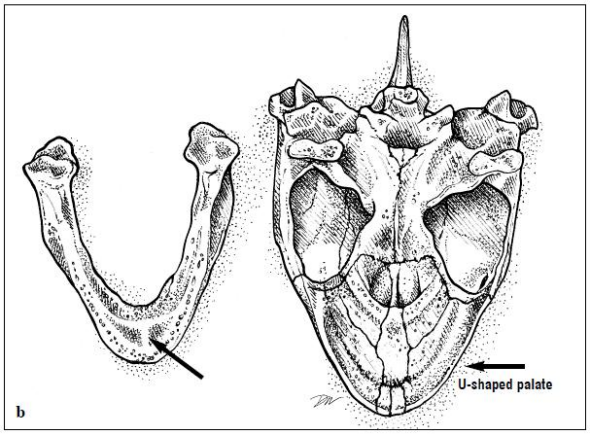
Chelonia mydas, lateral view.







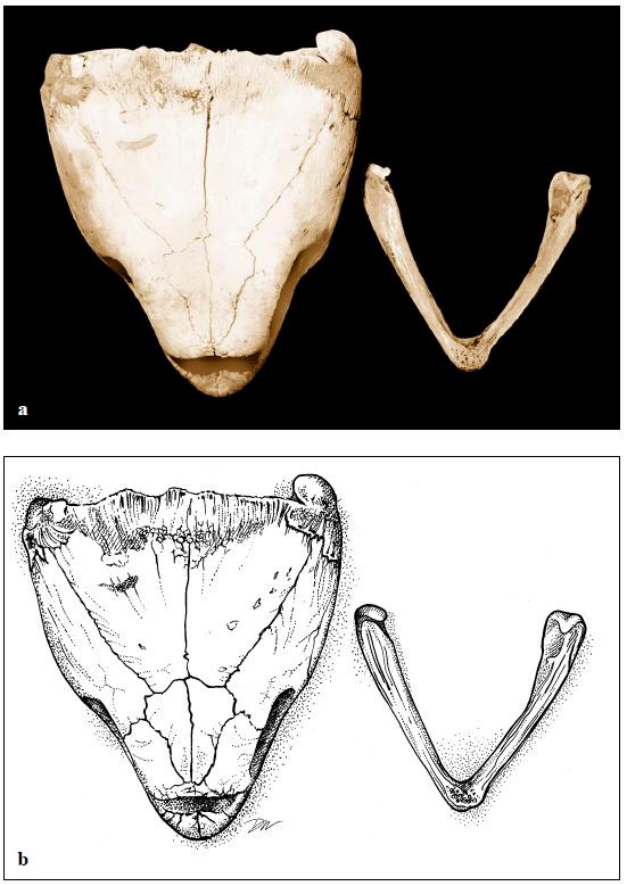
Chelonia mydas, dorsal and ventral skull. Note ridges on palate at arrows.



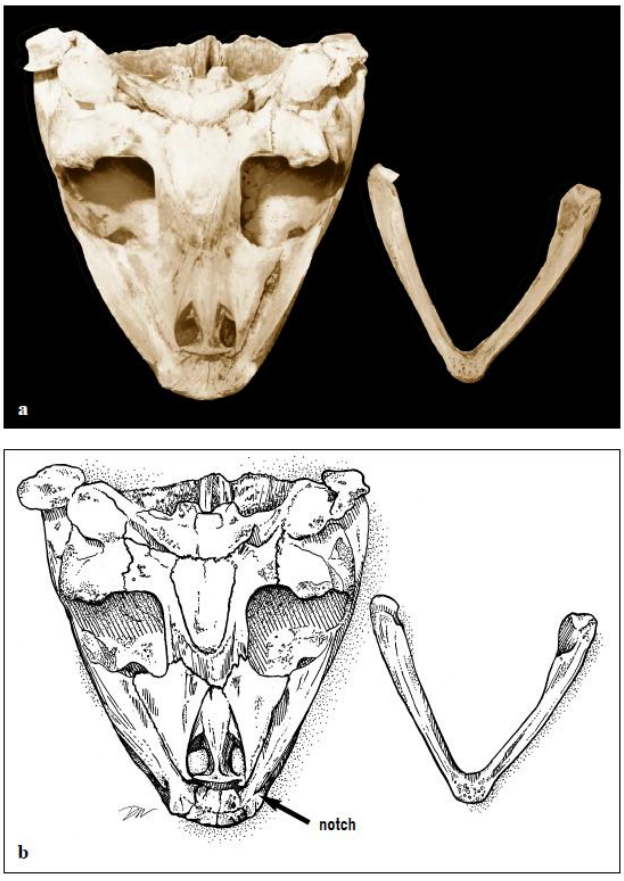
Chelonia mydas, ventral skull and lower jaw. Midline cusp of lower jaw at arrow.

Dermochelys coriacea

Leatherback skulls are unlikely to be mistaken for those of any other species. The skull is wide and rounded anteriorly with large orbits; there are no parietal notches. The bones articulate loosely; there is little or no secondary palate. The margins of the jaws are sharp and possess notches. There are pointed cusps on the anterior maxillary bones. The lower jaw comes to a dorsally directed point at the mandibular symphysis (where the two halves of the lower jaw join). The lower jaw has a cartilaginous portion medial to the dentary.



Dermochelys coriacea, dorsal skull and lower jaw. The bones fit together more loosely than in other species. The leatherback skull and skeleton has been described as neotenic (having embryonic characteristics) in form because of the lack of bony fusions.



Dermochelys coriacea, ventral skull and lower jaw. Note the lack of a secondary palate and the loose articulations of the bones.

Assignments:

1) Identify sea turtle species based upon presented skulls.
2) List anatomical characteristic upon which you identified individual species.

Species 1:

Anatomical characteristics of skull:

Species 2:

Anatomical characteristics of skull:

Species 3:

Anatomical characteristics of skull: