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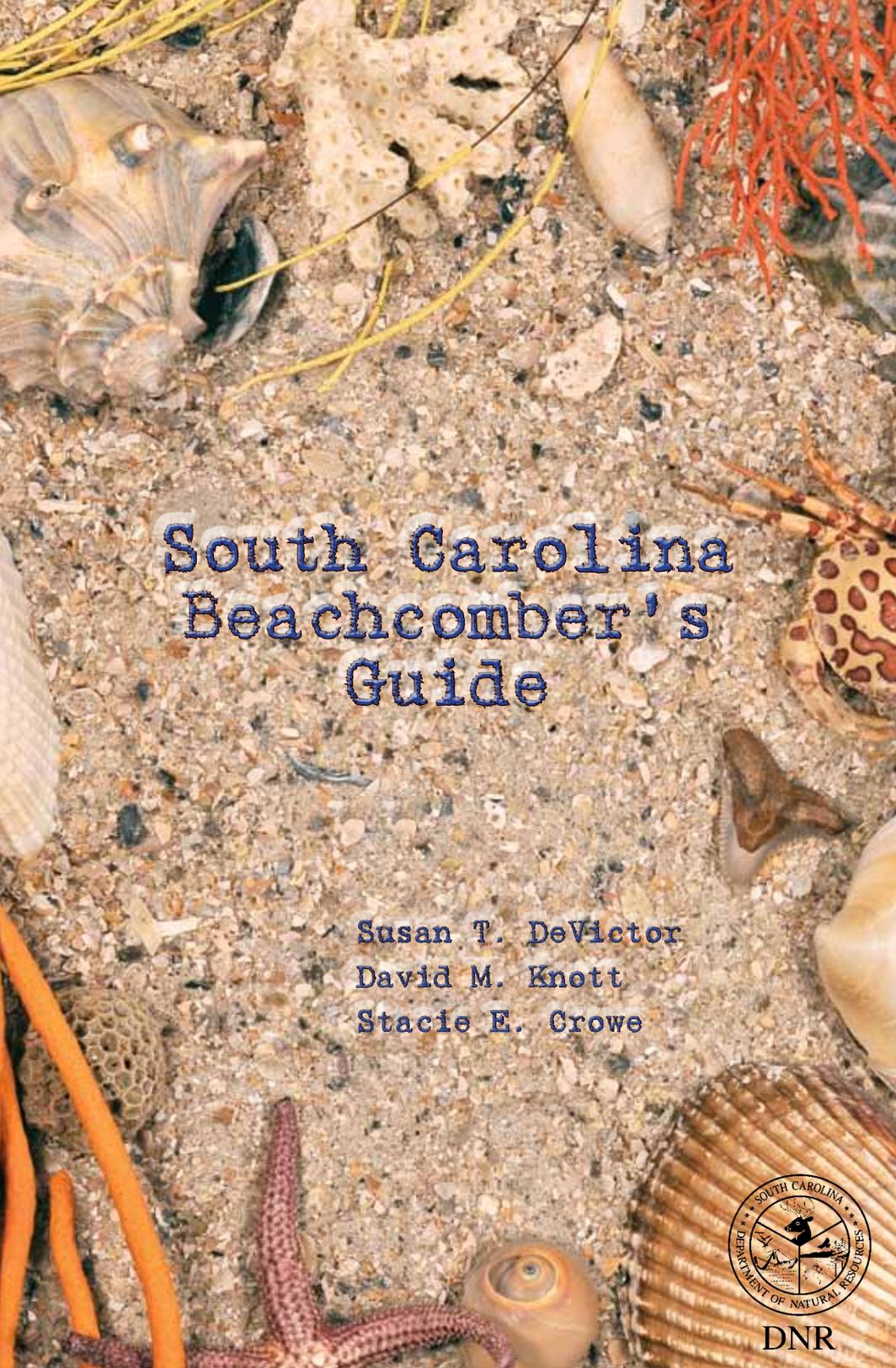


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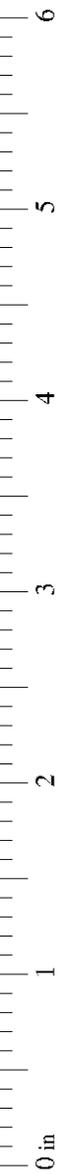


South Carolina Beachcomber's Guide

Susan T. DeVictor
David M. Knott
Stacie E. Crowe



DNR



South Carolina Beachcomber's Guide
A Guide to the Common Invertebrates, Plants and Natural Artifacts
of the South Carolina Seashore

Susan T. DeVictor, David M. Knott & Stacie E. Crowe
Southeastern Regional Taxonomic Center
Marine Resources Research Institute
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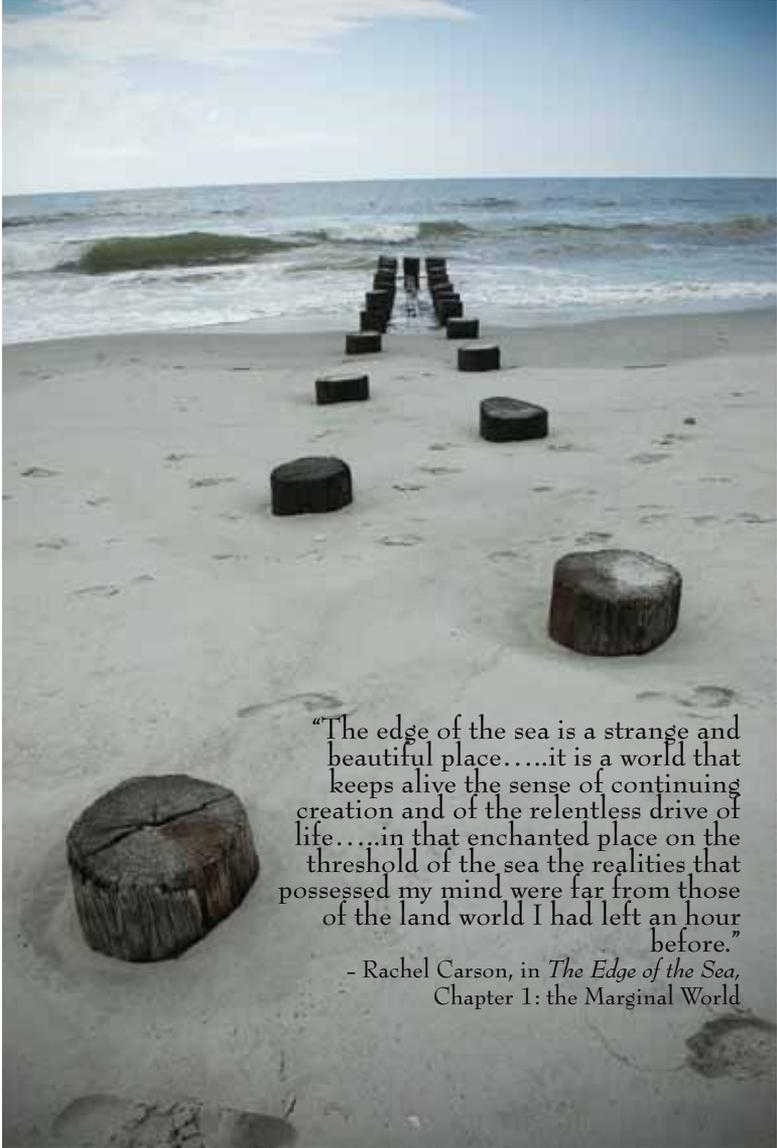
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“The edge of the sea is a strange and beautiful place.....it is a world that keeps alive the sense of continuing creation and of the relentless drive of life.....in that enchanted place on the threshold of the sea the realities that possessed my mind were far from those of the land world I had left an hour before.”

- Rachel Carson, in *The Edge of the Sea*,
Chapter 1: the Marginal World

Folly Beach, Charleston County

SOUTH CAROLINA BEACHCOMBER'S GUIDE

A Guide to the Common Invertebrates,
Plants and Natural Artifacts of the South
Carolina Seashore

Susan T. DeVictor
David M. Knott
Stacie E. Crowe

Southeastern Regional Taxonomic Center
Marine Resources Research Institute
South Carolina Department of Natural Resources

2010



DNR

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Callichirus major (p. 56, left) by Joseph Cowan; *Arbacia punctulata* test (p. 40), *Leptogorgia virgulata* (p. 48, left), and *saw palmetto* (p. 69) by Dr. Elizabeth Wenner; *Aplidium stellatum* (p. 66, left) by Wendy Watson; *Ocypode quadrata* (p. 61, left) and turtle crawl (p. 78) by Carrie Young.

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Back cover: Capers Island

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The South Carolina coastline stretches nearly 190 miles from the Little River Inlet on the North Carolina border to the Savannah River on the Georgia border. Along this coastline, beaches, estuaries, bays, rivers and creeks of all sizes create roughly 3000 miles of tidal shoreline. South Carolina beaches are renowned for their beauty and pristine quality, and one of the many activities that attract visitors to these unique habitats is beachcombing. This book was written to help beachcombers identify the most common marine invertebrates, plants, and natural artifacts that they are likely to encounter while walking along the beach.

How to Use this Book

The book is organized into sections, first by general taxonomic groups, then by the overall shape of organisms within those groups. These groupings are labeled along the outer page margins. Rulers are printed on the inside of the front and back covers (in inches and metric units) to allow comparison of the size of objects with sizes provided in the species profiles. Labeled illustrations at the beginning of each major section and a glossary of terms are provided to explain some of the characteristics of the organisms that may be encountered.

With more than 775 marine and estuarine invertebrates known from South Carolina (Kohlsaat and others, 2005), it was not possible to include all of the species that might be found on the beach; however, most of the common and conspicuous plants and invertebrate animals that are likely to be found by the casual beachcomber are included. A list of more comprehensive guides



Isle of Palms, Charleston County



Botany Bay, Charleston County

to seashore creatures can be found on page 85. The scientific names (genus and species) are given for most items, and common names follow those published by the American Fisheries Society. When possible, images of species as they appear in life, as well as images showing how they might look after being stranded for some time on the beach, are included.

The Physical Setting

The South Carolina seashore is shaped by a number of large-scale processes including the circulation of warm Gulf Stream water, a six to eight foot tidal range, heavy winter storms, tropical storms and hurricanes, and cool water upwelling from the nearby continental slope. These processes play a major role in determining the types of species that may be encountered near the water's edge. Many South Carolina beaches overlap, or are adjacent to, estuarine and salt marsh habitats that provide an array of interesting species in addition to those that live in shallow, near shore ocean waters.

The sand on South Carolina's beaches is derived, in part, from material that is carried by the rivers that flow from as far away as the

Appalachian Mountains across the Piedmont, Sandhills, Coastal Plains and Lowlands, from the mountains into the sea. This terrestrial sand, which varies in texture from very fine to coarse, is composed mainly of quartz particles. However, there are also stretches of beach that are dominated by shells or shell fragments, especially those of the eastern oyster, *Crassostrea virginica* (see page 16). Close inspection of the sand on most beaches in our state will reveal some mixture of various sized fragments of these two components (quartz and shell).

The size of the sand grains found on any particular beach, and at varying distances from the waterline, is largely a function of local wave energy and currents. All things being equal, beaches with high wave energy and steep slopes (often termed “reflective”, as they reflect wave energy away from shore) will be covered primarily by coarser, heavier sand grains, because fine sands are washed away. Beaches with lower wave energy and gentler slopes (termed “dissipative”, as they dissipate wave energy gradually) allow finer particles to settle and remain on the beach. The amount of wave energy in the surf can also separate sands of differing color, leaving ripples of light and dark stripes along the beach. This is caused by the composition of sand grains themselves, which vary in the amount of iron they contain. Darker sand grains are

usually high in iron, a dense mineral, causing them to settle faster than light-colored grains. Wind can move the finest sand grains, which rapidly cover various objects lying on the beach, such as shells and driftwood, as well as visitors’ bags, towels, and shoes. It is this process that also promotes the formation of sand dunes.

Beach Zones and Habitats

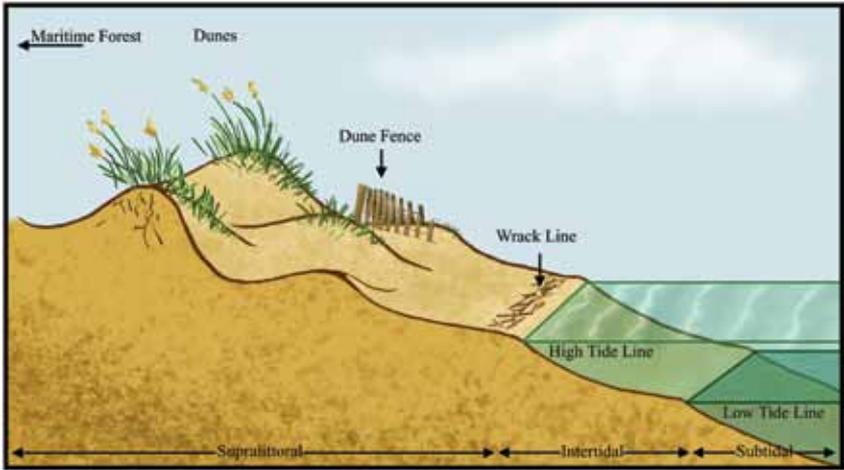
The prominent physical features of beaches are categorized into several zones based primarily on their



sand ripples

Otter Island, Colleton County

vertical position relative to the tidal waterline. The supralittoral zone, the most landward part of the beach, is influenced by saltwater spray and may become inundated only during exceptionally high tides or strong storms. The intertidal zone lies between the high tide line and the low tide line. This zone is alternately submerged and exposed, depending on the stage of the tide. As the name suggests, the subtidal zone is the lowest part of the beach that is nearly always under water.



Dunes and, to a lesser extent, maritime forest occupy most of the supralittoral zone. Several common species of plants stabilize the dunes and reduce the erosion that can be caused by waves and wind (see page 75). Occasionally, however, heavy surf like that produced during winter storms encroaches on and rapidly erodes the dunes. Evidence of such erosion can be seen in the vertical cliff-like faces that are sometimes found along the seaward edge of the dunes. Some communities where dunes have become severely eroded will construct “dune fences” that trap wind-borne sand and help build a new line of protective dunes. In addition to plants, various semi-terrestrial crabs, nesting or roosting birds, reptiles, and mammals may be found using this area. Among the many attractive features of SC beaches are relict or drowned maritime forests that create eerie yet beautiful beachscapes, sometimes referred to as “boneyards”. Warming climate and associated sea level



Eroded dune and beach wrack

Morris Island, Charleston County



dune fence



boneyard

Hunting Island, Beaufort County

rise, together with coastal development, construction of shoreline structures like jetties, and the dynamic nature of beach sediments, may all accelerate the formation of these dead forests.

The intertidal zone is a dynamic habitat easily identified by the presence of wet sand and constant wave swash. The upper edge of this zone is

often marked by a drift or “wrack” line composed of buoyant plant material and debris deposited by recent high tides. This is where we find some of the most interesting beach objects, like seaweed (e.g. *Sargassum* species), animal remains, driftwood, and assorted human artifacts. Further down the intertidal is the wave-washed swash zone that migrates up and down the beach with the tides. Numerous well-adapted invertebrates (e.g. *Donax variabilis*; see page 21) and fish (e.g. *Menticirrhus littoralis*) use this habitat, and freshly deposited shells can often be seen rolling in the swash. Sand formations like bars and runnels also may form in the intertidal zone as a result of localized wave energy. Bars are gently sloping sand wedges that are built up by slow sand deposition during calm weather. Landward of these bars, runnels, which are elongated tidal pools that run parallel to the waterline, may be formed as the tide moves up and down the beach. Often, live animals like fish, sea stars, sea cucumbers and crabs, may be trapped in these areas until the flooding tide connects them to the ocean once again.

The subtidal zone is constantly submerged and extends into the deepest parts of the ocean. Nearest to the shore in the surf zone, the subtidal habitat is battered by constant wave action, yet it is highly productive. The continuous recirculation and mixing in the surf zone leads to high concentrations of phytoplankton (small photosynthetic organisms), which support large numbers of invertebrates that feed on it and in turn support diverse fish communities.

Humans and the Beach

Beaches and their habitats create a natural system of protection for coastal areas. For example, berms dissipate and reflect wave energy, and dunes slow erosion, offering protection for the forests and human communities that reside more inland. On a larger scale, barrier islands buffer the mainland from the erosional forces of wind and waves. The inlets that separate many of these barrier islands bring calmer water into the estuaries and rivers on the protected landward side of these islands, where salt marshes and oyster beds can thrive. Maintaining healthy beach systems is particularly important for reducing damage caused by tropical storms and hurricanes, as these areas can absorb enormous wind and wave energy, protecting areas further inland.

Beaches are dynamic environments that experience a wide range of conditions due to changes in tides, currents and wave energy. These forces cause shorelines to naturally grow (accrete) and retreat (erode) over a period of years to decades. Development of coastlines for residential and commercial purposes creates a line of buildings and roads that interacts with the natural shoreline migration cycle. As the shore erodes up to these structures, large expanses of beach can virtually disappear, and if erosion continues, extensive damage may be caused to people's homes and businesses. In order to prevent this from happening, communities often build hard structures like seawalls and groins to stabilize the shoreline, or they place new sand on the beach, a process called "beach nourishment". Unfortunately, hard structures can significantly alter the beach ecosystem and even intensify erosion on nearby unprotected beaches. Beach nourishment, which involves dredging sand from shallow near shore areas and using it to build up eroded beaches, is preferred over the construction of hard structures, but it often must be repeated regularly. This practice can also have negative impacts on marine life inhabiting areas in or adjacent to the locations where dredging and nourishment occur.

You may be surprised to learn that day-to-day human activities can have harmful and lasting impacts on beach ecosystems. Pathways and foot traffic through the dunes can threaten roosting and nesting habitats, destroy protective plants, and make areas behind the dunes more susceptible to flooding during storms. The construction and regular use of elevated wooden walkways can significantly reduce these



effects. Vehicular traffic, removal or destruction of beach vegetation, harassment of wildlife (especially nesting birds) by unleashed dogs, and littering or abandonment of personal property can all have negative impacts on the health of beach ecosystems. Simple awareness of these effects and adherence to local regulations regarding beach use are important initial steps toward ensuring that our beaches are healthy and beautiful places to visit for years to come.

Life on the Beach

Some of the pleasure you may experience during your beach walk may be from the observation of living animals and plants in their natural habitats. For some, it may be only a fleeting glimpse of the ghost crab (*Ocypode quadrata*; see page 61) darting into its burrow. Others may be so lucky as to witness a crab's periodic excursion to the water's edge, where it moistens its gills. Farther down the beach, in the swash zone, the careful observer may see patches of the v-shaped patterns created by the antennae of sand crabs (*Emerita talpoida*; see page 55) as they strain tiny food particles from the receding swash. Another inhabitant of the swash zone is the colorful coquina clam (*Donax variabilis*, see page 21), which rides waves up and down the beach and is often the most common living animal found when digging in the intertidal zone. If you dig in enough places and look very carefully, you might correctly conclude that beach sand is home to an incredibly abundant community of small creatures. In fact, when averaged over the lower part of the beach, as many as 20,000 tiny marine worms, clams, and



Otter Island, Colleton County (180° view)

small burrowing crustaceans might lie in the top few inches of sand beneath your beach towel. They are harmless, so don't be alarmed!

The vast majority of items found on the beach, however, are the remains of animals that died earlier in their natural habitat. Following death, shells, carapaces, and other hard parts are often washed ashore by currents and waves. Occasionally, entire crustacean molts (cast off "skeletons" of growing animals) are found. They are sometimes mistaken for dead, intact animals, but close inspection reveals that they contain no muscle tissue or internal organs like you would see in recently deceased animals. Live or recently dead jellyfish are often stranded on beaches. Sometimes sessile (non-moving) organisms like sponges, corals and algae are torn from their attachment to the sea floor by currents or foraging animals, and then washed ashore. From time to time, a large number of dead or dying organisms may be seen on the beach. Various causes may explain such mass strandings – viral or disease outbreaks may target a single species; temperature, salinity or oxygen extremes may shock several species; storms may dislodge large numbers of living organisms and wash them ashore; and even natural mortality of unusually dense populations may explain some strandings.

Some of the items found on the beach may not be animal or plant remains, but merely traces of their existence. Egg cases laid by adult snails, for example, are common on beaches after they are dislodged following maturation and hatching of the young snails (see page 74). Tracks, holes and fecal matter mark the activity of animals like birds, crabs, shrimp, and worms (see page 72). Egg cases of skates and fossilized sharks teeth are common on South Carolina beaches (see page 73), while less common fossils like whale and manatee bones may also be found. South Carolina beaches are well-known nesting grounds for sea turtles, with the loggerhead being the dominant species, by far. The tracks, or "crawls", of female turtles can sometimes be found from the water's edge to the dunes, where the nests are excavated above the high tide line. These crawls may sometimes be seen by early morning beachcombers between May and August, if a high tide has not erased them from the sand (see page 78). If you see a crawl, help these threatened species survive by not venturing close to the nest.



Mass stranding of sea stars and arc shells, Isle of Palms, Charleston County (left); mass dieoff of fragile surfclams, showing countless specimens washed up on Folly Beach, Charleston County (right)

By the end of your beach walk, the objects that you have seen – whether fossilized, dead, or alive – will have provided you with a small glimpse of the hundreds of species of plants and animals that thrive on the beach and in nearby coastal waters. Please ensure the same enjoyment for beachcombers that follow you, by returning living ones to the water and taking with you only memories and the fewest non-living reminders of your visit to the shore.

MOLLUSKS

The phylum Mollusca includes chitons, scaphopods, bivalves, gastropods, and cephalopods. Of these molluscan classes, the bivalves and gastropods are by far the dominant mollusks found by beachcombers. The other classes, although not necessarily rare, are less likely to be encountered and are not treated in this guide.

Bivalves – (clams, scallops, mussels and oysters) – bivalves typically possessing two shelly valves that are joined at a dorsal hinge by a ligament, interlocking teeth, or both; part of the soft tissue may be modified into two siphons that circulate water over the gills for feeding and respiration

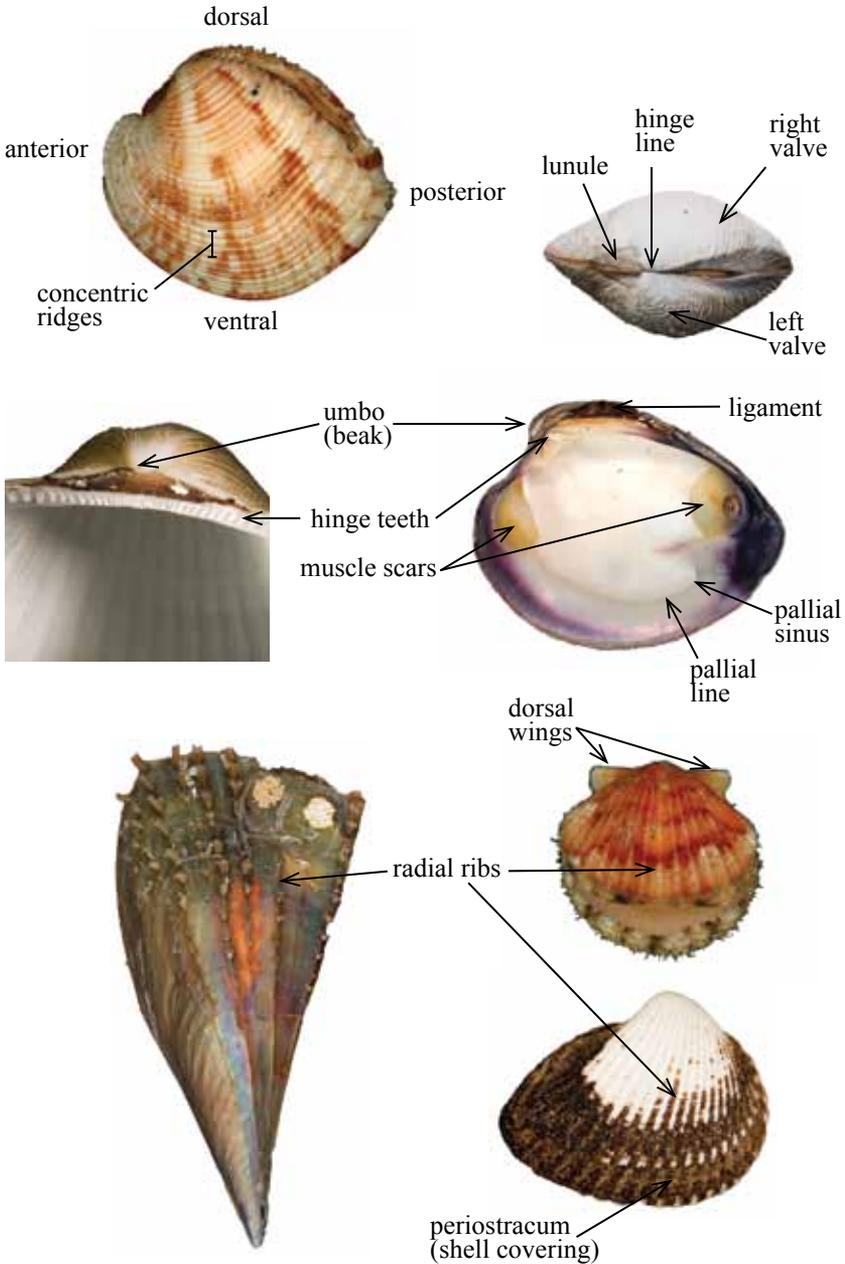
Gastropods – (snails, sea slugs) – snails typically have a single shell that is asymmetrically coiled around an anterior-posterior axis; shell at the apex of the spire is the oldest, with additional whorls added as the snail grows; some groups have a modified shell this is not so obviously coiled, or one that is highly reduced and carried internally (as in the sea slugs)

Chitons – oval shaped and dorsally rounded; covered dorsally by 8 bar-like shelly plates that are bordered at the margin by a thickened girdle of soft tissue; a strong ventral foot secures these animals firmly to hard surfaces

Scaphopods – (tusk shells) - most tusk shells are small, curved, fragile conical shells that are open at both ends; head reduced; thread-like tentacles clubbed at the tip are used to capture and manipulate prey

Cephalopods – (squid, octopus) – shell usually greatly reduced and internal; eyes well developed; prehensile arms or tentacles encircle the mouth, which has a sharp beak; muscular siphon is used to produce a water jet that can propel the animal rapidly

BIVALVE MORPHOLOGY





***Tagelus plebeius* (stout tagelus)**

Distinguishing characteristics: strong, stout shell, oblong and nearly rectangular; beak nearly central, fine concentric lines on chalky white shell; olive-green to brownish yellow periostracum; white interior with teeth at hinge, shelly bump below ligament, and large pallial sinus

Range: MA to Argentina

Size: shell length 2-3½" (~50-90 mm)

Habitat: on muddy intertidal flats in permanent burrows up to 20" deep; sometimes in salt marshes near the edge of bays or sounds

Remarks: similar to *Tagelus divisus*, which is smaller, purplish on interior and exterior surfaces, and with has rounded ends; valves much wider than those of the jackknife clams (*Ensis* species); small commensal crabs may occupy the burrow alongside this bivalve



***Ensis directus* (Atlantic razor clam)**

Distinguishing characteristics: slender “razor-shaped” valves, slightly curved, with blunt ends and sharp edges; length ~6 times height; exterior white with thin, brown to olive, varnish-like periostracum; triangular area along shell length may show faint concentric growth lines (upper L image); interior white with violet tint; L valve with 2 vertical hinge teeth near anterior end; each valve with long, low tooth posterior to hinge

Range: Canada to SC

Size: shell length 5-7" (~125-175 mm), but often shorter and occasionally longer

Habitat: muddy sand in sounds and offshore; low intertidal to shallow subtidal

Remarks: L image may show *Ensis minor* (lower), considered by some to be a subspecies of *E. directus*; *E. minor* is smaller (usually < 2"), narrower (L > 9 times H), and more fragile; rapid burrowers, both species are able to swim in rapid, darting bursts



***Atrina seminuda* (half-naked penshell)**

Distinguishing characteristics: large brown to purplish-black fan shaped shell; 7-9 coarsely scaled radial ribs covering roughly $\frac{2}{3}$ of the exterior surface, the remainder lacking ribs; interior with large, pearly, iridescent area extending from pointed anterior end to the central part of the shell; large round muscle scar surrounded by the iridescent area (sometimes only by a narrow margin in juveniles)

Range: NC to Argentina

Size: shell length 5-11" (130-280 mm)

Habitat: anterior end buried in sand in shallow offshore water from 1-70' ($\frac{1}{3}$ - 21 m)

Remarks: in the stiff penshell, *Atrina rigida*, scaled radial ribs cover nearly the entire exterior surface, and the interior muscle scar touches or protrudes beyond the margin of the iridescent area; large numbers of shells may be found on beaches after winter storms



***Atrina serrata* (sawtooth penshell)**

Distinguishing characteristics: brittle, tan or light brown to greenish, fan shaped shell with about 30 or more finely scaled, closely set radial ribs that cover the entire exterior surface; interior muscle scar lies well within the boundary of the pearly iridescent area

Range: NC to Suriname

Size: shell length 6-12" (150-300 mm)

Habitat: on sand or muddy sand in shallow water; low intertidal to about 20-30' (6-9 m); like other penshells, it lies buried, narrow end down and anchored to hard objects below the surface by its byssus; less than an inch of the shell protrudes above the sediment

Remarks: the shell of this species is thinner and more fragile than those of the other species of penshells in the South Atlantic Bight; it is also the longest shell of all the bivalves in the region



Crassostrea virginica (eastern oyster)

Distinguishing characteristics: shell narrow at the hinge, gradually widening to a rounded or irregularly elongated oval; shape may be quite variable, often determined by the surface to which it attaches; top valve flatter than bottom; grayish white exterior; interior glossy white with a prominent purple muscle scar (top L image); hinge teeth absent; shells may be riddled with small pinholes and tunnels that are produced by yellowish-green boring sponges

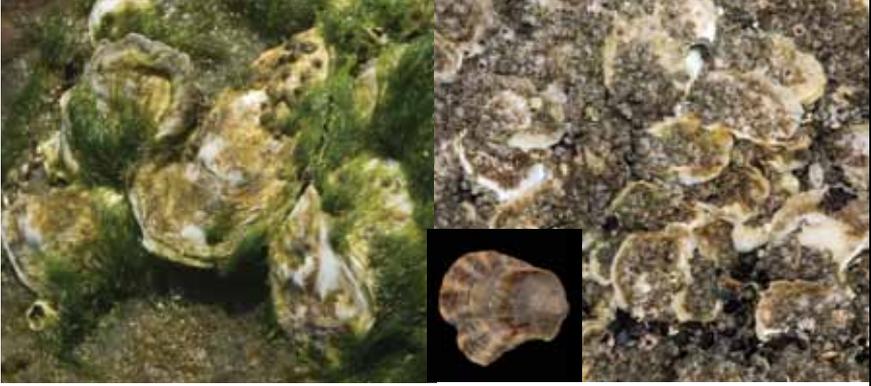
Range: along the eastern coasts of North and South America, from Canada to Brazil

Size: most shells are 2-6" in length (50-150 mm), but occasionally to 10"

Habitat: this is a conspicuous estuarine inhabitant; permanently attached to hard surfaces, especially other oysters (lower L image); in SC, many oysters live in dense beds on sandy mud, mud or sand along creek banks and on mud flats; from the middle of the intertidal zone down to several meters depth

Remarks: shells of this species that are found on ocean beaches are usually heavily weathered and may vary in color from white to black; very abundant along stretches of some beaches, after they have been washed out of estuaries and tidal creeks (lower R image); distinguishable from another common southeastern oyster (see *Ostrea equestris*, facing page) by its elongated shape and by the absence of a row of small teeth around the margin of the shell's interior; the tiny oyster pea crab (*Zaops ostreum*) is often found living inside the oyster within the gills; the eastern oyster is the target of one of the most valuable shellfisheries along the US Atlantic coast, and large oyster beds provide important habitat for many species of fish and invertebrates





***Ostrea equestris* (crested oyster)**

Distinguishing characteristics: similar to *Crassostrea virginica*, but more rounded than elongate; flat top valve fits into cupped lower valve, which has a raised, wavy margin; top valve with row of tiny, smooth bumps on interior margin on each side of hinge; exterior yellowish brown to whitish gray; interior dull gray with greenish tinge, central muscle scar lacks color; sometimes with faint violet stain along interior margin

Range: VA to FL, Bermuda, Bahamas, Gulf of Mexico to Argentina

Size: shell length 1-3" (25-75 mm)

Habitat: hard surfaces in high salinity estuaries and sounds; on rocks, jetties, seawalls and other man-made coastal structures; does not form reefs; intertidal to 350' (~100 m)

Remarks: formerly called *Ostreola*, this oyster differs from the eastern oyster in shape, lack of purple in muscle scar, and presence of a row of bumps on each side of the hinge



***Pteria colymbus* (Atlantic wing-oyster)**

Distinguishing characteristics: asymmetrically oval shell with long straight hinge that extends posteriorly; exterior dark brown to black, with lighter radial rays and a wrinkled or scaly surface; interior pearly with a wide brown non-pearly margin; left valve somewhat inflated, right valve flatter; juveniles may have prickly spines that disappear as the shell grows larger

Range: NC to Brazil

Size: shell length 1½-3¼" (38-83 mm)

Habitat: often attached to sea whips or sea fans in shallow sounds or offshore from 12-100' (3½-30 m); occasionally found on rocks or shells

Remarks: the "wings" are much longer than those of the Atlantic pearl-oyster, *Pinctada imbricata*; pearls made by this species are rare and too small to be of great value



***Brachidontes exustus* (scorched mussel)**

Distinguishing characteristics: elongate fan-shaped shell, expanded somewhat dorsally; beaks at anterior end; often with heavy mass of tough fibers (byssus) attached to lower edge; exterior greenish, yellowish-brown, or blackish-brown, often in combinations; fine to coarse radial ribs that form 90-140 tiny teeth on margin of interior; 1-4 small purplish hinge teeth; interior coppery or blotched with purplish or reddish-gray

Range: NC to Argentina

Size: shell length $\frac{1}{2}$ - $\frac{3}{4}$ " (~10-20 mm), occasionally to 1" (25 mm)

Habitat: intertidal in estuaries and on beachfronts; on shells, rocks, pilings, etc.; dense mats of mussels attached by byssal masses form a band below barnacle and oyster zones

Remarks: smaller and more inflated than ribbed-mussel (see below); the similar *Ischadium recurvum* is more hooked anteriorly; favored prey of *Asterias forbesi* (p. 38)



***Guekensia demissa* (ribbed-mussel)**

Distinguishing characteristics: thin, elongate, oblong-oval shell, tapering at one end; numerous strong radial ribs that may branch toward the posterior end; exterior brown, dark purple, yellowish-green or bluish-green; exterior coating (periostracum) may be eroded, showing whitish patches of shell; interior bluish-white to silver, somewhat iridescent; hinge without teeth; beak near, but not at, the apex of the shell

Range: Nova Scotia, Canada to northern FL

Size: shell length 2-5" (50-130 mm)

Habitat: intertidal, estuarine on mud banks and *Spartina* salt marshes

Remarks: often grows in clusters near the stems of *Spartina*, fastening itself to the plant's roots with fibrous byssal threads; shells found on the beach have been exported from nearby estuaries by tidal currents and washed ashore by waves



Anomia simplex (common jingle)

Distinguishing characteristics: smooth, thin, irregular oval or circular in shape; lower valve thin, flat, translucent, with a slot-like hole near the apex; upper valve thicker than lower, convex (cup-shaped), variable color (sulfur-yellow, tan, orange, coppery red, white, silver gray or black)

Range: Nova Scotia, Canada to Argentina and Bermuda

Size: shell 1-2" in length (30-40 mm)

Habitat: shallow water from near the shoreline to 30' (9 m); bottom valve is attached to hard objects like shells, rocks, logs, or wharfs by a byssus that passes through the hole,

Remarks: shell variable in shape, often distorted to mimic the surface of attachment; often the most abundant shell on the beach; when strung together and hung as a wind chime, the shells produce a pleasant sound, from which the common name is derived



Argopecten gibbus (Atlantic calico scallop)

Distinguishing characteristics: dorsal wings nearly equal in size; 19-21 radial ribs with numerous growth lines; bottom (right) valve whitish with little color; top valves of fresh shells colorfully mottled with various shades of orange, pink, lavender, rose, red, or maroon; tiny marginal blue eyes are unusual among bivalves (image on R)

Range: MD to FL, Bermuda, Bahamas, West Indies, Gulf of Mexico to Brazil

Size: shell length 1-2½" (25-65 mm)

Habitat: on sediments of hard sand and shell fragments in depth of 10 to 1200' (3-366 m)

Remarks: known formerly as *Aequipecten gibbus*; an important commercial species, especially off the FL and NC coasts; although more active than most bivalves, because of its ability to 'swim' by clapping its valves together, the scallop may still provide a suitable surface for the settlement of other animals like barnacles (image on L)



***Dinocardium robustum* (Atlantic giant cockle)**

Distinguishing characteristics: heavy, inflated, asymmetrically oval shell; exterior yellow-white to tan, mottled with reddish-brown spots, somewhat darker on the posterior slope; 32-36 low radial ribs, smooth toward the rear, lightly scaled toward the front; beak nearly central, flanked by strong lateral teeth; interior rosy or reddish-brown, white margin along the front edge; grooves in the lower edge give it a scalloped appearance

Range: MD to Mexico, Caribbean Central America, West Indies

Size: shell length 3-5" (75-130 mm)

Habitat: on sand in shallow water, usually just offshore; less common to 100' (30 m)

Remarks: largest cockle on Atlantic coast; common prey of gulls, which drop the animals from 20-30' in the air to expose the flesh; a strong foot makes rapid burial and active movement possible for this bivalve, which lives close to the sediment surface



***Mercenaria mercenaria* (northern quahog)**

Distinguishing characteristics: thick, oval, inflated valve with beak angled anteriorly; exterior with concentric growth rings, except in smooth central patch; tan, off-white, or dull yellowish gray exterior; interior white, stained with purple near the margins

Range: Gulf of St. Lawrence to FL, Bermuda, Gulf of Mexico, introduced worldwide

Size: shell length 2-5" (50-125 mm)

Habitat: intertidal to subtidal in sounds and estuaries, especially in coarse, shelly sand, near oyster reefs, but also in finer mixed sediments; buries shallowly up to 1" (25 mm);

Remarks: most valuable clam harvested in the US; also known as a hard clam, chowder clam, cherrystone, or littleneck; may live more than 40 yrs; resembles the larger southern quahog (*M. campechiensis*), which lacks purple in interior of shell and has growth rings over the entire surface; these 2 species may hybridize where they co-occur



***Divalinga quadrisulcata* (cross-hatched lucine)**

Distinguishing characteristics: thin, circular inflated valves with central beak; exterior glossy white with fine incised grooves running diagonally from both ends of the shell and intersecting in a v-shaped chevron pattern that radiates from the beak; fewer coarse concentric growth lines; interior also glossy white, minutely toothed along the margin

Range: MA to Brazil

Size: shell length $\frac{1}{2}$ -1" (12-25 mm)

Habitat: on sand in shallow offshore water; occasionally deeper, to >300' (91 m)

Remarks: previously referred to as *Divaricella quadrisulcata*; very common washed up on sandy beaches; the long worm-like foot constructs a mucous lined tube, which brings water to the animal, allowing it to live deeper in the black, sulfurous sand than most other bivalves; shells of this species are used extensively as craft material



***Donax variabilis* (variable coquina)**

Distinguishing characteristics: elongate, triangular wedge-shaped shell with beaks toward the posterior; exterior with fine radial scratches, most prominent near posterior; fine concentric ridges; color highly variable (white, yellow, orange, pink, red, lavender, mauve, purple, bluish), often with darker shaded radial rays of color; margin of shell interior finely toothed; interior color also variable, often glossy white or purple

Range: NJ to FL, Gulf of Mexico, Caribbean coast of Central America

Size: shell length $\frac{3}{4}$ -1" (~20-25 mm)

Habitat: the shallow, intertidal surf zone of sandy ocean beaches

Remarks: shallow burrower with ability to alternately emerge and burrow to move up and down the beach with the tide; can survive up to 3 days in dry sand; edible as broth or stew; the similar *Donax parvulus* is smaller, smoother, wider and more rounded



***Dosinia discus* (disk dosinia)**

Distinguishing characteristics: disk-like shell nearly circular, outline interrupted only by small, sharp, centrally positioned beak; valves strongly flattened; exterior with fine, crowded, evenly spaced concentric ridges (adults with ~50 per inch); exterior glossy white or beige, sometimes with remnants of a thin varnish-like coating; interior white

Range: VA to FL, Bahamas, Gulf of Mexico to Yucatán Peninsula

Size: shell length 2½-3" (60-75 mm)

Habitat: in estuaries and just offshore on sand flats; 6-40' (2-12 m)

Remarks: finer ridges than the similar *Dosinia elegans*, which has ~25 per inch; often occurs on ocean beaches after storms, many times with both valves still connected by the strong, dark hinge ligament; specimen on L above shows evidence of predation by a gastropod like the shark eye (see p. 33)



***Eurytellina alternata* (alternate tellin)**

Distinguishing characteristics: oblong, solid, compressed shell with narrow posterior end and rounded anterior end; numerous parallel concentric ridges (ridges more dense on right valve than left); angular ridge that runs from the beaks to the posterior margin (or edge); exterior creamy white with shades of yellow or pink; interior glossy white or yellow

Range: NC to FL, Gulf of Mexico, Brazil, Bermuda

Size: shell length up to 3" (~75mm)

Habitat: sandy, shallow water to 420' (~130m)

Remarks: formerly known as *Tellina alternata*; should be compared with *Eurytellina angulosa*, which is more triangular in shape and has equally dense concentric ridges on both valves; holes in shell may be attributable to an attack by a carvorivorous gastropod (see page 33, shark eye)



***Macrocallista maculata* (calico clam)**

Distinguishing characteristics: smooth, sturdy egg-shaped shell; exterior highly glossy, cream or tan with checkerboard pattern of brown marks; usually with 1 or 2 bands of slightly darker brown spots radiating from the beak to the ventral shell margin; interior may have very light pink tint in central area and/or yellowish blush

Range: NC to FL, Bermuda (introduced), Bahamas, West Indies, Gulf of Mexico, Caribbean Central America, South America to Brazil

Size: shell length 2-3½" (50-90 mm)

Habitat: in sand, from just below the low tide line to more than 150' (45 m)

Remarks: similar in appearance to *Macrocallista nimbosa*, the sunray venus, which is larger (up to 6"), more elongated, and with numerous dark rays on the exterior, rather than the checkerboard pattern of *M. maculata*



***Raeta plicatella* (channeled duckclam)**

Distinguishing characteristics: white, oval shaped, thin and very fragile shell; exterior has thin, regularly spaced concentric lines; narrow posterior slope with high, inflated beaks; interior white with grooves corresponding to external ridges

Range: NJ to FL, Gulf of Mexico, Caribbean

Size: shell length up to 3" (~75mm)

Habitat: shallow water to 40' (~12m); common in sandy mud

Remarks: similar in appearance to *Anatina anatina*, the smooth duckclam, which has a diagonal ridge running from the beak to the ventral margin (bottom edge of the shell) and with much finer concentric ridges which are more irregularly spaced than *Raeta plicatella*



Spisula raveneli (southern surfclam)

Distinguishing characteristics: oval shell; glossy light brown (fresh) or cream colored (weathered); exterior surface with fine concentric growth lines and a faint ridge running from the beak to the lower margin on the posterior slope; spoon-shaped pit near beak may have remnants of dark brown internal ligament; each valve has two elongated lateral teeth with saw-tooth ridges and a v-shaped cardinal tooth

Range: Cape Hatteras, NC to TX

Size: shell length 2½-5" (64-127 mm); larger toward the northern end of its range

Habitat: sandy or muddy bottom in shallow water to 60' (18 m), but occasionally deeper

Remarks: lighter in color than the larger Atlantic surfclam, *Spisula solidissima*, which it gradually replaces south of VA; the related fragile surf clam, *Mactrotoma fragilis*, has two faint exterior radial ridges instead of one, and lacks fine ridges on the lateral teeth



Noetia ponderosa (ponderous ark)

Distinguishing characteristics: thick, rounded triangular shell, nearly as high as long; rounded in front and tapering at rear; anteriorly located beak twisted and pointing to rear; dark periostracum, often worn off near beak; white shell; 27-31 raised radial ribs, with a fine groove running down the center of each; multi-toothed hinge line slightly curved; interior white, with shelf-like flange along bottom edge of posterior muscle scar

Range: VA to FL, West Indies, Gulf of Mexico, Caribbean Central America

Size: shell length 2-3" (50-75 mm)

Habitat: in sand of creek bottoms, inlets and offshore; low intertidal to 70' (~20 m)

Remarks: differs from incongruous ark (p. 25) by its lack of rib beading, and from blood ark (p. 25) by its more rounded shell; shallow burrower, occasionally found with an attached sea whip



Lunarca ovalis (blood ark)

Distinguishing characteristics: sturdy, oval, white shell covered by periostracum, which may be worn away near beak; beaks point anteriorly, nearly touching on intact specimens; 26-35 smooth radial ribs lacking grooves or beading; hinge line slightly curved; interior white, lower margin toothed with left valve slightly overlapping right

Range: MA through Gulf of Mexico, West Indies, Caribbean Central and South America, to Uruguay

Size: shell length $1\frac{1}{2}$ - $2\frac{1}{3}$ " (~40-60 mm)

Habitat: mud or sand, from low intertidal to 60' (18 m); juveniles may attach to rocks

Remarks: one of the few mollusks with hemoglobin in its blood, giving internal tissues a bloody red color; differs from other arks in details of hinge line, shape and texture of ribs, beak morphology, or alignment of valves along lower margin



Scapharca brasiliiana (incongruous ark)

Distinguishing characteristics: a well-inflated, deep shell, with height only slightly less than length; 26-28 clearly beaded radial ribs (see inset); strong beaks pointing toward one another near the center of the conspicuously dark-colored ligament; articulated shells with left valve slightly overlapping the right one along the lower margin; hinge teeth in a straight row, with smaller teeth nearest the beak, larger ones toward the ends

Range: NC to TX, West Indies, Caribbean Central America, South America to Brazil

Size: shell length $1-1\frac{3}{4}$ " (25-70 mm)

Habitat: shallow water just outside the breakers; on sandy or muddy bottom

Remarks: formerly known as *Anadara brasiliiana*; the ark burrows into the surface sediment layer, where it feeds on suspended particles that it filters from the water



Arcinella cornuta (Florida spiny jewelbox)

Distinguishing characteristics: plump shell with 7-9 pleated radial ribs that are covered along their length with slender tubular spines; spines may be worn down in specimens that have washed ashore (L image); beaks curving forward with a prominent heart-shaped depression (lunule) in front; interior finely scalloped along the margins; shell with whitish exterior; interior creamy white with hints of yellow, pink or reddish tints

Range: NC to FL, Gulf of Mexico, Caribbean Central and South America to Venezuela

Size: shell length 1¼-1½" (~ 30-40 mm)

Habitat: on rubble bottom in shallow water from 10-70' (3-21 m), but occasionally deeper

Remarks: formerly known as *Echinochama cornuta*; the young of this genus are found attached to hard surfaces (e.g. rock, coral, shell), but as they age they detach and become free-living, unlike the other jewelboxes, which remain attached



Cyrtopleura costata (angelwing)

Distinguishing characteristics: fragile, chalky white (sometimes tinged with pink), elongate shell tapering to rounded ends; ~30 exterior radial ribs, scale-like where they cross weaker concentric ridges; hinge without teeth, but with broad spoon-like plate (apophysis) below beak; thickened plate-like extension curves up from interior and posterior over the top of beak; interior sculpture of grooves and pits reflects sculpture of exterior

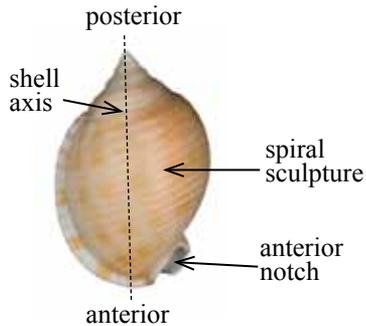
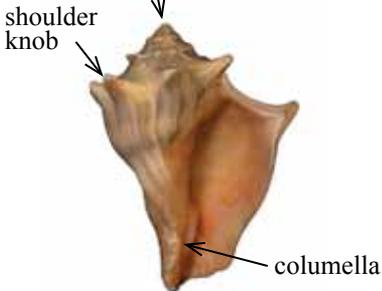
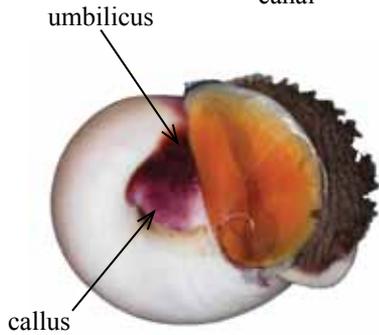
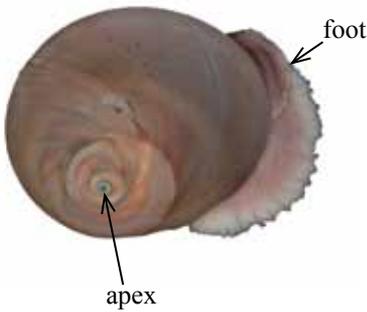
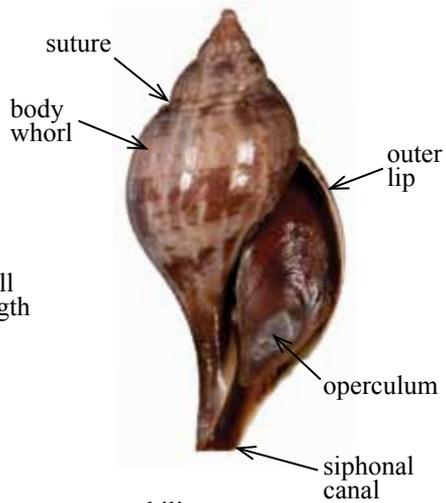
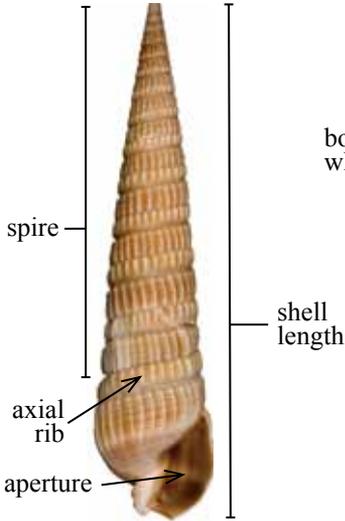
Range: MA to FL, West Indies, Gulf of Mexico, Central and South America to Brazil

Size: 4-7" (100-175 mm)

Habitat: burrows up to 3' in mud or clay by rasping with anterior end; intertidal-60' (18 m)

Remarks: similar to *Petricolaria pholadiformis* (Atlantic mud-piddock; has weaker ribs, squared posterior end, finger-like apophysis) and *Barnea truncata* (false angelwing, has hinge teeth, lacks apophysis and recurved plate over beaks)

GASTROPOD MORPHOLOGY





***Busycon carica* (knobbed whelk)**

Distinguishing characteristics: large, robust shell with ~6 whorls bearing low to prominent knobs on shoulders; aperture roughly $\frac{3}{4}$ of total shell length, opening on the right (dextral), and ending in a long, open canal (partially worn on specimen in image); exterior cream to yellowish gray, interior glossy and variously orange, yellow, or brick red; young specimens with streaks of brown, purple or violet

Range: MA to Atlantic coast of FL; more common towards the southern end of range

Size: shell length 4-10" (100-250 mm); males rarely as large as females of the same age

Habitat: on sand or sandy mud in estuaries and offshore, usually to ~30' (10 m), but occasionally deeper; also congregates on clam beds or oyster reefs while feeding

Remarks: the most common of the four species of whelks in SC, where it is commercially harvested; lays strings of egg capsules that may be longer than 1' (0.3 m) (see p. 74)



***Busycotypus canaliculatus* (channeled whelk)**

Distinguishing characteristics: without knobs, but overall shape is similar to knobbed whelk; 5-6 whorls, with fine beading toward tip of spire; dextral shell, but like *B. carica*, left-handed shells are seen rarely; joint (suture) between whorls marked by a broad, flat-bottomed channel that winds up the spire; yellowish white to gray exterior, interior of dextral aperture yellowish tan to brown, with shades of orange; fresh shells with thick coat of fuzzy hairs (periostracum; see shoulder of body whorl in image above)

Range: MA to northeast FL

Size: shell length 4-8" (100-200 mm)

Habitat: intertidal flats and oyster reefs in sounds and inlets; offshore to 60' (18 m)

Remarks: like *Busycon carica*, this carnivore uses a muscular foot to hold bivalve prey while chipping its valve edges until it can pry them apart to feed (see egg capsules, p. 74)



***Busycon sinistrum* (lightning whelk)**

Distinguishing characteristics: thick strong shell, similar to knobbed whelk but with a left-handed aperture (sinistral) and smaller triangular knobs on shoulders; exterior dark gray to fawn colored, in life streaked vertically with purplish or violet-brown lines that are aligned with shoulder knobs on body whorl; interior with yellow to violet tints, less orange than knobbed whelk; small animals brightly colored, but fade at length of 8-9"

Range: NJ to FL, northern Gulf of Mexico

Size: shell length 7-12" (175-300 mm); occasionally to 16" (405 mm)

Habitat: sandy intertidal flats and oyster reefs in estuaries; near shore to 80' (25 m)

Remarks: known previously as *Busycon contrarium* or *Busycon perversum*; recent work suggests the sinistral whelks should be referred to *Busycon perversum*, with one of three subspecies, *Busycon perversum laeostomum*, being found along the US Atlantic coast



***Pleuroploca gigantea* (horse conch)**

Distinguishing characteristics: tall, spindle shaped shell; exterior cream, orange or brown, often covered with a brown periostracum; knobbed spire with up to ten roughly textured whorls; oval, orange-colored aperture; long, well-developed siphonal canal; ridges along columella extend into inner aperture; large, brown operculum

Range: NC to FL, Gulf of Mexico

Size: shell length up to 2' (61 cm)

Habitat: sandy flats up to 20' (6 m)

Remarks: *Pleuroploca gigantea* is the largest gastropod found in the northeast Atlantic and is a significant predator on other large mollusks; egg capsules are funnel shaped and deposited in clusters (see p. 74)



***Fasciolaria hunteria* (banded tulip)**

Distinguishing characteristics: spindle-shaped, smooth whorls, high spire and well-developed siphonal canal; thin, distinct, uninterrupted bands along spirals (bands may appear faded if shell is eroded, resembling *Fasciolaria tulipa*, below); distinct sutures; oval-shaped aperture with ridge along top inside corner (inset image); large, brown, horny operculum; exterior, mottled white to brown

Range: NC to FL, Gulf of Mexico

Size: shell length up to 3" (80 mm)

Habitat: intertidal and offshore sandy flats to 40' (12 m); jetties and rocks

Remarks: more common (in SC) and typically smaller than *Fasciolaria tulipa* (below); a major predator on other mollusk species; empty shells often inhabited by hermit crabs



***Fasciolaria tulipa* (true tulip)**

Distinguishing characteristics: spindle-shaped, smooth whorls, high spire and well-developed siphonal canal; thin bands along spirals distinct but interrupted by faded areas; distinct sutures; oval-shaped aperture and large, brown, horny operculum; exterior mottled brown or red

Range: NC to FL, Bahamas, Caribbean, Mexico, Brazil

Size: shell length up to 8" (200 mm)

Habitat: intertidal and shallow offshore sandy flats

Remarks: no ridge along top corner inside aperture (compared with *Fasciolaria hunteria*, above); larger of the two tulip species; a major predator on other mollusk species; empty shells often inhabited by hermit crabs



***Echinolittorina placida* (periwinkle)**

Distinguishing characteristics: 5-7 whorls apparent; background color white, with narrow oblique wavy or zigzag brown to black lines

Range: Wilmington, NC through the Gulf of Mexico to northern Yucatan

Size: shell length ~ $\frac{1}{8}$ - $\frac{3}{4}$ " (3-20 mm)

Habitat: the high intertidal zone on jetty rock, limestone and other natural hard surfaces, where it grazes on algae

Remarks: because of the similarity of markings on their shells, this species has been frequently misidentified as *Littorina ziczac* in the South Atlantic Bight; it has only recently been described as a new species; close examination of crevices and sheltered faces of beach jetty rocks will often turn up these snails, often in the higher level of the intertidal zone where the barnacle *Chthamalus fragilis* (see p. 63) is abundant (L image)



***Epitonium* species (wentletraps)**

Distinguishing characteristics: small, white porcelain-like shells with pointed spires (damaged on L specimen); whorls smooth, inflated, convex, with distinct axial ribs (costae); most species in SC lack spiral sculpture; aperture circular or oval, often with thickened lip; small details in number and shape of ribs, angle of spire, shape and size of aperture are used to distinguish among the many species of this genus (> 600 globally)

Range: worldwide

Size: shell length of SC species $\frac{1}{2}$ -1" (12-25 mm); elsewhere, up to $\sim 4\frac{1}{2}$ " (115 mm)

Habitat: most species live offshore; few in shallow water; shells favored by hermits

Remarks: carnivorous on anemones and corals; when disturbed, may exude purple dye that may also anesthetize prey during feeding; most common species in SC are *Epitonium angulatum*, *E. rupicola*, *E. humphreysii*, *E. krebsii*, and *E. multistriatum*



***Semicassis granulata* (scotch bonnet)**

Distinguishing characteristics: inflated body whorl and short spire with deep, distinct, beaded spiral sculpture or grooves; columella with small bumps; large aperture with teeth along inside of outer lip; siphonal canal upturned; operculum crescent-shaped; exterior pale yellow, pink or creamy white with square, brownish spots that appear regularly distributed

Range: NC to FL, Gulf of Mexico, Caribbean, Brazil

Size: shell length up to 4" (120 mm)

Habitat: shallow water on sandy flats

Remarks: previously known as *Phalium granulatum*; preys on sea urchins and sand dollars; empty shells often occupied by hermit crabs; deposits eggs in tall, cylindrical towers



***Oliva sayana* (lettered olive)**

Distinguishing characteristics: shell long and narrow, nearly cylindrical; majority of the shell length made up of the last body whorl, with a very short spire; distinct sutures; aperture nearly as long as the shell and very narrow; inner lip with wrinkled folds; operculum absent; siphonal canal poorly developed; shell smooth and glossy, with dark brown or purple letter-like markings

Range: NC to FL, Gulf of Mexico

Size: shell length up to 2½" (64 mm)

Habitat: sandy bottom from intertidal to offshore shallow water

Remarks: this species is the South Carolina State Shell and received its common name because of its markings that look like writing; another olive in this area, *Olivella mutica*, is much smaller, has an operculum, and has a larger spire to shell length ratio



***Terebra dislocata* (common Atlantic auger)**

Distinguishing characteristics: slender, elongate shell which narrows to a sharp point; exterior off-white to various shades of gray or brown; body has ~15 whorls with numerous ribs, knobby spiral band at the base of the suture gives the appearance of alternating large and small whorls; small, elongate aperture; twisted columella

Range: VA to FL, Gulf of Mexico, Brazil, Bermuda

Size: shell length 1½ -2" (~35-50mm)

Habitat: shallow water, intertidal flats, silty-sand beaches

Remarks: the Atlantic auger is a carnivore, but it lacks the radula (harpoon-like tooth) and poison gland found in most other augers; *Terebra dislocata* burrows under the sand and preys on marine worms; common as a Pleistocene fossil in Florida and Bermuda



***Neverita duplicata* (shark eye)**

Distinguishing characteristics: smooth globose shell with 4-5 whorls; slate gray to tan, with bluish tinges; apex coiled, resembling an eye (R image); dark callous near aperture

Range: MA to FL, eastern Gulf of Mexico through TX

Size: shell height 2-2½" (~ 50-60 mm); shell width ~ 3-3½" (~ 75-85 mm)

Habitat: on sand in shallow water at the low tide line and below; rarely to 80' (24 m)

Remarks: referred to previously as *Polinices duplicatus*; a carnivorous snail, often responsible for the minute holes drilled into bivalve shells found on the beach; females produce 'sand collars' (see p. 74), which are actually a mix of sand and mucus, on which she attaches her light tan egg capsules; empty shells are popular homes for hermit crabs in the surf zone, and they also provide hard surfaces for attachment of animals like slippersnails and barnacles (L image)



***Crepidula plana* (eastern white slipper snail)**

Distinguishing characteristics: flat, convex or concave (depending on object to which it is attached), oval, pure white shell, thin and semi-transparent, with fine concentric lines on wrinkly outer surface; glossy white, sometimes iridescent interior; interior plate (“deck”) less than half the length of shell; apex rarely turned to one side

Range: Nova Scotia to Brazil, Bermuda

Size: shell length 1-1½" (~25-40 mm)

Habitat: shallow water; always found attached to solid surface

Remarks: always pure white in color as opposed to other species; commonly found inside dead *Busycon* (whelk) and *Neverita* (moon snail) shells; horseshoe crabs (*Limulus*) will frequently have several *Crepidula plana* under the carapace; rarely stacks itself with others like *Crepidula fornicata*, but a single small male may attach to a large female



***Crepidula fornicata* (common Atlantic slipper snail)**

Distinguishing characteristics: oval, arched shell, smooth or wrinkly outer surface, exterior creamy white to brownish, often flecked with reddish-brown; shelf-like plate (or “deck”) partially covering interior, slightly concave with a wavy edge, reaching nearly half the length of the shell; apex prominent and turned to one side

Range: Canada to TX

Size: shell length ¾-2" (~20-50 mm)

Habitat: shallow water; often occur in stacks on hard surfaces

Remarks: a hermaphroditic species, beginning life as male and becoming female as they grow larger; often growing in stacks, the largest and oldest snail is on the bottom and is female, while smaller males are toward the top; differs from *Crepidula plana* (above) by its arched shell, longer interior plate and stacking behavior



***Sinum perspectivum* (white baby ear)**

Distinguishing characteristics: elongate-oval, flat shell; large aperture may make up more than $\frac{3}{4}$ of the area of the shell; sculptured outer surface with fine, spiral threads on top of whorls; exterior milky white with a thin yellow-brown periostracum; interior pearly white; when alive, mantle and foot completely cover shell; no operculum

Range: MD to Brazil, Bermuda

Size: shell length $\frac{1}{2}$ - $1\frac{3}{4}$ " (~15-45 mm)

Habitat: shallow water; intertidal sandy areas

Remarks: name derived from the shape of the aperture opening which resembles a baby's ear; despite its innocent name, *S. perspectivum*, like the other members of the family Naticidae, is carnivorous; usually burrows under the sand and preys on other mollusks, especially bivalves

ECHINODERMS

The phylum Echinodermata includes sea stars, brittle stars, sea urchins, sand dollars, sea cucumbers, and feather stars. Feather stars are unlikely to be encountered on the beach, and although brittle stars occasionally wash up on the beach in sponges, neither group is represented in this guide.

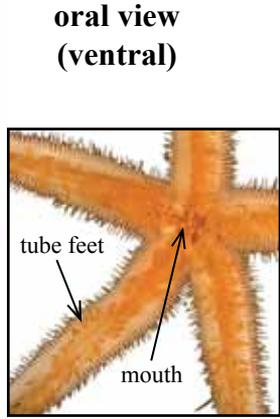
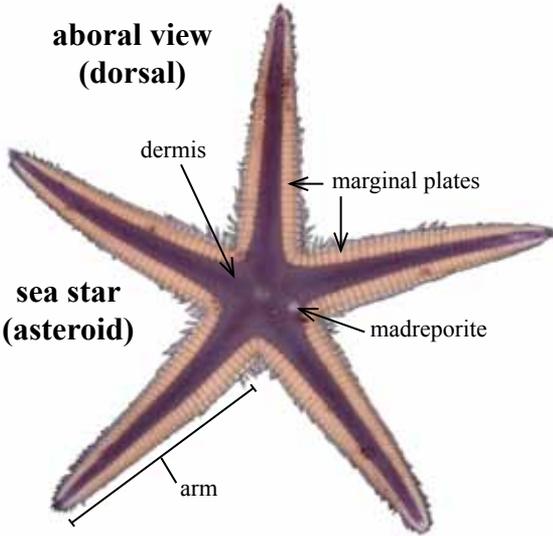
Asteroids – (sea stars) - typically with five stout arms and tube feet; may have spines between arms or on upper surface; slow moving when alive

Ophiuroids – (brittle stars) - typically with five thin, flexible arms; may have spines on arms; when alive, usually very agile and fast-moving

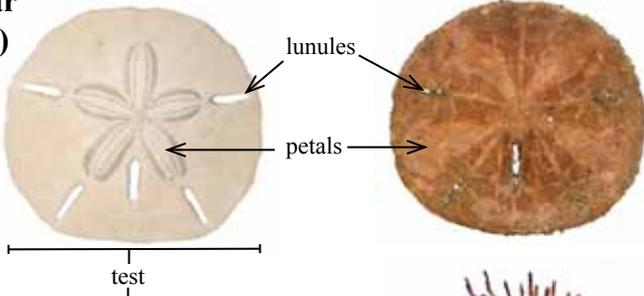
Echinoids – (sea urchins, sand dollars) – urchins have a sub-spherical body shape with prominent spines covering a hard test; spines may remain attached, but typically only the test remains after death; single hole at top of test; sand dollars have a disc-shaped body with very small spines covering a hard test; spines only attached while alive; five or six distinct elliptical holes (lunules) in the test

Holothurians – (sea cucumbers) - tube-like body shape; may have blunt spines; hard test lacking

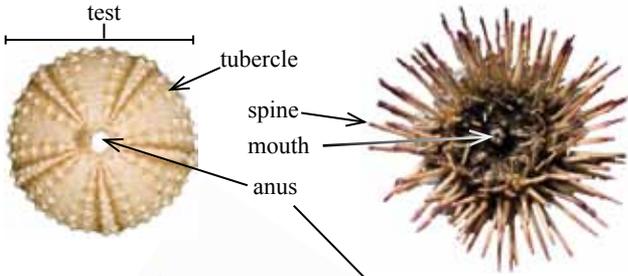
ECHINODERM MORPHOLOGY



sand dollar (echinoid)



sea urchin (echinoid)



sea cucumber (holothurian)





***Astropecten articulatus* (royal sea star)**

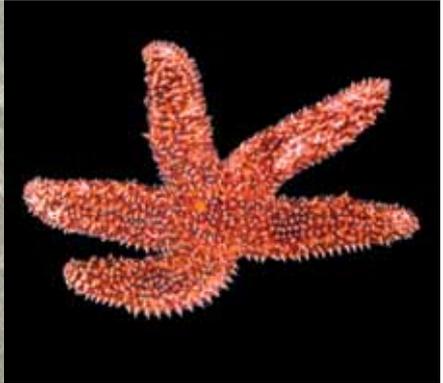
Distinguishing characteristics: dermis (skin) appears smooth, typically varying in color from purple to deep blue (occasionally brownish red), outlined with pale orange or white marginal plates; arms slender and tapering, with small white spines along lower edge

Range: Chesapeake Bay to Colombia, South America, southern Gulf of Mexico, Caribbean

Size: up to 8" (203 mm) from tip of arm to tip of one of the two opposite arm

Habitat: sandy bottom in depths up to 540' (165 m)

Remarks: this species is fast moving for an echinoderm; like most sea stars, *Astropecten articulatus* is a voracious predator on mollusks, other echinoderms and small crustaceans; this species may also burrow under the sediment



***Asterias forbesi* (Forbes' common sea star)**

Distinguishing characteristics: blunt arm tips; reddish- brown or purple, to brownish; distinct orange madreporite, ~ 1/8" (4 mm) across, found off-center on the aboral surface of the disc; spines generally scattered on disc and arms, rather than in regular rows

Range: ME to TX

Size: 7-10" (~ 180-250 mm) from tip of arm to tip of one of the two opposite arms

Habitat: shallow subtidal on jetties and hardbottom up to 160' (49 m)

Remarks: the madreporite is the external opening of the water vascular system, which serves to control movement of the animal; a carnivorous species with a preference for mollusks, this species is often a pest on commercial oyster and clam beds; on jetty rocks it typically feeds on small mussels that it opens by slowly pulling the valves apart



***Luidia clathrata* (striped or lined sea star)**

Distinguishing characteristics: small central disc with 5 flattened arms; top (aboral) surface bluish-grayish, but sometimes with brownish or pinkish tint; dark, narrow strip down the center of each arm is flanked by finer dark wavy lines (the less common *Luidia alternata* has a dark disc and distinct light/dark banding along each arm); oral surface usually cream colored (more yellow in *Luidia alternata*)

Range: NJ to FL, Bermuda, Gulf of Mexico, Caribbean, South America to Brazil

Size: 8-11" (~ 200-280 mm) from tip of arm to tip of one of the two opposite arms

Habitat: in protected and offshore waters on mud, sand or shell hash; from 0-130' (40 m), but rarely to more than 550' (168 m)

Remarks: often stranded on beaches following winter storms (see p. 75); arms are easily broken; 'pinched' tips may indicate regeneration of damaged arms



***Mellita isometra* (sand dollar)**

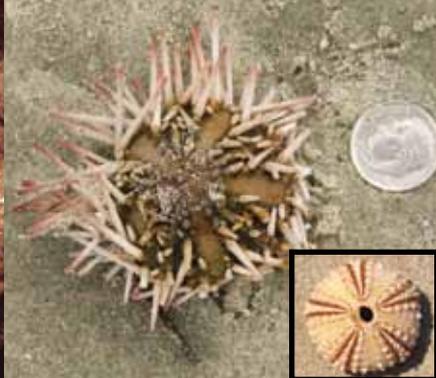
Distinguishing characteristics: thin, flat, circular test with five complete lunules (oval slots), and star-shaped pattern on both sides; test is white or gray when dead (image on L) and tan, brown or dark green while alive (image in R); small spines present and often moving while alive, resembling felt

Range: MA to FL, Bahamas

Size: diameter up to 4" (100 mm)

Habitat: soft sandy bottom on intertidal and shallow areas from 3-164' (1-50 m)

Remarks: *Mellita isometra* can be found in dense aggregations burrowed just beneath the surface of the sand in shallow water; another, similar species is the six-hole urchin (*Mellita sexiesperforata*), which is easily distinguishable as having six lunules



***Arbacia punctulata* (purple-spined sea urchin)**

Distinguishing characteristics: test (image on R, lower right) hemispherical with numerous tubercles (small raised bumps); test color purple or dark brown, but may fade to almost white after death; when present, the long, slender spines correspond with the color of the test, sometimes lighter in color near the bases

Range: MA to Panama, Gulf of Mexico, Caribbean

Size: diameter with spines up to 4" (110 mm); test only, up to 2" (50 mm)

Habitat: hardbottom, shelly or sandy areas; jetties; typically in depths less than 164'

Remarks: *Arbacia punctulata*, like most echinoderms, uses tube feet for locomotion; these tiny suction cups use water pressure to attach to the substrate; the eggs of *Arbacia punctulata* have been extensively used for biological research



***Lytechinus variegatus* (variegated urchin)**

Distinguishing characteristics: test hemispherical with numerous tubercles (small raised bumps); test color typically light red or with tinges of green, but may be variable; if present, spines are densely packed and short, and vary in color from light red to white

Range: NC to FL, Bermuda, Caribbean, Brazil

Size: diameter with spines up to 4" (110 mm); test only, up to 3" (85 mm)

Habitat: hard bottom or sandy areas; typically in depths less than 164' (50 m)

Remarks: this species exhibits "covering behavior", which involves positioning random objects (shells, etc.) on its upper surface in response to light; it may be difficult to distinguish bare tests of *Lytechinus variegatus* from *Arbacia punctulata*; however, *L. variegatus* tests are typically larger (image on L); although it has poison glands, *L. variegatus* is non-venomous to humans



Pentamera pulcherrima (sea cucumber)

Distinguishing characteristics: body form tube- or barrel-shaped, tapered at each end; hair-like tube feet along 5 rows along body; color white to light pink; skin may appear translucent

Range: SC; Gulf of Mexico

Size: length up to 2" (50 mm)

Habitat: soft muddy or fine sand substratum; 0 to 80' (0 to 24 m)

Remarks: *Pentamera pulcherrima* is a burrowing species that is easily dislodged and washed ashore, where can be seen in shallow tide pools; like other sea cucumbers, *P. pulcherrima* has a mouth and tentacles at one end and anus at the other



Sclerodactyla briarius (brown sea cucumber)

Distinguishing characteristics: body form tube- or barrel-shaped, tapered at each end, with fine hair-like tube feet scattered on surface (may be "sanded off" if beached); branching tentacles may be visible near mouth, or retracted out of sight; color dark brown or green; when stranded on beach out of water, body resembles a dark, limp blob retracted into an almost spherical shape

Range: Nova Scotia to FL, Gulf of Mexico, Venezuela

Size: length up to 4¾" (120 mm)

Habitat: soft muddy or fine sand substratum; 0 to 20' (0-6 m)

Remarks: this sea cucumber burrows into the sand, leaving only its feeding tentacles and anus above the surface; often found with organs and viscera ejected from body (image on L), a defense mechanism common to most sea cucumbers

CNIDARIANS

The phylum Cnidaria includes jellyfish, hydrozoans, anemones, and corals. Cnidarians are characterized by the presence of minute stinging cells and their radial symmetry (circular body plan). Cnidarians may have a free-living medusoid (jelly-fish like) phase, a polyp (fixed anemone-like) stage, or both, in their life cycle

Hydrozoans – (bushy hydroids, Portuguese man o’war) - may be sessile or free-living, having a medusoid (jellyfish-like) stage, or a colonial polyp stage, or both stages in their life cycles

Scyphozoans – (jellyfish) free-living, pelagic, individual organisms with multiple tentacles and a circular bell

Cubozoans – (box jellies) - free-living, pelagic, individual organisms with four tentacles and a box-shaped bell

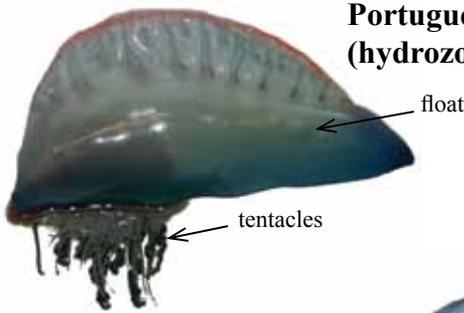
Anthozoans – often sessile and colonial, but some kinds, such as anemones, live a solitary lifestyle and can move; anthozoans have no medusoid (jellyfish-like) stage

Zoanthids – flower-like colonial animals, often living in bushes or mats

Anemones – flower-like organisms with numerous tentacles, usually individual

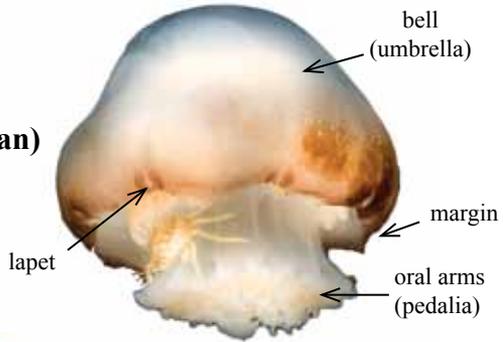
Corals – flower-like animals with six or eight tentacles, often with a hard or stiff interior skeleton, usually colonial

Cnidarian Morphology

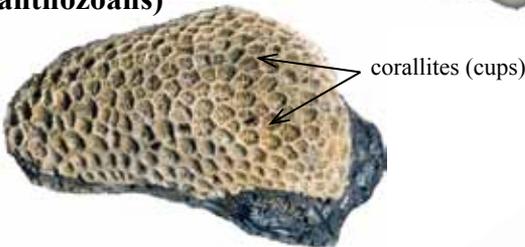


**Portuguese man o' war
(hydrozoan)**

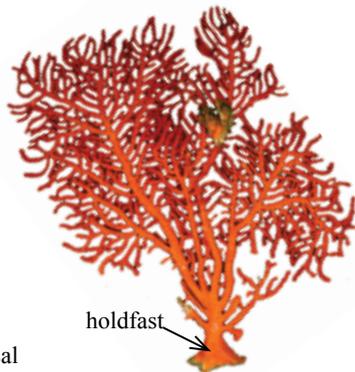
**jellyfish
(scyphozoan)**



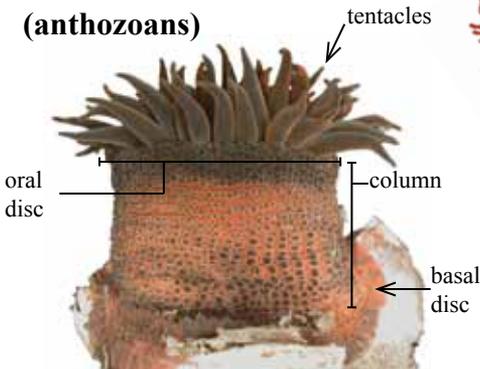
**stony coral
(anthozoans)**



**octocorals
(anthozoans)**



**anemones
(anthozoans)**





Physalia physalis (Portuguese man o'war)

Distinguishing characteristics: large, oblong, translucent gas-filled float that is typically tinged with blue, pink and/or purple; the upper surface has a flange that is wing-like for wind resistance; long tentacles up to 165 ft (50 m) but may be broken off if beached

Range: FL, Gulf of Mexico, Caribbean; appears on mid-Atlantic coasts when washed in by storm activity

Size: float length 2-6" (50-150 mm)

Habitat: pelagic; floating on the surface in tropical and sub-tropical water

Remarks: not a true jellyfish, but a colonial animal made up of many zooids that are specialized for feeding (image L), defense, etc; the sting of *P. physalis* is very toxic, painful, and medical attention may be necessary; tentacles may continue to be active and sting after being beached, so caution should be exercised when this animal is encountered



Aurelia marginalis (southern moon jelly)

Distinguishing characteristics: bell relatively flat and saucer-shaped, with four circular gonads oriented in a clover-shaped structure in the center; arms of mouth shorter than diameter of bell; bell margin with numerous hair-like tentacles; pigmentation unnoticeable when beached, but may appear translucent pink in water

Range: DE to FL, Gulf of Mexico, Caribbean

Size: bell (umbrella) up to 12" (30 mm) in diameter

Habitat: coastal pelagic (neritic)

Remarks: moon jellies are very common in southeast coastal waters; they are not reported as highly venomous, but they do have the ability to sting, especially on sensitive skin areas such as the neck, forearms, etc.; *Aurelia marginalis* has recently been distinguished from the northern species, *Aurelia aurita*; in the past they were considered the same species



***Chrysaora quinquecirrha* (sea nettle)**

Distinguishing characteristics: bell surface somewhat warty and may have brown pigmentation; deep notches along margin of bell with 2-3 tentacles between; arms of mouth long with frilly edges

Range: New England to the Caribbean Sea, Gulf of Mexico

Size: bell (umbrella) up to 10" (250 mm) in diameter

Habitat: coastal pelagic (neritic)

Remarks: the sea nettle is a very common species found in the South Atlantic Bight; highly variable with regards to pigmentation, from white to highly pigmented with red or brown; sting is mildly venomous; specimens observed in the water have been noted to have shrimp riding on bell (R); reported as present year-round



***Stomolophus meleagris* (cannonball jelly)**

Distinguishing characteristics: bell subspherical, resembling a cannonball; top of bell typically white, bottom of bell with a conspicuous spotted brown band; margin of bell with ~12 small notches between 8 large notches; arms and tentacles short

Range: western Atlantic from New England to Brazil, Gulf of Mexico

Size: bell up to 7" (180 mm) in diameter

Habitat: coastal pelagic (neritic)

Remarks: very common species along the eastern US coast, often washing ashore in large numbers in winter and spring; considered in some areas as a fishery resource; often associated with small fish, as well as spider crabs, which may remain attached when jellyfish is beached; juveniles may be present in estuarine waters; preyed upon by sea turtles; not considered venomous to humans



Chiropsalmus quadrumanus
(fourhanded boxjelly)

Distinguishing characteristics: clear bell (umbrella) with four distinct, hand shaped arms (pedalia), each with 5-9 tentacles attached

Range: western Atlantic from NC to Brazil; Gulf of Mexico

Size: bell diameter up to 4" (100 mm); height, up to 5½" (140 mm)

Habitat: coastal pelagic (neritic), washing ashore with storm activity and tides

Remarks: this species is a member of the class Cubozoa; as the name implies, it appears to have four distinct sides to its bell, although this feature may not be apparent when the jellyfish is not in the water; boxjellies are well known for the intensity of their sting, which is highly venomous when compared to other local jellyfish; the fourhanded boxjelly is observed on beaches from June through November

Tamoya haplonema
(glassy boxjelly)

Distinguishing characteristics: clear bell (umbrella), taller than wide, with four simple, lobe-shaped pedalia (arms), each with a single tentacle

Range: western Atlantic, from NY to Argentina; Gulf of Mexico

Size: bell diameter up to 2" (53 mm); height, up to 3½" (90 mm)

Habitat: coastal pelagic (neritic)

Remarks: as with *Chiropsalmus quadrumanus* (above), this cubozoan has a 'boxy' (cuboidal) shape and four arms; the tentacles may be withdrawn (such as R, see arm tips) or broken off; this species is highly venomous when compared to other local jellyfish; the glassy boxjelly is typically observed on beaches from May through December





hydroids

Distinguishing characteristics: delicate, bushy, sessile cnidarians that may be confused with plants when washed ashore; as colonial animals the stems have numerous polyps with microscopic stinging tentacles, which may be retracted into a cup-shaped structure (theca), which are arranged in a feather-like or zigzag fashion along stems; typically with a flexible, chitin exoskeleton

Habitat: fouling organisms attached to hardbottom, jetties, pilings and docks; benthic

Remarks: hydroids are more closely related to the Portuguese man o' war than to corals; may cause minor skin irritation when disturbed due to the stinging cells in the polyps; shown above are (L) a species in the Family Halopterididae with a sea spider clinging to it, and (R) the fern hydroid, *Tridentata marginata*



Titanideum frauenfeldii (brilliant sea fingers)

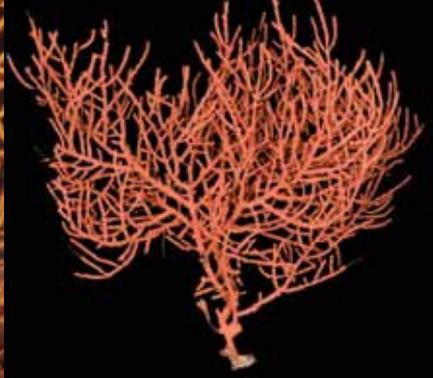
Distinguishing characteristics: sparsely branched (occasionally unbranched) octocorals with stiff, rod-like stems; color varies from yellow to red; flush surface with small round pores (image on R) containing polyps

Range: NC to Cuba; north Gulf of Mexico

Size: height up to 15" (38 mm); stems up to 1/2" (8 mm), but may be wider at base

Habitat: attached to hardbottom; benthic

Remarks: this octocoral is attached to a hard surface by a holdfast; unlike the related sea fans and sea whips commonly found in the same habitat, this species has no wood-like stem; live specimens have small white polyps within pores, but are usually retracted



Leptogorgia hebes (regal sea fan)

Distinguishing characteristics: highly branched, with dome-like polyp mounds and slit-like pores on slightly flattened stems; deep red, purple, orange, or dark yellow

Range: western Atlantic from VA to north FL, Gulf of Mexico, Aruba, Brazil

Size: height up to 18" (450 mm); stems up to 1/4" (6 mm) in diameter

Habitat: attached to hardbottom; benthic

Remarks: this octocoral lives attached to hard substratum by a holdfast, which is typically visible below the branches; the wood-like stem is covered with polyps within colorful tissue while alive; often only bare or partially bare stems may be remaining on beached specimens; may have gall barnacles or brittlestars attached; previously named *Lophogorgia hebes*



Leptogorgia virgulata (colorful sea whip)

Distinguishing characteristics: stems sparsely branched near base, with small pores through which polyps emerge; cylindrical stems; whip- or thrush-like; may be deep red, purple, orange, yellow, white or variations in between

Range: NY, Chesapeake Bay to FL, Gulf of Mexico, Brazil

Size: height up to 36" (~1 m); stems up to 1/5" (2-5 mm) in diameter

Habitat: attached to hardbottom, as well as dock pilings, floating docks, etc.; benthic

Remarks: this octocoral may be attached to a hard surface by a holdfast or occasionally attached to bivalve shell or other object; the wood-like stem is covered with polyps within colorful tissue while alive; often only bare or partially bare stems may remain on beached specimens; lives in marine and estuarine environments; an occasional fouling organism



Renilla reniformis (sea pansy)

Distinguishing characteristics: leaf- or heart-shaped frond bearing white polyps on upper surface (image on R); bare stem-like stalk on underside (L image, top right); color varies from light pink to dark violet

Range: NC to Brazil, Caribbean

Size: frond width up to 1½" (40 mm)

Habitat: anchors in soft, sandy substratum

Remarks: colony has the ability to inflate and deflate by pumping water in and out through pore-like polyps; stalk inflates to anchor colony in sandy substratum; bioluminescent (only visible in the absence of light) when disturbed; unlike other related octocorals, such as sea fans and sea whips (*Leptogorgia* species), this species has no wood-like stem



Telesto species (telesto)

Distinguishing characteristics: typically orange, red, yellow or brown, with a shrubby branching growth form and no distinct internal stem; Each cylindrical tube contains a single polyp which is usually not visible when found out of the water

Range: NC to FL, Gulf of Mexico

Size: colonies up to 4" (12 cm); less than ⅛" (2 mm)

Habitat: attached to hardbottom; benthic

Remarks: this octocoral is covered with polyps within colorful tissue while alive; colony often covered or fouled with sponge or bryozoan tissue (R, far right specimen); three *Telesto* species occur in South Carolina: *Telesto fruticulosa* (orange telesto), *T. sanguinea* (red telesto) and *T. nelleae*, as well as a closely related fouling species, *Carijoa riisei* (white telesto)



***Astrangia poculata* (northern star coral)**

Distinguishing characteristics: small, ball shaped or encrusting colonies with compact circular corallites; little to no space between corallites; in some cases there is a common wall; dead, eroded skeletons appear white (image on L), while live specimens vary from tan to brown (image on R)

Range: MA to FL

Size: diameter up to 2" (50 mm); corallite diameter up to ¼" (6 mm)

Habitat: attached to hardbottom and other structures (pilings, etc.)

Remarks: may be hemispherical or semi-encrusting; referred to as *Astrangia danae* in some works; color of live specimens depends on the presence or absence of zooxanthellae, a symbiotic algae that lives within the coral and which contributes to the growth of its skeleton



***Oculina arbuscula* (compact ivory tree coral)**

Distinguishing characteristics: branching white or brown stony coral; corallites (cups) raised, often with wide space between; branch tips may be forked; color usually white and eroded when encountered on beach (image on L), but live colonies may be tan to dark brown (image on R)

Range: NC to GA

Size: colonies may reach up to 3' (1 m); branch diameter typically up to ¾" (20 mm); corallite diameter up to ⅛" (4 mm)

Habitat: attached to hardbottom to 20-328' (6-100 m)

Remarks: grows in bushy colonies and provides habitat to small crustaceans and other organisms; color of live specimens is dependent on the absence or presence of zooxanthellae (see northern star coral, above)



***Bunodosoma cavernata* (warty anemone)**

Distinguishing characteristics: olive green, orange or brown in color; 40 vertical rows of wart-like structures on the column (between tentacles and base); numerous short tentacles surrounding an orange or mottled mouth

Range: NC to FL, Gulf of Mexico, Caribbean

Size: disc diameter up to 2" (50 mm); height when expanded, up to 4" (100 mm)

Habitat: clings to shallow water jetties and other hard substrata; sand

Remarks: this species is highly motile and can bury itself in sand or contract tightly to survive emergence at low tide; resembles a dark, gelatinous substance when exposed to air and retracted; tentacles are sticky



***Calliactis tricolor* (tricolor anemone)**

Distinguishing characteristics: tan to pink colored disc, often mottled or with thick dark bands or stripes; numerous tentacles, when expanded (image on R), appear banded and are commonly white, but may be pink or orange; when not inflated, has a flat shape with tentacles retracted (image on L)

Range: NC to FL, Gulf of Mexico, Caribbean, Brazil

Size: disc diameter up to 2" (50 mm)

Habitat: benthic, on other living invertebrates

Remarks: commonly found attached to gastropod shells inhabited by hermit crabs, or attached to the carapace of a crab; capable of switching from one shell to another on its own power, or as directed by resident hermit crab

ARTHROPODS

The phylum Arthropoda includes the insects, the chelicerates, and the crustaceans. All arthropods have jointed appendages and an exoskeleton. Terrestrial insects are often present on SC beaches, but there are few strictly marine species. Insects are more likely to be considered as pests than as beach treasures, and they are not represented in this guide.

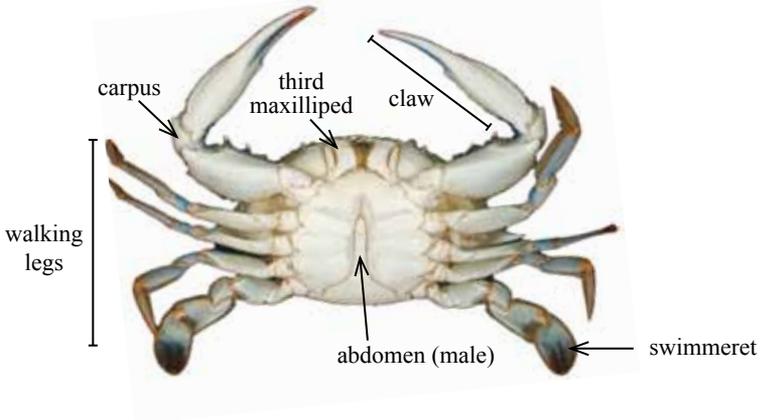
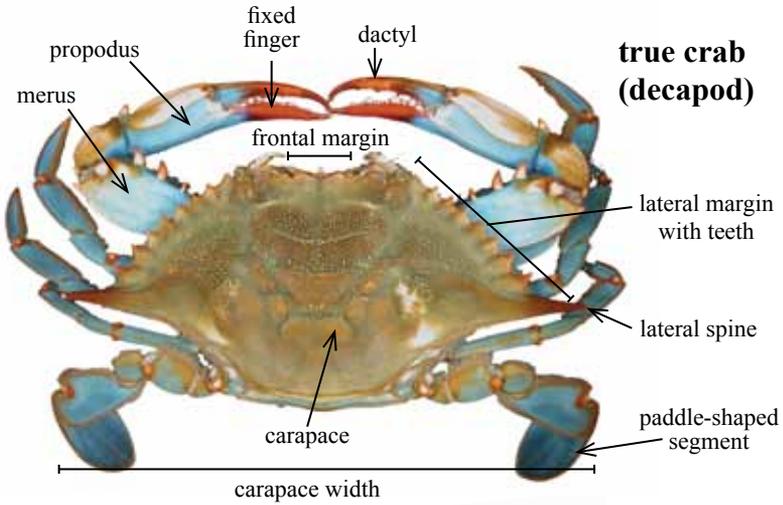
Chelicerates – (horseshoe crabs, sea spiders) - main body parts of a horseshoe crab are the prosoma (front region), opisthosoma (rear region), and telson; a pair of small pinchers (cheliceræ) and four pairs of walking legs located under the prosoma; sea spiders (see page 47) superficially resemble true terrestrial spiders; although common in SC coastal waters, they are rarely encountered by beachcombers

Crustaceans – mainly aquatic, gill breathing arthropods; among arthropods, the possession of two pairs of antennae is unique to the crustaceans

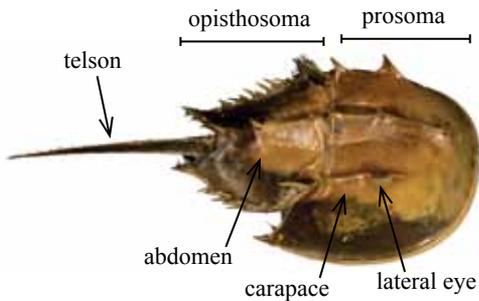
Decapods – (shrimp, hermit crabs, crabs) - the typical decapod body comprises three main parts: head, thorax, and abdomen; a common feature of the decapods is the presence of five pairs of legs on the thorax; in “true” crabs, the first pair is modified into claws; various morphologies allow adaptation to a wide range of habitats, including deep sand burrows, mollusk shells, the sandy swash zone, soft sediments and hard surfaces, both above and below the tide line

Maxillopods – (barnacles, copepods) - the barnacles that are most conspicuous to beachcombers, the acorn barnacles, are often mistaken for mollusks, because of their house of overlapping calcareous plates (sometimes called shells); the soft internal parts of the animals are usually visible only during feeding, when the plates that seal the opening at the top of the conical shell (the operculum) are opened to let the barnacle feed using its hairy, leg-like cirri; copepods are generally small and inconspicuous, and they are not treated in this guide

ARTHROPOD MORPHOLOGY



horseshoe crab (chelicerate)





Limulus polyphemus (horseshoe crab)

Distinguishing characteristics: green to blackish-brown body with three distinct parts: the horseshoe-shaped head and thorax (prosoma), the middle abdominal section (opisthosoma), and the dagger-like tail (telson); prosoma with pair of large, compound eyes that are set widely apart midway along the prosoma; five pairs of legs on the underside, the front four with weak pincers (image bottom L), the last pair ending in leaflike structures used to push the animal along on mud and sand; five pairs of flat, overlapping “book gills” on the underside of the opisthosoma are partially covered by a joined pair of flap-like limbs

Range: ME to the Yucatán Peninsula

Size: length up to 24" (610 mm) to tip of tail; males about $\frac{2}{3}$ the size of females

Habitat: coastal waters to 200' (60 m); on sandy beaches during spring spawning

Remarks: not a crab at all, the horseshoe ‘crab’ is more closely related to spiders and scorpions than to crustaceans; this species has remained unchanged for nearly 350 million years; individuals can live more than 20 years, and older animals may be heavily fouled by barnacles, sea squirts, slipper shells, and bryozoans; mass spawning takes place on SC beaches during spring tides from April-June; females with an attached male (often followed by many ‘hopeful’ males, image bottom R), swarm onto beaches and deposit thousands of greenish eggs in shallow excavations; the young hatch from the eggs 2 weeks later, and after a planktonic life of a few weeks they settle onto sandy intertidal flats, where they spend the next couple of years as juveniles before moving to deeper water; the main predators of adults are loggerhead turtles and sharks; many commercial uses of horseshoe crabs have been pursued over the years, including harvest for fertilizer (formerly), and presently for bait or for extraction of a blood component that is used as the worldwide standard to test for contamination of medical equipment and injectable fluids; also of great ecological importance, the eggs of horseshoe crabs provide a vital source of nutrition for as many as 20 species of migrating birds





Albunea catherinae (beach mole crab)

Distinguishing characteristics: carapace flattened and about as broad as long; eyestalks narrow and triangular, with small black eyes at tip; front with spinous projections along edge; antennae longer than body; pinchers with small claws; color white to light brown

Range: NC to FL, Gulf of Mexico, Caribbean, Brazil

Size: carapace length up to $\frac{3}{4}$ " (20 mm)

Habitat: burrows in sandy bottom from the low tide mark to 98' (30 m)

Remarks: formerly named *Albunea paretii*; this mole crab is not as common in shallow water as *Emerita talpoida* (below) and does not typically filter feed in the swash zone; another species found in SC, *Albunea gibbesii*, looks very similar and can only be distinguished by the shape of the dacyls of legs 2-4, which are more blunt than those of *Albunea catherinae*



Emerita talpoida (Atlantic sand crab)

Distinguishing characteristics: carapace oval-shaped, subcylindrical and ridged, longer than broad; abdomen pointed and folded under body; first legs bluntly pointed and without pinchers; very small, indistinct eyes; long, distinct antennae adapted for filter feeding

Range: MA to FL, Gulf of Mexico, Mexico

Size: carapace length up to $1\frac{1}{2}$ " (36 mm)

Habitat: intertidal zone to depths of 11' ($3\frac{1}{2}$ m)

Remarks: can be observed filter feeding in the swash zone, using its exposed antennae to collect food particles from the outgoing waves on sloping beaches with cusps; sand crabs can dig remarkably fast and constantly move to maintain position with the changing tide



***Callichirus major* (Carolinian ghost shrimp)**

Distinguishing characteristics: elongated, membranous body, flattened top to bottom; head with small, smooth rostrum; claws unequal in size; abdomen long; transparent gray, except for porcelain white claws and hardened part of shell

Range: NC to FL, Gulf of Mexico, Brazil

Size: total length to ~ 4" (~100 mm)

Habitat: on sandy shores near the open ocean, often deeply buried; found from about mid-tide level to below low tide level

Remarks: forms a series of tunnels that may extend as much as 6' (2 m); it is rare to find this animal on the beach, and it normally goes undetected by beach visitors; the best clue to its presence is a small ¼ inch (6 mm) diameter hole in the sand near the low tide line, surrounded by a ring of small dark fecal pellets (see page 72)



***Clibanarius vittatus* (thin-striped hermit)**

Distinguishing characteristics: anterior shield (the hard part of the carapace) longer than wide; two claws and eight legs, the last two pairs small and designed to cling to the vacant mollusk shell in which the crab lives; claws usually equal in size, but the left may be slightly larger than the right; abdomen very soft and unprotected by exoskeleton; brown legs with thin, white stripes; claws and walking legs with black tips; antennae orange

Range: VA to FL, Gulf of Mexico, Caribbean, Brazil

Size: anterior shield up to 1¼" (32 mm) long and ½" (13 mm) wide

Habitat: on muddy or sandy beaches, jetties, in tidepools; from tide line to 72' (22 m)

Remarks: a variety of gastropod shells provide protection from predators; when disturbed, hermit crabs retract deep into the shell, possibly disappearing from sight; as they grow, they carefully select and move into a larger shell



Callinectes sapidus (blue crab)

Distinguishing characteristics: body flattened; five pairs of legs, first pair pincer-like and last pair paddle-like at their end; edge of shell with 9 teeth on each side, rear pair longest and ending in sharp spines; two prominent triangular teeth at front between the eyes (compare with *Callinectes similis*); body olive brown; bright blue on legs, along front and on pincers; female claw fingers red

Range: Canada to Uruguay, but most common from MA to TX

Size: carapace width (tip to tip of lateral spines) up to 9" (230 mm)

Habitat: bottom-dwellers in nearly every type of estuarine and near shore habitat

Remarks: one of the most important recreational and commercial species of the SC coast; living crabs less than 5 inches wide and those with a visible egg mass must be returned to the water if caught; tolerates nearly fresh to full-strength seawater



Callinectes similis (lesser blue crab)

Distinguishing characteristics: body shape very similar to *Callinectes sapidus*, but sharp rear pair of lateral teeth curved slightly forward; four teeth between the eyes, outer pair much larger than the minute inner pair (compare with *C. sapidus*); green carapace with irregular areas of iridescence at bases and between lateral teeth; some spines on claws and carapace white tipped; claws and walking legs tinted with fuchsia or violet to light blue

Range: DE to FL, Gulf of Mexico, Caribbean

Size: carapace width (tip to tip of lateral spines) up to $3\frac{3}{4}$ - 5" (95-125 mm)

Habitat: adults on sand and mud in lower estuaries and bays in moderate to high salinity

Remarks: distribution overlaps that of *Callinectes sapidus* in lower estuaries, where they compete for food and habitat; often a common by-catch species in the shrimp trawl fishery, but rarely retained in crab pots due to their smaller size



Portunus spinimanus (blotched swimming crab)

Distinguishing characteristics: similar in overall shape to blue crab (see page 57), nine lateral teeth on each side of carapace, the last only slightly larger than others; 6 indistinct and partially fused frontal teeth between eye sockets; carapace ridged and usually mottled brown or olive with red splotches; claws with dark red or brown fingers with large white spots near tips; last pair of legs with paddle-like tips

Range: NJ to FL, Gulf of Mexico, Caribbean, Bermuda, Brazil

Size: carapace width (tip to tip of lateral spines) up to 3¾" (94 mm)

Habitat: sandy areas, mud, hardbottom, estuaries, and jetties; to depths of 300' (91 m)

Remarks: this genus (*Portunus*) differs from the blue crabs (*Callinectes*) by the presence of two spines (vs. one) carpus and a triangular (vs. T-shaped) abdomen in males



Portunus gibbesii (iridescent swimming crab)

Distinguishing characteristics: similar in overall shape to blue crab (see page 57), 9 lateral teeth on each side of carapace, the last distinctly larger than others; 8 frontal teeth between eye sockets; carapace with brownish ridges and iridescent spots near marginal teeth (indistinct in eroded specimens); legs may be vibrant purple and iridescent; first legs long and slender (but somewhat variable), with dark red tips on claws; last pair of legs with paddle-like tips and a small, dark spot between some segments

Range: MA to FL, Gulf of Mexico, northeast coast of South America

Size: carapace width (tip to tip of lateral spines) up to 3" (76 mm)

Habitat: sandy areas, mud, estuaries, and jetties; to depths of 1289' (393 m)

Remarks: see remarks for *Portunus spinimanus* (above); differs from *Portunus spinimanus* by length of last lateral spine, iridescence, and purple spots on last paddle-like legs



***Arenaeus cribrarius* (speckled swimming crab)**

Distinguishing characteristics: similar in overall shape to blue crab (see page 57); carapace olive to light brown, light maroon, or gray, with many irregular round white or tan spots encircled by dark rims; claws with larger white splotches; 9 lateral teeth on each side of carapace, the last being large and pointed outward; 6 indistinct and partially fused frontal teeth between eye sockets; underside of carapace hairy; tips of second to fourth (walking) legs yellow; last pair of legs with paddle-like tips

Range: MA to Uruguay, Caribbean

Size: carapace width (tip to tip of lateral spines) up to 4½-6" (~120-150 mm)

Habitat: common on sand in shallow water of ocean beaches, but also to >200' (60 m)

Remarks: often entirely buried in sand, except for a channel that is kept clear by the claws and hairs around mouthparts, to allow water to bathe gills in branchial chambers



***Ovalipes ocellatus* (ocellate lady crab)**

Distinguishing characteristics: carapace flattened, fan-shaped, nearly as long as wide; five pairs of legs, first pair with large claws and last pair paddle-like at their end; carapace tan to gray with numerous dark purple spots; iridescence may be visible in areas; edge of shell with five sharp, equally sized teeth on each side (teeth may be worn away or appear duller on older specimens); three prominent triangular teeth at front between the eyes

Range: Canada, MA to GA

Size: carapace width (tip to tip of lateral spines) up to 3½" (90 mm)

Habitat: lives in most marine habitats up to depths of 130' (40 m)

Remarks: *Ovalipes ocellatus* is known for being aggressive and likely to pinch; buries itself in the sand; similar to *Ovalipes stephensoni*, which lacks spots



Hepatus epheliticus (calico box crab)

Distinguishing characteristics: semicircular or fan shaped carapace (narrowing toward abdomen), convex, and light colored with many irregularly shaped red or brown spots; carapace margin scalloped or notched; two flat, broad, equal sized claws and eight spotted walking legs; claws with distinct toothed crest along top

Range: Chesapeake Bay to FL, Gulf of Mexico, Caribbean, Mexico

Size: carapace width up to 3½" (88 mm)

Habitat: tidal creeks and sandy bottom in depths up to 150' (46 m)

Remarks: uses its broad claws to cover its face when buried in the sand; sometimes has the tricolor anemone (*Calliactis tricolor*, see page 51) attached to carapace



Menippe mercenaria (Florida stone crab)

Distinguishing characteristics: carapace smooth and oval in shape, brown to red in color, with lighter spots; juveniles may be purple or gray, sometimes with tiny white spots; front margin of carapace lobed; the 2 large, toothed claws may be unequal in size; tips of claws black; eight smaller hairy walking legs, crossed by reddish bands

Range: NC to FL, Gulf of Mexico, Bahamas, Caribbean

Size: carapace width up to 5 or 6" (130-150 mm)

Habitat: prefers oyster reefs and rock jetties; sometimes found on sand or mud

Remarks: males with larger claws than females; both sexes use claws to crush prey, such as barnacles and oysters; a small, largely incidental commercially fishery for claws exists in SC, but only one claw may be harvested from each crab, and the crab must be released alive with the remaining claw intact; claws regenerate within a few months



***Panopeus herbstii* (Atlantic mud crab)**

Distinguishing characteristics: carapace trapezoidal, $\sim 2/3$ as long as wide, olive brown to slate gray; five teeth behind eye sockets along each lateral margin (note: first two teeth may be indistinctly separated); claws slightly unequal in size, moveable finger of larger claw with large white tooth at base of cutting edge; tips of claws black or brown

Range: MA to Brazil, Bermuda

Size: carapace width $1\frac{3}{4}$ - $2\frac{1}{2}$ " (~40-65 mm)

Habitat: muddy estuarine sediments near oyster shells or stones and on tidal creek banks near oyster clusters; intertidal to 70' (22 m);

Remarks: dominant mud crab in salt marshes; remains on beach were probably washed out of the estuary; carnivorous, mainly on oysters, mussels, smaller crustaceans and worms; largest of roughly $\frac{1}{2}$ dozen local mud crabs; capable of killing adult oysters



***Ocypode quadrata* (ghost crab)**

Distinguishing characteristics: body box-like with two claws and eight walking legs; carapace distinctly rectangular with a granulated surface; color varies from white to gray, with yellow tint and white underside; long, club-like protruding eyestalks; claws often lighter colored, unequal in size, with toothed fingers; hairy walking legs are longer than carapace

Range: RI to FL, Gulf of Mexico, Caribbean, Brazil

Size: carapace up to 2" (50 mm) in width; burrow openings 1-3" (25-75 mm)

Habitat: lives in burrows (see page 72) on sandy beaches

Remarks: *Ocypode quadrata* is typically active at night but occasionally can be seen emerging from burrows during the day to wet their gills in the ocean and feed; burrows can be up to 4' deep; among other things, ghost crabs prey on sea turtle hatchlings



***Libinia emarginata* (portly spider crab)**

Distinguishing characteristics: globular carapace nearly circular in outline, slightly pointed in front; row of about nine spines down the center of the carapace, with another row of seven marginal spines behind the eye socket on each side; rostrum only slightly v-shaped; pincers equal in size, with moveable finger of claw slightly curved; walking legs long and hairy; grayish-brown to dirty yellow, with white tips; body covered with short hairs, to which sponges, bryozoans and hydroids may be attached

Range: Canada to Florida Keys, northern Gulf of Mexico

Size: males larger than females; width to about 5" (125 mm); leg span to 12" (305 mm)

Habitat: estuaries, inlets and coastal ocean; to 160' (49 m); common on muddy sand

Remarks: more common than *Libinia dubia*, which is very similar, but with only six spines down the center of the carapace, and a more visibly forked rostrum



***Persephona mediterranea* (mottled purse crab)**

Distinguishing characteristics: hemispherical carapace with a lateral ridge of granulation; anterior (eye sockets) is abruptly squared off; three sharp spines project from the posterior end of the carapace; color is light tan with reddish or brownish mottling; two claws are relatively slender and equal in size; eight walking legs significantly thinner than claw-bearing appendages; legs mottled; purse-like pocket formed under folded abdomen

Range: NJ to FL, Gulf of Mexico, Caribbean, Brazil

Size: carapace width up to 2½" (58 mm)

Habitat: burrows in sand or shelly bottom; found in water up to 180' (55 m)

Remarks: the purse-like structure protects eggs from abrasion in female crabs; molts or dead specimens may wash in after storms



A



B



C



D



E



F

Barnacles are adapted to life in a wide variety of microhabitats. Some are associated with corals, sponges, crustaceans, turtles or whales. Others burrow into shells or limestone, while some are parasites of decapod crustaceans. Beachcombers are most likely to encounter those that spend their lives cemented to hard surfaces, where they live in crowded aggregations. Despite their hard external shell, barnacles are crustaceans, unrelated to molluscan shellfish like clams or oysters. Even though they are difficult to distinguish by non-specialists, some may be recognized upon close inspection. The large white ivory barnacle (*Amphibalanus eburneus* - A) is distinct when fully grown. Some of the smaller species can be identified by the pattern of red color on their shells (*Amphibalanus venustus* - A; *Amphibalanus amphitrite* - B; *Balanus trigonus* - C). The invasive species *Megabalanus coccopoma* (E and F) is hard to confuse with native species because of its large size, as is the much smaller species *Chthamalus fragilis* (B and D) that is common high in the intertidal zone.



Diopatra cuprea (plumed worm)

Distinguishing characteristics: the plumed worm lives in a large black tube with small shells and shell fragments, sticks, seaweed, or other items attached to it; the portion of the tube that is embedded within the substratum has no attached particles and is smooth, gray and often collapsed; the body of the worm is highly iridescent and has five long antennae protruding from its head; frilly gills lie immediately behind the head

Range: MA to Brazil

Size: tube length up to 12" (300 mm); width up to ½" (100 mm)

Habitat: muddy bottom

Remarks: the structure built by *Diopatra cuprea* provides habitat and substrata for other small animals and plants on which the worm feeds; the top end of the tube is bent down so that the opening faces the substratum



Owenia fusiformis (shingle tube worm)

Distinguishing characteristics: uniform, platelike sand and shell are grains fused to the tube in an overlapping, shingle-like manner, with edges of particles facing upward toward the opening; the worm lives within the tube where it can reverse its orientation when necessary; the short, branched tentacles of the worm (visible when extended) assist with filter feeding

Range: MN to FL, Gulf of Mexico, Caribbean, Venezuela, Brazil

Size: length up to 6" (150 mm)

Habitat: shallow, sandy or muddy substrate

Remarks: *Owenia fusiformis* anchors itself in sand, leaving its feeding end about ½ inch above the seafloor; small particles are trapped in its tentacles or swept off the sediment surface



encrusting and branching bryozoans (moss animals)

Distinguishing characteristics: encrusting species make net-like, crusty sheets (image L, inset) composed of microscopic box-like capsules, usually appearing white when dried; arborescent (branching) species take on a bushy plant-like form of a stiff chitinous or calcareous tissue; composed of numerous microscopic capsules with pores (image R) each containing a microscopic lophophore (tentacled stalk)

Habitat: encrusts shells or may be attached to hardbottom; washes ashore with substratum

Remarks: bryozoans are colonial animals that take on many forms, such as encrusting sheets, bushy, plant-like structures, calcified coral-like colonies, rubbery mats (see *Alcyonidium* species below) or leafy shrubs; they contain hundreds of microscopic zooids living within the boxlike capsules that make up the exoskeleton; the zooids' project their tentacles through openings in the capsules to filter feed



Alcyonidium species (rubbery bryozoan)

Distinguishing characteristics: gray to brown rubbery, gelatinous colonies that encrust other sessile organisms and form branching, shrubby masses; colonies have hundreds to thousands of microscopic zooids, which are small box-like capsules, each containing a microscopic lophophore (tentacled stalk) with 14 tentacles

Range: unknown

Size: colonies may approach the size of the encrusted substratum; zooids reach up to 1/100" (½ mm)

Habitat: encrusts substrata (pilings, floating debris, hardbottom) and sessile organisms

Remarks: two common species in SC are *Alcyonidium hauffi* and *Alcyonidium polyoum*; *Alcyonidium hauffi* typically grows on octocorals such as the sea whip (*Leptogorgia virgulata*, image on R) and is considered a fouling organism



Aplidium stellatum (sea pork)

Distinguishing characteristics: in life, this firm, rubbery colonial ascidian (tunicate or “sea squirt”) is light pink to orange, with red clusters of zooids (individuals); the colony is thickly folded on the surface and shaped to some degree by the substratum to which it is attached

Range: MA to FL

Size: colony may grow to 1" in thickness (25 mm) and 12" across (~300 mm)

Habitat: subtidal; attached to hard substrata like jetty rocks, docks or pilings

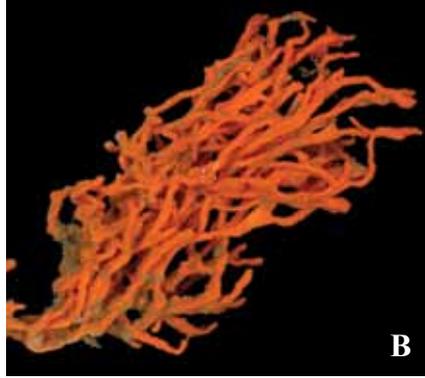
Remarks: pieces that wash ashore after breaking off from larger colonies have usually lost the individual zooids, and only the rubbery matrix (tunic) that encloses them remains; the pink color is often bleached out, leaving a beige blob of tunic; ascidians are highly evolved relatives of the Vertebrata (animals with backbones), placing them among the invertebrates most closely related to humans

Sponges

Among the most primitive taxa of invertebrates, sponges exhibit remarkably differing shapes (branched, cup or vase shaped, conical, globular, encrusting). In some cases, the shape gives a clue; but, close examination of microscopic skeletal fibers or spicules is often necessary to identify the species. A common feature of all sponges is the aggregation of microscopic individual cells within a stiff or spongy skeleton. The cells are specialized either to constantly circulate water throughout the sponge in canals, or to capture tiny suspended food particles from the circulating water. Sponges of many colors occupy a wide variety of coastal and marine habitats. The red beard sponge (*Microciona prolifera*, opposite, A, B) grows on pilings or piers in shallow water or on deeper hard surfaces offshore. The yellow boring sponge (*Cliona celata*, opposite, C) makes its home within the shells of bivalves like hard clams and oysters. Occasionally, a large finger sponge (*Haliclona oculata*, opposite, E, F) washes onto the beach from offshore, while the sun sponge (*Hymeniacidon heliophila*), because of its mat-like growth form, is less likely to be uprooted.



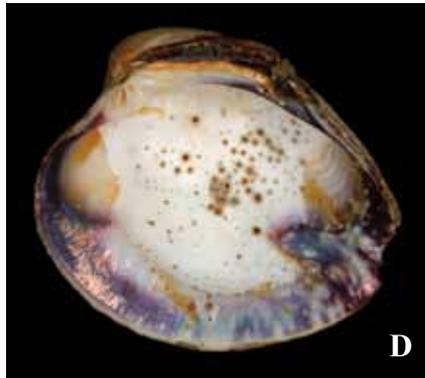
A



B



C



D



E



F

A: red beard sponge, *Microciona prolifera*, desiccated on beach; **B:** *Microciona prolifera*, alive; **C:** yellow boring sponge, *Cliona celata*, alive; **D:** effects of boring *Cliona celata* on bivalve shell; **E:** *Halicliona oculata*, desiccated on beach; **F:** *Halicliona oculata*, alive



***Uniola paniculata* (sea oats)**

Found from VA to FL and in the Gulf of Mexico, this important beach dune stabilizing grass grows to 5' (1½ m) in height; tan stalks and seed plumes with green grass-like leaves; flowers June-November.; often found at highest point on dune; spreads through rhizomes, stabilizing dunes; lawfully protected from disturbance on SC public lands



***Ipomoea imperati* (beach morning-glory)**

Leaves smooth, shiny, oval or fiddle-shaped, some lobed at the base; trailing or creeping habit; flowers August-October, appearing white with yellow center; NC to FL, Gulf of Mexico, Caribbean; a similar beach morning glory, *Ipomoea pes-caprae*, may be found in SC, but is typically found in tropical latitudes; *I. pes-caprae* has pink or purple flowers and is lobed only at tip of leaf

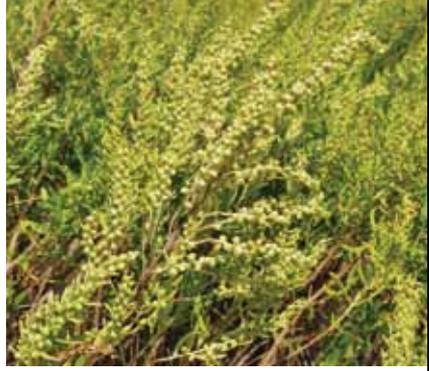


***Oenothera drummondii* (beach evening primrose)**

Creeping or spreading habit, but may become bushy; leaves and stems with dense hairlike coating; small oval leaves reaching 1½" (40 mm) in length and ½" (10 mm) in width; flowers yellow, up to 3" (75 mm) in diameter, with distinct petals and long anthers, appearing April-October; NC to SC, Florida, Gulf of Mexico

Iva imbricata
(seashore elder)

Shrubby, up to 3' (1 m) in height; woody stems with fleshy, elongate leaves, four times longer than wide; small berry-like yellow flowers appear August-November; VA to FL, Gulf of Mexico; a similar species, *Iva frutescens* (marsh elder), is found near salt marshes



Yucca aloifolia
(spanish bayonet)

Tree- or shrub-like, with sharp, long, stiff, sword-like leaves clustered around an unbranched stem; up to 10' (3 m) in height; a spike of large, white, bell-shaped flowers arises from stem during June and July; black fruit maturing in late fall; SC to FL, Gulf of Mexico, Caribbean; similar species: *Yucca gloriosa* has smooth leaf margins, and *Y. filamentosa* has hair-like filaments on the edges of leaves



Serenoa repens
(saw palmetto)

Shrubby with several stems branching from base; leaves palm-like with many elongate points splaying from circular base, reaching 3' (1 m) in diameter; white flowers appearing in summer; black berries; more frequently found in woods behind dunes, but may be visible from beach; NC to FL



Opuntia compressa
(prickly pear cactus)

Succulent cactus form with blade like segments connected by joints; segments up to 1" (25 mm) thick and 10" (25 cm) long; plant height up to 16" (40 cm); large spines may be present on blades, and smaller hair-like spine at joints; large yellow flowers appear August-October, followed by purple pear-shaped fruit; a similar species, *Opuntia drummondii* (Devil-joint), has smaller, thinner segments





dune grass

Dune grasses are hardy plants that are able to grow quickly in the fine shifting sand of beach dunes; shiny leaves of these plants prevent the loss of precious water and also reflect the sunlight that can raise the temperature and cause desiccation of less well-adapted species; when enough of these pioneer plants colonize an area of the dune, the stability that their roots provide enables other beach plants to follow



***Cakile edentula harperi*
(sea rocket)**

Shrubby, succulent plant reaching 20" (50 cm) in height; dark green, spatulate leaves, typically lobed and toothed, up to 6" (15 cm); small, white or pale purple flowers with four petals appear in fall; fruit pod with two segments; MN to FL



***Croton punctatus*
(beach croton)**

Shrubby plant reaching 39" (1 m) in height; leaves wide at base, felt-like, light green, oval, reaching 2" (5 cm) in length; inconspicuous flowers from May-November; NC to FL, Gulf of Mexico



***Hydrocotyle bonariensis*
(seaside pennywort)**

circular, shiny leaves with scalloped edges, up to 4" (10 cm) in diameter, growing directly from creeping stems; inconspicuous white flowers growing on stem from root, from May-November; NC to FL, Gulf of Mexico, Caribbean, Brazil

Ulva lactuca **(sea lettuce)**

Alga in the Division Chlorophyta (green algae); bright, translucent green, sheetlike frond, usually attached but may float onto shore in mats up to 3' long (1 m); attaches to jetties, hardbottom, rocky substrata, etc., in the intertidal to subtidal zones; worldwide in temperate and tropical climates; some botanists believe that this species should be referred to as *Ulva rigida*



***Ulva* species** **(green alga)**

Chlorophytes that were formerly in the genus *Enteromorpha* are now known to belong in the genus *Ulva*; two species are common in the lower intertidal zone on jetties and seawalls in SC; the filamentous *U. intestinalis* is hollow and tubular along its entire length; *U. linza*, however, is hollow only near the base, but flat like *U. lactuca* for most of its length



Aghardhiella subulata **(red alga)**

This species, in the Division Rhodophyta, is a red to greenish brown alga with branches that narrow slightly at their bases; individual strands are round in cross-section, not flattened as in some species of the genus; it grows year-round on jetties, mainly in the intertidal zone; this and other common genera of red algae growing on jetties may be difficult to identify by a non-specialist (e.g. *Gracilaria*, *Hypnea*)



***Sargassum* species** **(sargassum seaweed)**

Alga within the Division Phaeophyta (brown algae); yellowish brown bladelike leaves and air-filled spherical floats (bladders), which resemble berries; two species, *Sargassum fluitans* and *Sargassum natans*, form large (100+ feet) mats in the open ocean, which sometimes wash ashore in smaller tufts; once beached, foliage darkens and dries out, but bladders remain visible





ghost crab burrow

Found above the high-tide mark, these holes are entrances to burrows of the ghost crab, *Ocypode quadrata* (see page 61). The crab retreats into the hole when threatened, but sometimes can be seen from a distance, cautiously crawling back out if left undisturbed. Pellets of sand near the hole are evidence of continual burrow maintenance.



ghost (or mud) shrimp burrow

(see page 56, top) These burrows can penetrate the subtidal sand up to several feet. Studies using resin casts have shown that these burrows may be part of extensive networks of shrimp colonies. The shrimp rarely leave the burrows and they filter feed on detritus and food entering the burrow. These shrimp have an important role in nutrient and oxygen cycling in beach sediments. The cylindrical grains shown here are fecal pellets ejected from the burrow by the animal.



polychaete hole

Worms living in the intertidal zone of sandy beaches expend energy to maintain their homes. Some dig straight holes and line them with mucous, others make a leather sheaths to line their U-shaped burrows, and yet others cement together individual sand grains to build conical “brick” houses. All of them must continually remove sand that washes in, and here you see evidence of that process.



protected sea turtle nest

Sea turtle nests are often enclosed with cage material to exclude some larger egg predators (foxes, raccoons, etc.), while allowing the hatchlings to crawl out once they emerge from the sandy nest. Sea turtle eggs and hatchlings are protected by Federal and State laws, and the nests should be left undisturbed at all times.



skate egg case

The leathery, dark brown-black “mermaid’s purse” (above R) is the empty egg case that at one time held a single, developing skate pup (above L). The 2 inch long cases are attached to the bottom and serve as a protective barrier for the skate embryo and its yolk sack. Skates, such as the clearnose skate (*Raja eglantera*, above, L), are close relatives of stingrays and sharks, but do not give live birth to fully developed pups.

fossilized shark tooth

Typically most shark teeth found on SC beaches are those from extinct species. Shark teeth lost in the feeding process sink to the bottom and where they become buried and fossilized over time. When they are eroded from the rock, they are carried away with other sediment and may wash ashore. Shark teeth are often found near river inlets. While most teeth found on beaches are small (up to 2 inches), valuable large (over 4 inches) teeth can be found offshore and in dredge spoil areas.



palmetto tree root ball and trunk

Even its designation as the state tree and symbol of South Carolina cannot save the Cabbage Palmetto from this occasional fate. A salt tolerant species that can grow close to the dune line, when it faces the gradual erosional forces of the ocean, or the rapid undermining caused by storms, the eventual result is often what is shown here. It’s difficult to confuse the remnants of the root ball and lower trunk of a Palmetto with any other artifact that you’re likely to find on the beach.





channeled whelk egg cases **A**



knobbed whelk egg cases **B**



channeled whelk **C**



horse conch **D**



knobbed whelk **E**



horse conch **F**



shark eye sand collar **G**

gastropod egg capsules

Many of the more evolved gastropods have adopted a strategy to maximize reproductive success by brooding their eggs in protective capsules. As eggs are laid by the female, they are enclosed in rubbery capsules (each with anywhere from 20 to 100 eggs) that are produced by a special gland and molded into distinctive shapes. Whelks produce strings with as many as 100 1-inch disk shaped capsules attached to a tough cord (A and B). Capsules differ slightly among species, making it possible to identify those of the channeled whelk (C, knife-edged) and knobbed whelk (E, flat-edged). Vase shaped horse conch egg capsules are massed together (D and F), while those of the shark eye are embedded in a protective “sand collar” (G). Egg masses are secured to the ocean floor or an immovable object as the embryos develop into tiny snails, which eventually crawl out of the capsule through a small opening. After the young emerge, strings and masses of capsules become dislodged and are often washed ashore.



beach erosion

Otter Island, Colleton County

An exposed, raw edge of a sand dune indicates rapid erosion of the beach by heavy wave action that occurs during high tides. Common causes are winter storms, hurricanes and storm surge, and poorly designed beach renourishment projects. Since barrier islands are dynamic land forms, shifting shorelines are natural. However, human impacts and coastal development often intensify beach erosion.



Isle of Palms, Charleston County

mass strandings

Under normal circumstances, most of the natural objects found on the beach are the remains of animals and plants that have died previously and are washed ashore over a period of time. Occasionally, however, there is a mass die-off of numerous species that wash onto the beach while they are still alive, but subsequently die where they are stranded. It is often difficult to attribute such mass strandings to a particular cause; but, the possibilities include winter storms, hurricanes, temperature extremes, heavy freshwater runoff, salinity changes, low oxygen levels, and species-specific outbreaks of disease. While the sight of so many dead and dying animals can be disturbing, in most cases the populations from which they came are remarkably resilient and adapted to the harsh conditions of the near shore environment.

Otter Island, Colleton County



marsh plants on accreting shore

The vast expanses of salt marsh behind the barrier islands fringing much of the South Carolina coast are a familiar and aesthetically pleasing sight. However, when they grow near inlets close to ocean beaches, marsh plants are influenced by the dynamic forces of wind and waves that continuously reshape the character of the shoreline. In some instances, the marsh grass *Spartina alterniflora* lies directly in the path of sand that is being transported along the shore and up and down the beach. When that happens, the plants that persist compose a habitat quite different than that of marshes in more sheltered areas. Although dominated by the same species of plant, this sandy *Spartina* stand is home to a faunal community that has little resemblance to that of estuarine marshes that grow on muddier intertidal substrata farther from the coast.

relict salt marsh/peat

The *Spartina* salt marshes on the backside of barrier islands trap fine sediments that are carried onto their surface by continual tidal inundation. As this mud accumulates, it gradually buries the marsh plants and roots, and this peat is overgrown by new plants. The barrier islands migrate slowly landward (a result of rising sea level and erosion of the beach), and eventually some of this buried peat ends up on the seaward side of the island. There it is subjected to beachfront erosion and emerges once again as the sand is washed away from its sticky surface. Close examination of these peat outcrops reveals microhabitats of miniature tide pools where small animals thrive. Remnants of the back beach salt marsh, like the shells of ribbed marsh mussels, oysters, and tangled root mats, are usually easy to find near the surface of the firm mud.



Hunting Island,
Beaufort County

Botany Bay
Charleston County



Morris Island, Charleston County

solid emergent structures (jetties, pilings)

Pilings, groins and jetties are man-made structures that provide rare, hard surface habitat for many marine species that would be otherwise absent from the intertidal zone. Because these structures are subjected to periodic emergence and submergence caused by tides, only organisms that can survive desiccation, such as barnacles, and certain bivalves, crabs and anemones, can colonize them. On tall structures like the pilings shown below, distinct zonation can be seen between the sand and the high tide mark. The bottom zone nearest the sand may be bare as a result of scouring, but above that grows a variety of sessile organisms that have differing tolerances to exposure to air. In addition to emergence, these animals are also subjected to greater temperature extremes.

Jetties and groins provide habitat for similar animals, however they have more surface area and complexity compared to pilings. Wave action and currents create depressions in the sand around these structures. As a result, a variety of animals may be observed in the calm water of tidepools at low tide.

Folly Beach, Charleston County



sea turtle nesting

Many South Carolina beaches are used heavily by loggerhead sea turtles (*Caretta caretta*) during nesting season. Female turtles ascend the beach leaving distinct “crawls” (see bottom image) made by their flippers, dragging carapaces and tails. They dig a large hole in the sand above the high tide line and lay approximately 120 eggs that look remarkably like ping-pong balls. The eggs hatch several weeks later, and unless they are misdirected by lights or eaten by predators, the young turtles make their way down the beach to the water. Often these nests are marked by researchers (see top images), and they should always be left undisturbed by visitors.



South Island, Georgetown County

GLOSSARY

abdomen – in arthropods, the part of the animal's body that is posterior to the head and thorax (p. 53)

accrete – to widen by building out in a seaward direction (regarding shoreline dynamics)

anterior – towards the front (head) end; apertural end of a gastropod or foot end of a bivalve; opposite of posterior

aperture – in gastropods, the opening into the shell (p. 27); in octocorals, the opening for retraction of the polyp

apex – the pointed tip of the spire of a gastropod shell (p. 27)

apophysis – a shelly projection beneath the hinge of some bivalves that is used for attachment of foot muscles

arborescent – an upright, branching, tree-like growth form

arm – see 'ray'

arthropod – any member of the phylum Arthropoda, all of which possess jointed appendages and a thickened, chitinous exoskeleton that surrounds the animal's soft tissues

ascidian – a primitive sessile chordate, composed of either a solitary zooid or a colony of microscopic zooids embedded in a tunic

axial rib – see 'costa'

axis – the central line through a structure; in gastropods, it runs from the apex to the anterior end (p. 27)

basal disc – the tough, foot-like base of an anemone that attaches it to a solid surface (p. 43)

beak – see 'umbo'

bell – the hemispherical, cup-shaped, tentacle bearing portion of a cnidarian medusa (p. 43)

benthic – attached to, living on, or associated with the ocean floor

bivalve – any member of the molluscan class Bivalvia, all of which possess two shells that are joined by a hinge

bryozoan – any member of the phylum Ectoprocta, which are colonial animals composed of zooids that each possess a crown of tentacles surrounding the mouth

byssus (byssal threads) – protein threads produced by some bivalves that are used for attachment to the substrate

calcareous – made predominately of calcium carbonate or limestone; shelly

callus – in gastropods, a thickening of the shell, usually on the inner part of the aperture near the columella (p. 27)

carapace – exoskeleton covering the head and at least some of the thorax of crustaceans; in crabs, the shell (p. 53)

chelicerae – a pair of claw-like feeding appendages located anterior to the mouth in horseshoe crabs

chelicerate – any member of the arthropod subphylum Chelicerata, which includes horseshoe crabs, spiders, mites, and scorpions; excludes the crustaceans and insects

chitin (chitinous) – a hard, flexible substance produced by invertebrates and used primarily for structural purposes (especially in the exoskeleton of arthropods); often described as "horny"

chordate – a member of the phylum Chordata, which includes a small number of invertebrates, as well as all of the vertebrates (animals with backbones)

cnidarian – any member of the phylum Cnidaria, including jellyfish, corals, anemones, among others; contain specialized stinging cells for defense or prey capture

columella – the central or axial column of a gastropod, around which the whorls are wrapped (p. 27)

commensal – a partner in the association of two different species that live together, one of which benefits from the relationship without harming the other

concentric lines – lines or ridges that curve parallel to the bottom edge of a bivalve shell, forming semicircles near the beak

corallites – the calcareous cup of an individual coral polyp (p. 43)

costa (plural: costae) – a ridge or rib that runs parallel to the axis of a gastropod shell (p. 31, bottom)

crustacean – any member of the arthropod subphylum Crustacea, which are mainly aquatic, gill-breathing animals with five pairs of head appendages and a various number of appendages on the thorax and abdomen that aid in locomotion and respiration

dactyl – the terminal segment of a jointed crustacean leg; in crabs, it forms the movable finger of the claw (p. 53)

dermis – the skin that covers the internal skeleton of an echinoderm (p. 37)

desiccated – the condition of extreme dryness, generally due to the loss of moisture from plant or animal tissue

dextral – on or pertaining to the right side, such as the position of the aperture in most gastropods (p. 29, bottom)

dorsal – pertaining to the back (not hind end) of an animal; in many cases this corresponds to the “upper” surface

dorsal wing – a triangular expansion on the dorsal margin of certain bivalves (p. 13)

estuarine – the aquatic environment where a river meets the sea, producing a mixture of freshwater and seawater

exoskeleton – a hard supporting skeletal structure that is secreted by, and external to, the **epidermis**; in arthropods it is segmented and chitinous

faunal – referring to animals

fecal pellet – a discrete piece of compressed fecal matter that is produced by certain animals (p. 72, second image from top)

filamentous – a thread- or hair-like growth form, often used in reference to algae

floral – referring to plants

frontal margin – in crabs, the front edge of the carapace that lies between the eyes (p. 53)

frond – a broad, leaf-like structure

gastropod – any member of the molluscan class Gastropoda, which typically possess a single shell (univalve) that is coiled in a spiral growth pattern



gonad – an organ that produces reproductive cells (e.g. ovary, testis, or ovotestis)

hinge – the dorsal part of a bivalve where the two shells are connected, often by a ligament and interlocking teeth (p. 13)

holdfast – the lower, expanded area of an octocoral (or other arborescent plant or animal) where it is attached to the substratum (p. 43)

iridescent area – an area inside bivalve shells or on the carapace of a crustacean that appears pearly

lateral margin/spine/teeth – in crabs, the edges of the carapace that lie to the outside of each eye (p. 53)

ligament – in mollusks, a structure, made of protein, used to connect bivalve shells, and also serving to open them when the muscles closing the valves are relaxed (p. 13)

lophophore – the U-shaped crown of feeding tentacles that surrounds the mouth of a bryozoan zooid

lunule – in bivalves, a depressed or flattened area anterior to the umbo, often heart-shaped (p. 13); in echinoderms, the slit-like openings in the test of a sand dollar (p. 37)

madreporite – a circular structure found on the skin (dermis) of sea stars and other echinoderms that regulates internal water pressure (p. 37)

marginal plate – one in a series of plate-like skeletal elements that line the rays of certain sea stars (p. 37)

medusa (medusoid) – the free swimming, bell-shaped “jellyfish” life stage of some groups of cnidarians

merus – the 4th segment (counting from the tip) of a 7-jointed crustacean leg; in crabs, it is often the largest segment, especially on the claws (p. 53)

muscle scar – a slight indentation on the inside of a bivalve shell that shows the location of a muscle attachment (p. 13)

neritic – the area of ocean from the low-tide line to the continental shelf (to approximately 656 feet (200 m) depth)

operculum – in gastropods, a thin, flat, plate, attached to the foot, which is used to seal the aperture (p. 27); in barnacles, the opening at the top of the conical shell that can be sealed by four calcareous plates

opisthosoma – the middle or abdominal section of the body of a horseshoe crab or other chelicerate (p. 53)

oral disc – in anemones, the area located at the top of the column that bears the tentacles and mouth (p. 43); in sea stars and brittle stars, the underside of the centralized area between the arms, where the mouth is located

Hunting Island, Beaufort County (180° view)



pallial line – the line on the inside of some bivalve shell that runs parallel to the bottom edge, marking the point of attachment of the mantle (the shell-producing tissue) to the shell (p. 13)

pallial sinus – an indentation in the pallial line of a bivalve that marks the place where the siphons can be withdrawn (p. 13)

pedalia – a broad, hand-shaped extension on the lower margin of the bell of a boxjelly that bears the tentacles

pelagic – floating or swimming freely off the bottom in open water

periostracum – the outer, skin-like protective coating on some mollusk shells that is often fuzzy, not shelly (p. 13)

polyp – the individual cylindrical component of a cnidarian that bears the tentacles; generally used to describe the individuals of colonial species that is attached to the substrate

polyp mound – a dome-like structure that houses a polyp in an octocoral

posterior – towards the rear (tail) end

propodus - the 2nd segment (counting from the tip) of a 7-jointed crustacean leg; in crabs, it is extended to form the fixed finger of the claw (p. 53)

prosoma – the anterior (head) section of the body of a horseshoe crab or other chelicerate (p. 53)

radial ribs – fan-like sculpturing on the outside of bivalve shells that consists of ribs that run from the umbo to the margin of the shell (p. 13)

ray – one of the multiple projections radiating from the central disc of a sea star or brittle star (p. 37)

rhizome – in plants, a thick underground stem that gives rise to shoots above and roots below

rostrum – in crustaceans, a forward projection, sometimes toothed or compound, located on the midline of the anterior margin of the carapace; maybe be sharply produced or barely noticeable

sessile – attached to the ocean floor or other surfaces; fixed in position rather than mobile

shoulder – in gastropods, the angled and slightly flattened part of a whorl, located below the suture, usually at the widest part of the whorl (p. 27)

sinistral – on or pertaining to the left side, such as the position of the aperture in some gastropods (p. 29, top)

siphon – a conical or tubular part of the soft tissue of a mollusk that allows the circulation of water over the animal's gills

siphonal canal – a folded, sometimes nearly tubular, anterior extension of the aperture of some gastropods, which allows the extension of a soft funnel-shaped siphon that is used to draw in water (p. 27)

spire - the posterior part of a gastropod shell that contains all of the whorls except the main body whorl (p. 27)

spiral sculpture - grooves, lines or other features of a gastropod shell that are arranged in a spiral pattern (p. 27)

spring tide – a tide during the lunar period having the greatest tidal range, which occurs roughly twice each month

substratum (plural: substrata) – the surface or material on which an animal or plant is attached or in which it lives

suture – in gastropods, the line or thin groove between whorls (p. 27)

telson – the hindmost segment of a crustacean, bearing the anus; the long, sharp tail of a horseshoe crab (p. 53)

tentacles – in cnidarians, the flexible, sensory fingerlike organs that capture food items and pass them to the mouth; often the site of heavy concentrations of stinging cells (p. 43)

test – in sea urchins and sand dollars, the hard, fused skeletal elements, sometimes called their ‘shell’ (p. 37)

thorax – in arthropods, the middle part of the animal’s body that lies between the head and the abdomen, usually bearing the walking legs, and in crabs, the claws

tube feet – in echinoderms, movable, fluid-filled, suction cup-like feet that are used for feeding and locomotion (p. 37)

tubercle – in echinoderms, a small rounded protuberance on the test that supports a moveable spine (p. 37)

tunic – in colonial ascidians, the body wall or rubbery material that supports and encloses the individual zooids

umbo – the dome-like raised area above the hinge of a bivalve shell; this is the oldest part of the shell (p. 13)

umbrella – see ‘bell’

valve – in bivalves, the shell; frequently refers to one of the two parts of the shell that are joined together by a hinge

ventral – pertaining to the front (not the head end) of an animal; in many cases this corresponds to the “bottom” surface

whorl – one full turn of a coiled gastropod shell

zooid – one of many ‘individuals’ in a colonial animal like an ascidian or a bryozoan

zooxanthellae – algal cells found in the tissue of some cnidarians; the photosynthetic algae provide nutrition for the animal host

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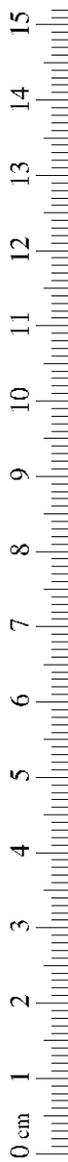
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