

SYMBIOSIS: MUTUALISMS AND COMMENSALISMS

Color the hermit crab pale brown. The sea anemone is light gray with red stripes.

Many species of *hermit crabs* form symbiotic relationships with *sea anemones*. The mutualistic nature of the relationship seems obvious. The sea anemones are attached to the hermit's shell and serve as a deterrent to predators. The sea anemone gets a solid place to attach and a free ride to potential feeding opportunities. Hermits (Plate 36) have been observed transferring sea anemones to new shells when their increasing size requires them to switch shells, clearly suggesting the anemones are beneficial to the hermits. What evidence is available to suggest there is a mutual benefit to the anemone? In some relationships, the anemone initiates the move itself, using its tentacles to attach to the hermit's new shell and releasing its base from the old one. One especially remarkable symbiosis is found in the deep sea off Hawaii. Here the anemone *Stylobates aeneus* attaches to a small hermit crab *Parapagurus dofleini* in a small shell. As the hermit grows and would normally require a bigger shell, the anemone enlarges the old shell with a chitinous secretion from its base. The anemone's base wraps around the entire shell, and its secretions follow the corkscrew-shape of the hermit's abdomen which is specially modified to fit into a snail shell. The resulting golden-colored *false shell* so resembles a snail's shell that a famous malacologist identified the shell as a mollusc and gave it a scientific name. This mutualistic relationship is especially appropriate as new, larger shells are not readily available to hermit crabs on the deep-sea floor, and sea anemones would be precluded from the soft deep-sea bottom without the solid attachment site provided by the hermit's shell.

Color the stingray a soft brown. The bar jack is silver with a black bar that extends from under the dorsal fin onto the caudal fin and is underlain by a blue bar.

A clearly commensal relationship is seen in the Caribbean between the *Southern stingray* and the fish known as the *bar jack*. The swift-swimming jacks are excellent hunters (Plate 109), however Southern stingrays are frequently seen with a single bar jack "riding shotgun" just above them as they swim along the bottom. When the ray stops to feed by digging into the soft bottom with its large pectoral fins to uncover buried prey, tasty food morsels

are thrown into the water with the sediment and the jack swoops in quickly to gobble them up. Similar commensal pairings of jacks and stingrays are also found in other tropical seas.

Color the sea bat and its commensal dark brown polychaete. The sea bat varies considerably in color, but is commonly red-orange.

The *sea bat* is an omnivorous scavenging sea star common on shallow rocky bottoms along the west coast of North America. It frequently harbors one to several thin *polychaetes* in the ambulacral grooves among its tube feet (Plate 39). When the sea bat everts its stomach on food, the polychaetes move in to help themselves to part of the meal. The polychaete is referred to as a "facultative" commensal because it is not obligated to this commensal lifestyle; it is also found living free in the environment. A commensal animal that cannot live without its host is called an "obligate" commensal.

Color the coral, pistol shrimp, crab, and sea star. The coral is pale brown to off-white, the crab has a reticulate (netlike) pattern of orange and gray outlined in red, and the shrimp's color varies from red to brown. The body of the sea star is gray and the spines are brown.

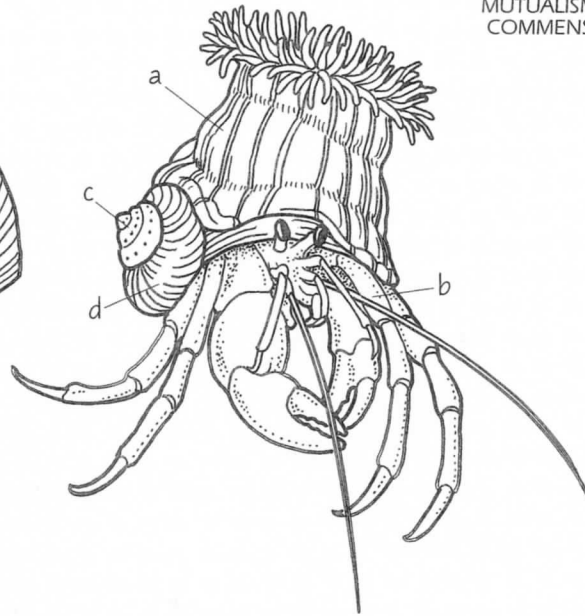
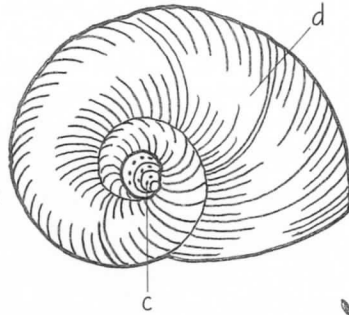
Many small invertebrates live commensally in the burrows or on the shells or bodies of larger invertebrates. Examples are the small pea crab and scale worm that share the burrow and food of the innkeeper worm (Plate 26). Large colonial invertebrates are especially targeted by commensal dwellers, and may resemble apartment houses given the number of hangers-on. One such relationship is found on the Pacific coast of Panama between small *pistol shrimps* and *crabs* that live among colonies of the branching coral *Pocillopora*. However, when the coral-eating *crown-of-thorns sea star* approaches the *Pocillopora* colony, what appeared to be a commensal relationship quickly reveals itself to be a mutualistic one. The small crustaceans rush to the tips of the *Pocillopora* branches, the pistol shrimp bangs away repeatedly on the star using the concussive snap of its large claw (Plate 71), and the crab nips the star's tube feet. The star hesitates and then retreats, forced to eat other, less preferred prey. If the shrimps and crabs are removed, the coral colony is soon eaten.

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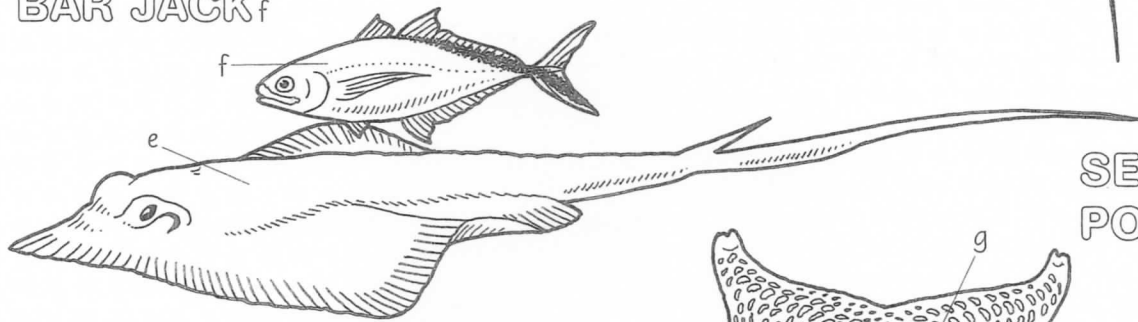
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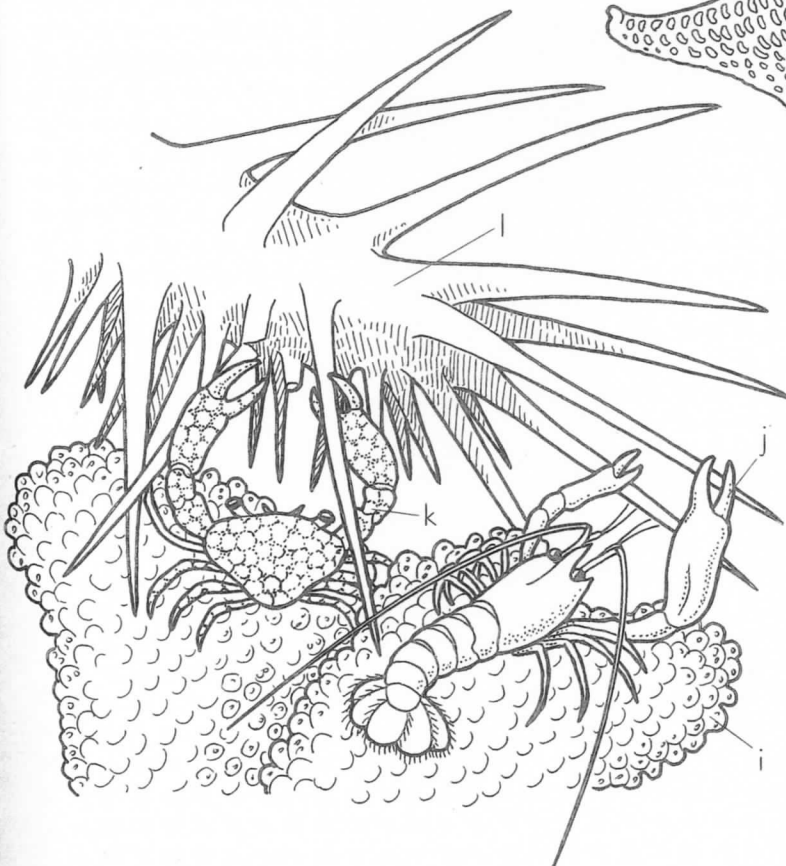
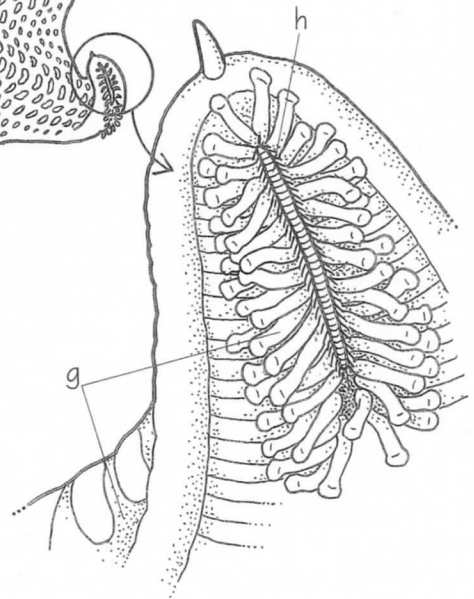
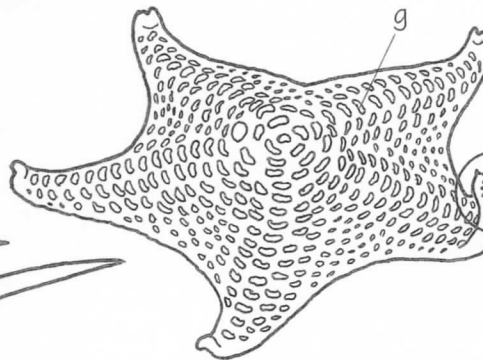
SEA ANEMONE_a
HERMIT CRAB_b
ORIGINAL SHELL_c
FALSE SHELL_d



SOUTHERN STINGRAY,
BAR JACK_f



SEA BAT,
POLYCHAETE_h



CORAL_i
PISTOL SHRIMP_j
CRAB_k
CROWN-OF-THORNS
SEA STAR_l