

APPENDIX 5C

Hazardous Marine Creatures

5C-1 INTRODUCTION

5C-1.1 Purpose. This appendix provides general information on hazardous marine life that may be encountered in diving operations.

5C-1.2 Scope. It is beyond the scope of this manual to catalog all types of marine life encounters and potential injury. Planners should consult the recommended references listed at the end of this appendix for additional information. Local medical personnel and expert organizations, such as the Divers Alert Network, are often good sources of information and should be consulted prior to operating in unfamiliar waters. A full working knowledge of the marine environment will help to avoid adverse incidents, severe injuries, and lost time.

5C-2 MARINE ANIMALS THAT ATTACK

5C-2.1 Sharks. Shark attacks on humans are infrequent. The annual recorded number of shark attacks is only 40 to 100 worldwide. Injuries result predominately from bites. Shark skin is covered with abrasive dentine appendages, called denticles, which may cause abrasions if a shark “bumps” a human victim.

5C-2.1.1 Shark Pre-Attack Behavior. Pre-attack behavior by most sharks is somewhat predictable. A shark that is agitated or preparing to attack may swim erratically, its pectoral fins pointing downward in contrast to the usual flared-out position, sometimes with humped back and upward snout, and sometimes in circles of decreasing radius around its prey. An attack may be heralded by unexpected acceleration or other marked change in behavior, posture, or swim patterns. Sharks are much faster and more powerful than any human swimmer. All sharks should be treated with extreme respect and caution (see [Figure 5C 1](#)). Attacks tend to occur upon persons at the surface, particularly if there is commotion.

5C-2.1.2 First Aid and Treatment.

1. Bites may result in significant bleeding and tissue loss. Take immediate action to control bleeding using large pressure bandages. Cover wounds with layers of compressive bandages preferably made with gauze, but easily made from shirts or towels, and held in place by wrapping the wound tightly with gauze, torn clothing, towels, or sheets. Direct pressure with elevation or sufficient compression on “pressure points” over major arteries will hopefully control all but the most serious bleeding. These pressure points are the radial artery pulse point for the hand; above the elbow under the biceps muscle for the forearm (brachial artery); and the groin area with deep finger-tip or heel-of-the-hand pressure for bleeding from the leg (femoral artery). When bleeding cannot be immediately controlled by direct pressure and elevation or by compressing pressure points, a tourniquet should be used to save the victim’s life even

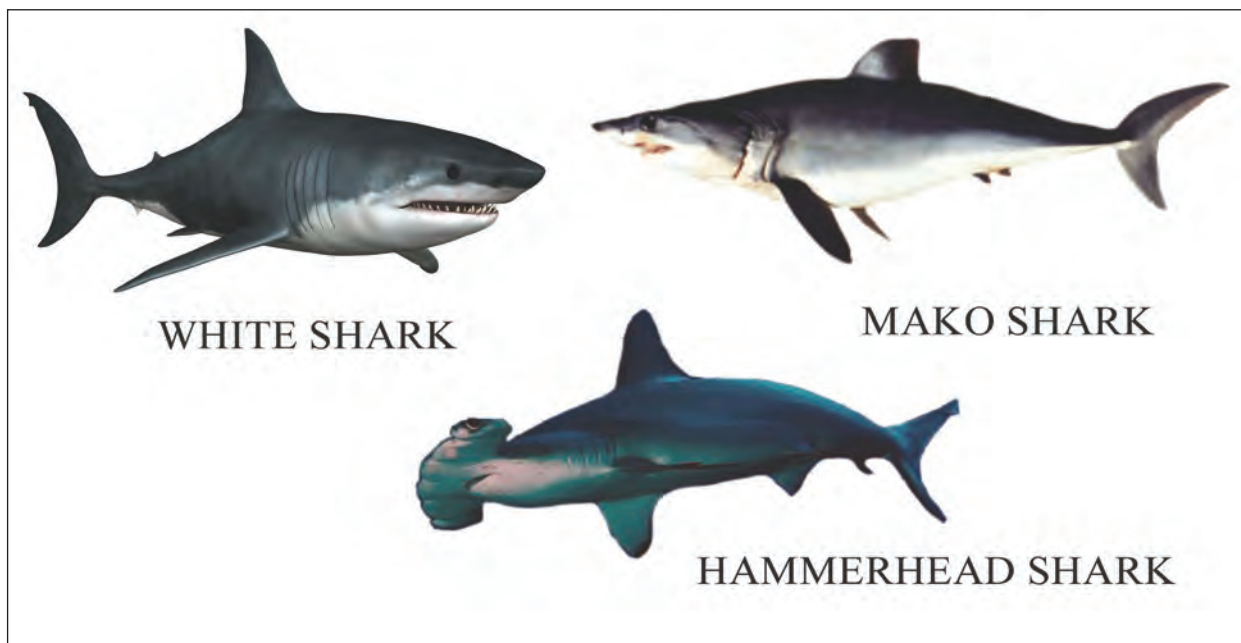


Figure 5C-1. Types of Sharks.

though there is the possibility of loss of the limb if the application exceeds a duration of 2-4 hours. Do not remove the tourniquet. It should be removed only by a physician in a hospital setting. Loosening a tourniquet prematurely may cause further shock by allowing recurrent bleeding.

2. Treat for low blood pressure (in the extreme, for shock) by laying the victim down and elevating his feet.
3. If medical personnel are available, begin intravenous (IV) Ringer's lactate or normal saline solution with a large-bore catheter (16 or 18 gauge). If blood loss has been extensive, several liters should be infused rapidly. The victim's color, pulse, and blood pressure should be used as a guide to the volume of fluid required. Maintain the airway and administer high flow oxygen by face mask. Do not give fluids by mouth. If the victim's cardiovascular state is stable, narcotics may be administered in small incremental doses for pain relief. Observe closely for evidence of depressed respirations due to the use of narcotics.
4. Initial stabilization procedures should include attention to the airway, breathing, and circulation, followed by a complete evaluation of the victim for multiple traumas.
5. Transport the victim to a medical facility as soon as possible. The goal is to treat hemorrhage with blood transfusions. Reassure the victim.
6. Should a severed limb be retrieved, wrap it in bandages, moisten with saline, place in a plastic bag and chill, but do not put the limb in direct contact with ice. Transport the severed limb with the victim.

7. Clean and debride wounds as soon as possible in a hospital or other controlled environment. Since shark teeth are cartilage, not bone, and therefore may not appear on an X-ray, operative exploration should be performed to locate and remove dislodged teeth.
8. Perform X-ray evaluation to evaluate bone damage. Severe crush injury may result in acute renal failure due to myoglobin released from injured muscle. Monitor closely for kidney function and adjust IV fluid therapy appropriately.
9. Administer tetanus prophylaxis: tetanus toxoid, 0.5 ml intramuscular (IM) and tetanus immune globulin, 250 to 400 units IM.
10. Culture infected wounds for both aerobes and anaerobes before instituting broad spectrum antibiotic coverage; infections with *Clostridium* or *Vibrio* species have been reported. Consider administering an antibiotic, such as ciprofloxacin, for acute shark bite wounds to prevent *Vibrio* infection.
11. Acute surgical repair and reconstructive surgery may be necessary.
12. In cases of unexplained decrease in mental status or other neurological signs and symptoms following shark attack while diving, consider arterial gas embolism or decompression sickness as a possible cause.

5C-2.2 Killer Whales. Killer whales live in all oceans, both tropical and polar. These large mammals have blunt, rounded snouts and high black dorsal fins ([Figure 5C-2](#)). The jet black head and back contrast sharply with the white underbelly. Usually, a white patch can be seen behind and above the eye. Killer whales are usually observed in packs of 3 to 40 animals. They have powerful jaws, great weight, speed, and interlocking teeth. Because of their speed and carnivorous habits, these animals should be treated with great respect. There have been no recorded attacks in the wild upon humans.

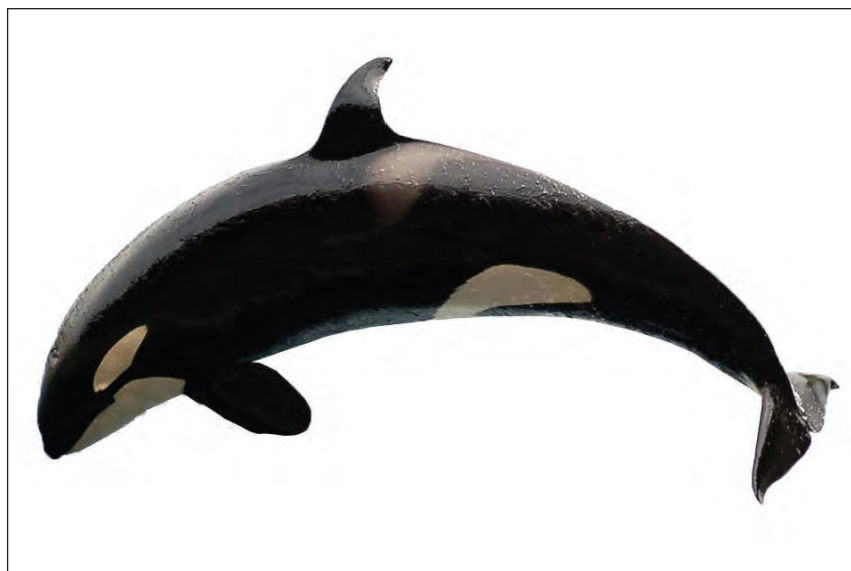


Figure 5C-2. Killer Whale.

5C-2.2.1 **Prevention.** When killer whales are spotted, all diving personnel should immediately leave the water. Extreme caution should be observed on shore areas, piers, barges, ice floes, etc., when killer whales are in the area.

5C-2.2.2 **First Aid and Treatment.** First aid and treatment would follow the same principles as those used for a shark bites ([paragraph 5C-2.1.2](#)).

5C-2.3 Barracuda. More than 20 species of barracuda inhabit tropical and subtropical waters from Brazil to Florida and the Indo-Pacific oceans from the Red Sea to the Hawaiian Islands. The barracuda is an elongated fish with prominent jaws and teeth, silver in color, and with a large head and V-shaped tail ([Figure 5C-3](#)). It may grow up to 10 feet long and is a fast swimmer, capable of striking rapidly and fiercely. It will follow swimmers but seldom attacks an underwater swimmer. It is known to attack surface swimmers and limbs dangling in the water, particularly if they are adorned with shiny metallic objects, such as jewelry. Barracuda wounds can be distinguished from those of a shark by the bite pattern. A barracuda leaves straight or V-shaped wounds while those of a shark conform to the shape of the shark jaws. Life threatening attacks by barracuda are very rare.

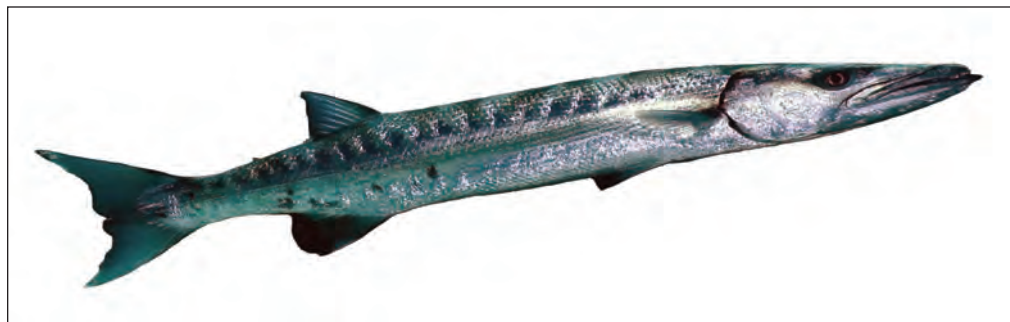


Figure 5C-3. Barracuda.

5C-2.3.1 **Prevention.** Barracuda are attracted by shiny objects, such as metallic fishing lures. Avoid wearing shiny equipment or jewelry in the water when barracudas are likely to be present. Avoid carrying speared fish, as barracuda may strike them. Avoid splashing or dangling limbs in barracuda-infested waters.

5C-2.3.2 **First Aid and Treatment.** First aid and treatment follow the same principles as those used for shark bites ([paragraph 5C-2.1.2](#)). Injuries are likely to be less severe than shark bite injuries.

5C-2.4 Moray Eels. While some temperate zone species of moray eels are known, they inhabit primarily tropical and subtropical waters. Moray eels are bottom dwellers commonly found in holes and crevices or under rocks and coral. They are snake-like in appearance and movement and have tough, leathery skin ([Figure 5C-4](#)). Morays can grow to a length of 10 feet and have copious sharp thin teeth. Moray eels are extremely territorial and attack frequently when divers reach into crevices or holes occupied by the animals. They are powerful and vicious biters and may be difficult to dislodge after a bite is initiated. Bites from moray eels range from

multiple small puncture wounds to extensive jagged tears with profuse bleeding if there has been a struggle. Injuries are usually inflicted on the hands or forearms.

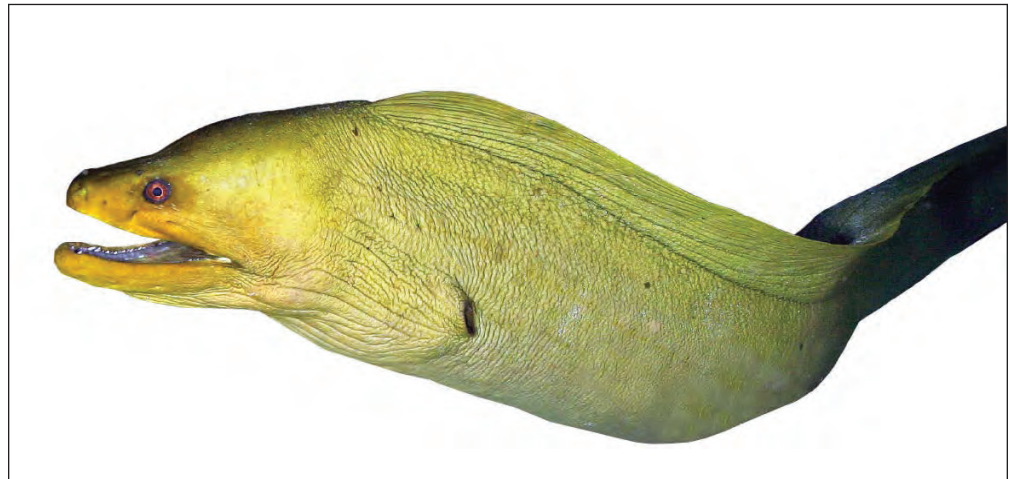


Figure 5C-4. Moray Eel.

5C-2.4.1 **Prevention.** Extreme care should be used when reaching into holes or crevices. Avoid provoking or attempting to dislodge an eel from its hole.

5C-2.4.2 **First Aid and Treatment.** Direct pressure and raising the injured extremity almost always controls bleeding. Arrange for medical follow-up. Severe hand or facial injuries should be evaluated immediately by a physician. Treatment is supportive. Follow principles of wound management and tetanus prophylaxis as in caring for shark bites. Antibiotic therapy should be instituted early. Immediate specialized care by a hand surgeon may be necessary for tendon and/or nerve repair of the hand to prevent permanent loss of function.

5C-2.5 Sea Lions. Sea lions inhabit the Pacific Ocean and are numerous on the west coast of the United States. They resemble large seals. Sea lions are normally harmless; however, during the breeding season (October through December) large bull sea lions are quite defensive and will be aggressive towards divers. Attempts by divers to handle these animals may result in bites. The bites are similar in configuration to dog bites and are rarely severe, but may cause unique infections.

5C-2.5.1 **Prevention.** Divers should avoid these mammals when they are in the water, and at any time when they are with their offspring.

5C-2.5.2 **First Aid and Treatment.**

1. Control local bleeding.
2. Clean and debride wound.
3. Administer tetanus prophylaxis as appropriate.

4. Wound infections are common and prophylactic antibiotic therapy is advised. “Seal finger” refers to an infection with *Mycoplasma* and is amenable to treatment with the antibiotic tetracycline.

5C-3 VENOMOUS MARINE ANIMALS

5C-3.1 Venomous Fish (excluding Stonefish, Scorpionfish, and Zebrafish). Identification of a fish following a sting is not always possible; however, symptoms and effects of venoms from stinging fishes do not vary greatly. Venomous fish are rarely aggressive. Contact is usually made by accidentally stepping on or handling the fish. Dead fish spines may remain toxic ([Figure 5C-5](#)). Local symptoms following a sting are usually severe pain combined with numbness and/or tingling around the wound. The wound site may become cyanotic with surrounding tissue becoming pale and swollen. General symptoms may include nausea, vomiting, sweating, mild fever, respiratory distress and collapse. Pain may seem disproportionately high for the apparent severity of the injury. Medical personnel should be prepared for serious anaphylactic reactions from apparently minor stings or envenomations. Pain is usually diminished by immersion into hot water (see below).

5C-3.1.1 Prevention. Avoid handling venomous fish. Venomous fish are often found in



Figure 5C-5. Weeverfish.

holes or crevices or lying well camouflaged on rocky bottoms. Divers should be alert for their presence and take care to avoid them.

5C-3.1.2 First Aid and Treatment.

1. Assist the victim to leave the water; watch for fainting.
2. Lay the victim down and reassure him.
3. Observe for signs of shock.
4. Rinse the wound with sterile saline solution or disinfected water. Surgery may be required to widen the entrance to the puncture wound. Suction is not effective for removing toxin.

5. Soak the wound in hot water for 30 to 90 minutes. This usually provides partial or total pain relief, but may sometimes be ineffective. The water should be as hot as the victim can tolerate but not hotter than 113°F (45°C). Immersion in water above 113°F (45°C) for longer than a brief period may lead to scalding. Use hot compresses if the wound is on the face. Adding magnesium sulfate (Epsom salts) or any other additive to the water offers no benefit. Hot water immersion is a useful technique that may be attempted for any puncture caused by a marine spine, such as that of the crown of thorns starfish (*Acanthaster planci*), the “horns” of the Pacific Lobster, spines of the Pacific Ratfish, and so forth.
6. Infiltration of the wound with 0.5 percent to 2.0 percent lidocaine without epinephrine, or another similar local anesthetic agent, is helpful in reducing pain. Narcotics may also be needed to manage severe pain.
7. Clean and debride the wound. Spines and sheath frequently remain within the wound. Be sure to remove all remnants of the spines or they may continue to release venom.
8. Tourniquets or pressure-immobilization are not advised. Use an antiseptic or antibiotic ointment and sterile dressing. Restrict movement of the extremity with splints and cravats.
9. Administer tetanus immunization as appropriate.
10. Treat prophylactically with topical antiseptic ointment. If more than a few hours to treatment will transpire, administer an antibiotic such as ciprofloxacin.

5C-3.2 Highly Toxic Fish (Stonefish, Scorpionfish, and Zebrafish/Lionfish). Stings by stonefish, scorpionfish, and zebrafish, also known as lionfish, may be quite severe. While many similarities exist between these fish and the venomous fish mentioned in the previous section, this separate section has been included because of the greater toxicity of their venoms and the availability of stonefish antivenin. Local symptoms are similar to those of other fish-induced envenomations except that they are generally more severe and may persist for days. With the sting of a stonefish, pain may be extraordinary and local tissue destruction extensive. Generalized symptoms are often present and may include respiratory failure and cardiovascular collapse. These fish are widely distributed in temperate and tropical seas. Zebrafish/Lionfish are now found in the Gulf of Mexico, Caribbean, and Atlantic Coast of the United States. They are shallow-water bottom dwellers. Stonefish and scorpionfish are less ornate with rugose or flattened bodies, sometimes dark and mottled. They tend to take on the appearance of their surroundings. Zebrafish are ornate and feathery in appearance with alternating patches of dark and light colors and stripes ([Figure 5C-6](#)).

5C-3.2.1 Prevention. Prevention is the same as for venomous fish ([paragraph 5C-3.1.1](#)).

5C-3.2.2 First Aid and Treatment.

1. Provide the same first aid as that given for venomous fish ([paragraph 5C-3.1.2](#)).

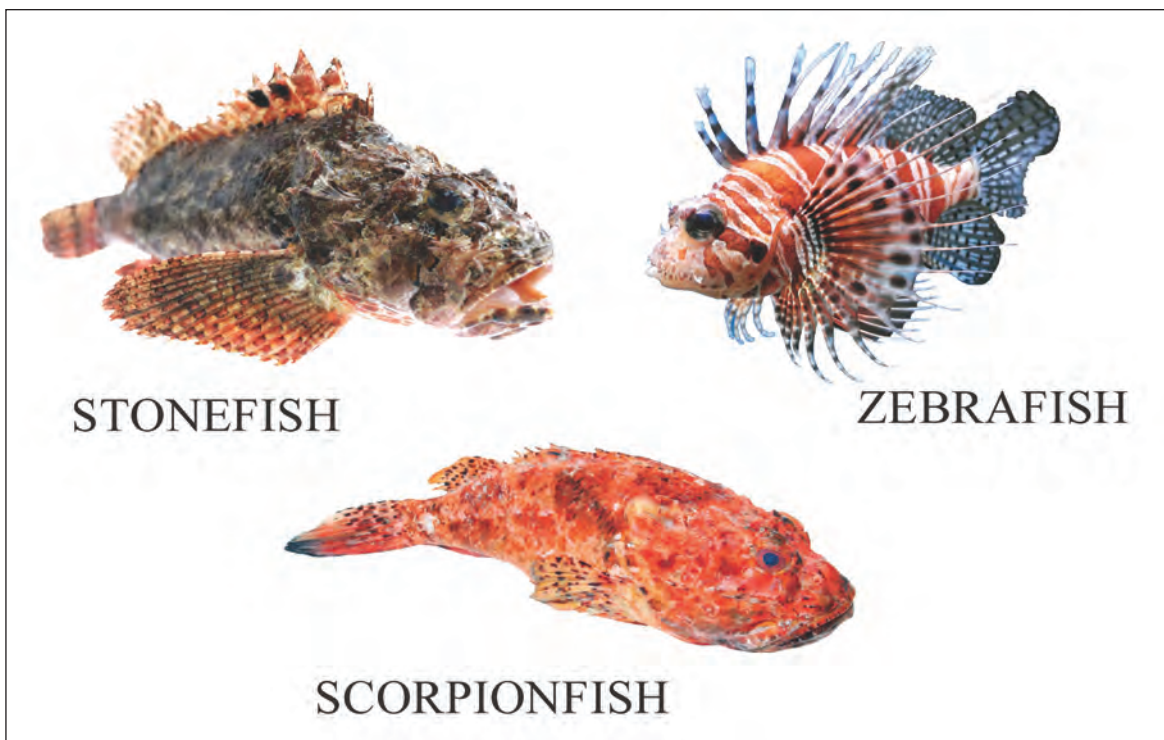


Figure 5C-6. Highly Toxic Fish.

2. Observe the victim carefully for possible development of life-threatening complications. The venoms affect many organ systems, including skeletal, involuntary, and cardiac muscle. This may result in muscular paralysis, respiratory depression, peripheral vasodilation, shock, cardiac dysrhythmias, and cardiac arrest.
3. Clean and debride the wound.
4. Stonefish antivenom is available from Commonwealth Serum Laboratories, Melbourne, Australia (see Reference 1 at end of this appendix for address and phone number). If antivenom is used, the directions regarding dosage and sensitivity testing on the accompanying package insert should be followed and the treating physician must be ready to treat anaphylaxis (severe allergic reaction). In brief, one or two punctures require 2,000 units (one vial); three to four punctures, 4,000 units (two vials); and five to six punctures, 6,000 units (three vials). Antivenin is delivered by slow IV injection while the victim is closely monitored for anaphylaxis.
5. Institute tetanus prophylaxis, analgesic therapy and antibiotics as described for other fish stings.

5C-3.3 Stingrays. Stingrays are common in all tropical, subtropical, warm, and temperate regions. They usually favor sheltered water and burrow into sand with only the eyes and tail exposed. The stingray has a bat-like shape and a long caudal appendage (“tail”) (Figure 5C-7). Most attacks occur when waders inadvertently step on the top surface of a ray, causing it to lash out defensively with its tail. The spine(s)

is located near the base of the tail. Wounds are either punctures or lacerations and are extremely painful. The wound appears swollen and pale with a blue rim. Secondary wound infections are common. Systemic symptoms may include fainting, nausea, vomiting, sweating, respiratory difficulty, and cardiovascular collapse.

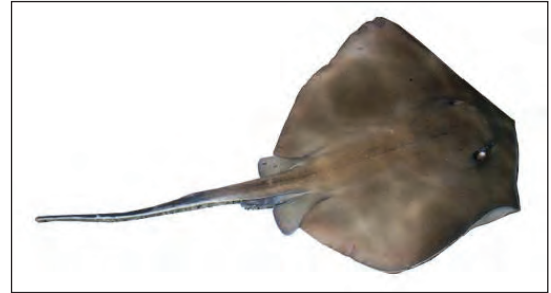


Figure 5C-7. Stingray.

5C-3.3.1 Prevention. In shallow waters which favor stingray habitation, shuffle feet on the bottom and probe with a stick to alert the rays and cause them to flee.

5C-3.3.2 First Aid and Treatment.

1. Give the same first aid as that given for venomous fish ([paragraph 5C-3.1.2](#)). No antivenom is available.
2. Institute hot water therapy as described under fish envenomation.
3. Clean and debride the wound. Remove the spine, if necessary by surgical means. Be sure to remove any remnants of the integumental sheath because it might continue to release toxin.
4. Observe the victim carefully for possible development of life-threatening complications. Symptoms can include cardiac dysrhythmias, hypotension, vomiting, diarrhea, sweating, muscle paralysis, respiratory depression, and cardiac arrest. Fatalities are quite rare. Intrathoracic or intraabdominal penetration may lead to organ puncture and/or serious hemorrhage. If the spine has impaled the victim in the neck or thorax, do not remove it until the victim has been brought to a facility where bleeding control can be promptly obtained in the operating room.
5. Institute tetanus immunization, analgesic therapy, and broad-spectrum antibiotics as described for fish envenomation.

5C-3.4 Coelenterates. Hazardous types of coelenterates include: Portuguese man-of-war, box jellyfish, sea nettle, sea wasp, sea blubber, sea anemone, and rosy anemone ([Figure 5C-8](#)). Jellyfish vary widely in color (blue, green, pink, red, brown) or may be transparent. They appear as balloon-like floats with tentacles dangling down into the water. The most common marine stinging injury is the jellyfish sting. Jellyfish can come into direct contact with divers in virtually all oceanic regions worldwide. When this happens, the diver is exposed to potentially tens of thousands of minute stinging nematocysts in the tentacles. Most jellyfish stings result only in painful, transient local skin irritation. The box jellyfish and other similar creatures, and Portuguese man-of-war are among the most dangerous types. The sea box jellyfish *Chironex fleckeri* (found in the Indo-Pacific) can

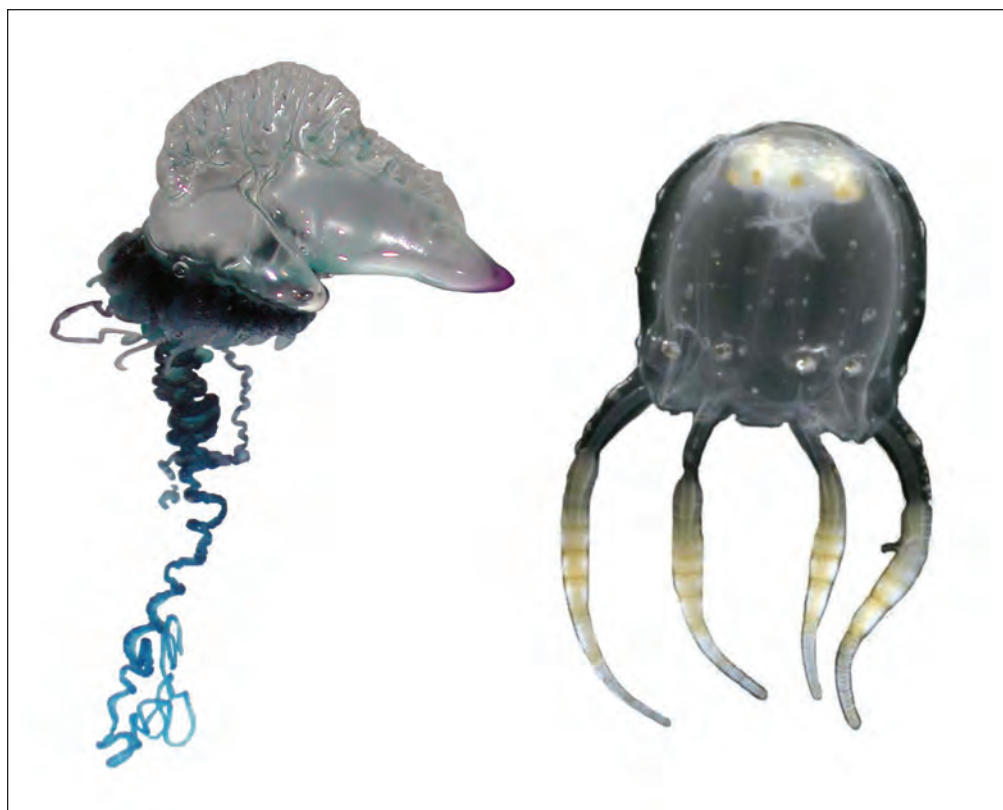


Figure 5C-8. Coelenterates. Hazardous coelenterates include the Portuguese Man-of-War (left) and the sea wasp (right).

induce death within 10 minutes of a sting by cardiovascular collapse, respiratory failure, and muscular paralysis. Deaths from Portuguese man-of-war stings, some of which may be attributed to allergic reactions, have also been reported. Even though intoxication from ingesting poisonous sea anemones is rare, sea anemones must not be eaten.

- 5C-3.4.1 **Prevention.** Do not handle jellyfish. Beached or apparently dead specimens may still be able to sting. Even towels or clothing contaminated with the stinging nematocysts may cause stinging months later.
- 5C-3.4.2 **Avoidance of Tentacles.** In some species of jellyfish, tentacles may trail for great distances horizontally or vertically in the water and are not easily seen by the diver. Swimmers and divers should avoid close proximity to jellyfish to prevent contacting their tentacles, especially when near the surface.
- 5C-3.4.3 **Protection Against Jellyfish.** Wet suits, body shells, or protective clothing should be worn when diving in waters where jellyfish are abundant. Petroleum jelly applied to exposed skin (e.g., around the mouth) helps to prevent stinging, but caution should be used since petroleum jelly can deteriorate rubber products. Safe Sea is a commercial product that functions as a combination jellyfish sting inhibitor and sunscreen.

- 5C-3.4.4 **First Aid and Treatment.** Without rubbing, gently remove any remaining tentacles that can be grasped using a towel or clothing. For preventing further discharge of the stinging nematocysts, copiously apply lidocaine or vinegar (3- to 10-percent solution of acetic acid). Topical isopropyl (rubbing) alcohol is recommended by some experts as an alternative decontaminant. Vinegar is absolutely advised for a box jellyfish sting. Hot water immersion (similar to that used for stonefish – see above – may be beneficial. Methylated spirits or methanol, 100 percent alcohol and alcohol plus seawater mixtures have not been proven to be of benefit. Indeed, these compounds may also worsen the immediate pain. Picric acid, human urine, and fresh water also have been found to either be ineffective or to even discharge nematocysts and should not be used, except for the hot water therapy noted above. Rubbing sand is ineffective and may lead to further nematocyst discharge so should not be used.
- 5C-3.4.5 **Symptomatic Treatment.** Symptomatic treatment for the inflammatory response that occurs from 24 to 72 hours after the initial sting can include topical steroid therapy (not very effective), anesthetic ointment (lidocaine 2 percent), pramoxine lotion, and systemic antihistamines and/or analgesics. Benzocaine topical anesthetic preparations should generally be avoided because they sometimes cause sensitization that leads to later skin reactions.
- 5C-3.4.6 **Anaphylaxis.** Anaphylaxis (a severe allergic reaction) may result from jellyfish stings. It is treated in standard fashion with injected IM epinephrine (such as EpiPen) antihistamines, and systemic corticosteroids.
- 5C-3.4.7 **Antivenin.** Antivenom is available to neutralize the effects of the box jellyfish (*Chironex fleckeri*). Antivenom may be obtained from Commonwealth Serum Laboratories, Melbourne, Australia (See Reference 4 for contact information). Antivenom is preferentially administered slowly through an IV, with a controlled infusion technique if possible. IM injection is safe, but should be used only if the IV method is not feasible. An initial dose of one vial (20,000 units) of sea wasp antivenin should be used by the IV route and three containers if by the IM route. Antivenom should be kept refrigerated, not frozen, at 36 to 50° F (2 to 10° C). Allergic reaction to antivenom should be treated with an IM injection of epinephrine (0.3 cc of 1:1,000 dilution), corticosteroids, and antihistamines. Treat hypotension (severely low blood pressure) with IV volume expanders and pressor medication as necessary.
- 5C-3.5 **Coral.** Coral, a porous, rock-like formation, is usually found in tropical and subtropical waters. Coral edges may be extremely sharp such that the most delicate-appearing coral may be the most hazardous because of its razor-sharp edges. Coral cuts, while usually fairly superficial, take a long time to heal and can cause temporary disability. The smallest cut, if left untreated, can fester and develop into a skin ulcer. Infections often occur and may be recognized by the presence of a red and tender area surrounding the wound. All coral cuts should receive medical attention. Some varieties of coral can actually sting a diver since certain structures termed “coral,” such as “fire coral,” are actually coelenterates with stinging cells.

5C-3.5.1 **Prevention.** Extreme care should be used when working near coral. Coral is often located within a reef formation subjected to heavy surface water action, surface current, and bottom current. Surge sometimes develops in reef areas. For this reason, it is easy for a diver or surface swimmer to be swept or tumbled across coral.

5C-3.5.2 **Protection Against Coral.** Coral should not be handled with bare hands. Feet should be protected with booties, coral shoes or tennis shoes. Wet suits and protective clothing, especially gloves (neoprene or heavy work gloves), should be worn when near coral.

5C-3.5.3 **First Aid and Treatment.**

1. Control local bleeding.
2. Promptly clean with soap and water, and then with medicinal (dilute) hydrogen peroxide or 10-percent povidone-iodine solution. If possible, sharply debride any jagged edges of full thickness skin wound, removing as best possible all foreign particles.
3. Apply antiseptic ointment, such as bacitracin, and cover with a clean dressing.
4. Administer tetanus immunization as appropriate.
5. Topical antiseptic ointment has been proven very effective in preventing infection. In severe cases, restrict the victim to bed rest with elevation of the extremity, wet-to-dry dressings, and systemic antibiotics. Systemic steroids may be needed to manage the inflammatory reaction resulting from a combination of trauma and allergic dermatitis. It may be difficult to differentiate infection from hypersensitivity.

5C-3.6 **Octopuses.** The octopus inhabits tropical and temperate oceans. Species vary depending on region. It is configured as a large head sac surrounded by 8 to 10 tentacles (Figure 5C-9). The head sac houses well-developed eyes, and horny jaws on the mouth. Movement is made by jet action produced by expelling water from the mantle cavity through the siphon. The octopus will hide in caves, crevices and shells. It possesses a well-developed venom apparatus in its salivary glands, and injures its victim by biting. Most species of octopus found in the U.S. are harmless. The blue-ringed octopus common in Australian and Indo-Pacific waters may inflict fatal bites. The venom of the blue-ringed or spotted octopus



Figure 5C-9. Octopus.

is a neuromuscular blocker called tetrodotoxin, which is also found in pufferfish. Envenomation from the bite of such an octopus may lead to muscular paralysis, vomiting, respiratory difficulty, visual disturbances, and cardiovascular collapse. Octopus bites usually consist of two small punctures. The bite may be painless, or a burning or tingling sensation may soon spread. Swelling, redness, and inflammation are common. Local bleeding just after the bite may be brisk because the clotting ability of the blood is sometimes retarded by the anticoagulant action of venom.

5C-3.6.1 **Prevention.** Extreme care should be used when reaching into locations, such as caves and crevices that are dark or not well visualized. Regardless of size, an octopus should be handled carefully even while wearing gloves. One should not spear an octopus, especially the large ones found off the coast of the northwestern United States, because of the risk of being entangled within its tentacles. If killing an octopus becomes necessary, stabbing it between the eyes is recommended.

5C-3.6.2 **First Aid and Treatment.**

1. Control local bleeding.
2. Clean the wound and cover it with a clean dressing.
3. For a suspected blue-ringed octopus bite, apply direct pressure with a pressure bandage and immobilize the extremity in a position that is lower than the heart using splints and elastic bandages.
4. Be prepared to administer mouth-to-mouth breathing and cardiopulmonary resuscitation if necessary.
5. Blue-ringed octopus venom is heat stable and acts as a neurotoxin and neuromuscular blocking agent. It is not neutralized by hot water therapy. No antivenom is available.
6. Medical therapy for blue-ringed octopus bites is directed toward management of paralytic, cardiovascular, and respiratory complications. Respiratory arrest is common, so endotracheal intubation with mechanical ventilation may be required. Duration of paralysis is between 4 and 12 hours. Reassure the victim, who may be comprehending their surroundings even though paralyzed.
7. Administer tetanus immunization as appropriate.

5C-3.7 **Segmented Worms (Annelida) (Examples: Bloodworm, Bristleworm).** This invertebrate type varies according to region and is found in warm, tropical or temperate zones. It is usually found under rocks or coral and is especially common in the tropical Pacific, Bahamas, Florida Keys, and Gulf of Mexico. Annelida have long, segmented bodies with stinging bristle-like structures on each segment. Some species have jaws and can also inflict very painful bites. Venom causes swelling and pain.

5C-3.7.1 **Prevention.** Wear lightweight, cotton gloves to protect against bloodworms, but wear rubber or heavy leather gloves for protection against bristleworms.

5C-3.7.2 **First Aid and Treatment.**

1. Remove bristles with a very sticky tape such as adhesive tape or duct tape. Topical application of vinegar may lessen pain, but this effect is variable.
2. Treatment is directed toward relief of symptoms and may include topical steroid therapy, systemic antihistamines, and analgesics.
3. Wound infection can occur but can be easily prevented by cleaning the skin using an antiseptic solution of 10 percent povidone-iodine and topical antiseptic ointment. Systemic antibiotics may be needed for infections.

5C-3.8 **Sea Urchins.** Sea urchins have worldwide distribution. Each problematic species of sea urchin has a radial shape and penetrating spines or seizing organs, known as globiferous pedicellariae. Penetration by sea urchin spines or the grasp of pedicellariae can cause intense local pain due to venom effects. Numbness, generalized weakness, paresthesias, nausea, vomiting, and cardiac dysrhythmias have been reported.

5C-3.8.1 **Prevention.** Avoid contact with sea urchins. Protective footwear and gloves are recommended. Spines can penetrate wet suits, booties, and tennis shoes.

5C-3.8.2 **First Aid and Treatment.**

1. Remove large spine fragments gently, being very careful not to break them into small fragments that remain in the wound.
2. Soaking the injured body area in nonscalding hot water up to 113° F (45° C) may diminish pain.
3. Clean and debride the wound. Topical antiseptic ointment should be used to prevent infection, but a deep puncture wound(s) may initiate an infection. If feasible, culture the wound before administering systemic antibiotics for established infections.
4. Remove as many of the spines and as much of each spine as possible. Some small fragments may be absorbed by the body. Darkened skin may not indicate retained spines, but rather pigment that has been released from the spine's surface into the wound. Surgical removal, preferably with a dissecting microscope, may be required when spines are near nerves and joints. X-rays or other imaging techniques may be required to locate these spines. Spines can form granulomas months later.
5. Allergic reactions and bronchospasm can be controlled with IM epinephrine (0.3 cc of 1:1,000 aqueous dilution) and by using systemic antihistamines. There are no specific antivenoms available.

6. Administer tetanus immunization as appropriate.
7. Seek medical attention for deep wounds.

5C-3.9

Cone Snails. Cone snails (sometimes called cone “shells”) are widely distributed in all regions and usually found under rocks and coral or crawling along the sandy bottom. The snail’s shell is most often symmetrical in a spiral coil and colorfully patterned on its surface, with a distinct head, one to two pairs of tentacles, two eyes, and a large flattened foot on the body (Figure 5C-10). A cone snail sting should be considered to



Figure 5C-10. Cone Shell.

be as potentially severe as a venomous snake bite. The cone snail has a highly developed venom apparatus: venom is contained in darts inside the proboscis, which extrudes from the narrow end but is able to reach most of the animal. Cone snail punctures are followed by a stinging or burning sensation at the site of the wound. Numbness and tingling begin at the site of the wound and may spread to the rest of the body; involvement of the mouth and lips is severe. Other symptoms may include muscular paralysis, difficulty with swallowing and speech, visual disturbances, and respiratory distress.

5C-3.9.1

Prevention. Avoid handling cone snails. Venom can be injected through clothing and gloves.

5C-3.9.2

First Aid and Treatment.

1. Lay the victim down.
2. Apply direct pressure with a pressure bandage and immobilization in a position lower than the level of the heart using splints and elastic bandages.
3. Incision and suction are not recommended.
4. Transport the victim to a medical facility while ensuring that the victim is breathing adequately. Be prepared to administer mouth-to-mouth breathing if necessary.
5. Cone snail venom results in paresis or paralysis of skeletal muscle, with or without myalgias. Symptoms develop within minutes of the sting and effects can last up to 24 hours.
6. No antivenom is available.

7. Respiratory distress may occur due to neuromuscular blockade. Victims should be admitted to medical facilities and monitored closely for respiratory or cardiovascular demise. Treat as symptoms develop.
8. If pain is severe, a local anesthetic without epinephrine may be injected into the wound site or a nerve block may be performed. Analgesics that produce respiratory depression should be used with caution.
9. Management of severe stings is supportive. Breathing may need to be supported with endotracheal intubation and mechanical ventilation.
10. Administer tetanus prophylaxis as appropriate.

5C-3.10

Sea Snakes. The sea snake is an air-breathing reptile that has adapted to its aquatic environment by, among other things, developing a paddle-shaped tail. Sea snakes inhabit Indo-Pacific waters and the Red Sea. The most hazardous areas in which to swim are river mouths, where sea snakes sometimes congregate, and the water is more turbid.

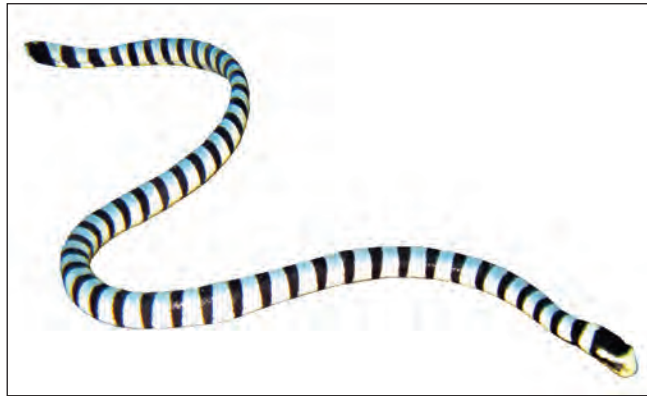


Figure 5C-11. Sea Snake.

The sea snake is a true snake, usually 3 to 4 feet in length, but may reach 9 feet. The most commonly encountered species are banded in appearance (Figure 5C-11). The sea snake is curious and while often attracted to divers, usually is not aggressive except during mating season.

5C-3.10.1

Sea Snake Bite Effects. Venom of certain sea snakes has toxicity that may exceed that of cobra venom. The bites usually appear as four puncture marks but may range from one to 20 punctures. Teeth may remain in the wound. The predominantly neurotoxic venom is heat-stable, so there is no clinical benefit to hot water immersion of the bitten body part. Due to the small jaws and short fangs of the snake, bites often do not result in envenomation. Sea snake bites characteristically produce little pain, and there is usually a latent period of 10 minutes to several hours before development of generalized symptoms: muscle aching and stiffness, thick tongue sensation, progressive paralysis, nausea, vomiting, difficult speech and swallowing, respiratory distress and failure, and dark-colored urine from myoglobinuria, which may herald incipient kidney failure.

5C-3.10.2

Prevention. Wet suits or protective clothing, especially gloves, may provide substantial protection against bites and should be worn when diving in waters where sea snakes are present. Shoes should be worn when walking where sea snakes are known to exist, including in the vicinity of fishing operations. Do not handle sea snakes. Bites often occur to the hands of fishermen attempting to remove snakes from nets.

5C-3.10.3 **First Aid and Treatment.**

1. Keep the victim still.
2. Apply direct pressure using a compression bandage and immobilize the extremity in the dependent position with splints and elastic bandages.
3. Incision and suction are not useful therapies.
4. Transport all sea snakebite victims to a medical facility as soon as possible, regardless of their current symptoms, as antivenom will likely be necessary.
5. Watch to ensure that the victim is breathing adequately. Be prepared to administer mouth-to-mouth breathing or cardiopulmonary resuscitation.
6. The venom predominately blocks neuromuscular transmission. Myonecrosis with myoglobinuria and renal damage are often seen. Hypotension may develop.
7. Respiratory arrest may result from generalized muscular paralysis; endotracheal intubation and mechanical ventilation may be required.
8. Renal function should be closely monitored because peritoneal or hemodialysis may be needed. Alkalinization of urine with sufficient IV fluids will promote myoglobin excretion. Monitor renal function and fluid balance anticipating acute renal failure.
9. Vital signs should be monitored closely. Cardiovascular support plus oxygen and IV fluids may be required.
10. Because of the possibility of delayed onset of symptoms, all sea snakebite victims should be observed for at least 12 hours.
11. If symptoms of envenomation occur within one hour, antivenom should be administered as soon as possible. In a seriously envenomed victim, antivenom therapy may be helpful even after a significant delay. Antivenom is available from Commonwealth Serum Laboratories in Melbourne, Australia and in the United States (see Reference number 1 of this appendix for address and phone number). If antivenom is used, follow the directions regarding dosage and sensitivity testing provided on the accompanying package insert. Be prepared to treat anaphylaxis (severe allergic reaction). Infusion of antivenom by the IV method or closely monitored drip over a period of one hour is recommended.
12. Administer tetanus immunization as appropriate.

5C-3.11 Sponges. Sponges induce skin irritation (dermatitis) with chemical irritants and spicules of silica or calcium carbonate embedded in a fibrous skeleton.

5C-3.11.1 Prevention. Avoid contact with sponges. Always wear gloves when handling live sponges.

5C-3.11.2 **First Aid and Treatment.**

1. Adhesive or duct tape can remove some of the sponge spicules.
2. Household vinegar (3- to 10-percent acetic acid solution) should be applied with saturated compresses for 30 to 60 minutes in an initial decontamination as soon as possible after contact with a sponge.
3. Antihistamine (e.g., diphenhydramine) lotion and later a topical steroid (e.g., hydrocortisone) may be applied to reduce the early inflammatory reaction. Severe reactions may require systemic administration (e.g., oral or injection) of a corticosteroid.
4. Antiseptic ointment is utilized if there are signs and symptoms of infection.

5C-4 POISONOUS MARINE ANIMALS

5C-4.1 Ciguatera Fish Poisoning. Ciguatera poisoning is caused by eating the flesh of a fish that has eaten a toxin-producing micro-organism, the dinoflagellate *Gambierdiscus toxicus*, or certain other species of dinoflagellates. The poisoning is common in reef fish between latitudes 35°N and 35°S around tropical islands or tropical and semitropical shorelines in south Florida, the Caribbean, the West Indies, and the Pacific and Indian Oceans. Fish and marine animals affected include barracuda, red snapper, grouper, sea bass, amberjack, parrotfish, and the moray eel. Incidence is unpredictable and depends on environmental changes that affect the level of dinoflagellates. The toxin is heat-stable, tasteless, and odorless, and is not destroyed by cooking or gastric acid. Symptoms may begin immediately or within several hours of ingestion and may include nausea, vomiting, diarrhea, itching and muscle weakness, aches and spasms. Neurological symptoms may include pain, ataxia (stumbling gait), paresthesias (tingling), and circumoral parasthesias (numbness around the mouth). Apparent reversal of hot and cold sensation when touching or eating objects of extreme temperatures may occur. In severe cases, respiratory failure and cardiovascular collapse may occur. Pruritus (itching) is characteristically made worse by alcohol ingestion. Gastrointestinal symptoms usually disappear within 24 to 72 hours. Although complete recovery will occur in the majority of cases, neurological symptoms may persist for months or years. Signs and symptoms of ciguatera fish poisoning may be misdiagnosed as decompression sickness or contact dermatitis from presumed contact with fire coral or jellyfish. Because of international transport of fish and rapid modern travel, ciguatera poisoning may occur far from endemic areas and afflict international travelers or unsuspecting restaurant patrons.

5C-4.1.1 Prevention. Never eat the liver, viscera, or roe (eggs) of any tropical fish. Unusually large fish of any given species may be more toxic. When traveling, consult natives concerning fish poisoning from local fish, although such information may not be reliable. Although there is a radioimmunoassay to test fish flesh for the presence of the toxin, there is no diagnostic test that can be applied to human victims.

5C-4.1.2 First Aid and Treatment.

1. Treatment is supportive and based upon symptoms.
2. In addition to the symptoms described above, other complications that may require treatment include hypotension and cardiac dysrhythmias.
3. Antiemetics and antidiarrheal agents may be required if gastrointestinal symptoms are severe. Atropine may be needed to control bradycardia. IV fluids may be needed to treat hypotension.
4. Intravenous mannitol infusion has been reported to be useful for severe acute ciguatera poisoning. Amytriptyline has been used successfully to resolve neurological symptoms such as depression.
5. Cool showers may induce pruritus (itching).

5C-4.2 Scombroid Fish Poisoning. Scombroid fish poisoning occurs from certain fish that have not been promptly cooled or prepared for immediate consumption. Typical fish causing scombroid poisoning include tuna, skipjack, mackerel, bonito, dolphin fish, mahi mahi (Pacific dolphin), and bluefish. Fish that cause scombroid poisoning are found in tropical and temperate waters. Bacteria in the fish flesh stimulate production of histamine and saurine (a histamine-like compound), which produce the symptoms of a histamine-like reaction: nausea, abdominal pain, vomiting, facial flushing, urticaria (hives), headache, pruritus (itching), bronchospasm, and a burning or itching sensation in the mouth. Symptoms may begin one hour after ingestion and last 8 to 12 hours. Death is rare.

5C-4.2.1 Prevention. Immediately clean any fish and preserve by rapid chilling. Do not eat any fish that has been left in the sun or in the heat longer than two hours. Try to place all fish intended for consumption on ice or in a cold refrigerator.

5C-4.2.2 First Aid and Treatment. An oral antihistamine, (e.g., diphenhydramine, cimetidine), epinephrine (given subcutaneously), and steroids are given as needed.

5C-4.3 Pufferfish (Fugu) Poisoning. An extremely potent neurotoxin called tetrodotoxin is found in the viscera, gonads, liver, and skin of a variety of fish, including the pufferfish, porcupinefish, and ocean sunfish. Pufferfish—also called blowfish, toadfish, and balloonfish, and called “fugu” in Japan—are found primarily in the tropics but also in temperate waters of the coastal U.S., Africa, South America, Asia, and the Mediterranean. Pufferfish is considered a delicacy in Japan, where it is thinly sliced and eaten as sashimi. Licensed chefs are trained to select the pufferfish least likely to be poisonous and also to avoid contact with the visceral organs in which resides concentrated poison. The first sign of poisoning is usually tingling around the mouth, which spreads to the extremities and may lead to body wide numbness. Neurological findings may progress to stumbling gait (ataxia), generalized weakness, and paralysis. The victim, though paralyzed, may remain conscious until death occurs from respiratory arrest.

5C-4.3.1 Prevention. Avoid eating pufferfish. Cooking the fish flesh does not destroy the toxin.

5C-4.3.2 **First Aid and Treatment.**

1. Provide supportive care with airway management. Monitor breathing and circulation.
2. Monitor rectal sphincter tone for progression of paralysis.
3. Monitor and treat cardiac dysrhythmias.

5C-4.4 Paralytic Shellfish Poisoning (PSP) (“Red Tide”). Paralytic shellfish poisoning (PSP) is due to mollusks (bivalves), such as clams, oysters, and mussels that ingest neurotoxin-containing dinoflagellates. Proliferation of these dinoflagellates in the ocean during certain months of the year produce a characteristic red (or other colored) tide. Some dinoflagellate blooms are colorless, so that poisonous mollusks may unknowingly be consumed. Local public health authorities must monitor seawater and shellfish samples to detect the toxin(s). Poisonous shellfish cannot be detected by appearance, smell, or folk methods (e.g., discoloration of either a silver object or a clove of garlic placed in cooking water). Poisonous shellfish can be found in either low or high tidal zones. Toxic varieties of dinoflagellates are common in the following areas: northwestern U.S. and Canada, Alaska, part of western South America, northeastern U.S., the North Sea European countries, and in the Gulf Coast area of the U.S. One type of dinoflagellate, although not toxic if ingested, may lead to eye and respiratory tract irritation from shoreline exposure when a “bloom” becomes aerosolized by wave action and wind.

5C-4.4.1 Symptoms. Symptoms of systemic PSP include circumoral paresthesias (tingling around the mouth), which spreads to the extremities and may progress to muscle weakness, ataxia, salivation, intense thirst, and difficulty swallowing. Gastrointestinal symptoms are not common. Death, although uncommon, can result from respiratory arrest. Symptoms begin 30 minutes after ingestion and may last for many weeks. Gastrointestinal illness occurring several hours after ingestion is most likely due to bacterial contamination of the shellfish (see paragraph 5C 4.5). Allergic reactions such as urticaria (hives), pruritus (itching), dryness or scratching sensation in the throat, swollen tongue and bronchospasm may reflect individual hypersensitivity to a specific shellfish and not be related to PSP.

5C-4.4.2 Prevention. The toxins are heat stable, so cooking does not prevent poisoning. Broth or bouillon in which shellfish is boiled is especially dangerous because the toxins are water-soluble and will concentrate in the broth.

5C-4.4.3 First Aid and Treatment.

1. No antidote is known. Lavaging the stomach with alkaline fluids (e.g., a solution of baking soda) has been reported to be helpful, but is unlikely to be of great benefit.
2. Provide supportive treatment with close observation and advanced life support as needed until the illness resolves.

- 5C-4.5 Bacterial and Viral Diseases from Shellfish.** Large outbreaks of typhoid fever and other diarrheal diseases caused by the bacteria genus *Vibrio* have been traced to consuming contaminated raw oysters and inadequately cooked crabs and shrimp. Diarrheal stool samples from victims suspected of having bacterial and viral diseases from shellfish should be placed on a special growth medium (e.g., thiosulfate-citrate-bile salts-sucrose agar) to specifically grow *Vibrio* species, with isolates being sent to reference laboratories for confirmation.
- 5C-4.5.1 Prevention.** To avoid bacterial or viral disease (e.g., Hepatitis A or Norwalk viral gastroenteritis) associated with oysters, clams, and other shellfish, an individual should eat only thoroughly cooked shellfish. It has been proven that eating raw shellfish (mollusks) definitely presents a risk for contracting gastroenteric disease.
- 5C-4.5.2 First Aid and Treatment.**
1. Provide supportive care with attention to maintaining fluid intake by mouth or IV.
 2. Consult medical personnel for treatment of the various *Vibrio* species that may be suspected.
- 5C-4.6 Sea Cucumbers.** The sea cucumber is frequently eaten in some parts of the world, where it is sold as “tre pang” or “beche-de-mer.” It is boiled and then dried in the sun or smoked. Contact with the liquid ejected from the visceral cavity of some sea cucumber species may result in a severe skin reaction (dermatitis) or even blindness. Intoxication from sea cucumber ingestion is rare.
- 5C-4.6.1 Prevention.** Local inhabitants can advise about the edibility of sea cucumbers in that region. However, this information may not be reliable. Avoid contact with visceral juices.
- 5C-4.6.2 First Aid and Treatment.** Because no antidote is known, treatment is symptomatic. Skin irritation may be treated as are jellyfish stings ([paragraph 5C 3.4.4](#)).
- 5C-4.7 Parasitic Infestation.** Parasitic infestations of fish can be of two types: superficial and within the flesh. Superficial parasites burrow into the surface of fish and are easily seen and removed. These may include fish lice, anchor worms, and leeches. Parasites embedded into flesh can become encysted or remain free in the muscle, entrails, and gills of the fish. These parasites may include roundworms, tapeworms, and flukes. If the fish is inadequately cooked, these parasites can be passed on to humans.
- 5C-4.7.1 Prevention.** Avoid eating raw fish. Prepare all fish by thorough cooking or hot-smoking. When cleaning fish, look for mealy or encysted areas in the flesh; cut out and discard any cyst or suspicious areas. Remove all superficial parasites. Never eat the entrails or viscera of any fish.