

Diving And The Environment

Topics Covered Today

To gain a more comprehensive understanding of this world, we will examine:

- The Marine Environment
 - Saltwater, Freshwater, Currents and Tides
- Marine Life
- Ecology

The Marine Environment

Salt Water Diving

Buoyancy and other characteristics

- Sea water is 2.5% denser than fresh water* so you are more buoyant.
- You will need to add more weight to your belt to compensate for this. (or reduce weight when you go from salt to fresh water)
- Various methodologies exist to calculate how much extra weight is needed in salt water diving.
- The typical method is to test on site to ensure adequate weight
- One method to estimate a starting point is to:
- [your weight + weight of gear + weight of empty tank] multiplied by .025

EXAMPLE: [180 pounds + 40 pounds + 35 pounds] X .025 = 6.4 pounds (extra weight required)**

*Note: 1 cubic foot of salt water weighs 64 lbs; 1 cubic foot of fresh water weighs 62 lbs

** You will also have to take into consideration exposure protection (e.g., drysuit v. bathing suit)

Other considerations for diving in marine (salt) water environments

Rinse gear with fresh water to remove salt crystals and other contaminants.

Salt water has an unpleasant taste and will irritate your eyes. A good fitting mask and proper technique for clearing your snorkel and second stage is helpful.

When around water, keep in mind:

The sunshine factor (direct and reflected exposure):

- Cover up with *long sleeves, pants, hat, sunglasses*
- Wear sun block (*try to refrain from using until after diving*)
- Stay in the shade
- Stay hydrated

Tidal Currents

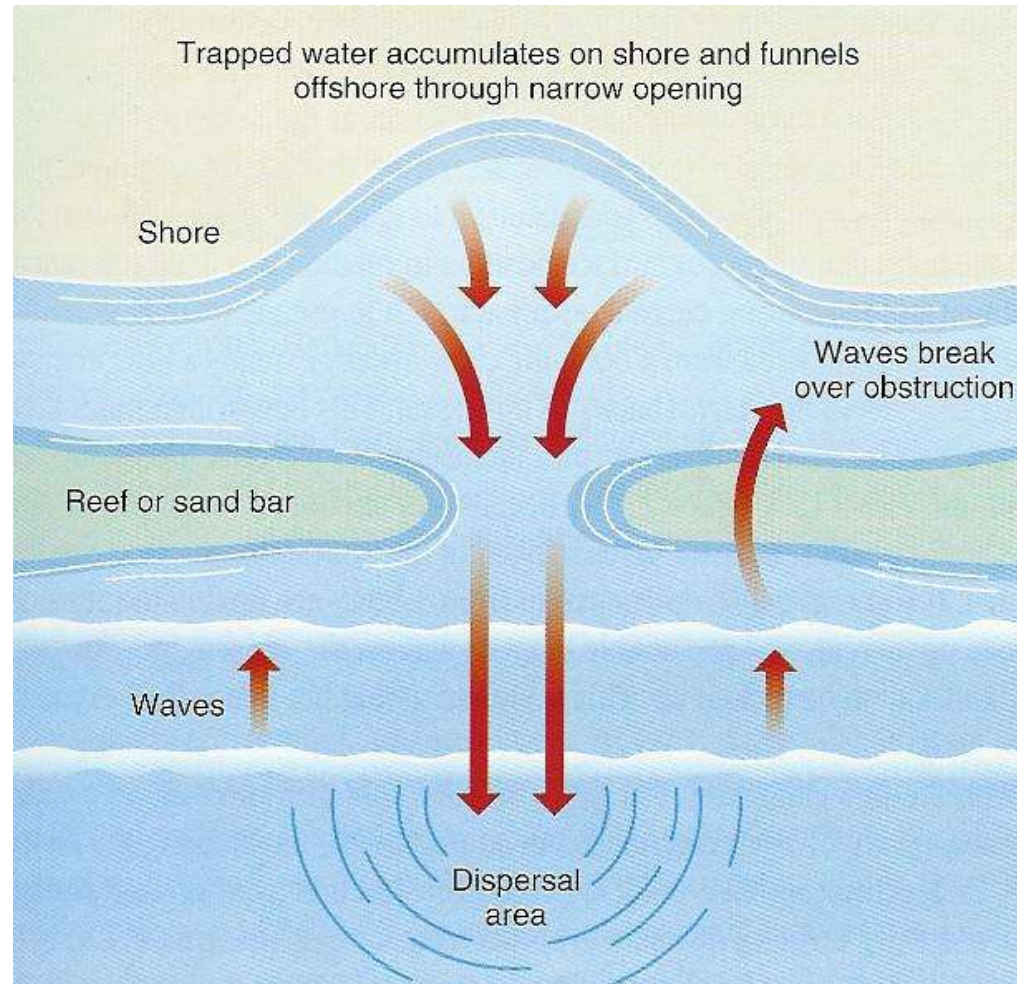
- **Flood tide:** incoming tidal flow
- **Ebb tide:** outgoing tidal flow
- **Slack tide:** the period between flood and ebb tides, when there is little or no current.
 - Most places on earth have 2 high and 2 low tides per day.
 - The moon is the greatest influence on tides.
 - Full moon / new moon – extremely high & low tides

At certain times, tides and currents may conflict and create hazards to divers. In partially enclosed bays and at the mouths of coastal rivers, currents often collide and churn.

Consult local dive shops or fishermen for optimal diving conditions.
Tide tables are available to assist mariners.

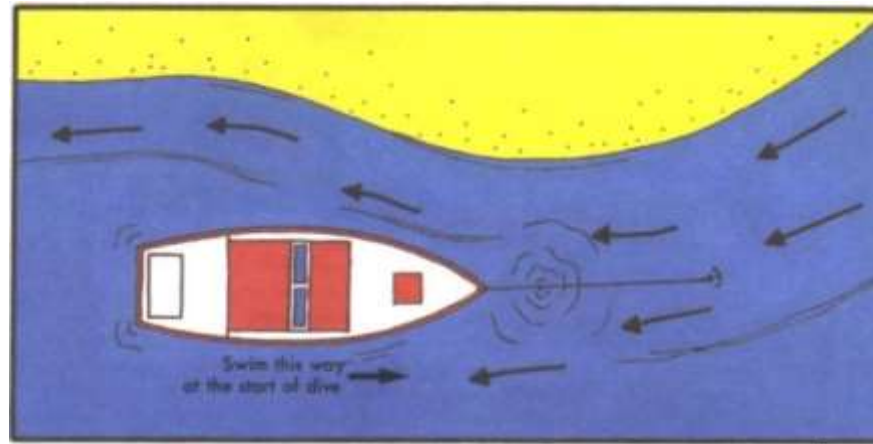
Rip Currents

- Backrush of water returning to sea through a narrow opening.
- Current will be narrow, strong and pull you away from shore. Dissipates shortly after passing through restriction.
- Identify by waves breaking off shore and fan shaped area of water on the shore.
- Recognize and avoid. Swim **parallel** to shore for about 60 ft and clear the rip, turn and proceed to shore.



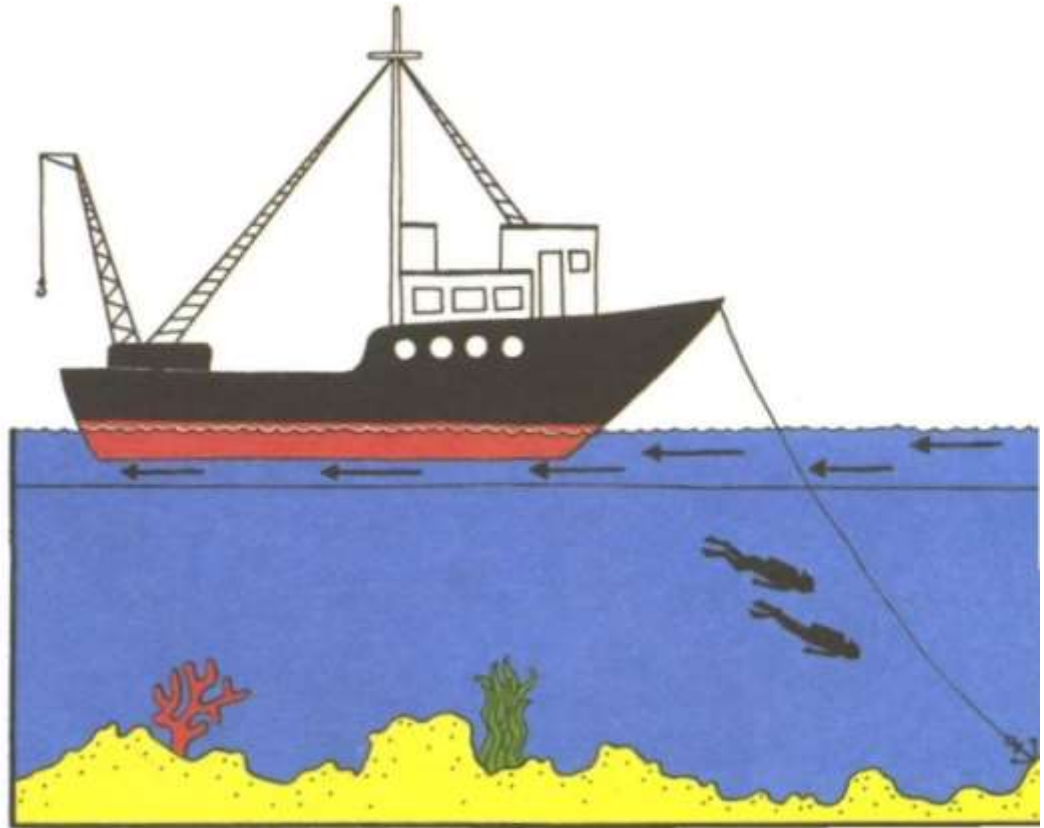
Long Shore Current

- Flows parallel to the beach; formed by constant waves striking the shore at an angle.
- Speed can be measured (distance/time).
- Boat will swing with the current (be cognizant of the wind).
- Go with the current and swim on a diagonal path to the shore.



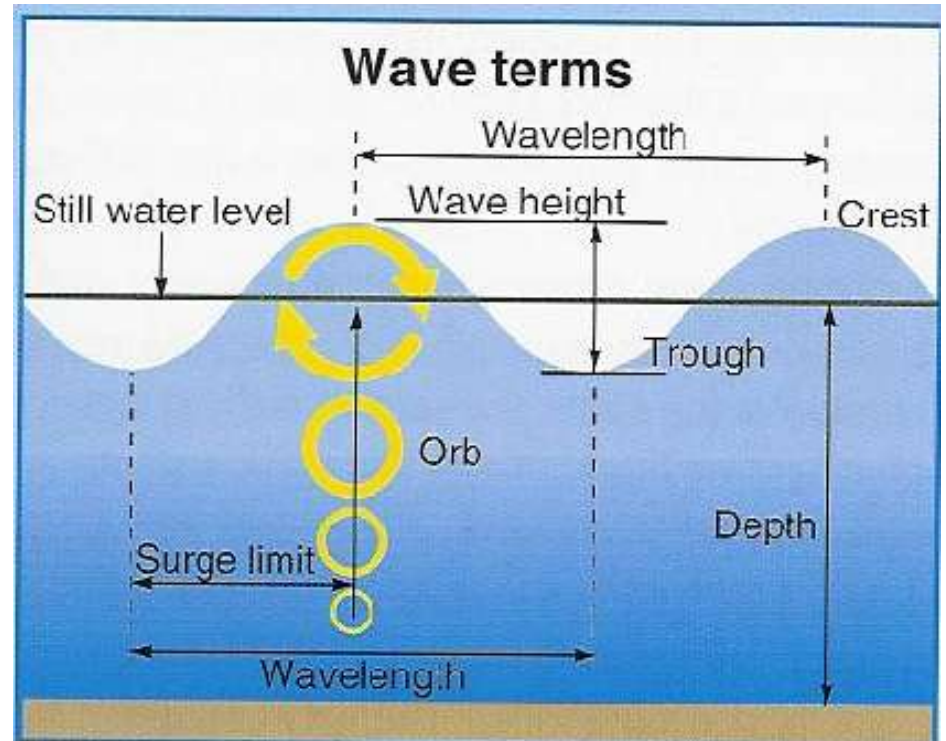
Swimming in Current

- Swim against the current first and return with the current using the rule of 3rds for air availability in your tank.
- Use a trailing line with a float off the back of your boat



Waves

- Crest: top of wave
- Trough: bottom of wave
- Wave length: crest to crest
- Wave height: trough to crest
- Wave period: time it takes two waves to pass a given point



Surf and Surge

Back and forth sub-surface motion.

The rush of water up onto the beach then back out to sea.

Makes entry and exit from shore tricky.

Can cause feeling of motion sickness.



Entry in Currents

- Have all equipment in place.
- Slide or shuffle backwards.
- Once deep enough, turn around and swim out through the surf with the regulator in your mouth.
- Let back rush of water help you out.

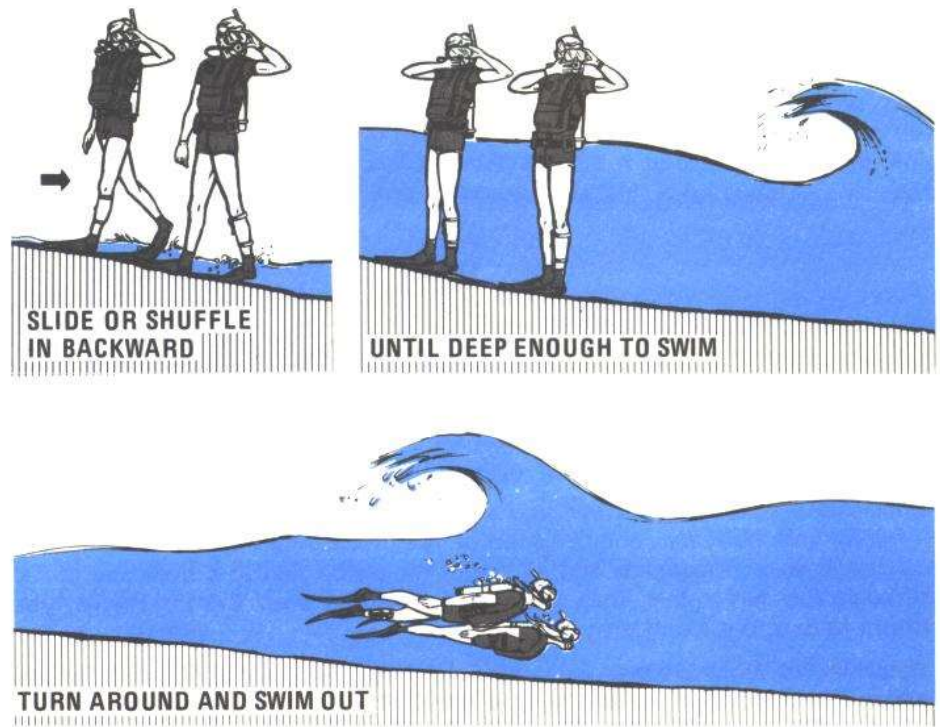


Fig. 3-23 Entering Surf

Exits

Surfacing from Depth

- Look up, arm above your head and rotate 360°.

Returning to Shore

- Surface a short distance from shore to evaluate the situation & check wave action.
- Swim into waist deep water, remove fins, grip tightly & walk in.

SAFETY PRECAUTIONS

Leave gear on (except fins) until on the boat or very close to shore

Carry a whistle

Carry a safety sausage

Have buoyancy compensator inflated

Navigation

- Descend facing the direction you will go (verify with compass).
- Start your dive **into** the current.
- Be aware of your surroundings. Take note of rocks, coral or other objects to help you locate your entry point.
- Look behind you every so often to familiarize yourself with the topography on the way back.
- When diving from shore, the slope will indicate the direction to travel in order to bring you back to the surface.
- Your exhausted bubbles will give you the surface direction.
- Wave action will cause a sandy bottom to develop contours that usually run parallel to shore.
- Note that kelp and grasses will lean with the current and suspended particles will flow with the current.
- Take the advanced diving course where you will learn about navigation.

The Freshwater Environment

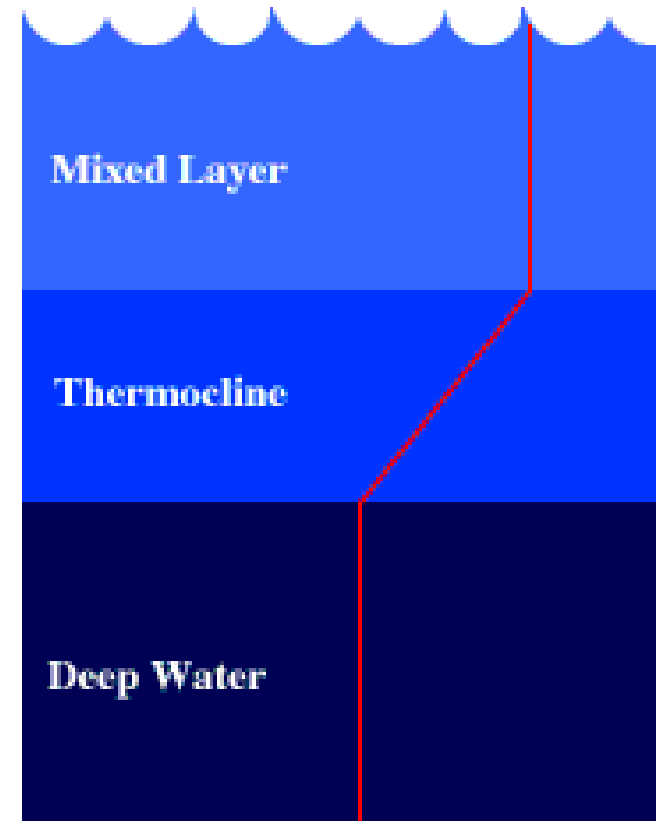
Freshwater Diving Locations

- *Rivers – currents, visibility, slippery banks*
 - *Lakes – weeds, garbage, sediments*
 - *Quarries – steep sides, sediments, left behind equipment*
-
- *18% of the world's freshwater is contained in the Great Lakes of North America*



Thermoclines

- The transition layer between the mixed layer at the surface and the deep water layer.
- The mixed layer temperature is roughly that of surface water.
- In the thermocline, the temperature decreases rapidly from the mixed layer temperature to the much colder deep water temperature.
- Protective wetsuit may be necessary.



Temperature



NOTE: Diving in cold water slows down your thinking.

Bottom Topography

- **Rock or Coral bottoms**
 - Clearer visibility, but may cause cuts and scrapes
 - Rocks often collect algae and can be slippery
 - Urchins cling to hard surfaces
 - May damage coral reefs if buoyancy not controlled
 - Wear gloves, boots and wetsuit
- **Sandy bottoms**
 - Silt will rise in clouds if disturbed, reducing visibility
 - Coral will die if covered with sand/sediment
 - Become neutrally buoyant & stay off the bottom
- **Mud bottoms**
 - May have a false bottom due to suspended sediment
 - Take care to not disturb bottom
 - Visibility may become obscured

Marine Life

Marine Plants

- **Kelp & Seaweed**

- Algae, attached by holdfasts to anchor the plant.
- Grow quickly (up to 1ft/day).
- Act as barriers to the shoreline against wave action.
- Located worldwide: in fresh and salt water.

Diving in Kelp/Seaweed

- Submerge feet first.
- Use arms to clear path.
- Stay calm, do not thrash, cut your way free.
- Vary kicks to minimize entanglement.
- Position knife, gauges etc.



Abrasions & Cuts

Barnacles

- Barnacles attach by means of an adhesive cement, produced by a gland, and secrete a shell around themselves.
- Form conspicuous encrustations on docks, boats, pilings, and rocky shores.
- Very sharp and will cut you if you bump into it.



Corals

- Colonies of polyps, animal not plant.
- Hard and soft corals (each hard coral polyp produces an external skeleton made of calcium carbonate).
- Types: finger, branching, horn, encrusting, leaf, brain, etc



Brain Coral

To minimize your impact on a coral reef, control your buoyancy and stay off the bottom



Fire Coral (don't touch)

Abrasions & Cuts

EFFECTS

- Redness, itching & pain
- Minor bleeding

TREATMENT

- Clean the wound with soap & water (remove any debris)
- Flush well with clear clean water
- Apply antiseptic ointment

PREVENTION

- Wear protective clothing (gloves, booties, wetsuits)
- **Avoid contact – Control your buoyancy**
- Be aware of your surroundings

Bites

Barracuda

Description

- Found in warm tropical regions
- Great Barracuda (Atlantic, Caribbean and Pacific) may be as large as 4 – 6 feet
- Bold and inquisitive, attracted to shiny reflective objects

Hazard to Diver

- Very fast with sharp jagged teeth and strong tearing jaws can leave large bite wounds with severe bleeding.
- Shows that it is agitated when grey spots along their sides turn black



© Bob Klemow

The muskellunge (muskie)
is often referred to as the freshwater barracuda

Octopus

Hazard to the diver

- Entanglement
- Bite from parrot-like beak



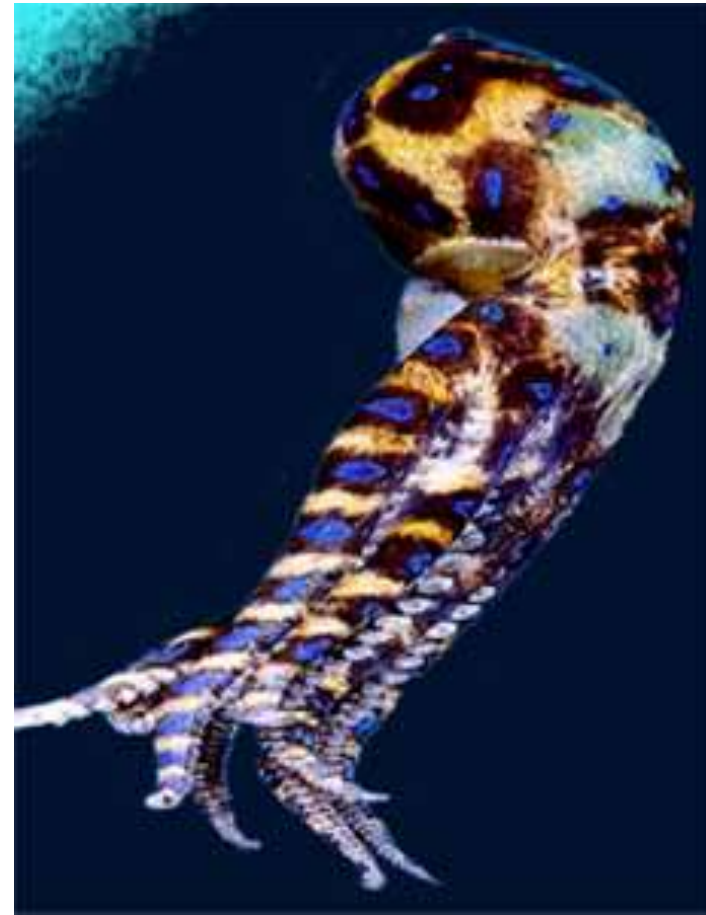
Blue-Ringed Octopus

Description

- Found in shallow reefs & tide pools from Japan to Australia
- Small, 20 cm (body mass the size of a golf ball)
- Usually dark brown or yellow, will change to vivid yellow with brilliant blue rings when angry

Effects

- Bite is often painless
- Produces a neuro-muscular poison in its salivary glands (10,000 times more potent than cyanide) leading to weakness, numbness, nausea, blindness, paralysis and respiratory failure



Sea Snakes

Description

- Approx 52 kinds, found everywhere except Atlantic, Red Sea and Mediterranean (Examples: Yellow belly, coral sea snake...)

Hazard

- Bite and inject venom (deadly)

Effects

- No redness, swelling or pain
- Delayed toxic reaction (20 min)
- Anxiety
- Muscle spasms
- Respiratory difficulty
- Convulsions
- Shock

FYI: Due to a persistent bite reflex, sea snakes can bite & inject venom for up to an hour after death!



Moray Eel

- Have poor eyesight, good sense of smell & sharp teeth
- Nocturnal, live in holes or caves in the reef and snatch hapless fish that wander by.
- Very fast with sharp jagged teeth and strong tearing jaws can leave large bite wounds with severe bleeding.
- DO NOT stick your hands in holes and crevasses



Sharks

- Over 250 species (only 6 types known to attack humans)
- Located in temperate waters worldwide
- Unpredictable: attacks can be unprovoked
- Lack air bladders so they need to keep swimming to maintain buoyancy
- Indiscriminate scavengers (will follow boats & eat garbage)
- Sensitive to sound, keen sense of smell (directional)
- Lateral line sensors (runs the length of their body assisting the shark in sensing predators or prey nearby)

Most sharks prefer cool waters,
so in warm tropical oceans they (usually) swim deep below the surface.

Orcas

- Resident orcas live in small life-long pods, travel near coastal areas and tend to feed on fish.
- Transients tend to hunt in packs for marine mammals including other whales.
- Offshore Killer Whales live in large groups (30-60 individuals) in open waters feeding on schooling fish and possibly sharks.
- 27 – 33 feet long
- Distinctive white & black markings
- Average orca will eat 550 lbs of food/day.
- Swim 30 mph+
- Inhabit seas worldwide
- Live 50-60 years



Sharks & Orcas

Hazard to diver

- Unprovoked attack / watch for shark posturing:
 - Exaggerated swimming motions, back arching, raising of the snout, lowering of the pectoral fins, and head swinging. The message is a clear one: BACK OFF!
- Massive wounds and death

Note: Spear fishing is a strong attractant to sharks and other predatory fish and is **not** encouraged by ACUC.



Turtles

Description

- Fresh and salt water
- Snapping Turtle is Canada's largest freshwater turtle
 - defensive if confronted on land, but in the water, they usually slip quietly away from any disturbance.

Hazard to Diver

- Bite

Effects

- Severe bite
- Pain swelling

Avoiding bites

- Do not handle marine life.
- Do not antagonize.
- Sharks: watch for posturing
- Back away facing the animal – do not turn away until clear.
- Do not wear shiny metal objects (barracuda).
- Avoid carrying fish or speared game.
- Don't feed eels or stick your hand in their homes. If bitten do not pull hand away quickly as teeth are slanted back.
- Avoid thrashing on surface (sharks).

Stings

Cone Shells

Description

- 400 poisonous species, 6 dangerous types
- Found in Indo–Pacific and Australia
- Bottom dwellers, buried in sand during day and emerge to eat at night.

Effects on Diver

- Speared from narrow end, releasing poisonous dart
- Pain, numbness, tingling around lips & mouth, respiratory distress, coma and death



JELLY FISH

Hazard to Diver

- Stinging tentacles (nematocysts)

Effects

- Stinging, burning shooting pain
- Redness, swelling, nausea, vomiting, abdominal cramps, respiratory distress, delirium & convulsions
- A large sea wasp is potentially deadly

Sea Nettles: found from BC to Mexico (and on the East Coast). Golden brown bell up to 10" in diameter, tentacles can trail for several meters.

Sea Wasps (aka Box Jelly): found in most oceans and seas. Almost clear they are difficult to see; bell ranges from 3-4.5" in diameter



Portuguese Man-Of-War

Colony of four individual animals

- Blue with iridescent shades of pink or green
- Floats on the surface
- Tentacles as long as 165 feet
- Float is a pear-shaped sac that secretes its own gas and with aerodynamic properties can catch the wind like a sail to change course
- Dead ones on shore still dangerous



Bristle Worm/Fire Worm

Description

- Found on most reefs
- Tan colored segmented bodies; covered with tufts of bright pink to orange or red & white sensory hairs

Hazard to Diver

- Tiny stinging bristles cause burning, red spots



Treatment

- No anti-venom for cone shells
- Pressure bandage to stop venom from spreading
- Keep victim still and transport to medical facility
- Do not rub the area (fire coral or jellies)
- Remove embedded bristles with tape (fire worms)
- Soak the stung area in vinegar, rubbing alcohol or diluted ammonia
- Ice for local relief
- Jellyfish stings – baking soda solution or meat tenderizer

Avoiding Stings

- Do not handle
 - If you must pick up a cone shell, handle from the **wider** end (no assurance you still may not get stung as the spear can reach the length of the shell)
 - Check local reports to see if there are Jelly Fish in the area
 - When surfacing from a dive where jellies are present, exhaust air from your octopus to displace any jellies in your ascent path.
- Wear protective gloves, boots and wetsuit
- Stay alert, be aware of the environment

Punctures

Sea Urchins

Description

- Spines may be short & blunt (cold water) or long and needle-sharp (warm water), are used as a defense against predators

Hazard to Diver

- Spines puncture skin and break off

Effects of penetration

- Intense burning, swelling, pain
- Irregular pulse and respiratory distress



Atlantic Ray

Hazard to Diver

- Puncture or laceration from serrated spine near end of tail

Effects

- Local pain, muscle cramps, weakness, nausea and shock



Stonefish

Description

- Found in Indo-Pacific/Australia
- Lies on bottom
- Excellent camouflage

Hazard to Diver

- 13 venomous spines



Lionfish

Description

- Found in Indo-Pacific region
 - coral reefs, especially in shallow waters,
 - hovering in caves or near crevices.
- Elongated dorsal fin spines and enlarged pectoral fins.
- Each species has a particular pattern of zebra-like stripes.

Hazard to Diver

- Venomous fin spines - fatalities are rare.



Venomous Fish

Effects

- Redness, swelling, pain,
- Muscle spasms,
- Respiratory distress and shock
- Temporary paralysis which may result in death if not treated
- Worse when more spines have punctured or deep penetration

Catfish (freshwater)

- Description
 - Global
- Hazard to diver
 - Venomous spines on dorsal and anal fins
 - Powerful neuromuscular sting
- Effects
 - Puncture wound
 - Pain, swelling
 - Nausea



Treatment of Puncture Wounds

- Remove spine or stinger if present
- Induce bleeding
- Soak in non-scalding hot water for 60 to 90 minutes
- Seek medical attention: antibiotics, anti-venom
- Be sure your tetanus immunization is current
- X-ray of the wound to detect any presence of broken spines
- Local anesthetic may provide relief in most cases.

Avoid the hazard

- Shuffle feet when entering the water
- Wear protective boots and wetsuit
- Maintain good buoyancy control
- Do not handle – avoid contact

Common Freshwater Animals

- Mammals - manatees, otters, muskrats and beavers.
- Amphibians - frogs, toads and salamanders
- Fish, crawfish, freshwater shrimp, insects
- Turtles, snakes, alligators

The waters of the world are rich in biological diversity.
ACUC encourages divers to respect the waters of the world.

NOTE: ACUC discourages spear fishing.

Ecology

Chemical Pollution

(Oil Pollution/Black Tides)

Spills from ships, offshore drilling, pipelines, routine bilge cleaning, leakage from wrecks, etc.



1989 Exxon Valdez oil spill in Prince William Sound, Alaska

Does this happen locally?

- Refueling recreational boats on our lakes & rivers
- Improper disposal of used engine oil or hydraulic fluids results in seepage into our waterways
- Oily road runoff from a city of 5 million could contain as much oil as a large tanker spill
- Air pollution from cars & industry: rain washes the hydrocarbons from the air into our lakes and oceans

Bacterial Pollution

- **Swimmer's Ear:**

Bacterial infection from polluted water

- Burosol solution

- If prone to swimmers ear, use a small amount of rubbing alcohol in each ear after swimming or diving to assist with evaporation & disinfection.

- **Hepatitis A, cholera, Salmonella, E.Coli**

- Contracted by ingesting contaminated water

- **Entomoeba Encephalitis:** through a cut you could contract a virus resulting in encephalitis (swelling of the brain)

Junk Pollution

Animals or fish (or *divers*), drown or strangle from entanglement. Animals and fish can become ill or die from ingesting plastics & other garbage

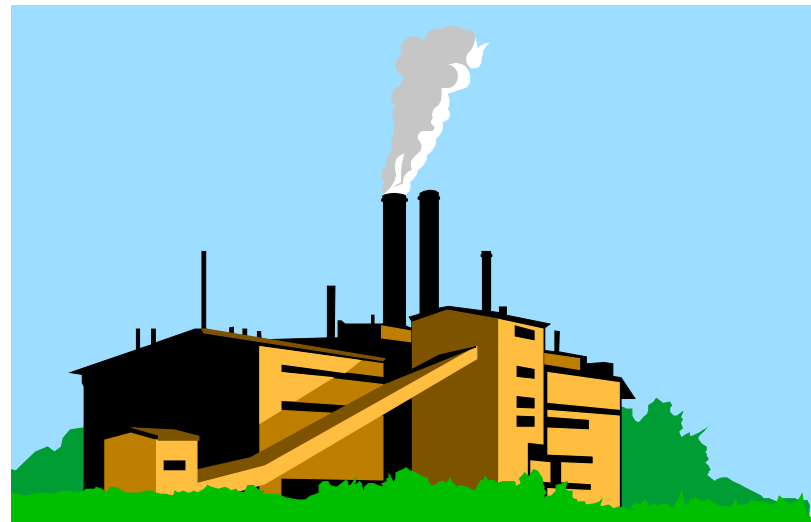
- Cans, bottles, shopping bags
- Barbed wire
- Fishing line
- Bicycles, shopping carts
- Guns, VCRs
- Vehicles
- Bank machines!

Putrification

- When large amounts of nutrients provided by pollution enter fresh water and cause vegetation overgrowth.
 - Chemical fertilizers from crops
 - Pesticides
 - Waste from cattle farms
- Plants die and rotting process absorbs oxygen in the water and produces lethal methane gas that kills animal life.

Acid Rain

- Industrial smoke stacks emit substances that form acid when mixed with water vapor in the atmosphere
- Results in rain and snow with high acid levels that cause freshwater creeks and lakes to turn acidic.
- Recognized by decrease in life forms - frogs and salamanders.



Red Tide

- Description
 - Population explosion of toxic naturally occurring dinoflagellates. Toxic blooms color the water reddish brown.
 - Factor which favor growth
 - Warm surface temps
 - High nutrient content
 - Low salinity
 - Calm seas
 - May - Sept



Shipwrecks

- Each wreck is unique.
- A complete wreck has more esthetic value than a skeleton.
- Vandalism erodes the value historically and recreationally.
- Deterioration of wood and metals in salt water.
- Promote shipwreck conservation.
- **Never** enter a wreck without specialty training.

- Ship wrecks found in cold, fresh water make excellent dive sites as:
 - they are better preserved than those in the oceans
 - are home to a wide variety of fish



*Finally
take only pictures
and leave only bubbles!*

THE END