The Dive Environment

During your first two confined water dives, you experienced the underwater environment for the first time. Even then, you probably noticed some underwater conditions that vary and affect divers.

If a relatively empty environment like a swimming pool or confined water site has environmental variables, just imagine the variables you can find at unconfined dive sites depending on weather, climate and other factors. The conditions that most directly affect you when you're diving are:

1. Temperature
2. Visibility
3. Water movement
4. Bottom composition
5. Aquatic life
6. Sunlight

Perhaps one of diving's greatest appeals comes from the diversity of environments you can explore. You can explore rivers, lakes, quarries, ponds, tropical seas or temperate oceans, each with its unique characteristics and its unique attraction. Weather, climate and season affect environmental

MAIN Objectives

Underline/highlight the answers to these questions as you read:

1. **What six general environmental conditions can affect you in any aquatic environment?**

2. **How can you obtain an orientation to an unfamiliar aquatic environment?**

THREE

Local wisdom.
Keep in mind that when you're planning to dive in an area for the first time, you want to get an orientation to the local area from, or better yet, dive under the supervision of, an experienced local diver.

conditions, so your dive experiences at a specific site will vary depending on the time of year.

During this section, you'll get an idea of how environmental conditions can affect you as a diver, plus basic information about both saltwater and freshwater diving environments. Your instructor will tell you a bit about the conditions you can expect at the dive site where you'll be making your first open water dives.

On this subject, keep in mind that when you're planning to dive in an area for the first time, you want to get an orientation to the local area from, or better yet dive under the supervision of, an experienced local diver. The PADI Discover Local Diving experience is one way to do this. This program is a guided tour by a PADI Instructor, Assistant Instructor or Divemaster that introduces you to a new dive environment, what's interesting about it, what to watch out for, and any unique dive skills or procedures you need to know. This is not only prudent for safety, but a local orientation is the best way to end up at the better dive sites and making the best dives.

Temperature

The discussion on exposure suits and heat loss in Section Two made it pretty clear that as a diver, you need to pay attention to water temperature and proper insulation. The amount of insulation varies with the water temperature, and the water temperature

Quick Quiz — Self Assessment 1

1. Conditions that can affect you as a diver in any aquatic environment include (check all that apply):
   - ☐ a. sunlight
   - ☐ b. temperature
   - ☐ c. water movement
   - ☐ d. bottom composition

2. To obtain an orientation to local dive conditions, you can (check all that apply):
   - ☐ a. check with a local PADI Dive Center or Resort.
   - ☐ b. take a Discover Local Diving orientation.
   - ☐ c. talk to an experienced local diver.
   - ☐ d. check the local newspaper.

How'd you do?
1. a, b, c, d. 2. a, b, c.

MAIN Objectives

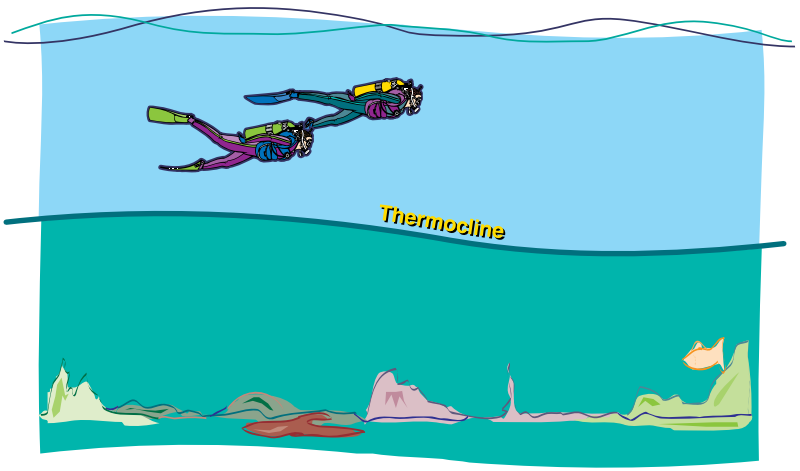
Underline/highlight the answers to these questions as you read:

3. **How can you expect temperature to change with depth?**
4. **What's a thermocline?**
5. **How should you plan to dive in an area known to have a thermocline?**

varies with where you are, the season, and to some extent with the weather. Water temperatures range from -2°C/28°F (yow!) in polar regions to more than 30°C/85°F (ahhhh!) in the tropics. Within a given region, water temperature usually varies, but not usually by more than 8°-11°C/15°-20°F throughout the year. In moderate climates, that's more than enough to make a dry suit preferable during cool seasons, and a wet suit more than adequate in the warm ones.

Water temperature often changes with depth, usually getting colder as you descend. Water tends to form distinct layers based on temperature, with a boundary so abrupt that in calm water you can swim in warm water and stick your hand into distinctly colder water. This is called a *thermocline*. The temperature difference above and below the thermocline may be as great as 8°-11°C/15°-20°F. Sometimes you can see distortion at the thermocline, somewhat like the shimmering rising from a hot asphalt road, caused by the mixing of two temperature layers.

You may find thermoclines in both fresh and salt water, and they're especially abrupt in freshwater lakes, ponds and quarries during the warmer seasons. The thermocline rises and falls with seasonal temperature.



Hot and cold.
Water tends to form distinct layers based on temperature, with a boundary so abrupt that in calm water you can swim in warm water and stick your hand into distinctly colder water. This is called a thermocline.

To stay comfortable and avoid excessive heat loss, base your exposure protection on the water temperature at

Nice and warm.
You can dive comfortably in even polar waters if you use an appropriate dry suit. But diving in extremely cold water or diving under ice requires special equipment and training.

your planned dive depth, which may be cooler than the surface temperature. Since bottom temperatures and thermoclines may be hard to predict, ask your PADI Resort, Instructor or Dive Center for local information. If you find unexpected cool water, you and your buddy may want to revise your dive plan and stay in the shallower, warm water.

Quick Quiz — Self Assessment 2

1. As you descend, most commonly you can expect a temperature change to _____ water.
☐ a. warmer ☐ b. cooler

2. While descending, a thermocline is
☐ a. an abrupt change to a layer of warmer water.
☐ b. a gradual change to a layer of warmer water.
☐ c. a gradual change to a layer of colder water.
☐ d. an abrupt change to a layer of colder water.

3. If you know there's a thermocline, in dive planning you should
☐ a. make no changes.
☐ b. choose your exposure protection based on the temperature at depth.

How'd you do?
1. b. 2. d. 3. b.

You learned in Section Two that body heat loss can create a serious health risk (hypothermia). Very cold water can also cause some equipment complications. Believe it or not, you can dive in even polar water (it is one of the world's most spectacular underwater environments) with adequate comfort — *but,* diving in extremely cold or icy water requires special equipment, plus special training and experience. You may find special courses (like the PADI Ice Diver course) locally that can provide you with supervised training in cold water diving.

Visibility

Pass a diver headed toward the water as you're headed away, and invariably you get the question, "Hey, what's the viz?" Visibility influences your dive significantly, so it's the first thing you want to know. During your open water dives, you'll learn how to keep from reducing the visibility, how to measure it, and when it's too poor to dive.

You define underwater visibility based on how far you can see horizontally. Since this can be somewhat subjective — sometimes you can see a silhouette but not much else — some divers add that the visibility is the horizontal distance you can recognize another diver.

Visibility ranges from 0 to more than 60 metres/200 feet. Factors that affect visibility include 1) water movement, 2) weather, 3) suspended particles and 4) bottom composition. Waves, surf and currents churn up sediment, and rain runoff commonly clouds visibility. If disturbed by your kicks, the boat wake or other water movement, fine bottom sediment can swirl into the water, quickly ruining visibility. In certain conditions, suspended microscopic animals (plankton) and plants (algae) proliferate and cloud the water — oceanic plankton blooms called red tides can be so extreme that they kill fish and turn the water reddish.

The effects of some visibility conditions are obvious, while others are more subtle. In limited visibility, it's more difficult to stay with your buddy and to keep track of where you are and where you're going. You may feel disoriented when you can't see the surface or the bottom for reference.

To handle these concerns, stay closer to your buddy than you might usually, where you can watch each other. Track your position using your compass and noting conspicuous features (you'll learn more about using your compass in Section Five). You can remain oriented while ascending and descending by using a reference line, or when shore diving, by following the bottom to and from deeper water.

If visibility is really poor, you may want to do something else. But with special training and experience, you may find you enjoy the challenges of diving in extremely limited visibility — you may find it surprising, but many divers do. You can learn more about the skills and challenges of low visibility diving in the PADI Underwater Navigator and Search and Recovery Diver courses.

It may sound strange, but diving in extremely clear water requires some caution. Because water magnifies, the bottom may appear closer than it really is. As you descend, you need to watch your depth gauge (or computer) and stay within your planned depth limit. Even though you can see the bottom and the surface, you can experience disorientation (vertigo) during descents and ascents without a reference in clear water. Again a line or

MAIN Objectives

Underline/highlight the answers to these questions as you read:

6. **What's the definition of "underwater visibility"?**
7. **What four principle factors affect underwater visibility?**
8. **Restricted visibility can affect you in what three ways?**
9. **How do you avoid the problems associated with diving in clear water?**

What you see, not how far.
With special training and experience, you may find you enjoy the challenges of diving in limited visibility — many divers do. You can learn more about the skills and challenges of low visibility diving in the PADI Underwater Navigator and Search and Recovery Diver courses.

Air clear.
Diving in extremely clear water may require some caution. The bottom may appear closer than it really is and, you can experience disorientation during descents and ascents without a reference.

other reference helps avoid this problem. And in clear water, remember to stay close to your buddy — just because you can see each other doesn't mean you're close enough.

Currents

Earlier, you learned to remain relaxed, avoid over exertion and take it easy while diving. You also learned that water resists your movement, which is why you streamline yourself as much as possible. So it follows then, that when you have a current pushing against you, you need to learn some techniques to avoid getting breathless and tired, to avoid using your air too quickly, and to avoid long, difficult swims back to the boat or shore. Let's start by looking at what causes current.

Currents are mass movements of water and occur in oceans, but also in large lakes, seas and even smaller water bodies to some extent. Some currents are global and relatively permanent (more about these in a bit), while others are temporary and caused by 1) winds blowing over the surface and 2) unequal heating and cooling of the water 3) tides and 4) waves.

Trying to swim against even a mild current can quickly

Quick Quiz

Self Assessment 3

1. You define underwater visibility as:
   - ☐ a. more or less the greatest distance you can see in any direction.
   - ☐ b. the least distance you can see in any direction.
   - ☐ c. the approximate distance you can see horizontally.

2. Factors that affect underwater visibility include (check all that apply):
   - ☐ a. water movement.
   - ☐ b. suspended particles.
   - ☐ c. bottom composition.
   - ☐ d. fish population.

3. Restricted visibility can cause (check all that apply):
   - ☐ a. buddy separation.
   - ☐ b. disorientation.
   - ☐ c. loss of direction.

4. When diving in clear water, it's recommended that you:
   - ☐ a. use a line or other reference when ascending and descending.
   - ☐ b. close your eyes to avoid vertigo.

How'd you do?
1. c. 2. a, b, c. 3. a, b, c. 4. a.

tire and exhaust you. It's a lot of work, which means you'll burn through your air faster, too. This is why you need to use the right techniques, and avoid all but a mild current.

When there's a mild current at a dive site, begin your dive by slowly swimming into the current so that at the end of the dive, instead of fighting to get back to the boat or shore, the current assists your return. Avoid long surface swims against even a mild current; you'll make better progress on the bottom where the current is generally weaker than at the surface.

If by accident you end up with a current carrying you past your exit point, don't try to swim against it. Instead, swim *across* (perpendicular to) the current. Fighting a current by swimming directly into it will exhaust you. By swimming *across* the current, you may be able to swim out of the current, reach a line trailed from the boat, or reach the shore down current.

MAIN Objectives

Underline/highlight the answers to these questions as you read:

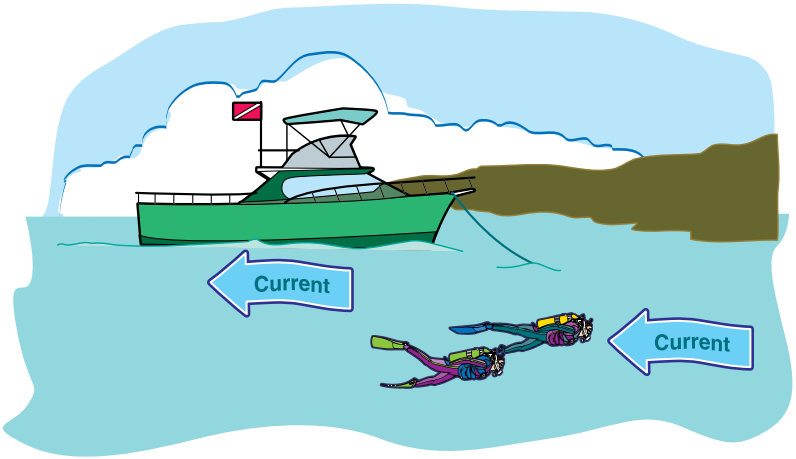
10. What four primary causes generate surface and underwater currents?

11. What should you do if you get caught in a current and carried downstream past a predetermined destination or exit point?

12. In most circumstances, which way should you go when there's a mild current present?

13. What should you do if you get exhausted and caught in a current at the surface while diving from a boat?

When diving from a boat, if you become caught in a current at the surface and can't get to the boat, don't fight it. Fill your BCD to establish buoyancy (drop your weights if you have a BCD problem), signal for help, rest and wait for the boat to pick you up. Above all, remain calm. Diving in *strong* currents and swift mov-



Face the flow.
When there's a mild current at a dive site, begin your dive by slowly swimming into the current so that at the end of the dive, the current assists your return to the boat or shore.

ing water (like rivers) requires special training and experience, which you usually find in areas where you find those conditions frequently.

Quick Quiz — Self Assessment 4

1. Causes of currents include (check all that apply):
   - ☐ a. waves
   - ☐ b. wind
   - ☐ c. tides

2. Under most circumstances, if there's a current you should begin your dive
   - ☐ a. swimming with the current.
   - ☐ b. swimming against the current.
   - ☐ c. swimming perpendicular to the current.

3. If a current carries you past your planned exit point
   - ☐ a. swim across the current to some other exit point, a line trailed from the boat, or out of the current.
   - ☐ b. fight the current as best you can.

4. When diving from a boat, if you get exhausted and caught in a current at the surface, you should
   - ☐ a. establish positive buoyancy, signal for help and rest.
   - ☐ b. fight the current as long as you can.

How'd you do?
1. a, b, c. 2. b. 3. a. 4. a.

Bottom Composition

You spend most of your time diving near the bottom ('cause that's where all the stuff is). The bottom's composition can affect you and the dive techniques you want to use. You can loosely categorize compositions as silt, mud, sand, rock, coral and vegetation. All of these harbor aquatic life and offer interesting diving, with rock, coral and vegetation bottoms. These ecosystems jump out at you, whereas it takes closer observation to appreciate the fascinating aspects of silt, mud and sand.

You can easily stir up some bottom compositions, especially silt and mud, and some compositions require care while entering and exiting, or while moving about underwater. You may sink into a soft mud bottom while wading, and if you drop something into a very soft silt or sediment, it may vanish into the bottom. If you don't pay attention to where you're going, there's some possibility of entanglement in submerged trees, bushes, man-

Gear tight, fins up.
Establish neutral buoyancy, keep all your equipment secure and stay well off the bottom. Swim with your fins up to avoid stirring the sediment and reducing visibility.

Main Objectives

Underline/highlight the answers to these questions as you read:

14. Aquatic bottom compositions include what six types?

15. What are the two ways to avoid bottom contact?

made objects or aquatic plants. Rocks or coral can cut and scrape if you're careless. Obviously, it's important to know the bottom composition and any problems associated with it. As you gain experience, you'll learn to know what type of bottom to expect in most cases, and how to cope with any associated problems. It's mainly a matter of awareness, watching where you put your feet and hands, and common sense.

Sometimes the bottom needs to watch out for you. As you've already learned, some organisms are so delicate that even a light touch can damage or kill them. So it helps you avoid problems and minimize environmental damage to avoid contact with any bottom that harbors sensitive aquatic organisms.

Regardless of the bottom composition, effective buoyancy control provides the easiest way to avoid contact. Establish neutral buoyancy, keep all your equipment secure and stay well off the bottom. Also, swim with your fins up to avoid stirring the sediment and reducing visibility. Although you'll learn to recognize insensitive bottom that you can settle on without hurting the environment and without significant risk to you, it's best to avoid direct bottom contact as much as possible.

Quick Quiz

Self Assessment 5

1. List the six general types of bottom compositions:
   1. _____
   2. _____
   3. _____
   4. _____
   5. _____
   6. _____

2. To avoid bottom contact, you (check all that apply):
   - ☐ a. pull yourself along gently by hand.
   - ☐ b. stand on your fin tips.
   - ☐ c. remain neutrally buoyant.
   - ☐ d. swim with your feet up off the bottom.

How'd you do?
1. silt, mud, sand, coral, vegetation, rock. 2. c, d.

Main Objectives

Underline/highlight the answers to these questions as you read:

16. What are the two basic classifications for interaction between divers and aquatic life?

17. What causes nearly all injuries from aquatic life?

18. What should you do if you sight an aggressive animal underwater?

19. Nine simple precautions minimize the likelihood of being injured by an aquatic animal. What are they?

20. Why should divers follow local fish and game laws?

Aquatic Life

Interaction with aquatic life. As a diver, you'll interact with new and fascinating underwater organisms. Some will swim up to you curiously, while others will flee in your presence. Some will freeze, solid as a rock. You may swim among aquatic plants that tower over you like a forest, or spread out beneath you like a manicured lawn. This privilege carries with it a responsibility.

Leave nothing but bubbles . . .
You can classify your interactions with aquatic life as passive or active.

You can classify your interactions with aquatic life as *passive* (watching, leaving undisturbed, photographing, etc.) or *active* (feeding, touching, disturbing, chasing, filleting, etc.) As the name implies, even passive *interaction* affects aquatic life, which is very sensitive to its environment. Approaching aquatic animals can cause them to alter their behavior and the natural rhythm of their lives. Move quietly and smoothly — which is less likely to disturb them — and you'll have more chances to observe aquatic animals behaving naturally, rather than fleeing or hiding.

Active interaction means that you make physical contact with aquatic life. You already know that bumping into sensitive coral, for example can harm it, and other active interactions like hunting, certainly don't benefit the organism you affect. Other active interactions can appear to benefit the organism or environment, but may or may not. Fish feeding, for example, can harm organisms if you feed them nonnatural foods; frequent, heavy feeding by humans can alter normal behaviors and cause fish and other animals to stop feeding on normal prey. This in turn creates a population imbalance that can widely affect the local ecology.

This isn't to say there aren't positive active interactions — freeing fish from an abandoned trap or surveying species populations to support protective regulations, for example — but you need to take the responsibility of ensuring that your active interactions — intentional or accidental — cause minimal damage and disruption to the environment and organisms you interact with. By doing this, you're doing your part

to assure that your children, and theirs, will be able to see and interact with the same creatures. You're setting a positive example as the underwater world's advocate and ambassador, and on a broader scale, you're contributing to a healthier planet — something we can all live with.

Aquatic animals. The typical aquatic animal responds to human approach with "Run away! Run away!" The vast majority are timid and harmless, yet fascinating and enjoyable to watch. But there are a few that require your caution.

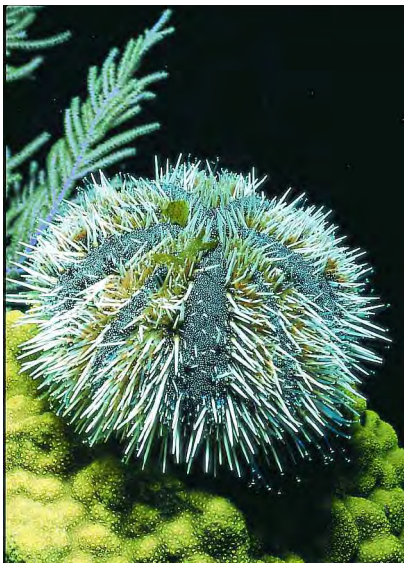
It is rare for humans to suffer attacks from aquatic animals.

Nearly all injuries involving aquatic life (plants or animals) result from human carelessness, and the vast majority are minor. It takes only a little bit of understanding and care to avoid potential problems.

You're far more likely to suffer from an unpleasant encounter with an unaggressive organism — such as a puncture wound from sea urchins, a sting from jellyfish and their relatives, or cuts and scrapes from barnacles and coral. To avoid these, watch what you touch and wear an exposure suit as protection from accidental contact. If you're not familiar with an organism, leave it alone. An excellent rule of thumb: If it's very pretty, very ugly, or it doesn't flee from you — don't touch it! Venomous fish and other stinging aquatic animals tend to have these characteristics.

Very few aquatic animals are outwardly aggressive. While it's true that almost any good sized animal is potentially dangerous when provoked, it's actually very rare for humans to suffer attacks from aquatic animals. The reputation of some animals as bloodthirsty killers, such as sharks and killer whales, resulted from inaccurate and distorted reports that became myths. The vast majority of incidents between sharks and divers involve spearfishing (wounded fish stimulate shark feeding behavior). Killer whales (more properly, orcas) have the capacity to harm humans, yet there's no documented case of one ever attacking a diver.

Injuries from animals that may *seem* aggressive, such as eels and stingrays, actually result from frightening animals, causing them to react *defensively* — such as if you carelessly stick your hand in an eel's hole without looking first. (If a giant arm came in your front door and started groping around your living room, you'd bite it, too.)



Sea urchin

Hands off.

If you're careful, you can avoid an unpleasant encounter with an unaggressive organism, such as a puncture wound from sea urchins, a sting from jellyfish and their relatives, or cuts and scrapes from barnacles and coral. Attacks by aquatic animals are very rare.

So if you see a shark, or some other potentially aggressive animal, remain still and calm on the bottom. Do not swim toward it, which could trigger a defensive reaction. Watch it and see what it does. Chances are, it's just passing through. And enjoy the experience — these are some of the most magnificent of nature's creatures, and you don't get to see them too often. If it stays in the area, calmly swim away along the bottom, keeping an eye on it and exit the water.

These guidelines will help you avoid potential problems with aquatic animals:

1. Treat all animals with respect. Don't tease or intentionally disturb them.
2. Be cautious in extremely murky water where you may have trouble watching where you put your hands. Potentially aggressive animals could mistake you for prey in murky water, so you may want to avoid diving if they're known to be in the area.
3. Avoid wearing shiny, dangling jewelry. These can resemble bait fish or other small prey and can attract the interest of some animals.
4. If you spearfish, remove speared fish from the water immediately.
5. Wear gloves and an exposure suit to avoid stings and cuts. It goes without saying that an exposure suit that covers your whole body offers more protection than cut off jeans and a t-shirt.
6. Maintain neutral buoyancy and stay off the bottom.
7. Move slowly and carefully.
8. Watch where you're going and where you put your hands, feet and knees.
9. Avoid contact with unfamiliar animals. If you don't know what it is, don't touch it.

While you may want to avoid contact with a few animals, there are others that some divers seek as game or specimens. To name a few, these include lobster, crab, abalone, scallops, fish, clams, conch and other shellfish. Before collecting any game, learn local fish and game laws, including seasons, size and catch limits and other restrictions. Fish and game laws exist to assure a continuing supply of these animals for the future. If local laws permit game tak-

ing, collect only what *you* can eat or use — even if the law allows more. Be reasonable in what you take, so that there can be game for divers to enjoy in the future. Keep in mind that in many areas, the local dive community does not engage in game taking, even if legal.

Aquatic plants. The first thing you'll notice is that it is far, far easier to sneak up on aquatic plants than many aquatic animals. Aquatic plants range from giant kelp forests common to New Zealand, California and other cool-water areas, to smaller grasses and algae in freshwater rivers and lakes. Plants provide food and shelter to aquatic animals, so you can usually expect lots of animal life in aquatic plant environments.

There's a small possibility of entanglement in some plant types. This isn't a serious problem, and you'll find that with a little care, you can move easily in and about aquatic plants without ever getting entangled. Keeping your equipment streamlined, watching where you go, and avoiding dense growth areas help minimize the chances of snagging or tangling.

If it does happen, remain calm. As soon as you feel that you're snagged, stop, and back up slightly. Don't turn around, which may wrap some of it around you. Chances are, you're only hung by one or two strands, so reach back and free yourself, with your buddy's help. Don't struggle or try to use force because that usually makes

Quick Quiz

Self Assessment 6

1. The two types of interactions you can have with aquatic life are (check two):
   - ☐ a. passive
   - ☐ b. aggressive
   - ☐ c. dominant
   - ☐ d. active

2. Nearly all injuries from aquatic life result from:
   - ☐ a. attacks
   - ☐ b. diver carelessness
   - ☐ c. feeding behavior
   - ☐ d. maternal protection

3. If you sight an aggressive animal underwater, you should watch it and leave the area calmly on the bottom if it remains or appears aggressive.
   - ☐ True ☐ False

4. Precautions you can take to avoid injury by an aquatic animal include (check all that apply):
   - ☐ a. wearing an exposure suit and gloves.
   - ☐ b. watching where you put your hands, feet and knees.
   - ☐ c. arming yourself with a spear-gun.
   - ☐ d. not touching anything you don't recognize.

5. You should follow fish and game laws:
   - ☐ a. to maximize the amount of game you take.
   - ☐ b. to help assure future populations of game animals.

How'd you do?
1. a, d. 2. b. 3. True. 4. a, b, d. 5. b.

Forest for the seas.
Kelp forests create impressive aquatic environments in temperate climates.

things worse. Although you want to minimize damage to aquatic life, if necessary break free by bending and snapping the stalk. This is usually more effective than using your knife. You'll learn more about handling entanglement later in this section.

Sunlight

Diving typically takes you into direct sunlight aboard boats, on beaches and off of docks, so you need to take precautions to prevent sunburn. Out of the water, wear protective clothing (broad brimmed hats, light long sleeve shirts, etc.), stay in the shade as much as possible and use sunscreen. Keep in mind that a cloudy day doesn't protect you — the burning ultraviolet rays penetrate the clouds, but since you don't feel the heat, you don't realize you're burning. That's why you see some of the worst sunburns on overcast days.

You can also sunburn in the water, especially in shallow water while snorkeling. Wear an exposure suit and waterproof sunscreen to protect yourself while snorkeling, and remember that in water you may not feel a burn until it's too late. Sunburn is probably the most common "injury" divers experience, and it's entirely avoidable. Don't let sunburn ruin a dive trip or vacation.

Fresh Water and Salt Water

As you gain experience diving, you'll probably discover great diving in fresh water and salt water, even though

MAIN Objectives

Underline/highlight the answer to this question as you read:

21. How can you prevent sunburn while out of the water (three ways), and what two ways can you use to prevent it while snorkeling?

Quick Quiz — Self Assessment 7

1. You don't have to worry about sunburn when it's overcast, or when you're in the water.

☐ True ☐ False

How'd you do?

1. False. You can sunburn through clouds and in water.

they differ in their conditions, animal and plant life, and call for different techniques and procedures. Depending where you're diving, you may pursue your favorite underwater activity — photography, wreck diving, whatever — somewhat differently in fresh water than in salt water. Or you may prefer entirely different activities in the environments.

MAIN Objectives

Underline/highlight the answer to this question as you read:

22. What are the general considerations for diving in freshwater, and in saltwater?

Freshwater diving. Typical freshwater dive environments include lakes, quarries, springs and rivers. Most of these offer good places for photography and exploration as well as more adventurous activities like wreck diving, ice diving, cavern diving and swift-water diving. Some of these require special training and equipment before you participate in them.

Even far from the sea.
Typical freshwater dive environments include lakes, quarries, springs and rivers. Most of these offer good places for photography and exploration as well as more adventurous activities like wreck diving, ice diving, cavern diving and swift-water diving.

Freshwater environment dive considerations include currents, bottom compositions, limited visibility, thermoclines, cold water, entanglement, deep water and boats — many of the same considerations you have in salt water. You may dive in mountain areas well above sea level, which requires special techniques and training to account for the altitude.

Since fresh water weighs less than salt water, you're not as buoyant for a given displacement. This means if you dive in fresh water after diving in salt water, assuming you're wearing the same gear and exposure suit, you'll need less weight. Keep in mind that you're likely to find a thermocline when diving in freshwater lakes and quarries.

Saltwater diving. The saltwater dive environment fits into three general areas: 1) temperate, 2) tropical and 3) polar. The vast majority of recreational diving takes place in the temperate and tropical areas, though as mentioned the Arctic and Antarctic offer spectacular diving for those trained and equipped for it. Saltwater activities include all general diving activities, plus photography, spearfishing, and diving on artificial structures like jetties, piers, oil rigs, wrecks and artificial reefs. General considerations for this environment include waves, surf, tides, currents, coral, boats, deep water, marine life and remote locations.

Quick Quiz

Self Assessment 8

1. Freshwater dive considerations include (check all that apply):
- ☐ a. deep water
- ☐ b. altitude
- ☐ c. thermoclines
- ☐ d. limited visibility

2. Saltwater dive considerations include (check all that apply):
- ☐ a. surf
- ☐ b. tides
- ☐ c. marine life
- ☐ d. waves

How'd you do?
1. a, b, c, d. 2. a, b, c, d.

Another world.
The vast majority of recreational diving in saltwater takes place in the temperate and tropical areas.

Clearly, every place you dive has its own considerations, which is why you want to get a local orientation to a new area. It makes your diving more fun, more enjoyable and safer.

Ocean Diving

The ocean is a dynamic environment that constantly changes and moves. It can be calm and tranquil, or angry and powerful. Its moods have a direct influence on diving. So without assigning it any more emotions, let's look at the basic principles behind waves, surge, longshore currents, rip currents, upwelling and tides. This way you'll understand what you'll see and experience ocean diving, and what you can expect.

Waves and Surf. Most water motion that concerns you as a diver involves waves. The wind forms waves by blowing over the ocean surface, with wave size determined by wind strength, and how long the wind pushes the wave. A strong wind blowing continuously for several hours can make waves large enough to trash the conditions — making them either unfavorable, or even hazardous. Once formed, waves can travel across an entire ocean, affecting the diving hundreds of kilometres/miles from where they formed.

A wave travels across the surface until wind from another direction flattens it, until it gradually loses its energy, or until it encounters shallow water and breaks as *surf*. This phenomenon is the basis for an entire culture of surfboards and bleached hair.

Waves break in shallow water because the wave bottom drags on the sea floor; this slows it compared to the wave top, causing the top of the wave to peak up and become unstable. Eventually the wave "stumbles" and breaks as surf, spilling its energy onto the beach.

Overhead Environments

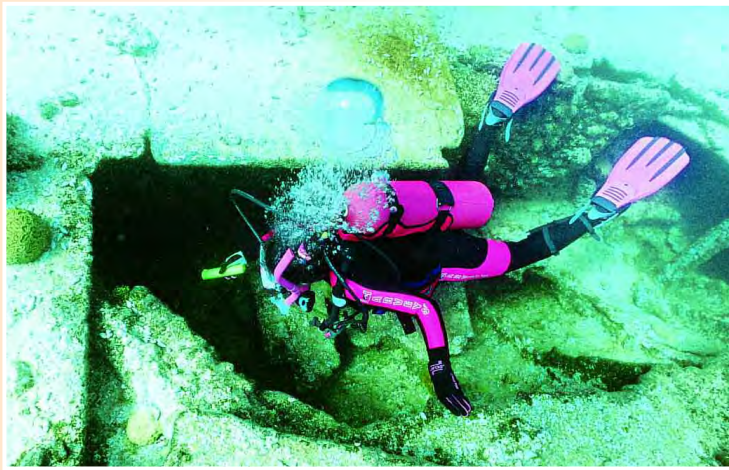
Whether you dive in fresh or salt-water, you may encounter places you can swim into that *don't* permit you to swim straight up to the surface. Examples include inside shipwrecks, under ice and in caves or caverns. These are called *overhead environments.* The may appear deceptively safe and simple — *but they're not*. They can pose hazards that you may not recognize, nor realize are present until it's too late.

Your training in this course prepares you for diving in *open water* — with direct access to the surface at any time. As soon as you lose the ability to ascend directly to the surface, your risk and the potential hazards go up dramatically.

You can learn to dive in these environments safely — but it requires special training and special (often extensive) equipment to handle the added risks and complications. For this reason, *until you have the training and equipment you need do not enter a cavern, cave, wreck or any other overhead environment.* Doing so places you in an unnecessary and *extremely hazardous* situation.

Many overhead environments may *seem* inviting and safe, but any time you can't swim directly up to the surface, you're in a special situation. A sobering thought: *One of the leading causes of diver fatalities is going into overhead environments without the proper training and equipment.* Those with proper training and equipment have an excellent safety record in caves, wrecks, under ice and in other overhead environments — those without this training (including otherwise highly trained dive professionals) have a *very poor* safety record in these environments.

Avoid this risk entirely. Enjoy the fun and adventure of diving outside the overhead environment. If you're interested in this type of diving, get the training you need — but stay out until then.



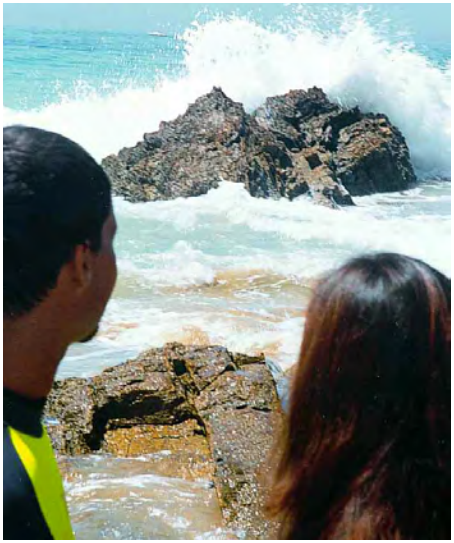
A deceptively easy way to die.
Do not enter a cavern, cave, wreck or any other overhead environment unless you have the training and equipment you need. Doing so places you in an unnecessary and extremely hazardous situation.

The area where waves break is called the *surf zone*. Moderate to large surf can complicate entries and exits unless you use special techniques. You won't find it difficult entering and exiting on a gently sloping beach through mild waves no higher than, say, your waist (technically surf, but not really considered "surf" in most dive environments) — but you need specific techniques to dive in higher surf.

Waves break in water only slightly deeper than their height, so watching the surf tells you something about the depth. An offshore reef, wreck or sand bar can create a shallow area that causes waves to break. Offshore shallow areas can be popular dive sites, or hazards to avoid (something to learn during an area orientation). Sometimes you'll see waves break, reform and break again. This indicates that the bottom rises, drops and then rises again as you move seaward. Knowing what the waves tell you helps you plan your dive.

Sometimes waves approach shore from different directions. Depending on the angles and timing, the waves can combine into very large waves, or cancel each other out and diminish the surf. This is why you often have a series of smaller waves — or none — followed by a series of larger waves. When entering and exiting through surf, you watch the water and learn the wave pattern, so that you can time your entries and exits to pass through the surf zone during the small waves.

Avoid diving in large and rough surf. Not only can it be hazardous, but the dive conditions tend to



Ocean in motion.
Most water motion that concerns you as a diver involves waves. The wind forms waves by blowing over the ocean surface, with wave size determined by wind strength, and how long the wind pushes the wave.

MAIN Objectives

Underline/highlight the answers to these questions as you read:

23. What creates surge and how do you avoid it?

24. What causes long shore currents, and how may they affect you?

25. Why would a wave break offshore?

26. What causes a rip current, and how do you know when there's one present?

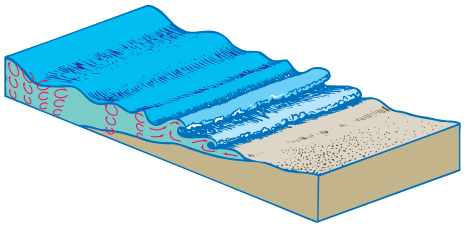
27. What should you do if you get caught in a rip current?

28. What causes an upwelling, and how might it affect local offshore dive conditions?

29. Tidal movement changes what three environmental conditions?

30. What's generally the best tidal level for diving?

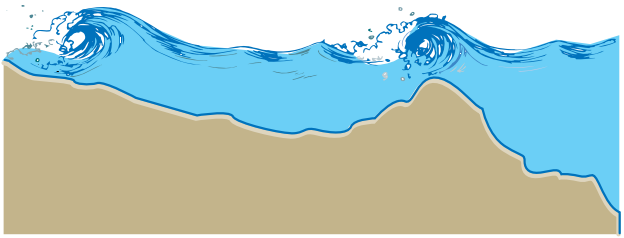
be poor anyway. You need specialized surf training before attempting to dive in surf of any size. In surf training, you learn to judge conditions and use the correct techniques for entering and exiting through the waves. Stay out of the surf until you have had this training. Keep in mind that surf diving techniques vary from area to area, and even from season to season in the same area.



Surf's up.
Waves break in shallow water because the wave bottom drags on the sea floor; this slows it compared to the wave top, causing the top of the wave to peak up and become unstable. Eventually the wave "stumbles" and breaks as surf, spilling its energy onto the beach.

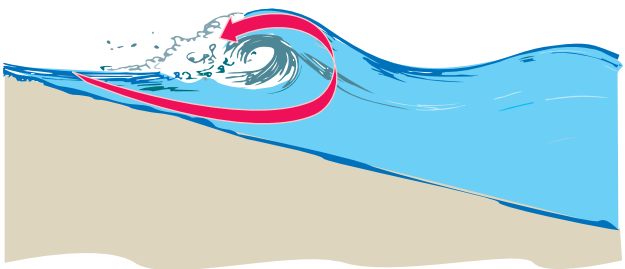
Surge. In shallow water waves passing overhead move you back and forth. This is called *surge*. Surge can move you an appreciable distance as large waves pass over, and strong surge can be hazardous. It tends to dissipate as you go deeper, so you can often avoid surge by planning a deeper dive. Avoid diving near shallow, rocky areas when there's strong surge present.

Undertow. After a wave breaks, it flows back into the ocean under oncoming waves, causing *undertow* or *backrush*. In conditions in which you're likely to be diving, backrush usually dissipates at a depth no greater than about a metre/three feet. It's not a current that pulls things far out to sea, but you do need to be aware of it. On steep beaches backrush can be quite strong; since the waves push your upper body shoreward and the backrush pulls your legs seaward, you have to pay attention to keep your balance during entries and exits. Avoid diving from beaches with extremely steep shorelines when there's anything more than very mild surf.

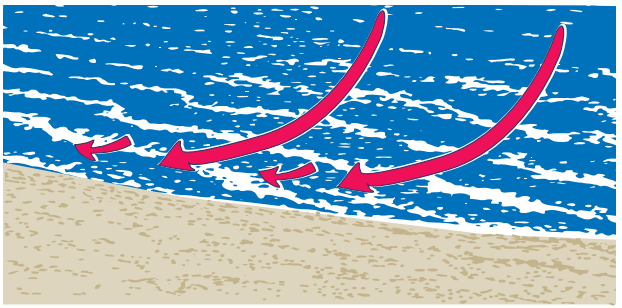


Offshore clues.
Waves break in water only slightly deeper than their height, so watching the surf tells you something about the depth. An offshore reef, wreck or sand bar can create a shallow area that causes waves to break.

Currents. Waves cause many of the currents that affect divers. They typically approach shore at a slight angle, which pushes water down the shoreline, creating a *longshore current*. A longshore current tends to push you down the beach — away from your intended exit area if you didn't know to account for it. When diving in a longshore current,



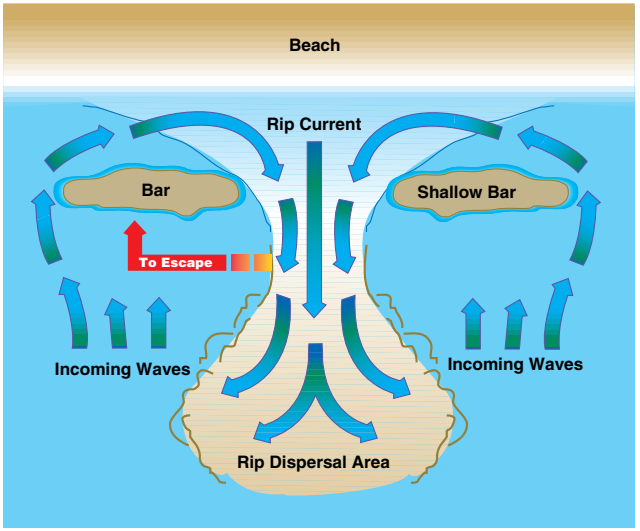
Flow underfoot.
After a wave breaks, it flows back into the ocean under oncoming waves, causing undertow or backrush.



Down shore, down current.
Waves approaching shore at a slight angle push water down the shoreline, creating a longshore current.

you can begin your dive up-current from your exit point, or dive into the current so you can drift back to the exit at the end of the dive.

Another wave-generated current is the *rip current*. A rip current occurs when waves push water over a long obstruction such as a sand bar or reef. The water can't flow out on the bottom, so it funnels back to sea through a narrow opening. Because they tend to be strong, rip currents can carry you away from shore very quickly, which can be alarming if you don't know what's happening and what to do about it. You can usually recognize a rip current as a line of turbid, foamy water moving away from shore; it also disrupts the waves where it rushes seaward.

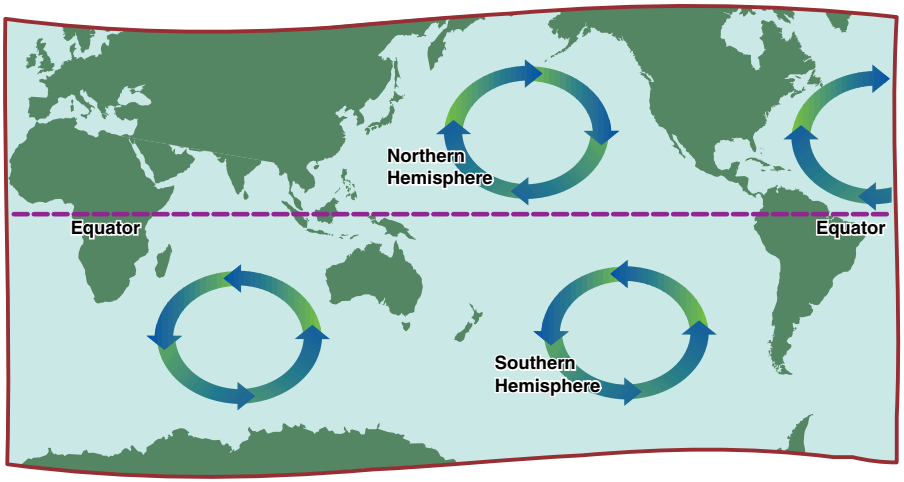


Rushing water.
A rip current occurs when waves push water over a long obstruction such as a sand bar or reef. The water can't flow out on the bottom, so it funnels back to sea through a narrow opening.

Obviously, you want to avoid rip currents. If you get caught in one, establish buoyancy and swim *parallel* to shore to clear the rip area. They're usually relatively narrow and disperse quickly in deeper water. Once you're out you can resume your original course, though you'll be further from shore. Never try to swim directly against a rip current.

When diving in current from a boat, you generally begin your dive swimming into the current, so that it's pushing you back to the boat when you end the dive. If you get caught in a current, don't fight it. At the surface, inflate your BCD, signal the boat to pick you up and rest.

Although most currents you encounter come from the wind, offshore currents, which are permanent large-scale currents like the Gulf Stream, can also affect diving. The earth's rotation generates these currents, which makes them generally predictable,

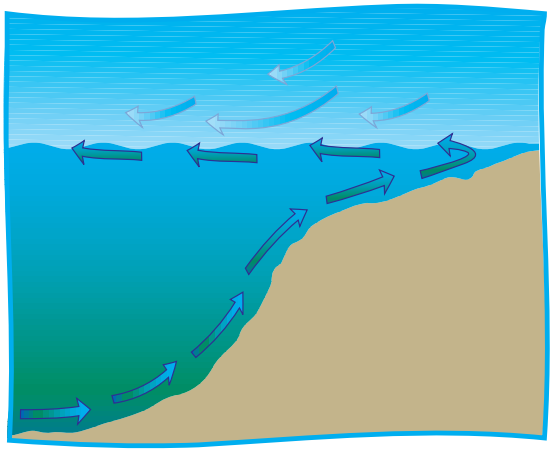


As the world turns.
The earth's rotation generates permanent, large scale currents. They're generally predictable, though eddies and counter currents can cause local flow direction to change.

though eddies and counter currents can cause local flow direction to change. Keep in mind that a current can sometimes change direction during your dive.

You'll learn a bit more about currents later.

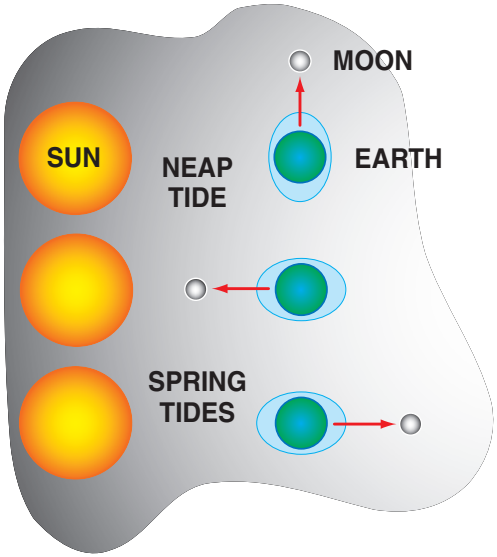
Upwelling. An upwelling is a slow-moving current commonly caused by offshore winds pushing the surface water away from shore. As the surface water moves out to sea, deep water flows up to take its place. The deeper water is usually clear and cold, creating excellent, though cooler, diving conditions.



Out of the deep.
An upwelling is a slow-moving current commonly caused by offshore winds pushing the surface water away from shore. As the surface water moves out to sea, deep water flows up to take its place.

Tides. The water level in the oceans and seas (and even some very large lakes) rises and falls in a daily cycle called *tide*. The moon and sun causes tide as their gravity pulls on the water, creating a bulge that, from our perspective, moves across the oceans as the earth turns. Tides vary in their time and height from place to place due to geographic configuration. They affect dive conditions — sometimes improving them, sometimes worsening them — by producing currents, changing depth and changing visibility.

Before diving, check local tide tables and become familiar with how tides affect local conditions. As a general guideline, the best diving conditions occur at high tide.



Outer space influence.
The moon and sun cause tides as their gravity pulls on the water, creating a bulge that, from our perspective, moves across the oceans as the earth turns.

Dive Planning

Dive planning avoids disappointments due to misunderstandings with your buddy, forgotten equipment or poor dive site conditions — it's really planning your fun. You can think of dive planning in four steps : advance planning,

Quick Quiz

Self Assessment 9

1. _____ create surge, which you avoid by _____.
   - ☐ a. Tides, avoiding high tide.
   - ☐ b. Waves, going deeper.
   - ☐ c. Tides, going deeper.
   - ☐ d. Waves, staying shallow.

2. Longshore currents tend to:
   - ☐ a. push you parallel to the shore.
   - ☐ b. carry you seaward.
   - ☐ c. None of the above.

3. Waves breaking off shore indicate:
   - ☐ a. a coming change in the surf conditions.
   - ☐ b. an upwelling.
   - ☐ c. a rip tide.
   - ☐ d. None of the above.

4. You can recognize a rip current by:
   - ☐ a. turbid, foamy water.
   - ☐ b. strong flow away from shore.
   - ☐ c. disruption of the waves.
   - ☐ d. All of the above.

5. If caught in a rip, you should:
   _____
   _____
   _____

6. An upwelling tends to cause _____ dive conditions.
   - ☐ a. poor
   - ☐ b. excellent
   - ☐ c. unpredictable

7. Tides affect diving conditions by (check all that apply):
   - ☐ a. causing currents.
   - ☐ b. affecting visibility.
   - ☐ c. generating rip currents.
   - ☐ d. causing upwellings.

8. Generally, the best tidal level for diving is:
   - ☐ a. low tide.
   - ☐ b. high tide.

How'd you do?
1. b. 2. a. 3. d. 4 d. 5. swim parallel to shore. 6. b.
7. a, b. 8. b.

Summary Points

In this subsection on The Dive Environment, you learned:

- Temperature, visibility, water movement, bottom composition, aquatic life and sunlight affect dive conditions.
- A thermocline is an abrupt transition to colder water.
- Plan your dive accounting for the water temperature at your planned depth.
- When possible, use a visual reference for descending and ascending.
- When diving with a current present, head into the current during the dive.
- If caught in a current, don't fight it. Swim across the current, or establish buoyancy and signal for assistance.
- Avoid bottom contact by staying neutrally buoyant.
- Most aquatic life injuries result from carelessness — watch where you put your hands, feet and knees.
- Wear gloves and an exposure suit to reduce the likelihood of aquatic life stings and cuts.
- Sunburn is entirely avoidable.
- Surf diving requires special training and techniques.
- If you get caught in a rip current, swim parallel to shore until you're out of it.

preparation, last-minute preparation and predive planning.

Advance Planning

Planning a dive starts when you decide to go diving. At this stage, you generally: select a buddy (or vice versa), establish a dive objective (i.e., agree on what you'll do on the dive), choose a dive site (may be a general choice at this stage), determine the best time to dive and discuss logistics (agree on where/when to meet, etc.) with your buddy.

It's a good idea to agree on a common objective to avoid misunderstandings. If you show up with camera gear and your buddy arrives kitted up for search and recovery, one of you won't be doing what you planned.

If necessary, you can check your log book for relevant information about the site if you've been there before. Plan an alternate dive site in case you can't dive at your primary site (poor conditions, speed boat competition, ex-spouse is there, etc.). Decide on the best time to go, which the tides and other activities in the area may influence. Finally, discuss logistics, such as when to leave for the dive, how to get there, what to take and emergency contact information.

Preparation

It's a good idea to start preparing for a dive at least a day or two ahead of time. Inspect all the equipment you'll be using, make sure your tank is filled, gather your equipment into one place and use an equipment checklist to make sure you've got everything. (There's a sample checklist in the Appendix.) Check your equipment while you have ample time to fix or replace anything broken, missing or that your dog chewed on. If possible, check local information sources like televi-

sion, radio, your dive center, etc., for a report on dive site conditions.

Last-minute Preparation

Just before you leave for the dive:

1. Check the weather report.
2. Let someone who isn't going with you know about your planned dive, including where you went, when you expect to be back and what to do if you're delayed. Include your mobile phone number if you take one with you.
3. Gather those last-minute type items like a jacket, hat, sunglasses, wallet, lunch, ice chest, certification card, log book, etc.
4. If you haven't yet, pack your gear bag; if you're boat diving, pack so the first thing in is the last thing out.
5. Make an "idiot check" so that you don't leave anything behind and show up with, say, only one fin.

Predive Planning

At the dive site, you plan the details. It's best to do the following before you start putting your gear together:

1. Evaluate the conditions. Take your time, especially if you're watching wave patterns.
2. Decide whether or not conditions favor the dive and your objective. If they don't, go to your alternate site, and if conditions are bad there, too, pull the plug. Diving's supposed to be fun; if it's not going to be fun, do something else.
3. Agree on where to enter, the general course to follow, the techniques to use on the dive and where to exit.
4. Review hand signals and other communications.
5. Decide what to do if you become separated.
6. Agree on time, depth and air supply limits.
7. Discuss what to do if an emergency arises.

The idea in predive planning is to anticipate, discuss and agree on as much as possible before you get in the water.

MAIN Objectives

Underline/highlight the answers to these questions as you read:

31. You need to plan your dives for what three reasons?

32. What are the four stages of proper dive planning?

33. What five general steps do you follow during the advanced planning stage of dive planning?

34. What four general steps do you follow during the preparation stage of dive planning?

35. What five steps do you follow during the last-minute preparation stage of dive planning?

36. What seven steps do you follow during the predive planning stage of dive planning?

You can't plan by accident.
Think of planning your dive as planning your fun – and safety. No one can plan a dive and follow that plan for you – you and your buddy have to do it.

Dive the Plan

It doesn't make much sense to form a dive plan, then not use it. You have more fun and fewer problems when your dive follows what you agreed upon. You'll get what you want out of the dive when you and your buddy understand what to do when because you discussed it before the dive. By following a solid dive plan, you're much less likely to run into any hazards, and more likely to handle them if you do.

A dive plan does not have to be complicated, nor does it need to take a lot of work, nor does it need to be inflexible. It can be very simple, take only a couple of minutes to discuss, and offer plenty of options depending on what you find underwater — but you should follow it.

Get the most out of diving by planning your dive with your buddy, and then diving the plan. This is important for your safety and fun – no one can plan a dive and follow that plan for you – you and your buddy have to do it.

Boat Diving

Chances are, you'll make a lot of dives from boats. In many areas, it takes a dive boat to reach the sites with the best clarity, the most aquatic life, and the most interesting reefs. Boats take you to dive sites inaccessible from shore, and in some places you reach all or most dive sites only by boat. Boat diving eliminates long, tiresome surface swims, dealing with surf, and hikes to and from the water. Beyond all this, it's fun to go boating with other divers. You get to know new people, sight see on the way to and from the dive site, and generally enjoy the whole experience.

Before heading out on a boat, spend some time getting ready:

1. Inspect your equipment for potential problems, fill your tank and pack spare parts. Once you're out

Self Assessment 10

1. Planning your dive helps avoid disappointments due to misunderstandings, forgotten equipment, or poor site conditions.
   ☐ True ☐ False

2. You can divide dive planning into advanced planning, preparation, last minute preparation and predive planning.
   ☐ True ☐ False

3. Steps in advanced planning include (check all that apply):
   ☐ a. choosing a buddy.
   ☐ b. agreeing on an objective.
   ☐ c. agreeing on logistics.
   ☐ d. reviewing hand signals.

4. In the preparation stage, you don't need to inspect your equipment.
   ☐ True ☐ False

5. Last-minute preparation includes (check all that apply):
   ☐ a. letting someone know where you're going and when you plan to return.
   ☐ b. packing items like ice chests, jackets, etc.
   ☐ c. checking the weather.

6. If you find conditions poor at your dive site:
   ☐ a. be brave and dive anyway.
   ☐ b. try your alternate site. Otherwise, cancel the dive.

How'd you do?
1. True. 2. True. 3. a, b, c. 4. False.
5. a, b, c. 6. b.

Cast off!

It's fun to go boating with other divers. You get to know new people, sight see on the way to and from the dive site, and generally enjoy the whole experience.

there, missing or broken gear often means you miss the dive. Having spares can make you immensely popular with other divers who need something but don't have their own spares.

2. Be sure you've marked your stuff so it doesn't get confused with someone else's on a crowded boat.
3. Use a dive bag for carrying your equipment to and from the boat.
4. Pack your equipment so what you need first ends up on top.
5. Take ample warm/dry clothing, as appropriate for the region. Be prepared because in many places, it's common to experience abrupt weather changes out on the water.

Prepare yourself as well as your equipment. Be well rested, especially if the boat departs early. It's best to avoid excessive alcohol the night before, and avoid foods you don't digest well. It's important to be well hydrated with lots of water or juices. Make sure you have your ticket, money, lunch and warm clothes, etc. all rounded up as necessary.

If you've not spent much time around boats, you're going to want to learn some new terms so that when the captain says, "the head is forward, on the portside o' the galley and aft o' the wheelhouse, mate," you don't respond, "Eh?"

The *bow* is the front of the boat,

MAIN Objectives

Underline/highlight the answers to these questions as you read:

37. What are three benefits of diving from a boat?

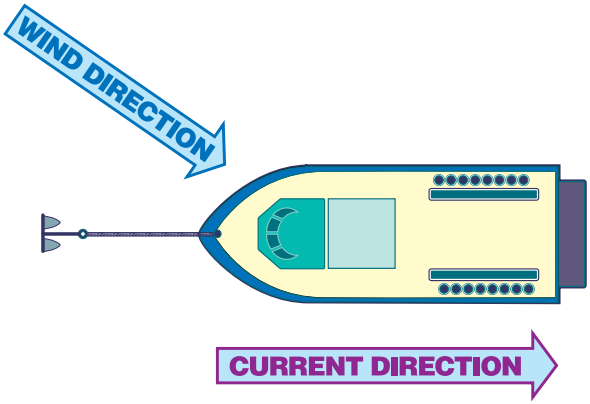
38. When preparing for a boat dive, what five general considerations apply to equipment preparation?

39. Before a boat dive, what four general considerations for personal preparation apply?

40. What part of the boat is:
- **bow (forward)?**
- **stern (aft)?**
- **starboard?**
- **port?**
- **leeward?**
- **windward?**
- **bridge?**
- **head?**
- **galley?**

41. By what four ways can you minimize the effects of motion sickness while on a boat?

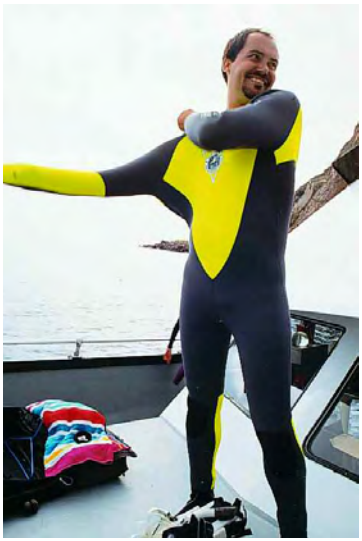
and the rear is called the *stern*. Going toward the bow is going *forward*, and *aft* is toward the stern. The *port* side of the boat is the boat's left when you stand facing the bow. The *starboard* side is the right. (To help you remember, "port" and "left" have the same number of letters. Think of "left port.")



Easy as she goes.
Typical charter dive boat layout.

When the wind blows across the boat, the wind comes from the *windward* side and the side away is the *leeward* (pronounced "loo-ard" in many areas) side. A boat's bathroom is called the *head*, and the kitchen is called the *galley*. The steering wheel is the *helm*, which is found *on* the *bridge*. The bridge is often in the *wheelhouse*, a cabin with all the controls that make the boat do what the captain wants (most of the time).

On charter boats, you may find areas off-limits, or just off-limits when you're wet. Check with the crew or captain before entering the bridge, galley or sleeping area when you're wet.



Try to arrive at least a half hour before departure. This gives you time to check with the crew, sign in and secure your dive equipment. On some charter boats, you'll also pick out a bunk or a cabin space to stow your dry clothes and personal items.

You need to think about seasickness before it happens. Seasickness is like sunburn in that it's one of those things that makes you absolutely miserable, but you can take precautions. So if you may be prone to seasickness, avoid it by taking seasickness medication (as advised by your physician) *before* you get underway and avoid greasy foods prior to boarding.

Underway, stay in the fresh air on deck and out of the boat exhaust. It helps to stay in the center of the boat, which moves the least, and watch the horizon. Try to stay busy setting up your equipment so you'll be prepared to enter the water as soon as possible. Reading and intricate tasks tend to promote seasickness, so leave the needlepoint at home.

If you do get sick, go to the leeward side (wind at your back) and have someone come with you (no joke — to hold on to you for safety when you lean over the side). Stay out of the head (that's about the *worst* place to go), and try to relax. To avoid seasickness, many divers *take seasickness medication* if it might be a problem — check with your physician or pharmacist if you need a recommendation on the type that's best for you.

The ride to the dive site can take minutes or hours, depending on where you are. Once the boat anchors at the site, diving begins only after the captain or crew give the okay. Typically a crew member briefs you about dive procedures, which you'll need to listen to closely. Pay attention to crew briefings, because they include important information you'll use to plan your dive with your buddy, such as current strength and direction, the depth, emergency procedures and similar information. If you fail to pay attention to crew briefings, you can put yourself and your buddy at risk.

As you gear up, be careful with heavy equipment. On a pitching boat, it's easy to lose your balance and hurt yourself, and dropping tanks or weight belts can damage the deck. When putting on your scuba unit, get someone to assist you and help you stay balanced. Many dive boats have benches and racks that make it easy to slip into your gear while seated. To don a weight belt, step over it rather than swing it around your waist.

Be careful walking with equipment on. Equipment changes your center of gravity and makes your balance awkward, all the more difficult if the deck is slippery and the boat rolls. If necessary, hang onto railings and handholds as you move, and don't try to walk with fins on. Put your fins on immediately before entering the water, using a rail or your buddy for balance.

When you and your buddy are ready to enter, check with the divemaster or a crew member, and enter where they tell you

to. The most common entry when you dive from large dive boats is the giant stride, but from smaller vessels you may use a controlled seated entry or a back roll. If you have a physical challenge that requires a different entry, let the crew know so they can accommodate you. Be certain the entry area is clear before entering.

If you're using a camera or other accessory, don't enter the water with it. Have someone hand it to you after you get in. Note the current direction so you can swim into it on the bottom, and then descend, preferably along the anchor line or other descent line to the bottom. On the bottom, get your bearings and swim into the current. Plan your dive and navigate so you finish near the boat with enough air so you'll be back on board with 20-40 bar/300 to 600 psi left in your tank. If there's a current, you'll find it easiest to ascend the anchor line, which keeps you from being carried past the boat.

If you hear the boat's underwater recall during the dive, remember to surface and look toward the boat for instructions, or as they direct during the briefing.

At the end of the dive, you usually surface in front of the boat, keeping one hand over your head for protection. When you break the surface, establish buoyancy and signal to the divemaster or crew that you're okay. Avoid swimming back to the boat immediately below the surface because if there are other boats underway in the area, they will not be able to see you. If you're at the surface away from the boat, watch out for boat traffic. You can use an inflatable signal tube, whistle or other signalling device to attract the attention of the dive boat, or of other boats that might not see you.

It's not very likely, but if you surface and the boat's not in sight, stay calm and get buoyant. The boat may have slipped anchor or the captain may have needed to leave for an emergency. Relax and wait to be picked up. If the shore and a reasonable exit area are close, slowly swim in that direction.

When you reach the boat's exit area, don't crowd it. Exit one at a time and stay clear of divers climbing the ladder ahead of you because they can fall, drop a weight belt or have a tank slip loose, which you wouldn't enjoy one bit if you're directly beneath. Hand accessory equipment up before climbing the ladder, but keep all your other equipment in place until you're aboard (mask on, breathing from snorkel or regulator, etc.) You'll usually need to take off your fins, but don't do so until you have a firm hold of the boat, because a current can carry you away from it and without your fins, you'd have difficulty swimming back. When wearing adjustable strap fins, you can slip the fins over your wrist so that if you did lose your grip, you'd be able to pull them back on and swim.

Once aboard, clear your stuff off the deck. A cluttered deck can cause people to trip, and stuff gets broken when divers step on it. Stow your gear directly into your equipment bag as you remove it, secure your tank and store accessories appropriately.

After the last dive, try to get your gear packed before the boat gets underway, since it's usually easier to pack at anchor. On a charter boat, pay attention to crew directions regarding pre and post dive roll calls, equipment stowage and other instructions.

Old salts.
On your first few boat dives, watch experienced boat divers and learn from them. Boat diving procedures are mostly common sense and not particularly difficult, and they allow boat dives to rank among your best dive experiences.

Quick Quiz

Self Assessment 11

1. Benefits of diving from a boat include (check all that apply):
   - ☐ a. reaching dive sites inaccessible from shore.
   - ☐ b. avoiding long surface swims.
   - ☐ c. fun.

2. In preparing your equipment for a boat dive, you'll want to (check all that apply):
   - ☐ a. inspect it.
   - ☐ b. use an equipment bag.
   - ☐ c. make sure everything's marked.
   - ☐ d. include appropriate clothing when you pack it.

3. To be ready for a boat dive, you should (check all that apply):
   - ☐ a. be well rested.
   - ☐ b. avoid excessive drinking the night before.
   - ☐ c. eat a heavy meal.
   - ☐ d. pack your bag so that what you need first is on top.

4. The _____ is the front of the boat; the _____ is the bathroom.
   - ☐ a. bow, starboard
   - ☐ b. stern, galley
   - ☐ c. bow, galley
   - ☐ d. bow, head

5. To minimize motion sickness (seasickness) you may choose to (check all that apply):
   - ☐ a. take seasickness medication.
   - ☐ b. stay in fresh air on deck.
   - ☐ c. look at the horizon.
   - ☐ d. stay near the center of the boat

How'd you do?
1. a, b, c. 2. a, b, c, d. 3. a, b, d. 4. d. 5. a, b, c, d.

On your first few boat dives, watch experienced boat divers and learn from them. Boat diving procedures are mostly common sense and not particularly difficult, and they allow boat dives to rank among your best dive experiences.

Problem Management

Diving enjoys a safety record better than many other sports and adventure activities — but common sense tells you that when you're under and in water, you face hazards and risks. The guidelines and procedures you learn in the course help you minimize and control (but never completely eliminate) these risks, and you'll find that if you and your buddy dive within your limitations, plan your dives and follow safe diving practices, you'll avoid problem situations. Keeping yourself physically fit and maintaining your dive skills also play important parts in problem prevention.

Nonetheless, if a problem does arise, you'll want to be able to care for yourself and lend assistance to another diver. This section introduces you to some of the basic concepts of dive problem management. In this section you'll learn how to prevent and respond to problems such as how to recognize when a diver needs assistance, how to assist another diver, how to respond to problems underwater and the basic procedures for emergencies with an unconscious diver.

Keep in mind, though, that if you plan to dive where secondary assistance (paramedic, lifeguard, divemaster or instructor) is either remote (by time, distance or both) or completely unavailable, you should have additional training beyond this course in first aid, cardiopulmonary resuscitation (CPR) and diver rescue. CPR and first aid training provide skills that can help others no matter where you are,

Summary Points

In these subsections on Dive Planning and Boat Diving, you learned:

- Planning your dive plans your fun.
- A dive plan doesn't have to be complex, nor take a lot of time, nor be inflexible, but you do need to follow it.
- Boat diving has many benefits that make it popular.
- You want to inspect and pack your gear appropriately before a boat dive.
- Different parts and areas on a boat have nautical terms you should know.
- Be careful when moving around on a rolling boat with your gear on.
- Listen to crew briefings about procedures, where to enter and exit the water, and other techniques and emergency considerations.
- Don't get under another diver who's climbing the boat ladder.
- You may choose to avoid seasickness by taking seasickness medication.

Serious fun.
To learn how to handle the specific and potentially complex problems unique to diving, plan to complete the PADI Rescue Diver course. Most divers cite the Rescue Diver course as one of the most rewarding they've taken.

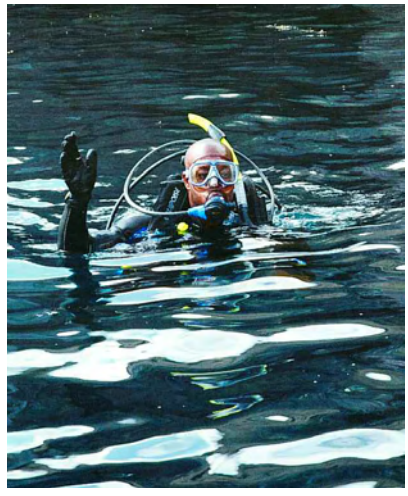
making them worth having apart from diving. The Emergency First Response course offered by PADI trains you in CPR and first aid emergency care. Emergency First Response is available through PADI Professionals, Dive Centers and Resorts.

To learn how to handle the specific and potentially complex problems unique to diving, plan to complete the PADI Rescue Diver course. The Rescue Diver course makes you a more capable diver by expanding and refining your problem prevention, management and handling skills. Although it covers a serious subject, and it *is* challenging, most divers cite the Rescue Diver course as one of the most rewarding courses they've taken.

But for now as a diver, you need to emphasize problem prevention and be prepared with emergency contact information: phone numbers for local paramedics and police, radio frequencies for Coast Guard, contact information for area diver emergency services like the Divers Alert Network (DAN) and the Diving Emergency Service (DES). In areas that lack diver emergency services, have the number and contact information for the nearest recompression chamber and emergency medical services. Carry change, a phone card, a mobile telephone, or whatever is appropriate so you can contact help in an emergency. Your instructor will give you emergency contact information specific to the area where you'll be diving.

Surface Problem Management

Considering that you scuba dive *underwater*, it may seem odd that the majority of diver distress situations take place *at the surface*, but that's exactly what happens. You can control or prevent surface problems by diving within your limitations, by relaxing while you dive and by establishing and maintaining positive buoyancy when you're on the surface.



Can you lend a hand?
Divers who have a problem, but who are in control of their actions normally appear relatively relaxed and breathe normally. Typically, they signal for help if appropriate, keep their equipment in place, move with controlled, deliberate movements, and respond to instructions.

Quick Quiz Self Assessment 12

1. You can prevent and control most problems at the surface by (check all that apply):
☐ a. establishing positive buoyancy.
☐ b. diving within your limits.
☐ c. relaxing while you dive.

2. If you have a problem at the surface, you should (check all that apply):
☐ a. establish positive buoyancy.
☐ b. ask for help.

How'd you do?
1. a, b, c. 2. a, b.

MAIN Objectives

Underline/highlight the answers to these questions as you read:

42. By what three ways can you prevent or control most dive problems that occur at the surface?

43. What should you do if a diving-related problem occurs at the surface?

Possible surface problems include overexertion, leg muscle cramps and choking on inhaled water. You've already learned about handling overexertion, and as you recall, if you choke on water, you hold your regulator or snorkel in place and cough through it — keep it in your mouth, and keep your mask on. Swallowing sometimes helps relieve choking, too. Be sure you have sufficient buoyancy, because coughing lowers your lung volume, decreasing your tendency to float.

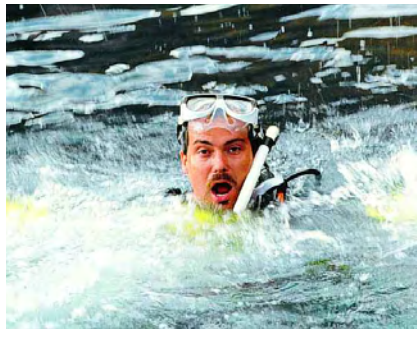
If you have a problem at the surface, immediately establish buoyancy by either inflating your BCD or dropping your weights. Let your equipment do the work — having to swim, tread water or otherwise having to fight to stay above water exhausts you quickly. Don't hesitate to discard your weights if you can't stay up with your BCD; weights are easily replaced.

Stop, think, then act. Need help? Ask! Whistle, wave and yell. It's the *smart, safe thing to do*. Get help when you need it, before a small problem becomes a big one, and you make it easier on yourself *and* other divers. Divemasters will tell you it's not the people who ask for assistance who give them gray hair — it's those who need it and *don't ask*.

Problem Recognition

Before you can help another diver, you have to recognize that the diver needs help, then follow your recognition with appropriate action. Divers who have a problem, but who are in control of their actions, look

pretty much like divers without problems. Generally, if they need help, they signal for it. Divers in control normally appear relatively relaxed and breathe normally. Typically, they keep their equipment in place, move with controlled, deliberate movements, and respond to instructions.



Red alert!

Panicked divers, fearing drowning, typically struggle to hold their heads high above the water. They usually fail to establish positive buoyancy, and spit out their regulators and shove their masks up on their foreheads. They pay no attention to their buddy or others and make quick, jerky movements. Their eyes are wide and unseeing, and they don't usually respond to directions.

Divers who have a problem and panic lose self control, and sudden, unreasoned fear and instinctive inappropriate actions replace controlled, appropriate action. Panicked divers, fearing drowning, typically struggle to hold their heads high above the water, expending tremendous energy. They usually fail to establish positive buoyancy, and spit out their regulators and shove their masks up on their foreheads, requiring them to fight even harder to breathe. Panicked divers will generally be anxious and breathe rapidly and shallowly. They pay no attention to their buddy or others and make quick, jerky movements. Their eyes are wide and unseeing, and they don't usually respond to directions. Divers exhibiting these signs need immediate help, because they will continue to struggle until completely exhausted and unable to remain afloat.

Assisting Another Diver

There are four basic steps to assisting another diver: 1) establish ample buoyancy (for *both* of you), 2) calm the diver, 3) help the diver reestablish breathing control and 4) if necessary, assist the diver back to the boat or shore.

Always begin with buoyancy — you reduce the immediate risk by assuring that neither

MAIN Objectives

Underline/highlight the answer to this question as you read:

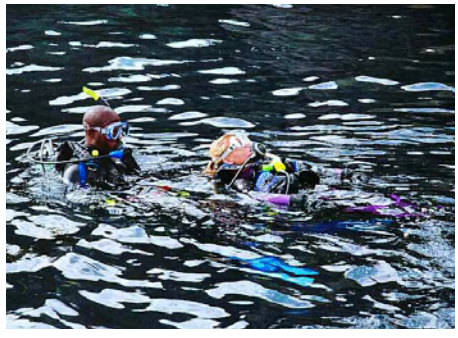
44. How do the appearance and actions of a diver who is under control differ from the appearance and actions of a diver who has, or is about to have, a problem involving panic?

QUICK QUIZ Self Assessment 13

1. Panicked divers typically (check all that apply):
- ☐ a. drop their weights and establish positive buoyancy.
- ☐ b. push off their masks and spit out their regulators.
- ☐ c. respond to instructions.
- ☐ d. need immediate help.

How'd you do?
1. b, d.

of you will sink. To do this, ideally throw or extend some flotation to the diver, but if you can't do that, inflate the diver's BCD and/or discard the weights. Once you've established buoyancy, calm the individual by talking, offering encouragement and persuading the diver to relax and take it easy.



Enjoy the ride.
After some time to rest and recover, if necessary assist the diver using the tank valve tow or the modified tired-swimmer carry.

To the rescue.
The fastest and preferred method for helping a diver establish buoyancy is to throw the diver something that floats, preferably on a line so you can gently pull the diver to you.

MAIN Objectives

Underline/highlight the answer to this question as you read:

45. What are the four basic steps to assisting another diver?

Have the diver take deep, slow breaths to reestablish breathing control, and encourage relaxation and self-control. After some time to rest and recover, if necessary assist the diver using the tank valve tow or the modified tired-swimmer carry, which you'll practice during Confined Water Dive Three.

Underwater Problem Management

You can prevent or control underwater problems by 1) relaxing while you dive, 2) keeping close watch on your air supply and 3) diving within your limitations. Of the few problems that do occur under water, the most likely are overexertion, running out of or low on air, regulator free flow and entanglement.

Overexertion. In Section Two, you learned to prevent overexertion by moving and breathing slowly and deliberately, and by pacing yourself. You also learned that if you do get overexerted, stop all activity, rest, relax and breathe slowly until you restore your normal breathing pattern.

Underwater, overexertion can give you a feeling of *air starvation* because breathing resistance through the regulator increases as you go deeper. Overexertion is the problem, but it may feel like your regulator isn't delivering enough air. Actually, you're demanding more air than it can deliver — as you recall, you prevent overexertion (and air starvation) by avoiding strenuous activity and by pacing yourself.

MAIN Objectives

Underline/highlight the answers to these questions as you read:

46. By what three ways can you prevent or control most dive problems that may occur underwater?

47. What are four problems that may occur underwater?

48. What, in order of priority, are the five low-on-air/out-of-air emergency procedures?

49. How do you breathe from a free-flowing regulator?

50. What should you do if you become entangled underwater?

Running low on or out of air. Running out of air is probably the easiest problem to avoid, and air stoppage due to a malfunction is extremely remote (more about this in a moment). To keep from running excessively low on or out of air, make a habit of checking your SPG frequently. Obviously, your SPG only works if you look at it.

But suppose the unlikely happens and your air either runs out or stops unexpectedly. It's still not a serious situation if you take a moment to consider your options and then act intelligently. Here are five options you can consider in a low-air situation, in their order of priority:

1. *Make a normal ascent.* Do what? No, it's not as odd as it sounds. If you're very low on air (you feel resistance and have to pull hard, but you're still getting something), your tank isn't completely empty. As you ascend, the water pressure surrounding you decreases, so more of the remaining air in your tank becomes usable. Breathing lightly (but continuously), you can make a controlled, continuous ascent to the surface.

2. *Ascend using an alternate air source.* Think of this as your best all-round choice when you're out of air. But for this to work, you must know how to locate your buddy's alternate, how to secure it and how to use it. Don't neglect these steps in your predive safety check.

3. *Ascend using a controlled emergency swimming ascent*. Supposing you're completely out of air and your buddy is too far away to provide an alternate air source (What did you learn about staying close to your buddy?) and the water is 6 to 9 metres/20 to 30 feet deep or less, you may decide to make a controlled emergency swimming ascent. This simply involves looking up and then swimming to the surface, exhaling continuously while making an *aaaahhh* sound into your regulator to release expanding air and to prevent lung over expansion injury. Upon reaching the surface, orally inflate your BCD for positive buoyancy. The emergency swimming ascent isn't difficult and you'll have a chance to practice during your third confined water dive.

Sing all the way to the surface.
A controlled emergency swimming ascent involves looking up and then swimming to the surface, exhaling continuously while making an "aaaahhh" sound into your regulator to release expanding air and to prevent lung over expansion injury.

4. *Buddy breathe with a single regulator.* Buddy breathing, which is sharing a single second stage between two divers, was once a standard air-sharing method, but became less and less favored as a viable option over the last 20 years. Alternate air sources have made buddy breathing unnecessary, along with the fact that buddy breathing is a moderately complex motor skill to perform in an emergency.

If you're deeper than 12 metres/40 feet and there's no alternate air source available, buddy breathing may be an option if you and your buddy remain calm, and if you're both trained and practiced with it. Once you begin buddy breathing, you and your buddy should continue all the way to the surface without attempting to switch to another out-of-air option. Your instructor may have you practice buddy breathing, but keep in mind that sharing air with an alternate air source is far more preferable and makes buddy breathing an unnecessary option.

5. *Make a buoyant emergency ascent.* You're too deep for a controlled emergency swimming ascent and you're too far for your buddy to help you. You can still make it to the surface, though the situation isn't ideal. You make a buoyant emergency ascent, just like a controlled emergency swimming ascent, except you drop your weights. You look up and exhale continuously, making the *aaaahhh* sound into your regulator as you rise to the surface. You're going to exceed a safe ascent rate, and that has some serious risks — so use this method only when you doubt you can reach the surface any other way. You can flare out to create drag and help slow your ascent if you start to rise faster than necessary to reach the surface safely.

After reaching the surface using any of these options, remember that you may need to inflate your BCD *orally* to establish positive buoyancy. Remember to discuss out-of-air emergency options with your buddy as part of planning your dive, and stay close together so you can assist each other if necessary, especially as you go deeper. Look after one another, watching your air supplies, breathing patterns, and time and depth limits. By remaining alert and monitoring each other, you can avoid air supply and other problems.

Quick Quiz Self Assessment 14

1. You can prevent or control most dive problems underwater by (check all that apply):
- ☐ a. relaxing while you dive.
- ☐ b. watching your air supply.
- ☐ c. diving within your limitations.
- ☐ d. maintaining a brisk pace.

2. Problems that can occur underwater include (check all that apply):
- ☐ a. overexertion.
- ☐ b. regulator free flow.
- ☐ c. entanglement.
- ☐ d. running low or out of air.

3. The general best all round option if you run out of air is:
- ☐ a. buddy breathing.
- ☐ b. buoyant emergency ascent.
- ☐ c. controlled emergency swimming ascent.
- ☐ d. None of the above.

4. To breathe from a free flowing regulator (check all that apply):
- ☐ a. don't seal your lips around the mouthpiece.
- ☐ b. allow excess air to escape.

5. If you become entangled underwater, your first response should be:
- ☐ a. to slowly untangle yourself.
- ☐ b. to cut yourself free.

How'd you do?
1. a, b, c. 2. a, b, c, d. 3. d. The best all round option if you run out of air is to ascend using an alternate air source. 4. a, b. 5. a

Regulator free flow. Today's regulators are extremely reliable; it's highly unlikely that a regulator malfunction would cut off your air. Besides this, they're designed to *fail-safe*, that is, most malfunctions result in an air free flow rather than no air. You can breathe from a free-flowing regulator by following a couple procedures.

First, don't seal your mouth on the regulator because the continuous flow could, in the worst case, cause a lung over expansion injury, but more likely it would make the regulator pop out of your mouth and flood your mask. Instead, hold the regulator in your hand and press the mouthpiece to the outside of your lips, inserting one corner if you like. Breathe the air you need like drinking from a water fountain, letting the excess air escape.

You should begin your ascent immediately if your regulator free flows because you'll exhaust your air supply quickly. When you reach the surface, turn off the air and don't use the regulator until it has been serviced by a qualified technician. If you maintain your regulator properly, keep it out of the sand or debris and have your PADI Dive Center or Resort service it annually, you'll probably never have a free-flow problem.

Entanglement. As mentioned earlier in the discussion on aquatic plants, entanglement is rare. Besides plants, though, fishing line, tree branches, loose line and old fishing nets have the potential to cause entanglement problems. Prevent entanglement by moving slowly, watching where you go and keeping your equipment secure so it doesn't snag or tangle.

As long as you have air and are unhurt, entanglement really isn't an emergency. Stop, think, and then work slowly and calmly to free yourself. Get your buddy to help you, and don't twist or turn because this usually wraps line around you and worsens the tangles. If your scuba unit is tangled, you may have to remove it, keeping your regulator in

your mouth, free it, and then put it back on. (You will practice taking your unit off and putting it back on underwater in Confined Water Dive Five.) If you're low on air, or you're severely entangled, you may need to use your knife to cut yourself free; if so, do so carefully — don't complicate the situation by injuring yourself or cutting a piece of gear. And, with tough rope, cutting may be slower than disentangling — use what works fastest. In any event, entanglement isn't common, and more of an irritation than a serious problem if you deal with it calmly.

Near Drowning and the Unresponsive Diver

Near drowning occurs when someone revives a diver (or swimmer) who became unresponsive (unconscious, or unable to respond or act coherently) and stopped breathing while submerged. Swallowing water, extreme fatigue, entanglement and lung over pressurization may be the cause, with panic, inefficient breathing, throat blockage, exhaustion, heart stoppage and unconsciousness contributing.

With an unresponsive diver, *the primary concern is to check for breathing and to begin rescue breaths if the diver isn't breathing*. If a diver is unresponsive underwater, bring the diver to the surface; someone may need to perform rescue breathing in the water, and if the victim has no pulse, CPR. You can't perform CPR effectively in water, so you need to get the diver out of the water.

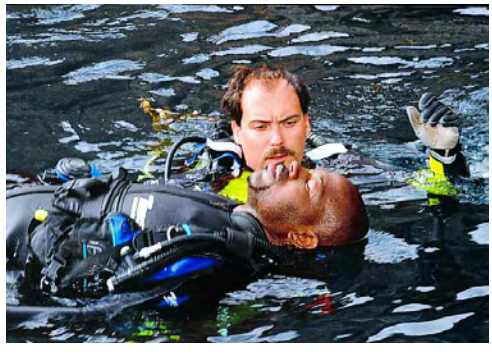
Here are the four general procedures to follow if a diver appears to lose consciousness and becomes unresponsive in the water:

1. Quickly bring the diver to the surface and check for breathing.
2. Establish ample positive buoyancy for you and the victim.
3. Get assistance as needed in providing rescue breathing.
4. Help remove the diver from the water.

MAIN Objectives

Underline/highlight the answer to this question as you read:

51. What are the four general procedures for dealing with an unresponsive diver in the water?



Breath is life.
With an unresponsive diver, the primary concern is to check for breathing and to begin rescue breaths if the diver isn't breathing.

Supine is fine.

If the diver doesn't require CPR or rescue breathing, keep the diver lying level on the left side supporting the head (called the recovery position). If the diver is responsive and more comfortable lying prone, that's fine.

Quick Quiz — Self Assessment 15

1. If a diver becomes unresponsive underwater, you should:
   - ☐ a. bring the diver immediately to the surface and check for breathing.
   - ☐ b. remove the diver's tank.
   - ☐ c. All of the above.

How'd you do?
1. a.

Assistance continues once out of the water, with the following steps also applying to a diver who, after diving, becomes unconscious or experiences symptoms of lung over expansion injury. These symptoms may include difficulty breathing, confusion, lowered alertness, a change in the level of consciousness, unclear thinking, visual problems, paralysis, and chest pain.

1. Keep airway open and check for breathing. If necessary, start and continue rescue breathing and/or CPR.
2. Observe the diver constantly, checking breathing and pulse.
3. If the diver doesn't require CPR or rescue breathing, keep the diver lying level on the left side supporting the head (called the recovery position). Don't let this position interfere with transportation or other aid, and should not be used if CPR is required. If the diver is responsive and more comfortable lying prone, that's fine.
4. Administer emergency oxygen if possible.
5. Keep the diver still and maintain a normal body temperature by protecting the diver from heat or cold.
6. Seek emergency medical assistance.
7. If unable to accompany the diver to medical treatment, write down as much background information as possible and attach it to the diver in a conspicuous place.

Confined Water Dive Preview

Neutral Buoyancy

By now you're aware that you need to maintain neutral buoyancy while diving to avoid bottom contact, so you can relax and maneuver easily, and so you can prevent rapid, uncontrolled ascents and descents. In the last confined water dive, you adjusted your weight for neutral buoyancy at the surface. During this dive, you'll develop your neutral buoyancy skills further.

Summary Points

In these subsections on Problem Management, you learned:

- Most problems occur at the surface.
- You prevent most problems by staying relaxed and diving within your limits.
- If you have a problem at the surface, establish positive buoyancy and call for help if you need it.
- A diver with a problem who is in control tends to respond to instructions, and to establish buoyancy.
- A panicked diver tends to spit out the regulator, push off the mask and to not to inflate the BCD nor drop weights.
- When assisting another diver, establish buoyancy, calm the diver, help the diver reestablish breathing control, and if necessary help the diver back to the boat or shore.
- If you watch your SPG, it's highly unlikely you'll run out of air.
- Using an alternate air source is your best all-round option when you're out of air.
- You can breathe from a free-flowing regulator by not sealing your lips on the mouthpiece.
- Entanglement isn't a big deal if you react calmly and carefully untangle yourself.
- Bring an unresponsive diver immediately to the surface, check for breathing and pulse, and begin rescue breathing and/or CPR as necessary.
- Ask for help when you need it.

You've undoubtedly found that you need to use your BCD to trim and fine-tune buoyancy when you descend and ascend, due to exposure suit compression, and due to air compressing and expanding in your BCD. When making changes to your buoyancy, whether adding or releasing air, do it slowly. Rapid changes make it difficult for you to control buoyancy and can lead to runaway ascents or descents.

You've probably been using mainly your low pressure inflator to fill your BCD underwater. To orally inflate your BCD underwater — which you might do if you had a low pressure inflator problem for instance, take your second stage in your right hand and the BCD inflator in your left. Take a breath, remove the regulator and blow about two thirds of this air into your BCD, operating the controls just like you did when orally inflating it at the surface. Save enough air to clear the regulator, and don't forget to blow a stream of bubbles as you switch back and forth — never hold your breath. Do this until you've inflated the BCD sufficiently to attain neutral buoyancy.

Let's look at the fin pivot method for establishing neutral buoyancy. This method guides you in getting the feel of neutral buoyancy. You'll practice doing this several times in the course, using both your low pressure inflator and your oral inflator. When you use your low-pressure inflator, remember to add air in short bursts. Don't hold the button down continuously, and release air from your BCD in small amounts, too.

Basically, here's how you fin pivot: 1) lie face down on the bottom, 2) breathe

Confined Water Dive Three

Skill Requirements

Here's what you'll be able to do when you successfully complete Confined Water Dive Three:

1. Independently establish neutral buoyancy under water by pivoting on the fin tips, or, when appropriate, another point of contact (both oral and low-pressure inflation).
2. Swim at least 10 metres/yards underwater while maintaining neutral buoyancy.
3. Demonstrate the cramp removal technique.
4. At the surface in water too deep to stand in, perform a tired diver tow for 25 metres/yards.
5. React to air depletion by signaling out of air, then securing and breathing from an alternate air source supplied by a buddy for at least one minute while swimming underwater.
6. Breathe effectively from a free-flowing regulator for not less than 30 seconds.
7. Simulate a controlled emergency swimming ascent by swimming horizontally underwater for at least 9 metres/30 feet while continuously exhaling by emitting a continuous sound.

slowly and deeply and 3) add air in small amounts to your BCD (or dry suit – your instructor will give you more detail on this if you'll be using a dry suit), gradually increasing your buoyancy until you slowly pivot upward on your fin tips as you inhale (buoyancy increasing with lung volume), and slowly pivot downward as you exhale (buoyancy decreasing with lung volume). This means you're neutrally buoyant at that depth and can fine-tune your buoyancy by controlling your lung volume. Be sure you don't hold your breath at any time.

If you have a physical challenge that makes it difficult to pivot on your fin tips, you can use your knees or another contact point for pivoting. However, use your fin tips if you can because it puts all your body mass on the same side of the contact point; a contact

Without LPI underwater.
To orally inflate your BCD underwater take your second stage in your right hand and the BCD inflator in your left. Take a breath, remove the regulator and blow about two thirds of this air into your BCD, operating the controls just like you did when orally inflating it at the surface. Save enough air to clear the regulator, and don't forget to blow a stream of bubbles as you switch back and forth.

Up and down.
To fin pivot: 1) lie face down on the bottom, 2) breathe slowly and deeply and 3) add air in small amounts to your BCD. Gradually increase your buoyancy until you slowly pivot upward on your fin tips as you inhale. When you exhale, you should slowly pivot back down again.

Minor difference.
If using a dry suit, you'll use the low pressure inflator on your suit instead of the one on your BCD to adjust your buoyancy for fin pivoting.

Protecting the environment.
After you've established neutral buoyancy, your instructor will have you swim 10 metres/yards or farther, remaining neutrally buoyant. This simulates how you swim avoiding damage to the environment when making open water dives.

point that has body mass on both sides (like your knees — your lower legs, feet and fin are on the other side) may not set your buoyancy quite as accurately.

With practice, you'll find it pretty easy to maintain neutral buoyancy, to the point that it becomes second nature. If it seems awkward at first, no worries. That's normal. Keep in mind that water's density slows movement, so changes in your buoyancy don't seem to have an immediate effect. That's why you add or release small air amounts and wait a moment to see what happens before adding or releasing more.

The volume of air in your BCD changes every time you change depth. In shallow water, where air volume expands and compresses the most for a given depth change, you'll find buoyancy control the most critical — it's actually easier as you go a bit deeper, like in open water.

Don't forget to adjust your buoyancy as you change depth, or you may find yourself floating away from the bottom unintentionally. If this should happen, exhale and vent air from your BCD, and swim downward. Some BCDs have extra exhaust valves that allow you to dump air while swimming downward at the same time. If you're unable to and end up in a runaway

ascent, flare out facing the surface to create maximum drag and resistance and slow your ascent, while breathing continuously and maintaining normal lung volume. With experience and by staying aware of your buoyancy, you should have few, if any, runaway ascents.

During a normal ascent, keep your hand on the deflator, releasing small air bursts as needed to prevent excess buoyancy. When you reach the surface, immediately inflate your BCD and establish positive buoyancy. You'll have to pay close attention to buoyancy control at first, but gradually it will become something you do automatically.

Neutral Buoyancy Swim

After you've established neutral buoyancy, your instructor will have you swim 10 metres/yards or farther, remaining neutrally buoyant. During this swim, pretend you're swimming over a reef with sensitive aquatic organisms and avoid any contact with the bottom. This simulates how you swim avoiding damage to the environment when making open water dives.

Ow!

To relieve a cramp, stop and rest the cramped muscle. Stretch and gently massage it to increase circulation and pull out the cramp. If you have a leg cramp in your calf muscle, you can stretch it by grasping the fin tip and pulling it toward you while you push with your leg.

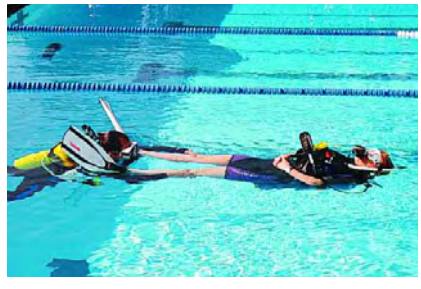
Cramp Removal

A cramp is a painful, involuntary muscle contraction, which, as a diver, you may experience in your leg or foot muscles. Several things can contribute to cramps: dehydration, working the muscle beyond its fitness level, restricted circulation, cold water, and all of these working together. Your fins can contribute to cramping if the blade is too large for your leg strength, or if the foot pockets are too small and your feet don't go in them properly. Fitness, proper fin selection, practice, proper insulation and pacing your activity, will help you avoid cramps.

But they can happen anyway. Like most problems, it's more of an irritation than an emergency if you stop and think about what to do. For a cramp, stop and rest the cramped muscle. Stretch and gently massage it to increase circulation and pull out the cramp. If you have a leg cramp in your calf muscle, you can stretch it by grasping the fin tip and pulling it toward you while you push with your leg. Your buddy can also brace the fin tip for you.

Pull.
Tank valve tow.

After relieving the cramp, rest the muscle for a few minutes before continuing at a slower pace — with about 50 to 75 percent of the load you had on the muscle before. A cramped muscle usually recovers better if you resume using it at a reduced pace after a brief rest than if you stop using it completely.



Push.
Tired diver push, sometimes called a modified tired-swimmer carry.

Tired Diver Tow

Sometimes divers become so tired and out of breath they can't swim to the boat or shore. Or, they may have severe leg cramps that prohibit swimming. You can assist such a diver by establishing positive buoyancy and having the diver do the same, then helping the diver to the boat or shore using one of several tows, such as the *tank valve tow* or the *tired diver push,* sometimes called the *modified tired-swimmer carry*. Your instructor will demonstrate these and let you practice them.

Thanks for the assist.
As soon as you feel breathing resistance, signal "out of air" and "share air" to your buddy. Secure and start breathing from your buddy's alternate air source.

Air Depletion/Alternate Air Source Combined Exercise

During your first two confined water dives, you learned how to use an alternate air source, and you learned what it feels like to run out of air. Now you're going to put these together to practice responding to running out of air. Your instructor will turn off your air like when you did the air depletion exercise. Don't look at your SPG — but as soon as you feel breathing resistance, signal "out of air" and "share air" to your buddy. Secure and start breathing from your buddy's alternate; after you take a moment to get situated and make contact with each other, your instructor will have you swim together for at least one minute while you continue to use the alternate. This simulates swimming to the surface from 18 metres/60 feet deep.

As soon as you secure your buddy's alternate and remove your regulator from your mouth, your instructor will turn your air

back on. That way, if you need to you can switch back to it. Confirm that the valve is open by checking your SPG, which should not be on (or near) zero if it is.

Free Flow Regulator Breathing

Earlier you learned that it's not likely that your regulator will fail so that it would cut off your air, but that a failure would most likely cause an air free flow. You can breathe from a free flowing regulator if you don't seal your lips on the mouthpiece. During this confined water dive, your instructor will have you practice breathing this way

Since your regulator probably won't cooperate by spontaneously malfunctioning right when you need to practice this, you'll *simulate* the free flow by (you guessed it) holding in the purge button.

Whoosh!
You'll simulate the free flow by holding in the purge button. Remember to breathe without sealing your mouth on the regulator, "sipping" the air you need while allowing excess air to escape.

Remember to breathe *without* sealing your mouth on the regulator, "sipping" the air you need while allowing excess air to escape. A free flowing regulator can really rush — don't be surprised if it jostles and floods your mask a bit. You'll breathe from your simulated free flow for at least 30 seconds, and your instructor may have you practice turning off your air after surfacing like you would with a real free flow. If you can't reach your tank valve unless you remove the scuba unit, do so for practice. Although your buddy might do this for you, doing it yourself develops self-reliance. Check your SPG when you're done; you'll be amazed how much air a free flow eats up in only 30 seconds — which is why you head straight for the surface if it happens.

Controlled Emergency Swimming Ascent

As you learned, the controlled emergency swimming ascent (also called CESA — pronounced "see-sa") is one option if you lose your air supply at 6 to 9 metres/20 to 30 feet or less, and your buddy is too far away to provide an alternate air source (Buddy system, buddy system! You shouldn't be that far from your buddy!).

Emergency swimming ascents are interesting because you start with air in your lungs, exhale all the way to the surface and still have air in your lungs when you get there. This happens because air expands in your lungs as you ascend; the potential

hazard is a lung over expansion injury, which you avoid by not holding your breath.

Horizontal is vertical.
Since you won't be 9 metres/30 feet deep during your confined water dive, you'll simulate the controlled emergency swimming ascent horizontally.

To make a controlled emergency swimming ascent, simply swim upward with all your equipment in place, including your regulator. Look up, reach up and come up, swimming at 18 metres/60 feet per minute or slower. Exhale the entire time by making a continuous *aaaahhhh* sound through your regulator as you ascend.

By saying *aaaahhhh*, you exhale air at the right rate to prevent lung over expansion injury, but you don't exhale too much either. The idea is to maintain a lung volume that is neither empty nor full.

Since you won't be 9 metres/30 feet deep during your confined water dive, you'll simulate the controlled emergency swimming ascent first *horizontally*, then diagonally from deeper to shallower water. You'll have enough air in your lungs to swim a long way horizontally while exhaling continuously, but 9 metres/30 feet will be ample for practice. After you do this horizontally, you can be more than sure that you can do it *vertically* assisted by air expanding in your BCD and lungs. After an actual controlled emergency swimming ascent, you don't feel out of breath — you still have air in your lungs. You'll get a chance to practice CESA vertically during your open water dives and may be surprised how much easier it is than simulating it horizontally.

Perhaps the greatest value of controlled emergency swimming ascent training is knowing you can do it. When you realize you can reach the surface without difficulty, even if you suddenly lose your air supply, you can relax and enjoy diving more. But watch your SPG and stay close to your buddy so you never need to.

General Open Water Skills

Now let's start looking at what you'll be doing during your open water dives. Depending on the course location, schedule, your preferences and other logistical concerns, you may have already made Open Water Dive 1, or may make Open Water Dives 1 and

2 after you successfully complete Confined Water Dive Three. You'll do this if you're completing only the Scuba Diver certification. Alternatively, you may make all your open-water dives after completing all five confined water dives.

During your open water dives, you'll apply and further develop the skills you've learned during the confined water dives, and you'll start picking up some new skills that you can't practically learn in a confined water environment. Skills in both categories may include : 1) evaluating dive conditions, 2) gearing up for a dive in open water, 3) making entries and exits through mild surf, 4) swimming on the surface and 5) descending/ascending in open water.

Diving report?

When you arrive at a dive site, you want to determine whether the diving conditions are within your training and experience limitations. Your instructor will show you how to account for considerations that have bearing on the dive.

Evaluating Dive Conditions

When you arrive at a dive site, you want to know whether the diving conditions are within your training and experience limitations. As you learned earlier, you normally check out the conditions before you gear up — no point unpacking and putting everything on only to find conditions don't warrant diving. Your instructor will show you how to account for considerations like weather, water temperature, bottom composition, waves, depth, local area hazards and anything else that has direct bearing on the dive. You'll also preplan your entry and exit points and procedures as part of this evaluation.

Decide whether you can make the dive safely. **Remember: This is *your* decision – you are ultimately responsible for your safety, and only *you* can make the final decision to dive.** If you don't feel confident about it, your instructor may have you check your alternate site for acceptable conditions. If conditions aren't good, it's best to go do something else — diving in poor or potentially hazardous conditions isn't fun. You're doing this for fun, adventure and challenge — not to expose yourself to unreasonable risks.

Suiting Up

In the discussion on exposure suits you learned ways to avoid overheating in your exposure suit as you get ready to dive. During

One piece at a time.
Suiting up requires thought at first, but after one or two dives, you'll be more familiar with your equipment and it becomes second nature.

your open water dives, you'll put this knowledge to use. Poor timing and sequence when you kit up can cause you to become somewhat frustrated, tired, breathless and overheated.

Ideally, you want to suit up so that you and your buddy finish simultaneously. This never happens, of course, but you can time it so you're both ready at about the same time while staying cool and rested, ready to enter the water.

First, it helps if you checked and packed your equipment properly before the dive. Start putting everything together, but take your time and rest as needed. In hot weather, cool off in the water if you need to. Pace yourself with your buddy, but be as self-reliant and independent as possible, so you become familiar with your equipment.

As a suggestion, prepare and don your equipment like this:

1. Assemble your scuba unit. Prepare anything else that can be made ready without putting your exposure suit on, such as defogging your mask, adjusting any straps, etc.
2. Don your exposure suit. If it is a wet suit, put on pants and boots first, then the jacket and hood.
3. Put on your weight belt. With a few scuba units, you'll put your weight belt on after the unit. If you're using an integrated weight system, it's usually part of your scuba unit.
4. Have your buddy help you put on your scuba unit.
5. Put on any wrist mounted gauges (often easier after putting on your scuba unit so they don't snag sliding into your BCD).
6. Perform the predive safety check with your buddy.
7. Don your mask and snorkel, which should've been adjusted ahead of time.
8. Put on your gloves.
9. Finally, just before entering the water (boat diving) or in waist deep water (shore diving) put on your fins; fins should've been preadjusted.

Suiting up requires thought at first, but after one or two dives, you'll be more familiar with your equipment and it becomes second nature.

Open Water Entries

Entry techniques vary from place to place according to the dive environment. If a dive site requires entry techniques that you don't know, always get an orientation to them so you can enter (and exit) safely. If your open water dives will be from shore, your instructor will teach you the proper entries for the dive site.

The following practices are generally recommended for most scuba entries from shore:

1. Have everything on before entering the water. Depending on the environment and conditions, you may have your fins on when you enter the water, or you may carry them until reaching water about waist to chest deep.
2. As a general rule, breathe from your regulator until you're floating in deeper water. This way, if you stumble, you can still breathe, even if you end up with your face in the water. Once in deeper water and floating with your BCD, switch to your snorkel to conserve air if you have a surface swim before descending.

3. If you're walking in with your fins on, walk backward or sideways and shuffle your feet. This helps you find obstructions or holes, scares away bottom-dwelling animals that could sting if you stepped on one, and helps minimize the chances of falling. In some environments, however, you may want to avoid shuffling your feet because it will disturb the visibility. Your instructor will teach you which is appropriate for your open water dives.
4. Swim as soon as the water is deep enough. Swimming is often easier than wading.

Surf Entries and Exits

Surf entries and exits require special training and shouldn't be attempted unless you have had that training. It is possible, though, that you'll enter and exit through *mild* surf as part of your open water dives. Here are a few simple general procedures.

Entries. First, watch the waves and note where they're breaking and how often. Do this during suiting up so you'll be familiar with the surf's pattern when you're ready to enter.

As you enter the water, breathe from your regulator. If wearing fins, walk backward, looking over your shoulder to watch where you're going and to see oncoming waves. Your buddy should be next to you, and if you're towing a float, it should be between you and the shore so a wave can't push it into you. The idea is to get through the surf zone as quickly as possible.

Hurry through the surf.
Breathe from your regulator when entering through surf. Your buddy should be next to you, and if you're towing a float, it should be between you and the shore so a wave can't push it into you. The idea is to get through the surf zone as quickly as possible.

When a wave is about to meet you, hold your mask (so the wave doesn't take it), stop, and lean into the wave as it hits you. It's best to have your side to the waves, which presents less surface to it and aligns your legs for the best balance. Once the wave passes, move on again quickly. As soon as the water is deep enough, begin swimming steadily and move quickly until you clear the surf zone, then rejoin your buddy if you became separated during the entry. Be sure to keep a hand on your mask whenever you go through a wave, and until outside the surf. Beyond the surf you can inflate your BCD and switch to your snorkel to swim out to your dive site.

Exits. When you're ready to leave the water through surf, stop outside the surf zone and watch the waves. Again, watch the wave sets — where they're breaking and when. The pattern can change during your dive, so take the time to check. Evaluate the situation and discuss it with your buddy.

Always save some air for exiting, because you'll use your regulator as you pass through the surf. Wait until the surf pattern reaches a lull, then swim toward shore as quickly as possible, keeping a hand on your mask when waves hit and checking your buddy every few seconds. Swim steadily with a free hand extended ahead of you. Avoid stopping in the surf zone and swim until you're in shallow water. If the backrush is strong and you are tired, you may elect to swim up to the beach and crawl out on your hands and knees. If you stumble in the waves, don't try to get up — just crawl out.

Handle waves the same way you did while entering — by stopping, holding your mask firmly and leaning against it. When you stand up, walk backward so you can watch the waves and stay

beside your buddy. If you have a surface float, push it ahead of you so it stays between you and the shore.

Surface Swimming

Swimming on the surface in open water differs from surface swimming in confined water. You may have lower visibility, you may have longer distances to swim, and there may be currents or waves. You've been simulating the right habits during your confined water dives, but here are a few reminders:

Use your snorkel.
Swimming on the surface in open water differs from surface swimming in confined water. You may have lower visibility, you may have longer distances to swim, and there may be currents or waves.

1. Swim with your BCD about half full so you won't have to struggle to stay at the surface. Don't over inflate your BCD, though because it creates unnecessary drag.
2. Pace yourself. Swim at a steady, comfortable pace. Surface swimming tires you more than swimming underwater, so don't try to go as fast.
3. Streamline yourself as much as possible. Keep your arms at your sides.
4. Use your snorkel, breathing cautiously to avoid choking on water that may enter the snorkel due to small waves.
5. Keep your fins below the surface when kicking. You may wish to swim on your side or back if conditions allow.
6. Check your location, direction and your buddy every 30 seconds or so. Stay close to your buddy, maintaining physical contact if necessary. Use something on shore, or an anchored boat, for orientation.

Descents in Open Water

You've been practicing proper descents during your confined water dives, but there are some points to remember in open water due to the greater depths and the bottom composition.

If you're weighted properly, you should be able to descend by slowly deflating your BCD and exhaling. Make the entire descent with your head above your feet, so you maintain control and orientation, and keep contact with your buddy. Remember to equalize your air spaces early and often during the descent.

You want to maintain neutral buoyancy during the descent — don't wait until you reach the bottom. Add small amounts of air

Equalize early and often.
As you descend, maintain buddy contact and stay oriented so you have your sense of direction when you reach the bottom.

as you descend so you reach the bottom neutrally buoyant. This minimizes kicking and stirring up the bottom.

For control and reference, it's a good practice to use a line during descents, or follow the bottom contour. If you descend along the anchor line of a boat, hold the line at arm's length so it won't strike you as the boat pitches up and down in the waves. Let your arm swing up and down with the line like a shock absorber so it doesn't jerk you up and down.

You want to descend steadily and with minimal effort, while maintaining neutral buoyancy so you can stop your descent at any time. Maintain buddy contact and stay oriented so you have your sense of direction when you reach the bottom.

Open Water Dives 1 and 2

Here's a preview of the skills and procedures you'll practice during your first two Open Water Dives. The sequence within each dive will vary, depending on the logistics, and your instructor may sequence some skills in different dives. Before each dive, your instructor will brief you about what you're going to do and when, along with other information you need for the dive, like communication signals, an environmental orientation, emergency procedures, safety rules, and so on.

Open Water Dive 1 introduces you to the skills you'll use on virtually all dives, to the experience of exploring underwater, and to the differences between confined water and open water. Open Water Dive 2 expands on this, plus you'll practice some of the skills you've mastered during the confined water dives.

Open Water Dive 1 Overview

Briefing
Equipment preparation
Don and adjust equipment
Predive safety check
Entry
Buoyancy/weight check
Controlled descent (max 12 m/40 ft)
Underwater exploration
Ascent
Exit
Debrief and log dive

* These skills may be sequenced in other dives, depending on logistics.

Open Water Dive 2 Overview

Briefing
Equipment preparation
Don and adjust equipment
Predive safety check
Entry
Buoyancy/weight check
(Cramp removal self and buddy)*
(25 metre/yard tired diver tow)*
(Snorkel/regulator exchange)*
Controlled descent (max. 12 m/40 ft)
Buoyancy control — fin pivot, low pressure inflator
Partial and complete mask flood and clear
Regulator recovery and clearing
Alternate air source use stationary and AAS assisted ascent
Underwater exploration and buoyancy control
Ascent
(Weight removal at the surface)*
Exit
Debrief and log dive