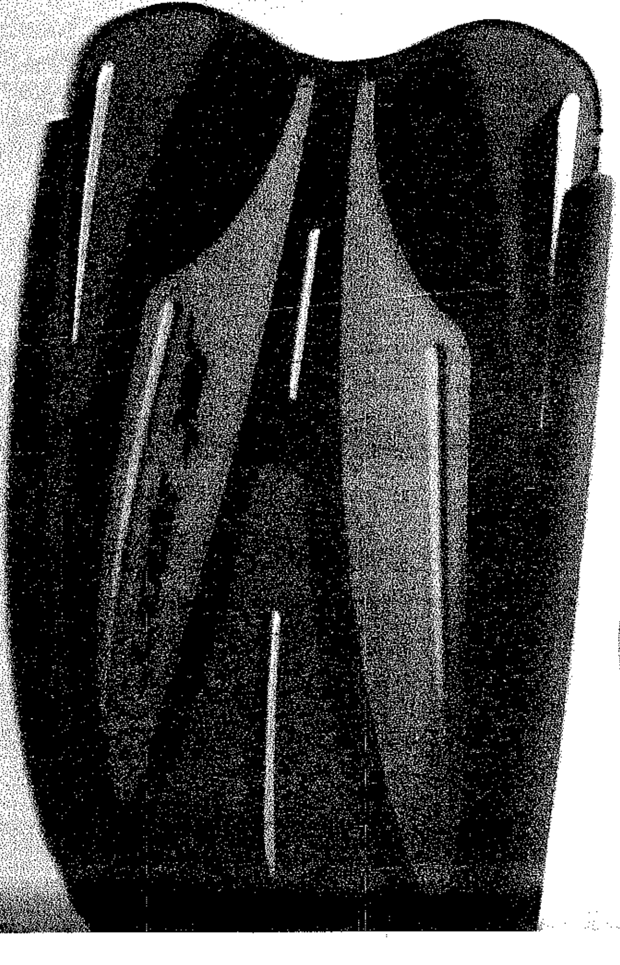
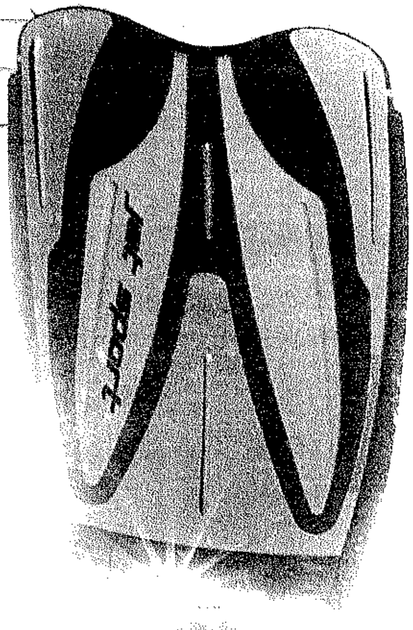
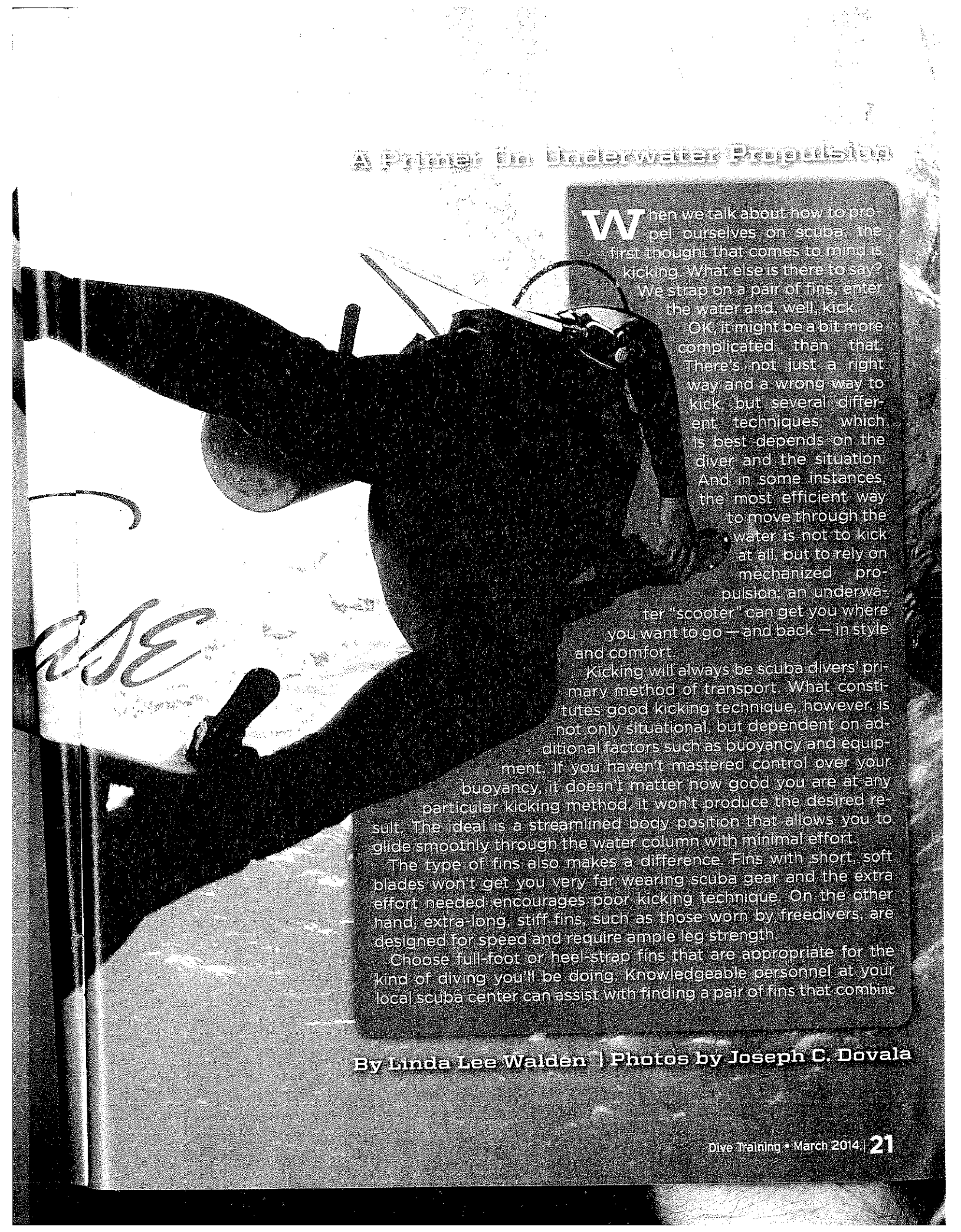
Getting There with Style and





A Primer in Underwater Propulsion



When we talk about how to propel ourselves on scuba, the first thought that comes to mind is kicking. What else is there to say? We strap on a pair of fins, enter the water and, well, kick.

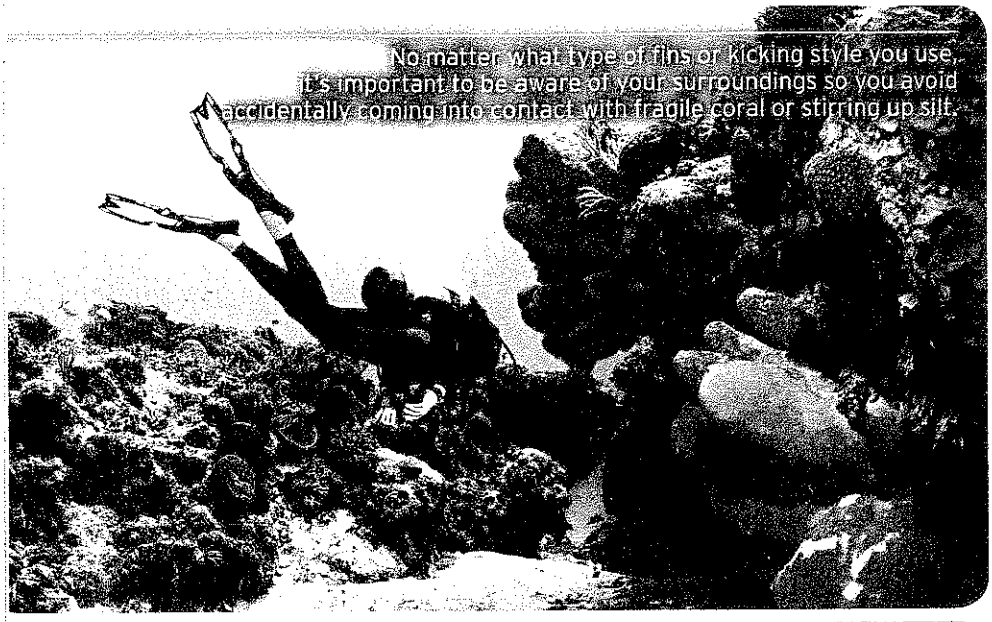
Ok, it might be a bit more complicated than that. There's not just a right way and a wrong way to kick, but several different techniques, which is best depends on the diver and the situation. And in some instances, the most efficient way to move through the water is not to kick at all, but to rely on mechanized propulsion; an underwater "scooter" can get you where you want to go — and back — in style and comfort.

Kicking will always be scuba divers' primary method of transport. What constitutes good kicking technique, however, is not only situational, but dependent on additional factors such as buoyancy and equipment. If you haven't mastered control over your buoyancy, it doesn't matter how good you are at any particular kicking method, it won't produce the desired result. The ideal is a streamlined body position that allows you to glide smoothly through the water column with minimal effort.

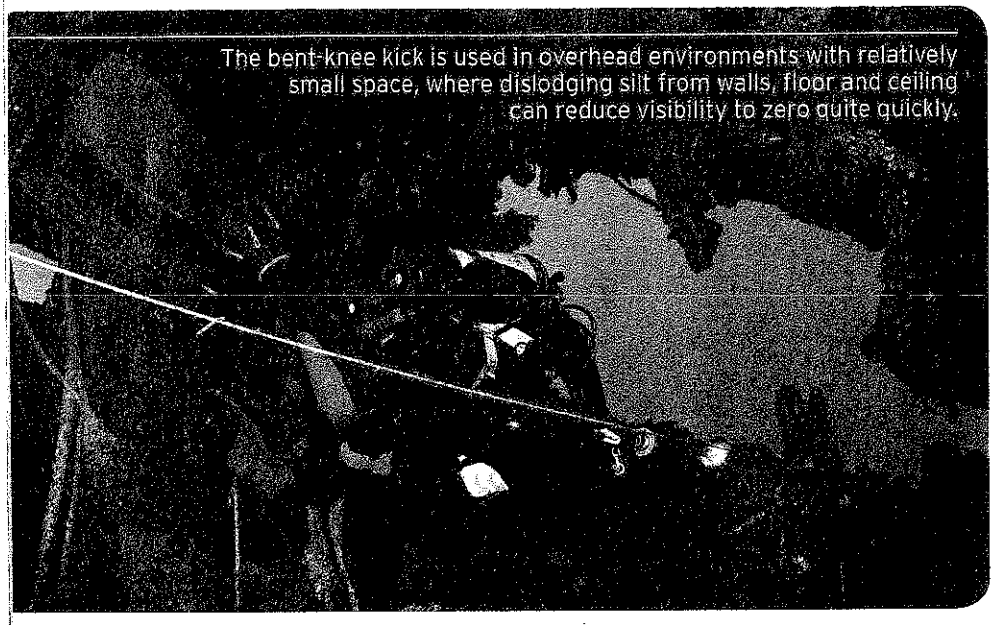
The type of fins also makes a difference. Fins with short, soft blades won't get you very far wearing scuba gear and the extra effort needed encourages poor kicking technique. On the other hand, extra-long, stiff fins, such as those worn by freedivers, are designed for speed and require ample leg strength.

Choose full-foot or heel-strap fins that are appropriate for the kind of diving you'll be doing. Knowledgeable personnel at your local scuba center can assist with finding a pair of fins that combine

By Linda Lee Walden | Photos by Joseph C. Dovala



No matter what type of fins or kicking style you use, it's important to be aware of your surroundings so you avoid accidentally coming into contact with fragile coral or stirring up silt.



The bent-knee kick is used in overhead environments with relatively small space, where dislodging silt from walls, floor and ceiling can reduce visibility to zero quite quickly.

power with maneuverability and do not overtax your legs.

With good buoyancy control and the right fins you'll find a variety of effective methods for getting from one place to another underwater.

Flutter Kick

The flutter kick is the basic kicking method that scuba students are expected to master during entry-level scuba training. This alternating leg, up-and-down kick is by far the most popular technique because, when done properly, it offers the most propulsion with the least expenditure of energy.

The flutter kick should be performed with legs straight and toes pointed. The torso, hips, legs and fin blades form a relatively straight line horizontally. Some divers inadvertently bend at the waist, causing the knees to bend; this turns the effective flutter kick into the awkward and ineffective bicycle kick.

When done correctly, the knees bend only slightly on the upward stroke and straighten (but not lock) on the downward stroke. The power comes on the downstroke by engaging the large muscles of the thighs. Upward and downward strokes of the flutter kick should be pronounced but comfortable. Exaggerated kicks increase turbulence, decreasing efficiency, wasting energy and using excessive air. The arms remain still, held at your sides or clasped in front of your body.

When performed in a slow, even rhythm, a relaxed flutter kick lets you glide smoothly while maintaining the desired pace at a constant level of exertion. Kick a little faster and your speed increases proportionally. However, due to water resistance, it takes four times as much energy to move twice as fast.

Some modern fin designs have necessitated modifications to the standard flutter kick. With Force Fins® and split-blade fins, for instance, the span of the kick is shorter and the knees bend more with each upward stroke. Very flexible blades provide a springing action that assists propulsion despite the more compact kick cycle.

Its efficiency makes the flutter kick the self-propulsion technique of choice when speed and distance are factors (e.g., when navigating to a specific underwater destination), swimming against a current or on the surface. It can also be effective when exploring a wall or closely examining bottom features. However, since the downward force of the kick can stir up silt and sand, which reduce visibility, the up-and-down motion must be kept short and slow when near the bottom, even to the point of moving just the ankles and assuming a head-lower-than-torso trim. This also helps avoid disturbing or hitting fragile marine life with the fin tips.

A variation on the standard flutter kick is the sideways kick. I often use it when swimming near the bottom. Keep the upper body flat in the standard facedown swimming position, but twist at the waist until the hips, legs and fins are facing sideways. The force of the flutter kick still propels you forward but the backwash is diverted to the side rather than downward. You can pass quite closely above bottom features without disturbing the substrate or living creatures.

Bent-Knee Kick

This technique is also a version of the flutter kick. It is the preferred (read required) kick for cave divers because

Finning Techniques

Flutter Kick
> The primary kick for covering distance underwater or on the surface.
> At depth when above the bottom or along a wall or steep slope.
> Swimming into a current.
> Not preferred where kicking up silt, damaging fragile features or injuring aquatic life are issues. Switch to the sideways flutter or frog kick.
> Not safe for use in overhead environments.

Bent Knee Kick
> For overhead environments to prevent silting.
> Does not provide adequate propulsion for distance or speed.

Scissor or Split Kick
> Alternate versions of the flutter kick to rest leg muscles.
> Not as powerful as the traditional flutter kick.

Frog Kick
> An alternative to the flutter kick while exploring a dive site.
> For a change to using different muscles.
> To minimize exertion.
> Close to a sandy bottom or above a reef.
> Not suited for narrow spaces or next to a wall.
> Not efficient for long swims, speed or against current.

Dolphin Kick
> As a change from the flutter or frog kick.
> Just for fun.
> Looks cool, especially if dolphins are in the area and you feel like showing off.
> Uses more energy; not good for distance or speed.

Backward Kick
> To back out of a tight spot without turning around, using hands or bumping into anything.
> Awkward and inefficient in other situations.

Sculling
> For maneuvering in tight spaces (not overheads) when use of the fins would damage the surrounding features or injure marine life.
> Using hands for propulsion not efficient for moving through open water.

it causes little disturbance of their surroundings. This is especially important in overhead environments with relatively small space, where dislodging silt from walls, floor and ceiling can reduce visibility to zero quite quickly.

The hips and thighs remain in a straight line with the torso, but the knees are bent with the fin blades pointing upward. The slow kicking motion is restricted to the lower legs and ankles, causing the force of the kick to travel backward, rather than up or down. Mastering this technique may take practice; be particularly careful not to drop the hips into a bicycling position.

For recreational divers the bent-knee kick provides a minimal-impact alternative when close to a silt or sand bottom or just above a reef. The limited motion and slow execution does not produce a lot of propulsion or backwash, so while it is good for slow cruising through tight reef spaces, it is ineffective for open-water distance or speed.

Scissor Kick

The scissor kick looks similar to the flutter kick: legs straight, knees slightly bent, up-and-down motion. However, the leg motion stops at the middle. On each stroke, rather than swinging the legs past each other in a continuous movement, the legs are brought together sharply (like a pair of scissors closing) and held in that position for a glide count. You can alternate legs as in the flutter kick or use one leg for the upward stroke and the other for the downward stroke.

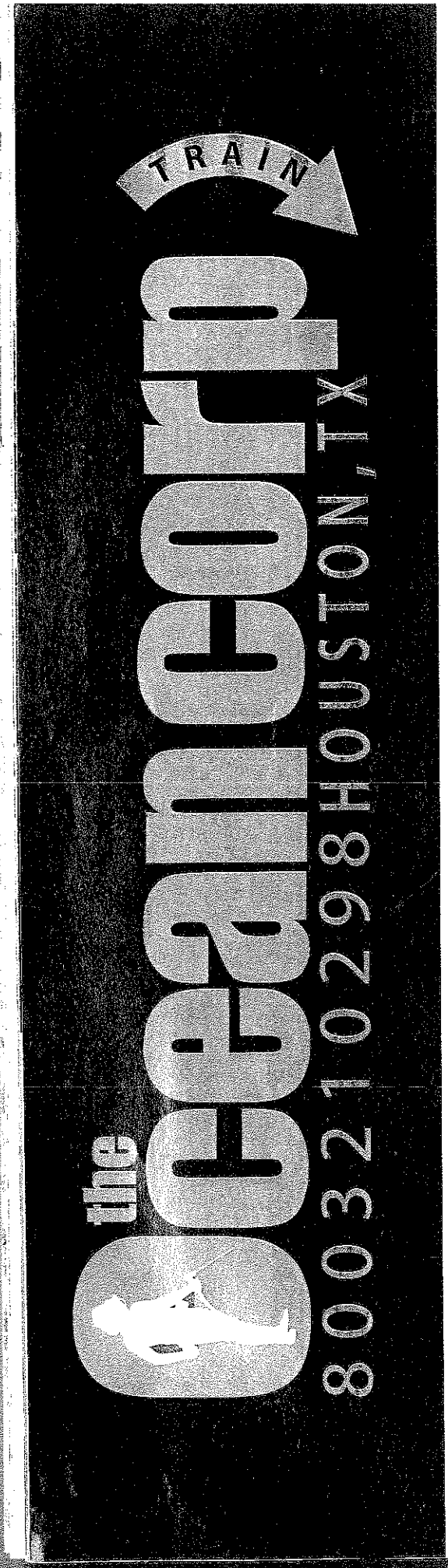
Periodically switching from the flutter to the scissor kick allows specific leg muscles to rest while using others. Although some divers prefer the scissor as their primary kick, it generally doesn't provide as much propulsion as the flutter.

A slightly different technique, sometimes called the split kick, involves bringing the fins together one on top of the other, rather than next to each other. The upper and lower legs are alternated only occasionally; switching is awkward with the fins brought together (i.e., top of the upper fin against the bottom of the lower fin) to create added thrust. This version provides extra power, but must be executed in a long, slow rhythm.

The sideways version of the scissor kick can be useful when swimming just above bottom features. Twist at the waist so that you're kicking sideways, parallel to the bottom rather than up and down, while keeping your upper body pointed more or less forward. As with any kicking method, it requires excellent buoyancy control to maintain a consistent depth.

Frog Kick

The frog kick is my favorite technique. I use it often when exploring a reef to minimize the effect of my presence and give my flutter kick muscles a break.



The technique is almost self-explanatory if you've ever observed the kicking motion of a frog. It is very similar to the leg portion of the breaststroke in swimming. The legs work in tandem, first extending out to the sides with the fins slicing through the water column. The power part of the stroke involves twisting the legs so the fins are perpendicular to the body and the direction of travel. The legs are then brought together forcefully, causing the fin blades to push backward against the water, propelling the diver forward. The last step in the frog kick is to glide while holding the streamlined legs-together, fins-pointed position.

The frog kick uses the large thigh muscles to produce efficient propulsion and requires little effort, thereby reducing breathing rate and air consumption. With proper buoyancy and trim, the gliding phase can be maximized, further reducing breathing rate. Another advantage is that the backward force minimizes silting and impact damage to underlying features and marine life.

Due to the width of the frog kick it is not suitable for use in narrow spaces or close to walls. A modified, or short, frog kick can be substituted that uses a narrow leg extension with most of the kick done by the calves and ankles. Little forward thrust is generated, but the legs remain close to the body and backwash is minimal.

Dolphin Kick

This method of propulsion involves the whole body. It is basically the same on scuba as when used by underwater swimmers. Beginning with the head, the body undulates up and down like a rolling wave with legs together and arms at your sides. The major portion of the thrust comes from the downward snap of the fins at the end of each cycle.

Since it uses the entire body, the dolphin kick consumes more energy than other scuba kicks, so is mainly used as a break from the flutter or frog kicks.

Backward Kick

Hopefully, you won't need to use this technique to get out of a tight place without turning around or damaging anything, but it's good to know that it's possible to swim backward on scuba, even if just for a few feet.

Picture yourself hovering between boulders, peering into a hole at an eel. As you stare, the eel begins to advance from its sanctuary. No room to turn around — besides, you don't really want to take your eyes off the toothy creature. What.do you do?

Kicking backward is definitely awkward and looks that way, but it works in a pinch. The technique is sort of like a reverse frog kick. Turn your fins outward to act like a scoop, then bend your knees to the side and pull the fins forward to create backward propulsion. To reset your legs for the next scoop you must turn the fins flat so they don't push water backward, killing your momentum.

Sculling

A more elegant alternative to finning backward is using the arms. As new divers it was drummed into us that you never propel yourself with the arms — a valuable rule that helps novices master buoyancy control as well as develop good kicking technique. However, when operating in a tight space, maneuvering with small motions of the arms and hands (sculling) can be the most practical alternative.

Keeping the upper arms close to the body, use your hands to push water in the direction opposite the way you want to move. The legs and fins should remain still and streamlined, or you can tuck the knees up to the chest to make sure your fins are out of the way.

The Easy Way

The great majority of recreational dives are conducted at open-water dive sites that can be easily reached by swimming from shore or accessed directly by boat. However, some activities require covering too much distance for self-propulsion to be practical. This is where diver propulsion vehicles (DPVs) come in.

Military and cave divers have long employed specialized underwater vehicles to propel them at speeds impos-

Also called scooters, DPVs generally consist of a pressure-resistant casing enclosing a watertight battery that powers an electric motor. This, in turn, drives a propeller. The casing is equipped with handholds containing speed controls. In the majority of models a single diver grasps the handles and is effortlessly pulled through the water column by the DPV.

sible for the unassisted diver, greatly increasing their range. Cave divers move bulky equipment to staging areas inside extensive cave systems; the military uses underwater propulsion vehicles in combat operations. Search-and-rescue teams, technical deep divers and underwater filmmakers make frequent use of (DPVs).

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Designs vary, but all DPVs involve some means of protecting the diver from the spinning propeller. Should the diver release his hold on the controls, the DPV stops running. Some tow-behind models include a leash to secure the scooter when the diver reaches his destination or stops to observe something along the way.

Typical recreational DPVs have a battery life of an hour or more and a recharge time of around six hours. Depth ratings vary from a modest 65 feet (20 m) to more than 200 feet (61 m); variable power settings allow for a range of speeds. On land DPVs can weigh as much or more than a scuba unit, but are designed to be neutrally buoyant with horizontal trim at depth.

Other types of DPVs include models that strap to the diver's scuba cylinder and operate via a switch on a cable, leaving the diver's hands free for camera gear, spear gun, etc. Larger, torpedo-shaped underwater vehicles, mainly used commercially, may carry two divers astride the body. Some DPVs border on being submarines; a wet sub is one in which the diver or divers sit inside the open vehicle wearing scuba gear. As you would expect, these DPVs are very costly and used primarily for covert military operations.

Scooters can be a lot of fun for recreational divers. Zipping along at depth without kicking is like flying underwater. You can cover a lot more terrain on a single dive or move easily against a current. Exertion, and therefore air consumption, are reduced. DPVs are useful for searching for lost items, visiting sites otherwise inaccessible from shore and exploring for new dive sites.

However, DPVs also entail significant disadvantages and hazards for divers untrained in their safe operation. The sensation of flying underwater is exhilarating, but can lead to unsafe behavior. Doing loop-the-loops seems cool, but the rapid change in depth and associated ambient pressure creates a serious risk of embolism and barotrauma to the body's air spaces.

Excellent buoyancy control is mandatory to avoid unintentional changes in depth. And in limited-visibility conditions speed can lead to collisions and entanglement. While increased speed adds a new dimension, scuba is primarily a visual sport; many small and cryptic creatures will be missed by the diver skimming hastily over their habitats while riding a DPV. Before using a scooter independently, completing a DPV specialty course or orientation by a scuba professional is highly recommended.

By moving slowly under your own power with a kicking technique appropriate for the situation, you're likely to see a lot more of whatever a dive site has to offer, but if you need to cover greater distances, a DPV may be the way to go.