undercurrent®
THE PRIVATE, EXCLUSIVE GUIDE FOR SERIOUS DIVERS

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Riding Rock Inn, San Salvador, Bahamas

—*As slick as the advertising*

With more than mild trepidation do I undertake a trip to a well-publicized resort like San Salvador. Full page ads displaying pictures of gleaming dive boats all in a row, package deals lower than most other places, representatives hawking vacations at every dive convention--they all smack of Club Med marketing for the masses or, perhaps, suggest a Denny's of the dive industry. I can only suspect that any resort which has the wherewithal to flack for itself, as does the Riding Rock Inn, must indeed cater to the hordes of newly certified divers who can be lured to the tune of a well-orchestrated advertising campaign. Me? I prefer subtlety.

So upon my arrival I am not necessarily impressed with the waiting vans to take us swiftly to the Inn, nor am I overwhelmed by the complimentary rum punch party, held at 5 p.m. on arrival day, to permit guests to meet one another and be briefed on hotel operations from the competent manager Enauld Thompson or receive a briefing on the diving from popular Dave Woodward. And although I don't mind showing my c-card, I find the request to show log books, if available, a bit persnickity. Nevertheless, I will reserve my judgment, I say, even though those glistening flat bottom dive boats await the scores of divers around me who proudly display their log books, pages empty from inexperience, and are just dying to attempt their first warm water dive. I can only pour another scotch to ease my anxiety about this novice throng of mainlanders.

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Since I do not have the space to engage in excessive verbal foreplay with the readers, I will simply say that yes, the crowds of novices at San Salvador are a liability to an old mossback like me, but it is about the only significant liability at Riding Rock Inn where the management and the diving are just as slick as the advertising brochures. For example, one need only look at the dive shop, Ski and Dive Limited, at the end of the pier, to view the care exercised: 220 steel 72's,

100 of which are pumped to 2,200-2,300 psi and sit in racks ready for the morning dives; well-maintained Scubapro quick-release back packs and plenty of rental gear, including regulators; three (and by now four) stable, flattop, 34' dive boats, covered with outdoor carpet and radio equipped. Get the picture?

And, as I quickly learned, the underwater life of San Salvador not only provides novices with a remarkable first outing, but in combination with the freedom permitted experienced divers, provided me with ten days of enjoyable diving. Here, at Christmas, the water temperature was a constant 80°, without current, and visibility ranged from 80 to 120 feet. A wall, dropping to 200 feet or so, offered many interesting caves, canyons and crevices. Coral, however prolific, was not particularly colorful and, in fact, I noticed a few areas where it was dead or dying. Swaying gorgonia and a variety of sponges, however, keep the scenery interesting.

But it is the fish life of San Salvador that makes the trip worthwhile. For years they have been hand fed by divers and now groupers, black durgeons, yellow-tail snappers and even queen triggers swarm about. Some fish have become too aggressive and one lady had to leave the water after a queen trigger nipped her ear, apparently angered that she had no food to offer; the management is reconsidering its feeding policy. Groupers to 40 pounds often follow divers throughout a dive and one grew so attached to my buddy the grouper chased away any other fish trying to join in. Another grouper even permitted by buddy to hug it. Of course there are plenty of other fish here: trumpets, jacks, barracudas (we saw no sharks), file fish, cow fish, trunk fish, french, grey and queen angels,and the list goes on. On a dive at French Bay Gardens a squadron of ten eagle rays floated in close enough for fine photos. I saw more basket stars than anywhere this side of the Red Sea and macro life was plentiful. My only disappointment was that famed Sandy the dolphin no longer promenades here, presumably having gone off to the big dolphin in the sky. But even without Sandy, fish life here rates among the best in the Caribbean. It is especially good for fish and macro photographers and one large wreck provided a nice backdrop for interesting shots. The guides strictly enforce reef preservation--nothing live may be taken from the reefs.

During my stay, each of the four personable divemasters--Chris McLaughlin, Al Zamrock, Dee Scarr and Tom Stansell--performed admirably. They provided excellent briefings before each dive then, while buddy pairs roamed freely, they patrolled the area to keep an eye on divers and, in fact, even checked the accuracy of each diver's depth guage, a wise procedure. Divers are free to select their own time and depth during the two morning dives and one afternoon dive, however they must strictly adhere to Navy tables. As each diver enters the water, he shouts his name and the captain logs the entry time; upon exit, he notes the time and depth. At the end the first dive, hanging at 10' for three minutes is required; the second dive is in 25 feet of water; a 5-minute stop at ten feet is required for the third dive. Weighted lines are suspended in the water to make the stops easy. Regulators hanging from 15-foot hoses are available should divers

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need additional air. Before the afternoon dive each diver must enter his repetitive dive group into the ship's log. Few divers knew how to determine their standing in the tables, which validates the guides' tough management of the dive profiles. There is no recompression chamber on the island.

Strong winds forced cancellation of one afternoon and night dive, so the following day we were motored to the south end of the island for beach dives, which were not very good at all. The guides seemed confused about handling the divers when the boats could not operate and ought to prepare themselves with better alternatives. The single night dive we made, I believe, was begun too early since the coral polyps had not yet opened and other critters had not begun foraging. The boats have on-board lights to make suiting up easy and two or more strobe lights are hung from the boat to mark its location and illuminate the ladder. Because sea wasps are common near the surface, divers are well advised to wear full wet suits or a pair of jeans and a top on this dive.

San Salvador and Cockburn Town have little to offer tourists besides diving and relaxation, although the management of the Riding Rock Inn makes every effort to provide diversion. Monday is the manager's cocktail party; Tuesday afternoon a van tour of the south end is offered and in the evening dive slides or movies are shown; a beach picnic at 1 p.m. on Wednesday is a nice touch and the repast includes conch, turtle steak and barbecued chicken; Friday nights many guests who are able raise cane at the Harlem Square Club in Cockburn Town, with transportation provided by the hotel; Saturday morning a tour of the north end of the island is offered. Frequently a native "rake and scrape" band plays in the evenings. Bicycles or motor bikes or a car may be rented for touring. The Inn has a swimming pool and well kept tennis courts, with racquets and balls, and sunfish sailboats are available.

The Riding Rock Inn is located in a pleasant setting on a good swimming beach. Snorkeling is average. The 32 rooms are clean and comfortable, and the six cottages are especially nice, with double beds, a convertable sofa, accessory furniture and a refrigerator. Linen is changed daily, but the maid service seemed a bit slow and I had to stash a towel in a drawer to have one for a shower after morning dives. There was always plenty of hot water. When the Inn is overbooked, divers are lodged nine miles away in apartments with kitchens at Sandy Point. Several Undercurrent readers have complained about the inconvenience of these distant apartments (even though the Inn provides scheduled buses and free motor bikes), but others enjoy the isolation. They may be selected purposely by vacationers, but we have been assured by the representatives of Riding Rock Inn that they are only assigned if the Inn is full and that people making reservations are told in advance that they will be placed in these units.

The food is quite good--not terrific--and always plentiful. A variety of standard choices were offered at breakfast. For lunch I would begin with a cup of exquisite conch chowder and follow with a sandwich, but many preferred the more hearty meals which were served. Dinner was preceeded with cocktails on the veranda,

Diver holds Breath for 27 minutes at Small Hope Bay Lodge; New Record Set

"Diving begins at Small Hope Bay with a mandatory check out at 10 ft., where each diver must disassemble and reassemble both mask and regulator."

That sentence appeared in last month's review of Small Hope, and the discerning reader would have realized that to perform such a stunt would require gills or an extraordinary pair of lungs. Our travel editor has neither.

Deep in the bowels of our fine organization a well meaning, though nondiving, copy editor, still high on the tale of our 185-foot dive, produced a grammatically correct, however nonsensical sentence. The intent was to explain that a diver must simply take off his mask and regulator while underwater to demonstrate to the guide that he knows what he is doing before he is permitted to proceed with the dive. Those who venture to Small Hope Bay may engage in a variety of unique activities at the behest of the divemasters, but disassembling a regulator underwater is not one of them.

where diving fables were freely exchanged, and then diners would select from two or more menu choices, frequently including conch, grouper, wahoo, or steak. Those joining the outside cocktail crowd, however, had to be carefully covered with the insect repellent found in each room, compliments of the house, since San Salvador's version of no-see-'ems, here called "flying teeth," would surreptitiously leave their mark on exposed parts.

One refreshing aspect of the Riding Rock Inn is that prices are indeed all inclusive. For $595, double occupancy (until December 15) single occupancy $715, the diver gets for eight days and seven nights, lodging, three meals a day, three tanks a day for six days (no diving is permitted on the day of arrival of the day of departure), round trip airfare from Fort Lauderdale, transfers between the airport and the hotel, sightseeing, and all gratuities. Only liquor is extra. Nonstop flights aboard a DC-3 depart Fort Lauderdale at 1 p.m. on Fridays, Saturdays and Mondays, and depart San Salvador between 3 and 4 p.m. on those days. The baggage limit is 70 pounds for a diver (44 for a nondiver) and 20¢ per pound is charged for excess baggage. If the plane is heavy, extra baggage may follow on another flight. If one must stay overnight in Fort Lauderdale prior to departure, select the Airport Holiday Inn. Columbus Landings personnel (they represent the Riding Rock Inn) will pick you up for the flight. To enter San Salvador one must have a passport, birth certificate, or voter registration card. A driver's license is insufficient. For more information write Columbus Landings, Riding Rock Inn, PO Box 14394, Fort Lauderdale, Florida 33302; for reservations you may write or call 800/332-9473. The current double rate for nondivers is $445; double in cottages is $625/person; triple is $585.

P.S. Riding Rock Inn offers PADI open water certification for $170.00; students pay nondiver room rates for the week. The students who dived on the boat I was on performed better than many of the certified divers who were trained on the mainland.

New Lab Tests of Aluminum and Steel Tanks

—*And little-known tips for maintenance*

The Scuba Safety Project at the University of Rhode Island (URI) was first funded in 1969 by the Food and Drug Administration of the U.S. Public Health Service to investigate various aspects of scuba accidents. One early study, planned and carried out by Lt. Richard Peyser of the U.S. Coast Guard, convincingly showed the potential explosion danger of steel tanks used in salt water.

"Out of 720 scuba-related fatalities, four deaths and two serious injuries could be attributed to compressed-air explosions or corrosion-produced accidents."

In 1976 the National Sea Grant Office of the Department of Commerce provided assistance to URI, in company with Luxfer USA (the manufacturer of alumninum tanks) and U.S. Divers Co., to do a corrosion study of aluminum cylinders under conditions similar to those in the study of steel cylinders in 1970.

From 1970 to 1975, the Scuba Safety Project gathered data on fatal diving accidents in the United States. Out of 720 scuba-related fatalities, four deaths and two serious injuries could be attributed to compressed-air explosions or corrosion-produced accidents. In only one of these six cases did a diving cylinder blow up, and this was a U.S. Navy Surplus 90-cubic-foot aluminum cylinder. Two accidents

San Salvador Photography Course

Paul Tzimoulis, editor of *Skin Diver Magazine* and master underwater photographer, teaches an underwater photography course at Riding Rock Inn. The one-week course, which includes lectures, personal tutoring, and the processing and analysis of ten rolls of Ektachrome, costs $300 over the base one-week rate at San Salvador (see accompanying article). Available dates are October 27-November 3, April 26-May 3, 1980. For information, write Riding Rock Inn, PO Box 14394, Ft. Lauderdale, Florida 33302.

resulted from the failure of air-pumping station components; in one case an air-storage reservoir exploded, and in the other an oil filter on the high pressure feed line. A third explosion involved a 150-psi-rated Hooka tank that was connected to a 2,400-psi source. The two other corrosion-related accidents involved old scuba tanks that were so filled with rust and water that, in one case, only 3 percent oxygen remained, while in the other a half-inch of wet rust product jammed the regulator.

Fortunately, most dive shops have a healthy and self-interested skepticism of battered and ancient scuba cylinders. The danger comes when the outside condition and date stamp do not reflect serious internal corrosion.

Testing of Steel Scuba Cylinders

—Condemned-in-service steel cylinders

About 40 old scuba tanks that had failed either visual or hydrostatic tests in dive shops were solicited from several sources in 1970. Eight were selected for study as having the most advanced or interesting internal corrosion pattern. In one of these tanks the internal coating had disappeared in several places and pits with depths of one-third the wall thickness were found, some of them hidden under the coating that remained. Four had large amounts of rust, enough to plug or stop an air regulator if the diver maneuvered, so as to bring the particles down over the regulator valve inlet extender, a serious danger to a diver.

Water Entry into Steel Cylinders

Some salt water had entered a number of the 40 condemned-in-service cylinders. Of course, humid air may leave a small amount of fresh water in a tank after charging, but this relatively benign intrusion cannot compare in corrosive activity to ordinary sea water. To demonstrate that water could enter a tank through a regulator, two single hose regulators from different manufacturers were attached to empty (that is, open to the atmosphere) tanks. These were taken to a 10-foot depth in a swimming pool and their purge buttons pressed 10 times for about 10 seconds each time. One regulator admitted 195 ml. of water and the other 211 ml. This experiment simulates the breathing-down of a tank on the surface, a dive to 10 feet, and attempting to get air by pushing the purge button. Clearly, a channel for water exists through single-hose regulators when the tank pressure, for whatever reason, is less than the ambient pressure.

Steel Cylinder Corrosion Tests

Six new uncoated steel cylinders were obtained from the same manufacturer. Each was equipped with a chromed-brass K-valve. 500 ml. of salt water was added to four test cylinders and 500 ml. of fresh water was added to the other two. A test temperature of 105° F was chosen and 100 days was arbitrarily chosen for the exposure.

At the conclusion of the 100-day test, the two freshwater tanks had minor corrosion but passed the hydrostatic tests. The horizontal cylinders with full pressure and salt water had by far the most dangerous corrosion. One tank wall thinned to 29% of the original thickness, suggesting that it could not have lasted much longer without an explosion. Two other tanks thinned to 59% and 88% of their original thicknesses respectively. The explanation for these differences appears to lie either in the mild initial corrosion found inside the tanks before the test or in the tanks being somehow different as to steel lot or manufacturing methods.

The tests revealed that (a) corrosion is accelerated greatly under increased oxygen partial pressure; (b) corrosion is accelerated even more by the presence of sea, as opposed to fresh, water; and (c) any tank position that spreads the interior water into a large area will show much greater corrosion.

Steel scuba tanks should be: (a) stored with only enough excess interior pressure to keep out water and contaminants (say, 50 psi); (b) when opened for inspection, they should be washed internally with fresh water and dried; and (c) stored in a vertical position. Removal of fresh water contamination by compressor filtering is far less important than keeping salt water out, or removing it after it gets in.

First Test of Aluminum Scuba Cylinders

In the early 1970s, a study by Battelle Memorial Institute and the Navy revealed that of 1,623 aluminum cylinders inspected at naval diving facilities, 25% were moderately or severely corroded. Although the rupture strength had been reduced by 4 percent in the corroded cylinders, they did not constitute an immediate hazard.

The Battelle findings appeared to place the blame for aluminum cylinder corrosion on the hydrofluoric acid that is sometimes used to clean aluminum, and it did not seem to pose safety problems for the sport-diving industry. By 1975, however, a problem appeared involving neck galling—that is, the lock-up and destruction of aluminum neck threads when a valve removal was attempted.

Because of known problems when aluminum and brass are immersed in an electrolyte, inverted tank tests would be necessary to cover the brass valve extender and alumnium neck with water.

The test cylinders were sealed with standard chrome-plated brass K-valves, to which the manufacturer had applied a light coating of Molycote 557, a silicone lubricant. The brass extender tubes, which reached inches into the bottle, were not chromed but had a natural brass finish. The seven aluminum cylinders were rated to contain the standard 72 cubic

feet of air at 3,000 psi. One new steel scuba cylinder was also tested.

Results of the First Aluminum Tests

At the conclusion of the 100-day tests, the air in two aluminum tanks showed 20.9 percent oxygen, 3.0 and 3.5 ppm carbon monoxide, .03 carbon dioxide, but the steel tank showed 15.0 percent oxygen, 10 ppm carbon monoxide, and .01 percent carbon dioxide. As a safety matter, the reduction to 15 percent oxygen is not as dangerous to the immediate health of the diver as the mass of heavy corrosion product that could have readily clogged his air inlet.

The wall of the steel cylinder had been reduced to 46 percent of its original thickness. A corrosion ring had completely covered the neck, leaving only a hole through which the valve extender protruded. The entire interior was heavily attacked with large sheets of corrosion scale hanging on the walls. Based on the loss of oxygen, about 1½ pounds of rust was produced.

Seawater corrosion studies never lack for surprises, but the results of the seven aluminum tank treatments seemed especially baffling. Three aspects stand out:

The valve threads locked tight on two tanks and the valves could be removed only by stripping the threads with a pipe wrench. Yet compared with others, these two tanks underwent negligible corrosive and pitting attacks. Two other tanks which were expected to show high corrosion did not. The valve threads on three aluminum tanks showed small amounts of corrosion products in the threads; four others showed considerable white corrosion products either covering the threads or partly covering the lower threads.

The aluminum-tank-galling result clearly identified an important consumer problem. We succeeded in jamming a quarter of our sample by a single saltwater exposure. There can be little doubt that the locking or galling was corrosion-related and not, as some people believed, the result of thread distortion or temperature effects.

The cylinder which contained fresh water was the only other aluminum cylinder to show significant pitting. A sample of the tap water used was analyzed and showed high copper which, in combination with other elements, led to the corrosion.

None of this evidence points to a safety problem with aluminum, however, since the worse pitting under the most unrealistic and corrosive treatment was still modest. The dramatic differences between the results of the steel tanks and the results of the worst aluminum cases suggest that if explosion or valve-clogging byproduct is ever to occur with aluminum scuba tanks, it will result from interior conditions or treatments that we have yet to discover.

On the other hand, the sensitivity of aluminum corrosion to trace elements, such as copper, in a corrosive and saline atmosphere does suggest consumer caution when cleaning out aluminum tanks. Steam cleaning and hot-air drying is probably the most benign treatment, and the user should rigorously avoid fluorine compounds, which caused the Navy aluminum tanks to corrode, or any other chemical on which high-pressure oxygen tests in a saline atmosphere have not been carried out.

Second Test of Aluminum Scuba Cylinders—Galling Experiment Study

The destruction of neck threads during valve removal does not seem to offer any safety problem. In fact, if sport-divers cannot be convinced that aluminum cylinders will withstand valve removal, they will continue to use the less safe steel tanks, and these, of course, get older and thinner as the years pass. However, very little corrosion need occur, in an absolute sense, to freeze the valve in place and ruin the tank.

Treatment Choices in the Second Aluminum Test

In this test we attempted to obtain an overall reduction in corrosion and to make a preliminary assessment of three valve thread lubricants. In two tanks the valve extenders were plastic and their threads were teflon-coated. Two other tanks had both K-valves and extenders made of aluminum alloy, completely anodized except for the valve extender. One tank had a standard brass valve and extender, modified with two O-rings to attempt to prevent water from reaching the threads, a device provided by one of our sponsors, U.S. Divers Co.

Results of the Second Aluminum Test

The cylinders fitted with the standard chrome-plated brass K-valve showed substantial pitting. When compared with the other four tanks, it is clear that this small brass extender for the tank valve is a primary source of corrosion activity in aluminum scuba tanks.

"...this small brass extender for the tank valve is a primary source of corrosion activity in aluminum scuba tanks."

Since all tanks could be opened, the use of any lubricant, rather than a specific lubricant characteristic, contributed to the relatively easy removal of the valve.

Two tanks had difficult thread removal because the teflon-thread protection came off and jammed in the threads. It is probable that the plastic extender, rather than the teflon, reduced the corrosion activity

in these two cylinders.

Present brass scuba K-valves could be made much more inert by simply covering the brass extender with some tight-fitting and inert plastic tube. This reduction in brass area should make pit initiation a far longer process.

Lubricants might present a possible health problem because their behavior under long-term, high oxygen partial pressure is not understood. One of the common complaints of divers involving aluminum tanks is the "smell" and "taste" of the air, especially after long storage periods. This appears to be the result of volatile agents in the lubricant mixing with the breathing air. This problem can be eliminated by allowing two to three hours between application of the lubricant to the valve and insertion of the valve into the cylinder. This effect is not, in our opinion, of the same urgency and damage potential as the accumulation of old rusting steel tanks.

"...the aluminum tank should last through several generations of a diving family."

Conclusions

These three tests give ample evidence that the present aluminum scuba tanks offer unparalleled safety in the containment of high-pressure air under the stringent environmental requirements of scuba diving. If the scuba tank is carefully cleaned, the brass K-valve extender covered as noted earlier, and the neck threads liberally and carefully and covered with a proper lubricant, the aluminum tank should last through several generations of a diving family. The use of aluminum valves in aluminum tanks would appear to almost eliminate corrosion problems except under the most exceptional conditions of saltwater exposure.

Aluminum tanks should be stored on their sides (first preference) or upright (second preference), but never inverted. Since any corrosion attack is less in reduced oxygen partial pressures, the reduction of tank pressure in aluminum tanks is desirable but by no means as important as in long-term storage of steel scuba tanks. When practical, valves of stored aluminum tanks should be left partly unscrewed. Nothing that could get into the open end of a stored tank could possibly damage it as much as having a tight valve gall in place.

Steel tanks should be stored at minimum (50 psi) pressure, upright if possible, and the interior should be checked at least annually, and perhaps as often as every three months if service involves tropical conditions or very frequent use. Anytime a diver breathes down his tank in the water to ambient pressure, there is a good chance that water may enter. Whether steel or aluminum, the tank should be opened and washed out with fresh water, then thoroughly dried.

The fact that very few injuries and deaths are caused by scuba tank corrosion is quite remarkable, considering the highly corrosive nature of salt water and oxygen at such high pressures. However, no steel tank is getting any younger; replacing them with aluminum tanks would appear, on the basis of these several tests, to offer even surer defense against a compressed-air explosion in a crowded dive shop or university gymnasium.

This study was performed by Francis Cichy, Mechanical Design Engineer, Beloit Corporation; Hilbert Schenck, Professor of Mechanical Engineering, University of Rhode Island; and John J. McAniff, Diving Safety Officer, University of Rhode Island. It was funded by the Food and Drug Administration, Luxfer USA, U.S. Divers Co., and the Office of Sea Grant, U.S. Department of Commerce. This article is an edited version for which *Undercurrent* takes all responsibility. A complete copy of the 20-page study, with photographs and charts, may be obtained by sending $2 to URI, Marine Advisory Service, Publications Unit, Bay Campus, Narragansett, RI 02882.

Junk Your Steel Tank?

No one can debate that many divers simply do not maintain their equipment properly. The University of Rhode Island study leaves no doubt that a diver who does not maintain his steel tank properly may be storing a lethal and uncontrollable weapon in his midst. For the most part, then, divers who are in the market for a new tank are purchasing a margin of safety when they select aluminum over steel.

Nevertheless, one should not presume that the advantage is so great that a well-maintained steel tank ought to be junked and replaced with a new aluminum tank. A steel tank which is properly maintained, inspected visually according to the suggestions of the Rhode Island study, and hydrotested every five years (and more frequently if the owner has any doubts whatsoever) will last most divers throughout their diving lifetime.

Do's and Don'ts for Dive Guides

—*What traveling readers expect*

When a traveling diver shells out a thousand or more dollars to take a dive vacation, he ought to get personal attention, exciting and safe diving. We found the operation of the Riding Rock Inn (see the

review on p. 1) in most cases a model operation, but there are still plenty of major dive resorts which go about their business in a disorganized, disinterested and even discourteous fashion. One need only read our reviews of diving in Maui, Hawaii (*Undercurrent,* November/December, 1978) and contrast the Lahaina Divers (a sterling operation) with the Blue Water Divers (just the opposite) to understand the differences.

Occasionally we use the pages of *Undercurrent* to communicate to the industry the needs of us, the diving consumers. In this case we are providing a list for dive guides, based on comments received from hundreds of our readers and our own staff, which states what we, as traveling divers, deserve and expect when we spend our small fortunes to travel to faraway places for diving and hospitality:

★ Meet with divers prior to their first dive, brief them on the operation, check c-cards or log books.

★ Brief new divers on what they will see and what not to touch; use slides or book photos.

★ Establish a schedule for boat departures and adhere to it so divers may plan use of their after-dive time.

★ Fill tanks to their rated capacity.

★ Use staff or strong-armed volunteers to load tanks on the boat; for some divers lifting 30+ lbs. is too much.

★ Prior to boat departure, require divers to verify that they have all gear, including tanks and weights.

★ Provide a comprehensive predive description of the dive site and provide a dive plan, telling divers what you expect from them (time, depth, etc.).

★ Review hand signals with new divers, explaining how to attract attention in emergencies (and only emergencies) by banging on a tank.

★ Suggest what type of photography is best (macro, fish, etc.) and underwater point out unusual subjects.

★ Before the dive help divers solve any problems (e.g., long straps, missing o-rings, too much weight) and help them lift their tanks.

★ Either hand camera gear to divers in the water or provide a shock cord for lowering it into the water.

★ Require that the Navy tables be observed and aid divers in computing their standing (without making them feel like idiots); have a set of tables on board; do not permit use of an SOS meter as a substitute.

★ Recommend that divers take a 3-5 minute stop on the anchor line at 10 feet on long or deep dives.

★ Require all divers to be within the general vicinity of the boat when down to 500 psi and to be on the surface with 200 psi, permitting each diver full bottom time consistent with his plan and his air consumption.

★ Provide some sort of underwater checkout for all new arrivals, regardless of credentials, and keep a careful eye on all first-time divers and general surveillance over the group.

★ Permit skilled and experienced divers, in pairs, to dive their plan and not be herded with others.

★ Always have a ladder for boarding; the motor is an inadequate substitute for tired divers.

★ Carry on board a small first-aid kit, with anti-sting applications, tools for emergency gear repair, a fish book for identification, and plenty of fresh drinking water.

★ Trail a drift line and float during every dive.

★ On night dives check each diver's light before entry; instruct them to signal by shining it in another's eyes.

★ On night dives have someone on board at all

Dive Guides Ripped Off?

Just before we went to press with the do's and don'ts for dive guides, we received the following letter to the editor from a midwest PADI instructor.

"I'm writing about your past comments about lethargic dive guides and their poor choices of dive sites, poor equipment maintenance and overall lack of concern.

"I've been an instructor for ten years and have more than 2,000 hours diving. For a year I've been actively searching for a full time job in the dive business and have run up against the same impenetrable wall wherever I go and, as a result, am angry and discouraged.

"It is easy for a tourist diver to think that an instructor guide really has it made: living in a beautiful tropical paradise, diving all the time, living in the sun and meeting a lot of new people. Now that's all well and good, but the dive guide lives in utter poverty. The going rate is room and board and damn little else, and he is expected to spend his days holding hands with a bunch of tourists and spend his nights fixing everything that breaks.

"How do you expect a man to work his heart out day after day for nothing but subsistence and all the time knowing that his boss has a long waiting list of people dying to take on the job for exactly the same terms. Furthermore, if he is to quit or get fired, he has little or no money to go home and get started again."

—name withheld

P.S. (from a similar letter from another writer) "I am greatly disturbed when I see these dive resorts that were built with coolie labor go on the market for hundreds of thousands of dollars. I know damn good and well that the guides and divemasters and staff who made the place what it is were sent home without a nickel in their pockets."

times, obviously a sound procedure during the day also.

★ On night dives hang an underwater light from the boat or anchor line, preferably a blinking strobe.

★ After a dive, ask for a critique; what you enjoy might not be of interest to other divers and vice versa.

★ Provide snorkeling opportunities whenever possible during a dive so nondiving companions can join the trip; to break the boat routine, plan full-day beach dives with picnic which nondivers can join for snorkeling.

★ Have alternative sites available for all conditions; have alternative activities available when diving is impossible.

Furthermore, we have a list of *don'ts* which we find equally appropriate:

★ Don't speak about mysterious sites which can be reached only when the sea calms if you know you'll never get there; don't say the divers should have been here last week when 10,000 eagle rays floated by and conditions were perfect. Concentrate on the present.

★ Don't rap on about your 300-foot dives and bare-handed shark wrestling; emphasize beauty and safety.

★ Don't ridicule people who ask you questions you hear from everyone, e.g., "have you ever seen sharks?"

★ Don't flirt with divers who have brought their own companions and don't neglect some divers while chasing others. Forget the sexist comments.

★ Don't play air consumption games; explain how to decrease consumption without encouraging competition.

★ Socialize with the divers if you're wanted, but give them time to socialize among themselves; don't get stumbling drunk in their presence.

★ Don't forget that a diver is on a vacation and that he has paid handsomely for the trip; your business is to provide him the best diving you can.

Deep Trouble

—*How diving affects simple task performance*

Two divers are learning to buddy breathe, sharing one regulator between them. Suddenly, they realize they're sinking. Why? They were concentrating so hard on learning to breathe that they forgot to kick.

A commercial welder is trying to transfer his skills to underwater work. He's been welding for years, but when he starts to work on a pipe underwater he finds himself making silly mistakes, doing things in the wrong order, forgetting how parts fit together—mental tasks that would seem to have nothing to do with the problems of the new environment.

In most sport-diving accidents, divers have three alternatives by which to save themselves—ditch their weight belt, inflate their bouyancy vest or just breathe on the regulator until they calm down. In far too many cases, divers do none of the above, although had someone asked them on a written test to name those three courses of action, they would have rattled all three off automatically.

Obviously, a human being faces significant problems when entering the water. The cues he normally relies on are gone. One's sense of balance disappears. It's impossible to tell where sounds are coming from. The person can't communicate, see clearly or distinguish colors well. There are strange animals and strange surroundings while the individual carries only a tenuous life-support system.

But should that affect a person's ability to do simple arithmetic? The ability to perform on simple abstract tests? One's memory of what was observed underwater? One's concentration? Or the ability to make decisions?

Whether or not it should, it does, according to studies by kinesiologist Glen Egstrom of UCLA. In a series of studies, Egstrom set out to measure just how much divers are affected by their surroundings when it comes to performing mental tasks. His findings have reinforced the need for a new orientation in diver training.

In one study, a group of experienced and novice divers were given sentence-comprehension tests ("B here precedes A:AB. True or False?") and diving questions involving calculations—pressures, remaining bottom time and so on—that they were to do in their heads or with whatever scratchpads they could manage underwater. They were tested both in a 15-foot tank with plexiglass observation ports and in the ocean at a depth of 18 to 20 feet and were given the tests both before and after completing a pipe-assembly task.

For the sentence-comprehension tests, locale didn't make much difference; scores were in the 90s for each group. But on the diving questions, there was a striking difference between performance in the tank and in the ocean, and between novices and experienced divers. Before the pipe assembly task, novices scored an average 87 in the tank, but only 52 percent in the ocean. Scores after the test were 60 in the tank, 57 in the ocean. Experienced divers did much better: 90 in the tank pretest, 77 posttest. In addition, the novices registered radical changes in heart rate, respiration rate and something called minute

volume—the total volume of air a person breathes in one minute—when out in the ocean, in no apparent connection to the tasks they were performing, which was attributed to either heightened anxiety or heightened arousal.

Another study, based on memorizing short passages about subjects related to diving, showed that the temperature of the water when the diver first learned the material had a significant effect on one's ability to report that material once the person surfaced. Like the drunken student who can remember what he or she learned better when drunk than when sober, a diver who learns material underwater can apparently remember it better underwater than on the surface. Thus, divers can be excused for their reputation as storytellers. Divers' reports about what happened to them while working underwater often are at odds with the facts as monitored by television camera. Egstrom once found a 15 to 20 percent loss of information in underwater divers compared to what a diver on the surface had observed of the same conditions.

It's not just environment; there's a definite psychological factor involved. To demonstrate that, Egstrom, with colleagues Gershon Weltman and Janice E. Smith, set up a fake pressure chamber. When subjects thought they were diving to 60 feet, based on a rigged gauge and hissing air to simulate pressurization and depressurization, they showed significantly higher anxiety scores and heart rates than a control group performing the same tasks outside. They performed their tasks correctly but took more time to do them; they were also less aware of other things around them, perhaps because they were focusing all their attention on the immediate task at hand.

Probably the best known psychological effect of diving is nitrogen narcosis, but beyond this condition are other factors that contribute to what Egstrom calls "cognitive disruption," a six-syllable way of saying that we're not as alert as usual. There's a cold factor, a kind of sensory deprivation, weightlessness and even a plain old aversion to water in some people. And, notes Egstrom, "there's a stress factor—we have in the past called it a 'water effect'—which is compounded if you take water and make it cold water; or water and fill it with animals, some of which have teeth. And then there is—I don't know how to say this other than that I have the intuitive feeling without any evidence—that some people really like it in the water and some people really don't. And a number of those people who don't like it in the water choose to operate in the water anyway. And will, in fact, many times say that they really like it and really enjoy it. But I don't think they do. And their performance would tend to show it."

Many of these effects can be overcome with training, but until the diver adapts to the new environment, the person may have to concentrate as much as

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50 percent more than an experienced diver on what he or she is doing. This concentration tends to create problems of its own. While in some stress situations —skydiving, for instance—concentration on one area—the parachute or the target—can be helpful; in skin diving, it tends to block out all the surrounding factors that can also be important. For instance, Egstrom notes that new divers often cannot spot abalone or scallops even if the instructor points them out. "I have to feel that part of it is that they're having stress interference. They aren't able to focus their observational powers on this thing, because they have other things on their mind—they're worried about being able to stay with their buddy, and how deep they are and how much air they've got in their tank."

This inability to concentrate on more than one subject at a time may be responsible for the "avalanching effect" that is often a cause of novice mishaps. "In a study of surf entries and exits, we noticed that if you trace back with people who have relatively serious problems, usually it starts off with one small thing, where they begin to concentrate on that one thing, and meanwhile the world around them goes to hell in a handbasket. The waves crash on their head, knock them over, roll them up on the beach. It's rare that there's any single catastrophic thing that brings on the trouble. It's usually a series of events, each one feeding on the error from the last."

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Arthur Bachrach, chairperson of the Behavioral Sciences Department at the Naval Medical Research Institute in Washington, DC, and a colleague of Egstrom's, notes that many of the 150 sport-diving deaths a year can be attributed to panic. "We find one of the psychological consequences is what we call stereotyped behavior. An individual who has a reserve valve on his tank may pull it and find that it's already been pulled and instead of taking coping action—like jettisoning the weight belt and going slowly to the surface—he may just continue to pull. And then there's a lot of superstitious behavior—like banging on the vending machine when the gum doesn't come out. After a while, it's futile, noncoping behavior but sometimes it works."

But people panic on the surface too. Is diving panic any different from, say, panic on the freeway? "I think the strange environment contributes," says

Bachrach. "We find people training for scuba do fine in the pool, and then when they go out into the sea, they panic. Those four walls of the pool are no longer there, and they're suddenly faced with this vast void; and it's not necessarily a diminished situation but an enhanced one in terms of the role of the stimuli—there are so many more than there were in the pool. The diminishment of senses, and the fact that the individual is losing a lot of his abilities, is coupled with the enhancement of more things happening around him."

As a result of these findings, most of which had not been studied before this decade, diver training has begun to emphasize the psychological factors. Diving instructors are finding that if we want to dive in the ocean, we'll have to learn in the ocean.

If there's one lesson humanity has learned since emerging from the sea eons ago, it's that we can't go home again—at least not without a great deal of mental preparation.

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The Cyalume Lightstick

—*Mandatory for night dives*

Sitting on the counter in many dive shops is a display box containing the Cyalume lightstick, priced at $1.50 to $2.50, depending upon the shop. Most divers who pass the display don't know much about the Cyalume, but if they do any night diving then they ought to make the light mandatory equipment.

The tubular plastic lightstick, about six inches long, is filled with a greenish liquid. The light is activated when the user, with two hands, bends the tube, breaking a small ampule inside, containing another liquid. When the two liquids mix, a greenish light results. The light is roughly equivalent in intensity to a small penlight or a candle and gives about three hours of usable light and 8-10 hours more of light about as bright as a luminescent night light. On one end of the Cyalume is an eyelet through which a cord may be run; the other end is flat so the lighted tube can stand.

For night diving the light is often attached to the back of a tank; in clear water someone aboard a boat can keep constant count of the divers, even if their dive light fails or it is lost from view when a diver shines it in a cave. Some people strap the light to their snorkel, and although critics of this method say it increases drag too much, it is readily visible in all directions—more so than when the diver has the light on his back. When not kelp diving, some divers allow the light to float, attached to their BC by a cord.

Should the primary dive light fail, the Cyalume provides an excellent backup light for reading gauges or signaling. The light on the snorkel or the floating light can be used for either purpose, or the diver can carry an additional lightstick which he can easily activate by feel in a few seconds, no matter how dark.

We called ten dive shops throughout the country and found that five required the Cyalume on night dives, and the other five recommended its use. In West Palm Beach, FL, Norine Rouse supplies one to each diver. She says that it provides a signal if a diver is caught in a current, and likes it because the light shows in all directions, not just in a single beam. The Dive Shop in St. Louis, MO does not require each student to carry a Cyalume, but uses it to mark exit points on the shore. Instructor John Hanlon puts it inside a frosted milk bottle because, he says, "it even shines brighter."

The Cyalume is an amazing little light. It is not a source of ignition and therefore can be used around explosives or where dangerous fumes are suspected. It is a cold light. It won't blow up, cause burns, corrode, break or drip. Since it can be taken underwater, it can surely be activated in snow or rain and, according to the manufacturer, will work in temperatures between 20°F and 160°F.

CYALUME—A SAFE, EFFECTIVE, COLD LIQUID LIGHT

It won't be long before everyone requires the Cyalume on night dives, but rather than wait for rules, the prudent sport diver will adopt it now as part of his equipment and, if he is especially wise, carry a couple in his car and keep them handy at home for other uses. In fact, Cyalumes are now used in swimming pools at parties, attached to kites for night flying, as a substitute for flares and candles and, in one case, a Navy pilot used one for landing his jet when a fuse blew and his instrument panel darkened. The Cyalume gave him plenty of light to

read the gauges.

If your dive shop does not carry the Cyalume, you may order two for $3 by sending a check to Quality Creations, 2801 Biscayne Drive, Youngstown, OH 44505. Dive shops interested in quantity purchases may also contact them.

Diving the Red Sea: The Egyptian and Israeli Accords

The best Red Sea diving is reached from dive operations located at Sharm-el-Shiekh on Israel's Sinai Peninsula. However, according to the terms of the recently negotiated peace agreement between Israel and Egypt, half the Sinai (which includes Sharm-el-Shiekh and nearby Ras Muhammad) will be turned over to Egypt before the year's end and the balance of the Sinai will be transferred to Egypt two years later. What, then, will happen to the diving?

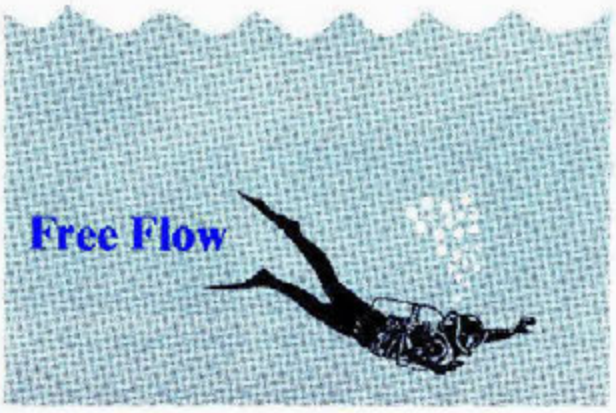
Undercurrent spoke with General Ghazala, military attache to the Egyptian Embassy in Washington, DC, who said that "every tourist operation will still be available. We have no intention of nationalizing or changing any business." In fact, Ghazala said that tourist-related businesses as will be encouraged and the Egyptian government will be stimulating tourism throughout the Sinai and Egypt.

Oren Most, the American-based representative of the Red Sea Divers located in Sharm-el-Shiekh, told *Undercurrent* that their business has received no official word regarding Egyptian attitudes, but rumors do indicate that a favorable attitude prevails. Carl Roessler, whose *See and Sea Travel* sends divers to the Red Sea, has spoken with Egyptian represenatives and confirms that they, too, indicated tourist businesses would be permitted.

Some people are concerned that the peninsula of Ras Muhammad, which is surrounded by excellent dive sites but also has military potential, may be closed to tourists, but Ghazala said that if some areas of the Sinai are selected for military use, permits for passage would probably be issued.

It would seem, then, that divers who are considering a trip to the Red Sea in 1980 will find that all of the dive operations are still in business and that the best of the sites remain accessible. However, given the unpredictability of the Middle East for the past 30 years, there are no guarantees. A diver with his heart set on the best of the Red Sea might be well-advised to take his trip this year.

For more information about diving the Red Sea, see *Undercurrent* November/December 1978 and January, 1979.



We thought the tubeworms at Moody's Pidertupo Village were enormous until we learned that scientists discovered 8½-foot worms living in tubes 9,000 feet deep 500 miles west of Ecuador. These worms have no eyes, no mouth and no gut, probably absorbing nutrients directly from the ocean.

The latest use for dolphins is being developed at the Academy of Applied Science at Concord, New Hampshire, where a team is being trained to swim Loch Ness, in Scotland, with cameras and strobes in search of the fabled monster. We never have figured out why it is worth spending all this money to find the monster and now we wonder why people should be permitted to catch and train dolphins for such folly.

The fearless captain of a local underwater recovery team in New Jersey, Peter Slaton, took a dive to close the valve in a flooded manhole, but only after being assured the water was Delaware River overflow, not sewage. When he surfaced, teeth chattering, he was quoted as saying, "I wish it was sewage because it would have been warmer." Frankly, we'd prefer the Caribbean.

We've never heard of a younger diver than little "J-Boy" Morton, four years old, who, accompanied by his father, scoots around the bottom of Arkansas' Lake Ouachita. The senior Morton designed a small tank and backpack for his son and never lets him go below 15 feet because, he says, "J-Boy's ears are not fully developed and injury could occur at greater depths."