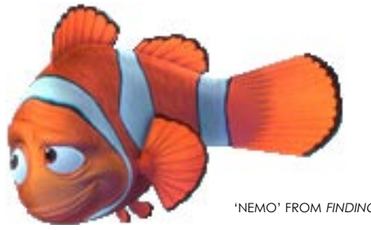
Edited by
Michael Arvedlund

The tale about Nemo's Nose & Clownfish Chemistry



'NEMO' FROM *FINDING NEMO* BY DISNEY/PIXAR FILMS

There are 28 recognised anemonefish species and ten species of host sea anemones. All anemonefish species are obligate symbionts of one or more host anemones in tropical and subtropical coastal waters.

Even before the clownfish achieved Hollywood stardom as cartoon character Nemo, most of us, divers and non-divers alike, knew about this little colorful fish nesting in a stinging sea anemone. As popular photographic subjects the symbiotic relationship between the fish and their invertebrate hosts have become one of the most well known images from the world beneath the surface. What is less known, however, is how the fish avoid being stung.

Text by Michael Arvedlund
& Peter Symes
Photos by Peter Symes,
Michael Aw, Edwin Marcow
& Malaysia Tourism

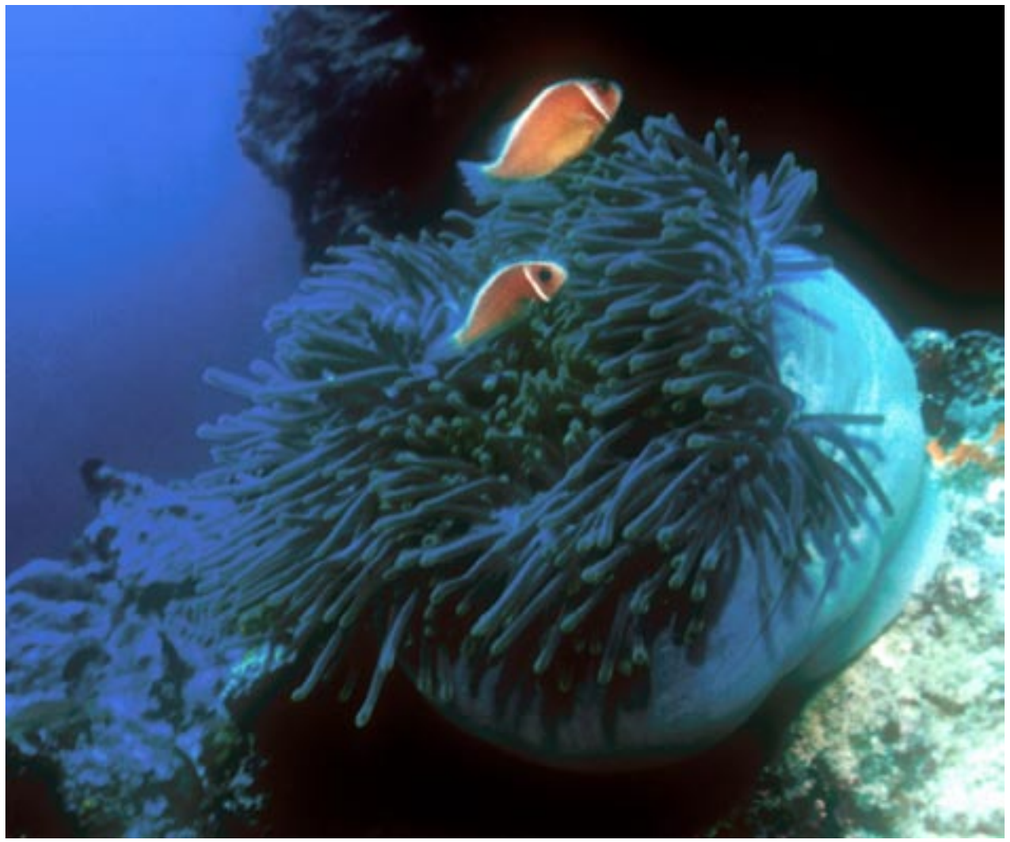


PHOTO BY PETER SYMES

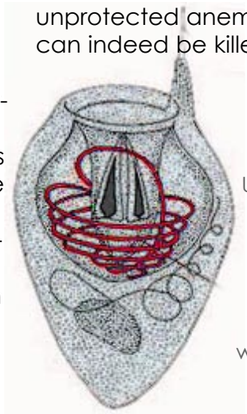
This is the tale about an odd relationship that not only works, but also is necessary at least on the part of the clownfish, which in nature is never found without an anemone whose stinging tentacle offers them protection from becoming prey of larger fish. But the clownfish also protects the anemone against being preyed upon by the butterflyfish. As most divers, who have the experience of taking a closer look at clownfish in an anemone, will testify, these fish are quite territorial and will protect their anemone very aggresively. They will fearlessly nibble at divers hands and poke at lenses.

Not plants Sea anemones, which contrary to their name are not plants but animals related to corals, live throughout the world's oceans. However, out of nearly 1000 species of sea anemones, only 10 are host to anemone fishes. These are found in the parts of the Indian and Pacific Oceans that lie within the tropics, or where warm tropical waters are carried by currents. Consequently, we find the associated clownfish in the same places. The anemones that are host to clownfishes must live in sunny places. They exist only in shallow water, because within the cells of an anemone's tentacles and oral disc live microscopic algae, which, like all plants, require sunlight for photosynthesis. In this process, sugars are produced from carbon dioxide and water. Some of these sugars fuel the algae's own metabolism, but most of them "leak" to the anemone, providing energy to it. This is, by the way, another example of symbiosis.

There are 28 species of clownfish and they all exhibit unique patterns of association with host sea anemones in nature. It ranges from the extreme specialist, the spine-cheek anemonefish (*Premnas biaculeatus*), which lives with one host species only, to the generalist Clark's anemonefish, (*Amphiprion clarkii*), which occurs with all ten hosts.

Nematocysts Sea anemones are related to corals, jellyfish and hydra. Together they make up the phylum cnidaria. A common trait for the cnidaria are nematocysts, the harpoon-like stinging capsules that give jellyfish their sting, fire coral their burn, and the tentacles of some sea anemones their stickiness. Within each capsule is coiled a fine thread-like tubule many times the capsule's length. When the capsule is stimulated to fire, the tube shoots out — inverting like the sleeve of a coat turned inside out — to penetrate or wrap around the target. Nematocysts function in prey capture and many can inject toxins, which are delivered to predator and prey by or through the everting tubule. The threads are frequently armed with spines that aid in puncturing a hole in the prey.

Over the years, many biologists have wondered how it is possible for the clownfish to adapt to such a hostile embrace. It has been suggested that the tentacles of the particular anemones do not contain nematocysts but all 10 host species are quite typical in this regard. It has been mentioned that the fish may not actually touch the tentacles. But while this is true for some Caribbean fish that seek protection behind and under sea anemones, as most divers will know clownfish do swim among tentacles, and in fact sleep on the oral disc at night. Another suggestion was that the skin of anemone fishes is thicker than normal so nematocysts cannot penetrate it, but this is not the case, the skin of clownfish differs little in thickness from that of other fishes, and may even be slightly thinner than that of the damselfish. Also, as mentioned below an unprotected anemonefish can indeed be killed by its



Nematocyst. Upon discharge, the coiled thread bores it way into the tissue of the prey, injecting a toxin with a paralyzing action

Nemo's Nose
& More Clownfish Chemistry

PHOTO BY EDWIN MARCOW. DIGITAL IMAGING BY PETER SYMES

host's sting. Finally it has been suggested that while a fish is present, the anemone will not fire its nematocysts. But although a sea anemone seems to be able to have some control over its firing, it still stings and captures prey while harbouring clownfish.

The biochemical details remain ambiguous. What we do know is that some anemone fish species have evolved resistance to toxins secreted by host anemones, but the essential protection from the nematocysts stems from the anemone fish skin mucus. Anemone fishes are innately protected from some anemone species but must acclimatise to live with others. Most anemone fishes are stung by unnatural hosts, i.e. hosts they do not live with in nature. However, the protection mechanism remains largely unclear. Several hypotheses exist, though they are not mutually exclusive.

Protection What seems to be the matter, is that clownfish somehow acquire or elicit protection, and that this protection can also disappear again. In experiments in aquaria where the clownfish has been separated from its host anemone for more than a few days or weeks, when the partners are then reunited and the fish swims into the host's tentacles, it withdraws rapidly, appearing to have been stung.

Depending on the species involved, this reaction is sometimes very obvious. However, a stung anemone fish will return to its host and carefully and gradually expose itself to the anemones tentacles through elaborate stereotyped motions, first touching the anemone with its ventral fins only, then exposing its entire belly. This process may take a few minutes or several hours but in the end the clownfish is able to dive right in.

Who? So, is it the fish or the anemone that is responsible for the protection? A clownfish which has been living alone will be stung by an anemone already harbouring another clownfish. It seems that the protective agent resides in the mucus coating that anemone fishes, like all fishes, have on their surface. But what is the source of this protective mucus? It has been speculated that when contact between the clownfish and anemone is initially made, the fish smears mucus from the anemone all over itself. And just as the sea anemone does not sting itself, the fish is thereby chemically camouflaged: it is, essentially, a fish in anemone's clothing. The fish's normal behaviour of returning to its anemone at least once a minute can be interpreted as serving to maintain its protective layer of mucus. According to this theory, what allows clownfishes to live in this peculiar habitat is their unusual behaviour.

PHOTO COURTESY OF 'MALAYSIA'

However, not all biologists subscribe to this hypothetis. There are other scientists who believe that the presence of protective mucus is the result of the fish being protected and not cause. According to their beliefs the fish's own mucus has evolved to lack components that stimulate nematocyst discharge, and the observed "acclimatization" behaviour just an artifact of artificially separating animals that normally never are parted. The secret to clownfishes' peculiar habitat, according to this interpretation, is their unusual biochemistry.

However, experiments have provided evidence that both fish and anemone may be active in forming the symbiosis for at least one combination of fish and anemone species. A fish kept in an aquarium with a surrogate sea anemone made of rubber bands glued to a Petri dish required an average of only 20 minutes to acclimate to a real anemone, whereas the acclimatization time being directly exposed to a real host anemone was two and a half hours. It appears that the mere perception of what seems to be a host anemone elicit the fish to produce an especially protective mucus, but since it must still undergo a period of acclimatization, that alone does not suffice. It seems necessary that the anemone alters or adds to the mucus somehow. ■

RECOMMENDED READING:
DAPHNE G. FAUTIN AND GERALD R. ALLEN. 1997. *FIELD GUIDE TO ANEMONEFISHES AND THEIR HOST SEA ANEMONES*. REVISED EDITION. WESTERN AUSTRALIAN MUSEUM, PERTH, PP 160. ELECTRONIC VERSION: **HTTP://BIODIVERSITY.UNO.EDU/EBOOKS/INTRO.HTML**

Chemical imprinting may be more widespread among reef fishes than was previously thought

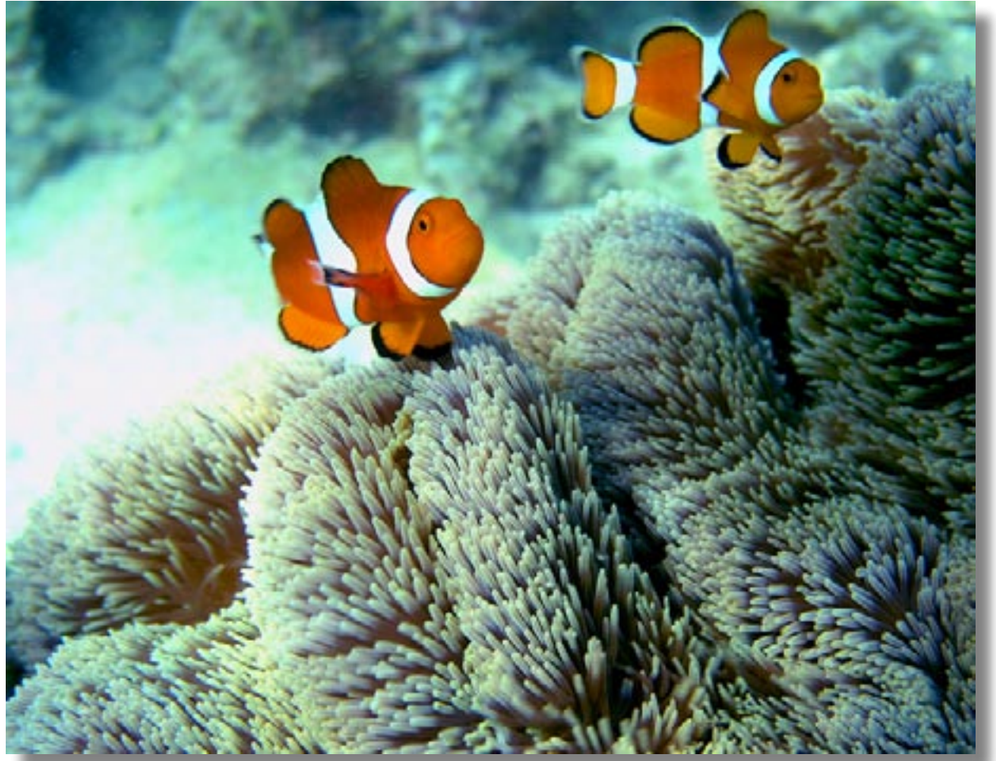


PHOTO BY MICHAEL AW

Nemo's Nose
& More Clownfish Chemistry

Text by Michael Arvedlund

Clownfish find their hosts by remembering their smell, which drifts over them as embryos.

Sea anemones have long been known to release very powerful olfactory compounds, which might best be described as perfumes. It seems that Clownfish become 'addicted' to the perfume as an embryo in the egg, lying next to the sea anemone covered in perfume-like compounds it releases. This hypothesis had to be proved underwater by locating a lot of clownfish egg-clutches nestled by host anemones. Over several weeks of successful dive-investigations, we observed about 40 pairs of clownfish with egg-clutches and, without exception, they had all placed their clutch right next to their host anemone's column, not even a millimetre away.

By good memory, and a keen sense of smell, juvenile clownfish can quickly track down a suitable sea anemone by smelling their way to the perfume, when they settle on the reef two weeks later. Earlier American and Japanese research on the fate of reef fish larvae established that clownfish larvae emerge from the egg case after seven to nine days, and immediately swim to the surface. They swim around in the ocean, sometimes drifting with the currents, vulnerable to the environment, and feeding on plankton.

After two weeks, the juvenile clownfishes are about a centimetre long and ready to settle on the reef. This always happens in the middle of the night, when there is less chance of being discovered by a hungry predator. Once the fish reach a coral reef, the search is on for a suitable host sea anemone to take them under its protective tentacles. Not all of them will be fortunate enough to find one, and the unlucky ones will end up on the menu of many larger fish or invertebrates on the reef. But for the lucky surviving ones, the smell they instinctively remember is their passport to safety.

This chemical imprinting may be more widespread among reef fishes than is thought, and smell the trigger which leads most fish to coral reefs when they come to settle. It is thought that olfactory cues, perhaps released from corals, similar to the perfume released from sea anemones, might be the trigger for many juvenile coral reef fish to settle. ■

Edited by
Andrey Bizuykin
& Peter Symes

New & Interesting

Equipment

Ellipse Alaska Cressi presents a new version of the Ellipse Titanium, for divers who mainly use regulators in cold water. The MC7 diaphragm first stage comes with the Cressi antifreeze kit that completely seals off the external elements of the first stage from contact with water. The second stage is identical to the one used in the Ellipse Titanium. **www.cressisub.com**

Third Generation Even before this new 'III', Sea & Seas Motormarine series was already a true classic, and the new generation of Motor Marine looks more than capable of living up to the reputation of its forebears. The III is more rugged and offers more controls than ever before. With features like two point focus for fast reliable focusing and a target light for accurate framing, the MM III is a perfect choice for the beginning photographer. Advanced features like strobe bracketing control and push-button shutter speed control provide creative freedom for the experienced photographer. All the controls of the MM III are on the top or back of the camera making them easier to read and operate. Price in the U.K. £844 / $1486 USD / €1219 EUR. **www.seaandsea.com**

www.seadesigns.com
$110 USD

iPod u/w
H20 Audio is launching the first underwater casing for the Apple iPod. The H20 SV-iMini will ship for $150 USD. The casing allows for underwater dial and push button access to a maximum of 10 feet (3 Meters) and full protection in wind and rain conditions. **www.h2oaudio.com**

Quotes & Comments

Professor Negropante on 'Featuritis' in software

"The speed and performance of software worsens with each succeeding release because of featuritis, the tendency to bloat new releases with features and options that monopolize the hardware's improved speed and memory. What you actually get is 10 different ways to do the same thing, with fewer and fewer of them intuitively obvious. Bloatware keeps the costs of computers, phones and other devices basically the same, thanks to featuritis. Users should reject the attitude that they are stupid, and that machines must be built the way they are."

"Simplicity should be a rule of thumb for mainstream products, while dedicated, special-purpose devices could be created for consumers of advanced features by adapting software to make the hardware act in different ways. The long-term strategy is to imbue computers with common sense."

"Simpler machines can be much less expensive, and while consumers, I believe, want this badly, the manufacturers have little interest in making this happen because the high end of any market is more profitable."

Nicholas Negroponte is the Wiesner Professor of Media Technology at the Massachusetts Institute of Technology and founding chairman of MIT's Media Laboratory. In 1995, he published The New York Times bestseller, *Being Digital*, which has been translated into over 40 languages. In the private sector, Professor Negroponte serves on the board of directors for Motorola, Inc.

On the grapevine Due to be realeased on March 1 is Mares new concept of "Limited Edition". According to a recent pressrelease dive equipment can now be custommade to order. The Italian manufacturer is responding to a slowing market by putting out equipment such as regulators and bcds in limited numbers of max 2,000 numbered pieces each. Number 0001 in each series can't be ordered but it will be offered the highest bidder in an auction and the proceeds will go to a charity

Sea & Sea On-line Photography Course

Sea & Sea introduces a novel approach to underwater photography training: The MX-10 On-line Photography Course taught by underwater imaging expert, Marty Snyderman.

The comprehensive program is designed exclusively for owners of the Sea & Sea MX-10 System. The entire MX-10 system is covered along with popular Sea & Sea accessories including the Close-Up Lens, Macro Lens, 20mm Wide Lens and the Fiber-Optic System. The course is easily accessible through a password protected area. Students have one year after their initial session to return to the site as often as they want, whenever they want, wherever they might be on the globe. As long as photographers have web access, they can review needed skills or techniques from an exotic resort, live-aboard or from the comfort of their home.
The price is $29.95 USD
www.seaandsea.com

Slate Slip A 2 or 3 pocketed, arm mounted slate holder. The diver can carry, and easily view more than one table or run time. Elasticated straps and Velcro fastening on pockets. Inside pocket size 10cms x 14cms SRP: £18.00
www.bowstonediving.com

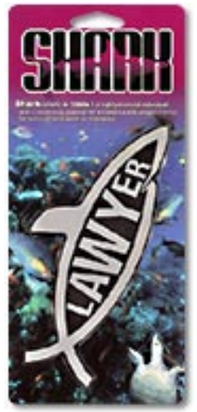
Archimede
New style for the casing of this instrument, with coloured inserts to improve its look. The strap is also new, with stretch inserts to absorb the squeeze of the suit deep down.
www.cressi-sub.it

F2 Pouch Set - Battery Pack and Lamp Holder
This packet contains a pouch to carry the battery pack, 1 strap to go around the bottle and an elasticised holder on a quick pull Velcro tab.
SRP: £15.00. **www.bowstonediving.com**

Primetime Scubapro-Uwatec writes: tThe Aladin PRIME is the NEW Uwatec computer for recreational divers with an array of features that compete with other manufacturers' top end products. This new computer is easy enough to use for anyone who is new to diving but at the same time has the necessary, advanced features to satisfy the more advanced diver. **www.scubapro.co.uk**

ArmorProducts In or out, it's up to you where you want to keep water. This dry boat backpack keeps your gear dry even in a wet boat environment, and keeps your car and cloths dry from wet gear you pack away in the backpack after a dive. The pack features touch PVC rubber coated tapaulin material, 100% non-corrossive PK zippers, contoured backpack straps with BCD style D rings, detachable with dry hidden pocket, regulator pocket, padded with access from inside for extra protection, continuous loop webbing for maximum durability, roomy size: 26" long x 18" wide x 12" deep, and 6,000 cubic inches of storage space.
www.armorbags.com

... and PC interface
A completely new interface both in terms of software and hardware. The hardware uses a new clamp that is easy and quick to position onto the computer contacts, to download the data to the PC (USB port). With the software you can create a comprehensive electronic logbook, with lots of information inserted automatically and other data that the user can insert manually. There is also a sophisticated simulator for dives using air or hyper-oxygenated mixes, which makes it an extraordinarily effective educational tool.



Shark These diving car emblems display underwater with way more class than any "Divers do it deeper" bumper sticker. Stick it to your car, boat or computer - the Dolphin Diver emblem will make a big splash with all your dive buddies all over the world. Fabricated out of a high quality polymer Signs of Success™ emblems are made to withstand car washes, road salts, and sunlight for years of indoor or outdoor display without fading or discoloration. The plaques are approximately 6" long and 2 1/4" tall and come with a strip of foam adhesive tape.
From $8.95 **www.signsofsharks.com**

Manta-Bite
Do you surface from your dive with aching jaws and teeth? Well, Manta-Bite could be the answer to your pain. Unlike other "orthodontic" mouth pieces, this unique design uses your cheeks, not your teeth, to keep the mouthpiece in place. This greatly reduces pain from jaw gripping as well as wear and tear on the mouthpiece itself. This will especially help divers with TMJ problems, removable dental appliances, missing back teeth or dentures. It's the most comfortable mouthpiece on the market. **www.manta-bite.com**

New Analyst 4.01
Analyst 4.01 is available in a Standard edition for the recreational diver and a Professional edition with added features for the more advanced diver. Analyst 4.01 is capable of checking for edition updates and automated registration/activation when the P.C. is connected to the internet. It also supports both USB and serial port interface protocols. Dan Export files for Diver Exploration are Level 3. Analyst 4.01 supports the Cochran Commander, Commander EMC-16, Commander EMC-20H and the Cochran Gemini, but not the Nemesis series or the Commander Plus, Commander Nitrox and the Gemini Plus. Additional features that are, or soon will be available in the Professional edition are:

- Blending Wizard
- Planning/Simulator (200 m)
- Inter-Dive Event Profiling
- Confined Water Protocol
- Script Files
- Half-Time Compartments Graph
- Parametric Cloning
- Flight Data Recorder

Download the Demo Edition of Analyst 4.01

Halcyon Apollo HMI Video Lighting. Introducing the world's first portable underwater studio lighting system, the Apollo HMI. The same quality and intensity of lighting that you would expect to find in a studio HMI lighting system, only capable of extreme depths independent of any surface-supplied power source.

By incoporating Halcyon's Helios NiMH battery technology into the Apollo HMI's design, Halcyon has been able to shrink the canister size down to less than a "standard" 14 amp hour lead acid primary light canister. The new NiMH Apollo HMI is one-third the size of the original Apollo HMI, with a longer burn time.

www.halcyon.net

Rebreather Wings Custom Divers has launched the *Variable Buoyancy System.* This dedicated rebreather wing has extra width allowing for the wing to inflate properly. The VBS has three zippable compartments around the outside of the wing. The compartments (which are completely independent of one another) expand, offering the diver variable buoyancy capability, whilst the elasticated cordless side panels allow for controlled even deflation. The design of the neck section ensures that the breathing loop and hoses are not caught and snagged, no matter what position the wing is bolted onto the back box. Divers also benefit from 4 D Rings attached to the Wing, making mounting accessories an easier task. **www.customdivers.com**

Resin body Sea and Seas new Video Light is compact, lightweight and made of synthetic resin body.

The LX-15, installed with a 15-watt 4.8 V halogen lamp has a continuous burn time of 40 minutes (when using Ni-MH 2,400 mAh battery), Ni-MH batteries sold on the market can be used, so there is no need to carry around exclusively-designed battery a charger. Equipped with a newly-designed reflector, with a beam angle of 70° even light from the center to the edges without a hotspot can be maintained, making the LX-15 very suitable as a video light.

www.seaandsea.com

Perla From Cressi, a new mask that copies the lines of the Focus. It has separate lenses, a skirt edge that adapts well to most faces and a much smaller inner volume. It is made from soft, transparent or dark silicone, and comes with strong and quick action buckles to adjust the strap. It is particularly suitable for free diving or snorkelling, but is just as appropriate for scuba diving.

www.cressisub.com

Tech Pouch with Scissors Good sized pouch with a D ring sewn inside, a zipped opening and a velcro front pocket for extra storage. Will slide onto 50mm webbing. Size 24cm x 24cm x 9cm. Complete with a pair of stainless steel scissors in a pouch, sewn to the font. SRP: £50.00 at **www.bowstone-diving.com**

Greenforce The info at the manufacturers website is rather compact: 6 Volt (NiMh 5 x 4,5 Ah). STD6 (Xenophot 20 Watt) Burn time: 75'. incl. handle and slow charger. Total length 180mm. Weight in air 1100 gr. Weight in water 630 gr.

www.green-force.com

'K-19 submarine' Vostok Amphibia automatic retro look Waterproof 200 m screwed head. Round shape solid case, size is 39 x 12 mm. All stainless steel case. Rotating bezel with markings. Band width 18 mm Stainless steel bracelet. Price ea. 54.00 USD **www.russian-time.com**

Pressrelease:

Suunto and Aida announce cooperation

Suunto D9 becomes the official AIDA depth instrument

Suunto, the diving instrument market leader worldwide, and AIDA, the International Association for the Development of Free Diving, have engaged in a co-operation related to AIDA diving events for which the Suunto D9 has been chosen as the official depth instrument. As result of the co-operation, for the first time ever, the exact profiles of the record dives can be monitored afterwards. Due to a sampling rate as low as 1 second, and 200 meter depth display, the Suunto D9 can produce detailed information on the record attempts. AIDA will publish all successful world record dive profiles using the Suunto Dive Manager PC-software.

Ikelite JVC DZ7 housing. A delightful compact size housing and camera allows you to capture the moment with the latest digital video technology, including digital stills that can be printed or sent as electronic mail. Molded of clear polycarbonate to provide seamless construction and corrosion proof performance. This "Clearly Superior" design provides full view of the camcorder, control functions, and assurance the system is safe. Changing between video and stills underwater requires only the flip of a switch. Link: ***Sample digital still photo.*** The housing operates safely to 200 feet. The housing lens port is threaded for 67mm wide angle lenses of Inon and Epoque.
www.ikelite.com

Pelican case The new 1610 case will be the toughest and biggest airline-legal carry-on case on the market. Complete with side handle, front handle and convenient extension handle, it will be the perfect rolling travel companion. An added value to this case is the effortless release latch for the extension handle. Also, the padlock protectors provide added strength and extra security against cutting and theft.
www.pelican.com

SUUNTO SAFETY NOTICE ABOUT THE NEW D9 COMPUTER.

Suunto production tests have found a software fault in the first series of Suunto D9 computers (products with serial numbers 4xxxxxxxx - 450000699, software version 1.x.x - 1.2.4). Suunto advice is that the above numbered D9 computers are not dived with before a software update has been made.

Although highly unlikely, the fault may under certain circumstances cause the depth and time display to update slower than normal. Any potential problems are avoided by upgrading the D9 software to version 1.2.8. There have been no reports of users experiencing this fault.

Sea Eagle II - Dual Bladder Wing from Northern Diver. Each of the independent bladders comes with its own power inflator and fitted with a shoulder pull-cord dump and an auxiliary rear kidney dump. The stainless steel backplate with comfort pad makes the Sea Eagle ideal for single or twin cylinder rigs. 2 front utility pockets, mounted on the waist straps, have velcro flaps, top and bottom, and can be used as easy-ditch secondary weight pouches or as conventional pockets. The Sea Eagle II incorporates a chest strap and crotch strap in conjunction with the internal cummerbund, making it one of the most comfortable and functional jackets on the market. Sizes: M, L, XL. Stainless Steel Twinning Bands and Manifold Available.
www.northerndiver.com

Free Scuba Buoyancy Simulator Software

This FREE program simulates some of the effects of diving with SCUBA. Some of the effects are exaggerated for instructional purposes. Click on the download links below to download either a Macintosh or Windows version of the program:

- **Macintosh**
- **Windows**

media

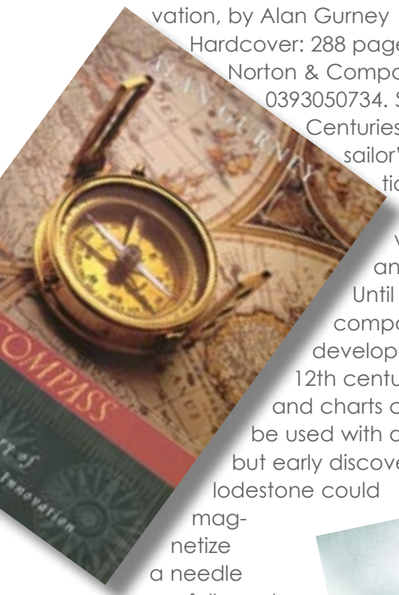
Books, Film, DVDs, CDs

Edited by Peter Symes
& Michael Symes

POINT & CLICK ON BOLD LINKS

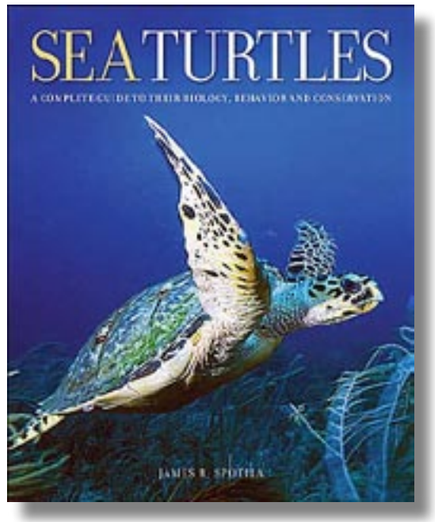
A Story of Exploration

Compass: A story of exploration and innovation, by Alan Gurney Hardcover: 288 pages, W. W. Norton & Company; ISBN: 0393050734. $22.95



Centuries ago, a sailor's directional aids were winds and vision. Until the compass was developed in the 12th century, maps and charts could not be used with accuracy, but early discoveries that lodestone could magnetize a needle were followed by a large number of devices. In 1901, the magnetic compass was finally replaced by the gyrocompass. Yet despite 20th-century technological upgrades, the magnetic compass still remains a fail-safe measure. This book relates the intensely interesting search to perfect that essential navigational device, the compass, its history up to modern times being filled with the stories of disasters that befell sailors who misused it. **www.amazon.com**

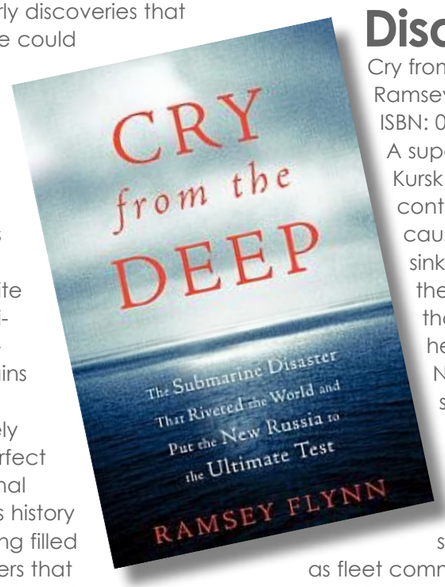
Sea Turtles



Sea Turtles: A complete Guide to their Biology, Behavior, and Conservation, by James R Spotila, Hardcover: 224 pages, The Johns Hopkins University Press; ISBN: 0801880076. $24.95

For more than a hundred million years, sea turtles have been swimming in the world's oceans. Having escaped the mass extinction that wiped out the dinosaurs, these ancient reptiles today face new dangers that threaten their survival. Marine biologist Spotila has spent much of his life unraveling the mysteries of these creatures and working to ensure their survival. In Sea Turtles, he offers a comprehensive and compelling account of their history and life cycle based on the most recent scientific data - and suggests what we can do now to save them. Sea Turtles is illustrated with stunning color photographs by the world's leading nature photographers. **www.amazon.com**

Disaster at sea



Cry from the Deep: The Sinking of the submarine Kursk, Ramsey Flynn, Hardcover: 282 pages, HarperCollins; ISBN: 0066211719. $25.95

A superb account of the loss of the Russian submarine Kursk in the Barents Sea in August 2000. Torpedoes containing hydrogen peroxide exploded in the Kursk, causing a blast registering 4.2 on the Richter scale, sinking the submarine. A few of the crew survived the explosions, but they probably did not live more than a few hours longer. Flynn reconstructs what he can of the fate of the submarine. The Russian Northern Fleet failed to recognize the obvious signs of an accident, and failed to take any constructive action. They also failed to inform political superiors, and didn't allow any cooperation with the efficient rescue gear of the NATO navies. Russian officials were then caught in several outright lies. Several critical hours were lost as fleet commanders failed to report that something dreadful appeared to have happened to one of its boats. This sealed the fate of those still alive in the submarine. **www.amazon.com**

Coming titles

Calfornia DVD

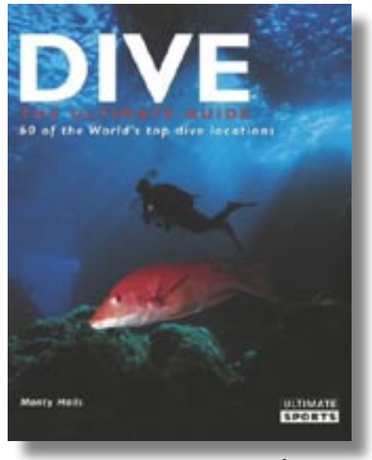
Calfornia marine life identification
Hammerhead Press
Hosted by Kristine Barsky, a professional marine biologist, with over 30 years of diving experience. Learn how to identify many of the most common marine creatures seen underwater off the California coast. More than 80 species of marine plants and animals are included in this program. **www.hammerheadpress.com**

Totally Wrecked DVD

Playing time: 60 minutes, Produced by Full Circle Productions. £14.99
The DVD follows the Full Circle Wrecks team as they dive the World's top ten shipwrecks. Included are all the best dives on each wreck, information on the operators and, of course, the slightly wilder side of a Full Circle Expedition. Follow the team as they have a close encounter with killer whales in New Zealand, explore an ancient Maori cave system, find human remains in Truk, experience real drama in the engine room of a wreck in Grenada, and dive the clearest water on earth outside the polar ice caps. **www.fullcircleexpeditions.com**

Where to go

Dive – The Ultimate Guide to 60 of the Word's Top Dive Locations
Monty Halls, Paperback: 320 pages, Ultimate Sports Publications Ltd; ISBN: 0954519914. £20.00
Authoritative, in-depth reporting on 60 of the world's top dive locations, including detailed accounts of the best dives and marine life at each location. This guide is packed full of practical dive information and well-designed data tables that enable the reader to identify key facts easily and quickly. It is totally up-to-date and well presented in a large page format that allows space for over 300 stunning colour photographs and high quality mapping of each location. It tells you everything you need to know about water temperature, visibility, local dive centres, dive governing bodies, conservation and important safety information, with useful telephone numbers and websites as well as general information about the geography of each location, local culture, visa requirements and how to get there.



www.amazon.co.uk

Movies

disney.go.com

Aliens of the deep in 3D

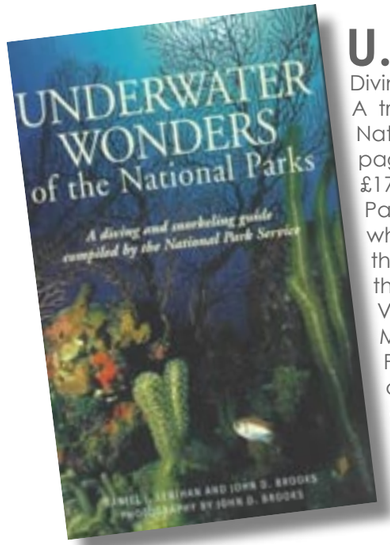
A 45 minute 3D film, directed by James Cameron. Academy Award winning director James Cameron takes audiences to the bottom of the ocean to encounter some of the strangest life forms on Earth, while inviting us to imagine what future explorers may someday find on other planets. Aliens of the Deep presents the highlights of more than 40 dives made to the Mid-Ocean Ridge, a submerged chain of mountains that winds 46,000 miles around the globe.

Sharks 3D

A new 3D IMAX movie. Jean-Michel Cousteau, the United Nations Environment Programme and 3D Entertainment joined forces with this new 3D film that offers an astonishing, up-close three-dimensional encounter with nature's ultimate, yet endangered predator while delivering a compelling conservation message. The film brings the viewer face to face with a multitude of the world's great shark species, including the Great White, Whale Shark and Hammerhead. Audiences experience them as they truly are in their natural habitat: not wicked man-eating creatures, but wild, fascinating, and highly endangered animals. The film, shot on location in Guadalupe Island, Socorro Island and the Sea of Cortez, Malpelo Island, the Red Sea, Sodwana Bay, Mozambique Channel and Rangiroa Atoll, consists uniquely of underwater footage. **sharks3d.com**

media

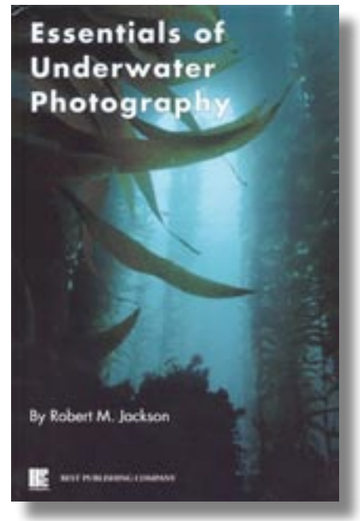
Books, Film, DVDs, CDs



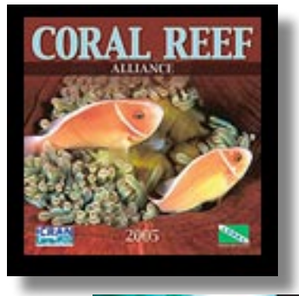
U.S.National Parks

Diving and Snorkelling the National Parks

A travel companion for diving and snorkeling in the National Parks. by Daniel F Lenihan, Paperback: 272 pages, Fodor's Travel Publications; ISBN: 0679033866 £17.35 (Sales of this book help to support the National Parks). Essentially a companion for divers and snorkelers which explains how and where to dive. It also details things to see and do for non-divers. The guide covers the North Atlantic, North Carolina Parks, Florida Parks, Virgin Islands, South-Central, Great Lakes, Rocky Mountains, Pacific Northwest, California, Hawaii, Pacific Territories and Alaska. It includes shipwreck diving off Cape Hatteras, Isle Royale, Fire Island, and elsewhere; kelp forests in the Channel Islands; and underwater geysers in Yellowstone. Also underwater archaeological sites such as remains of Spanish galleons in the Dry Tortugas, a Union warship off Cape Hatteras, and a ranch house in Lake Amistad. **www.amazon.com**



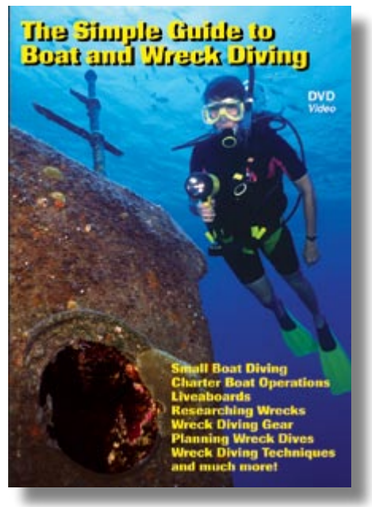
Looking for a calendar?



GUE's 2005 Calendar Global Underwater Explorer's 2005 Calendar is now on sale. $17.99 + shipping. This is the perfect gift for anyone who loves diving. The calendar, 8½ x 11 in, features amazing photos from David Evans, Andrew Georgitsis, Claudio Provenzani, David Rhea, Anthony Rue, Sonya Tittle, and Gary Woods. The calendar will remind you of why we live to dive on those dull days spent between time in the water. This is a thirteen month calendar, January 2005 - January 2006. **www.gue.com**

The Magnetic Island Underwater 2005 calendar is a collection of images from Magnetic Island in the Great Barrier Reef Heritage area of Australia. It highlights the special nature of the reefs and promotes Reef EcoTours. It is printed at A4 landscape size, on 160gsm gloss paper and spiral wire bound along the top edge. It sells for $22 wholesale, $25 retail which includes postage. **magnetictimes.com**

New DVD: Boat & Wreck Diving



The Simple Guide to Boat and Wreck Diving, 45 minutes, Hammerhead Press, $17.95. **www.hammerhead-press.com**. This video provides divers with important insights, tips and details about boat and wreck diving. Filmed by Steve and Kristine Barsky, it contains extensive information on diving from large charter boats, small boat operations, wreck diving gear, and wreck exploration. The video is an ideal supplement to any training agency's educational programs, or as a stand-alone introduction for new divers who are interested in learning about these specialties prior to enrolling in training. The underwater portions of the wreck diving program were shot on the wrecks of the Yukon and Ruby E, off San Diego's Mission Bay.

UWP Help

Essentials of underwater photography Robert M Jackson, Hardcover: 88 pages, Best Publishing Company; ISBN: 0941332772. $21.00. **www.amazon.com** Underwater photography is challenging, even in the age of autofocus and TTL cameras. This book illustrates these concepts with brilliant color photographs, each of which is accompanied by an explanation of exactly how it was accomplished. This book stresses basic knowledge needed to produce high quality images. Both beginning and experienced underwater photographers will benefit from the presentation of practical suggestions and realistic solutions for making photographs with housed 35 mm cameras, macro or wide angle lenses, and strobe lighting. A glossary of important photographic terms is included, as well as straightforward and comprehensive explanations of useful optical concepts, lenses, cameras, film and strobe lighting.

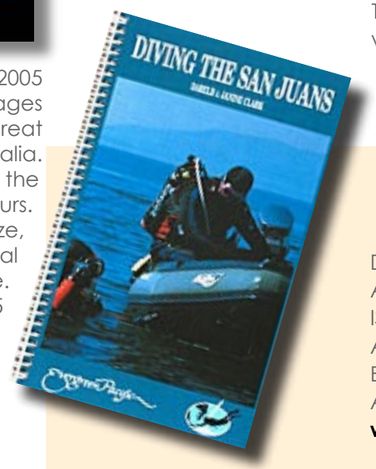
Movies

lifeaquatic.movies.go.com

The Life Aquatic

Internationally famous oceanographer Steve Zissou (Bill Murray) and his crew, Team Zissou, set sail on an expedition to hunt down the mysterious, elusive, possibly non-existant Jaguar Shark that killed Zissou's partner during the documentary filming of their latest adventure. They are joined on their voyage by a young airline co-pilot who may or may not be Zissou's son (Owen Wilson), a beautiful journalist (Cate Blanchett) assigned to write a profile of Zissou, and Zissou's estranged wife and co-producer, Eleanor (Anjelica Huston). They face overwhelming complications including pirates, kidnapping, and bankruptcy. 1 hr. 58 minutes

X-RAY REVIEW



Diving the San Juans

Dareld Clark
Accord Communications Ltd
ISBN: 0945265182. pp 135, ca. A5 format, spiral bound
Black/white illustrations
Amazon.co.uk price: £17.37
www.amazon.com

This, the first of a series of detailed practical guides to diving locations, covers over sixty dive locations within the San Juan Islands. It is fully illustrated with plant and animal life native to the Puget Sound area. Each well documented and mapped location provides an abundance of sites to choose from.

As the author says, it is the rare diver who has never been disappointed in a dive site because it did not contain the variety of plant or animal life that he or she had hoped to see. One of the purposes of this book, therefore, is to help you to select dives sites based on a knowledge of the environment and of the plant forms and the vertebrate and invertebrate populations to be found here.

The data for each dive site is divided into four sections: habitat and depth, dive profile, directions, and hazards. Apart from information about a specific site there is also much of general interest to be found here. All-in-all, then, this guide would be a very useful addition to the library of any enquiring and adventurous diver. First published 1988.

media

Books, Film, DVDs,

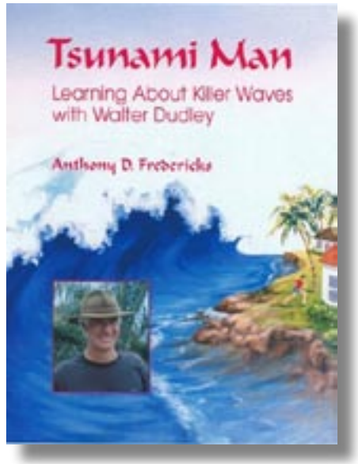
Dive Destination Guides

Dive Destinations 2005 + Caribbean Wreck Heaven

Dive Destinations + free DVD Filmed and produced for Sport Diver by former BBC newsman John McIntyre. Obtainable from **www.divedestinations.net** £8.95 + p&p. Dive Destinations 2005 covers more than 70 destinations and offers comprehensive information on climate, entry requirements, currency, language, electricity supply and so on, as well as details of the countries themselves and the types of diving you can do. The DVD, Caribbean Wreck Heaven, visits nine islands and explores more than 30 wrecks. Among the vessels dived on the DVD are the enormous Bianca C – the Titanic of the Caribbean – and the huge Spiegel Grove, alongside the Rhone, the Stavronikita and the James Bond wrecks. The DVD also contains an eight-minute bonus feature titled Shark Frenzy, which sees John get in the thick of a hectic shark feed in the Bahamas.

Silent Wrecks

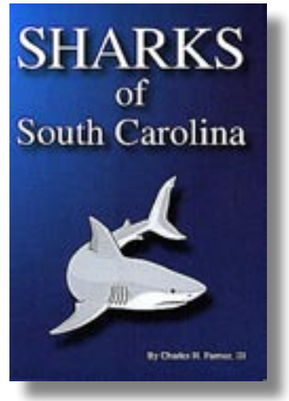
The Silent Wrecks of Kwajalein Atoll Video film, 55:30 minutes, Produced by Oceanic Research Group, $24.95 plus $3.95 shipping (USA), $7.95 shipping (outside the USA). NB this video is available in NTSC only. In 2000, members of Oceanic Research Group, along with history and dive specialists, filmed the underwater sequences for their full-feature documentary, The Silent Wrecks of Kwajalein Atoll. During the Second World War, Japanese and American forces fought for control of the Pacific. Kwajalein Atoll, part of the Marshall Islands, saw several battles during which many ships and planes came to rest on the floor of her lagoon. This film examines the battle for Kwajalein through the underwater wrecks of those battles. **www.oceanicresearch.org**



Big Waves

Tsunami Man: Learning about killer waves with Walter Dudley, by Anthony D. Fredericks, Paperback: 96 pages, University of Hawai'i Press; ISBN: 0824824962. £9.50. Filled with dramatic photographs and accounts of tsunami survivors, this book addresses the how and why of tsunamis, their impact on human lives and the way which information about these so-called killer waves is shared throughout the world. Young readers are also given an inside look at the life of a working scientist. **www.amazon.com**

Sharp Sharks



Sharks of South Carolina Charles Farmer, 160 pages, South Carolina Department of Natural Resources. It is available free of charge through the Department of Natural Resources. For the location of the DNR office call the DNR's switchboard at (843) 953-9300 or visit **saltwaterfishing.sc.gov**. To receive a copy by mail, send a check for $2 (postage) payable to the SCDNR, P.O. Box 12559, Charleston, SC, 29422-2559. This is the first comprehensive guide to shark species in the state. Included in the guide are 160 pages of information, a description and overview of 13 families of sharks and 39 species presented individually with illustrations pointing out the key characteristics essential in the identification process, along with other key information. The guide also delivers a message on the conservation of sharks. **www.lowcountrynow.com**

Games

Silent Hunter III, Simulation, Ubisoft Entertainment, £29.99, available: 17/03/2005. The king of submarine simulations returns with an all-new 3D game engine, new crew command features, and more realistic action than ever before. Command the cunning and deadly U-boats of the North Atlantic and experience the tension-filled atmosphere of a WWII submarine movie. The game includes a career campaign, patrols that have both single and historical missions, a mission editor, and multiplayer feature. Whether it's stalking destroyers or hiding from depth charges, players will experience their own personal war story. The spectacular graphics, multiplayer options and suspenseful gameplay combine to create the most impressive submarine simulation ever. **www.silent-hunteriii.com** or **ve3d.ign.com**

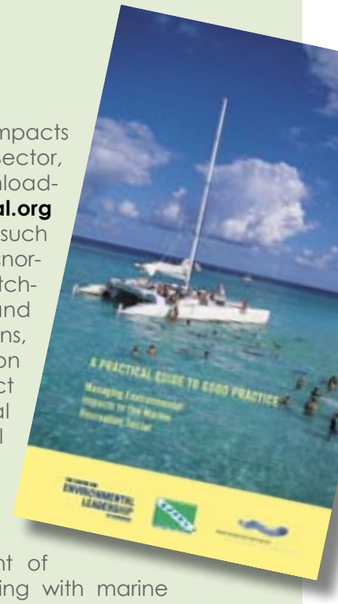
Screensaver

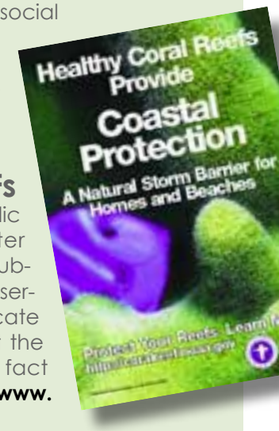
Sharks, Terrors of the Deep. Entertainment Software, Prolific Publishing, Inc. $19.95 when ordered on-line from **www.lifeglobe.com**. This special beta release of Sharks, Terrors of the Deep includes 11 species of your favorite sharks in two different scenes. The "Open Water" tank allows free movement of the sharks around your position and you will swear you feel those massive tails brush you as they cruise by for an inspection. The "Fantasy Theme Park Reef" features our menacing sharks circling-in, and underwater reef complete with a sunken galleon, reef fish, and perhaps a few other surprises. **dl.aaascreensavers.com**

Environment

A practical guide to good practice

Managing Environmen-tal Impacts in the Marine Recreation Sector, This guide can be downloaded for free at **www.coral.org** Marine recreation providers, such as companies that operate snorkeling and diving, whale watching, boating, jet skiing, and recreational fishing excursions, have a major influence on how tourist activities impact the natural and cultural resources in popular coastal tourism destinations. Tourism companies are recognizing that they can contribute to marine conservation and the economic development of local communities by working with marine recreation providers that adopt environmental and social good practices. To consolidate the extensive information already developed by various organizations regarding good practices within the marine recreation industry, a common supply chain management tool has been developed. This tool will provide a central reference on good environmental and social practice from marine recreation providers for the corporate community to use during purchaser-supplier business processes.





Pro-Active Posters & PDFs

The NOAA Fact Sheets and Public Service Announcement Poster Project was designed to create public awareness for long-term conservation of coral reefs and to educate tourists and other groups that visit the reefs. To download your FREE fact sheet in pdf format, click here: **www.icran.org/pdf/ICZMsm.pdf** or visit: **www.noaa.org**

Fraser Bathgate

Inteview by Gunild Pak Symes
Photographs courtesy of IAHD & Flemming Thyge

Fraser Bathgate, Vice President and Director of Training for the International Association of Handicapped Divers (IAHD), tells X-RAY MAG what drives him to dive off his wheelchair and into the depths of the underwater realm, why he wants to teach other disabled people how to dive and abled dive instructors how to use alternative approaches and teaching methods that encourage disabled individuals to take the plunge.

Tell us about yourself and the organization... The IAHD was set up to help train people in scuba diving that weren't able to go through the normal instructional methods with some of the major training agencies. We felt that was the wrong thing, so we wanted to introduce a method of teaching that would mean there was no exclusion for a lot of people that are excluded anyway. It wasn't just people with spinal injuries in wheel chairs, but also people with cerebral palsy, Down's syndrome, muscular dystrophy and spinal bifida... things like that which means that we get the freedom that everyone else experiences.

Also one of the benefits of water is that it is a great therapy anyway, and also leaving the wheel chair behind. It's the only sport where we can leave the wheel chair behind. The other great thing is it's also the only sport where we can go into a shop and buy straight out of the shop. We don't have to have things custom made. The only thing that we do have to have custom made anytime is a wet suit because obviously body shapes are different. But everything else can be bought directly from the shop, so they're not being penalized for having a disability.

Fraser Bathgate

And how did you get involved with IAHD? I had obviously been, being in a wheelchair myself, interested in trying to give something back to the diving community which we felt was very, very important because a lot of times divers tend to take out, they don't actually give back. And I felt it was important to try to give something back to the diving community as a whole.

Was your disability something that came later in life? Yes, I had a climbing accident. I was never a diver before, so I was the first person in the world in a wheelchair to qualify as an instructor. So that is unique.

And how did your teachers respond to you? It took me a long time to find someone who would be willing to teach me. When they did finally start to teach me, it was found that I could do just about as much as everyone else in the water. In fact, at certain points I could do things slightly better because my mobility came back when I was in the water, so it is like you are able bodied again. It's good.

So, you felt happier down in the water? I felt a lot happier, a lot safer and a lot more comfortable in the water.

Do you have pain above water and then less under? I know that some people that we have worked with have had things where they have pain on the surface, but when we take them under the water, the pain reduces. We

INTERNATIONAL ASSOCIATION OF HANDICAPPED DIVERS

The International Association of Handicapped Divers (IAHD) is a non-profit organization that organizes training programs for disabled divers. The organization offers a range of courses on different subjects very much like the PADI-system of diver education. You can read more about diving for disabled people at IAHD's international website: **www.iahd.org**

Fraser Bathgate will be at the January 2005 Danish Dive Show in Copenhagen where IAHD will run a training program over the weekend. To register for the course, contact Flemming Thyges at: **www.thygesdykkercenter.dk**

Bathgate

use a specific program that all of our students can breath nitrox 36 which assists the breathing rates and keeps them warmer for longer.

How does IAHD help dive centers develop programs for disabled divers?
We run training programs to train instructors to work with people with disabilities because it not just being able to work with them but also really understanding the different types of disabilities, how to look after them under the water, how to get them to achieve as much as you possibly can. So what we do when we run a training program, we do not only look at just the instructors, we look at the training facilities. We look at the swimming pools, we look at their dive sites, and we look at if they want to take them away on holiday all these sorts of things. So it assists them in becoming more of accessible center.

So it is a very collaborative process?
Very much so.

Do you have doctors involved?
We got a medical board with people who advise us. If we have a problem, we can go to them and they will advise us on different disabilities. Also we have people that are involved in sort of a board of recommendation, which assists us in doing new ideas and new programs and things like that.

So you really have some strong guidelines and criteria?
Very much so. Also we are recognized by most of the major training agencies as well as carving a link with DAN (Divers Alert Network) where they recognize our programs. We are working with people with disabilities.

So, if an owner/director of a dive center like for instance, Flemming Thyges of Thyges Divecenter in Denmark, wants to set up a program for disabled divers at his or her location, what do they have to do first?
Well, Flemming has fortunately done one of the training programs with us and that's really good. What it means is that now he looks at the rehabilitation centers that are in Copenhagen. We made links the last time I was across there, at one of the centers, and they want to introduce it to their people as well. To get it going, I am coming back to do the Danish Dive Show and we are going to take some people in the tank at the dive show so we can get them in the water.

And also we will have this new propulsion vehicle that we have been working with the manufacturers of, so we will be able to showcase that. Because we work with a lot of the manufacturers as well in making the equipment that is more user friendly.

And what does this propulsion vehicle do for disabled divers?
It straps to the tank and it's got an on-off button, so it can just push them through the water, so they don't have to worry about swimming as well.

So it just opens up a whole new world for disabled individuals?
You've got a three dimensional world that give you a freedom that you don't have on land. And you can do all the things that used to be able to do but you can't do on land anymore.

I *guess you've got a lot of happy divers coming out of your programs?*
Oh, yes a whole lot of happy divers! This is one of the only things that keeps you going, you know, because even when things are very difficult, you just do one of these sessions and it makes it all worthwhile.

Do you meet a lot of resistance?
From people that don't understand what we are doing – those who say, "You shouldn't have to be doing this." And we say, "Well if we don't do this, are YOU going to take them in the water?" And they don't look at that idea. So, you know it's making sure we get the word

Fraser Bathgate is the guest instructor of the specialty courses offered at Thyge's Dive Center in Copenhagen, Denmark

Bathgate

out to as many people as possible and take as many people as we know diving.

Do you work with governments or ministries? Yes, we have in the past because we have been invited to work with various countries especially in the developing world, as well as the Cayman tourist authorities like the Maltese tourist authority, the Seychelles, working with the Key Largo chamber of commerce in Florida. Setting people up like Flemming in Denmark to promote it because he is very enthusiastic and doing a lot. He will become our representative in Scandinavia, so anybody in Scandinavia who wants to work with us can contact him.

When did you start your with IAHD? I came in its second year. It's been going on now for 11 years. When I came on, I started developing different things and then, when a new CEO came on board, we were able to expand the programs that were available to everyone a lot faster. So, we have things like surface support specialists, nitrox program, two new pirate fish diver and recon diver. The Pirate fish diver is for people with a mental age of 12. And they collect six pieces on a treasure map and complete skills to get to the treasure chest.

That's a wonderful idea. So, you work with three different sectors: the government, business sector and the health community. Which one has been the most helpful to your organization so far?
They are all very much the same… because initially there was a lot of resistance from all of them but now that they understand what we are trying to do, that makes it all a lot easier for us to promote it and be a lot faster and promote it a lot faster.

How about the handicapped community themselves? The handicapped community themselves were very wary, a little bit at first. They didn't believe that it could be done; they didn't believe that we could work with these people, but now that we have proved that you can do it, then it's a lot better now.

And now they are much more excited to try it. Yes, especially when we can get people into the water, then it's a lot easier for us to promote it. It makes it a lot easier to work with and a lot more people will become involved with the program especially in the states. We are hooked up with the Miami project. We are hooked up with people up in University of Washington in St. Louis, Missouri. We are hoping to expand into Boston and places like that.

Do you get parents involved with their kids? We try to but sometimes the parents can be a bit of drawback. So this is why we developed this program, surface support program, so we can use them to assist rather than get in the way all the time.

So, if I am a disabled child or teenager who want to learn how to dive, what do I do first? You'll want to get in touch with us. Go onto our website and click under "Instructors" and it will tell you where the instructors are and you can contact them directly. And if you can't find one to contact directly, then you can contact the head office and we can see if we can organize something and get an instructor as close to you as possible.

Where do you want to be in 5 to 10 years? Retired would be nice. (Laugh) In 5 to 10 years, I would like to see that we have a large instructor base that is willing to work along side us and support what we do and actually help out in testing some of the new stuff we are working on. Get the scientists involved and the medical community to help promote us.

Instructors learn teaching methods for individuals with disabilties who want to learn to dive

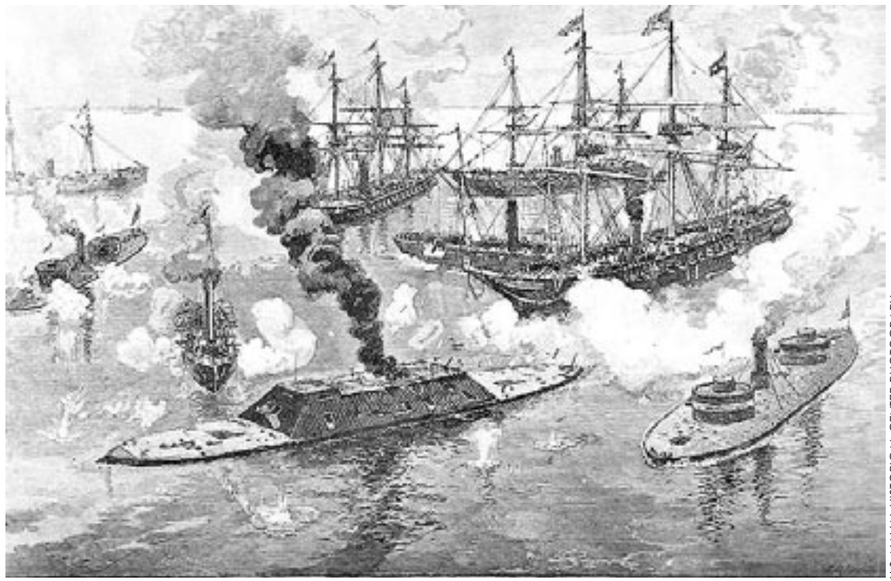
We are getting into a lot more developing of programs to assist people and give them more of a challenge. Because it is student-led and not instructor-led, you keep on presenting things for the divers to try, it gives them a hunger to try more new things. Maybe not just diving, but perhaps trying another sport that they had never thought about. And hopefully it will open up the whole of the market. Also the community in which they live in will become a lot more open as well.

How do you do this financially?
We are looking for support. Right now, it's just a lot of good will on our behalf. Because we are non-for-profit organization, no one is being paid to do this. We are trying to develop programs to be better for everyone.

Have there been any documentaries made or media coverage done on your programs? Yes, actually a documentary film has been made about me and how I got to where I am. And we are hoping the media will come out to meet us and cover our programs at the show. It's my first Danish Dive Show and I am really looking forward to it. ■

Wreck Rap

Text edited by Peter Symes



U.S. NAVAL HISTORICAL CENTER PHOTOGRAPH.

"Surrender of the 'Tennessee,' Battle of Mobile Bay" Line engraving after an artwork by J.O. Davidson. The Ironclad Chicasaw, which has now been rediscovered, is seen in the lower right corner

A surprising find. Beneath the turbid waters of the Mississippi River, archeologists have stumbled across a rare find: The remains of a Civil War ironclad. The USS Chickasaw, which played an heroic role in the Battle of Mobile Bay, has been rediscovered in a graveyard of shipwrecks upriver from New Orleans' French Quarter.

1864 The story of the USS Chickasaw, which is now the only known Milwaukee class ironclad river monitor left, is one of fame and ignominy. Six months after being commissioned into the Union navy in February 1864, the Chickasaw entered the Civil War as one of four monitors covering Rear Admiral David Glasgow Farragut's entry into the torpedo-filled Mobile Bay. After a fierce battle at Fort Morgan, the fleet made it into the bay to then face the CSS Tennessee, a Confederate ironclad. In the ensuing battle, the Chickasaw was credited with hammering away at the Tennessee with its guns.

1874 At the end of the war, the Chickasaw saw no more action, and the Navy decommissioned it in 1874. In the ensuing years, it was made into a coal ferry, and later, it carried railroad cars across the Mississippi in New Orleans. It was fitted with side-wheel propulsion.

1944 During World War II, the country kept the heavy-duty Chickasaw around just in case German saboteurs destroyed the Huey P. Long bridge across the Mississippi. The vessel was never needed to carry goods and trains across the river again, and its owners sank it. The Chicasaw was designated as shipwreck No. 2, and was put to rest in 1944 at the spot on the river with 19 other outdated and unusable vessels and barges. It has since been forgotten.

2004 The Chickasaw was rediscovered during recent survey work by the Corps of Engineers to stabilize the bed and bank of the Mississippi near the shipwreck graveyard. "The propeller shaft is the only thing that looks like it did under Eads," said archaeologist Joan Exnicios who works for the U.S. Army Corps of Engineers in New Orleans, about what remains of the Chickasaw. Officials said raising the vessel would be too costly, but rock will be placed around it to keep the vessel from moving. ■

WWW.WIKIPEDIA.COM

Rogue divers raid war grave wreck

Wilhelm Gustloff gets stripped

It is not well known, but the the worst disaster in maritime history was the sinking of the German liner Wilhelm Gustloff on January 30, 1945. As many as 10,000 people, mainly civilians, were aboard her when she went down one winter's night in the Baltic Sea, sunk by Russian torpedoes.

By the end of 1944, as Russian troops were pressing westwards and closing in on Danzig on the Baltic (today's Gdynia in Poland), mass evacuations took place before the Russians arrived. As many as 60,000 people crowded into the harbour. As soon as the gangplanks were in place, people surged onto the ships. So many got on that the rescue equipment, lifeboats and lifebelts, were hopelessly inadequate. Yet, the Wilhelm Gustloff set off with only a minesweeper escort. Several hours after leaving the Gulf of Danzig, passengers aboard the Wilhelm Gustloff may have thought that they were nearing safety. But that night the ship was attacked between Danzig and the Danish island of Bornholm.

It was torpedoed by the Soviet submarine S-13, commanded by Aleksandr Marineskom, and took three direct hits. As many as 9,000 or perhaps even 10,000 people perished in the icy waters. Fewer than a thousand were saved. The immense size of the ship and the location at a depth of 50 m makes her a very attractive wreck. Unfortunately, it also attracts rogue divers hunting for souvenirs and items that can be sold.

The great wreck which is also a designated gravesite for all those who perished with her, has gradually been stripped of everything from its portholes to its wash basins. Many of the divers are encouraged by rumours that items such as ashtrays and bed linen from the ship are regularly snatched by German collectors "for the price of a Mercedes." ■

For the full story, see:
www.patriot.dk/gustloff.html

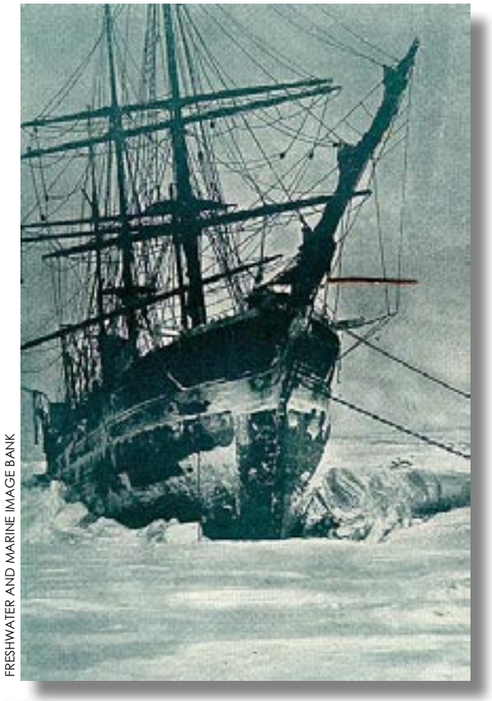
UnderwaterTimes.com™
the daily journal of life in and around water

Great Lakes: N.Y. Divers have found the shipwreck of the Etta Belle in the frigid waters of Lake Ontario

The Etta Belle sank in 1873 in relatively calm weather. The oak-hulled schooner sprang a leak just under the waterline on the port bow. After an hour of frantic pumping, the captain and his crew gave up, retreating into a small yawl for an eight-mile row to shore. It took them several hours to reach the shore, according to newspaper accounts at the time. Their escape was evidently hasty, because none of them retrieved any possessions. One crewman even arrived at Sodus Point stark naked.

The Etta Belle, now rests in 200 feet of water off Sodus Point, where it was recently found by found by two Rochester divers who specialize in hunting Lake Ontario shipwrecks. It is the oldest cargo-carrying schooner found on the southern shore of the lake. It's also one of just two that are fully preserved. In 1971, two divers found the St. Peter, a pristine wreck, near Pultneyville, Wayne County. Its full load of coal is still visible, bulging from two cargo holds, and coated with zebra mussels. Fewer than one thousand shipwrecks are thought to repose in Lake Ontario, and only about 200 have been explored by divers.

Two-masted schooner



FRESHWATER AND MARINE IMAGE BANK

Well preserved Lake water can get so deep and cold that some wrecks "are like ships in a bottle," said Great Lakes historian Brendon Baillod. A pair of British warships near Hamilton, Ontario, sunk in a gale in 1813, are so well preserved in 300 feet of water that "they could easily be refloated and sailed," he said.

About five shipwrecks a year, on average, are found on the Great Lakes. There are an estimated 6,000 altogether — most of them in lakes Erie, Huron and Michigan. The discovery of the Etta Belle had only "modest" historical value. But it is important in Lake Ontario, where there are very few wrecks to begin with," said Baillod, whose web site includes a database of sinkings and sightings on all five lakes, going back to 1679. ■

Footage from dives on the Etta Belle can be found at this link: ***www.shipwreckworld.com***

NS Savannah, the world's first and only nuclear passenger ship, now rusts with Ghost fleet

The N.S. Savannah was the world's first nuclear-powered cargo/passenger ship. First proposed in 1955, the Savannah was part of President Eisenhower's "Atoms for Peace" initiative. Congress authorized the construction in 1956 as a joint project between the Maritime Administration of the Department of Commerce and the Atomic Energy Commission. Savannah was launched in March, 1962. Designed to carry 9,400 tons of cargo, 60 passengers and 124 crew, N.S. Savannah was capable of cruising at 21 knots and traveling 336,000 miles on a single fuel load. In 1972, N.S. Savannah was decomissioned in an effort to reduce spending by the Martime Administration. From 1985, N.S. Savannah was stored near Patriot's Point Naval Museum, South Carolina until, in1999, when she was moved to James River Merchant Marine Reserve Fleet near Newport News, Virginia.

After 10 years of riding out storms and decaying with age, the Savannah is finally receiving some attention. Congress, for the first time, has allocated money to begin the ship's decommissioning. The $2 million is part of the omnibus spending bill that Congress recently approved.

The government overseer of the Ghost Fleet, the U.S. Maritime Administration, has a five-year $25 million plan to remove the defunct nuclear reactor still within the Savannah's belly and purge all remaining equipment, hoses and gaskets tainted with radioactivity. ■

Looters of sunken treasure subject to $100,000 fines

In the early days of diving, treasure hunters armed with underwater blowtorches prowled the waters outside Charleston Harbor for the H.L. Hunley. They planned to cut it up and sell souvenirs of the Civil War submarine, and perhaps even the bones of her crew, to collectors around the globe.

There was a time when such looting was pretty common. Now, with legislation that just passed Congress, federal agents can seize a treasure hunter's boat and fine him $100,000 for mining the government's archaeological gold. Bob Neyland, head of underwater archaeology at the Naval Historical Center and the Hunley project coordinator, said that the new Sunken Military Craft act was forced by rapid advance in shipwreck-hunting technology.

"This will go a long way to protecting war graves; and it will go a long way toward protecting archaeological sites," Neyland said." The idea is not for the government to hoard these vessels, but to protect the sanctity of war graves first, and then to learn from these wrecks and get the most out of them."

The act covers thousands of wrecks in foreign waters around the world.

Hunley submarine immersed in refrigerated storage tank at the WLCC upon recovery. From Friends of the Hunley **www.hunley.org**

It was part of the massive 2005 National Defense Authorization Act, a $420 billion piece of legislation that covers nearly 20 percent of the federal budget.

State Archaeologist Jonathan Leader said the new federal law is aimed directly at those looters and others with nefarious intentions. "Obviously they are not just going after people who stumble upon these wrecks," Leader said. "The real issue is people out for gain or profit off these wrecks. I have no sympathy for those people and am glad this is being done."

The law applies to any vessel built for military purposes, but not to commercial or merchant vessels. Courts have generally upheld these rights anyway, but the new law eliminates any question of salvage rights for military ships. James Hunter, a Naval Historical Center archaeologist also working at the Hunley lab, says it's an issue that comes up more often than many imagine. See **www.hunley.org** ■

Leigh Cunningham

Correct Weighting: What it is and how to get there...

Do you need to lose some weight?

Leigh Cunningham is the technical manager and TDI Instructor Trainer for Ocean College, Sharm El Sheikh.

Probably best known for his records - Leigh once held the record for the deepest dive in the Red Sea - and attempts of reaching extreme depths, he also has a wide range of teaching credentials to his curriculum:

TDI instructor trainer, DSAT Tech Trimix instructor, PADI MSDT IANTD Technical diver instructor CMAS 3 star instructor.

Regardless of the type of dive, shallow non-deco recreational dive or the 120 metre deep mix wreck dive in the Atlantic, correct weighting will increase the safety and comfort of any dive tenfold. However, it is often the case that not enough emphasis is put on correct weighting from the very beginning, i.e. at the Open Water course.

Text by Leigh Cunningham

There are indeed many instructors that do emphasise the importance of correct weighting, discussing, differing amounts of lead based on the thickness of the exposure suit, wet or dry, salt versus fresh water environments, aluminium versus steel tanks, positioning of lead to increase stability, lead bricks on a standard weight belt, soft shot weights in pockets on a belt, a harness belt system (very secure), ankle weights for those in dry suits and quick release pockets on a BCD. This is all good, keep it up!

Unfortunately, with some students, due to the stress of breathing underwater for the first time, good training and advice tends to go in one ear and out the other. By the time divers (who will naturally have inappropriate breathing techniques initially) have cracked the breathing pattern issue, they have forgotten what the instructor had to say about correct weighting in the first place.

The Open Water Instructor, myself included, also generally overweight students during initial confined water sessions to keep them steady on the bottom, particularly where confined water sessions are carried out in a sea water environment, in order to carry out required skills, without having students floating to the surface, left right and centre. Sometimes, the only way to get some students through the course is to keep them over weighted during the whole course. This is, obviously, not ideal, but in the real world, where you have five days to do an Open Water course, this is sometimes the case.

hallow rapid breathing = an over weighted diver

Students rarely learn how to breathe correctly underwater during the open water course, and for some it will take hundreds of dives before they get it right. But it is the key to correct weighting; a slow deep, controlled breathing pattern, so until you have this, you're wasting your time. Practice more, or take up golf!

Once you have the correct breathing pattern the steps to correct weighting are easy. So once again regardless of the type of dive,, the single tank non-deco dive, or the 6 tank rig in 150 metres. The end goal is the same.

We should be carrying enough lead to keep us at the shallowest stop depth at the end of the dive - whether it's the 6 or 3 metre stop on a deco dive, or the safety stop at the end of the non-deco dive - with the BCD or wing empty. The over weighted diver, will find buoyancy control harder, the under weighted diver, could end up with a run away ascent.

Bearing in mind that compressed gas has weight, dives will always start with the diver slightly overweight, at the beginning of the dive, the degree of overweighting for the non-deco single tank diver will be minimal. For the tech diver, on the deep mix dive, the degree of overweighting will vary more dramatically. This is based upon a number of factors, i.e. how many tanks is the diver carrying, hence the difference in compressed gas weight at the beginning of a dive compared to gas weight (with low gas pressure) at the end of the dive. In some extreme cases, where the diver is carrying multiple tanks, he or she might opt for the support team to attach

Leigh Cunningham

PHOTO COURTESY OF LEIGH CUNNINGHAM

Many tanks compound to the weight issue. Leigh Cunningham in the Red sea with big tank setup

drop weights on the rig during the ascent, to avoid having to be heavily overweighted at the beginning of the dive.

The tech diver should, however, consider some extra weight, in case you need to run to a bail out/emergency plan, where you would use some of your reserve gas supply, to finish your decompression obligation, ending the dive lighter than you would otherwise be if you were running to your primary plan.

Back to basics. Think back to your open water course. At the start of a dive, your instructor probably told you to deflate your BCD completely and hold a normal breath, by which you should ideally be floating at around eye level, or, if in doubt, sinking very slowly. A kilo over, no big deal, as it is better to be slightly overweighted, than slightly under.

In a perfect world, you would have cracked the ideal breathing pattern during the open water course. If not, and you have a few dives under your belt, try it now!

The rule will work for the single tank diver regardless of the thickness of the exposure suit, salt or freshwater, steel or aluminium tank ect. For the tech diver, due to more kit and multiple tanks, the story becomes more complicated.

Steel or Aluminium? Where tech divers using steel tank configurations, the diver could be overweighted with no additional weight, apart from the rig and kit he or she is carrying, not only at the beginning of the dive but also at the end. Now you have two choices; Use aluminium tanks which are less negatively buoyant, or at least mix and match your configuration, rather than having only steel tanks. If you are using a wet suit, change it for a thicker one with more positive buoyancy during decompression (shallow water). But don't forget: While a thicker the wet suit will offer more positive buoyancy during deco, the down side is that due to increased suit compression at depth it loses proportionately more buoyancy in deeper water. If you are using a drysuit, you could opt for using a suit made of crushed neoprene or a membrane type, rather than the thicker non-crushed neoprene dry suit, which would also have greater buoyancy changes throughout the dive. So, here we go, all you advanced tech divers out there, it looks like the crushed neoprene or membrane dry suit is the way to go. That is, unless you are diving in a tropical environment, where the air temperature is hotter than your average cup of tea! In which case we are back with the wet suit to avoid over-heating before getting wet! Hm, I'll leave it up to you.

Forget about drop weights if you have a decompression obligation

If you are using aluminium tanks all around, you may need to add weight to establish correct weighting. If so, in order to adjust trim and ensure a good diving position throughout the dive, consider where this weight is placed. A horizontal diver will off gas more efficiently during deco than the vertical diver who has up to a two meter depth difference between head and feet.

A weight belt might not be the best answer. How about a V- weight placed between the back gas and back plate and wing? Or lead on cam bands, strategically placed on the back gas and/or stage tanks to adjust trim. Forget about drop weights, you have a decompression obligation, so you will need the weight you started with in order to carry out shallow stops accurately.

The bottom line: In order to establish correct weighting, experiment with steel and aluminium tanks, and different types of weight systems. When you get as close to correct weighting as possible, your dive will be safer and more enjoyable. Have fun, and dive safe! ■

During basic training the instructor often overweight the students to keep them on the bottom during first exercises. More often than not the extra weigh never comes off again

PHOTO BY PETER SYMES

Shark Tales

Text by Edwin Marcow
Photos by Edwin Marcow & **Bite Back**

ILLUSTRATION COURTESY OF FIONA'S SHARK MANIA
WWW.OCEANSTAR.COM

CLOCKWISE FROM TOP LEFT: Great white shark; Hammerhead shark caught in fishnet; Shark tails and fins for sale at an Asian market

PHOTO BY EDWIN MARCOW

PHOTO COURTESY OF BITE BACK

77 year old Tyna Webb swam religiously every day except for Sundays when she would go to church. A very active woman, she would swim up and down the coast of Fish Hoek, South Africa, where she lived. On Tuesday, the 16th of November 2004, it was to be her last swim.

Tyna was attacked by an 18 foot long (6 m) Great White Shark, the ocean turned red and she disappeared under the surface — all that was left was a little red bathing cap floating in the swell.

As unfortunate and regrettable as this attack was, it was likely that the shark chose Tyna for a number of reasons. Perhaps it had not successfully hunted for prey that day, and this was the overwhelming desire of the shark to survive, rather than a random attack by some maniacal man-eating shark.

When we enter the ocean — to sail, surf, scuba dive or simply swim — we enter another world, the realm of the shark. No one would safari in Africa on foot without a ranger armed with a high-powered rifle, 'walkie talkie' communications, a first aid kit and a plethora of vital equipment, yet everyday, thousands of people around the globe enter the ocean, into another world without protection.

We, humankind, consider this world to be ours. But it isn't. One could argue that we enter this world on a limited visa as our visits are only fleeting. But, like tourists who enter a foreign place, when something goes wrong, as in the case of Tyna Webb, we blame the shark rather than accept that it was an accident or an act of nature. Our failure is not to use reason – but why?

The frequent sightings of large congregations of Great White sharks resting and patrolling just beyond the breakwater only a few feet from surfers who are catching waves on popular beaches along the Cape coast of South Africa will one day, I hope, help to reveal a more balanced image of this graceful and magnificent animal.

The irony is that sharks worldwide have more to fear from us than we do from them.

More than 90 percent of the world's shark numbers have decreased. In Australia, the Grey Nurse shark is close to extinction with less than a thousand remaining off the Australian east coast. A similar sorry tale is that of the Canadian Porbeagle shark whose numbers have also declined by 90 percent since the 1960's. It is now on the endangered species list.

It is estimated that tens of millions of sharks are killed each year by humans in the name of progress! Ever since shark cartilage has been advocated as a 'cure' for cancer, there has been a measurable decline in shark population numbers. Progress in pseudo-science — an unproven and discredited field — has endangered the future of the shark.

Research has shown that shark cartilage taken as a supplement will not arrest and cure cancer, yet shark cures continue to be sold in many health food stores. Although it is remarkable that, unlike human beings, sharks do not acquire cancer, and that their brains do not atrophy as they age, the belief that ingesting shark cartilage as a supplement will cure or prevent terrible illnesses is irrational. With the pervasiveness of these beliefs, a great disservice is also being done to many sick and vulnerable patients who, in desperation, turn their backs on proven medicine in favor of some magical cure.

It is the power of marketing and the discrediting of science that has overturned logical and balanced approaches to very real diseases.

PHOTOS COURTESY OF BITE BACK

Progress? A bowl of shark-fin soup will sell for $100 in the Far East. This dish is prized as a delicacy there. Its reputed medicinal value has helped spawn a vast industry — shark-finning.

Finning by trawler boats have also helped to decimate shark numbers globally. Sharks are caught in trawlers' nets. Then, they are hoisted onto the decks where their fins are removed and the sharks, still alive, minus their fins, are then thrown back into the ocean to die a slow and painful death.

One must ask the question: who is acting like an animal, and who is acting with grace and purpose?

If this rape of the ocean continues unchecked, shark numbers may well fall to unsustainable numbers. Due to their slow growth rate and low birth rate, sharks are particularly vulnerable to over fishing.

To date, 63 countries have agreed to ban the killing of sharks for their fins in the Atlantic Ocean. This is a very positive step forward following earlier conservation bills introduced in other countries, notably South Africa, which gave protection to the Great White Shark in the early 1990's.

Sharks have outlived the dinosaurs. They have seen empires come and go. If we are to protect the future of the ocean, and in turn the future of humankind, we must outlaw shark-finning and the trade of all shark products worldwide.

If you want to help save the sharks, visit the Shark Trust at ***www.sharktrust.org*** *or Bite Back at* ***www.bite-back.org*** ■

INSET: At £3.95, Sid the Chocolate Shark raises funds for the Shark Trust

Edited by
Andrey Bizuykin

What's hidden under the surface?

Portrait of a manufacturer

The Poseidon Story

POSEIDON - GREEK GOD OF THE SEA
Son of Kronos and Rheia, brother of Zeus, Hades, Hestia, Demeter and Hera, Poseidon is one of the six original Olympians. His mission is to give voice to the earth. Poseidon was commonly called the earth shaker and the earth encircler in The Iliad and The Odyssey of Homer. He pounds and shakes the earth and sea with his wrath and pleasure and answers to no one, except Zeus. His kingdom is the vast sea which he has populated with creatures of his own design. He rides the waves in a chariot drawn by dolphins but, curiously enough, his most honored creation is the horse.

History What is hidden under the surface? That was the question that a young boy named Ingvar Elfström asked himself in the 1940's. On fishing trips with his father, he used to sit and try to see the bottom of the sea. The problem was at that time and age, there was no one making diving equipment to buy. So, in order to explore that world, Ingvar decided to make his own equipment.

He made a full face mask in which he inserted a long flexible hose, which was then attached to a manual pump on the surface. When his father pumped air, the mask came halfway off and most of the air ended up in the water. Certainly, it was very primitive equipment, but it allowed Ingvar to make his first immersions under water. The first prototype of a breathing regulator followed in 1954.

Twin hose The first series of twin hose regulators that followed bore the name Poseidon Senior, and was manufactured by Ingvar in his kitchen. As it is the case with these twin hose regulators, where the combined first and second stages were placed behind the diver's neck, the long hoses caused a considerable breathing resistance. Ingvar was not happy with the design and it was clear that he had to change it. After a couple of years he started to develop a new single hose regulator together with Rolf Tistrand, who joined the company in 1957. Their next product was the regulator Cyklon Junior, where the second stage was transferred to the position we know so well today — in front of the diver's mouth. Today, this model is known as Cyklon 300 and Cyklon 5000, one of the real legends in the world of modern diving.

FILEPHOTO: POSEIDON

"We shall make equipment for scuba diving as long as one drop of water remains on a surface of the Earth "

Valves At approximately the same time, the partners began manufacturing valves for diving cylinders. Aided by Ingvar's good friend, Dennis Österlund, sales also started to take off. Products were sold under the name Poseidon and marketed by Aqua-Sport. The equipment that they could not produce was imported from foreign manufacturers. They bought cylinders in Germany in which they mounted valves in order to sell complete ready-to-use sets for scuba diving (a regulator plus a cylinder). When the company grew further and began to export the production to other countries, it was decided to transfer the manufacturing from Ingvar's kitchen to a small rented garage. Then, in 1958, the first dive-shop for the sale of underwater equipment was opened in Gothenburg, Sweden. Shortly after that, shops were opened in Stockholm and Malmö.

In those years, lack of proper suits was also a problem, and Poseidon decided to expand into this area as well and start manufacturing wetsuits. The main problem was finding a suitable non-permeable material. The American company, Rubatex produced a thick rubber material that, with a small modification, could be used in the manufacturing of wet suits.

Drysuit In 1961, Poseidon created the first drysuit, called "Narval." Before this time, all scuba divers used to dive only in wet suits or wool. Thus, when divers resurfaced, it was necessary for them to change clothes and get warm quickly at a campfire, before they put their suits on once more to dive again. "Narval" was a true gift for divers, though at depths of more than 20 meters, the suit produced quite a squeeze and became very uncomfortable. The reason why this happened was, of course, that inlet and outlet valves remained to be invented, but here, too, Poseidon was up for the job. The Poseidon company became the first in the world to develop and patent inlet and outlet valves for dry suits.

Neckseal Ingvar experimented with various ways of sealing, including one rather amusing way, where the hood of a suit had a steel band running along the perimeter of the face of the diver. This band had to be tightened so fast to ensure a good seal, that it was hard for a submariner even to hold a regulator in the mouth. It was very uncomfortable for the diver.

The next idea was sealing the suit with a neck seal, which then became another Poseidon patent. They patented the neck seal together with a hood. For this reason, other companies immediately started to copy Poseidon's neck seal, and not the integrated hood, thereby declaring that they have not broken conditions of the patent.

At that time, there were still no special materials for thermal protection of the diver or heaters for dry suits. Then, in 1963, Poseidon got a request from the Swedish Navy. Was it possible to produce a suit that could be used for longer exposure times? After some research and experimenting with differ-

POSEIDON DIVING SYSTEMS

Poseidon today

"It is not our task to produce the cheapest equipment. We don´t aspire to make to make the biggest possible production. Our purpose is to produce the best quality scuba diving equipment in the world "

Stefan Jennefalk, Poseidon

ent manufacturing techniques, they produced a dry-suit that fulfilled the Navy's demands. The first airtight neoprene drysuit, the UNISUIT, was delivered to the Navy in 1963, the same year Poseidon started exporting.

Spacesuits When NASA (the American space agency) started the space program, their experts had close contacts with Poseidon in regards to the development and creation of suits for astronauts. The company quickly expanded. Ingvar bought a mobile home, which he used for tours across Europe to sell equipment. In those days, cooperation between the companies making underwater equipment was quite good, and Ingvar cooperated with Mares on developing new regulators and with Cressi Sub on creating new types of suits. At this time, Poseidon started to manufacture the first universal 300 Bar tank connector.

Ingvar's big dream was realised in 1984, when a factory fully adapted for diving equipment manufacturing was built. Ingvar Elfstrom died in 1998 at the age of 70. His life's work made it possible for everyone to explore the exciting world under the surface of the sea.

"Technica" Drysuits. The neoprene in these drysuits has fewer bubbles than conventional neoprene and the material that goes into making this suit comes from four different countries. On delivery to the Poseidon plant in Göteborg (Gothenburg), Sweden, the material then undergoes rigourous tests on specially designed machines. Any batch that fails to meet the standards gets returned to the supplier. This test allows Poseidon to offer a 5000 dive guarantee on the material. Since 1997, the firm has used a material called "toughtex," which has a top layer that is similar to cordura, but is much more resistant to cuts and abrasions. All the seams and the boots are designed for a lifetime of 15 years. Before the suits leave the plant, they are tested in a water tank. Poseidon makes 3000 to 4000 drysuits a year, an estimated 8-10 % of all the drysuits in the world. The company's list of customers includes the armed forces of Germany, Norway, the United Kingdom and the United States, as well as the offshore oil industry in the Northsea and Alaska.

X-Stream is the lastest generation of Poseidon regulators. Before creating this series of regulators, Poseidon undertook an exhaustive analysis of future market trends and requirements. On the basis of the estimated prospects, Poseidon then began development and manufacturing of a completely new line of regulators intended for professional military divers, trimix-deep divers, technical divers, ice-divers and cave-divers. New materials, original design ideas and new technological innovations — all went into the new regulators, which were then called the "Poseidon X-STREAM." These regulators come in three models for use with trimix, nitrox and pure oxygen. They are all certified towards the extremely demanding CE and EN 738-1 standards and have been approved by the Swedish navy.

The "X-Stream TRIMIX" is, as the name implies, the model intended for use with trimix and heliox mixes. This regulator is certified to meet the professional standard NORSOK (Norway) in which the regulator must guarantee failsafe operation at a depth of 200 meters. The "X-Stream DURATION" is intended to be used with gas mixes containing up to 50% oxygen, whereas the "X-Stream DECO" is meant for use with pure oxygen. All second stages have a modern sleek design, an uniquely small size and weight, are comfortable and reliable in use, and simple to service.

Design The philosophy behind the X-treme series has been to reduce the number of possible failure points to an absolute minimum. The less complex, the less there is a chance that the apparatus can fail or break. Simple design also minimizes condensation points for ice to form. All viton o-rings have been removed from the first stage and the number of medium and high pressure ports are reduced.

One of the other design decisions was to use no less than 74 apertures (instead of one, as in all more primitive models of regulators) through which the can gasses pass, mix and get their relative speeds reduced. It has a balanced diaphragm where the valve is a big smooth ball, which essentially acts as a new anti-freeze system, ensuring the operation of the regulator even at very low temperatures.

Poseidon makes 25,000 regulators and 30,000 medium and high pressure hoses a year. Their kevlar high pressure hoses, which are designed for 1200 atmospheres, are still flexible enough

manufacturer

Poseidon

to be tied into knots without affecting their performance. One major characteristic about Poseidon is that there are no differences in standards between the equipment intended for 300-meter commercial divers and that intended for 10-meter amateur divers. All equipment that leaves the plant does so under the trademark "Poseidon."

Today, their trademark with the whale on a trident is well-known and enjoys a well-deserved reputation for quality all over the world. With only forty employees, Poseidon makes and exports production to forty countries. It has a very rational and effective manufacturing plant and remains committed to continued scientific and technological development — to always keep Poseidon at the forefront. ■

CLOCKWISE FROM TOP LEFT:
Top quality MPV modular multipurpose valves;
Stefan Jennefalk; Assorted parts;
The Swedish King, Carl Gustov;
Poseidon Headquarters in Gothenburg, Sweden

In next issue:
A visit to Apeks

Marine Archaeology

Adventure
Maritime Archaeology
Education
Historic Wrecks WW2
Japanese War Fleet

WANT TO BE A WRECK DETECTIVE?

ADMAT is back in action, this time in the Philippines where we have organised a maritime archaeological survey-training project in a beautiful and historically significant area. BSAC, the British Sub Aqua Club, have asked us to run this as an expedition, which we are, but as it is an ADMAT project it is open to all as usual.

text by Peter Symes
photos courtesy of A.D.M.A.T.

The Philippines were an important trading centre for the ancient Chinese and the Spanish, but many ships perished in typhoons that still rip through here part of the year. Maricaban Island was used as a safe anchorage as vessels sort refuge from the tropical storms. This is a unique opportunity to join a maritime archaeological training expedition. The expedition will be conducting an archaeological training survey, to solve the mystery of why 16th century Chinese pottery shards are being found off the beach. We will be training the team how to use side scan sonar, magnetometers, and traditional survey techniques.

WANT TO BE A WRECK DETECTIVE?

Join ADMAT on an archaeological under-water survey expedition in the Philippines

Two teams of 15 divers/students will be taking part in this exciting expedition from **16th - 30th April and 30th April - 14th May 2005**

Full details about this expedition, and how to apply to be a member of it, can be found on ADMAT's Web site: **www.admat.org.uk.**

Contact person is Dr. Simon Spooner, e-mail: **simon@admat.org.uk** Tel: +44 (0) 20-8399-1284.

Dansk kontakt er Christine Nielsen som kan nås på **christine@admat.org.uk**

A.D.M.A.T.

The Anglo~Danish Maritime Archaeological Team, or ADMAT for short, is a non-profit organisation set up to investigate, promote and protect historic shipwreck sites through field projects and education. Their projects are carried out as field schools and are also open to qualified divers, who are trained and under guidance of experienced staff.

ADMAT was founded by Dr. Simon Q. Spooner from England and Christine Nielsen from Denmark, hence the name Anglo~Danish. During work on historic shipwrecks in the North Coast of the Dominican Republic, they realised the great need for maritime archaeological work to be carried out, to protect shipwrecks from damage by looters and weather, and to investigate the shipwrecks in most danger in coastal areas. Also they recognised the need to make it possible for archaeological students to get hands on practical field experience, as well as informing the general public about the wealth of historical information lying at the bottom of the sea, and the importance of protecting it. Since the beginning of ADMAT, many individuals as well as organisations and museums from around the world, have volunteered to assist ADMAT in their endeavour.

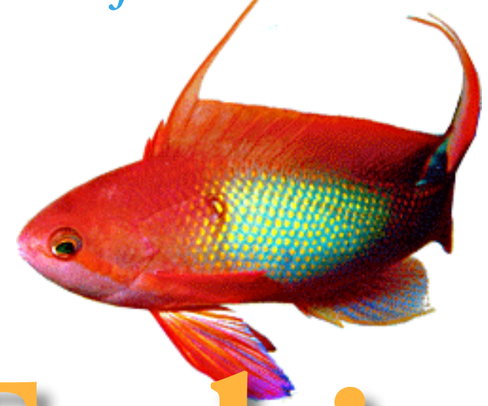
www.admat.org.uk/phil1.htm

All archaeological training will be given to the expedition members, including ADMAT's own Underwater Survey Diver course Pt 1&2, Proton Magnetometer Diver Course (both PADI SDC unique to ADMAT) and various relevant archaeological courses will also be run. These are very practical courses, with as much diving as we can do, this is not a beach holiday. Most of the survey site is approximately 10 metres deep, although some areas may go down to 30 metres.

Turtles, stingrays and sharks are common in the area and there is ample opportunity for underwater photography among the nearby rich corals. The expedition leader is Dr Simon Spooner, a well-known maritime archaeologist, founder of ADMAT, and Research Associate at the Centre for Maritime Archaeology and History, University of Bristol. The expedition will be based at the resort on Maricaban Island, three hours south of Manila. The island is ten kilometres long and two kilometres wide, with no roads or vehicles, surrounded by gin clear blue waters and rich coral with an abundance of colourful marine life. The resort is a small, local style family run guest-house. It is a two-storey building made of concrete and local bamboo right on the beach. The eight rooms are double or triple occupancy with single beds, wall fan, toilet and shower. The ocean is just a few meters away, with two small islands a few hundred meters away in the channel, making a superb relaxing view.

A special weekend trip to Coron Bay is planned, for those who want to do large wreck diving. This will be in the middle weekend of each trip. The WWII wrecks in Coron Bay have been one of the Philippines' best-kept diving secrets. In September 1944, Admiral "Bull" Halsey stumbled on a camouflaged Japanese fleet ahead of the US landing on Leyte. Carrier-based bombers sank 24 vessels, leaving a ghost fleet of Japanese hulks

The fishy art of survival



Text by Michael Symes
Photos by Peter Symes

Fish Fashion

Is there any diver who has not been fascinated by the wonderful colours of reef fishes and the reefs of their habitat? Those of us who have been lucky enough to experience at first hand this interaction between these creatures and their environment, cannot fail to have wondered about this rich excess of colour and the reasons for it. In nature there is a reason for everything – if we can but find it.

Humans use colours in many different ways. Normally, we only think of colours when they are being used in a decorative way; we liven up the interiors of our houses with paint and coloured wallpapers, and we brighten our textiles and clothes with many coloured dyes. And at sad events like funerals we also remove colour when we use black clothing.

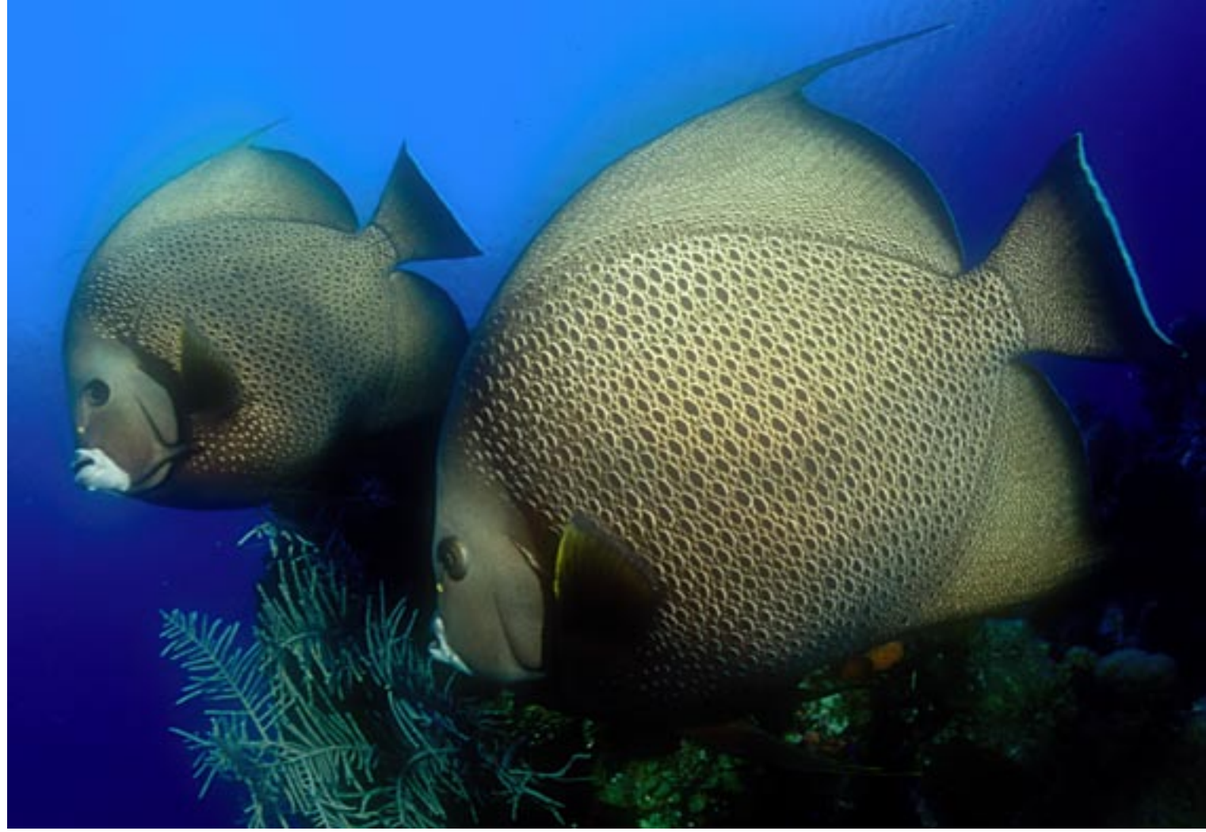
However, although we are not generally conscious of it, colour plays a much more important part in our lives than this. It can be important for our very survival. For example, we use colours as a diagnostic tool for our health. Not only do we use pale skin to diagnose anaemia and yellow skin as a symptom of liver disease but the bruising from subcutaneous bleeding after a blow can also be observed. Bad teeth can also be diagnosed from their colour.

The use of colour is also important for warning purposes in the case of red traffic signal lights, for example, and the red colour of certain very poisonous toadstools and frogs. We also use colour diagnostically to tell us when our bread is baked, or tell a ripe apple from a unripe one. Colour is very important cosmetically when used both as a sexual signal and as a means of camouflaging bad skin. And colour is very important when used for identification purposes, such as the colour coding of electrical resistors and for product identification, the Kodak yellow film packaging being a typical example. And one could go on, as there are many other important functions of colour for us humans; whole books have, in fact, been written about this subject.

But what about the submarine world of

ABOVE: Scalefin Anthias
RIGHT: Coral gardens, Sipadan Island, Malaysia

Fish Fashion



LEFT: Coral gardens
Sipadan Island, Malaysia

RIGHT: French Angelfish,
Cayman Islands

INSET: Pufferfish, Marsa Alam,
Red Sea, Egypt

fishes? Have colours any importance for them? Or are the beautiful colours that divers see in fishes and coral reefs only observed by them and have no function at all for fishes? For there certainly aren't any fish-dentists examining their patients for teeth decay, or fish-bakers making bread.

Several theories have been put forward over the years regarding the wonderful colours of the fishes in and around the reefs.

It was thought that the colours developed through natural selection in order that males will be attracted to females. However, males and females often appear to be the same with regard to colouration.

Perhaps, it was supposed, the colours are warnings that certain fish are toxic or otherwise nasty to eat. This is true for example for the Box fish. However, many brightly coloured fish are excellent eating, not only for other fish but also for us humans.

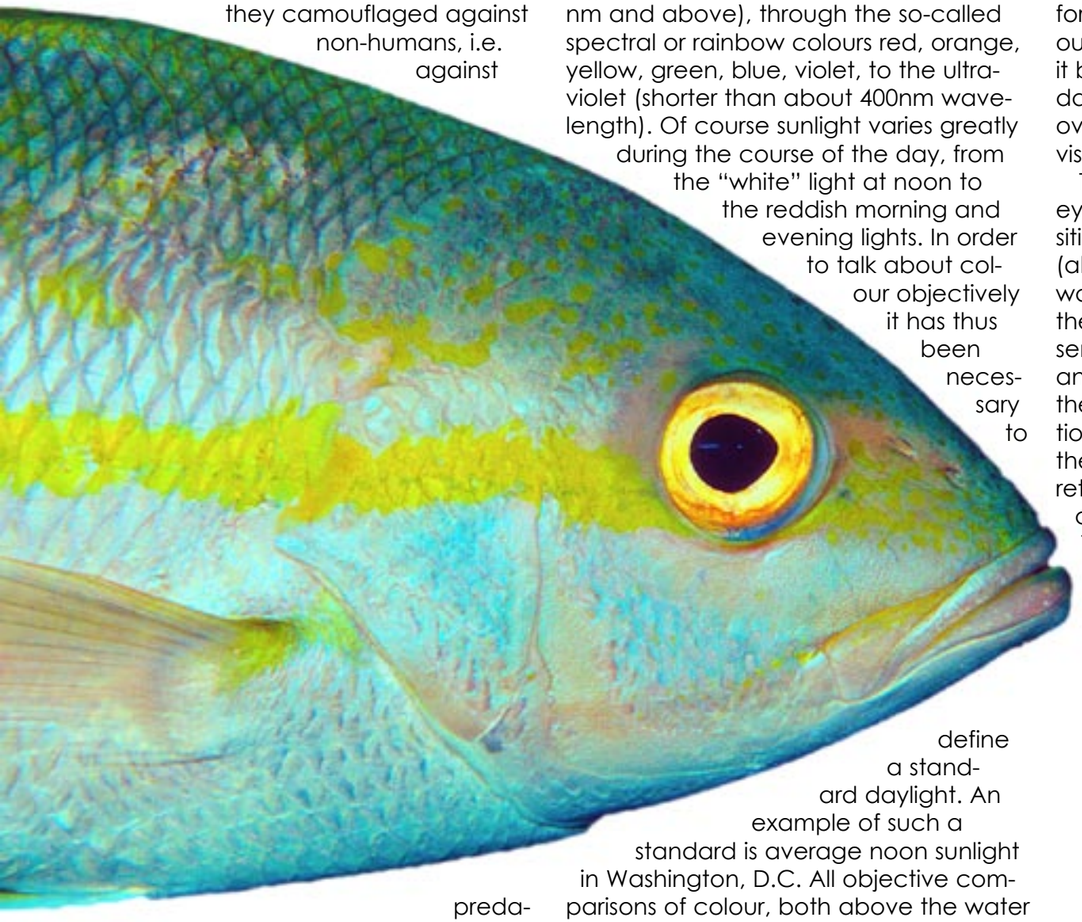
The gaudy appearance of the box fish reminds predators that poison is secreted through its skin when it is attacked. Predators associate the effects of its venom with the black and yellow combination of warning colours and learn to avoid them.

Konrad Lorentz, the Austrian animal behviourist, proposed that the fish colours might be acting as identifiers of possible mates. For humans this is no problem, as we only form a single species. For reef fishes, however, this could be a real problem as there are so many different species present in the reefs.

Or perhaps the colours are just a byproduct of fish-metabolism and have no real significance, neither at the present time nor over evolutionary time. However, from the point of view of evolution theory this seems unlikely.

Although there might be some truth in all of these theories the current consensus seems to be that fish use their colourings mostly for camouflage purposes. At first sight this would seem to be paradoxical, for the fish appear to us to be clearly observable against the uniform blue-grey background of the water or even against the many bright colours of the coral reefs. The critical words here, though, are "appear to us", for fish are

Fish Fashion



clearly not camouflaged against human sight. So, we can ask ourselves, are they camouflaged against non-humans, i.e. against predatory fish species? What do predatory fish actually see when they look at their prey? To attempt an answer these questions we must first look at some of the factors involved in the perception of colour.

The perception of colour

Firstly, there must obviously be light present, without light nothing can be seen. Human beings have evolved their colour vision under sunlight. Sunlight consists of electromagnetic radiation ranging from the infra-red (wavlengths 700 nm and above), through the so-called spectral or rainbow colours red, orange, yellow, green, blue, violet, to the ultra-violet (shorter than about 400nm wavelength). Of course sunlight varies greatly during the course of the day, from the "white" light at noon to the reddish morning and evening lights. In order to talk about colour objectively it has thus been necessary to define a standard daylight. An example of such a standard is average noon sunlight in Washington, D.C. All objective comparisons of colour, both above the water and in it, are then made using such standards.

Secondly, there must be cells in the eye to detect this radiation. Most vertebrates, including humans, use two systems of light-sensitive cells in their eyes. Two or more types of so-called cone cells (three in humans) produce a sensation of colour in abundant light, and a single type of rod cell detects light much more sensitively, but achromatically, under reduced lighting conditions. Thus, as a survival strategy, humans forgo their colour vision when it begins to get dark and switch over to their rod vision.

The human eye is most sensitive to green (about 550 nm wavelength) in the middle of the spectrum, with the sensitivity falling to zero in the infra-red and ultra-violet i.e. we can detect neither ultra-violet light nor infra-red radiation. To enable us to perceive colour, the three types of cell in the human retina, are sensitive to the blue, green and red spectral regions respectively. The relative amount of different light radiation falling on these three types of cell give rise to the perception of colour. For example, if there is relatively a lot of light of, say, 600nm wavelength and above, and little of the shorter wavelengths, we will perceive an orange/red colour.

So, when we humans perceive coloured objects we are using a specialised set of light sensitive cells under an illumination which preferably contains all the wavelengths to be found in sunlight at sea-level. Of course, we do observe coloured objects under quite different illuminations such as the strong yellow sodium light of some street lamps. But as we have all experienced, this form of lighting disturbs our normal colour perception, and the colours of a given object seen under such lighting will generally be much different to that seen under normal daylight. To take an example, an object that looks a pure bright blue under ordinary daylight can appear to be quite black under yellow light. The perception of the colour of an object therefore depends critically upon the type of illumination.

CLOCKWISE FROM LEFT: Snapper, Yellow Shrimpgobies, Batfish, Red Bigeye (Malaysia)

Light

Now, to any diver it is obvious that the light penetrating below the surface of the seas is somewhat different to that of daylight above the surface. Although water is apparently quite transparent it does absorb red light weakly, and has a bluish colour – a white object under the surface looks bluish-green. In 15m of

Fish Fashion

water
red light
is reduced to a
quarter of its intensity.

Sunlight is not always available, especially in the ocean depths, so some animals produce their own illumination. Glow worms, fireflies and several species of fish produce their own light by a chemical reaction, chemiluminescence, which is a by-product of their metabolism rather than the more usual heat.

Furthermore, it seems that fish do not have the same type of cells in their eyes as we do to enable them to see colours – at least in the way we do.

We then arrive at the core of the problem. How do fish perceive other fish?

To get some idea of this, we need to understand how the eyes of fish are constructed and how they react to the light entering them. We thus have to study the visual biology of coral reef fishes.

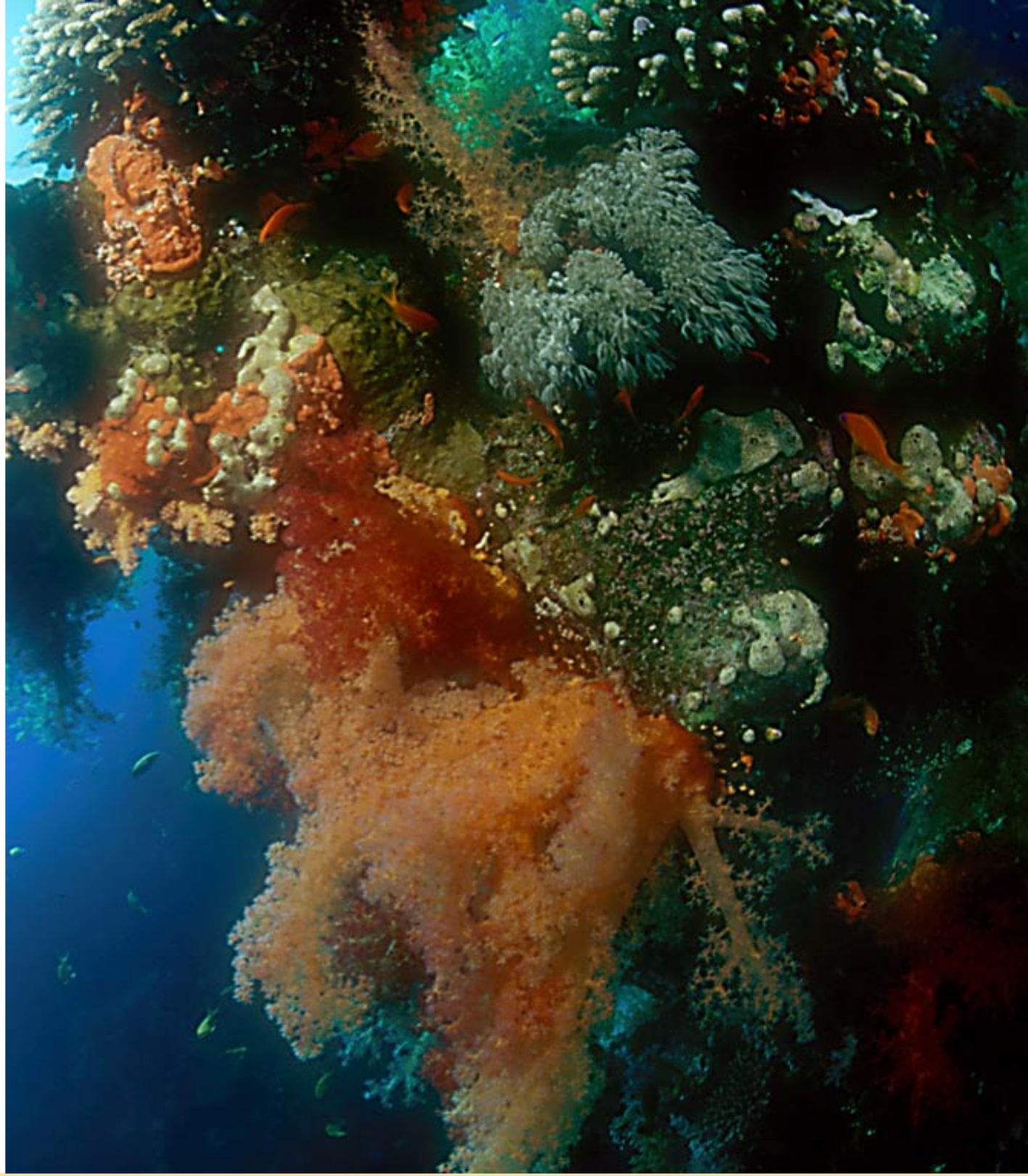
Visual biology of coral reef fishes

There has been a lot of research done on the vision of fishes, some of the most interesting that being carried out on coral reef fishes by, among others, G.S. Losey at the Hawai'i Institute of Marine Biology, University of Hawai'i ,and N.J. Marshall at the Vision, Touch and Hearing Research Centre, University of Queensland, Australia. In three very interesting articles published in Copeia, vol 2003, No. 3 they discuss the visual pigments of Hawaiian reef fishes, the colours of Hawaiian coral reef fishes, and the environmental light in the ecology of reef fish vision.

Visual pigments in reef fishes

The eyes of Hawaiian reef fish were examined for the spectral sensitivity of the visual pigments in the retina. The spectral absorption curves for the visual pigments of 38 species of Hawaiian fish were recorded using microspectrophotometry. The visual pigments of single cone-cells of the fish eyes had their maximum absorptions were at 347-376 nm (ultraviolet), 398-431 nm (violet) and 439-498 nm (blue). For humans the cone cells have maximum sensitivities at about 460 nm (blue), 540 nm (green) and 580 nm (orange). Thus, unlike humans, they had no visual pigments covering the green-yellow-red part of the spectrum. Generally speaking, there appear to be three types of short-wavelength vision in fishes: UV-sensitive, UV-specialized and violet-specialized. Some species, like the marine stickle back, in fact have four types of cone cells. At least some of the species examined could therefore possess true UV-colour vision and hue discrimination, although this would only be in a reduced part of the spectrum perceived by humans. This means that fishes cannot have the same perception of colour as humans.

UV-sensitive eyes are found throughout the fishes from at least two species of sharks to modern bony fishes. Eyes with specialized short-wavelength sensitivity (in the ultra-violet region of the spectrum) are common in tropical reef fishes. Water itself is fairly transparent to UV, with a more than 80% transmittance at wavelengths down to 300 nm. In research in which the visual perception of



ABOVE: Grouper
RIGHT: Soft and hard corals, Malaysia

Fish Fashion

Wall corals with Anthias

fishes is concerned, because most glass and plastics are UV-opaque, it might be necessary to ensure that aquarium dividers, specimen holding containers, etc., are UV-transparent. Op. Cit.

The colours of coral reef fishes

The colours of 51 species of Hawiian reef fish were measured objectively using a spectrometer. Such measurements record, independently of any human eye, the different wavelengths of the ambient light that are reflected by the fishes. It is this reflected light that enters the eye of a human or a fish to be perceived as what humans call a colour. In common with other known reef fish populations Hawaiian reef fish reflect light in the spectral wavelength region of 300-800 nm. This is an illustration of the fact that we see reef fishes in all the colours of the rainbow. Yellow or orange with blue, yellow with black, and black with white are the most frequently combined colours.

The authors state that "trends in fish colours seem to indicate that there are both visually driven selection pressures and chemical or physical restraints on the design of colours. UV-reflecting colours can function as semi-private communication signals. White or yellow with black form highly contrasting patterns that transmit well through clear water."

But as we have seen, fish cannot perceive yellow as such, due to lack of the necessary visual pigments, and will thus only see it achromatically, i.e. non-coloured, as a lighter or darker grey. Therefore, the patterns perceived on fishes by other fish is not due to colour but only to an achromatic contrast between the reflecting white or partially reflecting yellow areas, and the almost totally non-reflecting black areas. Fishes see other fishes, not in colour, but only as patterns of non-coloured grey stripes or areas, and black. If these achromatic patterns are similar to those arising in the coral reef environment (for these highly colured reefs will also be seen achromatically) then they will be camouflaged against predators.

We may conclude, then, that one of the main functions of the colours of reef fishes is for camouflage against their natural predators and not against we colour-perceiving humans who delight in their colours.

Camouflage

Although achromatic colour difference is probably the most important factor in successful fish camouflage it is interesting to take just a very short look at the other types of camouflage strategies used by fish.

Humans were very late compared with the fishes in discovering the survival advantages of camouflage on the battlefield, and it was not until the middle of the nineteenth century that khaki uniforms were introduced in the fighting in Afghanistan.

The uniforms of modern soldiers are now nearly always basically khaki coloured to match with the earth colours of sand and soil, or khaki/green to match with foliage, depending on the battlefield. But this is not the only, or even main factor in camouflage.

Kahki as camouflage

Khaki, Urdu for dust-coloured, was first used for the uniforms of the English regiment of Sir Harry Burnett Lumsden in 1848 when he was fighting against the Afghans. All British trops in India adopted khahi in 1885. The Boers used khaki clothing as camouflage in the first Boer War; in the second Boer War the British did as well.

The French suffered heavy losses during the first World War, because the troops wore red trousers as part of their uniform rather than, say, khaki, thus learning a bitter lesson about the need for camouflage.

Movement, sound, silhouette, shine, shape and shadow can all betray the presence of a soldier to the enemy on the battlefield. For fishes the enemy are the predators, the sharks and killer whales, and the battlefield is the submarine environment in and around the coral reefs.

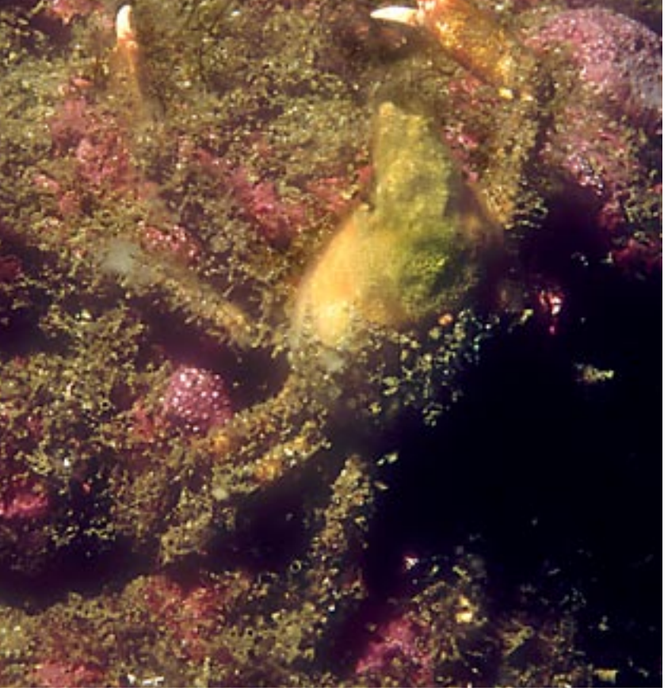
Plaice, turbot brill and flounder can match patterns of mud, gravel and sand so carefully that they can even mimic a chess-board.

Movement

One useful strategy is to keep still and hope that your enemy won't see you. This is a strat-

TOP TO BOTTOM:
Common Sand Goby (Denmark)
Sculpine (Denmark)
Crockodilefish (Borneo)

INSET:
Plaice (Denmark)



Decorator Crab, Puget Sound (USA)

Fish Fashion

LEFT: Angler fish (Malaysia)

Which came first, fish color or reef color?

egy used by, for example, goby and sculpine.

Silhouette and shadow

These may be avoided by keeping away from light sources by hiding under an overhanging coral.

Shape

The problem here is to break up the familiar fish outline and make it less recognisable. Like the soldiers uniforms which are coloured in broken patterns to look like leaves, so can fish camouflage themselves. At the approach of a diver an angelfish will try to hide itself among the coral branches, where its stripes serve to confuse its outline.

Also, as soldiers attach leaves and grass to their helmets to camouflage their shape, so spider crabs attach pieces of algae to their carapaces.

We see, then, that fishes have evolved quite complex camouflage strategies for survival in and against the background of the coloured reefs. But quite another question is, of course, why the reefs themselves are so vividly coloured. What role do colours play for the reefs themselves? Are they camouflaging themselves against something? And if so, what? ■