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AQUARIST

AND PONDKEEPER

The Magazine for Fishkeepers

Diving the Coral Reefs of Cuba

**CRABS, SHRIMPS
and LOBSTERS**
(Colour feature)

**SPECIAL
MARINE FEATURES**





COVER STORY Photo: M. Gilroy

Holocanthus trimaculatus, the Three-Spot Angelfish, is generally regarded as a member of the Family Chaetodontidae which includes the Angelfishes and the Butterflyfishes. According to evidence presented by Dr. Warren E. Burgess, well-known writer of numerous articles and papers in American marine journals, Butterflies and Angels should constitute separate Families. According to other authorities, however, they only constitute separate Subfamilies. In the Subfamily Pomacanthinae (Angelfishes), all the member species have a strong spine at the angle of the pre-opercle. In addition, the axillary process associated with the pelvic girdle is not well developed. In contrast, members of the Subfamily Chaetodontinae (Butterflyfishes) have well-developed axillary processes but no strong spines on the pre-opercle.

In total, there are about 160 species of Butterflyfishes in eleven genera, e.g. Chaetodon, but only about 30 species of Angels in seven genera. Of these, the most popular in the marine hobby are the various species of *Centropyge*, *Pomacanthus* and *Holocanthus*. Among the *Holocanthus* species, *H. trimaculatus* is one of those seen only relatively infrequently in aquaria. Like many other Angels, it comes from the Indo-Pacific, is strikingly coloured, has a robust appearance and exhibits vigorous territorial behaviour. However, (again, like other Angels), it requires experienced handling to maintain it in peak condition for any great length of time in aquaria.

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BRITISH SHORE FISH-1

by Dr. Peter Miller (University of Bristol)

On the beach, do you get fed-up with building sand-castles, frying in the sun, or losing money on the fruit machines? Take your hobby on holiday and discover shore fish. By shore fish, I mean the species which are found regularly between tide-marks, the limits of high and low water. Thanks to stranding, we sometimes encounter fish which would challenge even the champion aquarist. A few years ago, I collected metre-long Port Jackson Sharks from a tide pool in South Australia and, periodically, the shore yields the carcass of a long-dead Basking Shark, or sea-serpent as newspapers will identify them. However, on British shores, we can normally find a number of fish, characteristic of the intertidal zone and more or less modified in structure and physiology for the rather testing conditions of shore life. What species you find will depend on the physical nature of the shore, and we can follow the holiday brochure classification into rocky and sandy beaches. Shores with rocky reefs and boulders can usually provide deeper, permanent pools, as well as loose stony cover for the fish. The rocks provide a base for seaweed growth and a wide variety of invertebrate animals are also present. In sheltered locations, where weed cover is dense, typical intertidal fish, such as gobies, bullheads, and rocklings, should be common. Where wave action is heavy, seaweeds mostly disappear and many animals, including fish, cannot withstand the turbulent conditions. Nevertheless, a dense population of barnacles may provide a food source for at least one species, the Shanny, lurking in crevices. At the other extreme, although good for indulging your thwarted ambitions as a



A sheltered shore near Looe, Cornwall. Dense weed and numerous pools support a varied fish community

civil engineer, a shifting sandy beach does not offer the stable conditions of substrate for cover or seaweed growth required by many intertidal fish. Consequently, a number of rocky shore species are absent, or occasionally present only as young. However, shallow pools or gutters often house sand-dwelling fish, such as the Common Goby, and more temporary residents like young flatfish, sand-eels, dragonets, sand-smelts, and so on. In the higher reaches of estuaries, salt-marsh pools can also contain gobies, eels, small flounders, and even the Three-Spined Stickleback.

Some conditions of intertidal life pre-adapt the shore species as suitable aquarium fish. Most obviously, they are small in size, so that, when the tide recedes, effective shelter can be found under stones or in pools, to escape both predatory animals and the drying effects of air and sun. The latter

influences are seen on a large scale in the vertical zonation of different kinds of larger seaweeds on rocky shores. If necessary, nearly all regular shore fish can withstand several hours in air, if surrounded by moist seaweed or the wet contents of a crevice. During low water, the intertidal environment may also suffer drastic temperature changes, heated by the sun or chilled by wintry gales, while the salinity of small bodies of water can be quickly reduced by rainfall or drainage from a nearby stream running down the shore. In pools above high water of neap tides, alteration in water conditions between successive spring tides may range from freshwater flooding to saline evaporation. Thus, shore fish, tolerant to at least some extent in the wild, might be expected to show more resilience in the home aquarium than the usual variety of tropical marine species.

Other aspects of biology are also

easily related to shore conditions. Feeding by the typical species is mostly on common invertebrates, caught by sit-and-wait strategy. However, several species, such as the Shanny, display a rhythm of activity correlated with the tidal cycle, peak movement being at high-water, probably for feeding. A territorial sense is also found, with individuals returning to, or remaining in, particular pools, and may be specially evident during the breeding season. Except for rockling, the spawning of rocky shore species involves parental care of relatively large eggs, using greatly contrasting techniques. Such species, and the Common Goby from sandy shores, offer possibilities for breeding in captivity, using the usual methods for rearing the young of aquarium fish.

The shore fish most likely to be obtainable around British coasts are listed below, by family, very roughly in order of likelihood of capture, for rocky and sandy shores in turn. Scientific name and maximum size are given in parentheses. This is not a complete list of fish which have been found in the intertidal zone and excludes rarities. An illustrated key for the identification of the usual shore species will follow in a later issue of *The Aquarist*, so that full descriptions of the fish are omitted below.

Fish from rocky shores Blennies (Blenniidae)

The Shanny (*Blennius pholis*, 16 cm) is probably the most widespread of shore species, found under stones, in rock crevices, and in pools, from higher levels down to low water, and extending onto exposed shores. Usually olive to greenish brown, this blenny has a compressed head, with rounded forehead, and a tapering body, bearing large pectoral fins and long narrow pelvics, set under the head. Shannies are able to feed on barnacles, using powerful jaw muscles and strong teeth to bite these off the rock surface. When cornered, a large Shanny may even nip the aquarist. Young fish, unable to detach whole barnacles, browse on their feathery limbs by which the barnacles 'kick food into their mouths' when covered by the tide, and, rather unsportingly, may even bite off the



Shanny



Gunnel

(Not drawn to scale)

penis of the barnacle as this is waved prior to insertion into an adjacent individual. Shannies may also ingest large quantities of green weed (*Enteromorpha*), perhaps for associated small animals. From April to August, egg masses are deposited under rocks or within crevices, and protected by the male, who becomes dark in colour, with conspicuous white lips and thickened dorsal fin-rays. At least several broods may be laid by one female in a season. Young fish are seen in higher pools, displaying long dark pectoral fins. From study of earstones (otoliths), shannies are believed to reach a maximum age of over 10 years.

In deep pools, near low-water, young of the Tompot Blenny (*B. gattorugine*, 30 cm) are sometimes caught. Otherwise resembling the Shanny, the Tompot has a short tufted process above each eye and often more pronounced dark banding down the flanks. On south-west coasts, Montagu's Blenny (*Coryphoblennius galerita*, 8 cm) is a small species, typically above mid-tide level, in pools as limited as the tiny rock basins, lined with pink coralline seaweeds, near high water. Small shannies can occur in the same habitat, but Montagu's Blenny has a transverse triangular flap across the head. In summer, breeding males have a creamy white fringe to the crest, and iridescent blue spots over head and body. Diet comprises small crustaceans and barnacle appendages.

Butterfish (Pholidae)

The Gunnel (*Pholis gunnellus*, 25 cm) has an elongated, flattened body, reddish, and edged along the dorsal fin with about a dozen black spots. Usually revealed by turning stones from mid-tide and below, the Gunnel flaps away under adjacent cover. This coldwater

species breeds in winter, producing an egg mass around which a parent, usually the female, wraps her body. Food includes worms and crustaceans.

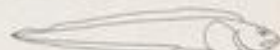
Eelpouts (Zoarcidae)

The Viviparous Blenny (*Zoarces viviparus*, 46 cm) has a long, tapering body, lacking a distinct tail fin but with a slight notch near the end of the dorsal fin. Around Britain, this fish is restricted to North Sea and Scottish coasts, living under stones or in pools, often near brackish water. Mating occurs in August or September, and the young develop within the ovary, nourished by a secretion from its walls. Broods of usually 100-200 offspring, already averaging 4 cm in length, are born in summer. This species feeds mostly on shrimps, prawns and small fish.

Bullheads (Cottidae)

The common shore bullhead of south and west coasts is the Long-Spined Sea Scorpion (*Erophrys balalis*, 17 cm), found in pools on sheltered shores with good weed cover. The large head, with numerous spines and a short barbel at the end of the upper jaw, is equipped with a broad mouth, and the species is a voracious predator, eating crabs and small fish, even in a bucket. Breeding lasts from February to April, with egg clumps in crevices or beneath stones. Males have a large genital papilla.

On northern coasts, another bullhead, the Bull Rout or Short-Spined Sea Scorpion (*Myoxocephalus scorpius*, 30 cm) also lives intertidally. This species has a more flattened, smoother nape, no jaw barbels, and fewer gill-cover spines. Often overall dark, the belly may be conspicuously spotted white. Habits are similar to those of the preceding species, with spawning in December to March.



Viviparous Blenny



Long spined Sea Scorpion

Sea-Snails (Liparidae) and Lump-suckers (Cyclopteridae)

The sea-snails are related to bull-heads but have no spines, a round sucker on the belly (derived from the ventral fins), and a tadpole-like body, with curiously wrinkled skin. Montagu's Sea-Snail (*Liparis montagu*, 6 cm), often vividly striped, is the commoner shore species, found under stones towards low-water. Another species (*L. liparis*, 18 cm) may also be encountered; in contrast to Montagu's Sea-Snail, the latter has the anal fin joined by membrane to the tail fin. Sea-snails reproduce from May to June, with small egg masses among fine seaweed or other growths. Despite their slow appearance, sea-snails are carnivorous, feeding on crustaceans and small fish.

In the north-east, the much larger Lump-sucker (*Cyclopterus lumpus*, 61 cm) undertakes an onshore spawning migration in February, when egg masses are laid in the intertidal zone and fanned by the male, which remains on guard at low water. Many of these plump fish, blue and red, with knobby back and ventral sucker, are then attacked by sea-birds.

Gobies (Gobiidae)

One of the most diverse fish groups, the gobies, are characterised by a simple ventral sucker, where the pelvic fins are attached along their inner edges and by a transverse anterior membrane

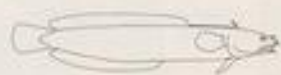
to complete the disc. It is the simplest and least efficient of the three kinds of ventral sucker found among British shore fish. The usual species of our rocky shores is the Rock Goby (*Gobius paganellus*, 12 cm), in pools or under stones with ample weed cover. Juveniles may occur among fine weed turf in upper pools. This species tends to be dark brown to purplish in colour, but with a broad pale or yellowish band across the top of the first dorsal fin, and the upper pectoral rays are free from the fin membrane. Rock gobies feed chiefly on crustaceans as well as worms. Breeding is in spring or summer, when small, pear-shaped eggs are deposited in a single-layered patch on the underside of a stone and guarded by the male. Like shannies, rock gobies may live more than 10 years.

In deeper pools, with submerged weed beds, a small reddish goby, seen in midwater groups, is the Two-Spot Goby (*Gobiusculus flavescens*, 6 cm). Both sexes have a large black spot at the base of the tail, and males another under the pectoral fin. Food includes plankton as well as invertebrates picked off rock and weed surfaces. Breeding from May to July, the species often lays its eggs on the inner surface of the hollow holdfasts of an oarweed (*Saccorhiza polyschides*), the 'sea-furbelow' of Victorians.

More unusual, the Giant Goby (*Gobius cobitis*, 25 cm) may be found on



Sea snail



Rockling

(Not drawn to scale)

Cornish coasts in large, very high pools, which are sometimes brackish. Similar to the Rock Goby, this species has a 'pepper and salt' coloration and its ventral sucker has an anterior membrane with prominent lateral corners.

Rocklings (Gadidae)

The rocklings belong to the cod family but are bottom-living and have the front section of the dorsal fin, except for the first ray, sunk into a longitudinal groove, lined with sense organs, over which the constantly vibrating, shortened fin-rays waft a current of water. Shore rocklings include three common species, all with a chin barbel, and either two or four barbels on the snout, making totals of three or five depending on species. The Five-Bearded Rockling (*Gilista mustela*, 20 cm), reddish brown in colour, is frequent under stones and in pools on shores with much seaweed. Food comprises small crabs and shrimps, sea-slaters and occasionally fish. Breeding in winter and spring occurs in deeper water and, alone among shore fish, rockling eggs float in the plankton. Young fish appear in shore pools from early summer and, as in other rocklings, are initially silvery, termed 'mackerel midges'.

The Shore Rockling (*Gaidropsarus mediterraneus*, 25 cm), sometimes reddish but often darker brown, has only three barbels. Otherwise like the Five-Bearded Rockling in habits, this species spawns during June and July. The larger Three-Bearded Rockling (*G. vulgaris*, 53 cm), which may be found at low water of spring tides, has distinctive brown spots.



Rock goby in a pool at Wembury, Devon

Clingfish (Gobiesocidae)

The clingfish are small, with flattened head and snout, and a complex ventral sucker, developed from the pelvic fins with part of the pectoral fin skeleton in support. This is powerful and clingfish may need prising or sliding from the side of a collecting jar. On sheltered, weedy shores, the Cornish Sucker (*Lepadogaster lepadogaster*, 6.5 cm), red with two blue spots on the back, is found beneath stones, often clinging to the undersurface. From May to August, small patches of round, golden eggs are guarded by either parent.

At extreme low water, the Small-Headed Sucker (*Apletodon microcephalus*, 4 cm), olive with a dark dorsal fin, occurs under stones. Like the Two-Spot Goby, this clingfish lays eggs (from May to July) inside hollow *Sacchariza* holdfasts; after a summer storm, holdfasts containing eggs (and rarely the male as well) may be gathered along the strandline.

Pipefish (Syngnathidae)

On rocky shores, the Worm Pipefish (*Nerophis lumbriciformis*, 15 cm) is found beneath stones or among dense weed. The writhing, semi-rigid body of this dark, worm-like fish is completely enclosed in bony rings, and has no fins except a short dorsal. Breeding occurs in summer, and males carry the developing eggs, large and yellow, attached along the belly. With a tiny mouth, food consists of small crustaceans and larval fish.



A good catch of worm Pipefish awaiting more suitable accommodation

Wrasses (Labridae)

Small Corkwing Wrasse (*Cremilabrus melops*, 15 cm), green to mottled greenish-brown with a dark spot below the end of the lateral line, live around weed in deeper shore pools, especially during warmer months. Spawning is



Clingfish—ventral view showing complex sucker

in summer, with a nest built from weed tucked into a rock crevice. Sometimes, young Ballan Wrasse (*Labrus bergyllia*, 50 cm) occur in lower pools; variable in colour, green to more obviously reticulate with dark-edged scales, but lacking a tail spot.



Corkwing Wrasse



Ballan Wrasse

(Not drawn to scale)

Sticklebacks (Gasterosteidae)

The marine Fifteen-Spined Stickleback (*Spinachia spinachia*, 20 cm) is larger and much more elongate than the familiar freshwater tiddler. This stickleback is found in shore pools with extensive weed beds. Small crustaceans, such as copepods, are eaten in midwater or from seaweed. During

the breeding season (April to July), the male constructs an oblong nest, at least several centimetres long, with seaweed fragments held together by filaments of a kidney secretion. Up to 200 large amber eggs may be deposited in a nest. On British coasts, the Fifteen-Spined Stickleback normally dies after a single spawning season.



Fifteen-Spined Stickleback

Eels (Anguillidae and Congridae)

Although the Common Eel (*Anguilla anguilla*, 142 cm) spends much of its life in fresh water, eelers and small yellow eels may be found on the shore under stones, especially near brackish runnels. Occasionally, larger, stouter Conger Eels (*Conger conger*, 305 cm), with the upper jaw longer than the lower, and the dorsal fin beginning just behind the level of the pectoral fin tip, may be encountered on the lower shore, a daunting prospect for the home aquarist. Congers on the muddy Somerset shore of the Bristol Channel used to be hunted with dogs!



Common Eel

DIVING THE CORAL REEFS OF CUBA

OUR party arrived at Havana Airport to be met by uncharacteristic Caribbean weather. An overnight thunderstorm had left its mark with wet roads, overcast skies and a distinct coolness in the air even for 5 o'clock in the morning when we landed from London via Madrid in Spain.

The purpose of my visit in November 1981 to this mysterious yet exotic island was to dive on some of the coral reefs around the Isle of Pines, off the southern coast of Cuba, as part of the first British diving group to visit the island since the revolution of 1959.

Inside the Jose Marti Airport we were met by a young man in his middle 20s, our Cuban guide, Nelson Sanchez, who was to be our official Cubatur "Man Friday" and he soon ushered us aboard a luxury coach to head for Havana for the first 2 days of our stay. We had landed on a Sunday morning and as we drove along the motorway to the capital all eleven members of our group were puzzled by the continuous stream of buses, vans and open lorries carrying what appeared to be thousands of city dwellers away from Havana out into the countryside, apparently to help bring in the harvest, something like the Kent hop-pickers, only on a grand scale and on their day off too.

Our destination was the "Habana Libre Hotel" (formerly the Havana Hilton) and after a welcome breakfast several of us decided to stroll down to the seafront, 15 minutes walk away, to get our first glimpse of the kind of waters we'd be diving in. No powder white coral sand beaches here however, just a sea wall, while 10 feet below it lay the remnants of a former reef level, now dead coral rock and rock pools stretching some 40 feet out from the wall to end at the water's edge, pounded by a good swell coming from the direction of Florida.

After watching several locals line-fishing from the rocks we headed back to our hotel for a well earned lunch, grateful to be in the cool of the restaurant after spending several hours in the sun where, unlike the morning, the



Members of the party relaxing prior to a dive

by N. Haines

temperature had climbed well into the 80's by noon.

Suitably refreshed we felt able to undertake another stroll, this time to the eastern part of the city along the water-front where the working class districts lay, an area we discovered of somewhat seedy tenements with every now and then a local headquarters of the "Committee for the Defence of the Revolution" and groups of little kids calling us "Tovarich" (Comrade) and asking us for "chiggly". We must have looked like a bunch of Russians, (there are a number on the Island, giving technical advice to the Cubans), and the kids were out to scrounge chewing gum. Despite the depressing aspect of this part of Havana, I found most of the Cuban people apparently reasonably dressed and nourished without the great extremes of poverty and gross wealth which exist on some other islands in the Caribbean, especially the nearby Bahamas, which I have visited on several occasions.

We returned to the "Habana Libre" for a well appointed dinner followed by a visit to the hotel's disco and bar to sample one or two of the many and varied rum daiquiris available before finally calling it a night after a long and tiring day.

The next morning we were taken on a coach tour of old Havana and some of the impressive Spanish-style buildings erected in the 19th and early 20th

centuries. At this point, a little excitement entered the scene. Shortly after walking around some 16th century sections of the capital, including the impressive Havana Cathedral, we boarded our bus near the Fuerza Castle, the second oldest Spanish building in the Americas, opposite the narrow entrance to the Port of Havana, when suddenly the conning tower of a Cuban Navy submarine came into view heading out to sea, on patrol. I had taken a good amount of cine-film already that morning and as our coach moved off, I started to shoot the sub, merely another interesting item to be captured on film, and thought no more of the incident until after lunch. I was about to board the bus outside the "Habana Libre", which was due to take us to the airport for the flight to the Isle of Pines, when I was tapped on the shoulder by our Cuban guide, Nelson, who asked me to step inside the hotel lobby as there was someone who wanted to see me, "Aha," I thought, "Fidel has heard I'm in Cuba, and wants to see me." No such luck. Apparently, while filming the sub, I had been observed by someone on a nearby public transport bus, reported to the appropriate authorities and behold, there in the lobby stood a little secret service man, all of 5 ft 3 in. tall, asking me to hand over the film I'd taken of the sub. Filming of sensitive military subjects was not allowed, particularly at a time when relations with the USA were very strained and made everyone on the island very jumpy and security conscious. Having handed over the offending film, I was free to board the coach, so we duly set off for the airport to board a Cuban Ilyushin for the flight south, 100 miles over the Cuban country-side and the Gulf of Batabano to the main town on the Isle, Nueva Gerona. On our arrival we piled once more onto the inevitable waiting coach, quenching our thirsts with a free drink from the bar at the rear of the bus and off across the Island to the hotel "El Colony", our diving centre for the next 10 days.

Shown to our rooms in the attractive



two storey hotel we just had time to unpack before dinner, followed by a briefing and slide-show in the bar, over several rum daiquiris, of the areas we would dive and the marine life we could expect to see. Somewhat tired with the almost constant travelling, jet-lag and no doubt the effect of the potent daiquiris we finally staggered back to our rooms, slumped onto our beds, more than ready for a good night's sleep before our first dive the next morning. A telephone call from the hotel's switchboard roused us on the dot at 7 o'clock and after breakfast our coach whisked us in a few minutes down to the harbour where our boat the *M.V. Key Largo* awaited us, a 20 metre fishing vessel converted to act as a floating diving platform for over 20 divers. Loaded up with all our diving equipment, underwater stills and movie cameras, flash-guns and cine lights, we headed out of the narrow entrance of the harbour, past a Cuban gun-boat moored nearby and headed for the open sea for the first of our dives.

As may be seen from the map of the area there is a peninsula jutting out nearly 20 miles Westwards from the main part of the Isle of Pines. Every day we had to negotiate this obstacle in order to reach the coral reefs we were to dive on, on the Southern side of the Island, a journey of some two hours. This was no

great inconvenience as it allowed us plenty of time to sunbathe on the upper deck of the boat and prepare our diving gear and cameras before we reached the morning's first diving spots. Our very first site, called in Spanish "Los Indios", was described to us and we were soon kitted up ready to go over the side, but not before we were divided into two groups of five divers each by the Cuban dive leaders Martine and Willey. Let me at this point explain that standard practice amongst British sport divers is to dive usually in pairs called the "Buddy System". Diving alone or in larger numbers is regarded as potentially dangerous as it's all too easy to "lose" a diver when you have to keep your eyes on all the divers in a group. None the less, Martine and Willey wanted us in the two groups headed by each of them so they could assess our diving capabilities. We learnt later that they were held personally responsible for the safety of their charges by the Cuban authorities.

To be perfectly frank, I recall very little of the details of those first two days' diving because the group diving system caused absolute ruddy chaos. We were taken on a veritable Cook's tour of the reefs with insufficient time to slow down and study what we wanted to see or photograph. The sight of a rather large southern stingray (*Dasyatis americana*) some

4 ft. across stands out in my mind from the morning dive to 90 ft. of that day and on the second morning entering a tunnel in the reef face at 125 ft. behind several other divers and getting a face full of sand for my trouble. After the experience of those first days our party decided to put its foot down and dive in the way we'd been trained. The dive leaders, satisfied that we all appeared to be competent, acquiesced in the knowledge that we all appeared to be pretty sensible, would not try bombing off to 300 ft. or some such similar idiotic escapade and were quite happy for the rest of our stay to let us do our own thing so that we could concentrate on what interested us.

Having sorted ourselves out, I could begin to take in more of Cuba's Caribbean marine life, and compare it with other areas I had dived before. My immediate impression of the differences were that the majority of Caribbean fish were generally more muted in coloration than those in the Red Sea, and the coral life was different too. The Red Sea seemed to have many more types of stony corals and soft corals, whereas, the Caribbean appeared to have more horny corals, sea fans, sea whips, gorgonians and so on. I won't attempt to describe every fish and coral that I saw in the course of the 10 day stay on the Isle of Pines as that would take too long for the scope of this article.

We dived twice a day from depths ranging from 25 ft. to 130 ft. The morning dive would always be the day's deepest which meant anything from 65 ft. to 130 ft., usually either on the deepest part of the edge of the slope or actually over the edge of the drop-off or wall where the depths plunged down to several thousand feet. Here on our deepest dives we would sometimes come across bushes of rare black coral, specimens of the Blackcap Basslet (*Gramma melacara*) a lovely Magenta coloured cousin of the Royal Gramma with a black mark or "cap" on the top of its head but only abundant at the 100 ft. to 200 ft. range as is the Longnose Butterfly fish (*Prognathodes aculeatus*).

This small butterfly, just over 3 ins. long, inhabits deep water, rarely being seen in the shallows.

On deep dives in the Red Sea it's not uncommon to sight sharks, but except for one occasion, we had no luck in spotting any of these toothy denizens of the deep in these Cuban waters, although they are most certainly around. After surfacing from the morning dive we would clamber aboard our vessel, divest ourselves of our diving kit, cameras etc. and swap stories of what we'd seen and photographed. Then we'd usually dry off by sunbathing on the flat roof above the wheel-house or in the bows, soaking up the sun whilst waiting for the cook to prepare lunch. This was one of the highlights of the day, plenty of good food, freshly caught fish, meats of various types, salad, French fries or creamed potatoes, followed by a cool beer from the ice-chest or even a tot of Cuban rum. Often we would move in close to shore and anchor for lunch perhaps a couple of hundred yards off a powder white coral sand beach to which some of the more energetic members of the party would swim or snorkel through the warm crystal clear waters whilst lunch was being prepared back on board. As we also had a wind-surfing board, some of the group even had a go at that with various degrees of success, to work up their appetites, no doubt.

As mentioned previously, to describe every dive we undertook, would take too long so I'll suffice with some of the highlights of our underwater ventures.

In no more than 30 ft of water were scattered the remains of 3 big ships which had been beached and had been previously used for target practice by the Cuban Air Force. The hulks had been taken over by large shoals of fish, Porkfish and French Grunts, strikingly coloured with blue and yellow horizontal stripes on their bodies. Elsewhere on the upper superstructures of the wrecks, where algae could grow under the strong sunlight, large numbers of Surgeon fishes, such as the Blue Tang (*Acanthurus coeruleus*) would browse contentedly taking no notice of the shoals of Blue Chromis (*Chromis cyanura*) accompanied by equal numbers



A Longspine Squirrelfish, *Holocentrus rufus*

of the similar but larger Creole Wrasse (*Clepticus parrae*) which schools with and mimics the Blue Chromis, though to the seasoned eye its heavier body, broader tail and more purple coloration make it easier to distinguish from the electric blue of its chromis companions.

Out on the sand, surrounding the wrecks, we could see dozens of Yellow and Spotted Goatfish (*Mulloidichthys marmoratus* and *Pseudupeneus maculatus*) as they probed the sandy bottom with their sensitive barbels in search for food, whilst Yellowhead Jawfish (*Opistognathus aurifrons*) would quickly pop back into their sub-sand burrows if anything disturbed them.

As we investigated the wrecks much care had to be taken, particularly inside the gloomy interiors, not to impale one's hands on the sharp black spines of the Long-spined sea urchins (*Diadema antillarum*) which contained an irritant poison. Occasionally one of our party might suddenly wring his bare hand at a sudden stab of pain. The venomous spines of the urchin? No, only a sudden bite from an aggressive blue and yellow damsel, the Beaugregory (*Pomacentrus leucostictus*) merely defending his little patch of territory which we'd blundered into.

At the edge of visibility rising up out of the sand were large mounds of

patch reef literally covered with various gorgonians sticking up like cacti in a desert—sea fans, purple green and brown, sea rods and other members of the same family, great brain, staghorn and elkhorn, pillar and fungus corals. Here, darting in and out of the many gullies, crevices and holes were the denizens of the reef, bold sergeant majors (*Abudefduf saxatilis*) decked out in their livery of black stripes on a silvery-yellow body, Bluehead Wrasse, the super males with their blue heads, black and white head bars and green bodies with their harems of attendant females showing off their yellow and black striped coloration.

No stranger to the reefs was the striking Rock Beauty Angelfish (*Holocentrus tricolor*) with its jet black patch covering two thirds of its body surrounded by brilliant yellow over its face, back, belly and tail fins.

Occasionally the divers would chance upon a large pair of Gray Angelfish (*Pomacentrus arcuatus*) who would balefully eye us before going on their way. Dropping like slow motion into some of the gullies separating the more built up areas of reef we would sometimes come across the beautiful Queen Triggerfish (*Balistes vetula*) with its varied body colour of blue and green and electric blue lines around its mouth, tail and rear dorsal and anal fins. Once when rising up out of these gullies over the brow of



Reef shot showing Common Sea Fan, *Gorgonia ventalina* (centre rear), Corky Sea Fingers, *Briarum abestinum* (middle and left foreground), Sea Rods, *Plexaura flexuosa*, Porkfish, *Anisotremus virginicus* (right) and, probably, a White Grunt, *Haemulon plumieri* (left)

the next gully we came upon a sight I'd never seen before whilst diving Caribbean waters—the silver ghost like forms of several large Tarpon (*Megalops atlantica*) some 5 to 6 ft long with almost hypnotic red gleaming eyes. With a renowned reputation among fishermen for being a great fighter when hooked, this primitive fish at that size is not one for the home aquarium. An observation which should also surely be made by all marine aquarists who, if they ever get to see the size which their angels or butterfly or triggerfish regularly reach in the wild, would immediately vow to put their charges into an aquarium of not less than 6 ft in length and nothing less than 100 gallons in order to let them grow to something near their full potential size and magnificence.

On our second visit to the wrecks, the sight of one of our divers trying to leap onto the superstructure of one of the wrecks was something to behold as he swore that 3 sharks were nibbling at his fins. After some hesitation the rest of us took the plunge and dived in to look for these dangerous "sharks". We initially investigated the wreck always keeping an eye out for those 3 "dangerous" creatures. Then I spotted them, cruising along the sand just 30 ft away from the wreck in formation, one about 5 ft long, the other 2 about 3 to 4 ft long. All the divers stayed safely hidden in the

confines of the ship's superstructure, apprehensive at the approaching "danger" for indeed the fish looked very shark-like in size and shape. But something about their mouths and snouts made me suspect that they weren't true sharks, very similar, but not sharks. Movie cameras whirring, I finned off the wreck in pursuit of them hoping to get some good shots, unfortunately my twin cine-cameras decided to run out of film just at that critical time. I had used up most of it shooting footage of the wreck and other fish. What a disappointment. Later on in our visit when back in Havana I met an old Cuban "sea-dog", a diver of many years. Through an interpreter I described the fish to him. "No, they weren't sharks," he said, "but 'Madregals'". I can find no references nor drawings of such a fish of that name in the usual reference books. To discover what they really were, I suppose, I'll have to dig deeper into more authoritative reference books than the ones I have access to at the moment.

A memorable dive also took place on another of these wrecks and was remarkable for the presence in the water of a huge barracuda, allegedly "tame", nicknamed by our Cuban crew "Lola", which was some 6 ft in length. An awesome sight with her mouth open showing 2 in. long fangs, especially when she got within a few feet of us on the scrounge for tit-bits from the divers. An encounter with a smaller barracuda was not quite so pleasant at a later date. After anchoring a few hundred yards off a lovely sandy beach at mid-day, 4 of us decided to go snorkelling to survey the shallows, some 15 to 20 ft below us and investigate the nooks, crannies and

ledges which abounded in the area. The four of us had split into pairs and my buddy and I, upon discovering some interesting underwater terrain, called one of the other pair over to take a look at what we'd found. "Never mind me coming over there, you come over here, fast. I'm being eyed up by a ruddy barracuda for his dinner," shouted our colleague. We duly finned over to him. True enough, there was a 3 ft fish circling him. Discretion being the better part of valour, we decided, to swim back to the dive boat as quickly as possible, keeping a watchful eye on our circling "companion", just in case. He followed us for over 100 yards. It's quite something to witness so called big hairy divers sweating profusely as they snorkelled vulnerably at the surface with such a menacing looking fish just a few feet below. Fortunately, I'd heard that barracuda make a habit of following divers around the reef, looking over their shoulders interested in what the divers are doing, like dogs, but rarely making aggressive moves. None the less, even I took more than an occasional glance backwards to see where exactly he was and what he was up to. You can never be too sure. We were most pleased when we finally clambered back on board ship.

During the latter part of our stay on the Island we managed to organise a night dive, a chance to observe those occupants of the reef who come out to feed during the hours of darkness. Even though I have made a number of night dives in the ocean it is still a strange sensation to observe the flashing torches of the other divers as they sweep around the underwater terrain picking out interesting objects, such as 7 ft nurse shark dozing in a cave. The sleeping forms of multi-coloured parrot fish wrapped in their night clothes of mucus and the startled spiny lobsters, caught in our beams of light, attempting to escape, paled on comparison.

Back at the hotel after recuperating from the day's diving we occasionally summoned the energy to visit the bar especially at the weekends when the "El Colony", proved a popular venue for the Cubans from the local capital, Nueva Gerona, together to have a good



old knees up. They let their hair down as well as anybody in the world when the opportunity arises. On several evenings liberally lubricated with a glass or two of the local rum our party would make its way down to the beach to tread the boards of the jetty which stretched 200 yards through shallow water no more than 4 ft deep at its end to observe the marine life attached to the piers, sponges, algae, crabs and shoals of darting night-time fish on the look for prey caught in the beams of our torches.

All too soon our stay on the Isle of Pines came to an end. On the afternoon of our final day's diving we enjoyed ourselves with a good old singsong enhanced by several bottles of rum on the deck of the *M.V. Key Largo* with our Cuban hosts as we headed for harbour for the last time. After saying our farewells we flew out for Havana for a final 3 days at the "Hotel Marazul" on Cuba's Northern coast some 20 miles to the east of the capital and the chance during the day to rest, after 10 days' strenuous diving, by wind-surfing,

sailing and water skiing or just plain lazing on the beach watching some of the attractive Cuban girls strolling by in their bikinis, even occasional Russians, on the Island as technical advisors. One female "Tovarich" with long blond plaited hair, built like an Olympic athlete, and "wearing" (if that's the word) the skimpiest black bikini you ever saw, springs immediately to mind as well as scores of muscular Cuban youths jogging up and down the beach shadow boxing, all trying to emulate their 3 times Olympic heavyweight champion Teofilio Stevenson, no doubt.

A visit to an incredible night club and cabaret in Havana, the "Tropicana", which no visitor to the Island should miss, still brings back happy memories.

After 14 memorable sun-soaked days, our time came to leave Cuba. Certainly a holiday to remember, both above and below water and the knowledge that Cuba has much to offer anyone interested in marine life. I certainly hope my next visit will not be many years in the too distant future.

Typical shot of a Caribbean reef showing Sea Rods, *Plexaura flexuosa* (a Gorgonian coral). Blue-striped Grunts, *Haemulon sciurus* (left) and French Grunts, *Haemulon flavolineatum* (right)

CRABS, SHRIMPS & LOBSTERS

by Martin Haywood



TROPICAL fishkeepers rarely have the opportunity to keep animals other than fish in their aquaria. However, marine aquarists have a huge range of animals available to them and amongst these probably the most popular invertebrates are the crustaceans. This phylum of over 30,000 species includes some of the most spectacular, awesome, interesting and aggravating animals. They range from the giant spider-crabs of Japanese waters, which can have a span of six feet or more, through flame-red bioluminescent shrimps to persistent and problematic parasites of fishes. Discounting these latter nuisances the most important to marine hobbyists are the crabs, shrimps and lobsters.

The common view of crabs is limited to one of the large, heavy shelled, boiled edible crabs seen on fishmongers' slabs. Most people have no conception of the huge

This interesting species of hermit crab has a symbiotic relationship with the anemone on its shell. The anemone affords the crab some protection while gaining scraps from the crab's meals

variety and the wide diversity in behaviour among these animals. They range from heavily armoured predators, as in the case of swimming crabs, to tiny, pea-sized species finding a home within the shells of living mussels. Clearly then, some care has to be taken in selecting specimens for the home aquarium.

Hermit crabs are often the first invertebrates kept by newcomers to the hobby but they can only rarely be considered a wise choice. They make excellent scavengers when small but all too often they out-stay their welcome, growing steadily bigger and getting more destructive

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Forty years ago, when I first visited that living aquarium of the northern-most tropical fish, the coral-reef in the northeast corner of the Red Sea, then the Gulf of Aqaba, we jeeped across the Aravah desert after sailing down the Dead Sea in a potash boat loaned for a Jerusalem Naturalists' Club expedition. We stayed the night at a sea-infested plaster-daub camel-post, then called Um Rash Rash. An almost unbelievable change now calls a resort of 20,000 Jews there the Gulf of Elat, a flourishing town of white modern buildings including 32 hotels where I found only half-a-dozen desert Arabs.

A mini-fleet of glass-bottomed boats now awaits fish-watcher tourists. One of the world's only five underwater observatories has 20 glass windows in a chamber seven metres below the surface at the end of a 100 metre pier. A museum has 23 aquaria tanks displaying Red Sea fish and marine life, the largest in a big circular aquarium and three open pools. Winter here never drops below 50°F. Skin-diving is another way of viewing its coral-fish, along marked pathways to an underwater signposted trail. A semi-submersible trimaran combines it all in comfort. There are large clams up to 20 inches wide, and after dark there are the luminous fish, brilliant jellyfish and serpent stars.

Its fishes are Indian-West Pacific, quite different from those of the nearby Mediterranean. Here we saw bright green and blue parrot-fishes often tinted red and cutting the coral with their sharp teeth. Wrasses far more colourful than their European relatives; thin, leaf-like surgeon-fishes bearing sharp, erectile spines either side of their tails and small-mouthed butterfly-fish with tiny teeth, striped and criss-crossed with yellow, green, brown and lilac merged into their colourful reef. Bizarre trigger-fish, often rhombic in shape, armoured with thick, spiny scales and often with long filaments to their fins, also bore erectile dorsal



by Eric Hardy

spines. Very elongated, poisonous spines were carried by slow-moving dragon-fish.

Also rough-skinned file-fish; colourful *Unraenas*, relatives of eels and richly orange-striped, velvet-black angel-fish, *Pomacanthus imperator* with spines on their cheeks. Most of these fish showed warning colours and are bitter or distasteful and left alone by predators. In contrast, striking red and silvery armoured soldier-fish

(*Hilocentrum*) are as edible as the red and grey mullets, sea-breams, garpikes and flying fish in the Gulf. So far back as 1879, Klunzinger listed some 760 fishes in the Red Sea.

I was interested in some of the remarkable colour changes in fishes which sometimes eclipse the chameleon, due to contracting or dilating pigment cells in the skin. The limited range of pigments is overcome by close combinations, such as bright green appearing not from green pigment but juxtaposition of black and yellow.

These colour phases are brought about by gland-like action at the nerve endings secreting neurohumor, which has two types, one spreading pigment, the other causing it to contract. However, the black and red fish from great dark depths in the oceans apparently don't change colour, as it has no advantage. Nearer the surface it enables fish to harmonise quickly with ever changing surroundings. Such fish can be placed in tanks with variously coloured sides and floor to test this. Flounders can accommodate quicker with brown, yellow or red than with blue or green backgrounds.

Colours vary most where the most notable changes take place in their habitat background; but some species—recognition marks, like 'eye-spots' usually remain constant, or intensify

A Red Gurnard—one of the 176 species from the Red Sea listed in 1879 by Klunzinger



in males under excitement from rivals or food. Such marks may keep shoals together or even 'freeze' their prey from escaping. Poisonous trigger-fish undergo marked changes when threatened, which is part of the warning nature of their colours.

In spring, female sticklebacks follow after the red tassel of an angler's pike spoon, or a tuft of red wool; but less than half go after yellow and few blue. This is probably because the male stickleback is marked with red in spring. Male sticklebacks are also attracted to anything red; it stimulates rival challenge, like the so-called robin redbreast which really has an orange chest.

Dark vertical lines, as in angels, are counter-shading to break up the outline in disruptive camouflage. Most fishes are short-sighted with little perception of detail, with a wholly sensitive retina instead of one sensitive spot like our eyes. They are more sensitive to movement. They can be trained to

recognise worms dyed red. Eels invented spectacles with part of the cornea standing slightly away from the surface to retain moisture when leaving the water to cross dry land. The four-eyed blenny invented bifocals, a divided cornea with a different angle to see above and below water as it swims.

Flora and Fauna near London

In a study of aquatic plants in the improved River Wandie, a Thames tributary near Wandsworth Bridge, London Natural History Society reports horned pondweed at Mill Lane and Goat Bridge, as well as *Potamogeton crispus*, starwort and *Elodea*. There are also *Elodea nuttallii*, yellow water-lily, *Potamogeton pectinatus* and *densus*, *Scirpus lacustris*, water-crowfoots and yellow cress in past records which don't seem to have recovered very rapidly and a longer clean water period may be necessary.

Elsewhere, palmate newts, usually

montane, found their way to a garden pond at Pinner's Heybridge Avenue, while Uxbridge Technical College has a well-established colony of great crested newts. Smooth newts are the usual visitors to London garden ponds. Common toads still spawn over most of Hampstead Heath and in Alexandra Park. A Surrey enthusiast spawned them in his fish-tank and liberated toadlets on Wimbledon Common.

More interesting were sand-lizards on a garden wall and compost heap in Totteridge, near the Pastures, in Hertfordshire; adders still on Kent's Hayes Common and Surrey's Banstead Heath, but declining; and several grass-snakes from Bookham and Hayes commons to Greenford. Common lizards are numerous on Hayes and Keston commons and more open parts of Bookham, and slowworms at Totteridge, Finchley, Mill Hill, and near Bookham railway-station.

MAJOR SOUTHERN FISH SHOW FROM 'AQUARIAN'

The Aquarian Fishkeeping Exhibition '84 to be held at Kempton Park Racecourse on June 9th and 10th promises to be one of the most important and sophisticated aquatic shows to be held in the UK. It is being organised by Thomas's the manufacturers of the 'Aquarian' range of flaked fish food and aquatic remedies in conjunction with the Association of Aquarists.

Although the show is only now being publicised it would appear that there is already great interest and support from all areas of the trade. Ron Hillcoat of 'Aquarian' said, "When the Association of Aquarists approached us last year about the need for a major event like this in the South, we had no hesitation in committing ourselves and

decided at the outset that this would be a prestigious show. For the first time at an event of its kind all trade stands will have purpose built units which will be matched by a large number of tableaux entered by aquatic societies from all over the country. With the combined experience of all the sponsors I have no doubt that the Aquarian Fishkeeping Exhibition is going to be a major success."

Before finally selecting Kempton Park as the venue for this show the organisers looked at many alternatives which were rejected for various reasons. Kempton provided all the necessary facilities as well as being only 40 minutes from Central London and just off the M4. The racecourse has massive free parking areas and the hall itself is well laid out with

ample bars and catering facilities. Adjacent to the exhibition hall is the elegant Kempton Manor within which is a large auditorium where every hour, guest speakers will demonstrate various aspects of fishkeeping. Also within the Manor there is a comfortable lounge bar and full restaurant facilities for those who wish to relax over lunch.

A wide range of trophies and prize money is to be presented after judging under the auspices of the Association of Aquarists.



If you care to take a quick look through the many publications available listing tropical fish, you will notice an apparent lack of information regarding this interesting cichlid. Being, perhaps, not the most colourful of aequidens species may account for the rather sad fact that this particular fish has never really gained the popularity with aquarists as other members of the family have done. Another reason could be that *A. paraguayensis* is rarely seen for sale in dealers' tanks. Why this situation should be, remains a mystery, for when you begin to consider the interesting mouth-brooding characteristics of this fish, coupled with the exemplary brood care afforded by both parents to the safety and well-being of their offspring, it seems even more baffling why this aequidens still rates a low position in the aquarists popularity stakes.

Description

Hailing from the River Paraguay and its tributaries in central South America, this fish can attain a length of approximately 6 inches, but tank-raised specimens rarely grow to more than 4 inches or so.

The overall body colour of adults is one of a brassy sheen, crossed both vertically and horizontally by black bars. There are from seven to nine vertical bars along the sides of the body, the first four or five being divided by a darker horizontal band stretching from behind the eye to the rear of the dorsal fin. According to the whim or condition of the fish, these bars can be increased or decreased in intensity at will—sometimes fading away altogether. The forehead is very broad, and the bars that cross this area tend to join together where they become divided by the horizontal band, forming a saddle-like marking, rather similar to a large curved capital letter "D". The mouth is relatively large for a fish of this size, having a white border to the top and bottom lip (possibly acting as a visual stimulant for fry seeking refuge from danger during the brooding cycle).

Both male and female exhibit the same coloration and markings, with the female, possibly, just a little heavier in the body. The only reasonably

An unappreciated CICHLID

(*Aequidens
paraguayensis*)



by John H. Baker

accurate method of sexing this fish (assuming you don't have a naturally matched pair), is to view the length of both dorsal and anal fins. The male, in the usually true cichlid fashion, has both these fins more elongated, with the dorsal fin tip sometimes overlapping the top edge of the caudal fin. The caudal fin, too, has each ray protruding from the rear edge giving it a lace-like appearance. Under suitable lighting, such as Gro-lux, the males finnage can look extremely colourful, taking on the delicate iridescence of mother-of-pearl. The pectorals are also more developed in the male, and the leading edge has a white border. Females are similar, but again, the length of this fin is much less.

Conditions

This fish makes no great demands on the aquarist as regards water chemistry. Middle values suit it admirably, and a temperature in the region of 74°-82°F is fine. For attempting breeding, the higher values should be maintained.

It is advisable to house these fish in fairly roomy quarters as they can become rather aggressive at spawning time. A large tank affords a better chance for a female to hide from an over-ambitious mate. Thirty inches in length would be an absolute minimum for an adult pair, four feet being the ideal.

It should be decorated with rocks and roots around the back and sides to allow plenty of retreats for hounded fish. Two or three medium sized round stones should be placed near the front of the tank, on which (hopefully) spawning will occur. Heavy

planting seems to reduce the timidity of these fish, and as they do no damage to even the most delicate plants, this can easily be accomplished. In my own tank, I have let *Hygrophila polysperma* and *Synneura triflorum* virtually run riot, thriving beautifully in the water conditions created for the fish.

It is necessary to carry out bi-weekly (or weekly) water changes of at least 1/3 the tank's volume as, along with other aequidens species, these fish are prone to certain disease if the water is allowed to become too mature.

Breeding

If breeding is desired (and with a suitable pair this is inevitable) it would be advisable to purchase about five or six young fish and allow them to pair off naturally. If young fish are not available, then it would be a wise policy to try and obtain one male and a couple of females. In this way the male's natural eagerness and aggressiveness can be divided equally between the two other fish, so preventing him from possibly injuring, or even killing, a lone female who was not yet ready to spawn.

The fish are sexually mature by the time they reach 2 inches in body length, and when you notice a couple taking an interest in each other, and chasing the remaining occupants away, then this is the time to remove them to the tank that will become their permanent home.

After a period of general tail-slapping and fin-displaying, the pair will indulge in bouts of lip-wrestling that can last anything up to fifteen minutes per bout. Assuming neither fish back down during these tests of

strength, a natural pair-bond is established that will remain with the fish for the rest of their lives. This behaviour will probably continue for a couple of days, interspersed with periods of mouthing a certain flatish stone that takes their attention. Very soon all of their interest is focussed on the stone that will become the spawning site. The activity increases to such an extent that both fishes work themselves into a frenzy, not just meticulously cleaning every particle from the stone, but sometimes indulging in a little gravel moving too—although I hasten to add that this fish is not a real digger but more of a "gravel mover"—where just a few odd stones are moved from A to B, and then usually back from B to A again.

Late afternoon appears to be the usual time for egg-laying when anything from about 80-400 or so translucent whitish eggs are deposited and duly guarded and fanned by both parents. If spawning has occurred in a tank with another fish present (as happened with my pair once), the intruder is kept well out of the proceedings in no uncertain manner. Usually, however, the unfortunate fish is merely nudged out of the spawning territory without damage being done. Perhaps it would have been a different story if the tank housing them had been smaller, not allowing the other fish to seek refuge amongst the rock-work.

After 48 hours or so of constant fanning, the parents begin to "pick" at the egg mass. At first it appears their motive is to remove the non-fertile eggs before they fungus and threaten the remainder, but on closer inspection it will be seen that both fish are taking the eggs into their mouths. Again, this activity usually takes place around late afternoon and by late evening all eggs have been removed to the comparative safety of the parents' mouths. Although you may think it impossible, they continue to take food for a few days without managing to spill even one of their progeny whilst doing so! However, after a few days, they refuse food and their chins begin to visibly distend as their young charges start to wriggle and become more active. It is not an uncommon sight to see one

fish standing guard while its mate releases the wriggling fry—obviously gaining as much relief itself as the fry are getting exercise. But let danger threaten and immediately the whole batch of wrigglers are quickly sucked back into the now rather cramped confines of the parent's mouth. The situation becomes even more uncomfortable for the adults when the fry reach the free-swimming stage (at around seven days from the eggs being laid). At this time, they are spat out at frequent intervals while both parents mount guard back to back. I have found that by depositing newly hatched brine shrimp in a certain area of the tank (using a pipette to direct them to the desired spot), the parents will then release the fry in order for them to feed.

Brine shrimp should be offered for the first week, together with microworm and liquid fry feed. From two to three weeks old they are able to take finely chopped *nsifex* and flake food. They are not fussy feeders at all—the main headache is to be able to have a constant supply of food at all times to satisfy their heavy appetites. With anything from 100-400 mouths to feed, the main task is to keep up supply with demand, apart from trying to find enough tanks for them to occupy.

When the fry are about two weeks old the parents begin to lose interest in their offspring, perhaps just occasionally catching an odd individual who has wandered off the beaten track, and spitting it back into the main batch. The fry, too, at this time start to leave the tight confines of their shoal, and begin to swim at all levels. It is around this time that the fry may safely be segregated from the adults without seemingly upsetting the harmony existing between them. I have found, to my cost, that to try to attempt separating the fry before they have become able to fend for themselves, you run the very real risk of turning the parents against each other. It seems both fish accuse each other of devouring the brood, and aggression ensues.

But by allowing the adults to gradually lose their interest in their progeny—as and when the shoal take off on their own and become less and

less dependant on them for protection, the natural pair-bonding developed between them remains intact and peace prevails. If the pair are then kept well fed on a plentiful supply of live meaty foods, you can expect another spawning about five weeks later.

The young fish bear a remarkable resemblance to other *Aequidens* species at this time. By the time they have reached one inch in length, the general coloration is silverish. There is a dark vertical bar running from the forehead through the eye and down over the cheek. A dark spot appears roughly half-way along the body, but in some specimens, this spot is absent or very pale. If it was not for the broad forehead, you would be forgiven for thinking they were the young of *Aequidens maroni* if you had not been acquainted with *paraguayensis*.

From one inch onwards, the characteristic vertical bars begin to appear, and the dark band running through the eye becomes weaker, until it virtually disappears altogether. Sexing can be achieved around the 1½-1¾ inch mark, when it will be noticed that the dorsal and anal fins are becoming more developed in the young males.

They are voracious feeders, and with heavy feeding, it becomes imperative to carry out frequent partial water changes if no losses are to incur. I recommend changing at least 25% of the volume every three or four days—according to how many fry are being kept. A simple poly foam filter is sufficient to give the required aeration and filtration, but it must be cleaned regularly—say every time you perform a water change—and the air flow must be adequate to ensure a good circulation of water. So there you have it. A fish that is easy to keep; exhibits extreme parental care; is a semi-mouthbrooder and with care, pairs mate for life. I think you would agree this species has all attributes that would—and should—make it a valuable addition to any aquarist's collection.

Hopefully, in writing this short tribute, I may well have kindled the interest in just a few people to try their hand at keeping this cichlid—perhaps helping this species to gain the popularity it deserves.

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towards both fish and other invertebrates as they do so.

As is widely known, hermit crabs live inside univalve mollusc shells, such as whelks and conchs, to provide protection for the soft rear part of the body. Less widely appreciated is the need for a few spare shells of slightly larger sizes to be available in the tank to provide alternate housing for the growing crab.

In complete contrast to the hermits are the tiny, delicate porcelain crabs, so called because their carapaces (dorsal shell) are often shiny and brightly decorated. These delightful little animals frequently hide among the stinging tentacles of sea-anemones where they gain protection from predators. Unlike other crabs which tend to be opportunist scavengers the Porcellanidae have a complicated and well developed filter-feeding mechanism which they rhythmically fan through the water to trap microscopic food particles. Porcelain crabs make splendid additions to an invertebrate tank but care must be taken that there are no other animals present likely to prey upon them. Like all crustaceans, they have a hard outer shell which is shed repeatedly to allow growth. For a short time after ecdysis (shell-shedding) the animal is soft and unprotected and a very tempting morsel to many predators.

An alternative form of protection is adopted by the sponge-crabs which are masters of camouflage. These bumbling, spindle legged crabs have very spiny shells which they decorate with sponge, algae or any other material which will help them blend into the background. In the aquarium they look remarkably like large, hairy spiders and are one of those animals you either love or hate. They are easy to maintain, generally long-lived and often become tame enough to take food from their owner's fingers.

Closely related to the sponge-crabs are the spider-crabs and the



commonly available Arrow-crab, *Stenorhynchus seticornis*, from the Caribbean Sea. Arrow-crabs make particularly interesting aquarium inmates. They can be easily sexed in that the males have much heavier main claws, but if a pair is to be kept they should be introduced at the same time, as large specimens will often severely damage smaller, newly introduced Arrow-crabs. They are named for their body shape which terminates in a long pointed and barbed snout which is used as a temporary food store, food surplus to immediate requirements being impaled on the spikes and saved for future use.

The typical crabs, like those of the British shore-line, which are heavily armoured and bear strong claws, have no place in most marine aquaria. They are destructive in the extreme, anything which is not already of a suitable size to be eaten being torn to size in very short order.

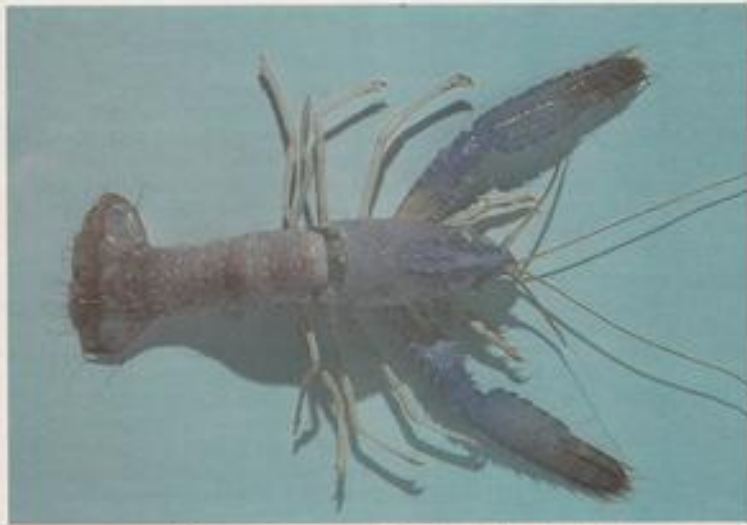
Occasionally sharp eyed aquarists





The very primitive Horseshoe or King-crab is not a crab but is more closely related to the spiders. It is easy to keep but spend much time under the gravel

The shed skin of the Hawaiian Lobster (*Emoplometopus occidentalis*), one of the few lobsters which can be kept with reasonable safety in domestic aquaria



The brilliantly coloured Cleaner Shrimp (*Lysmata grabhami*) not only makes an efficient scavenger but picks parasites and infected tissue from ailing fishes

This rich crimson and white Hippolytid shrimp from Sri Lanka is probably the most expensive shrimp currently available. It is found in deep water and has similar habits to *Lysmata grabhami*

may see King-crabs, or Horseshoe-crabs as they are also known, lying almost covered by gravel in dealers' tanks. These are essentially nocturnal scavengers and look rather like a grey, up-turned saucer with a short knitting-needle for a tail. Although called crabs they are actually part of the phylum Chelicerata which includes the land spiders, and make well behaved if somewhat shy inmates. There are now only four species as the surviving members of a much larger group which flourished 200 million years ago.

While many of the crabs can prove destructive, the vast majority of shrimps and prawns offered for sale make excellent additions to marine aquaria. The only commonly seen exceptions are the mantis shrimps (Stomatopoda). These species are often brilliantly coloured in red and green but spend most of their time in caves or excavations beneath rocks where they wait for unsuspecting prey, in the form of fish, worms or other crustaceans. They are armed with two razor sharp, blade-shaped claws with which they can easily slice through fish, crabs and into aquarists' fingers. They also have viciously spiked claws, like those of a praying-mantis, to grasp food animals which survive the initial onslaught. Despite these anti-social habits mantis shrimps are quite popular and if kept by themselves make intriguing and entertaining pets. They can grow to six inches long and are among the few invertebrates which seem to recognise their owner.

In complete contrast the cleaner shrimps of the family Hippolytidae are a positive benefit to the average aquarium. In the wild they perform a very valuable service in picking parasites and damaged tissue from the bodies of fishes, often very large species such as groupers and moray eels. They will continue this in captivity where the regularly available, scarlet and white *Lysmata* (*Hippolytina*) *grabhami* makes an attractive alternative to the commonly kept Cleaner Wrasse

(*Labroides dimidiatus*). Cleaner shrimps are happiest when kept with their own kind and in this situation fertile eggs are often produced. These regularly hatch and give rise to tanks full of jerkily swimming nauplii. Unfortunately the problems of feeding these larvae have yet to be solved.

The first crustacean to be regularly imported was the Coral Banded shrimp (*Stenopus hispidus*) and it is still justifiably popular. It is brightly coloured, with red and white hoop markings and sports greatly extended white feelers. Coral Banded shrimps are best kept singly as incompatible specimens will fight and severely damage each other. Occasionally dealers can supply male and female pairs which will live together quite happily for several years. Like all crustaceans *Stenopus* have to shed their hard outer shell to allow for growth. The old shell is cast off in one piece, a perfect, if slightly smaller replica than the now grown shrimp. Newcomers to the world of crustaceans are often surprised to see a second shrimp or crab in the tank which, the night before, held only one.

The cheapest, and one of the hardest of the various red and white shrimps is the Candy Shrimp (*Rhynchocinetes* sps) from Sri Lanka. Unfortunately they are often more timid than the foregoing species.

Symbiosis between clownfishes and sea anemones is well known and a similar form is enjoyed by the Periclimenes shrimps—known as anemone-shrimps. These small shrimps typically have glass clear bodies decorated with white, yellow or orange spots. They are found nestling among the tentacles of *Stoicactis*, *Radianthus* and *Disco-soma* anemones but their presence there is rarely tolerated by clownfishes and so mixing the two animals in the same tank should be avoided.

Most crustaceans have very catholic tastes, accepting almost all the commercially available foods with great gusto. One notable

exception is the Orchid Shrimp (*Hymenocerus elegans*). This beautiful creature is porcelain white with rich blue-green spots and bears two enlarged and flattened front claws which it waves like flags. Many hobbyists have bought them, only to have them die within a week or two after having refused all foods. The Orchid Shrimp appears to be restricted to eating starfish, a diet most amateur fishkeepers find both difficult and expensive to supply. Curiously, if the arms of a captive starfish are damaged the animal usually dies within 24 to 48 hours but *Hymenocerus* can keep their prey alive until it is almost totally consumed, a process which can take a week or two if the starfish is reasonably large.

There are many other species which are available from time to time and almost all can be relied upon to make good additions to the tank. The same cannot be said for the various lobsters and crayfish which are often available.

Lobsters are distinguished, for practical purposes, from crayfish by the possession of large, heavy and strong claws. Crayfish, instead, have very elongated and somewhat spiky feelers and generally are the better bet for aquaria. Small green and white and purple and white species (*Panulirus* sps) make excellent scavengers when small but they grow quickly and their digging often sends the tank decor tumbling. Comparatively few types of lobster are available, one of the commonest being the Hawaiian Lobster, *Enoplo-metopus occidentalis*, which varies from lilac to deep red, with white spots. These tend to be shy but are better behaved than the more heavily armoured species which should be kept alone if expensive losses are not to occur.

In general most crustaceans should pose few problems to most marine hobbyists. They make few demands by way of feeding and provided water conditions are good, with a fairly high pH and plenty of aeration, they will live long and interesting lives.



Coldwater Jottings by Frank W. Orme

NO MATTER what the weather may be like during this month of February, we know that spring is not too far away. Soon the trees and hedges will be donning their mantles of green and some early bulbs will have already bravely pushed their heads above ground as harbingers of the slowly awakening new season. As though with reluctance, the temperatures are gradually rising and the hours of daylight increasing. Before too long our fish will start to respond to the call of Nature's quickening tempo. Sluggishly the lethargic fish will begin to seek food in order to satisfy a growing hunger.

For our part, do we not also respond with a quickening of our anticipation? The coldwater fishkeeper is particularly prone to this annual rekindling of enthusiasm, evidenced by an increased interest leading to more frequent visits to the pond or fish-house. With growing pleasure we witness the renewed activity of our charges and, if interested in increasing our stock, begin to make plans for the coming breeding season.

Despite our enthusiasm, care must be taken not to overfeed at this early period (or at any other time for that matter), for uncasten food could lead to pollution of the fishes' environment. Initially offer very small amounts of food which leave the recipients still looking for more. Underfeeding sel-

dom kills, but many fish have died from the results of offering too much food to be quickly eaten. Possibly live *Daphnia* could be advocated as the ideal for feeding to the fish at this time of the year; uncasten *Daphnia* would survive for a time without causing any pollution, to be consumed later. There is, however, a risk in offering *Daphnia* which has been taken from waters containing fish—even if taken from fish-free waters there remains the possibility of introducing unwanted pests. Nevertheless *Daphnia*, if available, can be used provided care is taken

to ensure that nothing undesirable is also being introduced to the fishes.

In nature fish live by going through periods of plenty and periods when food is short. Dame Nature does not encourage her wild creatures to become overfat—nor does she like them to starve for too long. In natural waters the awakening appetite of the fish is satisfied by a corresponding increase in their natural foods. We should take note of her methods and treat our coldwater fish in a similar manner; she has, after all, taken care of her many creatures for much longer than we humans have and, dare I say, with much greater success.

Koi enthusiasts may be interested in 'Koi USA' which claims to be the largest Koi magazine published in the U.S. It is a bi-monthly magazine, produced under the supervision of the Associated Koi Clubs of America by volunteer staff, containing articles aimed at all levels of experience and covering all aspects of the hobby. Details can be obtained by writing to P.O. Box 1, Midway City, California 92655, U.S.A.

Not so long ago the schedule of an open show for coldwater fish came into my hands. The show was to be held in Newcastle upon Tyne, and catered

Continued on page 43



The Lionhead is also known as the Bramblehead, a name introduced by the G.S.G.B.



by
Roy Pinks

Just over a year ago I had to suspend my tropical fishkeeping because of extensive and highly disruptive building operations. This meant that tanks and equipment had to be stored and the remaining fish were relegated to a small tank in a spare room. Most of the fish were several years old and took the move badly, so there were numerous casualties over a period. By the time we were ready to begin putting things together again only three survived—a cardinal, a splash tetra and a Pakistan loach. When it came to the final transfer, the *Botia lohachata* alone made the grade—a point worth noting on the part of those who have doubts as to the hardiness of this group of fish.

With the exciting prospects of setting up tanks again I tried, as usual,

to analyse past mistakes and avoid some of the costly and distressing failures which conspire to defeat us. My main interest was to reassemble a 36 in. tank in the sitting room: this was always intended as some sort of showpiece, and as such it tended to play the part for a month or so, and then deteriorate because of widespread failure of the plant life. One of the drawbacks was that it was 18 ins. deep, and this tended to make it difficult for the available light to penetrate to all parts. I enhanced the number and type of overhead fittings so that I could build up an intensity towards noon and drop it off during the evening, but the efficacy of this was never properly tested because a prolonged attack of white spot made it necessary for me to add so many dosages of remedy to the water that the plants took a battering from which they never fully recovered.

It should also be recorded that no undergravel filter was installed, nor was there any filtration system on a permanent basis: I occasionally tried out a new type of removable filter, but these were never resident. My main dislike of undergravel filters was their alleged contribution to the failure of plant life by removing from the substrate the very elements on which most aquarium plants actually develop. I begin at this point to sympathize wholeheartedly with the beginner, who is beguilingly talked into buying all the gadgets, yet not understanding too clearly why he is getting them or how he is going to get the best use from them.

I think the situation can be expressed most simply by saying that the choices you have are:

(a) a tank, understocked with fish and overstocked with plants without filtration;

or
(b) a tank, understocked with fish and overstocked with plants with undergravel or similar filtration.

In the case of (a) you will tend to develop fine fish and thriving plants but the water will look dullish and there will be a depth of mulm on the tank floor. In the case of (b) the impression will be one of brightness and extreme clarity of water, and the fish will look lively and active. Plants tend to look thin but just about adequate. They usually seem to have just been put there, lacking the thrust of those which have become well established and are putting on growth.

It might be concluded from the above that an ideal situation could be achieved by combining the two, namely installing a filter but only using it occasionally. But in fact one has to consider what an undergravel filter actually does. The principle is that you leave some space under the gravel to enable moving water to travel through it. You cause the water to circulate by drawing it up the vertical uplift tubes by air pressure from your pump. The passage of water through the gravel encourages the growth of bacterial colonies, which break down the mulm in order to survive and multiply. It is the presence of fresh, oxygenated water which keeps the bacteria going. If this stops for long enough stagnation results and the tank becomes polluted.

I was in something of a dilemma in setting up my tank. I intended using up to 4 in. or more of gravel in order to achieve certain landscaping effects, but at this depth pollution is highly likely sooner or later, and there was a strong argument for an undergravel filter in any case, since the greater surface area of gravel offered much improved footholds for bacterial colonies to thrive on. On the other hand, since I aimed to achieve, one way or another, a really good initial plant growth before introducing any fish, the operation of a filter from the outset was not likely to help me. I therefore decided to install an undergravel filter, to be used when

Botia lohachata seems tougher than one would expect from the literature



COMMENTARY

it seemed that the overall state of the tank needed it. This might be months or even years off, but it seemed to be a reasonable precaution to take, and I did not regard it as an immediate working

essential. It would have to be borne in mind that if and when it did operate, its rate of turnover would need to be assessed. Many aquarists imagine that unless some gadget is working flat out the best results will not be achieved, but nothing could be further from the truth. The undergravel filter in the

shop will certainly have to run at high turnover because the fish are usually crammed pretty tight. If you work to the above formulae you will only ever need to run the thing gently, and in these circumstances perhaps the worst effects of the arrangement on plant life may be avoided.

Coldwater Jottings

Continued from page 39

for 15 classes—which included Goldfish in both single and twin tail varieties. I was, however, puzzled to find that there were classes for metallic, nacreous and calico types. Most aquarists know that the metallic type has the burnished, reflective scales typical of the Common Goldfish. But what is the difference between the calico and nacreous types? Nacreous was a term introduced some years ago, by the Goldfish Society of Great Britain, as being more accurate than the term calico. Nowadays both terms are used to describe the same scale/colour type, typified by the Shubunkin. It was also noted that one class gave, amongst others, the Lionhead and Bramble (presumably short for Bramblehead) as suitable varieties for the class. Again it was

the G.S.G.B., which introduced the name Bramblehead for the Lionhead—although it found little acceptance within the hobby. In other words, the organising society appeared to have a lack of knowledge in respect of the Goldfish varieties. Nacreous or calico is one and the same; the Lionhead and the Bramblehead is the same variety of Goldfish. It was a pity that the organisers did not ensure that they had the Goldfish classes correctly described. I wonder what they considered were nacreous, as opposed to calico, type Goldfish in order to separate the classes according to the schedule? Hopefully, these mistakes will not appear in any future schedule prepared by the society, for Coldwater Shows are not that numerous and should be encouraged, because it could be enough to decide a Goldfish exhibitor against entering any fish in that particular show.

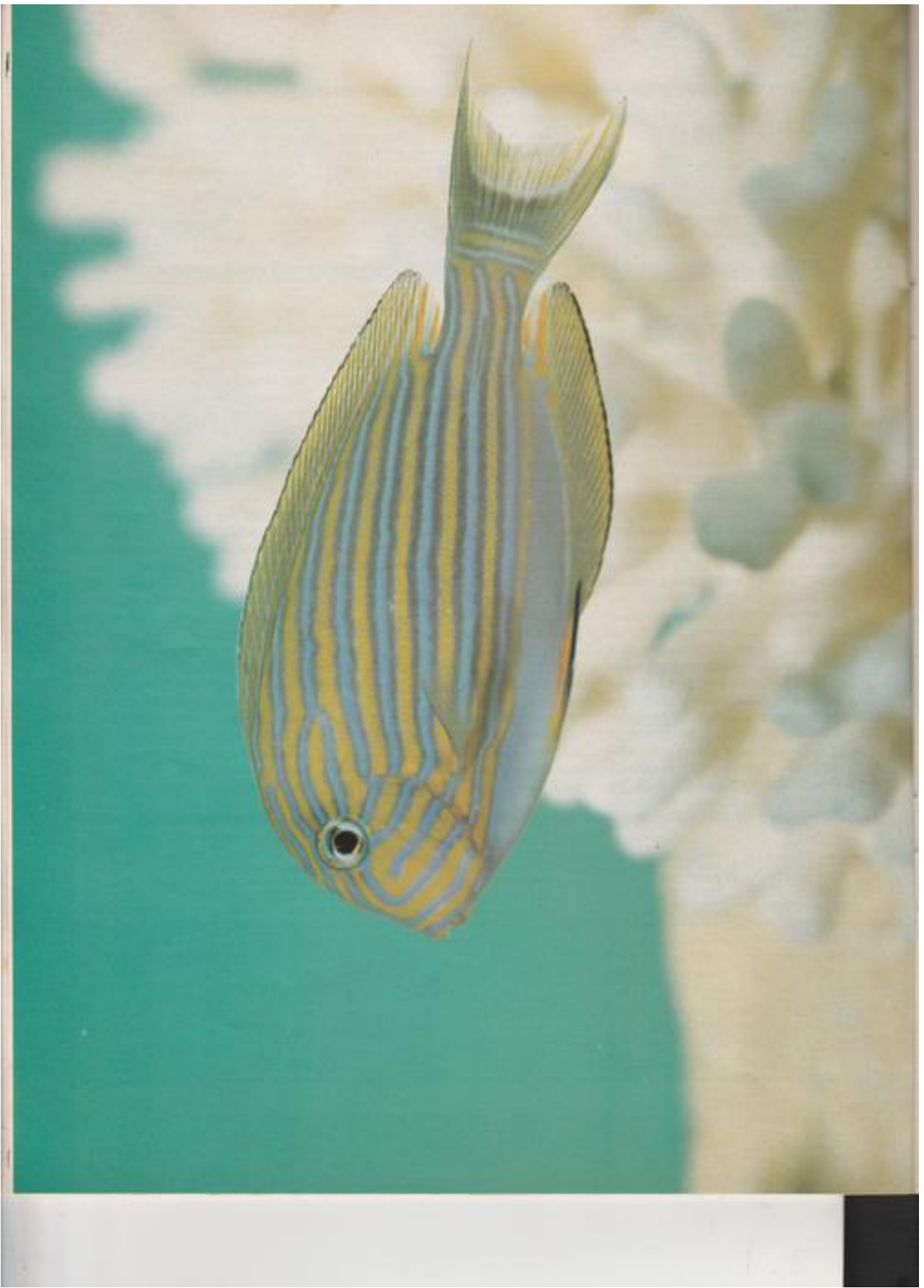
For general purposes it may be said that most varieties of fancy Goldfish can be found in three types, i.e. metallic, nacreous (also known as calico) and matt. The metallic type

(or group) has the shining metallic-looking scales found on the ordinary Common Goldfish, its colour may be reddish-orange, yellow or silver. It may also exhibit one or more of these colours together with black, however, the latter colour is not permanent. Nacreous/calico fish are the most colourful, exhibiting either a single colour or a number of different colours—whitish-pink, yellow, orange, red, blue, violet, brown and black. The scales lack the metallic appearance of the Common Goldfish, being transparent, however, there are often areas with a mother-of-pearl shine. It is this mother-of-pearl shine which gives rise to the nacreous title. Matt type Goldfish lack reflective tissue and are, usually, a pinkish-white colour with black eyes and always with reddish gill covers. This latter group may, sometimes, have similar colour(s) to the nacreous group which will appear much more intense due to the complete lack of reflective tissue. The normal type of matt fish is not considered of any great value by most Goldfish enthusiasts.

OSCAR

G. Robinson





SPOTLIGHT

The PYJAMA TANG

THE Pyjama Tang, or Striped Surgeon, as it is also known, is one of the very wide ranging family, the Acanthuridae, which are found throughout the tropics. Wherever there is warm, well oxygenated seawater and an ample supply of vegetable food, members of this family can be found. As a group they are characterised by having a pair of sharp spines at the base of the tail. In some species, such as the common Lipstick Tang (*Naso lituratus*) these spines are permanently erect. However, most of the Acanthurids retract these spines into grooves in the caudal peduncle and only extend them when defending themselves from, or threatening, other fishes.

The Pyjama Tang, which is obviously well named, has its spines well concealed among the stripes on the tail but several species advertise the scalpels' presence with bright colouring around the sheaths. The very desirable Achilles Tang from Hawaii is probably the best example, a vivid scarlet patch marking the danger zone.

The surgeonfishes are very popular with marine hobbyists for they present a wide array of colours, are not difficult to maintain and considering their size, often among the cheaper marine specimens offered for sale.

However, all too often, newcomers to marine keeping are disappointed with the performance of their fish. In the wild all the Acanthurids are wide ranging fish, found on the turbulent fringes of the reefs and in quite sizeable

Common name—Pyjama Tang
Specific name—*Acanthurus lineatus*
Size—Approx 9 inches

by

Martyn Haywood

shoals. In captivity many surgeonfish prove to be aggressive, particularly towards larger fish, and will sometimes be reluctant to feed. As often as not this type of behaviour is as least as much the fault of the fishkeeper as that of the fish. If a fish which is used to wide open spaces is enclosed in a small aquarium then aberrant behaviour can be expected. Many of the marine fish kept in aquaria are comparatively sedentary, either holding a small patch of reef as territory or patrolling a small area. These fish are usually eminently suitable for small tanks but only the very smallest specimens of surgeonfishes should be considered for tanks of less than 30 gallons.

The Pyjama Tang is found throughout the Indian Ocean and on the western fringes of the Pacific. Many fish are exported from Sri Lanka and the Philippines and so this fish is a common arrival in the shops. Unfortunately, despite its vivid colouring, it does not enjoy the popularity it deserves. When seen in the wild this fish's colouring is almost dazzling and when first imported they have this intensity. Unfortunately, when kept in the comparatively spartan environment of the retailers' sales tanks, the colours often fade.

However once they settle into the more peaceful habitat of a home aquarium, and particularly if there is a good growth of algae darkening the tank decor, the colour soon returns to its former glory. Indeed, many small specimens, particularly those from Sri Lanka, will develop a beautiful, delicate mauve sheen to the belly—a colour which is otherwise almost unknown among both marine and tropical freshwater fishes.

Some of the surgeonfishes prove reluctant to acclimatise to tank life, particularly the Powder Blue, Powder Brown and Achilles surgeons. Unless kept in 40 gallon or larger tanks these will often continually dash from end to end of the tank and are clearly distressed. Under this kind of stress these species may succumb to any of several stress-induced diseases. The Pyjama tang is much less prone to this type of behaviour and it is a rare specimen which does not settle and begin feeding within a day or two of its introduction to the tank.

Like most of the surgeonfishes, *A. lineatus*, will accept a wide range of foods. The smaller varieties of frozen foods, such as Artemia, Mysis, chopped shellmeat and squid are all suitable and readily accepted. In the wild, however, the Acanthurids are essentially herbivorous, grazing on algae, and eating only comparatively small amounts of animal food. It is vital to the long term health of all surgeons that the aquarist tries to simulate this kind of diet as best he can.

A well lit tank, which receives

SPOTLIGHT

regular additions of an algae fertilizer like SeaGreen will soon develop a healthy growth of green algae on which surgeons will graze throughout the day. Additionally a large proportion of the diet should com-

prise vegetable flake food, frozen spinach, frozen algae, well-washed lettuce and oatmeal. The digestive system of surgeonfish is designed to handle large quantities of vegetable matter and some, particularly *Zebrasoma* species (Sailfin, Yellow and Mink tangs) quickly develop problems if fed a diet which is too high in protein.

Some consideration should also be given though to what the fish's tankmates are to be. Like most larger marines only one Pyjama tang should be kept, putting two together being a certain recipe for

a demonstration of the effectiveness of the tail scalpels as weapons. Equally many surgeons will look upon larger fish of similar body shape, such as angelfishes (Pomacanthidae), as a potential threat and serious damage may result. In contrast they are usually safe to house with smaller fish and will not bother invertebrates other than those with feathery tentacles.

Given a fairly large tank, good water conditions and a proper diet the Pyjama tang is an eminently suitable candidate for the home aquarium.

NEXT MONTH

TO FLORIDA AND BACK. Keith Barraclough allows us to accompany him on his recent American trip. (Illustrated in colour).

SPOTLIGHT. Our feature next month will focus on a beautiful and highly coloured Goby.

Alan Hodgson describes his experiences in spawning **HOPLOSTERNUM LITTORALE**, a heavily armoured Catfish. **BASIS OF FISH HEALTH.** In the second of this fascinating series "Mayfly" describes the habits of the carp louse and how to deal with it.

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Fish Respiration

by Graham M. Clayton

I HAVE TRIED here to give an idea of the problems that fish face so that you will appreciate the difficulty they are presented with in clean, healthy waters. Maybe you will then think twice about overcrowding and tank maintenance.

Oxygen and life

Living organisms need oxygen for the release of energy, much of which comes from the oxidation of sugars and fats. After many small transformations, known collectively as respiration, this energy becomes available to the organism. Energy is not only required for the activities of the body—for the movement of muscles, conduction of nerves, secretion of glands—but also for the building of new tissue in the growth and reproduction of the organism, amongst numerous other things.

Oxygen is continually being used up within the organism and so fresh supplies have to be sought from the organism's environs, which is done via the gas exchange organ. In man, for example, this is the lungs, but among the crustaceans, molluscs and fish the gas exchange organ is the gills.

Aerial v. aquatic respiration

The great differences in air and water as regards respiration are shown in Table 1. The amount of energy required to push the air or water over the respiratory organ, ie lung or gill, depends upon the density and viscosity of the medium. Water is much more viscous and denser than

air, as anyone who has ever tried to walk through water will know. Hence man only uses about 1-2% of his oxygen uptake at rest to provide energy for the ventilation of his lungs. To move water over its gills, though, a fish has to expend more energy than this. G. M. Hughes suggested that this would account for more than 10% of the oxygen uptake of a fish at rest. So we have only just begun and fish already have a more difficult job to do.

A look at Table 1 will also show that water contains much less oxygen than air does. Oxygen represents about 21% of a given volume of air, but, even in well-aerated water, the oxygen concentrations seldom exceed 1% of a given volume of water. Hence fish are also faced with the problem of a smaller supply of oxygen. Consequently the fish must expose its gills to a relatively large flow of water to satisfy its oxygen requirements. Fish also have evolved a method which enables them to extract up to 80% of the oxygen from the water though, thus narrowing the gap between aquatic and aerial respiration. Man,

with his relatively inefficient lungs, only utilizes 25% of the oxygen in the air that enters his lungs. The reason for this great difference in the amount of oxygen used by fish and man from the surrounding medium is due to the counter-current system in the fish gills.

The counter-current system

Appreciation of this requires a closer look at the form and function of the gill filaments, the finger-like processes which radiate out, in close array from the gill arches. In the vascular, oxygen-catching part of each filament are tightly packed series of small, thin plates, usually called gill lamellae, as shown in figure 1. These delicate extensions of gill tissue, which may be leaf-like to semicircular in form, represent an enormous surface area over which water can flow. Clearly the more extensive the gills the greater the surface area through which oxygen can diffuse into the blood within the lamellae. Thus it is reasonable to expect that the more active fishes will have a relatively larger gill surface.

The blood in each lamellae, which flows in a fine network of capillaries, is brought very close to the gill surface, the intervening tissue being but a thin outer covering. Thus the path of oxygen molecules diffusing from water to blood is made as short as is biologically possible.

The blood flows across the lamellae in the opposite direction to the water. This is the counter-current principle and is a biological parallel to industrial heat-exchanges which employ a similar circulation to save heat energy by using hot exhaust gases from a furnace to pre-heat the air for combustion processes. So this pattern in fish

TABLE 1 Conditions for respiration in water and air

Respiratory medium	Water	Air
Respiratory organ	Gill	Lung
Oxygen content of inspired air	0.04-9.0 cc/litre	105-130 cc/litre
% utilization	Up to 80%	About 25%
Density	The specific gravity of water is about 1,000 times that of air (at 18°C)	
Viscosity	Water is about 100 times more viscous than air	

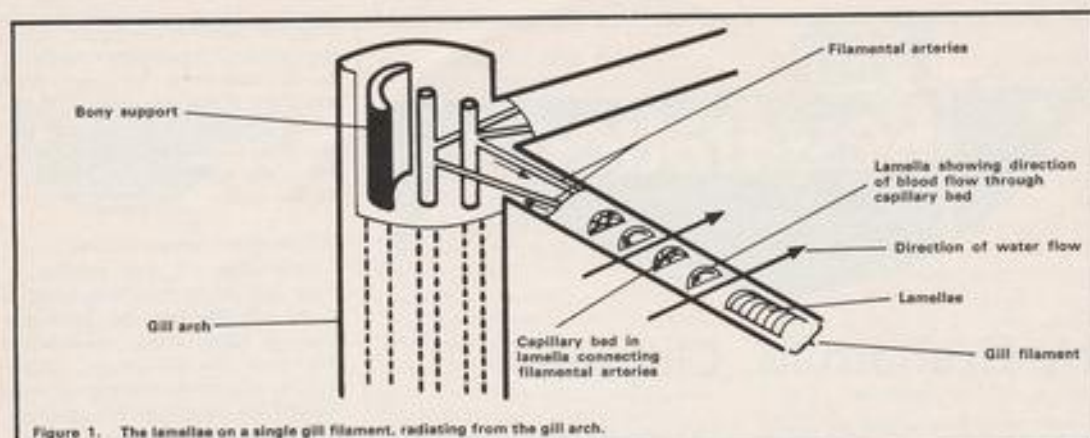


Figure 1. The lamellae on a single gill filament, radiating from the gill arch.

gills ensures that blood that has already become partly loaded with oxygen meets water which has had little of its oxygen removed from it. Correspondingly water which has had much of its oxygen removed is in contact with blood that is least saturated with oxygen. In this way it is theoretically possible for the blood to reach almost the same oxygen concentration as the inhalent water, as is shown in figure 2a.

In parallel-flow systems, where the blood and water flow across the gills in the same direction, the blood only ever reaches about half the oxygen concentration of the water at its best, see figure 2b. The counter-current principle in fish allows the blood to become about 80% as concentrated with oxygen as the water. So this goes part way to improving the situation of fish as regards their oxygen supply. The great efficiency of the system was shown by two Dutch biologists, E. H. Hazelhoff and H. H. Evenhuis, who experimentally reversed the flow of water through a Trout's gills and found that the amount of oxygen now absorbed was only 20% of the usual amount.

Complicating variables

The amount of oxygen used by fish, and all animals in general, varies according to many factors. Most important are their size, activity and temperature. Man only requires some 2-3 times the volume of oxygen per kilogram than that required by a

bony fish. Temperature affects the oxygen carrying capacity of the water and the metabolism of the organism. An increase in temperature will reduce the amount of oxygen per litre and increase the activity of the fish, which will then require more oxygen. The figures given in Table 2 are for Goldfish at rest or when swimming at constant speed, showing how the oxygen requirement affects respiration at differing temperatures.

Hence it can be seen that a 7-fold increase in temperature raises the metabolic rate some 28 times. So 28 times more oxygen is required, but the oxygen content of the water has, at the same time almost halved. The fish compensates for this by pumping more water through its gills in the same period of time. This increase of water flow, i.e. ventilation, is some 46-fold. (This ventilation volume is calculated at a utilization efficiency of 75%. This is marginally less than

the 80% theoretical maximum, but higher than the utilization efficiency when ventilation is rapid, since the efficiency falls under such conditions.)

Therefore an increase in temperature places a considerable stress on a fish. Table 2 also shows that the rates of fish oxygen uptake when active are only a few multiples of the resting rates. Humans though, when active, can take up 20 times more oxygen than when at rest and in insects this can be 100 times or more. With this in mind one can see the meaning of Dr. F. E. J. Fry's conclusion in his book, that "the maximum growth of fishes is likely to be more limited by the oxygen-carrying capacities of their gills than by the surface area of the alimentary tract that is available for the absorption of foodstuffs".

The implications to the aquarist

First, and the point I hope I have made most clear, is that water in the

TABLE 2 The relationship between temperature, the oxygen content of water, and the ventilation volume required to satisfy the metabolism of Goldfish

Temperature (°C)	Metabolism (cc O ₂ /Kg/hr) Active	Resting	O ₂ content of water (cc/litre)	Ventilation volume required (litre/Kg/hr)
5	30	8	9.0	1.3
15	110	50	7.0	9.0
25	255	140	5.8	32
35	285	225	5.0	60

(Source: G. M. Hughes, "Vertebrate respiration").

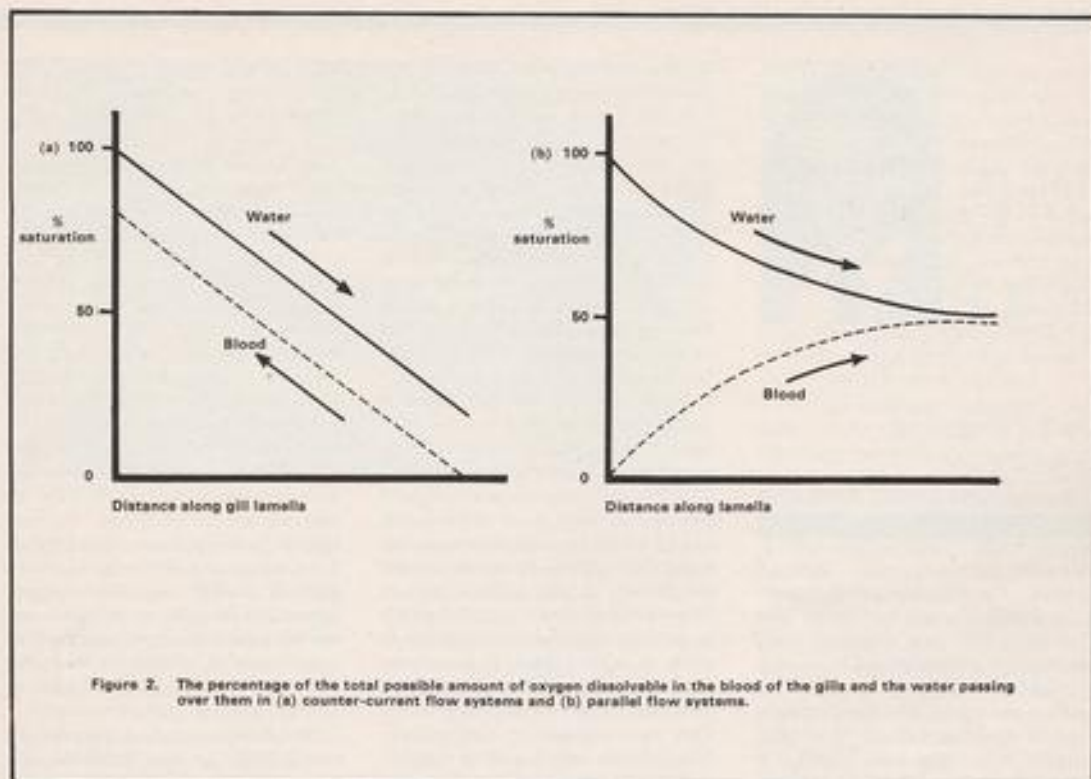


Figure 2. The percentage of the total possible amount of oxygen dissolvable in the blood of the gills and the water passing over them in (a) counter-current flow systems and (b) parallel flow systems.

best of condition is a difficult resource for animals to obtain oxygen from, be they crayfish, fish or snails. If you then appreciate this difficulty that aquatic organisms are presented with, maybe you will also appreciate the great service that good water management will give your fish. Rotting materials, such as uneaten food, excess fish excreta and dead fish, use up oxygen too and so compete with the fish for the little oxygen that is available. Therefore removal of dead fish and plenty of partial water changes will reduce the amount of decaying material present, then making more oxygen available to the fish. Plenty of aeration will also aid fish respiration by ensuring that as much oxygen as possible is present at all times.

Another point that was raised was that temperature increases place a stress on fish and so those White Cloud Mountain Minnows that you have in your tank at 78-80°F are

probably physical wrecks! Therefore check before you give the fish you buy a new home what its natural environment was like. If you care for your fish and want them to live a long and healthy life, which will be then cheap, enjoyable and trouble free to you, then find the temperature most suited to the fish and not just the temperatures it will survive in. Just as coldwater contains more oxygen than warmer waters, saltwater contains less oxygen than freshwater. So problems are more acute in tropical marine set-ups than in coldwater set-ups.

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Many books relevant here are expensive specialist books and so I recommend going to your local library for most of them. To look up the meaning of biological words which you do not understand there is an excellent dictionary called the "Penguin dictionary of Biology". The general principle of fish respiration is covered in nearly all general biology textbooks, such as J. W. Kimball's "Biology", Addison-Wesley (1978) and M. B. V. Roberts "Biology—A Functional Approach". There is also a very good book by N. B. Marshall called "The Life of Fishes". (1975) The Weidenfeld Natural History. When reading these books you will probably come across references to G. M. Hughes and his book "Vertebrate respiration" (1965) Heinemann Educational Books Ltd. This book, however, is very specialist and complex, and so is difficult to both obtain and understand.

WHAT IS YOUR OPINION?



by B. Whiteside.

B.A., A.C.P.

'Photographs by the Author'

WELCOME to this month's *W.Y.O.?* feature. I'm writing it in early December, 1983, but you'll be reading it in February, 1984. In February, 1964, my first article appeared in *The Aquarist & Pondkeeper*.

American reader, Mr. Martin Moore, has the following to say: "Regarding diseases in the aquarium: I believe it is possible to avoid them entirely, unless one routinely collects fishes from the wild. I have about five tanks which have been operating for variable lengths of time; the longest has been set up for over two years. In none of these tanks have I had any symptoms of disease or unhealth, with two exceptions: (1) A small firemouth cichlid—*Cichlasoma meeki*—whose caudal fin was torn up by the more boisterous tankmates; a minor case of tail rot set in; and (2) an African butterfly fish—*Pantodon buchholzi*—which had a parasitic nematode in one of its eyes. In no case have I had an epidemic of *Ichthyophthirius* or anything else. I attribute this to the fact that I do not overcrowd my fishes. In fact, the tanks are rather sparsely populated by some people's standards. And of course, the usual aquarium hygiene and maintenance procedures are followed. Only the largest aquarium has power (outside) filtration; it is a 34 gal. tank with a Dyanflo 150 filter. All tanks use undergravel filtration, except for

the one containing the firemouths; it contains nothing but an airstone. This just goes to show that it is unnecessary to spend a fortune on power filters and the like. A tank uncluttered with gadgetry is more pleasing to behold and much less expensive.

"As far as lighting goes, I have always used fluorescent bulbs. A 24in. bulb typically draws about 20 watts and puts out more light than a 60 watt tungsten bulb. Thus, it's much less expensive to operate. Also, the bulbs last a long time. I recently bought a Sylvania "Color Brite" bulb which is guaranteed not to burn out for three years, and is claimed to produce 54% more light than other fluorescent tubes. This last, claim appears to be true, and affords a solution to a problem I've had for a long time: standard aquarium hoods don't provide enough fixtures for the number of light bulbs I need to illuminate deep tanks. I usually have to produce supplementary lighting in order to achieve good plant growth. Also, the colour of the light is better than that of any of the other bulbs I've used, including "Aqualux." The Sylvania bulb is a better approximation of natural sunlight than anything else I've tried.



Pair of Angels

"As I mentioned, I use undergravel filtration extensively. I fail to understand some people's objection to these filters; they do not inhibit plant growth (or such has been my experience) and they prevent the build up of toxic

gases in the substrate around plant roots. They also take the place of power filters for removing ammonia. True, there are occasions when U.G. filters are not appropriate (as in tanks with burrowing or "earth-eating" fishes), but that is no reason not to use them when they are appropriate.

"I might mention that in this country I have never seen separate heating elements and thermostats offered for sale. The only units available are the usual integrated heaters. I have no reason to complain about these; they work extremely well and better models control the temperature to within one degree. On the other hand, separate units provide more machinery for the aquarist to look at, instead of fishes. I'm not sold on the idea of sub-stratum heating. I fail to see any advantages and can think of at least two disadvantages: these units must be more expensive, and the roots of plants may get too hot. I appreciate the information about the new "chip" heaters; I had intended to buy one, but now I definitely won't."

I've left Mr. Moore's original American spellings in most cases because they enabled me to identify that Mr. Moore is an American; he did not put any address on his letter. Two other little points also helped: Mr. Moore's letter was typed, which gave little away, but the writing in his signature indicated America or Canada; and when I held the paper up to the light I discovered a watermark that included the letters U.S.A., and the information: "74% cotton fiber content." Perhaps Mr. Moore's address was on the envelope of his letter; but all letters are opened at Brentford, and only the letters themselves are forwarded to my home in Northern Ireland. I hope he'll send me his address next time he writes.

Mr. George Thompson resides in Washington—but not in the U.S.A. His home address is 2 Berwick, Oxclose, Washington, Tyne-and-Wear. He wrote: "During the course of my employment I call at the kitchens of a local Indian restaurant and on a recent visit I saw a surprising sight. The staff were topping and tailing hundreds



Cardinal tetra

of 1-2in. fish, which appeared to be of the *Kryptopterus*—glass catfish—family, for the staff curry. When I saw this first I was very taken aback; then I realised that it is no different to our whitebait. It's just that I don't keep them in a tank at home.

"Once I got onto the subject they opened the freezer and took out a 15in. knifefish and a 2-3lb. *Clarias* catfish, also for food. It just seemed strange to me that the fish which some keep as pets are put in the pot by other races. It brought home to me a different side of this fascinating hobby. I will try to get some of the recipes so that your readers can try their prize fish in 'Molly Madras,' etc.

"Incidentally, I read some time ago that a prisoner serving a life sentence in prison was given a grant to do research into the possibilities of growing *Clarias* as a food fish on a commercial basis in Britain. I am quite sure he could be easily traced; and an article on his set-up and work would be very interesting."

The latest edition of my school magazine has been causing considerable interest on a national scale. As well as a lot of good poems, stories and playlets by pupils, I included a photo-feature that I produced on the 10 sets of twins who attend the high school in which I teach. Northern Ireland's leading newspaper, the *Belfast Telegraph*, took up the feature and pub-

lished an interesting article and photograph. Last week our twenty twins received front page coverage in the *Times Educational Supplement*. Today, Sunday, 4 December 1983, the twenty twins got a full double-page spread across the top of pages 4-5 in the *Sunday Times*—and a very good job of the photography was done by *Sunday Times* photographer Mr. Peter Dunne. I've just received a request from a national teachers' magazine for a photograph and story. I assume twenty twins out of 600 pupils must be rather rare. Did you see any of the articles? I've decided to splash out

for Christmas and buy myself a good camera with dedicated flash, etc. I hope I'll be able to take some rather more sophisticated photographs of fishes and aquaria for future features. I'm interested in the concept of TTL (through-the-lens) flash—where the camera actually measures the amount of light reflected from the film and switches off the flash gun when the film has been properly exposed. I hope I'll be able to write about my experiences in a future feature—and illustrate it with some pictures.

Having pounded my typewriter every month for 20 years to provide you with something interesting to read, I'm pleased to be able to include a letter from one of our oldest readers—and a fan of this feature—who was born in the last century. Street Farm Cottage, Park Street, Charlton, Malmesbury, Wiltshire, heads the letter sent to me by Mr. R. H. Chaplin, O.B.E., B.Sc., who writes; "Like the other readers of *The Aquarist* I derive much pleasure from reading your contribution each month; in fact, yours is the first article I read. I am 84 years old, am partially-sighted—hence the typewritten letter—and live alone in my 300-years-old, rejuvenated, Cotswold cottage.

"My interest in fishes—and reptiles—I inherited from my father. In

Pair of attractive killifish



1888, when he was 17, he caught a 9lb. 9oz. carp in the Penn Ponds in Richmond Park which he took home, alive, wrapped in some wet cloth, to where he lived in Pimlico. He kept it alive in the family bath for a week or so but ultimately decided to mount it in a glass case—which I have to this day. How many boys of 17 today could build a dust-proof case and mount a fish so successfully that it would still be in perfect condition nearly 100 years later?

"We always had an artificial pond in our garden, wherever we lived—mostly in or near Kingston-on-Thames—and my father built a 72in. x 24in. x 24in. aquarium in which he kept—after we had caught them by rod and line—roach, rudd, dace, minnows, gudgeon, carp, etc; and, disastrously, some small perch. These latter were only some 3in. or, at most, 4in. long but we realised one day that our shoal of minnows—large ones, 2in. or more long—was diminishing.

"As a youngster I built myself a vivarium which I stocked with grass snakes—caught locally in the brick-fields, since covered years ago by houses at New Malden—and viviparous lizards caught on Oxshott Heath. I also purchased large lizards from L. Cura & Sons, who had a reptile shop in the East End of London—circa 1910. About the same time I built a large cage in the garden and for many years we kept two pet monkey's.

"Matrimony, the bringing up of two sons, and my business commitments—I was the Chief Designer at Hawkers, and the prototype of the Harrier was my last aeroplane—meant that I had no spare time for any piscatorial activities on my part. About three years ago I returned to my old love of fishes and set up a 36in. tropical fish tank.

"I was prompted to write by your request for information about white worm culture. About a month ago I acquired a white worm culture from Burgh Aquatics of Skegness at 90p post free—as advertised in *The Aquarist*. Following the instructions sent out with the culture I set it up in a plastic



Glowlight—*Hemigrammus erythrozonus*

two litre ice-cream container with equal parts of John Innes No. 2 potting compost and peat, mixed with water and then squeezed out, into which I mixed the culture. A slice of moistened bread was laid on top of the culture and the lid tightly closed. I put this on the floor under my fish tank in my living room where the temperature is about 65°F as advised. After a week or so an inexhaustible supply of white worms is produced.

"Although the worms are available on the surface of the soil, particularly under the moistened slice of bread, my greatest difficulty is separating them from the soil. This I do with a pair of pointed tweezers—which is rather laborious, but perhaps a good thing as it stops me overfeeding the fish.

"Incidentally, I got a micro worm culture from the same source which successfully produces these worms. However, I find that because of their microscopic size they are not of much use to me; but I agree they would be perfect for fry.

"My one disappointment is my inability to contact fellow aquarists. The nearest society to me is in Bristol some 30 miles away, which is of little use to me because I can no longer drive a car because of my poor eyesight. I am sure that there must be other aquarists near me who might be pleased to come to see me but I cannot think of any method by which I might identify them. Have you any

suggestions? I feel my letter is already long enough but I have told you nothing of my experiences with my tank. I should be pleased to write another letter on this subject—if you are interested. Please accept my very best wishes for the future."

Thank you for your most interesting letter, Mr. Chaplin. I should be very interested to hear some more of your stories about the hobby as it was in the days of your youth—and, indeed, in the days of your father's youth. I feel sure that numbers of my readers will make contact with you and, possibly, visit you to have a chat about the hobby. I hope you or they will keep me informed.

Two Woolworth's 40-watt, clear bulbs lasted 84 and 99 days. Four such bulbs, in a 99p pack, are still the best value of which I know.

Photograph 1 shows a pair of angel-fish; 2 shows a cardinal tetra; 3 a pair of attractive killifish; and 4 a glowlight tetra. Please send me details of your experiences with any of these species. I should also like to have your views/opinions on: (a) under-gravel filtration; (b) outside box filters; (c) filter media; (d) water treatments bought in liquid form; (e) getting aquatic plants to grow (Indian fern is smothering five of my six tanks); and (f) the garden pond in winter. Drop me a line also if you have anything interesting to report about your reptiles and amphibians. Please write to me in my 21st year as a contributor. Goodbye until March.



of the Aquarium

Urchins

URCHINS belong to the Class Echinoides which, along with the Classes Asteroidea (Starfishes), Ophiuroidea (Brittle Stars), Holothuroidea (Sea Cucumbers), Crinoidea (Feather Stars) and some others (now extinct) form the Phylum Echinodermata.

This is a large Phylum with some 5,300 species, all sharing several common features. They are relatively large (the smallest being around 1 cm. in diameter), marine animals which exhibit five-fold symmetry (some Asteroidea depart from this) and possess an internal, calcareous skeleton. In some Echinodermata, the skeleton appears to be external but is, in fact, covered by tissue. All Echinoderms possess a system of internal vascular canals, part of which is developed into the characteristic tube feet of Starfishes and Urchins.

There are three main types of Urchins. These are: (i) the Sea Urchins "proper" (also referred to as Regular Urchins), consisting of at least nine Orders, e.g. Echinoidea which includes the Common Sea Urchin, *Echinus esculentus*, and the Slate Pencil Urchins, such as *Cidaris*; (ii) the Heart Urchins of the Order Spatangoida which includes the Purple Heart Urchin, *Spatangus purpuraceus*, and the Sea Potato, *Echinocardium cordatum*; and (iii) the Sand Dollars of the Orders Clypeasteroidea and Holoctypoida, e.g. *Clypeaster*.

Of these, the Sea Urchins are the most radially symmetrical. The others are all oval or elongated to varying degrees. This "deviation" is known as secondary bilateral symmetry.

All Echinoids possess spines, the strongest being found in the Sea Urchins and the weakest in the Sand Dollars and Heart Urchins which

burrow in sand. Each spine has a socket at its base which fits over a corresponding tubercle on each of the relevant plates which go to form the "shell" or test. An arrangement of muscles allows movement of the spines which, in some species, e.g. *Dialema* and *Athenosoma*, are poisonous.

Sea Urchins feed on all types of organic material, living or dead, using a highly specialised, efficient, but slow, feeding mechanism called Aristotle's Lantern.

All Echinoids are dioecious, i.e. the sexes are separate. Sperm and eggs are released into the water where fertilization takes place. A few species actually brood their eggs but the larvae of even these species soon become free-swimming and complete their development among the plankton.



A slate Pencil Urchin

Veiltails



A Veiltail Goldfish (*Carassius auratus*)

The term "Veiltail" is applied to artificially selected varieties of a number of fish species whose main distinguishing characteristic is a long, flowing caudal fin.

The most common species having Veiltail strains are the Guppy (*Poecilia reticulata*), the Angel (*Pterophyllum scalare*) and the Goldfish (*Carassius auratus*).

Not surprisingly, Veiltail specimens are never found in the wild. The reason for this is that, although a long, flowing, often brightly coloured or patterned caudal fin may appear beautiful to many aquarists, evolution has no room for such beauty. Its main criterion is efficiency and, therefore, only those individuals which are efficient at survival will reach adulthood and reproduce. Veiltails are inefficient swimmers and would not, therefore, survive long.

It would be wrong to regard all Guppies with long, flowing fins as Veiltails. There are, for example, Fantails, Veiltails, Deltas and Triangles, all with long, flowing tails and all appearing very similar to the uninitiated, but not to the expert.

A very interesting feature of the Veiltail configuration is that it is recessive in relation to the gene for "normal or wild-type" tail. Therefore, a cross between a Veiltail and a Short-tailed Guppy results in offspring which have short tails. The Veiltails only

appear if this F1 generation is allowed to interbreed, in which case one quarter of the second generation will have long tails. Veiltails, themselves, breed true.

In Goldfish, the Veiltail is distinguished, not just by its flowing caudal fin, but by the fact that the fin is divided into two equal, matching "halves". The anal fin is, similarly, double. Although Standards vary in detail between the major Goldfish Societies, there is general agreement on overall features so that all Veiltails have double anal and caudal fins, deep, roundish bodies and high, single dorsal fins. The colour of the body may be metallic or nacreous (which may include calico coloration). The eyes may be normal or telescopic.

Veiltail Angels have never acquired the same degree of popularity as Guppies or Goldfish, probably because a long caudal fin does not appear to complement the circular, laterally compressed shape of this species as well as it does the others.

Urochordates

UNLIKELY as it may seem, the Urochordata are related to the backbone animals (Vertebrata). Together with the Cephalochordata (*Aspidothorax*) and the Hemichordata (Acorn Worms), they are Subphyla (singular, Subphylum) of the Phylum Chordata.

Adult Urochordates are also known as Tunicates in recognition of the leather-like "tunic" which covers the body of some of the solitary species.

The Subphylum Urochordata is divided into three Classes, the Ascidiacea, the Thaliacea and the Larvacea. Of these, only the Ascidians are likely to find their way into marine aquaria. The reason for this is that adult Ascidians are sessile (attached) while the other two Classes are entirely free-swimming.

Adult Ascidians are commonly referred to as Sea Squirts because of their ability to eject water forcefully through one of their two siphons. All species are marine and some, e.g. *Ciona*

intestinalis, are very widely distributed. Most Sea Squirts are found in shallow coastal waters attached to rocks, shells, ship bottoms or even mud. Some, though, have been dredged up from considerable depths.



Ciona intestinalis, one of the commonest Ascidians

There is nothing in the anatomy of adult Ascidians to suggest that they belong in the Phylum Chordata. For the crucial evidence, one needs to examine the structure of the larvae. Unlike the sessile adults, larval Sea Squirts are microscopic and free-

swimming. They are called Appendicularia or Tadpole Larvae because of their superficial resemblance to larval amphibians.

The tail end of the larvae contains the crucial bit of "Chordate" evidence in the form of a skeletal, rod-like, segmented notochord. This structure is characteristic of all Chordates but is lost at some stage of development in most, including the Sea Squirts.

After a short free-swimming existence during which they do not feed, the Tadpole Larvae attach themselves by means of anterior, sucker-like, adhesive papillae to a suitable substrate and begin their remarkable metamorphosis.

The most obvious changes are the absorption of the tail with its notochord and neural tube, accompanied by a rotation of the body through 180° until the adult orientation with its two characteristic siphons is achieved. Once this has been completed, regular filter feeding and full growth into a hermaphroditic adult, (i.e., both sexes present in a single individual), can proceed.

Venomous Fishes

SOME fish are among the most venomous animals known. Fortunately, though, few are over-aggressive, reserving their venom largely for defence purposes. Nevertheless, great care needs to be exercised in the handling of these species. Commonsense itself will usually be sufficient to prevent injury. However, when an accident does occur, medical advice should be sought without delay.

Stonefishes of the Family Synanceiidae are, perhaps, the most deadly. They possess neurotoxins which have been known to be fatal to Man. Most species are very well camouflaged and often rest half-buried on the bottom. The venom is carried in glands situated near the base of the dorsal spines and the greatest danger of injury is through stepping directly on the fish. They seem to be so confident of their camouflage that they appear reluctant to move from their resting places even when disturbed.

Lionfishes, e.g. *Pterois* species, are the best-known of all the venomous fishes. (See Rockfishes—A-Z, December, 1983, for fuller details of this and related Rockfishes of the Family Scorpaenidae).

One of the most interesting groups of venomous fishes are the Moray Eels (Family Muraenidae). The interest lies largely in the uncertainty surrounding the nature of the venom-producing apparatus. Some reports suggest that the teeth themselves are responsible for injecting venom when the fish bites. Other reports suggest that the mucus covering the palate (roof of the mouth) is responsible for producing the venom which is secondarily transmitted via the teeth. In addition, some species of Moray have been linked with ciguatera poisoning. This disease results from eating the flesh of certain fish (including some species of Surgefish). However, in the case of Morays, it is suspected that the toxin is not produced directly by the fish themselves. It is thought that herbivorous fish first

acquire the toxicity from certain species of algae and then pass on the venom to the Morays.



Muraena helena, one of the 100 or so species of Moray Eels

Other venomous fish which are (variously) available to aquarists include Sabre-toothed Blennies, e.g. *Meiacanthus* (Family Blenniidae); some Catfishes of the Families Pimelodidae, Doradidae, Bagaridae, Siluridae, Arliidae, Ictaluridae, Clariidae, Heteropneustidae and (the most venomous) Plotosidae; Rabbitfishes, e.g. *Loxopneustes* (Family Siganidae); Stingrays (Family Dasyatidae); Scats (Family Scatophagidae) and Weevers (Family Trachinidae).

Tomorrow's AQUARIST



FISH RESEARCH PROJECTS

SCIENTIFIC research involving fish has been going on for many centuries, the work carried out on the Goldfish in China (probably) some 1,500 to 1,700 years ago, being among Man's very first such attempts. Details are vague, but of one thing we can be certain—the attempts were serious and, as such, constituted much more than mere observation. True, there were no computers, spectrophotometers, ultracentrifuges and other sophisticated equipment around but the investigatory nature of the work, centred around highly selective breeding programmes, classifies it as research.

Today, the drive for knowledge continues at an exhilarating pace with research programmes ranging from the basic-but-necessary to the bewilderingly complex. In many cases, the foundations for future research careers are laid down in early school life.

Our Mailbag regularly includes requests from pupils (from 8 to 18) and from undergraduate students for information (or possible sources of information). We always welcome such requests and do what we can to assist. If you are involved in any fish project, we would be happy to publicise your work. Just drop us a line giving us details of your project and we will try to help. Some reader somewhere may have just the bit of information you require. We look forward to hearing from you.

GUPPY GENETICS

ROBERT JOHNSON is an undergraduate at Leeds University who is carrying out research into Guppy Genetics. The aim of the project is to establish 'Family Trees' for a few Guppy breeds. From the hobby point of view, this information would be both fascinating and of immense value.

Robert's work, therefore, presents aquarists with an exciting opportunity to assist in an important research project.

Robert requires pure-breeding strains of Guppy, particularly long-established ones.

Most of the genetic data will be obtained from mitochondrial DNA. Mitochondria are minute structures found within living cells and are sometimes referred to as the "power-house" of the cells because of their involvement in energy production. These structures (organelles) are particularly suitable because they can occur in substantial numbers within cells and, since they contain DNA (the gene-carrying "blueprint"), they can, therefore, supply a considerable amount of experimental material.



Black female guppy

Ideally, any female Guppies supplied for the project should be virgin, having been separated from males from the age of approximately three weeks. Failing this, there will be some delay in the work until the offspring from these females can be obtained and isolated.

Equally useful to Robert would be accurate information, e.g. breeding records, for any strain submitted to him, or details of when a submitted strain was first developed.

If you can be of some assistance, please contact Robert Johnson or his tutor, Dr. J. C. Wootton at The Dept. of Genetics, University of Leeds, Leeds, LS2 9JT. Tel. Leeds 431751.

ELECTRIC FISHES

RORY McNAMARA is a student at a Sixth Form College in Basingstoke. For his 'A'-level Biology Project, he has chosen "Electrical Communication in Fish".

In addition to the better-known species, such as Electric Catfishes, Knifefishes and Eels, Rory would like to find out more about the ways in which other species communicate by means of electricity. He is, therefore, interested in the use of electricity for purposes other than attack, defence, or the capture of prey.

Any information, however trivial it might appear at first sight, concerning observations on the behaviour of such fishes, or references to relevant literature, would be gladly received. If you can help, please contact Rory at 117 Abbey Road, Basingstoke, RG24 9EB.

FREEZE-DRIED EARTHWORMS

SIMON GREENSLADE is a third year student at the Polytechnic of Central London investigating the possible use of freeze-dried earthworms as an aquarium food.

He has set up six experimental aquaria with young Tiger Barbs and is comparing their growth rate on freeze-dried earthworms, freeze-dried Tubifex and flaked food.

Although he can obtain experimental results directly from his own work, Simon would like to know of any other work carried out on the use of earthworms (live or otherwise) as an aquarium food. Comments on casual observations, strictly controlled experiments or references to appropriate background literature would, therefore, be greatly appreciated.

Simon can be contacted at 285 Archway Road, Highgate, London, N6 5AA.

Your questions answered...

Having problems? Send your queries to our panel of experts who will be pleased to be of service. Every query receives a personal answer and, in addition, we will publish a selection of the most interesting questions and responses each month. Please indicate clearly on the top left hand corner of your envelope which department you wish your query to go to. All letters must be accompanied by a S.A.E. and addressed to:

Your Questions Answered, The Aquarist & Pondkeeper,
The Butts, Brentford, Middlesex TW8 8BN.

TROPICAL



Dr. C. Andrews

Tropical



fish pox . . .

Can you give me some information on a condition known as 'fish pox'?

Fish pox is a relatively common disease of fish. It most frequently affects coldwater fish such as goldfish, koi, carp etc., although a range of other species are also susceptible (including roach, tench, and orfe). Fish pox is, in fact, one of the oldest known fish diseases, with records on its occurrence dating back to the sixteenth century.

The disease has fairly typical symptoms. The head, body and fins become covered in smooth, off-white (or pinkish) growth—which gives the fish the appearance of having been dipped in molten paraffin wax. This waxy growth is caused by a virus infection, which produces a proliferation (increase) of epithelial cells of the skin.

Although fish pox is rather unsightly, unless the infection is very pronounced, it is not particularly dangerous. Fish pox often occurs in a pond or aquarium, develops and then spontaneously disappears, perhaps to recur at a later date. The virus may well be dormant within the tissues of the host, to be activated and produce the typical growths on the skin at sometime in the future.

There is no reliable treatment for fish pox. In some areas the disease

appears to follow a seasonal pattern of occurrence—being most common in the summer-autumn period. In a pond or aquarium, its occurrence may also be linked to poor water quality or an adverse change in the water conditions. Improving the conditions within the pond or aquarium, moving the fish to a separate (isolation) tank, or perhaps increasing or decreasing the water temperature by a few degrees may all bring about the disappearance of the disease. Although the disease is related to a viral infection, infectivity is not usually very high, and other fish in the same pond or aquarium may remain unaffected.

A somewhat similar disease also affects marine (and to a lesser extent, freshwater) fish. *Lymphocystis* as it is known, is another viral disease, but which produces 'mulberry-like' lesions on the skin and fins of the fish. Like fish pox, lymphocystis is rarely fatal, and often disappears spontaneously (perhaps to recur at a later date). Although there is no reliable chemical remedy, some success has been achieved by the surgical removal of the nodules produced by the lymphocystis virus.

lyretail killifish . . .

Can you give me some information on the lyretail killifish?

The lyretail killifish (*Aphyosemion australe*) is a very attractive killifish from West Africa.

It is quite a hardy species and will even do well in the community tank. It does prefer a well planted aquarium



Aphyosemion australe

though. The male fish is more intensely coloured than the female, both of which may reach 4 cm. in length. Maintain at a steady temperature around 20-25°C and feed on *TetraMin* and *FD-Minus*.

For further information on killifish contact Ken Dossor, British Killifish Association, 12 Garth Terrace, Burton Stone Lane, York.

C.A.

Coldwater



terrapins in ponds . . .

I plan to build a pond, 10 x 5 x 3 feet in which to keep a pair of European and Stripe-necked Terrapins. I have read that they need a fair amount of mud at the bottom in which they hibernate through the winter. Where can I get some mud and what pond snails shall I need to keep the pond clean?

You could get the mud from an established pond but this could be dangerous as it might contain harmful

COLDWATER

Arthur Boarder

PLANTS

Vivian De Thabrew

KOI

Hilda Allen

MARINE

Graham Cox

DISCUS

Eberhard Schulze

pests and diseases. I think that very fine sand would answer your purpose as this would soon get muddy from the waste matter in the pond. As for pond snails, these never yet kept pond water clean and even if you had the large type, *Limnaea stagnalis*, they could be eaten by the Terrapins. That is, of course, if you realise their feeding habits. There may be no trouble during warm weather but if the water cools down the Terrapins will not eat. They appear to feed best at a temperature between 65°F., and 75°F. As they eat mostly animal foods they can soon foul up the water, especially in a pond where it would be almost impossible to clear out any uneaten food. I consider that the pond water would get murky in a week or ten days at the most and so the Terrapins may not be seen. Also, as they eat under water, you would not be able to see whether they are feeding or not. If you feel that you must make the experiment, do not be too disappointed if things go wrong; it is far better to keep these creatures in a tank where they can be observed more easily.

non-standard goldfish . . .

We have three coldwater tanks and would like to go in for breeding non-standard goldfish such as: Ryukin; Jikin; Tosakin and Osaka. Can you please tell us where we might obtain such varieties?

I am enclosing an address from where you may be able to obtain these

fishes, but I cannot be certain that these types are in stock at any given time. The fishes in question are named by the Japanese and in some cases the fishes are known under different names in this country. The Japanese are ever ready to introduce new varieties as improperly formed fry appear in a spawning. If I had given names for all the wrongly shaped fishes which appeared in some of my spawnings of fantails, their names would have been legion. Anyone who has had experience of breeding any variety of fancy goldfish will appreciate that what I say is quite usual.

all-red fantails . . .

I am trying to get some all-red scaled fantails but up to the present time I have not found any, only those with plenty of silver on them. Can you help?

The type of fantail you require is not easy to obtain today. I used to breed them but owing to failing eye-sight had to give up. I passed my stock on to an aquarist but unfortunately he has moved away with-



An (almost) all-red fantail

out giving me his address and after one successful year at breeding from these fishes he has failed to contact me. I can only suggest that you get the best ones you can and then breed from them and eventually you should get the type you need. It is not easy but each spawning should produce at least a few good specimens from which to choose further breeding stock. The trouble with these silver markings is that they can crop up after a time and once a fish has a small patch it is probable that it will increase in size and never seems to disappear. I am enclosing an address from where you should be able to get the specimens for your breeding project.

A.B.

Plants**planting medium . . .**

I am hoping to establish a 36 in. aquarium and would appreciate advice on the best planting medium.

The planting medium for an aquarium is very important, as it provides much of the nutrition required by the plants, and also room for the roots to establish well, thus ensuring healthy growth. A general-purpose medium would consist of a mixture of clay or peat with fine 'pea'-type gravel or coarse river sand. When peat is used, it should be either peat moss litter (i.e. the pulp

remaining after the extract has been taken out) or peat moss which has been thoroughly soaked in water for several hours, squeezed out and the resulting pulp used as the bottom layer of the mixture. This layer should be spread thinly on the tank bottom or just above the filter. The other material should be placed in a layer over the peat layer. The total depth of the medium should be about 3½-4 inches, to allow for good root development.

rising pH . . .

Two large tanks of 33 gallons each (tropical) were set up in February with substrata of coarse river sand (non-calcareous—checked with hydrochloric acid—no reaction), a little peat and earth under. Decor of bogwood (polyurethane) and slate. Heavily planted. Filled with rainwater, pH 6.2, GH 0; which could be ideal for growing *Cryptocorynes* and lots of other plants. After one month the pH was 7.2, GH 3, KH 3 and has remained so since despite water-changes of about 5 gallons weekly. Most plants are thriving especially *Cabomba*, *Indian Fern* and *Hygrophila triflorum*. The *Cryptocorynes* are very slow.

Can you say what is causing this increase in pH and hardness? Should I try to keep it at the original figures? Should I use a proprietary brand of chemical to keep a pH of 6.5? (This could be expensive with such large tanks and only holds it for two months). A smaller coldwater tank with the same coarse sand, planted with *Corkscrew Vallisneria* always had a pH of 6.2, so the mystery deepens.

From the information you give me the sudden increase in pH must either be caused by something in your layer of earth or from the polyurethane bogwood. Therefore I would suggest you experiment and remove these for a while to see if the pH is then successfully maintained at its original level. You could also increase your peat content. As you realise, using

chemicals to lower the pH level has only a temporary effect, and can prove expensive. The real answer is to establish the root cause. The plants which are thriving in your tank do so because they thrive in such alkaline conditions, whereas the *Cryptocorynes*, which prefer acid conditions, will not.

V.T.

Koi



sexing koi . . .

Just over two years ago a 7 to 8 in. Koi was sold to me as a male *Taisho-Sanke*, the red gradually faded and recently it proved to be a female *Shiro-Bekko*. Is such a thing unusual and what should I expect the youngsters to be?

I would say there is nothing very remarkable in a white, red and black Koi losing the red pigmentation, red is a very difficult colour to produce and maintain in Koi and smaller Koi are known to change. We have to remember that Koi are primarily man-made where coloration is concerned, no two Koi are alike and they cannot be classified as, for example, breeds of dogs can. The parent fish will have some influence but even in Japan, using pedigree parents of the same variety, no more than 20%-30% of the youngsters will be of that same variety. Clearly, I am unable to predict what your spawning will produce, any fish that are malformed should be culled at the first opportunity and hopefully you will have some young Koi that are attractive to the eye even if they do not all conform to the ideal.

Sexing Koi is far from easy, especially when small. In general, male Koi are long and slim and the pectoral fins are often quite pointed. Females are usually plumper with the body appearing more box-shaped and pectoral fins are frequently more blunt and rounded than those of the males. In planned spawnings, (as opposed to 'flock' spawnings involving all mature fish) it is usual to have one female to two or three males of the same variety.

variation in koi . . .

Since I started to keep Koi in a small way I have seen a great variation in the general appearance and colours of Koi for sale locally and at water garden centres. Can you tell me why this should be as I have been assured that Koi is a word in Japan and all Koi come from that country?



Variously coloured young Koi

Yes, Koi is a Japanese word meaning carp. If giving these beautiful fish their proper name "Nishikigoi", this can be literally accepted as meaning fancy carp which you will readily appreciate covers the wide range of colours, patterns, scalings, etc. usually associated with these fish.

There is no doubt that the development of a few minor colour variations of the common carp into the present day standard of multi-coloured Koi did originate in Japan. If your reference to general appearance means quality rather than health, then it is equally true to say that the best quality Koi do come from Japan.

As a result of the ever-increasing appeal and popularity of Koi in the last decade or so, Koi are now more intensively farmed in several areas of Japan to satisfy the demand for relatively cheap garden pond type fish.

Prices can vary enormously from almost pence to thousands of pounds, dependent on both the quality and size of the Koi. In the U.K. the cost of air-freight can add dramatically to the price of a medium to large specimen when individually packed.

It is recognised that all so-called Koi do not come from Japan, they are imported from the U.S.A., Singapore, Israel and even European sources as far as I am aware.

Koi, for want of a better word to signify these fish, whether they are Japanese or not, do breed in this country and some quite good Koi are produced where the facilities of home-breeders allow growing-on in the more or less natural conditions of large ponds or lakes.

However, the first-class breeding fish established through many years and the necessary expertise to cull, assess and develop prize Koi of great value remain in Japan.

H.A.

Marine



local marine problems . . .

I have been keeping local marines for some twelve months or more and am still perplexed as to a recurring problem in my tank.

For some reason I cannot get my water crystal clear as in my tropical tank. pH is constant at 8.5. Nitrites are all but non-existent. The substrate is crushed cockle, and coral sand, with limestone decor. The algae grows in lush green abundance, I've never lost a fish or crustacean, but still the water does not appear clear. I have stripped down the tank once to move it, and in doing so tried as variation on the lengths of the uplifts, previous they were the short King British style. I have tried installing a corner filter with carbon and regular vacuuming keeps the filter bed unclogged. At present my tank (30 in. x 15 in. x 15 in.) houses four rock gobies, two sand gobies, one small blenny, two angular crabs, one hermit and a few prawns and anemones. Lighting consists of two, two foot tubes, one gro-lux, one northlight, the pump is a Nimrod '3' which seems to push through plenty of air. I have asked all my local suppliers but none seem to have experienced this problem before?

The cloudiness of the water is due to the excessive presence of microscopic planktonic organisms, ie viruses, bacteria, fungi, algae, protozoa and metazoa, although there is probably a predominance of bacteria and unicellular phytoplankters.

You could control this problem, (which you will find to be at its worst twice each year—in Spring and Autumn), in any or all of the following ways:

1. Reduce the lighting to one 'Northlight' only.
2. Buy a diatom filter.
3. Do a hefty partial water change using 'Ultramarine' sea salts, (NOT natural seawater!), which will have the effect of lowering the water's fertility.
4. Reduce feeding and/or stocking levels for same reasons as in (3) above.
5. NEVER use 'Seagreen', 'Seatracer' or 'Seavita' in this aquarium. When culturing such hardy native creatures, these otherwise essential three water treatments are unnecessary and may even exacerbate the problem by over-enhancing the seawater's fertility level.

G.C.

Discus



providing for discus . . .

I have been keeping fish for about 3 years and now I would like to move into Discus. The tank I will use is 36 inches long, 12 inches wide and 15 inches deep. The only decoration would be 3 plant pots. I do not want to put gravel or undergravel filters as this makes the tank hard to keep clean. I would filter using a FLUVAL 102 and use peat, C 100 water purifiers and filter wool to remove all the small pieces of dirt. I would use the spray-bar on the filter to help aerate the water. Would it harm the fish if the filter was switched off? I will blank off the sides of the

tank leaving just the front glass clear. I will use a very little Growlux tube at night only, though not all night as it will be in my bedroom, but just to keep it light till I go to bed. I will feed beef-heart once a day and for the other feeds a choice between Cichlid Flake, F/D Tubifex, Gamma range of Tubifex, Bloodworms and Daphnia. Is this set-up all right for Discus and if so how many fully grown Discus Fish can it hold?



Young Brown Discus

You obviously have studied your subject very well and your set-up will be perfect for keeping Discus Fish, with one exception. You must never switch the filter off for more than 3 or 4 hours otherwise you will get into trouble. By that I mean that, although the fish would probably be all right, the bacteria, Nitrosomonas and Nitrobacter, which will build up on the filtering material and changing toxic nitrogen compounds into harmless substances, can only exist with an adequate oxygen supply. By switching off the filter you would also switch off the oxygen supply and the bacteria will die. Bacterial denitrification will occur, which converts the relatively harmless nitrate into the harmful interim stages of nitrite and ammonia and when you put the filter on again without having cleaned the filtering material you would put it into the water and the fish would not be very happy.

Your aquarium will certainly take 5 or 6 Discus fish.

E.S.



The New Tetra Starter Kit —an easy introduction to tropical fishkeeping

I FELT rather like a child at Christmas as I tore the paper off the large package that the postwoman brought me. It was like—indeed it was—a large selection 'box' of Tetra products for me to review for this magazine. The New Tetra Starter Kit consists of a large cardboard display board displaying a range of Tetra products and covered in a polythene see-through wrapper. It states on the front of the cardboard display board: "A selection of basic products and advice to introduce you to the hobby. Includes: TetraMin Flake and Tablet Food (TabiMin Tablet Food), Aqua-Safe, Foam Filter, Nitrite Test Kit, *Beginner's Aquarium Digest* (and Free: *Aquarium Digest International* (and) Tetra Pisces Thermometer. Worth over £2.00."

Printed on the reverse of the large cardboard sheet are "Ten easy steps to tropical fish keeping".

Most aquarists already know all about TetraMin Staple Food and TabiMin Tablet Foods; many aquarists already use these products—as I do. The Staple Foods has the following guaranteed analysis: Min. Crude Protein—45%; Min. Crude Fat—5%; Max. Crude Fibre—7%; Max. Moisture—8%; and Max. Sodium Chloride—3%.

Tetra AquaSafe is a "conditioner for (freshwater) aquarium water (and



conditions new water and neutralizes chlorine." The quality of the water in the area in which I live is normally high so I do not use or need products such as this; but it would be useful in some areas or houses. The Tetra Billi Filter is a neat little unit that uses a plastic foam sponge as the filter body/medium. The unit is suitable for tanks up to 10 gallons in capacity. It operates as a mechanical filter, i.e., removes particles from the water; and as a biological filter, i.e., bacteria develop in the foam and breaks down the debris collected. The foam sponge should be washed weekly, to retain its efficiency, in water of the same temperature as the aquarium—so that the bacteria will not be killed/destroyed.

The Nitrite No. 2 Test Kit contains two bottles of re-agents and a plastic test vial. A colour chart is provided on the kit box. The kit is very simple to use. I tested a sample of water from one of my tanks that has been running unchanged for—at least ten years, I should say. The plants grow well and the gouramies flourish. The water gave a reading of below 0.1mg. N/litre—which is "Ideal water conditions". I have never before tested the nitrite level in any of my tanks; only the pH and hardness.

The Tetra Pisces Aquarium Thermometer is a neat little unit for use on the outside of the aquarium. It is manufactured by the American Thermometer Company. This thermometer can be removed and replaced elsewhere, if necessary.

The *Beginner's Aquarium Digest* is

an excellent little booklet of 34 pages and contains plenty of excellent coloured photographs of fishes and plants. There is also a very useful set of coloured paintings of individual fishes. (One sentence that did not meet with my approval was: "... Artificial plants have several advantages...") My Tetra Starter Kit contained issue No. 18 of *Aquarium Digest International*. As expected, it contained a host of excellent coloured photographs of tropical fish and a lot of interesting written material.

Any beginner would be delighted to receive this kit—although I'd nominate a heater and thermostat as being rather more important for the beginner than, say, a water conditioner or a nitrite test kit; however, not everyone keeps tropical fish. In any case, the kit obviously contains products from the Tetra range and I do not think that Tetra produces a thermostat/ heater—but I may be wrong. I can certainly recommend this most useful outfit.

B. WHITESIDE

Management changes at Buckley Press Ltd.

With effect from January 1st, 1984 Mr. W. W. Charman has resigned as Chairman and joint Managing Director of Buckley Press Ltd., publishers of *The Aquarist & Pondkeeper*. He remains on the Board as a Non-Executive Director until June 30th.

Mr. G. Fowler, joint Managing Director succeeds Mr. Charman as Chairman.

Meet the Societies



Hounslow and District Aquarists Society



The H.D.A.S. Logo



Male *Betta splendens*

SOME of our readers may be aware of the adoption scheme run by the Zoological Society of London in which individuals or organisations are invited to "adopt" an animal (or part of in the case of large, expensive ones). H. & D.A.S. members are not only aware of the scheme but have, in fact, done something about it. They have, quite appropriately, adopted the Siamese Fighting Fish at the Zoo's Aquarium, sponsoring its upkeep and thus helping the Zoological Society meet its ever-increasing maintenance bill.

To the best of my knowledge, H. & D.A.S. are the only Society in the U.K. involved in the scheme and we are pleased to bring this original activity to the notice of our readers in the hope that others may follow suit.

The H. & D.A.S. was founded in 1950 with the aims of furthering and promoting interest in the keeping, breeding and showing of tropical and coldwater fish, and of furthering the knowledge in all other aspects of the hobby.

Meetings are held every other Wednesday at St. Stephens Church Hall, Parkside Road, Hounslow, starting at 8.00 p.m. All are welcome. The Hall itself seems ideally suited to the Hounslow style of meeting in that it has a large main hall which can be easily divided to allow Table Shows and lectures to be held simultaneously, and for refreshments to be made available.

Most of the meetings include a Novice Show, specifically designed for first-ever competitors. These are usually judged by a Judge from F.B.A.S. (to whom the H. & D.A.S. is affiliated).

The Society's Social Secretary organises outings to places of interest, including fish farms, Zoological Gardens, other Clubs and evenings in London.

Competitions are also held with other Societies throughout the year and displays are mounted at local functions, such as garden parties, fêtes and carnivals.

Trophies won by members, including the "Breeder of the Year Trophy", are presented at the annual Dinner-Dance held at the end of the year. The H. & D.A.S. programme of activities also includes a Spring Dance and a highly successful Open Show.

Subscription rates: Single, £4.00; Double, £5.00; Juniors, £2.00.

Apply to: Mr. Bob Nelhams, 35 Exeforde Avenue, Ashford, Middx. Tel. Ashford (69) 59880.

British Marine Aquarists' Association



The B.M.A.A. Logo



Hippocampus sp.

THE B.M.A.A. was formed in 1970 by a group of hobbyists from the Midlands to cater for the needs of the growing body of native and tropical marine enthusiasts in the U.K. Since then, the membership has grown steadily, with a recent boost, to over 200. Although most members are U.K. based, there are some from other countries as well, including the U.S.A., New Zealand, Hawaii, Israel and Malaysia. Therefore, despite the "British" in the name, there is a distinct international "feel" about the B.M.A.A.

This, no doubt, is partly the result of the diving expeditions made to exotic places by various members (see elsewhere in this issue of A & P for further details of one such expedition).

A second reason must also be the involvement of some of the eminent Honorary Members of the B.M.A.A. who include Professor C. W. Emmens from Australia, Graham Cox from Seaquariums (U.K.) and Professor L. Fishelson from Israel.

The Association's publication is "Marineews" which appears every other month. In addition to articles on a wide range of subjects, there are product reviews, letters, a For Sale and Wanted section, a discussion page (where questions are raised and discussed by members), a problem page, an information service and many other items. It is hoped to make "Marineews" a monthly publication at some stage in the future.

Being such a widespread Association (and, incidentally, the only specialist Association of its kind in the U.K.), the B.M.A.A. encourages the formation of regional groups which can meet and exchange news and views on a more regular basis.

There are two main "national" meetings every year, a Seminar which is held every May in Dewsbury, West Yorkshire, and an AGM in October which also includes, in addition to normal AGM matters, lectures by leading names in the hobby.

The B.M.A.A. also has its own, ever-expanding library of slides which it makes available, on loan, to regional groups and individuals free of charge.

Subscription rates: Single or Joint Membership, £8.00. Apply to: Steve Preston, 16 Fountain Drive, Roberttown, Liversedge, West Yorks., WF15 7PX. Tel (0924) 405387.

NEWS...



SOUTH WEST



Newbury A.S. 1983 open show results: Best Fish in Show: T. Cruickshank (G); Best All-Rounder: R. Somers; Best Junior: Gary Rowley; Highest Pointed Newbury Member: John Smith; Highest Pointed Newbury Junior: Russell Barrett; Highest Pointed Visiting Society: Tonbridge; F.B.A.S. Championship Class (C): John Smith; F.B.A.S. Supreme Champion: John Smith.

Class Ag: 1, M. Bird (Tonbridge); 2, C. Tonna (Reading); 3, E. Stallwood (Newbury); 4, B. May (Pangbourne). Ak: 1, Mrs. Smallwood (Newbury); 2, J. Taylor (Haringey); 3, E. Stallwood (Newbury). Ba: 1, R. P. Adams (Salisbury); 2, D. Crickshank (Hendon); 3, R. Somers (SELAS); 4, S. Thorne (Newbury). B: 1, C. Tonna (Reading); 2, W. A. Knight (Havant); 3, J. Bath (Solent); 4, Miss S. Edwards (East Kent). C: 1, H. Smith (Salisbury); 2, Mrs. P. Edwards (East Kent); 3, J. Andrew (Basingstoke); 4, J. Handley (Solent). Cb: 1, N. Jackson (Pangbourne); 2, P. Whiddett (Tonbridge); 3, P. Edwards (East Kent); 4, C. Richards (Salisbury). C-1: 1, J. S. Smith (Newbury); 2, J. Handley (Solent); 3, N. Jackson (Pangbourne); 4, W. A. Knight (Havant). Da: 1, D. Cox (Yeovil); 2, R. Grace (North Wilt.); 3, R. Somers (SELAS); 4, R. Grace (North Wilt.). Db: 1 and 2, C. Buntingham (Tonbridge); 3, R. Somers (SELAS); 4, W. Chapman (SLADAS). Dc: 1, D. Ford (Bracknell); 2, M. Draper (Tonbridge); 3, M. Bird (Tonbridge); 4, P. English (E. Dorset). D-1: 1, R. Somers (SELAS); 2, D. Windsor (E. Dorset); 3, W. A. Knight (Havant); 4, P. Taylor (North Wilt.). Ea: 1, R. Somers (SELAS); 2, M. A. Clarke (Bracknell); 3, T. Laughlan (Haringey); 4, W. Crookford (Peterfield). E: 1, J. Edwards (East Kent); 2, D. Windsor (E. Dorset); 3, R. Somers (SELAS); 4, S. Goodison (Chard). F: 1 and 3, P. May (Pangbourne); 2, C. Richards (Salisbury); 4, L. P. Lovegrove (Basingstoke). Da: 1, G. Lawson (East Dorset); 2, J. Bath (Solent). G: 1, T. Cruickshank (Hendon); 2, R. Somers (SELAS); 3, C. Richards (Salisbury); 4, J. Edwards (East Kent). H: 1, T. Cruickshank (Hendon); 2, D. Ford (Bracknell); 3, C. Richards (Salisbury); 4, W. A. Knight (Havant). J: 1, P. Ratcliffe (Tonbridge); 2, C. Ralph

"Collectors of Aquatic Literature" is a new specialty club formed earlier this year in the United States. Members will receive four issues a year. Members who contribute articles and information once each year receive half of the subscription price back and become contributing members. Each member receives (each issue) one half page free to advertise books and periodicals that he wishes to obtain, sell, or trade. Write to Mr. David Hopp, 3112 Main Blvd., Modesto, California 95351 if you wish to join.

Aqua Club 08 presents 2nd European Exhibition of Aquariums and Terrariums from Sunday 29th April until Saturday 12th May at International Exhibition Hall, Charleville Metziers, France. Purified aquariums, specialist societies, trade stands, organised leisure activities, etc. For further information apply to: Aqua Club 08, Sous Ligheul, Algemeent F 08000, Charleville Metziers, France Tel: (24) 39-04-08.

From Aquarists' Societies

(Basingstoke); 3, R. Ratcliffe (Tonbridge); 4, D. Nice (SLADAS). K: 1 and 2, F. Mills (W.D.A.S.); 3, C. Tonna (Reading); 4, H. A. Miller (Chard). L: 1, C. Amey (Dorchester); 2 and 3, Jean Draper (Tonbridge); 4, N. Jackson (Pangbourne). Ma: 1, C. Amey (Dorchester); 2, Gary Rowley (Bradley Heath); 3, C. Tonna (Reading); 4, W. Knight (Havant). M: 1, C. Richards (Salisbury); 2, R. Somers (SELAS); 3, W. Chapman (SLADAS); 4, P. Taylor (North Wilt.). N-hm: 1, G. Ford (Bracknell); 2, R. F. Adams (Salisbury); 3, S. Norris (Bracknell); 4, C. Ralph (Basingstoke). N-oi: 1, P. Cox (Bournemouth); 2, Mrs. P. Edwards (East Kent); 3, T. Laughlan (Haringey); 4, A. Waller (Southend). N-t: 1, N. Jackson (Pangbourne); 2, S. Parnseddon (W.D.A.S.); 3, C. Ralph (Basingstoke); 4, J. Bath (Solent). O: 1, B. Lock (SELAS); 2, D. Cox (Yeovil); 3, P. Cox (Bournemouth); 4, M. Bird (Tonbridge). P: 1, D. Cox (Yeovil); 2 and 3, R. Somers (SELAS); 4, E. Lock (E.D.A.S.). Q: 1, W. A. Knight (Havant); 2, Mr. and Mrs. P. Andrews (Reading); 3, Mrs. P. Edwards (East Kent); 4, R. Somers (SELAS). R: 1, C. Amey (Dorchester); 2, P. Cox (Bournemouth); 3, Mrs. P. Edwards (East Kent); 4, T. Laughlan (Haringey). S: 1, S. Norris (Bracknell); 2, D. and P. Lambert (Kingston); 3, Mr. Rowley (Bradley Heath); 4, Mrs. P. Edwards (East Kent). T: 1, S. Parnseddon (W.D.A.S.); 2, Mr. and Mrs. P. Andrews (Reading); 3, J. Smith (Mid-Sussex); 4, C. Tonna (Reading). U-ad: 1, W. Crookford (Peterfield); 2, P. Whiddett (Tonbridge); 3, W. A. Knight (Havant); 4, E. Binnard (Portsmouth). U-bc: 1 and 2, A. Hughes (Bristol); 3, E. Binnard (Portsmouth); 4, P. Taylor (North Wilt.). V: 1, D. and P. Lambert (Kingston); 2 and 3, A. Waller (Southend); 4, P. Cox (Bournemouth). X-t: 1, R. F. Adams (Salisbury); 2, A. Waller (Southend); 3, M. Bird (Tonbridge); 4, P. Mills (W.D.A.S.). X-ov: 1, J. Taylor (Haringey); 2 and 3, P. Whiddett (Tonbridge); 4, J. Taylor (Haringey). Y: 1, S. Norris (Bracknell). Z: 1, P. Mills (W.D.A.S.); 2, J. Taylor (Haringey); 3 and 4, Mrs. E. Stallwood (Newbury).

AT the December meeting of Bristol A.S. Vice-President Vic Capaldi showed a selection of slides from his collection. Dick Pincock who has organised the Table Shows throughout the year, reported a record total of 177 entries. Highest Points Coldwater: V. Capaldi. Highest Points Coldwater Novice: W. Perkins. Highest Points Tropical: Miss A. H. Morgan. Highest Away Points Novice: D. Garland. The evening concluded with a social largely funded by the Society in appreciation of members support during 1983.

North Avon A.S. enjoyed a very light hearted, but enjoyable and interesting evening in December. We had brought our meeting forward a week to avoid the rush of last minute arrangements normally encountered in the week before Christmas. Following the preliminary requirements of the meeting, we came to an item on the agenda entitled "Mystery Guest Speakers", which in fact was the members themselves. A member was asked to talk to the meeting on any aspect of the hobby he or she liked, maybe an unusual occurrence, a problem experienced and solved, an achievement, or any other suitable item, following which he or she selected another member to do likewise. This produced a great deal of interest, and the involvement of the whole gathering. We were also delighted to have with us members of Bristol Tropical Fish Club who had come along to engage us in an

Monthly reports from Secretaries of aquarists societies for inclusion on this page should reach the Editor by 3rd of the month preceding the month of publication.

Inter-club Challenge in the category of A.V. Tropical. Our members are to be congratulated for their response, with special thanks to Bristol Tropical for their attendance, and to Mr. Bob Touse who very kindly agreed to judge the exhibits. It resulted in Bristol Tropical taking the honours by a mere 18 points (200-182). All those present enjoyed some festive fare which hopefully set them in the mood for Christmas. With a new year, we look forward to an even greater range of facilities and events for members, and anyone interested, will find us at Heston Folk Centre, High Street, Heston, Bristol on the third Monday in each month, or contact the Secretary, R. W. Cummins, 1 St. Anne's Close, Cadbury Heath, Worsley, Bristol BS11 5EL.

SOUTH EAST



Tongham Aquarists 1983 Knock-out final, held at the Victoria Hall, Ash, on 1st December, 1st, R. Cooke, *Parasitophorus mima*. 2nd, M. Bird, *Ailae sulvatus*. 3rd, M. Bird, *Parasitophorus lumbard*. 4th, N. Malinich, *Tilapia zilli*. Judge: Roger Paine.

The Society's Annual General Meeting also took place on the same evening, and the following officials were elected for 1984: Chairman: J. Outley. Secretary: S. Baines. Treasurer: A. Outley. Show Secretary: A. Pearce. P.R.O.: S. Baines. A vote of thanks was extended to retiring members M. Bird and D. Barrett for their support during 1983. Our club meetings are held every 1st and 3rd Thursday of each month and new members are always welcome. For further information please contact: S. Baines (P.R.O.) on Yeatey 878439.

AT the Annual General Meeting of the Federation of British Aquatic Societies held at Conroy Hall, London, on 3rd December 1983, I was honoured by being appointed General Secretary as from 1st January 1984. I would therefore like to inform all interested parties that as from that date all correspondence should be addressed to me as follows: Mrs. Sylvia M. Brown, 46 Arthurs Road, Goodmayes, Eford, Essex IG9 5QJ.

Two other Council positions were also filled at that meeting by members of affiliated societies who were co-opted onto the Council during the latter part of 1983. I believe these names and addresses should also be useful to your readers: Mr. Les Derrick, Hon. Treasurer, 5 Glenholme Avenue, Shirley, Croydon CR9 7HT and Mr. Colin Richards, Public Relations Officer, 1 Verney Street, London NW10.

Aylesbury Aquarists are all set for 1984. New Secretary is G. Sale, phone Aylesbury 33068 for all enquiries. New members welcome to a full season. Fish talks, action and discussions.

IN place of the November meeting members of the East Sussex Herpetological Society went on a "behind the scenes" visit to London Zoo Reptile House, where members had an interesting and enjoyable time handling many of the species kept and learning how they are looked after at the zoo. Details of future meetings can be obtained from the Secretary, Mr. P. Martin, 20 Silverlands Road, St. Leonards-on-Sea, East Sussex TN37 7DE. Tel: Has. 440991.

THE British Koi Keepers' Society proudly announce the formation of yet another section, the 16th, this time in Wirral—Merseyside. They meet regularly on the third Thursday in the month at 8 p.m. in the "Anchor", Irby, Wirral, Merseyside. (You'll find them in the smoke room).

Anyone interested can contact the Section Membership Secretary, Ray Buchall, 18 Coleman Drive Grassy, Wirral L49 3AJ.

AT the A.G.M. of Bristol A.S. the following officers were elected: President, H. C. E. Thomas; Vice-president, J. Day; Secretary, T. C. Harper; Treasurer, Mrs. I. Day; Reporting Secretary, Mrs. J. M. Thomas; Committee, Messrs. V. Caplan, I. Midon, W. Perkins, G. Smith; Registrar, Miss A. H. Morgan; Auditors, V. Cole, I. Midon.

Two possible members retired from the Committee, while still remaining active members. Dick Pinnock who is well known on the Show Bench for his strain of Lionheads as well as the Trophy Manager at the Bristol Show. Vic Cole who has acted as Secretary for the past eight years, and whose Newsletter has been so informative, was also a very successful exhibitor with his strain of Bristol Showbunkins. Both were warmly thanked for their services.

The Society meets on the second Tuesday at St. Ambrose Church Hall, Stretford Road, Whitehall at 7.30 p.m. Further information or advice from the Secretary, T. C. Harper, 11 Bridge Walk, Bristol BS7 0LB (0272-699231).

MIDLANDS AND WALES



AT the Annual General Meeting of the **Aberdare Aquarist Society** held on 12th December, the following Committee were elected for 1984: Chairman, R. Roberts; Vice-Chairman, W. George; Secretary, D. C. Davies; Treasurer, Mrs. N. Bruce; Show Secretary, R. Williams; Assistant Show Secretary, Master M. Buchanan; Minutes Secretary, Mrs. C. Rees.

Aquarist of the Year: B. Rees. Junior Aquarist of the Year: Master G. Howells.

THE Black Country Aquarists now meet on the first and third Tuesdays of each month at Woodside Community Centre, Healy Hall, Dudley at 8 p.m. For further details contact the Secretary, Mrs. Angela Rooker, 10 Freeland Grove, Highcross, Kingswinford, West Midlands DY5 8PJ. Telephone: Kingswinford 296385.

NORTH



Accrington & District A.S. A new committee was voted in as follows: Secretary, Mr. Stuart, Hindley, 10 Queens Street, Accrington, Lancashire BB5 5AQ. Tel: Acc. 395371. Show Secretary, Miss S. Hoolding, Tel: Acc. 36204. Chairman, Mr. P. Poole, Treasurer, Mrs. W. Hindle. The society meets on the 1st Wednesday in the month at "The Blockade" Hotel, Accrington at 8.00 p.m. Everyone welcome.

St. Helens A.S. held their Annual General Meeting on 5th December. The following changes effective from the same date took place. On the Committee: Chairman, Mr. M. Collins, 148 Boundary Road, St. Helens, Lancs. Tel: St. Helens 56670. Secretary, Mrs. H. Steelman, 10 Ribble Avenue, Hamblin, Merseyside L35 9NJ. Tel: 051-428 4213. Show Secretary, Mrs. M. Brownlow, 23 Drake Street, St. Helens, Lancs. Assistant Show Secretary, Mr. F. Banks, 9 Gregory Street, Leigh, Lancs. Tel: Leigh 607026.

AT the A.G.M. of **Oldham & District A.S.** the officers elected were: Chairman, Mr. E. Coupe; Vice-Chairman, Mr. N. Stevenson; Treasurer, Mr. E. Birchwood; Secretary, Mrs. B. Colley, 11 Chamworth Street, Oldham; Show Secretary, Mr. A. Chadwick, 9 Bronville Close, Chadderton, Oldham OLI 2RH. Fund Raising Officer, Mr. A. Rushworth. Public Relations Officer, Mr. R. Colley, Mr. R. Scollcock; Librarian, Mr. N. Stevenson.

Although membership does not grow, enthusiasm does. New members, old members, visitors to the club are always welcome. Meetings are held on alternate Tuesday evenings at 8.00 p.m. at "The Apple" Hotel, Shaw Road, Rycton. Further details from Mrs. Barbara Colley, telephone: 061 620 7607.

Dates for the diary

A monthly information column to keep you up to date on forthcoming events.

FEBRUARY

12th February: SHEAF VALLEY A.S. open show at Donner Twist Dell, Cemetery Road, Sheffield.

18th February: THE BILLINGHAM AQUARIST SOCIETY'S Auction in the Billingham Community Centre. Bring your surplus fish and equipment, 11 a.m. to 1 p.m. Auction starts 1.00 p.m. 10% of proceeds to Billingham A.S. For further information contact Secretary, Mr. G. R. McGregor. Tel: Stockton 563025.

MARCH

4th March: KEIGHLEY A.S. open show, Victoria Hall, Keighley, 40 classes. Further details from Show Secretary, Mr. B. Murray, 7 Westhill Avenue, Coltonworth, Bradford, West Yorkshire. Tel: (0535) 273453.

4th March: NORTH WEST GROUP BRITISH KILLIFISH ASSOCIATION are holding their 3rd open show at the Top-Hall, Midlow Common, Leigh, Lancs.

11th March: HARINGEY A.S. 2nd open show will be held at Highgate Wood Lower School, Park Road, Hornsey, London N6. Further details contact Show Secretary, A. Dempsey, 31 Oakfield Road, N4. Tel: 01-272 1894.

18th March: SKEGNESS & DISTRICT A.S. 7th open show, to be held at the Imperial Cafe (opposite Pier), North Parade, Skegness.

18th March: BEDFORD AND DISTRICT A.S. third open show will be held at the West End Club, Kempston, Bedford to A. of A. standards. Please phone Bedford 43016 or 42937 for details or write to Mick Dashwood (Hon. Secretary), 37b St. Michael's Road, Bedford, Beds. MK40 2LZ.

24th March: EAST DULWICH A.S. annual open show at Pinesy Hall, Stoopford Road, Manor Place, Waltham, London SE17. For further information please contact The Secretary, D. Windsor, 32 Biddystone Road, Brockley, London SE14 2TE.

28th March: HALIFAX A.S. Spring auction at Forest Cottage Community Centre, Goslin Lane, Ilkley, Halifax. Details, ring David Shields, Halifax 60116.

APRIL

1st April: SUDBURY A.S. open show, to be held at Neasden High School, Quinson Street, Neasden NW10. Further details and schedules from: B. Wimeridge, 142 Joel Street, Northwood, Middlesex. Tel: Northwood 24850.

1st April: RUNCORN A.S. open show will be held at the R.I.C.C. Centre, Helsby, Nr. Runcorn, Cheshire (new venue). Plaques for all class winners, annual trophies, etc. Further information, schedules, etc., Ruth Mackie, 23 Adèle Road, Runcorn WA7 4TU. Tel: 79099 (N.B.—New venue easily accessible from motorway. Maps will be sent with schedules if requested).

8th April: CENTRAL MIDLANDS CICHLID GROUP 1st "Cichlid Only" open show. To be held at the Penkridge Middle School, Tealside Road, Penkridge. Details and show schedules available from either Maureen Hall, 71 Saxton Road, Penkridge, Staffs; or Mick Kirkham, 10 Bracken Way, Koginry, Staffs. 25 classes plus auction and other attractions.

8th April: TAUNTON & DISTRICT A.S. open show to be held at the Youth and Community Centre, Tangier, Taunton. Schedules available from F. W. Coles, "Widewater Cottage", Screoch Owl, Huxworth, Bridgewater, Somerset TA7 6AJ.

15th April: KIRKCALDY A.S. annual open show at Balwearry High School, Balwearry Gardens, Kirkcaldy. Fish auction, tombola and centre facilities. Schedules from A. Lurie, 164 Elgin Drive, Glenrothes, Fife.

22nd April: OLDHAM & DISTRICT A.S. annual open show to be held at Werneth Park, Oldham. Further information and show schedules can be obtained from 9 Bronville Close, Chadderton, Oldham OLI 2RH; telephone 061-652 6207.

22nd April: MALVERN & DISTRICT A.S. 11th open show which is being held at St. Joseph's School Hall, Newyears Road, Malvern. Details and show schedules from S. K. Yallop, 3 Monkshole, Yarkhill, Ledbury, Herefordshire HR8 2TX. Tel: Trumper 562.

22nd April: EAST KENT AQUATIC STUDY GROUP 1st open show, at Catholic Social Club Hall, Claverack Road, Harve Bay. Show schedules from: J. Edwards, 14 Upper Dane Road, Margate, Kent.

28th April: YEOVIL A.S. open show at St. Michael's Hall, Yeovil. Schedules (s.a.e. please) from T. C. Perry, 316 St. Michael's Avenue, Yeovil BA22 8NJ.

28th April: MERSEYSIDE A.S. annual open show will be held at the Rainhill Village Hall, Rainhill, Lancashire.

MAY

5th May: SOUTHERN, LEIGH AND DISTRICT open show, St. Clements Hall, Leigh-on-Sea, Essex. Schedules available nearer the date.

6th May: STRET福德 AND DISTRICT A.S. open show at Hartford Community Centre, Canterbury Road, Davyholme, Manchester. For further information contact show secretary, Gary Cummins, 16 Royal Avenue, Urmston, Manchester. Tel: 061-748 8973.

12th May: BOURNEMOUTH A.S. annual open show will take place at Kinross Community Centre, Pithams Park, Kinross, Bournemouth. Show schedules will be available after 1st April, from Show Secretary, Jack Jeffery, 15 Woodland Avenue, Bournemouth Dorset BH5 2DJ. S.a.e. will be appreciated.

12th May: WILLENSHALL AQUARIST GROUP 1st open show will be held at the Frank F. Harrison Community Centre in Walsall. Details and schedules will be available from Alan W. Davis, 5 Star Close, Bentley, Walsall WS2 0LU, West Mids.

20th May: ABERDARE A.S. second open show at Aberaman YMCA. Schedules from Mr. R. Williams, 298 Cardiff Road, Aberaman, Aberdare, Mid-Glam. CF44 6LU.

20th May: BRADWELL & DISTRICT A.S. first annual show, will be held at Bradwell County Primary School. For further details contact the Show Secretary, Mr. J. Biskamoot, 17 Cedar Road, Chesterton, Newcastle-under-Lyme, Staffs.