PUBLISHED RESEARCH BY AQUARIAN®

A selection of scientific papers and conference presentations by AQUARIAN® staff (names highlighted) and academic partners.


GOOD FOOD
FOR GOOD HEALTH

Good nutrition is paramount to the health and well-being of ornamental fish. The nutritional quality of the diet will have a profound influence on all aspects of the fish’s lives: growth, reproduction, longevity, colouration, behaviour, activity, and resistance to disease and environmental stressors.

The combination of a high quality diet and optimal environmental conditions is the key to successful fish-keeping.

Fish food manufacturers have a responsibility to deliver the best nutrition for ornamental fish. Mars FishCare, the owners of AQUARIAN® foods, takes this responsibility very seriously.

INDEX

1. Experts in advanced nutrition of ornamental fish
2. Complete nutrition
3. Natural ingredients
4. Enhancing the natural colours of fish
5. Antioxidants
6. Creating the perfect balanced food
7. Healthy growth and nutrition
8. Technical product information
9. Feeding strategies and feeding dynamics
10. Working with public aquariums and fish conservation projects
11. Published research
EXPERTS IN ADVANCED NUTRITION OF ORNAMENTAL FISH

AQUARIAN® has accrued over 30 years' know-how in ornamental fish nutrition, health and husbandry. Part of the global Mars Fishcare business, AQUARIAN® has dedicated aquarium facilities that house tropical freshwater, marine, and temperate fishes of ornamental interest. It is staffed by university-qualified scientists, fish nutritionists, chemists, aquarists and aquatic technicians.

RECENT AQUARIAN® RESEARCH PROGRAMMES

<table>
<thead>
<tr>
<th>Research Field</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antioxidant properties of phytonutrients</td>
<td>Evaluating the benefits of dietary carotenoids in combating the side-effects of oxidative stress in ornamental fish.</td>
</tr>
<tr>
<td>Haematology and blood plasma chemistry</td>
<td>Investigating haematological parameters of ornamental fish species. This data helps assess nutritional status, health and immune function.</td>
</tr>
<tr>
<td>Optimised protein utilization and water quality</td>
<td>Studies on protein metabolism and amino acid profiling to achieve high-performance low-polluting diets.</td>
</tr>
<tr>
<td>Dietary pigments and skin colour</td>
<td>Studying effects of dietary colour enhancers on social signalling in the dwarf gourami (Colisa lalia).</td>
</tr>
<tr>
<td>Environmental enrichment</td>
<td>Advancing nutritional and environmental enrichment techniques to stimulate natural feeding and activity behaviours in aquarium fish.</td>
</tr>
</tbody>
</table>

AQUARIAN® staff regularly present their findings at international scientific conferences and in peer-reviewed scientific journals and books. Over 100 articles have been published in the aquarium hobby and aquatics trade press.

AQUARIAN® actively collaborates with leading universities that are engaged in improving fish nutrition and fish health—including University of Plymouth, Cardiff University, and University of Swansea.

AQUARIAN® supports and funds a university lectureship in Aquarium Sciences and Conservation at the University of Plymouth.

AQUARIAN® staff lecture on ornamental fish nutrition and health to aquatics training colleges (such as Sparsholt College and Reaseheath College).
**COMPLETE NUTRITION**

A complete diet delivers all the essential nutrients that fish need for healthy development and normal function. The importance of a complete diet is especially relevant to captive fish (particularly those held in aquaria) which have to rely mostly on foods provided by the fishkeeper.

**MAJOR COMPONENTS OF A COMPLETE DIET**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>FUNCTIONS</th>
<th>MAJOR SOURCES IN AQUARIAN® FISH FOODS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>Essential for tissue growth and repair, and for metabolic regulation processes. Also used as an energy source.</td>
<td>Egg, Fish meal</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>A rich source of energy; fats have twice the caloric (energy) value of proteins and carbohydrates. Also a key component of cell membranes and for the synthesis of prostaglandins and other eicosanoids.</td>
<td>Wheat, Starch</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Diverse roles associated with physiological and metabolic activities. Some vitamins play an important role in immunity and the resistance to stress.</td>
<td>Vegetables, Levels boosted using natural and synthetic premixes.</td>
</tr>
<tr>
<td>Minerals</td>
<td>Major structural elements of bones and teeth. Also play a role in blood formation and function. Present in cell fluids and other tissues.</td>
<td>Various raw components, Levels boosted using a premix.</td>
</tr>
</tbody>
</table>

**Protein chemistry: essential amino acids**

Proteins are large molecules that consist of chains of hundreds or thousands of sub-units known as amino acids. About 20 different amino acids are used in the construction of proteins. Some of these amino acids can be synthesised by the fish. However, these are ten amino acids that fish cannot manufacture themselves and these must be obtained via the diet — these are known as essential amino acids (EAA).

All AQUARIAN® foods supply the ten essential amino acids that fish require in order to manufacture proteins. They are: Arginine, Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan, and Valine.

**MOLECULAR MODEL OF LYSINE**

— an essential amino acid for fish

**Dietary deficiency diseases in ornamental fish**

Nutritional deficiency problems in fish are mostly caused by a lack of certain key micronutrients. Even if just a single essential ingredient is missing from the diet, this will result in development abnormalities, disease, or even death. For example, a dietary lack of thiamine (vitamin B1) or riboflavin (vitamin B2) has been linked to poor growth, haemorrhaging of the fins or skin, and disorders of the nervous system.

**Deficiency symptoms in fish**

- **Pantothenic acid**
  - Anaemia
  - Exophthalmia (pop-eye)
  - Clubbing of the gill lamellae

- **Niacin**
  - dropsy-effect (oedema in stomach)
  - Swollen gills
  - Skin haemorrhages

- **Folic acid**
  - Anaemia (lowered red blood cell count)
  - Pale gills

- **Vitamin E**
  - Anaemia
  - Pale gills

- **Vitamin C**
  - Haemorrhaging of fins and skin
  - Deformed backbone (scoliosis and lordosis)
  - Poor wound healing

- **Vitamin A**
  - Exophthalmia (pop-eye)
  - Fading of skin colours
  - Haemorrhaging of fins and skin

...there are ten amino acids that fish cannot manufacture themselves and they must be supplied by the diet — these are known as essential amino acids (EAA).
AQUARIAN® ADVANCED NUTRITION — MADE WITH NATURAL INGREDIENTS

Why natural?
The inclusion of natural ingredients in AQUARIAN® diets helps reflect the various food items that fish consume in the wild — such as single-celled microorganisms, algae, higher plants, aquatic invertebrates, and fish.

The use of natural ingredients ensures the best formulation to deliver maximum nutritional value. For example, amino acids and sugars can each exist in two structural forms, known as L and D isomers. These two isomers are mirror images of each other — just like our left and right hands.

Fish and other animals utilise L isomer amino acids whereas the D amino acid isomers are of less nutritional value. In the case of sugars, it is the D isomers that are nutritionally important. The incorporation of natural ingredients in AQUARIAN® foods ensures that fish receive the correct isomeric forms of these key nutrients.

L- AND D- ISOMERS OF THE AMINO ACID, ALANINE

Fish cannot manufacture carotenoids themselves, hence these important substances must be obtained via the diet

Natural phytonutrients
The term phytonutrients describes certain organic components that are present within plants (e.g. vegetables). They comprise a range of chemical families including the carotenoids that have proven benefits to ornamental fish.

Fish cannot manufacture carotenoids themselves; hence these important substances must be obtained via the diet.

- Carotenoids function as pigments, helping to bring out the full natural colours of fish.
- Carotenoids help protect fish against oxidative stress, and boost the immune system to help fight disease.
- The carotenoids lutein and zeaxanthin are important for eye health.

CAROTENOIDS

PIGMENTERS
(enhance colour)

ANTIOXIDANTS
(protective role)

EYE HEALTH
(Lutein & Zeaxanthin carotenoids)
ENHANCING THE NATURAL COLOURS OF FISH

Skin colouration in fish serves a number of beneficial purposes, such as camouflage, recognition, and behavioural signalling. Much of the natural colouration within the fish’s skin is derived from dietary pigments.

**AQUARIAN® research into fish colours**

Over the years, AQUARIAN® has undertaken extensive studies on dietary pigmenters and their beneficial effects on ornamental fish (see, for example, Obra et al. 1999).

AQUARIAN® has developed a non-invasive technique for quantifying skin colour in fish, which involves using a Minolta colorimeter (AQUARIAN® research publication: Mela et al. 2002).

Using this methodology, a study was conducted comparing the influence of a number of natural pigmenters on goldfish colouration. The most effective pigmenter was found to be the carotenoid lutetin, found naturally in marigold meal. Significant colour enhancement was detected within three weeks of receiving the lutetin-rich diet.

Lutetin is commonly found in the xanthophores (yellow pigment cells) of several fish species, including goldfish. Lutetin is one of several natural colour enhancers used in AQUARIAN® foods. The betalains are another group of natural pigmenters found in fish. Studies by AQUARIAN® have shown that dietary betalains protect the colours of ornamental fish when stressed (AQUARIAN® research publication: Baron et al. 2008). Betalains also have antioxidant properties — see Antioxidants, page 12.

How fish get their colours

The colour of the fish’s skin is due mainly to pigments that are packaged within special cells, known as chromatophores. The chromatophores are located mainly in the dermal layer of the skin. The fish’s internal organs may also possess ‘free’ colours that are not associated with chromatophores.

**Colour cells in fish**

The colours produced by cells are either due to pigments (known as biochromes) or are the result of light refracting or reflecting from the fish’s body surface (these are known as structural colours or schematochromes).

**Dietary pigments and reproduction in ornamental fish**

Studies by AQUARIAN® in conjunction with the University of Plymouth (UK) have revealed a link between dietary pigmenters and mate choice in dwarf gouramis (*Colisa lalia*). Female dwarf gouramis were found to be more attracted to males whose skin colour had been enhanced through the dietary intake of certain pigmenters (AQUARIAN® research publication: Baron et al. 2008). These studies show the potential benefits of dietary pigmenters for the captive breeding of gouramis and other ornamental fishes.

All AQUARIAN® food granules contain lutetin. AQUARIAN® colour flakes contain higher quantities.
ANTIOXIDANTS PLAY A KEY ROLE IN HEALTH AND LONGEVITY

Antioxidants are important dietary constituents that have many health benefits for fish. They play a role in dampening the side-effects of oxidative stress.

Free radicals and oxidative stress in fish

Fish (and other animals) produce chemicals known as “free radicals” during normal metabolism (e.g., mitochondrial respiration) and as part of their response to disease, ageing, pollution, and certain forms of stress. It allowed to persist in the body, the highly reactive free radicals can damage the cells and tissues causing oxidative stress.

Within the fish’s body, free radicals are mopped up (neutralised) by other chemicals known as antioxidants. Fish obtain these beneficial antioxidants via their diet. Important dietary micronutrients that possess antioxidant qualities are the carotenoids and vitamins E and C.

Lycopene, lutein and betalain carotenoids — natural dietary antioxidants

Among the natural antioxidants studied by AQUARIAN® is the betalain group of carotenoids. (The term “betalain” is derived from beetroot which is a rich source of these phytonutrients). The betalains are themselves divided into two sub-groups — the betacyanins and the betaxanthins. A major betacyanin is betanin.

Other carotenoids with antioxidant properties include lycopene (from tomatoes) and lutein, both extensively studied by AQUARIAN®.

AQUARIAN®’s antioxidants combat thermal stress

AQUARIAN® studies on goldfish have shown that when fish are exposed to higher water temperatures they produce more free radicals (due to the fish’s increased metabolism). This thermally-induced elevation in free radical levels can cause oxidative stress to the fish.

Studies on AQUARIAN® foods show that their scientifically optimised blend of vitamin antioxidants (vitamins E and C) helps protect fish against the stress of temperature fluctuations. These findings support the use of higher levels of vitamins E and C in AQUARIAN® diets. (AQUARIAN® research publication: Snellgrove et al. 2007).

Further studies have shown that the antioxidants used in AQUARIAN® diets are taken up into the fish’s blood and tissues where they help the immune system.

![Diagram of Protective Mechanism of Antioxidants]

Free radicals
Lutein protects the lipids in the membrane from attack by free radicals
Consolidates the membrane
Lutein

PROTECTIVE MECHANISM OF ANTIOXIDANTS

..free radicals are mopped up (neutralised) by other chemicals known as antioxidants

**Benefits to retailer**
- Helps protect fish against thermal stress
- Helps protect fish against stress fluctuations
- Benefits to retailer

**Benefits to hobbyist**
- Helps protect fish against thermal stress
- Helps protect fish against stress fluctuations
- Benefits to hobbyist

Greater resistance to thermal stress
CREATING THE PERFECT BALANCED FOOD

A correctly balanced diet contains all the necessary ingredients in the right proportions to deliver optimal nutrition. This is one of the hallmarks of an advanced food formulation.

Considerations when formulating a balanced diet
- Provision of appropriate lipids and carbohydrates as energy sources
- Provision of quality proteins (containing all the essential amino acids) for tissue growth and repair
- Understanding of possible synergistic antagonistic and sparing interactions between macro — and micro-nutrients
- Provision of non-limiting levels of minerals, vitamins, and other micro-nutrients
- Provision of the essential fatty acids — Omega 3 and 6 series

Amino acid profiling
AQUARIAN uses amino acid profiling techniques to ensure that its diets contain the essential amino acids in the correct proportions for protein synthesis. This is important as some essential amino acids are required in greater proportions than others. For example, the fish’s dietary requirements for the amino acid lysine are generally far higher than for histidine or tryptophan (based on percentage of dry diet).

ESSENTIAL AMINO ACIDS PROFILE

**Optimised amino acid composition**

- High proportion of amino acids used for protein synthesis (tissue growth)
- Synthesized protein from amino acid building blocks
- Minimal levels of excess amino acids
- Minimal production of toxic ammonia
- Cleaner, safer aquarium water
- Healthy fish

*Optimised dietary amino acids profile in AQUARIAN* — benefits for water quality and fish health

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>Carp</th>
<th>Tilapia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arginine</td>
<td>1.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Histidine</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Isoleucine</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Leucine</td>
<td>1.3</td>
<td>1.4</td>
</tr>
<tr>
<td>Lysine</td>
<td>2.2</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Indispensable amino acid requirement of juvenile common carp and juvenile Nile tilapia. Values as percentage of dry diet. Carp and tilapia diets comprise 38.5% and 28% total dietary protein respectively (Data from Nose, 1979; Santiago and Lovell, 1988).
HEALTHY GROWTH AND NUTRITION

Many fish that are purchased for the aquarium or pond will be immature specimens that have not reached adult size. Proper growth of these young fish is essential for their long-term health, for any growth abnormalities are generally irreversible and incurable.

Paramount to healthy growth is good nutrition. Poor nutrition is a significant cause of growth abnormalities in fish. For example, a dietary lack of phosphorus can lead to stunted growth and bone defects such as demineralisation ("fragile bones") and spinal curvature.

Fish do not grow at a steady rate. During early development, their rate of growth (relative to body weight) can be extremely high. For example, the fry of some species are capable of increasing in weight by up to 40% per day. With the onset of sexual maturity, the growth rate slows down and a significant proportion of the diet is channelled into gonadal development; ovaries and testes. When fully adult, growth virtually ceases.

AQUARIAN® ensures that all its diets produce normal growth in fish. As part of AQUARIAN®’s scientific feeding trials a number of growth indices are monitored at regular intervals over the course of the study. The resultant morphometric and weight gain data is critically evaluated to confirm that fish fed on AQUARIAN® diets grow into normal healthy adults.

FACTORS THAT CAN INFLUENCE GROWTH IN AQUARIUM FISH

FOOD
• Abundance
• Size
• Composition
• Digestibility

INTRINSIC FACTORS
• Age
• Sex
• Health
• Stress
• Reproductive state
• Genetic factors

ENVIRONMENTAL CONDITIONS
• Temperature
• Oxygen level
• pH
• Nitrogenous wastes
• Pollutants
• Photoperiod/season

SOCIAL INTERACTIONS
• Fish density
• Aggression
• Competition
• Predation

GROWTH RATE

Specific growth rate (SGR) = 100 x (ln w2–ln w1)/trial days where w1 and w2 is the weight of the fish on day 0 and end day, respectively.
> Measures gain in body weight over time.

Food conversion ratio (FCR) = bodyweight gain (g) / weight of food fed (g).
> Indicates proportion of food converted into tissues.
AQUARIAN® FOODS
TECHNICAL DATA

AQUARIAN® FLAKE DIETS

Tropical flake
- Advanced formulation fully meets the nutritional requirements of tropical community fish.
- Rich in natural protein sources including fish meal.
- With natural pigments and antioxidants to improve colour and health.

Goldfish flake
- Delivers superior nutrition for goldfish and other coldwater cyprinids.
- Contains optimal protein levels required by goldfish, as shown by AQUARIAN®’s in-house nutrition studies.
- For all types of common and fancy goldfish. Also ideal for small koi and other coldwater fish.

Colour enhancing food
- Enriched with high-performance natural pigments selected from AQUARIAN® trials.
- Scientifically proven to enhance the natural colours of tropical and coldwater fish.

Vegetable flake
- Contains unique blend of plant and algae-derived ingredients.
- Specially formulated for freshwater and marine fish that require high levels of dietary vegetable matter.
- Ideal for barbs, livebearers and other herbivorous species. Provides vegetable enrichment for all community fish.

Marine flake
- Delivers all the nutritional needs of marine fish.
- Includes fish and shellfish derivatives, algae and molluscs — reflecting natural food organisms found on the coral reef.
- Readily accepted by wild and captive-bred marines, as proven by AQUARIAN®’s scientific palatability studies.

Baby fish food
- Complete protein-enriched diet to ensure healthy growth and development in young fish.
- Optimal levels of essential amino acids, minerals and vitamins for normal formation of soft tissues and bones.
- Ideal for livebearer fry and for weaning egg-layer fry onto dry foods.

AQUARIAN® FOODS
TECHNICAL DATA

OTHER AQUARIAN® DIETS

Algae wafer
- Unique formula contains three types of algae (Ghurial, Chlorella and Kelp).
- Slow-dissolve formulation ideal for picus and other slow-grazing fishes.
- Perfect for bottom-dwelling fish that enjoy algae as part of their diet — e.g. picus (including L. koi, koi males, bettas, and angelfish).
FEEDING STRATEGIES

AQUARIAN® has developed a concise yet comprehensive range of superior diets that enable simple feeding programmes. They offer complete nutrition and feeding enrichment without the need to use a bewildering range of fish food products.

AQUARIAN® diets fall into two categories:

**Staple diets.** Nutritional complete diets which can be fed every day, 7 days per week.

**Specialty diets and treats.** These foods are also nutritionally complete. However, they are generally given occasionally — e.g. 4 to 5 times per week instead of the staple diet. These foods provide feeding enrichment and satisfy the special dietary needs of certain fish, such as algae-eaters.

**Simplified feeding programmes**

- **GOLDFISH AQUARIUMS**
  - Staple diet (every-day food)
    - For small-medium goldfish feed AQUARIAN® Goldfish Flakes
    - For medium-large goldfish (and small koi), feed AQUARIAN® Goldfish Pellets
  - Specialty diets and treats (occasional foods)
    - To enhance the natural colours of goldfish (e.g. if fish go off colour) give occasional feeds of AQUARIAN® Colour-enhancing food

- **FRESHWATER TROPICAL AQUARIUMS**
  - Staple diet (every-day food)
    - For small-medium tropical fish feed AQUARIAN® Tropical Flakes
    - For large tropical fish (e.g. adult angelfish, discus, large barbs), feed AQUARIAN® Sinking Pellets
  - Specialty diets and treats (occasional foods)
    - To enhance the natural colours of tropical fish (e.g. if fish go off colour) give occasional feeds of AQUARIAN® Colour-enhancing food
    - For aquariums that house benthic fish (bottom-dwellers), such as plecos, catfishes, give occasional feeds of AQUARIAN® Vegetable Flakes

- **MARINE AQUARIUMS**
  - Staple diet (every-day food)
    - For most community marine fish, feed AQUARIAN® Marine Flake
  - Specialty diets and treats (occasional foods)
    - For marine aquariums that house yellow tangs and other fish that enjoy extra vegetable matter give occasional feeds of AQUARIAN® Vegetable Flakes

- **FRY BREARING AQUARIUMS**
  - Good nutrition is vitally important for the healthy development of fry. AQUARIAN® Baby Food is specially formulated to ensure healthy growth in young fish.
    - This high protein diet is ideal for baby livebearers (e.g. guppies, mollies) and for weaning baby egg-layers onto dry foods

In addition to researching the nutritional composition of its diets, AQUARIAN® has undertaken extensive studies on the practicalities of feeding ornamental fish.

**Feeding quantity**

The energy requirements of fish are much lower than those of mammals or birds. For example, the maintenance energy requirements of a goldfish (at 20°C) is around 40 kJ / kg bodyweight / day whereas those of a dog or budgerigar are considerably higher, at around 460 and 1670 kJ / kg bodyweight / day, respectively. AQUARIAN® have studied the energy requirements of a range of ornamental fish in order to produce diets that deliver the correct energy levels (AQUARIAN® research publication: Pannevis & Earle, 1994).

For aquarium fish, gauging how much to feed is complicated by the widely differing energy needs of the various species and sizes of fish within a community aquarium. For example, a 0.18g neon tetra requires sufficient food to deliver 68 Joules of energy per day, whereas a 1.9g moonlight gourami requires around 550 Joules per day (AQUARIAN® research publication: Pannevis & Earle, 1994).

One simple feeding strategy is to give only as much food as the fish will completely consume within a few minutes. Remove any food left after this time, to prevent pollution. Some species, however, require longer foraging times, such as algae-grazing benthic catfishes. AQUARIAN® has catered for such needs by producing a “slow-dissolve” formulation Algae wafer food that can be safely left in the aquarium until fully consumed.

**Feeding frequency**

The majority of ornamental fish are small species that tend to feed frequently in the wild. Studies by AQUARIAN® have shown that such fish utilise food more efficiently if the daily food ration is split into two or more separate feeds. Most ornamental fish will therefore benefit from being fed two or three times per day. Young fish need more frequent feeds.

**Target feeding**

It is vital to ensure that all the fish within the aquarium receive sufficient food. A strategy known as target feeding can be useful in some situations to achieve this goal.

For example, fast-sinking foods, such as AQUARIAN® Algae wafers, are ideal for target feeding benthic (bottom-dwelling) fishes, such as catfishes and loaches, that may otherwise lose out at feeding times. Nocturnal active benthic feeders (e.g. some catfishes) can be targeted by offering a fast sinking food an hour or so after the aquarium lights have been switched off.

**Simplified feeding programmes**

<table>
<thead>
<tr>
<th>Species</th>
<th>Initial Weight (g)</th>
<th>Energy Requirements</th>
<th>Feeding Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GDJ (g) fish/day</td>
<td>mg JDE/day</td>
<td>% body wt/day</td>
</tr>
<tr>
<td>Goldfish (Carassius auratus)</td>
<td>3.6</td>
<td>239</td>
<td>14.4</td>
</tr>
<tr>
<td>Neon tetra (Paracheirodon innesi)</td>
<td>0.16</td>
<td>68</td>
<td>5.6</td>
</tr>
<tr>
<td>Zebrasoma desjardinii</td>
<td>0.5</td>
<td>&lt;252</td>
<td>&lt;2.0</td>
</tr>
<tr>
<td>Kribensis (Pelvicachromis pulcher)</td>
<td>1</td>
<td>&lt;182</td>
<td>&lt;0.2</td>
</tr>
<tr>
<td>Moonlight Gourami (Trichogaster microlepis)</td>
<td>1.0</td>
<td>&lt;506</td>
<td>&lt;2.5</td>
</tr>
</tbody>
</table>

Energy requirements of two species of ornamental fish (Pannevis & Earle, 1994). Feeding requirements are based on AQUARIAN® Flake diets of 1665 kJ / 100g and 1783 kJ / 100g, digestive energy for goldfish and tropical species respectively. Goldfish were maintained at 28°C, tropical species at 25°C. JDE = Joules of Digestible Energy.
AQUARIAN® – A KEY PLAYER IN FISH CONSERVATION PROJECTS

AQUARIAN® diets are widely used by professional aquarists and by 9 out of 10 major UK public aquariums.

Supporting ex-situ conservation programs

AQUARIAN® foods are used by a number of academic institutions involved in the captive breeding of highly endangered fishes. These include the Fish Ark project at Morelia University in Mexico which is involved in conserving and breeding highly endangered Mexican fishes (including livebearing goodells such as Ameca splendens, Allotoca goslinei, and Zoogoneticus tequila).

AQUARIAN® has funded a working visit by London Zoo aquarium staff to Project Piaba in the Brazilian Amazon. Project Piaba is involved in the sustainable ornamental fishery for cardinal tetras and other Amazonian species of aquarium interest.

Saving the Celestial Pearl Danio

Discovered in 2006, this beautiful fish is already under threat in its native Myanmar. An ex-situ breeding programme was needed to help save this species from extinction. World-class aquarists Pete Liptrot and Paul Dixon of Bolton Museum’s Aquarium rose to the challenge and became the first to successfully breed this fish in captivity.

Superior nutrition was crucial. “We needed a diet that contains plenty of appetite stimulants and meets all their nutritional requirements” said Pete. “AQUARIAN® was ideal and was accepted instantly by our wild-caught adults.”

AQUARIAN® diets are widely used by professional aquarists and by 9 out of 10 major UK public aquariums’