

Scientific Photography of Fishes

A 'keep it sweet and simple' guide for the Global Freshwater Fish BioBlitz



Prepared by

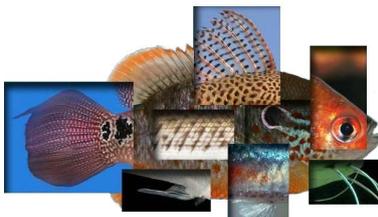
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With contributions from the IUCN SSC/WI Freshwater Fish Specialist Group

All photographs and artwork are by the author except where credited.



Global Freshwater Fish BioBlitz

The Global Freshwater Fish BioBlitz, a citizen science project, invites members of the public to contribute their photographs of fish observed in their natural habitat. The photographs, along with details of when and where the fish was observed, are uploaded and recorded [here](#).

This information will be used to assist scientists with wildlife monitoring and contribute directly to the conservation of endangered freshwater fishes.

About this guide

This guide covers different aspects of the scientific photography of fishes, and is divided into the following sections:

- basics of photography
- macro photography
- choosing a specimen to photograph
- live specimen *in-situ*
- live specimen *ex-situ*
- freshly dead specimen in the field
- freshly dead specimen in a controlled environment
- preserved specimen in a controlled environment
- photographic equipment and accessories for successful macro photography
- humane treatment of fishes

Caveat 1: This following guide is based on personal experiences using Single Lens Reflex (SLR) systems, from 35mm film era (1990) to digital format (post 2005), using almost exclusively Nikon™ brand camera systems.

Caveat 2: Most of the techniques, described in the guide, were self-taught or learnt informally from other practitioners, books, and by trial and error. The author and organisations associated with the Global Freshwater Fish BioBlitz take no responsibility for any errors that may occur as a result of the application of these techniques.

Caveat 3: It is often said that it is the photographer's skill that defines the imagery; but with better equipment, it is easier to achieve that goal.

For scientific photography of fishes, one must keep in mind the need for accurate depiction of the subject, with no distortion or altered perspectives. The use of an SLR system and dedicated macro lens (preferably 1:1 life size ratio) will assist in presenting the subject as accurately as possible. The macro lenses made for SLR cameras have been built for extreme sharpness and minimal distortion. Nikon has a patented system in their macro lenses called CRC (Close Range Correction), but other camera brands also have similar systems in place. Compact cameras are without doubt more portable and convenient to use, but the close-up function usually distorts the image and changes the perspectives depending on the focal length used.

Always remember to keep a record of the details of each fish in your photographs. This will include the date and information about the precise location of where the fish was observed, and the species identification, if known. You might also have a field collection number for any dead fish that will be brought back to the laboratory for subsequent examination. Ensure that all this information is associated with the photograph number. If you are photographing a specimen in a museum collection, carefully record the museum collection number of the fish. Some people write this information on a piece of paper and include that in an extra photograph of the fish, to act as a reference.

Basics of photography

There are three main parameters of photography; shutter speed, aperture and ISO:

1) Shutter speed

Shutter speed is measured in seconds, usually shown as a fraction, and the larger the number, the faster the shutter speed, e.g. 1/1000 sec. Some exposures may be measured in whole seconds, thus making them long exposures. Shutter speed controls motion blurriness, and a fast shutter speed will be able to capture the shot faster, so making the images sharper. Typically, for macro shots with adequate lighting, minimum shutter speed is around 1/60 sec or faster.

2) Aperture

Aperture is usually depicted as f-stops, which controls the depth of field. The f-stop is usually listed as f2.8, f4, f5.6, f8, f11, f16, f22, f32. The relationship between f-stop and depth of field is inversely proportionate. A larger f-stop has a smaller aperture and more depth of field, whereas a smaller f-stop has a larger aperture and less depth of field. Most lenses are sharpest at f8 to f11, but when more depth of field is required, the f-stop can be pushed down to f32. However, this will cause some loss of sharpness (discernible when highly magnified at 200% - 300%).

3) ISO

ISO refers to the speed of the film (during the film era), but in the digital age, it provides a standardisation for calibrating the process of capturing available light using a digital sensor. A lower ISO number (e.g. 50, 100) allows the capture of a cleaner image; whereas a higher ISO number (e.g. 3200, 6400) leads to a more pixelated image, due to less available light in the environment. An important feature for *in-situ* photography is the auto-ISO function, which manages the successful capture of a subject in low light conditions.

Top Tip

Remember the three main principles of photography – light, light, light. More light is always desirable, but the light must be controllable.

Macro photography

This is a section on macro photography deals with close-up imagery. Most modern macro lenses are capable of life size (1:1) reproduction. Some older lenses or manual lenses are only capable of half-life size (1:2) reproduction. More than life size reproduction of imagery can be achieved by using add-on magnifying filters, placement of extension tubes (individually or stacked) between camera body and lens, or by using a set of bellows (elaborate adjustable extension tube) between the camera body and lens (enabling the whole setup to be fully manual).

Generally, if the physical characteristics of the specimen are to be captured, the focus point is on the eye or head region. If the subject of interest is a body part, then manual focusing is required to pinpoint the region. For most macro work, manual focusing allows a smoother work flow, and the desired result.

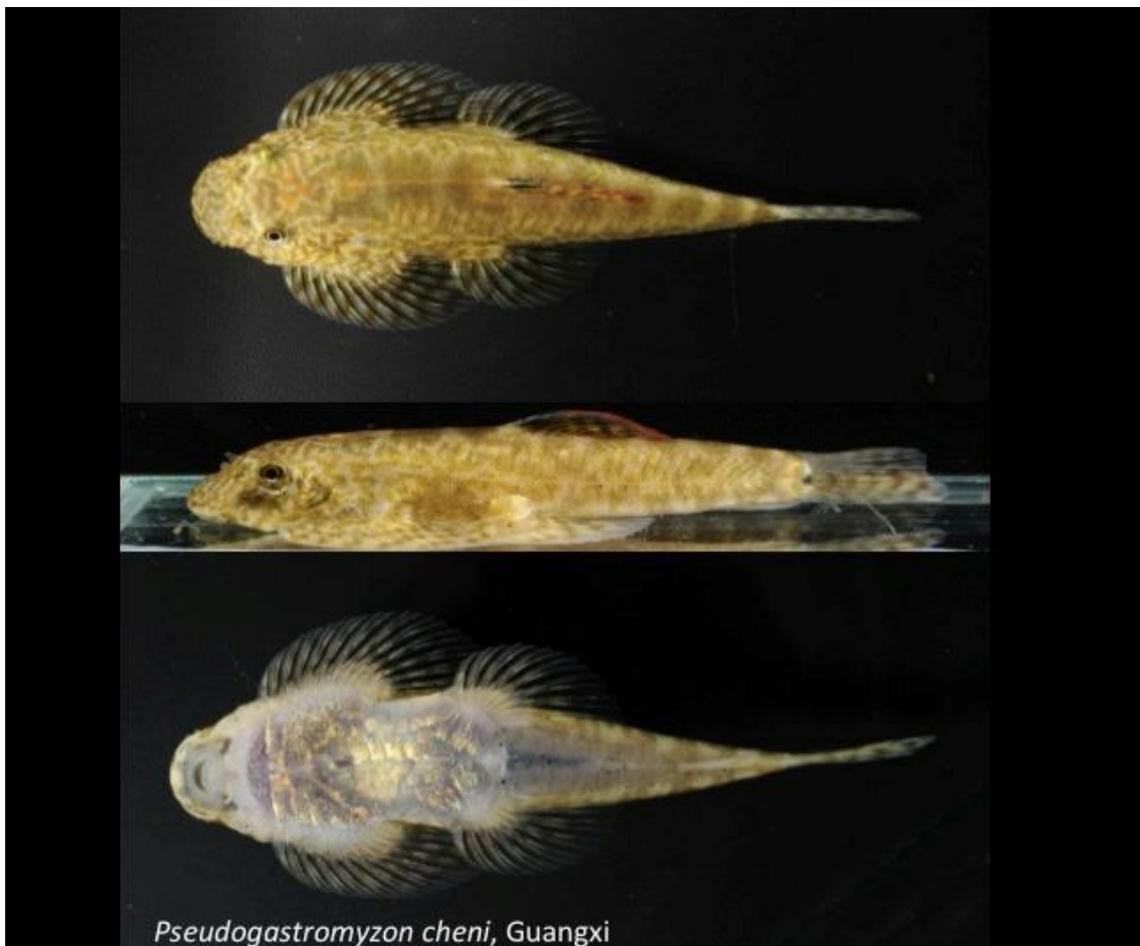
Choosing a specimen to photograph

If there is a range of specimens to choose from, a good representative should be picked. Avoid using specimens that have lost scales, or have their fins damaged. In cases where there are differences between juvenile and adult colouration, both phases should be documented. In cases where sexual dichromatism or dimorphism is exhibited, photograph both sexes.

The typical convention is for the left side of the fish to be photographed. Sometimes, both left and right sides are documented due to rarity of the specimen or abnormalities. Sometimes, only the right side is available for photography due to curvature of the preserved specimen or its left side being damaged. In this case, the image can be flipped mirror-wise, and stated as right-side reversed.

Photographs taken when the fish is alive or freshly preserved in the field is the best way as the fish's natural colours can still be seen and the specimen is in optimal condition. Preserved fish should, therefore, be photographed as soon as possible after death and/or preservation.

There are three standard views: dorsal, lateral and ventral views. For some fishes, only the right or left sides are photographed (e.g. flatfishes), or only the dorsal view is photographed (e.g. rays). For elongated fish, they are often curled into a 'C' shape and photographed.

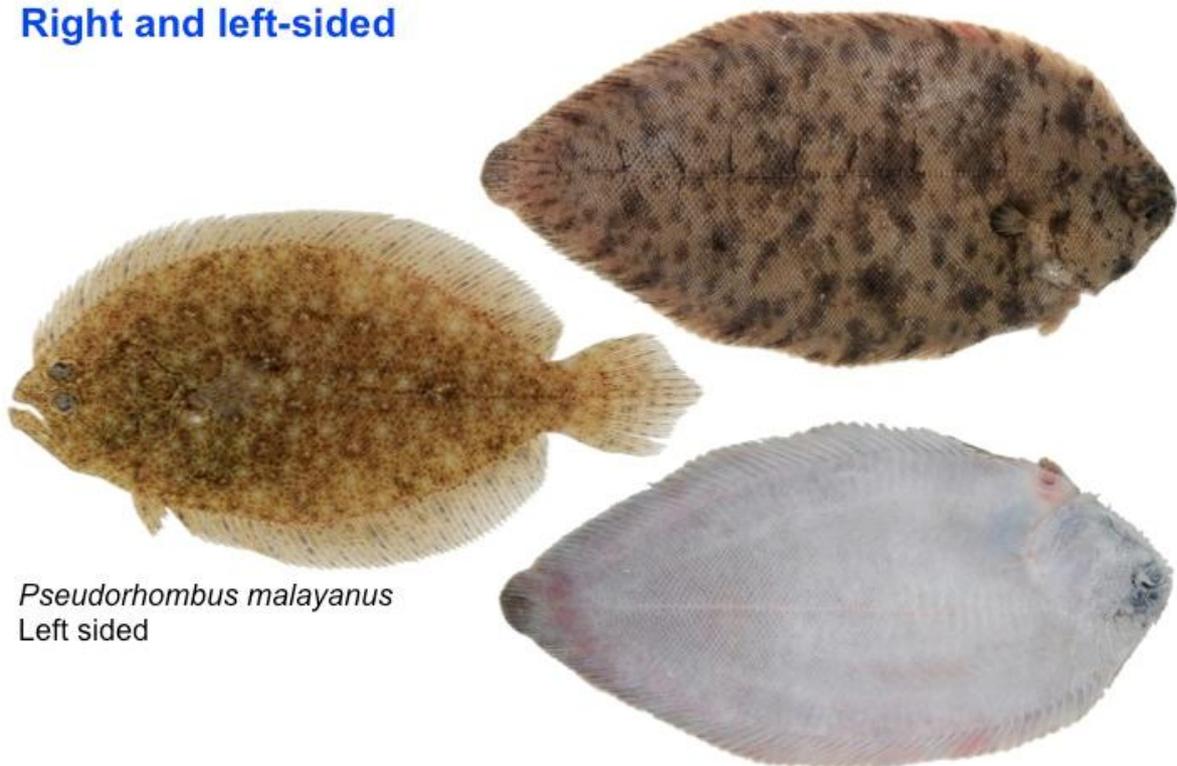


Dorsal view



Himantura signifer
Dorsal view with tail excised
Kalimantan Tengah

Right and left-sided



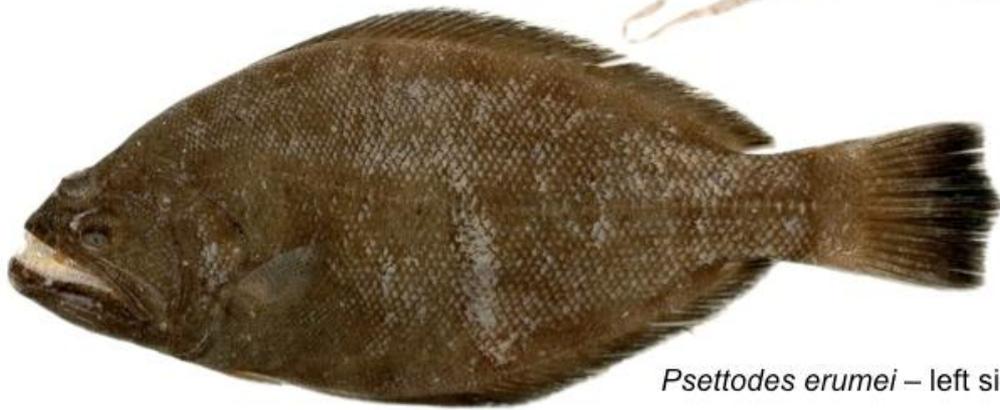
Pseudorhombus malayanus
Left sided

Brachirus orientalis – right sided
Top: sighted side; bottom: blind side

Right and left-sided



Synaptura commersiana (with polychaete prey in mouth)
Right sided



Psettodes erumei – left sided

Long-bodied fish



Monopterus javanensis
Body curved into reverse C shape



Stiphodon aureorostrum - Tioman

Live specimen *in-situ*

Using specialised waterproof casings for the DSLR camera and appropriate ports for relevant lens are a necessity! Underwater strobes are required to freeze the action and reinstate colour, especially in the marine environment where the red light rays are the first to be attenuated due to depth of water.

For most *in-situ* photography in the marine environment, the photographer has to be properly qualified to use SCUBA gear and have adequate buoyancy control to conduct such activity safely and successfully. The time span for such activity is severely limited by the amount of compressed air and depth of the dive. For aspects on diving, please consult a professional dive agency (e.g. PADI, NAUI, BSAC).

For *in-situ* photography in the freshwater environment, the water tends to be more turbid (containing more suspended particles), leading to the issue of excessive backscatter of light. In shallow streams, snorkelling would be adequate for observation and photography. Waterproof compact cameras are ideal in such situations, but if external strobe(s) are available, the resulting images are improved.

For underwater photography, there is a common tendency to face the strobes directly on the subject. This can often lead to backscatter or overexposure on parts of the subject or background. The proper method is to face the strobes directly outward (perpendicular to lens surface) and use the weaker side beams of the flash to illuminate the subject and reduce backscatter.

In-situ photography basically requires specialised equipment (often costing more than the camera itself), plenty of patience and a bit of luck!

Here are some suggested parameters to try: M (manual) mode, shutter speed 1/100 to 1/250 sec, aperture f11 to 25.

Live specimen *ex-situ*

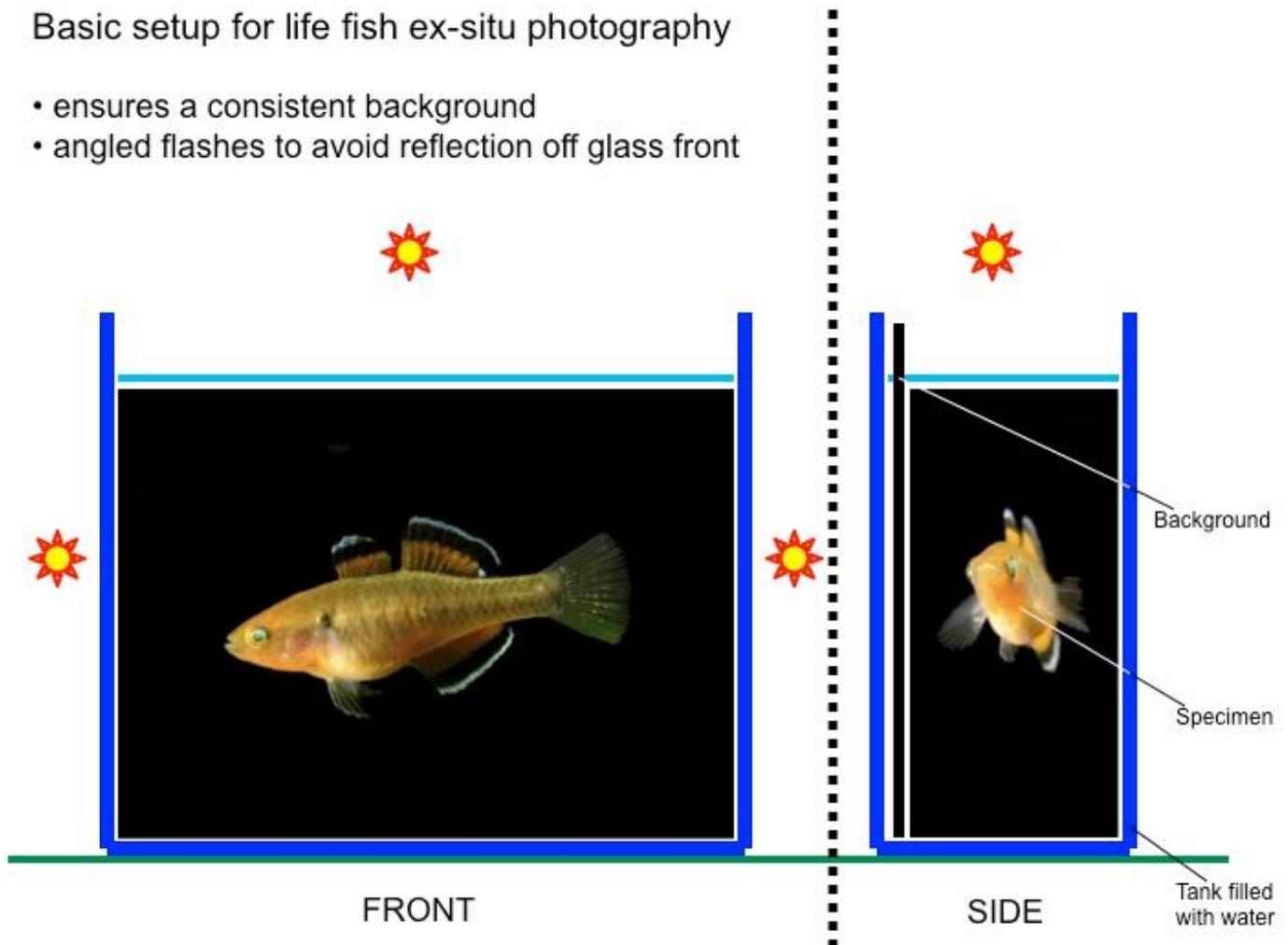
For *ex-situ* photography of fish, the most convenient method is a specially constructed glass tank with narrow width to restrict the movement of the fish. This type of glass tank is termed photo-tank, and the dimensions can be variable, depending on the size of the subject to be photographed.

The background of the photo-tank has to be taken into consideration. Usually, a uniform and plain background of a neutral colour is preferred, e.g. black or white. The fish can be further restricted by a plane of glass or coloured plastic sheet. It is important to ensure that the fish is kept parallel to the camera.

Here are some suggested parameters to try: M mode, shutter speed 1/80 to 1/125 sec, aperture f11 to 32.

Basic setup for life fish *ex-situ* photography

- ensures a consistent background
- angled flashes to avoid reflection off glass front



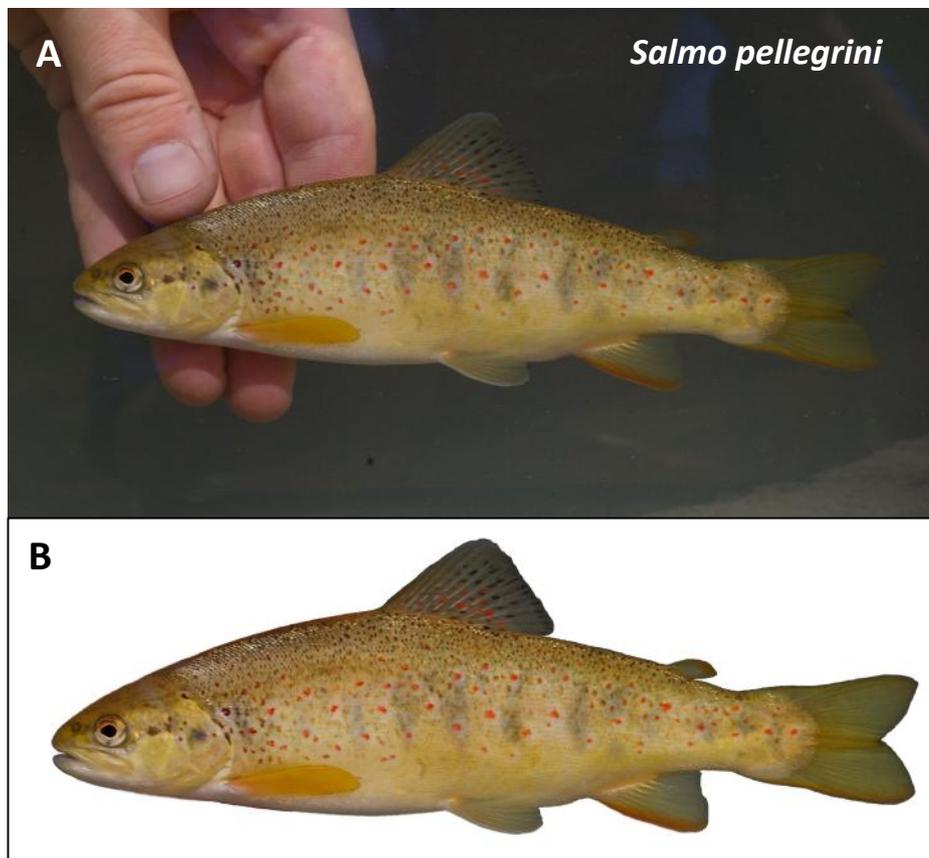
Further recommendations from the IUCN SSC/WI Freshwater Fish Specialist Group

Some people work in a two-person team, with one person taking the photograph and another manipulating the fish. The person controlling the fish can do this by hand, by gently holding the fish against the front glass of the aquarium. Ensure that the fins are in a natural position and that the mouth is not open for breathing (which may also indicate undue stress). If holding the fish by hand, do not position your hand behind the fins; then you can easily remove the hand from the final photograph using PhotoShop or some other image processing software.

Benthic fishes can be photographed from above, sitting flat on a stone or directly on the floor of the aquarium; take care on using a clean stone or background of neutral colour.

It is important to keep the water in the tank clean, and to keep the front glass of the aquarium clear of drops of water or other marks that might reduce the quality of the image. Take several photographs to increase the chance of getting the ideal shot.

The fishes may also be gently anaesthetized to make it easier to manipulate them, and to reduce stress. (However, this will not work well for benthic fishes positioned on the floor of the aquarium, because the fishes tend to lean over to the side). Use anaesthesia carefully, and the fish should be placed in a container of water from the habitat, to recover, before being returned to its natural habitat. Every attempt should be made to reduce the stress to the fish when they are being photographed (see section on Humane Treatment of Fishes, below). The resulting images may not be aesthetic, because the fish is isolated in an aquarium tank, but they document the colouration and physical characteristics well, and this will assist BioBlitz Curators with species identification.



Photograph A of live *Salmo pellegrini* *ex-situ*. Photograph B image edited using PhotoShop. Images by Jörg Freyhof.

Freshly dead specimen in the field

For fisher catch, pose the fish on a flat surface. It might be necessary to support the fish under the head or back to ensure it lies on the ground parallel to the camera. Include a scale bar (or any relevant object) in the photo and shoot with or without flash. For natural lighting, early morning or late afternoon sunlight is more diffused and suitable. For flash, tilt the flash head away from subject to avoid glare from shiny scales; or use bounced flash (off the ceiling or a large flat surface). For large fish specimens, photographing with a person holding the fish would provide a good scale of size.

Fishes collected from dives might be euthanised by the collector; this should be done with an overdose of anaesthetic or some other technique that is internationally recognised as humane (see section on Humane Treatment of Fishes, below). The fins of the dead fish can be stretched out with pins and gently brushed with formaldehyde and subsequently photographed either dry or in a liquid medium. Photography of fish in a liquid medium is more tedious, but yields better results. The liquid medium helps to reduce glare from shiny scales, prevent drying out and curling of fin margins, barbels and scale edges; and allows fine structures to flare out, e.g. papillae.

Here are some suggested parameters to try: M mode, shutter speed 1/100 to 1/250 sec, aperture f8 to 16 (depending on light levels).



Aprion viriscens. Noumea: Cuvea (fresh catch from trolling)



Natural lighting, market fish, Central Kaiimantan
Belodontichthys dinema

[Take note of the foot being used as a scale bar in both photographs]

Freshly dead specimen in a controlled environment

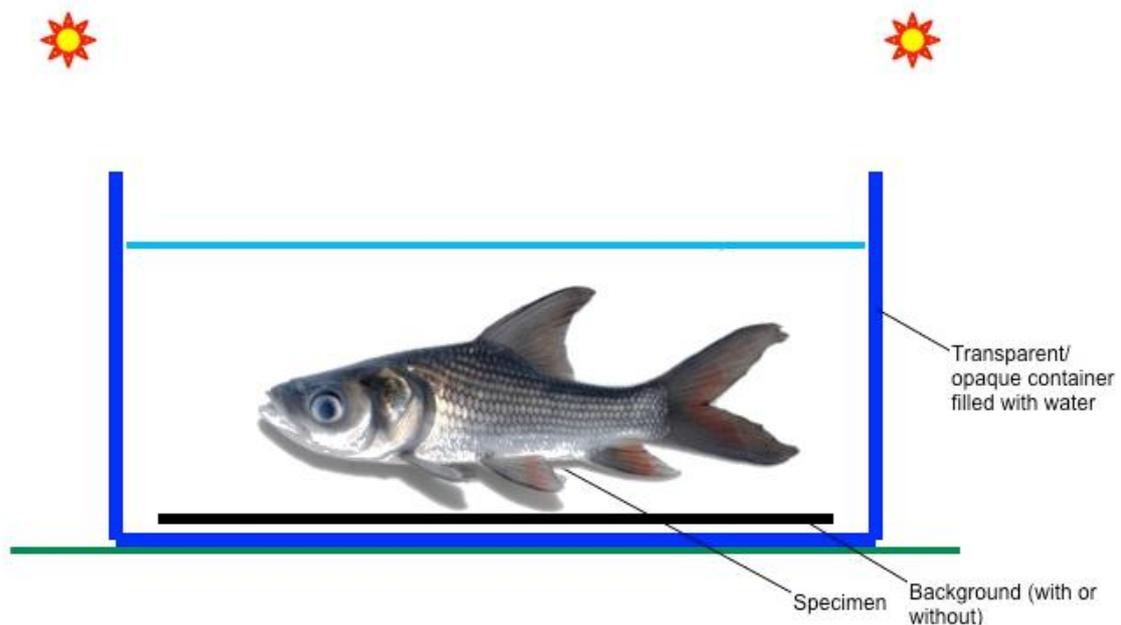
In this situation, the fins can be spread out and gently brushed with formaldehyde and subsequently, photographed either dry or in a liquid medium. The advantages of photographing a fish in a liquid medium have already been highlighted. Using multiple flashes aids to reduce harsh shadows and provide even lighting.

For very large fishes, it becomes impractical to photograph them in a liquid medium, due mainly to availability of a sufficiently large container. The floor of the preparation room would suffice. The flashes have to be carefully placed to reduce glare and provide sufficient lighting. The gas in the air bladder of teleost fish has to be extracted (usually with hypodermic syringe and needle), so that the fish can rest on the bottom of the container.

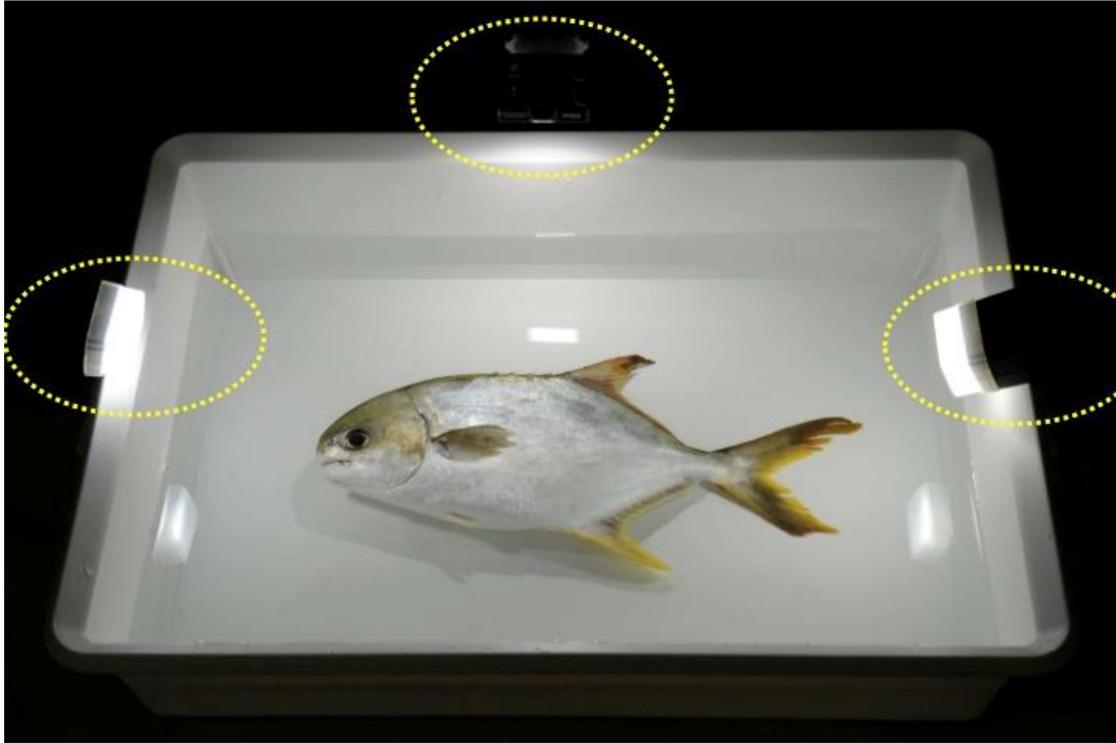
Here are some suggested parameters to try: M mode, shutter speed 1/100 to 1/125 sec, aperture f16 to 25.

Basic setup for fishes

- ensures a consistent background
- liquid medium used for floating structures and avoiding glare
- need to neutralise the air trapped in the airbladder



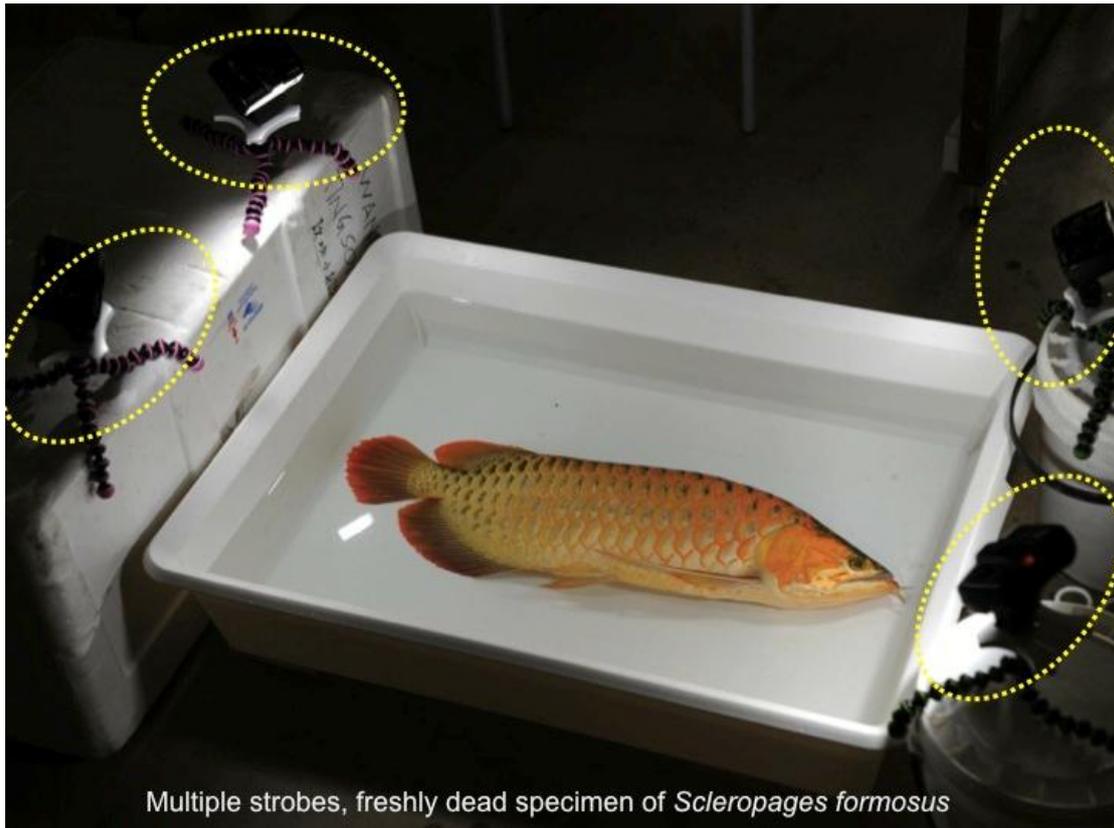
Examples of freshly dead specimens in a controlled environment



Multiple strobes, freshly dead specimen of *Trachinotus blochii*



Multiple strobes, freshly dead specimen of *Trachinotus blochii*



Multiple strobes, freshly dead specimen of *Scleropages formosus*

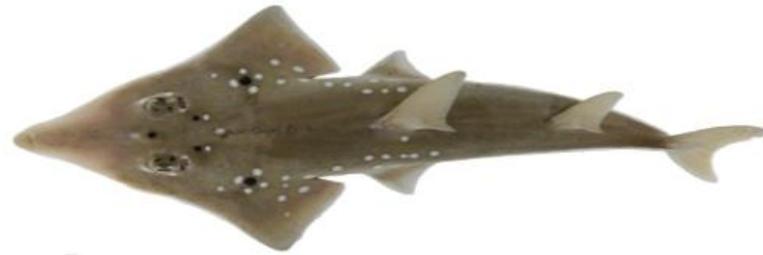


Multiple strobes, freshly dead specimen of *Scleropages formosus*

Specimen around 530 mm SL



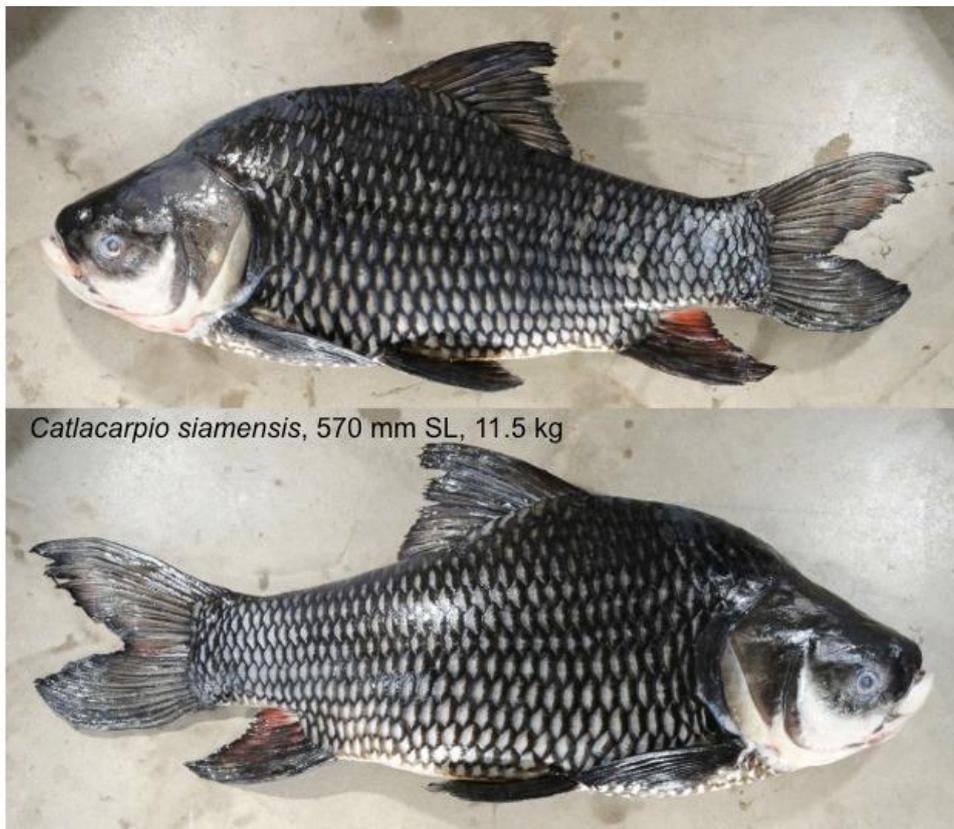
Rhincobatus springeri, 495 mm SL



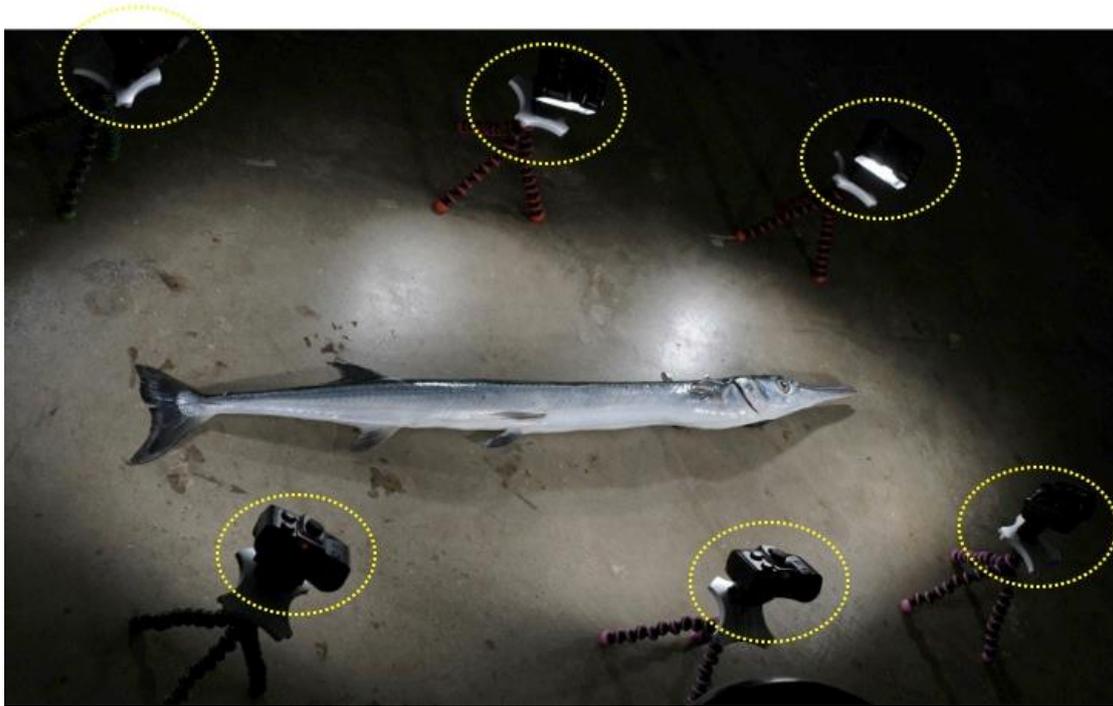
Rhincobatus springeri, 495 mm SL



What if the specimen is LARGE?



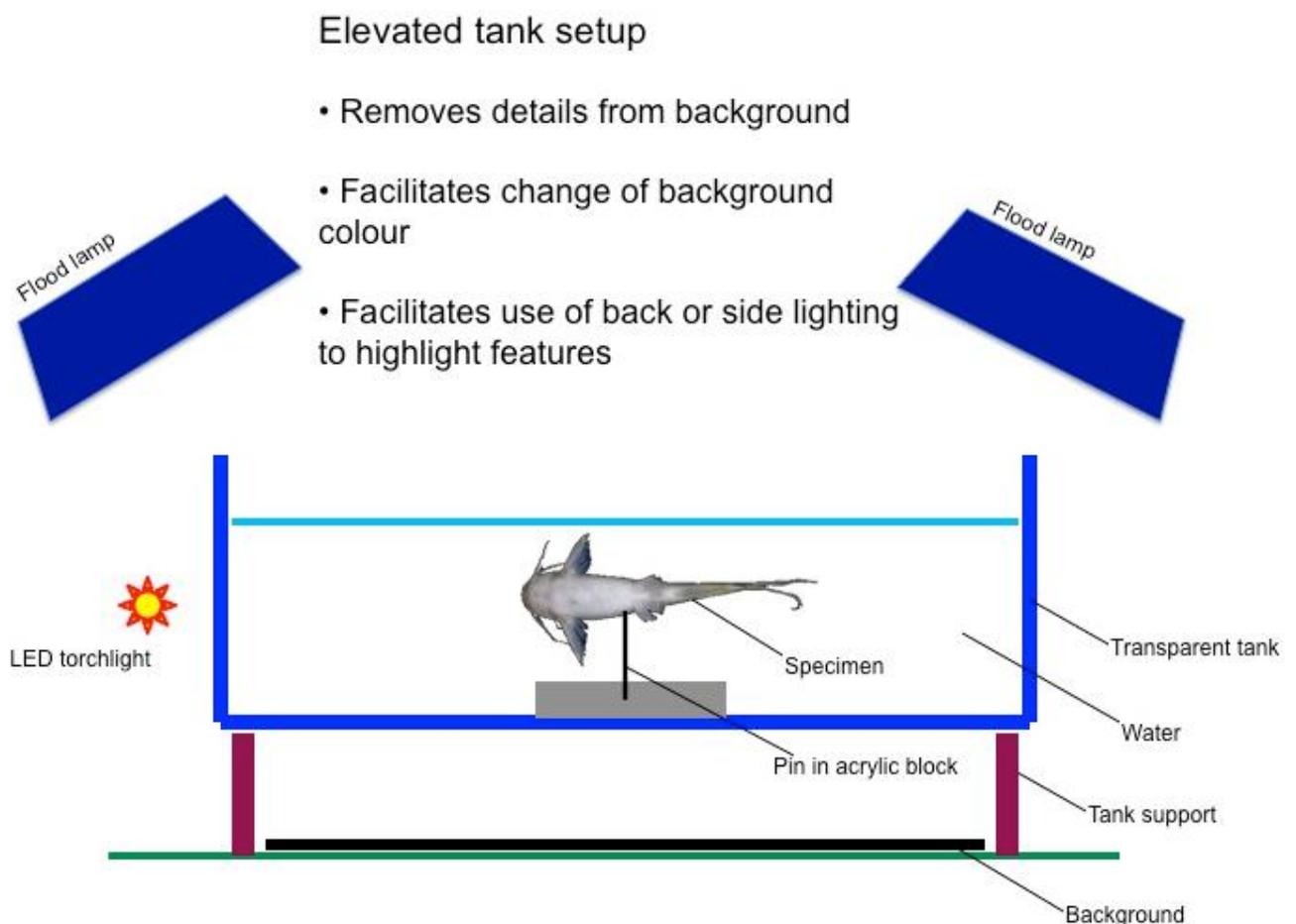
Tylosurus crocodilus, 890 mm SL, 985mm TL, 1.4 kg



Preserved specimen in a controlled environment

This is relevant for freshly preserved fish specimens, but can also be applied to museum specimens stored in ethanol for a few years to more than a century old. For most modern collections, formaldehyde had been used as a fixative at some stage. This fixative makes the soft tissue rigid and can be used to make specimens very useful for future workers in terms of ease of counting fin rays and scales.

One precaution for this technique is to presoak or rehydrate specimens stored in ethanol prior to photography, so that the specimens will not float. The liquid medium to be used in the glass tank is typically water, as it is easy to handle and easily available. An alternative medium to use is ethanol, but it is flammable and contaminated ethanol turns cloudy.



Copy stand with fibod lamps, preserved specimen photography



Direct output from camera
10/16 sec, f25



Processed image
Background masked
Contrast adjusted

Specimens photographed out of liquid medium:
Examples of dried scales and frayed curled fins



Betta dennisyongi



Betta raja

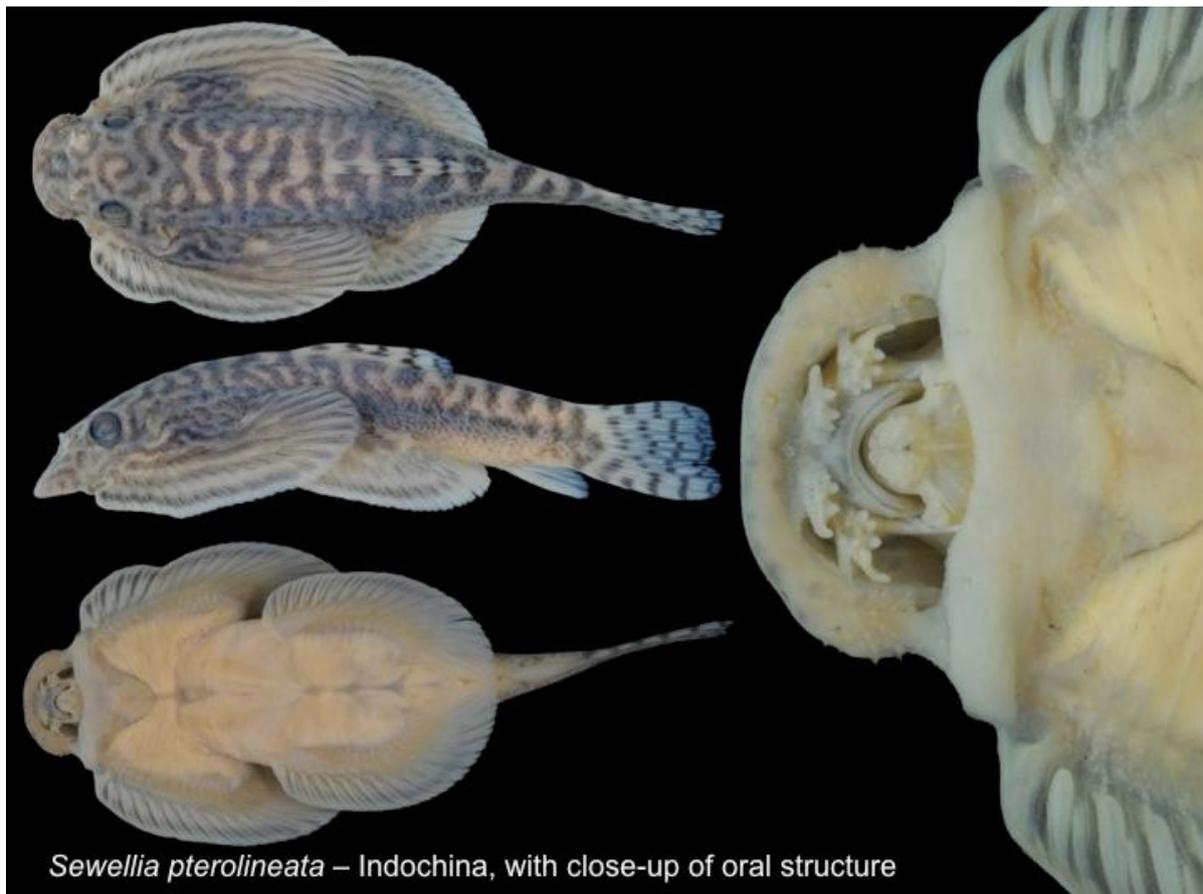
Specimens photographed within liquid medium:



Betta raja



Silurichthys ligneolus



Sewellia pterolineata – Indochina, with close-up of oral structure

There are two main categories of preserved fish specimens; wet and dry.

For wet preserved fish, placing the suspended specimen in a shallow glass tank method is a tried and proven technique. The specimen is suspended on one side with an embedded pin in an acrylic block. The suspended specimen is immersed into the liquid medium held in the shallow glass tank. The tank is in turn on raised supports, so as to allow the placement of a coloured background; black velvet cloth, or blue or white plastic or paper are common choices. A wet preserved fish specimen can also be photographed dry, but barbels, fin margins and scale edges may curl and the specimen may become damaged, which should be avoided.

Here are some suggested parameters to try: A (aperture) mode, shutter speed whole seconds to 1/100 sec (depending on colour of specimen), aperture f11 to 32.

The main advantage of this technique is the ability for use of A mode. The camera and lens setup is very stable due to the use of the copy stand. Deep depth of field can be achieved as the shutter speed can be very long.

Equipment and accessories for successful macro photography

Lenses:

Nikon produces a range of excellent macro lenses (termed as micro by Nikon). For autofocus range, the macro lenses can be divided into three main groups (by no means a complete listing):

- AF-D (older range of autofocus lenses, relying on screw-driven motors) – 60 mm f2.8, 105 mm f2.8, 200 mm f4;
- AF-S (newer range of autofocus lenses, electronic silent autofocus) FX (full frame and crop sensor use) – 60 mm f2.8, 105 mm f2.8 VR;
- AF-S DX (crop sensor use only) – 40 mm f2.8, 80 mm f3.5.

Third party brands of macro lenses are also available from Sigma, Tamron, Tokina and Zeiss (formerly known as Carl-Zeiss).

Flashes:

Dedicated Nikon speed lights are available for macro photography. Typical hotshoe mounted flash photography provides adequate light, but limited manipulation of light and harsh shadows. Off-camera flash photography offers more versatile control of light, providing more lighting and less harsh shadows. In order to take advantage of that, either tethered lighting or remote lighting regime can be used.

Nikon has a dedicated macro flash system that makes use of infra-red triggers and is, thus, wireless. The R1C1 system (most complete, other being R1 system) consists of a commander unit (SU 800) and two small remote flashes (SB R200). The flashes (SB R200) can be deployed either mounted on an adaptor ring, individually on stands or mounted on to small tripods. This is the author's personal preferred system, usually deployed with more than 2 SB R200 flashes (up to 8 units).

Camera metering system:

There are three metering systems available: spot, centre-weighted and matrix metering. For macro photography, spot metering is preferred as the subject is the interest here and the background is irrelevant. This is especially so for light coloured or dark coloured subjects.

Remote shutter release:

This accessory is for more controlled triggering of the shutter release, to avoid unnecessary vibrations associated with manual finger triggering. If the remote shutter release is not available, the timer function can be alternatively used to achieve the same result.

Mirror-up function:

This function is only available in more advanced models of Nikon camera body (e.g. D7000, D7100, D200, D300, D600, D700, D800, D2, D3, D4). The mirror is an unfortunate carry over from the film SLR system. The mirror is used to reflect light through the lens up to the pentaprism to the viewfinder. When the shutter release is triggered, the mirror is flipped up for light through the lens to fall upon the film or sensor. The flipping of the mirror creates minute vibrations usually not affecting general photography. However, for small fish

subjects or setups in a controlled environment (e.g. laboratory), these minute vibrations from the mirror flip will cause deterioration to edge sharpness of the captured image.

Using the mirror-up function, the shutter release has to be triggered twice; the first trigger to flip the mirror (with a short wait of a few seconds), then the second trigger for image capture. This technique is similarly used for telephoto prime lenses.

Camera copy stand and associated accessories:

A camera copy stand is a very useful tool to stabilise the camera and lens set for photography of specimens in a controlled environment. A pair of flood lamps can be used to provide adequate lighting for photography of specimens in a controlled environment. The camera copy stand can also be used for document duplication as well. A cheaper alternative would be to use a tripod, but this will not be as convenient to set up and use.

Other accessories:

- Shallow glass tank for placement of specimen in a liquid medium for photography on the copy stand. The glass tank should be on raised stands to facilitate change of background colour.
- An acrylic block with embedded pin (sharp end outwards, perpendicular to acrylic block surface) for placement of specimens for photography, so as to suspend the specimen above the background, to achieve out of focus for the background.
- Black velvet, thin white (or other relevant colour) plastic sheet for background colour.
- Scale bar or ruler to place next to specimen for photograph.
- A pair of dial calipers to measure the specimen length, if a scale bar is not used.
- Variable strength LED torchlight can be used to add texture or cast shadows to close-ups of certain parts of the fish subject (e.g. oral structure, tubercles, translucent structure).

Human qualities:

Patience

Perseverance

Willingness to experiment

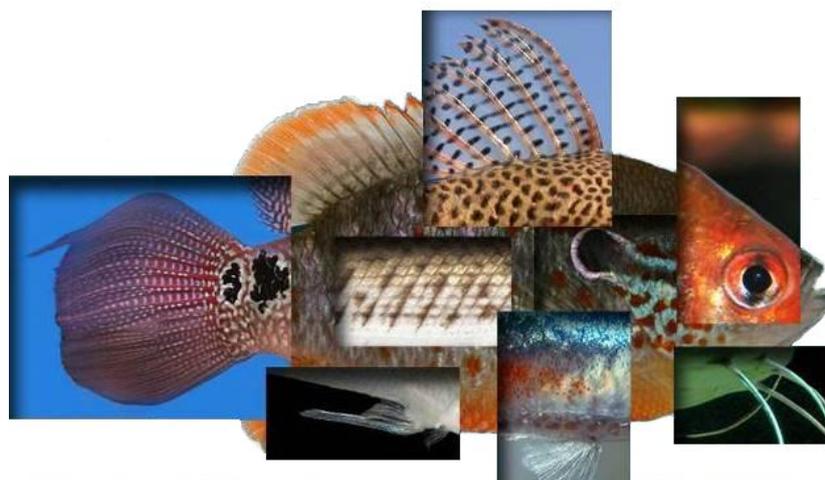
Humane Treatment of Fishes by the IUCN SSC/WI Freshwater Fish Specialist Group

A critical component of photographing fishes in the field - whether they are in their habitats or temporarily removed to be photographed in an aquarium set up on site - is to have the least possible disruptive effect on the fish and their habitat. This means that the habitat itself should be minimally disturbed during the process of photographing the fishes, and that the fishes should be stressed as little as possible while alive.

There are ethical guidelines that should be consulted for the treatment of animals during fieldwork and research (*Animal Behaviour* (1998), 55, 251–257). If fishes are being collected for preservation in scientific collections (e.g. in museums) then the methods of collection and euthanasia should also follow ethical recommendations as described in the *Journal of Fish Biology* (2006), 68, 1–2 and (2011) 78, 393–394.

Now it's time to put theory into practice. Good luck!

Don't forget to upload your photographs to the Global Freshwater Fish BioBlitz



Global Freshwater Fish BioBlitz

www.iucnffsg.org/bioblitz

For more information about the BioBlitz, please contact info@iucnffsg.org

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