

# Project Concept: Wallace's Dreamponds - Conserving Sulawesi's Ancient Lakes

**Project goal:** The endemic flora and fauna of Sulawesi's ancient lakes are safe from extinction.

## Summary

The ancient lakes of Sulawesi contain some of the most unique sets of flora and fauna for any lakes in the world. Seven lakes are the focus of this project including Poso, Lindu and the Malili lakes of Matano, Mahalona, Towuti, Wawantao and Wasapi. These lakes include more than 120 endemic fishes and invertebrates and many endemic plant species. Being highly restricted in range and specialised to the conditions of these lakes, this unique aquatic community is intrinsically under high risk. However, in recent years the level of threat has increased dramatically with increasing development in the area. Severe threats now stem from invasive species, mining, sedimentation, and collection for the aquaria trade.

Much of the past conservation work in the area has been confined to survey and research. However, conservationists have now turned to direct actions to halt the threat and allow the ecology to restore. These actions have until now been discrete and have not reduced the threat.

This project will bring together the agencies required to step up the conservation sufficiently to a scale that will allow the endemic species to survive and recover. The first step of the process is to make a clear action plan including considerations for ex-situ conservation of the most threatened species.

## Location

Sulawesi lies just east of the Wallace Line. The Wallace Line is an ecological division between continental Asian and the Pacific-Australian species. The division is named

after Alfred Wallace, who discovered the theory of evolution at the same time as Darwin. Wallace's inspiration came largely from Sulawesi. The fauna and flora was distinctly different to that of Borneo only a short distance to the west. The lakes of Sulawesi could have become to Wallace what the Galapagos became to Darwin. These lakes could be considered Wallace's Dreamponds.



Lake Matano © Wim Giesen

Sulawesi has 13 lakes over 5km<sup>2</sup> in surface area. Two (Poso and Towuti) are the second and third largest in Indonesia. Lake Matano is the deepest lake in South-East Asia at 590m depth. Seven lakes all in the central area of Sulawesi and mainly focused on the Malili system are the focus of this project as they are the most unique and highly threatened.

## Focal species:

The lakes of Sulawesi are living laboratories of evolution in action. Research has shown that within each lake entire 'flocks' of species have evolved by forming distinct adaptation to respond to the specific opportunities they face in each of the lakes, forging out a way to survive.



*Marosatherina ladigesii*, a species of sailfin silverside endemic to Sulawesi. In the aquarium trade this species is commonly known as the Celebes rainbowfish. To date 31 species of sailfin silverside have been described from the island of Sulawesi. *Marosatherina ladigesii* is considered Vulnerable to extinction of the IUCN Red List of Threatened Species.

For example, in just four families there are more than 100 endemics which have evolved into distinct species:

- **Sailfin silversides:** Sailfin silversides are a family of small fish which are known only from the Malili lakes and two small islands off Sulawesi and New Guinea. They are closely related to the rainbowfishes of Australia and are characterised by splendid male yellow and blue colourations (Von Rintelen *et al.*, 2012).
- **Aytid shrimps:** The shrimps of the Sulawesi lakes have recently attained notoriety following work to uncover new species and their subsequent popularity in the aquarium trade. The first shrimp species were described from the Malili lake system in 1937, and now 21 species are recognised from the ancient lakes of Sulawesi. Like the sailfin silversides, the shrimps of the Malili lakes show specific adaptations to different resources. *Cardina spongiloca* of Lake Towuti is the only known instance of a sponge-dwelling shrimp species in a freshwater environment (Von Rintelen *et al.*, 2012).
- **Snails:** The largest species flock of the ancient Sulawesi lakes are the freshwater snails of the genus *Tylomelania*, or “rabbit snails”. There are approximately 75 species endemic to Sulawesi and the majority of these are known from Lake

Poso and the Malili Lake system. The process of their speciation is estimated to have begun 5.4 million years ago (Von Rintelen *et al.*, 2014) and they are atypical in that they give birth to live shelled young.

- **Crabs:** There are at least 9 species of freshwater crab, five present in the Malili lakes and a further four in Lake Poso and its tributaries (Chia and Ng 2006). These lake crabs tend to be larger than their river dwelling relatives and also show ecological specialisation, with different species for example exhibiting variations in pincer size – suggested to be an adaptation to different feeding behaviours (von Rintelen *et al.*, 2012).

In addition to these three main groups of endemics there are also many other species of fishes and invertebrates. For example, 5 species of halfbeak fish have also been described from the Malili lakes as well as 10 species of goby, many of which are important to the food security and livelihoods of communities living around the lake. There are also undoubtedly more species new to science which are yet to be described (Herder *et al.*, 2012).

#### Threats:

Until recently the endemic fauna of the Malili Lakes and Lake Poso were described as “the only more or less pristine species flocks left

in Asia” (Kottelat and Whitten 1996). The same geographic and ecological isolation which had resulted in the evolution of species endemic to these lakes had for many years also guarded them from many threats. In the last few decades as these conditions have begun to change, many of the extraordinary endemics of the Malili lakes and Lake Poso have become increasingly threatened by extinction. For example, all fourteen species of atyid shrimp assessed on the IUCN Red List from the Malili lakes are categorised as either Endangered or Critically Endangered (IUCN Red List 2019).

The principal threat to the endemic aquatic biodiversity of the lake is assessed to be the introduction of invasive alien species. One species in particular has caused significant concern after a rapid increase in its population in Lake Matano since 2005. The flowerhorn cichlid is a hybrid fish generated for the ornamental trade (Hilgers *et al.*, 2018) and following its introduction into Lake Matano it has now spread to all coastal areas of this lake (Herder *et al.*, 2012). There are also concerns about other non-native species which either have already reached the lakes or could reach them in the future. Between 2000 and 2010 fourteen invasive fish species were recorded in the Malili lakes basin Herder *et al.*, (2012).

Other important developments affecting the lacustrine environment include potential overexploitation of some native fish species through commercial fisheries (Herder *et al.*, 2012, see Parenti and Soeroto 2004) and overexploitation of some of the lakes more

charismatic fauna. In particular, the shrimps and snails of the lakes with their kaleidoscopic colouration and unique adaptations have proven very popular in the aquarium trade.

Finally, the Malili Lakes have also been impacted by the development of mining for nickel within their watershed, although the appreciable efforts have been taken to reduce its impact on the lakes water quality. Associated with the development of the region is also the construction of dams for power supply, for example a third dam was recently constructed on the River Larona.

**Conservation action:** The majority of conservation work undertaken on these lakes has been until recently focused on survey and research. Even these have been limited. Recently there has been some discrete and local activities to control deforestation, remove invasive species, restore forest cover and to raise awareness with the local communities.

**The first action** is to bring together the various experts and agencies to determine an ambitious and urgent Action Plan for the lakes. This process will be able to combine the knowledge of the researchers and local communities together with expertise with solutions to the main threats and the needs and opportunities for the lakes and the people living by them. Solutions to the invasive species and sedimentation will be required. The feasibility of ex-situ conservation will also be considered.



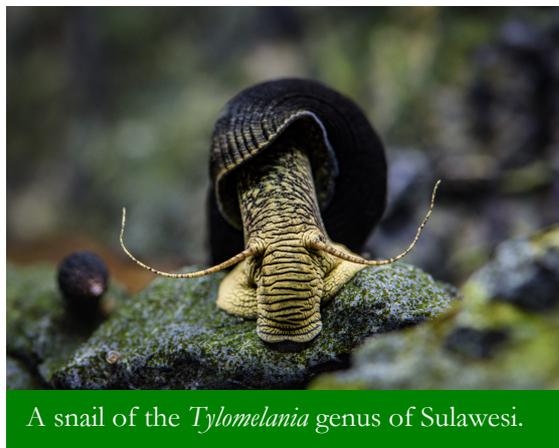
Lake Towuti © Wim Giesen

Lake Towuti is the largest of the Malili Lakes at 560 km<sup>2</sup>. It is the second largest lake in Indonesia, after the better known Lake Toba. It is the final lake in the Malili Lakes cascade, and is drained into the Gulf of Bone by the Larona River.

Government participants will be included in the planning to ensure that there is the strongest governmental support for the plan. **The Action Plan for the Sulawesi Lakes** will then form the basis of a series of project proposals to follow up with immediate implementation of the plan.

**A total of £54,200 (\$US70,000)** will be required to host the meeting with international, national and local experts and to complete the action plan and project proposals. This first phase of the project, aim to achieve the following outputs:

- A complete contemporary understanding of the conservation priorities and needs for the Sulawesi lakes
- A new global collaboration at the correct scale to halt the extinction of one of the world's most unique sets of flora and fauna.
- A comprehensive and collaborative The Action Plan for the Sulawesi Lakes
- To complete a series of project proposals for immediate implementation of the Action Plan.



#### **Implementing Partners:**

Burung Indonesia will be the main convenor for the workshop, however the project will implicitly attempt to engage all stakeholders who are engaged in the management of the lakes, from government agencies, to local communities, to conservation organisations.

**Budget:** The total budget required to implement the project is **£54,200**.

For more information email: [mike@shoalconservation.org](mailto:mike@shoalconservation.org)

#### **References:**

Chia O.K.S and Ng P.K.L., 2006, The Freshwater Crabs of Sulawesi, With Descriptions of Two New Genera and Four New Species (Crustacea: Decapoda: Brachyura: Parathelphusidae), The Raffles Bulletin of Zoology, Vol.54, No.2, pp.381-428

Giesen W, Baltzer M, Baraudi R, 1991, Integrating Conservation with Land-Use Development in Wetlands of South Sulawesi, Indonesia, PHPA/AWB, Bogor, 240pp.

Herder F, Schlieven U.K, Geiger M.F, Hadiaty R.K, Gray S.M, McKinnon J.S, Walter R.P, Pfaender J, 2012, Alien invasions in Wallace's Dreamponds: records of the hybridogenic "flowerhorn" cichlid in Lake Matano, with an annotated checklist of fish species introduced to the Malili Lakes system in Sulawesi, Aquatic Invasions, Vol.7, Issue 4, pp.521-535

Hilgers L, Herder F, Hadiaty R.K, Pfaender J, 2018, Alien Attack: Trophic interactions of flowerhorn cichlids with endemics of ancient Lake Matano (Sulawesi, Indonesia), Evolutionary Ecology Research, Vol. 19, (2018)

IUCN, 2019, The IUCN Red List of Threatened Species, Version 2018-2, Accessed 06.01.19 [www.iucnredlist.org](http://www.iucnredlist.org)

Kottelat M and Whitten T, 1996, Freshwater Biodiversity in Asia: With Special Reference to Fish, World Bank Technical Paper No.343, The World Bank, Washington DC

Parenti L.R and Soeroto B, 2004, *Adrianiichthys roseni* and *Oryzias nebulosus*, two new ricefishes from Lake Poso, Sulawesi, Indonesia, Ichthyological Research, Vol.51, pp.10-19

Von Rintelen T Von Rintelen K, Glaubercht M, Schubart C, Herder F, 2012, Aquatic biodiversity hotspots in Wallacea: The species flocks in the ancient lakes of Sulawesi, Indonesia, eds. Gower D, Johnson K, Richardson J, Rosen B, Rüber L, Williams S, 2012, Biotic Evolution and Environmental Change in Southeast Asia, pp.290-315, Cambridge University Press

Von Rintelen T, Stelbrink B, Marwoto R.M, Glaubrecht M, 2014, A Snail Perspective on the Biogeography of Sulawesi, Indonesia: Origin and Inter-Island Dispersal of the Viviparous Freshwater Gastropod *Tylomelania*, PLOS ONE, Vol.9, No.6: e98917