

SUPPLEMENTARY DESCRIPTION

Berau, East Kalimantan

Kakaban island

Kakaban is a trapezoidal shaped island with a maximal (diagonal) length of 7 km and a 40-60 m high ridge encircling a large marine lake (Figs. 1A & 2A, and see Tomascik et al., 1997). The southern coast of Kakaban island has a beach with *Avicennia* mangroves; the remainder of the coast surrounding the island is exposed rock in direct contact with the sea. Steep reef walls surround the island to a maximum depth of 200 m. Kakaban lake is one of the largest marine lakes presently known to science and was first scientifically described by Kuenen (1933) during the Dutch “Snellius” expedition to Indonesia from 1929-1930. The lake and its biota were described in more detail by Tomascik & Mah (1994) who called the lake “*Halimeda* lagoon”. As a result of their fieldwork many rare and novel genera and species were found across a variety of taxa: a varunine crab (*Orcovita saltatrix* Ng & Tomascik, 1994), two holothurians (*Holothuria* (*Lessonothuria*) *cavans* Massin & Tomascik, 1996 and *Synaptula spinifera* Massin & Tomascik, 1996) (Fig. S1A), and an ascidian (*Styela complexa* Kott, 1995). Since 2001 there is a jetty and walkway towards the lake built for easy access for tourists.

Kakaban lake

The average depth in the lake is 8m with two deeper areas of 10-12 m in the north and in the southwest separated by a shallow *Halimeda* bank of 0-2 m depth. A large portion of the lake in the center towards the east is very shallow (Fig. 2A). The west and south coasts are bordered by a flat nearshore zone and are fringed by a 1-5 m wide mangrove belt (predominantly *Bruguiera gymnorrhiza* (L.) Lam. and *Rhizophora mucronata* Lam.) which results in an irregular coastline with mangrove islets and bays (Fig. 2A, S1D). The eastern part of the south coast contains *Nypa* palm in addition to the other mangroves. The submerged roots of the mangroves are highly intertwined and meshed, providing a wall-like structure (Fig. S1B). In some locations the roots hang above the bottom while in others they are rooted in the bottom. The northern cliff coast is near vertical and mangroves are rare, resulting in a predominantly steep rocky shoreline (Fig. S1C). The east coast consists mostly of exposed rock interspersed by patches of mangroves. There are areas on the east coast with cavern formations 1-2m inland, these are all dead-ended. The bathymetry of the lake is indicated in Fig. 2A.

The rocky coast and the submerged mangrove roots were covered with mussels, sponges, ascidians and algae (Fig. 3A), amidst which were holothurians, asteroids, and ophiuroids (Fig. S1A). Sponges had a high abundance and diversity (>40 species) in the lake. Along the upper part of the intertidal area there were high abundances of gastropods (predominantly *Nerita* sp., *Terebralia* sp., *Cerithium* sp.) and bivalves (predominantly *Brachydontes* sp.). The sediment below the roots was dark black-brown scattered with sponges fallen from the roots. The bottom in front of the roots was covered with *Halimeda* where *Cassiopeia ornata* jellyfish, and *Holothuria cavans* sea cucumbers were abundant, with few sponges (Fig. 3B). *Halimeda* spp. were the most dominant algae in terms

of biomass. The shallow lake slope was covered by *Halimeda* algae down to a depth of ~5-6 m. The sediment at the lake floor was dominated by dead *Halimeda* thalli. The benthic habitat at >6 m depth was dominated by fine mud where locally patches mussels provided a solid substrate which was usually colonized by sponges (Fig. 3C). The lake housed large swarms of the jellyfish *Mastigias papua*. A detailed description of flora and fauna was provided by Tomascik & Mah (1994) and Tomascik et al (1997). A sea turtle had been released in the lake by humans before 2008 and was in poor health with decomposing flesh in 2009.

Kakaban lake had the smallest measured tidal amplitude (19 cm), which was damped to 11% of the adjacent sea amplitude (175 cm) and showed the largest delay (3 h 30 min) compared those in the surrounding sea (Table1A). The water had a vertical transparency of 6-8 m and had a green tinted color which transitioned to a light orange-brown color at depths greater than 5 m.

Pondok Sene

Outside Kakaban lake, along the eastern coast, separated by a steep cliff from the sea was a second lake. Pondok Sene is enclosed by land, except for a visible and large tunnel by which seawater gushes in and out with wave action and changing tides. At low tide the depth is 2 m in the north and 10-50 cm in the south. The sediment in this lake consisted of light colored carbonate sand. Pondok Sene most resembled a lagoon containing stony coral and the reef flat sponges *Spheciospongia vagabunda* and *Clathria reinwardti*. Despite its proximity (<100 m) the fauna in this lake was not similar to that of the larger and more isolated Kakaban lake.

Maratua island

Maratua is a horse-shoe shaped island with a rim of raised limestone that is 0.3-1.4 km wide and 10-120 m high. The island hugs a large lagoon of approximately 29.5x6.5 km with a depth of 0.5-5 m at low tide. Tomascik et al. (1997) mentioned the existence of 'anchialine lagoons' on the inner side of the raised rim of Maratua with the presence of *M. papua*, but they gave no further information on the location or characteristics of these lakes. The first records of species and localities of the Maratua lakes were published in a technical report resulting from a KNAW-Naturalis-LIPI expedition to the Berau Region (Hoeksema, 2004). Two lakes, Haji Buang and Bamban, separated by a mangrove swamp, are present on the western arm of Maratua Island (Fig. 1C). The mangrove swamp separating the two lakes is dominated by *Bruguiera gymnoriza* with the presence of gastropods (*Cerithium* sp., *Terebralia* sp., *Nerita* sp.) and algae (*Caulerpa* spp.), but no sponges and mussels. A steep limestone cliff separates Haji Buang lake from this mangrove swamp. We located five anchialine pools on Maratua: Buli Halo, Sibon, Bandong, Payung Payung and Tone Sibabang. This is the first description of these pools and we will describe Tone Sibabang in detail as an example. Additionally, we located two blue pools (Embo-Embo and Hapsi) at the southern end of the western arm of Maratua (Fig. 1C) where the only source for fresh water on Maratua is located (according to inhabitants of nearby villages).

Haji Buang lake

Haji Buang lake is a large, elongated lake separated from the sea by a steep limestone ridge of ~100 m height to the west and a lower limestone ridge of 20-40 m to the east. Between the western ridge and Maratua lagoon runs a mangrove swamp. The average depth of the lake is 8-10 m with two deeper areas in the north (14 m) and in the south (17 m) (Fig. S6XX). The majority of the coastline of Haji Buang lake is formed by limestone rocks covered in sponges (Fig. 3D). The coastline in the east is rimmed by a shallow plateau extending 1-2 m from the coast which is almost fully exposed to air at low tide (Fig. S1G). This plateau transitions into a steep wall-like slope that ends in the sediment at 3-4 m depth, from which the bottom sediment gently slopes down. The majority of the west coast is a vertical limestone wall which caves inwards at some places at approximately 1 m depth. Along the northern end of the west coast a shallow plateau extends 2-3 m from the coast with a 0.5-1 m depth, followed by a steep slope ending in the sediment at 2-3 m depth. Only the southern coast of Haji Buang lake is fringed by mangroves (predominantly *Bruguiera gymnorhiza*) with a seagrass field (*Enhalus* sp.) in front of it (Fig. S1F). Along and below the intertidal area on the rock there were high abundances of gastropods (predominantly *Nerita* sp., *Terebralia* sp., *Cerithium* sp., *Chicoreus* sp.) and bivalves (predominantly *Brachydontes* sp.). Sponges occurred in high abundance and diversity (>30 species) along the coast (Fig. 3D). Along the east coast the sponges were covered by a thick 'blanket' of algae (*Caulerpa* spp.) (Fig. 3E). *Caulerpa* algae were generally abundant in the lake, and abundance decreased with increasing depth. We observed no *Caulerpa* algae at depths >6 m. *Cassiopeia ornata* was abundant on *Caulerpa* (densities of 5-15 ind. m⁻²). Haji Buang lake contained a dense population of *M. papua*. In the south near the mangroves we observed, in September 2008 and May 2009, swarms of juvenile *M. papua* (0.5-1.5 cm width) (Fig. S1E). A green sea turtle had been introduced to the lake before 2008, but was not observed in 2008 or 2009.

The tidal amplitude in the lake was damped to 48% of that in the sea with a delay of 2 h 30 min (Table1A). We observed water flowing through the porous limestone rock at high tide. The water had a vertical transparency of 6-7 m and a general color of a milky green which transitioned to more brown-orange in water deeper than 5-6 m. In the southern end of the lake the visibility was lower than in other parts. There are two paths leading to the Haji Buang lake: one from the east, used by tourists from the nearby diveresorts, and one from the west, used by people from the nearby village Payung Payung.

Bamban lake

The second lake on Maratua, located north of Haji Buang lake, is a large, elongated lake (Fig. S1H). On the east coast the rock was covered in patches by mussels interspersed with sponges at a lower diversity and abundance than in Kakaban lake and Haji Buang lake. Small numbers of *M. papua* were present and high numbers of sea urchins. Due to the presence of a saltwater crocodile we were not able to survey this lake comprehensively. One surface water sample was taken for salinity (26 ppt). The lake was accessed from the east along a 150 m pass over a 10 m high ridge.

Tone Sibagang pool

Tone Sibagang is located in the village Teluk Alulu, approximately 20 m east from the main road and is separated from the sea by low limestone rock (Fig. 1C). The pool is small, circular with a uniform bowl-shaped basin and a maximum depth of 0.75 m at low tide (Fig. 1F, S2A). The pool was fringed by lowland tropical forest vegetation or mangrove associated flora, the *Bruguiera* and *Rhizophora* mangroves were absent. The bottom consisted of a mixture of areas of exposed rock and areas covered with a layer of dead leaves, *Caulerpa* algae, detritus and silt (Fig. S2B). Dense populations of small red shrimp *Antecaridina lauensis* ($> 20 \text{ ind m}^{-2}$) and gastropods (*Nerita* sp., *Terebralia* sp., *Cerithium* sp.) were present. We observed in total only four individuals of the three sponge species *Suberites diversicolor*, *Spirastrella* aff. *decumbens* Ridley 1884, *Lissodendoryx* aff. *similis* Thiele, 1899. Humans had released large reef fish and one green sea turtle in the pool. Contrary to Haji Buang lake, there was little tidal dampening (pool amplitude 90-100% of adjacent sea amplitude) and the delay was less than one hour. The salinity, however, was significantly lower than in the adjacent sea (Table 1A). The water had a horizontal visibility of 10 m and a green-blue tinted color.

Other pools on Maratua island

All the other pools on Maratua island represented small, uniform bowl-shaped basins with maximum depths at low tide of < 0.5 m. Buli Halo (Fig. 1E, 3G) near the village Boheh Silian contained the red shrimp *Antecaridina lauensis* and *Caulerpa* algae in the central pool. A tunnel connecting the pool to the adjacent sea had a high cover of an assemblage of seven sponge species (*Haliclona* sp., *Geodia* sp., *Placospongia melobesioides* Gray, 1867, *Placospongia mixta* Thiele, 1900, *Higginsia* sp., *Axinyssa* aff. *pitys* (de Laubenfels, 1954), *Spirastrella* aff. *decumbens*), gastropods (*Nerita* sp., *Terebralia* sp.), cnidarians (anthozoans), and algae (*Caulerpa* spp.), as well large reef fish. Sibong was covered in *Caulerpa* algae and its basin is dry at low tide (Fig. S2G), except for a small cavern area toward the east side. This cavern contained sponges (*Spheciospongia* aff. *peleia* (de Laubenfels, 1954), *Tethya* aff. *coccinae* Bergquist & Kelly-Borges, 1991, *Spirastrella* aff. *decumbens*), ascidians (*Eudistoma* sp.), molluscs (*Nerita* sp., *Terebralia* sp., *Cerithium* sp.). Bandong is located behind the gradeschool in Teluk Alulu and is used as a public toilet (Fig. S2D). This pool had a high cover of *Caulerpa* algae (Fig. S2G) and contained a few individuals of one sponge species (*Suberites diversicolor*), ascidians (*Eudistoma* sp.), and gastropods (*Nerita* sp., *Terebralia* sp., *Cerithium* sp.). Payung Payung pool is located in the village Payung Payung and is heavily used as a public toilet (Fig. S2C) and the flora and fauna in the other pools were not present here.

Blue pools

Embo-Embo

This blue pool is located 75 m inland, separated by limestone rock from the sea coast that is fringed with *Avecinnia* and *Sonneratia* mangroves. The pool is present in a chasm in the ground running parallel to the coastline which was approximately 1-3 m deep to the water level with almost sheer vertical walls (Fig. 3H). The pool was accessed through a cave to the north of the pool, which opens exposing the pool to air. The depth of the pool is 5-6 m with very clear, deep aquamarine blue color, and a visible halocline at 1-2 m depth. Only one sample

of surface water (above the halocline) was collected to measure salinity (11 ppt) and temperature (25-28 °C). The bottom of the pool consisted of organic detritus, silt, and a tree trunk.

Hapsi

This pool is located 200 m inland and approximately 500 m from the village Boheh Silian. Similar to Embo Embo, Hapsi is also situated in a chasm with vertical walls of up to 20 m. A portion of this pool is roofed over by rock. The water is clear aquamarine blue with a visible halocline at 1m depth.

Raja Ampat, West Papua

Raja Ampat represents a group of islands at the northern tip of Bird's Head peninsula in West Papua and is an intricate and rugose karst system. Lakes were found on the islands of Mansuar, Gam, Wayag and Urani (Fig1A&B). Each of these islands is characterized by a karstic scenery including a complex shaped coastline and frequent occurrence of inland depressions (Figs. 5L and S5E). The islands of Wayag and Urani in Northern Raja Ampat are characterized by the scarcity of freshwater sources and as such are practically uninhabited.

None of the lakes and pools have been formally named and only one lake had a local name (Sauwandarek). As such we use our fieldnames where appropriate. In total nine lakes and pools were surveyed and here we provide their first description. The lakes and pool on Gam and Mansuar islands were located during the EWIN-LIPI-Naturalis expedition to Raja Ampat in 2007 (Becking et al., 2007) in collaboration with researchers from the University of California, Merced and Coral Reef Research Foundation, Palau. Previous biota descriptions from lakes on Gam and Mansuar island are only of ascidians by Monniot (2009).

Sauwandarek lake, Mansuar island

This lake is located on Mansuar island and is the type locality for the species *Suberites diversicolor*, a sponge frequently found in marine lakes (Becking & Lim, 2009). Sauwandarek is a medium sized, oblong shaped lake, separated from the sea to the north by a low pass and to the south by a mangrove swamp and limestone ridge (Fig. S6C). The average depth is 8 m with three deeper areas: one in the center (20 m), one in the southwest (19 m) and one in the south (17 m) (Fig. S6D). The majority of the coastline is fringed by mangroves (predominantly *Bruguiera* sp.) (Fig. S3A). Along the southwestern coast there is a 20-25 m area of exposed limestone rock with a plateau extending 1-3 m from the coast with a depth of 0.25-1 m. In the southern part there is a mangrove islet (Fig. S6CD). The mangrove created an intertwined wall of roots, as in Kakaban lake. The depth along the coastline ranges from 0.75-1 m and gently slopes down to greater depths. Mussels, sponges, ascidians and algae covered most the coast consisting of mangrove roots, fallen tree trunks, and rock (Fig. S3B). Cover decreased with increasing distance from the coast. There was a high abundance of sponges, but only of moderate diversity (18-20 species). In contrast to the larger lakes in East Kalimantan, neither *Caulerpa* nor *Halimeda* algae were very dominant in biomass. The mangrove roots and epibionts were largely covered by brown-purple filamentous algae. At 1-4 m depth there were patches of mussels, some partly covered by sponges. At least two green sea turtles had

been introduced by humans before 2007 and these were still present in 2009. The skin of the turtles had turned a deep yellow color.

The delay in tidal phase was at least two hours and the amplitude appeared to be damped as judged by an intertidal zone in the lake of less than 0.5 m, between 20-50% of the amplitude in the surrounding sea (1-1.5 m). The water turned to a dark brown-orange color at 2-4 m depth in 2007 and at 0.5-1 m depth in 2009. The temperature was up to 34°C at this and greater depth. The lake was accessed from the north side of the island along a path of 500 m in length with little elevation. This path continues towards Sauwandarek village beyond the lake, hence the locals refer to the lake as Sauwandarek.

Ctenophore lake, Gam island

This lake is located in northern Gam (Fig. 1B) and is a small L-shaped lake that is separated from the sea by high limestone ridges from all wind directions (Fig. S6E). The lake is highly connected to the adjacent lagoon by means of a wide (1-2 m) and low (<0.5 m) tunnel on the western coast (Fig. S3C). Ctenophore lake has a uniform basin with a maximum depth of 8.5 m in the central part of the lake (Fig. S6F). The perimeter of the lake is mostly exposed or mud covered rock with sparsely distributed *Bruguiera* and *Rhizophora* mangroves. The periphery lake floor was covered with shell fragments, but further from the edge the bottom was covered in leaves and silt. Sponges, ascidians, oysters and mussels covered the mangrove roots and rocky coast, the abundance and biomass decreasing from the coasts. There was both a high cover and diversity of sponges (>30 species) that were predominantly reef flat species. We observed high densities of ctenophores and *Aurelia* sp. in the middle of the lake, and fewer than 10 individuals of *Cassiopeia* sp. along the rim. Large reef fish (e.g. *Acanthurus* spp.) rushed in and out of the lake. Judged by the intertidal zone, the tidal amplitude was 90-100% of that of the surrounding sea. After heavy rain a layer of fresh water of 5-25 cm thick remained visible for at least a day. Ctenophore lake was accessed from the west along a 80 m long and 10 m high pass.

Big Caulerpa Lake and Wallace Lake, Gam island

Two other lakes are present on Gam (Fig. 1B), which are similar to Ctenophore lake with high connection to the sea by means of tunnels, few mangroves, and a high diversity and cover of predominantly reef flat sponges (Fig. S3EF). In contrast to Ctenophore lake, these lakes contained living stony corals (Fig. 3F). Big Caulerpa lake was surrounded by steep cliffs (Figs. S3D & S5C) and contained a high abundance of *Caulerpa* algae with large globular thalli. Wallace lake was designated this name as a reference to the six week stay of Alfred Russel Wallace, during his travels in the “Malay Archipelago”, in the village Bessir (now named Yen Bessir) just south of this lake (Wallace, 1869).

Red Shrimp pool, Gam island

The Red Shrimp pool near Wallace Lake is similar to the small anchialine pools in East Kalimantan, with a uniform, bowl-shaped, shallow basin (<0.5 m at low tide). It is full of small red shrimp *Antecaridina lauensis* and some *Nypa* palms are present.

Cassiopeia lake, Wayag island group

This lake is located in the eastern part of the Wayag island group (Fig. 1A) and is a small, almost circular lake that is separated from the sea by a low limestone ridge (<10 m high) from all directions except to the east where there is little elevation (Fig. S5A). The lake has a uniform, bowl-shaped basin with a maximum depth of 4m in the center. The lake is rimmed by a wide (1-4 m) and shallow plateau with a depth of <0.5 m at low tide. In the east there is a shallow bay. The coastline is composed of predominantly exposed rock interspersed with single trees of *Rhizophora* mangrove. Patches of mussels and sponges covered the lake floor amidst which there were bristleworms, red worms and green zoanthids (Fig. 5E, S4B). Fields of *Caulerpa* algae covered the subtidal area until 3 m depth. The lake floor at >3 m depth was covered by light colored sand with occasional occurrence of sponges (predominantly the species *Suberites diversicolor*). In the northern area we observed many dead crabs and bleached or dead sponges (Fig. S4A). There was a high abundance of sponges but only of a moderate diversity (15 species). In the central area there were a small number of *M. papua* jellyfish and along the shallow plateau there were high abundances of large *Cassiopeia ornata* jellyfish (5-15 ind m⁻²). There was a green sea turtle, but it was unknown how it came here. We observed no fish in this lake. The tidal amplitude in the lake was damped to 89% of the sea amplitude, with a 1 h 20 min delay (Table 1B). During one visit the visibility in the lake was highly reduced towards the western coast (horizontally less than 1 m) where the water was a brown-yellow color. During our second visit after a rainstorm, however, the visibility increased in the whole lake (1- 5 m) and we observed the brown-yellow water layer below 2 m depth. The lake was accessed from the east along a 60 m pass with little elevation.

Tricolore lake, Wayag island group

This small, shallow, hourglass-shaped lake is located in the central part of the Wayag island group (Fig. 1A). Tricolore lake is separated from the sea by a high limestone ridge (>20 m) to the east and a low (<5 m) ridge to the west. The lake has three basins split by mangrove patches and has four deeper areas of 2m. depth, one each in the west, the northwest, the north and in the central area (Fig. S5B). The lake is fringed by *Rhizophora* and *Bruguiera* mangroves, except along the west side which consists of exposed rock and a 1-2m deep cavern with no visible connection to the sea. The lake bottom was covered with *Caulerpa* algae amidst which there were high abundance of bristleworms and white bullomorph opisthobranch molluscs (Fig. S4C). The deeper part of the lake bottom consisted for a large part of mollusc fragments covered by a thin layer of detritus and of mangrove leaves, especially in the deeper area of the northwest part. The other deeper areas of the basins were covered with

Caulerpa algae. Contrary to the other investigated lakes, oysters instead of mussels were abundantly attached to all available hard substrates. Sponges and ascidians were attached to mangrove roots in patches in the center of the lake (Fig. S4D), and in the cavern along the west side, but these were notably absent in the southeast part of the lake. In the whole lake the sponge abundance was low compared to other lakes but the diversity was relatively high (>20 species). The tidal amplitude in the lake was damped to 68% of the tidal amplitude of the sea, with a 2hr20 m delay in phase (Table1B). The color of the water was blue-green with a linear visibility 5-6m. The lake is named after its apparent three colors from the air: blue-green, dark brown, and orange-red (Fig. S5B). The lake was accessed from the west along a 70 m pass with little elevation of 2-4m.

Mud lake, Wayag island group

This lake is located in the western part of the Wayag island group (Fig. 1A). Mud lake is a small, shallow, oval-shaped lake with a uniform basin with a maximum depth of 2.3m in the central area. The lake is separated from the sea to the north by a high limestone ridge (>20 m high) and to the south by a low one (<5 m high) and a wide mangrove swamp. The lake coastline is fringed by mangroves (predominantly *Bruguiera* sp.). At the east side of the lake there is a cave which may have a direct connection to the sea. The south coast is muddy and is <0.25 m deep up to 5 m distance from the coast (Fig. S4E). The depth along the rest of the coast ranged between 0.5-1m. All sessile biota was covered with fine mud and filamentous brown algae (Fig. S4F). Translucent shrimp were abundantly present. Sponges and ascidians were sporadically attached to mangrove roots and tree trunks, and had the highest cover in the cave. The degree of connection to the sea is expected to be moderate judged by an intertidal zone of 0.5-1m (70-80% of the adjacent sea amplitude). The color of the water was blue-green and below 0.5-1m depth transitioned to brown-yellow with a high content of flocculent sedimentation. The vertical visibility was 1-2m. The lake was accessed from the south along a 500 m pass through a mangrove swamp and over an elevated limestone ridge of 3-5 m.

Urani lake, Urani island

This lake, located in the western side of Urani island (Fig. 1A), is a small, tear shaped lake that is separated from the sea in all wind directions by 20-40 m high limestone ridges (Fig. 2C). The lake has a uniform, bowl-shaped basin with a maximum depth of 6m in the central area of the lake (Fig. 2D). A dense mass of *Caulerpa* algae on the lake floor may have biased our handheld sonar measurements, obscuring the actual basin depth. A 1-5 m wide belt of mangroves (predominantly *Bruguiera*) fringes the perimeter of the lake. The west coast is represented by exposed limestone and a cavern with no visible connection to the sea. The depth along the coast ranges from 1-2m and slopes down steeply. Many trees had fallen into the lake (Fig. S5D). There was a mixture of *Caulerpa* and *Halimeda* algae in the lake, but *Caulerpa* was the most abundant. Large portions of the mangrove roots and the lake bottom are covered by *Caulerpa* algae. Sponges, ascidians and mussels were attached to all available substrate, amidst which were orange worms and ophiuroids (Fig. S4H). The large red shrimp *Parhippolyte uveae* appeared abundantly present (Fig. S4G). The degree of connection to the sea was expected to be moderate,

judged by an intertidal zone of 0.5-1m (70-80% of the adjacent sea amplitude). The water was tinted a milky blue-green color and the vertical visibility was 4-5 m.

Lakes located by air

We located seven additional lakes by air, but these are not part of the present survey: WAY05 (Wayag island, N0° 10' 35.9' E130° 01' 18.1"), WAY06 (Jin island, N0° 08' 14.0" E130° 09' 00.7"), WAY07 (Jin island, N0° 08' 10.7" E130° 09' 04.1"), WAY08 (Bag island, N0° 06' 28.6" E130° 12' 57.5"), GAM01 (Gam island, S0° 26' 59.3" E130° 30' 02.3"), GAM02 (Gam island, S0° 26' 57.2" E130° 30' 04.7"), FAM01 (Fam island, S0° 36' 01" E130° 45' 08").

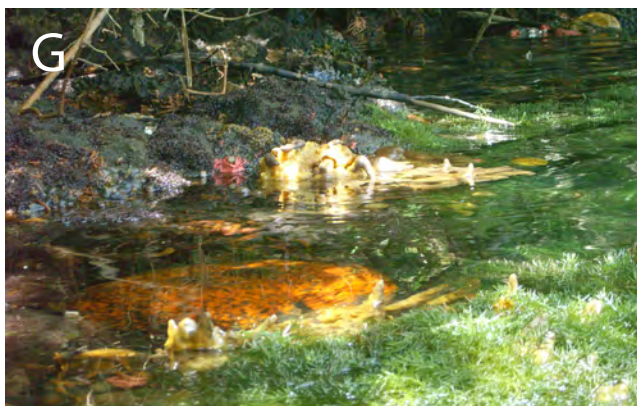
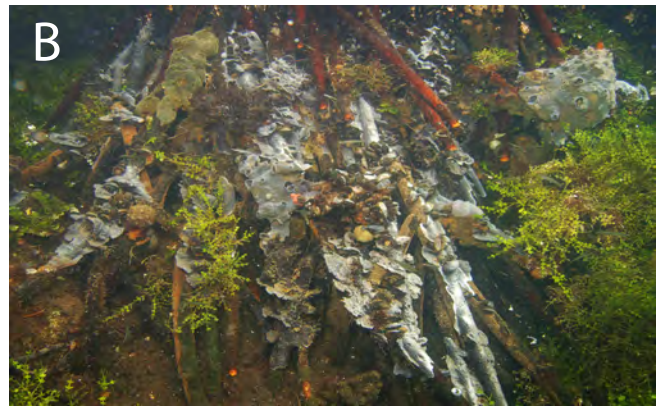


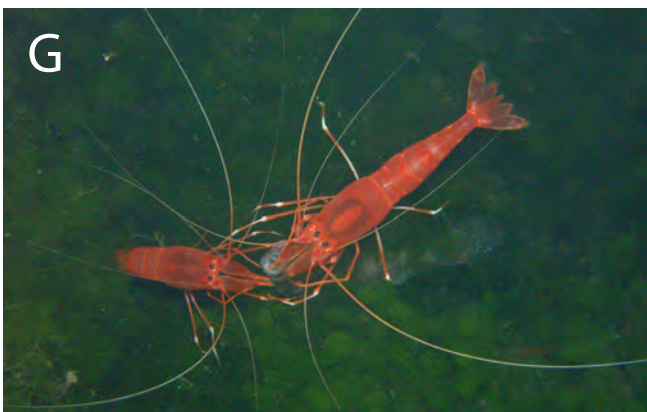
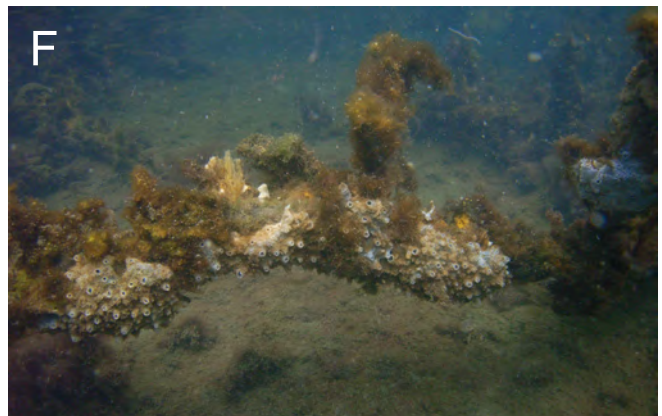
Figure S1. *In situ* photographs of marine lakes in Berau (East Kalimantan, Indonesia): Kakaban lake **A.** mangrove root covered in sponges with holothurian, **B.** mangrove roots intertwined as wall, **C.** north coast rocky shore, **D.** mangrove baylet; Haji Buang lake **E.** swarm of small juvenile *Mastigias papua* jellyfish, **F.** *Enhalus* sp. seagrass, **G.** sponges and algae along coast exposed to air at low tide, **H.** overview of Bamban lake. All photographs by L.E. Becking, except **F.** by N.J. de Voogd.



Figure S2. *In situ* photographs (by L.E. Becking) of anchialine pools in Berau (East Kalimantan, Indonesia): **A.** Tone Sibagang overview, **B.** Tone Sibagang at high tide, **C.** Payung Payung pool with out-house, **D.** Bandong pool, **E.** *Antecaridina lauensis*, **F.** algae covering rocks in pools.



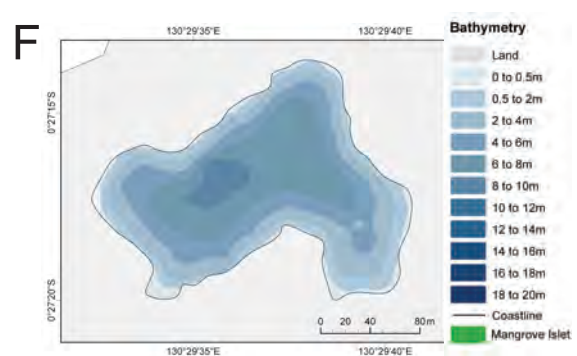
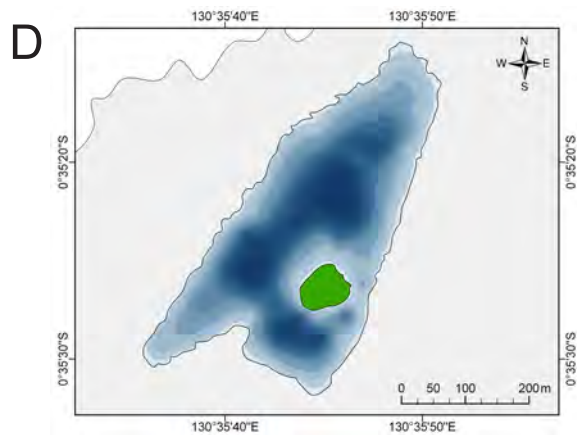
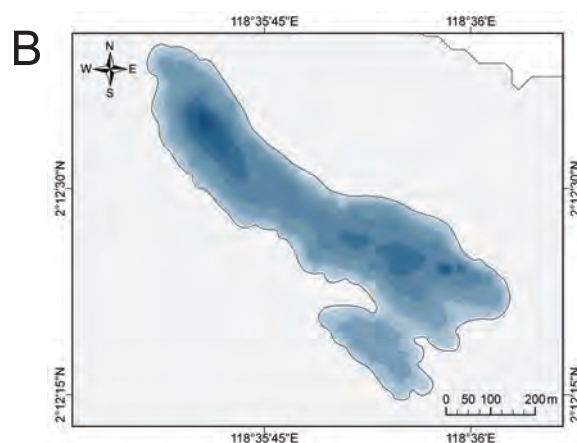
Figure S3. *In situ* photographs (by L.E. Becking) of marine lakes in central Raja Ampat (West Papua, Indonesia): **A.** overview of Sauwandarek lake, **B.** mussels, ascidians and sponges on mangroves in Sauwandarek lake, **C.** tunnel in Ctenophore lake, **D.** cliff in Big Caulerpa lake, **E.** sponge reef in Wallace lake, **F.** elongated sponges in Wallace lake.



S4. In situ photographs (by L.E. Becking) of marine lakes in northern Raja Ampat (West Papua, Indonesia): Cassiopeia lake **A.** branching brown sponge (*Haliclona* sp.) partially bleached, **B.** red worms and mussels; Tricolore lake **C.** mangrove roots with *Caulerpa* algae, oysters, and bullomorph opisthobranch molluscs (white), **D.** mangrove root with sponges, mussels, ascidians, and algae; Mud lake **E.** muddy coast, **F.** sponge and lake floor covered in silt and algae; Urani lake **G.** *Parhippolyte uvaea*, **H.** branch covered in mussels, sponges and tubeworms.



S5. Aerial photographs of Raja Ampat (West Papua, Indonesia): **A.** Cassiopeia lake, **B.** Tricolore lake, **C.** Big Caulerpa lake, **D.** close up of Urani lake (note fallen trees on surface), **E.** overview of Wayag island group, **F.** Drifter water aiplane. All photographs by L.E. Becking, except **F.** by E. Dondorp.



S6. In situ photograph and bathymetric map of **A.,B.**Haji Buang lake, Aerial view and bathymetric map of **C.,D.** Sauwandarek lake, **E.,F.** Ctenophore lake.