At the heart of the coral triangle in West Papua: an Indonesian-French scientific exploration of a white area with closed-circuit rebreathers (eCCR): [poster]

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At the heart of the coral triangle in West Papua: an indonesian-french scientific exploration of a white area with closed-circuit rebreathers (eCCR)

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The Bird's Head isthmus connecting the Bird's Head Peninsula with the rest of New Guinea is one of the last pristine areas remaining in Southeast Asia. Dominantly covered by limestone karsts, this vast region of West Papua (Indonesia) is still a terra incognita. At the heart of the coral triangle, the Kumang and Lengguru limestone karsts and reef slopes are today a major biodiversity reservoir with high levels of endemism.

The French Indonesian 'Lengguru 2014' expedition was headed by IRD and P2O-LIPI, RCB-LIPI and POLTEK. Exploration and sampling effort were concentrated on several reef steep slopes from -180 m to the surface using closed-circuit rebreathers (eCCR) and open circuits. 'Lengguru 2014' expedition was the first French oceanographic campaign organized by a national and academic research organization to use the rebreather.

The scientific diving operations were made under the responsibility of the French research institute IRD. Nevertheless, the French regulation presently only allows the use of rebreather for recreational uses. The main author participates as an expert for the Ministry of Labor to reform the law with specific applications to scientific purposes. This scientific expedition was therefore permitted in phase advance.

The Lengguru 2014 expedition was organized in complete autonomy for 8 weeks. It required extensive preparation and logistics, as well as some strengthened safety procedures for scientific dives. Forty vertical transects have been performed from -100 meters depth to the surface, silently with great autonomy and optimized decomposition. The exploration of flooded karsts by cave diving has been possible with rebreather. It does not bubble and offers such autonomy. The use of eCCR offers together scientific benefits and enhanced dive safety.

The 'Lengguru 2014' Expedition provided a science-based assessment of functional, genetic and morphological diversity for several marine biotas (chondrines, hard corals, gorgonians, mollusks) with prime importance for biodiversity conservation.

MATERIALS, METHODS AND ACTION STRATEGY

The 30m length vessel of POLTEK "Ahiru" and several 45m inflatable boats provided the means.

2 bottles of 
- medical oxygen and helium
- 350 kg of soda lime

3 compressors for breathing air + 2 oxygen boosters (redundancy)
1 rebreather for spare and training of indonesian scientists, many spare equipments and consumables

Many balikus: carbon 6 tons 300 m3, 11 tons SBO fast transport, all oxygen compatible
Security equipments, communication equipments including repeaters (radio and satellite) at each diving location, divers life, decompression times, etc.
Several HD camera (photos and videos)
Equipment for observation, measurement and sampling

ADVANTAGES : ENHANCED DIVING SAFETY ...

Significant improvement of the autonomy / Gas economy / Increased reserve

Limitation of thermal losses (breathing of hot, humid air) => Decreased risk of decompression accident, no risk of heating in cool water diving

... AND SCIENTIFIC BENEFITS

Autonomy: significant increase of the intervention time
Long interventions: reduction of the number of dives required / especially in the 40-50 m zone or more when observations, manipulations or uses of equipment require time / realisation of vertical profiles from the bottom to the surface

- bushes => safer breathing / increased safety => less hazards

Non-destructive approach, respect of biotopes
Exploration of the area up to 100 meters possible due to recyclables and the use of gas mixtures (no accessible to OC divers)

The unexplored twilight zone contains an abundant, rich and unique biodiversity totally different from those of the upper zones.

RESULTS & OUTCOMES

The use of rebreather in sciences exploration constitutes a new technological paradigm.

- Exploration and sampling effort on several reef slopes (with 40 stations) including the twilight zone (vertical transects between 1000 meters depth)
- More than 650 specimens collected (hard corals, gorgonians, schizomata, mollusks, algae, seagrasses...)
- DNA barcoding and traditional taxonomy systematically for all samples. Additional and specific molecular marker for some biota.
- Observation and photo identification (several hundreds reef fishes, turtles, cisticans...)

A data management strategy, with a share scientific database, a photos database of several thousands images.

Besides inventing organism communities based on the twilight zone observation, biologists infer the phylogenetic relationships of sampled taxa along with those originating from peripheral regions for a better understanding of the underlying diversification processes and for helping their conservation.

Such joint scientific venture organized at the heart of the coral triangle and in a global context of biodiversity loss, represents an important contribution to the knowledge of historical and evolutionary processes explaining the uniquely biodiversity encountered in this still poorly studied region located at the junction of Asia and Australasia and at the interface of the Indian and Pacific Oceans. It was also the opportunity to communicate, to increase scientific capacity building, and to raise public awareness through multimedia and photographic exhibitions, seminars and various web supports including a pedagogic program.

REFERENCES

© Photos : E. Bahuet, G. Diraimondo, R. Hocdé - Lengguru 2014 - IRD

www.lengguru.org