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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The Bird’s Head Ismuth 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 limestones karst, this vast region of West Papua (Indonesia) is still a terra incognita. At the heart of the coral triangle, the Kumaga 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 slopes in West Papua (Indonesia) to observe some groups: reef fishes, rays and sharks, to study and sample several habitats: hard corals, gorgonians, echinoderms, mollusks, algae, seagrasses (Fig. 2 & 3).

The French-Indonesian ‘Lengguru 2014’ expedition was organized in complete autonomy for 6 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 decompression. The exploration of flooded karsts by cave diving has been also possible with rebreather: it doesn’t bubble and offers such autonomy. The use of eCCR offers together scientific benefits and enhanced diving safety.

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

**RESULTS & OUTPUTS**

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 with vertical transects between 100 meters depth and surface.
- More than 650 specimens collected (hard corals, gorgonians, echinoderms, mollusks, algae, seagrasses...)
- DNA barcoding and traditional taxonomy systematically for all samples. Additional and specific molecular characterizations were also performed for species and population level analysis.
- Observation and photo identification (several hundreds reef fishes, turtles, corals...)
- A data management strategy, with a share scientific database, a photos database of several thousands images. Besides inventing organism communities based on DNA barcoding and traditional taxonomy, 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.

**ADVANTAGES : ENHANCED DIVING SAFETY...**

**AND SCIENTIFIC BENEFITS**

**Significant improvement of the autonomy / Gas economy / Increased reserve Constant oxygen partial pressure >> Optimization of decompression**

**Limitation of thermal losses (breathing of hot, humid air) >> Decreased risk of decompression accident, no risk of freezing / icing in cold water diving**

**...and decompression accident**

**Non-destructive approach, respect of biota**

**Exploration of the area up to 100 meters possible due to recycles and the use of gas mixtures only (no necessary to DC dives to 40 meters)**

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

**PRINCIPLE OF THE CLOSED CIRCUIT REBREATHER (eCCR)**

A breathing loop to re-breathe the same gas

- Breathe, never exhaust your gas!
- Supply of metabolized oxygen (O2)
- Use of air or gas mixtures

**Different kinds :**

- Oxygen rebreather, closed-circuit rebreather (eCCR)
- Semi-closed-circuit rebreather (OCR), semi-closed and semi-open systems

Use of an unique model of electronical closed-circuit rebreathers (eCCR) : Vision or XPD Inspiration from APDiving

Use of an unique model of electronical closed-circuit rebreathers (eCCR) including

- gas mixtures for deep dives (eCCm) and air (eCCa)
- Manufacture and use of standard gases (air / TEC 90/90 or TEC 75/75) for all eCCr models (TEC 90/90 or Deepex 1x)

The French-Indonesian ‘Lengguru 2014’ expedition...