SANTO 2006
Expedition
Progress Report

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February 2007

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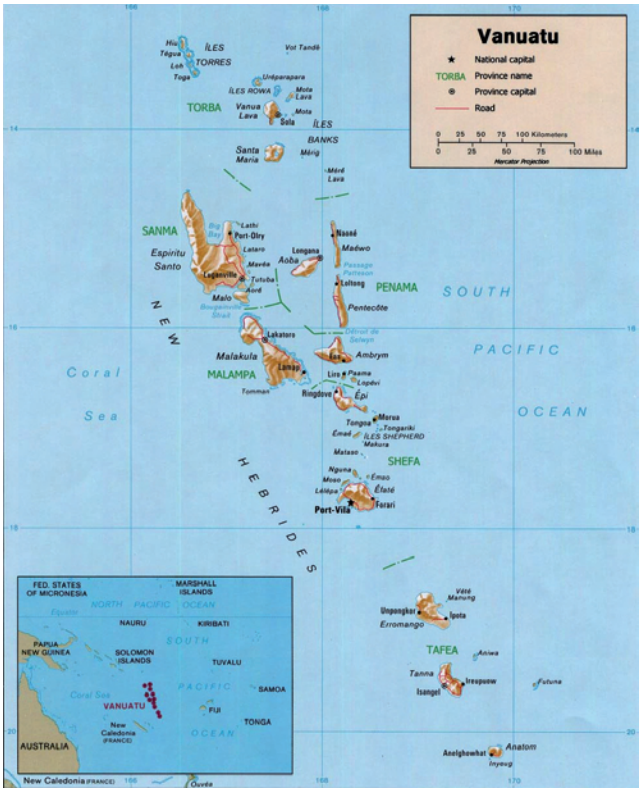
SANTO 2006 - SUMMARY REPORT

The SANTO 2006 expedition, the first biological survey of its kind, was designed to achieve a comprehensive assessment of the living organisms, both marine and non-marine, of a tropical oceanic island, Espiritu Santo (or Santo), in Vanuatu, located in the SW Pacific Ocean.

This global biodiversity assessment covered all the major environments (offshore deep-sea, reefs, caves, freshwater bodies, mountains, forest canopies) and also addressed issues regarding how indigenous biodiversity has been impacted by 3,000 years of human presence.



The SANTO 2006 Expedition was jointly coordinated by the Muséum national d'Histoire naturelle (MNHN), the Institut de Recherche pour le Développement (IRD), and Pro-Natura International. A total of 203 participants (of whom 153 scientists) from 25 countries were involved in 4 themes (Marine Biodiversity; Forests, Mountains & Rivers; Karst; Fallows and Aliens;) to document the fauna and flora of Santo.

This report summarizes the first findings of the expedition, and preliminary results are presented in Sections 1 to 4. There is still much work to be done, such as sorting samples and undertaking detailed studies of the materials and data collected in the field. A Scientific report is planned for publication later this year (September 2007) and numerous scientific papers will be published in the months and years to come.

An expedition such as SANTO 2006 requires considerable reactivity and flexibility in the management and distribution of funds, and would simply not have been possible without private funding. Supports from the private and public partners are gratefully acknowledged, not only by the Principal Investigators, but also by everyone in the international network of the expedition and the post-expedition scientists. The final balance sheet is still being prepared, but our initial interim reports indicate that expenses are in line with the budget. This has been achieved thanks to detailed and accurate provisional budget and

a careful expenses auditing exercise that was carried out on a weekly basis by a specially designated person throughout the whole project.

All in all, the operating costs of the Santo 2006 expedition amounted to ca. 1,100,000 €, covered with supports from the following sources: the Stavros Niarchos Foundation (500,000 €), the Total Foundation (150,000 €), the Committee for Research and Exploration of the National Geographic Society (68,000 US$), the Sloan Foundation (45,000 US$), the Veolia Foundation (36,000 €), Triballat (25,000 €) and various public funds: the Fonds Pacifique of the French Ministry of Foreign Affairs (140,000 €), EDIT, a Network of Excellence of the European Commission (46,000 €), the French National Research Council (CNRS, 26,000 €), the French Embassy in Vanuatu (17,000 €), the European Union representation in Vanuatu (5,000 €). Universal Sodexho and Telecom Vanuatu Limited provided in kind contributions (valued to ca. 45,000 €). In addition, use of the *Alis* Research Vessel amounted to ca. 275,000 €, covered in kind by IRD.

Main findings

Preliminary scientific results are detailed for each of the four scientific components in Sections 1 to 4 below.
It should first be noted that each of the planned scientific projects and sub-projects was successfully completed in the projected time frame and according to the initial written scenario. Some logistical and meteorological problems naturally arose, but they did not cause any major disturbances to the scientific programme.

Overall, the general feeling of the Scientific Committee and the Principal Investigators responsible for each scientific component is that Santo 2006 represents a breaktrough in the approaches and methodologies used for biological inventories.

The main goal of the expedition, which was a comprehensive inventory of Santo's biodiversity, was achieved, within the constraints of a 4-month project. Some species were no doubt overlooked in our survey, but they are few in number and it would take years to sample all groups of organisms exhaustively. The most hidden parts of the island Biota have been however carefully checked. There is no question that we now have a much clearer and realistic figure of what is living in this isolated part of the world.

Well over 10 000 species of plants, animals and fungi were collected during the 4 months of the expedition. This outstanding yield of specimens and associated biological data is mostly the result of the dedicated and hard working participants involved in the expedition. But beyond that, as Pr. Roger Kitching states below in Section 2, integrative research is by far more efficient than the sum of individualities. In other words, Santo 2006 was more than just numbers: collective work almost always yields much more achievements than segragate research activities carried out without a master plan.

We have shown, perhaps for the first time ever, that the immense task of filling gaps in the biological inventories of the poorly known yet highly diverse groups of animals (invertebrates) and plants is possible provided the appropriate scale and size of operation are selected and the work is well designed and executed.

It should also be noted that the most exciting and striking results do not lay in the impressive list of species collected: most of the scientific teams have also gathered extremely interesting data on the spatial distribution of elements of Santo's biodiversity and on species assemblages. Some unexpected biodiversity patterns have already emerged and will require further analyses. This knowledge of biodiversity patterns will provide the essential foundation on which to build more sophisticated assessments of ecological and evolutionary processes.

Lessons learned and possible improvments

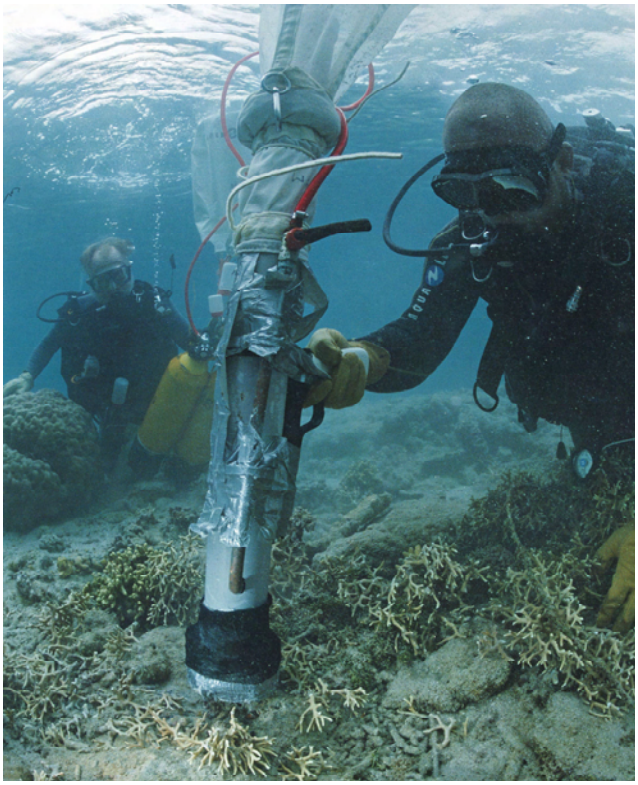
We have learned a lot from the Santo 2006 experience, but two main lessons of particular importance can be drawn:
The success of the project can, to a large extend, be attributed to the careful selection of enthusiastic and experienced participants, who acted as a superb professional group of experts. Mobilizing high quality senior scientists for this kind of operation is by no means an easy task. Forming such an effective team was a challenging issue, which Santo 2006 tackled sucessfully. In fact, the collective interest and commitment of the participants is a major 'product' of Santo 2006 and a very valuable resource for future endeavors.
However, keeping Scientists mobilized for future operations will be a challenge and we have to take

types, such as seagrass beds, mineral sediments, etc. Many reefs were not in good shape, obviously not the result of overfishing as there is very little subsistance fishing going on in Santo, and no dynamite fishing. We believe that perhaps the hurricanes of the 1980s are to be blamed (see map of hurricane tracks).
We also found that most species were extremely scarce in the number of stations where they occured and in the individual numbers, more so than in many other sites known to the participants.
Thus, the paradox is: even if Santo is not a site of exceptionnal richness, as we have deployed an exceptionally complete workforce we came up with an exceptionally comprehensive species inventory rivalling with richest spots known in the world !

Few figures

Logistics

8 boats, ranging from R.V. *Alis* (27 meters long) to a 4 meters aluminium service boat.
Aldric (the only one of the small boats to be equipped with a log) alone covered 1,200 nautical miles.
Small boats (i.e. excluding Alis) and land vehicles together used 6,800 liters of fuel.
5,000 meals served, 3,000 dive tanks filled,1,000 liters of ethanol used for preservation of samples.



Sampling intensity

588 sampling events
- intertidal collects: 76
- hand picking and other targeted
- sampling (SCUBA): 188
- bulk brushings (SCUBA): 46
- bulk vacuum cleaner (SCUBA): 45
- tangle nets and “lumun lumun”: 37
- coastal dredging: 44
- coastal trawling: 2
- quantitative sampling (grabs): 40
- trap lines: 5
- offshore dredging and trawling: 105

Malaise Trap Programme
(Villemant, Durand)

Malaise traps are tent-like structures which intercept actively flying insects, directing them into a apical collector containing 70% ethanol.

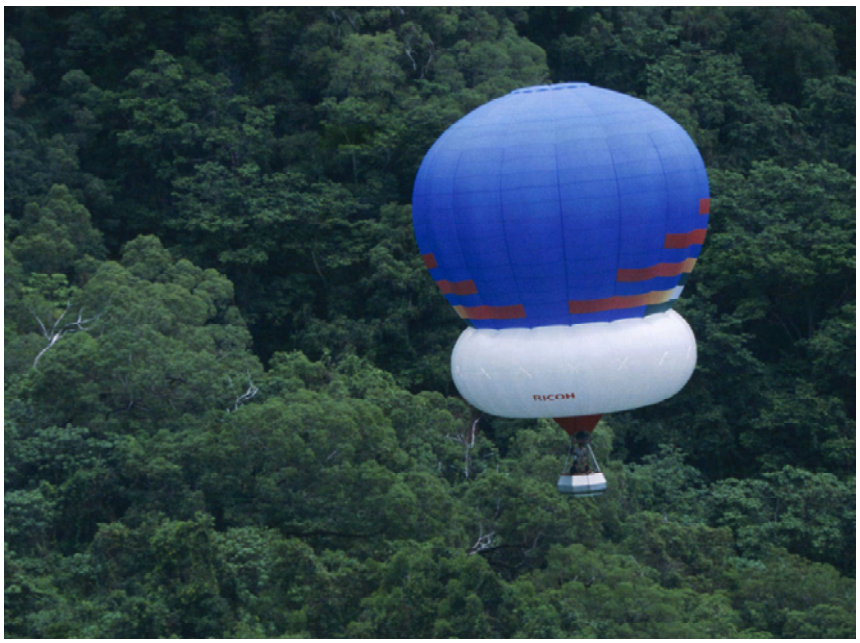
The traps used in the IBSICA surveys were of the so-called Townes design. Sites at all altitudes were targeted with ground zone traps. In addition, in one site at each altitude, one trap was mounted in a frame and hauled into the canopy. Malaise traps catch a range of insects but are particularly effective in sampling Hymenoptera and Diptera. Specimens were preserved for further sorting in France.

Special Habitats and Bark Spraying Programme (Schmidl)

In any forest there are localized patchily distributed habitats which, potentially, contain specialized insect fauna. Schmidl targetted these habitats at all altitudes and sites. He hand collected from structures and resources such as dead wood, fungus fruiting bodies, phytotelmata (water-filled treeholes) and bark surfaces.

This sub-programme involved spraying bark surfaces with a pyrethrum-aerosol and collecting the resulting samples on sheets arranged beneath the spraying location. A range of arthropod groups may be encountered in this fashion.

All-taxa canopy programme using the canopy- glider



The IBISCA programme employs state-of-the-art methods of canopy access and sampling since the starting of field studies in Panama (2003).

IBISCA-SANTO represents the first attempt to combine single rope technique and the use of a new flying device, the Canopy-Glider for sampling in the upper-canopy.

The Canopy-Glider showed great promise as a research tool but, by the time it was up and running in Santo because of logistics constraints, it was essentially too late to use it for scientific work. However the demonstration flights helped to devise a dedicated research project for the glider within the overall goals of the IBISCA Project.