BIOPAPUA Cruise: Highlighting the deep-sea benthic biodiversity of Papua New Guinea

A Report Submitted to School of Natural and Physical Sciences,
University of Papua New Guinea

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BIOPAPUA Deep-sea Research Expedition 2010

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BIOPAPUA Deep-sea Research Expedition 2010 Report

1. EXECUTIVE SUMMARY

The marine environment is the largest of all habitats that make up the biosphere of our planet. Although the earth is 71 % ocean in area, we only explored less than 10 % of the seafloor. Most of our knowledge of marine biodiversity are derived from the coastal marine environment and its diverse ecosystems. Papua New Guinea is no exception and currently PNG is considered as a region of marine biodiversity hotspot under the coral triangle initiative charter. Deep-sea is defined as epipelagic waters (water below 200 m). The photic zone extends as far as 100 m deep depending on the turbidity of the water column. Primary producers utilize light energy and provide the basis of the food chain that we are familiar with. However, from epipelagic to mesopelagic (1000 m) and bathypelagic (4000 m) zones there is no light hence primary production by photosynthesis is absent.

The first reports of unexpectedly high species diversity in bottom living communities were announced in 1967 when scientists used a new technique: the epibenthic sled to sample the deep-sea benthos (Hessler and Sanders, 1976). Most deep-sea organisms totally depend on organic fall from the epiphotic zone such as carcasses, faecal matter and sunken vegetation. Furthermore in 1977, scientists discovered the hydrothermal vents and its associated rich communities of animals on the Galapagos Rift. Ever since then, deep-sea research has become a new frontier of research on biodiversity and evolution of benthic biota.

PNG occupies 0.2 % of the world area and has 5-7 % of the known world biodiversity. The biota are mainly from terrestrial and coastal ecosystems. Conversely, the deep-sea biota of PNG are basically unknown just like other third world island-nations that don't have the know-how and resources to conduct basic research on its pristine benthic environments.

BIOPAPUA deep-sea research expedition was a timely effort by the National Museum of Natural History in Parish and the University of Papua New Guinea to conduct an inventory exercise of the deep-sea organisms that thrive at the depths ranging from 100 to 1500 m in all waters of PNG. The data obtained were interestingly satisfying to all parties involved and it is likely that a more specified cruise will be planned in the near future.

In several years time most organisms collected will be identified to taxonomic level and the data will be published in academic journals, museum monographs, and scientific communication. This is the beginning of knowledge accumulation of our rich benthic organisms and one day PNG will increase its biodiversity index further to become the Indo-Pacific 'hotspot' in marine biodiversity.

This report is the narrative of the BIOPAPUA cruise that highlighted the major parties involved and the brief baseline data of the results that comprised major groups of organisms collected. The narrative is the basis of a series of reports that will transpire into various forms to meet specific needs of relevant bodies in PNG especially in regard to Fisheries Policy, Biodiversity Management Policy and Deep-sea Policy. Without such policies in place, our rich marine resources that evolved for millions and millions of years would continue to be plundered by unscrupulous interest groups in the name of socio-economic development.

Dr. Ralph R. Mana
Principal Researcher UPNG-BioPapua Cruise

2. INTRODUCTION

The deep benthos of tropical seas represents one of the last frontiers of marine biodiversity and deep-sea research. The highly diversified marine environments and the geodynamic history of the tropical region is thought to sustain unique biological ecosystems since the first discovery of the deep-sea organisms that dwell in depths as below as 7000 m. Papua New Guinea is a region of the highest marine biodiversity of the world which is centrally located in the Indo-Pacific gradient of biodiversity as referred to as coral triangle. However, the biological data of its deep-sea region are still largely unknown and the area remains unexplored by marine biologists. The only deep-sea expedition was conducted by the HMS Challenger in 1870s. Other specific targeted deep-sea investigations were carried out by foreign researchers who are affiliated with mining companies such as Misima gold mine, Lihir gold mine, Simberi gold mine, Nautilus deep-sea exploration and, Ramu Nickel and Cobalt mine. The data obtained at certain geographical locations by the mining affiliated researchers are usually classified as 'non public' data and cannot be utilized in building our knowledge of our deep-sea resources in association with the physical oceanographic features. Therefore the BIOPAPUA cruise (an integral part of the Tropical Deep-Sea Benthos research program) which is a collaborative partnership between the University of Papua New Guinea and National Museum of Natural History (MNHN) in Paris was aimed to fill this gap of biodiversity knowledge from 100 to 1500 m deep in the waters of PNG. The main objective of the deep-sea cruise BIOPAPUA was to establish a reference state of this benthic biodiversity.

2.1 OBJECTIVES

The goals of the BIOPAPUA cruise were to explore the deep-sea benthic fauna with three nested objectives:

1. Deep-sea benthic biodiversity and new species; Description of fauna and barcode species identifiers, with discovery of new species,
2. Sunken wood ecosystem; Focus on sunken wood-associated fauna and selected species through research on the functioning of this deep-sea ecosystem in an evolutionary perspective and,
3. Endemism and seamount; Endemism and seamounts by correlations between age and isolation of seamounts and composition of the benthic fauna including the understanding of dispersal strategies of the species

3. METHODS

During the BIOPAPUA cruise, low tech methods of sampling was deployed on board of the vessel. This method was based on both uses of classical fisheries technique (Trawling) and research technique (Dredging). The data on the nature of bottom were obtained with the multi-beam echosounder.

3.1 SAMPLING METHODS

The Vessel

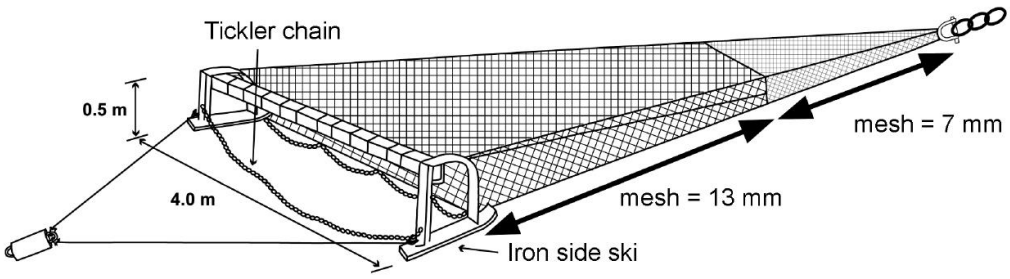
BIOPAPUA expeditions was made possible with the support of the vessel *R.V. Alis*.
This scientific vessel is owned by the Institut de Recherche pour le Développement (IRD).

Research Vessel ALIS

Total length 28.40 m
Floating length 24.50 m
Width: 7.60 m
Raw gauge 198.80 Tx
Net gauge 77.80Tx
Total crew: 12 persons
Scientific crew: 6 persons

According to the nature of the seafloor, the dredge was deployed first on rocky substrates while trawl was more efficient on soft substrates.

Trawling (Figure 1): the standard French beam trawl is composed of a 4 meters (m) wide wooden beam that is fixed onto heavy iron runners situated at both ends of this bar. These runners serve as skis so that the trawl can glide on the sea floor. The height of the iron sides is (0.5 m, length 0.45 m, giving an effective height of 0.35 m) defines the vertical opening of the net while the beam determines the horizontal opening of the net. The heavy weight of the runners at the base of the opening of the net settles the trawl and keeps it well on the ground. A fine-mesh (15 and 12 mm) net is attached to this system; the ground rope of the net is strengthened with chain to allow digging into the sediment for stirring up organisms or substrate on and in the sediment. A tickler chain (4.5 m long, 10 kg) is placed before the net. A conical net proper is situated behind the ground rope. This conical shape allows for good filtration of the water and guides the organisms caught in the net towards the cod-end of the trawl.
The cod-end is double-layered, with an inner finer meshed bag. The trawl is connected to the warp of the ship by two wires of 4 m long forming a triangle with the beam (crowfoot). The trawl is generally deployed at a speed of 2.5-4.5 knots (with pay-out speed about 1 m/sec) and towed at 1-2.5, mostly 1.5 knots ground speed.



	French beam trawl
Type of frame	Iron side skis (100 kg) Wooden beam (70 kg)
Span	4.0 m
Mouth height	0.5 m
Mouth width	3.8 m
Mouth area	1.9 m^2
Net length	8.8 m
Stretched mesh width	13 mm 7 mm
Total weight	230 kg
Tickler chain	4.5 m long, 10 kg

Figure 1: The French beam Trawl (technical characteristics and illustrations)

Dredging (Waren Dredge; Figure 2): a typical dredge consists of a strong metallic frame behind which is placed a net to retain sediment and fauna. The frame is connected to a wire and hauled by a boat at slow speeds (1-2 knots), sometimes slower depending on bottom roughness. The bag of the dredge is composed of several layers; an inner bag made of thinner mesh (3-5 mm) is protected by 1-2 outer layers with a larger mesh size (20-50 mm) and a stronger weave. In the Warén Dredge used during the Tropical deep sea Benthos programe and related expeditions, the external layer is made of a strong metallic ring net.

Prof. Anders Waren from Swedish National Museum of Natural Museum, Stockholm is the designer of the Waren Dredge used for dredging non-homogenous rugged sea floor during the cruise. He is involved in deep-sea benthos research for the past 40 years.

The photograph showed Dr. Ralph Mana and Prof. Anders Waren in LEG2 of the BIOPAPUA cruise.

Figure 2: The Warén dredge

3.2 ANALYSIS METHODS: MUSEUM PROCEDURES AND EDITORIAL CONVENTIONS

Regarding precision of geographical coordinates, shipboard data result in considerably more information than was necessary for appropriate localization of the specimens collected. Positions were recorded on the bridge of the ship, often at two or more of the following times: (a) when the dredge/trawl was put out to sea and the winch starts paying off cable; (b) when the dredge/trawl reaches the bottom, the winch was stopped, and the dredge/trawl started being dragged/towed on the bottom; (c) after 20 minutes (dredge) or 30-60 minutes (trawl), the cable started being hauled back onto the winch; (d) when the dredge/trawl arrived at the surface and was hauled on board. Given the distance covered by the ship during towing (at 2-3 knots, about 2 km were covered in 30 minutes), and given the fact that the net was towed a long way behind the ship (up to several kilometres of cable may be paid out), we drew attention to the false impression of exact location that many unedited station lists may give. As a standard procedure, we had retained on the MNHN labels the position of the ship at the time when the trawl/dredge started being dragged/towed on the bottom, if known; because of the length of cable paid out and the distance of the net behind the ship, decimals of minutes of latitude/longitude did not make sense (one-tenth of a minute = 180 m) and positions were thus rounded up to the nearest minute. For depths, we retained both the depth at the time of initiation of dragging/towing (b, above) and the depth at the time of initiation of hauling (c, above).

On board MNHN procedures and editorial conventions

While at sea during the expeditions, the megafauna and larger macrofauna were sorted to phylum. "Specials", such as wood associated fauna or specific groups of molluscs (eulimids or solenogastres on hosts, cocculiniforms on organic substrates, or exceptionally fragile specimens) were kept separate. The small fractions (inferior to 1 mm) and residues that could not be sorted on board with the naked eye were bagged and either frozen or ethanol-fixed.

Sorting and preservation of specimens

The sorted organisms were photographed immediately and it was especially important for mega fauna such as fish, crustaceans, molluscs echinoderms and sponges. Major taxonomic groups were:

∗ Cnidarians, Ascidians and Sponges: Specimens of hard and soft corals, gorgonians, sea anemones, other cnidarians, ascidians and sponges. The specimens were preserved in 80% ethanol. Actinaria (sea anemones): genetic samples were preserved in 80-100% ethanol; vouchers were preserved in formalin (10% in sea water, buffered with borax). Anemones were relaxed in cold sea water with menthol crystals prior to fixation.
All Cnidarians but the CITES-listed Antipatharia (black corals), Scleractinia (hard corals) and Hydrozoa (hydrozoans) were individually photographed, subsampled for genetics and preserved in 80% ethanol.

∗ Fish: Specimens were identified (if possible) and photographed and preserved in formalin.

∗ Echinoderms: Specimens of holothuria, echinoids, asteroids, ophiuroids as well as noting down associations with molluscs and crustaceans.

∗ Crustacea and Pycogonids: Specimens of crabs, shrimps, galatheids, lobsters, hermit crabs, barnacles and the occasional isopods and amphipods. They also photographed representative specimens of each major species before preservation.

∗ Molluscs and Brachiopods: Specimens of gastropods, bivalves, cephalopods as well as noting down associations with molluscs and crustaceans. Photographs of selected samples were taken for colour records.

∗ Wood and wood-associated animals: This group was tasked to work out wood hauled from the station and

collected boring molluscs and other organisms burrowing in wood. Specimens were preserved in 90% ethanol for molecular analysis, in 2.5% Glutaraldehyde for morphological studies.

∗ Tissue sampling and Photography (Barcoding): Tissues were sampled from different species of fish, gastropods, bivalves and crustaceans. Molluscs were treated by using cold 5–8% magnesium chloride solution to relax specimens before cutting off foot tissue sample. This tissue was immersed in absolute ethanol while the rest of the body and shell were preserved in 80% ethanol.

During the expedition, each lot was labelled and packed separately according to their phylum. The material was then sorted to operational groups, which can either be a class, a family, or even artificial but practical groups. Each processed lot carried a label that explicitly provides in full: the region/country of the expedition; cruise acronym and name of the ship; station number; latitude, longitude, depth; if relevant, the name of collectors on the shipboard party. For most of the Tropical Deep-Sea Benthos cruises, station numbers were preceded by a two letter prefix that referred to the type of gear used: CP, Chalut à Perche (Beam Trawl); DW, dragueWarén (Warén Dredge). Since 1985, all stations in the main MUSORSTOM cruise series are numbered consecutively (now over 4,000). When citing material in publications, each lot was unambiguously designated by the combination of the cruise acronym and station number.

(A)

Cruise name → Cruise Name BIOPAPUA 2010
Station number → Station Number CP 3656
Depth → Depth 641 – 677 m
Date → Date 22/09/2010

(B)

Munidopsis bispinoculata
Baba, 1988
MNHN-Ga-7043

Papua New Guinea, Pacifique,
BIOPAPUA, Alis, **CP3656**,
prof. 641 - 677 m ;
167°57'60" E, 16°39'40" S,
S. Samadi et al. coll., 22/09/2010

Figure 3: Examples of labels performed (A) during the cruise and (B) in the National Museum of Natural History (MNHN-Paris)

3.3 EQUIPMENT

3.3.1 Scientific equipment

Multibeam sounder	100kHz EM 1002 SIMRAD 93 kHz
Monobeam sounder	SIMRAD EK 500.
Sounder	FURUNO 28/200 khz.
Echosounders	SIMRAD EK60 (38, 70, 120, 200 KHz) Installation in December 2009.

Acoustic Doppler Current Profiler	RDI 150 kHz BB
Trawl sensors	SCANMAR
Thermosalinometer	SEABIRD SBE21
Expendable bathythermograph	SIPPICAN MK21 XBT/XCTD
Meteorological sensors	Batos 1.1 D - Météo France

3.5 SURVEY PROGRAM AND EQUIPMENT

3.5.1 General survey program

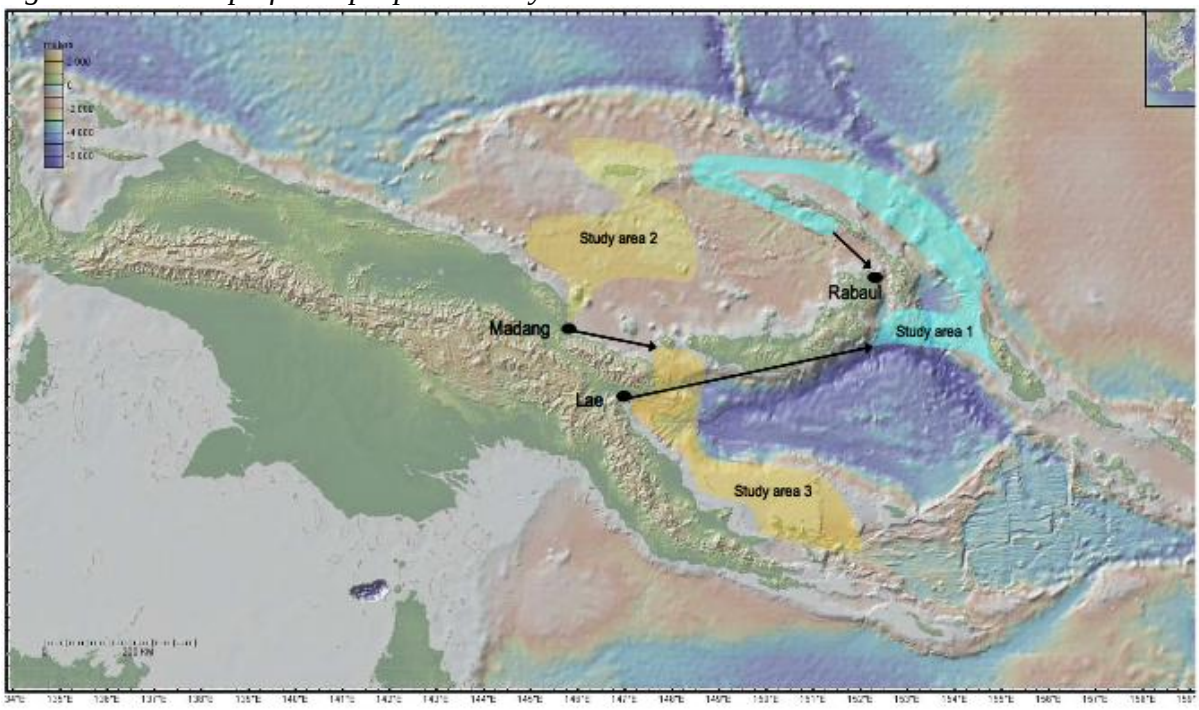
The cruise was conducted during the summer 2010, from August 22nd to October 20th 2010 with an unfortunate and tragic interruption when we lost a crew member during the first LEG (40 days on sites of the study). This cruise was set into three parts (LEG).

LEG1: Departed Lae August 22nd and stopped over at Rabaul August 29th
LEG2: Cancelled
LEG3: Departed Rabaul September 18th and stopped over at Madang October 2nd
LEG4: Departed Madang October 5th and stopped over at Rabaul October 20th

Study areas was located at 3 miles from the coastline and the sampling depth range was between 100-1500 m depth for all stations. (See map below)

The first map (Fig. 4) below portrayed the 3 areas of interest initially planned for the study during the cruise however, the exact areas studied was slightly different. The exact areas surveyed are shown on the 3 maps (Fig. 5) in the results section. The 3 maps indicated the station number and the studied localities. All the stations and their respective coordinates are located at appendix 1. Some areas of interest in regard to the mining development are Astralobe Bay, New Hanover, Huon Gulf, off Rabaul and off New Ireland.

Figure 4: The map of the 3proposed study areas



4. PARTICIPATING AGENCIES

4.1 MUSEUM NATIONAL D'HISTOIRE NATURELLE (PARIS)

The National Museum of Natural History / Muséum National d'Histoire Naturelle (MNHN) has been an exceptional scientific establishment for over 300 years and is a worldwide specialist in biodiversity and naturalist and environmental issues.
Created in 1635, originally as the Royal Garden, and responsible for major scientific discoveries in the field of Natural Sciences, today the Museum is a public cultural, scientific and professional institution, under the joint authority of the Ministry of Higher Education and Research and the Ministry of Ecology, Energy, Sustainable Development and Spatial Planning. At the crossroads between Earth, Life and Human sciences, the Museum exercises its vocation through five fundamental objectives: fundamental and applied research, the conservation and enrichment of collections from natural and cultural heritage, teaching,

Features related to the BIOPAPUA cruise that are worth noting

- Small footprint of the BIOPAPUA cruise (inferior to 1 Km^2 for the entire cruise)
- Qualitative sampling with preservation of all taxonomic groups
- Short terms sampling efforts (less than 40 days on study sites)
- No direct impact on fisheries or reefs
- Near surface environmental impacts was insignificant

expertise and the dissemination of knowledge. Strengthened by its history, the Museum has become a benchmark centre for the study and preservation of biodiversity.
A prestigious research establishment, it relies as much on field studies as on laboratories, as well as great inter-disciplinarity, exceptional collections – one of the three greatest in the world- and unique expertise. It can therefore, through various dissemination activities and its teaching activity, inform and raise awareness in many public areas about protecting our planet.

A few key figures:
- 1880 people, including 500 researchers;
- 68 million specimens in the natural history collections;
- 350 students (masters and doctoral school);
- 13 sites in Paris and the regions;
- + 2 million visitors a year.

4.2 COLLABORATING INSTITUTES IN PAPUA NEW GUINEA

The Biological Sciences Department at School of Natural and Physical Sciences, University of Papua New Guinea (UPNG) cooperated with the MNHN team for BioPapua. MNHN have been in contact with Dr Ralph Mana, Head of the Biological sciences at UPNG during the early phase of the BioPapua cruise preparation.
The objectives of this marine expedition was approved by various government agencies such as Environment and Conservation Department and National Research Institute and, Dr Mana had underlined the importance of such inventory of the deep-sea organisms and their biodiversity in PNG waters. This project would benefit PNG in a significant way in light of the current underwater sea mining exploration, conservation of marine biodiversity and fisheries. As far as possible, the collection of fishes would be duplicated during the cruise itself, with one set deposited at the 'National Fish Collection' (UPNG), and one set in MNHN.
A memorandum of understanding (MoU) has been signed between the National Museum of

Natural History (Paris, France) and the school of Natural and Physical Sciences (UPNG, Port-Moresby).

4.3 SCIENTISTS AND STUDENTS ONBOARD

The principal investigators of the project are Dr Sarah SAMADI and Dr Philippe BOUCHET, Professor, representing the Museum, and Dr Ralph MANA, Professor, representing the University, acting as umbrellas for all participants.

Below is the list of scientists involved in each LEG of the cruise and their respective affiliations.

LEG1
22 / 08 /2011 to 29 / 08 / 2010

Scientific team
Sarah SAMADI (researcher, IRD, Paris France)
Justine THUBAUT (PhD Student, MNHN, Paris France)
Tin-Yam Chan (Professor National Taiwan Ocean University, Keelung, Taiwan)
Julie PONSARD (PhD Student, University of Liège, Belgium)
Mao-Ying LEE (PhD Student, NTOU, Keelung, Taiwan)
Alfred KO'OU (UPNG, Port Moresby, PNG)

LEG3
22/09/2010 to 2/10/2010

Scientific Team
Laure CORBARI (Assistant professor, MNHN, Paris France)
Marie-Catherine BOISSELIER (Researcher, CNRS, Paris France)
Anders WAREN (Professor, Swedish Museum of Natural History, Stockholm Sweden)
Gilbert DUVAL (Dr in medicine, Nantes, France)
Jesse APONE (Student, UPNG, Port Moresby, PNG)
Ralph MANA (Professor, UPNG, Port Moresby, PNG)

LEG4
06/10/2010 to 18/10/2010

Scientific team
Sarah SAMADI (researcher, IRD, Paris France)
Justine THUBAUT (PhD Student, MNHN, Paris France)
Eric PANTE (PhD Student, University of Louisiana, Lafayette USA)
Ruei-Ly LEE (Research assistant, NTOU, Taiwan)
Edwin SOHUN (Research assistant, UPNG, Port Moresby PNG)
Gilbert DUVAL (Dr in medicine, Nantes, France)

5. TIMETABLE FOR PUBLICATIONS

5.1 IMPLEMENTATION OF THE PROGRAM / TIMETABLE FOR PUBLICATIONS

Project implementation timetable

Date	Key milestones
August-October 2010	BIOPAPUA cruise conducted
October 2010	Cruise report issued: cruise narrative, station list and maps
June 2011	Publication of outreach and education material: posters and PowerPoint presentations
September-December 2011	First detailed inventory of catches: lists of material at family level for all invertebrates, list of material at genus or species level for fishes
November or December 2011 or January 2012	Research visit of UPNG co-Principal Investigator to France
2012 and/or 2013	Research/training visits of UPNG faculty to MNHN, including training on molecular barcoding for taxonomy
End 2012 and End 2013	Yearly progress reports: lists of specimens identified; scientific papers based on specific parts of BIOPAPUA samples published in academic journals
End 2014	Final report on project: copy of database with lists of specimens lodged at UPNG; scientific publications based on BIOPAPUA samples compiled on paper and electronic version for archiving at library of UPNG

5.2 DELIVARABLES

Research Results: description of baseline condition of deep-water benthic fauna, discovery of species new to science, publication of specialist academic research papers.
Outreach: publication of education /outreach material: posters and fisheries by catch identification guide.

Outreach and education material such as posters would be distributed to respective institutions and agencies (Universities, NFA, DEC, NRI, WWF...), all maritime provinces, mining industry and others. Powerpoint presentation of the cruise would be done at the university and during the coming 4th Science and Technology Conference at University of Natural Resources and Environment Vudal campus July 2011. Next year 2012 a detailed report of the BIOPAPUA deep-sea research expedition would be released. Details of the cruise is available on this website (http://en.ird.fr/all-the-current-events/live-science/biopapua-cruise.

6. RESULTS TO DATE

The data derived from the BIOPAPUA cruise that became part of this this report were provided by respective specialists onboard the research vessel *Alis*. Data such as station codes and bathymetric data of the surveyed area were available. Most photographs of fish were from the PNG team. Crustacean samples were provided by the Prof. Tin-Yam Chan of National Taiwan Ocean University (NTOU). Cnidarian data came from Eric Pante, PhD Student, University of Louisiana, Lafayette USA. Other invertebrate groups data were provided by Dr. Sarah Samadi and other the scientists of MNHN. First detail inventory of catches will be made available late this year 2011 (see section 5.1). Posters of fish and crustaceans were prepared by UPNG and Taiwanese teams and funded by Dr. Tin-Yam Chan's research grant.

Fish identification will be done by the UPNG team with the assistance from Professor Kwang-Tsao Shao of Biodiversity Research Center, Academia Sinica, Taiwan (R.O.C). Until now effort to move the 7 drums of formalin-stored specimens at Rabaul port to UPNG is unsuccessful because of the inefficiency on the part of the shipping agency. As soon as the specimens arrive at UPNG identification work on fish will commence.

Crustaceans will be sorted out in Paris at June 2011 and most of the identification work will be done by NTOU scientists and others. Cnidarians will be studied by Eric Pante and sea anemones will be identified and described by Dr. Estefania Rodriguez, at the American Museum of Natural History (New York City, USA).

Molluscs will be studied by MNHN scientists and other affiliated taxonomists. Other invertebrate groups will be studied by other scientists. Wood-associated organisms data will be analysed by Dr. Laure Corbari (Assistant professor, MNHN, Paris France) and others.

Refer to section 5.1 for BIOPAPUA timetable for project implementation and publication. It is important to note that for some specimens identification, it will take less time but for others it can take years. Consequently each organism will be treated at Phylum, Class or Order level or otherwise stated.

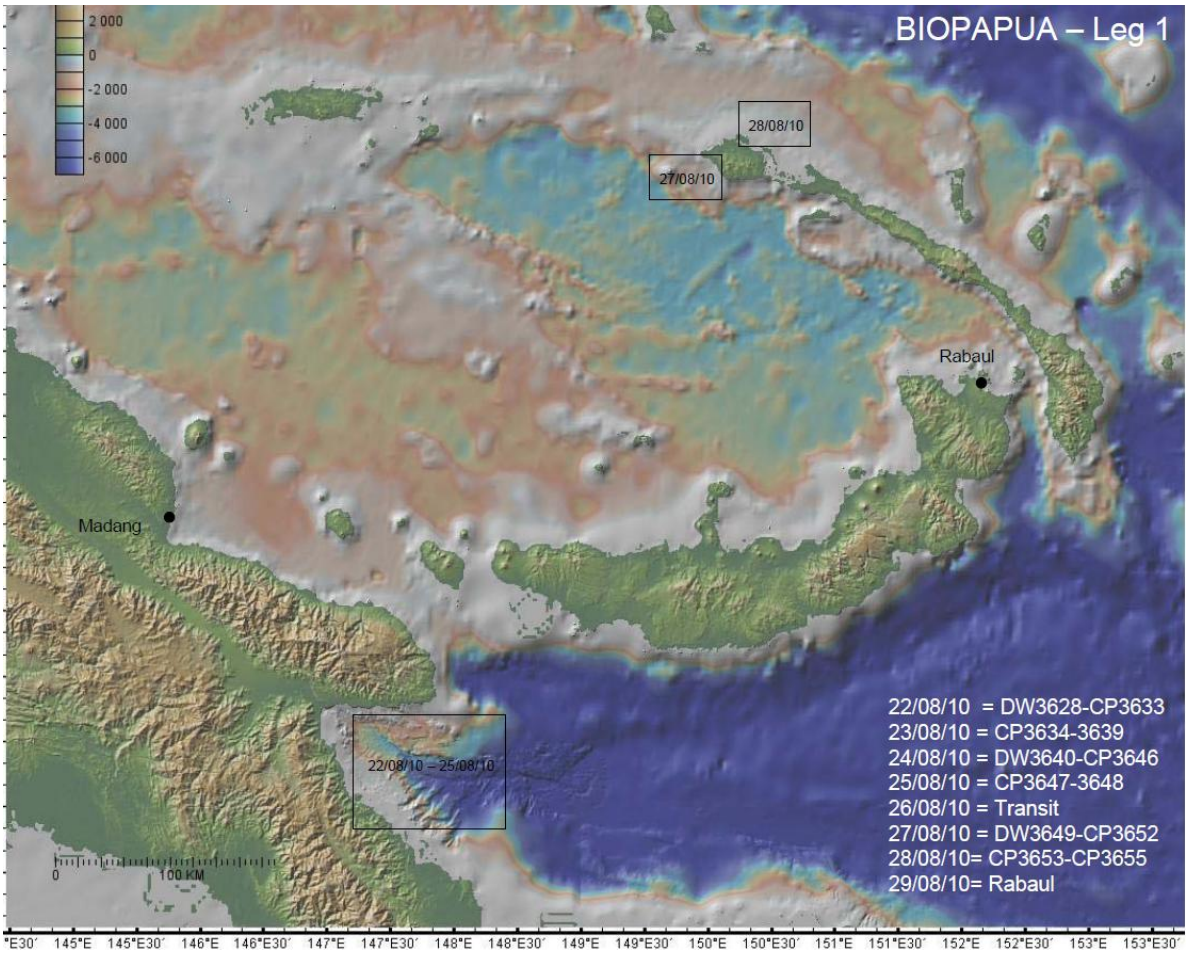
6.1. STATIONS AND LOCALITIES

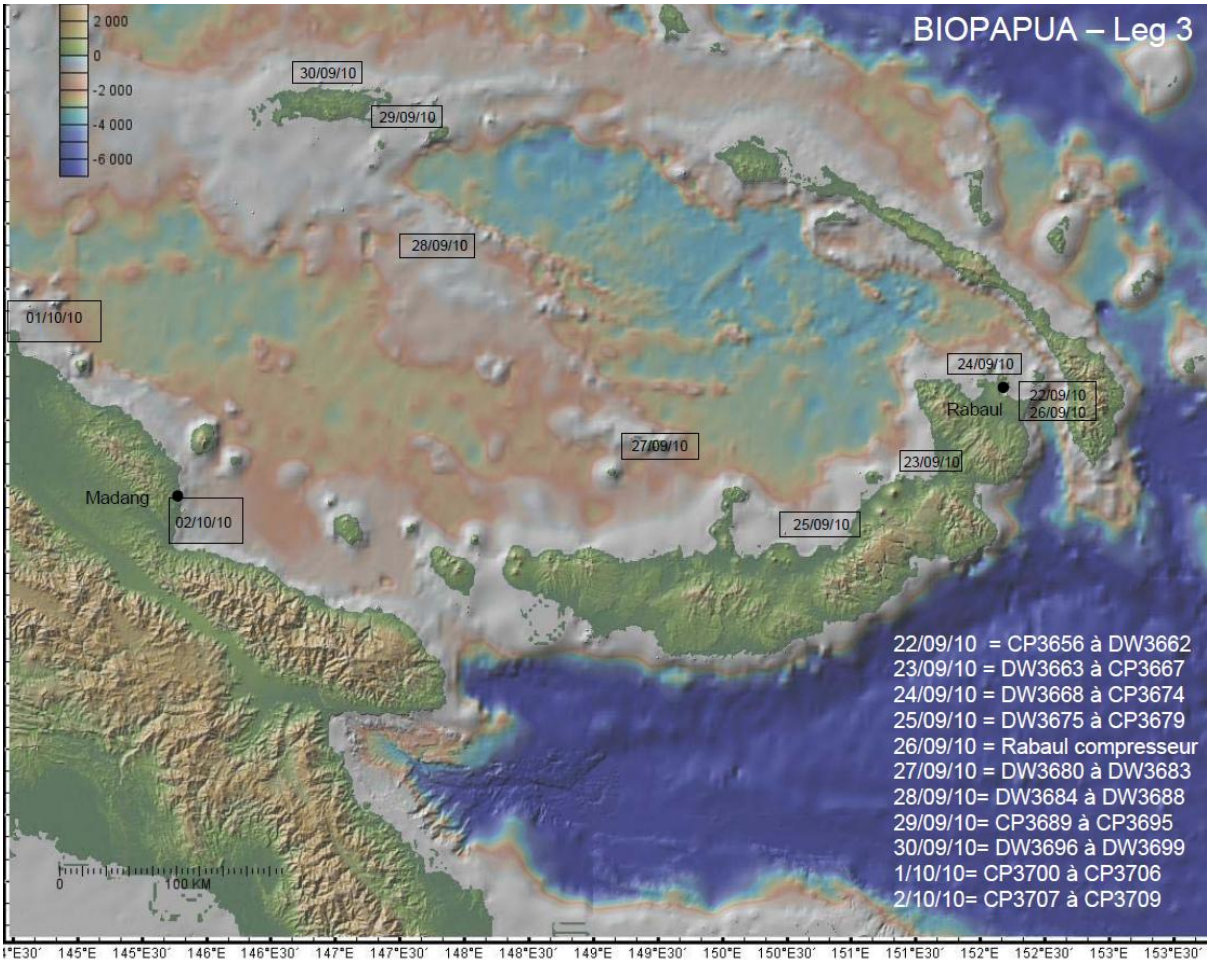
The total number of stations surveyed was 156 comprised of the 3 Legs; LEG1 (28 stations), LEG3 (54 stations) and LEG4 (74 stations). Fig. 5 showed the 3 maps for the 3 LEGs indicating the station codes and the dates of operation onboard the research vessel. In LEG1 only 3 areas were surveyed; Huon Gulf and Tami Island at Morobe Province, and Southern

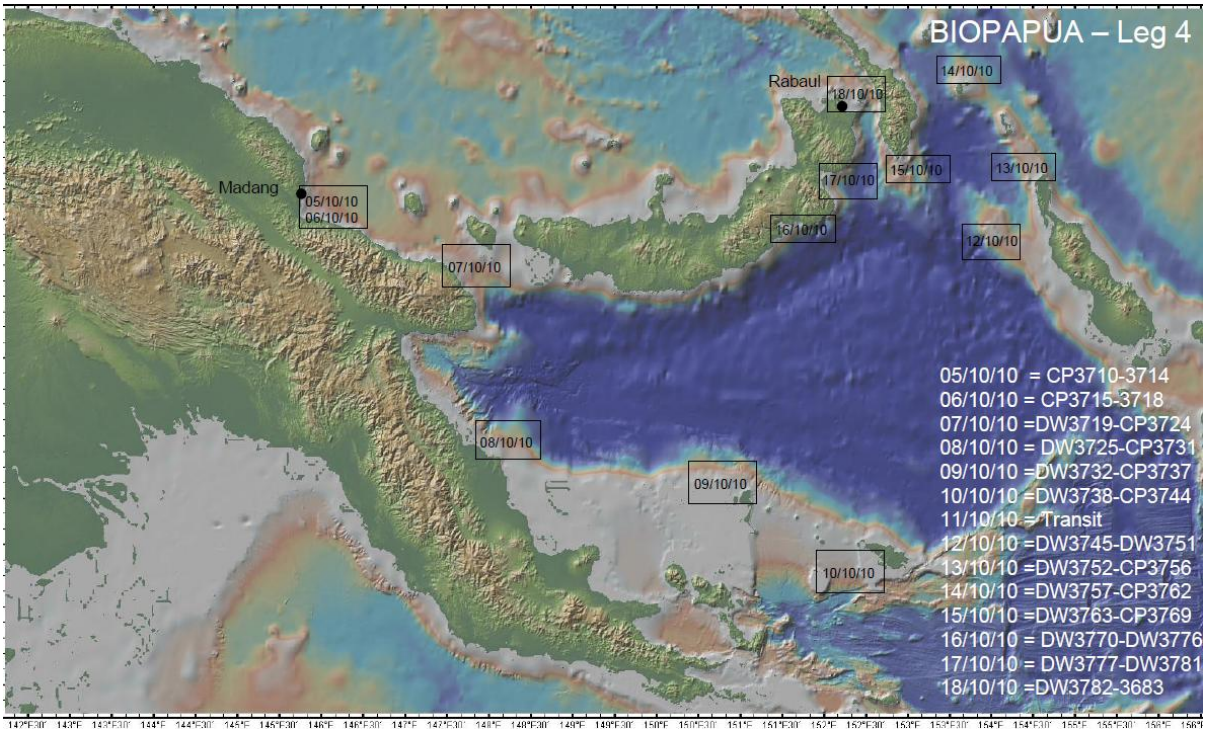
and Western Hanover in New Ireland Province. The unfortunate tragedy of a crew member shortened the cruise. In LEG3 9 areas were surveyed; off Rabaul, Open Bay, Northern Rabaul, Kimbe Bay, Vitu Islands WNB, Seamounts southern Manus island, Manus island, off Sepik River and off Madang. In LEG4 12 areas were surveyed; Astrolabe Bay, Vitiaz Strait, off Mambare Bay Oro Province, off Lancasay reefs Milne Bay Province, off Woodlark islands, seamounts off Bougainville, off Bougainville, off Feni islands, off New Ireland, Jacquinot Bay East New Britain, Wide Bay East New Britain and off Rabaul.

All the stations and their coordinates are at the appendix of this report. Depths at shooting the underwater gear, depths at trawling and depths at hauling the gear were recorded with their coordinates (see appendix).

Figure 5: The 3 maps of the studied localities, station codes and dates of survey




BIOPAPUA – Leg 3
2 000
0
-2 000
-4 000
-6 000
30/09/10
29/09/10
28/09/10
01/10/10
24/09/10
22/09/10
26/09/10
Rabaul
27/09/10
23/09/10
Madang
02/10/10
25/09/10
22/09/10 = CP3656 à DW3662
23/09/10 = DW3663 à CP3667
24/09/10 = DW3668 à CP3674
25/09/10 = DW3675 à CP3679
26/09/10 = Rabaul compresseur
27/09/10 = DW3680 à DW3683
28/09/10= DW3684 à DW3688
29/09/10= CP3689 à CP3695
30/09/10= DW3696 à DW3699
1/10/10= CP3700 à CP3706
2/10/10= CP3707 à CP3709
0
100 KM


BIOPAPUA – Leg 4
14/10/10
Rabaul
18/10/10
Madang
05/10/10
06/10/10
17/10/10
15/10/10
13/10/10
16/10/10
12/10/10
07/10/10
05/10/10 = CP3710-3714
06/10/10 = CP3715-3718
07/10/10 =DW3719-CP3724
08/10/10 = DW3725-CP3731
09/10/10 =DW3732-CP3737
10/10/10 =DW3738-CP3744
11/10/10 = Transit
12/10/10 =DW3745-DW3751
13/10/10 =DW3752-CP3756
14/10/10 =DW3757-CP3762
15/10/10 =DW3763-CP3769
16/10/10 = DW3770-DW3776
17/10/10 = DW3777-DW3781
18/10/10 =DW3782-3683
08/10/10
09/10/10
10/10/10

6.2 MAIN GROUPS OF ORGANISMS COLLECTED

Major groups of deep-sea mega faunal organisms were collected included fish, crustaceans, echinoderms, molluscs, cnidarians, ascidians, sponges and fungi. Usually it will take years for specialists throughout the world to identify the specimens down to Family or species level. In this report the emphasis will be on the data handled by UPNG and Taiwanese teams who are the custodians of the fish and crustaceans respectively. Other data were provided by Dr. Sarah Samadi and other scientists of MNHN. Eric Pante of University of Louisiana, Lafayette, USA, provided data on cnidarians and contributed to section 6.2.5. Seafloor mapping data were provided by the second officer of the research vessel *Alis*. Surveyed stations and the coordinates were made available by the MNHN team.

6.2.1 Fish and Elasmobranches

A total of about 200+ fish species and 5 species of elasmobranches were collected. Some fish species (Fig. 6 F and G) were abundantly caught while others (Fig.6 C, D, L, N and P) were rarely seen. Some species were caught throughout the three areas of survey while others tended to be localized in their distribution pattern. For example, one shark species (Fig.6 G) was distributed all throughout the waters of PNG and thus found at most stations. Importantly, most of the fish specimens were not seen before by the researchers onboard research vessel *Alis*. In fact, I have not seen 99% of the fish sampled. Thus proper identification of such specimens is the primary challenge to the UPNG team and Professor K.T. Shao of Academia Sinica, Taiwan (R.O.C) who will assist in identifying the fish to Family, Genus or species level. Below are the representatives of some of the 200+ fish species caught during the entire cruise.

(A)

(B)

(C)

(D)

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(F)

(G)

(H)

(I)

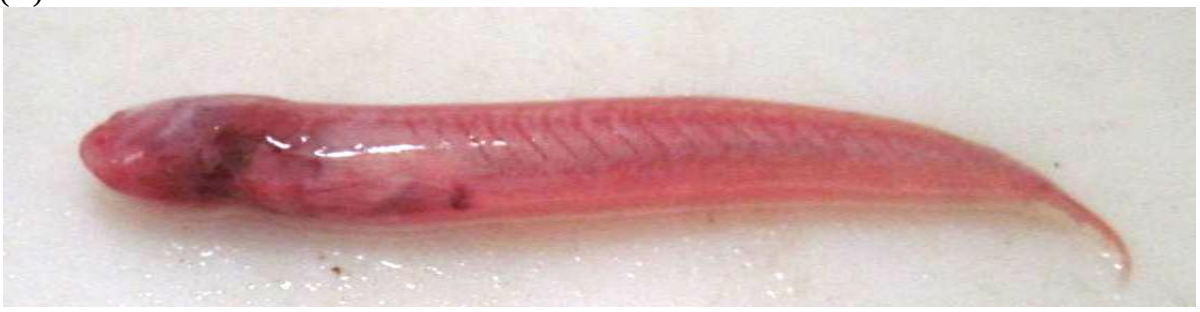
(J)

(K)

(L)

(M)

(N)



(O) (P)

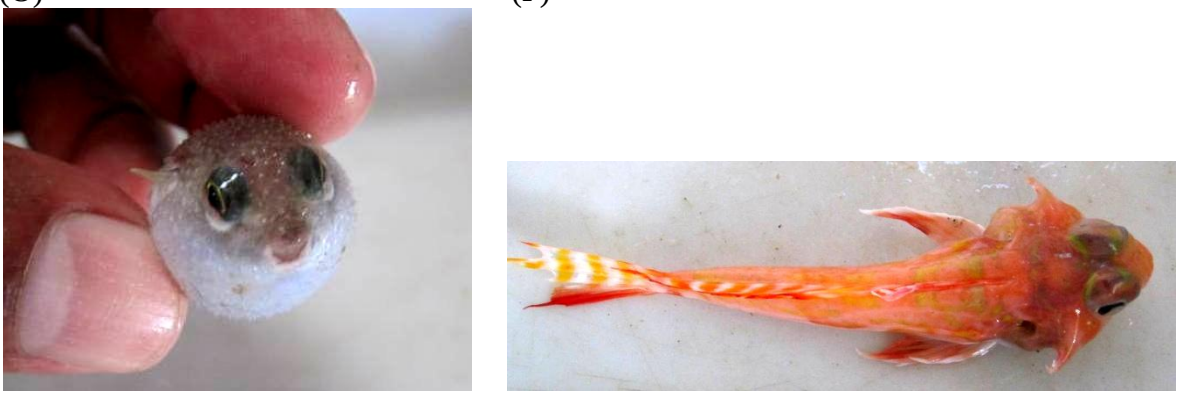


Figure 6: Some of the fish and elasmobranch fish caught during the cruise. Some fish (F) and shark (G) were caught in abundance at most stations. Few fish (J) were about a meter long. Dorsally located eyes is a common feature of many different fish (A, B,C, D and K). Deep sea ray (J) and chimera (K)were rare. A 50 cm long red fish (L) was rarely caught and flatfish (M) was abundant at most areas. A rare small reddish fish (N), a rare puffer fish (O) and a bright orange fish (P).

6.2.3 Crustaceans

There were about 300+ crustaceans species (crabs, shrimps, lobsters, hermit crabs, barnacles, isopods and amphipods) collected during the cruise. One new Genus was discovered and is currently being described by Professor Tin-Yam Chan of National Taiwan Ocean University. Fig. 7 B and C showed the 2 new species. According to Prof. Chan 6 new species were identified so far and more are likely to show up when MNHN researchers and Prof. Chan sort out the decapod crustacean specimens in June 2011 at Paris. Some species (Fig. 7 A) were rarely seen but others were caught in abundance (Fig. 7 L). Spider crabs were caught in association with tube worms indicating the presence of hydrothermal and cold seeps. A rare spider crab was observed (Fig. 7 M). Crustaceans living in associated with other organisms were observed (Fig. 7 P).

Commercial species included Chaceon crab (Fig.7 E and F) which is caught around the world with a high price. Puerulus, Aristeus and other shrimps (Fig. 7 G, H, I and J) were also caught and these species command medium price. Cirripedes (barnacles) were common in Basamuk/Astrolabe Bay.

(A) (B)

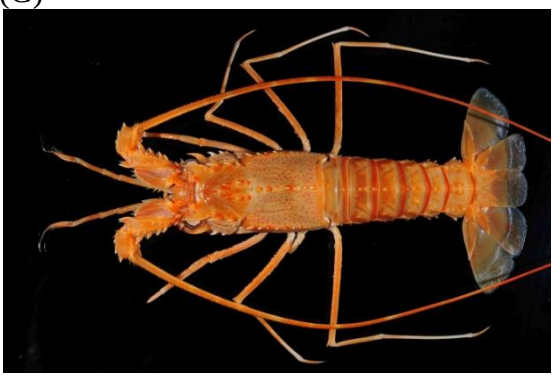
(C)

(D)

(E)

(F)

(G)



(H)

(I)

(J)

(K)

(L)

(M)

(N)

(O)

(P)

Figure 7: Shrimp A) is a rare species, and B) and C) are new species collected during the cruise. D) spider crab is associated with tube worms and is found near the hydrothermal vents. E) A Chaceon crab which is a high priced species. Other commercial shrimps (G, H, I, J and K) were also caught at various stations. L) Species caught in abundance. M) A rare spider crab. Amphipods and isopods found in debris (N). Barnacles from Basamuk/Astrolabe Bay (O) and a hermit crab with a sea anemone (P).

6.2.4 Molluscs and Brachiopods

Gastropods (shells), bivalves (mussels, scallops and oysters) and cephalopods (squid, octopus, nautilus and cuttlefish) were handled by the MNHN scientists-Dr Sarah Samadi and others. Gastropods and bivalves came in various forms and sizes. It was revealed that some specimens were never seen before and could be new species (Fig. 7 A and B). Scallops, oysters and clams were present at various stations and some species were abundant while others were rare (Fig. 8 C). The mussels that were taken 4 miles out of Sepik river were identified as hydrothermal or cold seeps chemosynthetic mussels which derived their energy from chemosynthetic microorganisms such as bacteria (Fig. 8 D and E). The shell (F) obtained at the same location could also be chemosynthetic. There were couple of squid and octopus species obtained and they were of different sizes, some as small as 10 cm long (Fig. 8 K and L) and one species (Fig. 8 M) was more than a meter long. A bathypelagic squid with webbed arms was caught (Fig. 8 N). Co-existence was observed between shells and sea urchin (refer to section on echinoderms). This mutual/parasitic relationship is a common phenomenon observed between the invertebrates living under the harsh environmental condition at deep depths.

(A) (B) (C)

(D) (E) (F)

(G) (H)

(I)

(J)

(K)

(L)

(M)

(N)

Figure 8: Many different gastropods were collected and some were new to science (A) and (B). C) A rare bivalve. The chemosynthetic mussel (D, E) and a shell were present at Sepik River samples. Shells came in different shapes (G and H) and abundance (I).J) A common mussel. A small squid (K) and octopus (L) and a one meter long squid (M). N) A squid with webbed arms.

6.2.5 Cnidarians, Ascidians and Sponges

Cnidarians (hard and soft corals, sea anemones and sea pens) and ascidians (tunicates) were handled by the USA and NMNH teams. Dr. Sarah Samadi of MNHN provided most of the data on these groups of animals and Eric Pante of University of Louisiana, USA provided the rest of the data. The sea anemones will be identified and described by Dr. Estefania Rodriguez at the American Museum of Natural History (New York City, USA).

Nephtheid soft corals (Octocorallia) (Fig. 9 A) were collected in some of the stations at 1000m deep. Other types of Cnidarians such as hydrocoral (Hydrozoa) (Fig. 9 B), orange whip, sea pen, cream, branching corals and octocorals of the family Primnoidae (Fig. 9 C) were also seen and some were common species. Other types of sea pans, sea fans, hydroids, black coral and zoanthid were observed (Fig. 9 G-K). These group of corasl were seen associated with sea stars (Fig. 9 H and K). Gorgonian or Chrysogorgiid corals (n=57) were prevalent at most stations (Fig. 9 L-P). Association with other organisms were observed; octocoral of the family Chrysogorgiidae (*Chrysogorgia sp.)* associated with a galatheid crab or squat lobster (Fig. 8 P) and an unidentified octocoral with an ohiuroid arm (Mollusc) (Fig. 9 X).

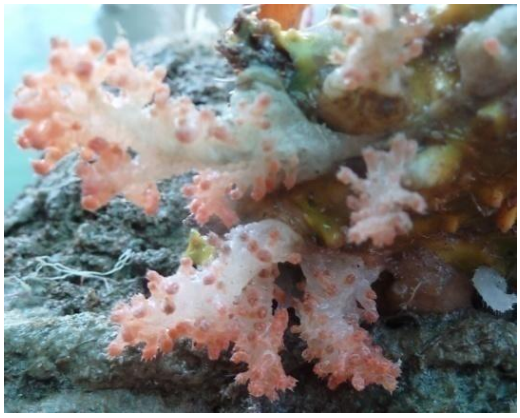
Several species of sea anemones were caught at most stations. Some sea anemones (Actinaria) were collected in abundance (Fig. 9 D). Ring sea anemones were usually observed attached on various substrates (Gig. 9 N). Others were associated with different substrates (Fig. 9 P-X). Such relationship could be parasitic or symbiotic in nature.

Several species of sponges were observed at several stations but were not common (Fig. 9 E).

Eric Pante's Box

Cnidarians (excluding the CITES-listed black corals, hard corals and hydrocorals) were collected at 70 stations (i.e. almost half of the stations surveyed), between 160 and 1390 m depth. Sea anemones, sea pens, soft corals and scleractinians were particularly prevalent, and reflected the diversity of habitats sampled. Among soft corals, the families Chrysogorgiidae, Primnoidae and Isididae (bamboo corals) were particularly well represented. Specimens from these families will be used in phylogenetic analyses currently ongoing at the University of Louisiana at Lafayette. At least one genus (of the family Isididae) was recognized onboard as new to science. Sea anemones were seen in association with numerous organisms, including different octocoral species, hermit crabs (Fig. 7P), and hexactinellid sponges. A wealth of ring sea anemones (highly-specialised sea anemones that wrap their pedal disc around the axial skeleton of gorgonians) was collected. These organisms are extremely poorly known, and the collections of BioPapua will certainly significantly contribute to their characterization. Ring sea anemones are noteworthy, because they were first characterized from the waters of Papua New Guinea (Hiles 1899). Multiple associations were observed between gorgonian corals and other organisms (Fig. 9 L-P), such as galatheid crabs, stalked crinoids, ring anemones, and egg masses. Fifty five specimens of the octocoral genus *Chrysogorgia* were sampled. This genus is currently being used as a model system to study the evolution of deep-sea corals from seamounts and island slopes, and the BioPapua specimens will soon be integrated in a large-scale biogeographic study.

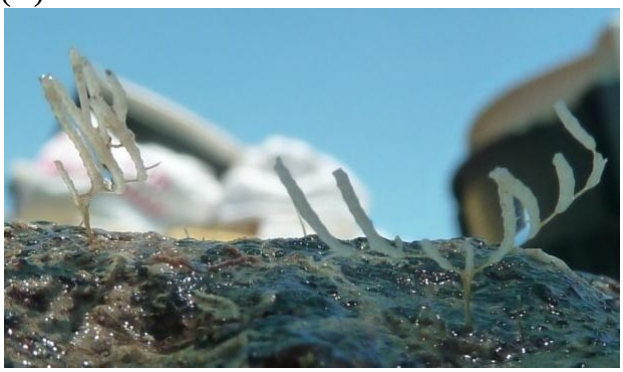
(A)



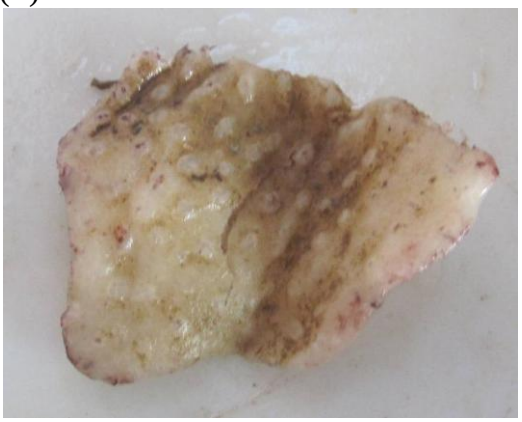
(B)

(C)

(D)



(E)



(F)

(G)

(H)

(I)


N/O Alis, Papua New Guinea
Station
OCT 2010
Genetics ID

(J)


MNHN, BioPapua Cruise

(K)


photos: EP

(L)

(M)


MNHN, BioPapua Cruise,
N/O Alis, Papua New Guine
Station CP3924 7 OCT
Genetics ID PN 6 30

(N)

(O)

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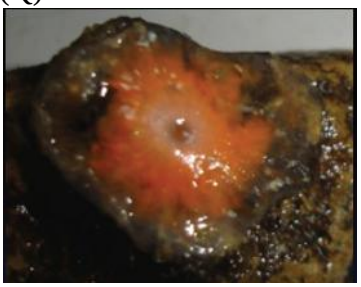
(Q)



(R)

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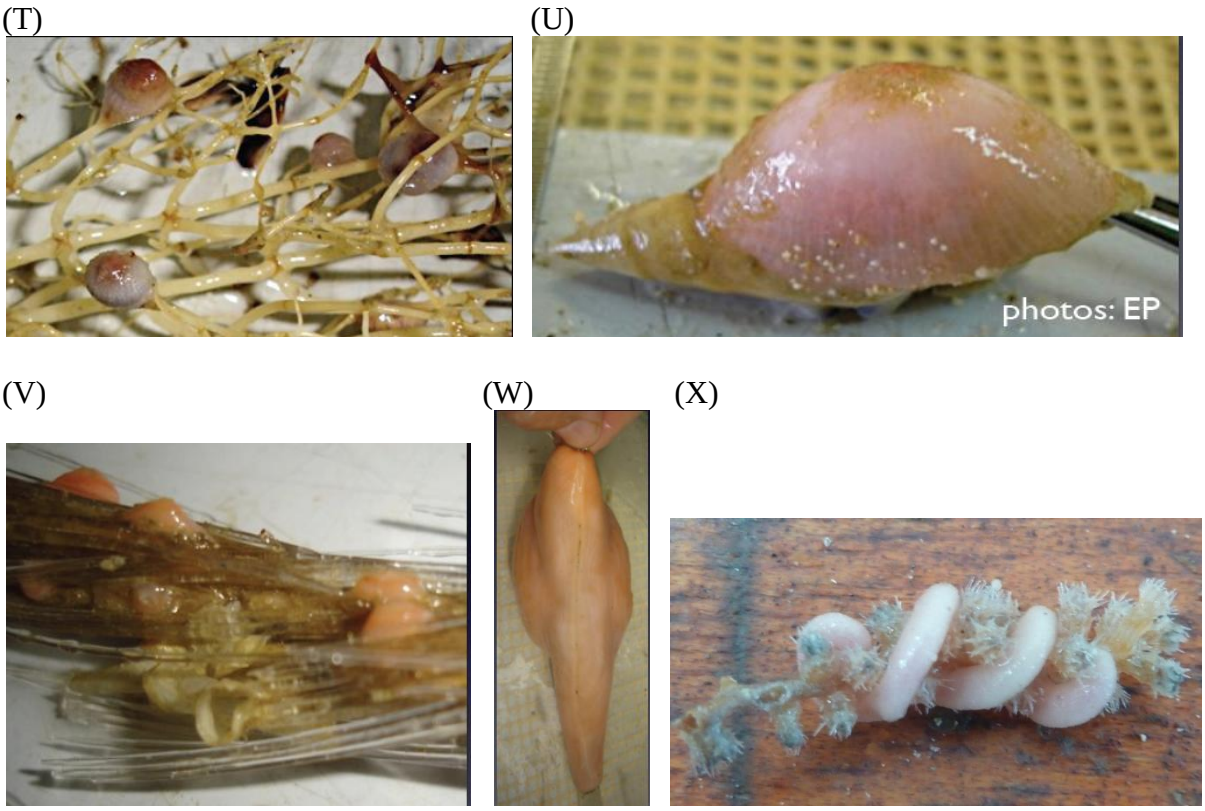

Figure 9: Nephtheid soft coral of family Octocorallia (A), hydrocoral (hydrozoa) (B), orange whip, sea pen, cream, branching coral-octocorals of the family Primnoidae (C), unknown cnidarians (D), sponge (E), Actinarian sea anemones (F), sea pans, sea fans, hydroids, black coral and zoanthid (G-K), association with sea stars (H and K), gorgonian corals (L,M and O) and association with a squat lobster (P) and mollusc ohiuroid arm (X). Ring sea anemones (N) and association with various substrates (Q-W).

6.2.6 Echinoderms

Asteroids (sea stars), Holothurians (sea cucumber), Echinoids (sea urchins and sand dollars) and Crinoids (sea lilies) were collected. Some sea stars were big (Fig. 10 A) while others (Fig.10, B and C) were about 10cm in diameter. Only a few sea stars with 10 podia (leg-like structures) were collected. Various sea star species with 5 podia were common at most stations. Sea cucumbers were regularly caught and few were comparatively large (40cm long) as in (Fig. 10 D) while others were rare (Fig. 10 E). Various species of sea urchins were seen and few of them (Fig. 10 F and G) were abundant at the Sepik River and Basamuk/Astrolabe Bay stations. Others (Fig. 10 H) were collected at only a few stations. A few types of deep-sea Crinoids (sea lilies) were observed especially at hard rocky bottom (Fig. 10 I). Sea lilies were the most primitive of the echinoderms in evolutionary sense. Association with other organism such as gastropod were observed (Fig. 10 J). This mutual/parasitic relationship between deep-sea organisms is a common phenomenon involving mostly the invertebrates that thrive at the extreme environmental conditions.

(A)

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(H)

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(J)

Figure 10: Various types of sea stars, big and small (A, B, and C). Some sea cucumbers were rare (D and E) but others were commonly caught. Sea urchins (F and G) were abundant at muddy substrates seafloor such as Sepik River and Basamuk/Astrolabe Bay stations. Various sea lilies (I) and a sea urchin associated with numerous shells (J).

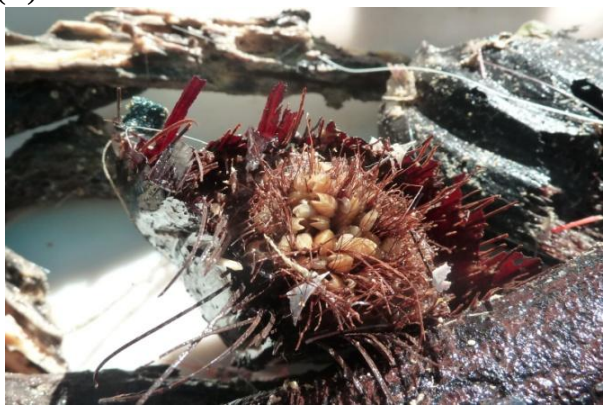
6.2.7 Wood and wood-associated animals

Wood were commonly caught with the catch at most stations. MNHN scientist (Dr. Sarah Samadi) provided biota living on sunken wood for our data. The wood-associated animals is an interesting field of research in understanding deep-sea ecosystems and evolution where the source of energy is not light-driven (photosynthesis) as in photic zone (100m deep). Instead the energy source now is thought to come from the whale fall, chemosynthesis by bacteria utilizing methane and sulphide at hydrothermal vents and cold seeps and the sunken vegetation. In chemosynthesis bacteria utilize methane and sulphide as energy source at the hydrothermal vents and cold seeps that form the basis of the food chain for the organisms that thrive in the harsh environment- complete darkness, extremely hot vent water and tremendous water pressure. Sunken wood is a rich source of stored energy and those organisms that can unlock and utilize the energy would provide a new source of energy at great depths. Such sources of energy in turn provide the basis for new ecosystems found in deep-sea environment.

Associated with sunken wood we found several groups of organisms such as chiton (Mollusc) (Fig. 11 A), molluscs (Fig. 11 B, C and D), crustaceans (Fig. 11 E and F), echinoderms (Fig. 11 G, H and I) and annelid (Fig. 11 J). Sometimes we observed more than one organism thriving on a sunken wood. The chronology of colonization of the wood would normally be sequential as for the mollusc and annelid worm (Fig. 11 I) thriving together side by side on the sunken wood.

(A)

(B)



(C)

(D)

(E)

(F)

(G)

(H)

(I) (J)

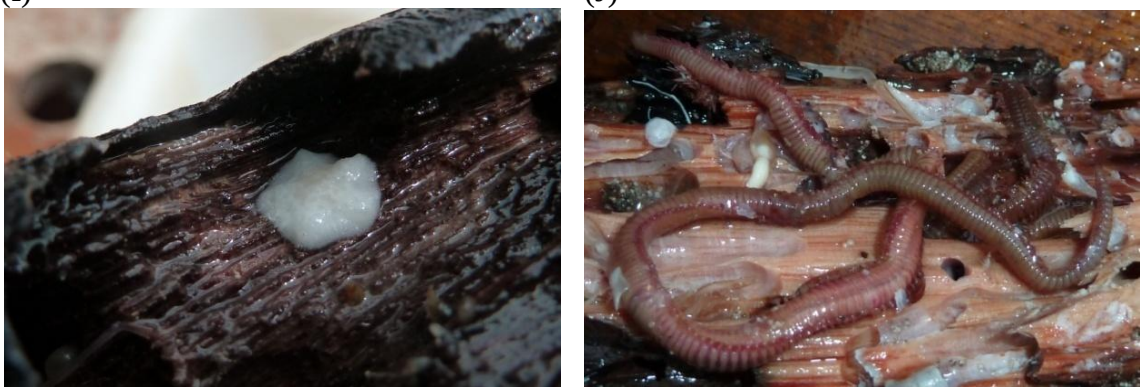


Figure 11: Organisms associated with wood were numerous. A) chiton mollusc, B)gastropod shells, C)shell, D)bivalves, E) crustacean, F)crab, G)holothuroid, H and I) asteroids, and J) annelid worms.

6.2.8 Other organisms and organisms less than 1mm

We were also confronted with strange deep-sea organisms that were very rare. The Pycnogonida sea spider species of Phylum Arthropoda (Fig. 12 A) was an example. A rare polychaete worm (Annelida) (Fig.12 B) with numerous white dorsal parapodia were observed on hard substrate. Fish with its associated organisms such as sea anemone (Fig. 12 C) and others (Fig. 12 D) were observed). The data were provided by Dr. Sarah Samadi.

The small fractions smaller than 1 mm (containing meiofaunal organisms) and residues that could not be sorted onboard with naked eye were bagged and 80% ethanol-fixed. In LEG2 Prof. Waren handled the residues.

(A) (B)

(C) (D)

Figure 12: A) sea spider. B) polychaete worm. Hosts and parasites found in deep-sea fish (C and D).

6.3 GEOMORPHOLOGICAL AND OCEANOGRAPHIC FEATURES

Mapping of the seafloor in each station area provided a rich source of data of the physical characteristics of each surveyed region. Analysis of mapping data and combining with sea-floor substrates and organisms collected at each station, we could demonstrate the presence of geomorphological features such as deep-sea canyons, ridges, hydrothermal vents and cold seeps. For example, the seafloor mapping data indicated a few major canyons and terrains at Basamuk Bay (Figure 13). Such analysis would be done in due course. Physical oceanographic features such as sea currents were observed in places like Northern Manus and Basamuk/Astrolabe Bay.

(A) (B)

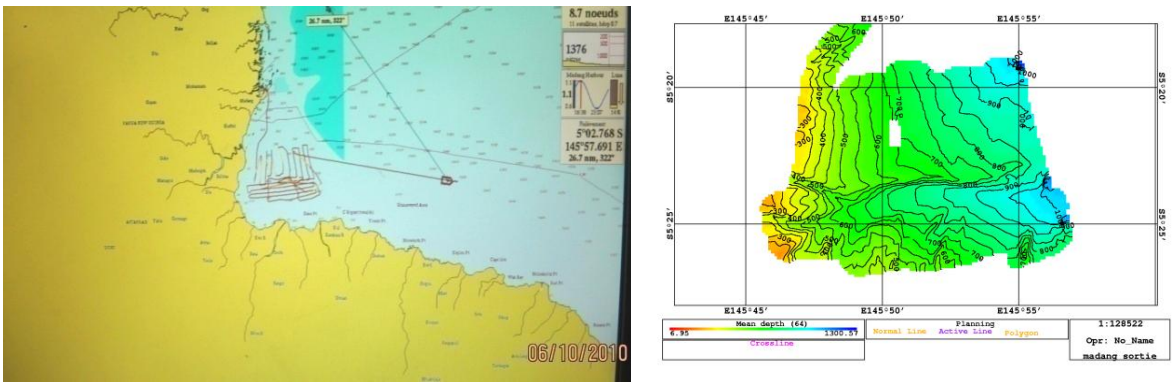


Figure 13: Map of Basamuk/Astrolabe Bay (A) and the bathymetric contour of the surveyed area (B) indicating a canyon and numerous terrains.

6.4 SUMMARY

A brief baseline results of the major Phyla of organisms collected during the BIOPAPUA cruise were mentioned and new species were indicated accordingly to illustrate for the first time the deep-sea benthic biodiversity of PNG. Wood associated organisms were demonstrated. Further analysis of the data will reveal many new aspects of the deep-sea ecosystems, and the physical and geomorphological features that support such a rich biodiversity. Seamounts and endemism data will then be available. According to the project timetable, by the end of 2011, the first detailed inventory of catches of the major groups of benthic organisms should be sorted out into Family, Genus or species level. Fish will be handled by UPNG team and Professor Kwang-Tsao Shao of Biodiversity Research Center, Academia Sinica, Taiwan (R.O.C). Crustaceans will be studied by Dr. Tin-Yam Chan and others. Other invertebrates will be sorted out by MNHN scientists and other researchers throughout the world. Most of the data and publications will be made available to Dr. Ralph Mana, Biological Sciences Division. Next year 2012 a detailed report of the BIOPAPUA deep-sea research expedition will be released. Details of the cruise is available on this website (http://en.ird.fr/all-the-current-events/live-science/biopapua-cruise.

7. ACKNOWLEDGMENTS

I would first like to thank the MNHN in Paris and the French Government for funding the BIOPAPUA cruise as part of the bigger Tropical Deep-Sea Benthos program. Special thanks are extended to the Captain of the research vessel *Alis* and the friendly and hardworking crew members. Without their seaman spirit and expertise the cruise would not have been a success. My colleagues, Dr. Sarah Samadi of MNHN provided most of the photographs on invertebrate groups and wood-associated animals while Dr. Tin-Yam Chan of National Taiwan Ocean University contributed most photographs of crustaceans for this report. Eric Pante at University of Louisiana, USA provided data and contributed to the section on cnidarians. Maps, stations and station coordinates were made available by the MNHN team. I appreciated the understanding of the Division of Biological Sciences for the logistical support that was provided and the dean of School of Natural and Physical Sciences Prof. Frank Griffin for signing the MoU between UPNG and MNHN that set forth the process of project implementation in 2009. I must also mention the support that was shown by the Department of Environment and Conservation and Jim Robins of National Research Institute. Finally but not the least without the dedication and commitment of PNG team members- Mr. Alfred Koou and Mr. Edwin Sohun, we would not have sampled over 200 species of deep-sea fish. Editing of the first draft by my overseas colleagues yielded the final report.

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Appendix 1. Details of the BioPapua cruise showing the dates of survey, depth at shooting gear, depth at hauling gear, coordinates and locality of survey.

Date	Ship	Cruise	Depth1	Depth2	F.Latitude	F.Longitude	V.Latitude	V.Longitude	Area	Locality
22/08/2010	N/O ALIS	BIOPAPUA 2010	272	266	06°55.879'S	147°01.850'E	06°53.175'S	147°00.650'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
22/08/2010	N/O ALIS	BIOPAPUA 2010	240	269	06°49.708'S	147°08.033'E	06°57.108'S	147°07.812'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
22/08/2010	N/O ALIS	BIOPAPUA 2010	305	307	06°58.245'S	147°08.380'E	06°53.692'S	147°02.721'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
22/08/2010	N/O ALIS	BIOPAPUA 2010	613	652	06°49.600'S	147°05.352'E	06°51.443'S	147°06.292'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
22/08/2010	N/O ALIS	BIOPAPUA 2010	700	740	06°58.225'S	147°07.975'E	06°55.512'S	147°08.130'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
22/08/2010	N/O ALIS	BIOPAPUA 2010	395	406	06°51.841'S	147°04.672'E	06°53.876'S	147°04.641'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	279	290	07°28.170'S	147°29.112'E	07°28.510'S	147°30.787'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	280	302	07°28.181'S	147°31.394'E	07°29.161'S	147°33.114'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	462	495	07°27.892'S	147°32.659'E	07°27.153'S	147°30.792'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	608	615	07°24.624'S	147°27.536'E	07°25.379'S	147°29.711'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	890	895	07°24.430'S	147°35.997'E	07°23.219'S	147°33.710'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
23/08/2010	N/O ALIS	BIOPAPUA 2010	900	932	07°22.582'S	147°31.797'E	07°23.107'S	147°34.554'E	PAPUA NEW GUINEA	South of Lae, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	322		06°46.630'S	147°59.782'E	06°46.022'S	148°00.369'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	380	476	06°45.655'S	147°59.824'E	06°45.165'S	148°01.364'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	245	295	06°46.288'S	147°58.101'E	06°45.834'S	147°58.755'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	400	436	06°46.907'S	147°52.149'E	06°46.812'S	147°51.313'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	360	406	06°43.985'S	147°49.405'E	06°45.515'S	147°50.176'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	418	403	06°46.394'S	147°50.605'E	06°44.469'S	147°49.693'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
24/08/2010	N/O ALIS	BIOPAPUA 2010	460	485	06°46.190'S	147°50.244'E	06°44.749'S	147°48.559'E	PAPUA NEW GUINEA	Tami Island, Gulf of Huon
25/08/2010	N/O ALIS	BIOPAPUA 2010	592	660	06°46.270'S	147°14.773'E	06°46.586'S	147°12.317'E	PAPUA NEW GUINEA	Off Lae, Gulfe of Huon
25/08/2010	N/O ALIS	BIOPAPUA 2010	682	1012	06°45.905'S	147°14.723'E	06°47.907'S	147°13.791'E	PAPUA NEW GUINEA	Off Lae, Gulfe of Huon
27/08/	N/O	BIOPAP	720	728	02°40.	150°06.	02°38.	150°04.	PAPUA	Southern New

2010	ALIS	UA 2010			119'S	135'E	684'S	367'E	NEW GUINEA	Hanover
27/08/2010	N/O ALIS	BIOPAPUA 2010	805	823	02°40.715'S	150°05.922'E	02°39.178'S	150°03.291'E	PAPUA NEW GUINEA	Southern New Hanover
27/08/2010	N/O ALIS	BIOPAPUA 2010	840	865	02°37.809'S	150°02.904'E	02°41.027'S	150°03.229'E	PAPUA NEW GUINEA	Southern New Hanover
27/08/2010	N/O ALIS	BIOPAPUA 2010	1019	1390	02°42.962'S	150°03.370'E	02°44.283'S	149°59.980'E	PAPUA NEW GUINEA	Southern New Hanover
28/08/2010	N/O ALIS	BIOPAPUA 2010	700	680	02°12.200'S	150°22.500'E	02°12.700'S	150°23.400'E	PAPUA NEW GUINEA	Western New Hanover
28/08/2010	N/O ALIS	BIOPAPUA 2010	490	505	02°14.700'S	150°18.321'E	02°14.040'S	150°15.613'E	PAPUA NEW GUINEA	Western New Hanover
28/08/2010	N/O ALIS	BIOPAPUA 2010	440	402	02°15.271'S	150°13.842'E	02°15.073'S	150°15.555'E	PAPUA NEW GUINEA	Western New Hanover
22/09/2010	N/O ALIS	BIOPAPUA 2010	266	276	04°19.480'S	152°17.980'E	04°19.460'S	152°18.980'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	350	370	04°18.540'S	152°21.950'E	04°18.370'S	152°20.100'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	400	412	04°17.380'S	152°18.870'E	04°17.410'S	152°20.760'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	508	508	04°16.200'S	152°18.050'E	04°14.150'S	152°16.700'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	680	720	04°10.730'S	152°15.490'E	04°09.180'S	152°16.200'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	750	790	04°08.570'S	152°16.590'E	04°07.050'S	152°17.080'E	PAPUA NEW GUINEA	Off Rabaul
22/09/2010	N/O ALIS	BIOPAPUA 2010	840	1020	04°06.080'S	152°16.550'E	04°04.540'S	152°16.350'E	PAPUA NEW GUINEA	Off Rabaul
23/09/2010	N/O ALIS	BIOPAPUA 2010	220	292	04°49.860'S	151°39.380'E	04°49.690'S	151°38.710'E	PAPUA NEW GUINEA	Open Bay
23/09/2010	N/O ALIS	BIOPAPUA 2010	195	340	04°50.140'S	151°39.780'E	04°49.860'S	151°38.470'E	PAPUA NEW GUINEA	Open Bay
23/09/2010	N/O ALIS	BIOPAPUA 2010	225	340	04°50.100'S	151°39.450'E	04°49.690'S	151°38.230'E	PAPUA NEW GUINEA	Open Bay
23/09/2010	N/O ALIS	BIOPAPUA 2010	760	866	04°40.770'S	151°34.460'E	04°40.050'S	151°33.450'E	PAPUA NEW GUINEA	Open Bay
23/09/2010	N/O ALIS	BIOPAPUA 2010	670	921	04°42.170'S	151°34.730'E	04°39.810'S	151°33.560'E	PAPUA NEW GUINEA	Open Bay
24/09/2010	N/O ALIS	BIOPAPUA 2010	411	383	04°07.400'S	151°55.767'E	04°07.510'S	151°57.530'E	PAPUA NEW GUINEA	Northern Rabaul
24/09/2010	N/O ALIS	BIOPAPUA 2010	382	389	04°07.470'S	151°57.680'E	04°07.610'S	151°55.900'E	PAPUA NEW GUINEA	Northern Rabaul
24/09/2010	N/O ALIS	BIOPAPUA 2010	497	500	04°06.700'S	151°54.120'E	04°06.060'S	151°55.680'E	PAPUA NEW GUINEA	Northern Rabaul
24/09/2010	N/O ALIS	BIOPAPUA 2010	585	601	04°04.340'S	151°57.640'E	04°04.400'S	151°55.760'E	PAPUA NEW GUINEA	Northern Rabaul
24/09/2010	N/O ALIS	BIOPAPUA 2010	702	724	04°03.990'S	151°51.670'E	04°03.800'S	151°49.580'E	PAPUA NEW GUINEA	Northern Rabaul
24/09/2010	N/O ALIS	BIOPAPUA 2010	885	1050	04°01.330'S	151°48.960'E	03°59.850'S	151°50.880'E	PAPUA NEW GUINEA	Northern Rabaul

24/09/2010	N/O ALIS	BIOPAPUA 2010	805	788	04°02.660'S	151°47.560'E	04°02.460'S	151°50.150'E	PAPUA NEW GUINEA	Northern Rabaul
25/09/2010	N/O ALIS	BIOPAPUA 2010	665	700	05°20.920'S	150°46.150'E	05°20.500'S	150°44.750'E	PAPUA NEW GUINEA	Kimbe bay
25/09/2010	N/O ALIS	BIOPAPUA 2010	720	704	05°20.130'S	150°43.850'E	05°20.700'S	150°45.550'E	PAPUA NEW GUINEA	Kimbe bay
25/09/2010	N/O ALIS	BIOPAPUA 2010	760	800	05°20.000'S	150°45.980'E	05°19.600'S	150°43.780'E	PAPUA NEW GUINEA	Kimbe bay
25/09/2010	N/O ALIS	BIOPAPUA 2010	535	604	05°22.190'S	150°46.010'E	05°21.480'S	150°45.040'E	PAPUA NEW GUINEA	Kimbe bay
25/09/2010	N/O ALIS	BIOPAPUA 2010	490	715	05°22.400'S	150°45.090'E	05°20.590'S	150°45.390'E	PAPUA NEW GUINEA	Kimbe bay
27/09/2010	N/O ALIS	BIOPAPUA 2010	647	615	04°37.104'S	149°29.170'E	04°37.410'S	149°27.470'E	PAPUA NEW GUINEA	Vitu Islands
27/09/2010	N/O ALIS	BIOPAPUA 2010	564	712	04°37.490'S	149°27.410'E	04°37.500'S	149°27.450'E	PAPUA NEW GUINEA	Vitu Islands
27/09/2010	N/O ALIS	BIOPAPUA 2010	515	812	04°37.820'S	149°27.940'E			PAPUA NEW GUINEA	Vitu Islands
27/09/2010	N/O ALIS	BIOPAPUA 2010	291		04°38.550'S	149°27.670'E	04°37.160'S	149°27.940'E	PAPUA NEW GUINEA	Vitu Islands
28/09/2010	N/O ALIS	BIOPAPUA 2010	550	600	03°14.700'S	147°20.200'E	03°14.195'S	147°20.611'E	PAPUA NEW GUINEA	Seamounts, Southern Manus island
28/09/2010	N/O ALIS	BIOPAPUA 2010	946	1006	03°14.470'S	147°19.310'E	03°15.640'S	147°18.590'E	PAPUA NEW GUINEA	Seamounts, Southern Manus island
28/09/2010	N/O ALIS	BIOPAPUA 2010	964	1025	03°14.220'S	147°19.500'E	03°15.950'S	147°18.340'E	PAPUA NEW GUINEA	Seamounts, Southern Manus island
28/09/2010	N/O ALIS	BIOPAPUA 2010	305	579	03°02.740'S	147°31.520'E	03°03.830'S	147°31.900'E	PAPUA NEW GUINEA	Seamounts, Southern Manus island
28/09/2010	N/O ALIS	BIOPAPUA 2010	402	640	03°02.770'S	147°31.840'E	03°03.750'S	147°32.440'E	PAPUA NEW GUINEA	Seamounts, Southern Manus island
29/09/2010	N/O ALIS	BIOPAPUA 2010	685	679	02°14.127'S	147°25.045'E	02°15.863'S	147°29.145'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	618	611	02°12.760'S	147°18.570'E	02°13.880'S	147°16.470'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	499	517	02°11.710'S	147°16.500'E	02°11.000'S	147°18.380'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	408	448	02°08.795'S	147°19.505'E	02°09.673'S	147°18.797'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	300	300	02°10.870'S	147°15.430'E	02°10.170'S	147°16.820'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	200	219	02°10.490'S	147°15.360'E	02°09.950'S	147°16.240'E	PAPUA NEW GUINEA	Manus Island
29/09/2010	N/O ALIS	BIOPAPUA 2010	198		02°10.450'S	147°15.380'E			PAPUA NEW GUINEA	Manus Island
30/09/2010	N/O ALIS	BIOPAPUA 2010	326	355	01°54.660'S	147°10.800'E	01°54.499'S	147°11.792'E	PAPUA NEW GUINEA	Manus Island
30/09/2010	N/O ALIS	BIOPAPUA 2010	368		01°54.300'S	147°12.120'E			PAPUA NEW GUINEA	Manus Island
30/09/2010	N/O ALIS	BIOPAPUA 2010	214		01°55.470'S	147°10.120'E			PAPUA NEW	Manus Island

									GUINEA	
30/09/2010	N/O ALIS	BIOPAPUA 2010	252		01°54.960'S	147°07.310'E			PAPUA NEW GUINEA	Manus Island
01/10/2010	N/O ALIS	BIOPAPUA 2010	215	213	03°55.423'S	144°39.466'E	03°56.134'S	144°40.370'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	198	219	03°55.840'S	144°39.750'E	03°56.760'S	144°40.710'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	80	91	03°55.960'S	144°38.670'E	03°56.900'S	144°39.660'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	361	750	03°54.370'S	144°39.110'E	03°52.540'S	144°40.700'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	400	656	03°50.030'S	144°36.960'E	03°49.250'S	144°39.090'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	280	550	03°49.090'S	144°35.390'E	03°47.750'S	144°35.900'E	PAPUA NEW GUINEA	Off Sepik River
01/10/2010	N/O ALIS	BIOPAPUA 2010	720	729	03°47.500'S	144°38.060'E	03°47.980'S	144°38.690'E	PAPUA NEW GUINEA	Off Sepik River
02/10/2010	N/O ALIS	BIOPAPUA 2010	460	466	05°00.426'S	145°49.742'E	04°58.872'S	145°49.516'E	PAPUA NEW GUINEA	Off Madang
02/10/2010	N/O ALIS	BIOPAPUA 2010	529	502	05°01.270'S	145°50.210'E	04°58.440'S	145°49.760'E	PAPUA NEW GUINEA	Off Madang
02/10/2010	N/O ALIS	BIOPAPUA 2010	675	640	05°01.110'S	145°51.450'E	04°58.130'S	145°51.580'E	PAPUA NEW GUINEA	Off Madang
05/10/2010	N/O ALIS	BIOPAPUA 2010	372	384	05°23.290'S	145°47.250'E	05°21.610'S	145°47.720'E	PAPUA NEW GUINEA	Astrolabe Bay
05/10/2010	N/O ALIS	BIOPAPUA 2010	434	447	05°20.920'S	145°48.220'E	05°23.030'S	145°48.060'E	PAPUA NEW GUINEA	Astrolabe Bay
05/10/2010	N/O ALIS	BIOPAPUA 2010	551	550	05°20.310'S	145°49.000'E	05°22.330'S	145°49.140'E	PAPUA NEW GUINEA	Astrolabe Bay
05/10/2010	N/O ALIS	BIOPAPUA 2010	610	608	05°20.130'S	145°49.680'E	05°22.480'S	145°50.040'E	PAPUA NEW GUINEA	Astrolabe Bay
05/10/2010	N/O ALIS	BIOPAPUA 2010	676	720	05°22.560'S	145°51.290'E	05°20.370'S	145°50.920'E	PAPUA NEW GUINEA	Astrolabe Bay
06/10/2010	N/O ALIS	BIOPAPUA 2010	628	780	05°24.655'S	145°48.612'E	05°24.050'S	145°51.070'E	PAPUA NEW GUINEA	Astrolabe Bay
06/10/2010	N/O ALIS	BIOPAPUA 2010	760/825	875	05°24.000'S	145°50.550'E	05°23.920'S	145°53.200'E	PAPUA NEW GUINEA	Astrolabe Bay
06/10/2010	N/O ALIS	BIOPAPUA 2010	850	945	05°24.420'S	145°53.190'E	05°26.540'S	145°55.780'E	PAPUA NEW GUINEA	Astrolabe Bay
06/10/2010	N/O ALIS	BIOPAPUA 2010	851	865	05°22.530'S	145°55.550'E	05°20.850'S	145°53.710'E	PAPUA NEW GUINEA	Astrolabe Bay
07/10/2010	N/O ALIS	BIOPAPUA 2010	410		06°04.570'S	147°37.141'E	06°03.341'S	147°36.087'E	PAPUA NEW GUINEA	Vitiaz strait
07/10/2010	N/O ALIS	BIOPAPUA 2010	520	523	06°02.920'S	147°35.730'E	06°02.520'S	147°35.190'E	PAPUA NEW GUINEA	Vitiaz strait
07/10/2010	N/O ALIS	BIOPAPUA 2010	554	542	06°02.090'S	147°34.930'E	06°03.230'S	147°36.590'E	PAPUA NEW GUINEA	Vitiaz strait
07/10/2010	N/O ALIS	BIOPAPUA 2010	608	625	06°02.850'S	147°37.180'E	06°01.430'S	147°35.170'E	PAPUA NEW GUINEA	Vitiaz strait

07/10/2010	N/O ALIS	BIOPAPUA 2010	701	700	06°02.030'S	147°37.490'E	05°59.860'S	147°35.750'E	PAPUA NEW GUINEA	Vitiaz strait
07/10/2010	N/O ALIS	BIOPAPUA 2010	880	860	05°57.190'S	147°37.440'E	05°58.610'S	147°38.580'E	PAPUA NEW GUINEA	Vitiaz strait
08/10/2010	N/O ALIS	BIOPAPUA 2010	410	444	07°53.385'S	148°00.926'E	07°53.075'S	148°00.056'E	PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	460		07°52.950'S	147°59.785'E			PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	459	476	07°53.010'S	148°00.770'E	07°53.320'S	148°02.400'E	PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	498	501	07°53.200'S	148°02.510'E	07°52.500'S	148°00.620'E	PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	575	655	07°51.410'S	148°00.270'E	07°51.820'S	148°02.730'E	PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	750	710	07°51.430'S	148°03.580'E	07°50.630'S	148°01.300'E	PAPUA NEW GUINEA	Off Mambare bay
08/10/2010	N/O ALIS	BIOPAPUA 2010	895	1150	07°49.810'S	148°01.250'E	07°49.600'S	148°03.770'E	PAPUA NEW GUINEA	Off Mambare bay
09/10/2010	N/O ALIS	BIOPAPUA 2010	340	358	08°16.160'S	150°31.200'E	08°16.390'S	150°29.460'E	PAPUA NEW GUINEA	Off Lancasay reefs
09/10/2010	N/O ALIS	BIOPAPUA 2010	353		08°16.400'S	150°29.940'E			PAPUA NEW GUINEA	Off Lancasay reefs
09/10/2010	N/O ALIS	BIOPAPUA 2010	389		08°15.780'S	150°29.580'E			PAPUA NEW GUINEA	Off Lancasay reefs
09/10/2010	N/O ALIS	BIOPAPUA 2010	450	500	08°15.640'S	150°32.840'E	08°15.160'S	150°34.050'E	PAPUA NEW GUINEA	Off Lancasay reefs
09/10/2010	N/O ALIS	BIOPAPUA 2010	760	769	08°14.670'S	150°34.700'E	08°13.960'S	150°32.180'E	PAPUA NEW GUINEA	Off Lancasay reefs
09/10/2010	N/O ALIS	BIOPAPUA 2010	587	.	08°14.790'S	150°44.840'E			PAPUA NEW GUINEA	Off Lancasay reefs
10/10/2010	N/O ALIS	BIOPAPUA 2010	473	491	09°05.586'S	152°13.842'E	09°06.649'S	152°14.146'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	503	546	09°07.440'S	152°14.080'E	09°09.250'S	152°14.740'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	556	645	09°09.820'S	152°15.100'E	09°11.930'S	152°16.140'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	694	766	09°12.690'S	152°16.530'E	09°14.410'S	152°17.740'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	448	470	09°06.190'S	152°18.610'E	09°08.020'S	152°18.810'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	540	585	09°09.490'S	152°17.620'E	09°10.850'S	152°15.590'E	PAPUA NEW GUINEA	Off Woodlark Islands
10/10/2010	N/O ALIS	BIOPAPUA 2010	776	856	09°14.310'S	152°16.010'E	09°17.010'S	152°17.200'E	PAPUA NEW GUINEA	Off Woodlark Islands
12/10/2010	N/O ALIS	BIOPAPUA 2010	369	377	05°32.555'S	154°00.859'E	05°32.960'S	154°00.311'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
12/10/2010	N/O ALIS	BIOPAPUA 2010	455	524	05°33.760'S	154°01.180'E	05°33.670'S	153°59.830'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
12/10/2010	N/O ALIS	BIOPAPUA 2010	458		05°33.210'S	153°59.300'E			PAPUA NEW	Seamounts, off Bougainville

									GUINEA	
12/10/2010	N/O ALIS	BIOPAPUA 2010	398	399	05°34.560'S	154°00.510'E	05°36.630'S	154°00.680'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
12/10/2010	N/O ALIS	BIOPAPUA 2010	620	663	05°37.130'S	154°00.080'E	05°39.190'S	153°58.900'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
12/10/2010	N/O ALIS	BIOPAPUA 2010	660	654	05°41.240'S	154°00.100'E	05°39.460'S	153°59.160'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
12/10/2010	N/O ALIS	BIOPAPUA 2010	768	735	05°35.070'S	154°03.210'E	05°37.290'S	154°03.590'E	PAPUA NEW GUINEA	Seamounts, off Bougainville
13/10/2010	N/O ALIS	BIOPAPUA 2010	412		05°04.280'S	154°30.870'E			PAPUA NEW GUINEA	Off Bougainville
13/10/2010	N/O ALIS	BIOPAPUA 2010	608		05°04.600'S	154°29.310'E			PAPUA NEW GUINEA	Off Bougainville
13/10/2010	N/O ALIS	BIOPAPUA 2010	632	615	05°03.800'S	154°29.130'E	05°02.200'S	154°29.360'E	PAPUA NEW GUINEA	Off Bougainville
13/10/2010	N/O ALIS	BIOPAPUA 2010	662		05°03.530'S	154°28.990'E			PAPUA NEW GUINEA	Off Bougainville
13/10/2010	N/O ALIS	BIOPAPUA 2010	750		04°59.400'S	154°28.360'E			PAPUA NEW GUINEA	Off Bougainville
14/10/2010	N/O ALIS	BIOPAPUA 2010	214		04°01.096'S	153°36.376'E			PAPUA NEW GUINEA	Off Feni Islands
14/10/2010	N/O ALIS	BIOPAPUA 2010	278	298	04°00.990'S	153°35.780'E	04°00.190'S	153°36.360'E	PAPUA NEW GUINEA	Off Feni Islands
14/10/2010	N/O ALIS	BIOPAPUA 2010	287	352	03°59.690'S	153°37.070'E	04°00.400'S	153°35.530'E	PAPUA NEW GUINEA	Off Feni Islands
14/10/2010	N/O ALIS	BIOPAPUA 2010	613	660	03°59.040'S	153°44.480'E	03°57.560'S	153°42.760'E	PAPUA NEW GUINEA	Off Feni Islands
14/10/2010	N/O ALIS	BIOPAPUA 2010	760	823	03°57.350'S	153°43.520'E	03°58.570'S	153°45.760'E	PAPUA NEW GUINEA	Off Feni Islands
14/10/2010	N/O ALIS	BIOPAPUA 2010	995	1050	03°57.260'S	153°48.610'E			PAPUA NEW GUINEA	Off Feni Islands
15/10/2010	N/O ALIS	BIOPAPUA 2010	160	170	04°40.434'S	153°02.688'E	04°39.534'S	153°02.952'E	PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	220		04°39.090'S	153°03.090'E			PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	470	620	04°36.510'S	153°04.500'E			PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	400	406	04°41.760'S	153°04.250'E	04°43.920'S	153°04.220'E	PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	340		04°52.470'S	152°55.580'E			PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	360	325	04°46.230'S	152°47.700'E	04°47.740'S	152°48.540'E	PAPUA NEW GUINEA	Off New Ireland
15/10/2010	N/O ALIS	BIOPAPUA 2010	300		04°48.420'S	152°48.920'E			PAPUA NEW GUINEA	Off New Ireland
16/10/2010	N/O ALIS	BIOPAPUA 2010	220	294	05°32.900'S	151°31.300'E	05°33.600'S	151°31.800'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
16/10/2010	N/O ALIS	BIOPAPUA 2010	295	422	05°33.470'S	151°31.880'E	05°34.260'S	151°32.960'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)

16/10/2010	N/O ALIS	BIOPAPUA 2010	402		05°33.860'S	151°32.930'E			PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
16/10/2010	N/O ALIS	BIOPAPUA 2010	465	639	05°34.070'S	151°33.640'E	05°34.790'S	151°35.070'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
16/10/2010	N/O ALIS	BIOPAPUA 2010	470	680	05°34.090'S	151°33.670'E	05°35.110'S	151°35.210'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
16/10/2010	N/O ALIS	BIOPAPUA 2010	640	849	05°34.880'S	151°34.980'E	05°35.540'S	151°36.250'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
16/10/2010	N/O ALIS	BIOPAPUA 2010	386	700	05°32.050'S	151°40.180'E	05°33.360'S	151°40.170'E	PAPUA NEW GUINEA	Jacquinot Bay (New Britain)
17/10/2010	N/O ALIS	BIOPAPUA 2010	400	619	05°00.210'S	151°59.100'E	05°01.370'S	152°00.350'E	PAPUA NEW GUINEA	Wide Bay (New Britain)
17/10/2010	N/O ALIS	BIOPAPUA 2010	563	836	05°01.068'S	152°00.127'E	05°02.939'S	152°01.235'E	PAPUA NEW GUINEA	Wide Bay (New Britain)
17/10/2010	N/O ALIS	BIOPAPUA 2010	752	998	05°02.330'S	152°00.897'E	05°04.143'S	152°02.066'E	PAPUA NEW GUINEA	Wide Bay (New Britain)
17/10/2010	N/O ALIS	BIOPAPUA 2010	782	1085	05°02.575'S	152°01.009'E	05°04.540'S	152°02.470'E	PAPUA NEW GUINEA	Wide Bay (New Britain)
17/10/2010	N/O ALIS	BIOPAPUA 2010	390		05°04.120'S	152°00.600'E	05°00.000'S	152°00.000'E	PAPUA NEW GUINEA	Wide Bay (New Britain)
18/10/2010	N/O ALIS	BIOPAPUA 2010	600	600	04°16.210'S	152°39.912'E	04°15.180'S	152°39.971'E	PAPUA NEW GUINEA	Off Rabaul
18/10/2010	N/O ALIS	BIOPAPUA 2010	854	1020	04°15.340'S	152°39.220'E	04°18.290'S	152°39.440'E	PAPUA NEW GUINEA	Off Rabaul