BISMARCK 2008

PELAGIC

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2008 Campaign proposal

SUMMARY SHEET N°1	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

Date file prepared: JANVIER 2007

Year requested : 2008
Length of work (not including port-work zone transits) : 20 days **Period** *(if necessary) :* Just after Bismarck 2008 - Benthic, April-July 2008 **Zone :** Bismarck Sea, Papua New Guinea **Country whose territorial waters are involved:** Papua New Guinea **Country whose economic zone is involved:** Papua New Guinea

	Main mission leader	**Other mission leader**
Surname First name:	RICHER DE FORGES Bertrand	ALLAIN Valérie[1]
Agency :	Institut de Recherche pour le Développement (French Institute of Research for Development -IRD)	Secretariat of the Pacific Community (SPC)[2]
Laboratory:	P6 IRD MNHM CNRS, UR148/UMR7138, Systématique, Adaptation et Evolution	Oceanic Fisheries Programme / Tuna Ecology and Biology
Address :	BP A5 98848 Noumea Cedex, New Caledonia	BP D5 98848 Noumea Cedex, New Caledonia
Tel.:	+ 687 26 07 34	+ 687 26 20 00
Fax :	+687 26 43 26	+687 26 38 18
E-mail :	richer@noumea.ird.nc	valeriea@spc.int

Work : Bathymetry, biology (OPM, zooplankton, micronekton and acoustic measurements) and physical oceanography (temperature, conductivity, fluorescence, oxygen and current measurements). **Ships wanted in order of preference:** R/V Alis **Submarine :** no **Heavy equipment:** IKMT micronekton pelagic trawl, WP2 triple pelagic trawl, EK60 depth sounder, TAPs acoustic profiler, multibeam mapper, ADCP, XBT, LADCP, thermosalinograph. **Will an expedition be needed to recover the equipment?** no	**On-board scientific and technical teams** Oceanic Fisheries Programme / Secretariat of the Pacific Community (SPC) – Noumea : 2 IRD / LEGOS / UR065 – Noumea : 1 IRD / ACAPPELLA / US004 – Brest : 1 IRD / US025 – Noumea : 1 National Fisheries Agency – Papua New Guinea: 1 **On-shore scientific and technical teams** Robert Leborgne and intern, IRD/CAMELIA/UR103 Noumea Oceanic Fisheries team, SPC IRD/LEGOS/UR065 team Noumea IRD/US025 team IRD/ACAPPELLA/US004 team

Campaign theme

Ecosystem of the seamounts in the Bismarck Sea : understanding the interactions between seamounts and the pelagic ecosystem through study of the pelagic fauna and oceanographic parameters

[1] Christophe Maes, IRD Noumea LEGOS, and Erwan Josse, IRD Brest ACAPPELLA will be responsible, respectively, for the physical oceanography and acoustics sections of this campaign.

[2] SPC Secretariat of the Pacific Community : for information about this organisation, please see the footnote no. 4 (page 4).

ABSTRACT	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

ABSTRACT

The BISMARCK2008-PELAGIQUE (BP2008) cruise is one of two complementary campaigns (BB2008 and BP2008) in the Bismarck Sea (Papua New Guinea) that have two objectives: to study the relationships between tuna aggregations and seamounts in order to sustainably manage this important resource and to determine benthic fauna biodiversity on the seamounts so as to preserve these exceptional ecosystems. The benthic section (BB2008) involves mapping the seamounts and describing their benthic fauna. The pelagic part (BP2008) consists of describing the zone's physical oceanography and the seamounts' specific characteristics through temperature, salinity and courant profiles and describing the pelagic fauna (POM, zooplankton, micronekton) through acoustic measurements, biomass and movement estimates, a fauna description and a description of the trophic structures using stable isotopes. In addition, a longline fishing campaign will make it possible to estimate tuna catches, their size structure, movements and trophic position. The goal is to gain a better understanding of the impact seamounts have on the ecosystem, particularly on tuna. This campaign is a joint scientific and financial effort of the IRD and the Secretariat of the Pacific Community (SPC). The expedition on the Alis will last 20 days from its departure from Madang after the BB2008 cruise to its arrival in Rabaul. The scientific team comprises two SPC scientists, three IRD scientists and a PNG observer from the National Fisheries Agency.

DOCUMENT N° 1	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

SCIENTIFIC, TECHNOLOGICAL OR TECHNICAL PROJECT

BISMARCK 2008

Pelagic Ecosystems and Benthic Biodiversity of the Seamounts in the Bismarck Sea.
Ecosystèmes pélagiques et biodiversité benthique des monts sous-marins de la Mer de Bismarck.

BISMARCK 2008 objectives

The scientific objective of this series of campaigns is to better understand the role of seamounts in both benthic and pelagic ecosystems.

Bismarck 2008 is structured around two overall objectives, i.e. conservation, through an inventory of benthic fauna biodiversity, and sustainable management of the exploitable resources and oceanic tuna fisheries linked to seamounts.

In order to fulfil these objectives, several areas will have to be explored to both describe the seamounts and study the benthic and pelagic fauna populations by highlighting pertinent parameters that make it possible to explain the seamounts' role in the ecosystem. For those reasons, the study will cover :
- the seamounts' physical characteristics (bathymetry and oceanography),
- the biodiversity of the seamounts' benthic fauna,
- a study of the pelagic ecosystem, in particular micronekton (DSL[3]) that serves as food for tuna.

The selected study zone is the Bismarck Sea in Papua New Guinea. This region has several seamounts that have not been studied. It is at the heart of the important western and central Pacific tuna fishery. And finally, a benthic biodiversity study of this zone will make it possible to complete the series of MUSORTOM and related campaigns, thereby ensuring geographic continuity of bathyal fauna samples from Taiwan to the Tonga Islands. In addition, the work proposed in this zone complements a series of tuna tagging campaigns by the SPC[4] in 2006 and 2007 (cf. paragraph PNG tagging campaigns 06-01 and 07-01 page 12).
The Bismarck Sea is logistically interesting due as it has several ports that can handle large-size ships and provide all the necessary supplies, i.e. Kavieng and Rabaul in the eastern part, Wewak and Madang in the western part and Lae in the southwest.

In order to carry out a comprehensive sampling program on the bathymetric, oceanographic, benthic and pelagic aspects, it has become clear that, for logistical reasons (different equipment and scientists), we need to conduct two consecutive campaigns. One will be devoted to studying bathymetry/cartography and benthic biodiversity (Bismarck 2008-Benthic), and the other to studying oceanographic characteristics and the pelagic ecosystem (Bismarck 2008-Pelagic). Given the long transit time required to reach the study area (estimated 9 days from Noumea), carrying out two consecutive campaigns will make it possible to optimise the ship's time once it is in the zone. It should be noted that a study of large oceanic predators (tuna, marlin, sharks, etc.) will be carried out at the same time as the Bismarck campaigns using a longliner chartered by SPC. This solution was chosen so as not to overload the schedules of the Bismarck campaigns, which are already very ambitious in terms of sampling, and because commercial fishing boats generally have better yields in terms of large pelagic fish catches.

This series of campaigns will make it possible to strengthen existing ties between the Secretariat of the Pacific Community[4, page 9] and the French Institute of Research for Development (IRD), two agencies that work to provide scientific and technical support to developing countries in the Pacific and which have signed a Memorandum of Understanding. So, in addition to providing scientific knowledge important for conserving and sustainably managing Papua New Guinea's resources, the project will provide an opportunity to train PNG staff in scientific sampling techniques. One or two PNG staff will be joining the scientific teams to participate in each of the campaigns.

[3] Deep Scattering Layer : schools of small marine organisms (fish, molluscs, crustaceans, etc.) involved in nychthemeral vertical migrations (at the surface at night, in the deep sea during the day) visible on echo-sounders.
[4] SPC : Secretariat of the Pacific Community (http://www.spc.int/). SPC Headquarters are located in Noumea, New Caledonia next to the IRD site. SPC also has offices in Fiji and in the Federated States of Micronesia, with a total of 344 staff, 191 of whom work in Noumea. The SPC is a bilingual (French/English) international organisation (26 member countries) that delivers priority programmes to its 22 Pacific island member countries and territories in Melanesia, Polynesia and Micronesia. It provides technical assistance, professional and scientific support and advice on planning, management and skills transfer in the areas of agriculture, forestry, coastal and oceanic fisheries, maritime affairs, community education, culture, women's and youth development, demography and statistics, information technology and communications, media and public health.

BISMARK 2008 – PELAGIC: objectives and background

Theories and objectives

Certain seamounts are well known by fishers as places where pelagic fish congregate, thereby leading to high catches (Fonteneau, 1991). In the Pacific, examples of this can be found in Australia (Britannia Seamount) (Campbell & Hobday, 2003), Hawaii (Cross Seamount – Emperor Seamount) (Beverly *et al.*, 2004; Yasui, 1986), and Tonga (Capricorn Seamount), in particular. The reason fish aggregate around seamounts is still open to debate and several theories have been advanced to explain this phenomenon:

- A high primary production brought about by the specific oceanographic conditions (currents, nutrients, etc.) around seamounts may allow development of a rich food chain that attracts pelagic fish (Boehlert & Genin, 1987). This theory implies that nutrients at the surface remain there long enough for plankton, and then an entire food chain, to develop around the mount.
- It may be that the micronekton (DSL[3, page5]) involved in nychthemeral vertical migrations get trapped at seamounts since the existence of the mounts may disturb this migration. An accumulation of micronekton could attract large pelagic fish.
- The seamounts' non-food related role should not be overlooked in explaining the aggregation of large pelagic fish around mounts, which may serve as spawning areas or nurseries for certain species.
- The theory of a "meeting place" has also been advanced, i.e. that in a uniform oceanic environment, fish have a tendency to gather around landmarks, in this case seamounts, in particular so that they can form larger schools to provide better protection against predators (Fréon & Dagorn, 2000a).

The purpose of this campaign is, then, to better understand and explain the influence seamounts have on the pelagic environment, fish aggregation and fisheries linked to this ecosystem, in particular tuna fisheries.

In order to fulfil this objective, several areas will have to be explored during the Bismarck 2008-Pelagic campaign in order to both describe the seamounts' specific environments, particularly oceanographic factors that play a major role, and study pelagic populations by concentrating on pertinent parameters that will help explain the link between tuna and seamounts. For those reasons, the study will cover:

- the physical characteristics of the water masses entering the Bismarck Sea and a study on the disturbances seamounts cause them, in particular, by measuring the currents, salinity and temperatures along the vertical;
- the biological characteristics of the organic particulate matter, zooplankton and micronekton (DSL[3, page5]) which are tuna's staple food, with measurements of their vertical movements and biomasses and species identification, both around the seamount and far from them;
- study of certain of the biological parameters of tuna and large oceanic fish populations (diet and movements) during the complementary tagging (PNG tagging) and longlining campaigns carried out and/or planned by SPC.

The objectives of this campaign are complementary to those of the Bismarck-Benthic campaign, which will focus on mapping seamounts and studying benthic fauna biodiversity (cf. corresponding campaign proposal), and the 06-01 and 07-01 PNG tagging and the PNG-LL08-01 campaigns designed to study tuna movements and their trophic links with seamounts (cf. paragraph PNG tagging 06-01 and 07-01 campaings, page 6).

Tuna: a major resource for the Pacific and Papua New Guinea

Tuna is a major subsistence and economic resource in the Pacific, particularly for the region's developing countries. Annual tuna production in the Western and Central Pacific was estimated at 2,145,367 tons in 2005[5], i.e. the highest value ever reached, and an increase of 5% over the previous record set in 2004 (Williams & Reid, 2006). This tonnage accounts for 77% of Pacific production and 49% of world tuna production with a value of US$ 3 billion.

Tuna fishing is carried out throughout the western and central parts of the Pacific but production is particularly high in the equatorial zone (between 10ºN and 10ºS) where purse seiners operate almost exclusively (Figure 1). Papua New Guinea's EEZ, which spreads out over some 2.4 millions sq km, is one of the biggest and most productive in the region. Tuna fishing is the country's largest fishery with 91 local or related fishing units and 136 licensed foreign purse seiners. In 2005 a total of 284,204 tons of tuna were caught in this EZZ, i.e. 13% of regional production (Kumoru & Koren, 2006).

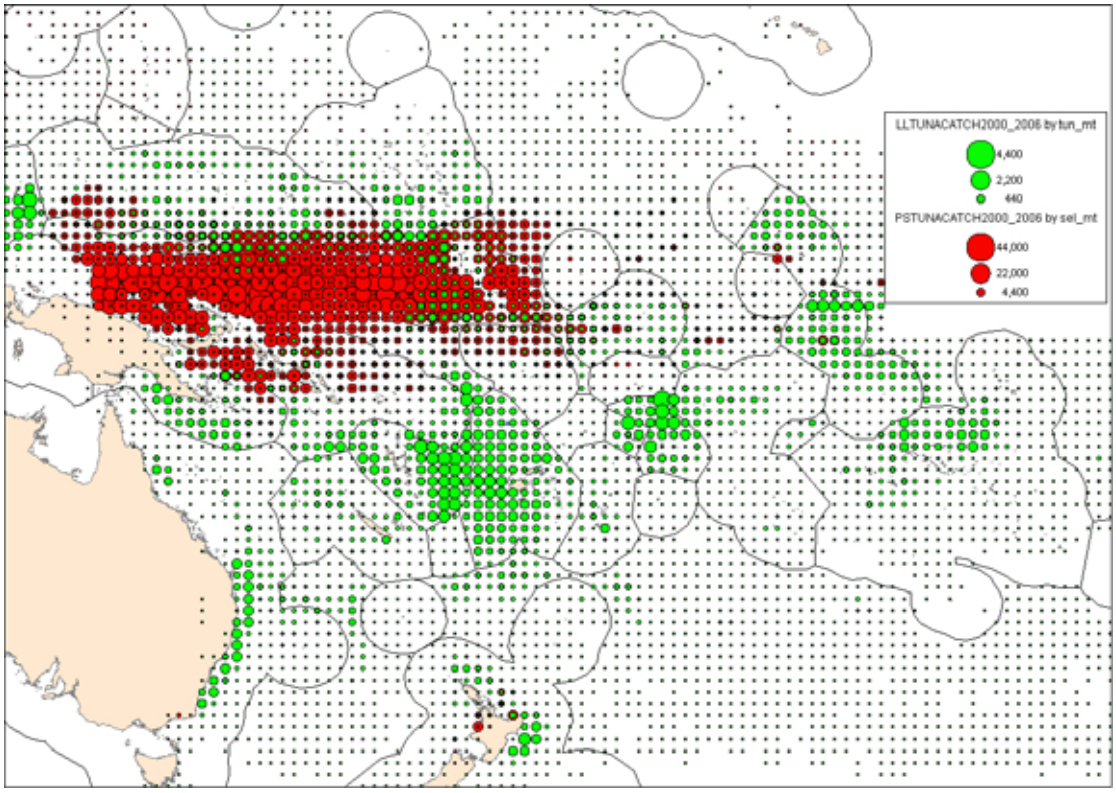

Figure 1. Tuna tonnages (skipjack, yellowfin, albacore and bigeye) caught by longlines (LL-green) and purse seine (PS-red) for 2000-2006 in Western and Central Pacific (resolution of 1 sq degree). The scale is different for longline and purse seine.

Regionally, catches are composed of 67% skipjack (*Katsuwonus pelamis*), 20% yellowfin (*Thunnus albacares*), 8% bigeye (*Thunnus obesus*) and 5% albacore (*Thunnus alalunga*) ; 71% of this tonnage was caught by purse-seiners, 11% by longliners, 10% by pole-and-line vessels and 7% by trolling and other artisanal techniques (Figure 2).

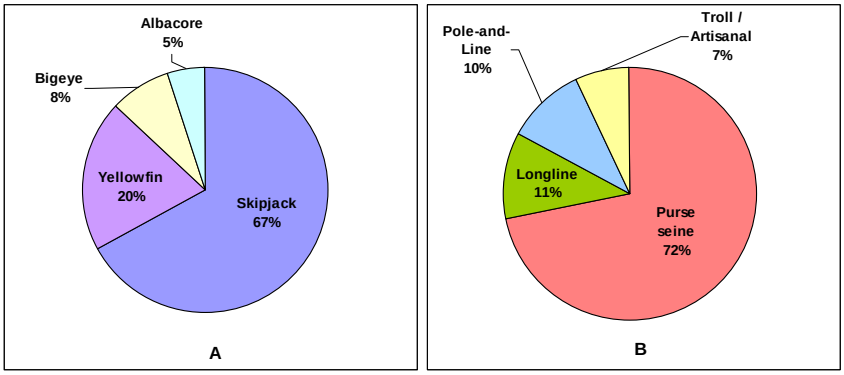

Figure 2. Distribution of tuna catch percentages (in tons), A) by species B) and by fishing gear. 2005 aggregate data for Western and Central Pacific.

[5] Best estimate dated August 2006 but which must be considered provisional.

PNG tagging 06-01 and 07-01 campaigns

Purse-seine fishing, which accounts for nearly three-quarters of all catches (Figure 2), is done at the surface on schools of fish that can be free or associated with floating natural debris (coconuts, tree trunks, etc.) or artificial floating or anchored rafts (FAD : fish aggregation device) that tend to aggregate fish.
There has been a very dense deployment of anchored FADs in Papua New Guinea, particularly in the Bismarck Sea (Figure 3), which makes it a area of special interest for study. In fact, FADs may act as ecological traps and change the lifestyles of associated species (disturb migration patterns, negative impact on growth) (Fréon & Dagorn, 2000b; Fonteneau *et al.*, 2000; Marsac *et al.*, 2000).

This problem is one of the research areas for the IRD's UR 109 Téthys[6] and the FADIO[7] program that operate in the Indian and Atlantic Oceans. In the Pacific, on this same topic, *i.e.* better understanding the impact FADs have on tuna behaviour, SPC has collaborated with several partners to organise a vast tuna tagging program whose first phase took place from August to November 2006 (06-01 PNG tagging) and whose second phase is planned for February to March 2007 (07-01 PNG tagging) in the Bismarck Sea (Oceanic Fisheries Programme of the Secretariat of the Pacific Community, 2006). The results of the first tagging campaign, i.e. 06-01 PNG, have been extremely encouraging with some 22,420 tuna tagged (62% skipjack, 35% yellowfin, 3% bigeye).
In addition to an in-depth study of the impact of FADs, these tagging campaigns also provide an opportunity to collect samples from around seamounts in the zone. More specifically, the study around the seamounts covers tagging small-size tuna (1679 tuna tagged during 06-01 PNG tagging) to study their movements and taking biological samples (stomachs and muscle samples– 62 tuna sampled around seamounts during 06-01 PNG tagging) to study their feeding habits.
Since the primary objective of these campaigns is tagging, work at sea is conducted on a commercial pole and line ship, the best fishing technique for tagging purposes but one that does not allow the collection of large-size specimens or the recording of oceanographic parameters, and, even less so, collection of fauna samples from the benthos or small pelagic species.

The Bismarck campaigns are, then, designed to collect benthic and pelagic fauna and SPC has planned an expedition on the longliner PNG-LL 08-01 to collect large-size tuna to complete the work already done during the 06-01 and 07-01 PNG tagging campaigns with a view to better understanding the role seamounts play in the ecosystem.

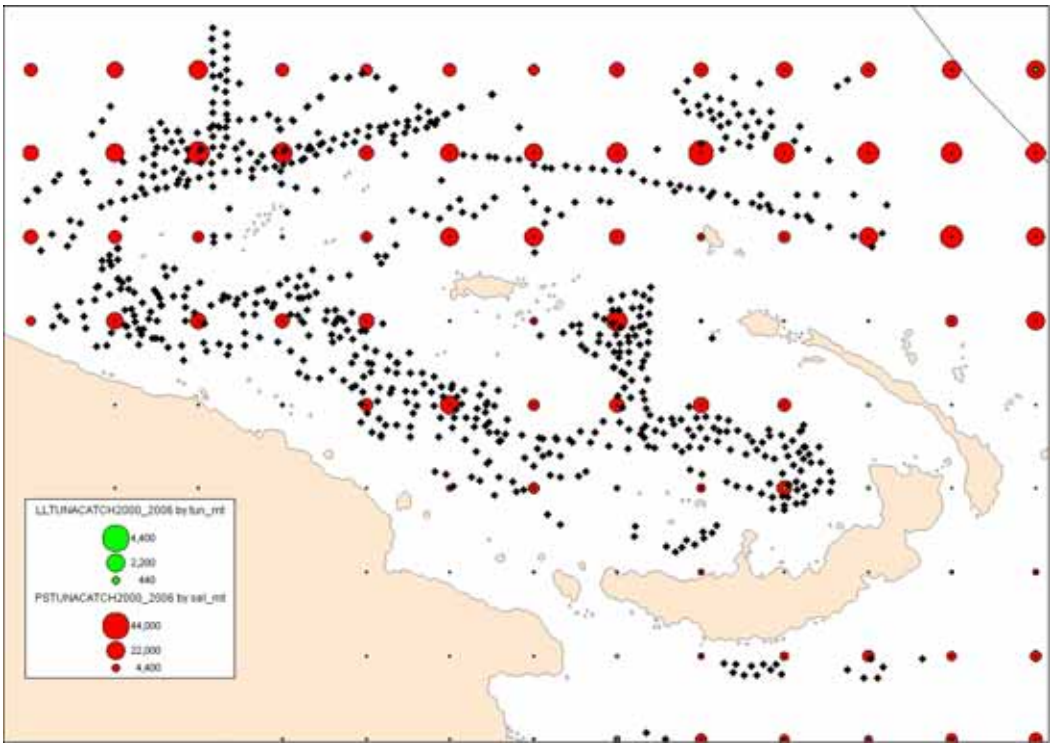

Figure 3. Tuna tonnages (see Figure 1 caption) and anchored FAD distribution (black diamonds) in the Bismarck Sea (Papua New Guinea).

[6] http://www.brest.ird.fr/ur109/activites/impacts.htm
[7] FADIO project http://www.fadio.ird.fr/

Characterising thermocline waters entering the Bismarck Sea

In oceanographic terms, the waters of subtropical origin that cross the Bismarck Sea contribute in large part to the equatorial undercurrent in terms of the main thermocline (Tsuchiya et al., 1989 ; Fine et al., 1994 ; Blanke and Raynaud, 1997). Variations in this mass flow and the physical and chemical properties of these waters are major elements that come into play in the low-frequency modulation of the mean state of the equatorial rail current (Gu and Philander, 1997, McPhaden and Zhang, 2002). Fluctuations in this mean state are, in their turn, involved in low-frequency modulation of the ENSO (El Niño Southern Oscillation) phenomenon. At these time scales, uncertainty about future changes in the ENSO against the background of global warming produce, in part, uncertainty about oceanic circulation of the subtropical gyre.
In the southwest Pacific, thermocline waters are mainly fed by the Solomon Islands Sea. This water source, at about 10°S, is the main study topic of the FLUSEC-1 oceanographic campaign, scheduled for June 2007 as part of the international SPICE (www.ird.nc/UR65/SPICE) program. This campaign should make it possible to estimate the meridional mass flow entering the Solomon Island sea, while, at the same time, differentiating the different origins of these water masses (western rim Australian currents, north Vanuatu stream, etc.)
So, the Bismarck campaign provides an opportunity to complete this description of the physical properties of the thermocline waters. It seems that these waters mainly transit by Vitiaz and St George Straits before joining the equatorial regions. In fact, these two straits, which are relatively narrow (~50 km) and deep (~1000 m), are the only passageways linking the Solomon Islands Sea to the Bismarck Sea (Figure 7). If possible, an estimate of the mass flow will also be made. Direct estimates of the mass movements through these straits are extremely rare (Lindstrom et al., 1987), but Butt and Lindstrom (1994) have shown that these movements account for half of the water in the equatorial undercurrent between 149°E and 153°E. More recently, i.e. in 2006, the American campaign KILO2006 (PI, Jim Murray) sampled the same zone but mainly in terms of current measurements without being able to set up a large number of hydrological stations (data analysis is currently underway in collaboration with Christophe Menkes).
We propose to complete these observations by hydrological measurements, analyse the data in a complementary way and put them into a more general overview with the regional ocean circulation model made by ROMS, available at the IRD Centre in Noumea. These actions will be carried out in collaboration with Christophe Menkes (LOCEAN, Noumea) and the members of the LEGOS' OLVAC team in Noumea.
In this way, the oceanographic measurements made during the Bismarck campaign will allow a better understanding of water mass circulation in both the region and the Bismarck Sea. This characterisation at the scales of both the region and the zone is a prerequisite for characterising oceanographic parameters at the smaller, seamount scale.

Conservation and the impact of fishing on seamounts

Seamounts are characterised by a high rate of endemism, support vulnerable benthic communities and are known for aggregating pelagic species, whose species composition there differs from open-sea fauna. There is growing interest in seamount ecosystems - in particular with regards to the conservation of these unusual ecosystems- and so, in the impact of fishing. While bottom trawling has an undeniable impact on habitat and benthic fauna, the possible impact of pelagic fisheries is still unknown but supposed to be very low or inexistent. (Koslow *et al.*, 2001 ; Campbell & Hobday, 2003). Scientific studies on such complex ecosystems have, however, been sporadic and often limited in scope.
For all those reasons, the Bismarck project proposes to carry as complete a survey as possible (bathymetry, oceanography, benthic and pelagic fauna) on a few seamounts in the Bismarck Sea.

Pelagic and benthic biology, bathymetry and oceanography: a mechanistic approach, multi-disciplinary research

The theories mentioned in the "Theories and objectives" section (page 5) demonstrate the importance of sound knowledge of oceanographic parameters in attempting to explain the influence seamounts have on the ecosystem. This is particularly true for pelagic organisms whose habitat is the water mass, which can only be characterised by oceanographic parameters such as temperature, current and salinity. Other parameters come into play when a benthic ecosystem is involved, such as the type of substrate and topography.
A mechanistic approach seems to be the most appropriate one for this study, whose goal is to explain the influences seamounts have on the ecosystem. These are physical parameters such as bathymetry and oceanography, e.g. currents, temperature, that will make it possible to explain the existence and movement of pelagic and benthic species. Integrating the results of these different disciplines will make it possible to go beyond a descriptive study and should make it possible to gain a better understanding of the operating mechanisms of the ecosystems at the seamounts studied.

Research plan

The seamounts in the Bismarck Sea have not been explored and detailed bathymetry of this area is spotty and often limited to the coastal zones. The only data available for the moment are global satellite bathymetric data with a precision of 2' (S2004/ETOPO2 data). Using these data, Kitchingman & Lai (Kitchingman & Lai, 2004) identified a number of potential seamounts but detailed examination of these data revealed numerous errors. A new analysis of global bathymetric data and SPC's historic information from past fish tagging programs in this zone made it possible to identify some sure or highly-probable seamounts. There are three potentially interesting large zones, i.e. in the east where a large bank spreads out at a depth of 400 m (a large number of fish have been tagged at this site), in the west where there may be an isolated seamount at a depth of 600 m and, finally, in the central part of the Bismarck Sea, where there are many possible seamounts (Figure 4).
The final choice of study sites will be based on the results of SPC's 06-01 and 07-01 PNG tagging campaigns, which will locate seamounts in the zone. Then, detailed cartography during the benthic part of the 2008 Bismarck project will allow us to make precise gridlines of the seamounts selected for sampling during the pelagic part.
Oceanographic measurements will be taken and fauna collected both at the seamounts and away from them in order to be able to make comparisons and, in that way, better understand the effect seamounts have on the pelagic ecosystem.

Operation timetable:

- Noumea – Rabaul crossing and preparation : 10 days (about 1600nmi @ 9knots)
- Bismarck-Benthic campaign: 20 days (bathymetry and benthic fauna)
- Stopover in Madang : 2 days (supplies, change scientific teams, change equipment)
- Bismarck-Pelagic campaign : 20 days (oceanography and pelagic fauna)
- preparation and Rabaul – Noumea crossing: 10 days (about 1600nmi @ 9knots)

i.e. a total time period of 62 days for the Bismarck project.

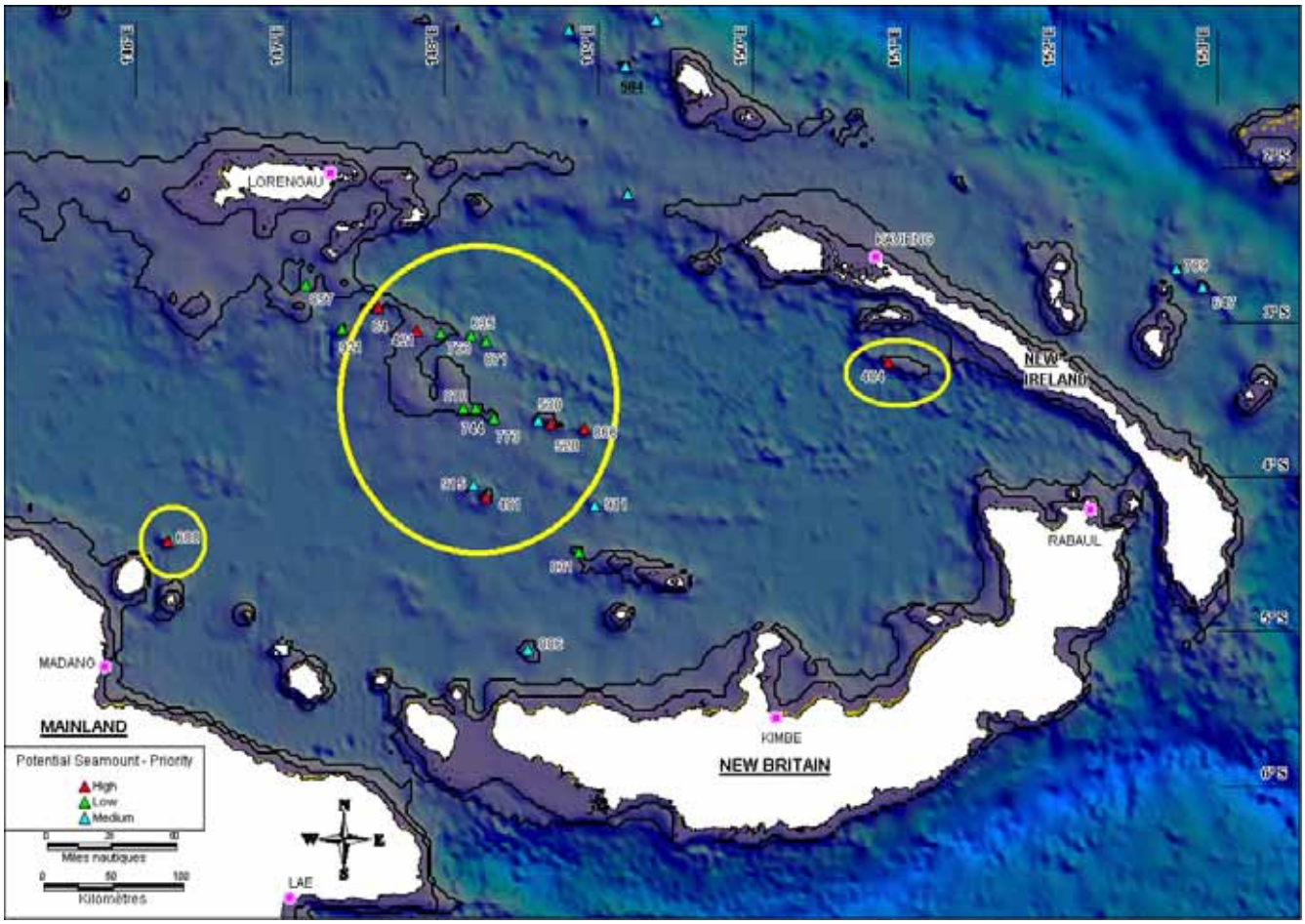

Figure 4. Potential and/or certified seamounts in the Bismarck Sea. The outlines in black show the 200-1000 depth zone. The yellow circles show potential survey zones for the campaign. The numbers next to the seamounts show the depth at the summit as predicted using altimetry satellite data. The colour code for the mounts show the level of priority for exploration

Projet progress

The Bismarck is the continuation of two other major projects carried out by SPC and IRD.

The 2008 Bismarck-Benthic section is the continuation of the MUSORTOM and related campaigns (see the corresponding project proposal for work progress) (Richer de Forges & Justine, 2006).

The 2008 Bismarck-Pelagic part is integrated into a vast project to study pelagic ecosystems in Western and Central Pacific (see "Collaborations and ancillary programs" section, page10 and http://www.ffa.int/gef/). This project focuses on studying the trophic relationships between large pelagic fish, and between 2001 and 2006, 3157 stomachs from 60 fish species were sampled, some 2793 (88%) of which were then examined.
The part of the project that focuses on the influence seamounts have on the pelagic ecosystem began in 2006, when SPC organised a working group in March 2006 that brought together 14 specialists of seamounts in the Pacific and Europe (SPC-New Caledonia, IRD-New Caledonia, University of Hawaii, NIWA[8]-New Zealand, CSIRO[9]-Australia, Ministry of Fisheries-Tonga, IUCN[10]-Switzerland, FFA[11]-Solomon Islands) (Allain *et al.*, 2006). This meeting allowed the participants to make an inventory of the research on seamounts in the Pacific.
SPC has also begun, in collaboration with the NFA (Papua New Guinea National Fisheries Authority), a tuna tagging program in the Bismarck Sea that includes tagging and sampling around seamounts. In November 2006, after three months of fieldwork, more than 22,000 tuna had been tagged and more than 800 stomachs had been sampled for the trophic relation study ; of these some 1679 tuna were tagged around seamounts and 62 stomachs were sampled. A second campaign is taking place from February to May 2007. The two campaigns will make it possible to identify seamounts in the study zone and get results on tuna behaviour around the mounts (how long they stay there, vertical and horizontal migration) and on their feeding habits. The analysis phase for collected data began in late November 2006.

Collaborations and ancillary programmes

The Bismarck 2008 -Pelagic campaign fits into SPC's "Pacific Islands Oceanic Fisheries Management Project 2005-2010" (OFMP)[12] , which is a follow-up to the "Strategic Action Programme of the Pacific Small Island Developing States 2000-2005 ", two GEF[13]-funded studies. The goal of these projects is to allow conservation and sustainable management of the living resources of the Pacific Ocean and one of their activities is to improve scientific knowledge about the tuna's pelagic ecosystem in the Pacific so as to provide guidance on managing this resource.
For the project currently underway, the OFMP, in collaboration with the FFA[11] and IUCN[10], one new activity consists of gaining a better understanding of the influence seamounts have on tuna resources and evaluating the impact tuna fishing has on seamounts.
As part of this project, collaborative efforts have also begun with the PNG Fisheries Agency (NFA) to carry out the PNG tagging campaigns, a sampling and tagging campaign in the Bismarck Sea. This agency has been advised of preparations for the Bismarck 2008 project.
The study on biological samples (stomach contents) is being carried out in collaboration with taxonomists from various countries, e.g. New Zealand, Australia, Hawaii, and stable isotope analyses are being done in collaboration with the Stable Isotopes Biogeochemical Lab at the University of Hawaii.
This Bismarck 2008 project (Benthic and Pelagic) already has the support of the CENSEAM (see the letter of support attached to the file). CENSEAM (Global Census of Marine Life on Seamounts[14]) is a Census of Marine Life (CoML[15]) project, which brings together researchers from all over the world to improve knowledge about seamount ecosystems.
The physical oceanographic observations to be carried out as part of this proposal will supplement efforts already made as part of the international SPICE (www.ird.nc/UR65/SPICE) program under the direction of the World Climate Research Program, CLIVAR/GOALS (Climate Variability and Predictability/Global Ocean Atmosphere Land System). At the national level, the SPICE-France program headed by Lionel Gourdeau has been funded through LEFE for a period of two years. We should recall that the Flusec-1 oceanographic campaign also depends on these two research programs.

[8] NIWA : National Institute of Water and Atmospheric Research, a national research agency in New Zealand.
[9] CSIRO : Commonwealth Scientific and Industrial Research Organisation, a national research agency in Australia.
[10] IUCN : International Union for the Conservation of Nature and Natural Resources or World Conservation Union, an international organisation based in Gland, Switzerland that brings together countries, government agencies, NGOs and scientists.
[11] FFA : Forum Fisheries Agency, an international for tuna fisheries development and management in its 17 Pacific Island member countries; it is based in Honiara, Solomon Islands.
[12] OFM project: http://www.ffa.int/gef/
[13] GEF : Global Environment Facility, an independent financial agency of the UN Development Program that provides funding to developing countries for grassroots environmental and sustainable management projects.
[14] CENSEAM: http://censeam.niwa.co.nz/
[15] CoML: http://www.coml.org/

Expected results

The goal of this study is to explain the influence seamounts have on the pelagic ecosystem by using a mechanistic approach to determine how interactions between seamounts and the ecosystem operate. The expected results of the campaign are:

1) A better understanding of the impact the seamounts studied have on oceanographic parameters such as Taylor column formation, upwelling, main thermocline characteristics and vertical displacement, etc. Through a ripple effect, these physical constraints have an impact on the entire ecosystem and so they constitute variables which may explain phenomena observed in the food chain.
2) Better understanding of water mass displacement in the Bismarck Sea and straits.
3) Better understanding of the ecosystem's various pelagic and benthic components (biomasses, species composition, movements), from the lower trophic levels (phytoplankton, zooplankton, micronekton) right up to large predators (tuna and other large oceanic species – through a complementary campaign longlining by the SPC– PNG LL 08-01) and their interactions (trophic relations through a study on stable isotopes, stomach contents and movements).
4) Integration of the bathymetric and benthic fauna data collected during the Bismarck -Benthic campaign.
5) An overall report on the seamounts studies so as to understand how they operate (bathymetric-oceanographic-benthic-pelagic interactions) and, in this way, get the information required for formulating management and/or protection measures for these unusual ecosystems.
6) This complete study could provide a standard model for later studies on seamounts.

Depending on the results obtained, one or more scientific publications could be produced.

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DOCUMENT N° 2	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

CAMPAIGN DESCRIPTION

Methodology, list of work, strategy

LISTE OF WORK

In order to characterise water masses in the Bismarck Sea and straits and observe the impact seamounts have on them, vertical profiles to a depth of 1000 m will be made for several parameters:
- temperature
- pressure
- salinity
- oxygen
- fluorescence.

In order to characterise pelagic fauna in the Bismarck Sea and at seamounts, samples several components of the pelagic ecosystem will be sampled and various parameters will be measured:

Ecosystem component	Parameters measures	Comments
Organic particulate matter	Biomass estimates (filtration) Trophic level (stable isotopes)	
Zooplankton	Biomass estimates (net and acoustics) Vertical movements (acoustics) Species identification Trophic level (stable isotopes)	
Micronekton	Biomass estimates (trawling and acoustics) Vertical movements (acoustics) Species identification Size structure Trophic level (stable isotopes) Other biological parameters as the occasion presents itself (stomach contents, genetics, etc.)	
Large oceanic species (tuna, marlins, sharks, etc.)	Biomass estimates (longline and acoustics) Vertical movements (acoustics and tags) Species identification Size structure Trophic level (stable isotopes) Stomach contents	The acoustics will be carried out during the Bismarck-Pelagic campaign, the rest of the work to be conducted by SPC during additional campaigns

STATIONS

A series of physical measurements stations will be set up at the beginning of the campaign in order to characterise water mass exchanges between the Bismarck Sea and Solomon Islands Sea at St. George and Vitiaz Straits (Table 1, Figure 7). In order to properly characterise hydrology in the Bismarck Sea, other stations will also be set up along the itinerary along the transects between seamounts every ½ degree (Table 2, Figure 7). There will be 13 stations in the straits and 14 transect stations.

The 06-01 and 07-01 PNG tagging campaigns in 2006 and 2007 will make it possible to more precisely locate seamounts in those areas identified as potentially interesting based on satellite data (Table 3, Figure 4, Figure 7). As an initial estimate, the mount on Site 1, whose existence has been proven, and at least one mount each in Sites 2, 3 and 4, whose existence and exact positions still need to be confirmed, will be explored. The Bismarck 2008 - Benthic campaign will allow us to precisely locate these seamounts and determine their depths. It will also provide detailed bathymetric maps of the seamounts explored and, in this way, make it possible to determine the feasibility of studies at these sites and finalise the list of mounts to be explored during the Bismarck 2008 -Pelagic campaign. The mount at Site 1 will be studied in depth since its existence has been proven and it is a large structure that forms a vast plateau whose summit should be at a depth of about 400 m. There are plans to do two perpendicular transects covering 14 stations in all, where physical measurements will be taken. OPM and zooplankton samples will be taken at 10 of the 14 stations both during the day and at night, i.e. 20 zooplankton hauls. Trawling for micronekton will be carried out at 8 of these stations during the day and at night in deep waters and at night on the surface at six stations, i.e. 22 trawling runs (Figure 5).

For the mounts at Sites 2, 3 and 4, sampling will be less detailed with one or two perpendicular transects depending on the time available and prevailing sea conditions. Each transect will include a station at the summit of the mount, two stations above the slope and two stations at a distance (where the depth is about 2000m) (Figure 6).

Priority during this study will be given to spatial stratification of the sample, but temporal stratification could also be done depending on the amount of time available. This would consist of repeating at night some of the work carried out during the day over all or part of the stations, taking care to avoid sunrise and sunset when the DSL makes its vertical migrations. Night work would only involve fauna samples.

In spite of this preliminary estimate, it should be noted that the number of stations will be adapted to working conditions at sea and the time available in line with the actual situation in the field.

Finally, since the purpose of this campaign is to determine the influence seamounts have on the pelagic ecosystem, it would be best to have a comparative strategy with study of oceanographic parameters and pelagic fauna at several sites located away from the selected seamounts. In that way, in addition to the analyses carried out on the mounts, measurements will also be taken at control sites located at least 30 nautical miles from the mounts (Table 2, Figure 7). Three control stations have been chosen : R4, R10 and R13.

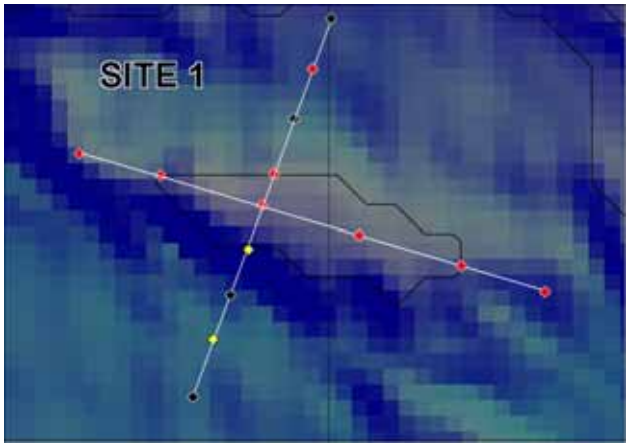

Figure 5. Sampling plan at Site 1. The black diamonds show those stations where only physical measurements will be taken, the yellow diamonds: stations with only physical, OPM and zooplankton ; red diamonds: stations with physical, OPM, zooplankton and micronekton. The coordinates for the edges of this map are 150.63E, 151.32E and 3.52S, 3.03S.

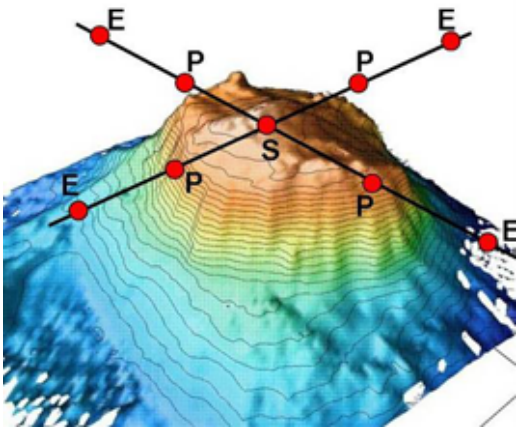

Figure 6. Three-dimensional diagram of a seamount showing the station transects planned at various levels : summit (S), slope (P) and distant stations (E).[16]

Strait	Name of stations	Transect	Longitude (deg., min)	Latitude (deg., min)	Number of stations
Vitiaz	D1 to D5	Transect 1 – beginning Transect 1 – end	147°30 E 147°50 E	5°95 S 5°15 S	5 stations
Vitiaz	D6 to D8	Transect 2 – beginning Transect 2 – end	147°50 E 148°30 E	5°15 S 5°15 S	3 stations
St George	D9 to D13	Transect 3 – beginning Transect 3 – end	152°15 E 152°15 E	3°40 S 4°15 S	5 stations

Table 1. Positions of physical measurement stations in Vitiaz and St George Straits.

[16] This diagram, which is given as an example and modified for the illustration, is a 3D-view of Bear Seamount located in the Atlantic Ocean, whose summit is located at a depth of 1000 m (source of picture: National Oceanic and Atmospheric Administration: http://www.oceanexplorer.noaa.gov/explorations/deepeast01/logs/sep13/media/bear_seamount.html).

Transect stations	Longitude (dec.)	Latitude (dec.)	Comments
R1	146.500	-5.500	
R2	147.000	-5.736	
R3	148.441	-5.000	
R4	148.325	-4.500	Control station
R5	148.153	-4.000	
R6	147.912	-3.500	
R7	148.000	-3.154	
R8	148.500	-3.500	
R9	149.000	-3.614	
R10	149.500	-3.500	Control station
R11	150.000	-3.422	
R12	150.500	-3.325	
R13	151.500	-3.449	Control station
R14	152.000	-3.560	

Table 2. Positions of the physical measurement transect stations along the itinerary. Sampling of pelagic fauna will also be carried out at the control stations.

Site	Long (dec)	Lat (dec)	Depth (m)	Priority
site 1	150.874	-3.25139	404	high
site 2	148.608	-3.63461	530	medium
site 2	148.691	-3.65127	520	high
site 2	148.907	-3.68447	866	high
site 3	147.574	-2.90112	64	high
site 3	147.824	-3.05111	421	high
site 4	148.191	-4.05154	915	medium
site 4	148.275	-4.13441	481	high
	144.524	-1.93455	504	high
	144.674	-1.65108	644	low
	145.108	-2.11793	649	high
	146.207	-4.41825	608	high
	147.108	-2.75118	857	low
	147.341	-3.03428	921	low
	147.975	-3.06746	763	low
	148.125	-3.55136	744	low
	148.174	-3.08404	635	low
	148.208	-3.55126	810	low
	148.274	-3.11779	871	low
	148.324	-3.61786	773	low
	148.541	-5.11793	806	medium
	148.808	-1.10128	850	medium
	148.874	-4.48435	831	low
	148.975	-4.18453	911	medium
	149.174	-1.33461	584	medium
	149.191	-2.16727	865	medium
	149.374	-1.03444	849	medium
	152.741	-2.65109	789	medium
	152.908	-2.7678	647	medium

Table 3. Positions of potential seamounts detected after analysis of satellite images and shown on **Figure 4** and **Figure 7**.

WORK AT STATIONS

Physical oceanographic measurements will be taken at the strait stations, transect stations and seamount stations. Acoustic measurements and biological samples will be taken at the three control stations (R4, R10 and R13) and the seamount stations. In the event of temporal stratification of the samples, only the biological samples will be repeated at night.

Physical oceanographic measurements : the work to be conducted at the stations (straits, transect and seamount) will consist of temperature, conductivity, pressure, oxygen and fluorescence profiles using the SBE19 probe to depths of up to 1000 m. Following US25's recommendations, this probe will be equipped with two Doppler current meters (L_ADCP) to measure currents.

Biological samples (pelagic fauna) : organic particulate matter (OPM) samples will be taken at each station to measure stable isotopes at the base of the food chain. For zooplankton, three consecutive vertical hauls will be made at each station at depths of 100, 200 and 500 m to identify the species, estimate biomasses (dry weight) and measure stable isotopes. Finally, micronekton samples will be taken at each control station and, for the seamounts, at the summit station, on two stations on the slope and possibly at two stations located at a distance, both during the day and at night in deep waters plus one surface sample at night at the summit station. The micronekton samples collected during horizontal hauls will make it possible to identify the species, estimate biomasses and measure stable isotopes. Acoustic measurements from the EK60 will be recorded on an on-going basis on the

transects both at the seamounts and control stations in order to estimate micronekton biomasses and their vertical movements. The TAPs acoustic profiler for zooplankton will be used at all the stations. Acoustic signals marking the vertical migration phases of zooplankton and micronekton, i.e. at sunset and sunrise, will be recorded.

WORK EN ROUTE

Certain on-going physical oceanographic measurements will be made :
a) for the zonal and meridional currents using the hull ADCP (0-300 m),
b) for surface temperature and salinity using the thermosalinograph.
c) for the main meteorological parameters using the Batos station.
In terms of acoustics, on-going data acquisition is possible en route since the boat's speed is less than 7-8 knots.

METHODOLOGIES

Physical oceanographic measurements: the measurements to be taken en route do not require any equipment handling; the hull ADCP, BATOS weather station and thermosalinograph will be powered up at the beginning of the trip and will record the parameters on a continual basis. For each station, the Seabird SBE19 probe with all its detectors and equipped with an LADCP will be dropped down to a depth of 1000 m using the side winch to record the parameters. Each operation takes about an hour.

Biological samples (pelagic fauna) :

OPM : sample surface water (about 15 litres) using a special bucket designed for this purpose off the side of the boat, transfer water into filter system, turn on pump (Gast Oil-less diaphragm-type pressure/ vacuum pump) for filtering with Whatman GF/F filters, 25 mm (nominal pore size 0.7) with a Millipore Swinnex filter holder for different amounts of time depending on how many particles there are. Filtering time is generally under an hour and requires simple surveillance without any handling. Record the volume filtered. Keep filter in freezer.

Zooplankton : deploy and then slowly bring back in the WP2 triple net (200µm mesh) at the back of the boat using a shunt from the small side winch, rinse net, record flow meter figures, recover; rinse and store plankton samples in appropriate containers and storage devices so they can be examined later in the laboratory. The overall operation, i.e. 3 consecutive vertical hauls, rinsing and storing samples, takes about 1.5 hours.

Micronekton : deploy IKMT net with the back winch to the depth of the DSL based on acoustic data; deep horizontal hauls and oblique surface haul at night beginning just under the DSL surface depth as determined by acoustics. Recover micronekton. Sort by taxonomic group (fish, cephalopods, crustaceans, gelatinous organisms). Identify species, count on board or store samples for later examination in a laboratory depending on sample size and the time available. The net is dragged for one hour each time and the overall operation, i.e. deployment, dragging, recovering samples, takes between 1.5 and 2 hours.

Acoustic measurements: either the ALIS will be equipped with hull sounders, or the US004' transportable EK60 will be installed on a pole off the side of the boat. Once the sounder has been turned on, the 3-4 available frequencies (38, 70, 120 and 200KHz) will be acquired simultaneously while the boat goes at a speed of 7-8 knots. The TAPs installed on the small side winch will be dropped to a depth of 200 m at a speed of 1m/s at the various stations ; the operation is quick and takes about 10-15 minutes.

Overall outline of the mission, length, stopovers

In order to optimise use of transit time through the zone, it would be best for the two missions, i.e. Bismarck-Benthic and Bismarck-Pelagic, to be scheduled one after the other. In the same way, since the detailed mapping work is supposed to be done during the Bismarck-Benthic campaign, it is important that this mission take place first since these data will then be used during the Bismarck-Pelagic campaign.

Provisionally, the missions should take place as follows:

- Noumea – Rabaul transit: 9 days (about 1600nmi @ 9knots)
- set up equipment on-board, get supplies in Rabaul : 1 day
- Bismarck-Benthic campaign : 20 days (bathymetry and benthic fauna)
- stopover in Madang : 2 days (supplies, change scientific crews, change equipment)
- Bismarck-Pelagic campaign : 20 days (oceanography and pelagic fauna)
- Prepare boat for return trip, get supplies in Rabaul : 1 day
- PNG – Noumea transit: 9 days (about 1600nmi @ 9knots)

i.e. a total time of 62 days for the BISMARCK project including 20 days of transit, then 42 days in the zone, divided into 2 days of stopovers and 20 days of field work for each mission (Benthic and Pelagic).
The two missions will visit the same sites to carry out different types of measurements and sampling.
The stopover is necessary given the very different nature of the work to be done during the two consecutive missions. So, the scientific team will have to be changed and the equipment on board will have to be rearranged. The stopover will also allow the boat to get supplies.

Desired time frame: between April and July 2008 (outside tropical storm season).

Provisional daily timetable for work

Since both missions, i.e. benthic and pelagic, are supposed to cover the same zones, any changes made to the itinerary during the first mission, i.e. benthic, will have to be repeated during the second, pelagic, mission.

Days	Work	Approximate work times
D1-D9	Leave Noumea, transit, arrive in Rabaul ; take on scientists in Rabaul, take on supplies – 1600nmi at 9 knots, i.e. about 9 days	
D10	Take on scientists at Rabaul, set up equipment, take on supplies	
D11-D30	BISMARCK BENTHIC mission (please see corresponding campaign proposal for the daily timetable)	
D31-D32	Stopover in Madang, change scientific team, rearrange equipment, take on supplies	
D33-D34	Transit Madang –D1 with 2 physical measurement stations (R1 and R2) Transit between D1 and D5 with 5 physical measurement stations (D1 to D5)	15h 12h
D34-D35	Transit between D5 and D8 with 3 physical measurement stations (D6 to D8) Transit between D8 and Site 4 with 2 physical measurement stations (R3 and R4) and 1 biological sample station (R4)	9h 14h
D35-D37	Work at Site 4 : 10 physical measurement stations 10 OPM and zooplankton sampling stations 7 micronekton sampling stations	10h 15h 14h
D38	Transit between Sites 4 and 3 with 2 physical measurement stations (R5 and R6)	14h
D39-D41	Work at Site 3 : 10 physical measurement stations 10 OPM and zooplankton sampling stations 7 micronekton sampling stations	10h 15h 14h
D41-D42	Transit between Sites 3 and 2 with 2 physical measurement stations (R7 and R8)	13h
D42-D44	Work at Site 2 : 10 physical measurement stations 10 OPM and zooplankton sampling stations 7 micronekton sampling stations	10h 15h 14h
D45-D46	Transit between Sites 2 and 1 with 4 physical measurement stations (R9 to R12) and 1 biological sample station (R10)	24h
D46-D50	Work at Site 1 : 14 physical measurement stations 10x2 (day/night)=20 OPM and zooplankton sampling stations 8x2(day/night)+6(surface)=22 micronekton sampling stations	14h 30h 44h
D51	Transit between Site 1 and D9 with 2 physical measurement stations (R13 and R14) and 1 biological sample station (R13)	17h
D52	Transit between D9 and D13 with 5 physical measurement stations (D9 to D13)	10h
D53	Enter Rabaul Port, take on supplies, debark scientists, prepare the boat for the return trip	
D54-D62	Leave Rabaul, transit, arrive in Noumea – 1600nmi at 9 knots, i.e. about 9 days	

Situation map of the study zone

Figure 7 shows the overall and detailed situation of the study zone for the Bismarck project.
Site 1, which is located south of Djaul at 150º52'E and 3º15'S, is a large bank whose summit is located at a depth of about 400 m. Its existence has been proven by several information sources, notably the tuna tagging operations carried out by SPC in the 1990s. A special effort will be made at this site because it is the biggest and it is particularly favoured by pelagic fisheries.
Site 2 includes several potential seamounts whose summits are located at depths of 866, 520 and 530 m in a square situated between 148 º34'E - 3º46'S and 148 º59'E - 3º32'S.
Site 3 includes several potential seamounts whose summits are located at depths of 760, 420 and 65 m in a square situated between 147 º33'E - 3º06'S and 148 º01'E - 2º51'S.
Site 4 includes several potential seamounts whose summits are located at depths of 480 and 900 m in a square situated between 148 º09'E - 4º13'S and 148 º24'E - 4º00'S.

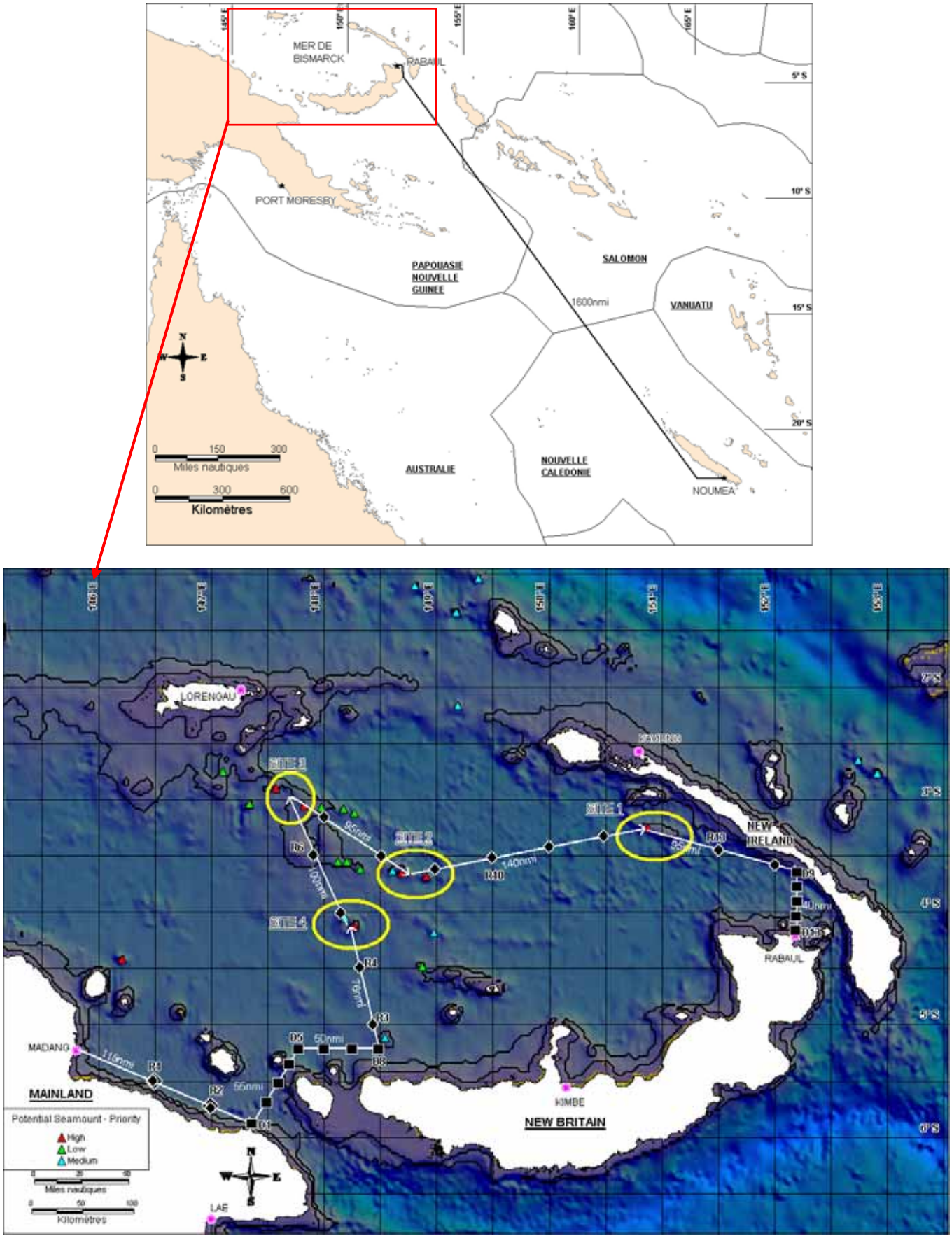

Figure 7. Overall situation map and detailed map of the study zone for the Bismarck-Pelagic project. The itinerary is in white with departure from Madang and arrival in Rabaul. The black squares show the hydrological stations in the straits (D1 to D13) ; the black diamonds show the hydrological stations in the transects (R1 to R14). The seamounts are shown by coloured triangles.

DOCUMENT N° 3	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

MEANS TO BE IMPLEMENTED

Support ship

The R/V Alis has the equipment needed for this study and is located on site in Noumea.

Equipment installed on support ship

- Hydrologic winch with slip rings – 1500 m of cable required
- Hull ADCP, computer for acquiring data and computer for data processing.
- Computer for data processing and printer
- Seabird SBE19 probe
- Intercom (lab, bridge, winch)
- Complete Batos weather station
- Fax, e-mail, Imarsat-C
- Freezer ($3m^3$) to store samples
- multi-beam mapper.
- EK60 hull probe (38, 70, 120 and 200 KHz)

-aft-winch , 1000 m of cable required

Mobile equipment / requesting team's equipment / equipment provided by outside organisations

Equipment	Supplier	Number	Frequency and length of use
Oceanographic data			
Thermosalinograph and computer for data acquisition and processing	IRD – US 025	1	Continuously
XBT probe	IRD – US 025	1	Replacement for SBE19 prove or in the event of bad weather
LADCP (RDI) system + computer for data acquisition	IRD – US 025	1	At each station
3 salinity sample containers	IRD – US 025	1	At each station
Pelagic fauna			
If the EK60 is not installed on the ship, transportable SIMRAD EK 60 probe + computer for data acquisition	IRD – US 004	1	Continuously at each station
TAPs acoustic profiler	IRD – US 004	1	At each station
Equipment to filter out OPM (bottle, pump, filter)	SPC	1	At each station
WP2 - triple plankton net with flow meter	IRD – UR 103	1 frame 6 nets	At each station
IKMT micronekton net	CSIRO – Australia CENSEAM	1	At each station
Heat chamber for dry weight (zooplankton)	IRD – UR 103	1	After each sample

DOCUMENT N° 4	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

SAMPLE AND DATA ANALYSIS AND PROCESSING

Sample and data analysis and processing – on board

Oceanographic data

Physical data will be processed in part on board and in part at the IRD Centre in Noumea (TSG, CTD, LADCP and meteorological measurements on a PC). The IRD staff involved in data processing has a good deal of experience in processing this type of data, based on more than 25 oceanographic campaigns carried out in the region since 1984.

Biological data

OPM : after the water sample has been taken, it is filtered until the filter becomes clogged. The volume of water filtered is measured and the filter is kept in the freezer for analysis on land.

Zooplankton : after rinsing the nets and recovering the samples, the contents of one net will be stored in formaldehyde for identification of the species composition, while the contents of the second net will be laid out on a piece of silk to be dried in the heat chamber at 60º then frozen to determine the dry weight, and the contents of the third net will be frozen for isotope measurements. These analyses will be done on land.

Micronekton : wherever possible, samples will be sorted on board with species identification, counting the number of specimens, measuring the lengths of the specimens in sub-samples for each species (20 specimens per species), storing 20 specimens per species in the freezer for analysis on land.

Acoustics : work on board will be limited to acquiring data.

Sample and data analysis and processing – on land

Sample and data analysis and processing – on land

Oceanographic data

Physical data will be processed in part on board and in part at the IRD Centre in Noumea (TSG, CTD, LADCP and meteorological measurements on a PC). The IRD staff involved in data processing has a good deal of experience in processing this type of data, based on more than 25 oceanographic campaigns carried out in the region since 1984.

Biological data

OPM : the frozen filters will be sent to the University of Hawaii for stable carbon and nitrogen isotope measurements

Zooplankton : the samples in formaldehyde will be analysed at the CAMELIA Laboratory at IRD Noumea by an intern under the supervision of Robert Leborgne. Analysis will make it possible to determine the sample's species composition through sorting using a binocular microscope, and identification and quantification by taxa. A biomass estimate will be made by measuring the dry weight of the sample put in the heating unit. Finally, the frozen samples will be sorted by taxon and sent to the University of Hawaii to measure the stable carbon and nitrogen isotopes.

Micronekton : those samples that are not processed on board will be processed at the SPC laboratory (sorting, identification, counting, weighing and measuring). One sample of the various species will be sent to the University of Hawaii for stable carbon and nitrogen isotope measurements. The stomach contents of certain species will be examined.

Acoustics : Acoustic data will be processed by the IRD / ACAPELLA (US004) team by integrating the zooplankton and micronekton data from the nets and dragging.

DOCUMENT N° 5	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

SCIENTIFIC AND TECHNICAL TEAM

1 – Requesting team

Projet head: Bertrand Richer de Forges
Team leader: Valérie Allain

On-board team

Surname First name	**Institute Laboratory**	**Speciality**	**Responsibility and role on board**	**Responsibility and role on land**
ALLAIN Valerie	CPS/OFP Noumea	Biology/Fisheries science	Oversee biological sampling, micronekton identification	Process micronekton samples, analyse data and write mission report
MAES Christophe	IRD/LEGOS/UR065 Noumea	Physics	Oversee oceanographic data, CTD and TSG data	Process and analyse data and write mission report
VARILLON David	IRD/US25	Electronics	Oversee electronic and computer aspects	Processing and filing
SPC Assistant	SPC/OFP Noumea	Biology/Fisheries science	Assist with biological sampling	Help analyse data
JOSSE Erwan	IRD/ACAPELLA/ US004	Acoustics	Record acoustic data	Analyse acoustic data
PNG Observer	National Fisheries Authority Papua New Guinea	Fisheries Science	Assist with biological sampling and recording oceanographic data	

Land team

Surname First name	**Institute Laboratory**	**Speciality**	**Responsibility and role**	**Time spent**
Leborgne Robert	IRD/CAMELIA Noumea	Zooplankton	Analyse zooplankton data, supervision	1 month
Intern	IRD/CAMELIA Noumea	Zooplankton	Process zooplankton samples	5 months
Sanchez Caroline	SPC/OFP Noumea	Biology	Process biological samples	2 months
Leroy Bruno	SPC/OFP Noumea	Biology	Process biological samples	2 months
Popp Brian	University of Hawaii	Biochemistry / isotope	Analyse stable isotope samples	2 months
Menkes Christophe	IRD LOCEAN	Physics	Analyse physical data	2 months
Anne Lebouyrges-Dhaussy	IRD/ACAPELLA/US004	Acoustics	Analyse acoustic data	2 months

2 – Bibliography of the requesting team: 2000-2006

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3 - Collaborative efforts planned

This campaign will provide an opportunity to strengthen existing ties between SPC and IRD; these two agencies have signed an MOU. So, the data on seamounts the IRD teams acquire during the Bismarck 2008 -Benthic campaign will be used during the Pelagic campaign during which IRD and SPC staff will work together closely.

The Bismarck 2008-Pelagic campaign funded jointly by the IRD and SPC fits into SPC's "Pacific Islands Oceanic Fisheries Management Project 2005-2010 " (OFMP)[17], which is a follow-up to the "Strategic Action Programme of the Pacific Small Island Developing States 2000-2005 " project, two GEF[18].-funded studies.

SPC and the IRD play important roles in the transfer of skills to developing counties and, as part of this project, collaborative efforts will be set up with the PNG Fisheries Agency (NFA) so that they take an active part in the campaign (see Document no. 6).

CENSEAM is also going to provide support to this project; notably in terms of lending sampling equipment and providing funding for transport of the materials.

The physical oceanographic observations made as part of this proposal will supplement efforts already made as part of the international SPICE program (www.ird.nc/UR65/SPICE) under the responsibility of the World Climate Research Programme, CLIVAR/GOALS (Climate Variability and predictability / Global Ocean Atmosphere Land System). Nationally, the SPICE-France programme under the supervision of Lionel Gourdeau has been funded through the LEFE for a two-year period. We should recall that the Flusec-1 oceanographic campaign also depends on these two research programs.

[17] OFM project: http://www.ffa.int/gef/

[18] GEF : Global Environment Facility, independent financial agency of the United Nations Development Program that provides funds to developing countries for projects on the environment and sustainable management at the grassroots level.

DOCUMENT N° 6	**NAME OF CAMPAIGN :** BISMARCK 2008 – PELAGIC BP2008

INTERNATIONAL ASPECTS AND CONTRACTUAL COMMITMENTS

Distinction between work in international waters– EEZ – territorial waters

All the work will be conducted in the PNG's EEZ

Preliminary contacts

For this scientific project, initial contact has been made with Ludwig Kumoru (Fisheries Manager – Tuna) at the NFA-National Fisheries Agency (PNG fisheries agency) to inform the department of preparations for the project. A detailed project description will also be sent out.
As part of the tagging operations conducted by SPC, close collaboration has been set up between SPC and the NFA. The Bismarck 2008 project would, then, promote the excellent contacts that already exist between these two agencies.
This project will also benefit from the experience acquired by SPC during the 2006 and 2007 tagging campaigns in terms of logistics at the ports in Rabaul and Madang, whether this be for port access procedures, contacts with the authorities; water, fuel and food supplies.

Invited foreign staff

An NFA – Papua New Guinea staff member has been invited to take part in the campaign (duty travel costs funded by SPC).

Post-campaigns events

As part of the GEF-OFMP project, an information bulletin about the project will be published on that project's[19] Web site and in the SPC Fisheries Newsletter[20].

Other contractual commitments

In order to complete this study on seamounts and their impact on the pelagic environment, a sampling campaign of large pelagic fish will be carried out at the same time or shortly afterwards. SPC plans to charter a commercial longliner to fish for tuna and other large predators around the seamounts and in the zones between seamounts. The purpose of this parallel fishing campaign is to determine the impact seamounts have on fishing yields, fish sizes and the species composition of catches. In addition, biological samples will be collected to conduct isotope and stomach content analyses, which will make it possible to supplement the food chain analysis undertaken during the Bismarck 2008 campaign.

[19] http://www.ffa.int/gef/
[20] http://www.spc.int/coastfish/News/Fish_News/accueil-fish-news.htm