APPENDIX 5

STAR REPORTS

STAR CHAIR REPORT TO COUNCIL (OCTOBER 2001)

Madam Chair, Distinguished National representatives and Delegation members, representatives of Institutions and Organisations, Ladies and Gentlemen.

Introduction

STAR is SOPAC's Science, Technology and Resources Network and it interfaces between the SOPAC Secretariat and PIC members of SOPAC and the international scientific community. It does this in several ways. Every few years, an international scientific workshop or meeting is either convened by STAR, or held under its auspices, on a broad theme relevant to the SOPAC region. The last such workshop, on ENSO effects, was held in Nadi in 1999. STAR members also correspond and tender advice during the intervening year.

Each year, a meeting at which scientific papers are presented and discussed, and thematic Working Groups meet, is held in conjunction with the Annual Session of the SOPAC Governing Council. This year, as has been the arrangement for several years now, STAR met from October 17th to 18th, prior to the opening of this Council Meeting. We were pleased to have delegates from the Regional Wastewater Meeting join us during the first day, and students from the College of the Marshall Islands attended throughout. STAR presenters are compiling the material from their talks for the students.

This year, two special general meetings have been held under the auspices of STAR. They will be reported separately.

STAR Presentations

During this STAR meeting, 35 scientific papers were presented orally and a considerable number of others by the posters you see on the walls around you. Abstracts of these are published in SOPAC Miscellaneous Report 445. The eight sessions of oral presentations were chaired by John Collen, Faatoia Malele, Loren Kroenke, Keith Crook, John Bonato, Yves LaFoy, Ben Ponia and Gary Greene. Papers were grouped into the themes of Energy, Water and Sanitation, Minerals, Hazards, Tectonics and Geology, Habitats and Coastal, and Technology. As is the norm for these meetings, the information presented covered a very wide range and participants included several representatives from disciplines other than earth science. For example, papers were presented by members of the biological, engineering and legal professions in addition to the geoscientists.

Let me briefly outline the scope of the presentations for you. During the Energy sessions, papers on wave generation of electricity, geothermal power and gas hydrates in the SOPAC region, and the regional energy information database attracted considerable interest.

Papers in the Water and Sanitation section included information on various strategies in this area and on the application of GIS techniques. The minerals resources of Papua New Guinea formed another presentation.

During the Hazards sessions, several papers summarised recent work on tsunamis, including data supporting the origin of the Sissano Tsunamis as the result of a submarine slump and the potential hazards around Lae and Port Vila. Thise session ended with a paper on risk management in the region in general.

The Tectonics and Geology papers covered regional perspectives on plate tectonics, and a summary of the geology of Guam.

The Habitats and Coastal papers were wide-ranging and included general papers on issues and problems, discussion of areas with specific challenges such as Majuro and Tarawa, and more specific discussions of sedimentary processes and environmental settings.

Within this theme, a paper by Professors Neil Levy and Gary Greene on the impacts of causeway development contained a resolution that STAR recommended that I pass on to Council. This reads as follows:

"STAR recommends that SOPAC endorse the project of TAP (The Atoll Project) to study causeway impacts on atolls and encourages the implementation and fund raising to undertake such a project.

Further, STAR endorses the concept and encourages the pursuit of an inventory of causeways, current and planned, as the first year phase of the project.

The project will be undertaken by TAP, a consortium of the Moss Landing Marine Laboratories (California

State University) and Golden Gate University, School of Law, with the assistance of the SOPAC Secretariat."

The application of Information Technology permeated much of the meeting but the session specifically devoted to this covered both the increasing capacity in the region and the increasing availability of high resolution satellite imagery with the potential this brings to Pacific research. The Oceans section examined the ARGO Project, sea level change and PacificGOOS.

Working Groups

In addition to the scientific presentations, five working groups also met. These were the Energy, Hazards, Habitats and Ocean Observing Systems, Water and Wastewater, and the Coastal and Nearshore Processes Working Groups. I will report briefly on their recommendations here and the full reports will be tabled during the following TAG/Council sessions. Other Working Groups that have met in the past were not convened because of the lack of persons with appropriate expertise at this meeting.

Energy Working Group:

The Energy Working Group recommended that STAR specifically note and endorse the following points:

- That SOPAC increase its activity in identifying and evaluating appropriate prototype technologies in renewable energy that can be introduced into the region, ie - work with innovative companies / organisation / institutions to achieve the above objective.
- That SOPAC increases its activities in energy education, including students in intermediate grades. (US Geothermal Industries Corporation offered to provide educational information on geothermal energy to SOPAC).
- That consideration be given to the hosting of a Regional Energy Ministers Meeting. As appropriate, this could be combined with the proposed Joint Energy Meeting scheduled for February 2002.
- That the Energy Unit's staffing levels are marginally adequate and that Management immediately address additional staffing requirements. The objective should be to seek appointments in early 2002 so as to facilitate delivery of the energy programme and improvement in the level of service to member countries.
- That SOPAC prepare technical publications on geothermal, wave and wind energy technologies.

Further:

1) The Energy Working Group acknowledged the participation of US Geothermal Industries Corporation and Rhode Island University, noting the need to encourage member countries to seriously consider submitting papers to STAR 2002.
2) The Energy Working Group noted the preparation of the Regional Energy Policy Paper.
3) The Energy Working Group noted:
   a) the proposed Joint Regional Energy Meeting scheduled for February 2002;
   b) that SPC were taking the lead role in the coordination of the meeting as agreed; and
   c) that the venue was still to be confirmed, although the Cook Islands had reconfirmed their offer to host the meeting made at the REM2000 in Kiribati.

The Water Working Group:

The group reviewed the recommendations that were put to Council by the Water Working Group in 2000. Clive Carpenter of SOPAC WRU introduced the participants to the Water Resources Unit Strategy for Water and Sanitation, the Pacific Wastewater Policy Statement and the Pacific Wastewater Framework for Action. The group, mainly comprised of Pacific islanders, provide a positive feedback towards the development of such activities on a national level.

Recommendations:

- The group took note of SOPAC's Water Resources Unit Strategy for Water and Sanitation and recommends strongly that Council endorse it as an important document for the further development of the Water Resources Activities.
- The group took note of the Pacific Wastewater Policy Statement and the Pacific Wastewater Framework for Action, and recommends strongly that Council endorse both documents.
- The group, in addition, recommends that Council note the recommendations made during the Regional Wastewater Meeting held 10-15 October 2001, including:

1) The recommendation that a Pacific Wastewater Focal Group be established to continue the dialogue on wastewater in the region; and

2) The recommendation that Pacific Island Countries develop National Frameworks for Action and establish National Wastewater Focal Groups.

- The group recommends to Council that SOPAC take a lead in collaboration with SPREP and the Pacific Wastewater Focal Group in mobilising funds that will be made available through the Global Programme for Action (GPA) to implement demonstration projects on wastewater in the region.

- The Group took note of the recommendations of the UNEP-funded workshop on Environmentally Sound Technologies for the Integrated Management of Solid, Liquid and Hazardous Waste for Small Island Developing States in the Pacific held in Majuro from 16-19 October 2001. The Group recommends to Council that SOPAC initiate further activities in this field, including research and dissemination of information in the Pacific region on Environmentally Sound Technologies.

The Hazards Working Group:

The Hazards Working Group reviewed the second version of the report "Site specific earthquake hazard determination in the capital cities of the South Pacific" which was tabled by Graham Shorten. This fulfils the recommendation of last years working group.

- As in the two previous years, the Working Group recommends that an array of Pacific seismograph stations is urgently needed along with the establishment of a Regional Centre for Applied Seismology to better determine the seismic hazard facing the Pacific Islands. The Working Group heard that the Director of Seismology at the Geophysical Institute of Israel has offered to utilise a year of sabbatical leave in 2002 to help in the establishment of the Centre. The Working Group recommends that the most effective approach for funding might be to seek participation of JICA to complement its existing activities in setting up telemetered seismic arrays in PIC's. The Working Group recommends that member nations form a consortium of interested parties to seek and combine bilateral funds from JICA for this regional project.

- With respect to locally-generated tsunami, the Working Group recommends that SOPAC carry out a shallow-water swath bathymetry survey along the northern PNG coast (as in year's Working Group recommendations) to complement the deep water cruises already carried out by Japan. The survey would greatly aid in the investigation of the transmission mechanism of the Sissano tsunami. Similarly the Working Group recommends surveys in other areas prone to tsunami (eg. Mele Bay, Vanuatu, and the Solomon Islands) as part of a coordinated regional program of investigation.

- The Working Group recommends that the Pacific Cities urban hazard and risk assessment project be extended to include Lae and Madang, PNG.

- The Working Group recommends that an onshore seismic reflection survey be conducted in the Lae region, in order to test the hypothesis of Keith Crook that Lae is located astride a plate boundary.

- The Working Group recommends that continuous global positioning systems (C-GPS) stations be established on selected Micronesian atolls to investigate their vertical motion due to tectonic uplift/subsidence.

The Coastal and Nearshore Processes Working Group:

The working group reviewed the recommendations of the 2000 Working Group and discussed the papers presented during the STAR session to assess progress made during the past year and to suggest new activities.

Chunting Xue and Russell Howorth's presentation on the coastal geology of Majuro and the publicized controversy over aggregate dredging and mining in Majuro underscored the importance of exploration for, evaluation and utilisation of sand and aggregate resources. The Working Group agreed that in addition to the recommendations of the previous year, an important step concerning the supply and use of aggregate was the inclusion of specific requirements in the formulation and pre-implementation stages of construction projects. Robert Smith's investigations of the offshore shelf deposits in atolls were discussed. While the group recognised that the expansion of such work to other offshore locations was obviously needed, the group also discussed the technology that was already available to exploit such resources and that it was well-utilized in the islands of the Indian Ocean. Economic or business decisions were identified as a primary constraint to the adoption of such technologies in the pacific island nations. Similarly the group noted that Pacific island nations should include aggregate export and import within the context of trade and technical cooperation.

Discussions of the aggregate and sand supply assessments led to the recognition of progress made

by John Collen and colleagues towards characterising the origin, composition and distribution of sediment deposits in lagoonal systems through their work in Tuvalu and other areas. Because an understanding of production and loss mechanisms, particularly the rates of such mechanisms, was critical to the sustainable harvesting of sand resources and the estimation of impacts, the group agreed that research should progress towards tackling this issue.

The Working Group noted that the acquisition of the multi-beam and side-scan systems had made survey work much more efficient. The purchase of advanced software would be necessary as more and complex data were collected over a shorter time. Robert Smith and Simon Young's recent work in Manihiki, Cook Islands, showed that, the multi-beam systems were very effective when supplemented with remote sensing data.

It was pointed out that just as different technologies used collectively yielded desirable results so also a multi-disciplinary approach would likely produce a more informative output. The group recognised that the island management system demanded such an approach towards research. It was noted that the multi-beam work and the sediment characterisation work were elements of such an approach and may have been more useful if they had been performed at one location.

The progress made regarding the involvement of students in research was also discussed briefly to answer questions raised by last year's Working Group. Two students were helping at SOPAC and three students had been involved in research with John Collen. More students were likely to be involved in the next year.

The group recognised that the "approval" of projects usually preceded the information developed through the environmental impact assessment. It was pointed out that this led to a negative perception about the usefulness of the EIA as a tool that was beneficial to government, society and the developer. The group also considered the role of culture and of the uniform application of the EIA system. It was suggested that the difficulties usually arose primarily because of inappropriate sequence of actions rather than the EIA process itself. The expense of EIA was viewed as a cost of the project to be borne by the proponent as a normal practice.

Reclamation was discussed in view of its successful application in Maldives and Singapore, its intrinsic value and as an alternative to "band-aid" solutions. It was considered applicable in some locations and would take some time to be adopted on a large scale. The group linked habitat identification and delineation and its implications towards zoning of areas of the lagoon. Such a zoning system may include off-limit areas for dredging and delineate areas open for dredging similar to the concept applied for marine parks and reserves.

The Working Group recommended:

- exploration and identification of sand and aggregate resources to be continued.
- identified alternative aggregate and sand resources be used.
- technologies for utilisation of offshore deposits to be considered for adoption.
- project documents and tender documents should consider the source and quantities of aggregate and sand.
- software and hardware related to multi-beam, sidescan and remote sensing continue to be acquired to maintain a cutting edge and to make data processing efficient.
- research related to sediment supply, movement and loss in nearshore regimes in islands be prioritised.
- environmental assessment be emphasised as an essential and beneficial tool for developers and society, particularly in small island nations.
- beach profiling training be expanded to include the use and interpretation of data.
- reclamation of suitable large areas be explored to enhance engineered living areas.
- response actions be developed, disseminated and practised for vessels grounded in nearshore environments.
- research programs be developed to support integrative multi-disciplinary approaches towards aggregate supply, habitat characterisation and use of lagoonal systems.

Habitats and in Ocean Observing Systems:

Members with interests in Habitats and in Global Ocean Observing Systems met together.

- The Working Group discussed accessing EU funding for a regional conference related to GOOS and marine habitat science objectives, and recommended that SOPAC investigate obtaining funds for holding such a conference.
- Recognising the need for understanding fisheries and other biological habitats and noting that SOPAC has the ability to compile existing geological, geophysical and remote sensing data

sets that can be used to characterise marine benthic habitats, the Working Group recommended that SOPAC initiate a Marine Benthic Habitat Program.

- Further, the Working Group noted that much of the recently collected multibeam bathymetric and backscatter data could be easily converted to habitat maps.

- To conform with other Pacific habitat mapping projects, and to standardise habitat classification within a GIS, the Working Group recommended that SOPAC undertake a review of existing schemes from the US and Australia. A pilot study could be carried out using existing data sets (e.g. Port Villa).

- The Working Group was informed of an international marine habitat mapping workshop to be held at the Moss Landing Marine Laboratories in California from 1-4 May 2002. The Working Group encouraged all interested in benthic habitat mapping techniques to attend.

- The Working Group encourages the application of interdisciplinary participation in marine science surveys and studies which multi-task objectives (eg geohazards assessment, habitat characterisation, physical oceanography). The Working Group recommended that SOPAC includes biological and seabed geological sampling and photography as an integrated part of future swath bathymetry surveys to increase their value for benthic habitat studies.

- The Working Group recommends that SOPAC seeks to actively co-operate with those CROP organisations that have a living marine resources mandate (such as SPC, FFA, USP and SPREP) and relevant NGOs (such as TNC and WWF) to develop interdisciplinary (biological-geological-oceanographic) teams that can work together for the benefit of sustaining regional fisheries.

- In addition, the Working Group notes that physical oceanographic programs such as GOOS may contribute significant data useful to habitat assessment and the Working Group encourages SOPAC to facilitate multidisciplinary approaches to habitat mapping.

General Meetings

This year, and I believe that this is an important development, STAR also convened two general meetings to discuss scientific issues that are regional in nature. The first meeting dealt with global climate change and sea level rise (Supplement 1), and the second with the issue of World War Two wrecks (Supplement 2), including that of the USS *Mississinewa* in Ulithi Atoll, FSM. Reports of both meetings are attached to this report as supplements.

STAR Business Meeting

The STAR Business Meeting elected myself to continue as Chair of STAR for the coming years and Mr Faatoia Malele, Deputy Director of the Meteorology Division of Samoa, to continue as Vice-Chair of STAR.

General Comments from Chair of STAR

The organisation of STAR was disrupted this year by travel and other difficulties that caused a number of delegates to withdraw at a fairly late stage. However, this simply exacerbated a trend that has been apparent for several years, which is the reduction in the number of papers presented by scientists based outside the region. The reasons for this are varied – many revolve around funding difficulties.

I must compliment SOPAC staff and other scientists from within the region on rising to the occasion and making many extremely valuable presentations. This is not a platitude – much of the information presented is extremely exciting. I hope that this will continue; however, I am also committed to getting as many scientists from outside the region to these meetings as possible in order to expand the scientific base available and will begin planning for next year's meeting immediately I finish here. To that end, I must thank Nauru for their early notification of the dates and venue for next year's meeting. Perhaps I should note that international conferences are now planned up to 18 months or more ahead, and many scientists need this amount of lead-time to plan their schedules and arrange funding.

At this point, I would appreciate this opportunity to convey some personal impressions of this STAR meeting. The first is the clearly applied direction to much of the research. I raised this observation last year as, although this has always been a particular feature of STAR, it is becoming more clearly articulated and was apparent in most presentations. It is also obvious from even a cursory glance at the posters around the walls. This aspect was certainly enhanced by the increased contribution from SOPAC staff.

STAR discussions, and indeed the entire contents of the two specials sessions, were often regional in nature and are becoming more directed towards the provision of quality technical advice to member governments. This seems to me to be in the spirit of the opening remarks made by President Note and

also by yourself, Madam Chair. It is also explicit in the resolution regarding causeways that I submitted to you earlier in this address.

My last observation is also one I raised last year. As I said then, it is clear that the work of SOPAC, important though it is to the region, would also be of inestimable value to the wider scientific community. This year's presentations by SOPAC staff have strongly reinforced my view on this. Those of us who are aware of this work can access it through SOPAC's publications but much of the scientific world is less informed. I would again urge SOPAC staff to consider publishing the results of their work in international scientific journals or as books so that it reaches a wider audience and perhaps corrects some of the imbalances that we know exist in the scientific literature. During the past year I have discussed this issue with a number of STAR colleagues and all of us would be happy to assist, by advising on appropriate formats and journals, by helping edit material, and so on.

As usual, STAR is indebted to staff of the SOPAC Secretariat for their cheerful efforts that make the meeting possible. And finally, Madam Chair, may I take this opportunity on behalf of STAR to thank our hosts, the Government and people of the Marshall Islands, for the hospitality shown to all of us during our stay here so far. It is very much appreciated.

That concludes my address. Thank you.

John Collen/Chair, Science Technology and Resources Network (STAR), Majuro, 20 October 2001

SUPPLEMENT 1

Report on the Group Discussion on Global Climate Change and Sea-Level Rise

1. Background:

In a 27th September 2001 email to SOPAC Senior Technical Advisers, on "Global Warming – Pre-Majuro" Alf Simpson (Director of SOPAC) wrote:

"In Majuro I think in behoves such a gathering as SOPAC's Annual Session (and STAR) to firstly help in determining where we should stand on the issue and where we should contribute to the debate. We need to recognise that SPREP and the Pacific Island Forum (PIF) have looked to leadership on the subject. Secondly, if we can find the time, I think such a gathering of scientists should attempt to objectively and dispassionately talk about the scientific issues with our member country reps and in particular those from Majuro. At the very minimum we might look at Graham's information sheet, which he provided for a local newspaper, and review/edit/strengthen it. It could provide a base in which we have consensus and which we can then use to develop SOPAC's policy or approach".

2. Briefing Document:

A 24-point briefing document "Information from Daily Post re Fiji", prepared by Graham Shorten of SOPAC, was attached to Alf Simpson's message, as an aid to the discussion. That document is 'Attachment A' to this report. It was distributed at the group discussion.

3. Themes Developed During the Discussion:

3.1 The Focus of SOPAC's Response: The issue of Global Climate Change/Sea Level Rise (GCC/SLR) is very sensitive politically. High quality information on effects in the SOPAC region is not readily available to decision makers, let alone the general public. Mis-information is not uncommon, and some disinformation has been distributed. SOPAC should focus on the **scientific** aspects of GCC/SLR : the data and their implications. A concerted effort to collect certain relevant data will probably be requested.

3.2 Scope of the Problem: SOPAC has had sea level rise on its plate since the 1987 Lae Workshop, at least. Locally, sea level rise (or fall) can be caused by earth movements that are unrelated to global climate change.

Understanding the GCC/SLR problem requires scientific input of many kinds, from several scientific disciplines, over a range of time scales, covering the 37.5 million km^2 SOPAC area and beyond. The input needed will come from many fields – climatology, meteorology, oceanography, geophysics, tectonics, geomorphology, sedimentology and marine biology, at least.

Information from these fields of study will form the database needed to determine the regional and local effects of GCC/SLR. Once the effects are identified, or have been reliably predicted, local and regional responses can be developed, and prioritised, to mitigate or manage the problems arising from GCC/SLR.

Consideration of the effects of GCC/SLR, and the responses to it, will involve experts in engineering, water, energy and other fields of technology and applied science.

3.3 Response to IPCC Requests: The IPCC has called for input from PICs on GCC/SLR. SOPAC can assist

PICs providing access to reliable scientific and technical data within its area of expertise, that bear on the problem. SOPAC's Water and Energy programs are important in assisting PICs to adapt to problems arising from GCC/SLR. SOPAC can thereby service certain GCC/SLR information needs of policy makers and others who represent the Pacific region.

3.4 SOPAC's Role: SOPAC was seen as the logical organisation to maintain or provide access to ocean and earth science and other technical databases applicable to GCC/SLR issues affecting PICs. Such databases, components of which are based outside the SOPAC region, could then be accessed remotely by PICs and other CROP agencies when needed.

4. Recommendation

The STAR meeting to be held in Nauru in 2002 should be lengthened to at least four days and begin with a special GCC/SLR symposium and workshop. The workshop will review GCC/SLR ocean and earth science data, seek to identify regional and local effects of GCC/SLR, and to highlight data inadequacies. It will provide advice on the range of scientific and technical data, and databases, required to support SOPAC's responses to the GCC/SLR needs of PICs. The meeting may also make recommendations to the SOPAC Governing Council on SOPAC's future roles in relation to GCC/SLR issues.

If logistic or flight scheduling problems prevent such an extension to the STAR meeting, the GCC/SLR symposium and workshop could be held in Nadi immediately before the 31st Annual Session of SOPAC in Nauru. The latter would include the regular 2-day STAR meeting.

5. Addendum for noting

The Pacific Islands Forum has adopted a "Pacific Islands Framework for Action on Climate Change, Climate Variability and Sea Level Rise", which was approved at a meeting of CROP organisations (including SOPAC) held during 2000. This "Framework for Action" is relevant for determining SOPAC's future roles in relation to GCC/SLR issues.

Keith A W Crook/Chair and Rapporteur

Addendum to Supplement 1

GLOBAL WARMING INFORMATION PRODUCED FOR DAILY POST, FIJI

1. It is a demonstrated fact that the levels of carbon dioxide have increased significantly in the Earth's atmosphere since the 19th Century Industrial Revolution

2. It is widely believed that higher levels of carbon dioxide can cause a 'greenhouse effect'; warming the Earth's atmosphere and oceans

3. The anthropogenic greenhouse effect does not account for all the possible warming that has occurred or may occur in the future

4. The annual global mean surface temperature of the Earth has increased by about 0.06ºC per decade since 1900

5. In the 20-year period 1978-1997 the mean surface temperature increase has been 0.16ºC per decade

6. Some of the warming is a carry-over from the general warming that has occurred in the 10,000 years since the last Ice Age, while some warming (up to 0.10 ºC per decade) has occurred as a result of increasing urbanization and land-use change over time and other anthropogenic effects

7. Changing solar radiation since 1900 may have contributed to about half of the observed warming of the Earth's surface over the last 100 years

8. If the Earth's oceans are warmed they will expand and generally sea level will rise

9. Based on numerical modelling predictions, an internationally-recognised panel of climate experts (IPCC - Intergovernmental Panel on Climate Change) has suggested a range of scenarios where the average global sea level will rise by some centimetres over the next ten years (look up the internet to find latest predictions of IPCC's Third Report in 2001)

10. Whether or not, and by how much, sea level rises or falls at **any particular locality** depends not only on how much the global ocean expands, but also on whether that locality is moving up or down relative to the centre of the Earth due to local effects of tectonics (faulting, subsidence or uplift) and isostasy (buoyancy response)

11. In other words, the net sea-level rise or fall is relative and local, and depends on a number of factors, for any location on the Earth's surface - this aspect is recognized in Phase III of the AusAID Pacific Island Sea-Level Information Project

12. Many localities in the high latitudes of the northern hemisphere that were under the great ice sheets of the last Ice Age are still rebounding upwards elastically since the ice was removed (glacio-isostasy) - those places will continue to experience a local sea-level fall despite any expansion of the ocean

13. Many submerged island and continental shelf areas continue to be depressed by the increase in water load (hydro-isostasy) that came about as global sea levels rose about 100 m as the ice melted from the last Ice Age - this major melting event finished some 4-6,000 years ago

14. There is now evidence to suggest that global warming and large-scale melting of the ice caps has in the past, and may in the future, eventually upset some ocean circulation patterns and result in cooling events and mini ice ages in certain localities

15. Some places in Fiji will be affected by rising sea levels in the future - exactly how much depends on the balance between ocean expansion and local tectonics and isostasy

16. There is still uncertainty relating global warming to an increasing trend in extreme weather events. Available climate data do not show any significant or consistent increasing trend in extreme weather events

17. In the quarter century since the mid-1970s, El Niño events were relatively more frequent, resulting in significant climatic impacts on Pacific Island Countries including drought and coastal erosion. It is uncertain, however, whether there will be a significant change in the size or frequency of ENSO events in the future

18. There is however a definite and rapidly increasing global trend of economic loss from catastrophes, largely climate-related, on account of population growth in major cities and in marginal lands (including low-lying coastal lands) and the increasing concentration of property values. This trend will continue in Fiji as well as globally

19. Climatic effects related to the ENSO phenomenon and to possible global warming will impact Fiji in the future

20. These impacts will include short-term variations in regional sea level at least as great as the long-term predicted greenhouse sea-level rise, coastal erosion, tropical cyclone effects including damaging storm waves, storm surge and storm winds, flooding, changes in rainfall regimes and soil moisture budgets, droughts and loss or reduction of groundwater resources and consequential economic, social and environmental impacts.

21. To address these impacts, Fiji has to overcome the barriers ranged against it including limited capacity to respond to disasters, lack of information and knowledge, lack of local capacity and high dependence on overseas suppliers, disconnected organizations and institutional relationships and access to financial means

22. One way to increase information and knowledge about the effects of global warming is to support and foster ocean research through climate monitoring buoys in the Pacific

23. The best way to make any such effects less severe is to institute good coastal planning in Fiji, including planning for the protection of groundwater supplies, planning for urban development and coastal development and protection

24. The experience of other countries proves that one very important, and perhaps the most efficient and effective, aspect to good coastal planning is often to leave a buffer of undeveloped and unexploited land in the coastal zone in order to absorb the normal effects of climatic variability, not to mention any potential effects of future sea-level rise

SUPPLEMENT 2

Report on the World War II Wrecks Meeting

Federated States of Micronesia (FSM) concerns about the wreck of the USS *Mississinewa* in Ulithi Lagoon, Yap State, FSM and their desire to see the whole issue of war wrecks treated on a regional basis were conveyed to me as Chair of STAR a month or so ago. I circulated information on the issue to STAR members worldwide and arranged a special meeting to discuss the issues under the auspices of STAR.

As background, the USS *Mississinewa* was a United States fleet tanker that was sunk in 1944. The wreck was found in April this year, upside down in 36 m of water. After the passage of a typhoon through the area in July, the wreck began to leak oil into the lagoon. The leaks were patched by US Navy divers in August but the wreck still contains an estimated 9.6 million gallons of heavy bunker oil.

The meeting discussed a very wide range of issues relating to the issue in general and the *Mississinewa* wreck in particular. These covered scientific, technical, engineering, political and legal areas, and some of the items raised, in no particular order of importance, were:

- The significance of spill oil to carbonate-producing organisms;
- The nature and behaviour of bunker oil in sea water, and biodegradation of the oil;
- The importance of data on the physical condition, actual siting and oceanographic setting of wrecks;
- Other hazardous materials, such as picric acid leaching from explosives;
- Damage to and monitoring of Ulithi Lagoon;
- Wreckage within Chuuk Lagoon;
- Accumulations of wartime munitions other than wrecked ships;
- SOPAC's past work on wrecks in Iron Bottom Sound in the Solomons;
- The location of oil spill containment equipment in the region;
- Responsibilities and liabilities;
- The capacity of FSM to respond to a major oil spill.

It became clear during the course of the discussion that participants felt:

1) that the specific and general issues should be treated separately;
2) that there was no single organisation responsible for the issue or taking a lead in tackling it, but that it was appropriate that SOPAC / STAR at least contribute to the issue;
3) that there was a general lack of knowledge on the distribution and significance of WWII wreckage throughout the region but that compiling an accurate database on these would not necessarily be straightforward;
4) data from past Pacific oil spills and their effects should be compiled to assist planning;
5) attempting to deal with all potentially hazardous wrecks in the region is a very large undertaking that is prohibitively expensive at present;
6) the Ulithi situation is urgent, and clearly falls within the ambit of SOPAC's Disaster Management Unit;
7) regional progress requires the involvement of all stakeholders; and
8) a political solution is ultimately required.

The consensus of the meeting was that the Disaster Management Unit could assist immediately, by looking at the practicalities of containing an oil spill at Ulithi. The solution would be advanced by the SOPAC Work Program currently being investigated for the area. During this, swath mapping, water current measurements and so on would focus on Ulithi and Chuuk lagoons.