CRISP
Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique

SPC
Secretariat of the Pacific Community

SPREP
PROE

WORKSHOP PROCEEDINGS

Regional Workshop

"INVESTING IN CORAL REEF: IS IT WORTH IT?"

22-25 November 2010

Secretariat of the Pacific Community, Noumea, New Caledonia

With technical and funding support from:

CRIOBE EPHE - CNRS POLYNESIE

Agence des aires marines protégées

IUCN

afd AGENCE FRANÇAISE DE DÉVELOPPEMENT

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
FONDS PACIFIQUE

CRISP

Coral Reef InitiativeS for the Pacific
Initiatives Corail pour le Pacifique

The CRISP Coordinating Unit (CCU) was integrated into the Secretariat of the Pacific Community in April 2008 to insure maximum coordination and synergy in work relating to coral reef management in the region.

The CRISP Programme is implemented as part of the policy developed by the Secretariat of the Pacific Regional Environment Programme to contribute to the conservation and sustainable development of coral reefs in the Pacific.

The Initiative for the Protection and Management of Coral Reefs in the Pacific (CRISP), sponsored by France and established by the French Development Agency (AFD), is part of an inter-ministerial project that began in 2002. CRISP aims to develop a vision for the future of these unique ecosystems and the communities that depend on them and to introduce strategies and projects to conserve their biodiversity, while developing the economic and environmental services that they provide both locally and globally. CRISP also, has a role in fostering greater integration in this area between developed countries (Australia, New Zealand, Japan, USA), French overseas territories and Pacific Island developing countries.

The initiative follows a specific approach designed to:
- associate networking activities and fieldwork projects;
- bring together research, management and development endeavours;
- combine the contributions of a range of scientific disciplines, including biology, ecology, economics, law and social sciences;
- address the various land and marine factors affecting coral reefs (including watershed rehabilitation and management);
- avoid setting up any new body but supply financial resources to already operational partners wishing to develop their activities in a spirit of regional cooperation. This is why the initiative was established on the basis of a call for proposals to all institutions and networks.

CRISP Coordinating Unit (CCU)
Programme Manager: Eric CLUA
SPC - PO Box D5
98848 Noumea Cedex
New Caledonia
Tel./Fax: (687) 26 54 71
E-mail: ericc@spc.int
www.crisponline.net

This approach is articulated through a series of thematic objectives:
Objective 1: Improved knowledge of the biodiversity, status and functioning of coral ecosystems.
Objective 2: Protection and management of coral ecosystems on a significant scale.
Objective 3: Development of the economic potential represented by the use values and biodiversity of coral ecosystems.
Objective 4: Dissemination of information and know-ledge; and capacitybuilding and leadership with local, national and international networks.

The CRISP Programme comprises three major components:
Component 1A: Integrated coastal management and watershed management
- 1A1: Marine biodiversity conservation planning
- 1A2: Marine Protected Areas
- 1A3: Institutional strengthening and networking
- 1A4: Integrated coastal reef zone and watershed management

Component 2: Development of coral ecosystems
- 2A: Knowledge, beneficial use and management of coral ecosytems
- 2B: Reef rehabilitation
- 2C: Development of active marine substances
- 2D: Development of regional data base (ReefBase Pacific)

Component 3: Programme coordination and development
- 3A: Capitalisation, value-adding and extension of CRISP programme activities
- 3B: Coordination, promotion and development of the CRISP programme
- 3C: Support to alternative livelihoods
- 3D: Vulnerability of ecosystems and species
- 3E: Economic task force

CRISP is funded by the following partners:

Economic valuation of coral reef management for improved livelihoods in the Pacific: Investigating and communicating the factors that lead to success

Workshop proceedings

Introduction

From 22-26 November 2010, the Coral Reef Initiatives for the Pacific (CRISP) Coordinating Unit convened a workshop of some two dozen leading regional researchers and local policy-makers in New Caledonia. The workshop was financially supported by the French Pacific Fund (SPP) and was offered in partnership with the General Secretariat of the Pacific Community (CPS), the International Union for Conservation of Nature (IUCN), the Institute for Pacific Coral Reefs (ICRI), and the South Pacific Regional Environment Program (SPREP).

The title of the workshop "Investing in coral reefs: Is it worth it?"' was refined through an expert forum and specified during the week to reflect the role of economic valuation in coral reef management with the objective of improving the welfare of Pacific islanders. As a result, the objectives of the workshop were: 1) to report the results of economic valuation assessments of coastal marine management in human development in the region; 2) to discuss the dimensions of standard economic valuation techniques that require adaptation to the region; and 3) to enhance the communication between researchers and policy makers such that economic valuation research results are best suited for local policy decision-making.

Day 1 of the workshop provided the global context of economic valuation of coral reef ecosystems and a brief overview of related research conducted by participants. Day 2 explored the use and usefulness of Total Economic Valuation for decision-making in the Pacific. Day 3 discussions surrounded the use of economic valuation information in benefit-cost analysis (SBCA) of marine and coastal zone development projects. Days 4 & 5 sought to improve the usefulness of economic valuation research results focused on coral reefs in the Pacific to decision makers and managers and to discuss innovative conservation finance approaches appropriate to the region.

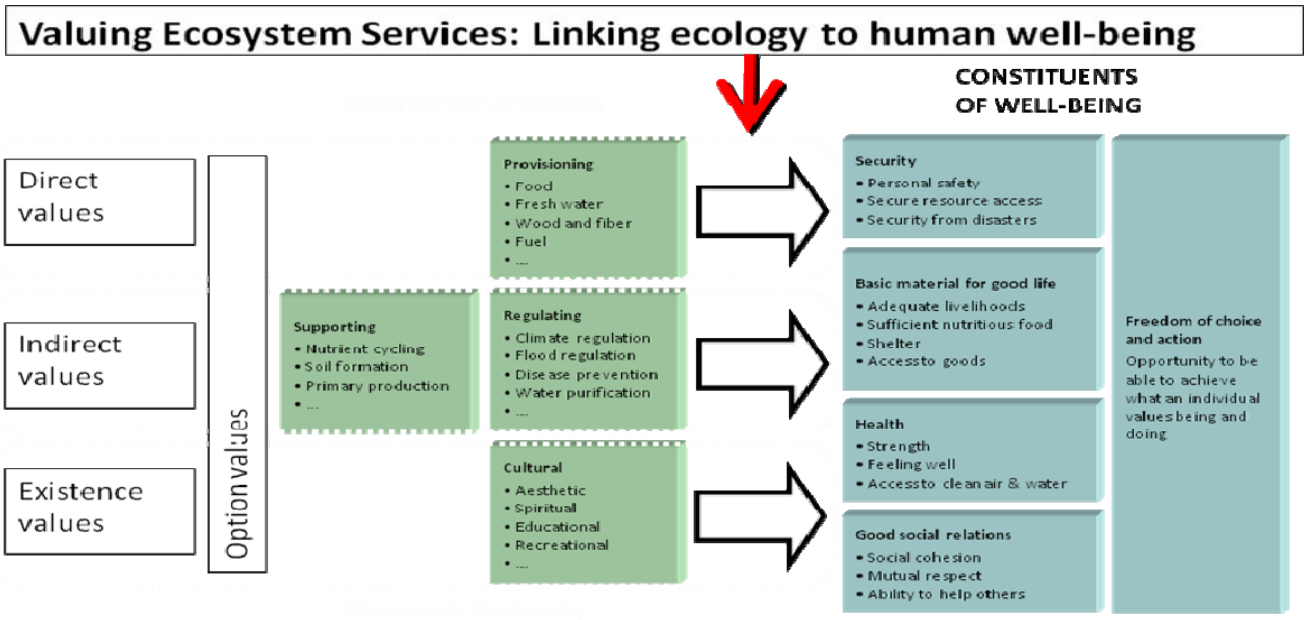
We do not hope to review economic valuation and benefit-cost analysis methods in general. This has already been done more than adequately in the TEEB project (www.teebweb.org). Here, we hope to begin from where TEEB leaves off, adding to the case history in a relatively understudied region, management regime and ecosystem, recommending any particularities of the region for the application of economic valuation methods, and synthesizing the lessons learnt on the interface between economic valuation, marine protected areas and livelihoods in the Pacific. This workshop report reviews the results, recommendations and conclusions of the week's proceedings.

Economics of coral reefs and island livelihoods in the Pacific: Global context

In the first day of the workshop more than two dozen presentations and ensuing discussions focused on the current state of knowledge of coral reef valuation, policy and management. Workshop participants sought to review and synthesize the global literature on coral reef valuation within the context of marine management in the Pacific. In essence, the workshop reviewed the case literature that indicates under what conditions economic valuation can provide policy relevant information as to whether imposing an active management structure, relative to more open access or passive management approaches, on a coral reef ecosystem improves local economic conditions. That is, are local people better off due to the management of marine ecosystems or are they not?

Economic valuation tools have been applied relatively sparingly to coral reefs and marine protected areas relative to their terrestrial counterparts. However, a significant case history has begun to emerge in recent years (Cesar and Chong, 2006). Like all cases of economic valuation, coral reef valuation is justified by market failure (Balmford et al., 2002). The sources of the market's failure to appropriate incorporate the value of ecosystem services from coral reefs include (Beukering et al., 2007):

- coastal overfishing,
- uncompensated reef damage by tourists or construction,
- negative externalities of terrestrial activities affecting water quality and reef health,
- unrecognized values of reefs for storm protection as costs avoided or economic opportunities foregone due to unenlightened reef management,
- traditional uses and cultural values, and
- other potential biodiversity and ecosystem service benefits or opportunities that are not accurately reflected in the marketplace.



Source: Millennium Ecosystem Assessment 2005

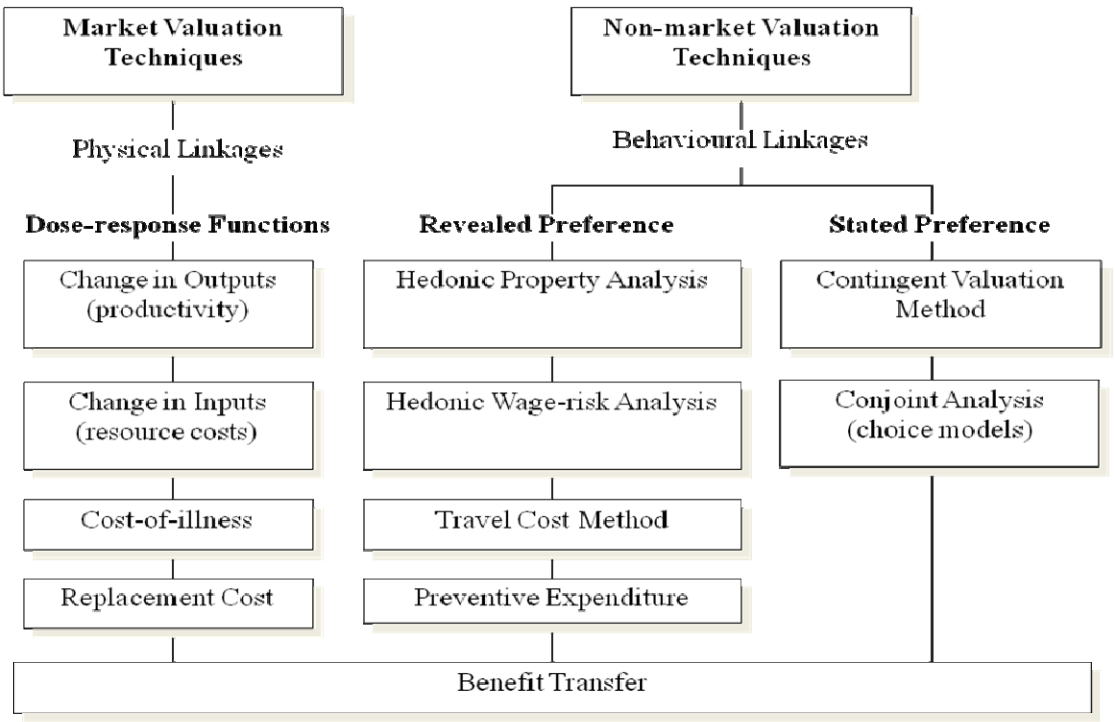
The economic valuation of coral reefs and MPAs has been motivated by all of the typical factors in the broader valuation literature (Pagiola, 2004): provide more 'correct' signals about the implications of resource use when the market fails to do so; compare valuable stocks & flows of resources with a common metric; improve decision making when tradeoffs are necessary; raise awareness of the role of ecosystems in human well being; provide a basis for policy formation and analysis; and help us to measure better so that we can manage better. For example, economic valuation research on coral reefs and MPAs were used:

- as ex ante or ex post justifications of the presence of MPAs,

- to analyze MPA performance or police effectiveness,
- to develop new decision tools, and
- for estimating the potential profitability projects.

As a result, the valuation tools employed have covered the full gamut of alternatives including:

- Total Economic Valuation (TEV) covering a selection of ecosystem services valuation with different techniques (e.g. choice experiments (contingent valuation, contingent behavior), travel cost analyses and hedonic price analysis)
- damage cost estimations for environmental impact valuations,
- biophysical approaches to link ecological process with ecosystem services,
- conceptual models and adaptive management for supporting decision-making,
- alternative livelihoods approaches and opportunity costs to reflect resource dependancy



As Table A5.2 shows, based on 101 data points, the total monetary value of the potential sustainable use of all services of coral reefs combined varies between 14 and 1,195,478 Int.$/ha/year. This excludes three services for which only one value was found (which would add over 200.000 Int$/ha/year to the total value, mainly from erosion-prevention).

Table A5.2 Monetary value of services provided by Coral reefs
(in Int.$/ha/year-2007 values)

	Coral reefs	No. of used Estimates	Minimum Values (Int$/ha/y)	Maximum Values (Int$/ha/y)	*No. of Single estimates*	*Single values Int$/ha/y)*
	TOTAL:	**101**	**14**	**1,195,478**	***3***	***206,873***
	PROVISIONING SERVICES	**33**	**6**	**20,892**	***1***	***20,078***
1	Food	22	0	3,752		
3	Raw materials	6	0	16,792		
4	Genetic resources				*1*	*20,078*
5	Medicinal resources	?				
6	Ornamental resources	5	6	348		
	REGULATING SERVICES	**17**	**8**	**33,640**	***2***	***186,795***
7	Influence on air quality	?				
8	Climate regulation				*1*	*627*
9	Moderation of extreme events	13	2	33,556		
11	Waste treatment / water purification	2	5	77		
12	Erosion prevention				*1*	*186,168*
13	Nutrient cycling	?				
15	Biological control	2	1	7		
	HABITAT SERVICES	**8**	**0**	**56,137**	***0***	***0***
16	Lifecycle maintenance (esp. nursery service)	?				
17	Gene pool protection (conservation)	8	0	56,137		
	CULTURAL SERVICES	**43**	**0**	**1,084,809**	***0***	***0***
18	Aesthetic information	12	0	27,317		
19	Opportunities for recreation and tourism	31	0	1,057,492		
20	Inspiration for culture, art and design	?				
21	Spiritual experience	?				
22	cognitive information (education and science)	?				

Source: TEEB, Chapter 5, Appendix C. (Groot et al., 2010)

In part due to the differing motivations of the valuation studies and the tools employed, research results are not always policy relevant. There is an observed tendency for the economic valuation hammer to be wielded to fix all manner of development challenges. Workshop participants fully recognize the power of economic valuation information. However, they caution that economic values are only part of the information set needed to inform decision-making and that some decisions do not depend on economic information or economic policy instruments. In an environment with a pressing need for policy relevant information, there is a particular premium on appropriately crafted applied science, potentially at a cost or loss to more pure ('bench') scientific inquiry. There is a perceived need to be able to communicate research results to at least three audiences: academics, policy-makers, and the public, including the business community, in this environment.

In general, high quality analyses require high quality data. Policy relevant studies of coral reefs and their management require consistent ecological and economic data at the appropriate spatial scale, measuring the most important indicators of influence and importance, over an ecologically, economically and politically appropriate time frame. Relevant ecological and economic data quality and quantity is a persistent concern worldwide, particularly in developing countries. A lack of adequate expertise and capacity to undertake economic valuation studies within the developing country context is another challenge facing decision-makers and analysts in developing countries. In addition, scientifically rigorous studies are typically both time consuming and expensive. Ex-post studies, for example, are dependent on

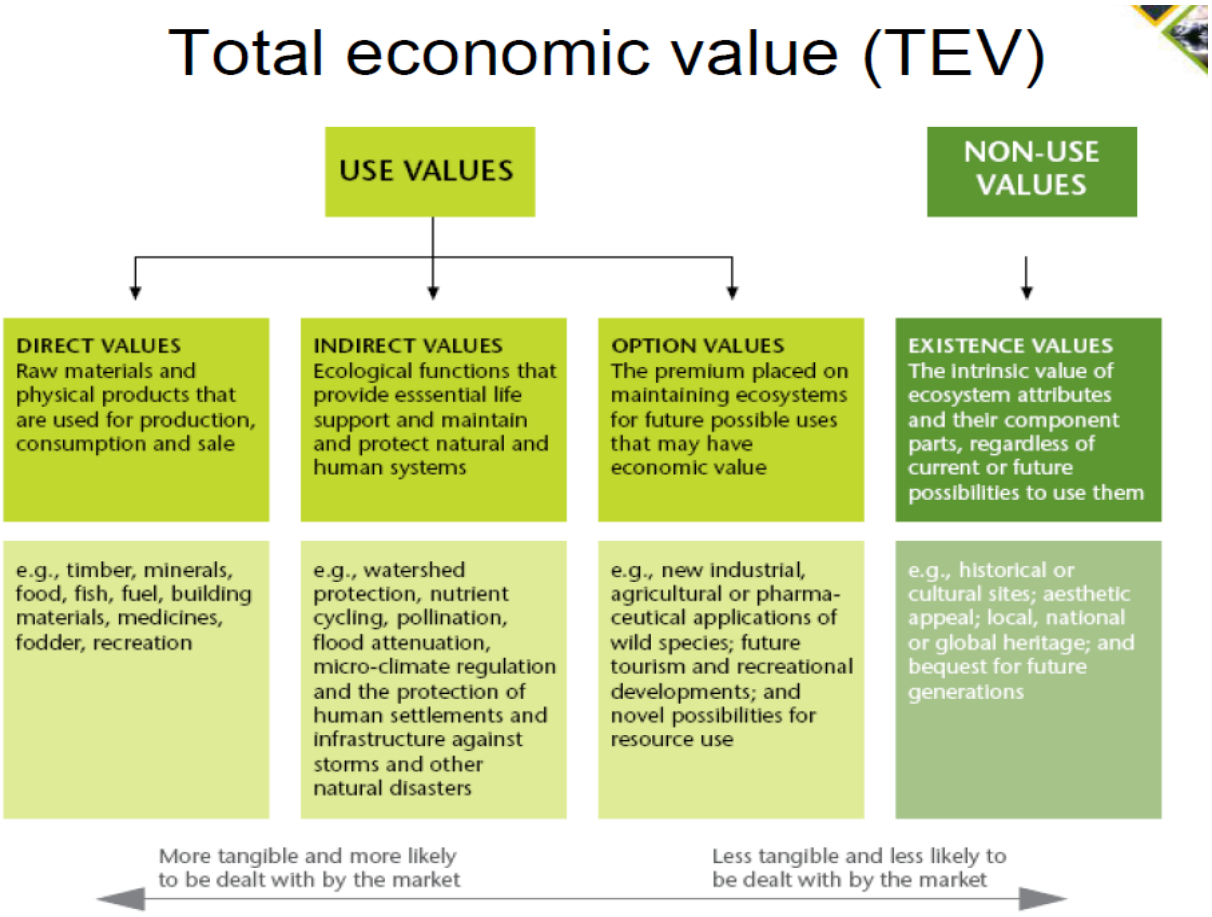
relevant data over a time series sufficiently long to be able to say with some level of confidence whether or not there has been a difference in the focal variables. Baseline data, essential for such analyses, are sorely lacking in most developing countries. Time and money are commonly the most constraining factors to decision-makers, particularly in developing countries. The Pacific is not exception on any of these dimensions.

A lack of local data, expertise, time and money, and research that is not policy-relevant, timely, and/or properly communicated, lead policy-makers to make poorly informed decisions or to seek out substitute information for guidance. Potentially useful information can be gleaned from the gray and peer reviewed literature 'off the shelf,' or more systematic approaches such as meta-analysis and benefits transfer can help to inform such decisions. The more similar the published case history is to the problem at hand, the more likely the information available is useful to making better decisions. As economic valuation approaches, measures, metrics, and indicators become standardized across studies, the more easily they can be transferred or analyzed collectively and the more likely they are to be useful to making individual decisions.

In this regard, consistency, breadth and depth of coral reef economic valuation information from the Pacific are improving, but remain in early stages. The transfer of information from one site to another can be particularly complex in the Pacific due to highly variable governance, property rights systems, and cultural norms and the emergent nature of many of the economies of the region. The great number (400-600) of MMAs in the region have not yet be classified by any potentially useful strata (e.g., fishing activity, tourism activity, proximity to formal market or population center, size, size of resident human population, age of MMA, evidence of active management, customary tenure) in order to better guide the transfer of values or appropriate categories for meta-analysis. Locating good natural experiments (comparable with and without MMA scenarios) is quite complicated and generally open to criticism no matter what focal dimensions are identified for common comparison.

The use and usefulness of Total Economic Valuation (TEV) of coral reefs

In the second day of the workshop discussions focused the use and usefulness of TEV to inform decision-making on coral reef policy and management in the Pacific. In essence, TEV is or should be, as the name implies, the sum total of expected annualized benefits across all ecosystem service stocks and flows provided by the unit of analysis.



Source: TEEB, 2010

Traditionally, TEV estimates expressed as absolute values are intended to serve an awareness raising or advocacy role (Abaza, 2004; Bolt et al., 2005). For coral reef ecosystems, TEVs have usually covered more than 15 services (Groot et al., 2002; Pascal, 2010). TEV has been recognized as a useful way to compare and synthesize very different services (e.g. subsistence fishery can be compared with coastal protection). Where market exchanges have generated a value approximating zero, absolute TEV estimates can be useful to get the attention of decision-makers about the great value of ecosystem services not being actively managed. Decision-makers easily grasp that you can't manage what you don't measure. Managing form a portfolio of ecosystem services, those that are well reflected in markets as well as those that are not, is the take home message from absolute TEV estimates. Absolute TEV estimates are more conducive to the visually appealing ecosystem service value maps that are increasingly popular as additional data layers to mapping platforms such as google maps. Unfortunately, unlike ecologically based ecosystem service maps, economic value maps comprised of point estimates of TEV from either case studies or benefit transfer approaches are theoretically unsupportable, despite their attractiveness and popularity.

Absolute TEV also provides guidance about the main stakeholders who benefit from the ecosystem processes. This is valuable information for decision makers to identify the socio-economic group impacted by some policy. However, TEV results cannot be used directly in compensation valuation exercises due to the different geographical scales and purposes of the assessment.

In addition, absolute TEV estimates do not provide any guidance whatsoever as to how to manage ecosystem services across alternative development scenarios where budgets are constrained. That is, they do not inform decision-making with any precision. For the purposes of policy formation, management and decision-making, relative TEV estimates are far more powerful.

Unfortunately, estimating all ecosystem goods and services over time and space is a complicated and expensive undertaking. "Cultural" values of coral reefs seems of particular import in the Pacific, while believable estimates of existence and bequest values (without double counting) in units ($/ha?) that are meaningful are common challenges for analysts worldwide. The economic analyst is always faced with a choice of what to measure, the response to which depends on what research question is to be answered. This is no different in the case of TEV. To derive an absolute TEV estimation, the economic analyst will no doubt choose to measure the 'most important' (meaning largest) apparent or likely values, potentially taking into explicit or implicit account the cost of collecting that information. Those ecosystem services that have direct (e.g, fish) or indirect (e.g., carbon, tourism) markets feature strongly in such estimates, potentially creating some bias toward provisioning service values in reported TEVs. For example, the main services estimated for most Pacific TEV analyses of coral reefs are: coastal protection, fisheries and tourism.

A 2010 report on the links between TEVs and decision making based on a bibliographic review of more than 80 economic valuations shows that very few results have been used in the decision making process (Laurans et al, unpublished).
From a policy perspective, it is unclear what ends such aggregations serve, even for competing development scenarios. In the policy context, more (costly) information is better only insofar as it may tip the scales in favor of one decision over another AND the differences due to the decision are more valuable than the cost of providing the information. This is an essential difference between science to inform policy and science to advance knowledge. Although there may be some correlation between what is most important in an absolute sense and what is most important in a relative sense, it is not necessarily the case.
For a relative TEV, the analyst should collect information about the ecosystem service values that vary across scenarios, not only those which are expected to be relatively large. Analysts may want to 'unpack' these values, particularly due to the differing quality of data and attendant confidence in estimates across ecosystem service values. In addition, the analyst should pay attention to the likelihood and cost of affecting a change in the value of ecosystem services across scenarios. That is, to be policy relevant, a relative TEV should assess the net value of changes in stocks and flows of ecosystem services across scenarios, whereas an absolute TEV could be excused for providing a gross 'big number' estimate, in order to gain the attention of policy makers.

Workshop participants reviewed 8 economic valuations of coral reef ecosystem services (Total economic value approach): Fiji, New Caledonia, Am. Samoa, Réunion, Bermuda, Panama, Belize, Martinique.

The Economic Value of the Coral Reefs of Saipan, Commonwealth of the Northern Mariana Islands

Pieter van Beukering and Luke Brander

At the core of the economic value of coral reefs on Saipan are the various ecosystem functions associated with these marine systems. These, in turn, translate into reef-associated goods and services (e.g. tourism, fisheries). The sum of these values forms the Total Economic Value (TEV), representing the entire economic importance of Saipan's marine environment, which was estimated at $61.16 million USD per year. Market values make up 73% of the TEV, while the remaining 27% consist of non-market values. Due to uncertainties in the data and the analysis, the TEV may vary between $42 million and $76 million per year. With an annual value of $42.31 million USD, the tourism industry is by far the greatest beneficiary of the services provided by coral reefs on Saipan. This economic importance is not reflected in the funds made available by the CNMI Government to manage the reefs.

The spatial dimension of interactions between the economy and coral reef is crucial in understanding their economic value. Generally, the beneficiaries of the reefs' goods and services are not spread evenly throughout Saipan, but vary from location to location. Therefore, Geographic Information System (GIS) tools were used to increase our understanding of this spatial variation in economic values. This helped us to recommend policy interventions more effectively. Although the average value of reefs per square kilometer amounted to $0.8 million, the highest value per square kilometer was around $9 million. This highest value category is predominantly comprised of the most popular diving and snorkeling sites. Having compared the distribution of reefs' total economic value and their anthropogenic threats, we conclude that, in general, the more valuable the reef, the poorer their condition and the greater their threats.

The economic value of coral reef ecosystem services of New Caledonia

Nicolas Pascal

New Caledonia represents a very specific socio-ecological and economic context. A huge coral reef complex (more than 4.500 km2 of reef and more than 20.000 km2 of lagoon zones) is present with a low-density population (245.000 habitants). The men and reef interactions are much contrasted amongst the different cultural groups present in New Caledonia. In the same way, a part of the population has based its economy on services with a very high purchasing power and coexists with a population living on a non-merchant economy relying partly on subsistence agriculture and fishing.

The 2009 annual financial value of services generated by New Caledonia coral reef ecosystems and associated ecosystems (mangroves, sea grass and soft bottom) has been estimated in a consolidated value between €190-€320 million euro ($250-$425 million USD).

The most important ecosystem service in terms of economic impact at the island level is the coastal protection against the waves and represents two thirds of the total value as avoided costs of flooding. It is followed by fishing (20% of the total value) and tourism (10%).

If we focus only on financial flows accountable in real GDP calculations, reefs create a wealth for New Caledonia that varies between €78-103 million Euros ($100-137 million USD). Fishing ranks first (70% approx.), followed by tourism (28%) and research & education. The importance of subsistence and recreational fishing is significant (27% and 22% respectively).

The possible applications of the study were discussed in several meetings with local policy makers. The valuation of compensatory measures for environmental impact, tradeoffs in environmental budget and the advocacy role seem to be the main ones.

TEV method challenges in the Pacific

Policy-makers in developing countries, including the Pacific, may find it useful for analyses to take into explicit account the potential effects of high degrees of resource dependency (lack of substitutes, high downside risk) (Lal, 2001) and subsistence behavior (lack of price signals and unusually low effort allocations) on some stakeholder groups. Typical assumptions about utility maximization as proxied by net income may come in conflict with assertions about a preference satisficing behavior among subsistence level stakeholders.

Although there is no published studies that we know of, it is possible that customary tenure arrangements in the Pacific significantly skew the influence of community in individual choice (constrains or enables), clan, family, village, resource allocation decisions (Cinner et al., 2007). This could call into question the appropriate scale of economic valuation analysis from the individual or individual household level to some broader group.

TEVs are at least as subject to assumptions and uncertainties about scaling, transferability and additivity of values, discount rate, time scale, and double counting as each of its component valuations. As a result, use of sensitivity analysis over the potential range of values, potentially informed by the literature, is highly recommended.

Another discussion was raised from the use of gross benefit or added values as final valuation results. The former is less data–demanding whereas the latter is more easily comparable with classical calculations of GDP and therefore more widely accepted.

Moreover, whether or under what conditions indirect and induced national economic effects should be included in TEV estimates is a matter of ongoing discussion. Indirect and induced (multiplier) effects of economic activity at the local level typically are not included in economic value estimates, but are essential to understanding the economic development dimensions of a policy or activity. Local economic development effects of marine management areas increase with the complexity of the local economy, with the proportion of local purchases (low imports = low leakage), with the degree of local labor input in the tourism and fishing services, and the degree of local value added (processing) in creating local goods and services. Needless to say, all inclusive resorts, chain restaurants, and duty free stores with imported goods are examples of economic activities with relatively low local input and, therefore, low local multiplier effects of tourism purchases.

Additional methodological questions include whether TEV estimates should be calculated at observed values or at optimal values in the current time period and what assumptions should be made about potential values with appropriate management into the future. In estimating the value of coral reef management, fish harvest, often based on the concept of maximum sustainable yield is of concern, particularly when tourism is a potential non-consumptive use of the fish stock. Notwithstanding the economic sub-optimality of MSY in an environment of increasing total costs of harvest, defining the tradeoffs of an MSY that values the diversity of fish species for tourism relative to selective fishing for consumption is an additional challenge.

The Sheraton paradox (Mirault, 2006) describes how, for some economic valuation studies, the value of tourism services depends mainly on room capacity independent of the future impacts

on the ecosystem through waste water, overcapacity, etc. The use of relative TEV as well as the choice of a temporal scale enough to reflect these impacts has been suggested.

Many challenges remain in the spatial distribution of the valuation of the ecosystem services. The first question addresses the choice of what is being assessed: the place where the ecosystem process take place?, the place where the human activity take place? or the place where benefits will be transformed into money? Other challenges concern important knowledge gaps in the marine ecological processes and their spatial distribution.

These dimensions and the clear benefits of standardizing approaches to the extent practicable, the most appropriate means to use TEV and customize valuation techniques to best serve the Pacific were of high priority to the group.

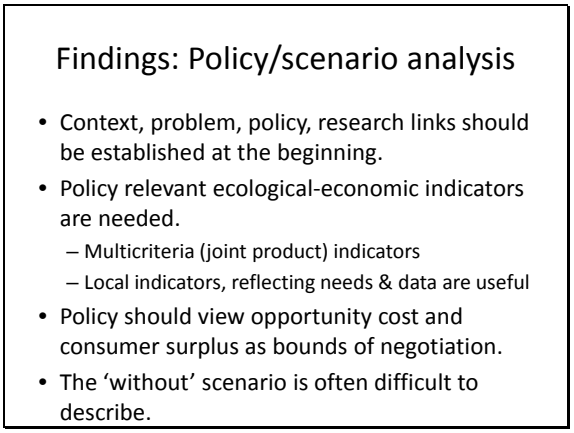
From research to policy: Benefit-cost analysis and the economic valuation of coral reefs in the Pacific

As discussions of the policy relevance of economic valuation in general and absolute versus relative TEV in particular proceed, the logical next step, methodologically and conceptually is to address social benefit-cost analysis (SBCA) within the context of coral reef management and economic development (Markandya et al., 2008; OECD, 2006). Here we use the term SBCA somewhat broadly to include various forms of scenario-based impact, cost-effectiveness and investment analysis that have been undertaken in the region. Ex post SBCAs can provide information about whether MMAs are worthwhile from various points of view. Ex ante SBCAs, what we are most often asked to conduct, require us to make guesses about potential or likely returns to investment. The predictive power of ex ante SBCAs are highly dependent upon the quality of the case history of relevant ex post SBCAs and an understanding of the likely effect of important exogenous factors on predicted results.

SBCAs can be carried out from a variety of perspectives including: local people and communities, a single local business, a business sector, government at various scales or individual government agencies, and/or donor agencies and other investors. In general, the most local level of analysis should match economic and ecological scales to the scale of the public good. Of interest here is whether it is more appropriate to study (therefore manage) a series or region of MMAs than an individual one. Typically (but clearly not always), MMAs in the region are small and are probably ecologically and economically dependent upon neighboring reefs for fish productivity for consumption and for tourism. However, MMAs are not typically managed in groups, but by individual villages with unique customary rights regimes, creating additional analytical challenges to the researcher.

'Who' counts often has strong implications for 'what' counts and affects the dimensions of the analysis including: time scale, discount rate, distribution of benefits and costs across stakeholder groups, geographic scale, what factors/effects are considered endogenous and exogenous, what measures or indicators are appropriate (e.g., B/C ratio, IRR, ROI, NB) and what policy levers are available.

Natural experiments across sites or scenarios are rarely in evidence and lines of credit and responsibility due to multiple investors/supporters and stakeholders/clients are rarely clean and may work at cross purposes rather than in concert without an unusual degree of coordination. In these small economies, individual projects/donors can result in large (non-marginal) changes in the local economy and culture. In addition to the well known concerns with aid dependency, estimating the effects of temporary or permanent structural changes in an economy are not well managed by traditional economic analytical approaches.



Although developing countries are generally less stable politically and economically than developed countries, nations of the Pacific constitute the extreme case on a number of stability dimensions. Many Pacific countries face important changes in their economic systems in the near term future (Bell et al., 2009). Traditional economic analysis faces substantial challenges in managing revolutionary (structural) change. All countries in the Pacific are insular. Many are physically small, economically poor and undiversified, culturally diverse, politically young, educationally underinvested, and are particularly susceptible to natural phenomena (Beukering et al., 2007). All of these factors contribute to human livelihood and ecological risk and vulnerability, more so than in most other regions of the world. Uncertainty, or a lack of information, risk due to exogenous shocks, and (lack of) resilience, or the rate of return to a given economic or ecological state resulting from a shock, generally put upward pressure on acceptable discount rates (between 3% and 10% is commonly assumed in Pacific regional analyses) and other risk adjusters, having the effect of increasing the standards for acceptable investment in the places that need it most (Weitzman, 2001).

Findings: Regional considerations

- Economic base: Environment & development are strongly intertwined.
- Ecological scale: MMAs are small & plentiful, but may not be the appropriate level of analysis.
- Risk: High level of vulnerability to disaster risk.
- Socio-economic scale: Strong role of community culture (customary tenure) in resource management & high level of subsistence activity.
- Political-economic context: Rapidly changing traditional economies.
- External effects: Potential for relatively large local impacts of individual projects and attention to donor/project coordination required.
- Ecological-economic data availability: Generally particularly low in quality, quantity, and/or accessibility.

Workshop participants reviewed a number of cost benefit analyses of Marine Protected Areas supported by the CRISP project. They included: 5 MMAs in Vanuatu, 6 MPAs in Hawaï, 1 MPA in Thailand, 8 MPAs in Africa, and 1 MPA in the Caribbean.

Assessment of Economic Benefits and Costs of Marine Managed Areas in Hawaii

Pieter van Beukering, Herman Cesar & Luke Brander

This study evaluated the economic value of 6 selected MMAs in Hawaii. It will also include the costs and benefits of their various management and financing regimes. These sites are: Hanauma Bay and Waikiki Diamond Head, both on Oahu; Molokini and Honolua on Maui, and Waiopae and Kahaluu on Big Island. Five studies were carried out under this research project. They address the: (i) fisheries benefits of MMAs in Hawaii; (ii) economic value and cost benefit analysis of management options; (iii) institutional/regulatory framework of MMAs in Hawaii; (iv) recreational survey of active reef users in Hawaii; and (v) sustainable financing of MMAs with descriptive case studies from around the world.

Based on the study, the following recommendations can be drawn: (1) Management of MMAs makes both ecological and economic sense; (2) Low enforcement efforts substantially decrease the benefits from MMAs. In fact, in the absence of decent enforcement, MMAs have no economic benefits, and their ecological advantages are much lower. (3) The very high benefit-cost ratios of proper MMA management suggest that Hawaii should put more financial resources aside for MMA management. If there is not enough political will or priority to do so, a system of user fees should be considered. (4) A small user fee would be sufficient to finance the additional costs of proper MMA management. And (5) Fees can be collected at the sites where implementation of this fee system is most straightforward. Part of the revenues of this system could be used to subsidize the management of other MMAs with few tourists, or in areas where the fee system would be cumbersome or impossible to implement.

Cost-Benefit analysis of community managed MPA

Nicolas Pascal

The number of reported Marine Managed Areas (MMAs) driven by local communities has strongly increased in the Pacific region in the last 10 years and has been estimated at more than 500 in 2007. They are now presented as one of the main fishery and coastal management tool adapted to the context of many Pacific countries where intervention of the official agency is minimum and where the participation of community is still important. The AFD, the French development bank, has supported several community-based MMAs with MPAs in the last 5 years in the Pacific and now request a bottom line analysis of their impacts on local economic growth, poverty reduction and on world biodiversity as a public good.

An appraisal of investment in community-based MPAs through a cost-benefit analysis (CBA) and Return on Investment (RoI) has been conducted in 5 selected villages in Vanuatu. Main impacts of MPAs on fishery, tourism, social capital, coastal protection service and bequest value have been assessed from 18 months in situ observations. As far as possible impacts have been compared to villages without MPA (control sites).

The results are: (i) the annual operational costs with effective enforcement are one of the lowest costs worldwide with values varying from 900 € to 4 000 € per MPA (equivalent to a mean annual 9 300€.km-2 of protected area); (ii) the average Return on Investment (RoI) is 1.8 after 5 years (std=0.9) with a potential of 5.4 (std=2.5) after 25 years; (iii) not all the investments in MPAs have been recuperated after the first 5 years and for some of them the RoI stays close to 1 after 25 years of projections when main uncertainties on estimations are applied; (iv) each MPA has produced benefits mainly on rural tourism and fishery (56% and 26% of the total respectively), which represent both important sources of local cash incomes and proteins for the villages. Observed benefits on fishery sector were revealed through an increase in productivity for the principal gears (from 4% to 33% increase in the catch per unit of effort) and for both subsistence and commercial fishery. Benefits on tourism are present for the niche of rural tourism where the role of MPA in the choice of the site was estimated to vary between 40% to 75%; Impacts on social capital, bequest value and coastal protection service have been estimated to represent 20% of the total benefits of the 5 MPAs; (v) Observed benefits have represented an average of 7% of the total village Gross Domestic Income (GDI). Impacts have been assessed at a village level to take into account some characteristics of customary, community and subsistence economic specificities.

MPAs may be a great investment

Thierry Clément, Jean-Roger Mercier, Catherine Gabrié

Six economic assessments have been conducted, at the request of the French Global Environmental Facility (FFEM in French) with the object of determining the Net Present Value of investing in MPAs. These MPAs are, Bamboung in Senegal, Curieuse in the Seychelles, Quirimbas in Mozambique, Mnazy Bay in Tanzania, Nosy Antafana in Madagascar and Soufriere in St Lucia.

The assessments have been conducted using the same methods and by the same consultants. The Net Present Values (NPV) generated over 15 or 20 years of creation and operation of the MPAs are generally high and the corresponding Internal Rate of Return (IRR) amazingly high, for 4 of them. While the authors are conscious of the limitations of the approach and of the risk of rapid overgeneralization of the results, we hope to attract sufficient interest and interaction in the academic community to help turn this pioneering effort, into a mainstream substantive analytical effort for the benefit of environmentally-sustainable development, decision makers, local inhabitants, users of the natural resources and financiers.

The main conclusions of this work are: NPV assessment is a very data-intensive process. While some of the data existed or could be collected by extensive or limited survey, many of the required information to get to the yearly TEV had to be derived from assumptions, some of which had not yet been subject to proper scientific validation. This was in particular the case for fish resource restoration after the creation of the MPA, a phenomenon supported anecdotally by the scientific monitoring, but not in a systematic manner. The disconnection between the initial plans for MPA monitoring and the actual, usually weak and patchy, conduct of that monitoring, was an added liability in this exercise.

Making coral reef management pay for local people: Opportunities for innovative conservation finance

Economic value is often confused with economic development opportunity (Gómez-Baggethun et al., 2009). Economic valuation research can be used to identify economic opportunity, but they are by no means one and the same. Some economic values are easily captured by local people in the market place by identifying private or community scale business opportunities. Other similar values can better be captured at the regional or national scale (Donlan et al., 2009; Engela et al., 2008; Kemkes et al., 2009). Still other values have only international markets or no markets at all and require a bit of creativity to capture in compensation of ecosystem service stewardship at the local level. Increments in these values captured by local people with the management regime in place are considered the benefits of MMAs over more passive coral reef management regimes.

For example, valuation research might identify tourism and fishing opportunities that a local community can capture by changing their fishing practices, marketing tourism opportunities,

or creating new tourist or fish products. These values are reflected in the marketplace and captured by the local people.

Some tourism services, such as taxis, hotels, restaurants, equipment, groceries, airports, hospitals, water, electricity and sewer, police and fire protection, are often provided at the regional or national level, but sometimes by private venders (Ferraro and Simpson, 2001). Private venders are sure to charge fees for such services. Governments serving this role need to recognize the additional costs they are absorbing by inviting tourists to their country and to charge accordingly. Green (or Natural Wealth) national accounting is a vehicle to incorporate ecosystem service values at the national policy level. Policy instruments available to capture some of these additional service costs include airport taxes, hotel bed taxes, sales taxes and other fees (Wundera et al., 2008). These benefits accrue to the country at large and are partially due to the stewardship of coral reef ecosystem services provided by the local people. Sometimes local people benefit from the services provided for tourists, particularly in the form of enhanced recreational opportunities. However, sometimes local people suffer when tourists take precedence for scarce water supplies or create more garbage than the locality can comfortably assimilate.

Increasingly, marine scientists argue that mangroves are important sinks for carbon (Brian C. Murray et al., 2010). The international market for sequestered carbon is gradually developing to the point that many thousands of farmers are receiving compensation for their captured carbon. There is no reason to believe that marine management area managers or the communities that provide coral reef protection could not be the recipients of such payments for ecosystem services (PES).

Many potential alternatives to financing MMAs/MPAs are available and are emerging (Kemkes et al., 2009; Peters and Hawkins, 2009). For example, for tourism, entry fees/taxes, usage fees, donations, sales taxes, operator licensing, research permits and others can be employed. For fishing, similar types of tools are available. To support management toward broader public goods, trust funds, revolving community development funds, endowment funds and other sorts of long term financing mechanisms are gaining significant attention among donors and recipients alike, although there remains a lot of work to be done on these tools.

Case study: Trust fund: Samoa

The sites of Aleipata and Safata are situated on the south coast of the island of Upolu (most populated of the two islands of West Samoa). Their surfaces are 24.6 M2 (63.71 Km2) for Safata and 19.5 M2 (50.53 Km2) for Aleipata. The MPA of Safata includes 9 villages and that of Aleipata has 11. The MPA of these sites are supported by the Ministry of Natural Resources and the Environment of Samoa, in partnership with the two management committees. The two MPAs are each managed by a Management Committee. These committees are constituted by the representatives of the villages forming the MPA (1 per village). The Management Committees apply the Management Plan which particularly consists in monitoring by the populations. They meet once a month to review the month before, and to prepare the coming month. The funds collected during the month (entrance fees for certain tourists, paid fines, etc.) are given at this time to the advisor of the Ministry to be deposited in the account of each MPA. These accounts are held by the Ministry, but 3 members of each committee have the signature.

At the end of 2007, CRISP, with FFEM funds of 72 K€, abounded an existing trust fund with the income paying a part of the PA costs. The yearly interest from this fund will be given to the Management Committees of the MPA (50 % each). According to the advisor of the Ministry of the Environment, this should cover between 50 to 60% of the management costs of the MPA.

It is incontestable that important things have been achieved in these two MPA in terms of the motivation of the populations and the implementation of management regulations. Building on what is acquired can be continued, but it is urgent to find lasting solutions for the funding of the routine functioning of the MPA, as the CRISP trust fund is only a partial solution and presents the counterproductive effect of comforting the Committees in their expectations of funding, without searching for themselves to see if these funds could be generated by the MPA with a little organization.

Some keys to sustainable financing of MPAs include:

- minimizing costs of management (particularly monitoring and reporting), potentially by collaborating across MPAs to defray known fixed costs and employ resources efficiently, as costs are relatively well known, but benefits are only predictive estimations.
- matching the scale of the good to the scale of the financing, such that local goods and services are locally supported, private goods and services are traded in the marketplace, and global public goods are compensated from global sources.
- Local institutional design that, to the extent practicable, understanding the donor's/investors perspective that, for example, large international donors would prefer to work with relatively few entities and contracts for relatively large amounts of money and reporting.
- Diversification of funding sources in order to maximize the total and minimize the variation.
- Acting creatively, not only employing the polluter pays principle to reduce the footprint of development, but also the beneficiary pays principle to maximize the returns to pro-ecosystem service management.
- Having a business and management plan for developing financing strategies that identifies the objectives of the MPA, the ecosystem services generated, the principal beneficiaries, and the known fixed and variable operating costs.
- Incorporate innovative marketing strategies by the management team to advertise the MPAs and their benefits
- A long term view, particularly when exploring some of the newer innovative finance approaches that would involve annuities from (public or private) trust funds and other long term financing strategies.
-

- **Case study: Mahe, Moorea**

Some management questions addressed in the study	*Valuation focus*	*(Valuation) method & decision making tool*	*Decision making message to remember and to communicate*
What are the management costs of the MPA network ? How the MPA network is financed? What is the current situation of the MPA network?	Annual operationnal costs of a MPA network (excl. transaction costs and opportunity costs related to loss of revenues for fishermen for e.g)	Cost analysis, scenarios, Governance and institutional analysis	Defining a financial strategy: (I) Reorganise current sources of revenues besides designing new mechanisms; (II) More communication about the socioeconomic contribution of coral reefs (and lagoons) to the local economy (investment of public and private resources in ecosystem management can be justified in economic terms); (III) take into account who are the beneficiaries of ecosystems services.
What financing mecanisms are available and which ones can be identified as the most potentially accepted ?	Potential revenues to cover operational costs of the MPA network; SWOT analysis of financial mecanisms (strenght/Weaknesses . Opportunity/threats)	Socioeconomic importance by estimation of a TEV based on 8 ecosystem services (with limited benefit transfer) and qualitative surveys; Preliminary CBA providing arguments for designing possible financial strategies;	

The way forward: Recommendations and lessons learnt

The means to increase the likelihood that local people will benefit from their coral reef stewardship is to involve them in the broader economic development process. Not only can local people be the recipients of research results, they can also help to guide and inform the research process such that research answers the economic development questions of highest priority to the local people.

The research process should begin with identifying the governance, ecological and economic context of the situation (ridge to reef), proceed to identify the key drivers of coral reef management challenges, the information required to make a decision regarding coral reef management, in particular by identifying the goals of management, and only then identify the appropriate economic tool to link ecosystem services to human well being and proceed to conduct the research to inform the decision.

Too often researchers are concerned with finding 'the truth' when such precision is neither necessary nor useful. In many policy contexts, the cost in time and budget that it takes to go from broad accuracy to robust precision is too high. This has been termed the '80-20' problem or solution, depending on one's perspective. The rule of thumb states that takes 20% of the time and budget to get an 80% accurate solution and the remaining 80% of the budget and time to get to the 100% solution. Scientists who want to 'make a difference' in the policy realm need to be convinced of the usefulness of the 80% solution. Workshop participants recommend that the methodological approach is 100% appropriate to the problem, such that the results found with 80% certainty derived from the approach are defensible.

Too often economic valuation is touted as the answer when we don't really know what the question is. Economics helps us to understand how to manage people, not the environment Economic research helps us to understand the influence of different states of the environment on people. It does not help us understand the effect of people on the environment. Economic

valuation of coral reef management is driven out of an assessment of the stocks and flows of ecosystem services derived from coral reefs. The means to reward people for stewardship of ecosystem values derived from coral reef management are diverse and evolving and depend on the type of ecosystem service values being created by their stewardship and are guided by the governance and cultural context of the management regime.

Workshop participants recommend additional work on areas where the Pacific region may diverge significantly from other regions of the world in the application of economic methods. In particular, work on the role of customary rights in individual decision-making, additional insights on risk, uncertainty, resilience and subsistence behavior in view of other ongoing work worldwide, categorization of MPAs along potentially important strata for predicting success, coordination or at least collaboration among research efforts in terms of methods and approaches such that the expanding case history can be extrapolated and extended to other contexts with greater certainty and usefulness.

We must reorient the perspective that the damaged coral ecosystem is the default and we are putting policies and actions in place to move us back toward a state of coral ecosystem health. The perspective should be that a coral ecosystem healthy is the default and any proposed activities affecting that health will be viewed pessimistically. That is fishing is the experiment, not the default. Green economics is when the green solution is the default and (sustainable) exploitation is the exception/policy.

Annex 1: List of Acronyms

ACRONYM	Developed name
AFD	French Development Agency (France)
AAMP	French Agency for Marine Protected Areas
CEMARE	Centre for the Economics and Management of Aquatic Resources (UK)
CRISP	Coral Reef Initiatives for the Pacific (New Caledonia)
CPS	General Secretariat of the Pacific Community (New Caledonia)
CRIOBE	Insular Research Center and Environment Observatory (French Polynesia)
CI	Conservation International
CSIRO	Commonwealth Scientific and Research Organization (Australia)
ICRI	International Coral Reef Initiative
IDDRI	Institute for Development and International Relations (France)
IRCP	Institute for Pacific Coral Reefs
IRD	Institute for Development Research (France)
IVM	Institute for Environmental Studies (IVM), Vrije Universiteit (Netherlands)
IUCN ORO	International Union for Conservation of Nature, Oceania Regional Office (Fiji)
IUCN HQ	International Union for Conservation of Nature, Headquarters (Switzerland)
MMA	Marine Management Area
MPA	Marine Protected Area
NOAA	National Oceanographic and Atmospheric Organization (USA)
RRRC	Reef and Rainforest Research Center (Australia)
SBCA	Social Benefit Cost Analysis
SOPAC	Pacific Islands Applied Geoscience Commission
SPREP	South Pacific Regional Environment Programme (Samoa)
SPP	French Pacific Fund
TEV	Total Economic Value
USP	University of the South Pacific (Fiji)
WCPA	World Commission on Protected Areas

Annex 2: List of participants, days 1-3

First name, FAMILY NAME, Organization
Thomas BINET, CEMARE
Luke BRANDER, IVM
Mahé CHARLES, AAMP
Thierry CLÉMENT, Oréade-Brèche
Eric CLUA, CRISP
Nicholas CONNER, WCPA
Gilbert DAVID, IRD
Emily GASKIN, NOAA
Paula HOLLAND, SOPAC
Padma LAL, IUCN ORO
Yann LAURANS, IDDRI
Florence MOUTON, AFD
Nicolas PASCAL, CRIOBE
Linwood PENDLETON, ICRI/Duke University
Vina RAM-BIDESI, USP
Andrew SEIDL, IUCN HQ
Olivier THEBAUD, CSIRO
Caroline VIEUX, SPREP
Jean-Yves WEIGEL, IRD
Clive WILKINSON, RRRC

Annex 3: About the participants

Thomas BINET holds a master's degree in fisheries sciences. He has worked within the OECD as a fisheries economist and later joined the Institute for European Environmental Policy as a fisheries policy analyst. For several years, he has been involved in economic valuations of marine ecosystems as an associate researcher within the Center for Economics and Management of Aquatic resources at the University of Portsmouth. He is currently in charge of an economic valuation of marine ecosystems within a sample of Marine Protected Areas in West Africa. He is also in charge of an economic valuation of ecosystem services in the French Southern Overseas Territories.

Luke BRANDER has a background in environmental economics. He obtained his Masters degree in Environmental and Resource Economics at University College London (1997-98). For the period 2000-2010 he worked as a researcher at the Institute for Environmental Studies (VU University Amsterdam). His main research interests are in the design of economic instruments to control environmental problems and the valuation of natural resources and environmental impacts. He has worked on the valuation of wetlands, forests, grasslands, mangroves and coral reefs through meta-analyses of the ecosystem valuation literature. He recently completed his PhD thesis, which addresses the valuation of landscape fragmentation. He is currently working as a freelance environmental economist based in Hong Kong. On-going projects include the economic valuation of coral reef ecosystem services in the US Virgin Islands; and the quantitative assessment of ecosystem service values for The Economics of Ecosystems and Biodiversity (TEEB).

Mahé CHARLES is an environmental engineer involved in the international network EarthCollective (www.earthcollective.net). He has worked on integrated assessment of the ecosystem functions, socio-economic importance and implications for sustainable management of coral reefs and lagoons. He specifically focused his research on the island of Moorea (French Polynesia) and its marine management plan. He has recently conducted a study focused on sustainable financing of MPAs in French Polynesia (study financed by CRISP programme and SPREP). His main areas of interests include environmental systems analysis, natural resources valuation and management, coastal and tropical ecosystems, participatory planning and management and integrated coastal zone management. He currently works at the French MPA Agency (http://www.aires-marines.fr/french-marine-protected-areas-agency.html) where he is in charge of the French socioeconomic analysis of the initial assessment for the European Marine Strategy Framework Directive

Thierry CLÉMENT is general manager of the Oréade-Brèche consultant office. He has worked in numerous marine protected areas, either in feasibility studies or in evaluation and particularly on economic evaluation of MPAs projects. His experience covers MPAs in Africa, the Indian Ocean, the Caribbean's and the Pacific Ocean. With Catherine Gabrié and Jean Roger Mercier, he is the author of a series of documents making a synthesis of the main lessons learnt from projects funded by the French GEF and the AFD, and supporting MPAs or biodiversity conservation. These documents are available on the French GEF Website at the following address http://www.ffem.fr/jahia/Jahia/site/ffem/lang/fr/pid/3676. Besides this, he has carried out the mid-term evaluation of the CRISP program.

Eric CLUA obtained a basic academic training in veterinary sciences (1984-1989) and then economics and business management (1989-1991). He was first appointed by the French Ministry of foreign affairs as project manager for livestock and MPA networking development in the Caribbean (1992-1995), before joining West Africa where he worked on integrated management of natural resources, including an environmental economics approach (1996-2000). Eric focused then on marine issues and did a PhD in marine ecology in the Tonga islands (2001-2003), as a seconded researcher for the Secretariat of the Pacific Community (SPC). He was then involved in 2004 in the setting up of the CRISP (Coral Reef InitiativeS for the Pacific) programme for the French Agency for Development (AFD). He is managing this 15 M€ multilateral programme since 2005. After his PhD, Eric has developed a specific scientific expertise in reef fisheries, shark biology and ecology and environmental economics.

Nicholas CONNER has over 29 years experience in natural resource management and rural development, focusing on conservation economics, socio-economic impact assessment, and natural resource policy development and analysis. As well as coordinating the IUCN World Commission on Protected Areas Specialist Group on Economic Valuation of Protected Areas, Nicholas is Principal Conservation Economist with the New South Wales Department of Environment and Climate Change. This work involves developing and managing projects on socio-economic aspects of biodiversity conservation, natural resource management, regional economic development, tourism, and ecosystem services. Nicholas has also worked as an environmental economics consultant in Europe, South-East Asia and Australia, and has recently been helping the IUCN Oceania Region in Fiji to develop a resource economics capacity building programme for the South Pacific.

Gilbert DAVID is a marine and island geographer by training, David Gilbert is Director of Research in the French Institute for Development (ex-Orstom). After 5 years spent in Vanuatu as junior research officer in Orstom and Port-Vila fisheries department, he defended in 1991 a PhD thesis at the University of Western Brittany (Brest). The topic was the village fisheries in Vanuatu and their contribution to food security in this country. The focus was made on the economic value of informal reef fishing, little regarded at this time compared to the commercial artisanal fisheries exploiting the FAD's pelagic resources and the deep bottom fish. From 1991 to 1996, he studied for IRD the effects of the Matignon Agreements on the economy and geography of New Caledonia. He has specialized since 1997 on ICZM (integrated coastal zone management) and marine protected areas. Until 2000, he worked at the management of coral reefs areas at the regional level in the western Indian Ocean (Regional Environmental Programme of the Indian Ocean Commission funded by EU). From 2002 to 2005, he coordinated the VALSECOR project on the socio-economic value of reefs in Reunion Island. Since 2006, he coordinates the project CRISP-GERSA project.

Emily GASKIN is a Policy Analyst with the National Oceanic and Atmospheric Administration (NOAA) at the Fagatele Bay National Marine Sanctuary in American Samoa. Prior to moving to the South Pacific Emily was a Presidential Management Fellow with the NOAA Budget Office in Washington DC. Emily has a Masters of Public Administration in Environmental Science and Policy from the Columbia University's School of International and Public Affairs. Her graduate dissertation looked at the potential costs and benefits for the use of Payments for Ecological services in Latin America. Emily received her bachelor's degree from the University of California, Los Angeles (UCLA). Her undergraduate thesis looked at the potential socioeconomic costs and benefits or cattle ranching and Eco-tourism in the Brazilian Pantanal.

Paula HOLLAND manages the Natural Resources Governance programme at the Pacific Islands Applied Geoscience Commission (SOPAC). As well as overseeing and conducting economic analyses such as valuations and cost benefit analyses, she conducts capacity building work in natural resource economics, designs projects and proposals and is involved in the strategic management of SOPAC. Paula has been a natural resource economist for 19 years and has experience in applying economic analysis to a variety of sectors including fisheries, waste management, disaster and conservation. She has conducted research in the economic dimensions of natural resource policy in the Pacific, Australia and northern Europe, in governments as well as academic institutions.

Florence MOUTON is the AFD (French Developement Agency) project manager for the regional projects in the Pacific area, essentially focused on environment. In particular, she is in charge of the Climate Change Adaptation topic, which is a major theme for the AFD in the region. She has worked on numerous developement projects in marine and rural fields in different parts of the world. She was also a project manager for the training center of the AFD (the CEFEB), responsible for creating the sustainable developement department and she has worked on numerous capacity building programs on environmental issues.

Padma Narsey LAL is the Chief Technical Adviser to the IUCN Oceania Regional Office. Dr Lal has over 35 years of experience in undertaking and managing resource and environmental economics project as well as interdisciplinary research in the Pacific, Australia and Asia. Her main focus has been policy analysis using resource and environmental economics supported by robust biophysical scientific and traditional knowledge. Her Pacific research over the several decades has covered a diverse range of subject areas, such as benefit cost analysis of resource and environmental management options, benefit cost analysis of wild

versus cultured live coral trade in Solomon Islands and Fiji, economic valuation of mangroves in Fiji, disaster and climate change as a development issue and mainstreaming of disaster risk reduction and climate change adaptation into national planning and budgetary process, customary land tenure, land management and conflict minimisation in the Pacific. Dr Lal is currently working on an IPCC Special Report on Climate Change and Extreme Event, as a Coordinating Lead Author (CLA) of the Chapter on National Systems for Managing Climate Change and Extreme Event. Dr Lal is also the cofounder of PREEN, Pacific Resource and Environmental Economics Network, and co-author of a Pacific resource/ text book, Economics of Resource and Environmental Project Management in the Pacific, recently published by IUCN.

Yann LAURANS has worked as an economist and consultant on various aspects of public policy, local policy-making and policy design. He designed and carried out the first monetary evaluation of wetlands ecological services from wetlands in France, in 1996, which was used to augment the budget devoted to wetlands protection by the Seine-Normandy Water Agency. As an applied research supervisor, he worked further on the practice and significance of wetlands economic evaluation for decision-making, as leader of a research programme of the French National Research Programme on Wetlands (2000). He also conducted research on coastal restoration economics. Yann Laurans was, during 6 years, chief economist of the Seine-Normandy Water agency (850 MioEUR annual budget). He was in charge of economic evaluation, modelling, cost-recovery assessment and scientific council secretariat. He was also the representative of water agencies in the economics common implementation strategy group for the water framework directive, from 2001 to 2005. As a consultant in the EC, he has been key expert on economic evaluation for pre-accession projects on water policy and planning, in Poland, Bulgaria, Malta, Slovenia... Since April 2008, Yann is back to consulting on an independent basis. He has created Ecowhat (www.ecowhat.fr) and is now assisted by a junior agro-economist specialised in biodiversity economics.

Nicolas PASCAL is an environmental economist specialized in coral reef ecosystems and reef fisheries and works as an associate researcher in the CRIOBE laboratory (South Pacific). Presently he is the coordinator of the economic taskforce of the CRISP project (Coral Reef InitiativeS for the Pacific), which conducts more than 10 economic assessments on ecosystem valuations, MPA cost-benefit analysis, fishery studies and conservation financing schemes. His PhD and present research fields are focused on economics of coral reef ecosystem services in the Pacific and on reef fisheries management. His academic background is based both on biological and financial studies. He also counts with 10 years of professional experiences in financial companies as investment director and analyst. He describes himself as pragmatic, direct and passionate.

Linwood PENDLETON is the Director of Ocean and Coastal Policy at Duke's Nicholas Institute. His work includes a number of collaborations with Nicholas School faculty including a global Marine Ecosystem Services Partnership, a policy lab on coastal and marine spatial planning, another policy lab on rethinking the way we manage inland waterways, and new work on deep sea marine protected areas. Linwood is an expert on marine and coastal economics and has given four congressional briefings in the last year on the economics of marine sanctuaries, coastal management, and coastal habitat restoration. Before coming to Duke, Linwood was a Senior Fellow and Director of Economic Research at The Ocean Foundation, and Director of the Coastal Ocean Values Center. Linwood was a tenured Associate Professor of Environmental Science and Engineering at UCLA, an Assistant Professor of Economics and Finance at the University of Wyoming, and an Assistant Professor of Economics at the University of Southern California. Linwood is an expert in coastal and marine economics, especially using empirical methods to understand the effects of environmental change on economic uses of the ocean. He works on coastal and marine recreation in the United States and Caribbean and marine fisheries in California, Panama and Brazil.

Vina RAM-BIDESI is a senior lecturer at the School of Marine Studies of the University of the South Pacific in Suva, Fiji. Her research interests are in the area of fisheries economics, resource management and trade. She has particular interest in community-based coastal fisheries management as well as the management issues affecting highly migratory tuna fisheries of the Western and Central Pacific. She has engaged in research work on fisheries economics, natural resource policy analysis, gender related issues and integrated coastal management. Her most recent studies are the socio-economic assessment of fishing practices in the Tarawa Lagoon and providing an overview on the economics of coastal zone Management in the Pacific Islands.

Andrew SEIDL is Head, Global Economics and Environment Programme (GEEP) with the International Union for Conservation of Nature, based at IUCN Headquarters in Gland, Switzerland. Prior to joining IUCN in 2009, Seidl was Professor & Public Policy Specialist at Colorado State University, a Visiting Professor and Erasmus Mundus Scholar at the University of Manchester, UK, Visiting Professor and Fulbright Scholar at the Latin American Center for Competitiveness and Sustainable Development (CLACDS-INCAE) in Costa Rica, Natural Resource Economist at the Center for Agricultural Research in the Pantanal (CPAP-EMBRAPA) in Brazil, and Commodity Analyst at the FAO-UN in Rome, Italy. His recent work appears in professional journals including Ecological Economics, Journal of Regional Science, Journal of Environmental Policy and Management, and Economic Systems Research and in popular press including New Europe, the OECD Observer and World Conservation. Seidl earned a BA (Economics and International Relations) from the University of Wisconsin and a Ph.D. from the University of Florida (Food and Resource Economics).

Olivier THEBAUD holds a PhD from the School of Higher Studies in the Social Sciences, Paris, and an HDR (Habilitation for Research Direction) from the University of Western Brittany (Brest, France). Prior to joining CSIRO in November 2009 as a senior economist for the Marine and Atmospheric Research Division, Dr.Thébaud was Head of the Economics Department of the French Marine Research Institute Ifremer, Deputy Director of the AMURE research group (one of the largest European research group in marine resource economic and law, associating Ifremer and University of Western Brittany), and Associate professor at the University of Western Brittany. His research focuses on ecological-economic modelling, and the economics of ecosystem-based approaches to marine and coastal resources. Key areas of application include the regulation of commercial and recreational fisheries, aquaculture, multiple ecosystem uses, accidental pollution, as well as biodiversity conservation policies such as Marine Protected Areas.

Jean-Yves Weigel, research director at IRD, is a fisheries economist. In recent years, its research effort has focused on the socio-economic effects and on the governance of marine protected areas. Recently (2006-2010), he was project leader of a joint research project between Kasetsart University (Faculty of Economics, Bangkok, Thailand) and IRD on the societal cost assessment of fisheries activities by comparison between MPAs and unprotected zones in Thailand, project funded by IRD and the European Commission (ECOST Project). Formerly (2002-2005), he was principal coordinator of CONSDEV Project entitled "Coherence of conservation and development policies of marine protected areas in West Africa" funded by the DG Research (European Commission). During the years 1999-2001, he was principal coordinator of a French Cooperation Project entitled "Dynamics of exploitation and valorization of estuarine fisheries in West Africa", and in 1998 visiting scientist at FAO Headquarters in Rome (Department of Fisheries). He has conducted other research projects in Vietnam, Indonesia and many West African countries for IRD (ex ORSTOM).

Clive WILKINSON is the coordinator of the Global Coral Reef Monitoring Network operating in more than 80 countries and publishing the 'Status of Coral Reefs of the World' reports every 2 years (1998, 2000, 2002, 2004, 2008). The GCRMN also published reports on the effects on coral reefs of the Indian Ocean tsunami of 2004 and the massive bleaching in the Caribbean in 2005. Clive was the co-author with Jos Hill on the compilation of coral reef monitoring methods that was also published by the GCRMN in association with Reef Check Australia. Before this he was the Chief Technical Advisor for a coastal resource research program in Indonesia, Malaysia, Philippines, Singapore and Thailand for 5 years. This program focused on training in coral reef and mangrove monitoring methods developed jointly by Asian scientists and those from the Australian Institute of Marine Science. This resulted in a book of monitoring methods that is still regarded as the 'bible' of methods. He was the Chair of the United Nations Global Task Team on the Implications of Global Climate Change and Coral Reefs from 1991 to 1995 and co-authored the definitive report on climate change and reefs in 1994. Clive worked as an active field scientist on the ecology of the Great Barrier Reef at the Australian Institute of Marine Science from 1980 to 2006. His research was principally on the nutrition of corals and sponges, and he has published more than 100 scientific articles. He received BSc and PhD training in marine microbiology and ecology from the University of Queensland, doing research on coral reef sponges at Heron Island. He is now based at the Reef and Rainforest Research Centre in Townsville Australia.

Annex 4: Workshop Agenda

CRISP Coordinating Unit
SPC – BP D5
98848 Noumea
New Caledonia
Tel.: +687 265 471
Email: ericc@spc.int

In partnership with:

CRISP Economic Workshop
"Investing in Coral Reefs: Is it worth it?"

22 – 26 November, 2010

Secretariat of the Pacific Community
Noumea, New Caledonia

Funded by:
French Pacific Fund
French Development Agency
French Global Environment Facility

Day 1 Monday 22 Nov.	**"Where does this workshop fit regarding coral reef economics around the world?"**
	Opening Session
8:30 am – 9:00 am	Registration
9:00 am – 9:30 am	Welcome and Opening remarks Speakers: SPC, SPP, AFD, IRCP, IUCN and SPREP
9:30 am – 10:00 am	Objectives and structure of the Workshop (Eric Clua – SPC/CRISP) Introduction of the Workshop facilitator (Andrew Seidl) + assistant facilitator (Jean-Baptiste Marre) Introduction of participants
10:00 am – 10:30 am	Coffee/tea break
10:30 am – 11:50 am	**Session 1: PLENARY** – **Overview on the global context of economic valuation in the domain of coral reef ecosystems** • Presentation 1 (20'): "History and role of environmental and resource economists" (speaker: Gilbert David – IRD) • Presentation 2 (20'): "The Millenium Economic Assessment (MEA) and The Economics of Ecosystems and Biodiversity (TEEB): interest and limitations" (speaker: Clive Wilkinson – RRRC) • Presentation 3 (20'): "Overview on the use of economical tools as a support for decision-making in biodiversity conservation" (speaker: Yann Laurans – IDDRI) • Presentation 4 (20'): Overview on the status of coral reef economics in the Pacific region" (Speaker: Padma Lal – UICN Oceania) *Learning objective:* *Participants understand the ongoing challenges at a global level*
11:50 am – 12:00	**Questions and remarks** • Open discussion on previous presentations and agreement over the workshop agenda *Learning objective:* *Participants understand the context and interest of the ongoing workshop*
12:00 – 1:30 pm	Lunch SPC deck (close to conference room)
1:30 pm – 3:00 pm	**Session 2: PLENARY** – **Presentation of ongoing projects based on economic valuation** (10' Presentations) • Presentation 1: ICRI • Presentation 2: WRI • Presentation 3: IUCN • Presentation 4: USP/SPREP • Presentation 5: NOAA • Presentation 6: Earth Collective/SPREP • Presentation 7: SPREP • Presentation 8: IFRECOR

	Learning objectives: *Participants learn about existing projects with connected objectives*
3:00 pm – 3:30 pm	Coffee/tea break
3:30 pm – 5:00 pm	**Session 2 (Ctd): PLENARY** – **Presentation of ongoing projects based on economic valuation** (10' Presentations) • Presentation 10: CRISP/SPC • Presentation 11: IVM • Presentation 12: IRD • Presentation 13: CEMARE • Presentation 14: CSIRO • Presentation 15: Oréade-Brèche Synthesis and discussion (30'): general trends and choices suggested by present initiatives *Learning objectives:* *Participants have a better idea about what should be assessed during the WS*
6:30 pm	**BBQ offered @ SPC Social Club**

Day 2 Tuesday 23 Nov.	**"What did we learn from previous experiences and field projects?"**
8:30 am – 9:00 am	**Synthesis: Review of previous day outcomes and objectives of the day**
9:00 am – 10:00 am	**Session 3: WORKING GROUPS – Synthesis of case studies per tools and economic domains** • Working group 1: Total Economic Values[1] • Working group 2: Cost Benefit Analysis on Marine Areas[2] • Working group 3: Sustainable funding of Marines Areas[3] • Working group 4: Others[4] *Learning objectives:* *Participants provide information from their own experience to synthesize lessons learned in the main economic domains*
10:00 am – 10:30 am	Coffee/tea break
10:30 am – 12:00	**Session 3 (Ctd): WORKING GROUPS – Synthesis of case studies** (some people may shift from one WG to another depending on their different focus) • Working group 1: Total Economic Values • Working group 2: Cost Benefit Analysis on Marine Areas • Working group 3: Sustainable funding of Marines Areas • Working group 4: Others *Learning objectives:* *Presentations are finalized for the afternoon discussion on lessons learned*
12:00 – 1:30 pm	Lunch SPC deck
1:30 pm – 3:00 pm	**Session 4: PLENARY** – **Presentations of synthesis from case studies** (30' presentation + 15' questions/discussion) • Presentation 1: Total Economic Values • Presentation 2: Cost Benefit Analysis on Marine Areas *Learning objective:* *Participants know about ground studies to be analyzed for lessons learned*
3:00 pm – 3:30 pm	Coffee/tea break
3:30 pm – 4:30 pm	**Session 4 (Ctd): PLENARY** – **Validation of methodologies and results** • Presentation 3: Sustainable funding of Marines Areas • Presentations 4: Others • Discussion: Which lessons learned can we get from these syntheses of studies? What impacts have been assessed? *Learning objective:* *Participants agree about key messages to be used and discussed in Day 4*
4:30 pm – 5:00 pm	Remarks and questions

Pre-identified participants are:

[1] E. Gaskin, P. Holland, Y. Laurans, M. Manley

[2] L. Brander, N. Pascal, J.-Y. Wiegel, T. Binet, L. Pendleton

[3] C. Mahé, L. Pendleton

[4] P. Lal, V. Ram, N. Conner, O. Thebaud

Day 3 Wednesday 24 Nov.	**"What do we keep? What do we dump? How do we improve?"**
8:30 am – 9:00 am	**Synthesis: Review of previous days and objectives of the day** • Debriefing of outcomes from Day 1 and 2 • Setting up of working group and briefing *Learning objectives:* *Participants know what is expected from them throughout the WG process*
9:00 am – 10:00 am	**Session 5: WORKING GROUPS (2 x 10 persons)** • Topic to be addressed: "Coral reef ecosystem services (ES): proposals for reef contributive factors calculations, spatial distribution of ES, determination of maximum sustainable values for fishery and tourism, management of uncertainties, non-use values in the Pacific, value projections and discount rates. Implementation of payments for coral reef ecosystem services: tradable licenses, incentives, compensation, etc. Feasibility in the Pacific context." • WG1 and WG2 will be addressing the same topics in parallel. *Learning objectives:* *Participants better understand the interest and issues linked to the concept of ES*
10:00 am – 10:30 am	Coffee/tea break
10:30 am – 12:00	**Session 5 (Ctd): WORKING GROUPS (Ctd)** *Learning objectives:* *Participants agree about a synthesis on the topic*
12:00 – 1:30 pm	Lunch SPC deck
1:30 pm – 3:00 pm	**Session 6: PLENARY – Restitution of WG** **"Validation of methods and challenges for future economic valuations"** • Debriefing WG1 (30') • Debriefing WG2 (30') • Discussion (30') *Learning objectives:* *Participants are informed about the conclusion from the other WG* *Results are discussed and integrated*
3:00 pm – 3:30 pm	Coffee/tea break
3:30 pm – 5:00 pm	**Session 6 (Ctd): PLENARY – Synthesis of WG outputs** **"Validation of methods and challenges for future economic valuations"** • Open discussion • Final synthesis *Learning objectives:* *End with clear recommendations about the most interesting methods to be promoted in the context of the Pacific region*

Day 4 Thursday 25 Nov.	**"How can we better use what we have learned from our experiences?"**
8:00 am – 12:00	**OPEN MORNING** **(Conference room booked for another meeting)** **or** **SNORKELLING at Signal Islet with Aquanature**
12:00 – 1:30 pm	Lunch (Not provided by SPC)
1:30 pm – 3:00 pm	**Session 7: PLENARY – OVERVIEW ON PRELIMINARY FINDINGS OF THE WS FOR INCOMING ATTENDANTS** • Presentation by the facilitator • Questions/discussion *Learning objectives:* *New participants in the WS understand what was achieved through the WS so far*
3:00 pm – 3:30 pm	Coffee/tea break
3:30. pm – 5:00 pm	**Session 8: PLENARY – OVERVIEW ON DECISION-MAKERS AND MANAGERS NEEDS** • Presentation by donor agencies (AFD, FFEM, etc.) • Presentation by managers • Open discussion *Learning objectives:* *Participants of the WS understand what are the expectations of the decision-makers and managers*

Day 5 Friday 26 Nov.	**"What's the next step?"**
8:30 am–10:00 am	**Session 9: WORKING GROUPS (2 x 15 persons)** • WG1: "What approaches and what kind of information would be useful to decision-makers?" • WG2: "What approaches and what kind of information would be useful to managers?" *Learning objectives:* *Acknowledge the potentials and limits of economic assessments outputs. Integrate economy in interdisciplinary approaches*
10:00 am–10:30 am	Coffee/tea break
10:30 am–12:30	**Session 10: Restitution of WG outputs** • Debriefing WG1 (20') • Debriefing WG2 (20') • Discussion and synthesis (50') *Learning objectives:* *End session with recommendations about objectives and methodologies that should be used for the next studies and about how messages should be formatted according to the different targets*
12:30–1:30 pm	Lunch
1:30 pm–2:30 pm	**Setting up of procedures for coordinating and validating methodologies of economic studies in the Pacific** • Presentation of the PREEN (Pacific REssource Economist Network) • What process is to be adopted? *Learning objectives:* *Participants know about a legitimate process for validating economical methodologies*
2:30 pm–4:00 pm	**Session 11: PLENARY – Validation of conclusions and actions to be undertaken** • Presentation of conclusions (30') • Proposals for actions to be implemented (30') • Discussion (30') *Learning objectives:* *Participants agree on conclusions*
4:00 pm–4:30 pm	Coffee/tea break
4:30 pm–5:30 pm	**Session 12: PLENARY – Wrap up and closing of the WS** **Overall evaluation of participants** • CRISP Closing speech (10')
6:15 pm–7:45 pm	**CRISP cocktail (**SPC deck)
8:00 pm–10:00 pm	**REEF BIODIVERSITY SIDE-EVENT (SPC Conference Room)** • Video-conference with the National Museum of Natural History in Paris organized around the coral reef spawning event to take place on the 26th of November; • Presentation of different projects and institutions supporting the sustainable development of reef biodiversity in New Caledonia; • Questions and debate. Public event.

Annex 5: References

Abaza, H., 2004. Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach. United Nations Environment Programme- 86 pp

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., Turner, R.K., 2002. Economic Reasons for Conserving Wild Nature. Science 297, 950-953.

Bell, J.D., Kronen, M., Vunisea, A., Nash, W.J., Keeble, G., Demmke, A., Pontifex, S., Andréfouët, S., 2009. Planning the use of fish for food security in the Pacific. Marine Policy 33, 64.

Beukering, P.J.H.v., Brander, L., Tompkins, E., McKenzie, E., 2007. Valuing the Environment in Small Islands. Joint Nature Conservation Committee, june 2007.

Bolt, K., Ruta, G., Sarraf, M., 2005. Estimating the cost of environmental degradation: A Training Manual. The World Bank: environment department papers.

Brian C. Murray, W. Aaron Jenkins, Samantha Sifleet, Pendleton, L., Baldera, A., 2010. Payments for Blue Carbon: Potential for Protecting Threatened Coastal Habitats. Policy brief: Nicholas Institute for Environmental Policy Solutions, Duke University.

Cesar, H., Chong, C.K., 2006. Economic Valuation and Socioeconomics of Coral Reefs:Methodological Issues and Three Case Studies. WorldFish Center - Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs.

Cinner, J., Sutton, S., Bond., T., 2007. Socio-economic thresholds that affect use of customary fisheries management tools. Conservation Biology 21 (6): 1603-1611.

Donlan, C.J., C.Wilcox, J.Mandel, L.Rodriquez., 2009. Opportunities for Using Debt Investment to Link Livelihood Improvement and Environmental Conservation Initiatives A Case Study Examining The Tropical Pacific Working Paper for CSIRO. Advanced Conservation Strategies. Midway, Utah.

Engela, S., Pagiola, S., Wunder, S., 2008. Designing payments for environmental services in theory and practice: An overview of the issues. Ecological economics 65 (2008) 663–674.

Ferraro, P.J., Simpson, R.D., 2001. Cost-Effective Conservation: A Review of What Works to Preserve Biodiversity. Resources for the future - S p r i n g 2 0 0 1 / i s s u e 1 4 3.

Gómez-Baggethun, E., Groot, R.d., Lomas, P.L., Montes, C., 2009. The history of ecosystem services in economic theory and practice: From early notions to markets and payment schemes. In press-Ecological Economics xxx (2009) xxx–xxx.

Groot, R.d., Kumar, P., Ploeg, S.v.d., Sukhdev, P., 2010. Estimates of Monetary Values of Ecosystem Services. The Economics of Ecosystems and Biodiversity The Ecological and Economic Foundations (TEEB D0-Chapter 5, Appendix C: The economics of valuing ecosystem services and biodiversity).

Groot, R.S.D., Wilson, M.A., Boumans, R.M.J., 2002. A typology for the classification, description and valuation of ecosystem functions, goods and services. . Ecological Economics Volume 41, Pages 393-408.

Kemkes, R.J., Farley, J., Koliba, C.J., 2009. Determining when payments are an effective policy approach to ecosystem service provision. Ecological Economics (2009), doi:10.1016/j.ecolecon.2009.11.032.

Lal, P., 2001. Coral Reef Use and Management – The Need, Role, and Prospects of Economic Valuation in the Pacific. International Consultative Workshop for Economic Valuation and Policy Priorities for Sustainable Management of Coral Reefs.

Markandya, A., Nunes, P.A.L.D., Brauer, I., Ten Brink, P., Kuik, O., Rayment, M., 2008. Review On The Economics Of Biodiversity Loss – Economic Analysis and Synthesis. Final report for the European Commission, Venice, Italy. 140 pp.

Mirault, E., 2006. Les fonctions et enjeux socio-économiques des écosystèmes récifaux : une approche géographique des valeurs de l'environnement appliquée à l'île de la Réunion. These, 700 pp.

OECD, 2006. Cost-Benefit Analysis and the Environment Recent Developments.

Pagiola, S., 2004. How much is an ecosystem worth? The International Bank for Reconstruction and Development/THE WORLD BANK, Washington, June 2004.

Pascal, N., 2010. Ecosystèmes coralliens de Nouvelle-Calédonie Valeur économique des services écosystémiques Partie I: Valeur financière. IFRECOR Nouvelle-Calédonie, Nouméa, Avril 2010, 155 p + 12 planches.

Peters, H., Hawkins, J.P., 2009. Access to marine parks: A comparative study in willingness to pay. Ocean & Coastal Management 52, 219.

Weitzman, M.L., 2001. Gamma Discounting. The American Economic Review (AER), 91(1), 260 - 71. .

Wundera, S., Engelb, S., Pagiola, S., 2008. Taking stock: A comparative analysis of payments for environmental services programs in developed and developing countries. Ecological economics 65 (2008) 834–852.