

# **Socio-cultural Valuation of Marine Biodiversity: A Working Paper in Methods**

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## **Introduction**

This paper presents in initial thoughts and rationale on feasible methods for the valuation of marine biodiversity in sociocultural terms. Valuation studies of biodiversity in general are full of complexity; how to define biodiversity, talk about it, and value it is difficult. Increasingly, however, the importance of such studies is recognized (e.g. Ruitenbeek and Cartier 1999) and consequently the number of valuation studies continue to grow. Until this point, however, studies have focused primarily on terrestrial biodiversity (e.g. Verschuuren 2006). Those which do exist on the marine side have primarily focused on either specialist or charismatic habitats such as coral-reefs (e.g. Spash 2002), or on the economic valuation of biodiversity (e.g., Ruitenbeek and Cartier 1999). These studies are indicative of a paradigm shift towards more economic means of modeling value and diversity. Perhaps more relevantly, they show that sociocultural valuation presents a more difficult and even more pressing task as indicators for sociocultural valuation of marine biodiversity have neither been developed nor tested. There is a great need for advancements in valuation science to assess the cultural importance of biodiversity and natural ecosystems, especially ones which provide methods for linking ecosystem functioning and human well being (Ghosh et. al. 2005, Verschuuren 2006; Vanclay 2002). As with Verschuurn (2006), this working paper presupposes the importance of cultural perceptions of biodiversity and cultural systems, such as traditional ecological knowledge (TEK), (Berkes and Folke 1998, Folke et al. 1998; Stewart and Strathern 2003; Verschuuren 2006) and seeks an emic perspective biodiversity values. Hence, the importance of such sociocultural valuation studies.

Despite the recent movement into the realm of valuation studies of marine biodiversity, little research has been conducted on the socio-cultural valuation of marine biodiversity. Scientists and managers alike are increasingly working to include social, economic, and environmental data as well as considerations into decision making. According to Daily et al (2000) it is important to identify and measure all social, economic and environmental impacts of a development in order to ensure environmental decision making is sustainable, efficient and equitable. However, we

know due to the intricacy of combining such disparate world views and data sets, that combining the social, economic, and environmental aspects into one method is extremely difficult and fraught with problems and limited success. The ecosystem approach attempts to include all three, and as Beaumont et al. point out, “Assessing ecological processes and resources in terms of the goods and services they provide translates the complexity of the environment into a series of functions which can be more readily understood, for example by policy makers and non-scientists” (2007: 254).

This working paper presents the use of q-method to elicit data from stakeholder in regards to environmental management. We propose to take this forward, using in for valuation of marine biodiversity. The paper is a sort of guide and “how to” in using Q sorts and Stakeholder analysis.

## **1 Q sorts and Stakeholder Analysis**

### **1.1 Main Rationale and Objective of Stakeholder Analysis**

From the perspective of the overall development of an effective strategy for biodiversity conservation, the reason of for a stakeholder analysis is to describe what conflicts exist around any biodiversity conservation measures being considered, who the local stakeholders in the conflicts are, what they believe, and what they want, and what they might be willing to give up. This is critical if the participatory decision strategies and action plans are to respond meaningful to the political and social realities in which biodiversity conservation policies are created and implemented. Without these steps policies and measures may fail to gain sufficient political support to be made into rules, and even if they are, they will often lack enough support among local people to be effective.

Many attempts at biodiversity conservation have failed because local people saw them as imposed on them, making the enforcement of the rules much too expensive to be effectively implemented. The answer to this dilemma is to implement biodiversity conservation through a facilitated process in which all of the local stakeholders – i.e. the people who are in the best position to undermine the effort if they choose to do so – are involved. Such processes never lead to everyone agreeing, and they always involve compromise, but they do lead to conservation measures that have a much better chance of actually working in the long run.

The methodological challenge to designing an effective negotiation process is to create a realistic picture of the political landscape in which biodiversity conservation needs to be implemented. The objective is to understand both the identities and desires of the local stakeholders in the terms and categories they themselves are using. You should not assume ahead of time that you know who the stakeholders are, let alone that they know how the stakeholders see themselves and their problems. Above all, you should not make any assumptions about which interested groups do or do not have a legitimate stake in biodiversity conservation and any related conflicts.

This part of the development of biodiversity conservation strategies should be thought of as the “listening” part. It is a model that can be used by anyone who wishes to facilitate biodiversity conservation to use to listen to the stakeholders and learn how they see themselves and their problems.

## 1.2 Approaches

### 1.2.1 Theoretical Background

The scientific method used in this research is discourse analysis (Phillips and Hardy 2002). For a very good and thorough example of discourse analysis to an environmental problem see Hajer (1994). The Worldnet Dictionary defines *discourse* as: 1) an extended verbal expression in speech or writing, or 2) an extended communication, often interactive. Discourse analysis is based on both of these definitions. The discourse analysis takes as its data the extended expressions of the stakeholders about the conflict of interest but it understands those expressions in terms of how they are part of, and are shaped by, an interactive process.

Discourse analysis focusses on existing and potential communications among stakeholders. In particular, it is interested in the intersection of *facts, values and interests* in the things that people say about the conflict. Understanding how people link these three things makes a number of contributions. On the side of facts, the discourse analysis helps to uncover where the presentation of validated scientific information may aid in reconciliation. It also may identify real disagreements that may benefit from, or even require, further research that will lead to potential solutions. On the side of values, the discourse analysis helps to uncover those areas where compromise is possible, and where it is impossible based on strongly held beliefs. On the side of interests, it gives information about where possible compromises and/or win-win outcomes are possible.

Discourse analysis comes out of the “embeddedness” perspective within social science. Embeddedness focuses on communications in two fundamental ways. It examines the shared and divergent understandings of social reality that form the background of both verbal and physical behaviour. It also examines the networks, the “who talks to whom,” which determine a person’s influence, prestige and some forms of power. The embeddedness view contrasts with, and is complemented by, the two other basic social science approaches: the atomistic view of society and the structural view of society.

The atomistic approach understands society as interacting actors in pursuit of objectives and seeks to understand how this competitive behaviour creates institutions. In the atomistic view communications are not seen as not central and important, but rather reflections of individual competition. They are understood as tactics, people make the claims they make in order to achieve their goals. In approaching negotiations around biodiversity conservation from an atomistic viewpoint the analyst focusses on interests, looking for ways that bargains can be made that allow the stakeholders to partially reconcile their conflicting objectives. This is, of course, an important part of the work of facilitating an effective resolution.

The structural approach sees society as made up of groups that form the attitudes of their members through world views or ideologies. These world views take the form of and are expressed as values. Hence, values are bound up in group identities, which is what makes them such a block to compromise. Group solidarity is the most important source of social power beyond the control of economic interests, so compromising on values becomes a betrayal. The structural approach sees different groups, with these different sets of attitudes and beliefs, competing with one another. These groups are closely linked to people’s economic interests, social identities, or both. Like the atomistic approach, the structural approach also sees

communications as derivative. Here, communications are seen as mere reflections of underlying realities that are linked to the ways that groups maintain power. In approaching the facilitation of biodiversity conservation from a structural viewpoint the analyst focusses on the relative power of the different stakeholders. Again this is a critical question for facilitating effective biodiversity conservation. If weaker groups are blocked from meaningful participation then they may undermine conservation in other ways. These ideologies and world views, based as they are on the powerful motivating factors of group power, interests and identities, strongly determine which conflict solutions stakeholders are willing to enter in to.

The atomistic and structural approaches both focus on competition and struggle, the main difference being the emphasis on the dynamics of competition between groups versus between individuals. While this is critically important for understanding the political context of biodiversity conservation, these are theoretical perspectives that achieve their insights by overemphasizing the competitive aspects of society and underemphasizing the cooperative aspects. And, in spite of the structural perspectives emphasis on groups, both perspective produce statements about individual people and what is going on in their heads. One does this by looking at people's goals and their decisions about how to achieve those goals, while the other does this by looking at their values, identities and beliefs.

The embeddedness perspectives complements this in an important way through a focus on what is truly social, on what is going on between people. It understands society as a shared reality made up of and reproduced by statements that draw on mutual understandings. Here, communications are understood as an interactive process of social construction and analysis describes these mutual understandings. After beginning from identifying these shared understandings, then the ways they relate to both goals and world views completes the analysis.

Discourse analysis is one of a number of methods based in the embeddedness perspective. It is a method that is particularly well suited for research in support of the development biodiversity conservation. Because of the sheer number and complexity of human interactions, embeddedness methods, e.g. network analysis, tend to be very time consuming and labour intensive. Discourse analysis can also be done very thoroughly, but it can also be done simply by holding a series of interviews and then intuitively arranging the results in to themes. This gives only a limited picture of the social and political realities but for most situations this will provide important information from a relatively small investment of time and resources.

The product of the discourse analysis is a description of the discursive themes. Themes are repeated patterns in which facts, values and interests are linked in the same way by participants in the discourse. Themes are interpretations and cannot be given precise boundaries and different ways of describing themes can be valid. The only meaningful test is the degree to which participants in the discourse see the themes as a coherent picture of their discussions. Some groups will agree with particular themes, some groups will disagree with the themes, but all the groups should be familiar with the themes as recurring parts of the discourse. Themes that are drawn on by only one group reflect world views and may be very limited in the degree to which they reflect shared understandings, while other themes that are drawn on by many groups may reflect shared understandings that can be the basis of conflict management and compromise.

### **1.3 The Definition of a Stakeholder**

A stakeholder is any group of people that is likely to be able to influence the content or effectiveness of biodiversity conservation. This definition includes government agencies at various levels, environmental groups, resource users, local businesses, such as those related to tourism, etc. Stakeholders can wield such influence either by participating in the creation of the biodiversity conservation measures or by helping or hindering their implementation. In other words, if an environmental group or a local business group has the possibility of having influence on the content of the biodiversity conservation plan, then that group is a stakeholder. Furthermore, if user groups have a possibility of violating the rules of the conservation plan then they are stakeholders because they can have a negative impact on its effective implementation, even if they didn't have any influence on its content. It is, of course, precisely this last situation, where the voices of those who can undermine conservation have been excluded from negotiating the content of the conservation measure, that we are trying to avoid.

### **1.4 Methodological Steps**

#### **1.4.1 Regional level interviews**

The research begins with interviewing people at the regional level. An initial series of key informant interviews will be done with officials in each country who represent both relevant government ministries and with the representatives of any non-governmental organisations that represent scientific, economic, or conservation interests in biodiversity or the measures being proposed for its conservation. These interviews provide more information about the nature of the conflict, explore the official positions if any of the various agencies and NGOs, and most importantly identify the primary local stakeholder groups.

The primary local stakeholder groups are the people to be interviewed in the next phase. We can distinguish between first and second level stakeholder groups. The first level are the main types - in ecological conflicts, these are usually:

- a) conservationists
- b) consumptive user groups and related industries
- c) non-consumptive user groups and related industries
- d) government officials from various agencies

The idea of the “second level” is to recognize that these categories hide many differences. Conservation groups have many different priorities. Very large differences in interests can exist between consumptive user groups who use one technique versus ones who use another. It is important that the investigator identify the actual critical stakeholder groups at this second level.<sup>1</sup>

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<sup>1</sup> Note that this is not at all the same thing as a commonly heard distinction between ‘primary’ and ‘secondary’ stakeholders, which is an attempt to frame an abstract definition of ‘stakeholder’ based on a functional distinction between user groups and others. That approach tries to define various levels of legitimacy among stakeholders. Such a distinction is not useful here where the definition of ‘stakeholder’ is based on their objective ability to influence the success of biodiversity conservation not on any preconceived idea of which stakeholders should be able to legitimately participate.

The number of such groups will depend on the actual situation and may vary considerably between different issues. The first job of the investigators after the regional interviews is to decide which different groups have to be involved the discussions around biodiversity conservation. This decision must remain open to change and redefinition during the research as more will be learned about differences during the interviews.

The second job of the investigators at this point is to define what is meant by “local”. The purpose of this is to understand the local level political realities that will have an impact on the success of biodiversity conservation. “Local” should not be taken in this discussion to mean a predefined geographical or administrative area. What constitutes “local” in respect to a particular set of issues should be defined by both the geographical and social landscapes over which the conflict is taking place. The local is the space where the members of the stakeholder groups that are directly affected by the conservation measures are operating and interacting with one another. This may mean a municipality, but it also may mean a county or even a larger region. One way to define the local may be the area of administration of the lowest level government officer concerned with the conflict. Important question in determining what is local would be to whom the stakeholders would take their concerns about conservation measures. Another will be the area over which members of particular stakeholder group meet with one another, for example a chapter of a concerned conservation organisation or business group. The basic idea is that this research is meant to examine interaction at the level in which policies are implemented and reacted to, not the level on which policies are formulated.

#### **1.4.2 Local level interviews**

Once the regional level interviews are complete the next step is the local level interviews. Enough interviews should be carried out to get a picture of the conflict. The best practice is to keep interviewing until you start hearing mainly things you have heard before. A good initial goal would be three interviews for each of the second level stakeholder groups that have been identified as important to conservation success. It is important here that they be people with quite different roles and at least one of these three not be seen as a ‘leader’ of the stakeholder group so that at least some assessment can be made of the degree to which the leaders actually speak for the group. The meaning of “leadership” in each group can be very different and this will be a critical question throughout the research process. The assessment of leadership in the interviews should still be looked at as very tentative as the research continues. Other techniques, such as using large-N surveys to gauge the divisions within and between stakeholder groups are available but would be very demanding of time and resources.

##### *1.4.2.1 Interview Goal 1: Understanding Perceptions of Interests*

The first goal of the local level interviews is to understand perceptions of interests. This step begins with gathering information on costs, benefits of conservation measures and their distribution through interviews with local stakeholders. The most important part is collating information on how the local stakeholders see these costs, benefits and their distribution. While information on costs and benefits and their distribution is mainly gathered through direct stakeholder interviews basic descriptions of the local areas and information to corroborate and compare stakeholders' perceptions can also be gathered from documentary sources, such as libraries, government agencies, etc. The products of this work are of use not only to

understanding stakeholder interests in relation to the discourse analysis, but can also provide input into a regional level analysis of the economics of the conservation measures.

In particular the following issues need to be covered:

- 1) The perceived economic costs of the proposed measures.
- 2) The perceived economic benefits of both consumptive and non-consumptive economic activities related to biodiversity
- 3) The perceived social costs and benefits of biodiversity conservation, the specific measures being discussed, the conflicts over those measures and both the consumptive and non-consumptive economic activities in the life of the community.
- 4). Appropriate potential mitigation strategies for reducing the costs of conservation measures when they are implemented.

For each of these four items the analysis needs to discover how perceptions differ among local stakeholders, and how extensive these social and economic costs and benefits are from the perspective of the overall community, and how these costs and benefits are distributed among stakeholder groups.

#### *1.4.2.2 Interview Goal 2: Understanding Perceptions of Facts*

The second goal is approached in concert with our natural science colleagues and begins with the prioritization of the factual basis for potential conservation measures. The emphasis here is on biological and ecological facts, but economic facts may also play a role. The interviews involve:

- 1) Examining how respondents see causal processes. A good way to do this is to ask what they see as the most important changes in the ecosystem over some appropriate time period and why they think it happened. Asking them to draw and discuss maps is another good technique, especially where landscape factors are important;
- 2) Examining which facts they believe to be the most relevant to conservation measures. What they see as the most important 'science' factors in these conflicts. What they believe has caused these factors and what they think can be done about it;

#### *1.4.2.3 Interview Goal 3: Understanding Stakeholders' Values*

The final goal is to understand the values that stakeholders attach to the issues involved in biodiversity conservation. One part of this is uncovering important group identities for both the respondent and for how the respondent sees other stakeholders. While it would not be effective for the interviewer to ask directly something like "what are your values," as that would lead to an abstract discussion of the meaning of a "value". It would be better to use indirect approaches to this question such as the following:

- 1) Ask who the respondent sees as main players in involved in discussions over biodiversity conservation and what they are after.
- 2) Ask how the respondent became involved personally in biodiversity conservation issues.
- 3) Ask the possible ways the respondent sees conservation being implemented and what his or her preference would be and why

4) Ask who the respondent sees as bears primary responsibility for creating any problems related to biodiversity conservation and why. Then ask who has primary responsibility for resolving the problem.

A number of other ways to explore the value issues will come up in the interviews. The important thing is to be alert to this issue and be willing to ask follow up questions.

### **1.4.3 Initial Analysis** Fejl! Bogmærke er ikke defineret.

Analysis begins with writing up the notes from the interviews. From these notes a team should work together to identify the themes using the following steps:

1) On a set of cards write statements made by respondents that connect in some fashion at least two of facts, interests and values. Choose statements that are relevant to biodiversity conservation measures and that meet one of two other criteria: a) they are statements that are repeated by three or more respondents or b) they are statements that the respondent felt strongly about. Continue until there are no more statements that fit these three criteria.

2) As a team, group these cards intuitively into like categories. At first, do not worry about the number of categories or the number of cards in the categories. When you have finished the grouping then you should merge the cards until you have no groups with less than three cards.

3) Give each group a descriptive name that is an “assertion”, meaning a statement that can be agreed or disagreed with. The reason for making these names in the form of assertions is to make sure that the themes are comparable with each other and can be analysed the same way. It is important to keep in mind, that the theme is much larger than just its name.

4) Write paragraphs describing each theme. The name is a summary, it should be the most important, representative, and central assertion within a theme, but it is not the entire theme. The entire theme is the whole linked together set of facts, values and interests and this should be described in the paragraph.

### **1.4.4. Q Sorting**

Q sorting (Brown 1986) would be a method for confirming the discourse analysis. In this technique you would ask the stakeholders in individual interviews to rate the statements in terms of agreement following a forced normal distribution. These ratings are then subjected to a factor analysis that reveals the positions of various groups and how strongly they feel about them. This is a fairly easy technique and can reveal subtle differences between groups. This last may be an advantage when dealing with conflict situations.

#### *1.4.4.1 What is a Q sort?*

A large number of statements, as many as possible, made by people on in focus groups or individual interviews are gathered together and grouped according to the identified themes. 16, 24 or if needed a slightly higher number of statements are selected to represent the themes.

The statements are as close as possible to the original wording used by the respondent with the important caveat that it must be clearly possible to interpret what it means for someone to agree

or disagree with the statement. For example the statement “It is only the grey seals that are eating too many cod” would not work because you would not know if the respondent was agreeing or disagreeing with the phrase “only the grey seals” or “too many”. Much natural speech contains these sorts of statements that are ambiguous from the perspective analyzing agreement and disagreement.

These sets of statements are given to respondents who order them following two criteria: agreement and strength of feeling. After they sort the statements there is a follow up interview asking them their reasons for their various choices.

Respondents order the statements following a forced quasi-normal distribution. With sixteen statements they give a value of -3 to one statement, -2 to two, -1 to three, and 0 to four statements with the positive numbers from 1 to 3 being the mirror image of the negative ones.

These rank orderings, or Q sorts, are then submitted to a Q factor analysis. Standard or R factor analysis consists of taking a set of correlations between real variables and identifying underlying pseudo-variables called factors. The point of these factors is that they are independent, i.e. not correlated at all with one another. The basic results of factor analysis are factor "loadings", numbers which indicate the extent to which each real variable is correlated with the factors, and factor "scores" which indicate how a particular respondent ranks on each of the factors. Q factor analysis turns R factor analysis on its side: rather than extracting factors from correlations between variables they are extracted from correlations between respondents. Thus the factor loadings apply to each person and the factor scores apply to the "variables", i.e. they apply to the statements that the respondents ordered.

#### *1.4.4.2 An example Q Sort Procedures and Response Sheet*

**Q sort introduction: We are working with Bel Air University to try to find out how concerned people in this area view issues around biodiversity conservation. Last year we held a series of in-depth interviews in this area. Now we are trying to find out how much people in the area agree or disagree with some of the things people told us. We want to do this in such a way that we can put the results in a computer and use the computer to compare what people are saying. We want to use the computer to find out how much people disagree with each other.**

**We have here 20 statements that were made during our interviews. We are going to ask you order them in terms of how much you agree and disagree with them and how important you think they are. You are going to make your order in a triangle shape because that is the best way for the compute to compare the opinions of different people.**

1. Record the answers to the information on the respondent information sheet. This will contain basic information about the respondent, i.e. age, education, position in community, membership in groups, etc. that will be used in subsequent analysis.
2. Shuffle the statement cards before each interview so they are presented in a random order. Read each card and ask R if he or she agrees or disagrees with the statement. Lay the cards out in two separate lines, one for agree and one for disagree.
3. Then turn first to the agree pile say: **These are the cards you agreed with, please select the card you think is the most important.**

When card is selected take it out of the square and place it to R's right so that with the writing facing toward R.

**Now please select the next two cards that you think are the next most important.**

When these cards are selected place one next to the one to R's right and place the other immediately above it. Which card is placed above or below does not matter. Continue with two more, then three more and so on until all the agree cards are finished.

Then turn to the disagree and say: **Please select the card you disagree with the most of all of them.**

When the card is selected take it out of the square and place it to R's left with the writing facing toward R.

**Now please select the next two cards that you disagree with the most.**

When these cards are selected place one next to the one to R's left and place the other immediately above it. The order of this placement does not matter. Have R select 2, more then three more and so on. Continue until the triangle is complete. When these cards are selected place two next to the one to R's left and place the other immediately above them.

When the triangle is complete it should look like this:

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          0
        -1 0 1
      -3 -2 -1 0 1 2 3
    -4 -3 -2 -1 0 1 2 3 4
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**Please look over the triangle in front of you and make sure that it runs from the statements you disagree with the most to the ones you agree with the most and think are the most important.**

When R is satisfied with the triangle record the scores of each statement on the response sheet.

**RECORD STATEMENT NUMBERS BELOW**

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Point to the card in the highest position and ask **why do you agree with this one the most?**

Record response:

Point to the card in the lowest position and ask **why do you disagree with this one the most?**

Record response:

#### *1.4.4.3 Q sort Analysis*

The analysis consists of doing a performing a principle components (factor) analysis on the matrix of statements by scores. This can be done with any standard statistical package. The analysis produces two sets of scores. The first is the “loadings” of the statements on a set of factors. The second set of scores relates respondents to factors.

The loadings are used to describe the meaning of the factors. This is much more art than science. The first thing the analyst must decide is how many factors to keep. The factor analysis itself can produce as many factors as the analyst wants. A common rule of thumb is to keep all of the factors that have “eigenvalues” higher than .1, which is to say that the factor explains at least 10% of the variance in the matrix. This rule of thumb is a good place to start, but the analyst must also see if selecting a different number of factors might yield a more cohesive and interpretable set of factor loadings. Once the final number of factors is determined the analyst describes the factors by examining the statements that are strongly loaded on the factor, either positively or negatively. The factors should “confirm” that is resemble the themes, if they do not there is a substantive problem in the interpretation of the discourse and this must be identified. Once the factors are identified the final step is to examine which groups of respondents agreed or disagreed with the themes. This is done by simply examining means and correlations among the respondent scores on the factors.

### 1.3 Required Reading

Phillips, N. and Hardy, C. 2002. Discourse Analysis: Investigating Processes of Social Construction London: Sage Publications. This is a guide to methods.

Hajer, M. A. 1995. The Politics of Environmental Discourse: Ecological Modernization and the Policy Process Oxford: Clarendon Press. This is a particularly good example of a discourse analysis of an environmental issue.

Brown, S.R. 1986. "Q Technique and Method: Principles and Procedures" Chapter 3, Pp 57-76 in Berry, W.D. and M.S. Lewis-Beck (Eds) *New Tools for Social Scientists: Advances and Applications in Research Methods* Beverly Hills: Sage Publications. Simple introduction to Q sorting.

### 1.4 References

Beaumont, N.J., M.C. Austen, J.P. Atkins, D. Burdon, S. Degraerd, T.P. Dentinho, S. Derous, P. Holm, T. Horton, E. van Ierland, A.H. Marboe, D.J. Starkey, M. Townsend, T. Zarzycki, 2007. "Identification, definition and quantification of goods and services provided by marine biodiversity: Implications for the ecosystem approach." *Marine Pollution Bulletin* 54 (2007) 253–265.

Berkes, F, and Folke, C, 1998. "Linking social and ecological systems for resilience and sustainability", in *Understanding Social and Ecological Systems*, Cambridge: Cambridge University Press.

Brown, S.R. 1986 "Q Technique and Method: Principles and Procedures" Chapter 3, Pp 57-76 in Berry, W.D. and M.S. Lewis-Beck (Eds.) *New Tools for Social Scientists: Advances and Applications in Research Methods* Beverly Hills: Sage Publications.

Folke, C., Berkes, F., and Colding, J. 1998. "Ecological practices and Social Mechanisms for building resilience and sustainability" in, *Understanding Social and Ecological Systems*, Cambridge: Cambridge University Press.

Ghosh, A., Traverse, M., Bhattacharya, D.K., Brondizio, E.S., Spierenburg, M., deCastro, F., Morsello, C., deSiqueira, A. 2005. Cultural Services, Chapter 14, Policy Responses, in Volume 3: Global & Multiscale Assessment Report, as part of the Millennium Ecosystem Assessment, Island Press, Washington, DC. Available at <http://www.maweb.org//documents/document.319.aspx.pdf> (last accessed at 26-2-2009).

Ruitenbeek, J. and Cartier, C. 1999. Issues in Applied Coral Reef Biodiversity Valuation: Results for Montego Bay, Jamaica. World Bank Research Committee Project RPO# 682-22. "Marine System Valuation: An Application to Coral Reef Systems in the Developing Tropics." Final Report, March 1999.

Spash, Clive L. 2002. "Informing and forming preferences in environmental valuation: Coral reef biodiversity" [\*Journal of Economic Psychology\*, Volume 23, Issue 5](#), October 2002, p 665-687

Stewart, P.J., and Strathern, A. 2003. *Landscape, Memory and History: Anthropological Perspectives*. Anthropology Culture and Society Series, London: Pluto Press.

Vanclay, F. 2002. Conceptualising Social Impacts, Environmental Impact Assessment Review, Environmental impact Assessment review 22 (2002) 183-211

Verschuuren, Bas. 2006. "An overview of cultural and spiritual values in ecosystem management and conservation strategies." Foundation for Sustainable Development, The Netherlands.