Project no: **INCO 003739**

Project acronym: **INCOFISH**

Project title: **Integrating Multiple Demands on Coastal Zones with Emphasis on Aquatic Ecosystems and Fisheries**

Instrument: **Specific Targeted Research Project (STREP)**

Thematic Priority: **International Cooperation**

Deliverable D6.1:

'Concepts and Tools for ICZM with a Special Focus on Stakeholder Engagement and Visualization Tools in Fisheries Management'

Due date of deliverable: **May 31, 2006**

Actual submission date: **May 31, 2006**

Start date of project: **01/05/2005** Duration: **3 years**

Organisation name of lead contractor for this deliverable: **Coastal Development Centre (CDC)**

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Work Package 6 Deliverable D6.1

Concepts and Tools for ICZM with a Special Focus on Stakeholder Engagement Visualisation Tools in Fisheries Management

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Acknowledgements

The report is the first deliverable of Work Package 6 to the EU-funded INCOFISH project, *Integrating Multiple Demands on Coastal Zones with Emphasis on Aquatic Ecosystems and Fisheries* (Project no. INCO 003739). We would like to thank the following members of Coastal Development Centre, Thailand for their contributions: Passara Ratanapisit, Ilada Neamthed, Montree Mongkala, Pisuttipong Suriyakarn, Idsariya Wudtisin, Fareed Kanji and Marco Boccia. We also acknowledge Kevin Stephanus and Rashid Sumaila, University of Namibia, Namibia, for providing information about Namibia coastal areas. Finally, we thank Daniel Pauly, Jackie Alder and the *Sea Around Us* Project for their collaboration.

Abstract

The INCOFISH (Integrating Multiple Demands on Coastal Zones with Emphasis on Aquatic Ecosystems and Fisheries) project aims to conduct specifically targeted strategic research towards reconciling multiple demands on coastal zones with special emphasis on developing countries. This report is the first deliverable for INCOFISH Work Package 6 (Coastal Transects). This Work Package will provide a framework for compilation and analysis of data relevant to the understanding of interactions, impacts and flows in the coastal zone. Specially, this report reviews the concepts and tools for ICZM (Integrated Coastal Zone Management) with a special focus on the use of visualisation tools in stakeholder engagement. Six case studies located within four countries (Scotland (UK), Thailand, Namibia and Mexico) were chosen to provide an overview of the current engagement approaches and visualisation tools being applied to develop an understanding of their effectiveness in fisheries management. Discussion about a new visualization and engagement tool currently developed under this Work Package called '*Coastal Transects Analysis Model*' (or CTAM) is also provided.

A framework of stakeholder engagement processes and tools was developed by drawing on ICZM concepts. This framework was used to guide the case study survey approach and overall analysis. The case studies tested the application and importance of a broad spectrum of engagement tools used in ICZM with a particular focus on fisheries management. The type and importance of the engagement tools used in each case study was assessed and compared. The key stakeholder groups in each case study were also analysed.

The primary stakeholders in fisheries management at all case study sites were fishers, with aquaculturists reported as key stakeholders in all sites where aquaculture was present. Tourism Operators and Associations, Coastal Land Developers and Recreation Users show all levels of engagement across the case studies. About half of the potential engagement tools were used in the six case studies, with tools using face-to-face communication the most commonly used. 'Workshops' was the only engagement tool used at all sites. It is also important to note both the limited use and relative ranking of 'technology assisted' engagement tools, and what can be learned in the development of CTAM. The factors and potential barriers that resulted in the minimal application of technology in the case study sites are worthy of further investigation. Such analysis should inform the development of CTAM, particularly to ensure that its use in future fisheries-related stakeholder engagement is optimised.

The effectiveness of the tools used in the case studies in both engaging stakeholders and in contributing to management outcomes has proven difficult to evaluate. While the descriptive summary of tools has yielded interesting results, the key constraint is the lack of accepted measures that would indicate their effectiveness.

Keywords:

Coastal Transects; Stakeholders; Community; ICZM; Fishery Management; Aquaculture; Decision-making Framework; Governance; Visualisation

1 Introduction

1.1 Paper Overview

The primary goal of Integrated Coastal Zone Management (ICZM) is to support the sustainable development of coastal lands and nearshore waters. Critical to the support of this goal is the shared understanding of key management issues in coastal areas that require management action. This sharing is required of all those with a stake in their outcome. ICZM stakeholders are usually from diverse backgrounds, professional experience, educational levels and world views. As a result, embracing stakeholder diversity is one of the most important challenges faced by coastal managers. Consequently, coastal mangers seek to use tools that harness the skills, experience and opinions brought by stakeholders into ICZM, while striving not to reduce these to 'lowest common denominators'. Inherent in effective engagement is recognition of the conflicting values and demands of stakeholders.

One mechanism used by coastal managers to assist in effective stakeholder engagement is the use of visualisation tools – ranging from simple visual tools such as hand-drawn maps through to sophisticated computer systems. These tools can allow stakeholders from diverse backgrounds to engage with coastal planning processes, such as fisheries planning through meaningful and moderated interactions. Visual tools can promote mediated engagement between stakeholders that promote shared understanding of issues and shared commitment to management actions.

There are marked differences in the style and application of stakeholder engagement tools as will be outlined in this report; this evolution reflects the broader trends in governmental decision-making worldwide and broader societal trends in globalisation, democratisation, the reach of technology and continued development efforts. More and more societies expect to be involved in decisions that affect them (Welp 2001). The combined implication of these trends is an altered set of expectations in the way that many coastal stakeholders are engaged in decision-making.

This rapid pace of change is likely to continue in the future as increasingly information-empowered communities demand greater access to information (Smith & McDonough 2001). This also may lead to greater demands for involvement in decision-making processes. In an increasingly democratised world there is also change in participatory representation, which crucially affects individual and community relationships with those who hold decision-making powers, primarily at different levels of government (Catt 1999, Grugel 2002). As citizens demand a greater involvement in decision-making that affects them it is clearly important to engage stakeholders in all stages of decision-making processes, as this will improve the effectiveness of communication with the objective of ensuring that different stakeholders have a set of realistic and standardised expectations (Lundquist & Granek 2005).

Stakeholder involvement can range from active participation to more passive observation. This concept is well demonstrated by Arnstein's ladder (Arnstein, 1969) (Figure 1), which outlines the degrees of citizen participation in decision-making, from non-participation to citizen control. The citizen involvement can range from affecting policy development down to the implementation of specific management actions at a local level (Ellsworth *et al*. 1997).

Figure 1 Arnstein's ladder of citizen participation in decision-making (Arnstein 1969)

This paper seeks to review concepts and tools for ICZM, with a special focus on stakeholder involvement. This will be undertaken through the overall analysis of ICZM and its evolution in the past 30 years, followed by analysis of the approaches and tools used in stakeholder engagement in ICZM. Case studies from coastal areas in four countries (Thailand, Namibia, Scotland (UK) and Mexico), analysing the roles and involvement of stakeholders, will be presented to illustrate the use of different stakeholder engagement tools. Finally, a discussion about visualisation tools will be provided, linking specifically to the roles that Coastal Transects Analysis Model (CTAM) may play in managing multiple demands in coastal areas and facilitating stakeholder engagement.

2 Conceptual basis of ICZM

The management of coastal issues is often undertaken with a disciplinary focus. For example, fisheries managers may consider nearshore fisheries as those fisheries or components of fisheries that are adjacent to the coast. They would suggest that principles of fisheries management are applicable, despite the fact that the productivity of many nearshore fisheries is directly linked to coastal and inland waterways and habitats. Although coastal zone management requires the involvement of a variety of specialists (including fisheries managers), the idea that one discipline can be applied to all geographic contexts must be balanced against the unique characteristics of the coast, which result from the overlap of terrestrial and marine environments. This is where the internationally recognised and applied concept of Integrated Coastal Zone Management (ICZM) is extremely useful.

ICZM is now considered an invaluable set of tools and approaches for managing coastal zones. Due to the unique nature of coastal zones, they require unique and integrated management and planning approaches (Kay & Alder 2005). ICZM has developed over the last 30 years as a result of concerns that existing planning and management systems and single-sector disciplines were inadequate to effectively manage the coast and the people who rely on it for subsistence, income and recreation (Kay & Alder 2005). ICZM is becoming an accepted standard to manage coastal zones in most developed countries of the world. The practice of ICZM in developing countries has grown quickly due to locally driven initiatives as well as significant funding aid donors (Cicin-Sian & Knecht 1998).

A review of global ICZM activity by Sorenson (2002) estimated approximately 700 coastal management programs are being implemented in around 145 coastal nations or semi-sovereign states (shown in Figure 2).

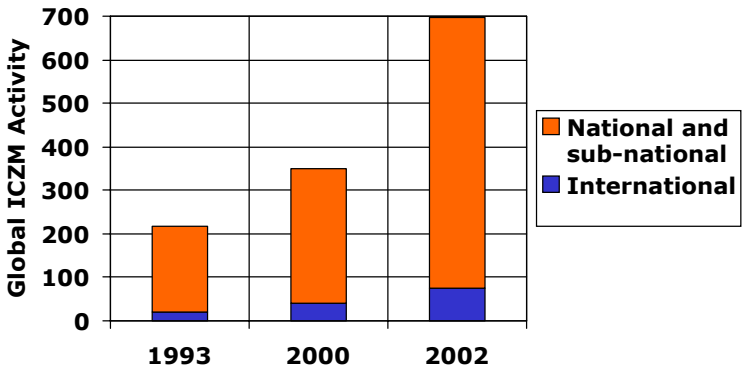

Figure 2 Estimated worldwide growth in ICZM initiatives (Kay & Alder 2005 adapted from Sorensen 2002)

Smith (*in press*) noted recently that Sorensen estimated that less than half (45%) of these ICZM initiatives were active. For the Asia Pacific region there is further ICZM activity data. The Coastal Zone Asia Pacific (CZAP) Conference identified (Chuenpagdee & Pauly 2004) 300 active projects between 1992-2002. Additional analysis of CZAP data is currently being undertaken (Smith *in press*).

Over the last ten years international literature in ICZM has built up extensively (Viles & Spencer 1995, Clark 1996, Cicin-Sain & Knecht 1998, Hinrichsen 1998, Beatley *et al*.

2002, Kay & Alder 2005). A wide range of conferences are also being used widely as a forum to address international and region-specific issues in ICZM, the details of which can be found at www.coastalmanagement.com including links back to the proceedings of past conferences.

ICZM program success is essentially due to their capacity to ensure that government, industry and the wider community understand and accept and apply the very principles, policies and processes that underpin the programs. This necessitates communication between the primary stakeholders, which can vary from ad hoc communication and meetings, consultation on plans and policies, and more sophisticated forms of involvement and partnership between the public and private sector (Kay & Alder 2005). Such effective stakeholder engagement is vital to the effectiveness of all components of ICZM, including its role in supporting sustainable fisheries management.

3 Overview of Stakeholder Involvement in ICZM

Within any particular coastal zone there is likely to be a wide range of stakeholders with differing issues and operating at different scales (Kay & Alder 2005). For the purpose of this discussion a ***Stakeholder*** is defined as *'any person or organisation with an interest in, or potentially impacted by, the development and implementation of an ICZM program'*. Applying this definition, example stakeholders would include:

- politicians representing coastal electorates;
- government officials spread across a range of agencies and governmental spheres;
- conservation groups;
- residents;
- extractive industries (fishing, mining);
- industrial users (shipping, transport, tourism);
- recreational users; and
- subsistence-based communities (either located on the coast or directly supported by coastal resources).

There are three key reasons that coastal managers employ stakeholder engagement approaches within their ICZM programs. The first key reason is founded in an underlying principle of ICZM, that is managing conflict and conflicting uses of coastal resources and zones. Fundamental to the premise of ICZM is that legitimate stakeholders will be involved in the coastal decision making process. Consensus planning is one method used in many ICZM initiatives to manage conflict between stakeholders. It aims to develop plans through the building of consensus between the various parties taking part in the planning process (Kay & Alder 2005).

Second, stakeholder engagement can be used as an information collection tool. In this context, it is assumed that stakeholders possess unique and/or difficult-to-collect data. For example, stakeholder knowledge that coastal managers consider important to elicit during stakeholder engagement processes includes:

- Indigenous knowledge
- Local place names and landmarks
- Historical information on trends and conditions (often over time periods before scientific data collection programs)

The third key reason for involving stakeholders in ICZM is a more pragmatic one. Simply, coastal managers have found that the effective operation of ICZM programs and the implementation of ICZM plans are greatly facilitated if those impacted by the outcomes are directly involved in the development of the approaches (Welp 2001).

Stakeholder engagement in ICZM occurs within the broader coastal planning context. There are several recognised approaches to coastal planning. The first is the '*Rational-Comprehensive Approach*'. This method assumes that all stakeholders act rationally with aim being to define a single set of management outcomes to be achieved within a particular timeframe. By definition, this process fixes future outcomes. The second approach involves adaptive planning and is known as '*Management by Experiment*'. This process involves the development of continuously evolving management outcomes in response to constantly changing management issues and challenges.

Stakeholder engagement as part of this planning approach would be an ongoing process.

An ICZM planning approach that is gaining in prominence is the use of '*Scenario Planning*' techniques. This is particularly so in coastal vulnerability planning in the face of greenhouse gas-induced climate change and sea level rise. Scenario development is a fundamental part of the analysis of potential future sea level rise and climate change and their impacts on the coastal zone (Kay *et al*. 2005). It has also been recently used by the Millennium Ecosystem Assessment to assess global fishing stocks. For example, scenario planning was used to look at increasing fishing pressure in the Gulf of Thailand (Pauly & Chuenpagdee 2003) and in the Chesapeake Bay, USA (Chuenpagdee *et al*. 2006).

4 Review of approaches for ICZM stakeholder engagement

4.1 Framework of stakeholder engagement in ICZM

As previously discussed in Section 3, the two principal reasons for undertaking stakeholder engagement in ICZM are 'conflict resolution' and 'facilitation of implementation'. These reasons provide a useful framework for analysing stakeholder engagement approaches within ICZM (see Figure 3).

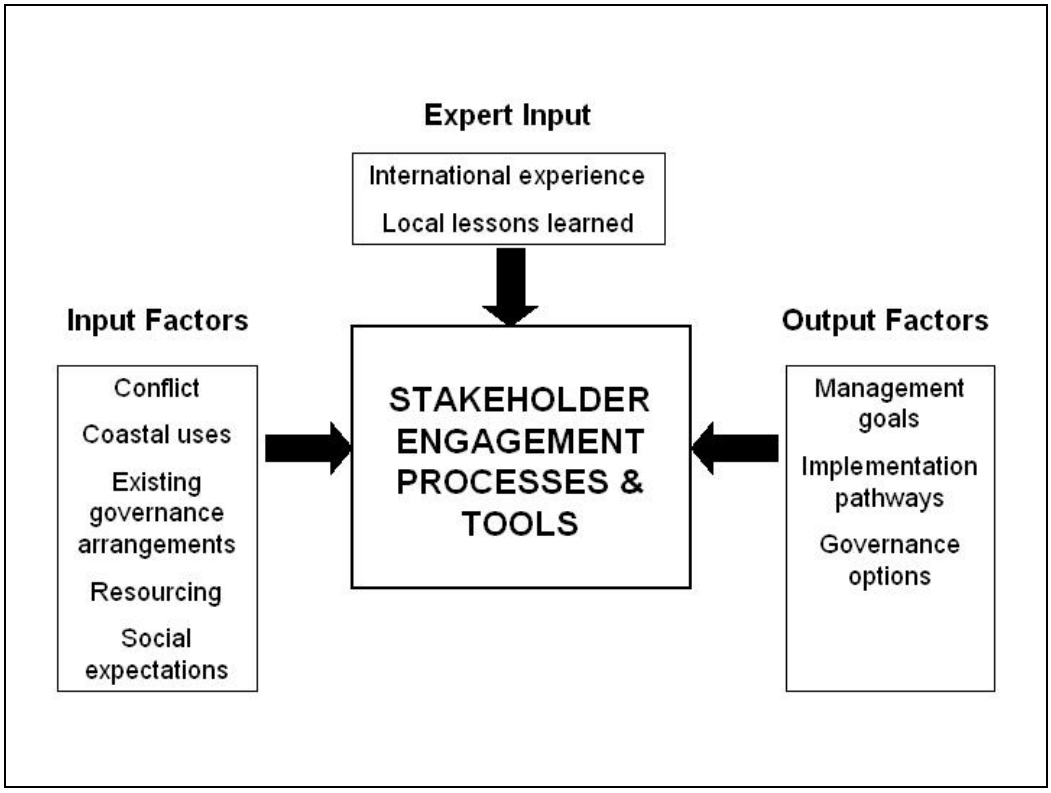

Figure 3 Framework of stakeholder engagement processes and tools in ICZM

Figure 3 provides a useful framework for stakeholder engagement process in which coastal managers merge both input and output considerations to develop a "best-fit" stakeholder engagement design. This design focuses on the achievement of optimal management outcomes within the constraints and opportunities imposed by a particular situational context. Such contexts are invariably determined by the coastal location (community factors, socio-economic issues, biophysical factors, geographic scales) within a particular country and region, as well as the time at which the approach is being designed and implemented. Community structures and membership are in a constant state of flux. In addition, governmental systems evolve to adapt to changing circumstances. For example, the stage of electoral cycles can radically impact the level and type of engagement at a political level.

An important consideration in ICZM stakeholder approaches is consideration of the difference between stakeholder consultation and stakeholder engagement. Often the terms involvement, participation and engagement are used interchangeably. There can be a danger of equating community consultation with meaningful stakeholder engagement (see Figure 4; Aslin & Brown 2004).

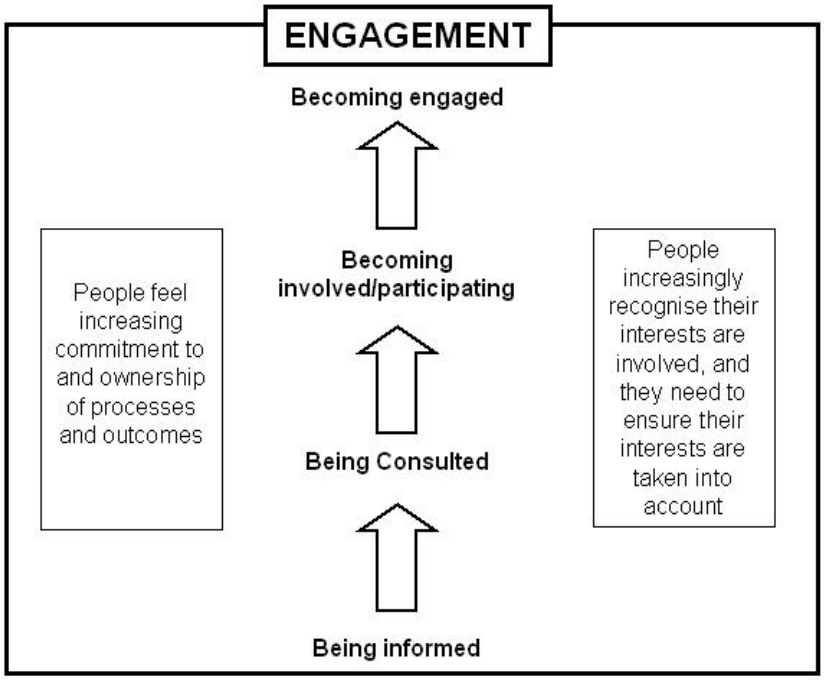

Figure 4 Consultation versus engagement (From Aslin & Brown 2004, p. 5)

Effective stakeholder engagement design uses overall stakeholder engagement principles and applies them to local communities. Stakeholder engagement principles include:

- degree of interest;
- degree of power;
- level of representativeness; and
- degree of impact.

One direct impact of an ICZM program may be on stakeholder livelihoods. An example is a subsistence fisher represented in an ICZM process through a local representative group, whose livelihood would be significantly impacted by an ICZM program. This could be contrasted with, a conservation non-governmental organization (NGO) with a high degree of interest, but whose livelihoods are not impacted by the outcomes of an ICZM process. Of course it is vital to analyse both the immediate stakeholder needs and longer-term generational and inter-generational timeframes. Inevitably, this requires balancing and/or trading off immediate resource extraction demands against ecosystem health and environmental sustainability considerations. This is a temporal factor, which is one of the underlying conflicts within ICZM and is often addressed by the expert stakeholders to provide long-term perspective.

The role of international practice in stakeholder engagement is an important one because, essentially, experts provide a structured framework for 'asking the questions' in order for local managers to choose the optimal approach tailored to the local economic, socio-political and environmental circumstances.

4.2 Overview of available stakeholder engagement tools

There is a wide range of tools and approaches that can be applied to ensure stakeholders are effectively engaged in ICZM. 'The techniques to be applied will depend on funding, staffing, social and political acceptability and the complexity of the issues and the community' (Kay & Alder 2005, p. 322). A comprehensive list of existing engagement tools was developed by the Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management (the Coastal CRC) (Coastal Zone Australia 2004[4]). In Table 1 we have grouped these stakeholder engagement tools based on the form of communication that they represent.

[4] A comprehensive explanation of each tool can be found at http://www.coastal.crc.org.au/toolbox/alpha-list.asp.

Table 1 Stakeholder engagement tools (Coastal Zone Australia 2004)

TOOLS		
Face-to-Face	**Face-to-Face**	**One-to-Many**
Backcasting	Planning4real	Information Hotline
Brainstorming	Prioritisation Matrix	Information Repository
Briefings	Public Conversation	Media Releases
Citizen Committees	Public Involvement Volunteers	Newspaper Inserts
Citizen Juries	Public Meeting	Poster Competitions
Community Indicator	Role Plays	Printed Information
Conference	Samoan Circles	Questionnaires and Responses
Consensus Conference	Scenario Testing	Shopfront
Design Charrettes	Search Conference	Snowball Sampling
Expert Panel	Sketch Interviews	Submissions
Field Trips	Speakouts	Surveys
Fish Bowl	Stakeholder Analysis	Technical Assistance
Focus Groups	Study Circles	Technical Reports And Discussion Papers
Future Search Conference	Visioning	Telephone Trees
Key Stakeholder Interviews	Workshops	**Technology Assisted**
Kitchen Table Discussion	**One-To-Many**	Electronic Democracy
Mediation and Negotiation	Civic Journalism	Interactive TV
Nominal Group	Community Fairs	Interactive Video Display Kiosks
Open House (Or Open Days And Drop-In Centres)	Deliberative Opinion Polls	MODSS: Multi-Objective Decision Making Support
Open Space Technology	Delphi Study	Simulation (Electronically Generated)
Participant Observation	Displays and Exhibits	Websites
Photovoice	Information Contacts	

It is important to stress that there are currently no agreed taxonomies for classifying stakeholder engagement tools in the various ICZM contexts described in this section – and shown above in Table 1. For example, 'visual aids', such as pictures and maps, are not explicitly listed, although they are mostly used as part of the listed tools either as information provided to stakeholders (e.g., as part of surveys) or as an interactive tool to capture information from stakeholders (e.g., as part of stakeholder analysis and Delphi study). On the same token, GIS-based mapping for resource use, distribution of resources, habitat suitability, etc. is most likely used in many of the 'Technology Assisted' tools. Another group of tools not included in the above is the use of 'transects', including 'coastal transect walk', where features of a coastal area, including morphology, habitats and resources, are recorded and 'historical transect' where major events in the past are recorded as part of timeline analysis (Sathiadhas *et al*. 2003).

Given that the main focus of this review is to learn about existing visualisation tools and how CTAM can contribute to the use of such tools in ICZM, discussion about this will be provided. In the following, six case studies in four countries will be described and analysed based on the stakeholder engagement tools used and in terms of potential use of existing and future visualization tools.

5 Comparative analysis of stakeholder engagement in four case study sites

A comparative analysis of stakeholder engagement was undertaken for coastal areas in four case study countries: Scotland (UK), Mexico, Thailand and Namibia. The case studies were pre-selected by INCOFISH Work Package 6 to represent both developed and developing countries and represent different coastal types and coastal management issues. In addition, case study countries were chosen to align with the INCOFISH project overall – including representation of experts from the case study countries in the project.

The Project Team carried out a survey with a series of questions relating to fisheries-related stakeholder engagement. The survey tool was distributed to key personnel involved in the INCOFISH project to complete for each country. The analysis was undertaken to provide an overview of the current engagement approaches and visualisation tools being applied to develop an understanding of their effectiveness in fisheries management. This information is vital both to analyse visualisation tool application in the case study countries in its own right, as well as providing justification for the visualisation tools being developed as part of the other components of Work Package 6.

Each case study is first outlined in turn below. The Section concludes with a comparative analysis of the case studies.

5.1 Scotland Case Study

Two contrasting coastal areas from the East and West coasts of Scotland, Moray Firth and Loch Torridon respectively, were chosen as case study locations.

Moray Firth, a large sea bay situated in the North East coast of Scotland, covers a sea area of 5230 km^2 and is Scotland's largest firth (Tilbrook 1986). It has more than 800 km of coastline, with an impressive landscape that ranges from high cliffs to mudflats and salt marshes. The Moray Firth's special features have been recognised and afforded protection in a wide range of nature conservation designations, including as Sites of Special Scientific Interest (SSSI), Royal Society for the Protection of Birds (RSPB) reserves, National Nature Reserves (NNR), Ramsar Sites and Natura 2000 sites (a Special Protection Area (SPA) and a Special Area of Conservation (SAC), status designated respectively under the European Union Birds and Habitats Directives).

The Moray Firth coast is an area with many different usages including commercial oil extraction, industrial waste discharges, military training, transportation, tourist and recreation activities, and commercial fishing (Harding-Hill 1993).

The Moray Firth has always been an important fishing area (Hopkins 1986) accounting for a large proportion of registered fishers (with 23% of all Scottish fishers being registered in the Firth's ports). Landings into Firth ports account for 19 and 23% of all Scottish landing in quantity and value respectively (Scottish Fisheries Statistics 2005). However, the fishing sector around the Moray Firth accounts, on average, for less than 1% of the working population, and around large urban centres this figure drops to less than 0.5% (Census 2001). Nevertheless, employment from fishing is very important in

some of the area's local communities, such as Fraserburgh, one of the most important fishing ports in the UK. Fraserburgh is estimated as having up to 50% of its workforce active in fishing or fishing related industries (Moray Firth Partnership 2006).

Nearly 54% of the firth's fishing fleet is composed of vessels under 10 metres in length, and the ports show the typical pattern of concentration on inshore fisheries. Many of the vessels originally fishing for fish have switched to shellfish, and Norway Lobster (*Nephrops norvegicus)* is now the most important commercial fishery in the Firth, although Mackerel (*Scomber scombrus*) and Anglerfish (*Lophius piscatorius*) are also important (Scottish Fisheries Statistics 2005).

Fishers are organised into 10 Producer Organisations (POs) and Fishermen's Associations, with the Scottish Fishermen's Organisation being the most representative. Aquaculture is not a very important activity on the East coast of Scotland. Nonetheless, the environmental impact of aquaculture is a major concern in the area. The strategy for Scotland's coast and inshore waters aims to minimise the impact of the marine fish farms and apply government's current policy presumption against further fin-fish farm development on the east coast of mainland Scotland (Scottish Natural Heritage 2002). There are several conflicts between fisheries and, mainly, conservation issues in the area. The main issues are related to the incidental capture of non-target species (like birds and marine mammals), the competition between commercial fisheries and top predators, the effect of fishing methods on the seabed, and over fishing.

Torridon is a remote rural area situated on the west coast of Scotland, with some of the lowest population densities in the European Union. The actual loch Torridon complex, an arm of the sea similar to a fjord, is 22 km long and comprises three clearly defined sections; the Outer Loch, Loch Shieldaig and Upper Loch Torridon (Minch Project 1999). The area has the status of 'Marine Consultation Area' (MCA), which has been conferred upon both Upper Loch Torridon and Loch Shieldaig, since January 1990 (Scottish Natural Heritage 2004).

In contrast to Moray Firth, the communities around Torridon rely heavily on fishing and other marine-based activities as a significant source of employment. Fishing activity is the major employer in the area. Aquaculture is also important, with a number of fish farms and shellfish units located within the area. Jobs associated with the tourist activity are also significant economic activities (Minch Project 1999).

The Loch Torridon fishing creek has a small number of registered fishers (29 in total), most regularly employed in fishing (72%) (Scottish Executive - Fisheries data 2005). The fishing sector accounts for 19% of Loch Torridon's and for 21% of Loch Shieldaig's working populations (Census 2001). At present Loch Torridon and Loch Shieldaig are characterised by a creel-only fishery, with an area closed to mobile fishing gear all year-round, established on November 2000. The Loch Torridon fishing fleet is composed of a number of mostly small one-man operated creel boats that catch mainly Norway lobster (*Nephrops norvegicus*) and edible crabs (*Cancer pagurus*), (Scottish Executive - Fisheries data 2005).

The Producer Organisations responsible for the Loch Torridon *Nephrops* Creels Fishery is the West of Scotland Fish Producers' Organisation (WSFPO). The Fishermen's Associations covering the Loch Torridon are the Highland and Islands Fisherman's Association, Mallaig and North West Fishermen's Association and the Scottish Fishermen's Federation.

Fish farming is an important employer in Loch Torridon and remains one of the major economic activities in the area. The environmental impact of aquaculture is one of the major concerns regarding the future sustainability of the activity in the area. According to the Scottish Executive '*Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters'* the fact that Upper Loch Torridon and Loch Shieldaig lie within the Wester Ross National Scenic Area and is a Marine Consultation Area, results in significant constraints to finfish and shellfish farms. The only fish processing industry in the area has been created in order to export live prawns, mainly to Spain and Italy.

Fisheries management in the Moray Firth and the Torridon area are directed ultimately by the European Union (EU) through the Common Fisheries Policy (CFP) and controlled in the United Kingdom (UK) by the Department of the Environment, Food and Rural Affairs (DEFRA). For Scotland, the Scottish Executive, through a subject specific concordat with DEFRA, enforces legislation and quota management rules through the Scottish Executive Environment and Rural Affairs Department (SEERAD). The most important fisheries legislation for the two areas is the *Inshore Fishing (Scotland) Act 1984, Sea Fisheries Prohibitions*, which sets a ban on mobile gear boats and suction dredging designed to protect fish stocks and ease gear conflicts.

In both Moray Firth and Torridon, the key stakeholders partaking in fisheries are actively engaged in fisheries management. As well as being organised into producer organisations and fisherman associations, other mechanisms have been established to bring together stakeholders to discuss issues affecting the fisheries. The Moray Firth Partnership (MFP), a voluntary organisation, was established in 1996 by the Scottish Natural Heritage (SNH), to tackle the challenges that the area has been facing recently and guarantee the sustainable future of the area's natural, economic, social and cultural resources (Scottish Natural Heritage 2002). The MFP through the Moray Firth Fisheries Action Group (MFP/FAG) brings together representatives from all interested stakeholders in the area to discuss issues affecting the Firth's fisheries, promote co-operation and develop action plans for the sustainable management of the Firth's fisheries. The partnership is made up of representatives from the local authorities and statutory agencies, fishing interests, port and harbour authorities, oil and other commercial interests, conservation bodies, recreational users, local community, and other interested parties.

In Loch Torridon, fishers are well organised and highly engaged in fisheries management. These fishers achieved, in 2000, a ban on mobile gear on Loch Torridon and the Inner Sound of Rona and the implementation of a closed-area (Scottish Statutory Instrument 2001 No. 174). The Inshore Fishing (Prohibition of Fishing and Fishing Methods) (Scotland) Amendment Order 2001), after a long campaign started following the 1985 removal of the three-mile fishing limit around Britain's coasts. After the achievement of the closed area the Loch Torridon fishing community implemented a set of local approaches to manage these fisheries. Fishers taking part in the Loch Torridon *Nephrops* Creel Fishery (LTNCF) fish according to the Torridon Management Plan (TMP), implemented under a voluntary code of practice. The Scottish Executive itself regards this localised approach to the management of a quota species, in its analysis of the Strategic Review of Inshore fisheries, as a good example of the sort of approach that could be developed within an Area Management Plan (Scottish Executive 2005).

Also, LTNCF was awarded the Marine Stewardship Council (MSC) label for sustainable and well-managed fisheries. The LTNCF applied for this award as a management strategy more than to increase the value of the catch. This international eco-labelling certification gives them a negotiation advantage in order to maintain the closed area when its experimental phase comes to an end. Besides all the management measures, fishers also created a Limited company, that operates as a co-operative in which fishers take equal shares, in order to export live prawns to continental Europe and thus substantially increase the profit from their fishing.

In both the Moray Firth and Torridon areas a range of tools have been applied in historic and ongoing engagement of fisheries-related stakeholders. Examples of the key tools used at both locations, include the establishment of expert panels, and mediation and negotiation. The role of the Moray Firth Partnership is currently the main forum for engagement of stakeholders in the management of coastal activities in the area. This is considered as an effective approach and one which is currently being held up as an example for other areas in Scotland. In the Torridon case study area, citizen committees and workshops were also common tools used. Other engagement tools that were used in these coastal areas were community indicators and focus groups. As well as these main techniques that were used, occasionally other tools such as media releases, surveys and key stakeholder interviews were implemented to address specific engagement needs. In contrast to Torridon where no technology assisted engagement tools were used, websites were widely used as part of stakeholder engagement in the Moray Firth area. As part of these engagement processes the only visualisation tools that appear to have been used to date include posters and pamphlets distributed in the Moray Firth area.

5.2 Mexico Case Study

The **Alacranes Reef**, is located 130 km north of Puerto Progreso Yucatan, Mexico . The reef is the largest coral reef system in the Gulf of Mexico and was declared a National Park in 1994. The Reef has traditional importance for commercial and subsistence fisheries of species with a high commercial value, such as lobsters (*Panulirus argus*), groupers (*Epinephelus morio*) and snappers (*Lutjanus campechanus*). In the past few years there has been a significant growth in alternative human activities in the area, including diving, eco-tourism and sport fishing (Ardisson *et al*. 1996, Gonzales 2001). Scientific research activities have also increased in the last few years, contributing to an improved awareness among regional inhabitants of the importance of preserving the Reef's resources (Gonzales 2001, Tuz 2001, Membrillo 2002).

Lobster fishing is the most important economic activity occurring in the Alacranes Reef National Park (ARNP). More than 20% of the total lobster catch for the Mexican state of Yucatan is obtained from the Reef and its surrounding areas, and many families depend on the income generated from this resource. The lobster-fishing season extends from July to February, and the total annual catch is approximately 38 tonnes (Bello *et al.* 2005). There are 300 fishers well organised into 4 fishermen unions or cooperatives; the unions form a larger organisation, the Fishing Federation, with representatives at different hierarchical levels.

A total of 25 vessels are used, with each ship used as a tender for five to seven small boats called "alijos", some of which do not have motors. The big vessels anchor in

deep lagoons for 15-18 days and the alijos are used to navigate in shallow areas of the Reef searching for lobster. Depending on the depth, the fishermen either snorkel or dive using a “hookah”, and a hook to catch lobsters. During 2000, the use of traps for lobster in deep areas around the Reef was authorised by Fisheries authority. It increased the fishing effort considerably and there is evidence that reproductive adults are being fished more than the past registered catches (Salas *et al*. 2005). Landings from the area have increased twofold in the last five years since the introduction of traps. Many small-scale fishers have since changed their permits to use traps as they see it as being more profitable.

The four fishermen’s unions are based in the Yucatan port of Progreso. They have experience in administration, funding and legal aspects. The Fishing Federation owns a fishing processing facility that allows them to gain better prices for the production. Entire production is landed at Yucalpeten, Yucatan (near Progreso) under supervision of union administrators, before distributed to processing facilities located at Progreso and Merida city. Most of the production is processed in the Federation processing plant.

Fishers’ unions have exclusive fishing permits that allow them to exploit fishing resources in the area surrounding and inside the Alacranes Reef. In the last few years, however, illegal fishing has become an important issue at the Reef. It is estimated that there are as many illegal fishers as legal ones, and sometimes fishers use one permit for many boats (Salas *et al*. 2005). The problem is that in many cases legal fishers know or are relatives of the illegal ones, so it has proved difficult to control the problem without creating social conflicts (Salas *et al*. 2005).

Alacranes Reef National Park (ARNP) is managed under the administration of the Federal government. Within ARNP, two “nuclei zones” and one “buffer zone” were established for management purposes. The two nuclei zones were considered as suitable areas for developing non-extractive human activities. The buffer zone was considered as a suitable area for developing sustainable extractive activities under the appropriate regulation and control. However, ten years after being declared a national park no official management program has been established. The past few years have seen a growing involvement of a variety of stakeholders interested in developing such a management program; among them are local organisations and non-governmental agencies, together with the authorities of the park, university researchers and scientific institutions. However, this has not been an easy task, since the area has multiple users with differing interests, which generates a variety of conflicting objectives not yet completely elucidated (Bello *et al*. 2006).

The first proposal for management of Alacranes Reef as a protected area was written in 1989-1990. In 1992 the first meetings between government and scientific institutions were held to determine the importance of the Reef and on the need for protection. In 1993 the decree proposal was submitted to the Federal Government. Nevertheless those efforts had very limited participation of stakeholders, particularly fishers, and were focused on technical aspects. Current authorities of the National Park perceive a low understanding by users about the extent and location of existing management zones, and the type of regulations and activities permitted that might challenge the implementation of management strategies in the area (Comisión de Áreas Naturales Protegidas, *in press*).

An “advisory committee” for the park was constituted in 2002 to develop a management program which included the best scientific information, and with the participation of key stakeholders. The committee includes authorities at various

government levels, local scientific institutions and universities, local unions of fishers, non-governmental organisations and tourist services providers. A collaboration agreement was set for the development of the study *'Alacranes Reef Resources Planning Based on Multi-Criteria Evaluation and GIS Spatial Modelling'* with the results to support the elaboration of the management program for the Park (Bello *et al*. 2005, 2006).

The study's objective was to develop an integrative and consistent methodological framework for participatory coral reefs' resources assessment, planning, decision-making and resource allocation based on multi-criteria evaluation (MCE) and geographic information systems (GIS) spatial modelling techniques, as well as on use of local expert knowledge. This study was divided into three stages (Figure 5).

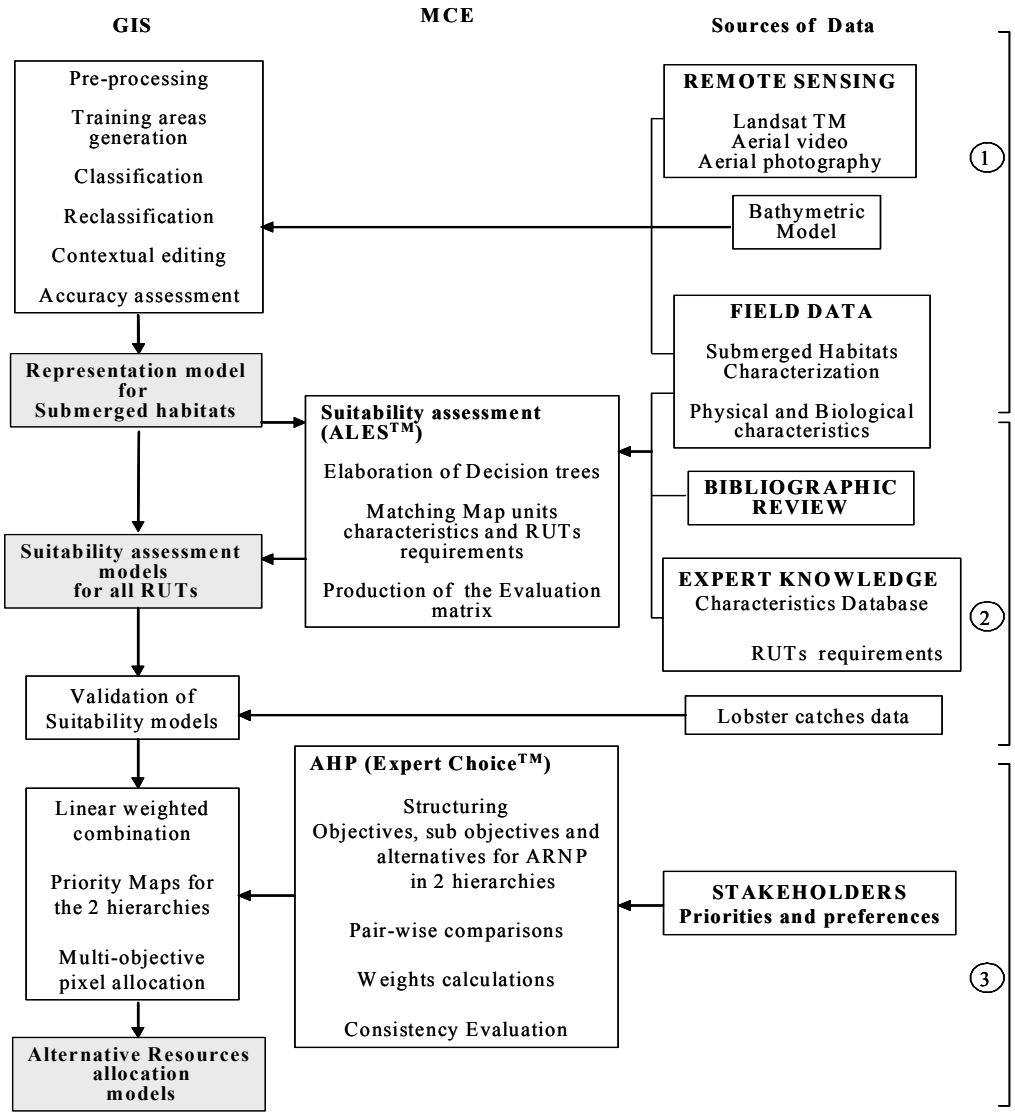

Figure 5 **A flow diagram of the methodological framework and modelling approach developed at Alacranes reef. Numbers to the right indicate the three major stages of the study. Grey boxes represent results from each stage.**

In the first stage, a spatial representation model for coral reef submerged habitats was developed, by combining Landsat™ imagery, aerial photography, aerial video and a digital bathymetric model. Stakeholder engagement tools were used mainly in the later two stages of the study as means to incorporate expert knowledge for the development of suitability assessment and resource allocation models. Suitability assessment models and maps for actual and potential resource utilisation types (RUTs) of reef resources were elaborated using MCE techniques to incorporate expert knowledge into the development of automated decision trees (DTs) designed to assess the suitability of ARNP submerged habitats for different RUTs. Management authorities organised a series of meetings with individual or focus groups of experts. The diversity of the stakeholder backgrounds required that the style of the meetings was adapted, varying from very informal talks to technically complex discussions. The thematic map of submerged habitats was presented to experts, using GIS-software together with a large size hardcopy of the habitats map, as well as personal handouts with copies of the map and the attributes database.

Following the stakeholder meetings, an evaluation matrix was obtained indicating the suitability rating assigned by experts for all RUTs from the model (DTs) which was exported to GIS, where suitability maps were produced. Experts reviewed the resulting suitability maps and provided opinion on how logical they appeared, based on their own personal experience of the area. They were also asked to propose further modifications to the evaluation process. Two suitability models, for lobster fishery and lobster preferential habitat respectively, were validated against field data as reported in Bello et al (2006).

In the third stage consensual decision models for coral reef resources planning were developed using a participatory approach. User's preferences and priorities were elicited through the "Analytic Hierarchy Process" (AHP) using the multi-criteria decision support software Expert Choice™, and used for the development of alternative allocation scenarios with GIS spatial modelling techniques (Bello 2004).

Expert Choice™ provides four different option modes for conducting comparisons: verbal, questionnaire, matrix or graphic. Considering the diversity in participants' backgrounds, the graphical option was chosen because it was considered easier to understand for the majority of users, and because its visual power makes it more intuitive and dynamic for working in groups. Comparisons of elements were performed traversing the hierarchy top-down from particular objectives to alternatives. After all comparisons for all levels of the hierarchies were completed, local and overall weights were obtained, and final results were reviewed by participants to make sure they expressed the group's opinions.

The management program for the Alacranes Reef National Park is currently under public revision. It has been posted on a website to enable comments and suggestions to be made. Authorities will consider this feedback and make appropriate changes to the document. The website has links to the PDF document, maps and to the GIS information for advanced users.

In addition to the use of experts, focus groups, facilitated meetings, multi-criteria evaluation techniques, and a website to engage stakeholders in this study, several other engagement tools have also been applied. These include brainstorming, citizen committees, conferences, workshops and key stakeholder interviews.

5.3 Thailand Case Study

Two coastal bays from the Andaman and Gulf of Thailand coastlines, Phangnga Bay and Ban Don Bay respectively, were selected as case study sites in Thailand.

Phangnga Bay covers three provinces, namely Phangnga, Phuket and Krabi, in the southern Andaman coast of Thailand. Phangnga Bay is a large semi-closed bay, with irregular coastlines and many small archipelagic islands. The Bay is rich in natural resources including mangroves, coral reefs, seagrass beds, and fisheries. The Bay is an important spawning ground, nursery area and habitat for many economically important marine species, including Indian mackerel, pomfret, shrimps, crabs and clams (Chuenpagdee *et al*. 2001).

Fishing is a dominant activity, despite declining catches due to heavy fishing and resource degradation, as well as tourism development and intensive shrimp culture, that often involves clear-cutting of mangrove forests and results in coastal land degradation and pollution. In addition to shrimp culture, coastal aquaculture of cockles, oysters, and fish cage culture of snapper and groupers are practiced. Small-scale and large-scale fishing is undertaken in the area, using gears such as trawl, small otter board trawl, anchovy purse seine, shrimp gill net, crab gill net, push net and fish trap. Recent studies show that there are almost 9,000 small-scale fishing vessels and about 600 large-scale vessels operating in the Bay area.

Residential housing development is high in the area, but the main development thrust is related to tourism activities. Phangnga Bay itself is not lined with big hotels as many are built in Phuket Town at the lower end of the Bay. The Bay receives massive amount of Thai and foreign tourists. Some areas within Phangnga Bay, particularly small islands, were severely affected by the 2004 Indian Ocean tsunami. Damage to fisheries resources and coastal habitats (including mangroves and coral reefs) were preliminary assessed (see, for example, Nootmorn *et al*. 2005; Pongsuwan *et al*., 2006), while long-term recovery and rehabilitation plans are being developed.

Ban Don Bay extends between Chaiya and Don Sak Districts of Suratthani Province, in the southern coast, Gulf of Thailand. Ban Don Bay is a small, open bay in the Gulf of Thailand, with gradual slope and shallow water. The Bay has important fisheries resources such as shrimp, mud crab and molluscs (mainly green mussels and cockles), and pelagic fish, particularly Indian mackerel. The mudflat area of Ban Don Bay serves as spawning grounds for fish and shrimp species, making it a prime location for coastal aquaculture, particularly for the economically valuable large oyster (*Crassostrea belcheri*) (Jarernpornnipat 2004a). Coastal shores were once lined with large areas of mangrove forests, most of which have been largely clear cut and converted to shrimp farms, particularly for the black tiger prawn (Chuenpagdee *et al*. 2001).

Fishing and aquaculture are the dominant activities in Ban Don Bay. Fishing is concentrated in Don Sak District, where shrimp gill nets and squid traps are the main gears used, but use of trawlers and push nets continue to increase in the wider bay area. Recent data show that there are about 315 small-scale fishing boats and 340 large-scale fishing boats operating in the Bay. Conflicts between small-scale and large-scale fishers arise due to competition for space, with large-scale fishing operating in coastal waters (often within 3 km zone reserved for small-scale fishing). Fish processing is also an important industry in the area, with several dried fish and dried shrimp factories, as well as other canning plants (Wattayakorn 1999).

Shrimp and prawns, oyster, and blood cockle are important aquaculture products with most of the harvest intended for exports. Locals collect coastal resources including shrimp, fish, crabs, honey and wood for their personal household consumption. Between 1992 and 2000, shrimp farming activities increased from 400 farms, occupying 2,300 rai (368 ha), producing 300 t of shrimps to 550 farms, occupying 3,500 rai (560 ha), with production of 1,400 t. Shrimp farming is not seen favourably by other stakeholders, particularly NGOs due to environmental degradation and clear-cutting of mangrove forests.

The adjacent land to Ban Don Bay is mostly used for agriculture and plantations (mainly for rice, rubber, and oil palm, but coconut and other fruits are also harvested). Settlers have increasingly moved into Suratthani Province, concentrating around the Bay and adjacent areas (Wattayakorn 1999, Jarernpornnipat 2004b). This has lead to further industrialisation in the region, destruction of the mangroves forests and other coastal pollution of the associated Tapi River. Importantly, fishing has increased, resulting in declining fisheries production. A southern seaboard project, involving oil-based industry and marine transportation, has been built, posing risks of incidental oil spills in the Bay area. Additionally, a highway connecting Suratthani Province, Gulf of Thailand to Phangnga provinces on the Andaman Sea, has been built to transport goods between these two regions. It is also used as a means to bring fishing boats from the Gulf of Thailand to Andaman Sea during monsoon season. Tourism in Ban Don Bay is not as developed as other provinces along the coast, except for the pier for ferry crossing to Samui and Phangan Islands, which are famous among foreign tourists. It is likely that tourism will increase in the region.

Throughout Thailand, the Department of Fisheries (DOF), under the Ministry of Agriculture and Cooperatives of the Royal Thai Government, is in charge of fisheries management. Fishing regulations for the area include licensing and restrictions in terms of gears, season and areas. For example, push nets are not allowed within 3 km from shore, although enforcement of this rule is problematic. Phangnga Bay, due to its important coastal habitats, particularly mangroves and seagrass (home to a protected marine mammal species *Dugong*), is also managed by the Department of Coastal and Natural Resources and the National Park Office, under the Ministry of Natural Resources and Environment. Its importance as a tourist destination means also that Department of Tourism and Department of Pollution Control are actively involved in regulating tourism activities, including enforcing building standards.

Ban Don Bay has been declared a “Conservation Zone” by DOF as it is a very important nursery for juvenile fish and shellfish, providing spawning grounds, shelter, and food. For this reason, fishery is closed every year for a three-month period. In addition to this seasonal closure, licensing, gear and area restrictions are used as regulatory measures. Enforcement, as in many parts of the world, is slack.

DOF has encouraged mollusc culture to replace artisanal motor push-net, which is considered a destructive gear. This was a successful management initiative until heavy storms caused shellfish farmers’ great financial hardships and they could not repay their high interest loans. Since then outside big-business investors have bought out leases to the culture areas and expanded their operation without consideration for long-term sustainability of the Bay (Jarernpornnipat 2004a).

Historic engagement of fisheries-related stakeholders in both Phangnga Bay and Ban Don Bay reflected the overall trend of fisheries management in Thailand, which was traditionally top-down and centralised. In 1994, the Government of Thailand, aiming to promote stakeholder participation in management, established a decentralisation

scheme where each sub-district elects its own local administration, referred to as the Tambon Administration Organisation (TAO). TAO operates in parallel with the administration by Regional Administrative Agencies, which has a local office for each sub-district, led by an appointed head, and a village-head office led by an elected head (Figure 6). The total number of TAO Committees varies depending upon the size of the sub-districts. TAO is in effect a co-management scheme that engages stakeholders. Other initiatives to engage stakeholders are usually conducted as part of research projects, including one important on-going research project, CHARM (Coastal Habitat and Resource Management), funded by EU.

At a local level, small-scale fishing communities in Phangnga Bay have been involved in creating local marketing cooperatives where fishers set prices for the products, and practice conservation measures, for example, by releasing of gravid crabs. This initiative, originally first tested in three fishing villages, has been expanded to many communities due to its success in the trial period. Cooperative members are generally better off with high prices that they receive from their catches. Another notable stakeholder engagement program aims at school children. The 'Children of the Sea' project, initiated through funding from an Italian government, involves teaching school children about traditional fishing methods and marine conservation in classrooms and outside.

Some of the principle tools used to engage stakeholders in fisheries management in both Phangnga Bay and Ban Don Bay have included briefings, public meetings, key stakeholder interviews, workshops, questionnaires and surveys. Other tools used less frequently are approaches as stakeholder analysis, focus groups and participant observation. Maps are often used as a visualisation tool to engage stakeholders in discussion about coastal management.

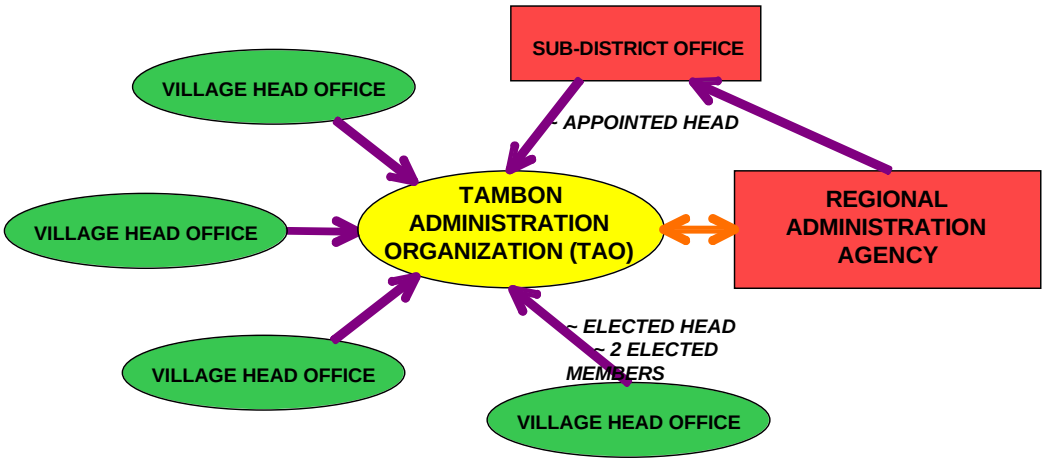

Figure 6 Thailand decentralised governance model

5.4 Namibian Case Study

The upwelling of the nutrient-rich Benguela Current that occurs along the Namibia coast generates a very productive marine system. The fisheries industry is a key part of the Namibian economy – the sector is the countries third largest (Stephanus & Amutenya 2006). The fishing industry has generated up to 10% of the country's GDP in recent years. The industry is highly structured with a small number of large fishing vessels. In 2003, the country's 335 vessels, of which 80% were Namibian flagged, landed over 600,000 tonnes of fish with a value of N$ 2.6 billion and an export revenue of N$ 3.5 billion. An estimated 13,637 people (8,225 onshore + 5,412 offshore) are employed in the industry.

Namibia's principal fisheries are demersal (70%), midwater (15%), small pelagic (10%), large pelagic (2%) and others (Stephanus & Amutenya 2006). Due to Namibia's unique geomorphology with exposed open ocean coastline and vast coastal dune systems, there are only two landing ports for these fisheries, at Walvisbay (70%) and Luderitz (30%).

There is an extensive recreational fishery in Namibia, made up of both Namibians (64%) and South African tourists (46%). Field surveys undertaken in 1997-1998 estimated a total of 8,300 recreational anglers equating to 173,000 recreational fishing days on the coast (Barnes *et al*. 2004). All recreational fishes are required to obtain a fishing license. The take up of these licenses is widespread.

Other important coastal resources in Namibia are offshore diamond mining, guano mining and tourism. Offshore diamond production is 1,064 CT/yr with a value of US$ 2,220 million/yr, while the tourism industry is worth an estimated US$ 723 million/yr (Stephanus & Amutenya 2006).

The current status of the fisheries resources in Namibia, and how those fisheries are managed, are a reflection of the nation's history (Nichols 2004). Before the independence of Namibia in 1990 there was extensive uncontrolled fishing from international fleets (Nichols 2004). The result was the near collapse of both the anchovy and sardine fisheries. Since independence, the fisheries have recovered. This is attributed to the successful fisheries resource management approach developed, implemented and enforced in Namibia (Nichols 2004, Sumaila *et al*. 2004).

The lead fisheries management agency in Namibia is the Ministry of Fisheries and Marine Resources (MFMR), which reports to cabinet through the Minister of Fisheries and Marine Resources (Figure 7). There is no delegation to regional or local authorities (Boyer & Oelofsen 2004, Olsen 2004).

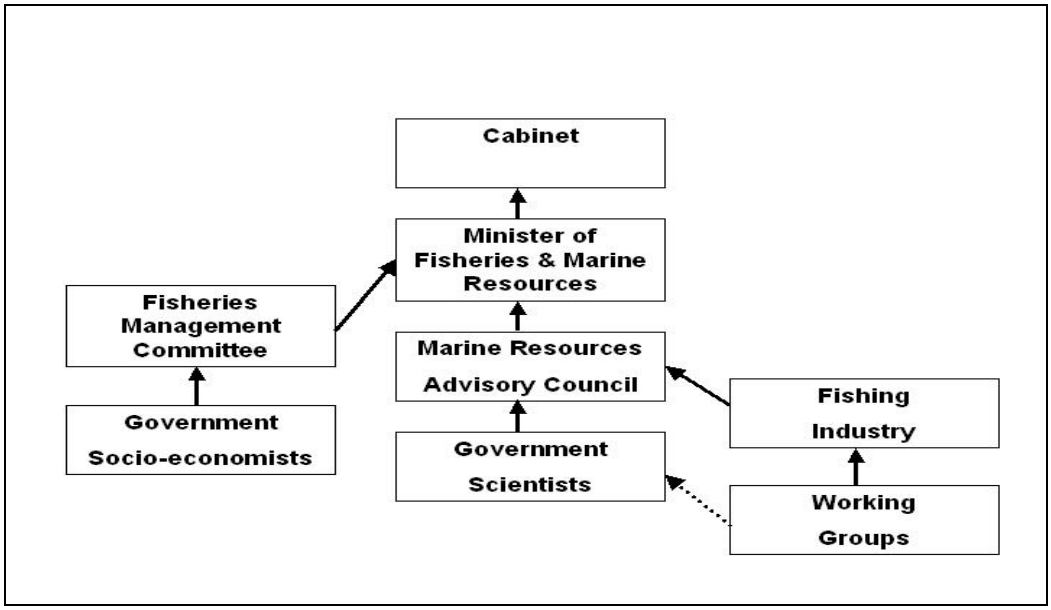

Figure 7 Management advice flow from researchers to decision-makers in Namibia (Boyer & Oelofsen 2004)

The Marine Resources Advisory Council (MRAC) has been established to advise the Minister on a wide range of fisheries-related matters. The fisheries legislation (*the Marine Resources Act 2000*) is centrally enforced via aerial, land and sea-based dimensions, with the implementation of remote sensing (VMS) well in progress. In addition, there is an extensive fisheries scientific research effort in Namibia, coordinated through the National Marine Information and Research Centre (NatMIRC).

The Ministry of Fisheries and Marine Resources (MFMR) as the key management agency in Namibia engages with a number of stakeholder groups (www.mfmr.gov.na). Engagement through the fishing industry is via organised associations. For example, the Hake Fishing Association has been created by the companies in the Hake Fishery to act as its peak body in engagement with government. The fish processors are mainly involved through the fishing companies. There are also independent fish processors, which are not as involved in management decisions.

Given the highly structured nature of the fishing industry in Namibia, with a limited number of boats, stakeholder engagement is considered to be efficient (Stephanus & Amutenya 2006). The fishing industry is represented in MRAC and fishing companies also have stock assessment experts, who are engaged with fisheries management authorities in the development of official stock assessments, and in turn fisheries quotas. Mapping of fishing grounds is used extensively with industry consultations such as electronic maps and related presentations. Regular expert workshops are also conducted on stock assessments with fishing industry. This is an important 'hands on' engagement approach in Namibia.

While there are clubs of recreational fishers in Namibia, there is no organised engagement between recreational fishers and management agencies. For example, there is little linkage between the development of angling licenses and management planning and enforcement. This appears to be due to the lack of an organised fishers association, rather than the lack of desire on behalf of management authorities to engage with this stakeholder group (Stephanus & Amutenya 2006).

However, an example of an engagement tool that is used to interact with recreational fishers is newspaper inserts, for example in the Republikein and Namib Times, released before the peak holiday season to inform recreational coastal users on regulations and sound fishing practices (Stephanus & Amutenya 2006). Also, as part of the recreational fishing licensing process, an information sheet is provided showing key species. In addition, it is understood that annual surveys are undertaken of recreational fisheries, although it is not known if these surveys include questions related to engagement tools, or ways to extend or modify existing engagement approaches. There is a desire among fisheries managers in Namibia to upgrade educational material and raise the awareness of recreational fishers. This is considered important to break down the current 'them and us' relationship between managers and recreational fishers.

5.5 Comparison of Case Study Findings

The results of the stakeholder relevance assessment and fisheries-related stakeholder engagement tools used in the case studies are shown in Table 2 and Table 3 respectively.

Table 2 Key fisheries-related stakeholder (non-regulatory) relevance matrix

Stakeholder group	Ranking*					
	Scotland		Thailand		Mexico	Namibia
	Moray Firth	Torridon	Ban Don Bay	Phangnga Bay	Alacranes Reef	Walvis Bay & Luderitz
Fishers	1	1	1	1	1	1
Aquaculture	1	1	1	2	Not present	1
Fish processing industry	1	1	2	2	2	1
Tourism operators and associations	2	2	3	1	2	2
Coastal land developers	2	Minimum	2	1	2	3
Oil and gas industry	2	Not present	Not present	Not present	Not present	Not present
Recreation users	2	2	2	1	2	1
Ports and marinas	2	Minimum	Minimum	Minimum	2	3
Local environmental group/environmental NGO's	3	3	3	2	3	2

*Ranking ❶ Primary ❷ Secondary ❸ Tertiary

Comparison of the case study findings shown in Table 2 clearly demonstrates the primary relevance of fishers, aquaculture and the fish processing industry in stakeholder engagement. Not surprisingly, fishers are shown to be primary stakeholders in all case study sites. Aquaculturists are primary stakeholders in all sites where aquaculture is present (4 out of 5), except Phangnga Bay where they are secondary stakeholders. The fish processing industry is a primary stakeholder in three case studies and secondary stakeholders in the remaining case studies.

The other stakeholder groups (Table 2) have varied levels of engagement. Interestingly, tourism operators and associations, coastal land developers and recreation users show all levels of engagement across the case studies. This appears to reflect the relative importance of these groups on a site-by-site basis. In contrast, where present, the oil and gas industry and ports and marinas have lower relevance scores. This implies that coastal management issues are largely concerned with fisheries and fishing-related activities, and less so on other coastal activities that are indirectly related to fisheries ecosystems. Local environmental group/environmental NGO's are all rated as secondary or tertiary stakeholders, which is rather surprising given that many of these cases are designated for protection and conservation. The seemingly low priority on conservation suggests that other management objectives such as income generation and employment dominate discussion in these areas.

Table 3 Tools used to engage fisheries-related stakeholders

Engagement Tool	Rank*					
	Scotland		Thailand		Mexico	Namibia
	Moray Firth	Torridon	Phangnga Bay	Ban Don Bay	Alacranes Reef	Walvis Bay & Luderitz
Face-to-Face						
Brainstorming	3				1	
Briefings			1	1		1
Citizen committees	2	1			1	
Community indicator	2	2				
Conference	3				1	
Consensus conference					1	
Expert panel	1	1			1	1
Field trips	2				3	
Focus groups	2		2	2	1	
Key stakeholder interviews	3	3	1	1	1	
Mediation and negotiation	1	1			2	
Open space technology						
Participant observation			2	2		
Prioritisation matrix	1					
Public involvement volunteers	2					
Public meeting			1	1		
Scenario testing				2		
Stakeholder analysis	3	3	2	2		
Workshops	3	1	1	1	1	1
One-to-Many						
Delphi study	3	3				
Displays and exhibits	2,3				1	
Media releases	3	3				1
Newspaper inserts						1
Questionnaires and responses	3	3	1	1		
Surveys	3	3	1	1		1
Technical assistance					1	
Technical reports and discussion papers	2, 3	3			3	
Technology Assisted						
MODSS: Multi-objective Decision Making Support					1	
Websites	1				2	1

*Ranking Code
❶ Key engagement tool
❷ Secondary engagement tool
❸ Tool used occasionally for specific engagement needs

Table 3 lists all the tools used in fisheries-related engagements in the case study sites. The table is a sub-set of the full range of tools potentially available for stakeholder engagements shown in Table 1. A total of 29 tools were used in the six case studies from a potential total of 63 tools shown in Table 1 (46%). However, there are slight differences between the groups of tools used. There is a slightly higher percentage of 'Face-to-Face' tools used in the case studies (19 used from a total of 37 – 51%), a slightly lower use of One-to-Many tools (8 from 20 – 40%) and a much lower use of 'Technology Assisted' tools (2 from 6 – 33%).

'Workshops' was the only engagement tool used in all six case study sites. Five of the six case studies ranked workshops as a key tool. Engagement tools used in the majority of case studies (4 or above case studies) were: expert panel, surveys, questionnaires and responses, stakeholder analysis and key stakeholder interviews. Interestingly, these engagement tools are within the 'Face-to-Face' group, implying thus the overall importance of 'Face-to-Face' tools in the current fisheries-related stakeholder engagement practices. This finding is also reflected in the slight over-representation of the 'Face-to-Face' group of tools compared to the 'One-to-Many' and 'Technology Assisted' groups of tools. The limit use of the latter will be discussed in the following section.

6 Visualisation tools for ICZM

The analysis of the six case studies shows that in most cases simple tools are used to engage stakeholders in fisheries and coastal management. The range of visual aids and visualisation tools used in these cases vary from basic use of poster and pamphlets in the Moray Firth Area to various maps used as part of stakeholder engagement tools in Thailand and Namibia. Among these, the most advanced use of visualisation tool is demonstrated is the management of Alacranes Reef in Mexico, where GIS-based maps are used as part of a decision-making model. The limited use of this, and other 'computer-assisted visualisation tools' in the 'Technology Assisted' category, should be noted, particularly in the development of CTAM, which will be later discussed.

In general, visualisation tools can range from being as straightforward as pencil sketches through to advanced computer-based user interfaces. An example of the application of a simple visualisation tool is the use of cartoon books to communicate the impacts of dynamite fishing in Indonesia and Papua New Guinea, with the aim of reducing explosive use (Kay & Alder 2005). A more complex example of a visualisation tool is the coastal cross-section concept developed by Pauly & Lightfoot (1992). This technique involves the presentation of a coastal area as an inshore-offshore transect with a range of icons representing the different processes affecting the coastline. The use of a standardised representation allows comparison of different coastal systems at a glance. Recently, the application of GIS technology to fisheries and coastal management has enabled the development of complex environmental models that can then generate virtual reality visualisations to facilitate communication with stakeholders, for example as used for the Norfolk coast in the UK (Jude *et al*. 2001).

Coastal management practitioners often use visualisation tools in two contexts to engage stakeholders. The first is to provide a medium through which current and present day issues can be discussed and consensus built on their relative importance. The second context, and perhaps the most important one, is to support stakeholders to consider the future of their coast. This is perhaps the central tenet of ICZM, that is, to develop a clear view of desired future coastal conditions and mechanisms to sustainably achieve those management outcomes. The choice of visualisation tools is affected by a range of factors shown in Figure 2 as input and output factors. Coastal managers are well aware that the overarching factor is audience appropriateness; tools must be matched to stakeholder confidence, competence of both the subject matter and the visualisation tool.

The ICZM context within which visualisation tools are used is fundamental to the design and application of the visualisation tools. For example, in traditional planning contexts (based on rational-comprehensive planning theories) (Alexander 1986), visualisation tools can be developed and applied only during the initial planning phase and then they are no longer required until the commencement of the next planning cycle. This contrasts markedly to the adaptive planning context in which visualisation tools are constantly required to address changing issues and management requirements, and as a result they themselves may be adapted to address the evolving circumstances. In the case of scenario-based planning, visualisation tools can be important to help visualise different scenario storylines. Because scenario-based planning requires the combination of uncertainties by its very nature, the combined effects of these uncertainties can be difficult to conceptualise. As a result, visualisation tools can be particularly powerful to help simplify and present these often-complex conceptual models.

Development of CTAM as a visualisation tool for ICZM can benefit from learning about strengths and limitation of existing tools. Visualisation tool is often computer-assisted and technologically focus, creating thus some barriers in wide-ranging application, particularly in data-sparse and resource-poor situations. Acknowledging these constraints, CTAM is envisaged as a simple visualisation tool that can assist coastal managers, practitioners, scientists, resource users and other stakeholders in the management of their coastal areas, particularly in addressing multiple demands.

CTAM is based largely on the original coastal transects analysis model developed by Pauly & Lightfoot (1992) (Figure 8). It will describe coastal areas from upland to deep-sea by cross-sections. In each section, coastal geomorphology, habitats, resources and management issues will be portrayed. A fully-developed CTAM will also consist of arrows indicating flows of fish biomass, cash and labour. A slight modification from the original coastal transect project will be related to an attempt to use images with 2.5 dimensions (i.e., showing certain depth or width of transects). The development of CTAM in the current information technology age benefits from the use of web-interface, visualisation software and GIS that enables interactive Internet use with interested users.

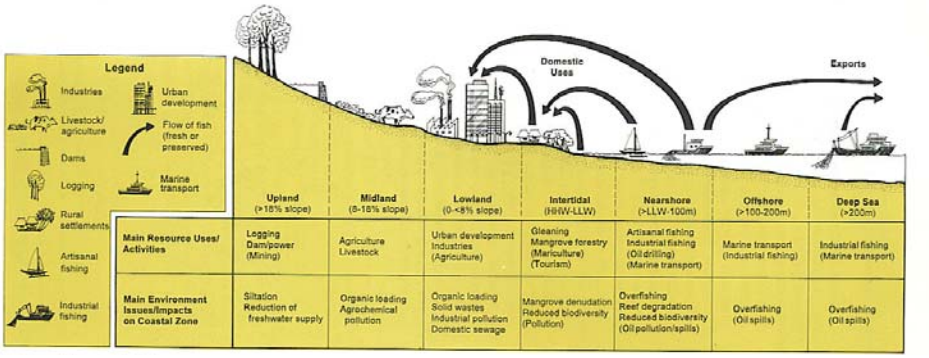

Figure 8 A coastal transect typical of many areas in Southeast Asia, as depicted by Pauly & Lightfoot (1992) (Source: The Coastal Transect Project, ICLARM, Manila)

An important consideration in the design of CTAM concerns data requirement. Thus, CTAM is developed as a model with a 'tier system.' Tier 1 is the most basic level where only descriptive information about a coastal area is required. For example, users are asked to provide information about coastal shape and slope and to indicate habitat types, existing resources and activities. Users will be quickly rewarded with an 'image' of their coastal areas, as well as a map indicating other coastal areas around the world that share similar characteristics (i.e., those in the same coastal transects classification developed as part of CTAM). The next level, Tier 2, asks for some quantitative information such as details about fisheries and aquaculture (e.g., landings/production, number of employment, etc.). It is at this level where the second image will appear, showing arrows that indicate flows of resources (mainly fish), cash and labour. At the final stage (Tier 3), further details about fisheries and coastal ecosystems, including governance system, management measures and issues, will be required as part of the decision-making model. Users with limited information (sufficient only for Tier 1) can still benefit from using CTAM as a learning tool, as prototypes will be provided for selected coastal systems.

As CTAM is designed as an on-line tool, a user-friendly web interface is developed to present simple questions, with multiple choice answers and drop-down menu. Pictures, images and icons are used when possible. Explanatory texts and help menu are thoroughly provided for clarification. Users can choose to receive notification about the development of CTAM through e-mail. Comments, suggestions and feedback from users in terms of ease of use and usefulness of the tool will be sought after. Model testing and modification will be an important part of the development process. This includes examining appropriate user groups and use environment. For example, the main target group of CTAM may not be individual fishers. Rather, the tool might be more appropriate for fisher and other resource user associations who can use it to pressure policy makers about their management decisions. It should also be useful as a communication tool to facilitate common understanding of the importance and interconnectivity of key processes and stakeholders within the immediate coastal areas and beyond. Ultimately, CTAM can be used to explore future scenarios, along with other ecosystem modelling tools such as Ecopath with Ecosim (EwE; www.ecopath.org).

7 Future research priorities

The review of the current status of stakeholder engagement and visualisation tools in fisheries management and ICZM and the case studies analysis summarised in this paper provide a number of insights into future research priorities. These insights point to both priorities for the remaining tasks of INCOFISH Work Package 6, specifically the development of CTAM and the stakeholder groups that it should target, as well as towards future research topics more generally.

First, it is clear from the case studies that the effectiveness in both engaging stakeholders and in contributing to fisheries management outcomes, has proved to be difficult to evaluate. While the descriptive summary of tools has yielded interesting results, perhaps the key constraint is the lack of accepted measures that would indicate their effectiveness. There is a clear research need to examine this issue, for example through examination of the factors that influence the choice of tools. This research could include examination of whether engagement effectiveness differs with different groups, e.g. small-scale fishers, large-scale fishers, in different cultural and economic contexts and to address different fisheries management issues.

There appears to be potential to develop future research themes in the development of such stakeholder-engagement effectiveness indicators. For example, the recent Perth (Australia) Coastal Planning Strategy (during 2004-2005) the particular stakeholder engagement approach used was evaluated using three key requirements (Department for Planning and Infrastructure 2005, Bruce 2006):

1. **Representativeness / inclusiveness**: giving all members of the community an equal chance of participation, resulting in a group that is representative of the diverse range of views in the community, and particularly inclusive of citizens who are not aligned on the particular issue.

2. **Deliberativeness**: is a learning forum; and includes access to information, opportunities for dialogue and discussion; and a process to move towards consensus.

3. **Influence**: the process must have the power to influence policy and decision-making.

It should be noted that the evaluation approach used in the above example was only one form of engagement - Deliberative Inclusion Process – within the overall spectrum of 63 potential tools available for coastal management engagement. Nevertheless, research into the application of such criteria, or modified criteria based specifically on fisheries-related engagements, would appear warranted.

Second, the case study analysis revealed that ‘Face-to-Face’ tools are currently the most widely used and most important in fisheries-related engagements. The case studies demonstrated different approaches to the application of these tools – with a clear preference for workshops as a primary tool. Further research would be valuable to analyse the component parts of these tools. For example, the detailed design of stakeholder engagement workshops and how these relate to the other ‘Face-to-Face’ tools used widely in the case studies – such as expert panels, key stakeholder interviews and the use of surveys and questionnaires.

Third, and most relevant to the goal of INCOFISH, is an opportunity to explore and develop tools such as CTAM to assist policy-makers, coastal practitioners, resource

users and other stakeholders in understanding the interconnectedness between coastal ecosystems and human activities. Further investigation is required to ensure the appropriateness of data requirements in CTAM and the effectiveness in the 2.5-D visual images. In particular, critical barriers to the adoption of CTAM need to be examined to provide critical insights in the system-design processes. An identification of suitable user groups for CTAM is required, along with ways to broadly disseminate and encourage its use. Ultimately, a question whether CTAM, as envisaged, would be a useful tool in ICZM needs to be answered. In other word, would CTAM help reconcile multiple demands in coastal zones?

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