ICES CM 2010 Code B:03

English final version

Integrating coastal zone dialogue : can initial networking of partners reduce conflicts in marine coastal areas?

Denis Lacroix
Ifremer ; Coordinator for Foresight analysis
Agropolis 34394 Montpellier Cedex 5 France
dlacroix@ifremer.fr ; Tel 33+4 67 04 75 33 / Fax 33+4 67 04 75 99
François Simard
IUCN ; Deputy head of global marine programme
28 rue Mauverney. CH 1196 Gland (Switzerland)
francois.simard@iucn.org; Tel 41+22 999 02 98 / Fax 41+22 999 00 25

Abstract

Integrated Coastal Zone Management (ICZM) is a link between three main fields: environment, society and economics. All of them are under strong and contradictory pressures with numerous factors and limited up-to-date and consistent knowledge. Nevertheless, decision makers have to find methods and means to manage the sustainable development of the coastal area, a place where different and frequently conflicting uses are steadily increasing, notably along the Mediterranean coastline. Numerous guidelines are available but their usual and common sense recommendations are rarely applied. The actor-network theory (Callon & Latour) could be a useful tool to clarify and reduce chronic resource use conflicts in coastal areas. The usefulness and efficiency of this theory was demonstrated in scallop fishery management in Northern Brittany in the 80's. After scaling up, this theory demonstrated its relevance and usefulness in two modern issues related to coastal management *lato sensu*: networking of actors involved in aquaculture development to train them in a new ecosystem approach (the IUCN initiative) and artificial reefs project management (for example the Portuguese model of Algarve). The asset of this theory is that it is a concrete and easily-applied method which can be proposed to any set of stakeholders, a soon as the challenge or the project has been defined. This practical method may also be used as a simulation process, notably in the context of foresight analysis.

Key words: coastal zone management, governance, actors network theory, foresight analysis

Introduction

Aquaculture is a quite recently developed activity which progressed from 5 million tons after the Second World War up to about 50 million tons 60 years later. In the middle of the last century, fish's contribution to human protein consumption was small; nowadays, it is the 4th main source of protein for man, after beef, chicken and pig but before sheep. The rapid evolution of this young food production sector (except the very old carp culture in China) explains why every new aquaculture project raises questions, fears and controversial discussions from some people, as well as enthusiasm and creativity from some others. This rapidly evolving situation justifies mobilizing sociology if decision makers want to undertake foresight analyses of this sector. The sociology of translation is a branch of sociology which seems to suit with the aim of a foresight capacity as translation is in the heart of the evolution of aquaculture: translation of scientific knowledge into development projects, translation of stakeholders' expectations into points of view expressed by group speakers, translation of issues into a permanent process of discussion between actors and investors, translation of various visions of development into programmes of actions until a possible "betrayal" of one or several actors. Any betrayal implies controversial discussion and strong potential changes (Callon *et al*, 2001).

Numerous previous studies (for example on mad cow disease or storage of nuclear waste) showed that, most of the time, the heart of the problem is much more linked to the context and relations between stakeholders and responsible institutions than to the problem itself (Marris, 2001).
In a similar way, the acceptability of a project related to aquaculture development, a domain which is frequently considered as high technology by the public, requires long and difficult discussions and may finally fail.
If the aim is to integrate the life of the society, any kind of development has to be built in a day by day process and never be bought or imposed (Dherse and Minguet, 1998). In aquaculture, and notably in marine aquaculture, this issue has been studied by numerous teams of researchers which gave rise to numerous publications: Mermet, 1992; FAO, 1995; Gesamp, 2001; Denis *et al*, 2001; Beuret and Pennanger, 2002; Hénocque and Billé, 2005; UE,1999; PNUE, 2001; Katavic *et al*, 2005; Efaro, 2006; Rey-Valette *et al* 2006; Soto *et al*, 2008; Evad, 2008; Cléach, 2008; Rey-Valette and Antona, 2009.

However, experience shows that check lists of procedures or methodological guides have limited impact on stakeholders in aquaculture development projects. Actually, these documents propose a comprehensive set of recommendations in order to achieve a "theoretical" optimum sustainable development. But problems met in testing their application are often resulting from the fact that stakeholders link together only when the project is decided or even once it has already started (Chia *et al*, 2009).

It seems to be preferable to activate the network of stakeholders before the position of each one is fixed. Sociology has some tools for this field of study, notably the "Actors network theory" (ANT), which was first defined in the case of Scallop fisheries (*Pecten maximus*) management, in the bay of St Brieuc (Northern Brittany, France) in the eighties. The theoretical framework is described in Callon's main paper (Callon, 1986).
After a brief presentation of this theory, we will see how it could help to reduce conflict risks in two examples: the management of a programme of artificial reefs in Algarve (Southern coast of Portugal) and the training of scientists and decision makers in the sustainable development of aquaculture in the Mediterranean.

1. The actors network theory (or theory of translation)

M. Callon started to study aquaculture in France in the beginning of the 80's, when this sector was considered a very innovative and risky activity. His initial study focused on the issue of Scallop fisheries management in the bay of St Brieuc with two main stakeholders: scientists (from the French national institute for marine sciences CNEXO, Ifremer today) and fishermen.

This theory (ANT) was developed by a team of French sociologists headed by M. Callon, B. Latour and M. Akrich from the "Centre de sociologie de l'innovation" of MinesParisTech (Callon, 1998 ; Callon *et al* 2001). It presents three singularities: first, it takes into account non only human individuals or groups but

also structures or “talks” (such as official reports, laws and regulations, public opinions, etc.); each of those so-called “actors” are represented by one main “speaker”. Second, this theory studies all relevant relations between the actors as they have an influence on the evolution of the whole system. Finally, it reveals which are the necessary meeting points for all the actors. Three functions impact the system : (i) the will of some actors to influence or “recruit” others to join their point of view, (ii) the management of the dialogue between the different groups of partners at various levels of truth in the expression of the points of view, (iii) severe controversies between groups of actors (including deny of legitimacy for an actor or the relevance of so-called common decisions) which lead to re-modelling a new balance of opinions, or the cancellation of all commitments, or an unforeseen innovative breakthrough.

It is useful to recall the three main principles of the method as they seem to fit well with issues related to aquaculture development:
The first principle is the neutrality (“agnosticism” says Callon) of the scientist considering knowledge about Nature and Society. Consequently, any kind of knowledge has to be considered equally “uncertain, ambiguous and refutable”.
The second principle imposes one single structure to describe and record the various points of view, since considerations on Nature and Society are always mixed by the actors themselves.
The third principle is the free association of facts coming from Nature and facts coming from Society. This opening of interactions is effectively observed in the mix of technical, sociological and political aspects frequently described in aquaculture R&D programmes (Hénocque et Billé, 2005).

Table 1 summarizes the 6 steps of the analysis of the issue in the framework of the ANT theory.

Phase	Step	Element / Key action	Main question
1 Network design	1	Network of actors	WHO ? WHAT ? WHICH ?
	2	Compulsory meeting points and collective tools	WHAT FOR? HOW ?
2 Actor dynamics	3	Interest of the points of view and recruitment of supporters	WITH WHOM ?
	4	Speakers and debate	ON BEHALF OF WHO?
3 Network removal	5	« Betrayal » (Misunderstanding in the translation)	WHY?
	6	Controversies and removal of the whole system	Negociate or quit ?

Table 1 : Main steps in the analysis of the issue in the framework of the ANT theory.

During the first phase, the main actors are identified. The term “actor” encompasses all the elements that are “acting” in “the plot” in the meaning of P. Schwartz (1991) in *The art of long view*, i.e. groups, decision-makers, key-technologies, regulations, ecosystem, animals, etc. This allows the identification of common major issues at stake or “Compulsory meeting points” where relation dynamics will play, as well as the “tools” that crystallize the expectations of a majority of stakeholders : a map of the rights of use on a given territory, a collective hatchery, a technology for the growth of shrimp in a new ecosystem, etc.

During the second phase, each actor tries to maximise the number of supporters of its point of view. In case of success, the “recruitment” is successful and the dominant actor has the weight of its allies. Speakers of each group of allies then start the debate on the stakes until a consensus is found. Each point of view may be analysed through four different screens: legitimacy, credibility, degree of truth, and acceptability of the message.

The last phase is optional as it depends on the possible “betrayal” of one or several actor(s) regarding the consensus selected at the end of the previous phase. Controversies then modify actor relations. Three kinds of evolutions may occur: a new equilibrium between actors, the cancellation of the network, or an innovation which modifies the plot and resets the process.

2. Two examples of application *de facto*

2.1. Artificial reefs in Portugal

Context and main stakeholders
Artificial reefs are one of the tools used to manage the coastal area. They have multiple definitions, aims and functions. The most common definition comes from FAO: "an artificial reef is a man made structure installed on the sea ground to protect, restore, sustain or stimulate the ecosystem". It emphasizes the variety of reef uses. The definition from Japanese universities highlights the usefulness of artificial reefs for fisheries (Simard 1989, 1996; Chii, 1990). For the US authorities, the key consideration is the impacts of these reefs on the ecosystem, notably in terms of restoration (Seaman, 2002), while for the European network for the study of these structures, the priority is given to the protection of the biodiversity and its potential productivity (Jensen, 1997).

All authors agree on the difficulty of measuring the real impacts of these structures at sea (open environment, bias from the observers…) at different time and space scales. Actually, their conception and management are the results of numerous objectives and decisions of a number of stakeholders (Gomez-Buckley and Haroun, 1994; Santos *et al*, 1995). The ecosystems related to artificial reefs show numerous levels of maturation according to their age, location and type of management (Pioch *et al*, 2008). After some years or, most of the time, decades, the exploitation of the artificial reefs for numerous purposes (such as fishing, tourism, restoration of habitats, etc.) creates a new ecosystem.

Who has the legitimacy to launch such a project? Several actors may develop this type of initiative. The major stakeholders are the following:

Fishermen are often greatly interested in such project as they are, most of the time, the first end-users, notably in Japan, where the coastal sea belongs to them. In Europe, they play a prominent role as they regularly ask politicians and the government for such programmes. The main motivation is the protection of shallow coastal waters from illegal trawling. That way, small fishermen try to protect their fishing areas using heavy blocks of concrete that have destructive effects on trawling nets (Ramos-Espla *et al*, 2000). Frequently, other types of structures are added with a dual function of production and protection. Those structures are specially designed to stimulate *a priori* the development of a diversified ecosystem and/or to restore or stabilize the level of catch.

In Spain, Portugal, France and Italy, **the State** defines the juridical rules for artificial reefs settlement and the exploitation and impact assessment rules (Relini *et al*, 1999). This responsibility is always the result of discussions between various stakeholders such as local authorities, fishermen associations (e.g. Prud'hommies in France or Confradias in Spain) and other groups, notably ecologists. In Spain, a line between some specific points along the coast divides the responsibility between the State (the open sea, beyond the line) and the province (the coastal waters). This zoning facilitates the partnership, the planning and the financing of artificial reef projects with 50 to 75% support from the EU (Revengs *et al*, 1996)[1].

Private companies also have the legitimacy to test structures to demonstrate their potential efficiency. In Japan, 38 companies are regularly proposing new artificial reef models, testing various designs, materials and sizes. They also provide 3 years of testing *in situ* with thorough monitoring by marine biologists. Then the authorities deliver a label, if justified, for a possible selection by fishermen associations when they need to mitigate some expected negative impact on fisheries from any permanent device (bridge, port…) or accidental event (oil spill…) (Nakamura, 1985). This type of proposal (reefs for mitigation) is now expanding in Europe and USA, where recreational parks and specific structures are used to mitigate ecological impacts of any damage at sea. The principle of the compensation is summarized by the motto: « No net loss » (Pioch, 2010)

[1] In 1999, in 12 years, Spain and Portugal had achieved 87 projects covering 973 km², which represents a total of 110.000 tons of concrete structures (Dao *et al*, 1999).

Some NGOs, like Reef ball©, promote artificial reefs to reduce the impacts of storms and hurricanes on tropical lagoons. **Research institutions (**like Ipimar**)** or universities (e.g. the 5 Japanese universities specialised in marine sciences and fishing) also undertake various initiatives in coastal zone management with scientific research objectives. As summarized by Professor H. Kakimoto (National advisor to the National coastal fisheries development association of Japan): "Sea is a more fertile environment than earth, but the challenge is: how to make it more productive?"

The question of acceptability is linked to the image of the sea in the mind of the stakeholders. The Japanese case is specific because the coastal sea belongs to the fishermen and fish is a vital source of protein for all Japanese people[2] (Simard 1989, Chii 1990). In numerous Mediterranean countries, including Portugal, the priority is given to the protection of fishing grounds and the establishment of marine protected areas (MPAs). The acceptability is therefore contrasted: negative for the fishermen using trawlers and positive for the other users (Serrano, 1998; Monteiro and Santos, 2000). Officially, fishermen using trawlers recognize that it is necessary to protect fish nurseries with one condition: the same rule for all (which is achieved by protection of reefs). Moreover, when positive impacts on the ecosystem, and notably the catch of marketable seafood, is scientifically demonstrated on the medium term, all fishermen are convinced. In some cases, they even ask for more reefs (In Portugal: C. Monteiro; In Spain: P. Pons Inglada; Head of the confradia of Villanova, Catalunya; pers. com.).

Application of the ANT theory to the Portuguese artificial reefs programme

In this first case, the application setting of the ANT theory is the equipment and the managementsettlement of the continental shelf, off the coast of Algarve, in south-east Portugal, with a depth varying from 15 to 35 m. (Monteiro, 2000; Santos, 2007). The objectives of Professor C. C. Monteiro, local director of Ipimar, are numerous: to protect the coast from trawling; to test the potential stimulation of productivity as the reefs are located close to the outlet of a great laguna (Faro), which is a well-studied nursery for fish; to increase scientific knowledge on the ethology of the main local fish species; and finally to improve relations between fishermen and scientists[3].

Its key idea of Monteiro, picked in France in 1989 after the first trials of artificial reefs in the Languedoc – Roussillon province (Doumenge, 1968), was to associate fishermen and scientists from the start of the project. Fishermen took place in the research vessel of Ipimar and, similarly, scientists went aboard fishermen boats when they were going to reef areas. The main assets were (i) to share data and experience in real time during 10 years, (ii) to facilitate the involvement of fishermen in the project and (iii) to save time and efforts in the demonstration of reef usefulness (Monteiro and Santos, 1998).

The "actors" are not numerous for a project of this size: fishermen, scientists (leader), local politicians, technologies for reef building and immersion (done by local companies), marketable species (fish and crustacean), other ecosystem species, international expertise, local population (3 villages) informed by local newspapers and radio.

The compulsory meeting points and collective tool are the artificial reefs themselves with the key question of their usefulness. Debates remained free and open as fishermen are actually working together. No controversy arose because the end-users are also shareholders of the project.

The speakers are few, well identified and stable. For example, C. Monteiro is still the leader scientist, 20 years after the start of the project.

The explicit objective of the project is an improved productivity of the area, without an attraction effect from neighbouring fisheries. The transparency of the project is high as the results of the experimental fishing are regularly published and information meetings, open to the public, are covered by local media.

---

[2] Il faut rappeler qu'un japonais consomme environ 90 kg de produits de la mer par an soit l'équivalent de toute forme de viande pour un français.

[3] Situation bien documentée par la bibliographie et lors d'une mission que j'ai faite sur place avec J.C. Dao et G. Véron et qui a donné lieu à un rapport de mission, en juin 1999 puis à des échanges suivis avec l'équipe de l'Ipimar à Faro et à Lisbonne.

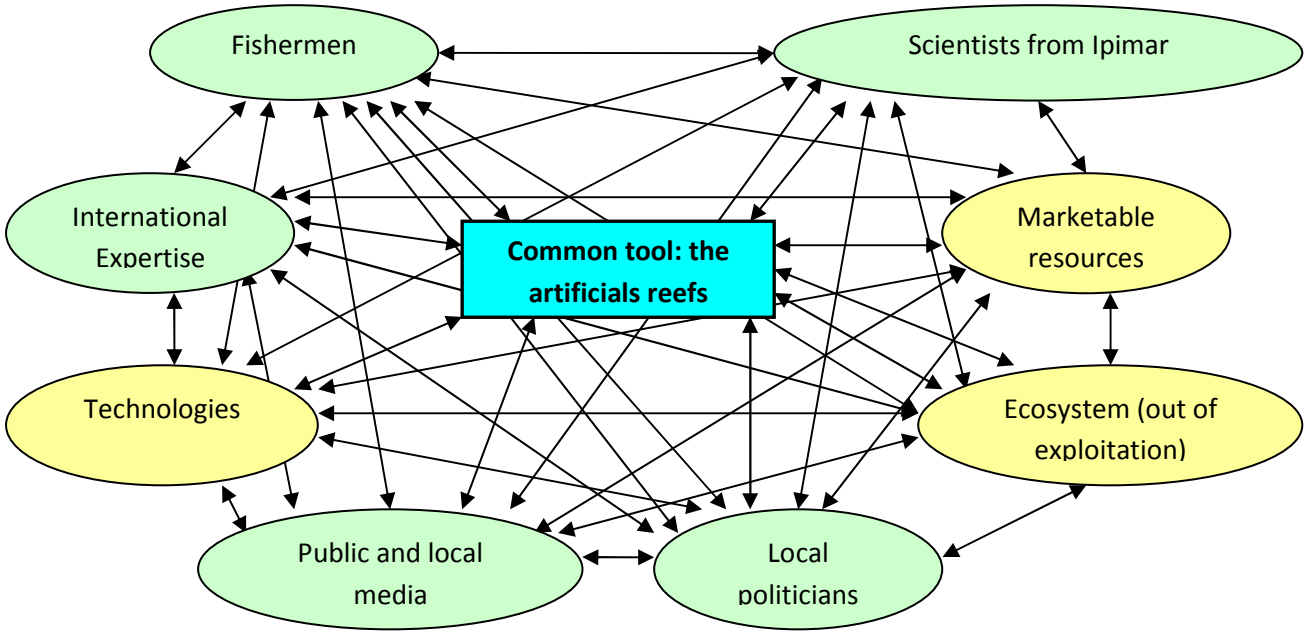

Figure 1: The network of actors involved in the artificial reefs programme developed in Algarve, Portugal, since 1989 (in yellow: non human actors)

Interest of the ANT theory in the case of the Portuguese artificial reefs programme

Figure 1 shows that the initial decisions of the leader in the programme organisation heavily contributed to the development of permanent links between the actors. The network is remarkably dense: 38 links for 8 actors. Consequently, almost each human actor knows the other actors and is in a logical interaction with the others; this situation facilitates the exchange of information, improves the transparency of the dialogue between actors and reduces the risks of controversy. Actually, each actor is in a position of mediator between most of the other actors. The system is consequently more reactive and adaptable than in a situation where actors have fewer opportunities to communicate.

The programme also provides a huge amount of data, which facilitates regular publications as a demonstration of the efficiency of the system and notably the unusual partnership between scientists and fishermen of Faro (Monteiro et Santos, 1998, 2000; Santos et Monteiro, 2007).

The ANT theory demonstrates the reasons for the success of this 20-year-old programme. The early involvement of stakeholders in the project and the careful management of all actors with a long term view clearly reduce the risk of misunderstanding, controversy and opposition. This approach shows its potential as an *ex post* analysis tool. However, it is interesting to notice that it could be used as a tool for *ex ante* analysis as well. This new type of tool would probably help to avoid forgetting some important actors, identify relevant links to be strengthened, and anticipate possible sources of competition or conflict. This kind of knowledge is not published most of the time but its value can be confirmed by all human actors.

If the relevance of a development project is ultimately dependent on its capacity to build sustainable social relations (Latour, 2006) and to create a common sense of equity (Jamieson, 2005), the ANT approach gives a useful and practical tool to facilitate the achievement of these two ambitious aims.

2.2. Sustainable development of Mediterranean aquaculture

Context

In this second case, the situation is the opposite. A network has been created deliberately by the Centre for Mediterranean Cooperation of the International Union for Conservation of Nature (IUCN). The purpose of this network creation was based on the following:

1. Mediterranean aquaculture developed strongly during the last 15 years, and contributes as much as fisheries in term of fish quantity, about one million tons (FAO Statistics 2008).

2. Resource use pressures on coastal areas are increasing on a long term basis (Plan Bleu, 2008).
3. Aquaculture is still in a first phase of development, in which farms are seen as external newcomers in the local society.

It has to be recalled that the United Nations Environment Programme has a specific plan for the Mediterranean (Mediterranean Action Plan, MAP,) whose secretariat is in charge of the implementation of the Barcelona Convention (1976) and its Protocols, and which includes several Activity Centres such as the Priority Action Programme located in Split (PAP/RAC) and working on ICZM. The MAP published several guides (1988, 1995), a book on best practices and a white book in 2001. Since 1989, the Coastal Area Management Programme (CAMP) aims to support authorities in charge of the implementation of ICZM.
The overall objective of the ICZM is to prepare the legal frameworks for action for the integration of all coastal activities with as few conflicts as possible. The recommendations prepared by the PAP/RAC are not imposed to countries but are guides for national legislation frameworks.
The tendency is to proceed from concepts to concrete implementation by using workshop-sites, at least one in each Mediterranean country. However, the major issue is the absence of control mechanisms for the implementation of the Protocols, whether or not they have been ratified by the countries. Moreover, these recommendations are very light in front of the economical challenges of coastal development and tourism. Resource use conflicts and environmental concerns are providing new layers of complexity.

A vast consultation programme for the sustainable development of aquaculture was launched at the beginning of the nineties in the framework of the MEDRAP project (Mediterranean Regional Aquaculture Programme) with the support of the FAO Department of Fisheries. The objective was to provide reliable and precise aquaculture regional data for the 15 countries involved. The tool was a numerical network managed from a technical centre located in Tunis under the supervision of FAO in Rome. Four fields, covered by four networks, were to be documented: environment (EAM), technology (TECAM), socio-economy (SELAM) and information (SIPAM). The network did not work well and only the SIPAM survived, in a reduced form. This failure can be explained by 2 reasons. First, the collection of real time data was done by national focal points who were not recognized in their own national institution; soon, most of them stopped providing the data which were necessary for maintaining the quality and pertinence of the system. Second, the data provided by the focal points were often quite different from the official data officially transmitted later to FAO (Lacroix 2010). These differences created recurrent difficulties in publishing .

Fifteen years after the launch of the project, it is paradoxical that such network would be very useful since the aquaculture did develop and that harmonization became a necessity, but it is barely surviving despite being in an institutional framework.

For these reasons, the IUCN Centre for Mediterranean Cooperation decided to create a network of experts covering a wide range of expertise on the sustainable development of aquaculture, by selecting them on their personal capacity and not on institutional designation. The other characteristic of the initiative was the multiple sourcing of funds, keeping clear independence and facilitating the availability of experts. Finally, it was essential to focus the work according to the ecosystem approach as recommended by IUCN (Shepherd 2004) and FAO (FAO, 2007; Soto *et al*, 2008). All kinds of topics are considered, such as employment and companies, gender, economical diversification, infrastructure development, food security, conflict management, good governance and equity, etc. These topics meet stakeholders' expectations so that the discussion is enriched and touches upon concerns that are not usually taken into consideration in some countries. For example, the usefulness of zoning the coastal area notably for special zones for aquaculture is demonstrated in some countries which facilitates the transfer of this initiative to other skeptical countries.

Application of the ANT theory to the sustainable development of Mediterranean aquaculture
Figure 2 presents the network of stakeholders involved in the project Guidelines for the Sustainable Development of Mediterranean Aquaculture. This project, funded by the Spanish Ministry of Agriculture, Fisheries and Alimentation, was launched in 2006. It included the drafting and publication of books on the following topics: interactions between aquaculture and the environment; site selection and site management; and responsible practices and certification. It has to be noted that scientific experts (researchers) are not included in "Institutions", and that "Companies" are clearly in the network. The bases of the working group have been built on the signature of a Memorandum of Understanding between IUCN and the Federation of

European Aquaculture Producers (FEAP). "Companies" includes producers' associations[4], producers[5], as well as consultants in aquaculture[6].
In addition, red arrows underline the strongest links in terms of frequency and quality; the strength of the system is expertise, not institution.

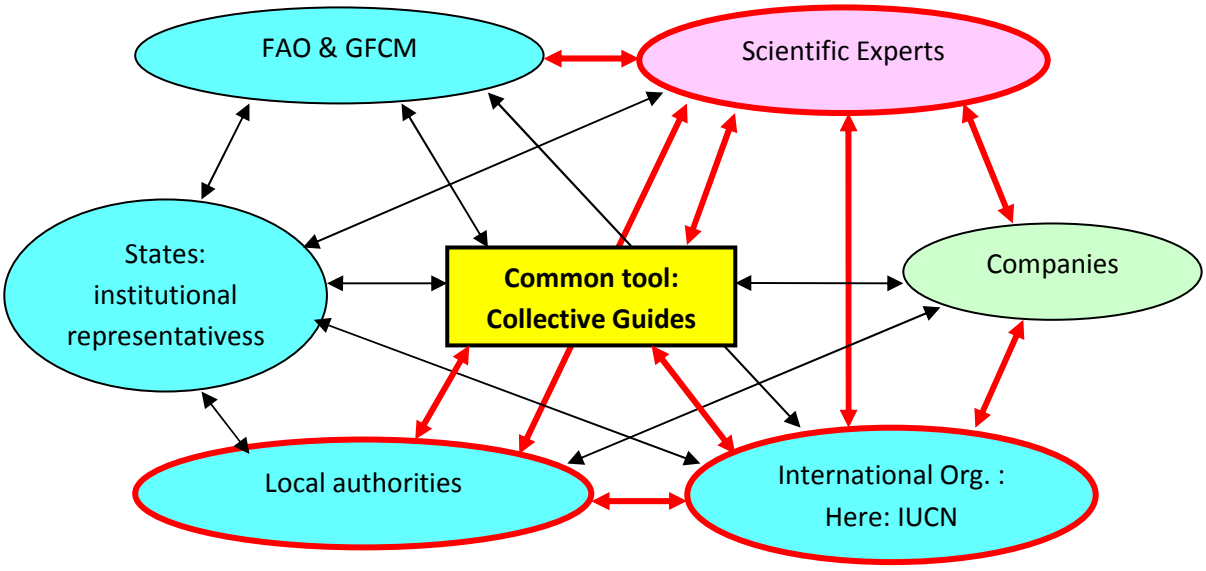

Figure 2: The network of stakeholders involved in the case of the elaboration of guides for the sustainable development of aquaculture in the Mediterranean (In blue: institutions; in red: main links)

Since all **stakeholders** are represented in the working group and have been nominated on the criteria of their excellence at the international level, the legitimacy, credibility and transparency of the network are optimized. All experts are **spokespersons**. The recruitment of the experts is related with the topic and if new needs of expertise appear with the debates, new experts may be invited to join the working group.
Debates are very open because none of the experts has to defend the interest of his government or organisation as it is often the case in international meetings. This does not mean that transparency of opinions and positions is absolute but that the consensus level is undoubtedly higher than in other institutional workshops. Fig.2 shows that scientific experts and IUCN communicate with all other stakeholders, and that the "red" network of personal capacities (excellence) is more active than the "black" network of institutions.

The common objective (Guidelines for the Sustainable Development of the Mediterranean) is simple, clear, based on facts and deliverables, easy to control and possibly permanently enriched. It cannot be "captured" by one of the stakeholders; its legitimacy and utility for all institutions are therefore strengthened.

Another advantage of the process is that **the "betrayal"** and rejection risks are almost reduced to zero because the final result is not imposed to the stakeholders but constructed freely (Chia *et al*, 2009).

Two examples of the application of this new approach to the common development of Mediterranean aquaculture are presented below.
Spanish authorities developed and applied the concept of "aquaculture zones" in large size "*Poligonos*" offshore (Murcia). This concept implies that environmental impact assessment studies are conducted by the regional authorities. This example inspired other countries such as Egypt, Algeria and Turkey. In order to solve common conflicts between aquaculture projects and other coastal activities, the governments of these countries try to put in place such zoning plans, but those plans are often used as ways to reserve areas rather than as development tools (S. Sadek; G. Yuzel; pers. com.).

---

[4] FEAP (Federation of European Aquaculture Producers) or Apromar (Spain)
[5] Kefalonia fisheries (Greece) or Culmarex (Spain)
[6] BRL (France), ACO (Egypt), AQUARQ (Greece), OKIANOS (Tunisia)

In Croatia, competition for access to marine areas became a limiting factor in the development of aquaculture. The Fisheries Department (Ministry of Agriculture) decided to put in place a concerted zoning plan to facilitate the integration of aquaculture in coastal development plans. The aim was to select reserved sites for aquaculture according to local constraints and sustainability principles. Following this political decision, an administrative framework was created including the compatibility criteria for the integration of aquaculture within the environment. Guidelines were drafted, which indicate the procedures to follow to have as few negative environmental impacts as possible on the site. This procedure was tested in Zadar County for the identification of several favorable zones for several species (tuna, mollusks, etc) following the ICZM recommendations. Data on each zone, utilized technologies and holding capacity have been transmitted to decision makers. This concrete initiative should facilitate aquaculture investments in Croatia (Katavic, 2010).

Recall of the importance of acceptability in aquaculture

The minimization of potential conflicts related to aquaculture development depends on the perception of this recent activity by the public and the media. In the framework of the analysis of country values (Inglehart and Welzel, 2007), the acceptability of aquaculture on the northern coast of the Mediterranean requires mainly values related to individualism (entrepreneurship, market exploration and conquest, ability to optimise the profitability) and the "rational modernity" (relevant use of technologies, management of the impacts). This is notably the case in Spain, France, Italy, Croatia, Greece and Israel. The ex-communist countries are shifting to this set of values, globally considered as "modernity" but values related to individual survival should still be significant. The first satisfaction of local needs should be dominant for the countries located on the eastern and western sides of the Mediterranean (Egypt and Turkey).

The participation of local communities in the preparation and planning of the project, including the financing, contributes positively to the acceptability. The feeling of participation may help to reduce criticism against the project and may even turn criticism into support, as has been observed for the installation of wind turbines onshore (Breukers et Wolsink, 2007). This change is notably observed when stakeholders are involved since the beginning of the project and when local employment is increasing and the reversibility of the devices is explained and secured (Gueorguieva-Faye, 2006).

Therefore, the sustainable development of aquaculture is possible when specific efforts are made to transform negative initial perceptions into positive opinions and, similarly, to change drawbacks (risks of organic pollution for example) into assets (synergies with mollusc culture or artificial reefs close to marine fish cages for example). All along this process, the State keeps a central role as responsible for the legal framework and as referee in case of open conflict. Most of the time, in Mediterranean countries, problems are more related to the lack of legal management than to an excess of public authority. The right balance is going to be found (Katavic, 2010), notably through the dissemination of targeted guidelines such as the IUCN ones.

Conclusion

In all innovative projects, the key for acceptability, and consequently the reduction of potential conflicts between stakeholders, lies in the early sharing of information and the explanation of the reasons for the technical choices. Debates are necessary and should involve all stakeholders. This process provides the opportunity to clarify and justify all components of the project and avoid at least the explicit fears against science and technology. "Debates require describing the project in detail (…), which makes it understandable for all. Therefore, they represent an enrichment of democracy" (Callon *et al*, 2001). In other words, "What citizens are asking for is not Zero risk but Zero despise" (Noiville and Gouyou, 2000).

In this context, the Actors network theory developed over the last 25 years by M. Callon and colleagues shows to be an interesting tool for both *ex ante* and *ex post* analyses. The originality of this approach, which was simplified here in a method to facilitate its use, comes from the fact that it helps to identify minor actors and underestimated links. The method also contributes to the open management of the different phases of any R&D project at sea, clearly showing the games of cooperation between actors and reducing the risk of shifting from useful debates to sterile controversies.

This approach can also be tested with various scenarios describing the evolution of a region, country, or global change (for e.g. climate). It is then possible to check if the project keeps a reasonable probability to remain compatible with the ecosystem approach of aquaculture[7].
As it is possible to estimate the positions of different actors according to various scenarios, the ANT theory provides the opportunity to analyse methodically the global evolution of the project in each scenario and consequently test its solidity and validity with regard to the global aims.
This process may also be tried in a classical *ex ante* analysis, which enriches its assessment potential up to the selected time scale. When this latter is chosen beyond 15 years, it becomes a new tool for foresight analysis

Literature cited

Beuret J. E., 2006 : La conduite de la concertation : pour la gestion de l'environnement et le partage des ressources ; Coll. Politique & Sociologie ; L'Harmattan ; 350 p.

Beuret J.E., and S. Pennanger, 2002: Quand les citoyens modèlent l'action publique : la gouvernance des espaces littoraux. Revue Pour N° 174. 171-178.

Blatrix Cécile, 2002 : Devoir débattre : les effets de l'institutionnalisation de la participation sur les formes de l'action collective ; Politix, vol. 15 n° 57 pp. 79 102

Breukers S. et M. Wolsink, 2007 : Wind power implementation in changing institutional landscapes : an international comparison, Energy Policy 35 2737 –2750 ; Elsevier

Callon M. P. Lascoumes and Y. Barthes, 2001 : La controverse comme apprentissage et traduction *In* Agir dans un monde incertain ; essai sur la démocratie technique. Seuil Paris. Coll. La couleur des idées ; Seuil ; 358 p.

Callon M., 1986 : Eléments pour une sociologie de la traduction : la domestication des coquilles St Jacques et des marins pêcheurs en baie de St Brieuc. L'année sociologique N°36 ; pp. 169 -208.

Callon M. 1998 : les différentes formes de démocratie technique ; annales des Mines (Jan.) pp 63- 73

Chia E., H. Rey-Valette, H. Lazard, J. Clément et S. Mathé, 2009 : Evaluer la durabilité et la contribution au développement durable des systèmes aquacoles : propositions méthodologiques. Cahiers de l'agriculture. 20 p. (sous presse)

Chii A., 1990 : Life pattern and culture of Japanese coastal zones viewed through the fisherfolk's outlook on the afterworld. Proc. On the internat'l symposium on the coastal zone. Kanagawa. 3-5 Oct. 1990 ; pp. 86-93.

Cléach M. P. (Coord.) 2008 : Marée amère : pour une gestion durable de la pêche. Rapport sur l'apport de la recherche à l'évaluation des ressources halieutiques et à la gestion des pêches; OPECST ; Assemblée nationale N° 1322 ; Sénat N° 132. 175 p. Chap. 4 L'aquaculture : passer du mirage au miracle

Cornish E., 2004: Futuring : the exploration of the future. Bethesda; Md : World Future Society, 313 p.

Dao J.C., D. Lacroix et G. Véron, 1999 : Rapport de mission en Espagne et au Portugal sur les aménagements physiques en zone côtière. 12-23 avril 1999; Ifremer. Rapport interne. DRV. 54 p.

Denis J., Y. Hénocque et M. Antona, 2001 : Des outils et des hommes pour une gestion intégrée des zones côtières : guide méthodologique. Unesco – COI ; Paris. 64 p.

[7] The American futurologist E. Cornish identifies the capacity of societies to manage science within the limits of the conservation of Nature as one of the two main issues at stake for mankind for the next 50 years (Cornish, 2004).

Dherse J.L. et Dom H. Minguet, 1998: L'éthique ou le chaos. Presse de la Renaissance ; 378 p.

Doumenge F., 1968 : Récifs artificiels : un programme de soutien et de développement de la pêche locale. Compagnie générale transatlantique. Univ. P. Valéry. Montpellier 3. 10 p.

Efaro, 2006: Trends in European fisheries and aquaculture research. Concerted action Multi-share (Q5CA-2002-1353)50 p.

Evad, 2008 (Coord. J. Lazard): guide to the co-construction of sustainable development indicators in aquaculture. Joint work of Cirad, Ifremer, Inra, IRD, and Univ. Montpellier 1). 144 p.

FAO, 1995 : L'ampleur des besoins. N° spécial cinquantenaire 1945-1995. FAO, Rome. 127 p.

FAO/NACA, 1995 : Regional study and workshop on the environmental assessment and management of aquaculture development (TCP/RAS/2253) . NACA environment and aquaculture. Devpt. Series N°1. Bangkok, Thailand. 492 p.

FAO, 2007: Sustainable growth and expansion of aquaculture: an ecosystem approach. *In* FAO state of the World fisheries and aquaculture Sofia 2006. Pp 76-83.

GESAMP, 2001 : Planning and management for sustainable coastal aquaculture development (part1) Rome FAO . 44 p.

Gueorguieva-Faye D., 2006 : le problème de l'acceptation des éoliennes dans les campagnes françaises : deux exemples de proximité géographique ; Revue Développement durable et territoires ; dossier 7 : Proximité et environnement.

Hénocque Y. and R. Billé, 2005 : Gestion intégrée du littoral. . Comm. Colloque Prospective du littoral pour les générations futures. Min. de l'écologie (MEDD). Mars 2005 Paris. 14 p.

Ingelhart R. D. and C. Welzel, 2007: World values survey: cultural map of the world. Internet site

IUCN, 2007: Guide for the sustainable development of Mediterranean aquaculture. Interaction between Aquaculture and the Environment. IUCN, Gland, Switzerland and Malaga, Spain. vi + 110 pp.

IUCN, 2009: Guide for the sustainable development of Mediterranean aquaculture 2. Aquaculture site selection and site management. IUCN, Gland, Switzerland and Malaga, Spain. viii + 303 pp.

IUCN, 2009: Guide for the sustainable development of Mediterranean aquaculture 3. Aquaculture Responsible Practices and Certification. IUCN, Gland, Switzerland and Malaga, Spain. vi + 70 pp.

Jamieson D., 2005: Adaptation, mitigation and justice in Perspectives on climate change : Science, Economics, Politics, Ethics. Elsevier editor; pp. 217 - 248

Jensen A.C. (Ed.), 1997: European Artificial Reef Research. Proceeding of the first EARRN conference, Ancona, Italy. Pub. Southampton Oceanography Centre, UK : 1-449.

Katavic I (coord), 2005 : Guidelines to marine aquaculture planning, integration and monitoring in Croatia. Dir. of Fisheries. Min. of agriculture. Zagreb. Croatia. 77 p.

Lacroix D. et S. Pioch, 2009 : « Un nouveau territoire de développement : la mer côtière ou le développement en 4D ». *In* Impertinences 2009 : 9 contributions pour penser et agir autrement. (préf. de V. Pécresse) Le cercle des entrepreneurs du futur ; Ed. La Documentation française ; pp. 51 – 66

Lacroix D., 2010 : Aquaculture et Prospective. Thèse de doctorat en Sciences animales. Ifremer - AgroParisTech. 280 p. (sous presse)

Latour B, 2006 : Changer de société - Refaire de la sociologie. Paris. La Découverte

Marris C., 2001: la perception des OGM par le public : remise en cause de quelques idées reçues; Economie rurale 266. Nov. Déc. 2001. pp. 58 – 79

Mermet, 1992 : Stratégies pour la gestion de l'environnement. La Nature comme jeu de société. Paris L'Harmattan. 205p.

Mermet L. (dir.), 2003 : Prospectives pour l'environnement. Quelles recherches ? Quelles ressources ? Quelles méthodes ? Coll. Réponses environnement. La documentation française. 107 p.

Mermet L. (dir.), 2005 : Etudier les écologies futures : un chantier ouvert pour les recherches prospectives environnementales. Ed. PIE Peter Lang. Ecopolis N° 5. 409 p.

Monteiro, C.C. & M. N. Santos, 1998: Comparison of the catch and fishing yield from an artificial reef system and neighbouring areas of Faro (Algarve, south Portugal). Fisheries Research, 39 : 55-65.

Monteiro C.C., Santos M. N. 2000 : Portuguese artificial reefs *in* Artificial Reefs in European seas. *A.C.* Jensen, K.J. Collins, A.P.M Lockwood (Eds). Kluwer academic publishers, Chap. 15: 249-261.

Nakamura M. 1985: Evolution of artificial fishing reefs concepts in Japan . Bulletin of Marine Science 37 : 271-278.

Noiville C, and P. H. Gouyon, 2000 : Principe de précaution et organismes génétiquement modifiés : le cas du maïs transgénique. In P. Kourilsky et G. Viney « Le principe de précaution » Ed. Odile Jacob. Paris 2000 Annexe II. pp. 277 – 340.

Pennanguer S., 2005 : Incertitude et concertation dans la prise de décision en gestion durable de la zone côtière. Thèse UQAR – Ensar 370 p.

Plan Bleu, 2008 : Les perspectives du Plan Bleu sur le développement durable en Méditerranée. PNUE / PAM. Sophia Antipolis. 28 p.

Pioch S., 2008 : Les habitats artificiels : éléments de stratégie pour une gestion intégrée des zones côtières. Essai de méthodologie d'aménagement en récifs artificiels adaptés à la pêche artisanale côtière. Thèse de l'Univ. Montpellier 3 Géographie / labo. Gestion des territoires. 140 p.

Pioch S., K. Kirfoyle, H. Levrel and R. Spieler, 2010: Green marine construction. To be published

PNUE/PAM/PAP, 2001 : Principes de meilleures pratiques pour la gestion intégrée des zones côtières en Méditerranée. 54 p.

Ramos-Espla A.A., Guillen J.E., Bayle J.T., Sanchez-Jerez P., 2000: Artificial anti-trawling reefs off Alicante, South-eastern Iberian peninsula: evolution of reef block and set designs. In Artificial Reefs in European Seas. A.C. Jensen et al., edits. Kluwer academic publ., NL. : 195-218.

Relini G., Ferrara G. (Ed.), 1995 : Les récifs artificiels dans la gestion de la bande côtière. Actes du colloque « Le barriere artificiali nella gestione razionale della fascia costiera marina ». Atti del convegno internazionale, Loano, Italie 1994. SIBM, Biologia Marina Maditerranea, 2(1) : 1-209.

Relini G., Ferrara G., Massaro E. édits, 1999: Proceedings of 7th International Conference on Artificial Reefs and Related Aquatic Habitats, San Remo, Oct. 1999, It. : 1-717 p.

Revengs S., F. Fernandez, J.L. Gonzales et E. Santarella, 1996 : Artificial reefs in Spain : the regulation framework. Proc. Of the EARRN. Ancona. Pp 161-174

Rey-Valette H. C. Bodiguel, S. Mathé and N. Mazouni, 2006 : La capacité d'anticipation des politiques de GIZC. Exemple de la pêche et de l'aquaculture en Méditerranée. Comm. Colloque internat'l su « GIZC : problèmes et perspectives ». 116-13 déc. 2006. Alger. 10 p.

Rey-Valette H. and M. Antona, 2009: Gouvernance et gestion intégrée du littoral : l'exemple des recherché françaises. VertigO. Vol. 9, N° 1; Mai 2009. 10 p.

Santos M.N. et C. Costa Monteiro, 2007: a 14 years overview of the fish assemblage and yield of the two oldest Algarve artificial reefs (Southern Portugal) », Hydrobiologia, n° 560 : pp. 225-231.

Schwartz, P. 1991: The art of long view : planning for the future in an uncertain world. John Wiley & Sons. 272 p.

Seaman W. édit., 2000: Artificial reef evaluation : With application to natural marine habitat. *CRC Press, Springer-Verlag* : 1-264.

Serrano J.L.G., 1998 : Les zones marines protégées dans les contextes des pêches : les récifs artificiels. Note du Secrétariat général des pêches maritimes ; DG ressources halieutiques. Dpt. Concessions aquacoles et récifales. 18 p. (Trad G. Véron)

Shepherd, G., 2004: The Ecosystem Approach: Five Steps to Implementation. IUCN Gland, Switzerland and Cambridge, UK. vi + 30pp.

Simard, F., 1989 : Japon : la pêche côtière, mutations technologiques et conséquences socio-économiques. Equinoxe n° 27 : 25-33.

Simard F., 1996: Socio-economic aspects of artificial reefs in Japan », Proc. of the 1st Earrn Conference 26-30 mars 1996, Ancona, Italy. Pp. 233-240

Soto, D. J. Aguilar-Manjarrez, N. Hishamunda (Ed.), 2008 : Building an ecosystem approach to aquaculture. FAO/Univ. de Illes Balears. Experts workshop 7-11 May 2007. Palma de Majorque. Spain. In FAO Fisheries and aquaculture proc. N° 14 Rome. 221 p.

UE, 1999: Vers une stratégie européenne d'aménagement intégré des zones côtières (AIZC). Principes généraux et options politiques. Doc. de réflexion 28 p. + annexes.

Ville de Marseille, 2009: Valorisation de la baie du Prado au moyen de récifs artificiels; Synthèse du Secrétariat général de la direction du développement durable. 20 p.