Community-Based Marine Turtle's Conservation (CBMTC), a Complexity Analysis

S. E. Merino[1]

ABSTRACT

While interpreting community-based marine turtle's conservation (CBMTC) initiatives in Cape Verde we became aware of the difficulties of decision makers, policy implementing institutions as well as scientists and conservation NGOs, to understand and integrate the eco-systemic and human dimension into marine resources management. We also encountered difficulties in applying long term strategies when establishing policy implementing instruments. The study that is presented here aimed at: un-wrapping the complex nature of marine turtle conservation, the multiple-dimensional picture in which occurs as coastal common; *(ii)* shedding a light on the multiple-scales and multiple-levels nature of the forces menacing local population of marine turtles and its supporting ecosystem; *(iii)* influencing the costal dynamics that takes place in an insular nation with an eco-geography very receptive to environmental changes. It is concluded that there is a need to reinforce policy strategies and legal frameworks with articulating instruments and tools in marine resources management - including the introduction of concepts

[1] The national institute for fisheries development and research (INDP), Cova da Inglesa, Mindelo, São Vicente, Cabo Verde islands, West Africa. sonia.merino@indp.gov.cv

such as coastal common property, community-based conservation, co-management and the establishment of community conserved protected areas. It is argued the need for a) the introduction of new procedures and a legal framework to legalise the right of local fishing communities to participate in the management and governance of their coastal common pool resources, b) for a mandatory framework orienting the inter-institutional integrated and articulated approach for the implementation of the environmental policy and c) the establishment of operational and flexible tools aiming for institutional and financial sustainability to implement conservation policies for marine turtles. All that aiming a turtles conservation common vision bound in time and space, contributing for the sustainable development and improved livelihoods of small scale fishing communities.

Key words: community-based conservation, marine turtles, Cape Verde islands, coastal management.

INTRODUCTION

Social-economic challenges lead to changes in paradigms in sciences supporting natural resources conservation and management. New problems such as those of fisheries management, conservation and sustainable development effectiveness request for the return into holistic views, but also to the practice of more integrative and dynamic approaches. The sustainable use of marine resources is the current paradigm and utopia in fisheries management around the world. It integrates both an eco-systemic view and the human dimension in the rational of the problematic (Berkes 2003, 621-628), but also a time and scale vision as supportive tool into its strategic planning.

Considering marine turtle's conservation as a question that relates to the management of a complex common property, as related to complex systems issues (Berkes 2006, 2003; Meireless & Rubio 1999, 166-168) shows useful, not only analytically and methodologically, but also operationally. Using an analytical framework in the interpretation of this complex system helped us to perceive problems faced by community-based (CB) resources management experiences, witch are multiple and of diverse origin, with numerous variants and components, with many links and interactions as well as hierarchically developed.

In Cape Verde Community Based Marine Turtle Conservation (CBMTC) experiences are successfully dealing with traditional consumption and poaching. Ironically, they do not have the capacity to influence rapid coastal transformation nor to stop external fishing fleet by-catch. There are environmental management/turtle conservation gaps at the systemic level, linked with priorities established at macro-level for economic sustainability that are driven by tourism development. This is mostly an issue of long term vision as well as of limitations in the adequate sharing of information among decision makers, policy strategy designers and administrators, which could be related to the poor understanding of the multiple linkages and interactions, when dealing with marine resources management and with the varied nature of problems arising from it.

Not less important is the absence or omission of existent mechanism and tools of articulation/follow up, between federal agencies and other involved stakeholders. Also the segregated approach in decision making in matters that might affect peoples life, therefore requiring for their involvement. All this creates an overall weak sustainability of the conservational interventions that are carried out by governmental agencies and local authorities as well as by international NGOs. Consequently, simple implicit scientific, educational and social-economic opportunities (Merino 2006(a); P. Hidrocarpo 2006(b), 72-76) existing in turtle's conservation are not yet understood, or they are undermined, along with the opportunities they could provide for sustainable development to fishing communities.

At community level, local capacities are weak, expressed as weak self-organisation and fragile social cohesion. There are also issues at institutional level, associated with comprehension and methodology, in the application of holistic and integrated approaches and tools. That manifests in the generalised poor articulation and lack of

synergies on issues asking for multi-disciplinary analysis and multiple stakeholders involvement.

In such intriguing framework, the follow-up of case studies of CBMTC showed that the problems encountered for its implementation, demand solutions and efforts that should born locally but that must be supported and encouraged from higher levels.

For small insular developing states[2] such as Cape Verde, part of the Sahel region, subjected to desert constrains, with a poor terrestrial nature and highly sensitive to over-exploitation [(Merino 2006(b), 99-103; Merino et al 2007(a), 95)] and climate change marine resources and fish stocks, the effective management of its fragile marine habitat and biodiversity is a prerequisite for the Nation's sustainability. Particularly important is the involvement of local users, direct beneficiaries, in the conservation and management of resources of the small scale fishery, representing 5.2% of the EAP (economically active population) (DGA/PNGP 2003).

Important to notice the particular oceanographic conditions of this archipelago, the effect of the Canary current and the Southern Equatorial counter current and the southern swells. These, by acting on the coastal littoral have also influence in hatchling success, as from them depend the peculiar phenomena of cyclical, in north/south direction, ongoing degradation/restoration of small unprotected sandy beaches (fishermen from Santo Antão, Sao Nicolau, Santiago and Maio, personal information). Nowadays new variants acting opposite also arise, yearly turtles monitoring shows on the possible influence of El Nino and Climatic changes for nesting habitat degradation and negatively impacting on nesting success and hatchling indexes

In Cape Verde, a country dependant on tourism as the core industry for economical strength, human development and socio-political stability, its overall balance very much depend on the effective management and sustainable use of the limited coastal resources biomass, which are the rich basis of opportunities for further tourism development.

All indicates that turtle's conservation in Cape Verde requires for changes in the common vision that centres attention in protection against local poaching, blaming fishing communities as primary consumers and traders of meat and derived products, seeing them as the main threat to turtles' survival. More attention should be given to national trends in the coastal dynamic. The trends of the current development in the coastal zone menaces the integrity of niches for various life stages of five different species of marine turtles, but also the distribution and density of important economic and subsistence resources in the artisanal fishery.

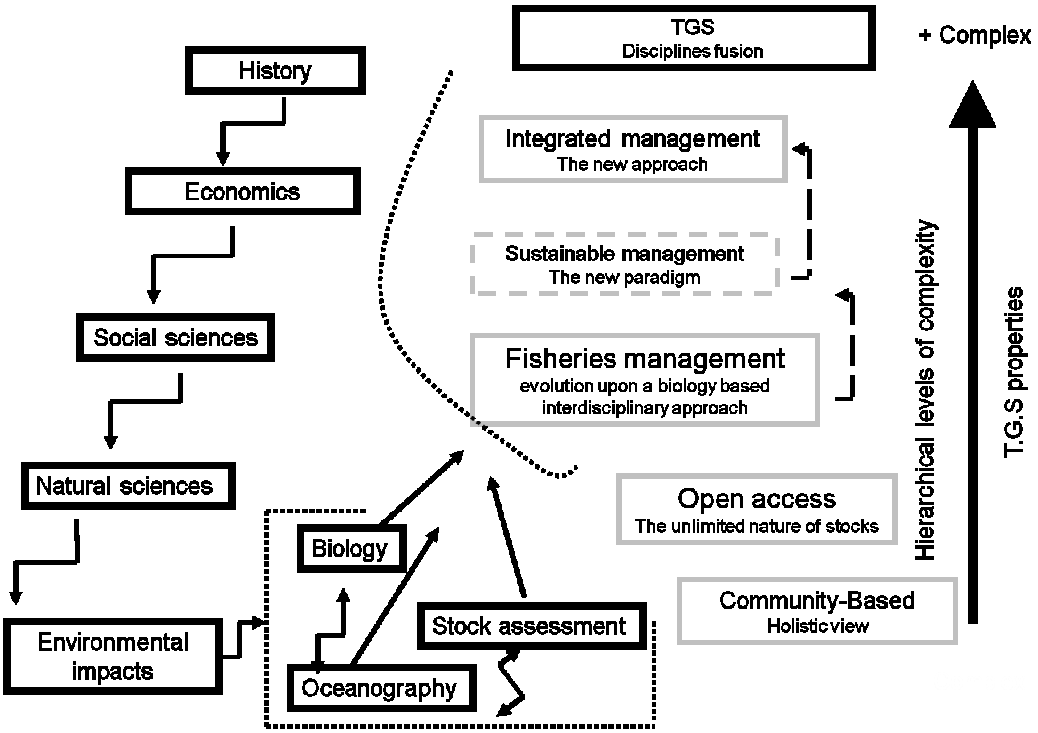
Linking turtles conservation to strategic decision making and major environmental policy can be a wise choice for monitoring the current trends of coastal habitat dynamics. It can serve as an effective bio-indicator for coastal habitat integrity monitoring (Frazier 2000), a missing connection in the turtle's conservation for Cape Verde.

[2] As defined by the United Nations Organization

MARINE RESOURCES MANAGEMENT

Resources management regimes have evolved from community-based, to governmental mechanism and together with them, the source of information to conceive and develop the management mechanism and tools have also jumped from local knowledge gathering (Berkes1998) to scientific knowledge. Not surprising, the global vision of marine resources management changed as well (fig. Nº 1.). From a former holistic and dynamic view, common to ancient communities around the world, like in Australia, Canada and Japan (Berkes and Kislalioglu 1991, Baland & Platteau 1996; Makino 2005; Berkes 2006), it became the currently prevailing in fisheries management.

Fig. Nº 1. Fisheries management evolution of paradigm regarding social-economic challenges (adapted from Ferrer 1997)



As far as the approach provides effective tool for practical purposes in a society, it will keep working. Once the system fails to answer social-economic needs, it pushes forward to impose due changes. As Anthony Charles stated in1998, fishery management is in transition, questioning centralized governmental static approaches, particularly relaying in biological research for questions dealing with socio-economic and development policies and legal frameworks interactions. At time and space scale in the scale of nature, those manifested at its ecosystem (species, populations, communities and so for) and human dimensions (social-economics, cultural, political and legal frameworks etc.).

The case of traditional Japanese artisanal fishing is the classic experiences on collective property effective management. Historically established as common's

property regime on the basis of customary laws, it was transformed into a governmental property regime by the end of XIX Century to become in fact an open access fisheries due to the public lack of capacity to control the mandate. Years after been officially banished, the customary regime was re-established and legally recognized. It survives to the present as the better succeeded model in fisheries management at local level (Baland and Plateau 1996, Makino 2004).

On the management of complex systems

In the long term in resources management, sustainability is the challenge and new paradigm (Fig. 1). In that framework the conservation of turtles can be understood as the management of a coastal common resource, a complex common system. Characterised by Berkes (2006) as those with emphasis on scale, self-organization, uncertainty and emergent properties such as resilience, and often impacted by forces or drivers of changes at various levels and scales of organization. Therefore their management requests for multiple level and dimension considerations.

From the perspective of the General Theory of Systems (GTS) (Meireless & Rubio 1999, 167) complex systems can be interpreted as those characterised by 1) a structure shaped by hierarchically acting multiple interactive elements (Bertalanffy 1976, in Meireless & Rubio 1999,166), this giving it's dynamic property, this defining the scale principle of Berkes (2006); 2) complex systems are characterized by self-organization which is driven by a control mechanism that re-establishes their equilibrium; 3) such mechanism acts through an un-adjustment in the time of responding (Meireless & Rubio 1999, 166) which makes complex systems intrinsically unpredictable (Hevia 1998, in Meireless & Rubio1999, 166), governed by chaos, this description works alike to the Berkes´s (2006) uncertainty principle; 4) in analogy with the resilience- emerging property principle of Berkes, when is in functioning, a complex system is sensible to comprehension and interpretation through the monitoring and analysis of particular emerging properties. As Meireless (1999) explains, that is possible due to the high opposition of the system to changes, a phenomenon driven by high inertia.

The analytical support for the interpretation of marine turtles common property management as complex system is provided by Berkes (2006) in the form of "the three common scale challenges framework" , including a) the failure to recognise important scale and level interactions; 2) the persistence of mismatches between levels and scales in human environmental systems and 3) the failure to recognise heterogeneity in the way scales are perceived and valued by different actor, known by the author(Berkes, 2006) as the scale challenges of ignorance, mismatch and plurality.

Common property resources rights

"Common property resources" are those over which nobody has exclusive property right, in such circumstances such stocks are regarded as belonging to the community (King 1995, 266). Fisheries are recognized as commonly owned resources because they are difficult to manage and as so are used unsustainably. Ownership rights for such common property resources are of three types, state property rights, private property rights and communal property rights (Berkes and

Kislalioglu 1991, 569). The right for using such resources is legalized under management regimens consequently designed as state property right regime, private property right regime and communal property right regime. Besides, in cases of absence of property right everybody have access to resources, no management regime exist. In such circumstances, those resources are acknowledged to be under open access regime (Berkes and Kislalioglu 1991, 569).

Common property resources are referred by Lenor Ostrom as “common pool resources” (Merino L. 2010, 5), “those where is difficult to exclude people” and “whatever I take, I take it way from any one else”. They are understood as “the situation in which the resource is held or controlled by an identifiable community of users” (Berkes and Kislalioglu1999, 569).

The community-based conservation (CBC) concept

CBC is understood as a concept whose central concern is empowerment (Sajise 1995, Fellizar 1994, Ferrer and Nozawa 1997, 116-119) of groups and social actors and the building up of a sense of self-reliance at the micro-level

It is characterised by the inclusion of several elements (Korten 1987, 116-119) such as a group of people with common interests, mechanisms for effective and equitable management of conflict (Korten 1987, Sajise 1995, Fellizar 1994, 116-119), community control and management of productive resources, local mechanisms for capture and use of available resources, broadly distributed participation in control of resources within the community, and local accountability. Besides, as a dynamic process (Sajise 1995, Fellizar 1994, 116-119) people are given the opportunity and/or responsibility to manage their own resources, define their needs, goals and aspirations and to make decisions affecting their well-being. It is inherently evolutionary, participatory and should be considered specific for each particular place in what refers to technical, socio-cultural, economic, political and environmental factors.

A CBC approach is people centred, community oriented and resource based process (Ferrera and Nozawa 1997, 116-119), aiming to achieve local development (Fellizar 1994, 116-119). From the perspective of knowledge, it starts from the basic premise that people have the innate capacity to understand and act on their own problems (Ferrera and Nozawa 1997, 116-119).

CBC, is a process of governance and political decision-making, geared towards the establishment of partnerships and power-sharing. A partnership between government and communities that is characterised by a consensus-driven mechanism, towards achieving a balance of interests (Rivera 1997, 116-119). In this sense, the goal is its development into co-management (Pomeroy 2006).

Community-based co-management (CBCM)

In the context of a Small Developing Country CBCM can serve as operational tool into artisanal fisheries effective management. The articulation and responsible engagement of stakeholders aim at facilitating and managing local users´ conflicts and empowerment.

The legal framework for a common property regime in Cape Verde

In Cape Verde marine resources are under governmental control, its management strategy is lead by the national fisheries management plan (DGA/PNGP 2003) and regulated through biannual operational plans which are approved by the National Commission of Fisheries. No customary experiences or clear legal framework for common property regimes exist, but in fact as alternative approach it can be possible for dealing with the conservation of some endangered species and over-exploited coastal commons.

The law regulating the creation of a national marine protected areas system allows for the establishment of protected areas in a "concerted management regime" (Decree-law Nº 3/2003). Besides, the national fisheries management plan general strategy document (DGA/PNGP 2003) recommends establishing community-based artisanal fisheries management regimes in a case-study base.

METHOD AND ASSUMPTIONS

This analysis is a contribution for better understanding complexities in the management of common pool resources in Cape Verde. It interprets case studies on marine turtle's conservation to identify alternatives for their sustainability. It tries to un-wrap the complex nature of marine turtle conservation, the multiple-dimensional picture in which it occurs as coastal common, to emphasise the multiple-scale and multiple-level nature of forces endangering the local populations of turtles and its supporting ecosystem. In such way, we wish to contribute for a better comprehension of coastal resources management and to simplify its implementation in Cape Verde.

This study interprets results of 4 years in CBC experiments supported in an analogical elucidation of Berkes´ (2006) four characteristics of complex commons: *scale, self-organization, uncertainty and resilience*, and throughout his proposed "*scale challenges of ignorance, mismatch and plurality framework*". Key to CBMTC products: local capture and consumption decline and people involvement are the indicators used to compare with those from conventional schemes followed by local specialised NGOs.

Overall turtles initiatives (Table nº.: 1) were observed, with particular interest to interpret product and impact from 4 experiences. Two of them established between 2007 and 2008 in a community-based perspective, Cruzinha da Garça in Santo Antão Island and Carriçal in São Nicolau. To them is common that they are localised in poor isolated fishing villages with pretty low economic opportunities. There local associations by free will decided to enter into turtle's conservation. The other two initiatives are a more restricted conservationist approach, the one from Sal Island started in 2008, the other is from Boavista, a thirteen years old turtle conservation effort established in 1998, with a particular interest on turtle's research. Both implement nature tourism.

For the analysis, as point for departure we propose a three component's premise:
i) Interpreting marine turtles as a coastal resource, with intrinsic economic value, an alternative and opportunistic coastal fishery, and mean of subsistence and revenue

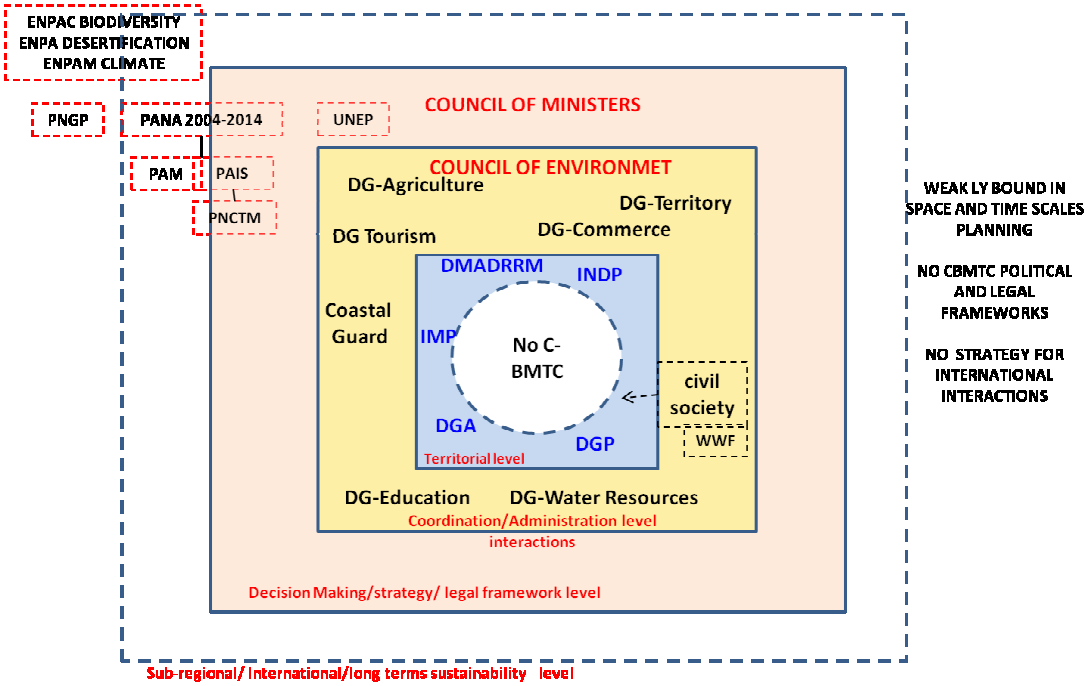
for family groups in fishing communities and coastal settlements, willing to manage it in a sustainable manner. *ii)* interpreting marine turtles as common property, a common pool resource, those owned by all, where is difficult to exclude people, therefore difficult to manage by centralised management approaches, for which surveying and controlling "through physical and institutional means is especially costly" (Ostrom 1999); and finally *iii)* understanding turtles conservation as a concern dealing with the management of a complex system, a multilevel common, with multiple components and scales: its eco-systemic and human dimensions, and variants: the social, economic, political and legal variables in the human dimension, for instance; and where interactions are characterized by hierarchy.

WHY MARINE TURTLES?

Conservation of marine turtles from Cabo Verde is an issue concerning to primary users but also to the international community. New drivers of change are emerging from the international and sub-regional platforms such are the cases of the USA National Oceanographic And Atmospheric Administration (NOAA) and the Fisheries Wild Life Service (FWS-USA) and the turtles conservation TOMAO and URTOMA networks (Fig Nº:. 2) and others. As member of the Rio Convention (1992) and Agenda 21 Cape Verde turtle's protection is framed in the national conservation policy (ENPAB, 1999; PANA II 2004; PNCTM 2007) and legislation (Decree-Law nº. 7/2002; Decree-Law nº. 53/2005). From 2008, it has attracted the interest of new international donors (UNEP/GEF) and NGOs (Turtles Fundation, SOS-tartarugas) etc.

In Cape Verde no mechanism for involving local users in resources conservation and management are established yet, neither oriented in the policy framework (fig. Nº.: 2)

Fig. Nº.: 2. the current national conservation policy framework for Marine Turtles Common. Weakly bound in time and space scales, while higher level driving forces protrude an international level linking instrument is not yet envisioned.



and articulation between conservation policy instruments is not at its best. Thus, with no complexity rationale of the issue it will be difficult to articulate actions for their effective protection. Analysing turtle's conservation supported in a complexity analytical framework *i)* it helps to comprehend the complex nature of other coastal common property resources, including the artisanal fishery*, ii)* to identify operational gaps in the national conservation policy framework (right side in fig. Nº.: 2), *iii)* and to argument the need and fairness for CBCM for common pool resources as complementary model at local level.

At territorial/institutional level a complexity analysis contributes to better interpret the national conservation model and consequently *i),* to improve turtles protection guidelines; *ii)* to improve long-term conservation policies as instruments promoting articulation of local (ecological) sustainable development; iii*)* to improve articulation of institutional actors and*; iv)* to contribute to institutional understanding of common pool resources management as tool promoting social cohesion and self-governance.

At the national/systemic level the complex system analysis offers an insight into the diversity of stakeholders, conservation views, interest and cultural approaches that are interacting across-scale. At this moment all the forces that are involved are driving Cape Verde turtle's conservation wider and pushy into many different directions, in a chaotic way.

The Cape Verde islands provide shelter to five different species of marine turtles (Fretey 2001; Lopez-Jurado 2001; Soumare and Merino 2005, 13; Merino 2006(c); Merino, 2007(b)). The archipelago is the fundamental link in the life cycle of the *Caretta caretta species,* the second in importance nesting place in the Atlantic Ocean, the third in the world after United States and Oman for that same species (Merino and Benchimol 2006(b), 110), and unique for the western Atlantic nesting ground (Hawks 2005). More than 3000 nesting females arrive every year to these coasts for nesting (Lopez-Jurado 2007, 13). For *Chelonia mydas and Eretmochelys*

imbricata the existence of feeding grounds have been registered linking juveniles and young adults to the northern islands, (Merino 2007(b); Merino et al 2007(c), 119-120). The occurrence of *Dermochelys coreacea* (Merino et al 2007(c), 119) *and Lepidochelys olivacea* (Merino et al, 2009(a)) is also registered in the north, these animals use the area as migratory corridor.

Marine turtles in Cape Verde have been historically endangered by the consumption of meat and eggs (Soumare and Merino 2005, 13; Merino et al, 2009(a); Merino and Correia, 2010(a)), they have been hunted for medicinal purposes (Merino et al 2007(c), 120-121). From the establishment of first colonial settlements turtles' meat has been used as food and trading commodity (Santos-Loureiro and Ferras-Torrão, 2008). Almost everyone asked agrees that "turtle meat is a delicious and succulent dish" while at the same time, turtle is part of the traditional diet among fishermen (Merino and Correia 2010(a), 10). Consumption of meat is common to all islands, its commerce is particularly important for fishermen from Santiago, who fish turtles from Boavista, Sal and Maio (Merino et al 2009(a), 5).

Excluding the island of Brava, conservation initiatives are registered for all islands (Tab. Nº.:1) and concentrate basically in protecting nesting females of *the C. caretta* (P. Hidrocarpo, 2006(a)) species against local poaching and to promote nature tourism (P. Hidrocarpo, 2006(b)).

Table Nº.:1. An overview of the marine turtle's initiatives in place in the Cape Verde islands.

Meta Regions	Islands	Project name	Responsable	& Nature	Started
1	Santo Antão	MTCP-INDP	INDP	Community-based research project, a federal regional initiative	2006
	São Vicente				
	São Nicolau				
	Santa Luzia MPA and islets Raso and Branco				
2	Sal	MTCP- Sal	SOS-TARTARUGAS	extric conservation, leaded by NGOs	2008
	Boa Vista	MTCP-Boa Vista	Natura 2000 & Turtles Fundation		1998
	Maio	MTCP-Maio	BIOSFERA		2010
3	Santiago	Tarrafal	Municipality	Municipality leaded local initiative	2008
	Fogo	Projecto Vito	Local NGO	Strict conservation, local initiative	2009
	Brava and islets Rombo and Seco	no local initiative yet exist			

In Boavista, the implementation of conservation initiates is responsibility of the Natura 2000 and the Turtle Foundation under Spanish and German management respectively. The English SOS-Tartarugas works in Sal while the National Institute

for Fisheries and Marine Resources Research (INDP) works in São Nicolau, São Vicente, Santo Antão. This institute also, provides technical assistance and support to initiatives that request so (Merino and Ferreira-Santos, 2009(b)); Merino and Correia 2010(a); Merino et al 2010(b)). Local initiatives exist also in Maio and Tarrafal de Santiago

From its foundation in 1998, Natura 2000 practices in Boavista a very restricted approach to turtles´ conservation that focuses essentially on research (P. Hidrocarpo 2006(a)) and nature tourism (P. Hidrocarpo 2006(b)). The NGO Naturalia was born to promote turtle's tourism and it been working for almost 6 years by now. In Sal, during the 2008 and 2009 turtle's season the SOS-Tartaruga was able to get around 55,000 Euros, all from turtles watching tourism (Jacquie Cozen pers. Communication 2010). The money is re invested in turtles from Sal island conservation and to support partners from other islands.

Nonetheless, consumption and trade are still happening. Sadly, in Boavista, after 13 years of conservation, local NGOs report that at least 1100 turtles were captured in 2007(Turtle Foundation, 2010). Local poachers in Sal can get up to 245 Euros for one turtle's meat (Merino & Correia, 2010(a) 10). And, even if captures showed a 70% decline between 2008 and 2009, in the same period poaching reached 91 (Lino et al 2010, 60). At present, local communities from Sal and Boavista islands are not involved in turtles´ protection. Thus, at this stage, it counts with the support of the Armed Force.

In 2009, efforts for a national coordination network (TAOLA) emerge, including international NGOs (WWF, TURTLE FUNDATION, IUCN) and international federal agencies (FWS, NOAA). Conservation motives are multiple, some are of economic nature, (local communities, conservationist NGOs) passing through strict turtles conservation purposes (SOS-Tartarugas, Natura 2000 etc.) to different types of research interests (University of Las Palmas, INDP, IFM-GEOMAR).

CBMTC: A COMPLEX COMMON MANAGEMENT ISSUE

In Cape Verde CBMTC makes evident the existence of gaps at time and space scale in the conservation strategy as well as gaps of comprehension of the theoretical and conceptual frameworks in what we here call the scale of nature, expressed in its eco-systemic and human dimensions. Challenges such as coastal habitat destruction and turtle's by-catch by the international fishing fleet have solutions beyond local will.

The eco-systemic basis in turtle's conservation

The difficulties arise from the complex biology and ecology of marine turtles, the dependence from a large ecosystem to support their life cycle, which requires of long oceanic migrations for reproduction and feeding at different stages in the life history. From ancient time, the Cape Verde marine and coastal habitat has served with peculiar characteristics for *Caretta caretta* species reproduction. Little we yet know on the importance of the zone for this species mating behaviour. Good knowledge we have on nesting female's populations.

With islands of particular good profile originally, characterized by long and extent organic sand beaches (Boavista, Sal, Maio, the south west of São Nicolau), free from flooding or dryness effects, suitable for high hatching success, the region is the only place in West Africa where *C. caretta* reproduces. In Cape Verde, any sandy beach either of organic or volcanic origin counts for reproduction success.

Caretta caretta have been reported for Boa Vista (Fretey 2001; Lopez-jurado 2001; Varo 2007, 125-144), Santa Luzia (Merino 2006(b,c); Merino et al 2009(a); Monzon-Arguello et al, 2010), Santo Antão, São Nicolau and São Vicente (Merino 2006(c); Merino et al 2009(a)); Sal and Maio (Varo et al 2007, 125-144; Lino et al 2010). They are also found in the more southern islands in Santiago, Fogo, Brava and the Rombo and Seco islets.

A current study indicates that genetically the *C. caretta* population from Cape Verde is unique in the world. Those from different island populations might be homogeneous between them, but altogether they are an independent unite in relation to other Atlantic or Mediterranean populations (Monzon-Arguello et al, 2010). After each reproduction period nesting females move to feeding zones in West Africa (Hawks L. et at, 2006), where they distribute from the Mauritania to Sierra Leona, in two different patterns, one neritic and the other oceanic. This fact alone is asking for a complex system view to approach the conservation of this marine and coastal common. Very little, if nothing is known about hatchlings and juvenile stages (4-15 cm) distribution in the Atlantic Ocean. Young and young adults seem to have oceanic distribution, and are possibly shared with the Azores and Madeira archipelagos, where an oceanic cluster of young loggerheads is known, in the range between 20 and 45 cm in length (Dellinger 2007, 99).

Other intriguing question relates to possible effects of numbers of turtles´ decline in the ecosystem. Newborn survival rate is around 1:1000, and it is well known by fishermen practical knowledge that hatchlings strategically link various levels in the trophic webs, as they are food not only for benthic fishes but also to crustaceans, young sharks, birds and so for. Some of those fishes are important economic fishing stocks source of income and high quality protein. Adult turtles are staple food for big predators at high sea.

All indicates for the need for a time and space bound eco-systemic strategy for research and conservation of marine turtles, producing information on the eco-biology and fisheries biased interactions across-level at multiple scales. As international common, such turtle's strategy requests for sub-regional and international interventions, and the equitable sharing of benefits, information and know-how. From that perspective, taking into account the consumptive culture there is the need to link community with marine protected areas in a local management instrument, inserted in the national system of protected areas policy and legal framework. Besides loggerhead turtles from Cape Verde trans-boundary distribution in West Africa request for conservation to be understood as an international common issue. Requiring for articulation with international and regional conservation networks (TOMAO and URTOMA), but also to consolidate the national (TAOLA) network and strategy and capture international donor and scientific assistance (NOOA, IUCN, WWF).

The human dimension in turtle's common pool resources conservation

If for developed countries sustainable marine resources management is serious challenge, for Cape Verde some kind of "impossible mission" arises. The archipelago is characterized by very poor fishing resources abundance (Merino et al 2007(a), 223). If Senegal catches annually 400000 tons of fish, Cabo Verde with difficulties manages to get 9000 tons per year (INDP 2008) of its maximum sustainable allowed 37000 ton annual catch (INDP 2008). It is then a challenge to control a large EEZ with 734265 **km^2** (Bravo de Laguna 1985), to put observers on board of foreigner fleet vessels and to register international captures´ real numbers. Besides, fisheries research signifies a considerable budget. Therefore we conclude that both for developed and developing countries, existing fisheries management systems reveal poorly efficient if not inefficient at aiming sustainable use of fishing resources.

No matter how scientifically sound management measurements are designed, surveying and controlling coastal commons through physical and institutional means requires high costs, and so is doing fisheries research around ten small islands scattered in the ocean. Tendencies show that Cape Verde annual landing are stable with some stocks captures steady diminishing (Merino et al, 2007(a)). Life in fishing communities as general trend gets harder, young people emigrate to other island or abroad, and who stays do not see any point on following their old men steps.

Similarly, Cape Verde turtles common are also diminishing. They have been consumed by local settlers from the time first Portuguese arrived in 1460 or before. And despite efforts, in some islands turtles continue to be locally captured and traded providing revenue to family groups.

In the present model, turtle's conservation is not easily accessible to local communities, as it concentrates efforts in a reductionist conservation view and based preferentially on scientific research approaches. A multiple stakeholders, multiple levels across-scale vision, impacted from international levels, arises also the issue of equitable sharing of produced benefits, which enables enthusiastic communities involvement from every different island. Therefore, the question requires and integrative and flexible dynamic for a broader view.

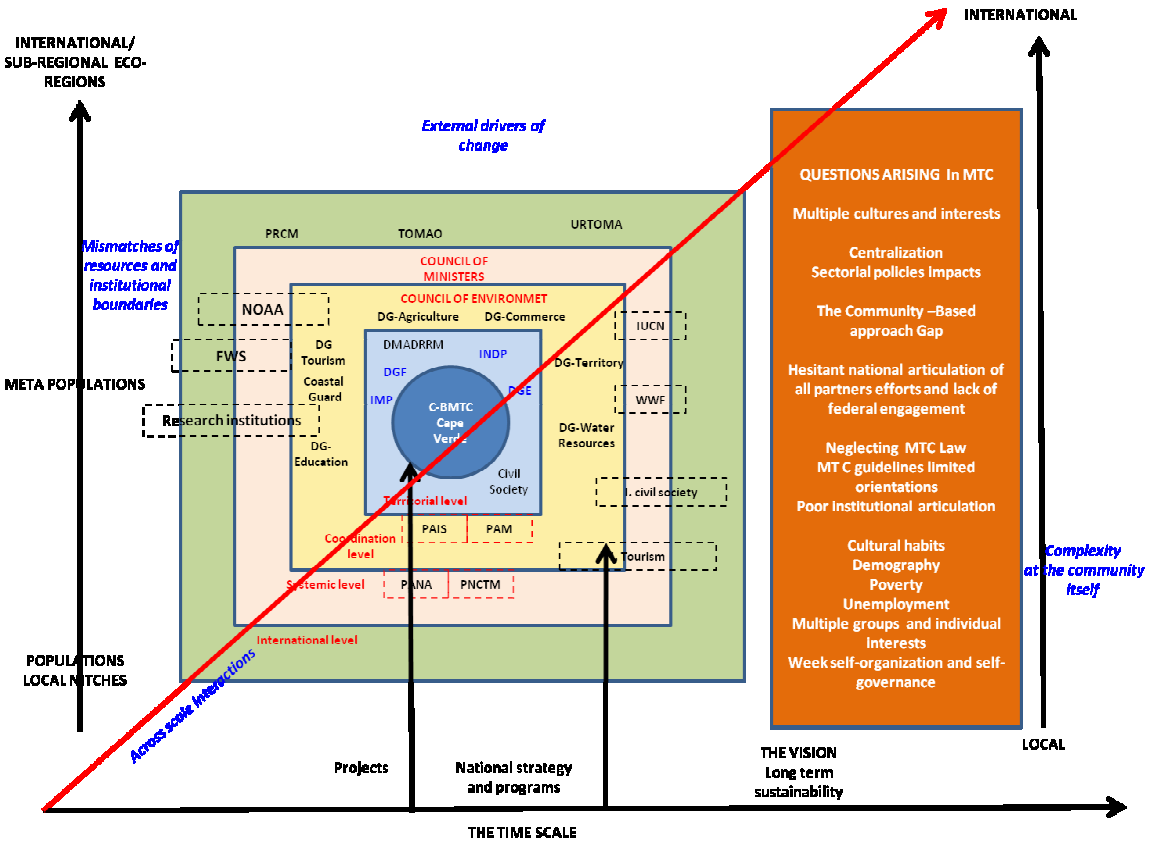
In the CBMTC experiences from Cruzinha da Garça and Carriçal effective consumption and poaching reduction has been possible due to direct intervention of communities in a most diverse sort of participatory interventions. There, captures were reduced to less than 5%. Local people working in turtle's conservation are motivated by the access to various kinds of benefits and opportunities, from information and training, the valorisation and development of local knowledge and community's values, but also, on the expectation for new jobs opportunities. Big impact inside the community in Cruzinha da Garça, has had the international recognition of their efforts by the Equator Initiative (2010). Articulation was possible supported by a strong social communication component.

Despite success, challenges are right there. Working on CBC is not a simple task or a strait solution. There are main questions of human dimension arising and roots are scale related, from bottom to upper level in the conservation system (fig Nº.: 4).

In first place are issues related with uncertainty and conception views. More than bizarre is the view of the majority of conservationist in Cape Verde assuming that human consumption is one major threat in turtle's protection. We disagree with such idea. Working locally, we witnessed that it is coastal littoral destruction the major threat to preservation of turtles. Sand mining intensity is a reflection of degrees of local poverty but also of surveillance and enforcement weakness, and of actions framed on goals established in the national development plan (PND, 2000) that regards tourism, and with it the supportive infrastructures, as the engine of national economic development. To complicate things, climate change effects: drought and erosion seriously challenge the integrity of the coastal littoral topology and marine turtle's preservation. All they together do menacing against local opportunities for sustainable development.

Tendencies are general for all islands. But deeply serious for representative nesting female's populations is the situation in Boavista, Sal and Sao Nicolau, were highest turtles occurrences are registered (Araujo 2009). In the first two islands, major mass tourism projects are developed and in the last, sandy beaches, historically used as the main source of raw material for houses construction, are inexistent anymore. In Santiago and Fogo sand mining is a source for revenues, in the others tourism industry compete with sandy beaches occupation and transformation of littoral. So, appealing to local consciousness and for changes in attitude by the common citizens is just a small element of the issue.

Fig.: Nº 4. Cape Verde Marine turtles conservation complex nature. Characterized by the complexity of the community itself, the mismatch of resources and institutional boundaries in the system, the existence of external drivers of change and implications across-levels and across-scale



In second place is the question of self-organization and self-governance and cohesion. Local fishing communities eagerly involve in turtles conservation as mean into different types of benefits, but social capital is week. At institutional level, limited specialised capacities for using integrative approaches and instruments to act in strengthen and incentive local social cohesion and organizational skills is another limitation. That all menaces a complex common management regime that protrudes to external drivers of changes impacting it against resilience and upon collapse. Because the lack of a policy instrument and legal framework orienting for CB co-management interventions it makes hard the implementation of CBC of coastal commons initiatives in Cape Verde.

On third place is the issue related to scale, of multiple institutions and actors interacting in turtle's conservation, and of impacts from sectors´ plans of actions affecting upon turtles and their habitats and local conservation implementation (fig Nº.: 4). That put in evidence the multiple scale and across-scale and across-levels interactions through community-based conservation experiments therefore requesting a mandatory co-management regime approach, as best mean for institutional articulation. The lack of such mandate manifests the strong difficulties regarding join interventions and synergies between stakeholders, particularly with those at meso-and-macro levels which are directly involved in decision making and control of execution.

Segregated policies planning predisposition make things harder and CBC difficult to applied due to the lack of policy and legal framework but also because there is not a vision that conservation of marine turtle's provides opportunities for local sustainable development with impact on the macro-economy. A unified voice and political will must arise articulating actions in CB turtle's conservation, from bottom up and back along scale with cross-scale mandatory support from related sectors.

In what refers to emerging properties, resilience of community-based approaches is a matter of long term sustainability. That depends of the system as whole capacities to sustainable develop actions across -levels and across-scales. As we have mentioned, the current frame in which turtle's conservation happens in Cape Verde is not institutional, organizational and financially sustainable. This is particularly true because implementation is centralised by the coordination agency that itself depends directly from governmental decisions for funding and therefore for supporting and promoting actions at all levels from bellow across-scale. Territorial institutions and local authorities suffer funding, organizational and specialised capabilities limitations. The oceanic archipelagic nature of Cabo Verde complicates things

So CBMTC strongly requests for authority's serious engagement and follow up through a mandate providing improved policy and legal framework, enabling operational execution, the necessary funding, as well as effective control and enforcement but also the the strength of the law. An integrated coastal zone management strategic framework can be suitable besides with an economic strategy for sustainable development at micro-level. Turtle by-catch stays a challenge.

CONCLUSIONS

CBMTC experiences have proven a practical tool to study phenomena behind common property resources management and the challenges towards its sustainability. CBMTC is a technical instrument effective in dealing with complex systems management issues. It allows exploring and applying complex systems and common property concepts and analytical frameworks. It has provided with an efficient instrument to apply integrated coastal zone concepts particularly in articulating stakeholder's information sharing at across-scale and across-level. At operational levels CBMTC provides with an efficient tool to local users empowerment for coastal commons conservation. At country level it has shown gaps to work on in resources management and sustainable development.

Major treat to coastal resources is habitat degradation. Industrial fishery is a particular threat to marine turtle's conservation as migratory species around the world. Opportunities for local sustainable development based on non conventional use of emblematic coastal and marine commons are also menaced by those threats. Poverty and cultural issues also play important role, but these are concerns effectively approachable by community-based mechanisms.

Cape Verde CBMTC is an international complex common management issue whose conservation is strongly impacted by international and regional interests.

Important to highlight the role of the prevailing in Cape Verde political stability and openness of the State in running CBMTC initiatives in search for local development. That has at its basis the traditional culture of tolerance and democracy that underpin the national socio-political level at the human dimension scale.

A CBMTC co-management regime as best instrument dealing with the management of complex commons requests

1) A policy and legal framework, including recognition that turtles are a coastal common property resource; the right to fishing communities to participate in coastal commons management and decision making as alternative and parallel instrument in the national fisheries management framework. The right to participate in the establishment of community conserved protected areas as territorial management instrument.

2) To up-date the existing turtles´ conservation policy instrument having in mind the complex system nature of this coastal common:

a. a time and space scales strategic planning approach including three levels coordinates for interacting scales: Local/today, or community based; Territorial/tomorrow or institutional and national/ international: long term sustainability or systemic

b. an eco-systemic strategy for developing the research and management planning, including community conserved turtles protected areas as integrative management instrument, besides, including a territorial administration and conservation strategy for a) Santo Antao, Sao Nicolau, Santa Luzia and Sao Vicente; b) Santiago, Sal and Boavista; c) Maio, Fogo and Brava.

c. A capacity building strategy with four pillars a) a co-management regime, b) participatory actions research as tool for local knowledge strengthen and further development; c) a strong social communication strategy; d) integrated, multidisciplinary research aiming follow-up actions and analysis supporting adaptive management

d. Articulate turtle's conservation with an integrated coastal zone management instrument, using CBMTC as bio-indicator in coastal dynamic trends monitoring for climate change and anthropic impacts in Small Island States sustainable development. Together with a strategy for economic development at micro-level based on conservation. An international objective is also a need

Policy instruments

It would be wise at macro-level, to establish an integrated coastal zone management (ICZM) strategic instrument, as Coastal Zone Management OBSERVATORY (CZMO), aiming coastal dynamic trends historical data gathering, analysis and evaluation for policy proposals design and further development. This effort should be strongly articulated with the national marine turtles plan policy instrument. A strengthening the turtles national network is recommended as forum aiming international articulation to trap financial support and in search for long term sustainability;

For the CZMO executions, at meso-level 3 regional coastal zone management trends monitoring units are advisable, for historical data gathering and information sharing, organizing information and providing specialised capacities building to multiple actors' across-scale at all level in the system.

At micro-level, linked to the turtles conservation plan and the CZM observatory, promote community-based marine turtle's conservation stations establishment, as local satellites for data collecting on coastal zone dynamic linked to in community conserved protected areas and supported in a conservation based economic development strategy

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