



**GENERAL FISHERIES COMMISSION FOR  
THE MEDITERRANEAN**  
**COMMISSION GÉNÉRALE DES PÊCHES  
POUR LA MÉDITERRANÉE**



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**GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN**

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ECONOMIC AND SOCIAL SCIENCES (SCESS)

**SECOND TRANSVERSAL WORKSHOP ON RED CORAL**

**Ajaccio, Corsica (France), 5<sup>th</sup> 7<sup>th</sup> October 2011**

**PROVISIONAL LIST ABSTRACTS**

For reasons of economy, this document is produced in a limited number of copies. Delegates and observers are kindly requested to bring it to the meetings and to refrain from asking for additional copies, unless strictly indispensable.

## **Genetic structuring of shallow vs. deep red coral populations: what can this tell us about the conservation strategies**

M. Abbiati

Given the decline of shallow-water red coral populations resulting from over-exploitation and mass mortality events, deeper populations are currently the most harvested, and very little is known about their biology and ecology. The persistence of these populations is tightly linked to adult density, reproductive success, larval dispersal and recruitment. Moreover, for their conservation it is paramount to understand processes such as connectivity within and between populations along both geographic and depth gradients. In our studies we have used two different approaches to investigate patterns of genetic structuring. The first examines the possible effect of depth (from 20 to 70 m) on connectivity and genetic variability in red coral populations. The second analyzes patterns of genetic structuring of mesophotic populations (from 58 to 118 m) in the Tyrrhenian Sea. A reduction of genetic variability along the depth gradient was observed, suggesting that depth has an important role in determining patterns of genetic structure in *Corallium rubrum*. Moreover, a threshold in connectivity was observed among the samples collected across 40–50m depth, supporting the hypothesis that discrete shallow- and deep-water red coral populations occur. Red coral mesophotic populations are genetically structured at all the analyzed scales. Nevertheless, limited larval dispersal could be detected between closer populations. These data suggest that habitat features together with biological processes promote the differentiation of red coral populations along vertical gradients, and that also deep water populations show phylogeographic structuring. Consequently, the hypothesis that deeper populations may act as a source of larvae helping recovery of threatened shallow water populations is not supported, and conservation and management strategies have to consider the three dimensional pattern of genetic structuring of deep and currently harvested populations.

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## **Monitoring and Spatial Analysis of Red Coral Fishing Activity: a new approach for prediction of vulnerable operating areas**

B. Abedllaoui, S .Benchoucha, N. Abid & C. Fanichi

In the Mediterranean Sea the Red coral is an endemic species, located mainly in the western part. It has a very slow growth. Its exploitation is so localized in space that could result sometimes in a irreversible process. The integration of space component through monitoring and identification of exploitation areas of this species are important for the preservation and sustainable management of this resource.

The current study focuses on the spatial analysis of data for the prediction and identification of vulnerable areas of red coral activity (*Corallium rubrum*) in the north of Morocco. It is based on regular monitoring of fishing activity and the collection of landings data from 2008 to 2011. The data and information collected are: the geographical position of the diving site, the depth, the catch in weights the size and the diameter at the colony basis.

The results of the spatial analysis by estimating Moran index, show a positive values (+0.0465) which indicate a similar association, but this value is so low to indicate a continuous and homogeneous distribution of the red coral in the whole space. However, the identification of local association by estimating the contribution of individual values, using the LISA index (Local Indicator of Spatial Association) shows the presence of two main associations whose exploitation characteristics are opposite. The analysis of the size frequencies distribution of red coral population between 2010 and 2011 confirm these results.

## **Molecular ecology of the red coral *Corallium rubrum*: state of the art and new tools for pending questions**

D. Aurelle

The management of red coral (*Corallium rubrum*) populations requires precise knowledge of the biology, ecology and evolutionary history of this species. Population genetics data are now available, mainly for north western Mediterranean and Adriatic shallow populations. Preliminary data are also available for deep and southern populations. Based on microsatellite loci these studies allowed to precise the neutral genetic structure of red coral. They evidenced short-distance differentiation, low mean dispersal abilities and a pattern of isolation by distance.

In a context of climate change, genetic studies could also help studying adaptive processes in the red coral. This will take advantage of the most recent developments in the acquisition and statistical analyses of genetics data. Two research directions are under progress in our team. First multilocus sequence data can be used to analyse the evolutionary history of the red coral and to evaluate different evolutionary scenarios in the context of past environmental fluctuations. The second research axis deals with acclimatation and adaptation of red coral populations facing the rising of sea temperature. Thermotolerance differences among individuals and populations can be studied through the levels of gene expression. The first results show high variability of expression for candidate genes usually involved in stress response, such as HSP. Further studies should take advantage of next generation sequencing approaches for gene expression and population genetics studies.

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## **Red coral (*Corallium rubrum*) in Sardinian sea: main regulations, status and biological features**

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The regulation of the red coral harvesting in Sardinia has a long history. Since 1979, to enable a sustainable exploitation of coral resource, harvesting has been ruled by the introduction of several restrictions (Regional Law n. 59 - 5 July 1979 “Coral Fishing Regulation”, partly modified by the Regional Law n. 23 of 30th May 1989).

Taking into account that these regulations could have affected the status of the red coral banks, the spatial distribution of the deep red coral resource in the Northern and Western coasts of Sardinian has been studied and, at present, the status of banks is continuously monitored.

Three zones with different demography and density have been identified from data on size structure obtained both by ROV video transects and colony sampling by professional divers. The specific ecological causes affecting the different observed red coral morphological structures are the object of an ongoing study.

Moreover, data on growth pattern and reproductive biology are presented. Two different growth rates were found for the deep colonies collected in the Northern and North western coast of Sardinia. Furthermore, the reproductive features of deep and shallow colonies of *C. rubrum*, collected between late May and June, are illustrated and compared. The analyses included the reproductive status of both polyps and colonies. Important reproductive parameters as fecundity and fertility of both female and male colonies for different size classes are also described.

## La pêche au corail en Corse

R. Miniconi

La pêche au corail représente un pôle important dans l'histoire de la pêche en Corse depuis l'Antiquité jusqu'au début du 19<sup>ème</sup> siècle. Après ces nombreux siècles d'exploitation des ressources autour de l'île mais également dans les mers de l'Afrique du nord, la pêche au corail reprendra en Corse dans les années 1960, avec un nouveau mode de prélèvement : la cueillette en plongée en scaphandre autonome. Elle connaîtra un âge d'or durant une trentaine d'années durant lesquelles les corailleurs devinrent des hommes riches et enviés.

Et puis, les gisements s'épuisèrent progressivement du fait des prélèvements que l'on pouvait évaluer en moyenne à 4 tonnes par an pour l'ensemble de la pêcherie.

Au début des années 1990, la pêche au corail devint plus discrète ; quelques corailleurs abandonnèrent le métier du fait de leur âge et de la dangerosité du métier (4 décès entre 1985 et 1995). Alors, face au constat fait par la profession d'une importante diminution de la ressource, le Comité des Pêches Maritimes et les Prud'homies vont réduire le nombre d'autorisations de 20 à 15, puis réduire ces licences à chaque arrêt d'activité d'un corailleur. Les méthodes de récolte du corail autres qu'en plongée sous-marine seront supprimées mais malgré cela, la faiblesse des stocks et la pression de cueillette font de la pêcherie insulaire en 2011, un espace en phase terminale d'exploitation...

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## **Beyond human capacities: An advanced two units ROV for pilot studies for red coral (*Corallium rubrum*) fishing**

P. Nutarelli, L.A. Chessa, F. Troisi & M. Ciliberto

Over the centuries, the human effort in devising systems to collect the precious red coral *Corallium rubrum*, has led to the creation of one method of fishing from the surface using dragging or scraping gears. Various types of equipments were made that had in common the trawl of pieces of nets supported by heavy iron and wood with chains or stones which detached the colonies from the rock catching the pieces broken off entangled in the nets (Italian bar and Saint Andrew's Cross).

This method, procured obvious environmental damages, the more severe when compared to the amount of colonies destroyed and lost because not recovered by the tufts of the nets.

After the Second World War, with the advent of self contained breathing apparatus a new method of fishing was developed directly executed by SCUBA diving by pick only. This method run better with respect to environment protection, also limiting the fishing depth and the duration of the operations. This led to the prohibition of the indirect method of fishing. The major problem of SCUBA method is that has caused many fatal accidents.

Nowadays, thanks to available technology it is possible to reap the greatest benefits, both in the exploitation of the resource and in the safety of the operators. To do this we designed an advanced machine with robotic submarine features. This ROV was developed exclusively for red coral fishing with the primary purposes of protecting the environment, select the colonies to remove without damages to adjacent areas. The system consists of an underwater robot which has almost ground operational functions. In short it consists in two units: a vehicle equipped with manipulators and mechanical arms that can operate on the coral through a mechanically stable coupling to the rock and a transport vehicle equipped with engines and instruments for navigation. The vehicles are mechanically linked together during the operational phase and separated during storage and maintenance. From the operational point of view, the search and retrieval vehicle, combined with mechanical couplings to the navigation vehicle, is moved (by the latter) near the coralligenous reefs. After the extraction of the telescopic legs the ROV is pushed (by the thrust of the engines) and kept absolutely still, near the rock. At this point, thanks to the camera built inside the clamp is easy to move it to about two meters from the reef were the coral colonies are settled.

The accuracy of the sampling is guaranteed by the quality of the arm and tilts, resulting in 1 cm of imprecision only. After the colony is strongly hooked, the arm is retracted inside the ROV exerting a pulling force of 200 kg. The colony is dropped inside a basket in the ROV. With this contribution we like to propose such type of ROV to carry out regional pilot studies to assess the

potential biological, environmental and economical impact of its use as suggested by SAC (GFCM, Rome, Italy 9-14 May 2011) and by a recent Decree of Sardinia Government ("Deliberazione N. 3/33 del 26.1.2009"). To do this we developed a research protocol that we wish to discuss during this Workshop in order to get recommendations for its improvements. This protocol aims to classify a series of close-up images of the colonies fishing video stills. Here are some of the features to detect: 1) impact; 2) settlement; 3) density; 4) coralligenous coverage; 5) loss of colonies.



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## The Italian research project on the deep-dwelling red coral populations: the first survey along the Tyrrhenian (NW Mediterranean) coasts

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In recent years the interest of the international community on the precious Mediterranean red coral increased and the need to regulate its harvesting on the basis of sound scientific data was clearly pointed out in several international meetings (Hong Kong 2009; Naples 2009, Alghero 2010). Although our knowledge on the main features of shallow (20-50 m deep) red coral populations increased in recent years, the deep-dwelling, commercial populations as well as the related community are poorly known and need dedicated research. On these bases an *ad hoc* interdisciplinary research project on red coral deep-dwelling populations was promoted by the Italian Environmental Ministry. This project involved researchers of several institutions working on red coral, cooperating within the "Italian Red Coral Research Group". A first survey cruise was carried out during early Summer 2010 in the Tyrrhenian Sea between 60 and 130 meter depth to investigate the following topics: 1) the demographic structure (in terms of size/age, spatial and sexual structure); 2) the population genetic structure; 3) the associated community with particular interest in epi and endobionts (which greatly affect colony economic value); 4) the microbial community associated to red coral colonies. Following historical and recent information about red coral fishing, 28 transects, 0.5 km each, were explored by Multibeam echosound and ROV. Red coral was found in 24 of them. On the bases of the new data thus collected, in part still under study, we hope to shed new light on structure, dynamics and resilience of deep-dwelling red coral populations.