



**GENERAL FISHERIES COMMISSION
FOR THE MEDITERRANEAN**



**COMMISSION GÉNÉRALE DES PÊCHES
POUR LA MÉDITERRANÉE**

Via Vittoria Colonna 1, 00193 Rome, Italy. Tel: + 390657055730 www.gfcm.org

GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

SCIENTIFIC ADVISORY COMMITTEE (SAC)

Report of the Transversal Workshop on Red Coral

Ajaccio (Corsica), France, 5-7 October 2011

OPENING, ARRANGEMENT OF THE MEETING AND ADOPTION OF THE AGENDA

1. The SAC Transversal Workshop on Red Coral was held in Ajaccio (Corsica) France from 5-7 October 2011. It was attended by 39 participants from 5 countries as well representatives of FAO and the GFCM Secretariat (see list of participants in Appendix B).
2. Mr. Guy-François Frisoni, Director of the Office for the Environment of Corsica (Office de l'Environnement de la Corse), welcomed the participants and thanked them for attending this meeting. He stressed the relevance of the GFCM as the appropriate regional body to present and discuss important issues related to the fisheries management in the Mediterranean and in the Black Sea.
3. Mr. Henri Farrugio, Chairman of the Scientific Advisory Committee, welcomed the participants and thanked the French authorities, in particular the Collectivité Territoriale de la Corse and the Office for the Environment of Corsica for their kindness in hosting and arranging the meeting.

4. Mr. Henri Farrugio and Jacques Sacchi chaired the meeting. Ms Pilar Hernández, from GFCM Secretariat, acted as rapporteur.
5. The agenda was introduced and adopted by the WS (see Agenda in Appendix A).
6. Ms Pilar Hernández recalled the main results and recommendations of the first Transversal Workshop on red coral held in 2010 in Alghero (Sardinia) and then framed the objectives of the present meeting. She also introduced some aspects of main issues addressed by the GFCM Recommendation 35/2011/2 (On the exploitation of red coral in the GFCM Competence Area).

INTRODUCTORY SPEECHES

7. A presentation addressed the history and the situation of current management measures in Corsica:

La pêche au corail en Corse (by R. Miniconi)

Abstract:

La pêche au corail représente un pôle important dans l'histoire de la pêche en Corse depuis l'Antiquité jusqu'au début du 19^{ème} 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 ont été 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.

SCIENTIFIC PROGRESS ON THE MEDIUM TERM WORKING PLAN ON THE STATUS OF RED CORAL BANKS IN THE MEDITERRANEAN: FISHERIES, BIOLOGY, ECOLOGY AND GENETICS

8. Two presentations dealing with progress done in genetic and molecular techniques showed that red coral populations exhibit short-distance differentiation, low mean dispersal abilities and a pattern of isolation by distance. The null connectivity between shallow and deep population is proved, thus the hypothesis that deeper and more preserved populations may serve as a source of larvae for shallower populations cannot be longer supported.

Molecular ecology of the red coral *Corallium rubrum*: state of the art and new tools for pending questions (by D. Aurelle)

Abstract:

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.

Genetic structuring of shallow vs. deep red coral populations: what can this tell us about the conservation strategies (by M. Abbiati *et al.*)

Abstract:

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.

STATUS OF DATA AVAILABLE INCLUDING WITH REGARD THE USE OF ROV

9. The progress of two ongoing Italian projects were introduced. One of them investigates coral populations between 60 and 130 meters depth in the Tyrrhenian Sea and other studies differences found in demographic structure in different colonies in Sardinia. The Spanish and the French representatives introduced the relative Spanish and the local Alpes Maritimes Côte d'Azur laws on red coral to the audience; the documents are provided as Appendix F to this report. Furthermore the French and Italian representatives of respective administrations shortly presented their views in management. The abstracts are copied here below:

The Italian research project on the deep-dwelling red coral populations: the first survey along the Tyrrhenian (NW Mediterranean) coasts (by G. Santangelo *et al.*)

Abstract:

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.

Red coral (*Corallium rubrum*) in Sardinian sea: main regulations, status and biological features (by M.C. Follesa *et al.*)

Abstract:

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.

10. The French delegate presented the regulation framework within which red coral harvest is considered a fishery activity in all respects. The abstract of his presentation is included here below.

Red coral harvesting in waters under French jurisdiction (by N. Gorodetska)

Abstract:

Red coral harvesting in waters under French jurisdiction is subject to a variety of legal instruments that are meant to ensure its sustainability. As a contracting party to the Barcelona Convention, France has implemented within its internal and territorial waters a legal framework which is in line with the Convention and with the obligations derived from its protocol concerning especially protected areas and biological diversity in the Mediterranean. Indeed, the enlisting of red coral in Annex III of the Barcelona Convention implies that the parties shall take all appropriate measures to ensure the conservation of the red coral while at the same time authorizing and regulating its exploitation so as to ensure and maintain their favourable state of conservation. As far as GFCM concerned, red coral harvesting management is legally covered by the GFCM agreement. The purpose of the Commission is indeed to promote the development, conservation, rational management and best utilization of all living marine resources, and not only fish species. The adoption of the red coral recommendation in 2011 is of high interest because it illustrates how the Barcelona Convention and GFCM, which are two independent international bodies, may coordinate their actions. The third set of regulations France is subjected to is the EU legislation that covers the “conservation of marine biological resources” and aims at ensuring a high level of protection as well as improvement of the quality of environment and at the same time a balanced and sustainable development of economic activities. The legal framework in force in the French Mediterranean waters is aimed at regulating the harvesting effort through technical measures, an authorization regime and time and space management measures, including marine protected areas (MPAs) and fallow areas. A bottom-to-top approach allows involving fishermen communities in the law-making process and improving the efficiency of the measures and the level of compliance on their side. From the point of view of the fisheries administration, the management of red coral harvesting cannot be restricted the sole objective of sustainability but shall take into consideration the working conditions of a dramatically ageing population. The experimentation of remotely operated vehicle (ROV) which is currently undertaken in Corsica may be considered as a means to address this issue by strengthening the safety of fishing activities. While strict rules of use have been set up in order to prevent any increase of the harvesting effort, the definition of a common scientific assessment framework is still pending. As a conclusion, the red coral harvesting activity in waters under French

jurisdiction boasts a satisfactory level of compliance as regards the red coral GFCM recommendation, although there is room for improvement concerning other aspects (data collection, assessment of the role of fallows...) as well as opportunities for further action such as the creation of a quality label.

11. The representative of Italian Fisheries Administration informed the meeting that whilst recognising the opportunity to utilise ROV as a new tool for prospection purposes and keeping in mind the GFCM Recommendation 35/2011/2, the correct approach would be a precautionary one, allowing, at the moment scientific supervision and evaluation of its impact, experimental use could be permitted also for harvest at a further stage. Italian Administration recently launched a call for research projects, on: “The use of the ROV for the definition of management plans of the red coral. Management strategies for species conservation, monitoring activity, control and human security”.
12. The Spanish legislation was sent to the meeting via e-mail and is enclosed along with the Regional legislation of Alpes Maritimes-Côte d’Azur in France as Appendix F.
13. Some representatives of the profession do a defence of the fishery with ROV as being more selective and controllable device than the human being on very hard work conditions. It can be controlled thanks to the visual monitoring through a video camera, furthermore the operating time can be set. Another aspect to be considered is the advantages that the ROV would provide to them in terms of security.
14. Some scientist recalled that the use of ROV can be both, extremely destructive or conservative, depending on the tools and to the methodology for its utilization. It would be important that the project should focus on the protocol on how to use the ROV and on the economic consequences for the sector.
15. The chairman recalled the text of the Recommendation GFCM 35/2011/2, highlighting that the use of ROV is prohibited for harvesting and that the three means of derogation must be taken in consideration very carefully by providing results of the needed scientific research. The group agreed that is the way the administrations should proceed.

STRATEGY TO SET UP A SYSTEM FOR DATA COLLECTION AND REPORTING TO THE GFCM

16. The Representatives of the FAO Fisheries and Aquaculture Statistics and Information Service, and of the GFCM introduced the current data reporting schemes.

The harvest data on red coral (*Corallium rubrum*) available in the FAO global capture production database (by L. Garibaldi)

Abstract:

FAO has a dedicated form called NS-8 to report data on “pearls, shells, corals and sponges” but for red coral only a few countries submitted harvest data on a regular basis. For this reason, since mid-1980s FAO contracted the Liverino company (Torre del Greco, Italy), a major import-export and coral jewellery wholesaler, to obtain comprehensive annual harvest data. Although a constant data source throughout the years ensures consistent information for trend analysis and data provided may also include IUU harvests that are otherwise not reported in official national data, there is a raising concern about a possible conflict of interest for data provided by the industry. FAO would like to progressively incorporate in its database as much as possible data from official national sources as continuous and unbiased data are needed to carefully and independently evaluate the status of the species that had been proposed to be listed in CITES. To this aim, each fishing country should nominate as soon as possible an official national contact (preferably from ministry, national statistical office, etc., rather than research institutes) committed to report annual data on red coral. FAO supports the GFCM initiative to set up a specific form to collect data on red coral and the two organizations would find an arrangement to avoid that countries have to report to both.

GFCM Proposal for a regional database on red coral. Data requirements and data entry tool (by P. Hernandez)

The Recommendation 35/2011/2 states the obligation of the contracting parties to “...ensure that authorized fishermen record and report to national authorities the daily catches and fishing effort by area and depths (e.g. number of fishing days, numbers of diving, etc) while allowing, whenever the case, comparisons with results of ROV experimental campaigns. This information must be made available to GFCM Secretariat for transmission to SAC for its considerations and advice”. To facilitate this transfer of information, the Secretariat is developing a data entry tool consisting of a series of excel sheet covering data on management system in force, catch and effort annual data as well as biological parameters.

17. The Workshop appreciated the general structure presented by the GFCM Secretariat for the regional database on annual harvest, national management measures and biological information on red coral. A few modifications of the data field proposed were suggested by the experts, who pointed out that biological parameters are not easily available for most fishing areas and unless specific research projects are in place there may be gaps of various years between data collection campaigns. In this sense, compulsory as well as optional fields are suggested in the final structure of the GFCM questionnaire to submit data on red coral that was finally agreed as shown in Appendix C.

18. Each GFCM members involved in red coral harvest is requested to nominate as soon as possible an official national contact in charge to report the data on red coral and communicate it to the GFCM Secretariat. It was also suggested that the compulsory data on harvest for the previous calendar year should be submitted by the official national contact to the GFCM Secretariat within the 31st August.

STRATEGIES FOR PLANNING LOCAL AND REGIONAL MANAGEMENT AND CONSERVATION PLANS

19. A study on the spatial distribution and on the management scheme of Morocco that every year does assessment to decide on the number of licenses and the area opened to the fishery was presented. Following it, two presentations dealt with the use of ROVs for exploratory work and at the end of the session, IWC introduced a proposal for a Management plan.

Monitoring and Spatial Analysis of Red Coral Fishing Activity: a new approach for prediction of vulnerable operating areas (by B. Abedllaoui *et al.*)

Abstract:

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.

20. Two other presentations addressed the utilization of ROV one showed the long term study by a fisherman for prospective purposes and the second one introduced a specialized vehicle with harvesting computerized arms. This ROV is able to select branches by measuring the diameter and is very stable when it is fixed to the bottom in front of the selected colony.

Using the ROV and data acquisition (by M. Ciliberto)

Abstract:

During the survey phases with the boat to find coral reefs, I used a computer software (TrackMaker[®]) that allows to record waypoints in correspondence to the rock identified. It also allows to take note of the characteristics (depth, height, exposition) as well as the time and the date of the observation. In a second phase the exact point where the ROV is lowered is recorded

and the search of red coral colonies is planned. This phase is made following the current direction. Typically the first ROV lowering is good to establish with certainty the direction of the current in order to schedule the next operation. During the search phase the type of coral observed is annotated with markers of different shape and color (e.g., letter A for coral of good size, letter B coral of medium size, letter C for young coral that must not be collected). The complete ROV tracks are also recorded with the time of the survey the date, the minimum speed, the average speed and the exact length of the path. During the ROV observations, presence of lobsters, ghost nets, Italian bar abandoned with their cables, amphorae, wrecks and all that is worthy of interest for any future survey is registered. Any data recorded with this program, can be immediately displayed on the Google Earth satellite maps, in this way a clear view of all the geographical notes recorded are available. Any waypoint could be displayed by pictures and movies. Finally I would like to point out that such kind of recording were made for 10 years with this program. More than 2500 inspections were carried out and 10,000 rocks detected, for a total of about 2,000 (two thousand) kilometers.

Beyond human capacities: An advanced two units ROV for pilot studies for red coral (*Corallium rubrum*) fishing (by P. Nutarelli *et al.*)

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").

A reasoned index for an Adaptive Management Plan for Red Coral (*Corallium rubrum*) in the GFCM Competence Area (by M. Pani)

Abstract:

In May 2011 the 35th GFCM Commission adopted an historical recommendation on the exploitation of Red Coral in the Mediterranean that is consistent with the principle of sustainable use and will ensure that the species is properly conserved in the future (Rec.GFCM/35/2011/2). IWMC has played a leading role in promoting the conservation of red coral for several years. As part of this work, IWMC participated in the GFCM process and presented documents that led to the adoption of the Recommendation at the 35th session of the GFCM, held in Rome from 9 to 14 May. IWMC was able to demonstrate that the conservation of the red coral is intertwined with the livelihoods and ancient traditions of thousands of people across the Mediterranean Sea, and argued that common management measures should be implemented in the region. Many of the measures suggested by leading scientists in the region, and presented by IWMC in the GFCM Workshop on red coral held in Alghero in September 2010, were taken into account. The adopted binding Recommendation, based on a proposal by the European Union, requests Contracting Parties to prohibit the exploitation of Red Coral populations at depths of less than 50 meters, ensure that authorized fishermen record and report to national authorities the daily catches and fishing effort by area and depths (e.g. number of fishing days, numbers of diving, etc), engage in capacity building efforts and other research cooperative activities to improve knowledge on red coral and red coral fisheries, including entering into cooperative arrangements with other appropriate international bodies, and promote participatory programmes with relevant stakeholders. Detailed provisions on the use of ROVs (remote operated vehicles) are also included in the Recommendation. The scientific and technical knowledge acquired through the actions foreseen in the Recommendation will be taken into account by the Scientific Advisory Committee in developing an adaptive regional management plan. A reasoned index for an adaptive regional management plan is presented here for discussion (see Appendix E) and is intended to be filled collectively by relevant scientists and institutions under the co-ordination of the Scientific Advisory Committee (SAC) of GFCM. The adoption of a management plan shall be the top priority for everyone concerned with the sustainable utilization of Red Coral in the Mediterranean and GFCM and should be carried out as foreseen by GFCM with a participatory approach with all stakeholders.

21. To do this end, the authors have developed a research protocol introduced in Appendix D. 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.
22. The group acknowledges the good example of a pilot study to assess the impact of ROV that has been presented to the Regional Authority of Sardinia last July. The Ws has been

informed, that given the interest of the study by the fishermen, the associations have propose to support the project in case that the administration has difficulties to afford this research.

MANAGEMENT ADVICE INCLUDING ON MINIMUM SIZE

23. There is a general agreement on the need of establishing minimum commercial sizes in each area according to the most update scientific knowledge on growth dynamics of the local colonies.
24. According to the last data provided by the scientist on commercial populations (between 60 and 120 m) in NW Mediterranean at the Workshop, a size of 7 mm diameter would be the minimum size that would allow the safe reproduction of the populations. The studies should be extended to other areas..

GENERAL CONCLUSIONS AND RECOMMENDATIONS

25. According to the results of the last research studies carried out and presented at the Workshop the following conclusions are outlined:

- a) ROV survey of mesophotic red coral (60-120m depth) distribution in the Tyrrhenian and Sardinian seas has been done: population size–age structure (in the Tyrrhenian sea about 25% of colonies are of harvestable size); reproductive parameters (fertile colonies >90%); and growth rates (about 0.28 mm year⁻¹ in diameter); colony morphology vary under different environmental conditions (currents, depth, etc.).
- b) New genetic markers (nuclear and mitochondrial) have been developed showing local adaptation of populations and variability in responses to stress; evidences of the occurrence of a boundary in population structure across a depth of about 50m; genetic variability follows a depth cline; mesophotic populations are structured (genetic and/or demography) at a regional level (Tyrrhenian and Sardinian Seas); Moroccan and Algerian populations are genetically differentiated (preliminary genetic data).
- c) The microbial community associated to red coral colonies has been characterised.
- d) The utility of ROV for prospection, sampling and evaluation of deep coral banks as well as for a better selection of sites has been proved. The implementation of the required studies as stated in the GFCM35/2011/2 should focus, *inter alia*, in the areas specified in Recommendation 2 of the present report.

26. Conclusions of data reporting systems by FAO and GFCM:

- e) The current harvest data available in the FAO capture database, mostly provided by an industry source raised concern about a possible conflict of interest. FAO would like to progressively incorporate in its database as much as possible data from official national sources.
- f) The GFCM database for red coral is an important step forward and represents a useful instrument to comply with the data requirements of Rec.35/2011/2. The information required is divided into 4 sections, with compulsory and optional fields to be filled in.
- g) The Workshop agreed that coral harvesting is a fishery activity in all respects, and hence that socio economic analysis is a priority in the context of coral sustainable utilization.

RECOMMENDATIONS

To GFCM/SAC

- a) FAO and GFCM should find an arrangement to avoid that countries have to report to both organisations.
- b) In the data entry tool prepared for the population of the database it has to clearly be stated what fields are compulsory: harvest, effort, depth management schemes in force, and which are optional (biological parameters only available through research projects).
- c) The Workshop recommends that the Sub-Committee on Economic and Social Sciences (SCESS) starts analyzing the socio economic components of the red coral activities.

To National Administrations

- d) Involvement of stakeholders in data gathering: collaborative actions between science, fishermen and artisanery should be carried out to support the collection of data and to suggest management actions (e.g. data on red coral stocks, data on surveys, fragments of red coral colonies from non accessible regions, data on population structure).
- e) Stock identification and certification: to promote an efficient management of red coral, a correct assessment of the harvesting effort is needed, scientific observers could be on board of red coral fishing boats to collect data on harvested colonies to feed GFCM database; this, together with the creation of professional associations among coral fishermen is preliminary to the establishment of a certification scheme for the Mediterranean red coral; DNA bar-coding could be a suitable supporting tool for the identification of the origin of red coral colonies.
- f) Each CPC harvesting red coral should nominate an official national contact, preferably from the national office in charge of fisheries statistics, committed to report annual data on red coral.
- g) CPCs shall designate specific ports for the landings of authorized red coral catches. This measure is important for enforcement purposes, allowing Parties to specify the localities where red coral can be landed.
- h) A minimum size of 7 mm of diameter measured within one centimeter from the base of the colony is recommended without prejudice that stricter measures be adopted by the CPCs. A tolerance of 5% of the total weight of the daily catch is the accepted for undersized pieces.
- i) For the proper implementation of the measures included in point 7 of REC-GFCM/35/2011/2 it recommended that CPCs establish a quota system based on number of licenses issued, preferably under a seasonal quota or total allowable catch (TAC)

decided by CPCs in local harvesting management units according to the results of cooperative research programmes with the involvement of relevant stakeholders.

- j) To progress on the setting up of an Adaptive Regional Management Plan on Red Coral the Workshop recommends using Appendix E of this report as a framework index for drawing up such plan.

To National Scientific Institutions

- k) Habitat loss and stock conservation and restoration: to assess the indirect impact of other human activities on red coral banks (e.g. increased sediment load due to trawling, habitat loss due to pollution and climate change, lost and abandoned nets etc.). To identify red coral banks that, for their strategic location and peculiar feature, deserve the establishment of off-shore *no take zones or MPAs*. Development of restoration techniques (e.g., colony transplantation and habitat creation).
- l) Efficiency and impact of the use of ROV in surveys and harvesting: The research programs referred in paragraph 3.c of the Rec 35/2011/2 should assess, *inter alia* 1) the efficiency of ROV surveys in quantifying red coral stock; 2) selectivity of the ROV harvesting methods in relation to the harvesting tools (mechanical arms, nets, etc.); 3) the potential increase of the harvesting effort (total catch) compared to diving harvesting techniques, in relation to the increase of the fishing time; 4) the possible impact on deeper water red coral populations which may become accessible using ROV, but are not accessible to divers, 5) possible impacts related to disturbance of ROV vs. divers on the sea bottom assemblages (gorgonians, sponges, other deep corals, lobsters).
- m) Demography: collect data on population density, on colony growth rate, on population size and age structure; assess population reproductive features, larval output and recruitment rates; develop demographic models to simulate population trends under different exploitation/protection regimes. Large and small-scale remote surveys and mapping methodologies should be standardized. These studies should be extended to southern and eastern parts of the Mediterranean.
- n) Natural mortality: assess frequency and effects of boring organisms and pathologies (e.g. infective bacteria, boring sponges) on populations.
- o) Genetic connectivity and structuring: extend the sampling to the Atlantic, Southern and Eastern Mediterranean sea following specific sampling designs comparing shallow and deep water populations and patterns along bathymetric gradients. Small scale (meters) genetic studies to assess larval dispersal and recruitment patterns (in synergy with demographers)

OTHER MATTERS

27. The Workshop unanimously thanked the hosting country (FRANCE) in particular Collectivité Territoriale de la Corse and the Office for the Environment of Corsica for their hospitality at its headquarter and excellent organization. The professional divers acknowledge the improvements done during the last years on the collaborative work with the scientists and express their willingness to progress forward in this line

ADOPTION OF THE REPORT/RECOMMENDATIONS

28. The Workshop formally adopted the Conclusions and Recommendations and agreed to adopt the entire Report by e-mail by the 30th of October 2011.

ADOPTED AGENDA

Wednesday, 5 October 2011

Morning Session, 9:00-13:00

1. Opening, arrangement of the meeting and adoption of the agenda

1.1. Introductory speeches

- *La pêche au corail rouge en Corse* (R. Miniconi. Conseil scientifique régional du patrimoine naturel)

2. Scientific progress on the medium term working plan on the status of red coral banks in the Mediterranean: fisheries, biology, ecology and genetics

2.1. Presentations

- *Molecular ecology of the red coral *Corallium rubrum*: state of the art and new tools for pending questions* (Aurette D.)
- *Genetic structuring of shallow vs. deep red coral populations: what can this tell us about the conservation strategies* (Abbiati M.)

2.2. General discussion

Lunch time (13.00-14.30)

Afternoon session, 14.30-18.00

3. Status of data available including with regard the use of ROV

(Representatives from responsible institutions are expected to introduce their data collection and management schemes at national level)

3.1. Presentations

- *The Italian research project on the deep-dwelling red coral populations: the first survey along the Tyrrhenian (NW Mediterranean) coasts* (Santangelo *et al.*)
- *Red coral (*Corallium rubrum*) in Sardinian sea: main regulations, status and biological features* (Follesa *et al.*)

3.2. General discussion

Thursday, 6 October 2011

Morning Session, 9:00-13:00

4. Strategy to set up a system for data collection and reporting to the GFCM

4.1. Presentation

- *GFCM Proposal for a regional database on red coral. Data requirements and data entry tool.*

4.2. General discussion

Lunch time (13.00-14.30)

Afternoon session, 14.30-18.00

5. Strategies for planning local and regional management and conservation plans

5.1. Presentations

- *Monitoring and Spatial Analysis of Red Coral Fishing Activity: a new approach for prediction of vulnerable operating areas (Abdellaoui et al.)*
- *Using the ROV and data acquisition (Ciliberto)*
- *Beyond human capacities: An advanced two units ROV for pilot studies for red coral (*Corallium rubrum*) fishing (Nutarelli et al.)*
- *A reasoned index for an Adaptive Management Plan for Red Coral (*Corallium rubrum*) in the GFCM Competence Area (Pani)*

5.2. General discussion

6. Management advice including on minimum size

Friday, 7 October 2011

Morning Session, 9:00-13:00

7. General conclusions /Recommendations

8. Any other matters

9. Adoption of the Report and closure of the meeting

LIST OF PARTICIPANTS

Marco **ABBIATI**

University of Bologna
Via S Alberto 163,
48123 Ravenna Italy
Tel/Fax: +3554246171
E-mail: marco.abbiati@unibo.it

Mauro **ASCIONE**

Assocoral
Via Cappuccini,
64 Torre del Greco
80059 Napoli, Italy
E-mail: assocoral@libero.it

Didier **AURELLE**

Aix-Marseille Université,
Centre d'Océanologie de Marseille,
UMR 6540 DIMAR
Station Marine d'Endoume,
Rue de la batterie des Lions
13007 Marseille, France
E-mail: didier.aurelle@univmed.fr

Abdellaoui **BENYOUNES**

Institut National de Recherche
Halieutique INRH-Tanger, Maroc
Institut National de Recherche
Halieutique (INRH)
BP 5268, Dradeb,
Tanger, Morocco
E-mail: byounes10@hotmail.com

Luca **BEDIN**

Ministero delle Politiche agricole,
alimentari e forestali
Direzione Generale della
Pesca Marittima e dell'Acquacoltura
Viale dell'Arte 16 00144 Roma, Italy
E-mail: l.bedin@politicheagricole.gov.it

Mauro **BERTELLETTI**

Ministero delle Politiche agricole,
alimentari e forestali
Direzione Generale della
Pesca Marittima e dell'Acquacoltura
Viale dell'Arte 16 00144 Roma, Italy
E-mail:
m.bertelletti@politicheagricole.gov.it

Rita **CANNAS**

Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: cau@unica.it

Jean Pierre **CARDUCCI**

Corailleur
Représentant des corailleurs auprès du
CRPMEM (Comité Régional des Pêches
Maritimes et des Elevages Marins)
Association des corailleurs corses
Quartier neuf 4,
20260, Calvi, France
Tel: +33 607067150
E-mail: jpcorail@aliceadsl.fr

Angelo **CAU**

Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: cau@unica.it

Lorenzo **CHESSA**

University of Sassari
Department of Plant protection
Via De Nicola 9
07100 Sassari, Italy

E-mail: chessa@uniss.it
Massimo **CILIBERTO**
University of Sassari
Department of Plant protection
Via De Nicola 9
07100 Sassari, Italy
E-mail: maxcili@tiscali.it

Ciro **CONDITO**
Assocoral
Via Cappuccini 64, Torre del Greco
80059 Napoli, Italy
E-mail: assocoral@libero.it

Plinio **CONTE**
Ministero delle Politiche agricole,
alimentari e forestali
Direzione Generale della
Pesca Marittima e dell'Acquacoltura
Viale dell'Arte 16 00144 Roma, Italy
E-mail: p.conte@politicheagricole.gov.it

Mathieu **DAUSSET**
Préfecture de Corse
Secrétariat général pour les affaires de Corse
Chargé de mission mer, littoral,
eau et assainissement
Délégué du DIRM en Corse
9 par Bolvideré
20000 Ajaccio Corse, France
Tel: 04 95 11 13 05
Fax: 04 95 21 32 70
E-mail: mathieu.dausset@corse.pref.gouv.fr

Maria Cristina **FOLLESA**
Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: cau@unica.it

Luca **GARIBALDI**
Fisheries and aquaculture Statistics and
information service, Food and Agriculture
Organization of UN (FAO)
Viale delle Terme di Caracalla 1
00153 Rome, Italy

E-mail: luca.garibaldi@fao.org
Jean-Philippe **GIORDANO**
Coraldiver professional
Piantarella 20169
Bonifacio, France
Tel: +33 (0) 607313955
E-mail: giordano2a@free.fr
Web site: www.corailrouge.com

Nicolas **GORODETSKA**
Ministère de l'Agriculture, de
l'Alimentation, de la Pêche, de la Ruralité et
de l'Aménagement du territoire, France
Bureau des affaires européennes et
internationales
Direction des pêches maritimes et de
l'aquaculture
3 place de Fontenoy, 75007 Paris, France
E-mail:
nicolas.gorodetska@agriculture.gouv.fr

Antonio **IANNIZZOTTO**
Ministry of Environment and Land and Sea
Protection - Nature Protection Directorate
Advisor for CITES Management Authority
Via Capitan Bavastro, 174
00144 Roma, Italy
E-mail: iannizzotto.antonio@minambiente.it

Pierre **LEJEUNE STARESO**
Station de Recherches Sous-Marines et
Océanographiques
Stareso, pointe revellata, BP33
20260 Calvi, Corse, France
E-mail: pierre.lejeune@stareso.com

Antoine **LOCATELLI**
Patron pecheur corailleur
Corse Pozzoniello
20169 Bonifacio, Corse, France
E-mail: anlocatelli@aol.com

Antonio **MACCARONI**
Ministero delle Politiche agricole,
alimentari e forestali
Direzione Generale della
Pesca Marittima e dell'Acquacoltura
Viale dell'Arte 16 00144 Roma, Italy
E-mail: a.maccaroni@politicheagricole.it

Roger **MINICONI**
CSRPN
Casali Plaine de Peri
20167 Peri, France
E-mail: roger.miniconi@gmail.com

Tommaso **MASSA**
Assocoral
Via Cappuccini 64, Torre del Greco
80059 Napoli, Italy
E-mail: assocoral@libero.it

Piero **NUTARELLI**
Elettronica Enne
Via Bertola, 31
17047 Vado Ligure, Italy
Tel: +39 0192100116
Mob: +39 336393129
E-mail: elenne@tiscalinet.it

Silvia **NUTARELLI**
Elettronica Enne
Via Bertola, 31
17047 Vado Ligure, Italy
E-mail: elenne@tiscalinet.it

Atef **OUERGHI**
Programme officer
UNEP/MAP/RAC/SPA
Boulevard Leader Yasser Arafat –
BP 337 – 1080 Tunis Cedex, Tunisia
Tel: +21 67120649/485/861
E-mail : atef.ouerghi@rac-spa.org
Web site: www.rac-spa.org

Marco **PANI**
IWMC
Piazza dei Mercanti 2,
Roma, Italy
E- mail: pani.marco@gmail.com
Web site: www.iwmc.org

Claudia **PEDONI**
Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: cau@unica.it

Philippe **PERONNE**
Délégation à la Mer
et au Littoral de Corse-du-Sud 4,
Boulevard du Roi Jérôme
20000 Ajaccio, Corse, France
E-mail:
Philippe.peronne@corse-du-sud.gouv.fr

Cristina **PORCU**
Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: cau@unica.it

Juan **QUINTANA CASAS**
Professional Coral Diver
Elettronica Enne
Palamós, 118
17200 Girona, Spain
Tel: +34 606887105
E-mail: juanqc@yahoo.es

Jean Michel **RAFFAELLI**
Président de l'Ass. des patrons Pêcheurs de
Corail Corse
Ass. de Corailleurs de Corse
Villa Mordijane 20245 Galeria,
Corse, France
E-mail: jmraffaelli@yahoo.fr

Flavio **SACCO**
Dipartimento di Scienze della Vita e
dell'Ambiente
Via T. Fiorelli, 1
09126 Cagliari, Italy
E-mail: flaviosacco@unica.it

Giovanni **SANTANGELO**
University of Pisa
Dep. Biology (Zoology)
Via Volta 6
I-56126 Pisa, Italy
E-mail: gsantangelo@biologia.unipi.it

Dominique **TORRE**
Patron pecheur corailleur /Secrétaire de
l'Ass. des patrons Pêcheurs de Corail Corse
Ass. Corailleurs de Corse
Im. Le CORALIA r.te de Sanguinaires
20000 Ajaccio, Corse, France
E-mail: jmraffaelli@yahoo.fr

Fausto **TROISI**
Cam Srl
Porto Fertilia,
Sassari, Italy
Mob: +39 335433751
E-mail: info@marinadifertilia.it

Chairman

Henri **FARRUGIO**
Chairman of the Scientific Advisory
Committee of the GFCM (General Fisheries
Commission for the Mediterranean)
IFREMER
Av. Jean Monnet, BP 171,
34203 Sète France
Tel: +33 (0)4 99573237
Fax: +33 (0)4 99573295
E-mail: henri.farrugio@ifremer.fr

Co-Chairman

Jacques **SACCHI**
331 Chemin du Phare
34200 Sète, France
Tel: +33 (0)4 99573208
Fax: +33 (0)4 99573295

E-mail: jsacchi@hotmail.fr

Coordination

Pilar **HERNANDEZ**
Information Management Officer
GFCM Secretariat
Via Vittoria Colonna 1
00193 Rome Italy
Tel: +39 0657054617
Fax: +39 0657056500
Email: pilar.hernandez@fao.org

RED CORAL DATA COLLECTION FORM #2

Year

Country

Reporting Authority / Institution

MANAGEMENT INFORMATION*

*Optional

Number of harvesting licenses in the country

Number of active licenses

Number of new licences

Cost of license fee per year

Permitted quota (annaul or daily) per active license

Period in which harvest of red coral is allowed

Legal minimum size (plus/minus allowance)

Depth range allowed in national legislation

Is the harvest declared by diver, or recorded by authorities?

How is the minimum size controlled?

Is there alternate areas system in place?

If yes: how many areas?

How long intervals?

Is there any research project in place?

If yes: go to the Biological data sheet

PROPOSAL OF A PILOT STUDY ON ROV IMPACT

In order to carry out a research program to assess the impact of the ROV, a series of pilot studies, as already recommended by the Workshop of 2010 and as stated in the Recommendation GFCM 2011/2 should be developed in different sites and areas of the Mediterranean. The proposal exposed during this Workshop is to be considered a first contribution in this sense. This protocol has been presented to Autonomous Regional Government of Sardinia in July 2011 to apply for funds and the answer is pending. Nevertheless we include the proposal as a Appendix D to the present Report for its consideration by other Institutions of the GFCM competence area and by Subcommittees of the SAC. The proposal eventually could be adopted as a protocol after a proper revision and possible amendments.

Research protocol:

Experimentation should be carried out in commercial conditions on a professional vessel with observations on the running system and the quality and size of harvested product and should be analyzed in terms of constraints and benefits during a period of time which should be defined according the local conditions.

For the analysis of the data, a statistically significant number of ROV images will be considered. For each image the following features will be assessed and divided into categories according to a score on semi quantitative basis:

1) coralligenous coverage 2) colonies density 3) colonies position 4) Impact of ROV on colonies 5) impact on coralligenous; 6) colonies lost during the ROV ascent 7) turbidity produced by ROV.

Statistical analysis of the data will be performed to assess the impact of red coral harvesting.

The technical features of the ROVs to be used are highlighted below.

In the eventual use of ROVs for harvesting operations

Objective:

A pilot study (see above) should be preliminary carried out to demonstrate the feasibility of using ROV for harvesting in good conditions of profitability, safety for the fisherman and sustainable exploitation.

Technical features requested:

- The ROV capture should catch coral branches only one by one avoiding any other system as dredging, trawling, etc.

In order to give a correct precision for the coral picking the ROV must be equipped with a stabilization system to ensure a correct position of the gear during coral harvest operation and one additional camera must be installed on the collecting device. A system of measurement of the size (e.g. diameter) of the coral branches must installed on the gear in order to check the correct size before collecting. The support vessel should be equipped with a recorder positioning system, and echo-sounder.

**A REASONED INDEX FOR AN ADAPTIVE MANAGEMENT PLAN FOR RED
CORAL (*Corallium rubrum*) IN THE GFCM COMPETENCE AREA**

- I. Introduction
- II. Description of the Fishery
 - a) History of Exploitation
 - b) Vessels and gears
 - c) Evaluation of Gear Performance and Efficiency
 - 1. Evaluation of scuba diving performance and efficiency.
 - 2. Evaluation of the use of ROVs in the framework of scientific experimental campaigns (Rec. GFCM/35/2011/2)
 - a) Prospection
 - b) Harvesting
 - d) Global Economics of the Red Coral Industry
 - 1. Domestic Commercial Harvest
 - 2. Domestic Commercial Processing
 - e) Employment
 - f) Jurisdiction
 - g) Stocks
- III. Biology
 - a) Life History
 - b) Habitat
 - c) Distribution and Abundance
 - d) Growth and Mortality Rates
 - e) Reproduction and Recruitment
 - f) Biomass per Recruit
 - g) Yield per recruit
 - h) Optimum Yield and demographic models
 - i) Sustainable Yield and Maximum Sustainable Yield (MSY)
 - j) Stock identifications using genetic tools
- IV. Management

- a) History of Research and Management
 - b) Management Objectives and Philosophy
 - 1. Specific Adaptive Management Objectives
 - c) Domestic Fishing Capacity, Expected Harvest Level
 - 1. Country profiles
 - d) Domestic Processing Capacity and Expected Processing Level
 - 1. Country profiles
 - e) Management Measures: Rationale, Options and Recommendations
 - 1. Suggested Conservation and Management Measures
 - f) Enforcement
 - g) Administrative costs
 - h) Relationship to Existing Regulations
 - i) Future Research Needs
 - j) Alternative Exploratory Areas Management approach
 - k) SAC Review
 - l) Commission Review
- V. Environmental Impacts
- a) Biological Impact of Domestic Fishing
 - b) Impacts to Artisan Industry
 - c) Alternatives to the Proposed Plan
 - d) Relationship between Local Short-Term use of Man's Environment and the Maintenance and Enhancement of Long-term productivity.
- VI. References
- VII. Glossary
- VIII. Appendices

**LA PÊCHE AU CORAIL ROUGE EN MÉDITERRANÉE CONTINENTALE
FRANÇAISE**

<http://151.1.154.86/GfcmWebSite/SAC/SCSS-SCMEE-SCSA/2011/RedCoral/docs.html>

THE SPANISH LEGISLATION ON RED CORAL

<http://151.1.154.86/GfcmWebSite/SAC/SCSS-SCMEE-SCSA/2011/RedCoral/docs.html>