

A brief report on

Red coral (Sardinia Coral)
Corallium rubrum (Linnaeus, 1758)



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Abstract

Red coral *Corallium rubrum* (Order Scleractinia; Family Coralliidae) is an anthozoan species, dominant component of the “Coralligenous” assemblages. Its habitat ranges from shallow to deep (up to 300 m) sea. It has a slow growth rate (0.2 – 2 cm/year) and late reproduction (7-10 years). *C. rubrum* is endemic to Mediterranean and Eastern Atlantic, with highest concentrations in the North-West coast of Sardinia (Italy). Red coral is the most valuable of the precious corals and commercially valuable beds are now found in Sardinian waters and along African coasts, from Morocco to Tunisia. *C. rubrum* is listed in Annex V of the European Union Habitats Directive (92/43/CEE), in Annex III of the Bern Convention and Annex III of the Protocol concerning Special Protected Areas and Biological Diversity in the Mediterranean (under the Barcelona Convention). It has recently been proposed to be listed in CITES (Qatar, March 2010) by US and Sweden on behalf of the European Community. Many countries adopted special measures of management for the red coral at sub-regional scale (e.g. Regione Sardegna), some examples are given in this short review.

Class: **Anthozoa**
Order: **Gorgonacea (Alcyonacea)**
Family: **Coralliidae**
Genus: *Corallium*
Species: *Corallium rubrum*

Biology

C. rubrum is a rocky bottom species inhabiting a wide depth range from **7 to 300 meters**, and possibly even deeper (CITES Cop14 Prop. 21, 2007). In shallow waters (between about 15 and 70 meters), *C. rubrum* colonies grow in caves, crevices, overhangs and other protected interstices in dense patches with as many as 127-1300 colonies/m², the majority of which are less than 5 cm tall, with dense patches confined to small areas with large expanses of uncolonized habitat (Workshop on Red Coral, 2009). Coral exploitation is progressively restricting their occurrence at the deeper range of their bathymetric distribution. In deeper waters, between 70 and 130 meters, coral colonies tend to be larger and more dispersed, and typically settle on open surfaces. It is rare to find colonies that reach their historical maximum size of 30-50 cm, except in areas where fisheries have never operated. Below 130 meters, colonies tend to be even larger and less dense (CITES Cop14 Prop. 21, 2007; Workshop on Red Coral, 2009).

C. rubrum is a long living species (about 100 years) and, as many other gorgonian species, show a **slow growth rate** and late reproduction (7-10 years) (K-selected species features) (Torrents et al., 2005; CITES Cop14 Prop. 21, 2007). The size at first reproduction in this species is much smaller (2.4 cm) compared to other gorgonian species (usually about 15 cm in height). Red coral exhibits average growth rates of 0.2-2 cm/year in length and 0.24-1.32 mm diameter, with growth rates declining with age. Historically, *C. rubrum* colonies frequently attained masses greater than 2 kg and basal diameters of 3-10 cm. Colonies today rarely exceed 20 cm in height and 2 cm basal diameter, because commercial take has removed most large individuals (Torrents et al., 2005; CITES Cop14 Prop. 21, 2007). Data available on larval biology and genetics population structure denote a low rate of exchange between local populations, indicating that persistence of populations is mainly supported by local recruitment. Therefore, the persistence of local populations may be mainly assured

by the reproduction output of colonies smaller than the commercial size (Torrents et al., 2005).

Red coral is one of the dominant components of **Mediterranean ‘coralligenous’** species assemblages. These complex communities are composed of a wide variety of suspension feeders, exhibiting high species richness and functional diversity. *C. rubrum* coexists with other gorgonians, large sponges and other benthic invertebrates (CITES Cop14 Prop. 21, 2007).

Distribution

The genus *Corallium* is widely represented by a variety of species (27) distributed in tropical and subtropical waters. *Corallium rubrum* (the only species of the genus distributed in the Mediterranean) is **endemic to the Mediterranean and eastern Atlantic**, from Greece and Tunisia to the Straits of Gibraltar including Corsica, Sardinia and Sicily, occurring primarily around the central and western basin, with smaller populations in deeper water in the eastern basin and off the Atlantic coasts of Africa around the Canary Islands, southern Portugal and around the Cape Verde Islands (Pérès and Picard, 1964; FAO, 1984; CITES Cop14 Prop. 21, 2007).



World distribution of *C. rubrum*

This species is found in small patches at relatively high abundances (127 colonies/m² in Spain; 200-600 colonies/m² in France; and up to 1300 colonies/m² in the Ligurian Sea, Italy) in shallow water (10-30 m depth), and occurs as isolated colonies in deeper water. At Costa Brava, Spain the overall abundance of *C. rubrum* was estimated at 3.4 colonies/m². Several decades ago, densities of 55 colonies/m² were observed at a depth of 40 m (Palma

de Malloca), 20 colonies/m² at 60 m depth along the Costa Brava, and 90-100 colonies/m² in Corsica (FAO, 1984; CITES Cop14 Prop. 21, 2007).

Italian distribution

Mediterranean populations of *C. rubrum* off **Calabria, Campania** (Naples area), **Sardinia, Sicily**, and parts of the French and Spanish seacoasts all had significant Corallium banks in the 1950s, but most have been over-exploited and are no longer commercially viable. *C. rubrum* has also been extirpated from one location east of Graham Bank (Sicily Channel) and from three banks off the coast of Sciacca (Strait of Sicily) that were discovered between 1875 and 1880 and fished until 1915. Nowadays the highest concentrations of red coral in Italy are in Sardinia (primarily in the North-West coast, Alghero area) in the Ligurian sea (Portofino Marine Reserve, Punta Giglio), Sicily and in some of these locations (Capo Caccia, Sardinia) it can be found in very shallow waters, when living within superficial caves.

Interest of Fisheries

C. rubrum is the most valuable of the precious corals. In the Mediterranean Sea their populations have been commercially exploited for use in jewellery since antiquity (Santangelo et al., 1993; Santangelo and Abbiati, 2001). Professional harvesting and poaching are the main sources of mortality in this species. Harvesting has caused a marked decrease in mean and maximum colony size in present red coral populations (Torrents et al., 2005).

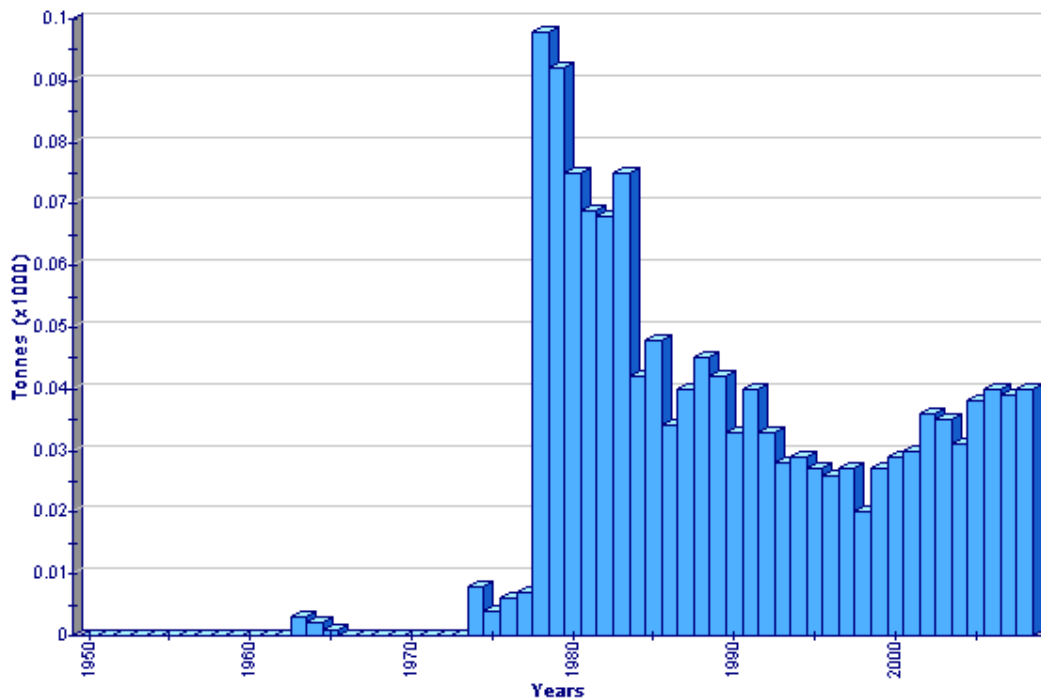


Red coral handcrafts and jewelry

Overfishing especially affects long-lived K-selected species rather than species with a short life-span because long-lived species generally show slow growth rates, low fecundity and late maturity. These parameters determine that long-lived species tend to decline more rapidly and take much longer to recover after strong disturbances (Torrents et al. 2005).

FAO data for 1967–2004 show the economic importance of individual countries in the harvest of *C. rubrum*: Italy (33.5%), Spain (17.6%), Tunisia (15.3%), France (9.9%), Morocco (8.9%), Algeria (7.7%), Greece (3.6%), Croatia (2.4%), Albania (1.1%). These figures are likely to be **heavily underestimated** (CITES Cop14 Prop. 21, 2007).

Red coral is captured both dragging the bottom with a wooden cross (*ingegno*) and by diving. The total catch reported for this species to FAO for 1999 was 26.5 t. The countries with the largest catches were Spain (6.9 t) and Italy (3.9 t). Harvest of *C. rubrum* in the Mediterranean decreased by 66% between 1985–2001.



Global Capture production for *Corallium rubrum* (FAO Fishery Statistic).

Production (tonnes) of *Corallium rubrum* 2000-2008

Country	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total
Albania	1	1	2	2	0	0	0	0	1	7
Algeria	3	5	5	2	2	1	1	1	1	21
Croatia	2	2	2	1	1	6	6	2	4	26
France	4	4	6	4	4	11	9	8	8	58
Greece	2	1	2	2	2	2	2	1	1	15
Italy	4	5	5	9	6	5	5	6	7	52
Montenegro	0	0	0	0	0	0	1	1	1	3
Morocco	3	3	4	1	1	1	1	1	2	17
Spain	4	5	6	8	8	6	5	5	5	52
Tunisia	2	2	2	2	3	4	6	11	8	40
Grand total	25	28	33	31	27	36	37	37	39	293

Production of *Corallium rubrum* in the Mediterranean and Black Sea Area (FAO FishStat).

Throughout the Mediterranean, *C. rubrum* populations have shown a **dramatic decrease** in their size, age structure and reproductive output over the last 20 years, and the only remaining commercially valuable beds are now found along the African coasts from Morocco to Tunisia, in the Bonifacio Strait off western Sardinia, and along the Spanish coasts. Most remaining populations in shallow water are characterized by the **absence of large colonies**, and an overall shift to non-reproductive colonies below the smallest legal size for commercial harvest (mean size throughout the region is now 3 cm) (CITES Cop14 Prop. 21, 2007).

In **Spain**, 89% of the colonies in fished areas were below legal size for harvest and the mean height decreased from 61.8 mm to 27 mm between 1986 and 2003. Even in areas that have been protected from fishing for over 14 years, the largest colonies were rarely found to exceed 20 cm and the average basal diameter was only 4.8 mm, corresponding to an average age of 7.5 years (CITES Cop14 Prop. 21, 2007). In **Italy**, approximately two-thirds of a well-studied population was non-reproductive (Santangelo et al., 2003). Coral beds on the Sicilian and Tyrrhenian coasts are no longer commercially exploited because shallow populations have been extirpated and remaining colonies are only found in deep. Currently the red coral is captured only in Sardinia, with harvest regulated through a specific regional law requiring a license system and based on a management plan. Italy is a major importer of *Corallium* used mainly by jewelry designers and handcrafts (CITES

Cop14 Prop. 21, 2007). In **France**, colony size (basal diameter and height) in non-harvested sites was four times larger and the average height was two times greater than that of corals in harvested area (CITES Cop14 Prop. 21, 2007).

Other threats

Secondary human impacts for this species include pollution, sedimentation, tourism recreational diving and incidental take and habitat degradation associated with long-line fishing and bottom trawling. A mass mortality event in 1999 affected shallow-water populations (< 30 m depth) along 50 km of coastline in the Provence region off France, with overall mortality estimated in millions of colonies, attributed to a fungal and protozoan disease and linked to temperature anomalies (CITES Cop14 Prop. 21, 2007).

International regulation and protection

C. rubrum is not currently listed on the International Union for Conservation of Nature (IUCN) Red List of Threatened Animals or on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). During the last conference of the Parties in Doha, Qatar (March 2010), United States of America and Sweden on behalf of the European Community have requested to include the *Corallium* spp. in Appendix II of CITES (Cop15 Prop. 21) but this proposal has not been accepted.

In 1994, the **European Union** banned the use of dredging equipment *ingegno* or “St. Andrews Cross” for the harvest of *C. rubrum* because it unselectively destroys coral populations and habitats (Council Regulation No. 1626/94). *C. rubrum* is listed in Annex V of the European Union Habitats Directive (92/43/CEE), in Annex III of the Bern Convention and Annex III of the Protocol concerning Special Protected Areas and Biological Diversity in the Mediterranean (under the Barcelona Convention).

The Contracting Parties to the Barcelona Convention requested RAC/SPA to hold an ad hoc meeting in order to propose a work programme aiming to conserve the Coralligenous

ecosystem, in which the red coral is a dominant component. As a result of the ad hoc meeting, organized in Tabarka (Tunisia) by RAC-SPA, the work programme was elaborated and submitted to the approval of the Focal Points Meeting (June 2007, Palermo, Italy). The creation of this Action Plan was the result of the examination process of the work programme. It was adopted during the last Ordinary Meeting of the Contracting Parties (OMCP) held in Almeria from 15 to 18 January 2008. The main objectives of the Action plan is to allow the **conservation of the coralligenous and others calcareous bio-concretions in the Mediterranean Sea**, rising solidarity and scientific cooperation between States and increasing the knowledge concerning these assemblages, essential prerequisites in order to implement efficient management measures.

At **local scale** *C. rubrum* is fully protected in Gibraltar (Nature Protection Ordinance, 1991) and in Malta (Flora, Fauna and Natural Habitats Protection Regulations, 2003). *C. rubrum* harvesting is regulated in Croatia, Greece, Morocco, Tunisia and Spain (CITES Cop14 Prop. 21, 2007). The harvest of *C. rubrum* in Algeria was suspended in 2001 under Décret Exécutif no. 01-56, awaiting the results of a study evaluating the resource. *C. rubrum* is not considered threatened in France. However, the fishery there is subject to management and regulation: collection by diving is generally prohibited, but licenses are issued on provisional exemptions, which are subject to annual renewal (CITES, Cop14 Prop. 21, 2007). In Corsica, the numbers of collectors has been limited to eight and they have agreed to work below 50 m depth to allow the stocks in shallower waters to recuperate. A number of countries have established marine reserves in which *C. rubrum* is protected, e.g. Cap Couronne in France. Sardinia (Italy) has regional legislation on coral fishing, issued in 1979: every year thirty licensed professional fishermen are allowed to harvest corals only in restricted areas and specific periods. In 2007 the Sardinian Government banned coral fishing for the whole year. The Spanish Government has established reserves for the protection of *C. rubrum* in the Mediterranean Sea and has regulated red coral harvesting since the mid 1980s (CITES Cop14 Prop. 21, 2007).

Management measures

Management has been hampered by problems associated with enforcement and jurisdiction, the multinational character of the fishery, presence of precious coral beds in the marine environment not under the jurisdiction of any State, and a lack of knowledge of the status of populations and the biology of *Corallium*. Results from a study led by Torrents & al. (2005) indicate that management strategies for the conservation of red coral should lead to **increase the abundance** of large colonies to guarantee a good reproduction output, since the reproductive effort of this species is higher in large (>50 mm in height) and medium size colonies (30–50 mm) than in small ones (<30 mm). Suggested measures are minimal harvesting sizes and no-take areas in shallow habitats (<50 m) (Torrents et al., 2005).

The international Workshop on Red Coral (Naples 23-26 Sept. 2009) underlined the need of a **comprehensive Mediterranean approach** to red coral management based on a common assessment of current management, monitoring, and research findings across the region. According to the Workshop results, the management of red coral should be based on key scientific parameters such as population structure, genetics, colony and population growth rates (reproduction and recruitment) and connectivity. It also should be adaptive based on feedback from fishery data and input from relevant stakeholders. *C. rubrum* populations above 50 meters depth are well studied, at least in Spain, France, and Italy, but deeper water populations and populations in other countries are poorly known. The majority of shallow water populations are, or have been, over-exploited, and the overall extent of red coral populations and of their decline is not known at a Mediterranean scale. Therefore, there is a clear need to determine the extent of populations and their decline (or recovery) trends. Shallow water (less than 70 meters) populations (according to the Workshop) should need to be fully protected from harvesting. While deep water populations (from 70-150 m) should be a priority for research and fishery management (Workshop on Red Coral, 2010).

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