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## Chemistry and Ecology

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713455114>

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**To cite this Article** Giaccone, G.(2008) 'Review of taxonomy situation of marine vegetables in Mediterranean Countries within the Mediterranean Initiative on Taxonomy (MIT)', *Chemistry and Ecology*, 24: 1, 185 – 196

**To link to this Article:** DOI: 10.1080/02757540801966330

**URL:** <http://dx.doi.org/10.1080/02757540801966330>

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## Review of taxonomy situation of marine vegetables in Mediterranean Countries within the Mediterranean Initiative on Taxonomy (MIT)

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*(Received 02 July 2007; final version received 18 October 2007)*

The Project of the Mediterranean Initiative on Taxonomy (MIT) aims at carrying out in the Mediterranean area the objectives of the Global Taxonomy Initiative (GTI), within the outline of the Convention on Biological Diversity (CBD). As an exemplification the present work reports, through the knowledge on vegetable taxonomy, an evaluation of the state of taxonomy of marine vegetable organisms in the Mediterranean Countries and in particular in Italy. An accurate evaluation on the state of taxonomy of the marine vegetable organisms in the Mediterranean Countries needs data collection from scientists and scientific organisations operating within every single Nation. Available statistical data on the distribution of Phycologists in the Mediterranean area, shows a significant but not always sufficient number of specialists according to the development of the coastal area in Spain, France, Italy, Greece, Turkey, Russia, Romania, and Israel. Qualified presences can also be found in Egypt and Tunisia. All Countries need a generational renewal of taxonomy specialists, programmed by Governments and not trusted to the chance of personal choices or to a successful University career. All Countries need to increase their number of taxonomists and to provide them with a higher level of specialisation in order to manage the Mediterranean Initiative on Taxonomy (MIT) and to carry out the Convention on Biological Diversity (CBD).

**Keywords:** Mediterranean Initiative on Taxonomy; marine botany; phycologists; Mediterranean countries

### 1. Introduction

The Regional Activity Centre for Specially Protected Areas (RAC/SPA) submitted to the National Focal Points for SPA, Project of the Mediterranean Initiative on Taxonomy (MIT), within the outline of the 6th Protocol of the Barcelona Convention ratified by Italy with Law n. 175 dated 05/27/1999) [1] during the Valencia meeting held on 23–26 April 2001 [2]. This project aims at carrying out in the Mediterranean Area, the objectives of the Global Taxonomy Initiative (GTI, 1996), within the outline of the Convention on Biological Diversity (CBD, 1992), ratified by Italy with Law n. 124 dated 02/14/1994) [3].

According to the document (UNEP/CBD/COP/6/3, 2002) [4], approved by the Conference of the contracting Parties, GTI promotes the taxonomic works necessary to realise CBD at the three

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levels of genetic, specific and ecosystem biodiversity of vegetables, animals and micro-organisms. It especially deals with the lack of taxonomic information pertinent to the identification of the biodiversity constitutive elements in the various parts of the biosphere. Furthermore, it also aims at strengthening the abilities to develop the taxonomic activity in all regions, in particular in the developing Countries, through the creation of reference collections, databanks, taxonomic professionals, necessary for the preservation and fair, sustainable and lasting utilisation of the Planet biological resources. In order to attain this goal, the GTI fixes some operational objectives; among them the creation of structures for taxonomic training and the increase of human resources in the field of taxonomy according to an international solidarity with the Countries of origin of the exploited biological resources.

The GTI document [4] suggests to find the common roots of the ethical principles, supporting the execution of the decision V/16 of the Parties Conference (Article 8j) upon CBD, with ‘the acknowledgment of the spiritual and cultural values’ of autochthonous and regional communities, in the outline of the GTI operational objective number 5, and in particular, in the Mediterranean Region to motivate MIT with shared values.

In the Stockholm Conference (1972), inside the Declaration of Rio de Janeiro (1992), in the Johannesburg Conference (2002) and in the more recent meetings of the Earth Summits, the international Community became aware of the fact that the social and economic development of capitalism (in the individualistic, consumer and maximizing model) is not lasting nor sustainable by nature and in particular by the biodiversity and that air, water and soil are getting more and more polluted and climate has been changing at least at a local and maybe at a regional level. The declarations of these Conferences, organised by UNO and the regional Conventions they promote (such as the Barcelona Convention) to harmonise the needs of biodiversity and natural environment with those of social and economic development, always remain non operative due to a lack of ethical and moral principles referred to the spiritual and cultural values of regional and local communities. In particular, as far as the Mediterranean region (cradle of the three monotheist religions) is concerned, this happens because there is no respect of the ‘gold rule’ also present in the other religions, ‘do only to others what you would like the others do to you’ and ‘the others’ involves all living elements organised in the ecosystems of our Planet. The MIT project working group, formed by the National Focal Points for SPAMI, while analyzing taxonomy in the Countries of the Barcelona Convention, pointed out what follows:

- The number of taxonomists is declining in the majority of the Countries of the region. This is due to the fact that taxonomy does not number among the priorities set for search, and students are no longer drawn by this discipline;
- Authorities dealing with conservation of biodiversity call upon universities and researchers to assist them in taxonomy. The implementation of conservation programs will be affected by the lack of taxonomists in the medium term if adequate measures are not taken;
- Natural history museums play an important role in taxonomy and in the maintenance of reference collections.

Based on the above items and in an attempt to compensate for the gaps highlighted by those items, the working group put forward the following recommendations:

- (1) Invite the Contracting Parties to attach greater importance to taxonomy and to strive to increase the number of specialists in Mediterranean taxonomy;
- (2) Complete an inventory of taxonomy specialists in Mediterranean countries for those taxons that are important for the implementation of the SPA Protocol;

- (3) Prepare an inventory of laboratories with marine taxonomic competence, the capacities at their disposal, and their possibility of taking on students for training in taxonomy. The inventory should also encompass specialised scientific societies (e.g. societies for herpetology, ichthyology, etc.);
- (4) Identify the urgent need of Countries in the field of taxonomy;
- (5) Launch programs to train taxonomists and to provide study grants and other means to encourage students to specialise in taxonomy. In this way, the bilateral cooperation mechanisms could be put to use;
- (6) Given the important role of reference collections in taxonomy work, it is important to carry out a study of the situation of reference collections of Mediterranean marine species. This study should lead to a programme for their development, continuance and networking as tools to support taxonomic work;
- (7) Promote the organisation of thematic workshops on taxonomy to allow exchanges between Mediterranean taxonomists;
- (8) Elaborate and update guides for the identification of marine species;
- (9) The implementation of the above recommendations should be integrated into a Mediterranean strategy, which must take account of their initiatives, particularly the global Taxonomy Initiative undertaken within the framework of the CBD.

The major objectives of MIT on Taxonomy are the following:

- Species that build up habitats.
- Species that are indicators of environmental quality;
- Species that make a contribution to marine resources, either directly or indirectly, by their role in trophic networks.
- Endemic species.
- Threatened species.

## 2. Materials and methods

Using the author's competencies in vegetable taxonomy, the following paragraphs report, as an exemplification, an evaluation on the state of taxonomy of marine vegetable organisms in the Mediterranean Countries, and especially in Italy.

An accurate evaluation on the state of taxonomy of marine vegetable organisms in the Mediterranean Countries needs data collection from taxonomists and from scientific Societies operating in every single Nation. As far as European Countries are concerned, from Spain to Turkey, this data is available in Official Publications [5] of the EEC. As far as the other Countries of the Barcelona Convention are concerned, information is not sufficient for an exhaustive evaluation, thus evaluations herein reported and data cited are to be deemed provisional. An exhaustive evaluation must be performed on the basis of data available on:

- Number of taxonomists with competencies in Mediterranean marine vegetables;
- Number of Herbaria with collections of Mediterranean marine vegetables registered or not registered in the Index Herbariorum;
- Number of tutors, disciplines, University Degrees (Bachelor, PHD, Masters) and of schools specialised in the field of taxonomy of marine vegetable organisms, or in general in Marine Science present in the Universities of the various Countries and accessibility to students and researchers from other Countries.

- Number of SPA and in particular of SPAMI (Specially Protected Area of Mediterranean Interest) which have laboratories of taxonomy and that organise Stages open to students and researchers from other Countries.

### 3. Results and discussion

#### 3.1. Number of taxonomists specialised in Mediterranean marine vegetables

The approximate estimate of Phycologists who work in the Mediterranean Area and/or in the linked Oceans is 534. Probably only 50% of them are concerned with Marine Botany. Scientists studying taxonomy of marine vegetables at the three levels (genetic, specific and ecosystem) are little more than 100. The available scientific literature shows that at present in the Mediterranean area there are more or less only ten high level competent taxonomists, recognised by the Scientific Community all over the world; then there are about 50 at a medium level and the rest is to be classified as taxonomy scholars of marine vegetable organisms, possessing a general culture of botanic taxonomy or of marine biology. In order to increase the number of high level specialists it is necessary to promote the institution of PHD Degrees in marine vegetable taxonomy at the major Universities in the various Countries, especially in those located along the coasts or in the islands (Table 1).

The fields of activity undertaken by the taxonomists are: Specific Taxonomy 9.1%; Molecular Biology 2.3%; Syntaxonomy 8.1%; Teaching 6.4%; and Other 74.1%.

As far as the actual knowledge on the Mediterranean marine vegetable biodiversity is concerned, it is enough documented by the publication of species catalogues both for the whole area and for the single Mediterranean Countries. Molecular Taxonomic Biology is barely represented, syntaxonomy at a habitat level is sufficiently known only in Spain, France, Italy, Slovenia, Tunisia and Greece.

MIT promotion needs the compilation of a Mediterranean Marine Flora, of diagnostic Keys supported by an iconography and by a Manual of studying methodologies of the marine phyto-benthos and of the Mediterranean habitats. Some of these instruments for taxonomy are available or under preparation thanks to the initiative of the Italian Society for Marine Biology (ISMB) and

Table 1. Distribution of phycologists in barcelona convention countries [5,6].

European countries		Non European countries	
Spain	160 Atl. and Med. Sea	Israel	38 Med. Sea and Red Sea
Italy	122	Egypt	8 Med. Sea and Red Sea
France	73 Atl. and Med. Sea	Tunisia	8
Russia	41 Baltic and Black Sea	Algeria	4
Greece	32	Morocco	4 Atl. and Med. Sea
Romania	11 Black Sea	Lebanon	4
Turkey	10 Med. Sea and Black Sea	Libya	2
Slovenia	3	Syria	1
Croatia	3		
Malta	2		
Montenegro	1		
Serbia	1		
Cyprus	1		
Monaco	1		
Albania	1		
Bulgaria	1 Black Sea		
Ukraine	1 Black Sea		

of RAC/SPA and it is urgent to finance and complete these projects and to translate the elaborates in at least two languages (French and English).

In short, Table 1, containing the distribution of Phycologists in the Mediterranean Area, shows that, with regard to the development of the coast line, there is a significant but not always sufficient number of specialists in taxonomy of marine vegetables in Spain, France, Italy, Greece, Russia, Romania, Turkey and Israel. Taxonomic researches are also performed in Lebanon, Libya, Croatia, Slovenia, Malta, Algeria, Morocco, Egypt and Tunisia. All countries need a generational renewal of taxonomists scheduled by Governments and not trusted to the chance of personal choices or to a successful University career. All Countries need to increase their number of taxonomists and to provide them with a higher level of specialisation in order to manage the Mediterranean Initiative on Taxonomy (MIT) and to carry out the Convention on Biological Diversity (CBD).

Instead, the number of reference collections in the Herbaria is acceptable and they are distributed all over the Mediterranean Countries. It is necessary to ascertain, through an inquiry, their consistency, state of preservation, management model, indexing, accessibility and fruition, availability of expert taxonomists working on Collections, the management and development financial situation. In a medium term, it is necessary to promote, for all reference Collections, an electronic indexing including scanning of the Herbaria documentation. In the long term the Governments and the UNEP/RAC/SPA should economically support the Mediterranean Herbaria with adequate informatics programs to create linked websites. The Herbaria of the Department of Botany, Algae division, of the University of Catania represents a good model of electronic data filing; another model is that of the Herbaria of the Department of Biology, Algae division, of the University of Trieste; both marine Herbaria are available online.

Synthetic data summarising the biodiversity of the Mediterranean marine organisms are reported in Tables 2, 3 and 4.

Table 2. Biodiversity of marine organisms [6].

Ecosystems	Area	Plants (Macrophytobenthos)	Animals (Metazoans)
World Ocean	99.2%	8000	130,000
Mediterranean Sea	0.8%	1351 (16.2%)	7,241 (5.5%)

Table 3. Chorological spectrum of the Mediterranean marine organisms [6].

Bio-geographical regions	Animals	Plants
Mediterranean Sea (endemisms)	28.6%	26.6%
Mediterranean Sea + Atlantic Ocean	50.1%	48.6%
Mediterranean Sea + Indian-Pacific Ocean	4.4%	4.9%
Mediterranean + Atlantic + Indian Pacific	16.8%	19.9%

Table 4. Marine organisms found in the last 50 years in three Mediterranean geographic sectors [6].

Kingdom	West Mediterranean Sea	Adriatic Sea	East Mediterranean Sea
Animal sp. n. 4094/7.241	87.1%	48.9%	43.1%
Plant sp. n. 1.100/1.351	89.5%	64.4%	57.6%

As far as vegetable biodiversity is concerned, an updated list of the vegetable, marine and brackish assemblages in the various Mediterranean habitats, along with the list of Mediterranean endemic vegetable species, is reported in a RAC/SPA publication [7]. According to the CPN norm (Code of Phytosociological Nomenclature, Barkman and others, 1986, subsequently updated), types are documented in published phytosociological tables. Three monographs on Mediterranean marine vegetation contain all information on vegetable marine assemblages effectively or non effectively described for the Mediterranean Sea [8–10].

As far as genetic biodiversity is concerned, there are just a few bio-molecular studies and the most advanced were mainly carried out on some marine Angiosperms (*Posidonia* and *Halophila*), on species of the *Caulerpa* genus and on some Cyanobacteria. There are no genetic sequences officially deposited for any Mediterranean marine vegetable species, even though interesting experiences are being carried out in some labs on this aspect of the vegetable biodiversity. In Italy, the most advanced centres are those of the Zoological Station in Naples for marine Angiosperms, those of the University of Pisa for the genus *Caulerpa* species and those of the University of Catania for Cyanobacteria.

### 3.2. *Conferences on algal taxonomy held to favour exchanges among taxonomists in the Mediterranean Area*

In the Mediterranean Area covered by the Barcelona Convention there are some scientific societies periodically organising thematic conferences on taxonomy of vegetable species of the biogeographical Mediterranean Area. OPTIMA (Organization for the Phyto-taxonomic Investigation of the Mediterranean Area) is the international scientific society appointed to do this.

The X OPTIMA Meeting was held in Palermo on 13–19 September 2001 during which a Symposium on Marine Algae was organised by G. Giaccone on the following themes (proceedings were printed in 2003 on the 16th volume of the *Bocconea* magazine, published under the auspices of OPTIMA):

- Taxonomy of Rhodophyta with particular reference to Mediterranean species (by A. Athanasiadis, Goteborg).
- Taxonomy of Phaeophyta, with particular reference to Mediterranean species (by A. Gómez Garreta, Barcelona).
- Chemotaxonomy and evolution of Mediterranean Marine genus *Cystoseira* C. Agardh (Phaeophyta, Fucales). (by V. Amico, Catania).
- Corallinales des Mer Italiennes: connaissance actuelle et futures perspectives (by G. Bressan, L. Babbini, Trieste).
- The benthic macroalgal flora of Italy : floristic and geobotanic considerations (by G. Furnari, M. Cormaci, G. Giaccone, Catania).

In Spain, the ‘Simposio Nacional de Botànica Criptogàmica’ periodically organises ateliers on Cryptogams of the Mediterranean Area and of the near Atlantic Ocean, with a section on Phycology for both marine and fresh water species. The working group for Phycology of the Italian Botanic Society, holds periodical meetings in Italy.

Since 1996, the European Symposium of Phycological Society is held in Europe every four years and it is attended by Phycologists coming from the Mediterranean Countries. The International Seaweeds Symposium is also held every four years. Marine vegetables themes are also treated in ateliers organised during the ICSEM (International Commission for Scientific Exploration Mediterranean Sea) and the ISMB (Italian Society for Marine Biology) Congresses. Finally, within the MAP (Mediterranean Action Plane) RAC/SPA organised tree Mediterranean Symposia on Marine Action Plane for the Conservation of Marine Vegetation in the Mediterranean Sea

(Ajaccio, 2000 and Athens, 2003, Marseille, 2007) [11]. The proceedings were published and these Symposia will be probably organised again every three or four years. Thus, it is presumable that scientific societies and societies organising Symposia and Congresses on the Mediterranean coastal and marine vegetation, are willing and ready to organise future occasions of meetings and exchange of taxonomic knowledge in the Mediterranean Area. The RAC/SPA role could be that of sponsoring and programming a series of themes aiming at increasing the taxonomic culture on the Mediterranean marine organisms both at a species level and at a genetic and habitat one. Finally, in December 2005 within the MIT context, the RAC/SPA organised at the Phycology Lab of the Department of Botany of the University of Catania, an international Session of training on reference collections of marine vegetation, attended by young researchers from Lebanon, Tunisia, Algeria and Morocco.

In May 2006 at Tabarca in Tunisia, the RAC/SPA organised within the MIT context, two workshops among taxonomists expert in biodiversity of the Mediterranean Sea: one on Coralligenous assemblage and on organogenic surface formations in the Mediterranean Sea and the other on the Red Coral.

### **3.3. Drawing up and updating of identification guides for the Mediterranean vegetable marine species**

#### *3.3.1. Guides and general catalogues*

The only general guide for the identification of the vegetal biodiversity, treating species and their aggregations in the various habitats of the Mediterranean littoral system, was published in Trieste by G. Giaccone on 26 February 1973. As far as taxonomy at a species level is concerned, the guide reports analytical keys of Cyanophyta, Rhodophyta, Phaeophyta, Chlorophyta and Angiospermae.

This guide was conceived for students on Phycology. This discipline was taught in Italy for the first time, after the author obtained in 1969 his diploma as a University teacher on Algology. The guide also contained a complete iconography which was never published but photocopied for students.

In 1986, in Palma de Mallorca (Spain), on the occasion of the 30th Congress and Plenary Assembly of the International Commission for the Scientific Exploration of Mediterranean Sea (ICSEM), a project was presented for the drawing up of the Mediterranean Algae Check List and of their distribution ascertained since 1940.

At present the following parts have been published: Fucophyceae [12], Chlorophyceae [13], Rhodophyceae Ceramiales [14].

Furthermore, other general publications on Mediterranean marine species biodiversity are still existent [15–24].

Literature estimates that biodiversity of the Mediterranean Macrophytobentos is formed by 1.351 taxa and represents 16.2% of biodiversity of the world Ocean, even though the marine area of this sea is only 0.8% of the world Ocean: so it is a relatively high vegetable biodiversity.

#### *3.3.2. Partial guides and catalogues*

Partial guides for the identification of the marine vegetation were generally written for divulgating purposes and for environmental education and treat only a dozen or at the most a hundred of species [25–34]. The most recent catalogue reporting the distribution of marine algae (924 taxa valid on 1063 registered by the various authors after 1940) along the Italian coasts is published by Furnari et al. [35].



National marine flora catalogues, or catalogues of delimited stretches of coast and in particular of the Mediterranean islands, are available for almost all the Mediterranean Countries, as confirmed by the result of the RAC/SPA/SAP/BIO (Strategic Action Plan for the Conservation of Biological Diversity) Questionnaire 'Questions about the status of knowledge of marine and coastal biodiversity in the Mediterranean Sea' prepared by Boero [36].

### 3.3.3. *Floras and Monographs*

As far as the Mediterranean Sea is concerned, there is a lack of general marine floras both in the whole basin and in the single nations. On the contrary, there are many national terrestrial floras and one for all the European Countries. The publication of the Iberian Phycologic Flora has been started in Spain, but only the first volume was published [37]. In these last 50 years of studies on the Mediterranean Sea, some monographs have been published on taxonomic Orders, Families and Genus complexes. Usually, these systematic monographs are not limited to the Mediterranean taxa, but they treat them in particular. The Authors of these partial taxonomic monographs are Phycologists both from the Mediterranean and from other Countries. A non exhaustive list of these monographs and identification guides can be consulted in the above mentioned volume of Costello et al. [18]. An exhaustive list of taxonomy texts at a gene, species and habitat level, is reported in the attachment relative to the list of volumes and extracts kept in the Department of Botany, Phycology Lab Library of the University of Catania [6].

### 3.3.4. *Technical Manuals and/or practical guides for the study of the Mediterranean marine vegetal species or biocenotic diversity*

During these last decades in the Mediterranean area scientists have been trying to standardise methods for the study of marine vegetal species and biocenotic biodiversity. Some projects are nearly ready, others have already been carried out [38–54,58].

Working Groups of the Italian Marine Biology Society are drawing up some guides and manuals projects for the study of the Mediterranean marine biodiversity, among them the most advanced and nearly finished are [59].

### 3.3.5. *Action Plan for the Conservation of the Mediterranean Marine Vegetation*

On the 9 and 10 April 1999 in Tunis at the UNEP office (RAC/SPA), a group of experts sent by the Parties contracting the Barcelona Convention, elaborated, in the context of the MAP Phase II, an Action Plan for the Conservation of the Mediterranean Marine Vegetation. The plan was approved in Malta in October 1999 [60], Italy ratified it in 2000. An evaluation on the realisation of the Plan was written in a document approved in 2005 in Seville during a meeting of the Focal Points for SPA [11].

The need to elaborate an action plan for the marine vegetation, is justifiable on the one hand for the relevance of the vegetal diversity of this sea that, even though representing 0.8% of the World Ocean surface, hosts 16.2% of the whole planet marine vegetation (26.6% are endemic species!), and on the other hand for the collection of evidences of wide degraded coastal areas, without vegetal mantle and often undergoing the action of invasive species of tropical origin.

Furthermore, conservation of the marine vegetation is introductory and fundamental for the conservation of the entire Mediterranean biodiversity and habitats, not only for its trophic role, but also for its role as a fundamental biotic factor in the evolutionary ecology of the marine and coastal ecosystems of this bio-geographic province of the Planet.

Numerous threats hang over the Mediterranean vegetation and they are different according to the pertained species and to regions.

The major threats are:

- development of inhabited and productive infrastructures along the coasts: pollution;
- anchorage in sandy and rocky bottoms;
- trawl fishing;
- the uncontrolled development of aquaculture and mariculture systems, in places not devoted to this productive usage or non compatible with these installations.
- use of explosives for fishing or for industrial works;
- laying of undersea cables;
- discharging of solid materials along the shore, without prior building of containing structures on the sea front;
- changing the sedimentary regimen with interventions on the river beds and on the hydrographic basin;
- extracting sand from the sea-bed for beach restoration;
- competition with imported non-native species;
- stamping on the rocky littoral and leveling of sandy dunes for tourist and agricultural usages;
- extreme exploitation of vegetal species for industrial and alimentary purposes;
- upheaval of the rocky bottoms due to date-mussels fishing;
- uncontrolled fishing of herbivores (fishes, sea urchins etc.) that thwarts the picking process to conserve the vegetal mantle diversity.

The major objective of the Action Plan are:

- conserving both the vegetal biodiversity and the different vegetal assemblages. Their conservation also needs promotion and increasing of studies on biology and ecology of species and of communities;
- preventing disappearing and degradation both of marine Angiosperms meadows and of the other vegetal formations, conserving the biotic and abiotic conditions of the Mediterranean coastal marine environment;
- conserving the marine assemblages that can be considered as natural UNO monuments such as *Posidonia* barrier reefs, terraces or platforms with Vermetids, covered by soft algae; algal organogenic surface formations; Coralligenous circalittoral assemblages and certain *Cystoseira* belts.

To achieve these objectives it is necessary to carry on concrete actions in the Mediterranean regions and nations by basins and homogenous bio-geographic sectors. Safeguard and promotional actions regarding in a particular even though not critical way, all species listed in the Annex II of the SPAMI Protocol of the Barcelona Convention, must be extended at least to the habitat building species, such as marine Angiosperms, *Cystoseira* species and limestones bilding algae.

It is urgent to produce in the research centers of the contracting Parties, the following scientific documents: marine vegetal species critical lists, updated mapping on their repartition, floras by basins and bio-geographic sectors, registering and classing of sources and causes of the marine vegetation degradation. At a Mediterranean regional level, it is urgent to offer a specialist training to the young researchers of those Countries with a lack of research and training centers in Marine Botany. In order to do so, developed Countries must boost specialist trainings and increase the number of trainers and researchers in Marine Botany.

#### 4. Final remarks and recommendations

Mediterranean cultures, being rooted in the conception of unity of the human beings and of the sacral characteristic of nature, are open to a culture able to carry on solidarity among States 'in managing resources and their common cultural heritage to the advantage of the present and future generations' (MAP II).

This solidarity promotes conservation of biodiversity and nature sustainable development, it integrates environmental, economic and social needs resulting in the eradication of poverty and safeguarding of the natural resources.

This strategy is based on the definition contained in the report on 'Our common future' of the Brundtland Commission (WCED, 1991), appointed by UNO, after the Stockholm Conference (1972), to prepare the document 'A global agenda for change', in view of the Earth Summit in Rio (1992) on the sustainable development and conservation of biodiversity which led to the formulation of the Agenda 21 'A sustainable development is a development that satisfies present needs without impairing the ability of future generations to satisfy their needs'.

The 'satisfaction of needs' is thus the central point of the whole view of the UNO Commission, that the General Assembly translated into some strategic priorities, clearing claiming that 'it is necessary to give a clear priority to the concept of "necessity", in particular the necessity of our contemporary most indigent people' and in the holistic conception of the human species and biodiversity conservation, of the future generations which, without biologic resources and a proper environment, could not have their fitness. In summing up the document of the Brundtland Commission: 'We can affirm that the concept of sustainable development leads to a major change, which needs a new culture, based on the social question, and in particular on the eradication of global poverty; a culture characterised by the respect of nature, based on new economic, technological and legislative paradigms including production and consuming standards. This culture could be the great challenge of next century' [61].

This culture, also in the scientific field of knowledge on biodiversity and development sustainability, urges anthropologic models, political structures and habits not existing at present, shifting from the individual to the community, from a limited group to a global family, structured at a regional level, sharing knowledge, technologies and resources in the respect of the spiritual and cultural values of the Mediterranean area communities: '... The economy of spiritual forces is, for the destiny of a community, still more determinant than the economy of economic instruments... Freedom implies belief, ethical belief, education and consciousness' [62].

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