ACTION E2

Summary

The conservation of species, habitats, ecological and developmental processes, the safeguard of the sustainability of natural resources and the protection of the quality of a system are accomplished through the application of accepted methods of sustainable management of which an essential tool is monitoring. Monitoring is necessary for the assessment of the conservation status of the structural and operational characteristics of the system, for the evaluation of the efficiency of the management measures implemented in an area, for the early diagnosis and prediction of problems, etc.

Under the frame of the ACCOLAGOONS project, Action E.2: Establishment of a monitoring system for the marine habitat types aimed at the enhancement of the conservation of the priority and the rest marine habitats at both sites. As identified under the implementation of Action A2, the following marine habitat types (included in the Annex I of the Directive 92/43/EC, or not) were identified in both sites:

1110	Sandbanks which are slightly covered by sea water all the time
*1120	* Posidonia beds (Posidonion oceanicae)
*1150	* Lagoons
1170	Reefs
119A	Soft substrata without vegetation
119B	Soft substrata with vegetation

The establishment of a monitoring system is of a great importance for the conservation of the above mentioned marine habitat types. As defined by the bibliography, monitoring is the periodic (in regular or non-regular intervals) survey, which is conducted to test the degree of convergence with a standard or some baseline data or the degree of deviation from a predicted value. Examples of such standards or baseline data are the population of an animal species, the vegetation cover, the species lists or numbers of species, the structure of habitats, the classification of plants and the presence-absence of indicator species. Through monitoring, any change (or the

absence of it) in time and in a specific site is being detected. However, most of the times it is hard to determine how large the change in the value of the indicator must be (in quantity or characteristics) so as for it to signal the need for a modification on the existing management practices or the implementation of new measures. This occurs mainly because of the numerous gaps that exist in our knowledge and understanding on the dynamics of any natural ecosystem. For the implementation of a monitoring program a necessary condition is the presence of baseline data since, and in accordance with the above definition, it is a survey process which is conducted to test the degree of convergence with a standard or some baseline data or the degree of deviation from a predicted value. In the case that such data do not exist, the first step of the implementation process is the collection of data on the subject to be monitored, followed by regular or non regular survey (Baseline Monitoring Program) and specification of the reference level (temporal definition). Concerning the pre-operational situation in both sites, as regards to the marine habitats, it should be mentioned that the only available data (either baseline data or updated data) were from the relevant project "Habitats identification and mapping", of the Ministry for the Environment, Physical Planning and Public Works.

The design and establishment of the monitoring system for the marine habitat types in the studied area took into consideration the results of Action A2 « Management plan of the priority habitat type *1120 "Posidonia beds (Posidonion oceanicae)" and of other marine habitat types of the project marine zone» and it was implemented at three scales:

- ✓ Monitoring at a macroscale, via mapping of habitat types, implemented every three years via the combination of remote sensing techniques (satellite images) and in situ verification (two maps produced for each site during ACCOLAGOONS: during 2011- Action A2 and 2014-2015 – Action E2).
- ✓ Monitoring at a mesoscale, via observing *Posidonia oceanica's* limits and via observing permanent surfaces: limits are being monitored with SCUBA diving in combination with satellite images and the establishment of a system with fixed marks. Monitoring of the fixed marks (balise) takes place every two years (implemented twice during ACCOLAGOONS - first record in 2012 during the establishment and second record during the summer of 2014). The permanent sampling surfaces are being monitored at least once a year: it took place four times during ACCOLAGOONS for the years 2012-2015.

- ✓ Monitoring at a microscale, via the combination of non destructive (in situ measurements) and destructive methods (samples collection): includes the detailed description of the phytocommunities (number of taxa, coverage of taxa, etc) on both hard and soft substrate (habitat types *1120, *1150, 1110, 1170 & 119B) as well as epiphytes, samples are being sorted under a stereoscope and taxa are identified with a microscope, it took place twice during ACCOLAGOONS (2012 and 2014, with additional sampling during 2013).

In details, from the onset of this Action (January of 2012) until the end of it (September of 2015), the following actions took place:

- Research and continuous review of literature and other relevant documentation concerning Mediterranean marine phytocommunities and monitoring methods
- Planning of the establishment of a monitoring system of *Posidonia oceanica* meadows' and other communities on both hard and soft substrate: meetings with the divers – scientists, field excursions based on maps produced during the Action A2 and on personal unpublished data, evaluation of personal experience of our external collaborators from the establishment of such monitoring systems in other Mediterranean areas.
- Preliminary survey of the selected proposed sites via SCUBA diving. During our preliminary survey we visited and swam around extended areas, looking for the meadows' limits. As a result of this procedure, we have chosen two sites for the establishment of a monitoring system of *Posidonia oceanica*'s limits in Epanomi. One meadow is located at the northern part of Epanomi area, close to the lagoon, whereas the other meadow is at the southern part of the area (during 2012).
- Permissions from the Port Authority for the establishment of the monitoring system and for all the *in situ* actions.
- Placement of the fixed marks (balise) in two meadows' sites. The establishment of the monitoring system as well as all of the previously mentioned *in situ* actions was realized as scheduled by divers – scientists with a rented boat and rented diving equipment. This was a time and energy consuming procedure which included: approaching and finding of the

previously selected points of the meadows (via GPS use), throwing of the balises from the boat, removal of the balises underwater from the divers and the placement in their final position, taking pictures and videos as mentioned in the literature, etc.(during 2012)

- Collection of data concerning the structure of the marine habitat types. Two methods were realized: a) Non destructive methods (*in situ* data collection). Direct observations by SCUBA diving along the shoreline: quantitative measurements by the use of quadrats or photographic images or semi-quantitative abundance estimations by the use of reference scales. The above mentioned methodology was implemented mainly in phanerogams' meadows and in particular in *Posidonia oceanica* meadows, *Cymodocea nodosa* meadows, *Zostera noltii* meadows and in mosaic meadows. B) Destructive methods (collection of samples). In order to estimate the status' tendency as well as the structure changes of macroalgae phytocommunities on both sites, we collected samples via SCUBA diving, from sampling areas of 625 cm2 regarding the typical hard substrate by means of a hammer and chisel. Additional sampling was randomly made in order to collect as many species as possible. Samples collected were preserved in appropriate conservative solutions were analyzed at the laboratory (during 2012 and 2014, with additional in situ observations during 2013).
- Establishment of a monitoring system via permanent surfaces (including cases where patches of *Posidonia oceanica* are present and not a meadow) at Aggelochori site. Monitoring was implemented by visiting the specific sampling surfaces at least once a year and recording *in situ* reduction or expansion of phytocommunities, presence or absence of characteristic species or/and sampling when needed (during 2012, 2013, 2014 and 2015).
- Mapping of the marine habitat types via the combination of remote sensing techniques and in situ data collection (during 2014-2015). In details, a map for each site was produced during 2015 in order to create a time series of data.

For the implementation of all of the above mentioned actions, the personnel of BEC worked together with external experts. For the collection of as many data as possible, the team leader of the action and other colleagues visited the sites for more

than 30 times during those 4 years, trying to cover all seasons and as many sampling points they could. Almost all of the areas in both sites were investigated either by the coast or by using a boat. The satellite images of the sites were very for the estimation of habitats extent and the identification of mosaic meadows.

As for the general conclusions of Action E2:

- ✓ Monitoring at a macroscale: all of the habitat types identified and mapped during 2011 (Action A2) were also recorded during 2015. The *Posidonia oceanica* meadows constituted a very important (by means of extend) habitat type in Epanomi south site (strengthening the necessity for Natura 2000 site's extension). There was an increase in *Cymodocea nodosa* meadows and therefore an increase in habitat type 119B, which replaced 119A in a lot of points within Epanomi South region. The habitat type:* 1120 remained almost stable, with some new small patches of *Posidonia* being abundant throughout the sites.
- ✓ Monitoring at a mesoscale: as a general remark the limits of *Posidonia oceanica* meadows that we monitored with fixed marks remained almost stable between the years 2012 and 2014. In few points in Epanomi South the meadow expanded and in few points in Epanomi North the meadows shrinked. In Aggelochori, as monitored via the establishment of permanent surfaces, some patches shrinked and some new patches appeared. The main reason that we did not notice significant differences in Epanomi meadows is that the meadows are in a better conservation status than in Aggelochori and changes are taking place slowly due to the relative stability of the meadows. On the other hand, in Aggelochori we haven't noticed extended dense meadows but mainly pathes which are not so stable and they are more vulnerable to environmental pressures which are more significant in Aggelochori. Concerning the other habitat types, which were monitored via permanent surfaces we noticed that most of the phytocommunities presented seasonal changes as a result of changes in epiphytism and in the life cycle (falling of leaves, etc) of the plants.
- ✓ Monitoring at a microscale: The values of phonological parameters are normal for the meadow of Epanomi South site and not normal for the sites Aggelochori and Epanomi North (reduced foliar surface, intense foliar necrosis, increased grazing, major epiphytism, etc). The meadows of Aggelochori site are characterized by the intense development of epibiotic organisms on the leaves, which actually lead to an increased foliar necrosis, especially regarding the adult leaves. The region of

Epanomi North is facing an increased grazing pressure, which is obvious from the missing leaves' apex or even from the marks on the sides of the leaves. The invasive green macroalgal taxa *Caulerpa racemosa* was abundant in Epanomi North site during 2012 and 2013, whereas it disappeared during 2014 and 2015. The phytocommunities of *Cystoseira* spp. species are characterized by a higher biodiversity which increases along the gradient of Thermaikos inner gulf to Chalikidiki. Populations of opportunistic nitrophilous chlorophyceae are abundant in Aggelochori site. The priority habitat type *1150 is characterized by the presence of marine angiosperm meadows such as *Zostera noltii* and *Ruppia cirrhosa.*

According to the results of E2 Action, the established monitoring system can play an important role in future Integrated Coastal Zone Management of both Natura sites as it can be used to understand the trend and the mechanisms affecting the extent and structure of the habitat types. During the implementation of E2 there were no particular issues instead of the delay of the placement of the friendly moorings. Although this delay does not interfere with the fulfilment of E2 Action, we agree that under the frame of Action E2 it would be important to estimate the results of the management action of environmentally friendly mooring's installation. Nevertheless, the delay of the implementation of Action C1 did not give us the opportunity to do so. Despite those circumstances, the estimation of C1's results on *Posidonia oceanica* meadows will be implemented, during the new project that will be realized after ACOOLAGOONS. In details, RCM has released a tender and the offers are under evaluation.