PLASMAR

Bases para la planificación sostenible de áreas marinas en la Macaronesia

Activity 2.3.2. Marine Monitoring Campaigns

TECHNICAL REPORT

PLASMAR Consortium

PROYECTO COFINANCIADO POR LA UNIÓN EUROPEA
Investigación e Innovación

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1 Introduction

Monitoring campaigns were undertaken in the different archipelagos considering the methodologies developed in Activity 2.3.1. The rotation of teams and experts among the project partners was foreseen in order to promote a better exchange of methods, knowledge and experiences among Plasmar partners. The data obtained in campaigns will be included in the IDDM as data sets compliant with INSPIRE and available for the final action: 2.1.2 Pilot zoning.

2 Partners involved

- Agência Regional para o Desenvolvimento da Investigação, Tecnologia e Inovação (**Activity coordinator**)
- Universidad de Las Palmas de Gran Canaria,
- Governo Regional dos Açores- Direção Regional dos Assuntos do Mar,
- Dirección General de Pesca. Consejería de Agricultura, Ganadería, Pesca y Aguas Gobierno de Canarias
- Secretaria Regional do Ambiente e dos Recursos Naturais- DROTA

3 Results

The results presented refer to the campaigns developed between the different Plasmar partners in the Macaronesia region.

3.1.1 3.1.1. Habitat monitoring

Based on the developed monitoring method of the benthic habitat, documented by deliverable of action 2.3.1 *Habitat characterization protocol, using acoustic tools: Side Scan Sonar*, we delivered first habitat monitoring campaign at Gran Canaria. The campaign was delivered in March 2019 with the idea to survey benthic habitat in areas, of Gran Canaria that were assigned for the aquaculture industry.

The campaign was delivered on:

11/03/2019 – The equipment was ensembled at 9:30 on the boat that was rented for the campaign. Although weather forecast was predicting calm sea, without waves, the conditions in front of the PLOCAN site were not satisfying to perform survey. Waves were not exceeding 1m high, but still disturbing acoustic print delivered by sonar. Due to that survey on the Area 1 was finalized at 13:00 and continued in the area that is covered by local port Talliarte. We finalize daily campaign testing the equipment in the area where conditions were satisfying.

12/03/2019 – Delivered daily survey in front of the Punta Salineta, conditions were very well, and daily campaign fulfil with plan.

13/03/2019 – Delivered survey in front of the Punta de Tufia and area in front of the airport. Conditions were satisfying and daily campaign fulfil with plan.

To obtain final results, classified benthic habitats for surveyed area, it is necessary to preform another survey, recognizing benthic habitats in situ for established referenced points, diving or dragging submarine camera.

Delivered and tested method needs perfect conditions (waves <0.5m), and post campaigns of recognizing benthic habitat.

The campaigns were very time costly and did not provide results that we excepted. It is necessary to improve method, as current method is expensive and not efficient.

Due required weather conditions, it was impossible to plan and organize campaigns in Azores and Madeira.

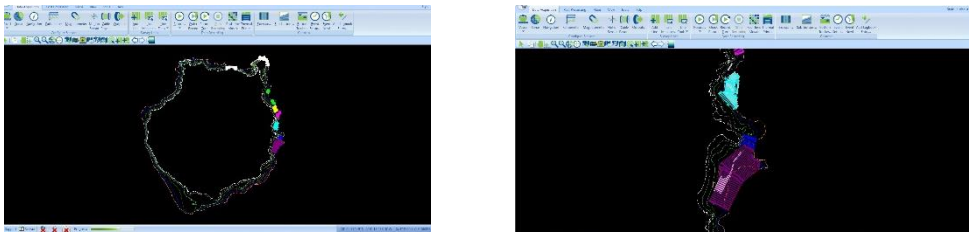

Figure 1. *Images regarding the Habitat monitoring campaign performed in Gran Canaria.*

3.1.2. Non-Indigenous Species

The introduction of non-indigenous species (NIS) is actually a common threat to biodiversity in coastal communities, and in the last years the rate has significantly increased. Maritime traffic is currently a vector which more contribute to exchange marine species around the world. Artificial substrates like pontoons or breakwaters provides particularly favourable habitats for many NIS, turning harbours and marinas hotspots to new species arrivals. Within PLASMAR project we compared three different sampling methods in order to identify the optimum one to monitor and detect, with image analyses, new conspicuous species arrival in marinas of Macaronesia region. The three methods were tested in two marinas of Madeira Archipelago: marina Quinta do Lorde (Madeira Island) and marina Porto Santo (Porto Santo Island). The first method consists in the placement of PVC plates (10x10x0.3cm) horizontally in the marina (1m deep) working as an artificial subtract and control system here for the arrival of fouling species; the second method consists in taking photos of the pontoons in the submerged part; and the third method consists in making videos (1 min.) also of the submerged part of pontoons. The images obtained from each method were analysed with a specific software in order to compare the information that each method provides. The preliminary results showed that the video method provides adequate information about abundance and richness of conspicuous species arrivals, and consist in a simple, cheap and fast survey. This new video methodology is now being used at regional scale by monitoring the principal marinas and ports of Canaries, Azores and also Madeira archipelagos. The development and application of a standard and common approach for the detection of NIS in the Macaronesia is a key step in order to unify and give a coordinated response to the European Commission's Marine Directive in relation with the Descriptor 2.

3.1.3. Marine Litter/ Microplastics

Plastic pollution is a global threat around the world that Microplastics, as small particles are ubiquitous and can have additional negative impacts for marine ecosystems. The damage that microplastics can cause, not only physical, due to ingestion, but also the effects of the associated chemical pollutants in marine life, is still unknown. Within PLASMAR project we evaluated the levels of microplastics on beaches, and sea surface in the Macaronesian region. In beaches the microplastics present in the tidal line were quantified, and in the surface of the sea the floating microplastics were collected with a manta net. The preliminary results showed that microplastics are present in the sediments of all sampled beaches of Madeira and Gran Canaria. In Madeira the most abundant items were the filaments (Álvarez, S. et al., 2019, submitted for

publication). The samples analysed confirm also the presence of microplastics on sea surface with predominance of fragments and fibres (Herrera, A., et al 2019, submitted for publication). In Gran Canaria, results showed that in the north and northeast oriented beaches maximum abundances up to 244 gr/m^2 were found in the tidal line. On the sea surface, the maximum values were found at Las Canteras Beach (Gran Canaria island, Canary Islands), a semi-enclosed bay, with concentrations of more than one million of particles/Km^2.

According to these results we conclude that Macaronesia is an area highly affected by microplastic contamination and that microplastics are present in the food web. The results of these studies have been published in one article in the Marine Pollution Bulletin and another two articles are under review. In addition, methods for study microplastics on beach and sea surface were standardized and the methodologies published in common protocols for the Macaronesian region. The methodology developed for separating microplastics from organic matter was published in the Marine Pollution Bulletin.

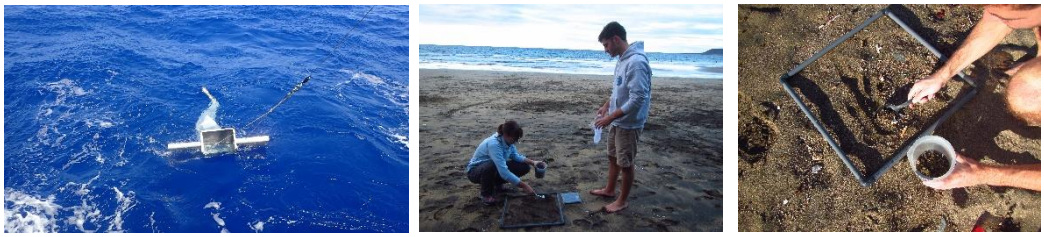

***Figure 2**. Images of the sampling methodology for microplastics. First picture on the left refers to the use of manta trawl (for water sampling); pictures on the wright side refer to protocol developed for beach sampling.*

3.1.4. Population of commercial fish species & Elements of food webs

Catch statistics are the most widely available fisheries data but very few stocks have reliable biomass assessments. On the other hand, effort data are not available for many fisheries, so it is not possible to standardize to produce CPUE as an indicator of biomass making it difficult to estimate sustainable biological and exploitation limits. For the evaluation of the criteria included in Descriptor 3 of MSFD we used a method for stock assessment of data-poor fisheries including some representative species of the three archipelagos, either due to the volume of catches or their biological importance. The results obtained allow a preliminary evaluation of these stocks based on the F/FMSY and B/BMSY criteria. This type of model has its limitations and its uncertainty depends on the input data, but nevertheless it serves as a first approximation to estimate the MSY and this information can be combined with other information available to propose possible management strategies.

Regarding Descriptor 4, the monitoring methods include the development of ecosystem models using Ecopath with Ecosim software. These models will allow the analysis of trophic networks and the state of marine ecosystems; also, the spatial results referring to biodiversity will be uploaded to the web platform INDIMAR. To include the distribution of the fleet in these models for a better adjustment of the impact of fishing on marine species, campaigns were developed by the Canary archipelago that collected spatial data on the usual fishing areas of the artisanal fleet. The ecological models allow understanding the food web structure for a particular area, and dynamics simulations using the temporal and spatial modules included in the software can help clarify the exploitation status of the stocks. This tool also enables to identify important gaps in our present knowledge of the ecosystems for further research.

3.1.5. Sea floor integrity

Monitoring campaigns provided: a description of the community present on the sandy seafloor; an assessment of possible changes in the biological structure of that habitat, as consequence of the sand extraction; an evaluation of the impacts caused by the activity, and a description of geological dynamics of the extracted areas.

Campaigns followed four methods: with nets on the suction tube on board of vessels licensed to monitor organisms sucked during the extraction; visual surveys on the seafloor for biological characterization of undisturbed bottoms and after pumping, for a qualitative assessment of macro fauna; underwater sampling quadrats by SCUBA, with compressed air sucking tube. Samples of sediment were characterised (type and granulometry) and used to determine the concentration of heavy metals (Hg, Cd, Pb, Cr). The analysis also aimed to evaluate the plastics present in the sediments.

The results obtained at the end of the sampling period, showed that these methodologies are complementary, indicating that there is no perfect method to do this kind of studies. Overall, it was not possible to distinguish differences in biodiversity between exploited and non-exploited areas, although higher values for several species were found between São Miguel samples and Faial island.

Campaigns and reports prepared by Fundação Gaspar Frutuoso, University of the Azores, delivered to the Regional Directorate for Sea Affairs (DRAM), Secretariat for the Sea, Science and Technology, Regional Government of the Azores, under the 25/DRAM/2018 service provision contract, PLASMAR project (co-financed by ERDF as part of POMAC 2014- 2020).

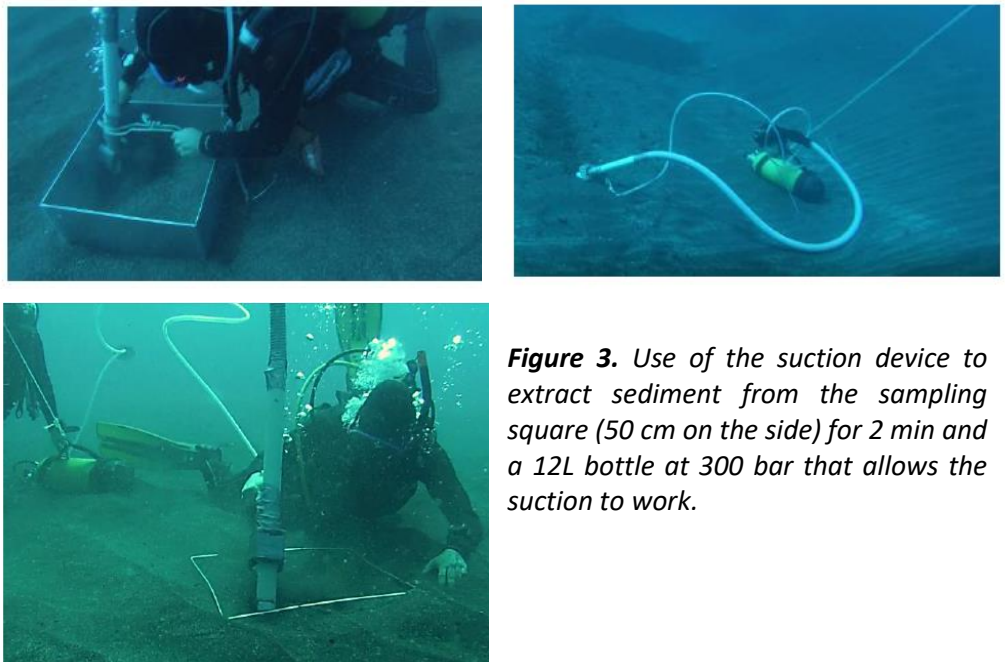

Figure 3. *Use of the suction device to extract sediment from the sampling square (50 cm on the side) for 2 min and a 12L bottle at 300 bar that allows the suction to work.*

3.2. Workshops and Training Sessions

3.2.1. Habitat monitoring

In relation to the habitat monitoring, project partners were given chance to participate in our pilot campaign at Gran Canaria. As this type of campaigns are conditioned by the sea conditions, we could only provide few days before when we are going to preform monitor. As we excepted good weather in March, we invited all partners that there is a possibility to participate in pilot habitat campaign. ARDITI send one person which participated in campaign, get experience with side scan sonar and understand all issues and problems to use this equipment.

3.2.2. Non-Indigenous Species

- Campaign to define the methodology: 3 times, 2 locals (Q. Lorde and Porto Santo) = 6 sampling
- Macaronesian campaign: 1 time, 15 locals (6 Canary, 5 Azores and 4 Madeira) = 15 sampling
- Madeira campaigns: 4 times, 4 locals (Calheta, Funchal, Q. Lorde and Porto Santo) = 16 sampling

In the 19th April 2018, in the marina of Ponta Delgada (São Miguel Island, Azores) it was performed a training on a new methodology developed by the MARE-ARTITI team for monitoring Non-Indigenous Species (NIS) in human-made structures implemented in harbors or marinas in Macaronesian region.

Figure 4. *Images of the training session in Azores for NIS detection in marinas.*

3.2.3. Microplastics

Regarding the microplastics training sessions, they were organized dividing the protocols for sediments and for sea surface.

Concerning sediments:

- Pilot study: 1 time, 5 locals (Seixal, Porto da Cruz, Prainha, Formosa and Porto Santo) = 5 sampling

- Monitoring campaign: 4 items, 5 locals (Calheta, Funchal, Machico, Prainha and Porto Santo) = 20 sampling

Concerning sea surface:

- Campaign 2017: 1 time, 12 transects = 12 sampling

- Campaign 2018: 1 time, 6 transects = 6 sampling

In April 2019 there was a workshop in Azores for all project partners so that all regions could have the knowledge of the sampling protocols developed. Attendance list in Annex I.

Figure 5. *Images of the workshop of microplastics sampling protocol performed in Azores in 2019.*

3.2.4. Population of commercial fish species & Elements of food webs

There was a Workshop subjected to the theme: “Introduction to ecosystem modelling with Ecopath with Ecosim (EwE)” performed for all partners in Apil of 2019 in Azores.

Figure 6. *Images of the workshop on Ecopath and Ecosym performed in Azores in 2019.*

3.2.5. Sea floor integrity

In the project proposal, it was planned to hold a workshop and a "training session" in each of the 3 archipelagos. However, the contract "Development of Marine Monitoring Methods Necessary to Apply the Ecosystem Based Approach, Activity 2.3.2 - PLASMAR Project Marine Monitoring Campaigns" only started in October 2018, consequently the fieldwork and validation of the proposed methodology ended in early 2020, which made it impossible to carry out the above-mentioned activities.

4. Annex

4.1. Papers

4.1.1. Couce Montero, L., Christensen, V., Bilbao Sieyro, A., Pérez González, Y., Jiménez Alvarado, D., & Castro, J. J. (2019). Temporal and spatial predictions of effect of alternative

fishing policies for the Gran Canaria marine ecosystem. Journal of Fish biology, 94(6), 882-895.

4.1.2. Ferrario, J., Gestoso, I., Ramalhosa, P., Cacabelos, E., Duarte, B., Caçador, I., Canning-Clode, J. (2020). Marine fouling communities from artificial and natural habitats: comparison of resistance to chemical and physical disturbances. Aquatic Invasions (*in press*).

4.1.3. Gestoso, I., Cacabelos, E., Ramalhosa, P., Canning-Clode, J. (2019). Plasticrusts: A new potential threat in the Anthropocene´s rocky shores. Science of Total Environment. 687, 413-415.

4.1.4 Herrera, A., Asencio, M., Martínez, I., Santana, A., Packard, T., Gómez, M. (2018). Microplastic and tar pollution on three Canary islands beaches: An anual study. Marine Pollution Bulletin, 129, 494-502.

4.1.5. Herrera, A., Garrido-Amador, P., Martínez, I., Samper, M.D., López-Martínez, J., Gómez, M., Pacakard, T. (2018). Novel methodology to isolate microplastics from vegetal-rich samples. Marine Pollution Bulletin, 129, 61-69.

4.1.6. Ramalhosa, P., Gestoso, I., Duarte, B., Caçador, I., Canning-Clode, J. (2019). Metal pollution affects both native and non-indigenous species recruitment in a subtropical island system. Marine Pollution Bulletin, 141, 373-386.

4.2. Reports
- 4.2.1. Protocolo de amostragem de espécies não-indígenas (NIS)
- 4.2.2. Beaches Protocol- ULPGC-ARDITI-PLASMAR
- 4.2.3. Manta Net Protocol- ULPGC-ARDITI-PLASMAR
- 4.2.4. Protocolo Playas- ULPGC-ARDITI-PLASMAR
- 4.2.5. Protocolo superficie agua del mar
- 4.2.6. Relatório técnico das metodologias nas futuras campanhas dos fundos marinhos arenosos subtidais dos Açores. Gaspar Frutuoso & Universidade dos Açores. Relatório preparado para a Direção Regional dos Assuntos do Mar (DRAM).

4.3. Workshop presentations
- 4.3.1. Workshop Ecopath Azores
- 4.3.2. Workshop Microplastics Azores

4.4. Attendance List
- 4.2.1. Participants_ULPGC_Training_EXPOLAB_18.04.18
- 4.2.2. Participants_ULPGC_Training_EXPOLAB_18.04.18
- 4.2.3. Participants_ARDITI_Training_EXPOLAB_18.04.18
- 4.2.4. Participants_ARDITI_Training_MARINA_18.04.18.

4.5. Services
- 4.3.1. Habitat monitoring- MEMORIA DE SERVICIO

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