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RESEARCH ARTICLES

Small Islands and Islets: Laboratories or Key Sensors for Environmental Policies in the Mediterranean Basin?

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By building the PIM Initiative, the European and International Delegation of France's Conservatoire du Littoral et des Rivages Lacustres (Coastal Protection Agency) aims to use small islands as laboratories to unite actors and build ambitious environmental policies in the western Mediterranean basin. This study examines the position of these small islands as a relevant model for conservation policies and actions. It is based on data collected during a two-year immersion in the PIM Initiative and uses several methodological and analytical tools. While working on the small islands of the Mediterranean basin, the PIM Initiative uses three main techniques: building a collective, gathering environmental data, and spreading a representation of these territories to wider publics. These techniques are analyzed using the framework of the circulatory system of scientific facts (Latour, 1999). This analysis highlights three preconceptions: (i) small islands group a limited number of actors, (ii) islands attract and facilitate consensus, and (iii) actions implemented on small islands can be replicated on larger islands and the mainland. The article concludes by discussing how the PIM Initiative is poised between considering small islands as laboratories which should become models for environmental policies, or as key sensors, specific territories which highlighted some broader features.

Introduction

Islands are often seen as laboratories with a double meaning. On the one hand, islands are thought of as scientific laboratories, as “small and confined sites for investigative research, which the rest of the world finds appealing to learn from” (Grydehøj & Kelman, 2017; also Chandler & Pugh, 2021, p. 211). The notion of correlational machines is used to describe islands as places of study and analysis, as learning tools for understanding natural or social phenomena: “in this epistemological framing, islands become increasingly recast as instruments of knowledge: as ‘correlational machines’, analogous to the thermometer or the compass” (Chandler & Pugh, 2021, p. 213). Islands are key sensors, or sites of amplification where some processes are more easily observable or more evident (Dawson & Pugh, 2021). On the other hand, islands are sometimes considered as a “laboratory *on* nature for

testing sociotechnical systems” (Gugganig, 2021, p. 2). This view positions islands as places where new policies and procedures can be tested through the practical implementation of innovative actions (Grydehøj & Kelman, 2017). These tests are often a preliminary phase to the deployment of these innovative socio-technical systems in other areas and on the mainland. For some authors, islands are models in the sense that “scientific models serve as simplified representations of a pattern or process to aid in the explanation of the empirical world” (DiNapoli & Leppard, 2018, p. 157). Islands as models extends the discussion on the laboratory-island and overlaps the two dimensions explained above: experimentation to be reproduced and a model to be followed.

Islands appear to be essential in environmental science and the formalization of environmental policies (Grove, 1997). They occupy a special place in the natural sciences, from biogeography to ecology (Calado et al., 2014; Whittaker & Fernández-Palacios, 2007). For example, “for Charles Darwin, the Galápagos Islands were an ‘ideal research laboratory’ (Okiihiro, 2009, p. 11), while Alfred Wallace found islands to be ‘good natural experiments’ to comprehend colonization, extinction and evolution” (Gugganig, 2021, p. 5; also Cox et al., 1973/2016, p. 24). These territories were originally considered as natural laboratories; their small size and clear geophysical demarcation making them ideal places to conduct naturalist inventories (Crouteix & Guyot-Tephany, 2019). At the end of the twentieth century, when notions of biodiversity and its hotspots become key to the elaboration of territorial environmental policies (Myers, 1988; Wilson, 1988), the importance of islands increased internationally as priority areas for protection.

Without calling into question the importance of islands in scientific discoveries, in the natural sciences, in particular, it is important to highlight the limits of the metaphor of the island-laboratory. First, the island-laboratory is based almost exclusively on the image of the island as a remote, enclosed, and pristine space (Gugganig, 2021). This remote and enclosed territory, with well-defined boundaries, makes it possible to imagine having an exhaustive understanding of it and being able to control all its parameters. Yet, islands are often territories of interconnectedness (Greenhough, 2006, p. 235) where isolation is relative. Perceiving the island as a bounded and controllable space remains a desire, as these territories are subject to natural and cultural incursions (Dawson & Pugh, 2021; Edmond & Smith, 2003). For example, in the context of the (semi-enclosed) Mediterranean Sea, islands need to be considered as part of a regional system, with interactions with each other and with the mainland (Baldacchino, 2004, 2008). Island maritime boundaries are often deceptive (Greenhough, 2006, p. 226). Then, in constructing the image of the laboratory island, there is a homogenisation of island characteristics which are in reality more or less relevant depending on the island (Grydehøj & Kelman, 2017, p. 107). Finally, the idea of the island laboratory pushes the

scientists or agents behind socio-technical innovation to position themselves outside the island space, which is not always possible or desirable (Greenhough, 2006).

These criticisms of the island-laboratory must, of course, be qualified, particularly in view of the size of the islands, the research questions and the objectives of the socio-technical systems being tested. The aim of this paper is to understand the extent to which islands, and in particular the smallest of them, can be relevant territories for building and promoting ambitious environmental policies. Here, islands are seen as laboratories in both senses: in the scientific sense of characterising environmental issues and in the sense of a testing area for implementing environmental strategies and actions that can be replicated on larger islands and the mainland.

In order to contribute to the discussion on laboratory-islands for environmental sciences and actions, I studied and analysed an example of environmental action carried out by a French international cooperation agency using small islands to promote ambitious environmental policies in the western Mediterranean basin: the European and International Delegation of France's Conservatoire du Littoral et des Rivages Lacustres (Coastal Protection Agency). It is a national public institution created by the law of July 10, 1975, today under the supervision of the Ministry of the Environment. "Its mission is to carry out, [...] a land policy for the safeguarding of the coastal area, respect for natural sites and ecological balance" (French Law No. 75-602, 1975, first article) (Deboudt et al., 2008; Joveniaux, 2017). Building on this history and this original function, at the end of the 1990s, the Coastal Protection Agency created a European and International delegation. By creating partnerships with various foreign agencies, often Mediterranean organizations, the European and International delegation of the Coastal Protection Agency provides institutional and technical assistance, and support for the implementation of projects on pilot sites. During its actions and project conception in the Mediterranean basin, the European and International delegation gradually became interested in small islands. Its agents see these territories as particularly suitable for the realization of concrete projects able to assemble many actors. They created the PIM Initiative (Initiative Petites Îles de Méditerranée, Small Mediterranean Islands Initiative) in the mid-2000s. It became an independent Non-Governmental Organization (NGO) at the beginning of 2017. The initiative, based on the exchange and sharing of knowledge, aims to support the establishment of efficient and practical management of islands and islets with the realization of scientific and technical missions in the field in order to build and highlight protection projects. A longstanding member of the PIM Initiative summarized this goal by saying:

The first idea of the PIM Initiative [...] was to say: it is difficult in the Mediterranean basin to convince public decision-makers that the coast must be protected, so we're going to undertake a sort of political action, where we're going to start by working

on the small islands and the surrounding marine territory. And the idea is that what is done there, and what is feasible there, can also be done on the mainland, on the coast. But it is easier on an island. We're going to make a cocktail, and we're going to include people of all nationalities, we're going to include managers, university lecturers, naturalists... and we're going to carry out inventory assignments, and we're going to think about management.

In short, the European and International Delegation of the Coastal Protection Agency is dedicated to environmental protection, working specifically in the Mediterranean basin, whose objective is to disseminate its conservation tools and methods abroad, and which relies on small islands and the imaginaries they convey to highlight the need to protect the coastlines of the western Mediterranean basin and test practical projects. Note that, in the case studied here, it is a mainland and not an island stakeholder who “embraces visions of an island paradise and vulnerability to capitalise on the symbolism and visibility of eco-island status” (Grydehøj & Kelman, 2017, p. 111).

In order to examine the relevance of the laboratory-island model in environmental science and policy, the Mediterranean Sea provides a very rich field of investigation for two main reasons. First, with its diversity and its more than 15,000 islands and islets, this semi-closed sea is a fertile ground for the study of islandness (Depraetere & Dahl, 2007; Vogiatzakis et al., 2017). Second, the Mediterranean Sea faces many environmental issues and is also recognized as a hotspot for biodiversity on a global level (Médail, 2014; Myers et al., 2000).

By analysing the strategy of the European and International Delegation of the Coastal Protection Agency, and the actions of the PIM Initiative, I seek to answer the following questions: how can small islands be laboratories or models for environmental policies and actions in the western Mediterranean basin? What means, tools, or methods were put into practice? What preconceptions are behind this strategy and these actions, and what are their limits?

After clarifying the original methodology and the frameworks used in this study (at the intersection of science, environmental actions, and policy), I examine the strategy of the European and International Delegation of the Coastal Protection Agency in creating the PIM Initiative and its actions. In the following section, I discuss the preconceptions on which this strategy and these actions are based, and the limits encountered in the field. A final section concludes.

Methodology and Analytical Framework

The conceptual framework and methodology of this study are the result of a specific position, anchored in an operational context. The research behind this study takes place at the heart of the PIM Initiative. For two years

(2015-7), the researcher was immersed and actively participated in operational tasks working as a member of the European and International Delegation of the Coastal Protection Agency.

Three methodological tools

This specific position had consequences for the research methodology and offered some opportunities (participant observatory and access to documents for their analysis) which had been coupled with more conventional methodological tools (semi-structured interviews and questionnaires).

Participant observation

First, the data collection was executed mainly during operational work in the European and International Delegation of the Coastal Protection Agency, where participant observation is central. These observations were collected daily in field notebooks. The notebook includes writing about the arguments and ideas of each stakeholder at the various meetings, by taking notes and recording the verbatims. For example, the researcher took part in meetings with foreign naturalists to set up a data-sharing agreement or attended meetings with the leaders of the PIM Initiative to discuss the relevance of integrating a new stakeholder, or to develop a communication strategy.

Participant observation was active and declared. The researcher was fully integrated into the Europe and International Delegation. An agreement between the research laboratory, the researcher and the Coastal Protection Agency formalised the data collection and the research work. All the members of the Initiative PIM knew that research in humanities and social sciences was being carried out.

Documentary analysis

A second methodological tool consisted of gathering and analysing the communication instruments and technical reports of the PIM Initiative. The documents analysed are the reports about naturalist missions carried out between 2008 and 2012, the organisation, an environmental database, and two books published by the PIM Initiative. The first book Malherbe et al. (2012) contains the watercolours produced as part of the first PIM Initiative missions and the second books is a photographic publication by Renou et al. (2012). The PIM Initiative widely distributed the two books as a communication tool. These documents have been analysed using a grid that focuses on the role of scientists, their involvement in environmental actions, and the representations of small Mediterranean islands.

Interviews and questionnaires

Several semi-structured interviews and a series of questionnaires were conducted with the inhabitants, the scientists and the managers working on these small Mediterranean islands. Concerning the islanders, in 2015, 97 questionnaires were conducted in Capraia, Ponza, Ventotene, and Procida (Italy). In 2017, 12 semi-structured interviews were carried out in

Porquerolles, Le Levant and Frioul (France). To complete the data gathered through participant observation, experts and leaders of the initiative were interviewed (5 semi-structured interviews). In 2016, a round table entitled “Management and conservation of small Mediterranean islands: what interfaces between ecological sciences, human sciences and managers” brought together a geographer, two ecologists, a manager of the Calanques National Park (France), a representative of a biodiversity consultant, and official from the Balearic Islands Ministry of the Environment (Spain). These events were transcribed in their entirety and form part of the corpus of data for this research.

Thus, by combining these different tools (participant observation, documentary analysis, interviews and questionnaires), the research work focused on different environmental actions dedicated to the conservation of small Mediterranean islands in the 2-year period under review. A small island is defined by the PIM Initiative and its partners as: “a land mass of less than 1000 hectares, hosting at least one vascular plant, more than 5 meters distant from another emerged area with at least 50 centimeters depth in the strait.” Even if some of its actions relate to other larger islands such as the Kerkennah Islands in Tunisia, this study focuses on small islands according to this definition.

Conceptual framework taken from sciences and technology studies

By examining the role of the small islands of the western Mediterranean basin in the dissemination of environmental policies and actions, it seemed essential to acquire theoretical instruments to analyse the construction and dissemination of the environmental question. For these purposes, the research used analytical grids taken from science and technology studies, in particular those from actor-network theory (Akrich et al., 2006; Murdoch, 1998). This research is especially based on Callon’s work on the constitution of hybrid forums (Callon, 1984; Callon et al., 2009), and Latour’s work on the circulatory system of scientific facts (Latour, 1999, 2004). These frameworks are presented briefly here.

First, the notion of hybrid forums can be defined as an open space in which all the players can exchange views and build an innovative vision of a contemporary issue based on technical, social, and political points. These hybrid forums involve very heterogeneous profiles: experts, scientists, politicians, and citizens who have a desire to be involved in contemporary issues. These forums must also bring together different scales and different representations and areas of expertise. These hybrid forums oppose a more traditional vision of democracy called delegative democracy, in which the production of knowledge is schematically devolved to specialists and scientists, who are deemed to possess the expert knowledge able to guide political action. Establishing a hybrid forum is an alternative aimed at making more democratic decisions by integrating more information and different viewpoints (Callon et al., 2009).

This concept is useful to build an understanding of a possible structure of a collective by uniting different profiles including academics, NGOs, private structures, and managers of protected natural areas as in the case of the PIM Initiative. In order to analyse the links that may exist between these different actors more precisely, the theoretical framework proposed by Latour (1999) seems relevant. He schematizes the circulatory system of scientific facts by defining five interactive loops (loops in grey on the [Figure 1](#)) bringing together the different actors.

This circulatory system with five loops makes it possible to follow the actors involved in the construction and dissemination of the scientific fact (Tabak, 2015). The first loop, which he calls “mobilization of the world (instrument),” represents the work of the scientist necessary to highlight “non-human actors.” “The first loop deals with expeditions and surveys, with instruments and equipment, but also with the sites in which all the objects of the world thus mobilized are assembled and contained” (Latour, 1999, p. 101).

The second loop, “autonomization (colleagues)” aims to “show how a researcher finds colleagues”, indeed “to convince someone, a scientist needs data... but also someone to convince” (Latour, 1999, p. 102). This loop also “includes the history of scientific institutions. There must be organizations, resources, statutes, and regulations to keep the crowd of colleagues together” (Latour, 1999, p. 103). These two loops concern the research collective, the scientists and their work. They are based on data accumulated during fieldwork by their observations.

The third loop, “Alliances (Allies),” raises the need for scientists to interest many other actors, such as donors or potential users of their research results. To be able to integrate new allies, scientists must complete a translation (Callon, 1984; Callon et al., 2009; Latour, 2004) of their data into information to interest as many people as possible.

The fourth loop, “Public representation,” concerns the public domain and how the scientific fact is revealed to society. This loop is about the media, journalists, and the general public. This loop is certainly the furthest from traditional scientific work, but to convince and to be able to continue their work, scientists must communicate their research to society.

The fifth loop, “Links and knots” is metaphorically the heart of the circulatory system “it keeps the other loops running” (Eijck & Roth, 2013, p. 78). Without this loop, “the other four would die off at once. The world would stop being mobilizable; disgruntled colleagues would flee in all directions; allies would lose interest; and so would the general public, after expressing either its shock or its indifference” (Latour, 1999, p. 107).

This theoretical framework has been used in various scientific disciplines, such as in information science (Tabak, 2015), education science (Eijck & Roth, 2013), and agronomy (Warner, 2007). In this study, this framework is used to examine the place of small islands in environmental conservation

policies at an international level in the Mediterranean basin. This disciplinary or transdisciplinary or even adisciplinary aspect of the framework (Tollis et al., 2014) privileges its application to territories in a geographical study.

Results: How can small Mediterranean islands become laboratories or models for environmental conservation policies and actions?

For the PIM Initiative, small islands are potential laboratories for the study of environmental issues and models for initiating environmental actions in the western Mediterranean basin.

Therefore, the PIM Initiative aims to put the small islands of the western Mediterranean basin at the top of the international conservation agenda, to converge the eyes of decision-makers on these territories, capitalizing on their symbolic value, and visibility (Grydehøj & Kelman, 2017, p. 107). The key is to turn these territories into scientific objects and then into political subjects to circulate scientific facts.

The aim of this results section is to show how and by what means the PIM Initiative activates each loop in the circulatory system of scientific facts.

Construction of a collective: how to build alliances

In order to put the small islands of the western Mediterranean basin on the conservation agenda, the PIM Initiative set about building a collective which approaches in some aspects the hybrid forums described above. This collective brings together members of NGOs and management structures active in island territories, members of government agencies in countries with small islands (Algeria, France, Italy, Morocco, Spain, Tunisia), donors to Mediterranean territories and scientists studying the small islands of the western Mediterranean.

To enrol each of these actors in this collective, it was important to find common interests or objectives. Three main interests were identified.

Create interscalar links

The participants of the collective could create links with other stakeholders involved at different scales. Members of national agencies would find an arena to interact with members of local NGOs carrying out numerous actions in island territories. For example, at the end of 2016, following a training session organized by the PIM Initiative, a member of APAL (Agency for Coastal Protection and Management within the Tunisia Ministry of the Environment) commented on the importance of having the opportunity to engage in dialogue with members of Tunisian NGOs working on the islands of Kuriat (East Tunisia) or Zembra (North Tunisia) and highlighted the importance of cooperation.

Other actors who are particularly sensitive to this are the donors generally working on macro scales. In this case, they have the possibility of interacting directly with actors in the field such as NGOs or managers of natural protected areas active on a small Mediterranean island or an archipelago. Within the PIM Initiative, there are three main donors: the FFEM (French

Fund for the World Environment), the Rhône Mediterranean Corsica Water Agency (a French agency), and the Marseille municipality. The first two donors mentioned above act on an international or regional scale and are particularly open to the opportunity for creating links with actors on the ground. However, the third donor, the Marseille municipality, anchored in a local territory and officially the manager of the Frioul islands (an archipelago of small islands in the bay of Marseille), seems less interested by the possibilities of creating vertical links, but more interested by the opportunity to structure horizontal exchanges.

Structure horizontal exchanges

Being part of this collective make it easier to meet actors working on other islands, sometimes confronting the same problems. This interest is essentially shared by managers and members of local environmental NGOs. A manager, formerly a member of a local French NGO, explains:

When I started working on the Riou archipelago [near Marseille, France], I initially turned to a huge structure which was nearby: The National Park of Port-Cros. But I was alone working on an island, and I felt a little isolated. We were not “playing in the same league”, nor with the same means... And it is true that it was one of the advantages of the PIM Initiative, being able to connect with people working on different islands... with other managers all over the Mediterranean, with scientists who already had knowledge and connections around the Mediterranean Sea, with people confronted daily with the challenges of ensuring the protection of a territory. So, there was a need for discussion and information sharing.

Since 2012, the Riou archipelago has been integrated into the National Park of Les Calanques. However, this manager talks about the time before the creation of the National Park. At this time, he was working for a local NGO. Here, scientists are quickly mentioned, as actors who can facilitate links between territories.

Gathering information and data about territories

The third interest in participating in this collective is the possibility of gathering new information and data more easily. By exchanging information with actors working on other small islands in the western Mediterranean basin, collective participants can gather a lot of data about these territories. This is of particular interest for scientists for whom the collection of data is essential. This third interest approaches the mobilization of the world and autonomization loops described by Latour (1999).

Thorough knowledge of small islands: mobilization of the world and autonomization

From the start, the PIM Initiative associated itself with many scientists across a wide range of individuals, including researchers, experts, or specialists. They are individually known to possess expert knowledge. They can be ecologists working for research institutions (research centres and universities) often naturalists with a specialty (botany, ornithology, entomology, etc.), recognized erudite persons specialized in taxonomy (for example herpetology), working as consultants, or with an environmental NGO. In fact, scientists who are interested in the small islands and islets of the Mediterranean basin are often naturalists specialized in a taxonomic group. Islands are mainly recognized for their endemism or are considered as refuge territories where several species whose habitat is threatened on the mainland or on the largest islands find space to live and reproduce. These characteristics of these small islands have united naturalists and conservation biologists.

A scientific fact is circulated among scientists particularly in the mobilization of the world and autonomization loops (Latour, 1999). By bringing together different specialists, the PIM Initiative becomes a catalyst for these loops. Islands must be examined scientifically to be legitimately considered as an environmental subject (Gugganig, 2021, p. 8). To this end, the PIM Initiative has built up a database identifying many geographical and natural features of each of the small islands in the western Mediterranean basin. More than 1,300 small islands and islets have been listed in this database. To complete it, and in particular to collect as much naturalist data as possible, the PIM Initiative used three different methods: bibliographic work, the creation of partnerships, and field missions.

Bibliographic work

From the quantity of documents available nowadays through digitization and the increasing availability of articles, reports, and data on the web, a collection of naturalistic data on several small islands has been compiled. This includes older inventories carried out on the largest of the small islands on the northern side of the Mediterranean Sea (e.g., Porquerolles and Port-Cros in the French National Park of Port-Cros, Capraia and Montecristo in the Italian National Park of the Tuscan archipelago, or Tavolara at the North-East of Sardinia).

Create partnership with organizations or experts who own data

The second method mentioned above consists in transferring databases or gathering raw data, that experts have collected directly in the field. By bringing together databases or datasets, it is possible to gather a lot of original data quickly. For this, it is important to create partnerships with regional or national organizations or to contact each expert who collects naturalist

data. For example, in 2017, the PIM Initiative signed an agreement with the University of Cagliari (Italy) to swap environmental PIM data for naturalist university data.

Field missions

Between 2006 and 2015, in order to supplement the data available on certain little-known islets, the PIM Initiative funded several field missions. These missions brought together naturalists specializing in different taxonomic groups. The PIM Initiative aimed, as a minimum, to group an ornithologist, a botanist and a herpetologist. These missions require heavy logistical organization: after obtaining the various authorizations required for the study of certain protected areas, it is necessary to organize transport by boat to islets where access is sometimes difficult and mooring unavailable because of the absence of docks, beaches, etc. In addition to these logistical considerations, these missions must comply with several technical and scientific constraints. They should, for example, be organized in early spring to make the identification of most plants possible. Herpetologists prefer to work at night when it is more favourable for the observation of reptiles. Some methods also require returning after a few days to the island to collect material revealing the presence of certain species (for example plastic plates coated with resin, which when nibbled indicate the presence of small mammals such as rats).

The PIM Initiative often promotes these inventory missions, by associating communication campaigns. These occur simultaneously with the mission. They typically involve writing articles or posting videos on blogs and social media platforms. However, occasionally, a watercolour artist, or a wildlife or underwater photographer, are associated with a scientific mission to produce a public representation of a small island.

Public representation: dissemination of an image of small islands

Using communication tools aimed at the general public, the PIM Initiative is promoting a special representation of the small islands and islets of the western Mediterranean. Communicate tools for the general public. The PIM Initiative produces books such as the watercolours mission notebook (Malherbe et al., 2012) or the photographic publication (Renou et al., 2012). These books are used as communication tools by the PIM Initiative. They are regularly distributed to partners, members of environmental associations, and institutional professionals. In these publications, or communication tools, scientists are observed during their field work (Kervran, 2012) and photographed or painted carrying out inventories or banding birds, for example. A single image: precious, isolated, and fragile territories

With these communication tools, the PIM Initiative actively participates in the fourth loop, public representation, and in the construction and dissemination of a representation of these territories seen as a “squared hotspot” or “hotspots²” that is a small biodiversity hotspot – the island – located within the global hotspot of the Mediterranean Basin. Indeed,

these small islands are recognized as refuges and micro-speciation areas for many species (Médail & Diadema, 2006). Being islands and islets, their ecosystems are also considered fragile (Bonnaud & Courchamp, 2014). Thus, the islands, even the smallest of them, harbour a high rate of endemism and are threatened ecosystems. They correspond perfectly to the definition of a hotspot and are perceived as territories to be protected as a priority. These representations are found in Renou et al. (2012). This book includes a chapter called “treasure islands” with a section entitled “from isolation their wealth is born” which states: “Protected by their isolation, these populations [animals and plants] have closely adapted to the peculiarities of these areas” (p. 81). Later “a concentrate of biodiversity” (p. 92) and “Underwater as on land, the small Mediterranean islands serve as refuges for rare species often threatened by human activities on the coast” (p. 93). Then in the third chapter as “A Fragile heritage to preserve” (p. 122), in the “threatened islands” part it states:

their often military past and their relative inaccessibility have left small islands safe for a long time from disturbances linked to the human activities of the neighbouring coast. [...] The island ecosystems are however very fragile and the slightest disturbance can upset their balance and lead to the disappearance of endemic species. (p. 124)

This representation is based on scientific work in conservation biology and ecology. Other studies in other disciplines show that small islands are historically included in the exchanges in the Mediterranean and can be or have been frequented intensively (Marin et al., 2021). For example, some small islands have been used by Mediterranean populations since prehistoric times to exploit natural resources such as obsidian (D’Anna & Le Bourdonnec, 2021; Le Bourdonnec et al., 2010), while others have been developed for lazarettos or prisons such as the Frioul archipelago, France or the Santo Stefano Pontines islands, Italy (Parente, 2008). Some polluting factories have been relocated to small islands to keep them away from an urbanised coastline (Daumalin, 2006) and some islands are now the focus of intense tourist activity. The aim of the PIM initiative is not to take part in a scientific discussion on the isolation, fragility, or ecological importance of these islands, but to promote the conservation of the Mediterranean environment. To achieve this, they are building up a distinctive image and disseminating it widely.

Small islands should become banners in the fight against biodiversity loss. Small islands act as magnifying glasses, or a key sensor (Dawson & Pugh, 2021), highlighting environmental issues and making it possible to raise awareness amongst the general public.

Circulation of facts and representation: links and knots

Various activities of the PIM Initiative have been linked to the conceptual framework of the circulation of scientific facts above. The first four loops of the model were easily linked to certain activities of the initiative making small Mediterranean islands scientific objects and then environmental subjects likely to bring together many actors within the collective for their protection. In order to really circulate, a scientific fact must pass from one loop to another and it is therefore important to rotate them (“links & knots” loop). To create these links and these knots, two arenas exist in the PIM Initiative: a laboratory island (Grand Rouveau, France) and the development of training.

Grand Rouveau: a laboratory island

Grand Rouveau is a 6-hectare island, property of the Coastal Protection Agency located in the Embiez archipelago (France). In 2012, on this laboratory island, the PIM Initiative set up a long-term programme aimed at eradicating invasive species. This ecological restoration action takes place every summer. It started by uprooting the *Carpobrotus edulis* (Hottentot fig or sour fig). Then, in a second step, the elimination of invasive species continued with the eradication of the black rat (*Rattus rattus*). The PIM Initiative enlists volunteers to participate in these environmental actions. They might be agents of the Coastal Protection Agency, environmental rangers working for the Coastal Protection Agency near the island, local government agents working at Six-Fours-les-Plages municipality, various acquaintances, consultants, naturalists working in research structures, and so on. By bringing together different members of the collective on Grand Rouveau each summer and using this territory as a laboratory (according to PIM Initiative) for an experimentation of ecological restoration actions to conserve Mediterranean island biodiversity, the initiative builds an annual “knot.”

Training to stimulate the hybrid forum

The PIM Initiative also built a “cubed training programme” in 2017 entitled “Regional training in the management of coastal and island natural areas & in project development”. It brought together around thirty participants, mainly from the southern shores of the Mediterranean, and took place near Marseille, France for ten days. From the first day of training, participants were grouped in threes to represent a particular territory such as a small island for instance Zembra-Zembretta, La Galite, and the Kuriat islands in Tunisia or the Habibas in Algeria. Each of these trinomial was composed of a representative of a national agency involved in the territory concerned, a member of a local NGO, and a scientist working within a university or recognized as such by their title of doctor. Throughout the training programme ten trinomial were brought to work together, and the end evaluation exercise consisted in writing and presenting a common project. Each member of the trinomial brought their vision of the territory

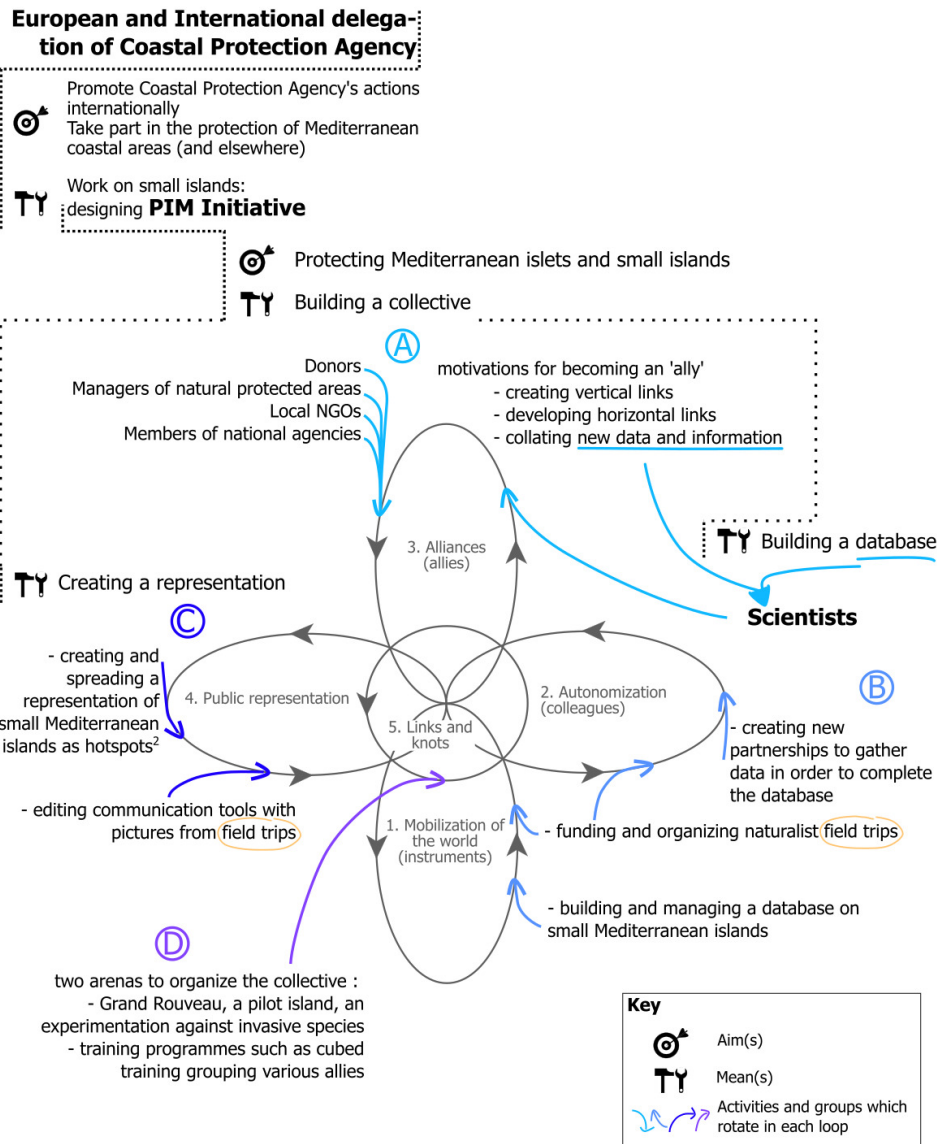


Figure 1. Activities and actors of the PIM Initiative integrated into the circulatory system of scientific facts (adapted from Latour, 1999, p. 100).

A: activation of the third loop: Alliances; B: activation of the first and second loops mobilization of the word and autonomization; C: activation of the fourth loop: Public representation; D: gathering the loops: links and knots.

to the project and their practical and theoretical knowledge. These three dimensions of the territory – the local dimension of users and from NGOs, the institutional dimension, and the scientific dimension – are essential in the eyes of the training organizers. It is for this reason that this training programme was called “cubed training” and it falls into the category of “links and knots.”

The scientific fact is circulating

These different results are conceptualized following the framework explained above. [Figure 1](#) summarizes these results using the circulatory system of scientific facts scheme.

The main result of this section is to show how scientific facts circulate, and consequently the biodiversity of the small islands of the western Mediterranean has become a scientific object and then an environmental subject discussed within a hybrid forum.

Discussion: Small islands: replicable models or confining laboratories?

The initial idea of the Europe and International Delegation of the Coastal Protection Agency in creating the PIM Initiative was to use the small islands as model to design environmental policies and actions for the Mediterranean coasts. How can the small islands of the western Mediterranean that have become an environmental issue be laboratories or models for the protection of biodiversity in the Mediterranean?

Three preconceptions underlie this idea. First, because small islands are territories where there are a limited number of actors, it is easier to implement environmental actions there than on the mainland or on larger islands. Targeting islands, especially small islands, means that all the actors involved in the territory can be included (possibility of exhaustiveness). The second preconception is that islands attract and facilitate convergence; it seems easier and quicker to gather different views on small islands, to converge ideas and engage the various actors. Finally, the third preconception: the actions implemented on the small Mediterranean islands should be replicated on the large islands and the Mediterranean coastal territories, since they have essentially the same environmental and administrative characteristics. These three preconceptions and their limits should be discussed. These limits challenge the fact that small islands are good laboratories or models and that environmental actions leave the laboratory (Akrich et al., 2006).

Small Mediterranean islands and the lure of the possibility of exhaustiveness of stakeholders

The small Mediterranean islands are often considered to have a limited number of actors intervening in the territory: a single manager, no or very few inhabitants, at most a handful of owners, occasional day trippers, etc. Indeed, “it is easier to become an eco-island than an eco-mainland” (Grydehøj & Kelman, 2017, p. 108). If these characteristics are generally found on the islets and the smallest islands, it is necessary to consider if they are still valid for the 1000-hectare-islands. For example, the island of Ponza in the archipelago of the Pontine Islands (Italy), covering an area of 985 hectares, has around 1,700 inhabitants all year long distributed between two villages. The summer population, however, can reach 23,000. Many private actors are also active on the island, such as tourism professionals (hotels, restaurants, sightseeing, etc.) and commercial fishing enterprises. Even if administratively the island of Ponza corresponds to a local government unit, the number of actors involved in its activities is considerable.

Uninhabited small islands can also reveal several actors involved in the management of the territory. For example, the 3-hectare island of If near Marseille, France is administratively attached to the 7th arrondissement of Marseille, in the heart of the National Park of Les Calanques and its castle (the Château d'If – of *The Count of Monte Cristo* fame – occupies the entire islet) is managed by the Monuments of France (another national institution). A private company is responsible for the maritime link between the mainland and the island, and it ferries around 100,000 day trippers annually to visit the castle. Thus, on a very small, uninhabited island, many actors are involved in the management of the territory such as the Calanques National Park, Monuments of France (Centre des monuments nationaux), local government units, and tourism operators. These actors highlight the different characteristics of the territories.

The definition of the PIM Initiative for a small island also includes the marine environment surrounding the island: “up to 50 meters in depth and a nautical mile in radius.” By including the marine fringe around the island in its definition, the PIM Initiative integrates new actors such as the national and regional agencies managing maritime domains, marine protected areas, commercial fishing enterprises, and marine environmental NGOs. Defining small islands and islets by their terrestrial *and* marine space nuances the hypothesis of a simplified system of actors.

Finally, the small Mediterranean islands show an overlap of different scales, from the most local to a most global, each scale including specific stakeholders. These few points indicate that the actor systems found on the small islands are not always simple. In fact, the environmental issues concerning these territories need to be considered within a system of several actors intervening on different scales.

Small Mediterranean islands: territories to which all eyes turn?

It is easier and quicker for the PIM Initiative to bring people together on the small islands than on the mainland coastline. Therefore, its strategy is based on the idea that building an active collective is simpler on islands, because these territories, and particularly the smallest ones, attract, gather and facilitate convergence. If the islands can unite people, this convergence contributes to a general goal: countering biodiversity loss. However, each stakeholder has their own objectives and can contribute in different ways to reach common goals. It is generally easy to find scientists, managers, or members of associations willing to participate in a mission on a small island. These territories, by their imaginary heft and emotional charge, attract curiosity and the desire to discover them. However, opportunities to go to these islets or small islands are rare, so it is logical that actors seize every chance to visit. However, each actor has their own objectives for exploring new small Mediterranean islands. For example, some scientists want to collect new data on these territories in relation to their research questions: perhaps on the distribution of a certain species, its population, or the organization of

a particular ecosystem etc. One scientist explained why he was so motivated to explore La Galite, a North-Tunisian-island, during the first field trips of the PIM Initiative in 2005:

The reason why I [participated in] the first mission of the PIM, is that I knew that there was something [a population of *Euleptes europaea*, a reptile endemic to the Mediterranean basin] there! Something which had been found in 1875 by Genoese naturalists. And I knew, even if there was not a single specimen in the library, I knew that they were excellent naturalists, and that if they had written it down, it was because they had seen it, I didn't have the slightest doubt! And I was pretty sure if they had seen it, I would find it.

The motivations of this scientist are very different from those of other actors in the collective. Some managers wanted to meet their counterparts to discuss a specific action, to observe the implementation of monitoring a protected species, or understand an action to combat an invasive species, etc. Thus, each actor will have their own concerns and different interests. In order for small islands to unite these different actors, it is therefore important that everyone understands and can discuss the different motivations (Gibbons et al., 2008). Field missions to the small Mediterranean islands can be seen as a time of sharing each other's aims. In this case, everyone must consider a new goal: to understand the motivations of the other groups of actors. If an expedition is a first step in building a relationship between these different groups, it will then have to be repeated in many other arenas in order to deepen and capitalise on this relationship. To create strong alliances, stakeholders must understand the methods and objectives of each participant.

While small islands attract and enable discussion between stakeholders, the objectives of each can be so different that it can be time-consuming and costly to overcome these divergences and build a functional hybrid forum.

What is the replicability of actions carried out on the small Mediterranean islands?

The third preconception that should be discussed here concerns the replicability of the actions carried out on the small Mediterranean islands and islets. As one member of the PIM Initiative quoted in the introduction said ("what is done there, and what is feasible there, can also be done on the mainland, on the coast. But it is easier on an island"), the PIM Initiative strategy is also based on the idea that this work on the islands should be a means of bringing about environmental policies and actions beyond the island in question. Therefore, it is important to question the reproducibility of the actions of the PIM Initiative on the large islands and Mediterranean coasts and discuss if they are an "eco-island trap" (Grydehøj & Kelman, 2017, p. 109).

If some environmental actions seem easily replicable on the continental coasts such as the implementation of inventory missions in order to gain a better understanding of the territory and clarify the environmental issues, other actions are not reproducible. For example, the fight against invasive species is doomed to failure on the mainland, given the widespread distribution of these species. A naturalist involved in the PIM Initiative express it clearly:

On the mainland, this fight [against invasive species] will not be won... There are spaces where we can fight, spaces where we can act. And these spaces are becoming increasingly rare, but among these spaces there are the islands. And the islands are, for me, the only place where we are able to control all of the flows and therefore are able to control all of the species. And so, if we want to keep a 'jewel of biodiversity'... if there is a place where we can do it, it is on the islands. And again, with the few species that there are, it is already difficult to meet our objectives.... If it is difficult on the islands, it is impossible on the mainland.

Perhaps, the fight against invasive species cannot be carried out with the same levers on small islands and on the mainland. While on the islands, it is necessary and potentially feasible to control arrivals and uproot or eradicate these species, on the mainland it is better to lobby to prohibit the commercialization of these species by changing regulations.

This last example of environmental actions carried out by the PIM Initiative, the inventory and eradication of invasive species, highlights the main theme addressed by this collective: biodiversity. By taking an interest in small islands and by mobilizing specialized scientists in these territories, the issue of island biodiversity immediately emerged. The small islands act as amplifiers or key sensors for thinking about biodiversity issues. During the construction of the collective and the circulation of scientific facts within the various loops, only the biodiversity issue was structured, and environmental actions only existed to address this issue. However, the environmental issues defined in the Mediterranean area include not only biodiversity (the Mediterranean basin being recognized as a hotspot), but also climate change (linked to transport, for example), natural resource management, coastal erosion (water resources, sand resources, overfishing and sustainable management of fish stocks, management of forest resources), or the fight against coastal urbanization and the degradation of soils, etc. Finally, the small islands of the Mediterranean appear as a vector of convergence for many of those engaged in environmental action but also show a form of confinement on the theme of biodiversity conservation.

Conclusion

For the European and International Delegation of the Coastal Protection Agency, working on small Mediterranean islands is a means of bringing together actors to determine the best means to protect the coastline of each country around the Mediterranean basin. To this end, this agency structured a collective aimed at the protection of small Mediterranean islands and islets: the PIM Initiative. Depending on the actor, protecting small Mediterranean islands could either be a means, for example, for the European and International Delegation, or an objective *per se*, as is the case for the PIM Initiative.

Gradually, the PIM Initiative and its collective came to focus on only one environmental issue: biodiversity. By working exclusively on small islands and implementing scientific expeditions, only the naturalistic particularities of the territories were highlighted. Determined by their isolation and their fragility, the small islands are perceived and represented as ecosystems to be preserved for their biodiversity. This collective has chosen to focus on this one environmental issue and only assembles allies specialized in biodiversity. By becoming an aim, the protection of small Mediterranean islands is enclosed in a particular representation of the territory, small Mediterranean islands become squared hotspots – hotspot in a hotspot – fragile ecosystems to be preserved for their endemism in the Mediterranean basin.

Are small islands too singular and specific to really be laboratories or models for environmental policies in the Mediterranean basin?

On the one hand, the small islands have brought together a collective made up of many different actors, members of NGOs or members of government agencies or scientists. These territories have also facilitated the establishment of solid links between these actors. On the other hand, because of their biogeographical characteristics and their shared representation of small Mediterranean islands, the only focus is biodiversity, and environmental actors working on other issues (adaptation and mitigation of climate change, tourism, agriculture, mariculture, etc.) have been excluded from the collective. Finally, the characteristics of the small Mediterranean islands can appear as obstacles when it comes to replicating some environmental activities on the mainland.

Therefore, the PIM Initiative is balanced precariously between considering small Mediterranean islands as either laboratories which should become models for environmental policies and actions or as specific territories with many features which prevents actions from being replicated. In this case, the small islands shut away the hybrid forum on one theme (biodiversity) and it becomes difficult to move beyond the laboratory to translate the scientific results or environmental actions for other territories. However, the small islands of the western Mediterranean basin are excellent key-sensors for understanding ecosystem dynamics and biodiversity issues, and for testing some environmental actions.

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