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The environmental and sociopolitical stakes of visual-monitoring within a protected marine area



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Abstract

This article offers a reflexive presentation of an interdisciplinary case study involving environmental sociology and marine biology. The creation of the Calanques National Park (April 2012), next to Marseille, the second largest city in France, has fuelled debate over the increasing impact of widespread leisure activities on the conservation of biodiversity. Given this, our research programme has developed visual interdisciplinary methods and critically analysed the notion of overuse. This paper presents a case study of Sormiou Bay, a natural anchorage site whose seabed is covered in a meadow of protected seagrass, *Posidonia oceanica*. Our research involved qualitative and quantitative field surveys and interval photography over a 19-month period, as well as the use of historical aerial photographs. Three main findings are presented here. First, our analysis reveals that a gap exists between actual and perceived levels of use, and this is exacerbated by a scale effect. Secondly, we point out the social and cultural factors, as well as the political context underpinning users' discourse regarding (over) use of the Calanques. Lastly, we underscore the gap between the environmental awareness of boaters, their actual behaviour and their impact on *Posidonia oceanica* meadows.

Keywords: Interval photography, interdisciplinary survey, overuse, National Park, anchorage site, *Posidonia oceanica*, Calanques



Introduction

From the outset, policies aimed at the creation and management of protected natural areas have to contend with the inherent tension between the protection of such sites and the ways they are used (Laslaz 2014). Given this, national parks tend to be (or are destined to become) places that encourage the practice of so-called nature-based leisure activities (Bessy 2011) which, given the milieu in which they are practised, do not generally have a neutral impact on the environment. Coastal areas are particularly exposed to such processes (Wong 1993). As an interface between land and sea, coastal areas tend to be affected by a strong anthropic influence on environments of great ecological importance. Such paradoxes are further exacerbated in peri-urban natural parks due to the proximity of a high density human population. This is true in the Calanques, France's first peri-urban and coastal national park. The Calanques National Park was officially created on 18 April 2012. It is located right next to a metropolis of 1.8 million inhabitants, including Marseille, the second largest city in France population wise.

The long process leading to the creation of a National Park began in the early 1970s and was repeatedly marked by controversy, many of them related to the issue of overuse (Deldrève and Deboudt 2012). Lack of adequate data regarding the use of the coastal massif further exacerbated the controversy and fuelled emotionally and ideologically loaded discourse from all of the protagonists involved (Claeys et al. 2011). Users of the Calanques are particularly hard to quantify, however: although disparate data exist, the diversity of observation protocols from which they derive limit the ability to compare them across space and time. Given this, our research has developed interdisciplinary tools, among others things, and sought to provide critical analyses of the notion of overuse (Tatoni et al. 2013). To do so, we have developed a mixed method approach associating interviews, questionnaires surveys and visual methodologies to compare actual and perceived levels of use.

This article will present a case study in Sormiou Bay, a hot spot both in terms of use and conservation issues. Sormiou Bay is a natural anchorage site whose bottom is colonized by a *Posidonia oceanica* meadow, a protected seagrass endemic to the Mediterranean. *Posidonia oceanica* dwells in the sublittoral zone, from mean sea level down to 30 to 40 m in depth, depending on water transparency and movement (Boudouresque et al. 2012). It has several ecological roles (Boudouresque et al. 2015): (i) an important primary production, as well as leaf epibionts which are highly consumed and exported to adjacent habitats (Vizzini et al. 2002); (ii) the net production of oxygen linked to carbon sequestration (Bay 1984); (iii) it is a spawning ground and nursery for a large number of species including teleost species that are targeted by artisanal fishing (Francour and Le Direac'h 1995; Harmelin-Vivien et al. 1995); and (iv) it works to stabilize sediment on sublittoral soft bottom, reduce turbidity and littoral erosion (Terrados and Duarte 2000).

Our research involved qualitative and quantitative field surveys (semi-structured interviews and questionnaires), as well as interval photography over a 19-month period. The specific spot was chosen based on sociological and biological factors. Yachting and anchoring were topics particularly present in the debates and controversies surrounding the creation of the national park, since previous oceanographic studies indicated that anchoring can damage *Posidonia oceanica* meadows (Leriche et al. 2006).

This article takes as its starting point the paradox inherent to managing protected natural areas and examines the gaps and crossover between their quantifiable use and their perceived use, the "green" intentionality of such uses, their measured ecological impact and their perception by users. We address three main questions. First, are quantifiable and perceived levels of use in accordance? Secondly, what are the social, cultural and political factors underpinning users' discourse regarding (over)use of the Calanques? And thirdly, how environmentally aware are boaters, how do they actually behave and what is their impact on *Posidonia oceanica* meadows?

The scientific and institutional context

From the perspective of the sociology of the environment, this study is part of the current debate over the paradoxes surrounding recreational use of protected natural areas. Policies focusing on the creation of protected areas are based on the two-sided and contradictory need to protect nature from the damaging effects of anthropization, and manage how the public will be received (Meur-Férec 2007; Bessy 2011; Laslaz 2014). Officially labelling an area as "protected" helps reinforce the conservation of its environment; but it also underscores its diversity and advantages, thus potentially attracting more visitors. Nature-based leisure activities are also not always as environmentally friendly as they intend to be, since they draw more people into fragile ecosystems (Mounet 2007). The managers of natural areas therefore frequently find themselves confronted with the issue of managing human flows.

Three main types of solutions have been suggested to address this paradox in the protection of natural areas. They reflect three different environmental ethics: anthropocentrism, biocentrism and eco-centrism (Callicott 2014; Larrère 2010; Light and Rolston 2002). The first involves the creation of strict nature reserve zones which exclude or greatly restrict human presence. This solution is rooted in a biocentric vision of the protection of nature – i.e., it views humans as a disturbing element and thus seeks to exclude them from the ecosystem. In its most radical forms, this may result in a complete ban on all touristic activity. At the opposite end of the spectrum are controlled or artificialized areas which are dedicated to leisure use. These are part of an anthropocentric vision according to which nature is meant to serve human needs in general and the tourist industry more specifically. The third

type of response is the result of a search for compromise, similar to the principles behind sustainable development. It is part of an eco-centric ethic that places humans and nature in the same biotic community and it calls for conciliation between the protection of nature and human use. Eco-tourism is described as capable of mediating such eco-centric compromise (Boley & Green 2016; Das & Chatterjee 2015; Wearing & Neal 2011), although it increasingly embraces the various green-washing strategies implemented by the tourism industry (Fennel 2003; West & Carrier 2004).

In France, the first generation of national parks focused on protecting natural heritage alone and was as such inherently biocentric. The 2006 legal reform (French national law #2006-436 of 14 April 2006 on national parks, natural marine parks and regional marine parks) also made it necessary to protect cultural heritage, thus requiring a more eco-centric approach.

The actual application of this eco-centric compromise between the protection of nature and human use has nonetheless raised several new questions. The relative generalization of environmental values (Dunlap et al. 2000; Van Der Born 2001) in recent decades has resulted in a widespread desire for nature as an escape from city life. The institutionalization of free time and relative democratization of access to leisure activities over the past few decades means that a larger share of the population is now able to fulfil such desires. Yachting itself has become increasingly popular; there are currently four million recreational boaters in France, ranging from luxury yachts to modest day boats (MEDDE Communications division, 2016). Given such challenges, natural area managers have worked in collaboration with the scientific community to develop tools to observe human use (see notably USDA 2011; Nihal and Güliz Öztürk 2010; Griffin et al. 2010; Dwight et al. 2007). Such data on use is often compared with the state of ecosystems and is analysed mainly by managers and naturalists interested in “carrying capacity” – a conceptualization starting in the 1960s under the impetus of Wagar (1964) which, ever since, has oscillated between being a scientific concept and a managing norm (Cole 1995). Very soon after its conception, it shifted from a biocentric view of nature management to an eco-centric view. This shift was driven by the concept's pioneer, Wagar (1964), who underscored that “it soon became obvious that the resource-oriented point of view must be augmented by consideration of human values.” Surveys of use as such gained a “perception” component. American national parks played a pioneering role in this. They developed applied and operational interdisciplinary protocols, like the research of Robert E. Manning into “social carrying capacity” (Manning 1997) which uses tools from the social sciences (Manning and Wang 1998) in a normative logic of “informed judgement” (Manning and Lawson 2002). Visual research methods are also very broadly used as observational tools in such research into use, as well as in “formulating standards of quality” (Manning

and Freimund 2004). This “perception” component of surveys developed by American national parks tended to be used into a normative way, as their goal was to control the number and/or the type of users. Thus, some scholars have highlighted that restricted access to national parks can lead to segregation processes, maintaining, reinforcing or creating situations of environmental injustice (Cronon 1996, Taylor 2000). The use of applied and normative surveys appeared only later in France, mainly developed by some geographers (Lemahieu et al. 2013; Brigand and Le Berre 2007). For its part, French Environmental Sociology mainly emphasizes social conflicts linked to the creation and the management of protected natural areas (Larrère et al. 2010), focusing on numerous dispute processes and, more recently, developing analysis in terms of environmental justice (Deldrève and Claey's 2016).

The findings presented here are the product of a middle ground approach to these two legacies. Inspired by the North American National Parks tradition, our research project involves both researchers from the life sciences and social sciences, as well as natural area managers. While attentive to the questions raised by managers, the social science researchers have nonetheless remained loyal to their epistemological positions and as such developed a critical and reflexive analysis of the postulate of overuse (Claey's et al. 2011). Similarly, the use of visual methods here remains loyal to the critical approach to visual sociology notably formalized by Becker (1974), Collier and Collier (1986) and Harper (2002). While this article does not explore the aesthetic and emotional potential of photography, which are an important component in visual sociology (Adams 1996; Condort 2002), it nonetheless believes in the “heuristic power of photography” (Piette 2017). Photography was used here as a tool for gathering data. This methodology was based on an instrumentation of the photographic counts to allow for a quantification of observations (Filion 2011). This research is part of a sociology that “includes” images and not one that is “based on images” (Harper 2002; La Rocca 2007). The images were later used as a tool to reproduce, thence becoming part of a sociology “with images” (Maresca & Meyer 2013). Our chosen photographic method was quantitative, spatialized and longitudinal. It sought foremost to be efficient in its numerical and spatial account of changes in the use of an anchoring site on a daily and weekly basis. This method was not normative, however, to the extent that the photographic counts were not seen as a “truth” meant to discredit the perceptions of social actors taken to be false or incorrect. To the contrary, the photographic data and discourse of social actors were understood as two different but complementary perspectives on the complex interactions between materiality and impression (Goldstein 2007). That is why our research chose to combine photographic data, interviews and questionnaires, once again underscoring that “visual methods work well in combination with others” (Stanczak 2007).

Methodology: interval photography as an interdisciplinary tool

Our study was conceived from an interdisciplinary perspective. As such, the sociological approach was enhanced by contributions from ecology with regard to the choice of the zone surveyed and in the wording of the interview grids and questionnaires used in order to focus the study on zones and objects of both ecological and sociological interest. Sormiou Bay and its *Posidonia oceanica* meadows were selected for the Bay's popularity as an anchorage spot (Fig.1).

Our research is based on a corpus that included data from a qualitative survey and a questionnaire-based survey among users of Sormiou Bay, and on interval photography. Both the interviews and questionnaires were conducted on-site with people on anchored yachts. Using sea kayaks, the interviewers covered the entire bay. The interviews were conducted at different times of day, both on weekdays and weekends, between June and September. The twenty-four interviews and one hundred and thirty-three questionnaires were all conducted on board anchored boats and were geo-referenced (Fig. 2).

The interviews asked boaters primarily about the following topics:

- how they viewed the Calanques,
- a description and the reasons for their visit,
- their thoughts on how the chosen site has changed over time,
- their knowledge about marine fauna and flora, with a specific focus on *Posidonia* habitats,
- their anchoring habits, including their favourite and least favourite sites,
- their estimates regarding levels of use at the anchoring site at the time of the interview, as well as their thoughts on usage levels in the Calanques more broadly,
- their knowledge and opinions about the National Park project (the survey period [2010 and 2011] was prior to the Park's creation in 2012).

All interviews were recorded and fully transcribed, and then underwent manual thematic analysis.

The main frame of the questionnaire was based on the travel cost method of economic valuation. Moreover, questions were asked about perceived levels of use and nature protection policies. The question about perceived levels of use was asked as follows: "On a scale of 1 to 10, where 1 means 'not busy at all' and 10 means 'much too busy', how would you rate the level of use at the site you have

chosen today?"

Luc Pauwels (2015) defines interval photography as a methodology "making series of images from the same vantage point with a set time span in between, resulting in a sequence of pictures that documents any visible changes that have occurred in the depicted scene". To implement the interval photography, a single lens reflex camera with a rain protection casing was placed in a location that allowed for the observation of the entire Calanque. The camera was equipped with an automatic-timer that took a photo every ten minutes from sunrise to sunset.



FIGURE 1: A BOAT ANCHOR DROPPED IN A POSIDONIA MEADOW, SORMIOU CALANQUE (© FRACHON).

An initial geometric adjustment stage was necessary in order to enable the processing of photographic data in the geographic information system software (GIS) (ArcGIS ESRI®) since the imaging was not done vertically. A matrix of dots spread across the entire Calanque was created based on a square grid with a dot every 50 m. A 6 m long boat was positioned at each dot on the grid based on the GPS coordinates of the dot and a photograph was taken from the box. A set of over 150 dots was as such compiled for the Calanque, thus creating a grid of starting points for the photos and a grid of terminating points on the GIS. The GIS could as such calculate the transformation between the two reference

systems. The precision of the transformation was verified by comparing with the coastline but also with the outline of the top edge of the aquatic plant habitat, visible transparently on the photos taken from the box and on the IGN photos. This transformation then allowed us to restore to the GIS information drawn from analysing the photos.

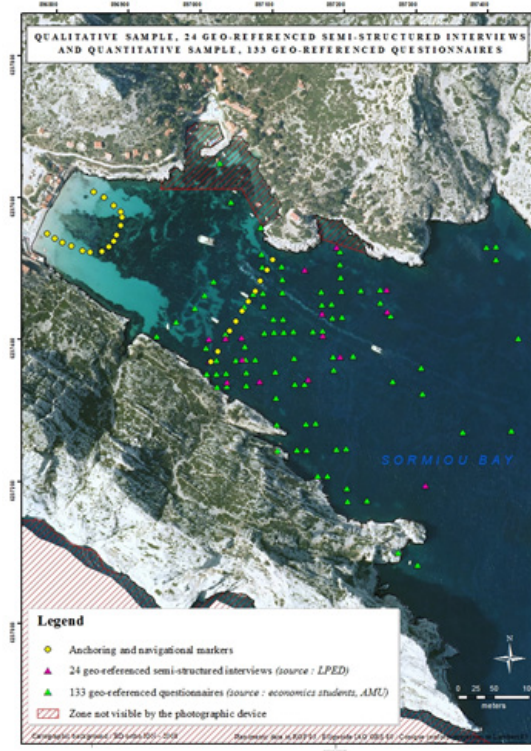


FIGURE 2: GEOREFERENCING OF THE SURVEY SAMPLES (INTERVIEWS AND QUESTIONNAIRES).

The first step of data analysis was focused on classic disciplinary analyses. The semi-structured interviews underwent thematic analysis and the questionnaires were subjected to statistical analysis (Fig.3).

The results obtained from the interval photography (total number of boats, density of boats) were then compared with the statements gathered in both the interviews and questionnaires in order to compare quantified levels of use and perceived levels of use. To do so, the interviewers used a GPS to identify the exact location of the boat surveyed, as well as the time and date. This information was then used to identify the boat on the photographs.

Survey 6 Sormiou

3 July 2010 – 11:30

Motor – 6,50 meters

26 boats in the Calanque

Home port : Vieux-Port

✓ Perceived use

« Interviewer 1 : Ok. So, do you feel that there are too many boats anchored today or is it alright?

HI : It's alright today, it's not... It's... It's close to the limit, but it's still alright »

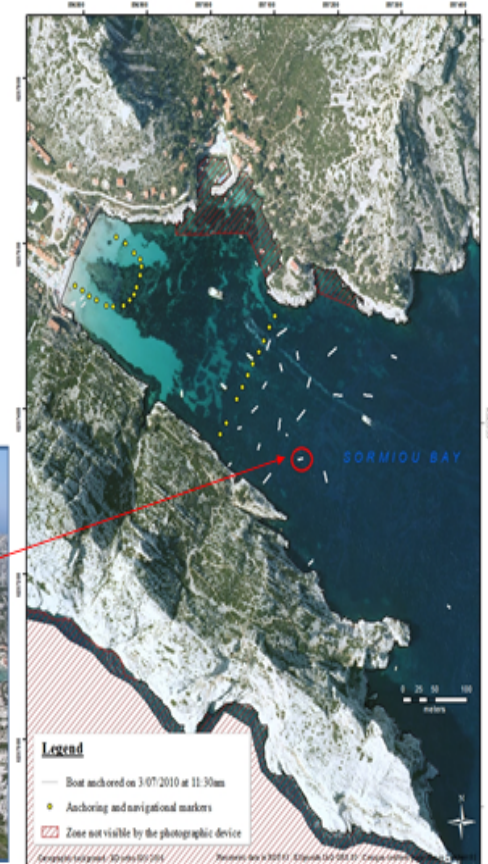


FIGURE 3: EXAMPLE OF A GEO-REFERENCED INTERVIEW ASSOCIATED WITH A SELECTION OF INDIVIDUAL VARIABLES, INCLUDING PERCEIVED LEVELS OF USE.

Results

Differences between quantified and perceived levels of use: A scale effect

The first result derived from comparing the interval photography and the questionnaire-based surveys was the lack of correlation between perceived use and quantified use at the scale of the Calanque (Fig. 4). It is as such that identical quantified levels of use (number of boats) were perceived very differently by different anchored boaters. The set of marks below drawn from the questionnaire-based surveys conducted with boaters in Sormiou illustrates this heterogeneity.

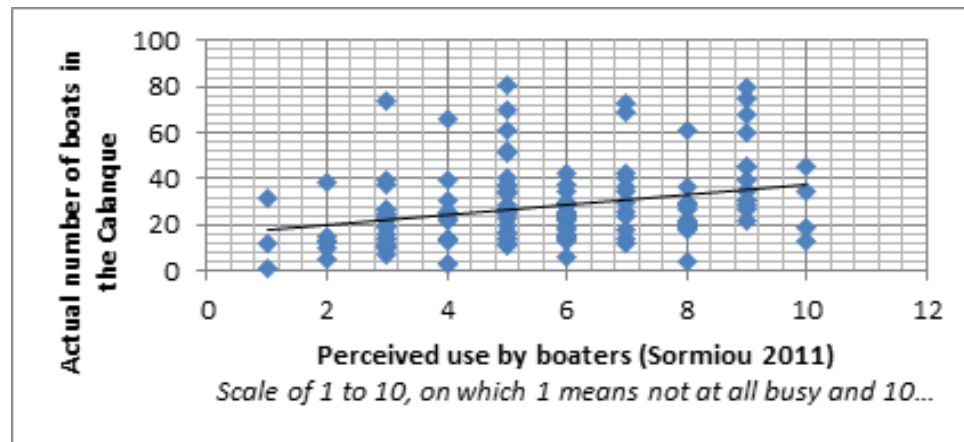


FIGURE 4: LINEAR CORRELATION BETWEEN THE PERCEIVED LEVELS OF USE AND THE ACTUAL NUMBER OF BOATS IN SORMIOU BAY.

Indeed, the same number of boats in Sormiou Bay counted with the photographic device resulted nonetheless in perceived levels of use that ranged across the entire scale from 0 to 10. Even extreme situations (less than 10 boats or more than 70 boats counted) provided very divergent estimates, although levels 9 and 10 of heightened use were absent when there were less than ten boats in the Calanque and, conversely, levels 0, 1 and 2 were absent when there were more than 70 boats present.

Several factors may help explain this. For one, the number of boats in the Calanque was a necessary but not sufficient indicator for describing actual use, which also required that other variables be considered, like the distance between the boat of the interviewees and the nearest boat or its size. Secondly, estimates by boaters regarding levels of use sometimes involved a complex, socially constructed process further influenced by an antagonistic political context rather than being based on a single, more or less warped, perception of an unequivocal physical reality. The survey was indeed realised during the creation of the National Park. Overuse and its management were one of the key issues of the public debate and its media coverage. In this context, rumours spread about strong access restriction policies. Further diachronic analysis of the photographs pointed up micro-scalar processes involving a concentration of boats anchored in certain areas; this was due in part to the location of the buoys demarcating the authorized anchorage area (Fig. 5).

The highest perceived levels of use were grouped along the buoy line demarcating the authorized anchorage area and more specifically its north-west perimeter (close to the access channel to the beach). Our analysis of the combined density levels (conducted using the photographic counts from August 2010) indeed

confirmed that this was the most densely used area.

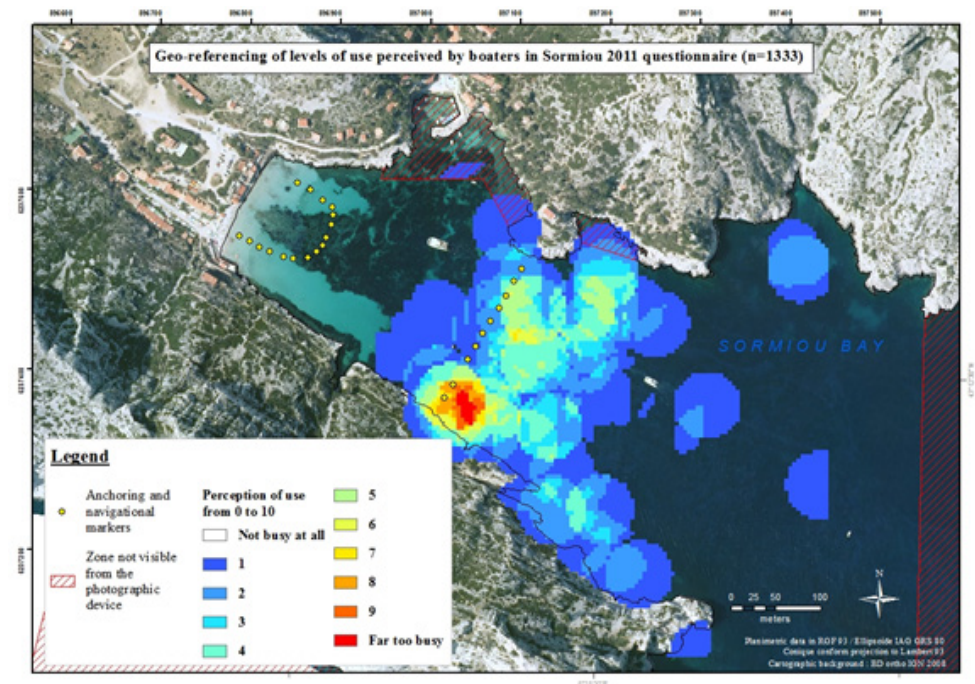


FIGURE 5: AVERAGE LEVELS OF USE PERCEIVED BY BOATERS IN SORMIOU (QUANTITATIVE DATA).

The concentration of boats along the buoy line was an undesirable consequence in the Boudonian sense – i.e., it was the undesired result, and potentially undesirable product, of an accumulation of individual behaviours (Boudon 1977). When asked about their choice for an anchoring spot, boaters tended to mention safety (being out of the wind and a good distance from the rocky cliffs), comfort (being sheltered from the swell) and access to the beach and its restaurants (either by tender or swimming). To this end, they tended to anchor as close as possible to the buoy line.

And so, while an interpretation at the scale of the entire Calanque revealed a lack of correlation between actual and perceived use, closer examination of the scale of analysis indeed revealed that the greater perceived levels of use were due to boaters being anchored in areas where there was a concentration of boats. Boaters' estimates regarding use were thus less based on the scale of the entire Calanque than related to the observation of their immediate surroundings.

Seeing and Counting... A social, cultural and political construction

Analysis of the semi-structured interviews sheds light on the argumentative logic (Grize 1982) used by boaters. To begin, when asked their opinion about the actual levels of use (at that very moment), boaters tended to use different types of reasoning which influenced their assessment of the situation at hand. One of the most common arguments was a comparison in time and space which led boaters to modulate their responses. The following interview excerpts and the corresponding photography provide an illustration of this kind of reasoning.

The first interview excerpt (interview #10) was taken from a boater whose boat was anchored in Sormiou Bay with thirteen other yachts, quite near the line delineating the anchorage area. The person's answer regarding the estimated level of use was as follows: "No, I do not find it excessive. It was a lot busier in Port Miou." Estimating that the level of use at that time and place was "not excessive", the person's answer was based on a comparison with another local bay.

The second excerpt was taken from a couple (interview #19) whose boat was anchored in Sormiou Bay with thirty-seven other boats, quite far from the line delineating the anchorage area. When asked about the level of use at that very moment, the couple had a short conversation:

- Man: "Well, it is somewhat busy, but it can be busier.

- Woman: It's true, there are a lot less than in June.

- Man: In August, too, I think.

- Woman: Yes, less than in June and July."

Considering the level of use at that precise time and place to be "somewhat busy", the couple based their answer on a comparison with other periods in the year.

Yet the arguments we collected about levels of use raised further questions. The survey was conducted over a two-year period preceding the creation of the national park. This period was marked by several controversies, especially regarding the changes that could result from the creation of a national park in terms of open and free access to the Calanques (Claeys et al. 2011, Deldrève and Deboudt 2012). In this context, more than simple yacht counting was involved when people estimated levels of use: social, cultural and political issues were also bound up in their considerations.

Based on a thematic analysis of the interviews, we were able to produce the following typology of boaters' positions regarding levels of use in the Calanques:

(1) No (over)use: Boaters felt that the Calanques were not overly busy. Within this category, there were two main positions.

- There is enough space for everyone: Users felt that there was enough space for everyone in the Calanques (maximum capacity had not been reached).

- Strategic denial: Anticipating the regulatory consequences and management decisions that might trickle down from acknowledging a situation of over-use, some users chose a stance of strategic denial. Their aim was to protect their current type of use.

(2) Accepted/mediated (over)use: Users felt that the Calanques were very busy (or even too busy), but advanced arguments about accepting and/or mediating the situation.

- An egalitarian and solidarity-based position: This position saw users underscore the high levels of use in the Calanques, while arguing in favour of open access for all to environmental amenities. This stance may also have involved a form of strategic altruism based on the principle that you cannot deny others access to what you would like to access freely yourself. It also drew on a register rooted in solidarity and mutual aid.

- Strategies of avoidance/isolation (space-time negotiations): Based on a similar acknowledgement of the high levels of use in the Calanques, this position was based on developing strategies to avoid the busiest places and periods, notably opposing the high season and off season, early morning and mid-day periods, closest and most accessible sites and sites that are further out and require greater knowledge of the area and physical effort (and/or technical skills) to reach. Such avoidance strategies encouraged the dispersal of users, particularly among boaters. For example, going to the next anchorage site if the initial one was deemed too busy.

(3) Critical of (over)use: Boaters felt that the Calanques were too busy.

- Critical of (over)use: Users were rarely categorically critical of situations of chronic over-use. When expressed, such criticism tended to be nuanced or else involved the stigmatization of certain users (e.g., sailboats versus motor boats, locals versus tourists), in line with Sartre's assertion that "Hell is other people."

- A distinction between quantity and quality of use: This position introduced a nuance by differentiating between a quantitative and qualitative description of use. The point here was to underscore that what is most disturbing for the environment and/or humans is not so much the number of users but rather their (potentially) disrespectful behaviour. In this sense, the crowding together of users might be

agreed to or even encouraged so long as those involved agreed to follow a code of good practice.

The above positions were derived from our analysis of the semi-structured interviews. They point out that estimates about levels of use are not part of a single process that deforms a physical reality (the number of boats) that can actually be quantified. Indeed, the arguments advanced by boaters were based not so much on the number of boats present in the Calanques but on their own activity, a territory, the national park project and nature. Boaters as such tended to express concern over the increase in regulations that might accompany the creation of a national park. They were especially concerned that anchoring options might be curtailed and/or have to be paid for. It was actually rare that boaters were categorically critical of over-use in the Calanques. Criticism was generally indirect, notably targeted at what Ginelli et al. (2014) call "bad company"; it was critical not so much of the overall number of boats than of the legitimacy of the presence of each in the Calanques. In doing so, a logic of social legitimization/de-legitimization was expressed which opposed users that were, for example, local/non-local, deserving/undeserving. Such reasoning distinguished between an accepted crowd based on embracing solidarity and conviviality with people who are socially and/or culturally similar and discourse about an imposed crowd (or one to be avoided) that was critical of "outsiders."

From environmental awareness to environmental behaviour and its impact on the ecosystem

Whether they mentioned it spontaneously or in response to the question asked explicitly by the interviewers, all of the boaters had more or less heard of Posidonia oceanica meadows. The main source of information about the seagrass beds was the eco-rangers who work in different protected marine areas in the region, as well as the media, when training to get their boating licence and, to a lesser extent, during their studies. The extent of people's knowledge varied from one boater to another, ranging from confusing different species to approximate naming to in-depth descriptions worthy of an Introduction to Oceanography course. When asked about how he had heard of Posidonia meadows, one boater replied, "On several occasions, a bit when I got my licence... Twice, I believe, from eco-rangers... And then at the port, you know everyone, it's something that's known and we talk about it and know it amongst ourselves... We're quite careful, obviously, about protecting the site."

Some boaters mentioned *Caulerpa taxifolia*, once again with varying degrees of precision and erudition. *C. taxifolia* is an invasive exotic macrophyte whose arrival in the Mediterranean was particularly mediatized in the 1990s (Boudouresque et al. 1995). The idea retained by those interviewed was that there are good and bad grasses/plants (the difference between these two groups of aquatic plants was not

clear to everyone).

Very few boaters contested the principle that Posidonia meadows should be protected. The most virulent opponents expressed their opposition on principle to the Park's creation throughout the entire interview, thus pushing them to contest the oceanographic analyses, "So I believe personally, it's not politically correct, but this thing about the Posidonia is a big scam."

The idea of protecting the Posidonia meadows was nonetheless generally accepted and even shared by the vast majority of boaters we met. Acceptance of the need to protect the Posidonia meadows was particularly easy since it coincided with technical interests related to the efficiency and safety of anchoring. Indeed, when boats anchor in a Posidonia meadow, their mooring may be unreliable, thus exposing them to the risk of drifting and colliding with other boats or even of running aground, "But when you're out sailing and you've anchored twice in the Posidonia grass and ended up getting caught in the wind, you understand very easily that an anchor won't hold in the grass. So after you've scared yourself two or three times. The next time you look for sand... It is out of the question to spend a night anchored in Posidonia meadows if you know it's going to be windy. Maybe exceptionally, if it was really nice out."

And yet, as the interval photography shows, most of the boaters interviewed had actually anchored their boats in the Posidonia meadows that cover most of the bay. The measures and observations conducted in the bay by the team of oceanologists, as well as analysis of the historical aerial photographs, reveal a deterioration of the Posidonia meadows which has resulted in a fragmentation of the seagrass bed. Boaters are not the only ones at fault, however.

The strip of grass bed along the central axis of the Calanque towards the north-west retreated from 1926 to the 2000s (Fig. 6). It is surrounded on each side by sandy zones that were already present in 1926 and which appear to be due to natural currents. These channels are perpendicular to the coast and are sometimes called "return channels". They cut into the seagrass bed and are caused by currents that allow surface water pushed by the wind towards the coast to return to the open sea along the sea bed. In these zones, natural fluid dynamics are opposed to the growth and development of the seagrass meadow. The circular zones of deterioration in the seagrass bed visible on the photo from 1950 appear to be a remnant of bombing conducted during the Second World War, since the bay was the stage of intense fighting between the Allies and the Germans.

The influence of boaters' impact on the seagrass bed was however the hypothesis retained for the zones that had the highest concentration of boats anchored. At the scale of the entire bay, the total number of anchored boats observed during our monitoring never reached the threshold considered critical in oceanographic

literature (Boudouresque et al. 2012). We nonetheless need to underscore that the impact on the seagrass bed varies greatly depending on the type of anchor used: the use of a chain versus a rope, the size of the boat and how the anchor is drawn up (Milazzo et al. 2004). The mechanical damage to the *P. oceanica* meadows due to anchoring is well documented and the mooring of big ships, particularly cruise liners, is a major preoccupation in many touristic sites (Ganteaume et al. 2005). Further, greater focus on the zones where the interval photography indicated the highest concentration of boats revealed situations in which the critical thresholds were exceeded. In these zones, the *Posidonia oceanica* meadow was largely fragmented.

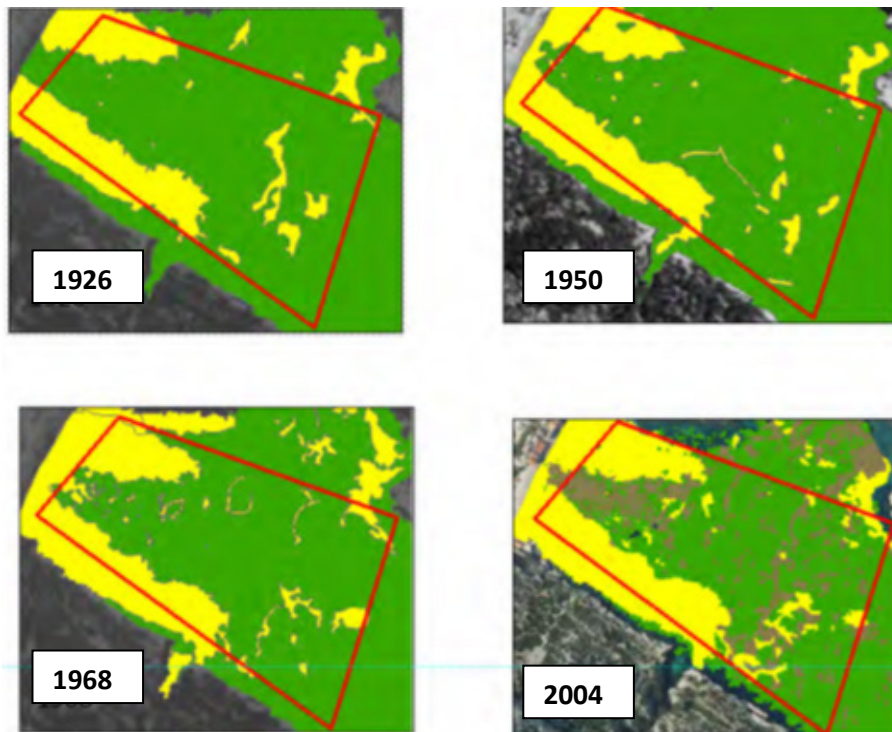


FIGURE 6: EVOLUTION IN POSIDONIA HABITAT IN SORMIOU BAY BETWEEN 1926 AND 2004.

GREEN: POSIDONIA. YELLOW: OTHER TYPES OF BOTTOM COVER. GREY-BLACK: LAND. RED OUTLINE: ZONE STUDIED.

THE DEAD MAT (IN BROWN) WAS MAPPED SEPARATELY FROM THE OTHER TYPES OF BOTTOM COVER ONLY IN 2004 (FRACHON, 2011).

The partial or total loss of *Posidonia* habitats is the result of a degradation process that simultaneously affects seagrass meadow heterogeneity (i.e. patchiness) and complexity (i.e. shoot density). It may also have an effect on the associated fauna such as the abundance of fish (Vega Fernandez et al. 2005).

Moreover, the average distance between anchored boats in these areas was inferior to the safe distances required to avoid the risk of collision tied to their swing circle. It was also in these zones that perceived levels of use were highest. Thus, these zones of localized concentration were characterized by alterations to the state of the *Posidonia* meadows, as well as by risks to the safety and comfort of boaters.

Discussion - Conclusion

This case study pointed out the importance of not confounding the dualism of objective versus subjective with the opposition between true and false. The use of photography and GIS allowed for a precise measuring method to be developed. But, as Auguste Comte (1936) initially noted, “precision and certainty are two qualities of very different nature.” In this sense, our experience showed that knowing the exact number of boats in an anchorage site was not sufficient to produce a heuristic interpretation of its level of use. The interdisciplinary method employed here was somewhat experimental. This initial experience revealed the need to take into account several spatial scales when collecting and analysing data. Here are not only technical considerations. This scale effect is also part of the social and material visibility/invisibility issue. The more or less numerous boats into an anchorage site are visible, but they are not seen in the same manner by all the boaters interviewed who do not evaluate likewise the level of use. In addition, the visibility/invisibility issue is reinforced regarding underwater environment. Despite they claimed not anchoring into *Posidonia* meadows, most of boaters interviewed actually did. Whether the boaters were honest or not, they actually faced the lack of visibility from the surface of the *Posidonia* meadows. Small waves and sunlight can modify the exact colour of seabed, weakening visual “evidence” of the presence of *Posidonia* meadows.

Therefore, photography could be used during the interviews to elicit and challenge users’ perspective regarding the level of use as well as the quality of underwater environment.

Finally, the questionnaire-based survey did not provide any variables that could explain the different degrees of perceived use. This is in part due to how the sample was constructed. During this first experience, we chose to use a diverse sample in order to cover the entire range of situations since the goal of the questionnaire was also to acquire general knowledge about the site’s use. In the future, however, it would be worth conducting a more targeted survey based on

the principle of a series of sociological “snapshots”. The goal would be to control the “number-of-boats” variable by collecting a large number of questionnaires on a single day during the same time frame. This approach could be renewed on at least three occasions in order to get three homogenous sub-populations in terms of actual use. It would then be necessary to describe each of these sub-populations and systematically compare them. The survey periods could as such be conducted during times of heavy use, medium use and light use. The usage thresholds could be set based on pre-existing knowledge about levels of use derived from the interval photography (maximum, average and standard deviation).

Ultimately, boaters’ estimates were not limited to a more or less accurate or warped vision of a quantifiable reality, but were rather part of a complex process that notably combined their experience and memory of the site, territorial identity and relationship with a code of boating etiquette, but also ethical considerations and strategic declarations. The relative tolerance noted in the users interviewed regarding heavy use of the Calanques was rooted in two different but not contradictory registers. First, even the most critical users tended to defend an egalitarian conception of access to nature. This egalitarian stance was sometimes based on strategic denial out of fear that stricter regulations would be applied. Whether “sincere” or “strategic”, the arguments advanced by these users were nonetheless based on principles of democratizing access to nature and environmental justice; they expressed a unanimous fear of stricter regulations due to the creation of the Calanques National Park.

Finally, the political context in which this study was conducted meant that the research team was extremely cautious about how its observation protocols and ultimate findings were used. Given the controversial atmosphere surrounding the creation of a national park and the definition of its regulatory future, our research and scientific observations could have been used for purposes of social control. This point was discussed within the research team and with our institutional partners prior to the survey. First, the team made sure that people’s anonymity was guaranteed (unidentifiable boats and crew in the photographs). Secondly, the use of semi-structured interviews and their sociological analysis allowed us to introduce a comprehensive approach that encouraged the deconstruction of preconceived ideas about “overuse”. The critical approach embraced by sociology should not however lead to nihilistic positions. To this extent, the association of photographs and interviews allowed us to compare the materiality of a process and its symbolic and socio-political dimensions. This first experience has fully convinced the national park managers of the interest of such approaches. The formulation of the management plans is still in process. But, managers have already expressed their wish to take into account users’ perceptions, taking seriously the notion of environmental justice, as a material reality as well as a feeling rooted in people’s minds.

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- (endnotes)
- ¹ This analytical approach will not be discussed here.
- ² An anchored boat turns around its anchor based on the direction of the wind and currents in the water. The speed and distance needed to avoid collision vary from one boat to another depending on size, weight and shape.