

Asinara National Park. An Example of Growth and Sustainability in Tourism

Donatella CARBONI^{a1}, Pierpaolo CONGIATU^b,
Matteo De VINCENZI^c

^a *Department of Humanistic and Social Sciences – University of Sassari, Piazza D'Armi, 17, 07100 Sassari SS, Italy*

^b *Asinara National Park, Porto Torres SS, Italy*

^c *National Research Council of Italy- Institute of Biometeorology (CNR – IBIMET) - Seat of Sassari, Traversa la Crucca, 3, 07100 Li Punti, Sassari, Italy*

Abstract: Despite its recent foundation (1997), the Asinara National Park (located in island not far from the northwestern coasts of Sardinia, Italy) has recorded a growing trend in tourism demand and visitors of all types in recent years. However, irresponsible tourism can have negative environmental impacts often made worse by the concentration of tourists in space and time. After analyzing the attractions, services offered, activities available, access and transport and quantifying the flow of tourism, arrivals and stays, availability of accommodation, water resources, etc. this paper aims to identify the actions needed to create an appropriate model for the evaluation of the tourism carrying capacity that the Park's territory can sustain.

Key words: *Asinara National Park, sustainable tourism, Sardinia, anthropic pressure, Italy.*

1. Introduction

Excessive anthropic pressure in a protected area, due to the combination of an increase in visits and the presence of structures and infrastructures for tourism, can have negative effects on the natural environment and landscape and also cause strong imbalances in the local socio-economic environment. Unless taught to respect the environment, every single tourist represents a potential threat in danger of spreading throughout the whole territory and becoming difficult to control. The anthropic load must therefore be limited and made to comply with proper management of the protected area given that an excessive distribution of people in one area can cause damage and degradation (Cetti Serbelloni, 1991; Galli and Notarianni, 2002).

Tourism can have several negative impacts on the environment. These effects are often made worse by the concentration of visitors in place and time since the flow of

¹ Corresponding author: Donatella CARBONI. Email: donatella_carboni@libero.it

tourists in protected areas is usually greatest in summer, with occasional peaks in spring during school trips and senior citizen outings. Not all the natural ecosystems can sustain tourism in the same way; the more fragile ones (coasts, sand dunes, humid areas, mountain habitats) are characterized by a reduced resilience and can suffer alterations of their delicate balance.

On the other hand, responsible and sustainable tourism can generate important socio-economic returns in the territory's communities and supply the authorities managing the protected areas with resources to co-finance their activities.

Nevertheless, the development of tourism, which disregards the protection of the environment, can endanger natural and cultural heritages and thus generating socio-cultural and economic conflicts within the communities concerned. This awareness has led various researchers to elaborate theories and methods that can determine appropriate sustainability of touristic fruition of the environment. Even when considering a natural park, the tourism carrying capacity takes into account the number of tourists, the flow of visitors and concentration/dispersion spatial models, the functioning of the ecosystems, as well as the quality of the visitors' experience (Coccossis et al., 2001).

Despite its recent creation, Asinara National Park (an island situated not far from the north-west coasts of Sardinia, Italy) has recorded a constantly growing tourism demand in recent years. In order to manage the flow of tourists in a sustainable manner, it is necessary for the Park's Management Authority to analyze the profile of the visitors as well as the ways and purpose of fruition. The aim of this paper is to lay the foundations for a dynamic tool that can provide guidelines for the appropriate management of future flows of tourism.

2. The Study area

2.1. Geographic setting

Asinara is an island (area approximately 51 km²) situated near the north-west tip of Sardinia (Italy). Its name comes from the Latin word *sinuaria* (sinuous, winding) which the Romans used referring to the shape of Island, with jagged coasts and many creeks. The Island has an elongated shape (length 17.5 km; width from 290 m, Cala di Sombro, to approximately 7 km in the northern area), its main axis runs northeast to south-west, and the coastline length is approximately 110 km.

Asinara is characterized by two types of coast, which make the landscape unique: high schist cliffs are found in the west, along with steep rocky slopes and many landslides rich in holes and caves, gullies and crevices. The eastern part of the Island has many inlets and small beaches with coarse sand, typical of a rias granitic morphology, with wide rocky outcrops (Ginesu et al., 1998; Oggiano, 1993).

The Island presents a varied morphology with different modest heights all over its surface reaching a maximum height of 408 m above sea level at Punta della Scomunica (in the north-west of the island). Asinara does not have an actual hydrographic system: watersheds are short and waterways are ephemeral with low flow rate; coastal ponds are very important humid areas with a high biodiversity (Giglio, 1970).

There are numerous wells and about fifty springs, but only two have significant flow rate. Some were used in the last century to create four superficial reservoirs, while others supply troughs for animals (Asinara National Park, Il Piano del Parco – Sistema Ambientale, 2008). The total water availability on the Island is approximately 100,000 m³. In addition to the four main tanks, various cisterns and other small tanks are distributed throughout Asinara and connected by gravity-fed pipes, but they are in a poor state of conservation and abandonment. The three water treatment equipments rely on obsolete technology; the cast-iron and polythene pipes distribution network has become worn over the years and its poor state of conservation has caused a malfunctioning, which to this day makes the drinkable water in some parts of Asinara very poor quality.

2.2. Bio-climate characteristics

The climate in Asinara is not very different from the extreme north-west area of Sardinia. The average annual temperature is approximately 18.0 °C, while the average annual rainfall is 480 mm, rarely reaching the annual average of Sardinia and occurring primarily in fall and winter (Italian Air Force Meteorological Service - Clino Asinara, <http://clima.meteoam.it/Clino61-90.php>)². Summer on Asinara is very dry because of the particular geomorphological characteristics. Winds primarily blow from north-west (mistral or “*maestrale*”, it can reach speeds of more than 20 meter per second and wind duration varies widely, from less than 24 hours up to 4-5 days following), west (“*ponente*”) for half of the year, and from north-east and east (“*levant*”).

The climate and the shallow soil, which is very rocky and highly susceptible to erosion, allow only the growth of Mediterranean maquis shrubland. This vegetation

² CLINO (acronym of CLImate NOrmals) is a statistical elaboration calculated over 30 years (1961-1990) of the meteorological quantities measured at the ground. It is used as a reference for anomalies, that is to say the difference of quantities between the last reference period and the thirty-year period. The CLINO for Asinara is based on data collected from 1961 to 1976 by an aeronautical military weather station located in the north. Since September 2006, a weather station has been operative in the south of the island, located in Fornelli and managed by the Institute of Biometeorology-National Research Council of Italy (IBIMET-CNR).

is lower where the soil is rockier, becoming garrigue. The main plant species characterizing the landscape are *Pistacia lentiscus*, *Juniperus sp.*, *Helichrysum sp.*, *Phillyrea angustifolia*, *Euphorbia dendroides*, *rosemary*, *limonium etc.* The only holm oak growth is in the north on the Asinara Island, Elighe Mannu, with a hilly coast covered in thick woody vegetation.

This environment has a high natural value due to the presence of extremely rare endemic species like *Centaurea horrida Badarò* (Boccheri, 1993; Diana and Corrias, 1998).

The isolated conditions, the virtually untouched environment and the various habitats of the terrestrial-marine transition have created the conditions for a wide fauna variety including many ornithological species and terrestrial vertebrate species. Taking into account nesting and overwintering animals, migrators there are approximately 150 species of birds, 13 of which are endangered, vulnerable or rare. Many of the species are of great importance because of their rarity, being included in national and international lists of endangered species (Torre and Monbailliu, 1993); these include the Corsican seagull and the European shag, which nest in colonies on the islets along the coast. The underwater flora and fauna is just as varied. The surrounding waters are, generally, of high quality with a corresponding integrity of the biological community. The surface temperature of the water reaches 26 °C in August and drops to 17 °C in December.

The western side of the Island is characterized by steep slopes, which continue underwater and plummet rapidly beyond 50 m. Strong currents and considerable waves, due to the mistral wind, prevent the formation of any significant sand deposits. On the eastern coasts, the seabeds mirror the morphology of the parts above water and therefore tend to slope gently to 50 m (average depth of the Gulf of Asinara).

2.3. The Asinara National Park

Asinara National Park was officially founded by Italian Law no. 344 in 1997. The Park includes all of the surface above water, the small islands within 1 km of the coastline, except for Isola Piana (Gazale and Congiatu, 2005). The Decree of Republic President of 3rd October 2002 and Ministry Decree of 13th August 2002 established the Protected Marine Area of Asinara (Area Marina Protetta dell'Asinara - A.M.P.) which has an area of 10,732 ha and a coastline length of 79.64 km (Ministero dell'Ambiente e della Tutela del Territorio e del Mare, 2010).

In accordance with Law no. 394 of 1991, the territory of Asinara National Park is divided according to the degree of protection, as follows (Figure 1): zones A – integral reserve areas in which the natural environment is entirely protected and access is denied, even on foot; zones B – the actual Park areas, in which all environmental and

nature activities are allowed as well as interventions for the management of natural resources. However, new buildings or transformation of the territory are not allowed nor is any activity which does not pertain to the Park's institutional duties; zones C – also known as agricultural zones, in which traditional agro sylvo-pastoral activities, fishing and harvesting of natural products can continue in accordance with the institutional aims of the Park, and moreover the production of quality craft is promoted; zones D – otherwise known as urban areas, these economic and social promotion areas are part of the same ecosystem. Activities, which are compatible with the institutional aims of the Park, are allowed in order to improve the socio-cultural life of the local communities and visitors enjoyment of the Park.

The main planning tools to manage the Park's territory are the Park Plan and the Park Regulations, in which every single element of the complex system is analyzed and the rules, conditions of use and fruition are identified.

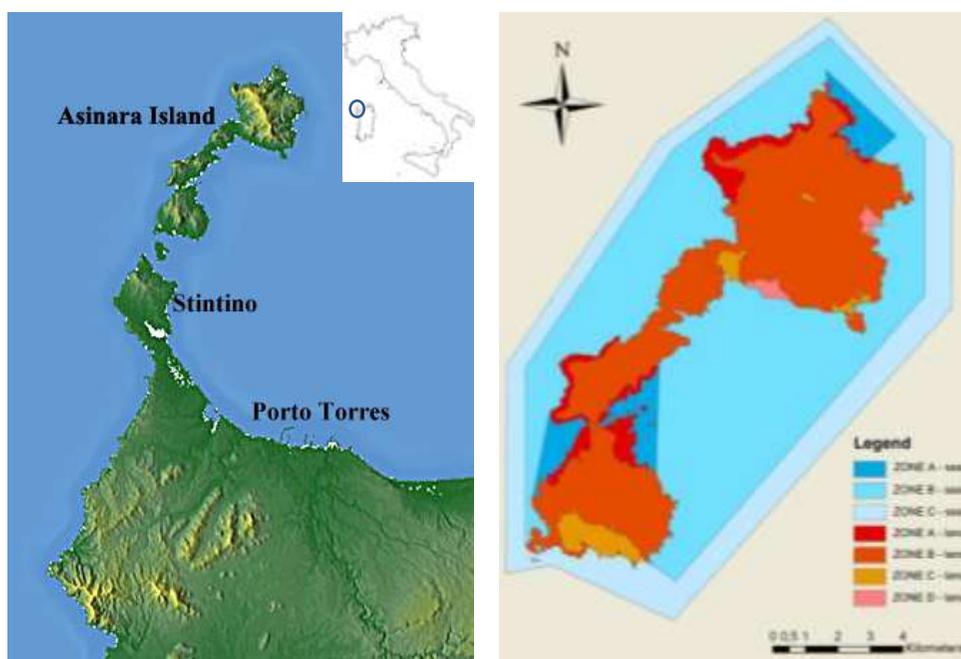


Figure 1. Left: Asinara map: geographical position. Right: Zoning of Asinara National Park and protected marine areas "Asinara Island". Source: Asinara National Park, 2014.

In particular, the Park Plan identifies current and potential environmental landscape units in which are applied specific models of management (models for the management of water resources, fauna, infrastructures, fruition system, fishing etc.).

3. Materials and methods

In relation to the aims of paper, which is to identify the actions needed to create an appropriate model for the evaluation of the tourism carrying capacity that the Park's territory can sustain, it was necessary to study the temporal evolution of the tourism proposal. For these reasons, we have analyzed:

- the existing tourism service (i.e. guided tours, tourist information, catering, accommodation);
- the activity of environmental education;
- the transport;
- the morphology and environmental physics of the Island;
- the cultural heritage (i.e. ancient buildings, museums);
- the sports activities, etc.

Moreover, we have also examined if the sustainable tourism on the island has favored the employment opportunities for local community; in fact, many companies and cooperatives have been created to manage the tourism services.

We have also analyzed the actions that the Park Administration has made in order to retrieve the buildings (bearing witness to past anthropization) of particular historical interest to host tourist facilities (visitor centers, hotels, restaurants, bars, cafes, museums, etc.). In accordance with the Park Plan, the management model of the land settlement system includes the restoration of certain buildings for new use. Conversely, some buildings are under "controlled degradation" and are left to become ruins, in order to preserve the memory of the past and provide a visual testimony of ancient usage (Asinara National Park, *Il Piano del Parco: Sistema Storico Culturale e Sistema Insediativo*, 2008).

Thanks to tourism, Asinara National Park stimulated new employment opportunities for Porto Torres and Stintino residents, notwithstanding the difficulties caused by the fact that it is an island. Despite its recent establishment, the Park has recorded a growing trend in tourism demand and increasing numbers of visitors of all types in recent years; visitors can be categorized as users "accompanied" and "independent" users. The latter typology is sure that has a stronger impact. In fact, because of conformation of the island and the limited number of personnel, the Park Authority has some difficulties to check that the independent visitors follow the rules for visits. Therefore it was necessary to offer the managers of the park a tool to help estimation of the maximum number of island users. This phase of the study was limited to quantifying the attractions, the flow of tourists, the number of arrivals and stays, available accommodation, services offered, proposed activities, access to the island and internal transportation in order to identify the actions needed to create an appropriate model for the evaluation of the tourism carrying capacity that the Park can sustain.

4. Results and discussions

4.1. The park's attractions

There are many attractions that appeal to tourists every year in Asinara National Park. In addition to the “untouched” nature, the crystal waters of the sea, the enchanting inlets, the breathtaking landscapes and views, the island offers the visitors an experience that also leads to the discovery of its history and culture. Every building, every ruin bears witness to a past composed of many pieces. All these encompass the different events which have marked its “biography” from the prehistoric age to the present: Roman trading expeditions, settlements of Camaldolesi monks, pirate incursions, settlements of Sardinian shepherds and fishermen from Liguria and Campania, attempts to colonize the Asinara Island, the founding of the Lazzaretto (quarantine colony) of the Kingdom of Italy and the prison farm, the years of the high security penitentiary.

There are several structures of cultural, historic and architectural importance: the Domus de Janas (Neolithic), Castellaccio (XI century), the ruin of the Camaldolesi monastery (1118), the coastal towers built in the early XVI century, the “cuiles” of shepherds, the ruins of “La Reale” hamlet and the seaside hamlet “Cala d’Oliva” (1700s), the lighthouse of Punta Scorno (1854), the church of the seaside hamlet (1860), the eleven branches prisons (from 1885 to the early 1900s), the Lazzaretto (late 1800s), the Royal Palace (early 1900s), the various cemeteries on the Island such as the monumental Cemetery of Italians (1916), the remains of the prison camps of Fornelli, Tumbarino, Stretti, Campo Perdu (1915-1916), the Austro-Hungarian Chapel (1916) and bone cemetery (1936), the Church of Cala Reale (1950) (Asinara National Park, Il Piano del Parco: Relazione generale, 2008).

The “white donkey”, symbol of Asinara, the absolute tranquility and silence are also important attractions for tourists.

Asinara is also a place of pilgrimage for “remembrance” tourism. This includes those who come to the Island to visit the places where they used to live, such as former guards and their families, or to discover their origins, their family roots, as their ancestors lived on the island before the establishment of the prison farm (e.g. the families of shepherds and fishermen who were sent away in 1885).

4.2. Access: sea and land transport

Navigation in the waters of Asinara National Park is only permitted to sail and motor boats authorized by the Park Authority for mass transit (Gazale and Congiatu, 2005). Mooring on the Island (Fornelli, Cala Reale and Cala D’Oliva) is concentrated in the east.

For many years, access to Asinara Island was precarious and insufficient since there were few transit watercrafts leaving from the north-west ports of Sardinia (Porto Torres and Stintino). In 2008, the Autonomous Region of Sardinia established maritime territorial continuity between Porto Torres and Cala Reale (approximately 15 nautical miles); this has allowed visitors to use means of transportation authorized by the Park Authority at a more affordable price, as well as a greater number of passengers.

The greatest flows of visitors come from Stintino and disembark at Fornelli, in the south, as this is the shortest distance (4 nautical miles).

In 2013, seven collective maritime transport services (one being a public service) were operative in the Protected Marine Area. These services are supplied by sea crafts of Stintino and Porto Torres and have the capacity to transport approximately 900 passengers.

The other types of maritime transport linking the mother Island to Asinara Park vary according to the type of visit chosen by users: sailing charter, diving and fishing tourism. The maximum capacity of sail boats is 116 passengers (2013 data supplied by Park Authority).

The Park's Regulations ban non-authorized private means of transportation, therefore the only means of transport by land are mass transit vehicles for guided tours, with guides on board, which go along the only cemented road (approximately 25 km) that links Fornelli, Cala Reale and Cala d'Oliva at scheduled times (Asinara National Park, *Il Piano del Parco: Sistema Storico Culturale e Sistema Insediativo*, 2008).

The land transportation system operates exclusively in summer. The busses of Sassari Public Transport Company (60 seats) link the three centers of Fornelli, Cala Reale and Cala d'Oliva. Public busses carried 6,433 passengers in 2010, 7,957 passengers in 2011 and 6,940 passengers in 2012 (data supplied by Asinara National Park).

The other private means of transport offer guided excursions in the Park year round; 16 off-road vehicles with 128 places were operative in 2013, 4 busses for a total of 93 seats, 4 trackless trains for a total of 187 seats (data supplied by Asinara National Park).

The means of transportation available on Asinara are quite diversified and the stops for authorized vehicles are dislocated in specific points; it is also allowed to move along dedicated paths using private or hired bicycles, electric cars and bicycles. The organization of internal mobility aims to support environmental sustainability. Controlling authorized means of transportation is the principle tool used to channel the flow of visitors by having them follow fixed signposted routes.

4.3. Visits and information services

Visits inside the Park are controlled by a set of fruition regulations issued by the Park Authority. The fruition regulations allow independent visits on foot, by bicycle or on horseback along the cemented road or Park trails.

Three visitor centers are operative in Asinara National Park, situated in refurbished buildings near Cala d'Oliva, La Reale and Fornelli. The centers are open from Easter to October. In summer, the centers are open every day and the opening times coincide with the arrival of boats from Stintino and Porto Torres. Each center has different characteristics than the others. The visitor centers are instruments to control the behavior of the visitors. Qualified personnel explain the rules (and rationale of them) for correct use of the environment since thorough education and information are much more effective than regulations alone.

4.4. Catering services

At present, there is one refreshment stop in Asinara National Park and a restaurant in Cala Reale, open since 2008. The restaurant serves 130 clients and includes a coffee shop. The clientele is composed of package groups, students on school outings, visitors arriving by public sea transport, boaters, Park staff and people who work on the Island.

It is generally difficult to quantify the flow of daily visitors who have used the café and, without booking, restaurant. The restaurant/café is open all year, but the number of visitors starts to increase in April, thanks to school tourism, and reaches its peak in the summer months. The highest number of restaurant bookings was in 2008 and the trend has decreased in following years probably due to the national and international economic slumps and because of the less than excellent quality of service. A potential off-season flow of tourists is however to be noted. In fact, there was a wider duration of use over 2011 with demand starting in February and October.

A new restaurant was opened in Cala d'Oliva in 2013, located in the former hamlet store and two additional refreshment stops were set up in the kiosks of Fornelli and Campo Perdu.

The hostel in Cala d'Oliva is the only accommodation available on Asinara Island. This has provided tourists with a place to stay overnight and therefore with more time to discover the island. The total capacity is 73 beds, in addition to those occupied by the personnel of the cooperative that runs the hostel (Cooperative sognAsinara, 2014). The structure is only open from Easter to October since there is no heating for the winter. The clientele of the hostel in Cala d'Oliva consists mainly of local tourists, tourists from mainland Italy and foreign visitors, mostly European.

Since 2009 the clientele has constantly decreased, surely due to poor management of the hostel although the trend of arrivals on the island has grown steadily (Table 1 and Figure 2).

Table1. Arrivals and stays in the hostel.

<i>Year</i>	<i>Arrivals</i>	<i>Stays</i>
2007	38	264
2008	611	1417
2009	1517	3439
2010	1364	2668
2011	1028	1877

Source: elaboration of data supplied by the “sognAsinara” Cooperative, 2012.

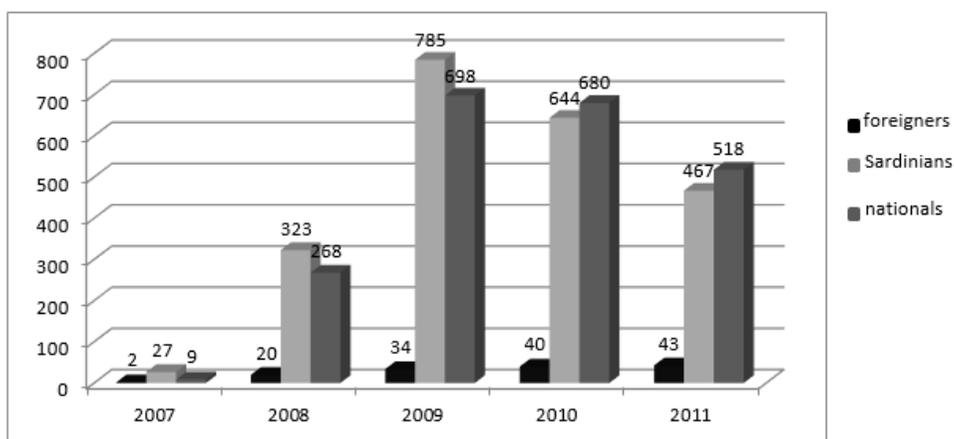


Figure 2. Origin of hostel clients.

Source: Elaboration of data supplied by the “sognAsinara” Cooperative, 2012.

Other structures on Asinara used as accommodation for official stays are the Director’s Residence, located in Cala d’Oliva, with 10 beds, the guestrooms in Palazzo Reale with en-suite bathrooms, for a total of 22 beds, managed, for institutional stays, directly by the Park Authority, by the Ministry of the Environment and by the Captaincy of Port.

4.5. Arrivals and stays

The system used to measure stays on the Island is based on the declarations of each operator, which are recorded on an official register submitted to the Park Authority at the end of the season. At the recorded values it is applied a corrective factor depending on the type of visit and based on actual measurements made by the Park personnel on random sample days. Park Authority estimates that values furnished by operators are 15 % less than the true values; in particular with some categories of types of visits

having a discrepancy of up to 50 % less than the visitors actually transported. These discrepancies have emerged thanks to some random surveys made by the Park Authority during the summer season.

The tables below show data collected over the last three years (Table 2). The number of annual visitors has grown from approximately 65,000 in 2011 to approximately 80,000 in 2013, an average increase by 10 %, which counters the 10 % drop of tourism in Sardinia (Regione Autonoma della Sardegna, 2014). The touristic season usually starts in April and continues until October. The greatest flow of tourists is registered in the summer months (85 % of annual presences), especially during the weekend of July and August. In late spring, there is a significant presence of organized groups of students and retirees.

Table 2. Type of visit, numbers (n.) of operators, numbers (n.) of means, places available and people transported accessing and operating in Asinara National Park.

Type of visit	n. operators			n. means			Places available			People transported		
	2011	2012	2013	2011	2012	2013	2011	2012	2013	2011	2012	2013
Diving	5	7	5	8	9	7	84	70	72	2,831	2,288	2,698
Fishing	6	6	6	6	6	6	62	63	63	2,105	1,230	1,037
Sea transportation	8	4	5	10	5	6	454	577	489	33,966	41,233	41,557
Shared rental	---	8	---	---	10	---	---	89	---	---	3,805	---
Boat taxi	---	---	8	---	---	9	---	---	92	---	---	4,424
Charter Sailing	9	8	10	12	9	12	123	86	98	4,844	5,713	5,838
Public sea transport	1	1	1	1	1	1	400	200	200	16,862	12,885	14,690
Private boats	1	1	1	---	---	2	63	63	63	5,292	8,136	8,606
Sea	30	35	36	37	40	43	1,186	1,148	1,077	65,900	75,290	78,850
Off-road	6	7	7	13	15	16	104	120	128	6,960	11,199	12,298
Bus	2	2	2	3	3	3	64	64	50	1,269	1,765	2,995
Trackless train	2	3	3	3	4	4	162	187	187	11,826	8,882	10,124
Hired bicycle	1	1	2	10	60	64	10	90	64	40	303	650
Horseback	1	1	1	7	7	7	7	7	7	200	200	163
Electric car	1	1	1	2	4	4	6	24	8	80	476	598
Public land transport	1	1	1	3	3	3	87	60	60	7,957	6,940	7,021
Land	14	16	17	41	96	101	440	552	326	28,332	29,765	33,849
Total	44	51	53	78	136	144	1,626	1,700	1,403			

Source: Asinara National Park, 2014.

4.6. Sports activities

A protected area is particularly suited to open air sports like canoeing, trekking, scuba diving, snorkeling, swim trekking. Such activities represent an interesting tourism product as they offer visitors a variety of ways to “live the park”.

It is possible to go horse riding along designated trails and undertake educational activities on horses and donkeys born and bred on Asinara. Equine and donkey assisted therapy services are planned for the future (www.parcoasinara.org).

4.7. Nature trail walks

Trekking is very popular with both associations and single visitors. This activity is available at various levels of difficulty depending on the length and slope of the trail. The trails of the National Park of Asinara branch off dirt roads which are connected to the main road and were used in the past by farmers and shepherds (Gazale and Congiatu, 2005). Seven nature trails have been signposted and mapped (Asinara National Park, *I sentieri del Parco*, 2011). In addition, there are two nature trails for visitors who are disabled or visually impaired; these trails are dotted with boxes displaying 3D depictions of animals and information about the plants and animals written in braille.

4.8. Discovering the bottom of the sea: diving

Sea watching by snorkeling and diving allows visitors to discover the underwater world of Asinara National Park and explore the sea bottoms, which are rich in varied sea life and Roman shipwrecks (like the wrecks in Cala Reale and Punta li Giorri). There are seven diving centers in Asinara National Park. The Park has organized specific itineraries to observe the vast diversity of the seabeds (www.parcoasinara.org).

4.9. Fishing tourism

Traditional fishing was originally introduced by the maritime communities of Liguria and Campania during their seasonal fishing activities in the Island. With time, they founded settlements and gave life to a local maritime culture, which exists to this day in the traditions of the fishermen of Porto Torres and Stintino.

Following the foundation of the Protected Marina Area (August 2002), the Regulations forbid fishing, the only exceptions being small fishing boats from Porto Torres and Stintino, which are allowed to fish provided they keep to a distance of 150 m from the coast. However fishing is strictly forbidden in zones A. Trawling within 3 nautical miles of the western coast and within 50 m of the eastern coast is also strictly forbidden since over exploitation would have negative consequences on the marine biodiversity and mechanical effects on the *Posidonia oceanica* meadows

(Asinara National Park, Il Piano del Parco: Relazione generale, 2008). One of the possible types of visits offered to the Park's visitors is fishing tourism managed by professional fishermen. This innovative activity responds to the demand to diversify fishing; this combines leisure with environmental education by fostering learning about marine ecosystems, fish species, local fishing practices and marine culture (Gazale and Congiatu, 2005). In 2013, six boats were authorized to practice fishing tourism in the Protected Marine Area of Asinara. According to estimates by the Park Authority, 1,230 visitors (2,105 visitors in 2011) chose fishing excursions; however, this activity has sharply declined over the years. There were in fact 13 fishing tourism boats in 2002, while there are only 6 today despite a rise in demand. This is explained by the high costs of excursions versus a quality of service that has not always corresponded to demand. Fishing along the coasts of Asinara takes place mainly in the eastern area of island from May to August.



Figure 3. Environmental education in Asinara National Park (Photo taken by authors).

4.9. Environmental education: the Center for Environmental Education of Cala d'Oliva, the Fauna Observatory of Tumbarino and the Sea Observatory of Cala Reale

Environmental education within a National Park carries great ethical and scientific importance since the territory is well suited to develop programs, experiences and activities created not only for schools but also for local businesses and communities and visitors (Figure 3).

The Centre for Environmental Education was founded in 2002 in Asinara National Park in the former central branch of Cala d'Oliva. A Fauna Observatory is located near the former prison branch of Tumbarino and a Wild Marine Animal Rescue Centre is found near the Sea Observatory of Cala Reale.

4.10. Nautical tourism

In summer, Asinara National Park is also a preferred destination for boaters who reach the island with their own sailboat. Provided they have the necessary authorization of the Park, these visitors are allowed to anchor in the waters on the eastern coast where mooring buoys can be found (Zone B), for a total of 63 berths. Motor boats are also granted access to the camp of Fornelli (Zone C), as well as the areas of Cala Reale and Cala d'Oliva via access canals.

Mooring and anchoring are strictly forbidden in Zone A. Anchoring, free sailing and long stays of boats which are not moored, sport fishing and professional fishing are not allowed.

Approximately 65 % of all boats are present in August; the buoy Camp of Cala Reale (34 buoys) is the most popular. According to the estimates of the Park Authority, 5300 people sailed through the Park using private boats in 2011, 8,100 people in 2012 and approximately 8,600 people in 2013.

This last year has seen a remarkable increase in fishing tourism (+11 %) and fast passenger transport – taxi boats (+31 %). Diving has remained stable, with about 2700 dives as well as charter sailing, reaching nearly 6000 users. The majority of visitors (about 42000) reaches the Island on passenger boats from Stintino, while the public sea line from Porto Torres does not boast the same popularity (about 15000 visitors), a means of transport which pays the price for the long journey despite nearly halving fares.

The ticket price varies depending on the port of departure (Stintino, Porto Torres) and of arrival (Fornelli, Cala Reale), the means of transport chosen (ship, sailing charters, catamaran, taxi boats, fishing tourism, etc.) and if the service is public or private. For example, the round-trip ticket Porto Torres-Cala Reale (16 miles) with the public line is 15 €; the cost of round-trip ticket Stintino-Fornelli (9 miles) ranges from 8 € to 20 € depending on the private operator chosen.

Off-road land excursions and the trackless train are the most popular, with over 10,000 visitors respectively. Independent visits on foot, by bicycle or on horseback are still low in demand perhaps due to the size of the island and the high summer temperatures. This category of visits may be exploitable in the cooler months, as the weather and temperature are normally pleasant in that time of the year.

5. Conclusions

The data analysis and the field investigations have highlighted both the complexity of Asinara Island as well as the need to solve some important problems for efficient management of the Park. Beyond the inadequacy or absence, in some cases, of essential services, which were not subjects of this study (i.e. water distribution, waste water treatment, permanent medical services, public lighting in urban areas, waste

collection and differentiation, internal public transport), the Asinara Park is greatly affected by the organization of visits which undoubtedly needs to be improved. In particular, only guided tours offer positive feedback, while independent visits should be reduced or eliminated. As in most of Sardinia, the concentration of tourists, especially in the two summer months (July and August), sometimes creates inconveniences and leads to overcrowding. Tourism is at its peak in summer and the demand is, above all, for sea and sand, but Asinara offers mostly rocky coasts, which force tourists to gather on the few beaches available. The reception offered to tourists by local operators is often inadequate and the personnel unqualified, unable to speak any foreign language, unaware of how to create tourism, which explains why appropriate training is much needed.

Furthermore, the problems caused by tourism and the need to manage these problems effectively require specific tools for possible expansion and better distribution the flow of tourists in a certain area enabling the Park Authority to develop the Park without jeopardizing environmental sustainability.

To this end, the tourism carrying capacity (TCC) of a natural park must be seen as a dynamic instrument, which can supply guidelines for effective management of future flows of tourism. In this respect, even various definitions of the tourism carrying capacity have been given over the time, none of them has ever been accepted universally from a theoretical point of view. Therefore, there is no standard procedure in practical terms to calculate carrying capacity of different tourist destinations or a protected area given that its calculation and measurement vary in time and depend on the characteristics of the place. Consequently, every tourist area is characterized by its own specific carrying capacity (Serreli, 2004; Fredella, 2009; Bottero and Cimnaghi, 2009).

Morover, by considering the data relative to tourist flows it is possible to establish the variables (for example the types of tourists and average daily spending for each category) and constraints (i.e. number of hotel beds, number of places available on public and private sea transportation, the availability of drinkable water, waste water treatment capacity, etc.) needed to calibrate suitable mathematical models to evaluate the anthropogenic load that the Park's territory can sustain.

Given the difficulties due to the insular specificity and complexity of Asinara as well as the consistency of the data available (sometimes incomplete or not available), this initial study is limited to identifying which actions are needed to create an appropriate tourism carrying capacity model. This has brought to light the importance of monitoring inbound tourists on a daily basis and subdividing arrivals on the basis of type of visit (excursionists and hostel tourists, sea and land means of transport used) and the areas visited. These steps are necessary in order to establish

how many tourists are in fact present in Park daily and consequently evaluate their impact on the protected area.

In order to reconcile tourism use and the bioenvironmental safeguard of the Park it is possible to hypothesize that certain actions are necessary for major sustainability: encourage out of season tourism and increase accommodation capacity; establish an efficient waste collection system, possibly differentiated, with ecological places in strategic points of the Island; increase water availability, which at the moment is the most limiting factor, through the improvement of the water network and the addition of water purification treatment machines or desalination equipment.

Despite everything, the characteristics and peculiarity of the Asinara Park make it a prized and increasingly appreciated Mediterranean tourist destination. Findings indicate that visits are constantly increasing contrary to the drop in tourists to Sardinia. Thus motivated by the peculiarity of the National Park and its potential, it is necessary to fine-tune a fruition model suited to the characteristics of the place, to preserve its biodiversity and 'ambiance' and to reach the level of other Mediterranean parks with similar characteristics. It is important to highlight that such insular geo-marine parks must not be measured solely using the parameter of 'tourism presence'. It is necessary to consider the criteria that account for their characteristics and uniqueness and possibly relate them to their wider context in order to ensure accurate analysis and programming.

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